Testimony of the Electric Infrastructure and Operations Panel

Exhibit __ (EIOP-16)

Workpapers comprised of:

Report on the Condition of Physical Elements of Transmission and Distribution Systems ("Asset Condition Report")
October 1, 2019

Annual Transmission and Distribution Capital Investment Plan ("5-Year CIP")
March 31, 2020

2019 New York Electric Transmission and Distribution 15-year Planning Report ("15-Year Plan")

Distributed System Implementation Plan ("DSIP")
June 30, 2020

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

CASE 17-E-0238

THE STATE OF NEW YORK PUBLIC SERVICE COMMISSION

THREE EMPIRE STATE PLAZA

ALBANY, NY 12223

OCTOBER 1, 2019

nationalgrid

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Chapter 1. Executive Summary

Pursuant to Section IV(6.3)(b) of the Joint Proposal approved by the New York Public Service Commission (PSC) March 15, 2018 in Case 17-E-0238 *et al.*,[1] Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid" or the "Company") submits this annual 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 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. 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 conductor and structures continue to show that 'older' assets are in serviceable condition. Often times assets require only repair and selected replacement as opposed to a complete rebuild. 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] Cases 17-E-0238 *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 and Establishing Electric and Gas Rate Plans* (March 15, 2018).

1. A. 1. Transmission System

National Grid's transmission system comprises transmission lines and substations operating at 69kV, 115kV, 230kV, and 345kV. National Grid has approximately 6,500 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.

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. Structures

There are five (5) steel structures graded at visual level 5 (significant pitting) and there are no steel structures graded at visual level 6 (very severe deteriorations) that required investment in 2018 (see Table 2A-7). The Company has annual inspection programs to identify and replace any priority reject wood poles when they are identified. There were 42 priority reject poles identified in 2018.

1. A. 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. 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 proceeding with substation rebuild projects for Gardenville 115kV, Huntley, Dunkirk, and Oswego 345kV as well as redeveloping projects for Rotterdam 115kV, Lockport 115kV, Lighthouse Hill 115kV, Inghams, and Boonville stations.

1. A. 1. 4. Circuit Breakers

The oil circuit breaker population is experiencing degradation that requires additional maintenance and creates system reliability and customer service concerns. A ten-year circuit breaker replacement strategy was approved in December 2010 to address oil circuit breakers posing the greatest safety and reliability concerns. A list of 99 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. 5. Transformers

National Grid has over 500 transformers in service. There are approximately 51 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.

1. A. 1. 6. Protection and Controls

National Grid maintains approximately 13,500 individual protection relays on the transmission system. Approximately 80% of the relay population consists of electromechanical and solid-state relays on which degradation, such as worn contacts and frayed wiring insulation due to heat, 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. 2. Sub-Transmission System

National Grid's sub-transmission system comprises lines and substations typically operating at voltages below 69kV. National Grid has approximately 2,900 circuit miles of overhead sub-transmission lines and approximately 340 circuit miles of sub-transmission underground cable. With certain exceptions noted in this report, the physical elements of National Grid's sub-transmission infrastructure are safe and adequate, although many sub-transmission assets have been in service for nearly a century.

Inspection and Maintenance program activities generate asset condition information and remediate asset condition issues. If a significant number of condition concerns are identified on a particular circuit, a detailed engineering review may be conducted leading to a comprehensive line refurbishment project.

1. A. 2. 1. Overhead System Assets

National Grid has approximately 64,000 wood structures and approximately 1,700 steel towers on its sub-transmission system.

1. A. 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 340 circuit miles of sub-transmission cable. Approximately one-half is more than 47 years old and one-third is more than 60 years old. A long term program has been initiated in the City of Buffalo to begin replacement of 23kV PILC cable.

1. A. 3. Distribution System

The Company's distribution system comprises lines and substations operating at 15kV and below. There are approximately 36,000 circuit miles of overhead primary wire and approximately 7,500 circuit miles of underground primary cable on the system supplying over 400,000 overhead, padmount and underground transformer locations. Additionally, there are over 500 substations providing service to customers.

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 in a proactive manner to ensure that 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. 3. 1. Overhead System Assets

For calendar year 2018, approximately 251,000 distribution pole inspections were completed, representing approximately 20 percent of the population. Based on these inspections, approximately 3,400 poles have been identified as requiring replacement over the next three years.

Also based on calendar year 2018 inspections, 198 transformers (out of a total population of approximately 340,000) were identified as candidates for replacement over the next three years.

1. A. 3. 2. Underground System Assets

There were over 3,000 manholes and vaults inspected in calendar year 2018. The inspection results can be found in Exhibit 3.

1. A. 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. 3. 4. Indoor Substations

National Grid has thirty-four (34) 23-4.16kV indoor substations in Buffalo and seven (7) substations elsewhere that were built in the 1920s through the 1940s and have been targeted for replacement. These stations present a number of reliability and safety concerns. Twenty-one (21) substation rebuilds in Buffalo have been completed. The five-year capital investment plan also discusses on-going and proposed indoor substation work.

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

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. 3. 6. Power Transformers

There are nine (9) 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. 3. 7. Circuit Breakers

National Grid has approximately 3,700 circuit breakers and 180 spares on the distribution system. Based upon condition, obsolescence or poor performance, certain families of breakers are targeted for replacement or refurbishment.

1. A. 3. 8. Protection and Controls

Approximately 18,700 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. Organization of the 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.

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

Chapter 2A. Transmission System Asset Condition

This chapter provides a detailed condition report of the Company's transmission assets. Specifically, it describes physical condition information, age profile of assets, and explanations of how the information is used to identify high risk facilities that may require intervention. Where programs are proposed to address specific problem areas, a description of the proposed remedial actions is provided.

Table 2A-1 provides an inventory of key system elements.

Table 2A-1
Transmission Asset Types (69kV and above)

Main Asset	Quantity
Steel Structures (Towers and Poles)	22,356
Wood Poles	49,471
Phase Conductor (Circuit miles)	6,517 Miles
Cables (Circuit miles)	53 Miles
Substations	206
Oil Circuit Breakers	277
SF_6 Circuit Breakers	516
Transformers	544
Batteries	260
Surge Arrestors	786
Sensing Devices	1,209
Reactors	18
Disconnect Switches	1,640
Relays	13,615

2. A. 1 Summary of Condition Concerns

2. A. 1. 1. Steel Structures / Wood Poles

Field inspection data obtained during foot patrols for steel structures have shown a reduction in observed level 5 - Significant Pitting and level 6 - Very Severe Deterioration steel structures over the past three years (see Table 2A-7). In addition, the Company has annual inspection programs to identify and replace any priority reject poles when they are identified. Of the 4,579 wood poles inspected by Osmose there were 42 reject wood poles identified in 2018, these poles will be replaced with new poles.

2. A. 1. 2. Phase Conductors

Conductors, static wire and splice failures pose potential safety and reliability concerns. The Conductor Clearance Strategy (SG163)[2] was developed to address this concern. Additionally, the Overhead Line Refurbishment Program provides a long-term approach designed to address issues regarding conductor condition, shield wires and splices. Lines that have had multiple conductor failures over the previous five years (shown in Table 2A-16) are being addressed. All of the overhead line refurbishment and conductor clearance projects listed in this document are associated with the 69kV and above system.

2. A. 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 proceeding with substation rebuild projects for Gardenville 115kV, Huntley, Dunkirk and Oswego 345kV as well as developing projects for Rotterdam 115kV, Lockport 115kV, Lighthouse Hill 115kV, Inghams and Boonville stations.

2. A. 1. 4. Circuit Breakers

The oil circuit breaker population is experiencing degradation requiring additional maintenance and creates system reliability and customer service concerns. A ten-year 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 has been assembled (see Table 2A-29). Many of these breakers will be replaced as part of their respective station rebuilds.

2. A. 1. 5. Transformers

National Grid has approximately 544 transmission transformers in service. Table 2A-33 provides a list of transformers currently being monitored. In some instances, further evaluation is necessary to properly understand their condition. Surveillance and regular dissolved gas analysis (DGA) sampling will enable the Company to appropriately identify and prioritize replacement.

[2] SG163 supersedes previous clearance strategy SG029 to allow the advancement of the North American Electric Reliability Corporation (NERC) recommendation entitled “Consideration of Actual Field Conditions in Determination of Facility Ratings.” For non-bulk circuits, SG163 suspended SG029 Version 3.

2. A. 2. Overhead System

2. A. 2. 1. Overhead Lines

Many of the steel structures on the transmission system have been in service since the 1930s (see Figure 2A-6). While engineering analyses continue to show that 'older' assets are often serviceable, overhead line assets experience declining reliability as the effects of environmental, mechanical and electrical degradation result in a failure to meet original design standards. In many cases assets require only repair and selected replacement as opposed to a complete rebuild.

The Overhead Line Refurbishment Program is designed to comply with the National Electrical Safety Code (NESC). Overhead line refurbishments occur following in-depth materials assessments and engineering evaluations. Actual physical condition and the severity of equipment deterioration determine whether and when overhead transmission refurbishment will proceed.

Many of the existing candidates for refurbishment were initially screened using five-year average reliability statistics, a process which incorporates the following factors: (1) customer, (2) exposure, (3) inspection, and (4) condition-related reliability performance. The resulting list of potential refurbishment projects, along with feedback from field personnel and engineering, is used to prioritize future overhead line refurbishment projects.

In general, the approach for refurbishing overhead lines involves only the replacement of in-kind overhead line components deemed to be in poor condition or failing to meet appropriate NESC requirements. If components are unlikely to perform adequately for at least 15 years, they may also be replaced when justified by an engineering evaluation and cost considerations. Condition issues are identified through engineering field inspections and, when appropriate, materials testing and analysis. For example, samples of older conductors may be tested to determine strength and ductility. Ground line inspection data may also be analyzed to determine if the NESC strength requirements are being met.

If a significant amount of line component replacements are necessary, alternatives to a one-for-one replacement are examined by Transmission Planning. For example, a line upgrade may be considered if transmission planning studies show that (1) a system re-configuration is a better option than a straight one-for-one in-kind replacement, or (2) another line might be cost effectively de-commissioned as a result of the upgrade.

2. A. 2. 1. 1.Condition and Performance Issues

Transmission lines are inspected on a recurring basis as follows:

- Aerial visual patrol: once each year
- Aerial infrared patrol: once each year
- Ground-based (foot) visual patrol: once every 5 years
- Wood pole inspection and treatment (Osmose): once every 10 years (guideline)
- Steel tower footing inspection and repair: once every 20 years (guideline)
- Tower painting: once every 20 years (guideline)

For ground-based visual patrols, issues are entered into an inspection database (Computapole) via a hand-held computer. For the aerial visual and aerial infrared patrols, issues are entered into Computapole manually. Each problem is given a priority code as follows:

Table 2A-2
Priority Codes

Priority Code	Required Response
Level 1	Problem must be repaired/addressed within one week
Level 2	Problem must be repaired/addressed within one year
Level 3	Problem must be repaired/addressed within three years
Level 4	Inspection findings “for information only”
Level P	Problem with a corrective action performed at the time of the inspection process

2. A. 2. 1. 2. Remedial Actions Performed

The Company’s Overhead Line Refurbishment Program establishes a systematic asset replacement and refurbishment approach for addressing overhead lines, targeting both wood pole and steel structure lines. Reliability improvements resulting from this program will be gradual and long term in nature. The program sets forth the following refurbishment categories: safety, life extension, and full refurbishments. Life extension refurbishments seek to improve reliability and extend the useful life of a line 15-20 years. Safety refurbishments seek to safely secure a line for approximately 5 years until a more comprehensive refurbishment or replacement project can be completed. The focus of a safety refurbishment is mostly at critical crossings (such as over roadways, parking lots, railways, and navigable waterways) where potential public safety concerns are the highest and corrective action is immediately required. A safety refurbishment is often pursued when severe degradation issues need to be addressed and will sometimes precede more comprehensive Article VII or Part 102 refurbishment projects. More comprehensive refurbishments will be based upon condition and typically are targeted to last beyond 15-20 years.

The Company uses a comprehensive screening tool to help prioritize circuits when considering condition-based refurbishments projects. This prioritization methodology is discussed in detail in section 2.A.2.1.3 below, and is solely for the purposes of screening. A circuit’s prioritization score and project scope will be determined after engineering field inspections and evaluations have been completed. Next, a circuit refurbishment project selection is then made. The following overhead line refurbishment projects are in conceptual engineering. During this part of the process, an engineering condition evaluation, which includes a field survey, will be completed. Based upon this condition assessment, an appropriate refurbishment scope and schedule will be determined.

Table 2A-3
Overhead Line Refurbishment Projects in Conceptual Engineering

Project Number	Title	Voltage	Typical Installation Date
C003422	Lockport-Batavia 112 ACR	115kV	1930s-40s
C027425	Gardenville-Homer Hill 151-152 South ACR	115kV	1920s
C027436	Frontier 180-182 ACR	115kV	1930s
C030889	Pannell-Geneva 4-4A ACR	115kV	1900s-20s
C034193	Gard-Dun 141-142 T1260-70 ACR Seneca	115kV	1930s
C036164	Colton - Browns Falls 1-2 ACR	115kV	1920s
C047816	Mortimer-Pannell 24-25 ACR	115kV	1910s
C055531	Brockport Tap ACR	115kV	1940s-50s
C060215	Frontier 181 ACR	115kV	1920s
C060217	Batavia-Golah 119 ACR	115kV	1950s
C060208	Greenbush-Stephentown #993 ACR	115kV	1920s
C060220	Mortimer-Golah #110 ACR	115kV	1950s
C069533	Lighthouse Hill-Clay #7 ACR	115kV	1930s
C075723	Border City-Elbridge #15/#5 ACR	115kV	1920s
C078570	Whitehall-Ticonderoga 3 Mount Defiance	115kV	1920s
C081476	Amsterdam-Ephratah 7/11/8/3 ACR	69 kV	1900s-20s
C081744	Gard-Dun 141-142 T1260-70 ACR	115kV	1930s
C083216	Laona-Falconer 172/173 ACR	115kV	1920s

The following overhead line refurbishment projects are underway or were completed since the last Asset Condition Report:

Table 2A-4
Overhead Line Refurbishment Projects now Past Conceptual Engineering

Project Number	Title[3]	Voltage	Typical Installation Date (Before)	Status
C003389	Gardenville-Dunkirk 141-142	115kV	1930s	Final Engineering
C033014	Alabama-Telegraph 115 ACR	115kV	1940s	Complete
C039521	Whitehall-Ticonderoga-Republic2-3	115kV	1920s	Final Engineering
C043995	Clay-Teall#10,Clay-Dewitt#3 Recond	115kV	1940s	Final Engineering
C050744	Spier-Rotterdam #2 Partial Shieldwire Replacement	115kV	1920s	Final Engineering
C069538	Huntley-Lockport 36-37 ACR	115kV	1930s-40s	Final Engineering
C081458	Gloversville-Marshville #6 ACR	69kV	1900s-1920s	Preliminary Engineering
C081471	Amsterdan-Rotterdam 3/4/5 Partial ACR	69kV	1920s-1930s	Final Engineering

The Company continues to evaluate the New Scotland-Leeds-Pleasant Valley corridor to determine what solutions are needed to enhance its reliability. A number of potential condition-based issues that may impact this corridor's reliability performance have been identified:

- potential exposure to cascading Type 3A/3B structure failure;
- the number of transmission crossings;
- tensile and torsional ductility tests on phase conductors;
- lightning performance; and
- susceptibility to damage from high winds based on current design criteria.

Osprey Mitigation:
Another overhead line remedial action outside of the refurbishment program discussed above includes Osprey mitigation efforts. There are growing populations of Ospreys in the Adirondack, Central, and Southwest regions of NY. Ospreys are birds of prey that build large nests of sticks, which can reach 4-7 feet in diameter and similar height, atop transmission structures. The nests

[3] Note that ACR stands for Asset Condition [and Reliability] Refurbishment.

typically weigh up to 400 pounds. Interruptions can occur when the nests come into contact with energized conductor or the bird droppings cause an arc between phase conductors.

The Company has addressed line outages caused by Ospreys on 115kV lines with the addition of new platforms atop poles adjacent to structures with nests, which is a proven alternative for the Ospreys to nest. Additionally, the Company uses on structure platforms to encourage the birds to build their nests in a more advantageous place on the structure. By placing the nests between phases of conductor, it reduces the likelihood of the nest coming in contact with the conductor and tripping the line.

Avian mitigation efforts for future transmission lines will be either included as part of asset condition refurbishments or the Osprey Mitigation Program (C076662) when problems with danger nests on a line require action to improve reliability. In FY20 the Osprey Mitigation Program is focusing on the Boarder City – Elbridge 10 and Lockport – Batavia 112 lines.

2. A. 2. 1. 3. Screening Methodology Approach

National Grid uses a screening tool to help prioritize all 115kV and above circuits when considering future transmission condition-based refurbishments projects. This tool is solely for the purposes of initial screening. The circuits selected to be refurbished will based upon initial screening score, engineering field inspections, and internal evaluations.

The screening factors were determined based on the findings of an internal asset criticality review team and assigned the following weighting percentages:

Customer – 20%
Exposure – 20%
Reliability – 20%
Condition – 40%

Within each of the four categories, the attributes are given a score from 1 to 5, with 1 being best (least critical) and 5 being worst (most critical). The weight for each score is given an exponential value to emphasize the criticality in any particular category. The exponential factor was chosen to create separation in the importance of each category. Based on the asset criticality team review of the scoring system and desire to show separation in the importance of each category, an exponential factor (Score x $^{4.29}$) was
applied resulting in the following approximate weights:

Score 1 – Exponential Weight of 1 (least critical)
Score 2 – Exponential Weight of 20
Score 3 – Exponential Weight of 100 (monitor)
Score 4 – Exponential Weight of 400 (recommended action)
Score 5 – Exponential Weight of 1000 (action required)

2. A. 2. 1. 4. Criteria used for Customer Score

For Customer, the factors used in the analysis for each bulk transmission line include system security, peak load flow, generation, and congestion. In the case of load transmission lines, additional factors include the number of customers on the line as well as any potential stranded load is considered. These factors are used to determine what is called Line Importance Factors (LIF). The LIF scores are separated into 10 percentiles and given a score of 1 to 10 based on their relative rating. The percentages used to determine the LIF score for both bulk and load lines are shown below:

LIF Bulk = System Security (50%) + Peak Load Flow (20%) + Generation (20%) + Congestion (10%)

LIF Load = System Security (30%) + Stranded Load (25%) + Number of Customers (15%) + Generation (15%) + Peak Load Flow (10%) + Congestion (5%).

CUSTOMER SCORE:

Score 1 – LIF 1
Score 2 – LIF 2 to 4
Score 3 – LIF 5 to 7
Score 4 – LIF 8 to 9
Score 5 – LIF 10

<u>2. A. 2. 1. 5. Criteria Used for “Exposure”</u>

As described above, there are five groups (or ranges) of data that indicate the exponential weighting factor for the determination of the criticality score in each of the four categories. For Exposure, the factors used in the analysis include the numbers of crossings (road, rail, and water) as well as the regional population density (density per square mile). A weighting of these factors within the Exposure category was used to determine the overall Exposure score. In the case of overhead transmission lines, the formula used for the data was:

Crossing Score = [(0.33 x # of road crossings) + (0.33 x # of rail crossings) + (0.17 x # of river crossings) + (0.17 x # of water crossings)] / circuit length

Crossing Ranking:

Score 1 – Crossing Score less than 0.5 per mile
Score 2 – Crossing Score 0.5 to 2 per mile
Score 3 – Crossing Score 2 to 4 per mile
Score 4 – Crossing Score 4 to 8 per mile
Score 5 – Crossing Score more than 8 per mile

Population Density Ranking:

Score 1 – Density less than 1,000 people per sq. mile
Score 2 – Density between 1,001 to 10,000 people
Score 3 – Density between 10,001 to 25,000 people
Score 4 – Density between 25,001 to 100,000 people
Score 5 – Density over 100,001 people per sq. mile

EXPOSURE SCORE: 0.67 (Crossing Ranking) + 0.33 (Population Density Ranking)

2. A. 2. 1. 6. Criteria Used for "Asset Condition"

For Asset Condition, the factors used in the analysis for each transmission line include the condition of the structures, the number of issues found per mile based on the most recent foot patrol inspection (5-year cycle), as well as the conductor and shield wire condition. Each of the four components is weighted equally (25%). Within each of the four components, the following criteria are used:

Structure Score = weighted average score between steel and wood = [Wood Score (# wood structures) / (# wood structures + # steel structures)] + [Steel Score (# steel structures) / (# wood structures + # steel structures)]

Where the wood score is based on the calculated strength loss calculated as a result of the ground line inspection (10-year cycle) for each structure along the line and placed into one of the following five categories with the responding wood structure score:

Wood Ranking:

Score 1 – Strength loss of no more than 2%
Score 2 – Strength loss of between 2% and 5%
Score 3 – Strength loss of between 5% and 10%
Score 4 – Strength loss of between 10% and 15%
Score 5 – Strength loss of greater than 15%

Wood Score = [(# of Score 5 x 1000) + (# of Score 4 x 400) + (# of Score 3 x 100) + (# of Score 2 x 40) + (# of Score 1 x 1)] / total # of wood structures.

The steel rating score directly corresponds to the score the structure received during a foot patrol inspection. Steel structures are rated from 1 to 5 based on the inspector's finding of rust and deterioration of the structure and footings are rated from 1 to 6. Training and guideline tools are given to the inspectors to help provide consistencies between inspection scoring along different lines. If footing scores are not provided, only the structure score is used.

Steel Ranking:

Score 1 – Inspection Rating 1
Score 2 – Inspection Rating 2
Score 3 – Inspection Rating 3
Score 4 – Inspection Rating 4
Score 5 – Inspection Rating 5 (and 6 for footings)

Steel Score = [(# of Score 5[&6] x 1000) + (# of Score 4 x 400) + (# of Score 3 x 100) + (# of Score 2 x 40) + (# of Score 1 x 1)] / total # of steel structures

The number of issues found per mile is scored based on the Level 1, 2 and 3 inspection issues identified in the 5-year foot patrol. The following provides the ranking based on the number of level 1 to 3 issues found on line per mile:

Issues Ranking:

Score 1 (1) – Less than 0.25 issues found per mile
Score 2 (40) – Between 0.25 and 0.50 issues found per mile
Score 3 (100) – Between 0.50 and 0.75 issues found per mile
Score 4 (400) – Between 0.75 and 1.00 issues found per mile
Score 5 (1000) – More than 1.00 issue found per mile

The circuit wire score is based on a combination of the conductor and shield wire relative ages. For the purpose of this analysis, the oldest relative age is used. The conductor score is based on the relative age of a conductor determined by the calculated tensile strength loss of the worse section of conductor found along the line. If the relative age of a conductor is not known and conductor testing results are unavailable, the actual age of the conductor can be used for a high-level analysis approach. The following provides rankings based on the relative age of a conductor:

Conductor Ranking:

Score 1 (1) – Relative age of 49 years or less
Score 2 (40) – Relative age of 50 to 59 years
Score 3 (100) – Relative age of 60 to 69 years
Score 4 (400) – Relative age of 70 to 79 years
Score 5 (1000) – Relative age of greater than 80 years

The shield wire score is based on the relative age of a shield wire determined by the calculated tensile strength loss of the worse section of shield wire found along the line. If the relative age of a shield wire is not known and conductor testing results are unavailable, the actual age of the shield wire can be used for a high-level analysis approach. The following provides rankings based on the relative age of a shield wire:

Shield Wire Ranking:

Score 1 (1) – Relative age of 39 years or less
Score 2 (40) – Relative age of 40 to 49 years
Score 3 (100) – Relative age of 50 to 59 years
Score 4 (400) – Relative age of 60 to 69 years
Score 5 (1000) – Relative age of greater than 70 years

Wire Score = 0.50 (Conductor Ranking) + 0.50 (Shield wire Ranking)
ASSET CONDITION SCORE: 0.33 (Structure Ranking) + 0.33 (Issues Ranking) + 0.33 (Wire Score)

2. A. 2. 1. 7. Criteria Used for "Reliability"

For Reliability, the factors used in the analysis for each transmission line includes a 5-year weighted Transmission Performance Score (TPS) which is comprised of outages along a line with respect to system security/availability, customer impact, and benchmarking. The weight of each criteria used are:

TPS = System Security/Availability (25%) + Customer Impact (50%) + Benchmark (25%)

Reliability Score:

Score 1 (1) – TPS greater than 97
Score 2 (40) – TPS 93 to 97
Score 3 (100) – TPS 89 to 93
Score 4 (400) – TPS 85 to 89
Score 5 (1000) – TPS less than 85

Figure 2A-5 below illustrates how the screening tool is used to identify transmission lines that are candidates for asset refurbishment projects showing a sample of commonly referred to circuits in the Company's Capital Investment Plan and Asset Condition Report. There are approximately five hundred (500) transmission lines and taps scored in the screening tool and comparing each one's relative priority score allows the Company to target higher priority lines with asset condition refurbishment projects.

Figure 2A-5
Key Screening Tool Circuits*

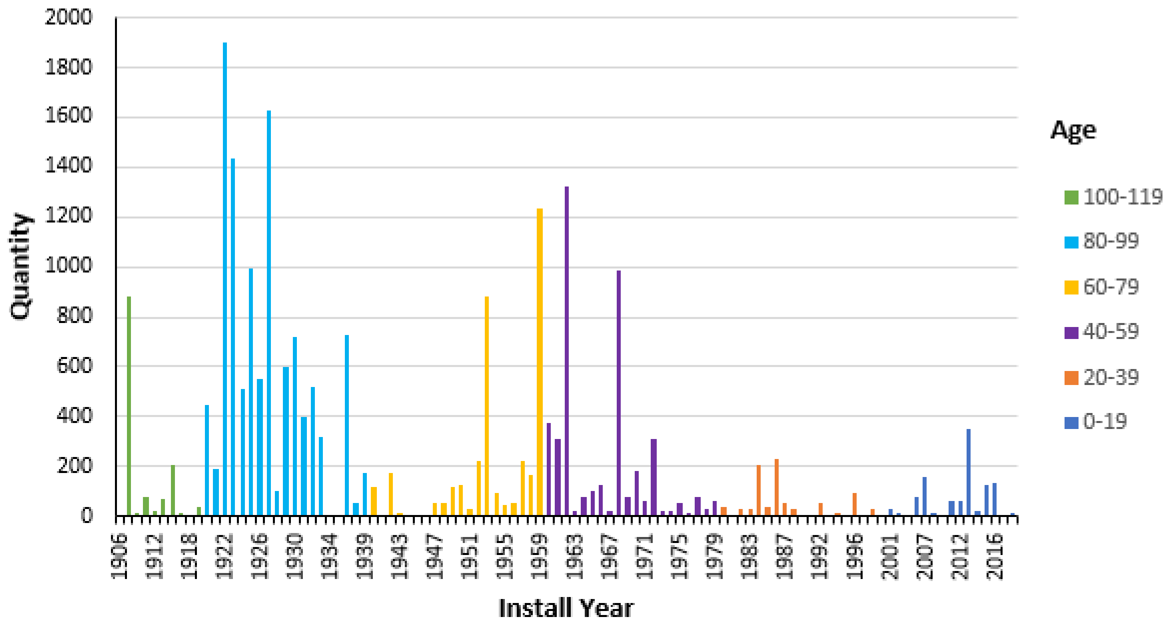
CIRCUIT_ID	Circuit Name	Voltage	Priority
T1090	Dunkirk – Falconer #161	115	Very High
T1100	Dunkirk – Falconer #162	115	Very High
T1260	Gardenville – Dunkirk #141	115	Very High
T1660	Niagara – Gardenville #180	115	Very High
T1890	Southeast Batavia – Golah #119	115	Very High
T1700	Niagara – Lockport #102	115	Very High
T1860	Pannell(Sta.122) –Geneva(Border City) #4	115	Very High
T2630	South Oswego – Nine Mile Pt.#1 #1	115	Very High
T1270	Gardenville – Dunkirk #142	115	Very High
T1450	Huntley – Lockport #37	115	Very High
T1690	Niagara-Lockport #101	115	Very High
T1700	Niagara-Lockport #102	115	Very High
T1160	Falconer – Homer Hill #153	115	Very High
T1230	Gardenville – Depew #54	115	Very High
T1500	Lockport – Batavia #108	115	Very High
T1510	Lockport – Batavia #112	115	Very High
T1810	Packard – Walck Road #129	115	Very High
T1550	Lockport – Mortimer #114	115	Very High
T5810	Ticonderoga-Republic #2	115	Very High
T5830	Ticonderoga-Whitehall #3	115	Very High
T1360	Homer Hill-West Olean	115	High
T3230	Malone – Lake Colby #5	115	High
T4030	Boonville-Porter #2	115	High
T1380	Huntley-Gardenville #38	115	High
T1390	Huntley-Gardenville #39	115	High
T2240	General Electric-Geres Lock #8	115	High
T1740	Niagara-Packard #192	115	High
T4300	Yahnundasis-Porter #3	115	High
T2660	Teall-Carr Street #6	115	High
T1080	Dunkirk – Falconer #160	115	High
T2120	Coffeen-Black River-Lighthouse Hill #5	115	High
T1570	Mortimer-Elbridge #2	115	High
T1340	Homer Hill-Bennett #157	115	High

*Inclusion in the table does not indicate a future project will be initiated. Final priority and project scopes will be determined based upon engineering field inspections and internal evaluations.

2. A. 2. 2. Steel Structures

The age distribution of the Company's steel transmission structures is given in Figure 2A-6, color-coded to show ages of steel structures in 20-year increments. The average age of these assets is 75 years old.

Figure 2A-6
NY Steel Structure Age Profile (69kV and above)



Field inspection data obtained during foot patrols for steel structures have been recorded in Computapole. Condition ratings for steel structures are categorized as follows:

1 - Serviceable
2 - Intact
3 - Light Corrosion
4 - Light Pitting
5 - Significant Pitting
6 - Very Severe Deterioration

Table 2A-7 provides a list of current visual grading levels for steel structures entered into Computapole over the latest three full calendar years' worth of data.

Table 2A-7
Steel Structure Visual Grades 69kV and above

Visual Grade	2016	2017	2018	Total	%
1	1,328	1,868	648	3,844	41.21%
2	401	1,436	813	2,650	28.41%
3	733	672	259	1,664	17.84%
4	213	476	469	1,158	12.41%
5	3	0	5	8	0.09%
6	3	1	0	4	0.04%
Total	2,681	4,453	2,194	9,328	100.00%

A priority code is also assigned with each visual grade when a steel structure is inspected. Towers in worse condition would be coded visual grades 5 or 6. Engineering personnel will evaluate Visual Grade 6 towers after they are identified. Transmission lines with significant levels of Visual Grade 4 and 5 are targeted for a more comprehensive engineering inspection and analysis. This type of evaluation frequently uses more thorough analysis considering overall structural integrity and identifies severe corrosion at key support points.

2. A. 2. 2. 1. Condition and Performance Issues

Steel tower failures are infrequent. However, over the last 5 years there have been three steel tower failures on the New York Transmission system attributable to condition, confirming the need to evaluate and manage this asset class:

- April 2018 – Structure number 289 failed on the South Oswego-Clay #4 115kV line. The structure that failed was a square based double circuit tower in part of the section of structures that were originally 69kV originating at Bennett's Bridge. On Structure number 289, only one side of the double circuit tower was energized. The steel tower was replaced with a wood structure. The Oswego-Clay #4 115kV line is currently under evaluation for a potential capital project.

- March 2017 – Following a windstorm with gusts exceeding 80 mph in western NY, structure number 146 on the Gardenville-Dunkirk 141 – 142 lines partially collapsed and was replaced with a wood pole structure.

2. A. 2. 2. 2. Remedial Actions Performed

Projects formerly identified as a result of the Steel Tower Strategy are being phased out. The more robust overhead line screening criteria described in Section 2.A.2.1.3, will be used to initially identify condition driven projects. This screening methodology accounts for the condition of steel towers based upon the 5-year foot patrol visual grading system. The following project C027432 in Table 2A-8 is the last project to be refurbished under the Steel Tower Strategy. C027432 will be re-inspected using the steel visual grading in the Overhead Line Refurbishment Program to confirm the need for refurbishment.

Table 2A-8
Remaining Steel Tower Strategy Driven Project

Project Number	Title	Voltage	Typical Installation Date
C027432	Mountain-Lockport 103/104 STR	115kV	1950s

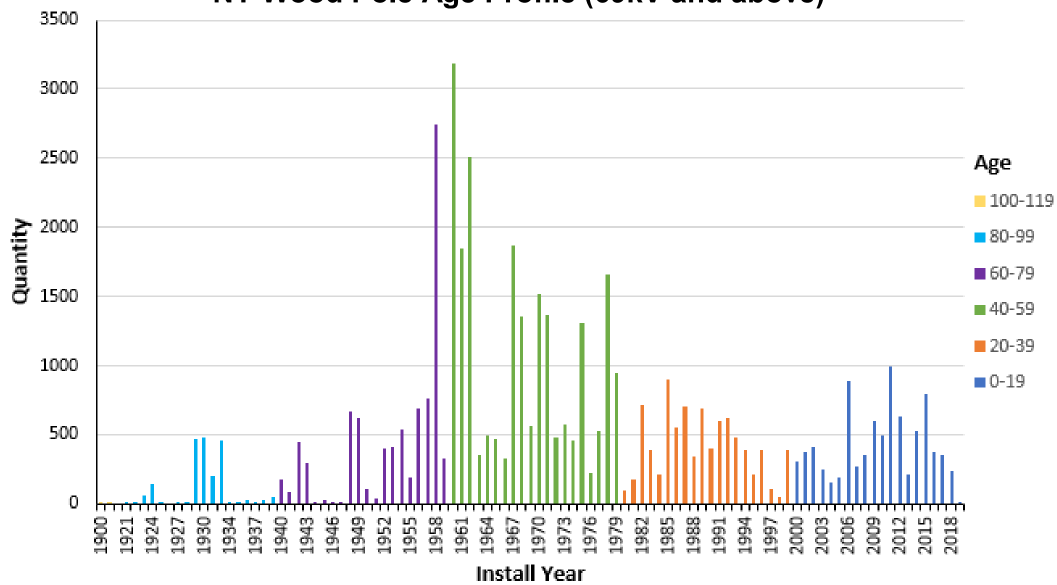
A steel tower painting program guides our approach toward the painting of steel structures to extend the service life of towers rated visual category 4 or better. The Company is working toward painting all of its 345kV and 230kV steel structures on a twenty-year cycle. For the 115kV circuits, painting priority is determined by applying visual rating codes.

In addition to the painting program, the Company performs a program of transmission footer inspections and repairs. This program systematically inspects foundations above and below grade and repairs damage primarily on a line-by-line basis.

2. A. 2. 3. Wood Poles

The age profile of the Company's wooden transmission poles is provided in Figure 2A-9. The average age of the Company's wooden transmission poles is 40 years.

Figure 2A-9
NY Wood Pole Age Profile (69kV and above)



2. A. 2. 3. 1. Condition and Performance Issues

National Grid inspects and treats the ground line of wood poles and structures on approximately a 10-year cycle. In addition, routine visual inspections of the entire structure are conducted once every five years. Wood poles and structures that do not meet the requirements of the NESC are classified as "rejects." Severely deteriorated wood poles and structures are classified as "priority rejects."

In general, reject poles and structures have two-thirds or less of their original design strength. Storm resiliency during severe weather events is the greatest concern for reject poles and structures. Failures can hamper service restoration efforts, increase outage durations and raise public safety concerns.

Priority reject poles and structures can potentially fail during "normal" weather conditions. For this type of reject pole, the residual strength may be below one-third of its original design strength and it is important to replace these poles and structures.

Consistent with the New York Public Service Commission Order issued on December 15, 2008, for Cases 04-M-0159 and 06-M-1467, priority reject poles are to be replaced within one (1) year of identification and reject poles within three (3) years of identification. If the construction crews, engineering, or the inspectors deem the situation poses a serious and immediate threat to the public or the delivery of power, the repair is done as soon as possible, but no longer than one week.

A continued growth in the population of woodpeckers is contributing to an increase in damage on wood poles. Wood pole and structure inspection criteria (per Strategy SG009, Version 2) were implemented at the end of 2007. As woodpecker damaged poles are identified, an appropriate priority code (i.e., maintenance code 526) and repair timeframe (generally within three years) is assigned. Progress is then tracked on an overall basis via Computapole monitoring.

Over the past three years National Grid has experienced several pole/brush fires on the wood 230kV and 345kV circuits. Investigations of the pole fires revealed that these fires occurred due to either missing down grounds or to lack of bonding between down grounds and the hardware.

Below is a brief summary of the two pole failures and three pole fires that have occurred over the last 3 years:

- July 2018 – a pole fire occurred on structure number 64 on the Lockport-Mortimer #111/#113 West Hamlin Tap 115kV line. An investigation found the fire may have been caused by a missing down ground.[4] Following the pole fire, the entire West Hamlin Tap was foot patrolled to document other poles missing down grounds.

- May 2018 – Structure number 330 on the Gardenville-Dunkirk #74 230kV line was involved in a pole fire. The cause was suspected to be lack of bonding between the down ground and the hardware.

- April 2018 – Structure number 51 on the Rotterdam-Eastover #38 230kV line was involved in a pole fire. An investigation determined the structure caught fire due to a lack of bonding between the down ground and the attachment hardware. The fire from structure number 51 also caught the Front Street – Rosa Road #11 115kV structure number 145 on fire. Both structures were replaced.

- April 2018 – The middle pole of a three-pole structure failed at the top of Structure number 254 on the Dunkirk-Falconer #160 115kV line. The line did not lockout. Winds the previous day were recorded to have gusts up to 23 mph.

- July 2016 – a pole failure on the Niagara-Lockport #101 - 102 115kV line was caused by a combination of wind gusts and effective pole strength. This failure led to additional loading on adjacent structures cascading to include six failures on the #102 line. The transverse structure failures of the #102 line fell into the #101 line, which runs parallel approximately 40 ft away, and caused six pole failures on the 101 line. Twelve poles in all failed in this event. Following this failure, National Grid re-evaluated the wood pole structures and reinforced each of them with Osmose ET-Trusses to increase their respective pole classes.

[4] Due to the number of bonding and grounded related pole fires over the past few years, National Grid has created a program to systematically add bonding to those 345kV and 230kV structures that lacked bonding.

Deteriorating wood cross arms are also being monitored. Below is a brief summary of the most recent wood cross-arm failures:

- April 2017 - the cross-arm on structure #45 on the 345kV Lafayette-Clarks Corners #4 line failed. Following the failure of this 1982 line, the entire circuit was aerially inspected. Other deteriorated cross arms and/or v-braces were identified and replaced. This circuit was younger than the circuits with the original failures. As a result, all wood H-frame 345kV structures are on the list of evaluation.

- May 2014 - structure #21 on the 345kV New Scotland-Alps #2 line failed. Structure #21 is a D-1501 similar to structure #156 that failed approximately 2 years prior. Both structure #21 and #156 are believed to have had the original laminated cross arms from the late 1960s.

National Grid collaborated with SUNY College of Environmental Science and Forestry on forensics of the failed D-1501 laminate cross-arm and v-brace from the New Scotland-Alps #2 345kV line as well as other samples taken from the line where it was determined that poor adhesion of the wood plies caused the failures. The Company expedited a project to replace these cross-arms at critical crossings on the #2 line, the Reynolds Road-Alps #1 345kV and the Alps-Berkshire #393 345kV lines. There are approximately 442 miles of lines across the transmission system with laminate cross-arms of that vintage and a replacement program has been developed.

2. A. 2. 3. 2. Remedial Actions Performed

A comprehensive wood pole management program and foot patrol inspections ensures “reject” poles, damaged poles, and rotting wood structures are replaced in a timely manner.

Table 2A-10 below lists foot patrol inspection results performed on wood poles over the last three calendar years. Inspectors assign priority level “Replace” codes for poles that appear broken, rotting or leaning on a scale of 1 – 3 with 1 being the highest replacement priority. They also assign priority level “Repair” codes for poles with lightning, insect, woodpecker or other damage on the same 1 - 3 scale. Poles that are in good overall condition are not assigned a priority level code.

Table 2A-10
Transmission Wood Pole Replace and Repair Codes from Computapole

Level	Replace Codes			Repair Codes		
	Number of Poles	Percent Codes vs. Inspections	Percent Completed	Number of Poles	Percent Codes vs. Inspections	Percent Completed
2016 Summary						
1	2	0.04%	100.00%	0	0.00%	N/A%
2	2	0.04%	50.00%	44	0.94%	81.81%
3	40	0.85%	45.00%	324	6.91%	29.32%
No Codes	4332	92.33%				
Total Poles Inspected	4692					
2017 Summary						
1	0	0.00%	N/A%	0	0.00%	N/A%
2	11	0.18%	9.09%	112	1.80%	67.85%
3	176	2.82%	1.70%	1107	17.75%	2.25%
No Codes	5083	81.48%				
Total Poles Inspected	6238					
2018 Summary						
1	0	0.00%	N/A%	0	0.00%	N/A%
2	0	0.00%	N/A%	41	1.14%	24.39%
3	64	1.78%	12.50%	407	11.33%	24.00%
No Codes	3136	87.33%				
Total Poles Inspected	3591					

To provide reliable service and improve storm resiliency, the Company manages its large stock of in-service wood poles through the Wood Pole Management Program. Prompt identification and remediation of “reject” poles is particularly important due the increasing average age profile of in-service wood poles (see Figure 2A-9).

The combination of the Company’s Wood Pole Management Program and the Overhead Line Refurbishment Program help identify and address deteriorating lines.

2. A. 2. 4. Foundations

Computapole field inspection data are gathered on both steel and concrete foundations. Condition ratings for steel foundation types are categorized by the following scale:

1. Serviceable
2. Intact
3. Light Corrosion
4. Light Pitting
5. Significant Pitting
6. Very Severe Deterioration

Concrete foundations are categorized by the following scale:

1. Serviceable
2. Light deterioration
3. Medium deterioration
4. Severe deterioration
5. Very severe deterioration

Tables 2A-11 and 2A-12 include the last three full calendar year inspection results for steel and concrete foundations, respectively, for structures that had foundation ratings.

Table 2A-11
Steel Foundation Inspection Results

Visual Grade	2016	2017	2018	Total	%
1	1,191	1,296	737	3,224	55.4%
2	477	1,035	363	1,875	32.2%
3	57	350	119	526	9.0%
4	17	43	104	164	2.8%
5	3	4	8	15	0.3%
6	1	4	9	14	0.2%
Total	1,746	2,732	1,340	5,818	100.0%

Table 2A-12
Concrete Foundation Inspection Results

Visual Grade	2016	2017	2018	Total	%
1	899	1,540	709	3,148	89.8%
2	26	157	114	297	8.5%
3	7	14	29	50	1.4%
4	3	5	2	10	0.3%
5	0	1	0	1	0.0%
6	0	0	0	0	0.0%
Total	935	1,717	854	3,506	100.0%

The results provided in Tables 2A-11 and 2A-12 from standard Computapole field inspections, which are above the ground line, may differ from those inspections performed by the footer inspection and maintenance program which inspect foundations below the ground line and repair those that are defective.

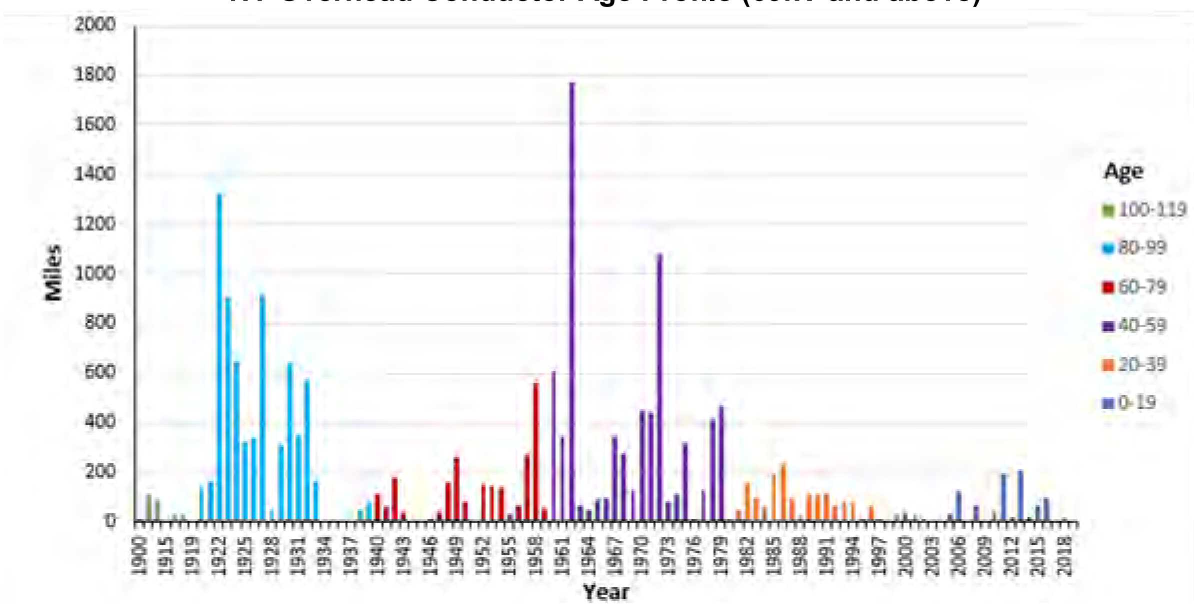
Steel grillage foundation usage started in the 1920s. This type of steel foundation comprises the majority of lattice structure foundation types.[5] However, approximately five to ten percent of the lattice towers that were constructed prior to the use of the steel grillage design use a battered type concrete foundation which has a limited amount of concrete exposed above the ground line. The remaining foundations (five to ten percent) are associated with steel poles and tend to be reinforced concrete.

2. A. 2. 5. Phase Conductor and Splices

There are 19,552 conductor miles across the service territory at voltage levels 69kV and greater.

Figure 2A-13 shows the age profile of overhead conductors in the service territory, color coded to show ages of conductor in 20-year increments. Many miles of conductors are over 70 years old (installed in 1948 or earlier) with the average age of transmission overhead conductor 65 years[6]. The 115kV network is by far the oldest, with the oldest circuits being over 100 years old.

Figure 2A-13
NY Overhead Conductor Age Profile (69kV and above)

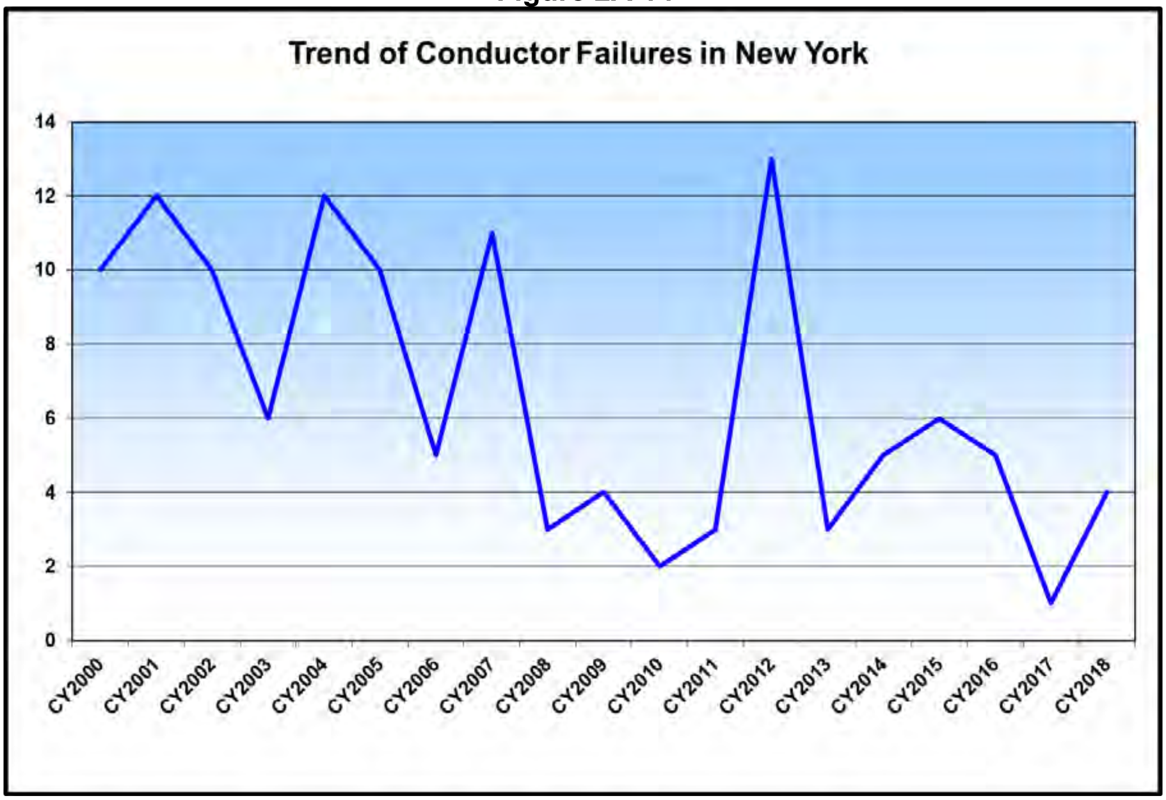


[5] Approximately 80 to 90 percent of steel structures in New York.
[6] This is for 345kV, 230kV,115kV and 69kV transmission lines altogether.

2. A. 2. 5. 1. Condition and Performance Issues

Conductor failures for 69kV and above from calendar year 2000 to 2018 (Figure 2A-14) show appreciable annual variability. Failures reflect a general downward trend since 2001, albeit with a spike in 2012.

Figure 2A-14



The total outage duration due to 69kV and above conductor failures shown in Figure 2A-15 shows a small increase in duration from 2011 to 2018, but still an overall continued downward trend in customer interruptions since 2004.

Figure 2A-15

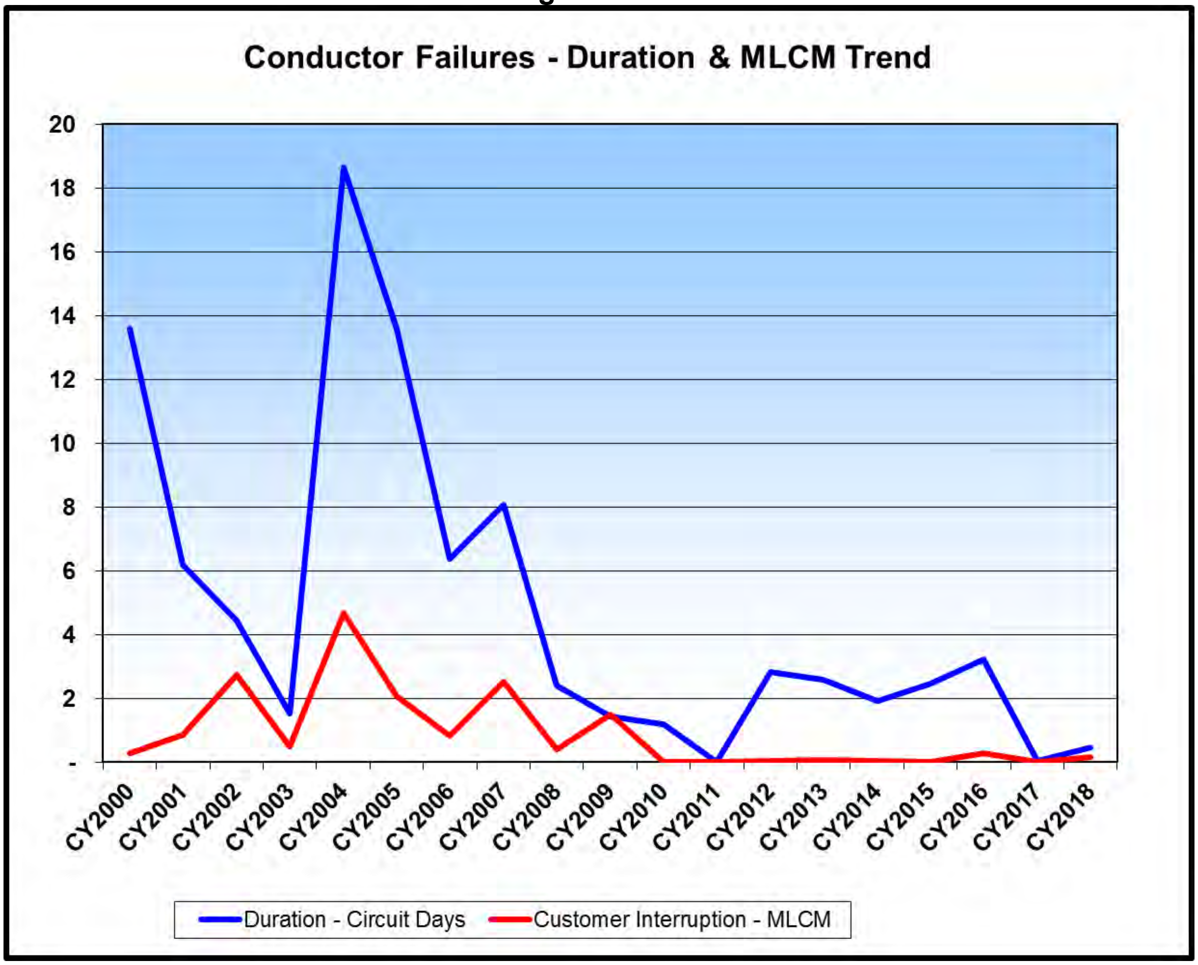


Table 2A-16 lists those circuits 69kV and above with two or more phase conductor failures between 2012 and 2017, an indication that conductor condition may be a concern on these lines.

Table 2A-16
Lines with Multiple Phase Conductor Failures from 2013 to 2018

Circuit ID	Circuit Name	kV	Failures
T1690	Niagara-Lockport #101	115	2
T1860	Pannell (Sta. 122) – Geneva (Border City) #4	115	2

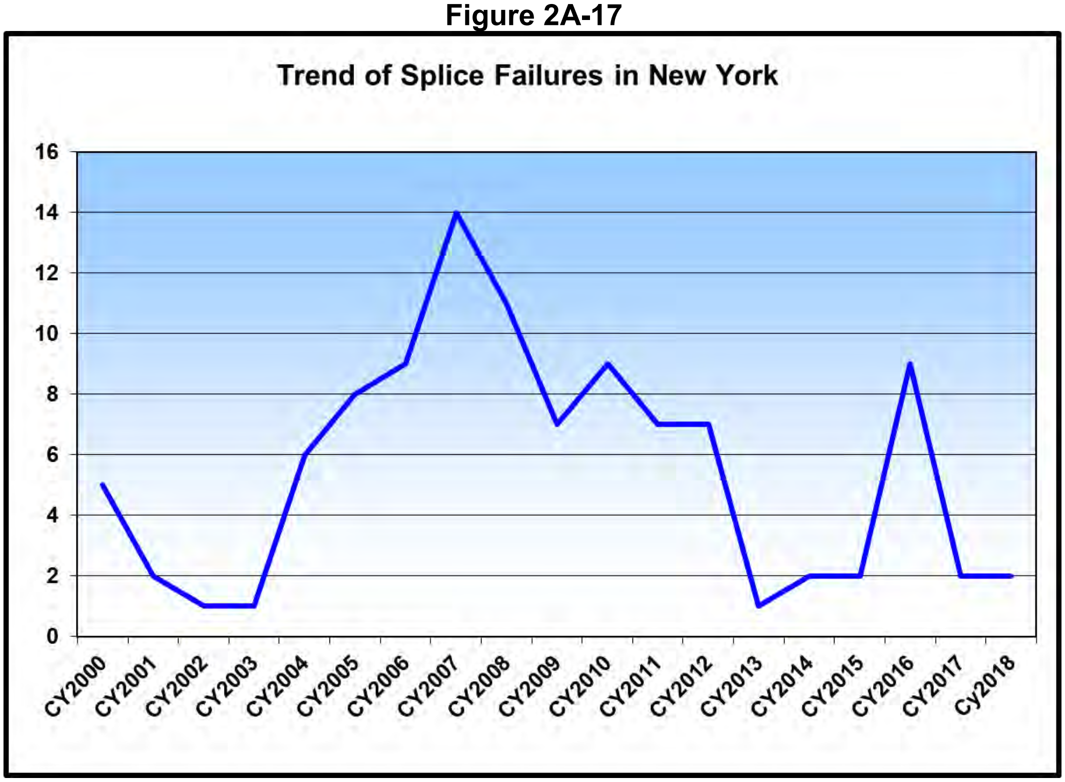
The Pannell-Geneva 4 has a project in conceptual engineering which is considering options for replacing the deteriorated 336.4 kcm ACSR "Oriole" conductor which is among the oldest ACSR on the transmission system. The steel strands showed excessive corrosion with the protective Zinc coating almost completely worn away. An asset condition refurbishment project on the Niagara-Lockport #101 and #102 lines has currently been initiated.

There are three general types of conductor splices used in the NY transmission system for ACSR (Aluminum Conductor Steel Reinforced), AAC (All Aluminum Conductor), and copper conductor. Over time, expansion and contraction of a splice due to heating and cooling eventually allows for the penetration of oxygen and water. Once water and oxygen are present within the splice, the electrical interface between splice and conductor begins to break down increasing the resistance of the electrical interface. As electrical resistance increases so does the splice temperature. Eventually, the temperature of the splice will begin to rise and lead to failure if undetected. Elevated line operating temperatures and quality of splice installation are also factors that affect splice service life.

The Company has worked to better understand the cause of splice failures. Infrared inspections continue to be conducted every one to three years, depending upon voltage. Aerial infrared patrols are conducted annually in an effort to prevent splice failures. Aerial visual patrols are also done to identify potential conductor, splice, and shield wire concerns.

Figure 2A-17 below shows that splice failures on transmission lines 69kV and above spiked upward from 2015 to 2017. This increase is due to eight (8) splice failures, of which four (4) were on the Huntley-Lockport 37 115kV line at the leading edge of splices on the 556.5 AAC portion of the line. An overhead line refurbishment project for the lines is now in construction which includes reconductoring the six mile 556.5 AAC section of the lines to remove all the remaining splices.

Figure 2A-17



2. A. 2. 5. 2. Conductor Clearance Program

The Transmission Conductor Clearance Program is an approximate eight-year program to address clearance issues on the 115kV, 230kV, and 345kV system. The Company utilizes Aerial Laser Survey (ALS) information to identify potential clearance issues which then must be confirmed in the field by engineering personnel. Corrective actions include re-rating individual lines, structure modifications or replacement, temporary measures (such as restrictive fencing), or the relocation of conflicting structures below an affected transmission line.

In 1914, the NESC established criteria for the minimum distance required between electrical conductors and the ground (conductor phase-to-ground clearance) as well as a number of other parameters. Since the NESC design criteria typically undergoes revision and updates once every four years, each line constructed by National Grid meets different versions of the NESC. The applicable code at the time of construction is considered the 'governing code' for the design criteria. The 2017 NESC is the current governing code for new transmission lines located in New York.

The primary driver of the Conductor Clearance Program is safety. It outlines a systematic approach for mitigating the confirmed substandard transmission spans to the governing code which may create a potential safety issue to the public and Company's employees.

2. A. 2. 6. Insulators and Fittings

This asset group includes glass, porcelain and polymer insulators. Some insulators are more prone to failure due to moisture ingress as a result of design and manufacturing defects, most notably Lapp Polypace polymer insulators. Moisture penetration through the insulator's sheath to the fiberglass core can cause the insulator to fail. This failure can be through brittle fracture, a mechanical failure of the fiberglass, or flash-under, an electrical failure mode caused by tracking along or through the fiberglass rod. Catastrophic brittle fracture failures typically result in the conductor dropping from the structure.

Porcelain insulators are widely used on the transmission system. When refurbishments are conducted on transmission lines, existing insulators and fittings are frequently replaced with new ones. Replacement may be needed for many reasons:

- Older lines frequently have shield wire configurations that provide limited lightning protection resulting in repeated lightning strikes over time. This causes a breakdown of the ceramic glazing which reduces the electrical and structural characteristics of the insulator. Insulators damaged in this way are prone to tracking and flashovers.
- Avian use of the transmission lines for perching contributes to insulator contamination; the corrosive nature of the avian waste wears away at the glazing after extended exposure. In addition, the contaminants themselves are easily ionized and cause tracking and flashovers. Repeated tracking and flashovers burn off the insulator's ceramic glazing, reducing both the electrical and structural properties of the insulator.
- In rural areas, insulator strings are sometimes used for "target" practice by hunters.
- Continued exposure to the elements and severe weather wear away at the insulator glazing. Eventually the ceramic glazing wears off reducing both the electrical and structural properties of the insulator.

- Though not a prominent issue, conductor galloping can cause structural damage to an insulator string when insulators strike other objects.

2. A. 2. 6. 1. Remedial Action Planned

Insulators and fittings are examined to determine if replacement is needed during the field engineering walk-down which is performed prior to line refurbishment projects. Depending upon condition, insulators and/or fittings may be replaced on a targeted or complete line basis. Damaged insulators observed during comprehensive helicopter inspections are identified for replacement as part of planned refurbishment projects or as routine maintenance through the I&M program.

2. A. 2. 7. Retired and De-energized Overhead Lines

The Company has developed a strategy (USSC-12-048) and a prioritization method to address lines that are permanently de-energized. The prioritization includes an assessment of some initial circuits and a methodology for continuing with future assessments. Table 2A-18 lists the current set of prioritized de-energized line projects:

Table 2A-18
Active List of Prioritized Transmission De-Energized Line Projects

Region	Line	Length (mi)	Voltage (kV)
Northeast	Ticonderoga-Sanford Lake 4	22.2	115
Northern	Newstech Tap on Black River-Taylorville #2	3.8	115
Mohawk Valley	Utica Converters Tap 6 off Porter –Terminal #6 115 kV	1.75	115

2. A. 3. Underground Cables and Related Equipment

2. A. 3. 1. Cables

National Grid's underground transmission cable network is comprised of high pressure fluid filled (HPFF) pipe-type cable operating at 115kV, 230kV, and 345kV, and solid dielectric cable systems operating at 115kV. National Grid has 53.3 miles of underground transmission cable in service, approximately 80 percent of which are high-pressure fluid filled pipe-type, as shown in Table 2A-19. The installation year, by voltage and mileage, is shown in Figure 2A-20. An age distribution by number of circuits is shown in Table 2A-21.

Table 2A-19
Underground Cable Miles by Voltage

	115kV	230kV	345kV	Total
HPFF Pipe Type	22.1	20.2	0.7	43.0
Solid Dielectric	10.2	0	0	10.2
Total	**32.4**	**20.2**	**0.7**	**53.2**

Figure 2A-20
Underground Cable Age Profile

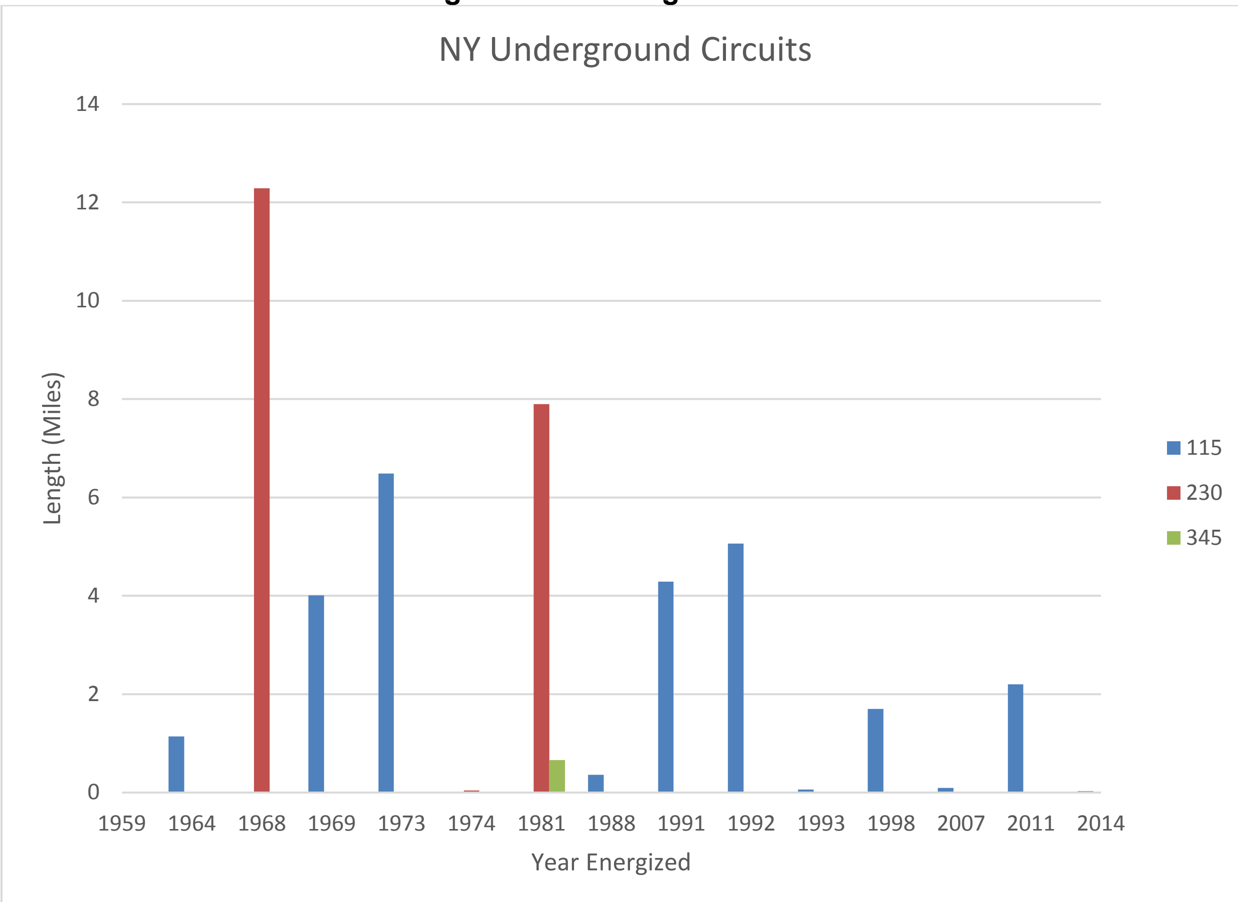


Table 2A-21
Asset/Age Profile Underground Cables (Circuits)

Asset/Age Profile (Years)	0-9	10-19	20-29	30-39	40-49	50-59	60+	Total	Ave Age
Number of Circuits	3	2	9	5	5	9	2	35	36.5
Circuit miles	2.23	0.09	11.1	8.9	6.53	17.4	6.9	53.16	56.5

2. A. 3. 1. 1. Condition and Performance Issues

Pipe Type Cables:

High Pressure Fluid Filled (HPFF) pipe type cables consist of paper insulated conductors installed within a steel pipe. The pipe is filled with a dielectric fluid, which is maintained at a nominal pressure of 200 psi. Pressure is maintained on pipe type cables by means of “pressurizing plants” which contain pumps, pressure control valves, a fluid reservoir, and controls and alarms. The steel pipes and fluid reservoirs on a pipe type cable system contain relatively large volumes of dielectric fluid. There are potential environmental risks associated with release of dielectric fluid

from these types of cables. While the likelihood of fluid leaks is rare, the consequential release volumes can be significant.
There are two major systems to be monitored on pipe type cable for both environmental integrity of the pipe system and to maintain reliable performance of the cables. They are the cathodic protection systems and the fluid pressurizing plants. The cathodic protection system protects the buried steel pipes from corrosion. Routine inspections are performed on the cathodic protection systems including annual surveys to determine that adequate protection exists along the cable routes. Bi-monthly visual and operational (V&O) inspections are also performed on the pressurizing plants.

A pressurizing plant condition assessment is on-going. This condition assessment is being undertaken by a combination of in-house personnel and external vendors and will form the basis of any future remedial work. Many of the current projects are a result of conditions identified during these assessments.

Table 2A-22 lists the locations of the pressurizing plants, cables served, manufacturer, and reservoir size.

Table 2A-22
Pipe Type Cables – Pressurizing Plants, Gas Cabinets, Crossover Assemblies

Station	City	Cables Served	Manufacturer	Reservoir Size (Gal)
Huntley Station	Tonawanda	Huntley-Elm #70	Jerome	15,000
Elm St	Buffalo	Elm-Seneca #71 Elm-Seneca #72 Elm St Bus Tie	Jerome	5,500
Seneca	Buffalo	Elm-Seneca #71 Elm-Seneca #72 Seneca-Gardenville #71 Seneca-Gardenville #72	Jerome	NA - Crossover Cabinet
Gardenville	W. Seneca	Seneca-Gardenville #71 Seneca-Gardenville #72	Jerome	5,500
Rochester Airport -East Portal	Rochester	Rochester #111 Rochester #113 Rochester #114	Jerome	3,500
E. Conklin	Onondaga	Conklin-Bailey #17A Conklin-Bailey #17B 10” Circulation Pipe	Salter	2,500
Teall Ave	Syracuse	Ash-Teall #7 Ash-Teall #8	Jerome	4,000
Temple St	Syracuse	Ash-Temple #9 Temple-Peat #10	Jerome	4,000
Oswego Steam	Oswego	Oswego-S Oswego #3 Oswego-S Oswego #5	Pikwit	4,000

Station	City	Cables Served	Manufacturer	Reservoir Size (Gal)
Trinity	Albany	Trinity-Albany Steam #5 Trinity-Albany Steam #9 Riverside-Trinity #18 Riverside-Trinity #19	Pikwit	8,000

The majority of the cable pressurizing plant equipment is of similar vintage to the high pressure fluid filled pipe-type cables on which they are installed. Cable pressurizing plants are electro-mechanical systems. As these systems get older, some age related problems are anticipated on both electrical and mechanical components. Some of these issues can be addressed by targeted component replacements, while others may require replacement of the entire pressurizing systems. Specific concerns are discussed in the "Remedial Actions Performed" portion of this chapter.

Another critical component of any pipe type cable is the cathodic protection system. The cathodic protection system provides protection against corrosion of the steel pipe. Pipe corrosion can result in fluid leakage and potentially lead to electrical failure. There are two primary types of cathodic protection systems installed on the National Grid pipe type cables. These include the older "Rectifier and Polarizing Resistor" systems, and the more modern "Rectifier and Polarization Cell" systems. The polarization cell is a battery-like device that is used to ground the cable pipe and to allow for a DC voltage to be impressed on the pipe. The polarization cell contains a liquid electrolyte (typically potassium hydroxide). A replacement for the polarization cell that doesn't require use of caustic chemicals has been developed in recent years. This is referred to as a "Solid State Isolator" (SSI). National Grid has been replacing polarization cells with solid state isolators as deterioration of cells has been identified, or as part of specific cathodic protection system upgrades. Table 2A-23 provides a list of the type of cathodic protection systems installed on each of the high pressure fluid filled pipe type cable systems.

As a result of ongoing maintenance and inspection programs, National Grid has identified some condition issues with certain cathodic protection systems. Specific concerns are discussed in the "Remedial Actions Performed" portion of this chapter.

Table 2A-23
Cathodic Protection System Summary

Cable	Location	Rectifier and Polarizing Resistor	Rectifier and Polarization Cell	Rectifier & Solid State Isolator (SSI)	Notes
Huntley-Elm #70	West			X	
Elm St Bus Tie	West			X	
Elm-Seneca #71 Elm-Seneca #72	West West			X X	

Cable	Location	Rectifier and Polarizing Resistor	Rectifier and Polarization Cell	Rectifier & Solid State Isolator (SSI)	Notes
Seneca-Gardenville #71 Seneca-Gardenville #72	West West			X X	
Rochester #111 Rochester #113 Rochester #114	West West West			X X X	
Conklin-Bailey #17A Conklin-Bailey #17B	Central Central		X X		To be converted to SSI
Ash-Teall #7 Ash-Teall #8	Central Central	X X			To be converted to SSI
Ash-Temple #9	Central	X			To be converted to SSI
Temple – Peat #10	Central	X			To be converted to SSI
Oswego-S Oswego #3 Oswego-S Oswego #5	Central Central	X X			To be converted to SSI
Trinity-Albany Steam #5 Trinity-Albany Steam #9	East East			X X	
Riverside-Trinity #18 Riverside-Trinity #19	East East			X X	

Solid Dielectric Transmission Cables

Solid dielectric transmission cables were installed beginning in the late 1980s. The solid dielectric cables represent a relatively low mile weighted average age profile. National Grid inspects transmission cable terminations and above ground cable equipment as part of the Substation V&O inspections. A small population of transmission cable terminations has been identified recently with cracks and/or fluid leaks. National Grid has replaced damaged terminations, and has increased sensitivity to a potential issue with transmission terminations as part of the V&O inspection process. Manhole inspections are also performed periodically. At this time, with the exception of a limited number of cable termination troubles, the installed solid dielectric transmission cables do not appear to have major condition issues.

2. A. 3. 1. 1. 1 Underground Asset Priority List

A risk-based review of all the New York underground assets was conducted and a priority list to address the risk was created. Different criteria were considered to create that list. Criticality of the line from planning and switching perspective, age deterioration, technology obsolescence and history of the cable were some of the criteria that produced table 2A-24 to address them in our future business plans.

. Table 2A-24 shows our cable system and its ranking in our New York service territory.

Table 2A-24
NY Cables Ranking

Rank	kV	Designation	Miles	Type	Installation
1	115	Rochester Airport #111	0.38	HPFF	10" Steel Pipe
2	115	Rochester Airport #113	0.38	HPFF	10" Steel Pipe
3	115	Rochester Airport #114	0.38	HPFF	10" Steel Pipe
4	345	Conklin-Bailey #17 (North)	0.33	HPFF	10" Steel Pipe
5	345	Conklin-Bailey #17 (South)	0.33	HPFF	10" Steel Pipe
6	230	Elm Street Bus Tie	0.04	HPFF	8" Steel Pipe
7	230	Elm-Seneca #71	3.16	HPFF	8" Steel Pipe
8	230	Elm-Seneca #72	3.03	HPFF	8" Steel Pipe
9	230	Huntley-Elm #70	7.9	HPFF	8" Steel Pipe
10	230	Seneca-Gardenville #71	3	HPFF	8" Steel Pipe
11	230	Seneca-Gardenville #72	3.1	HPFF	8" Steel Pipe
12	115	Ash-Teall #7	3.45	HPFF	6" Steel Pipe
13	115	Ash-Teall #8	3.44	HPFF	6" Steel Pipe
14	115	Ash-Temple #9	1.52	HPFF	6" Steel Pipe
15	115	Oswego-S Oswego #3	1.45	HPFF	8" Steel Pipe
16	115	Oswego-S Oswego #5	1.45	HPFF	8" Steel Pipe
17	115	Riverside-Trinity #18	2.02	HPFF	6" Steel Pipe
18	115	Riverside-Trinity #19	2.02	HPFF	6" Steel Pipe
19	115	Temple-Peat #10	2.49	HPFF	6" Steel Pipe
20	115	Trinity-Albany Steam #5	1.57	HPFF	6" Steel Pipe
21	115	Trinity-Albany Steam #9	1.57	HPFF	6" Steel Pipe

22	115	Amherst #36	2.3	Solid	Duct/MH
23	115	Amherst #36	0.047	Solid	4-6" PVC D/L
24	115	Amherst #37	2.3	Solid	Duct/MH
25	115	Amherst #37	0.047	Solid	4-6" PVC D/L
26	115	Dunkirk Cap Bank #1	0.03	Solid	Ductline
27	115	Rotterdam - Luther Forest #2	1.1	Solid	9-6" PVC D/L
28	115	Spier Falls-Luther Forest #302	1.1	Solid	9-6" PVC D/L
29	115	State Campus-Menands #15	0.23	Solid	8" Steel Pipe
30	115	State Campus-Woodlawn #12	0.23	Solid	8" Steel Pipe
31	115	Ash Street #16 XFMR Lead	0.06	Solid	Ductline
32	115	Huntley-Can Niagara Pwr Stn #46	1.7	Solid	10" PE Pipe
33	115	N Creek-Warrensburg #5	0.17	Solid	Ductline
34	115	N Creek-Warrensburg #5	0.19	Solid	Ductline
35	115	Temple-Gas Orange #11	0.7	Solid	Duct/MH

2. A. 3. 1. 2. Remedial Actions Performed

2. A. 3. 1. 2. 1. Pipe Type Cables

In prior years, concerns were expressed regarding the pump and auxiliary equipment preventative maintenance program. Electric Operating Procedure (EOP) T009 was developed to formalize the maintenance requirements of the cable systems. The requirements of this EOP are incorporated into the Substation & Maintenance CASCADE system for implementation and tracking.

In the 2008 and 2009 Asset Condition reports, the Company identified a pressurizing plant at the Rochester Airport as being in a deteriorated condition and presenting a possible reliability risk. To address immediate issues, maintenance and replacement of failed components was performed in 2009. Conceptual engineering has been completed for the design of a replacement pressurizing skid within the existing pressurizing plant. However, an alternative solution to replace the pipe type cables with a solid dielectric cable system was selected to address the asset condition, thereby eliminating the cable pressurizing plant all together.

Conceptual engineering for a project to add a pressurizing plant to the Trinity-Albany Steam #5 & #9 as well as Trinity-Riverside #18 & #19 circuits has also been completed. When implemented, adding a pressurizing plant at Riverside substation will reduce a “common-mode failure” reliability issue with these circuits.

The results of the pressurizing plant condition assessments will be used to prioritize future repairs and/or replacements.

A similar conceptual engineering project for Rochester Airport transmission lines (#111, #113, #114) is also under development. The report will consider another alternative which is to retrofit the lines with solid dielectric cables. The cost benefit and risk analysis of this option will determine the feasibility of the project. Retrofitting the lines with solid dielectric cables successfully will help National Grid plan the replacement of the rest of the pipe-type assets to optimize reliability and cost impacts on its customers. This project is driven by multiple factors as follows:

- The asset condition which includes a 2004 pipe leak and recent termination failure.
- The circuits were installed when pipe-type cable installation was prevalent in the 1960's; however, pipe-type cable systems are maintenance intensive and are being replaced by solid dielectric cables.
- Pipe-type cable manufacturers and support are dwindling due to lack of business. Okonite is the only North American manufacturer left in the business.

Of the circuits in Table 2A-21, twenty-one (21) circuits between 27 to 59 years old are pipe-type cables. This accounts for a total of forty-three (43) circuit miles which pose the same risk of lack of support in the future. The rule of thumb for a pipe life-cycle is 25 years after which the pipe may experience failures due to pit-holes. A thorough pipe integrity assessment, if possible, could help prevent such failures and predict the life-cycle.

As the costs of cable projects are estimated to be between $10M to $20M per circuit mile depending on the condition, careful planning will be required to balance potential significant funding requirements against risk.

With regard to cathodic protection systems, upgrades and repairs such as replacing the polarization cells with solid state isolators have been on-going. The type of cathodic protection system identified as "rectifier and polarizing resistor", while still functional, is considered obsolete. National Grid plans to convert these systems to "Rectifier and Solid State Isolator" systems over time.

2. A. 3. 1. 2. 2. Solid Dielectric Transmission

National Grid has a population of approximately 120 terminations of this type installed at 115kV. The Company is monitoring this population of transmission terminations as part of the V&O substation inspection process to determine whether there is a larger concern with this type of cable termination. In 2015, three of these terminations were found to be leaking on the two underground dips associated with the North Creek to Warrensburg #5 115 kV line. Two leaking terminations were at the Carboy transition structure (at the Hudson River Crossing), and one was at the Bennett transition station (at the Schroon River Crossing). All four terminations at the Carboy transition station and the remaining two terminations at the Bennett transition station were replaced in FY2016. The eight remaining termination are planned to be replaced in the spring of 2020.

Link Boxes and Sheath Voltage Limiters (SVLs)

For circuits contained within the substation fence, link-boxes are inspected as a part of substation V&O. For circuits with manholes outside of a substation, routine maintenance is completed as part of manhole inspections. National Grid's safety policy does not allow entering a manhole with energized cables. Therefore, manhole entry requires an outage. An Electric Operation Procedure (EOP) is under development to address the inspection and maintenance in solid dielectric manholes.

The purpose of a Sheath Voltage Limiter (SVLs) is to limit the voltage rise on a cable sheath and its bonding lead that could occur during switching transients, lightning surges and cable termination flashovers. There is currently no maintenance or testing of sheath voltage limiters. Consequently, there is no condition information available and no known on-going problems associated with SVLs. A link box inspection cycle will be established as part of the EOP.

2. A. 3. 1. 2. 3 Spare Equipment:

A review of the status of the existing spare material is ongoing, to determine if there is adequate spare inventory given the volume of in-service equipment and current quantity and condition of spare material. It is anticipated that some material like cable, splices, & terminations will need to be ordered to ensure timely repairs from cable failure events. Storage considerations of these spares need to be evaluated. Here are the steps needed for spare material storage:

1. Determine quantities, locations, and condition of existing spare material;
2. Compare that to the determined need quantity;
3. Get funding and purchase identified shortfalls;
4. Assess storage locations, and if storage conditions are causing deterioration, evaluate and obtain improved storage conditions.

Solving storage issues could take several forms - Moving outdoor stored materials indoors into existing or new shelters, transferring material to central stockroom locations, adding improved shelving to existing locations, re-crating broken or disturbed boxes, etc. This would have to be done on a case by case basis and in conjunction with the materials management group and substations group since sometimes substation buildings are used.

2. A. 4. Right of Way Vegetation Management

National Grid's Vegetation Management Strategy (VMS), or Program, seeks to minimize interruptions due to vegetation contact. Other objectives of the VMS include providing a clear and safe work space and access for maintenance and inspection activities.

National Grid's strategic approach to vegetation management within the ROW is to establish and maintain ROWs that are largely clear of all capable vegetation while maintaining a stable low-growing plant community that is beneficial to wildlife. National Grid's strategic approach to managing vegetation adjacent to the ROW is to prune and/or remove danger trees and/or hazard trees where property rights allow vegetation management work.

Vegetation management work on transmission and sub-transmission rights-of-way currently is organized into two programs:

Right-of-Way Floor Program – management of vegetation within the right-of-way corridor, and;
Off Right-of-Way Danger Tree Program – management of vegetation adjacent to the right-of-way corridor also referred to as the utility forest.

2. A. 4. 1. Floor Program

To achieve its vegetation management objectives, National Grid utilizes an Integrated Vegetation Management (IVM) approach which emphasizes selective herbicide use to control incompatible vegetation. IVM integrates the use of various vegetation management methods on both the right-of-way floor and the adjacent utility forest targeting tall growing, undesirable vegetation. The vegetation management methods include the use of herbicide, supplied as a cut stump basal bark; dormant stem treatment application or foliar application as well as non-herbicide methods; hand cutting; mowing; selective mowing; and selective pruning. IVM is a system of controlling tall growing vegetation in which species are identified, action thresholds considered, possible control options evaluated, and then selective, physical, biological and chemical controls are considered and employed.

The success of IVM on Company ROWs can be directly attributed to the adoption of a long-range management plan. Long range plans are designed to improve reliability through a balanced ecosystem approach by fostering a mix of low-growing, compatible vegetation, the use of site-specific prescriptive application methods, and the adherence to sound cyclical programming guidelines. Cyclical programming includes addressing maintenance of each ROW regularly. Cycle lengths for the right-of-way floor program range between four to eight years.

2. A. 4. 2. Danger Tree Program

The utility forest contains vegetation adjacent to the ROW floor where trees tall enough and close enough to electric conductors are capable of growing or falling into the conductors or structures. These trees are classified as danger trees and hazard trees. A danger tree is any tree on or off the right-of-way that, if it fell, could contact electric lines. A hazard tree is a danger tree which due to species and/or structural defect is likely to fall into the electric facility. National Grid prunes or removes danger trees and hazard trees to reduce the risk of off right-of-way tree-caused interruptions. Trees are pruned to achieve At Time of Vegetation Management (ATVM) clearance distance from vegetation, measured as a radius around the conductor. Danger tree cycles for transmission and sub-transmission line rights-of-way range from four to twelve years. The danger tree work is prioritized and scheduled based on interruption history, line prioritization, tree risk factor computed using tree height, conductor height and distance to line, and danger tree maintenance cycles. For sub-transmission, the Company's goal is to bring the cycle to six years. As previously reported, experience shows an upward trend in sub-transmission tree contacts.

The forest condition continues to be impacted by the Emerald Ash Borer (EAB). The Company has started the mitigation plan to address the risk presented by the EAB infestation. Transmission assets have been prioritized based on the aforementioned variables as well as; duration of known infestation in the region, location of asset in the vegetation management cycle, and known forest edge condition. For more information about the EAB mitigation process, see the Distribution Vegetation Management section 2.C.2

2. A. 4. 3. Patrols

The Company conducts a variety of patrols throughout the year to identify hazardous conditions that can compromise reliability of the electric system. National Grid Transmission Forestry personnel conduct one foot-patrol and one aerial patrol each year on all 230kV and 345kV ROWs. Beginning in 2016 certain 115kV circuits were also included in this patrol frequency due to changes in the NERC FAC 003-4 Standard. Otherwise, the Company conducts aerial patrols on

69kV ROWs once every two years (generally one-half of the circuits are patrolled annually). In addition, Operations personnel carry out periodic ground patrols and annual aerial patrols of all 115kV and higher circuits, which include identification of vegetation conditions.

2. A. 5. Substations

This section addresses the key elements of transmission substations including the inventory, condition and performance issues as well as other information for circuit breakers, disconnect switches, transformers, other equipment and substation rebuilds.

2. A. 5. 1. Substation Equipment Assessments and Asset Condition Codes

A common substation condition assessment approach has been initiated across all Transmission and Distribution substations. This includes, on a targeted basis, a visit to select substations by subject matter experts (SMEs) in the Substation O&M Services department to review the condition of the assets. The result is a report which gives each asset a condition code of 1 through 4, with 1 being acceptable and becoming less acceptable the higher the number, based on manufacturer family, condition, age and other relevant data (Table 2A-25) below.

Table 2A-25
Substation Condition Codes

Code	Classification/Condition	Implication
1 Proactive (Low)	Asset expected to operate as designed for more than 10 years	Appropriate maintenance performed; regular inspections performed
2 Proactive (Medium)	Some asset deterioration or known type/design issues Obsolescence of equipment such that spares/replacement parts are not available System may require a different capability at asset location	Asset likely to be replaced or re-furbished in 5-10 years; increased resources may be required to maintain/operate assets
3 Proactive (High)	Asset condition is such that there is an increased risk of failure Test and assessment identifies definite deterioration which is on going	Asset likely to be replaced or refurbished in less than 5 years; increased resources may be required to maintain/operate assets
4 Reactive (Very High)	Asset has sudden and unexpected change in condition such that it is of immediate concern; this may be detected through routine diagnostics, including inspections, annual testing, maintenance or following an event	Testing and assessment required to determine whether the asset may be returned to service or may be allowed to continue in service. Following Engineering analysis the asset will be either recoded to 1--3 or removed from the system

Manufacturer family evaluations, which would apply to GE type FK breakers, are composed of historical "family" performance and engineering judgment and experience. The condition code can be further refined by the site condition assessment described previously on the specific assets and local operations personnel input as to performance and maintenance history.

Aligned with the condition code is an impact code, higher numbers indicate higher impact as a result of failure, which combines with the condition code to provide a risk based framework for asset prioritization. As National Grid develops this approach, asset replacement and maintenance will be ranked based on condition, but prioritized based on risk.

In subsequent sections of this report, condition codes are used to summarize the status of the asset type population.

2. A. 5. 2. Circuit Breakers

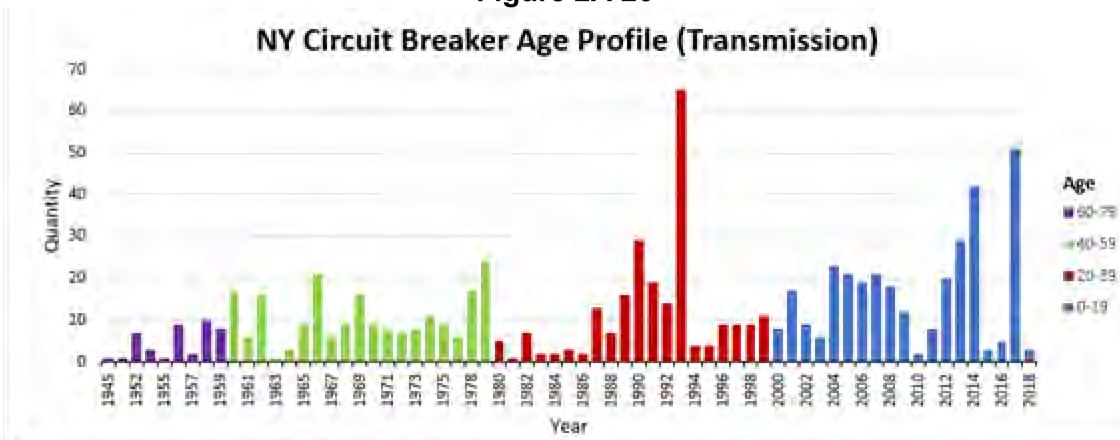
There are 793 circuit breakers located in transmission substations. The types of circuit breakers used in the service territory are categorized as gas and oil. The majority of circuit breakers in the service territory are 115kV. The following provides a brief summary of each type.

- Gas Circuit Breakers (GCB) – There are 516 (65%) newer technology GCBs. The population of GCBs are in good condition, with the exception of the earliest vintage (1979).

- Oil Circuit Breakers (OCB) – There are 277 (35%) older technology OCBs.[7] The average age of OCBs is 49 years. Approximately five percent are greater than 60 years old. These circuit breakers are located at the Inghams, Tilden, and Homer Hill substations. Projects to replace the OCBs at these three stations are in progress.

An age profile is provided in Figure 2A-26.

Figure 2A-26



[7] Ninety percent are 115kV, nine percent are 230kV and one percent are 345kV.

Table 2A-27
Circuit Breaker Age Profile

Asset/ Age (Years)	0-19	20-39	40-59	60-79	Total
All Circuit Breakers Within Respective Year Ranges	317	231	203	42	793

Predicted asset life of an OCB is 45 years with the earliest onset of poor performance predicted by age 40. There is evidence of deterioration through known failure mechanisms and in some cases circuit breakers are being kept in service using serviceable parts from retired equipment. This approach is not considered sustainable.

Due to the key function of interrupting faults carried out by circuit breakers, these assets cannot be allowed to become less reliable. As such, all circuit breakers should be replaced before they fail to operate as designed. Different deterioration modes and life limiting processes become known as switching devices age. Deterioration modes and factors that contribute to the end of life for OCBs include loss of elasticity of gaskets, allowing water ingress or oil leakage; frost jacking of porcelain to metal joints; excessive wear of moving parts; corrosion; etc. The anticipated asset life of OCBs is considered to have been reached when the cumulative effects of the life limiting factors result in an unacceptable level of performance and repair is either not possible or not economic.

2. A. 5. 2. 1. Condition and Performance Issues

In both Transmission and Distribution, circuit breakers are given a condition code based on manufacturer family and age data. Manufacturer family ratings are based on historical performance of that family. The condition codes are further refined by visual site surveys and operational tests performed on the specific assets.

The condition codes define the requirement to replace or refurbish based solely on the condition and performance of the asset while the replacement priorities also include criticality in terms of safety, environmental or reliability consequences of asset failure. This distinction recognizes that two assets, both with the same condition code, can have a different replacement priority due to the consequence of failure. Identified problematic circuit breaker families are listed in Table 2A-28.

Table 2A-28

Circuit Breaker Type	Numbers Remaining
Allis Chalmers - BZO	21
Westinghouse – GM	31
General Electric - FK	47

The Company is improving its knowledge of the asset population's condition issues and as a result has reassessed replacement priority scores for circuit breaker populations and the number of highest priority units for replacement has been reduced.

2. A. 5. 2. 2. Remedial Actions Performed

The majority of the problematic circuit breakers are attributable to just three circuit breakers types, namely the Allis Chalmers Type BZO, the Westinghouse Type GM and the General Electric Type FK.

- **Allis Chalmers Type BZO –** The operating mechanisms in this family of breakers, manufactured in the 1950s through 1980s, are showing an increase in accumulator pump and o-ring failures. Design changes and changes in component manufacturers over the years require different replacement parts for various vintages and these parts are difficult to obtain. Mechanism wear has resulted in reduced levels of reliability, increased maintenance costs and a number of failures.

- **Westinghouse Type GM -** Test results from this family of breakers indicate contact timing problems and questionable insulation integrity.

- **General Electric Type FK –** There have been problems with bushing oil leaks and lift rods issues due to moisture ingress with these circuit breakers. In addition lead paint is prevalent in this family of breakers.

The average age of SF_6 Gas Circuit Breakers is approximately 15 years. However, there are three Westinghouse 362SFA40 SF_6 Gas Circuit Breakers (362kV) that are over 35 years old in service at Dewitt substation (1979) and two at New Scotland substation (1976). These are the oldest SF_6 breakers in the system and experience gas leaks in the operating mechanism. This contributes to pole discrepancies which have resulted in reported instances of the breakers failing to close. The SF_6 gas leakage has been reduced through maintenance on these five Westinghouse breakers. There are no plans to replace these breakers at this time and maintenance will continue to be performed to lessen the SF_6 gas release to the atmosphere.

Table 2A-29
Potential Breaker Replacement Candidates

Location	Quantity	Voltage	Type
Batavia Station 01	4	115	FK-439 & BZO-115
Boonville Station	6	115	BZO-115 & GM-6
Cortland Station	4	115	FK-115, FK-439 & GO-3A
Dunkirk Station	5	230	230GW
Gardenville Station – New	5	230	FGK-230
Golah Station	3	115	FK-115 &'FK-439
Homer Hill Switch Structure	6	115	BZO-121, 'FK-439 & GM-6
Huntley Station	8	230	FK-439, 2300 GW & FK-115
Inghams Station	7	115	AA 10, GM-6 & BZO121
Lighthouse Hill Station 61	6	115	FK-115 & RHE-64
Oneida Station 501	5	115	RHE-63, FK-115 & GM-6
Oswego Switch Yard	5	115	FK-439 & 'FK-115

Location	Quantity	Voltage	Type
Packard Station	3	115	BZO-121
Porter Station	9	230	BZO-230 & FGK-230
Rotterdam Station	6	230	BZO-121 & FK-115
Temple Station 243	4	115	GM-6
Terminal Station 651	1	115	FK-115
Ticonderoga Station 163	1	115	FK-115
Tilden Station 73	3	115	GM-6
Whitehall Station 187	2	115	GM-6
Woodard Station 233	3	115	FK-115
Yahnindasis Station 646	3	115	FK-439

When the opportunity exists, circuit breakers will be replaced as part of station rebuild projects.

2. A. 5. 3. Disconnect Switches

There are approximately 1,600 disconnect switches on the system.

2. A. 5. 3. 1. Condition and Performance Issues

All disconnect switches are monitored during annual thermo-vision checks and bi-monthly visual inspections. Disconnect motor mechanisms are also inspected on a 24-month schedule.

Disconnect switches will typically be replaced at the same time as their associated circuit breaker replacement or when defective units are identified by operations personnel through the Substation Equipment Replacement Request (SERR) process. A failure of a disconnect switch to operate generally poses no system or safety risk.

Disconnect switches with condition issues are described below.

- ITE MO-10 Disconnects – 115kV, 230kV, 345kV - There are nineteen of these disconnects in the service territory. These disconnects, installed between 1979 and 1984, have experienced a higher than normal rate of required hot spot repairs. The remaining units include:
  - Nine disconnect switches located at Dewitt substation
  - Four disconnect switches located at Scriba
  - The remaining ITE disconnect switches at Elm substation (3), Rotterdam substation (1), Volney substation (1) and Reynolds Rd. substation (1).

- Westinghouse Type V Disconnect switches -115kV - These disconnect switches are either inoperable or limited to manual operation at Packard Substation. They have experienced motor, gear box, and adjustment problems due to mechanical wear, operating linkage problems, bearing problems due to lubrication issues, and insulators failing due to water ingress and thermal action.

2. A. 5. 3. 2. Remedial Actions Performed

- ITE MO-10 disconnects – 115kV, 230kV, 345kV - These disconnect switches are monitored through annual thermo-vision inspections. Problems are corrected individually when identified.

- Westinghouse Type V disconnect switches -115kV – Generally, any issues on these disconnect switches are being addressed as they are identified. The disconnect switches at Huntley and Gardenville substations will be replaced with future station rebuild projects.

Many of the most problematic disconnect switches are being addressed in conjunction with their associated breaker replacement strategies and substation rebuilds.

2. A. 5. 3. 3. Circuit Switchers

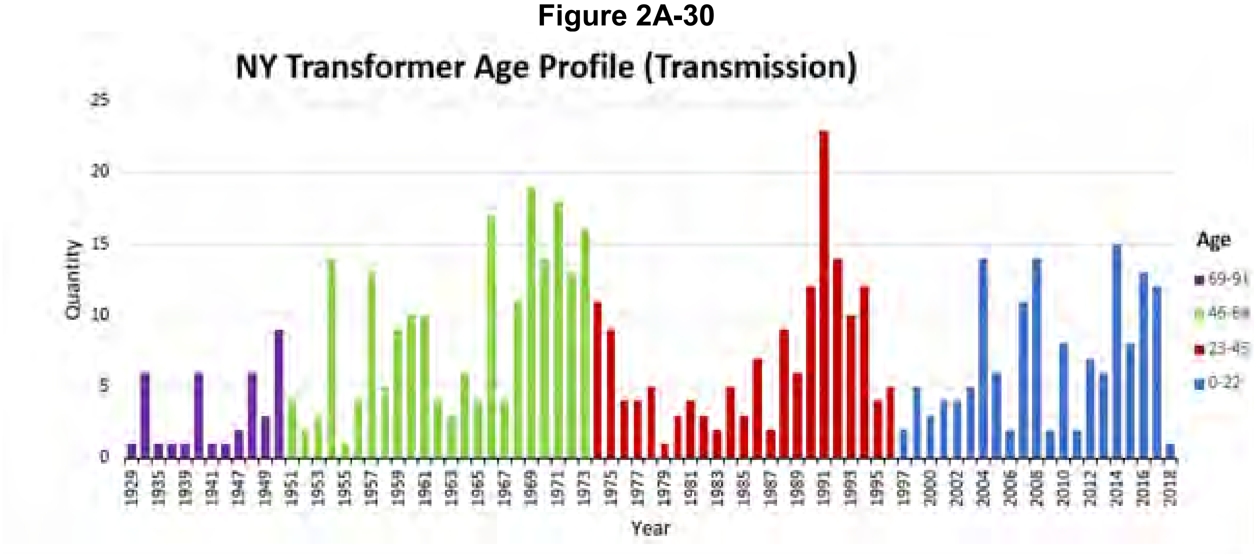
There were sixty-six (66) S&C Type G and Mark II circuit switches in-service identified to be replaced. In 2001 S&C Electric Company discontinued replacement component support for Type G and Mark II models. There is a lack of spare parts for these switches and increasing operational problems are being experienced in the system. The replacement of a circuit switcher generally requires the bus to be switched out to isolate the circuit switcher because there is typically no disconnect between the bus and the circuit switcher. The consequences of not doing this work will result in higher operation and maintenance costs as well as higher replacement costs under damage failure as opposed to a planned and scheduled replacement program.

A strategy was approved to replace thirty-nine (39) of these circuit switches at the most critical locations. Also approved in the strategy are the purchase of three (3) spare circuit switchers and one (1) mobile circuit switcher to help mitigate the reliability and safety concerns associated with any switches remaining in service.

2. A. 5. 4. Transformers

The transmission system has a transformer population of 544 units of various manufacture, type, and power rating at primary voltages greater than and equal to 69kV. An age profile is provided in Figure 2A-30, color coded to show ages of transformers in 20-year increments. There are currently thirty-one (31) system spares for the transmission transformer fleet.

Figure 2A-30



The numbers of transformers organized by age group are shown in Table 2A-31.

Table 2A-31
Transformer Age Profile

Asset/ Age Profile (Years)	0-22	23-45	46-68	69-91	Total
All Transformers Within Respective Year Ranges	144	158	204	38	544

Fifty-one percent of the total population of transformers is greater than 40 years old and the average age of transformers on the system is 38 years. Transformers installed in the 1950s and 1960s are approaching the end of their useful life based on known deterioration rates.

By the end of this decade the volume of transformers that may be in poor condition could rise to over two hundred (200) units. Although it is the Company's practice to assess the condition and risk associated with each transformer, power transformer age, by itself, is a useful indicator as to which transformers may be less able to perform their function due to accumulated deterioration. Paper insulation deteriorates with time and thermal loading history, and that deterioration is irreversible. As the paper degrades, the ability of the paper insulation to withstand mechanical forces is reduced and the mechanical integrity of the transformer is compromised when subjected to through faults or internal faults. In addition, the paper deterioration may lead to shrinkage of the winding packs thereby, reducing the mechanical stability of the transformer.

Given the possible substantial impact of power transformer failures on the transmission system, and the extensive lead times and disruption to normal operations, National Grid pursues a comprehensive approach to risk management of transformers. This includes thorough and regular reviews of the population and the generation of a 'watch list' of suspect and higher impact transformers for more frequent observation and review. National Grid also reviews each transformer individually to determine both condition and likely risks to the system before making a determination as regards to replacement or refurbishment requirements. Further, the Company is expanding its fleet of spare transformers to ensure there is adequate availability of units in the event of a failure given the long lead time for this equipment, as well as having mobile transformers available.

2. A. 5. 4. 1. Condition and Performance Issues

National Grid's maintenance program includes performing dissolved gas analysis (DGA) on transmission transformers annually. DGA is a cost effective condition assessment tool that detects anomalous behaviors within transformers which may indicate a developing fault. Analysis of this data is performed using the IEEE Standard C57.104.1991. Suspect units are placed on an enhanced sampling schedule. Power factor tests are performed on the transformers and their associated bushings, and an assessment of the load tap-changer is performed during routine maintenance. Additional transformer testing such as winding impedance, leakage reactance, transformer turns ratio (TTR), excitation, and sweep frequency response analysis (SFRA) may be

recommended if a review of DGA results indicate that anomalous results need to be investigated further.
Table 2A-32 provides condition codes based on the most recent review.

Table 2A-32
Transformer Condition Codes

Year	Code	1	2	3	4	Total
2018	TRF	489	36	14	2	542

The transformers that have been assigned a condition four are the TR#3 and #4 at New Gardenville substation.

The transformer condition codes are described as follows:

- Condition Code 1 – The transformer is expected to operate as designed for more than 10 years;
- Condition Code 2 – There is some deterioration or known type/design issues. There is obsolescence of equipment such that spares or replacement parts are not available. The system may require a different capability at the asset location;
- Condition Code 3 – The transformer condition is such that there is an increased risk of failure. Test and assessment identifies definite deterioration which is ongoing;
- Condition Code 4 – The transformer has sudden and unexpected change in condition such that it is of immediate concern; this may be detected through routine diagnostics, including inspections, annual testing, and maintenance or following an event.

A transformer with a condition code 4 is not automatically replaced, but may receive additional diagnostic testing and evaluation to further ascertain its condition. As a result of the further review, the transformer may be revised to a lower condition code.

2. A. 5. 4. 2. Remedial Actions Performed

The transformer watch list is based on condition and operational information and is used to monitor those transformers of concern and to plan for a rapid replacement of the unit if its condition worsens. Table 2A-33 provides a list of transformers currently being monitored on the watch list. In some instances, further evaluation is necessary to properly understand the condition. Power transformers are managed through routine visual inspection, regular dissolved gas analysis (“DGA”) sampling, and electrical testing. Transformers with tap-changers are also maintained in accordance with substation maintenance standards. Continuous surveillance enables the Company to prioritize replacements appropriately. The Company completes a small number of pre-emptive transformer replacements. However, this approach may be revised in the future based on failure rates or improved tools to determine the condition of the fleet of transformers.

Below is a list of transformer replacement projects and their status:

- North Leroy No. 1 TRF Replacement – Final Engineering
- Woodlawn No. 1 LTC TRF, 2 TRF Replacements – Preliminary Engineering
- Hoosick No. 1 TRF Replacement – Preliminary Engineering
- Mohican No. 1 TRF Replacement – Preliminary Engineering
- Harper No. 30, 40 LTC TRF Replacements – Preliminary Engineering
- New Gardenville No. 3, 4 LTC TRF Replacements – Preliminary Engineering
- Kensington Terminal No. 4, 5 TRF Replacements – Preliminary Engineering
- Seneca Terminal No. 3 LTC TRF Replacement – In-Service
- Seneca Terminal No. 5 LTC TRF Replacement – Preliminary Engineering

Table 2A-33
"Watch" List of Transmission Transformers

Substation	Region	Disp Desg	High Side kV	Low Side kV	Tertiary kV	Max MVA	Age
Bristol Hill Station 109	NYC	1 LTC TRF	115	34.5		33.3	24
Brockport	NYW	5 LTC TRF					
Edic Station 662	NYC	4 AUTO TRF	345	115	13.8	448	36
Elbridge Station 312	NYC	1 AUTO TRF	345	115	13.8	448	38
Golah	NYW	1 TRF	69	34.5		9.375	49
Golah	NYW	3 TRF	69	34.5		9.375	49
Harper	NYW	40	115	12		40	75
Harper	NYW	30	115	12		40	70
Hartfield	NYW	2 LTC TRF	115	13.8		9.375	49
Hoosick	NYE	1A	115	34	13.8	8.33	45
Hoosick	NYE	1B	115	34	13.8	8.33	45
Hoosick	NYE	1C	115	34	13.8	8.33	45
Kensington Terminal	NYW	4	115	23		40	64
Kensington Terminal	NYW	5	115	23		44.8	52
McIntyre Station 969	NYC	2 TRF	115	23		20	57
Mohican	NYE	1A	115	34	13.8	6.67	68
Mohican	NYE	1B	115	34	13.8	6.67	68
Mohican	NYE	1C	115	34	13.8	6.67	68
New Gardenville	NYW	3	230	120	13.8	125	61
New Gardenville	NYW	4	230	120	13.8	125	61
Porter Station 657	NYC	1 AUTO TRF	230	115	13.8	266	60
Porter Station 657	NYC	2 AUTO TRF	230	115	13.8	266	60
Rotterdam	NYE	7	230	115	13.8	298	53

Substation	Region	Disp Desg	High Side kV	Low Side kV	Tertiary kV	Max MVA	Age
Rotterdam	NYE	8	230	115	13.8	298	46
Rotterdam	NYE	4A	115	34	13.8	8.9	64
Rotterdam	NYE	4B	115	34	13.8	8.9	71
Rotterdam	NYE	4C	115	34	13.8	8.9	71
Seneca Terminal	NYW	3	115	23		40	80
Seneca Terminal	NYW	2	115	23		40	79
Seneca Terminal	NYW	4	115	23		40	80
Seneca Terminal	NYW	5	115	23		40	68
Solvay Station 57	NYC	1B	115	34		7	88
Solvay Station 57	NYC	3B	115	34		7.5	79
Solvay Station 57	NYC	4B	115	34		6.67	79
Solvay Station 57	NYC	2A	115	34		7.5	88
Solvay Station 57	NYC	4C	115	34		6.67	69
Solvay Station 57	NYC	1A	115	34		7	88
Solvay Station 57	NYC	1C	115	34		7	88
Solvay Station 57	NYC	3A	115	34		7.5	79
Solvay Station 57	NYC	3C	115	34		7.5	79
Solvay Station 57	NYC	2B	115	34		7.5	88
Solvay Station 57	NYC	2C	115	34		7.5	88
Solvay Station 57	NYC	4A	115	34		6.67	89
Terminal Station	NYC	2 LTC TRF	115	13.8		45	56
Valley Station 594	NYC	3 TRF-A	115	46		9.375	64
Valley Station 594	NYC	3 TRF-B	115	46		9.375	64
Woodlawn	NYE	2A	115	34	13.2	8.33	68
Woodlawn	NYE	2B	115	34	13.2	8.33	68
Woodlawn	NYE	2C	115	34	13.2	8.33	68
Yahnundasis Station 646	NYC	1 TRF	115	46		35	50
Yahnundasis Station 646	NYC	3 LTC TRF	115	13.8		30	43

2. A. 5. 5. Battery Systems

Battery and charger systems provide power to operate substation relay and control systems which allow station breakers to operate as designed.

Figure 2A-34

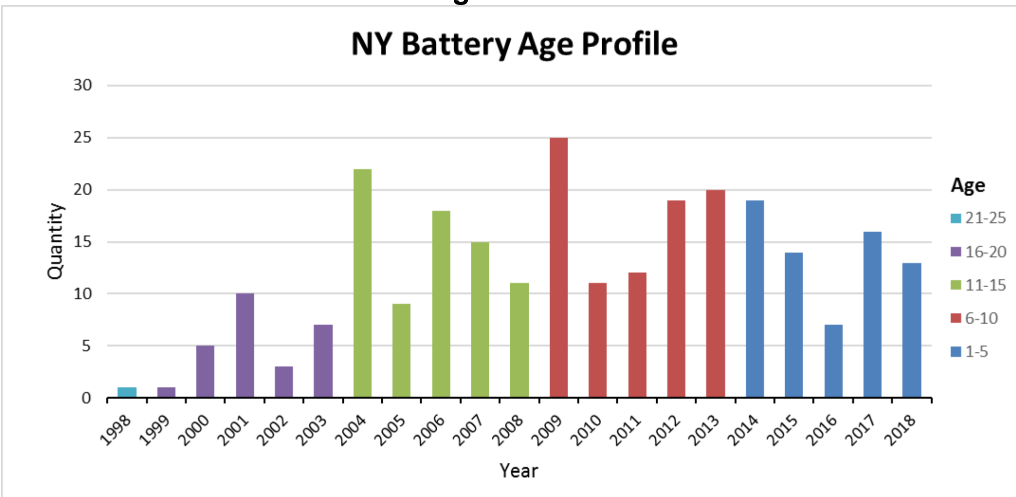


Table 2A-35
Battery Age Profile

Battery Asset Age Profile						
Asset Age	**0-4**	**5-9**	**10-14**	**15-19**	**20-24**	**Total**
Quantity	50	81	78	47	2	260

2. A. 5. 5. Remedial Actions Performed

National Grid's policy is to replace battery sets that are 20 years old or sooner if battery conditions determined through testing and inspection warrant replacement. The 20-year asset life is based on industry best practice and Company experience managing battery systems.

2. A. 5. 6. Surge Arrestors

The silicon carbide (SiC) surge arrestors at 69kV and above installed in the service territory are no longer an effective means of high side protection for transformers. Original installation dates are largely incomplete as surge arrestors were typically classified as part of transformer installations. Available information from manufacturers suggest that the silicon carbide (SiC) type surge arrestors over 30 years old should be replaced and therefore it was made into a best practice to replace them when the opportunity presented itself during on-going projects.

2. A. 5. 6. 1. Condition and Performance Issues

Due to condition and technology, SiC surge arrestors may no longer be effective. SiC gapped surge arrestors were manufactured and installed up to the mid-1980s. The technology is based on non-linear SiC resistors with a series-controlled spark gap. The spark gap is in a controlled environment and provides the trigger to activate the arrestors into operation. This design is now obsolete and no longer manufactured due to developments in new technology. Metal oxide (MOV) gap-less surge arrestors have replaced the SiC resistors and are now the preferred method to control lightning and switching over-voltages. The lightning protection capability of

MOV arrestors is superior to SiC and they reduce the likelihood of damage to adjacent equipment and also reduce the risk to personnel from lightning and switching over-voltages.

Currently, the lifetime of a silicon carbide surge arrestor is anticipated by National Grid to be approximately 20 to 25 years. The integrity of SiC beyond this time frame is hard to predict due to concerns over poor mechanical reliability (e.g. poor seals, internal corrosion, etc.) and difficulty of monitoring the condition of the series gaps. Industry sources recommend that all silicon carbide arrestors in service over 13 years be replaced due to moisture ingress. Manufacturers' data suggest that moisture ingress is the direct cause in 86 percent of failures.

2. A. 5. 6. 2 Remedial Actions Performed

SiC surge arrestors will be replaced with MOV surge arrestors when they fail, or when a transformer is being relocated or placed in service from storage. When a surge arrestor fails, any remaining non-MOV arrestors protecting a transformer or station bus are replaced at the same time. This is a more efficient program but requires toleration of SiC failure risk for longer periods of time. Programmatic replacement of SiC surge arrestors was reviewed and this approach is not practical or efficient. Surge arrestors are co-located with their associated transformer and outage constraints would make the planned proactive replacement extremely difficult.

2. A. 5. 7. Relays

National Grid maintains electro-mechanical, solid state and microprocessor relay types on the transmission system for protection and control. The protection afforded by relays is important to the stability of the electric transmission system. Relays are designed to protect high-value system components from the effects of system failures and to quickly isolate system failures so that no additional damage can occur. The table below identifies the number of relays by type currently deployed on the transmission system.

Table 2A-36
Count of Relays by Type

Design Type	# of Relays	% of Total
Electro-mechanical and Solid State	10,891	80
Microprocessor	2,724	20
Total	**13,615**	**100**

Several families of electro-mechanical and solid state relays are no longer sustainable on the transmission system. Further, many of these relays suffer from lack of manufacturer support such that technical support and spare parts are no longer available. Targeted relay replacements were selected based on family history, performance, field O&M experience and available manufacturer support.

With the advent of digital technologies, facilities can be upgraded resulting in greater capability and increased reliability. The first priority is to identify the worst performers and establish the appropriate remedial action. The Company also considers potential solutions to enable improved grid functionality and performance.

Microprocessor based multi-function relays are an ideal choice for a cost effective method to implement the transmission system protection. The upgrading of old protection systems with microprocessor relays can offer the following benefits:

- Micro-processor relays have proven good quality and high availability.
- Improved sensitivity, the executing or comparator component of old relays can only be operated at certain levels.
- A micro-processor relay which replaces multiple discrete relays results in reduced CT secondary burdens.
- Greater protection and control functionality, self-monitoring and the ability to record oscillographic information and Sequence of Events.
- Easy integration via network communications.
- Lower maintenance costs.

By replacing electro-mechanical and early generation solid state protection relays with technologically advanced integrated digital relays, performance, functionality and maintenance issues improve.

2. A. 5. 7. 1. Condition and Performance Issues

National Grid performs periodic testing of protective relays to ensure that the relay operates correctly and the overall protection scheme functions as designed.

On average, 20 percent of National Grid's relay packages (all types) are tested yearly based on scheduled maintenance intervals.

The relay families identified as those needing replacement because they are problematic, obsolete or no longer supported by the manufacturer are as follows, all of which are obsolete, offer no manufacturer support or spare parts:

- **GE (GCX13/17, CEY14/15/16GEYG, CEB) –** contact wear and bearing damage, setting drift.

- **GE (CFD, CPD, Type 40, MOD10, CFF, CR61/CT61, CS28A) –** resistor, capacitor, transistor and diode decomposition. Failed power supplies.

- **ABB (MDAR, REL301, REL302, SKDU/SBFU, HCB, LCBII) –** metal degradation, contact wear and setting drift.

- **ABB (KF) –** setting drift, metal degradation, bearing damage.

- **AREVA (OPTIMHO) -** resistor, capacitor, transistor and diode decomposition.

- **RFL (3253, 6710, 6745, 9300) –** metal degradation, setting drift.

2. A. 5. 7. 1. Remedial Actions Performed

National Grid initiated a study to identify the worst performing relay families which include electro-mechanical and solid-state relays. The study reviewed the population of relay families for those relays that are at end-of-life, are functionally obsolete, are known to have family reliability concerns, or are considered obsolete because technical support and spare parts are no longer available from the manufacturer.

The study identified approximately 245 relays and 54 communication packages requiring replacement. Strategy paper SG157 was approved to replace the relays and communication packages. In general, the replacement plan will be implemented on a line-by-line basis. The relays to be replaced are included in Table 2A-37 below:

Table 2A-37
Relays to be replaced under Strategy SG157

Substation	Priority	Packages	Communication
Dewitt	1	6	0
Mortimer	2	8	0
Lockport	3	7	0
Batavia	4	2	0
Cortland	5	2	0
Gardenville - New	6	4	0
Tilden	7	5	0
Rotterdam	8	10	3
Huntley	9	13	0
Golah	12	2	0
Temple	13	3	1
Watkins	14	3	0
Porter	15	4	1
Reynolds Rd	16	2	1
Sta 64 Grand Island	18	2	2
Schuyler	19	4	0
Curtis	20	4	0
New Scotland	21	1	1
Packard	22	13	2
Woodlawn	23	2	1
Trinity	26	3	1
SE Batavia	27	2	0
Elbridge	28	3	0
Walck Rd	30	1	0
Ash	31	3	3
Greenbush	32	2	0
S. Ripley	33	2	0
Terminal	34	4	0
Long Lane	35	2	3
Carr St.	36	4	0
Feura Bush	37	3	3

Substation	Priority	Packages	Communication
McIntyre	38	1	0
North Ogdensburg	39	1	0
Seneca Terminal St.	40	4	0
Riverside	41	7	3
Rosa Road	42	4	2
Independence	43	4	0
Grooms Road	44	0	1
Indian River	45	1	0
Lowville	46	1	0
Malone	47	1	0
N. Carthage	48	1	0
Ogdensburg	49	1	0
Total		**155**	**29**
Control House	**Priority**	**Packages**	**Communication**
Boonville	1	12	0
Geres Lock	2	18	0
Menands	3	4	1
Woodard	4	2	0
Mountain	5	4	0
Teall	6	2	2
Yahundasis	7	4	0
Total		**46**	**3**
Single Comm Packages	**Priority**	**Packages**	**Communication**
Rotterdam			1
New Scotland			7
North Troy			3
Reynolds Road			2
Alps			1
Altamont			1
Bethlehem			1
Grooms Rd			1
Total			**17**
Grand Total		**204**	**49**

Currently, relays are replaced based upon condition and performance issues and may also be replaced in conjunction with breaker or transformer replacements and station rebuilds for efficiency.

2. A. 5. 8. Digital Fault Recorders (DFR)

National Grid currently has sixty-one (61) digital fault recorders deployed that capture and store data from the power system during times of instability or system anomalies. The data is then downloaded to perform post-event analysis. The analysis yields detailed information about the state of the system before, during and after the event.

2. A. 5. 8. 1. Condition and Performance Issues

There have been no performance issues to date; however, older DFRs require more maintenance. At this time, the newer DFRs have experienced good reliability; however, they do not have sufficient operational history to project long term reliability of these devices. It is expected that they would have approximately the same reliability as microprocessor relays since they are built on the same platform. We are experiencing increased maintenance on the seven older DFRs due to age related condition issues. These devices are based on an older platform and have spinning disk drives for storage.

2. A. 5. 8. 2. Remedial Actions Performed

New DFRs will be installed with major capital projects at select locations across the service territory to provide adequate coverage.

2. A. 5. 9. Remote Terminal Units (RTU)

NERC Recommendation 28,[8] released in response to the August 2003 blackout, requires the use of more modern, time-synchronized data recorders. Many in-service RTUs do not satisfy this requirement and obsolete RTUs will not work with modern Energy Management Systems ("EMS"). New RTUs being installed will provide more timely and reliable data than their predecessors. In the event of a minor or major system disturbance that may affect the ability of the system to withstand further contingencies, accurate data received in a timely manner is a necessity in the restoration process. Data received from the new RTUs will quickly identify key devices that have failed or have been affected by the event. The data will expedite isolation of the problem, reduce the duration of the interruption and in some cases avoid spread of the outage to other system components.

2. A. 5. 9. 1. Condition and Performance Issues

RTUs are being replaced under this program for the following reasons:

- The target RTUs do not meet the criteria outlined in NERC Recommendation 28, which places the Company at risk for being unable to provide synchronized system data during a system emergency.
- The target M9000 RTUs and equipment are legacy systems and are no longer supported by the manufacturer. Replacement parts are either difficult to obtain or unavailable. Failure of an RTU may be un-repairable, requiring a complete unplanned replacement on short notice. This situation could occur when data from the failing RTU is most critical, such as during system events, resulting in reduced reliability performance.

[8] North American Electric Reliability Council (NERC) "Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations," April 5, 2004 Page-162

- Test equipment is obsolete and cannot be readily obtained or maintained. The PC based test equipment required for maintenance was acquired in the early 1990s and uses a DOS software platform.
- The targeted M9000 RTUs are not suitable for future integration of new substation devices and technology. The equipment does not have and cannot be modified to provide the capabilities required for modern supervisory control and data acquisition. This type of functionality is becoming standard to meet current reliability needs.

2. A. 5. 9. 2. Remedial Actions Performed

There are approximately 620 operating transmission and distribution RTUs under the Company's control, of which 158 units are being replaced under an ongoing RTU replacement program (SG002). To date all transmission projects within the strategy have been completed with the exception of those situated in Non-National Grid owned sites. Although new projects/programs are starting to replace RTUs with the M9000 protocol, and install new RTUs at stations that do not have one.

2. A. 5. 10. Station Rebuilds

Station rebuilds are appropriate where the number of asset related issues within the station are such that they require a comprehensive plan for replacement to achieve cost efficiency and maintain reliability of the system. Where a station rebuild is proposed, the Company will seek creative and innovative solutions and consider all appropriate alternatives. It should be noted that certain station rebuilds will occur within the same footprint while others will essentially be green field construction in an adjoining location to the existing station.

2. A. 5. 10. 1. Gardenville

Gardenville is a 230/115kV complex south of the Buffalo area with two 115kV stations in close proximity referred to respectively as New Gardenville and Old Gardenville which both serve regional load. New Gardenville was built between 1959 and 1969 and has some minor to moderate asset issues. Old Gardenville feeds regional load via eleven 115kV lines and was built in the 1930s. It has serious asset condition issues including, but not limited to: control cable, circuit breaker, disconnect and foundation problems.

Old Gardenville has had no major updates since it was built. Since 2004 there have been instances of busses tripping due to breakers not tripping for faults or other control issues. Occasionally, the bus trips via backup protection when a line breaker fails to operate for a fault. Since the entire station is problematic, a bus protection failure is likely and could lead to severe equipment damage and a large outage. Furthermore, there have been instances where lines have either tripped or failed to reclose due to bad wiring or other control issues. The worst condition control cables have been attended to in a separate project, but these are not considered to be permanent solutions. Rather, they are meant to correct control cable issues until all the cables can be addressed in a station rebuild.

The foundations at Old Gardenville are in extremely poor condition with more than half degraded and some even in full failure mode. This includes many structure foundations affecting the integrity of the structures themselves. Some circuit breaker foundations are in very poor condition raising the potential than an oil circuit breaker could move on its pad during a severe fault and lead to further damage and/or safety issues.

The project to rebuild the Old Gardenville 115kV station is in construction.

2. A. 5. 10. 2. Dunkirk

Dunkirk Station is a joint substation at Dunkirk Steam Station shared by NRG and National Grid. The substation serves as an interconnection to the electrical grid at the 230, 115 and 34.5kV levels. The plant was originally constructed in the early 1950s by Niagara Mohawk as the owner of generation, transmission and distribution assets. National Grid's major equipment includes four transformers: two new 230/120/13.2kV 125MVA autotransformers and two 115/34.5kV 41.7MVA transformers supplying four 230kV, five 115kV and two 34.5kV lines as well as NRG's station service. National Grid retains ownership of most of the 230kV and 115kV switch yard; however, the controls are located in the generation control room owned by NRG.

There are many asset condition issues at the Dunkirk substation. The foundations are in poor condition in the 230kV yard, including many structure foundations, affecting the integrity of the structure itself. Some circuit breaker foundations are in very poor condition raising the possibility that an oil circuit breaker (OCB) could move during a severe fault leading to more damage and/or causing safety issues.

The five 230kV OCBs are Westinghouse type GW design (1958 through 1961) and would be part of the OCB replacement strategy, if not for this project. The 230kV Westinghouse Type O bushings are a concern as the power factor and capacitance results are trending upwards.

Differential relaying for the 230/120/13.2kV autotransformers is in need of upgrading (presently there is no tertiary differential). The 230, 115 & 34.5kV disconnects have become more problematic and are at the end of their life. The 230kV bushing potential devices (BPDs) have become problematic as they age and the remaining BPDs will likely have to be replaced in the near future. Fencing around the yard is not compliant with National Grid standards and requires repair at the base or a berm built up to restrict animal entrance.

The control cable system in the 230kV yard is of particular concern. It is clear that the conduit system carrying control wires has degraded to the point that the integrity of the control wires has been compromised. Control wires inside the plant have also seen insulation degradation. In some cases, the wiring is so poor that troubleshooting abilities are limited for fear of handling control wires with degraded insulation. Grounds, alarms or breaker misoperations happen more frequently during periods of heavy rain, indicating poor insulation below ground.

Within the last four years National Grid has replaced both 230-120-13.2kV 125MVA GE autotransformers with new ABB 230-120-13.2kV 125MVA autotransformers and all 115kV OCBs with new SF_6 breakers, foundations and control cable.

The plant was originally constructed with generation, transmission and distribution assets combined, including station service, battery, relaying, alarm / annunciation, control and communications. All troubleshooting, maintenance testing, equipment replacement and upgrades require excellent knowledge of the plant operation. NRG and National Grid must maintain good lines of communication and share updated prints to preserve operation continuance. The separation of assets would help avoid inadvertent trips to line breakers or any possible equipment failures.

There are parallel efforts underway to address these issues. In the short term, a project was approved to install a new cable trench in the 230kV yard in 2009 and was completed in the summer of 2010. Control cables deemed faulty can be replaced using these new facilities. Conceptual engineering has been completed for a new control house and completely separate assets rebuilt within the existing yard. Other equipment, such as disconnects and potential transformers deemed to be at end of life will be replaced in place during a project to install a second bus tie breaker.

The Dunkirk station rebuild is in preliminary engineering.

2. A. 5. 10. 3. Rotterdam

Rotterdam is a large substation with 230kV, 115kV, 69kV, 34.5kV, and 13.2kV sections spread out over multiple tiers on a hillside. The 230kV yard is on the highest tier and is an important source for Schenectady, NY and the Northeast Region. The 230kV yard has had performance issues and one catastrophic failure of a Federal Pacific Electric ("FPE") breaker. These breakers have horizontal rotational contacts inside their tank as compared to vertical lift contacts in newer style circuit breakers. FPE breakers are no longer manufactured and spare parts are not available. There are two spare SF_6 gas circuit breakers stored at Rotterdam to replace the FPE breakers if one were to fail at this station.

Two of the three 230kV auto transformers (#7 & #8) are proposed for future replacement. This family of Westinghouse transformers has shown a higher than normal failure mode in the industry due to its design (specifically, due to T beam heating and static electrification). The internal design leads to "hot spots" in the transformer windings that generate hot metal gases that could lead to transformer failure. These transformers are to be replaced during the Energy Highway Segment A project.

Many of the 115kV breakers and disconnect switches are showing signs of degradation and have had issues in the past with equipment damage or not operating correctly. The concrete foundations supporting the breakers and structures, the differential, and voltage supply cabinets are all in poor condition and require repair or replacement. Some need attention now and others within the next 5 years.

A master plan for the site is being developed to address the sequence in which the station should be rebuilt and the retirement/movement of the 69kV & 34.5kV assets in the station with an emphasis on the overall station/system needs, stability, reliability, maintenance and future upgrade/system improvement possibilities. The master plan identified the retirement/upgrade of the 69kV assets and then rebuilding the 115kV yard would provide the best value and most flexibility for rebuilding and reconfiguring the 230kV yard in the future. Improvements expected by rebuilding the 115kV yard first include the reduction in the number of transmission line crossings, easier access and maintainability, and greater operating reliability and efficiency.

There are many factors that will help determine the appropriate configuration of the 230kV yard in the future, including potential alternatives related to National Grid's submittal in response to the Energy Highway Initiative.

The Rotterdam station rebuild is in conceptual engineering.

2. A. 5. 10. 3. Lockport

Lockport is a 115KV transmission station with thirteen 115kV transmission lines tying through the East and West Bus sections and serves an important role in the 115kV system in western New York. The overall condition of the station yard and control room is poor. Work is required on control cable duct banks, breaker operators, structure painting and concrete equipment foundations that are significantly deteriorated.

Lockport was originally part of the 25 cycle system dating back to the 1910s. The structures are severely rusted and in need of painting before the steel becomes compromised. Typical conditions of the structural steel at the station along with column and breaker foundations are deteriorated and need to be repaired with several potentially needing full replacements.

The original manhole and duct system for control cables is in degraded condition which has caused control wire shorts, battery grounds and unwanted circuit breaker operations. Station maintenance crews are restricted in performing repairs due to the overall condition of the duct bank because single control cables cannot be replaced without adversely affecting adjacent control cables in the same ducts.

There are two new 115kV SF_6 breakers while the remaining forty-year old 115kV, oil filled, BZ0 breakers show exterior rust and oil stains. Three of the 115kV oil breakers have continued hydraulic mechanism leaks common to the BZO style breakers. Failures of hydraulic system components have been notably increasing. Each of the oil BZO breakers has bushing potential devices which have been another source of failure.

Transformer #60 is a 115-12kV 7.5MVA transformer manufactured in 1941 which supplies Lockport's station service and Race Street Line 751. Race Street Line 751 is tied to the Race Street seasonal hydraulic unit. An alternate station service should be provided should TR #60 or station service fail.

The control room building is also in very poor condition and requires paint and floor repairs. Existing peeling paint is likely lead contaminated. It is an oversized building with continued maintenance costs for the original roof and the intricate brickwork. It contains a 90 ton overhead crane in the old 25 cycle frequency changer portion of the building which is presently used only to store old cable. The control house roof was repaired in the 1990s and brick pointing was also done to limit deterioration within the last 5 years. The old 25 cycle control circuitry has been disconnected with the DC battery to eliminate potential source of battery ground problems. Rodents are a frequent problem and signs of control wire damage are evident.

Conceptual engineering to rebuild the station in place was completed. The project has been deferred for further consideration in FY21.

2. A. 5. 10. 4. Lighthouse Hill

Lighthouse Hill is a switching station in northern NY. It has two 115kV buses and seven transmission lines connecting to the station allowing delivery of power from generating facilities in the north to substations in the Watertown and Syracuse areas.

The condition of the station is fair to poor depending on the specific assets being considered. An integrated plan has never been developed for the station since numerous relay upgrades have been performed without any improvements to the station itself. The disconnect switches are in very poor and hazardous condition with failed insulators and repairs appear to work only temporarily due to the design configuration. Most of the OCBs are in fair condition, but several are obsolete and would pose a challenge to significantly repair.

The seven OCBs are located 200ft from the Salmon River, located about 70ft below the grade elevation. The station is located approximately one mile upstream of the NY State wildlife fish hatchery. Although the risk is low, any significant oil spill in the station would have a significant environmental impact. There is also the risk of a flooding event at the station given its elevation and proximity to the river.

The 6B transformer has a history of gassing and replacement should be considered in the next few years.

Another significant issue at the station is that the land is owned by Brookfield Power and operated as a shared facility under a contractual agreement. The hydro station was previously owned by Niagara Mohawk. Not having direct access to Brookfield's control room at Lighthouse Hill limits the Company's control over the housing conditions for the battery and relay systems. National Grid has controls on the first floor of the control house which is immediately adjacent and downstream of Brookfield's hydroelectric dam. A release from the dam would likely flood the control room area.

Conceptual engineering for a new substation, relocated to a greenfield site along an adjacent road in the clearing near the transmission right-of-way and away from any flooding risk is underway.

2. A. 5. 10. 5. Huntley

In 2005 NRG (the owners of the Huntley Generating Station) announced the retirement of the four 115kV connected generators at Huntley, and in 2016 NRG retired the Generating Station. The Company has been working on separation plans to accommodate the plant retirement.

The Huntley 230kV and 115kV Switchyards located at the Huntley Steam Station in Tonawanda, NY are shared facilities between NRG and National Grid. The Huntley Generating Station is owned by NRG. The station was built in the late 1930s and is a terminal point for eight (8) 115kV lines, four (4) 230kV lines, one (1) 230kV pipe type oil filled cable, with the 230kV switchyard supplied by two (2) generators owned by NRG. A 230kV 91MVAR Oil Filled Reactor used for overvoltage protection on the 230kV oil filled cable is also installed in the 230kV switchyard. Protection, control, communication, DC battery systems and AC station service supply for the 115kV and 230kV switchyard are located within the Huntley Generating station. Each of these systems is located in different locations and different levels within the Huntley power house. The ground source for the National Grid 115kV grounded wye system is derived from three (3) NRG owned 13kV-115kV step-up transformer banks.

The Company's asset separation and asset replacement plan is intended to separate the National Grid owned assets from the NRG owned Steam Station building, and replace assets that are in poor condition in the National Grid Substation.

The asset separation would involve a new control house on National Grid owned property, the installation of new control cables, and removal of the necessary equipment to complete a clear point of delineation between the NRG Huntley Generating Station and the National Grid Huntley Substation.

There are as well many asset condition issues at the Huntley substation. The foundations are in poor condition in the 230kV and 115kV yard, including many structure foundations, affecting the integrity of the structure itself.

Some circuit breaker foundations are in very poor condition raising the possibility that an OCB could move during a severe fault leading to more damage and/or causing safety issues. The 230kV and 115kV OCBs are either Westinghouse type GW design or General Electric type FK design and would be part of the OCB replacement strategy, if not for this project.

The majority of the disconnect switches are in poor condition and required extra maintenance over the past few years. Also a recent project was approved to have spares procured for Huntley station in case one had to be replaced.

The Huntley rebuild project is in final engineering / construction since it is being handled as a phased project..

2. A. 5. 10. 6. Boonville

The Boonville substation was constructed in the 1950s and originally designed as a switching station for several 115kV transmission lines and the single source of the radial 46kV line to Alder Creek, White Lake, Old Forge, Eagle Bay and Raquette Lake. The use has not changed with the exception of the addition of a 23kV terminal for hydro generation.

The structural steel and foundations are deteriorated. The foundations have deteriorated due to the poor station drainage. The station was built alongside highway 12D in a farm field. Over the years it has sunk to an elevation lower than the highway and farm fields leaving drainage to no longer exist. This drainage issue is also present in the underground manhole and conduit system. The water surface level at the station causes the underground control cables to continuously be under water leading to their deterioration.
Electrically the station was designed with minimal redundancy and has antiquated relaying protection. The design has the single source transformer for the 46kV line to the Old Forge area connected off the south 115kV bus with no alternate method to supply the transformer if the south bus is out of service. The 115kV to 46kV transformer was replaced in the 1990s, but is still the only source and cannot be maintained properly due to outage restrictions. With no distribution at Boonville there is little need for a mobile sub connection. But there is a spare transformer for the 115/46kV TB#3 located at the station.

All of the electrical components at the station such as oil breakers, oil filled potential transformers and switches require replacement. The station control building is of brick design and needs reconditioning. The size of the building has also become an issue with the addition of EMS and relay upgrades over time. Also, the station perimeter fencing needs replacement on 3 sides.

The Boonville station rebuild is in preliminary engineering.

2. A. 5. 10. 7. Oswego

Three substations are located on the generation site owned by NRG which include a large 345kV switchyard (that was recently upgraded and in overall very good asset condition, except for the control house which is scheduled for future replacement) and 115kV and 34.5kV yards originally designed and integrated when the generating station and substations were owned by the same utility.

The 115kV substation is in poor condition with out-of-service equipment that has not been formally retired. Bus sections have been cut, rerouted, and breakers out of service with yellow hold cards. The disconnect switches to the OCBs are original to the station and are the pin and cap design that has an industry recommendation for replacement. The 115kV yard is sourced from the 345kV yard. This change occurred in the early 1990s, when Plants 3&4 that supplied generating power to the 115kV bus retired. The electro-mechanical relays and battery for this yard and the 34.5kV yard are still inside the generation plant which limits the Company's control and access to these assets.

The 34.5kV yard is the original to the 1940s plant 1&2 (retired decades ago). All equipment in the yard is of original vintage, is obsolete, and is in poor condition.

Recommendations for future conceptual engineering analysis include the immediate removal of the old R-55 breaker to meet standing EPA storage requirements, the retirement and removal of all permanent out of service equipment, and strategy for permanent separation or relocation of the yards to isolate the interests of National Grid from NRG.

This project has been approved and is in final engineering.

2. A. 5. 10. 8. Inghams

Inghams station is located in the town of Oppenheim, NY and is a connection between a hydro generating station and the transmission and distribution electric system. The transmission voltages at Inghams are 115kV and 46kV, and the distribution voltage at Inghams is 13.2kV. The Inghams station helps to moderate the electrical system as it has a phase angle regulator (PAR) type transformer.

The transmission planning department is looking to improve the capabilities of the PAR by specifying a replacement unit with a wider adjustment range.

The Inghams station was flooded in 2006 and remains a flood concern. After the station was repaired a new stone wall approximately five (5) feet tall was constructed along the station perimeter that is shared with the river boundary. The stone wall is considered a temporary measure as it will limit the current flow of the river if the river rises to flood heights again, but will not keep the station from being flooded.

The recommendation for the station is that the PAR be replaced and the existing PAR be kept as a spare unit, for emergency use. Also, the station will be relocated outside the current flood zone to be above the 500-year flood zone line.

The Inghams station rebuild is in conceptual engineering.

2. A. 5. 10. 9. Future Additional Station Rebuilds

The following substations are in the long-term conceptual engineering and/or system planning study phase for substation upgrade and/or rebuild: Harper, Elm Street, Sawyer Avenue, Seneca Terminal, Yahnundasis, Batavia, Kensington Terminal, Hoosick, and Mohican.

Chapter 2B. Sub-Transmission System Asset Condition

This section provides the condition of overhead and underground elements of the sub-transmission system.

Table 2B-1 summarizes the key overhead and underground sub-transmission assets.

Table 2B-1
Sub-Transmission Assets

Sub-Transmission Main Assets	Inventory
Towers/Poles	65,363
Overhead Line Circuit Miles	2,902
Underground Cable Circuit Miles	344

2. B. 1. Overhead System

Table 2B-2 provides a breakdown of the sub-transmission system structures.

Table 2B-2
Structure Types

Asset	Inventory
Steel Structures	1,770
Wood Structures	63,593
Total	**65,363**

2. B. 1. 1. Steel Towers and Steel Poles

Table 2B-3 shows a breakdown of the Inspection and Maintenance program results for sub-transmission steel towers and poles in the last three calendar years. The most frequent three asset condition codes are shown in the table[9]. A summary of all categories is shown in Exhibit 3.

[9] Priority levels greater than Level 3 not shown in Table 2B-3.

Table 2B-3
Sub-Transmission Steel Towers and Steel Poles Inspection Results

Level	Loose Bolts – 534	Structural Damage – 537	Tower Legs Broken – 531	Total	Percentage Code Complete
2016 Summary					
1	0	0	1	1	100%
2	0	1	2	2	33%
3	9	23	0	32	38%
2017 Summary					
1	0	0	0	0	N/A%
2	0	2	1	3	67%
3	1	23	1	25	0%
2018 Summary					
1	0	0	0	0	N/A%
2	0	0	0	0	N/A%
3	2	3	0	5	0%

In addition to the Inspection and Maintenance program, supplemental inspections are performed by the Company to determine if towers in the most deteriorated condition should be repaired or replaced.[10] Footing inspections on some lines have also been undertaken along with completing reinforcing and footing repairs. In a few cases, the estimated cost to repair deteriorated tower footings was excessive based on the overall condition of the tower which resulted in tower replacement. In other cases, the poor condition of a tower superstructure resulted in the footing being temporarily supported until the tower could be replaced or repaired. Typical superstructure problems included corroded, bent, detached, or twisted members, tilted towers, past vehicular or storm damage, and failed crossarms. In some cases, falling trees caused broken conductors or differential tensions on the towers, causing permanent bending or failure of members which required replacement. In some of these cases, the towers continue to function normally.

2. B. 1. 2. Wood Poles

Table 2B-4 below lists foot patrol inspection results performed on wood poles over the last three calendar years. Inspectors assign priority level “Replace” codes for poles that appear broken, rotting, or leaning on a scale of 1 – 3 with 1 being the highest replacement priority. They also assign priority level “Repair” codes for poles with lightning, insect, woodpecker, or other damage on the same 1 - 3 scale. Poles that are in good overall condition are not assigned a priority level code.

[10] The visual grading system described previously for transmission structures in Table 2A-7 is also used for sub-transmission towers.

Table 2B-4
Sub-Transmission Wood Pole Replace and Repair Codes from Computapole

Level	Replace Codes			Repair Codes		
	Number of Poles	Percent Codes vs Inspections	Percent Complete	Number of Poles	Percent Codes vs Inspections	Percent Completed
2016 Summary						
1	1	0.01%	100.00%	0	N/A%	N/A%
2	12	0.09%	100.00%	49	0.35%	91.83%
3	613	4.38%	19.57%	672	4.80%	32.29%
No Codes	12928	92.40%				
Total Poles Inspected	13991					
2017 Summary						
1	4	0.03%	100.00%	2	0.02%	100.00%
2	0	N/A%	N/A%	25	0.19%	76.00%
3	162	1.26%	4.32%	699	5.45%	1.14%
No Codes	12025	93.78%				
Total Poles Inspected	12822					
2018 Summary						
1	3	0.02%	100.00%	0	N/A%	N/A%
2	6	0.04%	33.33%	57	0.35%	29.82%
3	375	2.28%	2.13%	843	5.13%	2.01%
No Codes	15301	93.07%				
Total Poles Inspected	16440					

Table 2B-5 shows a more detailed breakdown of the Inspection and Maintenance program results of the most frequent four asset condition codes for sub-transmission wood poles in the last three calendar years.

Table 2B-5
Sub-Transmission Wood Pole Inspection Results

Level	Visual Rotting - 511	Wood Pecker – 526	Insects – 527	Leaning Pole – 512	Total	Percentage Codes Complete
2016 Summary						
1	1	0	0	0	1	100%
2	0	46	1	2	49	92%
3	613	507	163	1	1284	26%
2017 Summary						
1	4	0	2	0	6	100%
2	0	21	3	1	25	76%
3	162	622	75	1	860	2%
2018 Summary						
1	3	0	0	0	3	100%
2	0	57	0	0	57	30%
3	375	831	1	4	1211	2%

Most pole issues do not contribute significantly to interruptions, but often do present potential safety or environmental issues. Poles are replaced based on condition as identified through the inspection and maintenance process described above, and during overhead line refurbishment projects. Additional poles may be added or done concurrently based on engineering and line operations field walk-downs.

2. B. 1. 3. Overhead Line Refurbishment

There are approximately 2,900 circuit miles of sub-transmission overhead conductor. In addition to the Inspection and Maintenance program, the condition of circuit conductors, hardware, poles, overhead ground wires, drainage (in some cases), and towers is evaluated by Engineering personnel as related work is considered. Related work can include projects to improve reliability, upgrading circuits that are identified as being near their thermal limit or in poor condition. Conductor size and number of splices in a conductor are also reviewed to determine if replacement is warranted. Typically, #4 copper, #3 copper, #2 copper, #1 copper and Copper Copperweld conductors will be replaced on main lines and important tap lines. In all cases, these smaller conductors are over 65 years old and have had numerous splices installed on them due to past field incidents. In addition, these conductors are no longer standard relative to inventories available to fix or replace them.

The connection hardware between steel towers and insulator strings has also been problematic for older steel tower lines. There are two prevalent issues which have been identified on steel towers. First, the steel plate connecting the insulator string to the tower may become elongated and worn due to conductor movement. Second, the hooks that connect the insulator string to the tower plate become worn due to similar movement. In these cases, new hardware or steel plates are needed to prevent conductors from falling.

Overhead Ground Wires (Static Wires or Shield Wires) are usually located on specific lines and are installed with the original construction in most cases. Over time, these wires deteriorate and break depending on conditions and location. The refurbishment projects are reviewing cases where this has happened to determine if replacement is warranted to avoid future line outages and other potential safety concerns and keep the overall lightning protection consistent for these affected circuits.

2. B. 1. 4. Overhead Line Removals

Typically, when a line is de-energized due to the reduction/removal of demand loads (i.e. removal of a customer station) or due to reconfigurations to the system based on planning studies, the lines are "retired-in-place" so that they can be utilized at a future date if required and/or to maintain property rights in certain areas. In the past, removal of de-energized lines was dictated by emergency damage/failure type projects or in response to problem identification worksheet (PIW) safety concerns.

Primarily driven by safety, a de-energized line removal strategy was created identifying existing "retired-in-place" de-energized lines that the Company has determined will not be required/utilized at a future date based on the latest planning studies and therefore should be removed rather than repaired and maintained. National Grid adheres to the National Electrical Safety Code's general requirements for the inspection and tests of in-service and out-of-service lines (NESC Safety Rules for Overhead Lines, Rule 214). This rule requires the removal or maintenance in a safe condition of all assets that are permanently retired, which will maintain the safety of the public and field personnel when in proximity to de-energized lines.

The strategy has identified de-energized "retired-in-place" sub-transmission lines to be partially or completely removed. The active projects that need removal are shown in Table 2B-6 by removal priority.

Table 2B-6
Active List of Sub-Transmission De-Energized Line Removals

Priority	Region	Line Name	Voltage (kV)	Status
1	Southwest	Homer Hill-Ceres 809 Part I	34.5	Complete
2	Capital	School St-Watervliet etc.	34.5	Awaiting Scheduling
3	Mohawk	Terminal-Cornelia 43	46	Complete
4	Central	Westmoreland-Yahnundasis 24/Clinton Tap 24	34.5	Under Construction
5	Central	Miller Brewing Wastewater Treatment Plant tap 26	34.5	Awaiting Scheduling To Complete
6	West	Homer Hill-Ceres 809 Part 2	34.5	Awaiting Scheduling

Priority	Region	Line Name	Voltage (kV)	Status
7	West	Sanborn-S. Cambria 406	12	Under Construction
8	West	Cambria-Lockport 411	12	Under Construction
9	Central	Cortland – Munson 21; SUNY Cortland Tap	34.5	Awaiting Scheduling
10	Central	Emeryville – Loomis 2	23	Under Construction

2. B. 1. 5. Sub-Transmission Automation

Sub-transmission lines typically supply numerous distribution substations. The Company has focused on a number of lines (see Table 2B-7) that have experienced multiple interruptions over the past several years causing both Customer Interruptions (CI) and Customer Minutes Interrupted (CMI).

To mitigate these interruptions, Sub-transmission Automation (SA) will be installed. The SA will re-configure the sub-transmission lines after an event to minimize the CI and the CMI impact on customers. National Grid currently uses two types of sectionalizing equipment: S&C ScadaMate switches with 6800 Series controls and G&W Viper Reclosers with SEL 651R controls.

When installing S&C ScadaMate switches, each switch utilizes 900Mhz line-of-sight radios to communicate with the other switches on the line. The S&C switches will determine the location of the fault and how to re-configure the line based on the conditions each sense. Line-of-sight communications is required for the automation logic to function properly. In addition to the SA switches, a number of repeater radios, a head end radio base station, and RTU are required for the scheme.

When installing G&W reclosers with SEL 651R Controls, each recloser will utilize Verizon Cellular radios to communicate back to a centralized RTU. The Reclosers will send data to the RTU which will then determine the fault location based on the programmed logic in the RTU. This centralized automated platform will eliminate the need for multiple repeater radios. The number of SA Switches proposed to be installed on each line is included in the table below.

Table 2B-7
Sub-Transmission Automation Data (34.5kV)

Division	Line Names	Number of Customers	Customer Interruptions (CI)	Customer Minutes Interrupted (CMI)	Number of SA Switches Proposed
East	Nassau-Hudson #9	1,492	15,723	2,448,475	See note 1
	Snyders Lake-Hoag #9	959			See note 1
Central	Akwesasne-Fort Covington-Malone #26	4,528	24,119	4,469,700	8 See Note 2
	Akwesasne-Nicholville #23	3,727			5 See Note 2
	Nicholville-Malone #21	2,215			5 See Note 2
West	Phillips-Medina #301	3,536	58,150	4,393,260	5
	Oakfield-Caledonia #201	1,771			5
	Phillips-Telegraph #304	2,924			4
	Gasport-Telegraph #312	4,174			4
	Ransonmville-Phillips Rd #402	3,798			4
	Youngstown-Sanborn #403	1,739			2
	Amherst-Walden #701	835			2
	Delevan-Machias #801	2,329			2
	Sherman-Ashville #863	2,205			6

Note 1: For the Nassau-Hudson #9 Line, the plan is to install two reclosers and upgrade the controls of a third existing recloser to form a loop scheme. On the Snyders Lake-Hoag #9, the plan is to install one recloser and upgrade the controls.

Note 2: These schemes will utilize the G&W Viper Recloser with SEL 651R Controls. They will be utilizing the centralized automated logic model.

2. B. 2. Vegetation Management

2. B. 2. 1. Rights-Of-Way Widths

National Grid maintains approximately 2,900 miles of sub-transmission overhead line facilities on urban and rural rights-of-way (ROW). Critical factors in the reliability of the sub-transmission assets are the relatively narrow widths of the ROW as well as the lower conductor heights, making the danger tree issue very important.

The most current reliability data, cycle designations, and known field conditions will be used to maintain and prioritize work. ROW edge on sub-transmission is observed on the same cycle as the assigned floor cycle with work being scheduled based on the observed condition of the corridor.

2. B. 2. 2. Vegetation Management

In large areas across New York State, forest condition is continuing to be impacted by the invasive pest, Emerald Ash Borer (EAB). The Company's long-term strategy for addressing the EAB infestation is currently in its 3rd year. As of this report, 91 SubT circuits have been addressed for ash removal. For more information about the EAB mitigation process, see the Distribution Vegetation Management section 2.C.2

2. B. 3. Underground System

2. B. 3. 1. Underground Cables

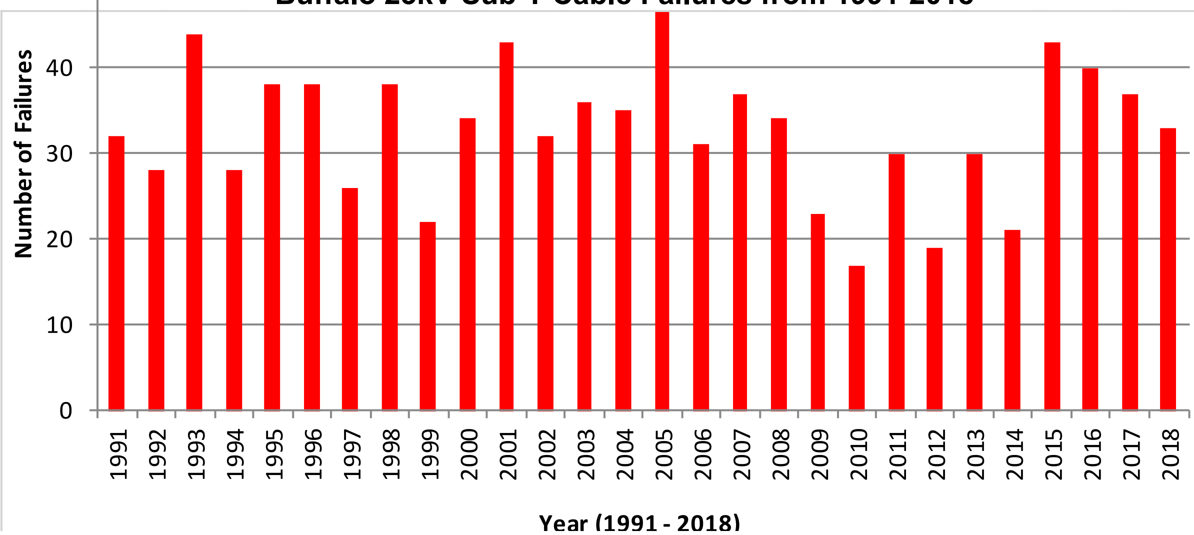
There are approximately 344 miles of sub-transmission underground cable. Planned cable replacements are driven by cable condition and performance history. The underground sub-transmission system consists primarily of paper-insulated lead-covered (PILC) and ethylene propylene rubber (EPR) type cables. There are also some Low Pressure Gas Filled (LPGF) type cables in the underground system.

Sub-transmission underground assets are replaced where they are considered to be in poor condition, have a history of failure, or are of a type known to have performance issues. Candidates for replacement are also evaluated based on loading considerations. Cable failures are tracked, but do not usually have an impact on reliability as the sub-transmission underground system is networked, and individual cable failures will not necessarily lead to customer interruptions.

2. B. 3. 2. Remedial Actions Performed

Of particular concern is the sub-transmission cable system in the Buffalo area. There are approximately 144 miles of cable that supply the 23-4kV Buffalo distribution stations, LVAC network, and customer owned stations. Numerous sections of the 23kV underground cables have been in service for over 80 years. See Figure 2B-8 for a graphical view of the Buffalo 23kV Sub-T cable failure data. A cable replacement program is being implemented to evaluate cables and assign priority levels to those in most urgent need of replacement. Replacement of the cables will improve reliability by reducing accumulating annual repair costs, reducing customer outages, and alleviating any thermal contingency concerns. Additional review will be conducted to develop a proactive plan for replacement of the remaining cables over a 15+ year time frame.

Figure 2B-8
Buffalo 23kV Sub-T Cable Failures from 1991-2018



Chapter 2C. Distribution Line Asset Condition

This section provides the condition of overhead and underground distribution system assets.[11] Since the population of certain distribution assets can be very large, even a small portion of a population requiring maintenance or replacement can be a significant annual management issue.

Table 2C-1 is an inventory of distribution overhead and underground system assets.

Table 2C-1
Distribution Line Assets[12]

Asset	Quantity
Overhead Distribution Circuit Miles	36,271
Underground Distribution Circuit Miles	7,725
Blade Cutout	16,318
Capacitor Installation	5,087
Elbow	95,495
Fuse Cutout	227,646
Handhole	77,837
In Line Fuse	533
Manhole	12,245
OH Regulator Installation	2,474
Pad	83,222
Pole	1,251,069
Pullbox	5,839
Recloser	1,487
Street Light Support	73,751
Switch Bypass	3,876
Switch Gear	3,485
Switch Installation OH	25, 045
Switch Installation UG	106
Transformer Distribution OH	340,547
Transformer Distribution UG	72,697

[11] Substation assets are covered in Chapter 2D.
[12] The majority of table data is from the National Grid Distribution Device & Structure Counts by Location downloaded Aug. 6, 2019. The reporting is by location rather than units (except for elbows). Each location can contain more than one unit. As an example, a count of “one” transformer location can include three single-phase distribution transformers that comprise a single three-phase bank. The data in the tables has not been rounded and the precision of the information should not be assumed to the degree of significant digits. Overhead and underground distribution circuit miles were taken from National Grid Blue Card Statistics - New York and New England downloaded on Mar. 28, 2019.

Asset	Quantity
Transformer Ratio OH	13,402
Transformer Ratio UG	112
Vault	1,826

Chapter 3, Exhibit 3 contains the Inspection and Maintenance Report summarizing program results from January 1, 2016 to December 31, 2018. Program activities generate asset condition information and remediate asset condition issues. The report does not include quantities of assets found in acceptable condition. More detailed analysis of asset condition for certain assets follows below.

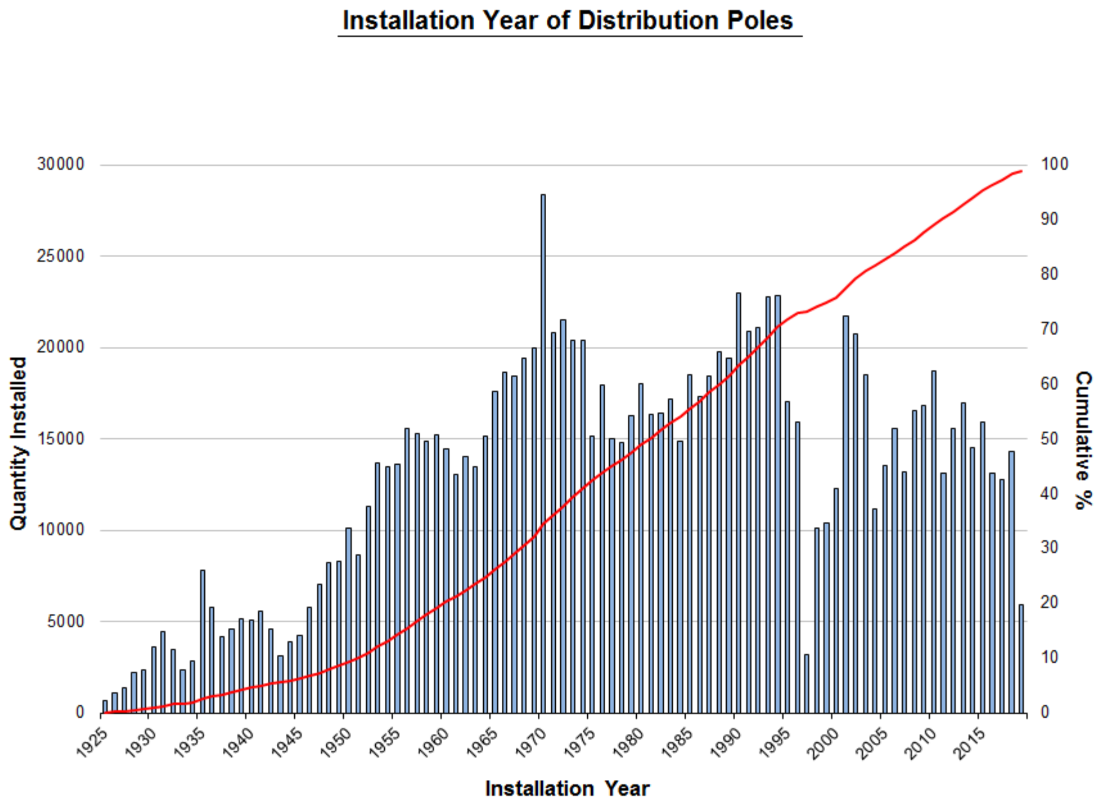
2. C. 1. Overhead System Assets

2. C. 1. 1. Wood Poles

Distribution structures include poles, system grounding, anchors and guying, crossarms, and riser pole equipment. There are approximately 1,251,000 distribution poles on the system with an average age of 38 years (Figure 2C-2). Distribution structures are in generally good condition, with 99 percent of structures inspected found in acceptable condition.[13] Some of the distribution assets are also attached to transmission or sub-transmission structures. The condition of those structures is discussed in either the transmission or sub-transmission section of this report rather than this section, as the distribution component is ancillary to the structure.

[13] A total of 251,012 poles were inspected (PSC Quarterly Report, Inspections Summary Report, Distribution Unique Inspections, Units Completed Table, December 31, 2018). Separate Computapole query indicates 246,353 poles had no pole related maintenance codes of any kind.

Figure 2C-2
Age Profile of Distribution Poles[14]



2. C. 1. 1. 1. Condition and Performance Issues

In Exhibit 3, the Distribution Overhead Facilities, Poles, Pole Condition heading summarizes the results of the Inspection and Maintenance program. Table 2C-3 shows a breakdown of the program results, including the four most frequent maintenance codes found.

14.

Table 2C-3
Distribution Wood Pole Inspection Results[15]

Level	Visual Rotting – Top 116	Visual Rotting – Ground 111	Leaning Pole 117	Wood Pecker 114	Other 110, 112, 113, 115	Total	Percentage Completed
2016 Summary							
1	0	0	0	0	296	296	100%
2	0	0	0	950	0	950	100%
3	2.974	1,981	349	0	2,498	7,802	73%
2017 Summary							
1	0	0	0	0	281	281	100%
2	0	0	0	656	2	658	99%
3	1,824	1,716	261	0	2,346	6,147	13%
2018 Summary							
1	0	0	4	0	457	461	100%
2	0	0	0	0	0	0	N/A%
3	1,535	1,399	274	0	2,854	6,062	4%

Figures 2C-4 and 2C-5 compare the installation year profiles of poles inspected in 2018 against poles that are candidates for replacement based on those same inspection results.[16] This profile is consistent with past years. A small percentage of the poles inspected were candidates for replacement, typically those poles are between 30 and 80 years old.

[15] Data source is Distribution Computapole Report 1030. The four most frequent codes are shown on this table. Exhibit 4, Distribution Overhead Facilities, Poles, Pole Condition heading summarizes all the wood pole asset condition codes.
[16] The following asset condition codes were considered as most likely resulting in pole replacement: 110 - Broken/Severely Damaged, 111 - Visual Rotting Ground Line, 113 - CuNap Treated, 114 - Woodpecker Holes, 116 - Visual Rotting Pole Top, 117 Leaning Pole. The poles considered candidates for replacement also had the following Priority Level codes: 1 (one week), 2 (one year), 3 (three years), P (performed during inspection), 9 (temporary repair) and 7 (emergency).

Figure 2C-4
Install Year Profiles of Poles Inspected Versus Replacement Candidates

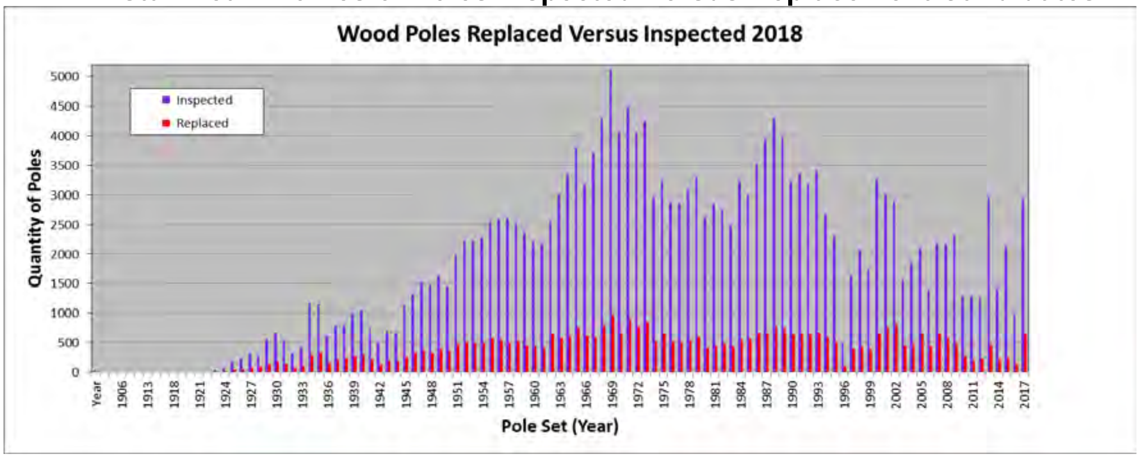
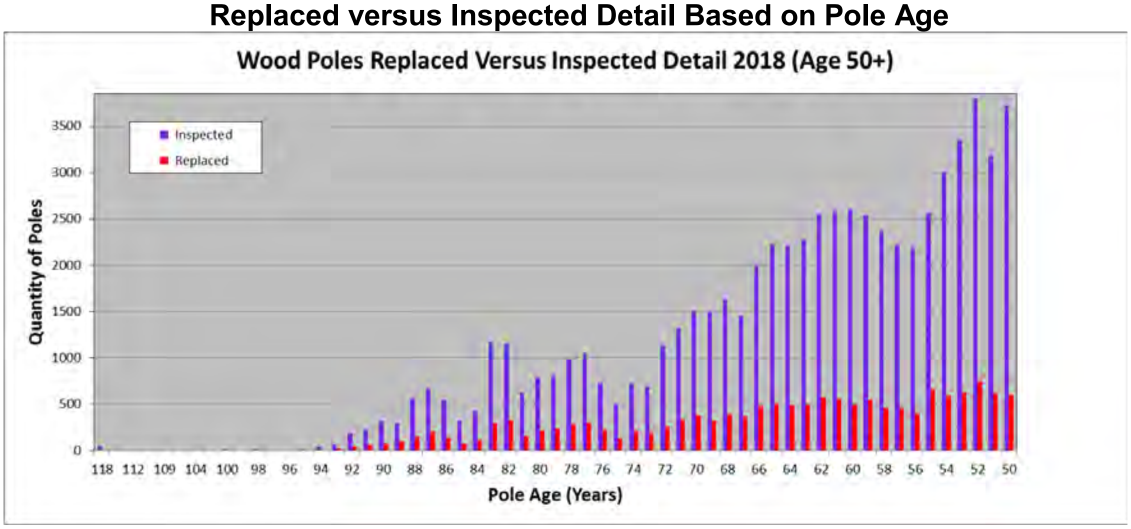


Figure 2C-5
Replaced versus Inspected Detail Based on Pole Age



2. C. 1. 1. 2. Remedial Actions Performed

A total of 11,000 poles were installed on the distribution system, including poles installed as part of the Inspection and Maintenance program and for other reasons such as new business.[17] Table 2C-6 shows the Inspection and Maintenance program results specific to distribution wood poles, further broken down by codes considered to require replacement. There can be multiple codes recorded per pole. The total number of inspected poles where no maintenance codes were found is also shown.

[17] Table 2C-13, *infra*, summarizes the distribution system overhead and underground equipment installed between July 1, 2018 to June 30, 2019.

Table 2C-6[18]
Distribution Wood Poles Replace and Repair Codes

Level	Replace Codes			Repair Codes		
	Number of Poles	Percent Codes vs. Inspections	Percent Completed	Number of Poles	Percent Codes vs. Inspections	Percent Completed
2016 Summary						
1	173	0.06%	100%	124	0.04%	100%
2	953	0.37%	100%	0	0.00%	N/A%
3	5,408	2%	73%	1,748	0.68%	73%
No Codes	251,891	98%				
Total Poles Inspected	255,732					
2017 Summary						
1	149	0.06%	100%	132	0.05%	100%
2	658	0.25%	99%	0	0.00%	N/A%
3	3,824	2%	12%	1,854	0.71%	14%
No Codes	255,034	98%				
Total Poles Inspected	260,764					
2018 Summary						
1	245	0.10%	100%	216	0.09%	100%
2	1	0%	100%	0	0.00%	N/A%
3	3,183	1.27%	1.13%	2,470	0.98%	8%
No Codes	246,353	98%				
Total Poles Inspected	251,012					

Between January 1 and December 31, 2018, inspections were completed on 251,012 distribution poles, representing 20 percent of the population. Based on inspection codes[19] approximately

[18] The replace codes used for this table are: 110 - Broken/Severely Damaged, 111 - Visual Rotting Ground Line, 113 - CU NAP Treated, 114 - Woodpecker Holes, 116 - Visual Rotting Pole Top, 801 - Osmose Priority Pole, and 802 - Osmose Reject Pole. The repair codes used for the report are the balance of pole codes available in the Distribution Field Survey Worksheet. The total number of poles inspected is per the December 31, 2018 PSC Quarterly Report, Inspections Summary Report, Distribution Unique Inspections, Units Completed Table. Separate Computapole query indicates poles that had no maintenance codes of any kind.

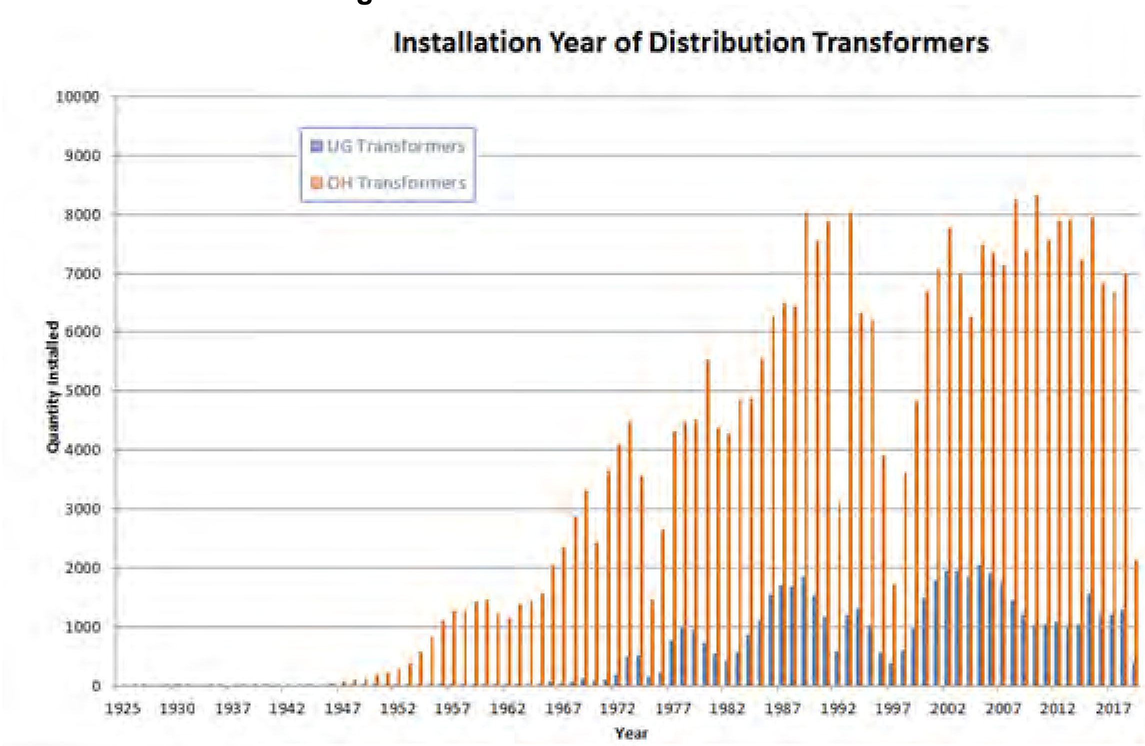
[19] Data source is Computapole Report 1030 taking counts of the following maintenance codes considered as most likely resulting in pole replacement: 110 - Broken/Severely Damaged, 111 - Visual Rotting Ground

3,429 poles are candidates for replacement over the next three years. The majority of the listed codes will not result in pole replacement. Multiple asset condition codes can be recorded for each pole.

2. C. 1. 2. Distribution Overhead and Padmounted Transformers

Figure 2C-7 shows the installation year profile data for overhead and underground distribution transformers on a per unit basis. The average age of overhead transformers is approximately 24 years for the 79 percent of transformers with age data. The average age of underground transformers is approximately 20 years for the 72 percent of transformers with age data.

Figure 2C-7
Age Profile of Distribution Transformers[20]



2. C. 1. 2. 1. Condition and Performance Issues

For overhead transformers, the results of the Inspection and Maintenance program are found in Exhibit 3, under the Distribution Overhead Facilities, Pole Equipment, Transformers heading. Exhibit 3 also contains a separate “Distribution Pad Mounted Transformers” table.

Line, 113 - CuNap Treated, 114 - Woodpecker Holes, 116 - Visual Rotting Pole Top, 801 - Osmose Identified Priority Pole, and 802 - Osmose Identified Reject Pole.

[20] A total of 81,100 overhead transformers and 19,531 underground transformers without age data are not shown. Transformers with installation dates prior to 1925 are included as without age data.

2. C. 1. 2. 2. Remedial Actions Performed

Remedial action performed as part of the Inspection and Maintenance program is contained in Exhibit 3. Table 2C-8 shows program results specific to distribution overhead transformers, further broken down by codes considered to require replacement.

Table 2C-8[21]
Distribution Overhead Transformer Replace and Repair Codes

	Replace Codes		Repair Codes	
Level	Number of Codes	Percent Codes Completed	Number of Codes	Percent Codes Completed
2016 Summary				
1	18	100%	0	N/A%
2	36	100%	2,824	100%
3	275	69%	5,894	70%
2017 Summary				
1	9	100%	0	N/A%
2	24	100%	1,915	85%
3	172	19%	6,490	21%
2018 Summary				
1	9	100%	0	N/A%
2	0	N/A%	226	93%
3	198	6%	6,874	1%

The majority of the Priority Level 2 and Priority Level 3 maintenance codes reported were for code153 – LA blown/missing/improper, code 155 – Animal guards required, and code 157 – Improper/missing bond, respectively.

Table 2C-13 shows a total of 6,263 overhead distribution transformer units were installed under various blankets, programs and specific projects such as Inspection and Maintenance, Distribution Line Transformer Upgrade and new business activities. Table 2C-13 also shows that 858 padmounted transformer units were installed.

2. C. 1. 3. Conductors

There are approximately 36,000 circuit miles of primary overhead distribution conductor. No age profile data is available for conductors because age data was not recorded on system maps until after the implementation of GIS in 2000.

2. C. 1. 3. 1. Condition and Performance Issues

In 2018, approximately 7,005 circuit miles were inspected. In Exhibit 3, the Distribution Overhead Facilities, Conductor, Primary Wires/Broken Ties heading summarizes the results of the Inspection and Maintenance program for primary conductor.

[21] The “replace” maintenance codes used for this table are: 150 - Weeping Oil, and 151 - Bushings Broken/Cracked. The repair maintenance codes include: 152, 153, 155, 156, and 157. The data source for this table is a Computapole Report 1030.

Table 2C-9
Recorded Maintenance Codes Per Circuit Mile Inspected

Year	Circuit Miles Inspected	Percent of System	Conductor Codes[22]
2016	7,461	20%	241
2017	7,448	20%	204
2018	7,005	19%	189

2. C. 1. 3. 2. Remedial Actions Performed

Remedial actions performed as part of the Inspection and Maintenance program are provided in Exhibit 3. A total of 203 circuit miles of new conductor was installed on the distribution system, including conductor installed as part of the Inspection and Maintenance program, the Engineering Reliability Review program, the Planning Criteria program, and new business.

2. C. 1. 4. Cutouts

There are approximately 228,000 cutouts on the distribution system.

2. C. 1. 4. 1. Condition and Performance Issues

Potted porcelain cutouts have been identified for replacement due to a mechanical failure mode and potential hazard associated with them. The strategy to replace potted porcelain cutouts has been included in the Inspection and Maintenance program. Beginning in the 2011 inspection cycle, the Company changed the Inspection and Maintenance program priority level for potted porcelain cutouts (maintenance code 281) from Priority Level 3 to Priority Level 2 to expedite the program.

The summarized results of the Inspection and Maintenance program for cutouts can be found in Exhibit 3 under the heading Distribution Overhead Facilities, Pole Equipment, Cutouts.

2. C. 1. 4. 2. Remedial Actions Performed

Remedial actions performed as part of the Inspection and Maintenance program are provided in Exhibit 3. As shown in Table 2C-10, the Inspection and Maintenance program has identified 164 potted porcelain cutouts from 2018 and replaced 1% percent of them.

Table 2C-10
Potted Porcelain Cutout in the Inspection and Maintenance Program

			2016		2017		2018	
Status			**Units**	**%**	**Units**	**%**	**Units**	**%**
Replaced			368	73.74%	106	16.18%	1	0.60%
Pending			131	26.25%	549	83.81%	163	99.39%
Total			499		655		164	

[22] The Conductor Codes used for this table are the same as used for Exhibit 3, Distribution Overhead Facilities, Conductors, Broken Wire/Broken Ties heading: 127 - Primary on Arm, 140 - Insufficient Ground Clearance, 141 - Damaged Conductors/Broken Strands, 145 - Damaged Stirrups/Connector, 146 - Improper Sag, 286 - Spur Tap Not Fused, and 402 - Infrared Problems Splice.

2. C. 1. 5. Switchgear

There are approximately 3,485 switchgears on the system. Switchgears are generally in good condition with only a minimal number of issues discovered from the Inspection and Maintenance program.

2. C. 1. 5. 1. Condition and Performance Issues

There is no unique heading in Exhibit 3 for switchgear. Switchgear related maintenance codes are under various headings in the Distribution Underground Facilities table.

Between January 1, 2018 and December 31, 2018, inspections were completed on an estimated 908 switchgears. There were 11 Priority Level 1, 2 or 3 issues identified.

2. C. 1. 5. 2. Remedial Actions Performed

A total of 42 new switchgear units were installed on the distribution system.

2. C. 1. 6. Capacitors

There are approximately 5,000 capacitor banks on the distribution system providing reactive support. Capacitor banks are in generally good condition based on the number of maintenance codes recorded during inspections.

2. C. 1. 6. 1. Condition and Performance Issues

There is no unique heading for distribution line capacitors in Exhibit 3. Capacitor related activity is reported under various headings in the Distribution Overhead Facilities table.

Table 2C-11 shows the inspection results on capacitor banks between calendar years 2016 and 2018.

Table 2C-11
Capacitor Inspection Results

Level	Animal Guard Missing – 166	Improper/ Missing Bonding - 165	LA Missing/ Blown - 167	Blown Fuse - 164	Missing Ground - 163	Total	Percent Complete
2016 Summary							
1	0	0	0	0	0	0	N/A%
2	0	0	0	49	17	66	100.00%
3	238	60	125	0	0	423	95.27%
2017 Summary							
1	0	0	0	0	0	0	N/A%
2	0	0	0	24	8	32	100.00%
3	2	36	143	0	0	181	34.80%
2018 Summary							
1	0	0	0	0	0	0	N/A%
2	0	0	0	0	0	0	N/A%
3	0	46	160	0	13	219	0.91%

The need to install animal guards is the most common code recorded against capacitor banks during inspection.

2. C. 1. 6. 2. Remedial Actions Performed

Table 2C-12 above shows the remedial action performed under the Inspection and Maintenance program. Capacitor maintenance is performed within the Inspection and Maintenance Program. Additionally, small capital projects are budgeted to address feeder level capacity and voltage support issues on the distribution system. As shown in Table 2C-14, a total of 56 capacitor units were installed between July 1, 2018 to June 30, 2019 on the distribution system, including those related to asset condition, feeder loading and voltage support.

2. C. 2. Vegetation Management

The Company's Distribution Vegetation Management (VM) Program consists of two components - cycle pruning and enhanced hazard tree mitigation (EHTM). The main purpose of the cycle pruning program is to create and maintain clearance between energized distribution conductors and vegetation, primarily tree limbs. The EHTM program is intended to minimize the frequency and damaging effect of large tree and large limb failures from alongside and above the Company's overhead primary distribution assets. This program assists in the Company's effort to provide reliable service to customers and meet regulatory targets.

The cycle pruning program has an interval of approximately 5½ years which is based on a combination of factors, including length of the growing season, growth characteristics of the predominant tree species, and the amount of pruning clearance that can be obtained. National Grid schedules the distribution circuit vegetation pruning maintenance and adjusts for actual field growth conditions to yield an average 5½ year cycle. Actual circuit schedules range from 4 to 6 years.

Stable and consistent circuit pruning provides a measure of reliability by reducing tree/conductor conflicts. It is also important in providing public safety and line crew access. Clear access improves efficiency in restoration and maintenance, and enhances the accuracy and efficiency of the line inspection process.

National Grid's EHTM program uses tree interruption prediction modeling based on historic tree interruption data as well as an estimated risk of future tree interruptions. This model takes into account customers at risk, miles of bare wire three phase construction, tree events per circuit mile, customers interrupted per tree event and the estimated overall cost to reduce the number of customers interrupted. The ranking provides a preliminary listing of circuits which are then field reviewed by arborists. A final list of circuits is developed that are expected to provide the most efficient and effective response to the mitigation. Once a circuit is chosen, a circuit partitioning process is utilized to divide the circuit into prioritized segments based on number of customers served after each protection device. Hazard tree inspection intensity is then applied to the circuit segments accordingly. For example, within the main line portion of the circuit where future tree failures may cause a station breaker operation (lock-out) for the entire feeder, the highest inspection intensity is performed. For fiscal year 2019, hazard tree mitigation work was performed on 45 poor performing circuits.

In large areas across New York State, forest conditions are being impacted by the invasive pest, Emerald Ash Borer (EAB). It is expected that in time, all trees of the Ash species will be either in decline or dead. In 2018 Ash trees accounted for approximately 4% of the tree outages on the distribution system and of the Ash events, 33% had EAB infestation. As of the first half of 2019 the system has experienced 7% Ash events and 63% of the Ash events have EAB infestation. National Grid funded a study to assess the risks and impacts associated with EAB in New York. Using the information obtained in the study, the Company developed a long-term strategy for mitigating the issue.

Ultimately, 100% of the Ash trees growing in proximity to National Grid US overhead assets will die. The rate of infestation and mortality within the Company's service area could put significant risk on our ability to deliver reliable electric service to customers. The Company has implemented a risk-based and pro-active mitigation program to address the mortality of Ash trees adjacent to the overhead system. The investment to mitigate the increased risk has been implemented and is in its third year. The program is intended to maintain a removal rate above the failure rate of Ash trees.

2. C. 3. Underground System Assets

National Grid's underground distribution system includes primary and secondary cables, secondary network cables, network protectors and transformers, manholes, vaults, and handholes. The Inspection and Maintenance Program inspected 18,260 unique underground facilities between January 1, 2018 and December 31, 2018. Items inspected include the condition of the underground structures themselves, and the condition of equipment within the structure, such as cables, splices, and network protectors. Padmounted transformers and switchgears are inspected with the overhead system and are discussed in the Overhead System Assets section above. Network system assets, a small portion of the underground system, are detailed in a separate section below.

2. C. 3. 1. Primary Underground Cables

There are approximately 7,700 circuit miles of primary distribution cable in the distribution system. The underground distribution system consists primarily of paper-insulated lead-covered (PILC), ethylene propylene rubber (EPR) type cables and cross-linked polyethylene (XLPE) type cables. Planned cable replacements are driven by cable condition and performance history. Network and radial events in the winter of 2012/2013 prompted a review of the existing cable replacement program. In 2013, National Grid selected an independent consultant to perform an assessment of the Company's Albany network system and provide a comparison to industry norms and best practices. This work included a review of Company standards, studies, policies, data management, and guidelines. The findings were expanded and shared on a system-wide basis. In parallel, National Grid developed a defined criticality scoring metric to identify primary, secondary, and secondary network cable replacement projects. A cable replacement program has been implemented to evaluate cables and assign priority levels to those in most urgent need of replacement.

2. C. 3. 1. 1. Condition and Performance Issues

In Exhibit 3, the Distribution Underground Facilities, Primary Cable heading summarizes the results of the inspection and maintenance program.

2. C. 3. 1. 2. Remedial Actions Performed

Remedial action performed as part of the Inspection and Maintenance program is shown in Exhibit 3, Distribution Underground Facilities.

2. C. 3. 2. Buffalo Streetlight Cable Replacement

This program replaces deteriorated underground street light cables and conduit in the Buffalo metropolitan area to address repetitive incidents of elevated voltage.

2. C. 3. 2. 1. Condition and Performance Issues

Elevated Voltage Testing has identified contact voltage incident rates that are greater than other areas in the Company's service territory.

2. C. 3. 2. 2. Remedial Actions Performed

On April 15, 2013, the Company filed a comprehensive long-term street light refurbishment plan for the City of Buffalo in Case 12-E-0201. This program has been successful in reducing elevated voltage conditions in the Buffalo street light system.

2. C. 3. 3. Manholes, Vaults and Handholes

There are approximately 12,200 manholes, 1,800 vaults and 78,000 handholes in the underground system.

2. C. 3. 3. 1. Condition and Performance Issues

There were 3,086 manholes, 74 vaults, and 21,848 handholes inspected from January 1, 2018 to December 31, 2018. The results of the Inspection and Maintenance program can be found in Exhibit 3, Distribution Underground Facilities.

In 2018, all Priority Level 1 maintenance codes were completed as follows: 267 instances were for maintenance code 600 – Broken/ Damaged, 8 instances were for maintenance code 625 – Secondary Needs Repair, and 1 instance was for maintenance code 614 – Cracked/broken. A significant amount of work was completed during inspection and listed as Priority Level P - performed during inspection.

Priority Level 2 maintenance codes have been reported as follows: 585 instances were for maintenance code 600 – Broken/Damaged, 29 were for maintenance code 611 – Cable/Joint Missing, 6 were for maintenance code 612 – Cables bonded/Grid Defective, 142 were for maintenance code 616 – Improper Grade, 85 were for maintenance code 620 - Rerack, 2 were for maintenance code 621 – Ring/cover repair/replace, and 1 was for maintenance code 722 – Submersible equipment - Leaking.

Priority Level 3 maintenance codes have been reported as follows: 12 instance for maintenance code 621 – Ring/cover repair/replace, 1 instance for maintenance code 706 – Improper Grade, 3 instances for maintenance code 730 – Anodes Missing, and 97 for maintenance code 731 – Anodes Need Replacement.

2. C. 3. 3. 2. Remedial Actions Performed

Remedial work performed as part of the Inspection and Maintenance program can be found in Exhibit 3. For calendar year 2018, 3,674 maintenance codes were considered Priority Level P and performed during inspection. The majority of Level P repairs performed during inspections involved replacing nomenclature on manholes and handholes.

2. C. 3. 4. Network Systems

National Grid’s network system is not extensive; however, the system is diverse and spread out among many communities. Table 2C-12 lists the networks including location (City & Division), peak load, number of supply substations, substation names, number of supply feeders, and number of network protectors (on Grid or in Spot Networks).

Table 2C-12
Network Listing

City	Peak Load (MVA)	# of Supply Substations	Substation Names	# of Supply Feeders	# of NWP's on Grid	# of NWP's in Spots	Last Update	Last Studied
Buffalo (Broadway)	1	1	Seneca Terminal Sta	3	4	3	Jun-2017	Aug-2015
Buffalo (Elm Street)	117	1	Elm Street	20	146	134	Aug-2018	Aug-2018
Niagara Falls	0.4	1	Gibson	3	8	0	Jun-2017	Aug-2015
Albany	32	2	Riverside, Trinity	10	85	36	Jun-2017	Apr-2010
Albany (34.5kV)	14.9	2	Riverside, Partridge	5	0	32	Jun-2017	Apr-2010
Glens Falls	2.5	2	Glens Falls, Henry St.	4	12	0	Jun-2017	Jan-2013
Schenectady	13	1	Front Street	5	45	9	Jun-2017	Jan-2014
Troy	11	1	Liberty Street	8	33	4	Jun-2017	Jan-2009
Cortland	1.98	2	Cortland, Miller St.	3	10	0	Aug-2017	Aug-2017
Syracuse (Ash Street)	26.4	1	Ash Street	10	93	37	Apr-2018	Jun-2018
Syracuse (Temple Street)	20.7	1	Temple Street	7	21	60	Jun-2017	Jun-2018
Utica	7.4	1	Terminal Street	4	27	13	Apr-2018	Apr-2018
Watertown	4.26	1	Mill Street	5	21	2	Jun-2016	Jul-2018

2. C. 3. 4. 1. Condition and Performance Issues

There is no unique heading for network equipment in Exhibit 3. This equipment is reported under various Distribution Underground Facilities headings. Vaults containing network equipment are included in the Manholes, Vaults, and Handholes section above.

Between January 1, 2018 and December 31, 2018 a total of 3,160 manholes and vaults had been inspected with no maintenance codes related to network transformers and protectors reported. Maintenance codes found were related to the vault structure and are included in the manhole and vault section above.

Network assets are typically inspected on a shorter cycle than required for the Inspection and Maintenance program. National Grid Standard Maintenance Procedure SMP421.01.2 currently requires extensive visual inspections of network protectors and transformers annually. Depending on the network protector style, diagnostic overhauls are required every two to five years including cleaning, adjusting, lubricating, and replacing broken or worn parts. Network protectors are also operationally tested annually, with improperly functioning units replaced or repaired. According to an internal scorecard, 3,160 manholes and vaults were inspected as of December 2018 with many containing network equipment.

2. C. 3. 4. 2. Remedial Actions Performed

Remedial action performed on vaults containing network equipment is covered above in the Manholes, Vaults, and Handholes section. Work specific to network vaults in 2018 included the replacement of 24 network protectors and 25 network transformers across upstate NY network systems.

2. C. 3. 5. Arc Hazard Analysis

In February of 2015, National Grid and other utility companies sponsored additional EPRI research on 480 volt spot network systems. The goal of the research was to evaluate realistic arc flash events inside and outside of network protectors and to evaluate the performance of additional protection systems such as optical sensors.

The findings of this research were:

480 volt faults within network protectors do not sustain longer than 1.5 cycles if the associated network transformer is de-energized. Measured incident energy exposures were below 8 cal/cm^2.

All realistic open-air 480 volt fault scenarios outside network protectors, but within vaults self-cleared within four cycles. Measured incident energy exposures were below 8 cal/cm^2.

Based on the research findings, National Grid is no longer proactively installing secondary arc flash mitigation devices (link boxes) and is evaluating additional high side load-break switches to be installed on the high side of transformers in 480 volt spot networks. The high side switches originally purchased were not proving to be as robust as originally thought. A new switch was recently chosen and added to the standard equipment catalog. Trial installation of this equipment will begin in 2019.

Table 2C-13
Distribution System Overhead and Underground Equipment
Installed July 1, 2017 to June 30, 2018

Equipment	Project Type	Unit Count
Wood Poles (Units)	Blanket	7,051
	Program	6,519
	Specific	1,280
	Total	14,850
Overhead Transformer (Units)	Blanket	4,575
	Program	1,116
	Specific	572
	Total	6,263
Primary Conductor (Feet)	Blanket	444,171
	Program	4,419
	Specific	621,016
	Total	1,069,606
Capacitor Banks (1Ph/3Ph) (Locations)	Blanket	31
	Program	16
	Specific	9
	Total	56
Line Reclosers (Units)	Blanket	71
	Program	310
	Specific	45
	Total	426
Line Regulators (Units)	Blanket	73
	Program	3
	Specific	4
	Total	80
Switchgear (Units)	Blanket	24
	Program	0
	Specific	19
	Total	43
Primary Underground Cable (Feet)	Blanket	183,516
	Program	14,036
	Specific	66,166
	Total	263,718
Padmount/ UG/Net Transformer (Units)	Blanket	567
	Program	108
	Specific	183
	Total	858
Manholes and Vaults (Units)	Blanket	14
	Program	2
	Specific	18
	Total	34

Chapter 2D. Distribution Substation Asset Condition

This section addresses substations that contain assets typically operating at 46kV or below, beginning at the station level (i.e., those being rebuilt or replaced), and then addressing individual assets.

A summary of the equipment types and populations for key substation assets is provided in Table 2D-1.

Table 2D-1
Substation Asset Inventory

Main Asset	Inventory
Substations[23]	522
Circuit Breakers	3,769
Power Transformers	734
Batteries/Chargers	733
Surge Arresters	1,188
Sensing Devices	2,274
Voltage Regulators/Reactors	597
Capacitor Banks	75

2. D. 1. Substation Inspections and Work Orders

Substation Visual and Operational Inspections (V&O's) are performed bi-monthly on each substation. V&O's are considered preventive maintenance since inspections identify defects in substation equipment for appropriate mitigation. Annual levels of follow up work orders which proactively address substation conditions have risen over time while Trouble Maintenance has fallen.

2. D. 2. Substation Flooding

Distribution substations are largely safe and adequate for seasonality and moderate storm events. Record-breaking events throughout the United States continue to underscore the importance of protecting infrastructure from flooding. A decade or more ago, National Grid experienced extreme flooding at several substations. Since that timeframe, historical event information and Federal Emergency Management Agency (FEMA) data has used as the basis to develop an on-going flood risk and management program and complete mitigation projects.
Capital projects have been completed to retire and relocate substations entirely out of flood zones, construct impermeable concrete floodwalls, raise vulnerable equipment, reinforce river-bank barriers, and other resiliency initiatives. All stations that have been affected by flooding have had,

[23] Substation count is now derived from FERC classification, which has resulted in an increase of the number of distribution substations.

at a minimum, some degree of mitigation completed. In addition to the resiliency hardening already completed, Union Falls station is slated for relocation and retirement.

FEMA Flood Insurance Rate Maps are examined at the planning stages of every project to assess the latest data, risk, and reasonable feasibility of avoiding flood risk. For new FEMA maps, these data have been developed from detailed hydraulic analysis based from extreme storm events and provide "Base Flood Elevations," *i.e.*, theoretical water levels to protect infrastructure against. Certain challenges exist such as a lack of elevation data on older effective FEMA maps, and certain regions in the state are unmapped entirely. This data also may not take into account the possibility of factors such as dam breaks, ice river jams, debris blocked bridges/culverts, and storm events in excess of the theoretical rainfall of 1 in 100 years. The American Society of Civil Engineers "Flood Resistant Design and Construction" Standard is utilized for mitigation and new construction projects. National Grid classifies stations as Flood Design Class 4, the most stringent and flood protective category.

In addition to targeted capital projects, an extensive amount of emergency response flood mitigation materials have been purchased and strategically located throughout New York State. National Grid field workforces have been trained on the equipment and the team of engineers and field crews are prepared to respond via notification from the Emergency Planning Department.

2. D. 3. Substation Equipment Assessments and Asset Condition Codes
The Company classifies substations by condition and impact codes as shown in Table 2D-2.

Table 2D-2
Substation Condition Codes

Code	Classification/Condition	Implication
1 Proactive	Asset expected to operate as designed for more than 10 years.	Appropriate maintenance performed; regular inspections performed.
2 Proactive	Some asset deterioration or known type/design issues. Obsolescence of equipment such that spares/replacement parts are not available. System may require a different capability at asset location.	Asset likely to be replaced or re-furbished in 5-10 years; increased resources may be required to maintain/operate assets.
3 Proactive	Asset condition is such that there is an increased risk of failure. Test and assessment identifies definite deterioration which is on-going.	Asset likely to be replaced or refurbished in less than 5 years; increased resources may be required to maintain/operate assets.
4 Reactive	Asset has sudden and unexpected change in condition such that it is of immediate concern; this may be detected through routine diagnostics, including inspections, annual testing, maintenance, or following an event.	Testing and assessment required to determine whether the asset may be returned to service or may

Code	Classification/Condition	Implication
		be allowed to continue in service. Following Engineering analysis, the asset will be either recoded to 1-2-3 or removed from the system.

Condition codes are used to summarize the status of the asset type population.

2. D. 4. Indoor Substations

Indoor substations were generally built in the 1920s through 1940s and are considered obsolete. The outmoded design of most of the stations does not meet accepted safety practices, and the protection and control systems have been superseded by new technology. Some indoor substation equipment is also in poor and/or overloaded condition. There are 34 indoor substations in Buffalo, five in Niagara Falls, one in Albany and one in Gloversville. In addition, there are two newer indoor substations in Buffalo, built after 1949. These stations will need replacement at the end of the program.

National Grid is exploring the strategic placement of 13.2kV substations within the City of Buffalo. Although installation of 13.2kV facilities is an option, conversion and the ability to maintain adequate feeder ties in urban areas has proven to be difficult. Distribution within the City is often underground or backyard construction. Given local code requirements and cost of conversion, converting the load has not proven to be the preferred option in many cases. The Niagara Falls indoor substations are supplied from an underground 12kV system. That system and the substations that supply it are of the same vintage and poor condition as the indoor substations. Several 115-13.2kV substations and feeders have been constructed in the area, so building smaller outdoor stations and limited conversion is an option being considered.

2. D. 4. 1. Condition and Performance Issues

Key safety issues associated with the obsolete Buffalo style indoor substation design are:

- The 23kV Conduit oil switches do not have the appropriate fault interrupting capability.
- The operation of the 23kV Conduit oil switch and the 4.16kV oil circuit breakers require the operator to stand next to the switch or breaker.
- The protective relay scheme does not provide detection for certain faults, and has inappropriate blocking, which may lead to equipment failure.
- The obsolete equipment does not meet current requirements for fault interrupting capability, operating interfaces, and personnel safety.
- Breakers have no provision for proper safety grounding.

Key reliability and customer issues associated with the obsolete Buffalo style indoor substations are:

- The existing protection scheme has limited the ability to connect some customer loads, cannot be upgraded, and must be replaced.
- Wear of 4.16kV breaker operating mechanisms has resulted in misoperations.
- In some locations, transformer banks are overloaded and poor ventilation in transformer bays has led to transformer overheating.

- The 23kV substation supply is overloaded on contingency.
- Given the obsolete protection scheme and equipment, equipment failures can escalate leading to extended customer outages.

2. D. 4. 2. Remedial Actions Performed

Buffalo Station 59 construction was completed in 2019. Buffalo Station 53 is progressing through design and will begin construction in 2020. Buffalo Station 32, Buffalo Station 38, Stephenson, Eighth Street, and Welch are planned for construction in the 5 year Capital Investment Plan.

2. D. 5. Metal-Clad Switchgear

Metal-clad equipment is prone to water and animal ingress which leads to failures. V&O surveys help detect such degradation but do not identify poorly performing electrical equipment unless there is significant deterioration or failure. Such identification is more likely with electro-acoustic detection techniques. An initial review using this technique identified a number of locations for further review. For example, the North Troy substation metal-clad switchgear was recently replaced after being identified using this technique.

2. D. 5. 1. Condition and Performance Issues

A further selection of metal-clad switchgear was assessed using a criticality ranking that led to the identification of deterioration. These metal-clad switchgear stations that have been assessed and identified for replacement or retirement based on review of performance and risk mitigation are listed in Table 2D-3.

Table 2D-3
Metal-Clad Substations with Performance Issues

Division	Station Name	Status
Substation – NY Central	Tuller Hill Station 246	In-progress
Substation – NY Central	Hopkins Road Station 253	In-progress
Substation – NY Central	Terminal Station 651	Engineering
Substation – NY Central	Temple Station 243	Engineering
Substation – NY Central	Fayette Street Station 28	Planning
Substation – NY Central	Pine Grove Station 59	Planning
Substation – NY Central	Duguid Station 265	Planning
Substation – NY Central	Little River Station 955	Planning
Substation – NY Central	Rock Cut Station 286	Planning
Substation – NY Central	Glenwood Station 227	Planning
Substation – NY Central	Whitesboro Station 632	Planning
Substation – NY Central	Malone Station 895	Planning
Substation – NY East	Chrisler Avenue Station 257	Engineering
Substation – NY East	Emmet Street Station 256	Engineering
Substation – NY East	Market Hill Station 324	Engineering
Substation – NY East	Avenue A Station 291	Conceptual
Substation – NY East	Prospect Hill Station 413	Conceptual
Substation – NY East	Ruth Road Station 381	Conceptual
Substation – NY East	Blue Stores Station 303	Conceptual
Substation – NY East	Pinebush Station 371	Planning
Substation – NY East	Johnson Road Station 352	Planning
Substation – NY East	McKownville Station 327	Planning

Substation – NY East	Delmar Station 279	Planning
Substation – NY West	Station 162	Engineering
Substation – NY West	Station 061	Conceptual
Substation – NY West	Station 140	Planning
Substation – NY West	Station 212	Planning
Substation – NY West	Station 155 - Worthington	Planning
Substation – NY West	Station 129 - Brompton Rd	Planning

The Company continues to evaluate metal-clad equipment via V&O inspections and Infrared Thermovision to provide baseline information. Electrical partial discharge surveys are performed as needed for individual cases involving suspect assets.

2. D. 5. 2. Remedial Actions Performed

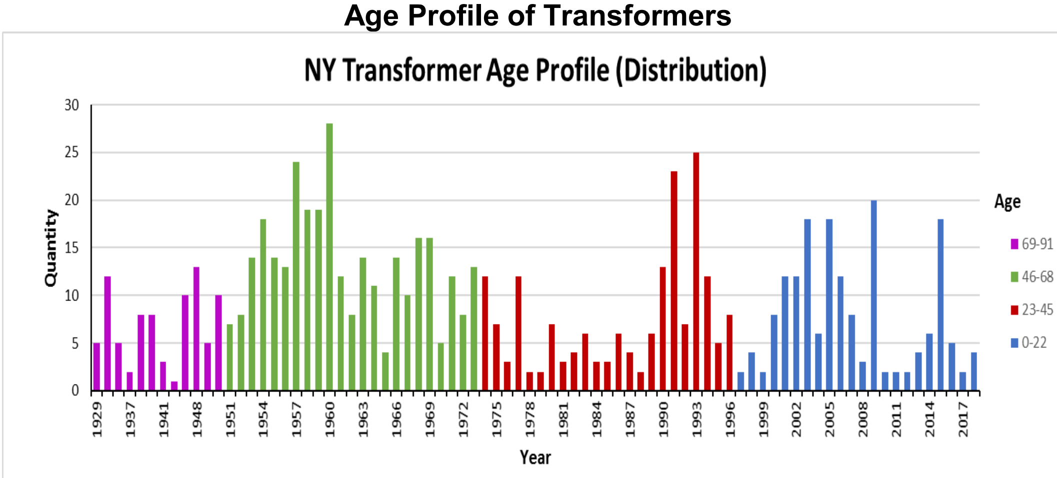
The priority of each metalclad replacement was reviewed with each region's substation operations department. In the Eastern division it was determined that Ruth Rd, Prospect Hill, and Blue Stores Substation metalclads have a greater need of replacement and are being advanced in the plan. In the Central region the Fayette St Metalclad was also raised in priority and a plan is being developed for its replacement.

2. D. 6. Power Transformers

National Grid has 734 distribution power transformers plus 64 spares with primary voltages 46kV and below. The population of power transformers is generally sound, with some exceptions discussed in this section. Most power transformers range in size from less than 1MVA to about 20MVA and may have several MVA ratings depending on available cooling options.

The average age of the distribution power transformer population is 41 years, which is displayed in Figure 2D-4. There are 425 power transformers greater than 50 years of age based on stored nameplate data. However, 6 distribution transformers have no year of manufacture indicated in the Cascade database, which implies that there may be additional units greater than 50 years of age.

Figure 2D-4
Age Profile of Transformers



Power transformer age is a helpful indicator of which transformers may be less able to perform their function due to accumulated deterioration. Power transformer paper insulation deteriorates with time and thermal loading history. The deterioration is cumulative and irreversible and thus cannot be addressed via maintenance. As the paper degrades, the ability of the insulation to withstand mechanical forces is reduced and the mechanical integrity of the transformer is compromised when subjected to through faults or internal faults. In addition, the paper deterioration may lead to shrinkage of the winding packs, thereby reducing the mechanical stability of the transformer.

Given the possible substantial impact of power transformer failures on the distribution system, and the extensive lead times and disruption to normal operations, National Grid pursues a comprehensive approach to risk management of transformers. This includes thorough and regular reviews of the population, procuring an appropriate number of spare units, and the generation of a ‘watch list’ of suspect and higher impact transformers for more frequent observation and review. National Grid also reviews each transformer individually to determine both condition and likely risks to the system before making a determination regarding replacement or refurbishment requirements.

2. D. 6. 1. Condition and Performance Issues

National Grid's maintenance practice is to perform a Dissolved Gas Analysis (DGA) on distribution power transformers rated 2.5MVA to 15MVA every two years and units rated above 15MVA annually. In addition, DGA may be performed more frequently on suspect units to monitor the condition more closely. Sampling and analysis may be quarterly, monthly, or more often; and this information is used to determine the current condition of the transformers and the likely degradation over time.

Table 2D-5 provides condition codes for 2018 and 2019 year-to-date based on this review. The condition codes for transformers have been assigned based on the transformer oil analysis (TOA) score. A score of 2 indicates gasses are present in the oil. A score of 3 indicated a significant increase in the levels of gasses or an increase over the minimum threshold for that class of transformer. A score of 4 is assigned when oil analysis shows a rapid increase in gasses or the presence of acetylene that indicates an internal arc.

Table 2D-5
Condition Code of Transformers

Year	Code	1	2	3	4	Grand Total
2018	TRF	493	174	14	11	752
2019	TRF	473	240	12	9	734

A transformer with condition code 4 is not automatically replaced. The transformer may receive more frequent DGA sampling and review. Most code 4 units will be revised to a lower condition code following a review, but it is possible that they will be replaced. Transformer replacements may also be based on maintenance and leak history.

2. D. 6. 2. Remedial Actions Performed

The transformer watch list is based on condition and operational information. The watch list is used to monitor transformers of concern to assess how their condition develops and, if need be, plan for rapid replacement of the unit. For example, transformers that are subject to a through fault, as may be initiated by a lightning strike, may:

- fail instantaneously as a result of internal stresses generated by the through fault;
- start to deteriorate from through faults weakening the transformer over time; or
- generate diagnostic gasses which are measured to determine degradation, and which may subsequently stabilize.

A review of possible transformer spares and mobile capability has been performed and documented for the transformers on the list. In addition, the ability to perform field ties and operate units as an open delta on single-bank units with delta high side windings[24] is reviewed as a possible solution if a problem arises. Furthermore, an increase in DGA sampling will occur, where needed, to monitor the transformer condition.

Table 2D-6 provides the current list of transformers on the "watch list".

Table 2D-6
"Watch List" of Distribution and Sub-Transmission Transformers

Substation	Region	Disp Desg	High Side kV	Low Side kV	Max MVA	Age
Phoenix Station 51	NYC	1 LTC TRF	34.5	4.8	7	49
Third Street Station 216	NYC	1 TRF	34.5	4.8	4.69	61
Delmar	NYE	2 LTC TRF	34.5	4.8	6.25	58
Schenevus	NYE	1 TRF	23	4.8	0.667	71
Station 023	NYW	3 LTC TRF	23	4.16	4.69	25
Station 122	NYW	3 TRF	23	4.16	3.125	64
Station 161 - Short St.	NYW	11 TRF	23	4.16	3.75	27
Station 39	NYW	3 LTC TRF	23	4.16	4.69	25
Station 48	NYW	4 LTC TRF	23	4.16	4.69	25

Programs are in place to replace substation power transformers. Of the transformers identified to be watched, all have been prioritized for future replacement or retirement based on condition and risk. Table 2D-7 describes transformers that will be addressed within five years.

[24] The three high voltage windings are connected in a delta formation rather than a grounded wye formation.

Table 2D-7
Transformers to be Replaced or Retired within Five Years

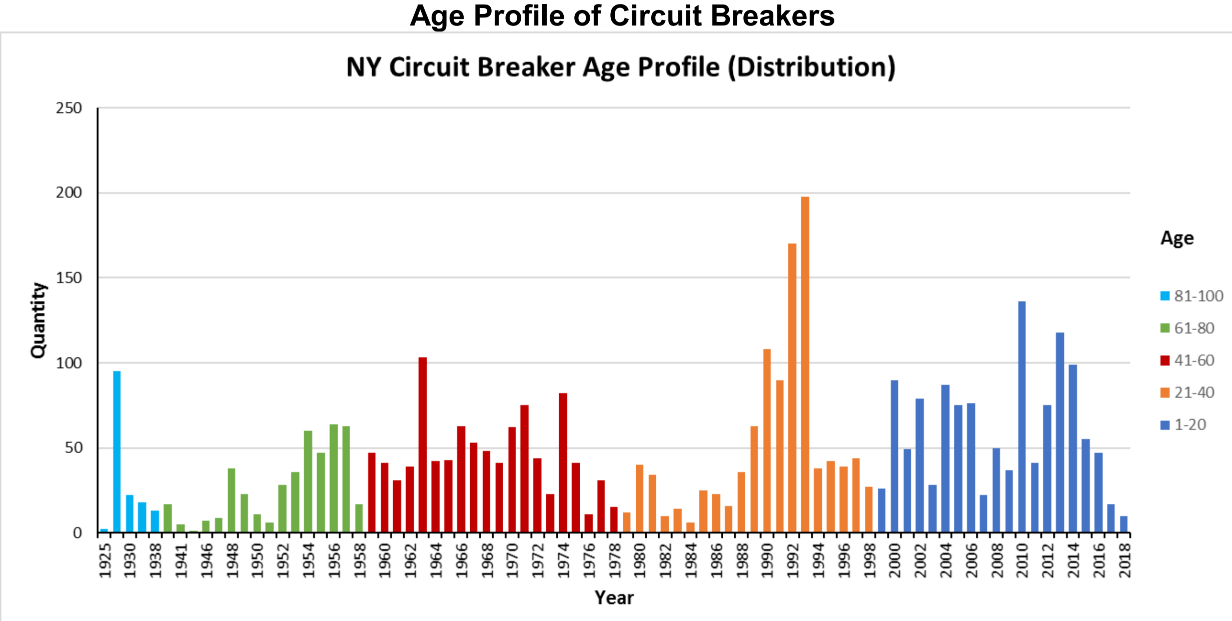
Station Name	QTY	Rating	Status
Avenue A Station 291	2	34.5-4.16 kV 5/6.25 MVA	Planning
Chrisler Avenue Station 257	2	34.5-4.16 kV 3/3.65 MVA	Engineering
Raquette Lake Station 398	3	46-4.8 kV 0.33 MVA	Engineering
Rock City Station 623	1	46-4.16 kV 5.6/7 MVA	Engineering
Station 053	3	23-4.16 kV 2.5/3.13 MVA	Conceptual
Station 085 - Stephenson Avenue	3	12-4.8 kV 3.5 MVA	Planning
Station 124 - Almeda Ave	4	34.5-4.16 kV 3.75/4.68 MVA	Engineering
Station 162	2	23-4.16 kV 2.5 MVA	Engineering

Although transformer replacements are based on condition and risk, a cautious approach is used to determine the appropriate number of transformers needing replacement per year.

2. D. 7. Circuit Breakers

National Grid has 3,769 circuit breakers and 180 spares on the distribution system, with an average age of 34 years as shown in Figure 2D-8. The substation circuit breaker population is generally sound and reliable; however, there are certain units which will be addressed as described below.

Figure 2D-8
Age Profile of Circuit Breakers



2. D. 7. 1. Condition and Performance Issues

There are relatively few gas circuit breakers (GCB) in the breaker population, but similar numbers of Air Magnetic Circuit Breakers (AMCB) and Oil Circuit Breakers (OCB) with an increasing amount of Vacuum Circuit Breakers (VCB) as shown in Table 2D-9. This analysis includes breakers and reclosers.

Table 2D-9
Breakers Types

Breaker Type	Percentage of Total Population 2018	Percentage of Total Population 2019
AMCB	22%	19%
GCB	1%	3%
OCB	19%	23%
VCB	58%	55%

Older breakers, though not inherently less reliable, are more difficult to maintain, may not meet the specifications needed for modern electrical systems and may not be supported in terms of replacements or spare parts.

Breaker condition coding was based on engineering experience and supported by discussion with local operations staff and Subject Matter Experts (SMEs). Condition codes have been applied to the operating population as shown in Table 2D-10.

Table 2D-10
Condition Code of Circuit Breakers

Condition Code	1	2	3	4	Grand Total
2018	3,210	737	61	0	4,008
2019	2,983	728	57	1	3,769

2. D. 7. 2. Remedial Actions Performed

Approximately 60 breakers have been replaced since the last report. Of the 63, 14 failed unexpectedly and were replaced with system spares.

Certain types of breakers with condition codes 2 and 3 are targeted for replacement/refurbishment over the next ten years due to either obsolescence or poor performance and are listed in Table 2D-11. Since there are many General Electric Type AM breakers of various condition codes, these breakers are reviewed annually for replacement.

Occasionally other breakers outside of the targeted family are identified for replacement due to obsolescence, excessive maintenance, or poor performance. The quantities have been updated in the below table.

Table 2D-11
Circuit Breakers to be Replaced/Refurbished

Type of Family	Quantity	Average Age (Years)
Federal Pacific (Code 3)	3	60
General Electric Type AM (Code 2)	5	59
ITE Type HK (Code 2)	58	48
ITE Type KS (Code 2)	27	52
McGraw Edison (Code 2)	61	46
Westinghouse DHP (Code 2)	27	52
Other (Code 3)	34	54

Replacements are prioritized based upon potential impact from failure. Therefore, some breakers with condition code 2 may be replaced prior to some with condition code 3 due to the higher impact associated with the failure of the code 2 assets.

2. D. 8. Protection and Controls

The following table indicates the number and type of relays currently installed in distribution substations.

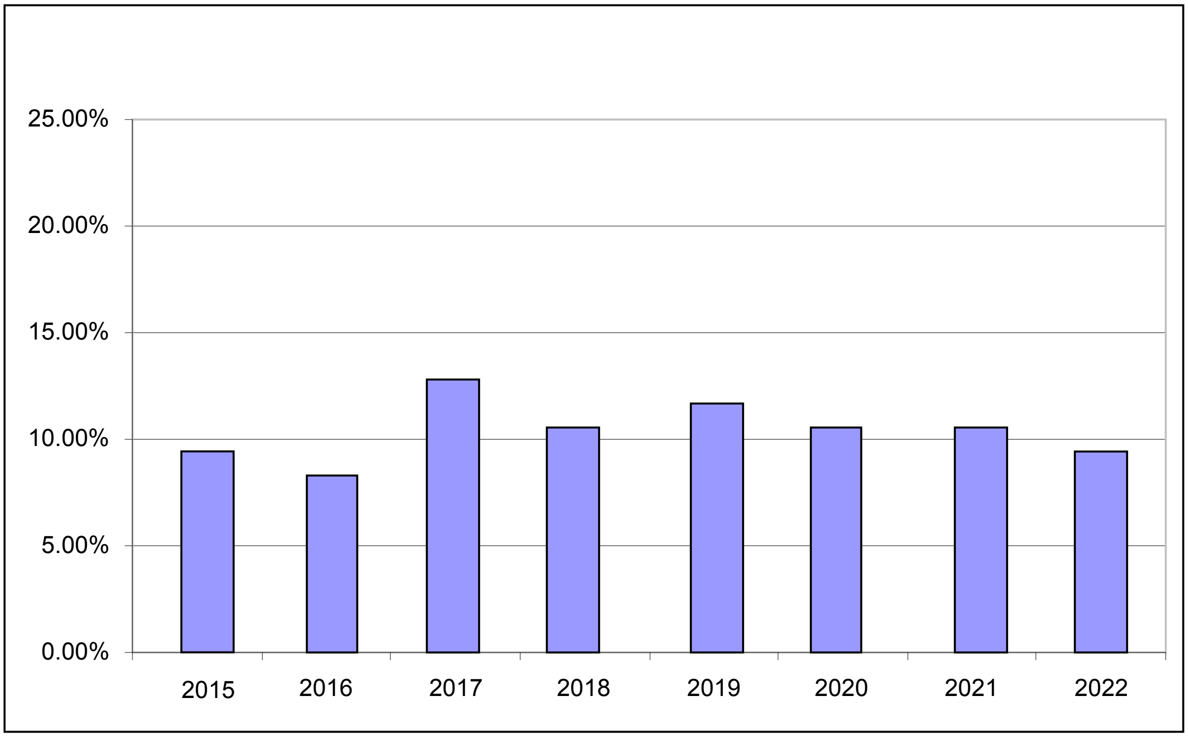
Table 2D-12
Distribution Relay Inventory

Class	Distribution
Electro-mechanical	18,689
Microprocessor	2,425

2. D. 8. 1. Condition and Performance Issues

The Company is testing between 8 and 15 percent of the relay population annually. The year on year variation occurs because of operational requirements. For example, a relay package may be tested earlier than its due date because of new installations/removals/substation rebuilds, or relay settings are changed. Each time a change is made to the relay setting, the relay is re-calibrated and the calibration date is automatically reset. When a relay is tested and fails, it will either be repaired or replaced.

Figure 2D-13
Forecast Percent of relay population to be tested (by Year)



2. D. 8. 2. Remedial Actions Performed

Following an assessment of protective relaying and substation control systems considered critical, a replacement program strategy was approved in 2010, and the project is currently underway.

National Grid will continue to assess the relay protection systems on the distribution and sub-transmission systems and adjust, upgrade, and/or replace protection and control systems as needed to provide safe and adequate operation of the network. The assessment will occur annually as part of a comprehensive annual asset health review. The recommendations of next year's relay replacement plans will take into account any new issues.

With the advent of digital technologies, facilities can be upgraded to gain greater capability and increased reliability. As substation projects are engineered and designed, the electromechanical and solid-state relays are being upgraded to modern microprocessor-based relays.

Microprocessor-based relays are an ideal choice for a cost-effective method to implement distribution system protection. The upgrading of old protection systems with digital systems can offer the following features and benefits:

- Improved quality and high availability;
- Improved sensitivity of monitoring equipment;

- A Digital relay can replace multiple discrete relays resulting in reduced CT secondary burdens;
- Greater protection and control functionality, self-monitoring, and the ability to record oscillographic information and Sequence of Events;
- Lower maintenance costs; and
- Easy integration to the Distributed Control System via network communications.

2. D. 9. Installation of Remote Terminal Units (RTUs)

Currently, approximately 46 percent of the 522 New York distribution substations have SCADA. The total number of additional stations that need SCADA is estimated to be 97. RTU installations or upgrades have been completed at the following substations since the last report:

- Collamer Crossing Station 1511
- Corinth Station 285
- Lehigh Station 669
- Brighton Avenue Station 8
- Milton Avenue Station 266
- Rock Cut Station 286
- Starr Road Station 334
- Trenton Station 627
- Wetzel Road Station
- Warrensburg Station
- Levitt Station
- Cobble Hill Station
- North Broadway Station
- Turin Station

Engineering is underway to install RTUs, wiring, control, and data acquisition capability at the substations listed below:

- Fitzpatrick (NYPA)
- Minoa Station 44
- Portage Street Station 754
- Voorheesville Station 178
- Union Street Station 376
- Lapp Station 26
- South Wellsville Station 23
- Watt Street Station 380
- Lake Road No. 2 Station 299
- Frewsburg Station
- Station 034
- Station 041
- Station 051
- Bennett Road Station 99
- Burgoyne Avenue Station 337

- Hague Road Station 418
- Shelby Station 76
- Station 130
- Station 215 – Buffalo Avenue
- Valkin Station 427

In addition to the RTU specific projects listed above, RTU installations and expansions are also incorporated into the work scope of larger substation projects.

2. D. 10. Obsolete Remote Terminal Units (RTUs)

There are approximately 620 operating RTUs under the Company's control, of which 158 transmission and distribution units are being replaced under an ongoing RTU replacement strategy (SG002).

See Chapter 2A (Transmission) for more information on RTUs.

2. D. 11. Batteries and Chargers

2. D. 11. 1. Condition and Performance Issues

The current population of batteries is in sound condition. If a battery system has reached the end of its expected life, it undergoes a condition assessment and a decision is made on replacement of the unit.

Table 2D-14 provides current condition codes for the battery and charger population.

Table 2D-14
Condition of Battery and Charger Population

COND	1	2	3	4	Grand Total
2018	511	126	48	8	693
2019	552	135	34	12	733

2. D. 11. 2. Remedial Actions Performed

Twelve station batteries and thirteen chargers have been replaced since the last report. National Grid's policy is to replace battery sets that are 20 years old, or sooner if warranted based on battery condition determined through testing and inspection per National Grid Substation Maintenance standards. The 20-year asset life is based on industry best practice and experience in managing battery systems. Where needed, the battery charger is replaced at the same time as the battery system.

2. D. 11. Other Substation Assets

Assets described here would be addressed individually should their condition dictate a rapid response, or while addressing maintenance, replacement or refurbishment ongoing at the same station. Information about other substation assets is generated through V&O Inspections and through feedback from Company personnel when they visit the site.

2. D. 11. 1. Substation Structures and Foundations
Generally, substation structures are sound, but some significant issues at particular stations may be identified and require remedial action.

2. D. 11. 2. Surge Arresters
There are no significant issues with relation to surge arresters in distribution substations.

2. D. 11. 3. Cap-Pin Insulators
Cap and pin insulators have a history of failure, especially when they are used as an insulator for hook-stick type disconnect switches. Insulators are replaced when they are identified as a risk, or as part of on-going work at a particular substation.

2. D. 11. 4. Sensing Devices
The term "sensing devices" is used to identify current transformers (CTs) and Voltage Transformers (VTs) / Potential Transformers (PTs). As indicated in Table 2D-15 below, the population of sensing devices has remained relatively stable and they are generally in good condition.

Table 2D-15
Condition Codes of Sensing Devices

TYPE	1	2	3	4	Grand Total
2018	1,837	393	10	0	2,284
2019	1,865	409	0	0	2,274

Sensing devices are inspected regularly as part of V&O checks and through annual Infra-Red (IR) inspections. Replacement focuses on any sensing device, regardless of manufacturer, which appears to be weeping or has external cracks, as these conditions can lead to moisture ingress, potentially resulting in failure of the device.

GE Type Butyl PTs that are more than 30 years old are replaced when the opportunity arises as they are known to be less reliable than the general population. GE Type Butyl PTs rated 46 kV, 34.5kV, and 23kV have been identified and prioritized for replacement due to recent failures. There are 125 identified GE Type Butyl PTs at these voltage ratings but only 12 over 30 years old.

2. D. 11. 5. Capacitor Banks and Switches
Table 2D-16 provides the distribution capacitor bank population, showing that the bulk of the population is in good condition.

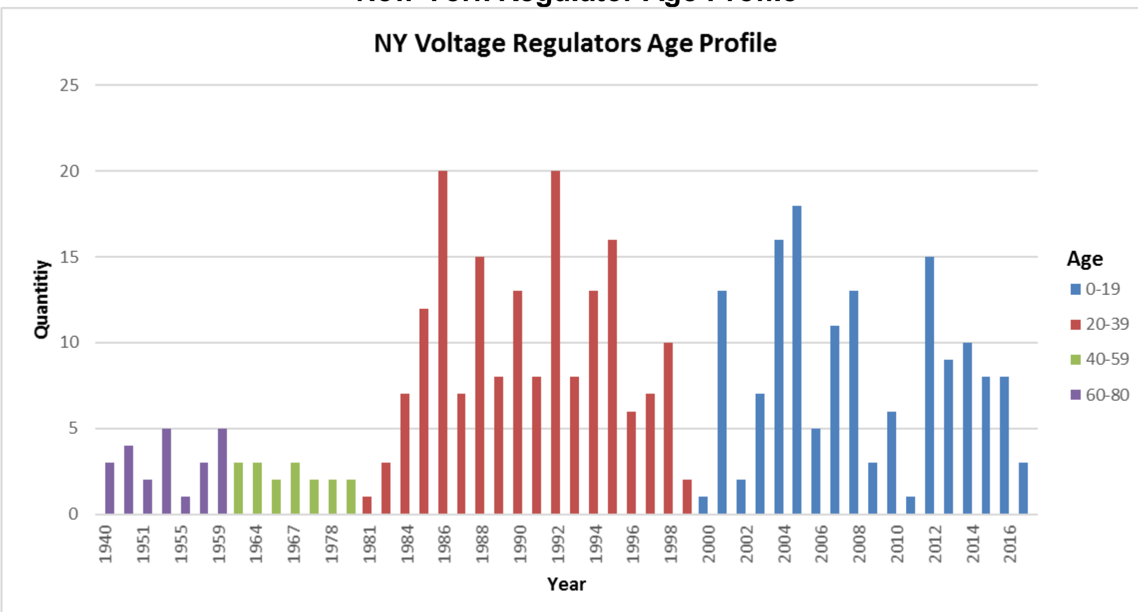
Table 2D-16
Capacitor Bank Condition Code

TYPE	1	2	3	4	Grand Total
2018	72	1	0	0	73
2019	74	1	0	0	75

2. D. 11. 6. Reactors and Regulators

Regulators and reactors provide voltage control and power flow management capability. There are approximately 540 regulators in operation, and 48 spares in transmission and distribution substations. The average age of the operating regulator population is 24 years, however 32% do not have age data, and therefore the average age may be older. The regulator age profile is shown in Figure 2D-17 below.

Figure 2D-17
New York Regulator Age Profile



There are 8 series connected air-core reactors at one substation that are 11 years old and one shunt reactor that has no information on date of manufacture.

2. D. 11. 6. 1. Condition and Performance Issues

Regulators of specific manufacturer and design that are considered to be less reliable are listed in Table 2D-18. There has been a high failure rate of Siemens JFR regulators purchased between 1988 and 1993. The most common failure mode is burning and failure of the moveable or stationary contacts. The General Electric IRS and IRT Induction regulators and the Westinghouse IRT regulators also have known switching problems, obsolete parts, and are less likely to sustain a through fault when compared to more modern type regulators.

Voltage regulators are monitored via V&O inspections and infrared surveys. Other problematic regulators may be identified from these inspections and Substation Equipment Replacement Request (SERR) submissions.

Table 2D-18
Voltage Regulator Types

Manufacturer	Type	Count
2018 Siemens	JFR	12
2018 GE	IRS/IRT	54
2019 Siemens	JFR	12
2019 GE	IRS/IRT	48

Table 2D-19
Condition Code of Regulators and Reactors

TYPE	1	2	3	4	Grand Total
2018 VREG	366	66	0	0	435
2018 REAC	8	0	0	0	8
2019 VREG	426	113	0	0	539
2019 REAC	9	0	0	0	9

2. D. 11. 6. 2. Remedial Actions Performed
All voltage regulators receive regular maintenance per Company standards. In addition, there is an approved strategy in effect to replace Siemens JFR and GE IRS/IRT Voltage Regulators.

Chapter 3. Exhibits

The following contains exhibits referenced in the Report.

Exhibit 1 – Electric Assets by Transmission Study Area

A. Northeast Study Area

Electrical Facilities			
Substations			
Amsterdam Station 326	Corinth Station 285	Malta Station 443	Scofield Road Station 450
Ashley Station 331	Crown Point Station 249	Market Hill Station 324	Sharon Station 363
Ballston Station 12	E. J. West Station 3838	Marshville Station 299	Smith Bridge Station 464
Battenkill Station 342	East Worcester Station 60	Mayfield Station 356	South Street Station 297
Bay Street Station 233	Ephratah Station 18	McCrea Street Station 272	Spier Falls Station 34
Bennett Switch Station 440	Farnan Road Station 476	Meco Station 318	St Johnsville 335
Birch Avenue Station 322	Florida Station 501	Middleburg Station 390	Stoner Station 358
Bolton Station 284	Fort Gage Station 319	Mohican Station 247	Summit Station 347
Brook Road Station 369	French Mountain Station 1054	North Creek Station 122	Ticonderoga Station 163
Burgoyne Avenue Station 337	Gilmantown Road Station 154	North River Recloser	Union Street Station 376
Butler Station 362	Glens Falls Station 75	Northville Station 332	Vail Mills Station 392
Cambridge Station 29	Grand Street Station 433	Ogdenbrook Station 423	Warrensburg Station 321
Carboy Switch Station 436	Goodspeed Switch Station 435	Otten Station 412	Weibel Avenue Station 415
Caroga Lake Station 219	Hague Road Station 418	Port Henry Station 385	Wells Station 208
Cedar Station 453	Hastings Switch Station 439	Pottersville Station 424	Whitehall Station 187
Cement Mountain Station 455	Henry Street Station 316	Queensbury Station 295	Wilton Station 329
Center Street 379	Hill Street Station 311	Riparius Station 293	Worcester Station 189
Charley Lake Station 254	Hudson Falls Station 88	Rock City Falls Station	
Chestertown Station 42	Indian Lake Station 310	Saratoga Station 142	
Church Street Station 43	Inghams Station 20	Schenevus Station 261	
Clinton Road Station 366	Johnstown Station 61	Schoharie Station 234	
Cobleskill Station 214	Knapp Road Station 432	Schroon Lake station 429	
Comstock Station 48	Luther Forest Station	Schuylerville Station 39	

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T5100	Clinton - Marshville #12	main line	115
T5240	Inghams - East Springfield #7	main line	115
T5250	Inghams - Meco #15	main line	115
T5250-1 Tap	Inghams - Meco #15	I-M#15 - Clinton Tap	115
T5260	Inghams - St. Johnsville #6	main line	115
T5260-1 Tap	Inghams - St. Johnsville #6	I-SJ #6 - Beardslee Tap	115
T5270	Inghams - Stoner #9	main line	115
T5270-1 Tap	Inghams - Stoner #9	I-S #9 - Center Street Tap	115
T5270-2 Tap	Inghams - Stoner #9	I-S #9 - Fage Dairy Tap	115
T5430	Mohican - Battenkill #15	main line	115
T5430-1 Tap	Mohican - Battenkill #15	M-B #15 - Irving Tissue Tap	115
T5440	Mohican - Butler #18	main line	115
T5440-1 Tap	Mohican - Butler #18	M-B #18 - GF Cement Tap	115

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage (kV)
T5440-2 Tap	Mohican - Butler #18	M-B #18 - Finch Pruyn Tap	115
T5440-3 Tap	Mohican - Butler #18	M-B #18 - S. Glens Falls Energy Tap	115
T5710	Spier - Butler #4	main line	115
T5730	Spier - Queensbury #5	main line	115
T5730-1 Tap	Spier - Queensbury #5	S-Q #5 - Ogden Brook Tap	115
T5740	Spier - Queensbury #17	main line	115
T5740-1 Tap	Spier - Queensbury #17	S-Q #17 Sherman Island Tap	115
T5740-2 Tap	Spier - Queensbury #17	S-Q #17 Ogden Brook Tap	115
T5750-1 Tap	Spier - Rotterdam #1	S-R #1 - Weibel Ave Tap	115
T5750-2 Tap	Spier - Rotterdam #1	S-R #1 - Smith Bridge Tap	115
T5750-3 Tap	Spier - Rotterdam #1	S-R #1 - Brook Road Tap	115
T5750-4 Tap	Spier - Rotterdam #1	S-R #1 - West Milton Tap	115
T5750-5 Tap	Spier - Rotterdam #1	S-R #1 - Ballston Tap	115
T5750-6 Tap	Spier - Rotterdam #1	S-R #1 - Malta Sub Tap	115
T5760-1 Tap	Spier - Rotterdam #2	S-R #2 - Weibel Ave Tap	115
T5760-2 Tap	Spier - Rotterdam #2	S-R #2 - Smith Bridge Tap	115
T5760-3 Tap	Spier - Rotterdam #2	S-R #2 - Brook Road Tap	115
T5760-4 Tap	Spier - Rotterdam #2	S-R #2 - Ballston Tap	115
T5760-5 Tap	Spier - Rotterdam #2	S-R #2 - Malta Sub Tap	115
T5770	Spier - West #9	main line	115
T5770-1 Tap	Spier - West #9	S-W #9 - IP Corinth Tap	115
T5770-2 Tap	Spier - West #9	S-W #9 - Stewart's Bridge Tap	115
T5770-3 Tap	Spier - West #9	S-W #9 - Scofield Road Tap	115
T5770-4 Tap	Spier - West #9	S-W #9 - Palmer Curtis Tap	115
T6510	Spier-Luther Forest #302	Main line	115
T5780	St. Johnsville - Marshville #11	main line	115
T5810	Ticonderoga - Republic #2	main line	115
T5810-1 Tap	Ticonderoga - Republic #2	R-T #2 - Hague Road Sub Tap	115
T5810-2 Tap	Ticonderoga - Republic #2	R-T #2 - Lachute Hydro Tap	115
T5810-3 Tap	Ticonderoga - Republic #2	R-T #2 - IP Ticonderoga Tap	115
T5810-4 Tap	Ticonderoga - Republic #2	R-T #2 - Crown Point Tap	115
T5810-5 Tap	Ticonderoga - Republic #2	R-T #2 - Port Henry Tap	115
T5820	Ticonderoga - Hague Road #4	main line	115
T5830	Ticonderoga - Whitehall #3	main line	115
T5830-1 Tap	Ticonderoga - Whitehall #3	T-W #3 - Otten Tap	115
T5870	Warrensburg - North Creek #5	main line	115
T5880	Warrensburg - Scofield Road #10	main line	115
T5890	Whitehall - Blissville #7	main line	115
T5900	Whitehall - Mohican #13	main line	115
T5900-1 Tap	Whitehall - Mohican #13	W-M #13 - Comstock (NYSEG) Tap	115
T5900-2 Tap	Whitehall - Mohican #13	W-M #13 - Comstock Tap	115
T5900-3 Tap	Whitehall - Mohican #13	W-M #13 - Burgoyne Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T5900-4 Tap	Whitehall - Mohican #13	W-M #13 - Adirondack Resources Tap	115
T5910	Whitehall - Cedar #6	main line	115
T5910-1 Tap	Whitehall - Cedar #6	W-C #6 - Great Meadow Tap	115
T5910-2 Tap	Whitehall - Cedar #6	W-C #6 - Burgoyne Tap	115
T5950	Indeck Corinth - Spier #18	main line	115
T5970	Queensbury - Cedar #10	main line	115
T6070	Spier - Mohican #7	main line	115
T6410R	Ticonderoga - Sanford Lake (retired)	main line	115
T6480-1 Tap	Mohican - Luther Forest #3	M-NT #3 - Hemstreet Tap	115
T6480-2 Tap	Mohican - Luther Forest #3	M-NT #3 - Mulberry (NYSEG) Tap	115
T6580	Global Foundries - Luther Forest #111	main line	115
T6590	Global Foundries - Luther Forest #222	main line	115
T6480	Mohican - Luther Forest #3	main line	115
834	Florida - Ephratah 7	main line	69
824	Florida - Schenectady International 3	main line	69
1006	Gloversville - Marshville 8	main line	69
828	Cobleskill - Schoharie 6	main line	69
1017	Cobleskill - Summit 5	main line	69
1014	Cobleskill - Summit 5, Grand St.	Mobil Sub Tap	69
1013	Cobleskill - Summit 5, Grand St. Tap	Grand St. Tap	69
1015	Cobleskill - Summit 5, Guilford Mills Tap	Guilford Mills Tap	69
1016	Cobleskill - Summit 5, Richmondville Muni Tap	Richmondville Muni Tap	69
829	Cobleskill - Summit 5, SUNY Cobleskill Tap	SUNY Cobleskill Tap	69
999	Gloversville - Marshville 6	main line	69
	Gloversville - Marshville 6-Ephratah	main line	69
1000	Gloversville - Hill Street 3	main line	69
1001	Hill St. - Meco 4	main line	69
839	Johnstown - Market Hill 8	main line	69
838	Johnstown - Market Hill 8, (bussed section)	main line	69
837	Johnstown - Market Hill 8, Glov/Johnst Wstwtr.Tap	Glov/Johnst Wstwtr.Tap	69
841	Market Hill - Amsterdam 11	main line	69
1002	Marshville - Sharon 16	main line	69
1004	Mayfield - Meco 7	main line	69

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
1005	Mayfield - Meco 7, Uni Dist. Corp. Tap	Uni Dist. Corp. Tap	69
830	Mayfield - Vail Mills 9	main line	69
843	Meco - Johnstown 12	main line	69
833	Northville - Mayfield 8	main line	69
832	Northville - Mayfield 8, (Buss tie)	main line	69
822	Rotterdam - Schoharie 18	main line	69
825	Rotterdam - Schoharie 18	main line	69
826	Rotterdam - Schoharie 18, Middleburg Tap	main line	69
1003	Sharon - Cobleskill 17	main line	69

The following transmission lines have portions in both the Northeast and Capital-Hudson Valley study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T5750	Spier - Rotterdam #1	main line	115
T5760	Spier - Rotterdam #2	main line	115
T6060R	Mohican - North Troy #3	main line	115
T6820	Luther Forest – Eastover Rd #308	main line	115

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
1	Dahowa	Cement Mountain	34.5
1	North Creek	Indian Lake	34.5
1	Mohican	Hudson Falls	34.5
2	Cement Mountain	Cambridge	34.5
2	Chestertown	North Creek	34.5
2	Fort Gage	Queensbury	34.5
3	Hoosick	Cambridge	34.5
3	Chestertown	Schroon	34.5
3	Fort Edwards	Hudson Falls	34.5
3	Glens Falls	Henry St.	34.5
3	Spier	Brook Rd.	34.5
4	Adirondack Hydro Hudson Falls	Mohican	34.5
5	Glens Falls	Ashley	34.5
5	Cement Mountain	Battenkill	34.5
6	Ballston	Mechanicville	34.5
6	Schuylerville	Battenkill	34.5
6	Spier	Corinth	34.5

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
6	Warrensburg	Chestertown	34.5
7	AHDC Middle Falls	Cement Mountain	34.5
7	Chestertown	North Creek	34.5
7	Queensbury	Bay St.	34.5
8	Ballston	Shore Rd.	34.5
8	Hoosick	Clay Hill	34.5
8	Spier	Glens Falls	34.5
8	Glens Falls	Spier	34.5
8	Warrensburg	Fort Gage	34.5
9	Queensbury	Warrensburg	34.5
9	Warrensburg	Queensbury	34.5
9	West Milton	Ballston	34.5
10	Glens Falls	Bay St.	34.5
10	Saratoga	Ballston	34.5
11	Brook Rd.	Ballston	34.5
11	Mohican	Glens Falls	34.5
11	Glens Falls	Mohican	34.5
12	Glens Falls	Mohican	34.5
12	Mohican	Glens Falls	34.5
12	Spier	Saratoga	34.5
14	Queensbury	Henry St.	34.5
17	Hudson Falls	McCrea St.	34.5

B. Capital and Hudson Valley Study Area

Electrical Facilities			
Substations			
Albany Steam Plant Station	Eastover Road Station 2931	Long Lane Station 504	Rosa Road Station 137
Alps Station 417	Elnora Station 344	Lynn Street Station 320	Rotterdam Station 138
Altamont Station 283	Elsmere Station 407	Maplewood Station 307	Russell Rd 228
Athens Station	Emmet Street Station 256	McClellan Street Station 304	Ruth Road Station 381
Avenue A Station 291	Everett Road Station 420	McKownville Station 327	Sand Creek Station 452
Bethlehem 21	Feura Bush Station 503	Mechanicville Station 971	Schodack Station 451
Blue Stores Station 303	Firehouse Road Station 449	Menands Station 101	School Street Station 975
Boyntonville Station 333	Forts Ferry Station 459	Nassau Station 113	Scotia Station 255
Brunswick Station 264	Front Street Station 360	New Krumkill Station 421	Selkirk Station 149
Buckley Corners Station 454	Genesee Street Station 260	New Scotland Station 325	Seminole Station 339
Burdeck Street Station 265	Gloversville Station 72	Newark Station 300	Seventh Avenue Station 244
Castleton 36	Greenbush Station 78	Newtonville Station 305	Shore Road Station 281
CESTM Station	Grooms Road Station 345	North Troy Station 123	Stuyvesant Station 977
Central Avenue Station 235	Hemstreet Station 328	Oathout Station 402	Swaggertown Station 364
Chrisler Avenue Station 257	Hoag Station 221	Partridge Street Station 128	Sycaway Station 372
Colvin Avenue Station 313	Hoosick Station 314	Patroon Station 323	Tibbits Avenue Station 292
Commerce Avenue Station 235	Hudson Station 87	Pinebush Station 371	Trinity Station 164
Corliss Park Station 338	Inman Road Station 370	Prospect Hill Station 413	Unionville Station 276
Curry Road Station 365	Johnson Road Station 352	Quail Hollow 457	Valkin Station 427
Delanson 269	Juniper Station 500	Randall Rd. 463	Voorheesville Station 178
Delaware Avenue Station 330	Karner 317	Rensselaer Station 132	Watt Street Station 380
Delmar Station 279	Lansingburgh Station 93	Reynolds Road Station 334	Weaver Street Station
Depot Road Station 425	Latham Station 282	Rifle Range 458	Wolf Road Station 344
East Schodack Station 447	Leeds Station 377	River Rd. 444	Woodlawn Station 188
East Springfield Station 477	Liberty Street Station 94	Riverside Station 288	

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T5010	Albany - Greenbush #1	main line	115
T5020	Albany - Greenbush #2	main line	115
T5030	Alps - Berkshire #393	main line	345
T5040	Altamont - New Scotland #20	main line	115
T5040-1 Tap	Altamont - New Scotland #20	A-NS #20 - Voorheesville Tap	115
T5060	Battenkill - North Troy #10	main line	115
T5060-1 Tap	Battenkill - North Troy #10	B-NT #10 - Mulberry (NYSEG) Tap	115
T5070	Bethlehem - Albany #18	main line	115
T6540	Eastover Rd- North Troy #306	Main line	115
T6550	Eastover Rd – North Troy #307	Main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T5080	LaFarge Building Materials - Pleasant Valley #8	main line	115
T5080-1 Tap	LaFarge Building Materials - Pleasant Valley #8	LBM-PV #8 - Buckley Corners	115
T5080-2 Tap	LaFarge Building Materials - Pleasant Valley #8	LBM-PV #8 - Blue Stores Tap	115
T5090	Churchtown - Pleasant Valley #13	main line	115
T5090-1 Tap	Churchtown - Pleasant Valley #13	C-PV #13 - Blue Stores Tap	115
T5110	Curry Road - Wolf Road #8	main line	115
T5110-1 Tap	Curry Road - Wolf Road #8	CR-WR #8 - Ruth Road Tap	115
T5110-2 Tap	Curry Road - Wolf Road #8	CR-WR #8 - Sand Creek Tap	115
T5120	Firehouse Road - North Troy #15	main line	115
T5120-1 Tap	Firehouse Road - North Troy #16	FR-NT #15 - GE Silicone Tap	115
T5120-2 Tap	Firehouse Road - North Troy #15	FR-NT #15 - Prospect Hill Tap	115
T5130	Front St. - Rosa Road #11	main line	115
T5140	G.E. R&D - Inman Road #20	main line	115
T5140-1 Tap	G.E. R&D - Inman Road #20	GERD-IR #20 - Elnora Tap	115
T5170	Schodack - Churchtown #14	main line	115
T5170-1 Tap	Schodack - Churchtown #14	S-C #14 - Valkin Tap	115
T5180	Greenbush - Hudson #15	main line	115
T5180-1 Tap	Greenbush - Hudson #15	G-H #15 - Trans Canada Tap	115
T5180-2 Tap	Greenbush - Hudson #15	G-H #15 - ValkinTap	115
T5190	Greenbush - Stephentown #993	main line	115
T5200	Grooms Road - Inman Road #15	main line	115
T5220	Hoosick - Bennington #6	main line	115
T5230	Hudson - Pleasant Valley #12	main line	115
T5230-1 Tap	Hudson - Pleasant Valley #12	H-PV #12 - Adm Milling Tap	115
T5280	Long Lane - LaFarge Building Materials #6	main line	115
T5290	Johnson Road- Maplewood #12	main line	115
T5300	Krumkill - Albany #7	main line	115
T5310	Leeds - Hurley Avenue #301	main line	345
T5320	Athens - Pleasant Valley #91	main line	345
T5330	Leeds - Pleasant Valley #92	main line	345
T5340	Maplewood - Arsenal #15	main line	115
T5350	Maplewood - Menands #19	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T6892	Maplewood - Reynolds Road #31	main line	115
T6890-1 Tap	Maplewood - Reynolds Road #31	A-RR #31 - Rensselaer Waste Water tap	115
T6890-2 Tap	Maplewood- Reynolds Road #31	A-RR #31 - GE Healthcare tap	115
T5370	McKownville - Krumkill #8	main line	115
T5390	Meco - Rotterdam #10	main line	115
T5390-1 Tap	Meco - Rotterdam #10	M-R #10 - Center St. Tap	115
T5390-2 Tap	Meco - Rotterdam #10	M-R #10 - Church St. Tap	115
T5390-3 Tap	Meco - Rotterdam #10	M-R #10 - Amsterdam Tap	115
T5400	Menands - Reynolds Road #2	main line	115
T5400-1 Tap	Menands - Reynolds Road #2	M-RR#2 - GE Healthcare tap	115
T5410	Menands - Riverside #3	main line	115
T5410-1 Tap	Menands - Riverside #3	M-R #3 - Albany County Waste Tap	115
T5420	Milan - Pleasant Valley #10	main line	115
T5450	New Scotland - Alps #2	main line	345
T5460	New Scotland - Bethlehem #4	main line	115
T5470	New Scotland - Long Lane #7	main line	115
T5470-1 Tap	New Scotland - Long Lane #7	NS-LL#7 - Owens Corning Tap	115
T5470-2 Tap	New Scotland - Long Lane #7	NS-LL#7 - MG Industries Tap	115
T5470-3 Tap	New Scotland - Long Lane #7	NS-LL#7 - BOC GasTap	115
T5470-4 Tap	New Scotland - Long Lane #7	NS-LL#7 - GE Plastics Tap	115
T5480	New Scotland - Leeds #93	main line	345
T5490	New Scotland - Leeds #94	main line	345
T5500	New Scotland - Feura Bush #9	main line	115
T5500-1 Tap	New Scotland - Feura Bush #9	NS-FB #9 - Owens Corning Tap	115
T5500-2 Tap	New Scotland - Feura Bush #9	NS-FB #9 - MG Industries Tap	115
T5500-3 Tap	New Scotland - Feura Bush #9	NS-FB #9 - GE Plastics Tap	115
T5520	North Catskill - Milan #T7	main line	115
T5530	North Troy - Hoosick #5	main line	115
T5530-1 Tap	North Troy - Hoosick #5	NT-H #5 - Boyntonville Tap	115
T5540	North Troy - Reynolds Road #16	main line	115
T5540-1 Tap	North Troy - Reynolds Road #16	NT-RR #16 - Sycaway Tap	115
T5550	North Troy - Wynantskill #14	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T5550-1 Tap	North Troy - Wynantskill #14	NT-W #14 - Sycaway Tap	115
T5560	Reynolds Road - Alps #1	main line	345
T5570	Reynolds Road - Greenbush #9	main line	115
T5580	Riverside - Reynolds Road #4	main line	115
T5580-1 Tap	Riverside - Reynolds Road #4	R-R #4 - Greenbush Tap	115
T5590	Riverside - Trinity #18	main line	115
T5600	Riverside - Trinity #19	main line	115
T5610	Rosa Road - G.E.(R&D) #14	main line	115
T5620	Rotterdam - Altamont #17	main line	115
T5620-1 Tap	Rotterdam - Altamont #17	R-A #17 - Burdeck St. Tap	115
T5630	Rotterdam-Bear Swamp E205	main line	230
T5640	Rotterdam - Curry Road #11	main line	115
T5650	Rotterdam - Front St. #16	main line	115
T5660	Rotterdam - G.E. #14	main line	115
T5670	Rotterdam - G.E. #15	main line	115
T5680	Rotterdam - New Scotland #13	main line	115
T5690	Rotterdam - New Scotland #19	main line	115
T5690-1 Tap	Rotterdam - New Scotland #19	R-NS #19 - Burdeck St. Tap	115
T5690-2 Tap	Rotterdam - New Scotland #19	R-NS #19 - Voorheesville Tap	115
T5700	Rotterdam - Woodlawn #35	main line	115
T5700-1 Tap	Rotterdam - Woodlawn #35	R-W #35 - Pinebush Tap	115
T5750-7 Tap	Spier - Rotterdam #1	S-R #1 - Swaggertown Tap	115
T5760-6 Tap	Spier - Rotterdam #2	S-R #2 - Swaggertown Tap	115
T5790	State Campus - Menands #15	main line	115
T5790-1 Tap	State Campus - Menands #15	SC-M #15 - Patroon Tap	115
T5790-2 Tap	State Campus - Menands #15	SC-M #15 - Everett Tap	115
T5800	Stoner - Rotterdam #12	main line	115
T5800-1 Tap	Stoner - Rotterdam #12	S-R #12 - Vail Mills Tap	115
T5800-2 Tap	Stoner - Rotterdam #12	S-R #12 – Church St. Tap	115
T5800-3 Tap	Stoner - Rotterdam #12	S-R #12 - Amsterdam Tap	115
T5840	Trinity - Albany #5	main line	115
T5850	Trinity - Albany #9	main line	115
T5920	Woodlawn - State Campus #12	main line	115
T5920-1 Tap	Woodlawn - State Campus #12	W-SC #12 - Pinebush Tap	115
T5920-2 Tap	Woodlawn - State Campus #12	W-SC #12 - Ruth Road Tap	115
T5920-3 Tap	Woodlawn - State Campus #12	W-SC #12 - Sand Creek Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T5930	Wynantskill - Reynolds Road #13	main line	115
T5940	Feura Bush - North Catskill #2	main line	115
T5940-1 Tap	Feura Bush - North Catskill #2	FB-NC #2 - BOC GAS Tap	115
T5960	Coastal Technology - Greenbush #16	main line	115
T5980	New Scotland - Albany #8	main line	115
T5980-1 Tap	New Scotland - Albany #8	NS-A #8 - Air Products Tap	115
T5990	New Scotland - Feura Bush #3	main line	115
T6010	Wolf Road - Menands #10	main line	115
T6010-1 Tap	Wolf Road - Menands #10	WR-M #10 - Everett Tap	115
T6090	Greenbush - Schodack #13	main line	115
T6160	Leeds - Athens #95	main line	345
T6360	Grooms Road - Forts Ferry #13	main line	115
T6360-1 Tap	Grooms Road - Forts Ferry #13	GR-FF #13 - Fire House Tap	115
T6370	Forts Ferry - Johnson Rd #14	main line	115
T6380	CESTM - Patroon #6	main line	115
T6390	McKownville - CESTM #2	main line	115
T6490-1Tap	Luther Forest - North Troy #308	LT-NT #308 - Mullberry (NYSEG) Tap	115
1019	Schenectady Int. – Rotterdam #4	Glennville Pump Tap	69
1020	Schenectady Int. – Rotterdam #4	Main Line	69

The following lines have portions in both the Capital Hudson Valley and Utica Rome transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T4070	Edic - New Scotland #14	main line	345
T4130	Marcy - New Scotland #18	main line	345
T4200	Porter-Rotterdam #30	main line	230
T4210	Porter-Rotterdam #31	main line	230

The following transmission lines have portions in both the Capital Hudson Valley and Northeast transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T5750	Spier - Rotterdam #1	main line	115
T5760	Spier - Rotterdam #2	main line	115

Transmission Lines			
T6060R	Mohican - North Troy #3	main line	115
T6490	Luther Forest - North Troy #308	main line	115

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
10	Emmet	McCellan St	34.5
13	Emmet	Woodlawn	34.5
5	Karner	Patroon	34.5
5	Knolls	Vischer	34.5
1	Lynn St	Woodlawn	34.5
11	McCellan St	Bevis Hill	34.5
1	Rosa Rd	Knolls	34.5
2	Rosa Rd.	Bevis Hill	34.5
32	Rotterdam	Scotia	34.5
34	Rotterdam	Lynn St	34.5
36	Rotterdam	Weaver	34.5
6	Scotia	Rosa Rd.	34.5
3	Vischer	Woodlawn	34.5
9	Weaver St.	Emmet	34.5
14	Woodlawn	Karner	34.5
3	Schenevus	Summit	23
2	Ephratah	Caroga	23
1	Northville	Wells	23
2	Wells	Gilmantown Rd.	23
7	Central Ave	Patroon	34.5
11	Latham	Newtonville	34.5
2	Maplewood	Liberty St	34.5
5	Maplewood	Norton	34.5
9	Maplewood	Latham	34.5
13	Maplewood	Liberty St	34.5
18	Maplewood	Menands	34.5
16	Newtonville	Patroon	34.5
3	Patroon	Krumkill	34.5
4	Patroon	Colvin Ave	34.5
5	Shore	Rosa	34.5
17	Crescent	School St	34.5
20	Crescent	North Troy	34.5
5	Greenbush	Castleton	34.5
6	Greenbush	Nassau	34.5
8	Greenbush	Snyders Lake	34.5

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
8	Hoosick	Clay Hill	34.5
4	Lansingburg	Seventh Ave	34.5
8	Liberty	Tibbits	34.5
5	Liberty	Seventh Ave	34.5
9	Nassau	Hudson	34.5
1	North Troy	Lansingburg	34.5
2	North Troy	Tibbits	34.5
7	North Troy	Tibbits	34.5
19	North Troy	School St	34.5
20	North Troy	Crescent	34.5
10	Rensselaer	Greenbush	34.5
11	Rensselaer	Greenbush	34.5
2	Tibbits	North Troy	34.5
7	Tibbits	North Troy	34.5
8	Tibbits	Liberty St	34.5
10	RPI	Tibbits	34.5
5	Seventh Ave	Liberty	34.5
2	Altamont	Voorheesville	34.5
10	Bethlehem	Avenue A	34.5
13	Bethlehem	Rensselaer	34.5
5	Bethlehem	Selkirk	34.5
1	Bethlehem	Voorheesville	34.5
2	Colvin Ave	Partridge St	34.5
9	Colvin Ave	Seminole	34.5
14	Delaware	Bethlehem	34.5
37	Delaware	South Mall	34.5
6	Delmar	Bethlehem	34.5
9	Krumkill	Delmar	34.5
8	Menands	Central Ave	34.5
320	Menands	Genesee	34.5
9	Menands	Liberty St	34.5
27	Menands	Riverside	34.5
36	Menands	South Mall	34.5
6	Newark	Maplewood	34.5
17	Norton	Menands	34.5
5	Partridge	Avenue A	34.5
9	Partridge	Riverside	34.5
39	Partridge	Riverside	34.5
164	Riverside	Albany Medical Center	34.5

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
36	Riverside	Albany Medical Center	34.5
10	Riverside	Dewitt Apts	34.5
35	Riverside	South Mall	34.5
38	Riverside	South Mall	34.5
8	Riverside	Times Union Center	34.5
14	Riverside	Times Union Center	34.5
8	School	Newark	34.5

C. Northern Study Area

Electrical Facilities			
Substations			
Akwesasne Station 825	Dennison Station 960	Loon Lake Station 837	Piercefield Regulator Station
Alcoa Station 902	Dexter Station 726	Lowville Station 773	Port Leyden Station 755
Antwerp Station 801	E. Norfolk 913	Lyme Station 733	Portage Street Station 754
Ausable Forks Station 846	East Oswegatchie Station 982	Malone Station 895	Pyrites Switch Structure 999
Balmat Station 904	East Watertown Station 817	McAdoo Station 914	Raybrook Station 839
Battle Hill Station 949	Edwards Station 916	McIntyre Station 969	Riverview Station 847
Black River Station 70	Eel Weir Station 915	Merrillsville Station 838	Saint Regis Station 977
Bloomingdale Station 841	Elm Street Station 898	Middle Road Station 2771	Sewalls Island Station 766
Bombay Station 897	Fine Station 978	Mill Street Station 748	Silver Lake Station 845
Brady Station 957	Fort Covington Station 896	Mine Road Station 777	Soft Maple Station 768
Brasher Station 851	Franklin Falls Station 843	Moira Station 859	South Philadelphia Station 764
Bremen Station 815	Gabriels Station 835	Morristown Station 933	Star Lake Station 727
Brier Hill Station 953	Gilpin Bay Station 956	Newton Falls Station 774	Sunday Creek Station 876
Browns Falls Station 711	Hammond Station 370	Nicholville Station 860	Taylorville Station 770
Carthage Station 717	Heuvelton Station 923	Norfolk Station 934	Thousand Islands Station 814
Chases Lake Station	High Falls Station 794	North Bangor Station 864	Townline Station
Chasm Falls Station 852	Higley Station 473	North Bombay Station 866	Tupper Lake Station 830
Coffeen Street Station 760	Hogansburg 855	North Carthage Station 816	Union Falls Station 844
Collinsville Station 716	Indian River Station 323	North Gouverneur Station 983	West Adams Station 875
Colony Station 899	Lake Clear Station 833	North Lawrence Station 861	Westville Station 885
Colton Station 471	Lake Colby Station 927	North Ogdensburg Station 878	
Corning Station 970	Lawrence Avenue Station 976	Norwood Station 936	
David Station 979	Leray Station 813	Ogdensburg Station 938	
Deferiet Station 724	Lisbon Station 963	Parishville Station 939	
Dekalb Station 984	Little River Station 955	Paul Smiths Station 384	

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage (kV)
T3000	Alcoa - Dennison #12	main line	115
T3020	Battle Hill - Balmat #5	main line	115
T3020-1 Tap	Battle Hill - Balmat #5	BH-B #5 - Zinco Tap	115
T3020-2 Tap	Battle Hill - Balmat #5	BH-B #5 - Gouverneur Talc Co. Tap	115
T3030	Colton - Battle Hill #7	main line	115
T3030-1 Tap	Colton - Battle Hill #7	C-BH #7 Little River Tap	115
T3030-2 Tap	Colton - Battle Hill #7	C-BH #7 Pyrites Tap	115
T3030-3 Tap	Colton - Battle Hill #7	C-BH #7 Dekalb Tap	115
T3050	Black River - North Carthage #1	main line	115
T3050-1 Tap	Black River - North Carthage #1	BR-NC #1 - Kamine-Carthage Co-Gen Tap	115
T3050-2 Tap	Black River - North Carthage #1	BR-NC#1 - Climax Co-Gen Tap	115
T3060	Black River - Taylorville #2	main line	115
T3060-1 Tap	Black River - Taylorville #2	BR-T #2 - Fort Drum Co-Gen Tap	115
T3060-2 Tap	Black River - Taylorville #2	BR-T #2 - Fort Drum #1 Tap	115
T3060-3 Tap	Black River - Taylorville #2	BR-T #2 - Deferiet Paper Tap	115
T3060-4 Tap	Black River - Taylorville #2	BR-T #2 - North Carthage Tap	115
T3070	Browns Falls - Newton Falls Pap. Co. #6	main line	115
T3080	Browns Falls - Taylorville #3	main line	115
T3090	Browns Falls - Taylorville #4	main line	115
T3100	Boundary Road - Dennison #1	main line	115
T3100-1 Tap	Boundary Road - Dennison #1	BR-D #1 - Rosemount Tap (CE)	115
T3100-2 Tap	Boundary Road - Dennison #1	BR-D #1 - McConnell Tap (CE)	115
T3100-3 Tap	Boundary Road - Dennison #1	BR-D #1 - Aldophus Tap (CE)	115
T3100-4 Tap	Boundary Road - Dennison #1	BR-D #1 - Courtaulds Tap (CE)	115
T3100-5 Tap	Boundary Road - Dennison #1	BR-D #1 - Loyalist Tap (CE)	115
T3110	Boundary Road - Dennison #2	main line	115
T3110-1 Tap	Boundary Road - Dennison #2	BR-D #2 - Rosemount Tap (CE)	115
T3110-2 Tap	Boundary Road - Dennison #2	BR-D #2 - McConnell Tap (CE)	115
T3110-3 Tap	Boundary Road - Dennison #2	BR-D #2 - Aldophus Tap (CE)	115
T3110-4 Tap	Boundary Road - Dennison #2	BR-D #2 - Courtaulds Tap (CE)	115
T3110-5 Tap	Boundary Road - Dennison #2	BR-D #2 - Loyalist Tap (CE)	115
T3110-6 Tap	Boundary Road - Dennison #2	BR-D #2 - ICI Plant Tap (CE)	115
T3120	Coffeen - Black River #3	main line	115
T3120-1 Tap	Coffeen - Black River #3	C-BR #3 - Glen Park Hydro Tap	115
T3120-2 Tap	Coffeen - Black River #3	C-BR #3 - Air Brake Tap	115
T3130	Coffeen - West Adams #2	main line	115
T3140	Colton - Browns Falls #1	main line	115
T3150	Colton - Browns Falls #2	main line	115
T3160	Colton - Carry (Stark) #9	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T3160-1 Tap	Colton - Townline #9	C-T #9 - South Colton Hydro Tap	115
T3160-2 Tap	Colton - Townline #9	C-T #9 - Five Falls Hydro Tap	115
T3160-3 Tap	Colton - Townline #9	C-T #9 - Rainbow Hydro Tap	115
T3160-4 Tap	Colton - Townline #9	C-T #9 - Blake Hydro Tap	115
T3160-5 Tap	Colton - Townline #9	C-T #9 - Carry Tap	115
T3170	Colton - Malone #3	main line	115
T3170-1 Tap	Colton - Malone #3	C-M #3 - Allens Falls Hydro Tap	115
T3170-2 Tap	Colton - Malone #3	C-M #3 - Nicholville Tap	115
T3180	Dennison - Colton #4	main line	115
T3180-1 Tap	Dennison - Colton #4	D-C #4 - Norfolk Tap	115
T3180-2 Tap	Dennison - Colton #4	D-C #4 - Mead Paper Tap	115
T3180-3 Tap	Dennison - Colton #4	D-C #4 - Lawrence Ave. Tap	115
T3180-4 Tap	Dennison - Colton #4	D-C #4 - Sugar Island Hydro Tap	115
T3180-5 Tap	Dennison - Colton #4	D-C #4 - Unionville / Hewittville Hydros Tap	115
T3190	Dennison - Colton #5	main line	115
T3190-1 Tap	Dennison - Colton #5	D-C #5 - Lawrence Ave Tap	115
T3190-2 Tap	Dennison - Colton #5	D-C #5 - Hannawa Falls Tap	115
T3200	Fort Drum - Black River #9	Not a tap (main line)	115
T3200-1 Tap	Fort Drum - Black River #9	FD-BR #3 - Indian River Tap	115
T3210	Lake Colby - Lake Placid #3	main line	115
T3210-1 Tap	Lake Colby - Lake Placid #3	LC-LP #3 - Ray Brook Tap	115
T3230	Malone - Lake Colby #5	main line	115
T3250	McIntyre - Corning #6	main line	115
T3270	M.E.F. - Alcoa #3	main line	115
T3280	McIntyre - Colton #8	main line	115
T3280-1 Tap	McIntyre - Colton #8	M-C #8 - Ogdensburg Tap	115
T3280-2 Tap	McIntyre - Colton #8	M-C #8 - McAdoo Sub Tap	115
T3280-3 Tap	McIntyre - Colton #8	M-C #8 - Little River Tap	115
T3290	North Gouverneur - Battle Hill #8	main line	115
T3300	Ogdensburg - McIntyre #2	main line	115
T3320	Taylorville - Boonville #5	main line	115
T3330	Taylorville - Boonville #6	main line	115
T3330-1 Tap	Taylorville - Boonville #6	T-B #6 - Northbrook Energy Tap	115
T3330-2 Tap	Taylorville - Boonville #6	T-B #6 - Moose River Hydro Tap	115
T3330-3 Tap	Taylorville - Boonville #6	T-B #6 - Lyonsdale Hydro/ Burrows Tap	115
T3330-4 Tap	Taylorville - Boonville #6	T-B #6 - Lyonsdale Co-Gen Tap	115
T3340	Taylorville - Moshier #7	main line	115
T3340-1 Tap	Taylorville - Moshier #7	T-M #7 - Eagle Tap	115
T3340-2 Tap	Taylorville - Moshier #7	T-M #7 - Sunday Creek Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T3350	Thousand Islands - Coffeen #4	main line	115
T3350-1 Tap	Thousand Islands - Coffeen #4	TI-C #4 - Lyme Tap	115
T3360	Willis - Malone #1	main line	115
T3380	Alcoa - North Ogdensburg #13	main line	115
T3390	East Oswegatchie - North Gouverneur #1	main line	115
T3400	North Ogdensburg - McIntyre #9	main line	115
T3410	O.E.F. - North Ogdensburg #1	main line	115
T6180	Corning - Battle Hill #4	main line	115
T6180-1 Tap	Corning - Battle Hill #4	C-B #4 - McAdoo Tap	115
T6180-2 Tap	Corning - Battle Hill #4	C-B #4 - Dekalb Tap	115
T6210	Raymondville - Norfolk #1	main line	115
T6210-1 Tap	Raymondville - Norfolk #1	R-N #1 - APC Paper Tap	115
T6270	North Carthage - Taylorville #8	main line	115
T6340	Adirondack-Chases Lake #13	main line	230
TNYPA-1 Tap	Moses-Reynolds-GM MRG1 (NYPA)	M-R-G MRG1 (NYPA) - Akwesasne Tap	115

The following transmission line has portions in both the Northern and Central transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T2120	Coffeen - Black River - Lighthouse Hill #5	main line	115
T3040	Black River - Lighthouse Hill #6	main line	115

The following transmission line has portions in both the Northern and Mohawk transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T4010	Adirondack-Porter #12	main line	230
T6350	Chases Lake-Porter #11	main line	230

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
21	Nicholville	North Bangor	34.5
22	Spencer Corners	Bombay	34.5
23	Nicholville	Bombay	34.5
23	Malone	Chasm Falls	34.5
24	Malone	Spencer Corners	34.5
26	Malone	Spencer Corners	34.5
26	Akwesasne	Fort Covington	34.5
23	Akwesasne	Nicholville	34.5
30	Lake Clear	Lake Colby	46
31	Lake Colby	Franklin	46
34	Union Falls	Franklin	46
35	Union Falls	Lake Clear	46
36	Union Falls	Ausable Forks	46
37	High Falls	Union Falls	46
38	Lake Clear	Tupper Lake	46
39	Piercefield	Tupper Lake	46
21	Colony	Browns Falls	34.5
22	Browns Falls	Newton Falls	34.5
22	Colony	South Edwards	34.5
2	Emeryville	Gouverneur Talc. Co.	23
21	McIntyre	David	23
21	Norfolk	Norwood	23
23	Emeryville	Mine Rd.	23
23	McIntyre	Heuvelton	23
24	Balmat	Emeryville	23
24	McIntyre	Hammond	23
25	Lisbon	Heuvelton	23
26	State St.	Little River	23
27	Balmat	Fowler	23
28	Mine Rd.	Colony	23
21	Old Forge	Raquette Lake	46
22	Boonville	Alder Creek	46
23	Alder Creek	Old Forge	46
21	Carthage	High Falls	23
21	Mill St.	Black River	23
21	South Philadelphia	Theresa	23
22	Black River	Black River Hydro	23
22	Carthage	Taylorville	23
22	Lowville	Boonville	23
23	Beaver Falls	Taylorville	23

Sub-Transmission Lines			
Circuit ID	From	To	Voltage (kV)
24	Carthage	North Carthage	23
24	Leray	Black River	23
24	South Philadelphia	Antwerp	23
24	Taylorville	Effley	23
25	Belfort	Taylorville	23
25	Coffeen	Dexter	23
25	South Philadelphia	Indian River	23
26	Carthage	Copenhagen	23
26	Coffeen	Mill St.	23
26	High Falls	Taylorville	23
27	Deferiet	Herrings	23
28	Herring	Carthage	23
29	Deferiet	North Carthage	23

D. Syracuse Oswego Cortland Study Area

Electrical Facilities			
Substations			
Ash Street Station 223	Dorwin Station 26	Lafayette Station 301	Sentinel Heights Station 128
Bailey Station 313	Drumlins 132	Lake Road No. 2 StationStation	Seventh North Street Station 231
Ballina Station 221	Duguid Station 265	Lords Hill Station 150	Sithe Independence Station
Bartell Road Station 325	East Conklin Terminal Station	Lorings Station 276	Solvay Station 57
Belmont Station 260	East Fulton Station 100	Lysander Station 297	Sorrell Hill Station 269
Brewerton Station 7	East Molloy Road Station	Mallory Road Station 40	South Oswego Station 292
Bridge Street Station 295	East Pulaski Station 324	McBride Street Station 123	Southwood Station 244
Bridgeport Station 168	East Syracuse Station 27	McGraw Station 228	Springfield Station 167
Brighton Avenue Station 8	Elbridge Station 312	Mexico Station 43	Starr Road Station 334
Bristol Hill Station 109	Euclid Station 267	Midler Station 145	Stiles Station 58
Buckabee Mears 300	Fabius Station 55	Miller Street Station 117	Teall Avenue Station 72
Buckley 140	Fairdale Station 135	Milton Avenue Station 266	Temple Station 243
Burnet Avenue Station 9	Fay Street Station 103	Minoa Station 44	Third Street Station 216
Butternut Station 255	Fayette Street Station 28	New Haven Station 256	Tilden Station 73
Camillus Station 10	Fisher Avenue Station 270	Niles Station 294	Truxton Station 74
Cardiff Station 13	Fly Road Station 261	Oswego Switch Yard	Tuller Hill Station 246
Carr Street Station 3877	Galeville Station 213	Paloma Station 254	Tully Center Station 278
Cazenovia Station 220	Geres Lock Switching Station 303	Parish Station 49	Varick Station 207
Central Square Station 15	Gilbert Mills Station 247	Park Street Station 144	Volney Station 285
Chittenango Station 16	Glenwood Station 227	Peat Street Station 250	West Cleveland Station 326
Cicero 17	Granby Center Station 293	Pebble Hill Station 290	West Monroe Station 274
Clay Station 229	Hancock Station 137	Perryville Station 50	Westvale Station 133
Cleveland Station 11	Hanson Station 738	Phoenix Station 51	Wetzel Road Station
Colosse Station 321	Harris Road Station 235	Pine Grove Station 59	Whitaker Station 296
Constantia Station 19	Headson Station 146	Pompey Station 120	Wine Creek Station 283
Coolidge Ventures Station 268	Herrings Station 743	Rathbun Station 160	Woodard Station 233
Cortland Line Station 277	Hinsdale Station 218	Ridge Road Station 219	
Cortland Station 502	Homer Station 129	Rock Cut Station 286	
Crouse Hinds Station 239	Hopkins Road Station 253	Sand Road Station 131	
Curtis Street Station 224	Jamesville Reclosing Station 152	Sandy Creek Station 66	
Delphi Station 262	Jewett Road Station 291	Scriba Station 319	
Dewitt Station 241	Labrador Station 230	Sealright Station 273	

The transmission lines located in the Central transmission study area are provided in the table below.

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T2000	Ash - Teall #7	main line	115
T2010	Ash - Teall #8	main line	115
T2020	Ash - Temple #9	main line	115
T2030	Auburn (State St.) - Elbridge #5	main line	115
T2040	Clay - Dewitt #3	main line	115
T2040-1 Tap	Clay - Dewitt #3	C-D #3 - Bartell Tap	115
T2040-2 Tap	Clay - Dewitt #3	C-D #3 - Pine Grove Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T2040-3 Tap	Clay - Dewitt #3	C-D #3 - New Venture Gear Tap	115
T2040-4 Tap	Clay - Dewitt #3	C-D #3 - Fly Road Tap	115
T2040-5 Tap	Clay - Dewitt #3	C-D #3 - Butternut Tap	115
T2050	Clay - Dewitt #5	main line	115
T2050-1 Tap	Clay - Dewitt #5	C-D #5 - Duguid Tap	115
T2060	Clay - DeWitt #13	main line	345
T2090	Clay - Teall #10	main line	115
T2090-1 Tap	Clay - Teall #10	C-T #10 - Bartell / Pine Grove Tap	115
T2090-2 Tap	Clay - Teall #10	C-T #10 - E. Malloy	115
T2100	Clay - Teall #11	main line	115
T2100-1 Tap	Clay - Teall #11	C-T #11 - Euclid Tap	115
T2100-2 Tap	Clay - Teall #11	C-T #11 - Hopkins Tap	115
T2110	Clay - Woodard #17	main line	115
T2110-1 Tap	Clay - Woodard #17	C-W #17 - Euclid Tap	115
T2110-2 Tap	Clay - Woodard #17	C-W #17 - OCWA Tap	115
T2130	Cortland - Lapeer #1	main line	115
T2130-1 Tap	Cortland - Lapeer #1	C-L #1 - Tuller Hill Tap	115
T2140	Curtis Street - Teall #13	main line	115
T2140-1 Tap	Curtis Street - Teall #13	CS-T #13 - Lysander Tap	115
T2140-2 Tap	Curtis Street - Teall #13	CS-T #13 - Anheuser Busch Tap	115
T2140-3 Tap	Curtis Street - Teall #13	CS-T #13 - Belmont Tap	115
T2140-4 Tap	Curtis Street - Teall #13	CS-T #13 - Sorrell Hill Tap	115
T2140-5 Tap	Curtis Street - Teall #13	CS-T #13 - Crouse Hinds Tap	115
T2140-6 Tap	Curtis Street - Teall #13	CS-T #13 - Hopkins Tap	115
T2150	DeWitt - LaFayette #22	main line	345
T2160	Dewitt - Tilden #19	main line	115
T2170	Elbridge - Geres Lock #3	main line	115
T2180	Elbridge - Geres Lock #18	main line	115
T2180-1 Tap	Elbridge - Geres Lock #18	E-GL #18 - Milton Tap	115
T2190	Elbridge - Geres Lock #19	main line	115
T2190-1 Tap	Elbridge - Geres Lock #19	E-GL #19 - Milton Tap	115
T2200	Elbridge - Woodard #4	main line	115
T2200-1 Tap	Elbridge - Woodard #4	-W #4 - Belmont Tap	115
T2220	FitzPatrick - Lighthouse Hill #3	main line	115
T2220-1 Tap	FitzPatrick - Lighthouse Hill #3	F-LH #3 - Scriba Tap	115
T2220-2 Tap	FitzPatrick - Lighthouse Hill #3	F-LH #3 - New Haven Tap	115
T2230R	Fulton Co-Gen - Clay #4	main line	115
T2240	General Electric - Geres Lock #8	main line	115
T2240-1 Tap	GE (Electronics Park) - Geres Lock #8	GE-GL #8 - Solvay Muni. Bridge St. Tap	115
T2240-2 Tap	GE (Electronics Park) - Geres Lock #8	GE-GL #8 - Solvay Muni. Matthews Ave. Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T2260	Geneva (Border City) - Elbridge #15	main line	115
T2260-1 Tap	Geneva (Border City) - Elbridge #15	G-E #15 - Hyatt Road Tap	115
T2270	Geres Lock - Solvay #2	main line	115
T2270-1 Tap	Geres Lock - Solvay #2	GL-S #2 - Solvay Muni. Matthews Ave. Tap	115
T2270-2 Tap	Geres Lock - Solvay #2	GL-S #2 - Crucible Steel	115
T2280	Geres Lock - Solvay #14	main line	115
T2280-1 Tap	Geres Lock - Solvay #14	GL-S #14 - Solvay Muni. Bridge St. Tap	115
T2280-2 Tap	Geres Lock - Solvay #14	GL-S #14 - TriGen Tap	115
T2280-3 Tap	Geres Lock - Solvay #14	GL-S #14 - Crucible Steel	115
T2290	Geres Lock - Tilden #16	main line	115
T2300	Indeck Oswego - Lighthouse Hill #2	main line	115
T2300-1 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 Wine Creek Tap	115
T2300-2 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 Alcan Tap	115
T2300-3 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 Scriba Tap	115
T2300-4 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 New Haven Tap	115
T2300-5 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 Schoeller Paper / E Pulaski Tap	115
T2310R	LaFayette - Oakdale #4 (36)	main line	345
T2320	Lighthouse Hill - Clay #7	main line	115
T2350	Nine Mile Point Unit One - Clay #8	main line	345
T2360	Nine Mile Pt. #1 - FitzPatrick #4	main line	115
T2370	Nine Mile Point Unit One - Scriba #9	main line	345
T2380	Nine Mile Pt. #2 - Scriba #5	main line	115
T2390	Nine Mile Pt. #2 - Scriba #6	main line	115
T2410-1 Tap	Oneida - Fenner #8	O-F #8 - Whitman Tap	115
T2420	Oswego - LaFayette #17	main line	345
T2430	Oswego - South Oswego #3	main line	115
T2440	Oswego - South Oswego #5	main line	115
T2450	Oswego - South Oswego #8	main line	115
T2470	Oswego - Volney #11	main line	345
T2480	Oswego - Volney #12	main line	345
T2520	Peat - Dewitt #7	main line	115
T2520-1 Tap	Peat - Dewitt #7	P-D #7 - Bridge St. Tap	115
T2520-2 Tap	Peat - Dewitt #7	P-D #7 - Headson Tap	115
T2540	Scriba - Volney #20	main line	345
T2550	Scriba - Volney #21	main line	345
T2560	Sleight Road - Auburn (State St.) #3	main line	115
T2580	South Oswego - Curtis St. #10	main line	115
T2590R	South Oswego - Fulton Co-Gen #7	main line	115
T2600	South Oswego - Geres Lock #9	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T2600-1 Tap	South Oswego - Geres Lock #9	SO-GL #9 - Clear water pump Tap	115
T2600-2 Tap	South Oswego - Geres Lock #9	SO-GL #9 - Anheuser Busch Tap	115
T2600-3 Tap	South Oswego - Geres Lock #9	SO-GL #9 - Lysander Tap	115
T2600-4 Tap	South Oswego - Geres Lock #9	SO-GL #9 - Sorrell Hill Tap	115
T2610	South Oswego - Indeck(Oswego) #6	main line	115
T2610-1 Tap	South Oswego - Indeck(Oswego) #6	SO- I #6 - Paloma Tap	115
T2610-2 Tap	South Oswego - Indeck(Oswego) #6	SO- I #6 - Wine Creek Tap	115
T2610-3 Tap	South Oswego - Indeck(Oswego) #6	SO- I #6 – Hammermill Tap	115
T2630	South Oswego - Nine Mile Pt.#1 #1	main line	115
T2630-1 Tap	South Oswego - Nine Mile Pt.#1 #1	SO-NMP1 #1 - ALCAN Tap	115
T2630-2 Tap	South Oswego - Nine Mile Pt.#1 #1	SO-NMP1 #1 - Paloma Tap	115
T2630-3 Tap	South Oswego - Nine Mile Pt.#1 #1	SO-NMP1 #1 - Lake Road #2 Tap	115
T2640	SUNY Cortland - Cortland #2	Not a tap (main line)	115
T2640-1 Tap	SUNY Cortland - Cortland #2	C-SC #2 - Buckbee Mears Tap	115
T2640-2 Tap	SUNY Cortland - Cortland #2	C-SC #2 - Borg Warner Tap	115
T2650	Teall - Dewitt #4	main line	115
T2650-1 Tap	Teall - Dewitt #4	T-D #4 - East Malloy Tap	115
T2650-2 Tap	Teall - Dewitt #4	T-D #4 - New Venture Gear / Coolidge Ventures Tap	115
T2650-3 Tap	Teall - Dewitt #4	T-D #4 - Butternut Tap	115
T2650-4 Tap	Teall - Dewitt #4	T-D #4 - Fly Road Tap	115
T2660	Teall - Carr Street #6	main line	115
T2660-1 Tap	Teall - Carr Street #6	T-CS #6 - Carrier Tap	115
T2660-2 Tap	Teall - Carr Street #6	T-CS #6 - Bristol Myers Squibb #1 Tap	115
T2660-3 Tap	Teall - Carr Street #6	T-CS #6 - Bristol Myers Squibb #2 Tap	115
T2670	Teall - Oneida #2	main line	115
T2680	Teall - Oneida #5	main line	115
T2680-1 Tap	Teall - Oneida #5	T-O #5 - Bridgeport Tap	115
T2690	Temple - Dewitt #10	main line	115
T2690-1 Tap	Temple - Dewitt #10	T-D #10 Bridge St. Tap	115
T2690-2 Tap	Temple - Dewitt #10	T-D #10 Headson Tap	115
T2700	Temple - SU/Gas #11	main line	115
T2710	Tilden - Cortland #18	main line	115
T2720	Volney - Clay #6	main line	345
T2740	Carr Street - Dewitt #15	main line	115
T2740-1 Tap	Carr Street - Dewitt #15	CS-D #15 - Bristol-Myers Squibb #1 Tap	115
T2740-2 Tap	Carr Street - Dewitt #15	CS-D #15 - Bristol-Myers Squibb #2 Tap	115
T2750	Clay - General Electric (Electronics Park) #14	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T2760	Independence - Scriba #25	main line	345
T2770	O.C.R.R.A. - Tilden #15	main line	115
T2770-1 Tap	O.C.R.R.A. - Tilden #15	O-T #15 – Rock Cut Rd Tap	115
T6030	Independence - Clay #26	main line	345
T6120	Geres Lock - Onondaga Co-Gen #12	main line	115
T6130	Geres Lock - WPS Empire State Co-Gen #11	main line	115
T6140	Fenner - Cortland #3	main line	115
T6140-1 Tap	Fenner - Cortland #3	F-C #3 - Fenner Oneida Co-Op (NYPA) Tap	115
T6140-2 Tap	Fenner - Cortland #3	F-C #3 - Labrador Tap	115
T6150	Hook Road - Elbridge #7	main line	115
T6150-1 Tap	Hook Road - Elbridge #7	HR - E #7 – Farmington Tap (NYSEG)	115
T6150-2 Tap	Hook Road - Elbridge #7	HR - E #7 - Hamilton Road Tap (NYSEG)	115
T6400	South Oswego - Clay #4	main line	115
T6400-1 Tap	South Oswego - Clay #4	SO-C #4 NY Chocolate Tap	115
T6400-2 Tap	South Oswego - Clay #4	SO-C #4 - NE Biofuels Tap	115
T6400-3 Tap	South Oswego - Clay #4	SO-C #4 - Owens Illinois Tap	115
T6400-4 Tap	South Oswego - Clay #4	SO-C #4 - Sealright Tap	115
T6470	Lafayette - Clarks Corners #4 (46)	main line	345

The following transmission line has portions in both the Central and Genesee Regions:

Transmission Lines			
Circuit ID	**Circuit Trunk Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1570	Mortimer - Elbridge #2	main line	115

The following transmission line has portions in both the Central and Mohawk transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Trunk Name**	**Main Line / Tap Name**	**Voltage (kV)**
T4280	Volney - Marcy #19	**Not a tap (main line)**	345

The following transmission line has portions in both the Central and Northern transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Trunk Name**	**Main Line / Tap Name**	**Voltage (kV)**
T2120	Coffeen - Black River - Lighthouse Hill #5	main line	115
T3040	Black River - Lighthouse Hill #6	main line	115

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
30	From	To	34.5
33	Ash St.	Burnet	34.5
25	Ash St.	Burnet	34.5
29	Ash St.	Carousel	34.5
24	Ash St.	Carousel	34.5
23	Ash St.	McBride	34.5
28	Ash St.	McBride	34.5
37	Ash St.	Solvay	34.5
38	Brighton	Tilden	34.5
39	Brighton	Tilden	34.5
38	Fayette	Ash St.	34.5
36	Fayette	Ash St.	34.5
37	Fayette	Solvay	34.5
20	Fayette	Solvay	34.5
22	McBride	Brighton	34.5
25	McBride	Brighton	34.5
33	McBride	University	34.5
26	McBride	University	34.5
27	Solvay		34.5
23	Solvay		34.5
25	Teall		34.5
28	Teall	Ley Creek Treat Plant	34.5
22	Teall	Syracuse China	34.5
33	Solvay		34.5
24	Mallory	Cicero	34.5
28	Woodard		34.5
29	Woodard		34.5
26	Woodard	Baldwinsville	34.5
32	Woodard	Crouse Hinds	34.5
32	Woodard	Teall	34.5

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
27	Teall		34.5
27	Woodard	Ash St.	34.5
28	Pebble Hill	Rathbun	34.5
38	Minoa	Whitman	34.5
33	Headson	Tilden	34.5
26	Headson	Minoa	34.5
28	Headson	Pebble Hill	34.5
34	Minoa	Whitman	34.5
29	Burnet Ave.	Headson	34.5
31	Teall		34.5
30	Teall	Headson	34.5
31	Elbridge	Marcellus	34.5
509	Elbridge	Jewett	34.5
33	Niles Tap		34.5
21	Harris Rd.	Tilden	34.5
20	Harris Rd.	Tilden	34.5
34	Solvay	Harris Rd	34.5
35	Solvay	Harris Rd	34.5
22	Solvay		34.5
20	Solvay		34.5
21	Cortland	Cortland	34.5
23	Cortland	Cortland	34.5
39	Cortland	Cortland	34.5
32	Labrador	Rathbun	34.5
24	Pebble Hill	Tilden-Tully Tap	34.5
30	Tilden	Tully Tap	34.5

E. Utica Rome Study Area

Electrical Facilities			
Substations			
Alder Creek Station 701	Lehigh Station 669	Rome Station 762	West Herkimer Station 676
Arnold Station 656	Levitt Station 665	Salisbury Station 678	White Lake Station 399
Boonville Station 707	Lewis Road Station 572	Schuyler Station 663	Whitesboro Station 632
Cavanaugh Road Station 616	Lighthouse Hill Station 61	Sherman Station 333	Whitman Station 671
Chadwicks Station 668	Madison Station 654	South Washington Street Station	Yahnundasis Station 646
Clinton Station 604	Middleville Station 666	Stittville Station 670	
Conkling Station 652	Old Forge Station 383	Terminal Station 651	
Debalso Station 684	Oneida Station 501	Trenton Station 627	
Deerfield Station 606	Peterboro Station 514	Turin Station 653	
Eagle Bay Station 382	Pleasant Station 664	Turning Stone Station 640	
Edic Station 662	Poland Station 621	Valley Station 594	
Fairfield Station	Porter Station 657	Voorhees Station 83	
Fenner Wind Farm Station	Raquette Lake Station 398	Walesville Station 331	
Frankfort Station 677	Rock City Station 623	Watkins Road Station 528	

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T2800	Watkins Road - Inghams #2	main line	115
T2800-1 Tap	Watkins Road - Inghams #2	WR-I #2 - Salisbury Tap	115
T4020	Boonville - Porter #1	main line	115
T4020-1 Tap	Boonville - Porter #1	B-P #1 - Stittville Tap	115
T4030	Boonville - Porter #2	main line	115
T4030-1 Tap	Boonville - Porter #2	B-P #2 - Stittville Tap	115
T4030-2 Tap	Boonville - Porter #2	B-P #2 - Boonville Muni. Tap	115
T4040	Boonville - Rome #4	main line	115
T4040-1 Tap	Boonville - Rome #4	B-R #4 - Madison Tap	115
T4040-2 Tap	Boonville - Rome #4	B-R #4 - Revere Copper & Brass Tap	115
T4060	Boonville - Rome #3	main line	115
T4060-1 Tap	Boonville - Rome #3	B-R #3 - Griffis AVA Tap	115
T4060-2 Tap	Boonville - Rome #3	B-R #3 - Madison Tap	115
T4080	Edic - Porter #10	main line	115
T4090	Edic-Porter #17	main line	230
T4100	Edic - Porter #20	main line	115
T4110	Levitt - Rome #8	main line	115
T4110-1 Tap	Levitt - Rome #8	L-R #8 - Lehigh Tap	115
T4110-2 Tap	Levitt - Rome #8	L-R #8 - Camden Wire Tap	115
T4110-3 Tap	Levitt - Rome #8	L-R #8 - Voorhees Ave Tap	115
T4110-4 Tap	Levitt - Rome #8	L-R #8 - Rome Cable Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T4140	Oneida - Oneida Energy (Sterling) #4	main line	115
T4150	Oneida - Porter #7	main line	115
T4150-1 Tap	Oneida - Porter #7	O-P #7 - Cavanaugh Road Tap	115
T4150-2 Tap	Oneida - Porter #7	O-P #7 - Walesville Tap	115
T4160	Oneida - Yahnundasis #6	main line	115
T4160-1 Tap	Oneida - Yahnundasis #6	O-Y #6 - Sherrill Power & Light Tap	115
T4170	Porter - Deerfield #8	main line	115
T4180	Porter - Deerfield #9	main line	115
T4190	Porter - Watkins Road #5	main line	115
T4190-1 Tap	Porter - Watkins Road #5	P-WR #5 - Deerfield Tap	115
T4220	Porter - Schuyler #13	main line	115
T4230	Porter - Terminal #6	main line	115
T4230-1 Tap	Porter - Terminal #6	P-T #6 - Utica Convertors Tap	115
T4240	Porter - Valley #4	main line	115
T4250	Rome - Oneida #1	main line	115
T4260	Terminal - Schuyler #7	main line	115
T4270R	Valley - Inghams #3	main line	115
T4290	Yahnundasis - Chadwicks #1	main line	115
T4290-1 Tap	Yahnundasis - Chadwicks #1	Y-C #1 - Special Metals Tap	115
T4300	Yahnundasis - Porter #3	main line	115
T4300-1 Tap	Yahnundasis - Porter #3	Y-P #3 - Utica Corp (Halsley) Tap	115
T4300-2 Tap	Yahnundasis - Porter #3	Y-P #3 - Walesville Tap	115
T4300-3 Tap	Yahnundasis - Porter #3	Y-P #3 - Debalso Tap	115
T4300-4 Tap	Yahnundasis - Porter #3	Y-P #3 - Conmed Tap	115
T6050	Watkins Road - Ilion Municipal Co-Gen #8	main line	115
T6050-1 Tap	Watkins Road - Ilion Municipal Co-Gen #8	WR-I #8 - Murphy Station Co-Gen Tap	115
T6560	Valley - Fairfield #12	main line	115
T6570	Fairfield - Inghams #3	main line	115
T6570-1 Tap	Fairfield - Inghams #3	F-I #3 - Salisbury Tap	115

The following line has portions in both the Utica/Rome and Syracuse/Oswego/Cortland transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T2410	Oneida - Fenner #8	main line	115

The following lines have portions in both the Utica/Rome and Capital Hudson Valley transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T4070	Edic - New Scotland #14	main line	345
T4130	Marcy - New Scotland #18	main line	345
T4200	Porter-Rotterdam #30	main line	230
T4210	Porter-Rotterdam #31	main line	230

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
22	Deerfield	Schuyler	46
26	Deerfield	Whitesboro	46
26	Pleasant	Schuyler	46
21	Schuyler	Valley	46
24	Schuyler	Valley	46
21	Trenton	Deerfield	46
27	Trenton	Deerfield	46
24	Trenton	Middleville	46
23	Trenton	Prospect	46
25	Trenton	Whitesboro	46
26	Valley	Inghams	46
27	Valley	Inghams	46
29	Whitesboro	Schuyler	46
29	Whitesboro	Homogenous Metals Tap	46
27	Yahnundasis	Clinton	46
25	Yahnundasis	Pleasant	46
24	Yahnundasis	Westmoreland	46
23	Yahnundasis	Whitesboro	46

F. Genesee Study Area

Electrical Facilities			
Substations			
Albion Station 80	Darien Station 16	Livingston Station 130	Royalton Station 98
Alabama Switch Structure	East Batavia Station 28	Livonia Station 37	South East Batavia Station
Attica Station 12	East Golah Station 51	Lyndonville Station 95	Shelby Station 76
Avon Station 43	Eagle Harbor Station 92	Medina Station	Sheppard Road Station 29
Barker Station 78	Elba Station 20	Middleport Station 77	Sonora Way Station 4381
Basom Station 15	Gasport Station 90	Mortimer Station	Sour Springs Switch Structure
Batavia 01	Geneseo Station 55	Mumford Station 50	Southland Station 84
Brockport Station 74	Golah Station	North Akron Station	Sweden
Station 171 - Burt	Groveland Station 41	North LeRoy Station 4	Telegraph Road Station
Butts Road Station 72	Hemlock Station 38	Newfane 170	University Station 81
Byron Station 18	Knapp Road Station 226	South Newfane 71	Waterport Station 73
Caledonia Station 44	Lakeville Station 40	North Lakeville Station	West Albion Station 79
Canawagus Station	Lapp Station 26	Oakfield Station 3	West Hamlin Station 82
Conesus Lake Station 52	Lima Station 36	Orangeville Station 19	Wethersfield Station 23
Corfu Station 22	Linden Station 21	Richmond Station 32	Willow Specialties 24
			York Center Station 53

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1000	Brunner - Sour Springs 118	main line	115
T1000-1 Tap	Brunner - Sour Springs #118	B-SS #118 - Shelby Tap	115
T1040	Alabama - Telegraph 115	main line	115
T1050	Batavia - Southeast Batavia 117	main line	115
T1050-1 Tap	Batavia - Southeast Batavia #117	B-SEB #117 Oatka Dairy Tap	115
T1320	Golah - North Lakeville #116	main line	115
T1320-1 Tap	Golah - North Lakeville #116	G-NL #116 - E. Golah Tap	115
T1320-2 Tap	Golah - North Lakeville #116	G-NL #116 - Kraft Foods Tap	115
T1490	Lockport - Batavia #107	main line	115
T1490-1 Tap	Lockport - Batavia #107	L-B #107 - Alabama Switch Struc. Tap	115
T1490-2 Tap	Lockport - Batavia #107	L-B #107 - Akron Village Tap	115
T1490-3 Tap	Lockport - Batavia #107	L-B #107 - East Batavia Tap	115
T1500	Lockport - Batavia #108	main line	115
T1500-1 Tap	Lockport - Batavia #108	L-B #108 - North Akron Tap	115
T1510	Lockport - Batavia #112	main line	115
T1510-1 Tap	Lockport - Batavia #112	L-B #112 - Oakfield Tap	115
T1520	Lockport - Hinman #100	main line	115
T1530	Lockport - Mortimer #111	main line	115
T1530-1 Tap	Lockport - Mortimer #111	L-M #111 - Alabama Switch Tap	115
T1530-2 Tap	Lockport - Mortimer #111	L-M #111 - Sour Springs Switch Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1530-3 Tap	Lockport - Mortimer #111	L-M #111 - University Sta. 81 Tap	115
T1530-4 Tap	Lockport - Mortimer #111	L-M #111 - Brockport Tap	115
T1530-5 Tap	Lockport - Mortimer #111	L-M #111 - West Hamlin Tap	115
T1540	Lockport - Mortimer #113	main line	115
T1540-1 Tap	Lockport - Mortimer #113	L-M #113 - Sour Springs Switch Tap	115
T1540-2 Tap	Lockport - Mortimer #113	L-M #113 - University Sta. 81 Tap	115
T1540-3 Tap	Lockport - Mortimer #113	L-M #113 - Brockport Tap	115
T1540-4 Tap	Lockport - Mortimer #113	L-M #113 - West Hamlin Tap	115
T1550	Lockport - Mortimer #114	main line	115
T1550-1 Tap	Lockport - Mortimer #114	L-M #114 - Sheldon/ Telegraph Road Tap	115
T1550-2 Tap	Lockport - Mortimer #114	L-M #114 - Sour Springs Switch Tap	115
T1560	Mortimer - Hook Road #1	main line	115
T1560-1 Tap	Mortimer - Hook Road #2	M-HR #1 - Lawler Tap (NYPA)	115
T1560-2 Tap	Mortimer - Hook Road #3	M-HR #1 - Hogan Road Tap (NYPA)	115
T1570-1 Tap	Mortimer - Elbridge #2	M-E #2 - Lawler Tap (NYPA)	115
T1570-2 Tap	Mortimer - Elbridge #2	M-E #2 - Hogan Road Tap (NYPA)	115
T1580	Mortimer - Golah #110	main line	115
T1590	Mortimer - Pannell Road #24	main line	115
T1590-1 Tap	Mortimer - Pannell Road #24	M-P #24 - Pittsford Tap	115
T1600	Mortimer - Pannell Road #25	main line	115
T1600-1 Tap	Mortimer - Pannell Road #25	M-P #25 - Pittsford Tap	115
T1610	Mortimer(Sta.82) - Quaker(Sta.121) #23	main line	115
T1610-1 Tap	Mortimer(Sta.82) - Quaker(Sta.121) #23	M-Q #23 - Pittsford Tap	115
T1860	Pannell(Sta.122) -Geneva(Border City) #4	main line	115
T1860-1 Tap	Pannell(Sta.122) -Geneva(Border City) #4	P-G #4 - Farmington Tap	115
T1870	Quaker Road(Sta.121) - Sleight Road #13	main line	115
T1890	Southeast Batavia - Golah #119	main line	115
T1890-1 Tap	Southeast Batavia - Golah #119	SB-G #119 - East Batavia Tap	115
T1930	Mortimer - Sta.23 & Sta.33 #901	main line	115
808	Golah-South Perry #853	Main line	69
	Mortimer – Golah #109	Main Line	69

The following transmission lines have portions in both the Genesee and Frontier study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1440	Huntley - Lockport #36	main line	115
T1450	Huntley - Lockport #37	main line	115
T1620	Mountain - Lockport #103	main line	115
T1690	Niagara - Lockport #101	main line	115
T1700	Niagara - Lockport #102	main line	115

The following transmission line has portions in both the Genesee and Central study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1570	Mortimer - Elbridge #2	main line	115

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
301	Phillips Road	Medina	34.5
302	Telegraph Road	Medina	34.5
303	Telegraph Road	Medina	34.5
304	Phillips Road	Telegraph Road	34.5
305	Medina	Albion	34.5
306	Waterport	Albion	34.5
307	Waterport	Brockport	34.5
308	Albion	Brockport	34.5
310	Brockport	Owens Illinois	34.5
312	Gasport	Telegraph Road	34.5
213	Caledonia	Golah	34.5
203	North Leroy	Caledonia	34.5
209	Attica	Wethersfield	34.5
208	North Leroy	Attica	34.5
206	Batavia	Attica	34.5
225	North Akron	Attica	34.5
223	Batavia	North Leroy	34.5
219	Oakfield	Batavia	34.5
201	Oakfield	Caledonia	34.5
227	North Akron	Oakfield	34.5
204	I2R Element	North Akron	34.5

205	I2R Element	North Akron	34.5
218	N. Lakeville	Ridge	34.5
224	N. Lakeville	Hemlock	34.5
226	N. Lakeville	Richmond	34.5
217	Golah	N. Lakeville	34.5
216	Golah	N. Lakeville	34.5

G. Frontier Study Area

Electrical Facilities			
Substations			
Adams Switch Structure	Buffalo St 34	Elm Street Station	Station 129
Alameda Ave 124	Buffalo St 35	Frankhauser Substation 995	Station 133 - Dupont
Ayer Rd 211	Buffalo St 36	Gardenville	Station 154
Beech Ave 81	Buffalo St 37	Gibson Station 106	Station 155 - Worthington
Buffalo Ave 215	Buffalo St 38	Harper Station	Station 205
Buffalo River Switch Structure	Buffalo St 39	Huntley Station	Station 206 - Tonawanda Creek
Buffalo St 126	Buffalo St 40	Kenmore Terminal Station 158	Station 207
Buffalo St 132	Buffalo St 41	Kensington Terminal Station	Station 209 - Long RdRd
Buffalo St 146	Buffalo St 42	Lewiston 87	Station 21
Buffalo St 157	Buffalo St 43	Lewiston Hts 86	Station 210 - Military Road
Buffalo St 160	Buffalo St 44	Lockport Rd 216	Station 212
Buffalo St 161	Buffalo St 45	Lockport Station	Station 214 - Youngs St
Buffalo St 162	Buffalo St 46	Maple Road 140	Station 217 - Walmore Rd
Buffalo St 201	Buffalo St 47	Martin Road 139	Station 224 - Sweethome Rd
Buffalo St 202	Buffalo St 48	Mountain Station	Station 50
Buffalo St 203	Buffalo St 49	New Walden Station	Station 58
Buffalo St 204	Buffalo St 51	Niagara Falls Blvd 130	Station 60 - Getzville
Buffalo St 208	Buffalo St 52	Oakwood Ave Station 232	Station 61
Buffalo St 21	Buffalo St 53	Packard Station	Station 64 - Grand IslandIsland
Buffalo St 22	Buffalo St 56	Park Club Lane 219	Station 80 - Eighth StreetStreet
Buffalo St 23	Buffalo St 57	Phillips Road Switch Structure	Station 82 - Eleventh StreetStreet
Buffalo St 24	Buffalo St 59	Renaissance Drive Station 229	Station 83 - Welch AvenueAvenue
Buffalo St 24a	Buffalo St 63	Ridge Station 142	Station 85 - Stephenson Avenue
Buffalo St 25	Buffalo St 66	Roberts Road	Station 89 - Ransomville
Buffalo St 26	Buffalo St 67	Sanborn Station	Station 97 - Summit Park
Buffalo St 27	Buffalo St 68	Sawyer Avenue Station	Walck Road Station
Buffalo St 28	Buffalo St 74	Seneca Terminal Station	Wilson 93
Buffalo St 29	Buffalo St 77	Shawnee Rd 76	Youngmann Terminal Station
Buffalo St 30	Buffalo St 78	Station 105 - Swann Rd	Youngstown 88
Buffalo St 31	Buffalo St 79	Station 121 - Clinton	Zimmerman Switch Structure
Buffalo St 32	Dale Rd 213	Station 122	
Buffalo St 33	Electric Ave 55	Station 127 - Delaware Rd	

The transmission lines located in the Frontier transmission study area are provided in the table below:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1010	Adams - Packard 187	main line	115
T1010-1 Tap	Adams - Packard #187	A-P #187 Niagara Falls Wastewater Tap	115
T1010-2 Tap	Adams - Packard #187	A-P #187 Carbo-Wash. Mills Tap	115
T1010-3 Tap	Adams - Packard #187	A-P #187 Occidental Chemical Tap	115
T1010-4 Tap	Adams - Packard #187	A-P #187 Great Lakes Carbon Tap	115
T1010-5 Tap	Adams - Packard #187	A-P #187 Pyron Tap	115
T1010-6 Tap	Adams - Packard #187	A-P #187 Dupont Tap	115
T1010-7 Tap	Adams - Packard #187	A-P #187 Buffalo Av. 215 Tap	115
T1020	Adams - Packard 188	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1020-1 Tap	Adams - Packard #188	A-P #188 Niagara Falls Wastewater Tap	115
T1020-2 Tap	Adams - Packard #188	A-P #188 Carbo-Wash. Mills Tap	115
T1020-3 Tap	Adams - Packard #188	A-P #188 Occidental Chemical Tap	115
T1020-4 Tap	Adams - Packard #188	A-P #188 Great Lakes Carbon Tap	115
T1020-5 Tap	Adams - Packard #188	A-P #188 Pyron Tap	115
T1020-6 Tap	Adams - Packard #188	A-P #188 Dupont Tap	115
T1020-7 Tap	Adams - Packard #188	A-P #188 Buffalo Av. 215 Tap	115
T1030	Airco - Buffalo River 147	main line	115
T1030-1 Tap	Airco - Buffalo River #147	A-BR #147 Co-Steel Recycling Tap	115
T1060	Beck - Lockport 104	main line	115
T1060-1 Tap	Beck - Lockport #104	B-L #104 - Mountain Switch Struc. Tap	115
T1060-2 Tap	Beck - Lockport #104	B-L #104 - Swann Road 105 Tap	115
T1070	Beck-Packard 76	main line	230
T1120	DuPont - Packard #183	main line	115
T1120-1 Tap	DuPont - Packard #183	D-P #183 - Carbon Graphite Tap	115
T1120-2 Tap	DuPont - Packard #183	D-P #183 - Harper Tap	115
T1120-3 Tap	DuPont - Packard #183	D-P #183 - Olin (NYPA) Tap	115
T1130	DuPont - Packard #184	main line	115
T1130-1 Tap	DuPont - Packard #184	D-P #184 - Carbon Graphite Tap	115
T1130-2 Tap	DuPont - Packard #184	D-P #184 - CH Resources Co-Gen Tap	115
T1130-3 Tap	DuPont - Packard #184	D-P #184 - Harper Tap	115
T1130-4 Tap	DuPont - Packard #184	D-P #184 - Olin (NYPA) Tap	115
T1140	Elm Street-Gardenville #71	main line	230
T1150	Elm Street-Gardenville #72	main line	230
T1190	Gardenville - Bethlehem #149	main line	115
T1190-1 Tap	Gardenville - Bethlehem #149	G-B #149 Harbor Front 212 Tap	115
T1190-2 Tap	Gardenville - Bethlehem #149	G-B #149 Ford Tap	115
T1190-3 Tap	Gardenville - Bethlehem #149	G-B #149 Bethlehem SWS	115
T1200	Gardenville - Bethlehem #150	main line	115
T1200-1 Tap	Gardenville - Bethlehem #150	G-B #150 Bethlehem SWS	115
T1200-2 Tap	Gardenville - Bethlehem #150	G-B #150 Harbor Front 212 Tap	115
T1210	Gardenville - Buffalo River Switch #145	main line	115
T1210-1 Tap	Gardenville - Buffalo River Switch #145	G-B #145 St Lawrence Cement Tap	115
T1210-3 Tap	Gardenville - Buffalo River Switch #145	G-B #145 Ridge Station 142 Tap	115
T1210-4 Tap	Gardenville - Buffalo River Switch #145	G-B #145 Great Lakes MDF	115
T1220	Gardenville - Buffalo River Switch #146	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1220-1 Tap	Gardenville - Buffalo River Switch #146	G-B #146 Ridge Station 142 Tap	115
T1230	Gardenville - Depew #54	main line	115
T1230-1 Tap	Gardenville - Depew #54	G-D #54 - American Standard Tap	115
T1230-2 Tap	Gardenville - Depew #54	G-D #54 - Walden (NYSEG) Tap	115
T1230-3 Tap	Gardenville - Depew #54	G-D #54 - Walden Station 69 Tap	115
T1230-4 Tap	Gardenville - Depew #54	G-D #54 - Cooper Industries Tap	115
T1230-5 Tap	Gardenville - Depew #54	G-D #54 - Veridian (Calspan) Tap	115
T1230-6 Tap	Gardenville - Depew #54	G-D #54 - Buffalo Tungsten Tap	115
T1290	Gardenville - Seneca #81	main line	115
T1300	Gardenville - Seneca #82	main line	115
T1300-1 Tap	Gardenville - Seneca #82	G-S #82 Station 155 Tap	115
T1370	Huntley-Elm Street #70	main line	230
T1380	Huntley - Gardenville #38	main line	115
T1380-1 Tap	Huntley - Gardenville #38	H-G #38 Station 129 Tap	115
T1380-2 Tap	Huntley - Gardenville #38	H-G #38 Amherst Term Station Tap	115
T1380-3 Tap	Huntley - Gardenville #38	H-G #38 Maple Station 140 Tap	115
T1380-4 Tap	Huntley - Gardenville #38	H-G #38 Station 54 Tap	115
T1380-5 Tap	Huntley - Gardenville #38	H-G #38 Station 61 Tap	115
T1380-6 Tap	Huntley - Gardenville #38	H-G #38 Urban Station 154 Tap	115
T1380-7 Tap	Huntley - Gardenville #38	H-G #38 Walden Station Tap	115
T1380-8 Tap	Huntley - Gardenville #38	H-G #38 Dale Road Station 213 Tap	115
T1390	Huntley - Gardenville #39	main line	115
T1390-1 Tap	Huntley - Gardenville #39	H-G #39 FMC Tap	115
T1390-2 Tap	Huntley - Gardenville #39	H-G #39 Station 129 Tap	115
T1390-3 Tap	Huntley - Gardenville #39	H-G #39 Amherst Term Station Tap	115
T1390-4 Tap	Huntley - Gardenville #39	H-G #39 Maple Station 140 Tap	115
T1390-5 Tap	Huntley - Gardenville #39	H-G #39 Station 54 Tap	115
T1390-6 Tap	Huntley - Gardenville #39	H-G #39 Station 61 Tap	115
T1390-7 Tap	Huntley - Gardenville #39	H-G #39 Urban Station 154 Tap	115
T1390-8 Tap	Huntley - Gardenville #39	H-G #39 Dale Road Station 213 Tap	115
T1400	Huntley-Gardenville #79	main line	230
T1400-1 Tap	Huntley-Gardenville #79	H-G #79 Amherst Station SUNY Tap	230
T1400-2 Tap	Huntley-Gardenville #79	H-G #79 Sawyer Avenue Tap	230
T1410	Huntley-Gardenville #80	main line	230
T1410-1 Tap	Huntley-Gardenville #80	H-G #80 Amherst Station SUNY Tap	230
T1410-2 Tap	Huntley-Gardenville #80	H-G #80 Sawyer Avenue Tap	230
T1420	Huntley - Praxair #46	main line	115
T1420-1 Tap	Huntley - Praxair #46	H-L#46 - FMC Tap	115
T1420-2 Tap	Huntley - Praxair #46	H-L#46 - Dunlop Tire Tap	115
T1420-3 Tap	Huntley - Praxair #46	H-L#46 - Dupont Tap	115
T1420-4 Tap	Huntley - Praxair #46	H-L#46 - Chevy Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1420-5 Tap	Huntley - Praxair #46	H-L#46 - Kenmore Term Station Tap	115
T1420-6 Tap	Huntley - Praxair #46	H-L#46 – American Brass Tap	115
T1420-7 Tap	Huntley - Praxair #46	H-L#46 - Encogen Tap	115
T1420-8 Tap	Huntley - Praxair #46	H-L#46 - CNP Station 18 Tap	115
T1420-9 Tap	Huntley - Praxair #46	H-L#46 - Buffalo Sewer Auth. Tap	115
T1430	Huntley - Praxair #47	main line	115
T1430-1 Tap	Huntley - Praxair #47	H-L#47 - Dunlop Tire Tap	115
T1430-2 Tap	Huntley - Praxair #47	H-L#47 - Dupont Tap	115
T1430-3 Tap	Huntley - Praxair #47	H-L#47 - Chevy Tap	115
T1430-4 Tap	Huntley - Praxair #47	H-L#47 - Kenmore Term Station Tap	115
T1430-5 Tap	Huntley - Praxair #47	H-L#47 – American Brass Tap	115
T1430-6 Tap	Huntley - Praxair #47	H-L#47 - Encogen Tap	115
T1430-7 Tap	Huntley - Praxair #47	H-L#47 - Buffalo Sewer Auth. Tap	115
T1440-1 Tap	Huntley - Lockport #36	H-L #36 - Station 138 Tap	115
T1440-2 Tap	Huntley - Lockport #36	H-L #36 - Station 206 Tap	115
T1440-3 Tap	Huntley - Lockport #36	H-L #36 - Ayer Rd Station 211 Tap	115
T1440-4 Tap	Huntley - Lockport #36	H-L #36 - Young Station 214 Tap	115
T1440-5 Tap	Huntley - Lockport #36	H-L #36 - Sweethome Station 224 Tap	115
T1450-1 Tap	Huntley - Lockport #37	H-L #37 - Station 138 Tap	115
T1450-2 Tap	Huntley - Lockport #37	H-L #37 - Station 206 Tap	115
T1450-3 Tap	Huntley - Lockport #37	H-L #37 - Ayer Rd Station 211 Tap	115
T1450-4 Tap	Huntley - Lockport #37	H-L #37 - Sweethome Station 224 Tap	115
T1470	Kensington - Gardenville #44	main line	115
T1470-1 Tap	Kensington - Gardenville #44	K-G #44 American Axle Tap	115
T1480	Kensington - Gardenville #45	main line	115
T1480-1 Tap	Kensington - Gardenville #45	K-G #45 American Axle Tap	115
T1620-1 Tap	Mountain - Lockport #103	M-L #103 Swann Road 105 Tap	115
T1620-2 Tap	Mountain - Lockport #103	M-L #103 Shawnee Station 76 Tap	115
T1630	Mountain - Niagara #120	main line	115
T1640	Mountain - Niagara #121	main line	115
T1650	Mountain - Niagara #122	main line	115
T1660	Niagara - Gardenville #180	main line	115
T1660-1 Tap	Niagara - Gardenville #180	N-G #180 - Long Road Station 209 Tap	115
T1670	Niagara - Gibson #197	main line	115
T1670-1 Tap	Niagara - Gibson #197	N-G #197 - Ferro Electronics Tap	115
T1670-2 Tap	Niagara - Gibson #197	N-G #197 - Global Metals Tap	115
T1670-3 Tap	Niagara - Gibson #197	N-G #197 - UCAR Carbon Tap	115
T1670-4 Tap	Niagara - Gibson #197	N-G #197 - Lockport Road 216 Tap	115
T1680	Niagara - Gibson #198	main line	115
T1680-1 Tap	Niagara - Gibson #198	N-G #198 - Ferro Electronics Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1680-2 Tap	Niagara - Gibson #198	N-G #198 - Global Metals Tap	115
T1680-3 Tap	Niagara - Gibson #198	N-G #198 - UCAR Carbon Tap	115
T1680-4 Tap	Niagara - Gibson #198	N-G #198 - Lockport Road 216 Tap	115
T1690-1 Tap	Niagara - Lockport #101	N-L #101Sanborn Station Tap	115
T1700-1 Tap	Niagara - Lockport #102	N-L #102 Sanborn Station Tap	115
T1700-2 Tap	Niagara - Lockport #102	N-L #102 Shawnee Station 76 Tap	115
T1710	Niagara-Packard #61	main line	230
T1720	Niagara-Packard #62	main line	230
T1730	Niagara - Packard #191	main line	115
T1740	Niagara - Packard #192	main line	115
T1750	Niagara - Packard #193	main line	115
T1760	Niagara - Packard #194	main line	115
T1770	Niagara - Packard #195	main line	115
T1780	Packard - Gardenville #182	main line	115
T1780-1 Tap	Packard - Gardenville #182	P-G #182 - Long Road 209 Tap	115
T1780-2 Tap	Packard - Gardenville #182	P-G #182 - Niagara Falls Blvd. Station 130 Tap	115
T1780-3 Tap	Packard - Gardenville #182	P-G #182 - ECWA RF Ball Pump Tap	115
T1780-4 Tap	Packard - Gardenville #182	P-G #182 - Youngmann Term Tap	115
T1780-5 Tap	Packard - Gardenville #182	P-G #182 - Park Club Lane 219Tap	115
T1780-6 Tap	Packard - Gardenville #182	P-G #182 - Walden Sun Tap	115
T1780-7 Tap	Packard - Gardenville #182	P-G #182 - American Standard Tap	115
T1790	Packard-Huntley #77	main line	230
T1800	Packard-Huntley #78	main line	230
T1810	Packard - Walck Road #129	main line	115
T1810-1 Tap	Packard - Walck Road #129	P-W #129 - Military Rd. Sta. 210 Tap	115
T1810-2 Tap	Packard - Walck Road #129	P-W #129 - Milpine Sta. 96 Tap	115
T1810-3 Tap	Packard - Walck Road #129	P-W #129 - Summit Park Sta. 97 Tap	115
T1810-4 Tap	Packard - Walck Road #129	P-W #129 - Bergholtz Switch Str. Tap	115
T1820	Packard - Huntley #130	main line	115
T1820-1 Tap	Packard - Huntley #130	P-H #130 - Military R. Sta. 210 Tap	115
T1820-2 Tap	Packard - Huntley #130	P-H #130 - Milpine Sta. 96 Tap	115
T1820-3 Tap	Packard - Huntley #130	P-H #130 - Summit Park Sta. 97 Tap	115
T1820-4 Tap	Packard - Huntley #130	P-H #130 - Bergholtz Switch Str. Tap	115
T1820-5 Tap	Packard - Huntley #130	P-H #130 - Sta. 78 Tap	115
T1830	Packard - Union Carbide Met. (Linde) #185	main line	115
T1830-1 Tap	Packard - Union Carbide Met. (Linde) #185	P-U #185 - Cascades NF Inc Tap	115
T1830-2 Tap	Packard - Union Carbide Met. (Linde) #185	P-U #185 - American Refuel Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1830-3 Tap	Packard - Union Carbide Met. (Linde) #185	P-U #185 - Occidental Chemical Tap	115
T1840	Packard - Union Carbide Met. (Linde) #186	main line	115
T1840-1 Tap	Packard - Union Carbide Met. (Linde) #186	P-U #186 - Cascades NF Inc Tap	115
T1840-2 Tap	Packard - Union Carbide Met. (Linde) #186	P-U #186 - American Refuel Tap	115
T1840-3 Tap	Packard - Union Carbide Met. (Linde) #186	P-U #186 - Occidental Chemical Tap	115
T1850	Packard - Urban(Erie St.) #181	main line	115
T1850-1 Tap	Packard - Urban(Erie St.) #181	P-U #181 - Niagara Falls Blvd Station 130 Tap	115
T1850-2 Tap	Packard - Urban(Erie St.) #181	P-U #181 - ECWA RF Ball Pump Tap	115
T1850-3 Tap	Packard - Urban(Erie St.) #181	P-U #181 - Youngman Term Tap	115
T6020	Walck Road - Huntley #133	main line	115
T6020-1 Tap	Walck Road - Huntley #133	W-H #133 Youngs Station 214 Tap	115
T6020-2 Tap	Walck Road - Huntley #133	W-H #133 Station 78 Tap	115
T6260	Bell Aero - Bergholtz #99	main line	115
T6260-1 Tap	Bell Aero - Bergholtz #99	B-B #99 Carborundum Tap	115
T6260-2 Tap	Bell Aero - Bergholtz #99	B-B #99 Walmore Rd Tap	115
TNYSEG-1 Tap	Urban-Erie 922 (NYSEG)	U-E 922(NYSEG) - Veridian Tap	115

The following transmission lines have portions in both the Frontier and Genesee transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1440	Huntley - Lockport #36	main line	115
T1450	Huntley - Lockport #37	main line	115
T1620	Mountain - Lockport #103	main line	115
T1690	Niagara - Lockport #101	main line	115
T1700	Niagara - Lockport #102	main line	115

The following transmission lines have portions in both the Frontier and Southwestern transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1240	Gardenville-Dunkirk #73	main line	230
T1250	Gardenville-Dunkirk #74	main line	230

T1260	Gardenville - Dunkirk #141	main line	115
T1270	Gardenville - Dunkirk #142	main line	115
T1280	Gardenville - Homer Hill #152	main line	115
T1950	Gardenville - Homer Hill #151	main line	115

The sub-transmission lines located in the Frontier transmission study area are provided in the table below:

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
605	Youngmann Terminal	Buffalo Station 58 Tap	34.5
605	Buffalo Station 58 Tap	Buffalo Station 124	34.5
605	Buffalo Station 58 Tap	Buffalo Station 58	34.5
606	Youngmann Terminal	Buffalo Station 58 Tap	34.5
606	Buffalo Station 58 Tap	Buffalo Station 124	34.5
606	Buffalo Station 58 Tap	Buffalo Station 58	34.5
701	Aero Commerce Park	Buffalo Station 67	34.5
701	Walden	Amherst	34.5
702	Walden	Ledyard Sw. Struct.	34.5
703	Walden	Galleria	34.5
1-E	Elm Station	Emerg. Hosp	23
2-E	Elm Station	Dunn Tire Park	23
3-E	Elm Station	--------	23
4-E	Elm Station	Station 48	23
5-E	Elm Station	Station 38	23
6-E	Elm Station	Station 38	23
7-E	Elm Station	Station 41	23
8-E	Elm Station	Station 41	23
9-E	Elm Station	Station 41	23
10-E	Elm Station	Dunn Tire Park	23
16-E	Elm Station	Station 34	23
17-E	Elm Station	Station 34	23
18-E	Elm Station	Station 34	23
23-E	Elm Station	Station 38	23
27-E	Elm Station	Station 34	23
35-E	Elm Station	Station 41	23
1-K	Kensington Station	Station 68	23
2-K	Kensington Station	Station 68	23
3-K	Kensington Station	Station 68	23
4-K	Kensington Station	Station 68	23
5-K	Kensington Station	SUNY Buffalo	23
6-K	Kensington Station	SUNY Buffalo	23

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
7-K	Kensington Station	Clearing Niagara	23
8-K	Kensington Station	Meyer Memorial Hosp	23
9-K	Kensington Station	Station 32	23
9-K	Station 32	Station 157	23
10-K	Kensington Station	Station 26	23
11-K	Kensington Station	Station 26	23
12-K	Kensington Station	Station 26	23
13-K	Kensington Station	Station 32	23
13-K	Station 32	Station 28	23
14-K	Kensington Station	Station 26	23
15-K	Kensington Station	Station 26	23
21-K	Kensington Station	Station 22	23
22-K	Kensington Station	Station 22	23
23-K	Kensington Station	Station 22	23
33-K	Kensington Station	Station 22	23
401	Youngstown 88	Lewiston 87	34.5
401	Lewiston 87	Mountain	34.5
402	Ransomville 89	Wilson 93	34.5
402	Wilson 93	Burt 171	34.5
402	Burt 171	Phillips Rd	34.5
403	Youngstown 88	Model City Landfill Tap	34.5
403	Model City Landfill Tap	Ransomville 89	34.5
403	Ransomville 89	Sanborn	34.5
404	Mountain	Lewiston Heights 86	34.5
404	Lewiston Heights	Niagara Stone Tap	34.5
404	Niagara Stone Tap	Graph Tap	34.5
404	Graph Tap	Graph	34.5
404	Graph Tap	Sanborn	34.5
405	Lewiston Heights	Mountain	34.5
52	Harper	Welch Ave 83	12.0
53	Harper	Welch Ave 83	12.0
54	Harper	Welch Ave 83	12.0
55	Harper	Welch Ave 83	12.0
60	Harper	Eighth Street 80	12.0
61	Harper	Eighth Street 80	12.0
62	Harper	Welch Ave 83	12.0
63	Harper	Welch Ave 83	12.0
65	Harper	Eighth Street 80	12.0
653	Harper	Stephenson Ave 85	12.0
654	Harper	Stephenson Ave 85	12.0

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
655	Harper	Stephenson Ave 85	12.0
71	Gibson	P24	12.0
71	P24	P31	12.0
71	P31	General Abrasive	12.0
71	P31	Titanium	12.0
73	Gibson	Globar	12.0
73	Globar	Beech Street 81	12.0
1-H	Sawyer	Station 22	23
2-H	Sawyer	Station 22	23
3-H	Sawyer	Station 22	23
4-H	Sawyer	Station 201	23
5-H	Sawyer	Station 201	23
6-H	Sawyer	Station 37	23
7-H	Sawyer	Station 48A	23
8-H	Sawyer	Station 48A	23
9-H	Sawyer	Station 33	23
10-H	Sawyer	Station 26	23
11-H	Sawyer	Station 26	23
12-H	Sawyer	Station 26	23
13-H	Sawyer	Station 22	23
14-H	Sawyer	Station 26	23
15-H	Sawyer	Station 26	23
16-H	Sawyer	Station 160	23
17-H	Sawyer	Station 160	23
18-H	Sawyer	Station 160	23
19-H	Sawyer	Station 37	23
20-H	Sawyer	Station 33	23
21-H	Sawyer	TOPS	23
22-H	Sawyer	Station 48A	23
26-H	Sawyer	Station 56	23
26-H	Station 56	Kenmore Mercy Hosp	23
27-H	Sawyer	Station 161	23
28-H	Sawyer	Station 56	23
28-H	Station 56	Kenmore Mercy Hosp	23
29-H	Sawyer	Station 48	23
33-H	Sawyer	Station 126	23
34-H	Sawyer	Station 126	23
35-H	Sawyer	Station 33	23
35-H	Station 33	Station 204	23
36-H	Sawyer	Switch 578	23

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
1-S	Seneca Station	Station 46	23
2-S	Seneca Station	Station 46	23
3-S	Seneca Station	Station 46	23
19-S	Seneca Station	OLV Hosp.	23
31-S	Seneca Station	Station 46	23
31-S	Station 46	OLV Hosp.	23
4-S	Seneca Station	Station 48	23
5-S	Seneca Station	Station 48	23
6-S	Seneca Station	Station 38	23
23-S	Seneca Station	Station 38	23
7-S	Seneca Station	Station 42	23
8-S	Seneca Station	Station 42	23
9-S	Seneca Station	Station 42	23
13-S	Seneca Station	Buffalo Color	23
14-S	Seneca Station	Buffalo Color	23
30-S	Seneca Station	Station 41	23
32-S	Seneca Station	Scrap Property	23
33-S	Seneca Station	Scrap Property	23
10-S	Kensington Station	Seneca Station	23
11-S	Kensington Station	Seneca Station	23
12-S	Kensington Station	Seneca Station	23
15-S	Kensington Station	Seneca Station	23
16-S	Seneca Station	Station 34	23
17-S	Seneca Station	Station 34	23
18-S	Seneca Station	Station 34	23
27-S	Seneca Station	Station 34	23
601	Buffalo Station 78	Buffalo Station 77 Tap	23
601	Buffalo Station 78	Buffalo Station 77 Tap	23
601	Buffalo Station 77 Tap	Buffalo Station 77	23
601	Buffalo Station 77 Tap	Buffalo Station 74 Tap	23
601	Buffalo Station 74 Tap	Buffalo Station 74	23
601	Buffalo Station 74 Tap	Buffalo Station 57	23
601	Buffalo Station 57	Buffalo Station 127 Tap	23
601	Buffalo Station 127 Tap	Buffalo Station 127	23
601	Buffalo Station 127 Tap	Buffalo Station 63	23
602	Buffalo Station 78	Buffalo Station 77 Tap	23
602	Buffalo Station 78	Buffalo Station 77 Tap	23
602	Buffalo Station 77 Tap	Buffalo Station 77	23
602	Buffalo Station 77 Tap	Buffalo Station 74 Tap	23
602	Buffalo Station 74 Tap	Buffalo Station 74	23

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
602	Buffalo Station 74 Tap	Buffalo Station 57	23
602	Buffalo Station 57	Buffalo Station 127 Tap	23
602	Buffalo Station 127 Tap	Buffalo Station 127	23
602	Buffalo Station 127 Tap	Buffalo Station 63	23
603	Buffalo Station 78	Buffalo Station 77 Tap	23
603	Buffalo Station 78	Buffalo Station 77 Tap	23
603	Buffalo Station 77 Tap	Buffalo Station 77	23
603	Buffalo Station 77 Tap	Buffalo Station 74 Tap	23
603	Buffalo Station 74 Tap	Buffalo Station 74	23
603	Buffalo Station 74 Tap	Buffalo Station 57	23
603	Buffalo Station 57	Buffalo Station 127 Tap	23
603	Buffalo Station 127 Tap	Buffalo Station 127	23
603	Buffalo Station 127 Tap	Buffalo Station 63	23
604	Buffalo Station 77 Tap	Buffalo Station 77	23
604	Buffalo Station 77 Tap	COLORFORMS Inc.	23
622	Buffalo Station 78	Buffalo Station 122 Tap	23
622	Buffalo Station 122 Tap	Buffalo Station 79	23
622	Buffalo Station 122 Tap	Buffalo Station 122	23
623	Buffalo Station 78	Buffalo Station 122 Tap	23
623	Buffalo Station 122 Tap	Buffalo Station 79	23
623	Buffalo Station 122 Tap	Buffalo Station 122	23
624	Buffalo Station 78	Waste Water Tap	23
624	Waste Water Tap	Buffalo Station 79	23
624	Waste Water Tap	Waste Water	23

H. Southwest Study Area

Electrical Facilities			
Substations			
Arcade Station	Delameter Station 93	Knights Creek Station 6	Ripley Station 53
Andover Station 9	Delevan Station 11	Lakeview Station 182	Shaleton Station 81
Angola Station 80	Dugan Road Station 22	Langford Station 180	Sherman Station 54
Ashville Station	Dunkirk Station	Levant Station 98	Sinclairville Station 72
Baker Street Station 150	East Dunkirk Station 63	Machias Station 13	South Dow Station
Bemus Point Station 159	East Otto Station 28	Maplehurst 04	South Randolph Station 32
Bennett Road Station 99	Eden Center Station 88	Moons Switch Structure	South Ripley Station
Berry Road Station 153	Eden Switch Stucture	North Angola Station	South Wellsville Station 23
Brigham Road Station 64	Ellicott Station 65	North Ashford Station 36	Steamburg Station 17
Bagdad Station	Falconer Station	North Chautauqua Station	Stow Station 52
Buffalo Station 149	Farmersville Station 27	North Collins Station 92	Valley Station 44
Busti Station 68	Finley Lake Station 71	North Eden Station 82	Vandalia Station 104
Cassadaga Station 61	Finley Road Switch Structure	North Olean Station 30	West Olean Station 33
Cattaraugus Station 15	Five Mile Road 1325	New Road Switch Structure	West Portland Station 151
Chautauqua Station 57	Franklinville Station 24	Nile Station	West Salamanca Station 16
Cloverbank Station 91	French Creek Station 56	Oak Hill Station 62	West Valley Station 25
Clymer Station 55	Frewsburg Station 69	Panama Station 70	West Perrysburg Station 181
Collins Station 83	Greenhurst Station 60	Petrolia Station 19	Whitesville Station 101
Cuba Lake Station 37	Hartfield Station 79	Poland Station 66	
Cuba Station 5	Homer Hill	Price Corners Station 14	
Dake Hill Switch Structure	Ischua Switch Structure	Reservoir Station 103	

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1080	Dunkirk - Falconer 160	main line	115
T1080-1 Tap	Dunkirk - Falconer #160	D-F #160 – Westfield Village Tap	115
T1080-2 Tap	Dunkirk - Falconer #160	D-F #160 - Columbia Gas Tap	115
T1080-3 Tap	Dunkirk - Falconer #160	D-F #160 - Cummins Tap	115
T1090	Dunkirk - Falconer 161	main line	115
T1090-1 Tap	Dunkirk - Falconer #161	D-F #161 - Willowbrook Switch Tap	115
T1090-2 Tap	Dunkirk - Falconer #161	D-F #161 - Special Metals Tap	115
T1090-3 Tap	Dunkirk - Falconer #161	D-F #161 - Ludlum Tap	115
T1090-4 Tap	Dunkirk - Falconer #161	D-F #161 – Roberts Road Tap	115
T1090-5 Tap	Dunkirk - Falconer #161	D-F #161 - East Dunkirk Tap	115
T1100	Dunkirk - Falconer #162	main line	115
T1100-1 Tap	Dunkirk - Falconer #162	D-F #162 - Willowbrook Switch Tap	115
T1100-2 Tap	Dunkirk - Falconer #162	D-F #162 - Ludlum Tap	115
T1100-3 Tap	Dunkirk - Falconer #162	D-F #162 – Bennett Road Tap	115
T1100-4 Tap	Dunkirk - Falconer #162	D-F #162 – Roberts Road Tap	115
T1100-5 Tap	Dunkirk - Falconer #162	D-F #162 - East Dunkirk Tap	115
T1110	Dunkirk-South Ripley #68	main line	230
T1160	Falconer - Homer Hill #153	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1160-1 Tap	Falconer - Homer Hill #153	F-HH #153 - South Dow Street Tap	115
T1160-2 Tap	Falconer - Homer Hill #153	F-HH #153 - Carrs Corner Switch Tap (NYSEG)	115
T1160-3 Tap	Falconer - Homer Hill #153	F-HH #153 - Salamanca-Frank St. Tap	115
T1160-4 Tap	Falconer - Homer Hill #153	F-HH #153 - Salamanca-Rochester Tap	115
T1170	Falconer - Homer Hill #154	main line	115
T1170-1 Tap	Falconer - Homer Hill #154	F-HH #154 - South Dow Street Tap	115
T1170-2 Tap	Falconer - Homer Hill #154	F-HH #154 - Carrs Corners Switch Tap (NYSEG)	115
T1170-3 Tap	Falconer - Homer Hill #154	F-HH #154 – Salamanca-Frank St. Tap	115
T1170-4 Tap	Falconer - Homer Hill #154	F-HH #154 – Salamanca-Rochester Tap	115
T1180	South Ripley-Erie #69	main line	230
T1260-1 Tap	Gardenville - Dunkirk #141	G-D #141 Martin Road Station 139 Tap	115
T1260-2 Tap	Gardenville - Dunkirk #141	G-D #141 Station 55 Tap	115
T1260-3 Tap	Gardenville - Dunkirk #141	G-D #141 Cloverbank Station 91Tap	115
T1260-4 Tap	Gardenville - Dunkirk #141	G-D #141 Shaleton Station 81 Tap	115
T1260-5 Tap	Gardenville - Dunkirk #141	G-D #141 Delameter Station 93 Tap	115
T1260-6 Tap	Gardenville - Dunkirk #141	G-D #141 North Angola Tap	115
T1260-7 Tap	Gardenville - Dunkirk #141	G-D #141 Silver Creek (NYSEG) Tap	115
T1270-1 Tap	Gardenville - Dunkirk #142	G-D #142 Martin Road Station 139 Tap	115
T1270-2 Tap	Gardenville - Dunkirk #142	G-D #142 Station 55 Tap	115
T1270-3 Tap	Gardenville - Dunkirk #142	G-D #142 Ford Tap	115
T1270-4 Tap	Gardenville - Dunkirk #142	G-D #142 Cloverbank Station 91Tap	115
T1270-5 Tap	Gardenville - Dunkirk #142	G-D #142 Delameter Station 93 Tap	115
T1270-6 Tap	Gardenville - Dunkirk #142	G-D #142 Bennett Road Station 99 Tap	115
T1270-7 Tap	Gardenville - Dunkirk #142	G-D #142 North Angola Tap	115
T1270-8 Tap	Gardenville - Dunkirk #142	G-D #142 Silver Creek (NYSEG) Tap	115
T1280-1 Tap	Gardenville - Homer Hill #152	G-HH #152 Springville Station Tap	115
T1280-2 Tap	Gardenville - Homer Hill #152	G-HH #152 Cobble Hill Tap	115
T1280-3 Tap	Gardenville - Homer Hill #152	G-HH #152 Machias Tap	115
T1280-4 Tap	Gardenville - Homer Hill #152	G-HH #152 Ischua Switch Tap	115
T1330	Hartfield - Moons Switches #159	main line	115
T1340	Homer Hill - Bennett Road #157	main line	115
T1340-1 Tap	Hartfield - Moons Switches #159	HH-BR #157 - Dugan Road Tap	115
T1340-2 Tap	Homer Hill - Bennett Road #157	HH-BR #157 - Wellsville Tap	115
T1350	Homer Hill - Dugan Road #155	main line	115
T1350-1 Tap	Homer Hill - Dugan Road #155	HH-DR #155 - West Olean Tap	115
T1350-2 Tap	Homer Hill - Dugan Road #155	HH-DR #155 - Cooper-Power Sys. Tap	115
T1360	Homer Hill - West Olean #156	main line	115
T1360-1 Tap	Homer Hill - West Olean #156	HH-WO #156 - Dresser Tap	115
T1460	Homer Hill - Indeck Olean #166	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1900	Valley (Station 44) - Ischua Switch #158	main line	115
T1910	Willowbrook Switch - Brigham #164	main line	115
T1950-1 Tap	Gardenville - Homer Hill #151	G-HH #151 Springville Station Tap	115
T1950-2 Tap	Gardenville - Homer Hill #151	G-HH #151 Cobble Hill Tap	115
T1950-3 Tap	Gardenville - Homer Hill #151	G-HH #151 Arcade Village (Muni) Tap	115
T1950-4 Tap	Gardenville - Homer Hill #151	G-HH #151 Machias Tap	115
T1950-5 Tap	Gardenville - Homer Hill #151	G-HH #151 Ischua Switch Tap	115
T6080	Falconer - Warren #171	main line	115
T6110	Homer City - Stolle Road#37	main line	345
T6450	Archade - Homer Hill #167	main line	115

The following transmission lines have portions in both the Southwestern and Frontier transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage (kV)**
T1240	Gardenville-Dunkirk #73	main line	230
T1250	Gardenville-Dunkirk #74	main line	230
T1260	Gardenville - Dunkirk #141	main line	115
T1270	Gardenville - Dunkirk #142	main line	115
T1280	Gardenville - Homer Hill #152	main line	115
T1950	Gardenville - Homer Hill #151	main line	115

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
803	Dake Hill	Machias	34.5
801	Delvan	Machias	34.5
816	Dake Hill	West Salamanca	34.5
804	Cold Spring	West Salamanca	34.5
802	Machias	Maplehurst	34.5
817	North Ashford	Nuclear Fuels	34.5
815	Bagdad	Dake Hill	34.5
856	Shaleton	North Angola	34.5
857	North Angola	Bagdad	34.5
862	North Angola	Bagdad	34.5
861	North Angola	North Ashford	34.5
851	Dunkirk	West Portland	34.5

852	Dunkirk	Hartfield	34.5
866	West Portland	Hartfield	34.5
859	Hartfield	South Dow	34.5
867	West Portland	Sherman	34.5
855	Hartfield	Sherman	34.5
863	Sherman	Ashville	34.5
854	Hartfield	Ashville	34.5
865	South Dow	Poland	34.5
860	North Eden	Eden	34.5
805	West Salamanca	Homer Hill	34.5
809	Homer Hill	Ceres	34.5
811	Homer Hill	Nile	34.5
541	Andover	South Wellsville	34.5
812	Nile	South Wellsville	34.5

Exhibit 2 - Transmission Inspection and Maintenance Report
Calendar Years 2016 – 2018

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Transmission

Transmission Facilities	2016				2017				2018			
Priority Level	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs
Repair Expected	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days
Towers/Poles												
Steel Towers												
Number of Deficiencies	1	3	75	0	0	8	104	0	0	0	27	0
Repaired in Time Frame	0	1	3	0	0	3	0	0	0	0	0	0
Repaired - Overdue	1	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	72	0	0	0	104	0	0	0	27	0
Not Repaired - Overdue	0	2	0	0	0	5	0	0	0	0	0	0
Poles												
Number of Deficiencies	3	108	1624	0	6	148	2146	0	3	104	1691	3
Repaired in Time Frame	3	84	161	0	5	86	22	0	3	3	1	1
Repaired - Overdue	0	10	0	0	1	4	0	0	0	0	0	0
Not Repaired - Not Due	0	0	1463	0	0	0	2124	0	0	101	1690	0
Not Repaired - Overdue	0	14	0	0	0	58	0	0	0	0	0	2
Anchors/Guy Wire												
Number of Deficiencies	0	20	331	0	0	7	311	1	0	9	214	0
Repaired in Time Frame	0	5	52	0	0	5	4	0	0	3	1	0
Repaired - Overdue	0	14	0	0	0	2	0	1	0	0	0	0
Not Repaired - Not Due	0	0	279	0	0	0	307	0	0	6	213	0
Not Repaired - Overdue	0	1	0	0	0	0	0	0	0	0	0	0
Crossarm/Brace												
Number of Deficiencies	1	18	212	0	1	6	239	2	2	34	156	0
Repaired in Time Frame	1	9	9	0	1	5	4	0	2	0	0	0
Repaired - Overdue	0	2	0	0	0	1	0	2	0	0	0	0
Not Repaired - Not Due	0	0	203	0	0	0	235	0	0	34	156	0
Not Repaired - Overdue	0	7	0	0	0	0	0	0	0	0	0	0
Grounding System												
Number of Deficiencies	0	16	309	0	0	11	482	0	2	10	226	0
Repaired in Time Frame	0	14	130	0	0	9	6	0	2	1	0	0
Repaired - Overdue	0	1	0	0	0	1	0	0	0	0	0	0
Not Repaired - Not Due	0	0	179	0	0	0	476	0	0	9	226	0
Not Repaired - Overdue	0	1	0	0	0	1	0	0	0	0	0	0
Conductors												
Cable												
Number of Deficiencies	0	1	68	0	0	0	111	0	1	2	86	1
Repaired in Time Frame	0	1	4	0	0	0	0	0	1	0	0	1
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	64	0	0	0	111	0	0	2	86	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Static/Neutral												
Number of Deficiencies	0	6	19	0	0	6	15	0	0	3	5	0
Repaired in Time Frame	0	0	4	0	0	2	0	0	0	0	0	0
Repaired - Overdue	0	6	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	15	0	0	0	15	0	0	3	5	0
Not Repaired - Overdue	0	0	0	0	0	4	0	0	0	0	0	0
Insulators												
Number of Deficiencies	2	15	101	0	2	11	91	1	1	26	59	0
Repaired in Time Frame	0	11	16	0	2	8	1	1	1	1	0	0
Repaired - Overdue	2	1	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	85	0	0	0	90	0	0	25	59	0
Not Repaired - Overdue	0	3	0	0	0	3	0	0	0	0	0	0
Miscellaneous												
Right of Way Condition												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Repairs												
Number of Temp Repairs	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Other												
Number of Deficiencies	0	14	39	0	0	34	115	0	1	5	10	0
Repaired in Time Frame	0	11	2	0	0	9	1	0	1	0	0	0
Repaired - Overdue	0	2	0	0	0	1	0	0	0	0	0	0
Not Repaired - Not Due	0	0	37	0	0	0	114	0	0	5	10	0
Not Repaired - Overdue	0	1	0	0	0	24	0	0	0	0	0	0

Transmission FacilitiesTotal												
Total												
Number of Deficiencies	7	201	2778	0	9	231	3614	4	10	193	2474	4
Repaired in Time Frame	4	136	381	0	8	127	38	1	10	8	2	2
Repaired - Overdue	3	36	0	0	1	9	0	3	0	0	0	0
Not Repaired - Not Due	0	0	2397	0	0	0	3576	0	0	185	2472	0
Not Repaired - Overdue	0	29	0	0	0	95	0	0	0	0	0	2

Exhibit 3 - Distribution Inspection and Maintenance Report
Calendar Years 2016 –2018

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Distribution

Overhead Facilities	2016				2017				2018			
Priority Level	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs
Repair Expected	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days
Poles												
Pole Condition												
Number of Deficiencies	301	954	7884	40	284	663	6211	44	463	1	6113	50
Repaired in Time Frame	287	907	2401	30	273	631	529	41	425	0	159	37
Repaired - Overdue	14	45	2	10	11	27	0	2	38	0	0	4
Not Repaired - Not Due	0	0	5481	0	0	0	5682	0	0	1	5954	5
Not Repaired - Overdue	0	2	0	0	0	5	0	1	0	0	0	4
Grounding System												
Number of Deficiencies	344	4445	10616	0	464	3807	6132	0	1153	1	5820	0
Repaired in Time Frame	340	4285	5146	0	434	3439	1401	0	1123	0	45	0
Repaired - Overdue	4	153	7	0	30	202	0	0	30	0	0	0
Not Repaired - Not Due	0	0	5463	0	0	0	4731	0	0	1	5775	0
Not Repaired - Overdue	0	7	0	0	0	166	0	0	0	0	0	0
Anchors/Guy Wire												
Number of Deficiencies	4	0	15514	20	3	0	12329	42	13	0	13194	0
Repaired in Time Frame	4	0	3806	19	3	0	872	38	12	0	68	0
Repaired - Overdue	0	0	50	1	0	0	0	4	1	0	0	0
Not Repaired - Not Due	0	0	11658	0	0	0	11457	0	0	0	13126	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Cross Arm/Bracing												
Number of Deficiencies	87	0	2150	2	52	0	1659	7	66	0	1095	7
Repaired in Time Frame	87	0	1134	1	51	0	356	6	65	0	21	6
Repaired - Overdue	0	0	1	1	1	0	0	1	1	0	0	0
Not Repaired - Not Due	0	0	1015	0	0	0	1303	0	0	0	1074	1
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Riser												
Number of Deficiencies	14	0	4268	1	4	0	4105	3	12	0	3810	1
Repaired in Time Frame	14	0	1288	1	3	0	330	1	12	0	13	1
Repaired - Overdue	0	0	9	0	1	0	0	1	0	0	0	0
Not Repaired - Not Due	0	0	2971	0	0	0	3775	0	0	0	3797	0
Not Repaired - Overdue	0	0	0	0	0	0	0	1	0	0	0	0
Conductors												
Primary Wire/Broken Ties												
Number of Deficiencies	37	155	47	2	41	101	55	8	28	114	45	3
Repaired in Time Frame	37	151	12	2	40	94	11	6	28	33	0	3
Repaired - Overdue	0	2	0	0	1	6	0	2	0	0	0	0
Not Repaired - Not Due	0	0	35	0	0	0	44	0	0	81	45	0
Not Repaired - Overdue	0	2	0	0	0	1	0	0	0	0	0	0
Secondary Wire												
Number of Deficiencies	21	0	518	3	32	0	257	12	36	0	250	0
Repaired in Time Frame	21	0	244	2	32	0	18	10	36	0	1	0
Repaired - Overdue	0	0	1	1	0	0	0	2	0	0	0	0
Not Repaired - Not Due	0	0	273	0	0	0	239	0	0	0	249	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Neutral												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Insulators												
Number of Deficiencies	12	357	24	3	19	227	4	9	18	76	113	0
Repaired in Time Frame	12	345	2	1	19	217	0	9	18	26	3	0
Repaired - Overdue	0	8	0	2	0	8	0	0	0	0	0	0
Not Repaired - Not Due	0	0	22	0	0	0	4	0	0	50	110	0
Not Repaired - Overdue	0	4	0	0	0	2	0	0	0	0	0	0

Pole Equipment												
Transformers												
Number of Deficiencies	18	36	5832	0	9	24	6440	0	9	0	5446	0
Repaired in Time Frame	18	34	1655	0	9	22	849	0	9	0	24	0
Repaired - Overdue	0	2	6	0	0	2	0	0	0	0	0	0
Not Repaired - Not Due	0	0	4171	0	0	0	5591	0	0	0	5422	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Cutouts												
Number of Deficiencies	4	84	353	0	6	21	354	0	3	9	98	0
Repaired in Time Frame	4	82	89	0	5	21	30	0	2	2	1	0
Repaired - Overdue	0	2	2	0	1	0	0	0	1	0	0	0
Not Repaired - Not Due	0	0	262	0	0	0	324	0	0	7	97	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Lightning Arrestors												
Number of Deficiencies	0	545	1483	0	0	253	1692	0	0	226	1825	0
Repaired in Time Frame	0	542	451	0	0	219	93	0	0	91	5	0
Repaired - Overdue	0	3	1	0	0	25	0	0	0	0	0	0
Not Repaired - Not Due	0	0	1031	0	0	0	1599	0	0	135	1820	0
Not Repaired - Overdue	0	0	0	0	0	9	0	0	0	0	0	0
Other Equipment												
Number of Deficiencies	4	154	3798	0	6	61	3819	1	5	29	3638	0
Repaired in Time Frame	4	138	1361	0	6	58	250	0	5	19	9	0
Repaired - Overdue	0	15	32	0	0	1	0	1	0	0	0	0
Not Repaired - Not Due	0	0	2405	0	0	0	3569	0	0	10	3629	0
Not Repaired - Overdue	0	1	0	0	0	2	0	0	0	0	0	0
Miscellaneous												
Trimming Related												
Number of Deficiencies	67	0	0	0	104	0	0	0	90	0	0	0
Repaired in Time Frame	66	0	0	0	103	0	0	0	90	0	0	0
Repaired - Overdue	1	0	0	0	1	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Repairs												
Number of Temp Repairs	0	0	0	0	0	0	0	0	0	0	0	19
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	17
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	1
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	1
Other												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Overhead Facilities Total												
Total												
Number of Deficiencies	913	6730	52487	71	1024	5157	43057	126	1896	456	41447	80
Repaired in Time Frame	894	6484	17589	56	978	4701	4739	111	1825	171	349	64
Repaired - Overdue	19	230	111	15	46	271	0	13	71	0	0	5
Not Repaired - Not Due	0	0	34787	0	0	0	38318	0	0	285	41098	6
Not Repaired - Overdue	0	16	0	0	0	185	0	2	0	0	0	5

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Pad Mount Transformers												
Pad Mount Transformers	**2016**				**2017**				**2018**			
Priority Level	**I**	**II**	**III**	**Temp Repairs**	**I**	**II**	**III**	**Temp Repairs**	**I**	**II**	**III**	**Temp Repairs**
Repair Expected	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**
Pad Mount Tansformers												
Damaged Structure												
Number of Deficiencies	22	265	68	1	21	259	50	1	19	248	61	0
Repaired in Time Frame	21	261	23	1	21	219	8	1	18	79	8	0
Repaired - Overdue	1	3	0	0	0	4	0	0	1	0	0	0
Not Repaired - Not Due	0	0	45	0	0	0	42	0	0	169	53	0
Not Repaired - Overdue	0	1	0	0	0	36	0	0	0	0	0	0
Damaged Equipment												
Number of Deficiencies	1	2	0	0	0	2	1	1	2	1	1	0
Repaired in Time Frame	1	2	0	0	0	2	0	1	2	1	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	1	0	0	0	1	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Cable Condition												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Oil Leak												
Number of Deficiencies	13	92	0	1	9	76	0	0	16	99	0	0
Repaired in Time Frame	12	87	0	1	9	69	0	0	15	24	0	0
Repaired - Overdue	1	5	0	0	0	4	0	0	1	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	75	0	0
Not Repaired - Overdue	0	0	0	0	0	3	0	0	0	0	0	0
Off Pad												
Number of Deficiencies	17	179	0	0	35	142	0	1	27	154	0	0
Repaired in Time Frame	17	170	0	0	35	139	0	0	24	75	0	0
Repaired - Overdue	0	9	0	0	0	0	0	1	3	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	79	0	0
Not Repaired - Overdue	0	0	0	0	0	3	0	0	0	0	0	0
Lock/Latch/Penta												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous												
Temporary Repairs												
Number of Temp Repairs	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Other												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Pad Mount Total												
Total												
Number of Deficiencies	53	538	68	2	65	479	51	3	64	502	62	2
Repaired in Time Frame	51	520	23	2	65	429	8	2	59	179	8	2
Repaired - Overdue	2	17	0	0	0	8	0	1	5	0	0	0
Not Repaired - Not Due	0	0	45	0	0	0	43	0	0	323	54	0
Not Repaired - Overdue	0	1	0	0	0	42	0	0	0	0	0	0

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Streetlights

Overhead Facilities	2016				2017				2018			
Priority Level	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs
Repair Expected	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days
Streetlight												
Base/Standard/Light												
Number of Deficiencies	0	124	0	0	0	358	2	0	0	325	2	0
Repaired in Time Frame	0	116	0	0	0	341	0	0	0	10	0	0
Repaired - Overdue	0	8	0	0	0	2	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	2	0	0	315	2	0
Not Repaired - Overdue	0	0	0	0	0	15	0	0	0	0	0	0
Handhole/Service Box												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Service/Internal Wiring												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	12	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	12	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Access Cover												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous												
Temporary Repairs												
Number of Temp Repairs	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Other												
Number of Deficiencies	0	5	0	0	0	0	0	0	0	2	0	0
Repaired in Time Frame	0	5	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	2	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Streetlight Total												
Total												
Number of Deficiencies	0	129	0	0	0	358	2	0	0	339	2	0
Repaired in Time Frame	0	121	0	0	0	341	0	0	0	10	0	0
Repaired - Overdue	0	8	0	0	0	2	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	2	0	0	329	2	0
Not Repaired - Overdue	0	0	0	0	0	15	0	0	0	0	0	0

nationalgrid

Transmission and Distribution Capital Investment Plan

Electric Transmission & Distribution System

Case 17-E-0238

March 31, 2020

Prepared for:

The State of New York Public Service Commission

Three Empire State Plaza

Albany, NY 12223

nationalgrid

Table of Contents

Chapter 1: Executive Summary

Niagara Mohawk Power Corporation d/b/a National Grid ("Niagara Mohawk" or "the Company") hereby submits its Five Year Capital Investment Plan (the "Plan") in compliance with the New York Public Service Commission ("PSC" or the "Commission") Order, issued March 15, 2018, in Case 17-E-0238.[1] The Plan outlines projected capital investment levels during fiscal years 2021 to 2025 (FY21 to FY25).[2] The Plan investment levels are summarized by system in Table 1-1, below, and reflect the Company's present estimate of investment levels needed to meet its obligation to provide safe and adequate service at reasonable cost to customers, as well as to continue to modernize the electric system to address the evolving needs of customers.

Table 1-1
Capital Investment Plan by System ($millions)

System	FY21	FY22	FY23	FY24	FY25	Total
Transmission	212.8	248.4	274.8	303.1	347.6	1,386.7
Sub-Transmission	39.8	56.2	61.0	56.0	57.8	270.9
Distribution	357.1	402.2	444.9	440.4	463.5	2,108.1
AMI	0.7	4.4	33.8	77.7	93.1	209.7
Total	**610.4**	**711.2**	**814.5**	**877.2**	**962.0**	**3,975.4**

The investment levels for FY21 reflect amounts included in the Joint Proposal approved by the Rate Case Order. The planned investment levels for FY22-FY25 are consistent with amounts the Company currently expects to be reflected in the Company's next rate case filing. The Plan assumes that the impacts of the novel coronavirus (COVID–19) pandemic will not result in a significant sustained impact on the Company's ability to deliver the plan. However, because these are unprecedented circumstances, the Company will continue to evaluate its system, customer needs, available resources, and applicable constraints, and adjust the Plan as appropriate and necessary in light of the evolving circumstances.

[1] Case 17-E-0238, *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 and Establishing Electric and Gas Rate Plans, issued and effective March 15, 2018 ("Rate Case Order").
[2] The period FY21 to FY25 covers April 1, 2020 - March 31, 2025.

1. A. Capital Investment Plan Summary

The Plan is presented by system and spending rationale. A view of planned investments by system is presented in Table 1-1 above, while a view of planned investments by spending rationale is summarized below.

Investment by Spending Rationale

The Company classifies capital projects into ten spending rationales based on the project's primary investment driver: (A) Customer Requests/Public Requirements; (B) Damage/Failure; (C) System Capacity; (D) Asset Condition; (E) Reliability; (F) Resiliency (G) Communications/Control Systems; (H) Distributed Energy Resource ("DER") Electric Systems Access; (I) Multi-Value Transmission ("MVT") (J) Non-Infrastructure.

Customer Requests/Public Requirements

Customer Requests/Public Requirements projects include capital expenditures required for the Company to meet customer requests for service and public requirements. Such items include new business requests (residential and commercial), including projects to support electric vehicle ("EV") load, new metering installations, outdoor lighting, third-party attachments, land rights, municipal relocations, generator interconnections (not including DER), and other requirements including municipal and customer interconnections.

Damage/Failure

Damage Failure projects are required to replace failed or damaged equipment and to restore the electric system to its original configuration and capability following equipment damage or failure. Damage may be caused by storms, vehicle accidents, vandalism or other unplanned events. The Damage/Failure spending rationale is typically non-discretionary in terms of scope and timing. The Damage/Failure budget may also include the cost of purchasing strategic spares to respond to equipment failures.

System Capacity

System Capacity projects are required to upgrade the capability of the Transmission & Distribution ("T&D") delivery system to provide adequate stability, thermal loading, and voltage performance under existing and anticipated system conditions.

Asset Condition

Asset Condition projects are required to reduce the likelihood and consequences of unplanned failures of transmission, sub-transmission, and distribution assets. Examples of such projects include replacing system elements such as overhead lines, underground cable or substation equipment. Asset Condition investments reflect targeted replacement of assets based on condition rather than wholesale replacement based on "end of useful life" criteria.

Reliability

Reliability projects include efforts to improve power quality and minimize service interruptions (with projects such as storm hardening[3]). Examples include investments to meet North American

[3] Storm Hardening is defined as the ability of the system to withstand the damaging effects of a storm. This falls under reliability because it is pre-contingency, where resiliency is more focused on post contingency.

Electric Reliability Corporation ("NERC") requirements, bring substations to Northeast Power Coordinating Council, Inc. ("NPCC") design, protection and operation standards, comply with New York State Reliability Council rules, and address reliability issues identified as a result of system studies.

Communications/Control Systems
Communication/Control Systems projects are required for monitoring and controlling the T&D system, and include such projects as installing Energy Management System ("EMS")/Remote Terminal Units ("RTU"), replace antiquated communication circuits with fiber optic cable and advanced metering communications.

DER Electric System Access
DER Electric System Access projects are investments required to enable the Company to support implementation of items such as non-wires alternatives ("NWA"), microgrids, storage, Distributed Generation ("DG") interconnections, and other third-party and market-driven needs.

Resiliency
Resiliency is a new spending rationale. Resiliency projects are intended to ensure the electric power system can recover quickly following an interruption. More broadly, these projects allow the Company to better prepare for extraordinary and high-impact, low-probability events and to rapidly recover from these disruptive events.

Multi-Value Transmission ("MVT")
MVT investments are capital investments in transmission projects that provide cost effective solutions to optimizing the existing network, bringing benefits for project developers, customers, and the State alike. MVT solutions increase deliverability of large-scale renewables while also addressing asset condition or reliability concerns. Customers receive economic benefits from increased injection of renewable resources and advancing refurbishment of degraded assets and reliability improvements.

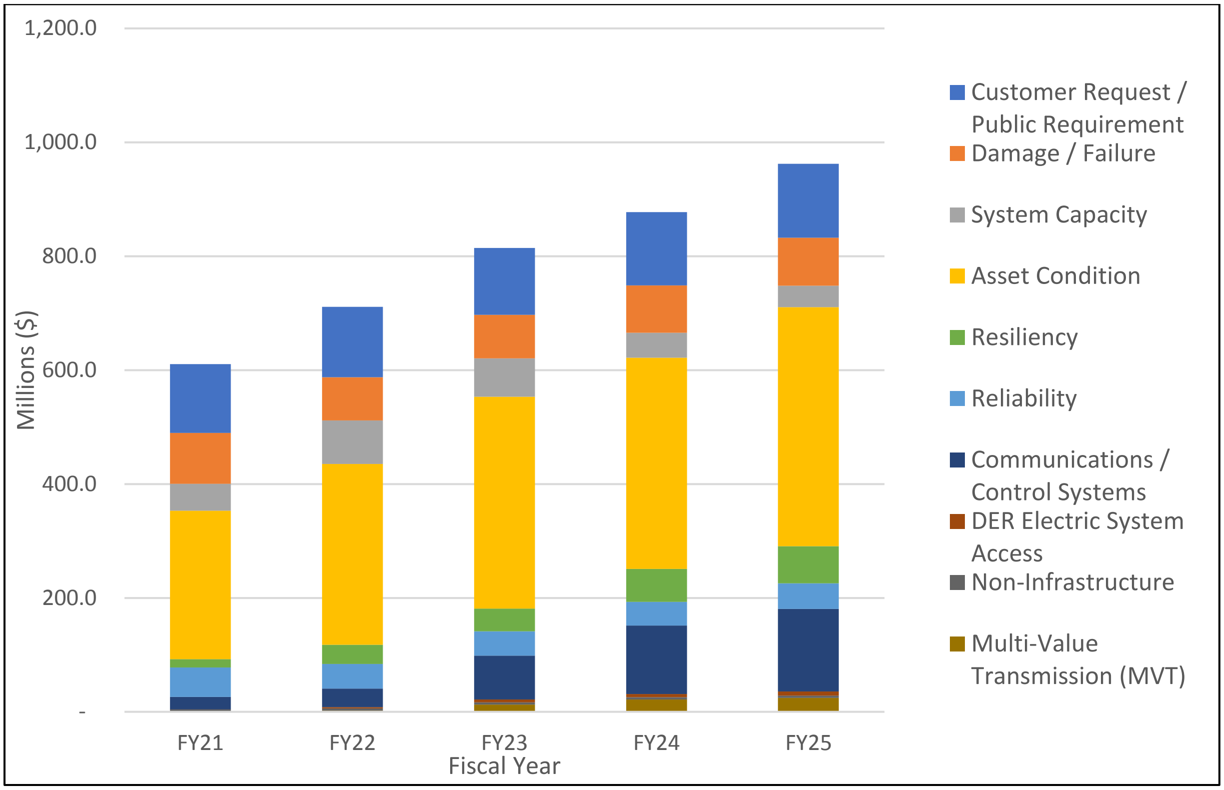
Non-Infrastructure
Non-Infrastructure projects are those projects that do not fit into one of the foregoing categories but are necessary to run the electric system. Examples in this rationale include substation physical security, radio system upgrades, and the purchase of test equipment.

Investment by spending rationale for FY21 - FY25 is provided in Table 1-2 and Figure 1-1 below.

Table 1-2
Investment by Spending Rationale ($ millions)

Spend Rationale	FY21	FY22	FY23	FY24	FY25	Total
Customer Request / Public Requirement	120.8	123.9	117.4	128.6	129.6	620.2
Damage / Failure	89.3	75.9	76.5	82.8	84.3	408.9
System Capacity	47.2	75.9	67.3	43.9	37.6	272.0
Asset Condition	260.9	317.7	372.0	371.2	419.6	1,741.3
Reliability	51.3	43.3	42.5	41.1	45.0	223.4
Resiliency	14.4	33.7	40.1	58.0	65.1	211.4
Communications / Control Systems	22.3	32.7	77.2	120.6	145.1	397.8
DER Electric System Access	0.1	2.1	5.0	5.3	7.1	19.5
Multi-Value Transmission (MVT)	0.3	2.3	12.6	21.8	24.5	61.6
Non-Infrastructure	3.7	3.7	3.9	4.0	4.0	19.3
Grand Total	**610.4**	**711.2**	**814.5**	**877.2**	**962.0**	**3,975.4**

Figure 1-1
Investment by Spending Rationale by Year FY21-FY25 ($ millions)



Spending Rationale Totals

The Customer Requests/Public Requirements and Damage/Failure spending rationales comprise approximately twenty-six (26) percent ($1,029.1 million) of planned infrastructure investment. This work is required to address items that are generally mandatory and non-discretionary in terms of timing.

The System Capacity spending rationale accounts for approximately seven (7) percent ($272.0 million) of the investment in the Plan. Examples of investments in this rationale include investments to resolve issues identified as a result of system studies, and planned expansions and network upgrades to accommodate regional load growth.

The Reliability spending rationale accounts for approximately six (6) percent ($223.4 million) of the total investment in the Plan. Examples of investments in this rationale include investments to bring substations to NPCC design, protection and operation standards, and to address reliability issues identified as a result of system studies.

The Asset Condition spending rationale represents approximately forty-four (44) percent ($1,741.3 million) of total planned investment. An example of a program in this spending rationale is the rebuild of the Gardenville Station, which is a 230/115kV complex south of the Buffalo area.

The Communications/Control Systems spending rationale accounts for approximately ten (10) percent ($397.8 million) of the total investment in the Plan.

The DER Electric System Access spending rationale accounts for approximately one-half (0.5) percent ($19.5 million) of the total investment in the Plan.

The MVT spending rationale accounts for approximately two (2) percent ($61.6 million) of the total planned investment.

The Resiliency spending rational accounts for approximately five (5) percent ($211.4 million) of the total planned investment.

The Non-Infrastructure spending rationale accounts for approximately one-half (0.5) percent ($19.3 million) of the total planned investment.

1. B. Investment by System

The following is a summary of planned investment by system. Chapters 2, 3 and 4 detail the transmission, sub-transmission and distribution system spending, respectively.

Transmission System Summary
The transmission system consists of approximately 6,500 miles of transmission line, 206 transmission substations,[4] more than 540 large power transformers, and over 790 circuit breakers at operating voltages of 69kV and above.[5] To serve the needs of customers over the five-year period covered by this Plan, the Company expects to invest approximately $1,186 million on the transmission system, as shown in Table 1-3 below. The majority of planned transmission system investment is in the System Capacity and Asset Condition spending rationales. The System Capacity category includes spending to address generator retirements, NERC/NPCC standards and transmission owner-led system studies. Substantial portions of the planned investment in the Asset Condition category relate to substation rebuild and overhead line refurbishment programs.

Table 1-3
Transmission System Capital Expenditure by Spending Rationale ($ millions)

Spend Rationale	FY21	FY22	FY23	FY24	FY25	Total
Customer Requests / Public Requirements	2.3	5.9	0.3	0.0	0.0	8.5
Damage / Failure	22.9	12.8	12.9	15.7	16.5	80.8
System Capacity	27.2	43.3	35.5	17.0	4.0	126.9
Asset Condition	132.3	161.8	176.2	199.6	236.0	905.9
Reliability	21.1	14.9	15.2	14.9	18.2	84.4

[4] The 206 transmission substations include transmission line locations with motorized switches.
[5] In prior capital investment plan reports, assets operating at 69kV had been classified as sub-transmission.

Spend Rationale	FY21	FY22	FY23	FY24	FY25	Total
Resiliency	0.0	0.1	4.5	15.7	20.0	40.3
Communications / Control Systems	6.5	7.2	17.3	18.0	28.2	77.2
Multi-Value Transmission (MVT)	0.3	2.3	12.6	21.8	24.5	61.6
Non-Infrastructure	0.2	0.1	0.3	0.3	0.2	1.1
Grand Total	**212.8**	**248.4**	**274.8**	**303.1**	**347.6**	**1,386.7**

Sub-Transmission System Summary

The sub-transmission system is comprised of lines and substations typically operating at voltages at or below 46kV. The Company has approximately 2,900 circuit miles of overhead sub-transmission lines and 344 circuit miles of sub-transmission underground cable. To serve the needs of customers over the five-year period covered by this Plan, the Company expects to invest approximately $271 million on the sub-transmission system, as shown in Table 1-4 below.

Table 1-4
Sub-Transmission System Capital Expenditure by Spending Rationale ($millions)

Spend Rationale	FY21	FY22	FY23	FY24	FY25	Total
Customer Request / Public Requirement	2.7	3.5	(1.1)	1.1	1.2	7.4
Damage / Failure	4.1	4.2	4.3	4.4	4.5	21.4
System Capacity	0.1	0.6	0.1	0.1	1.2	2.1
Asset Condition	29.5	44.6	54.5	45.1	49.3	223.0
Reliability	0.7	1.2	0.7	3.1	0.4	6.1
Resiliency	2.8	2.0	2.6	2.2	1.3	10.8
Grand Total	**39.8**	**56.2**	**61.0**	**56.0**	**57.8**	**270.9**

Distribution System Summary

The Company's distribution system consists of lines and substations typically operating at 15kV and below. There are over 36,000 circuit miles of overhead primary wire and over 7,500 circuit miles of underground primary cable on the system supplying approximately 410,000 overhead, padmount and underground distribution transformers. Additionally, there are 524 substations providing service to the Company's 1.6 million electric customers. The current five-year plan for distribution is presented in Table 1-5.

Table 1-5
Distribution System Capital Expenditure by Spending Rationale ($millions)

Spend Rationale	FY21	FY22	FY23	FY24	FY25	Total
Customer Request / Public Requirement	115.8	114.5	118.2	127.4	128.4	604.3
Damage / Failure	62.3	58.9	59.4	62.7	63.4	306.7
System Capacity	19.9	32.1	31.7	26.9	32.5	143.0
Asset Condition	99.2	111.2	141.4	126.4	134.2	612.4
Reliability	29.5	27.2	26.6	23.0	26.5	132.8
Resiliency	11.6	31.6	33.0	40.1	43.9	160.2
Communications / Control Systems	15.9	25.4	59.9	102.6	116.9	320.7
DER - Electric System Access	0.0	2.1	5.0	5.3	7.1	19.5
Non-Infrastructure	3.5	3.6	3.6	3.7	3.8	18.2
Grand Total	**357.8**	**406.6**	**478.7**	**518.1**	**556.6**	**2,317.8**

1. C. Significant Investment Areas Addressed by 2020 Plan

The Plan is designed to effectively address system investment needs, which include emergent as well as long-term issues. Significant areas of investment and focus in this year's Plan include:

- Asset Condition
- Multi-Value Transmission
- Resiliency investments
- Advanced Communications, Monitoring, and Controls, and DER Integration

Asset Condition

Asset Condition issues represent forty-four (44) percent of the total capital investment in the Plan. Asset Condition investments proactively address deteriorated assets before failure, thereby reducing the likelihood and consequences of electric system failures. This proactive approach is vital to the Company's ability to achieve adequate levels of service reliability and operational flexibility, and important to maintaining customer satisfaction and system performance.

Multi-Value Transmission

The Plan includes several MVT projects that are intended to address both the Company's system needs and broader State transmission needs. These projects benefit customers and the State by maximizing utilization of existing and planned renewable resources while avoiding the cost of overbuilt or otherwise inefficient solutions that only address a single system need. The Plan includes projects in the West, Northern and Mohawk Valley areas.

Resiliency Investments

The Plan includes several projects specifically intended to address resiliency efforts. A new "Resiliency" spending rationale was created in FY20 to provide greater focus on projects that give the utility the ability to recover quickly following a disaster or, more generally, the ability to better prepare for extraordinary high-impact, low-probability events and rapidly recover from such events. This involves not only increasing the flexibility of the grid with feeder ties, but also increasing grid "intelligence" by installing FLISR/DA schemes, DGA monitoring, microgrids, and distribution level sensors. In addition to specific resiliency projects, resiliency-related costs are reflected in other projects and programs in the form of enhanced standards or equipment requirements. At the Transmission level this includes an updated system design to reduce the number of customers interrupted by a Transmission-level event and minimizing the time to restore service through additional breakers, switching capability and the installation of additional supplies to load pockets. A resilient system will reduce reliability impacts caused by increasingly volatile weather and storm events and will require many years of focused investment to implement.

Advanced Communications, Monitoring, and Controls, and DER Integration

The Company must work to expand communications to support increased needs in line with initiatives to enhance the reliability and resiliency of the grid. Additionally, the Company is continuing to evolve in the role of the DSP provider, expanding the ability of third-party providers of DER to deliver value to both customers and the electric system, and modernizing the electric grid. Investments in advanced communications, monitoring, and controls technologies are essential to enhance DER integration. Examples of such investments included in this Plan include:

- Telecommunications enhancements
- System monitoring (Line Sensors and RTUs)
- FLISR (fault location, isolation and service restoration)
- 3V0 system protection
- Energy Storage
- VVO/CVR (volt-VAR optimization/conservation voltage reduction)
- DSCADA (distribution system control and data acquisition)
- AMI (advanced metering infrastructure)

AMI is a foundational component of the Company's grid modernization plan. Following a comprehensive collaborative process, the Company submitted its proposed AMI implementation plan report on November 15, 2018 in Case 17-E-0238. This proposal was supplemented on September 4, 2019, and is under consideration by the Commission.

1. D. Developing the Capital Investment Plan

The Plan is based on the Company's current assessment of the needs of the electric delivery system over the Plan period. Mandatory programs and projects (*i.e.,* those under Customer Requests/Public Requirements and Damage/Failure spending rationales) known at this time are included in the Plan. Such programs and projects include new customer connections, regulatory commitments, public requirements that necessitate relocation or removal of facilities, safety and environmental compliance, and system integrity projects such as response to damage/failure and storms.

Programs and projects in the other categories (*e.g.*, System Capacity and Asset Condition spending categories) are developed based on system studies and evaluation of existing assets by subject matter experts for inclusion into the Plan. Inclusion/exclusion of any given project is based on several different factors including, but not limited to: project in-progress status, risk score, scalability, and resource availability. When it can be accomplished, the bundling of work and/or projects is analyzed to optimize the total cost and outage planning. Additionally, the Company's Capital Plan includes a robust NWA review process (Appendix 4) to identify investment deferral opportunities to maximize customer value.

Because of the time period over which the Company must budget its infrastructure investments, there are inevitable changes in budgets and project estimates. Such changes may be due to changes in project scope, changing material or resource costs, changing customer needs, or a more refined estimate based on where the project is in its development. External factors, such as generation retirement announcements or new regulatory or legislative requirements or initiatives, also drive changes in the Plan budget. More recently, the restrictions related to the COVID-19 pandemic, and associated impacts on the economy and customer plans, are likely to influence changes in the Plan.

Cost estimates for projects that are already in process, or are soon to be in process, generally have +/- 10% cost estimates. Other projects at earlier stages in the project evolution process are accordingly less refined and more susceptible to changes in scope and budget. The projects in the Company's portfolio are continuously reviewed for changes in assumptions, constraints, project delays, accelerations, weather impacts, outage coordination, permitting/licensing/agency approvals, and system operations, performance, safety, and customer driven needs that arise. The portfolio is updated throughout the year.

The Plan includes certain reserve line items to accommodate contingencies not known at the time the Plan is developed and to allocate funds for projects in future years whose scope and timing have not yet been determined. As specific project details become available, emergent projects are added to the Plan with funding drawn from the reserve funds or individual projects in the Plan are re-prioritized. The Company tracks and manages budgetary reserves and emergent work as part of its investment planning and current-year spending management processes, and reports that information quarterly to Department of Public Service ("DPS") Staff.

The Company uses different approaches to deliver the Plan based on the differences in scope and character of transmission and distribution construction. With respect to the transmission portion of the Company's investment plan, the Company will supplement its internal workforce with competitively procured contractor resources. On the distribution side, the Company's internal workforce will continue to be primarily supplemented by the Company's contractor-of-choice arrangements and competitively procured contractor resources. Current trends in the contractor market reflect increased demand for resources, which has created additional challenges in timely procurement of those resources as well as upward cost pressures. The Company is continually evaluating these headwinds to ensure the optimal balance between flexibility of contract workers to address peak construction needs versus cost stability of increasing internal labor resources.

The Company's risk-based approach to selecting projects and programs for inclusion in the Plan, coupled with its efforts to improve cost estimating and implement performance metrics, results in a Plan that meets the needs of customers at reasonable cost.

1. E. Organization of this Filing

The remainder of this filing provides detail on the programs and projects that comprise the Plan. The document is divided into the following chapters:

Chapter 2 - Transmission System

Chapter 3 - Sub-Transmission System

Chapter 4 - Distribution System

Chapter 5 - Investment by Transmission Study Area

Chapter 6 - Exhibits

Chapter 2. Transmission System

The transmission system consists of approximately 6,500 miles of transmission line, 206 transmission substations,[6] 544 large power transformers, and 793 circuit breakers at operating voltages of 69kV and above. The Company expects to invest approximately $1,386 million on the transmission system over the next five years as shown in Table 2-1 below.

Table 2-1
Transmission System Capital Expenditure by Spending Rationale ($millions)

Spend Rationale	FY21	FY22	FY23	FY24	FY25	Total
Customer Requests / Public Requirements	2.3	5.9	0.3	0.0	0.0	8.5
Damage / Failure	22.9	12.8	12.9	15.7	16.5	80.8
System Capacity	27.2	43.3	35.5	17.0	4.0	126.9
Asset Condition	132.3	161.8	176.2	199.6	236.0	905.9
Reliability	21.1	14.9	15.2	14.9	18.2	84.4
Resiliency	0.0	0.1	4.5	15.7	20.0	40.3
Communications / Control Systems	6.5	7.2	17.3	18.0	28.2	77.2
Multi-Value Transmission (MVT)	0.3	2.3	12.6	21.8	24.5	61.6
Non-Infrastructure	0.2	0.1	0.3	0.3	0.2	1.1
Grand Total	**212.8**	**248.4**	**274.8**	**303.1**	**347.6**	**1,386.7**

This chapter briefly describes major investment programs that comprise a significant portion of the Company's overall five-year transmission capital investment plan. A complete list of transmission projects in the Plan is found in Exhibit 1.

The sections below describe the investment drivers and customer benefits of the projects, along with a description of significant changes from last year's Plan. Specific asset condition and performance issues are described in further detail in the annual Report on the Condition of Physical Elements of Transmission and Distribution Systems ("Asset Condition Report"), most recently filed September 30, 2019 in Case 17-E-0238.

[6] The 206 transmission substations include transmission line locations with motorized switches.

2. A. Customer Request / Public Requirement

Transmission investments in this spending rationale include acquisition of necessary land rights and public requirements (including municipal requests), customer interconnections, and wind farms. Because customer interconnection projects are typically reimbursable (*i.e.*, costs incurred by the Company are paid by the customer), there is no net effect to the Plan from such projects.

LaFarge Relocation (C079454 - $7.4M)

Drivers:
The customer, LaFarge Holcim US LTD, exercised its right to have approximately two (2) miles of the 115kV T5080 Lafarge-Pleasant Valley #8/T5940 Feura Bush-North Catskill #2 transmission circuit that currently crosses its property relocated due to quarry expansion plans. The Company's system crosses LaFarge's property under an agreement from 1962, and the agreement contemplates relocation upon the customer's request.

Customer Benefits:
The relocation will accommodate the customer's plan to expand the mine footprint. The double-circuit 115kV transmission line currently crosses the western edge of the proposed mine expansion area. The customer will provide the Company with an alternative permanent line location across an undisturbed portion of their property, thus avoiding future relocations.

2019 to 2020 Variance:
This project continues to proceed as planned. The project variance relates to the time taken for extended negotiations with LaFarge regarding obligations and responsibilities under the 1962 agreement, and issues regarding the location of the new line.

Table 2-2
Transmission – LaFarge Relocation
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.0	3.0	0.3	0.0	0.0	-	4.3
2020	-	(0.04)	7.2	0.3	0.0	0.0	7.4

2. B. Damage / Failure

The Damage/Failure investment levels for the transmission system are based on historical actual costs. The Company does not forecast any significant specific transmission system projects in the Damage/Failure spending rationale over the five-year period of this Plan.

Gardenville-Five Mile 151/152 Erosion/Road (C082708 - $21.1M)

During fall 2018, Transmission Maintenance was notified by a landowner of a slope failure in the 151/152 Gardenville-Five Mile Rd corridor just north of Abbott Hill Rd in the Town of Concord. Following a site visit and subsequent comprehensive inspections of the corridor from the air, numerous other areas were identified.

The travel path on top of the embankment at this location is too narrow for vehicles to traverse down the right of way. Currently, no 115kV double circuit transmission structures are in imminent danger. However, slope stability and culvert deterioration need to be remediated so land owner property, access roads and electric assets are not damaged.

A civil and environmental consulting engineering firm was retained to inspect the corridor and triage sites that required immediate attention from those that could be repaired/replaced later. It was determined by the consultant and confirmed by Niagara Mohawk that twenty (20) of the one hundred eight (108) culverts under the 151/152 Gardenville-Five Mile Rd corridor between Str 127 at the north end at Omphalius Road and Str 208 at the south end south of Sharp Road were in immediate need of replacement.

Drivers:
Currently, with the culverts and wing walls failing or failed, fine-grained soils are mixing with storm water and potentially reaching Eighteen Mile Creek which is a NYSDEC Class A stream. If a culvert fails, allowing turbidity to reach Eighteen Mile Creek, it could endanger fish and wildlife and have other consequences.

The Company's consultant has inspected all one hundred eight (108) culverts and identified (20) twenty culverts as urgent in nature. The recommendation is to address these culverts as soon as possible.

Customer Benefits:
The community is supportive of this project as many of them over the past few years have been affected by flooding caused by inadequately sized or plugged culverts.

The community would benefit from the conservation of a clean Eighteen Mile Creek. This ensures that fish and wildlife are undisrupted from a failure of a culvert.

2019 to 2020 Variance:
This project was not in the 2019 Plan.

Table 2-3
Transmission – Gardenville-Five Mile Erosion/Road
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	6.4	2.0	2.1	4.9	5.7	21.1

115kV Levitt-Rome #8 Structure 42 Replacement (C083619 - $2.9M)

Levitt – Rome #8 is a radial 115kV circuit. During an inspection, structure number (Str#) 42 was found to be leaning excessively. This structure is an angled dead-end with poor access. A failure would result in customers being without power for days.

In its current configuration, any fault on the mainline cannot be isolated. Faults on the tap can only be isolated manually by operating a switch. Adding an additional switch allows for a lockout on the mainline to be isolated. Adding supervisory control to the switches also allows for them to be operated remotely and facilitates potentially quickly restoration.

This project will replace Str# 42, install a new gang operated, load break field switch with supervisory control to the mainline downstream of the Lehigh Tap, add supervisory control to the two existing switches on the circuit, and perform other identified maintenance work.

Drivers:
The primary driver of this project is reliability. Access to Str# 42 is difficult due to surrounding wetlands.

Customer Benefits:
The primary benefit is avoidance of extended outages and improved reliability. Additionally, increasing the number of switches on the circuit, and adding supervisory control will reduce the duration of an outage.

2019 to 2020 Variance:
This project was not in the 2019 Plan.

Table 2-4
Transmission – Levitt-Rome #8 Str. 42 Replacement
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	2.9	0.0	0.0	0.0	0.0	2.9

Machias – Replace TB#1 (C083642 - $1.2M)

This damage/failure project was created to replace Transformer #1 (TR#1) due to high gassing in the main tank and trending towards failure and was removed from service based upon this discovery to avoid having it fail in-service.

Drivers:
The transformer needed to be replaced due to high amounts of gassing.

Customer Benefits:
The replacement of the transformer helps maintain the reliability of the system.

2019 to 2020 Variance:
This project was not in the 2019 Plan.

Table 2-5
Transmission – Machias – Replace TB#1
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	1.2	0.0	0.0	0.0	0.0	1.2

2. C. System Capacity

There are four (4) significant areas of transmission system investment in the System Capacity spending rationale in the next five (5) years: generator retirements, transmission-owner led system studies (compliance with NERC/NPCC and other reliability rules), transmission projects in support of distribution, and PSC Ordered Project in Support of New York Independent System Operator ("NYISO") Public Policy Planning Process.

2 C.1 Generator Retirements

Generator retirement related projects are intended to reinforce the transmission system to avoid or mitigate reliance on market generators to maintain system reliability and performance.

The Company does not control, and has limited ability to project, future generator retirements. As a result, investment plans related to unannounced retirements are difficult to develop. The Company actively participates in NYISO working groups that monitor generator retirements. To the extent future generator retirement announcements affect the Company's investment needs, the Company's subsequent investment plans will reflect those investment needs. Currently there are no generator contingency plans in this investment plan.

2 C.2 Transmission-Owner Led System Studies

These projects result from studies performed by the Company's Transmission Planning department. Transmission needs, and alternative solutions are investigated during periodic area studies to determine whether the system complies with reliability standards. Included in this testing are: compliance with NERC TPL reliability standards; NPCC Regional Reliability Reference Directory #1; New York State Reliability Council ("NYSRC") reliability rules; and the Company's Transmission Planning Guide (TGP 28). These standards require the entire transmission system to meet voltage, thermal, and stability criteria.

Eastern NY Division Reinforcements

Reinforcements in the Company's eastern division are focused in the Capital and Hudson areas, as well as the Mohawk Valley region. The major projects include:

Reconductor/Rebuild the thermally-limited portion of the 115kV Maplewood-Menands #19/115kV Maplewood-Reynolds Rd #31 lines and upgrade terminal equipment at the Menands and Maplewood substations. (C069466 - $5.1M, C078287 - $0.5M, and C079071 - $0.7M)

Riverside-Reynolds Rd #4 Forbes Tap (C043592 $4.1M) provides a 115kV source for the new Forbes Ave 115-13.2 kV substation.

Drivers:
The transmission system serving the Capital/Hudson area is currently exposed to post contingency thermal overloads during summer peak periods. These overloads affect the Maplewood #19/31 circuits.

Customer Benefits:
These improvements will strengthen the transmission network and ensure compliance with reliability standards. The improvements will correct existing asset condition, safety, and environmental concerns, and resolve existing thermal and voltage problems. Without the proposed projects, significant load shedding would otherwise be necessary to relieve projected overloads. In addition, the reinforcements in eastern New York will reduce dependence on local generation for reliability of service within the region.

2019 to 2020 Variance:
The variance between the 2019 and the 2020 Capital Investment Plans is due in part to the near completion of the 115kV Rotterdam – Curry Rd #11 reconductoring project and the Rotterdam 19/20 Reactor project.

Table 2-6
Transmission – Eastern NY Region Reinforcement
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	11.7	8.4	6.5	0.4	0.0	-	27.0
2020	-	0.2	4.6	4.3	1.3	0.0	10.4

Western NY Region Reinforcements

This program involves significant capital expenditure over the next five (5) years and beyond to construct reinforcements of the 115kV transmission system in western New York, including the Frontier and Genesee regions that extend from the Buffalo area east to Mortimer Station. This program will strengthen the transmission network and ensure adherence to reliability standards. It will correct existing asset condition, safety, operational and environmental concerns and improve the reliability of several circuits.

The major components in this program with investment levels greater than $1 million include:[7]

Reconductor 3.7 miles of the Niagara-Packard #191 circuit to resolve thermal constraints. (C079489 - $8.2M and C079501 - $0.3M)

Reconductor/Rebuild the thermally constrained portions of the Packard-Huntley 130 and Walck-Huntley 133 circuits. (C079500 - $9.5M)

Reconductor 3.4 miles of the Niagara-Packard #192 circuit. (C079488 - $5.1M and C079503 - $0.3M)

[7] The costs shown below are limited to the period covered by this Plan.

Reconfigure the circuits between Packard and Gardenville to alleviate area thermal overloads (C081799 - $12.8M & C060215 - $9.9M)

Installation of series reactors on the Packard-Gardenville 181/182 115kV circuit. The reactors will increase circuit impedance, reducing circuit power flow, and alleviate contingent thermal constraints. Install two new breakers at Gardenville as part of the reconfiguration. (C079506 - $8.3M)

Drivers:
Studies of the 115kV and 230kV transmission systems were conducted for the Frontier, Southwest and Genesee regions of western New York to determine compliance with applicable reliability standards. The studies evaluated the system for existing load levels up to a fifteen-year forecasted load level. Included within each of these evaluations was testing of both N-1 and N-1-1 design criteria, ensuring compliance with NERC TPL Standards, NPCC Directory #1, NYSRC Reliability Rules and the Company's Transmission Planning Guide (TGP 28). These standards require the entire transmission system to meet N-0 and N-1 voltage, thermal and stability criteria, and require the bulk power system and long lead time items to meet the same criteria for N-1-1 conditions. Several reliability criteria issues for the area were discovered under various study conditions. In the Frontier Region, multiple reinforcement projects are required to correct adverse conditions.

The NYISO solicited and evaluated proposed solutions, in accordance with the Public Policy Transmission Planning Process ("PPTPP"), to address transmission needs in Western New York that are driven by Public Policy Requirements for greater utilization of renewable energy from the Niagara hydroelectric facility and through imports from Ontario, Canada. However, the NYISO selected project does not address overloads on the Company's local area 115kV transmission system. This results in the need for multiple area projects to relieve thermal constraints under contingent scenarios.

Customer Benefits:
Customers will benefit from this program in several ways, including:

Exposure to service interruptions, including load shedding, in the event of certain key contingencies would be reduced significantly. The need to dispatch generation out of merit order to ensure voltage support and stability will be reduced or avoided.

Circuits that are normally open, which provide a backup source to loads in the Homer Hill area will be operated normally closed, reducing the frequency and length of outages for certain contingencies.

Some capability to accommodate new or expanding load will be added to the system.

2019 to 2020 Variance:
The variance between the 2019 and 2020 Plans is largely a result of major capital investments in response to the NYISO Public Policy project selection. Additionally, forecasted capital spend and scope for the 115kV Packard – Erie #181 circuit reconductoring project has changed, allocating capital spend outside the timeframe of the Plan.

Table 2-7
Transmission – Western NY Region Reinforcements
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	3.1	6.4	25.5	14.1	12.3	-	61.4
2020	-	3.1	20.5	21.6	8.8	0.3	54.3

Central NY Region Reinforcements

Syracuse Area Reinforcements

The Syracuse Area Reinforcements program is focused on system improvements in and around the Syracuse area. These reinforcements are necessary to respond to system capacity needs and to avoid thermal overloads during contingency conditions.

The program scope includes:

Reconductoring two separate parts of the Clay–Teall #10 115kV, 6.75 miles and 6.08 miles sections, as well as 10.24 miles of the Clay-Dewitt #3 115kV line. This project is required for compliance with mandatory NPCC and NERC performance criteria. (C043995 - $31.5M).

The increased system available fault levels and impact as a result of the Energy Highway Segment A project is anticipated to require DeWitt Station to meet more stringent NPCC Station requirements. Projects C081783 - Dewitt Station 115kV Rebuild - $2.7M, C082023 - Dewitt Station Relocate 115kV Line - $0.7M, and C081784 – Dewitt Station 115kV Rebuild LAB - $0.4M address this requirement.

Drivers:
Annual studies of the 115kV and 345kV transmission systems are conducted for the Central region of New York, which extends from Elbridge Substation in the west to Oneida Station in the east, to determine whether the systems comply with reliability standards. Included in this testing are compliance with NERC TPL Standards, NPCC Regional Reliability Reference Directory #1, NYSRC Reliability Rules and the Company's Transmission Planning Guide (TGP 28). These standards require the entire transmission system to meet voltage, thermal, and stability criteria.

Several reliability criteria issues for the area were identified under study conditions. Issues include thermal overloads on 115kV circuits in the Central Region, and a reinforcement of the DeWitt substation. In addition, due to area load growth, a second transformer at the Malone 115kV substation is needed.

Customer Benefits:
Customers will benefit from this program in several ways, including:

Significantly reduced exposure to service interruptions, some resulting from load shedding, in the event that certain key contingencies were to occur.

Added capability to accommodate new or expanding load to the system.

2019 to 2020 Variance:
The primary variance between the 2019 and 2020 Plans is due to Article VII siting issues resulting in a change in the forecasted years of the Clay-Teall #10 and Clay – Dewitt #3 reconductoring, as well as the start of the DeWitt substation rebuild.

Table 2-8
Transmission – Syracuse Area Reinforcements
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	32.6	20.1	8.4	0.0	0.0	-	61.1
2020	-	19.2	11.9	0.8	0.6	3.0	35.5

2 C.3 Transmission Projects in Support of Distribution

The following transmission projects were identified to support the distribution and/or sub-transmission system by the Distribution Planning department.

Western Division – Genesee Region

Golah Sub Rebuild (C051831 - $8.4M)

Drivers:
Distribution Planning Studies of the Genesee area found reliability criteria issues as well as asset condition issues at Golah station. Issues involve transformer overloads and low voltage exposure during certain contingencies. Reinforcement projects are required to correct adverse conditions such as reconfiguration of the Golah 115kV bus and the Golah 69/34.5kV transformer capacity.

Customer Benefits:
Addressing the issues at Golah station will reduce constraints on the Sub Transmission system. The larger size transformer allows for expansion of renewable generation in this area.

2019 to 2020 Variance:
This project now includes the addition of the $1.0M East Golah second 115kV tap.

Table 2-9
Transmission – Golah Substation Rebuild
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.9	4.3	0.7	0.0	0.07	-	5.9
2020	-	0.06	2.4	4.5	1.3	0.1	8.4

Western Division – Frontier Region

Elm Street Relief – Add 4th Transformer (C049594 - $1.5M)

This project adds a fourth 230-23kV transformer to Elm Street station in downtown Buffalo and replaces all 23kV breakers with an interrupting rating of less than 40kA.

Drivers:
The Elm Street station supplies the Buffalo low voltage AC network, spot network loads, and several distribution stations. The station has four (4) transformers with three (3) in parallel and is designed for double contingency operation due to its supply to the downtown core. However, the existing load is above the summer emergency rating of the smallest transformer. Replacing the smallest transformer is in a sperate funding project and will mitigate the ratings violation for that transformer. The project to add the fourth transformer also included the replacement of 23kV breakers due to increased fault current at the station.

Customer Benefits:
This project restores the capability of the station and provides for some limited load growth.

2019 to 2020 Variance:
The variation on the project is due to delay attributed to resource availability per the specific projects in the area and outage availability.

Table 2-10
Transmission – Elm Street Relief – Add 4th Transformer
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.1	0.3	0.0	0.0	0.0	-	1.4
2020	-	0.7	0.8	0.0	0.0	0.0	1.5

Riverbend Area Reinforcements (C046693 - $1.6M)

These projects reinforced the 34.5kV system in the Ridge-Riverbend-Outer Harbor area. This area has experienced significant development due to New York State investment in certain key large commercial sites. The transmission line projects, Ohio Street 115-34.5kV station with two (2) 30/40/50MVA transformers with six (6) 34.5kV feeders is field complete and provides a new supply to the existing and future sub-transmission customers and new distribution station in the area. The remaining spend is to finalize relay upgrades at Ridge to accommodate new protection of the Ohio Street station.

Customer Benefits:
These projects provide sufficient capacity for the new industrial, commercial and residential customers supplied from the 34.5kV system directly or indirectly through a new distribution station. These projects improve the 34.5kV system reliability by completing a new supply on the customer side of the nature preserve.

2019 to 2020 Variance:
The variation year on year is due to the scope and timing of the project.

Table 2-11
Transmission – Riverbend Area Reinforcements
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.4	0.9	0.0	0.0	0.0	-	2.3
2020	-	0.7	0.9	0.0	0.0	0.0	1.6

Youngs Street Station 214 115kV Tap (C054963 - $1.2M)

This project is part of the distribution project to install an additional transformer at Station 214. In order to facilitate the installation of the second transformer, this tap must be made to prevent circulating current and maintain the reliability goal of the project.

Drivers:
Distribution planning studies forecasted unserved load for a transformer or bus outage due to limited capacity at adjacent substations.

Customer Benefits:
This project provides for improved reliability for the customers served from Youngs St. Station 214.

2019 to 2020 Variance:
The project was not in the 2019 plan.

Table 2-12
Transmission – Youngs Street Station 214 115kV Tap
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.05	1.08	0.07	0.0	1.2

Central Division – Northern Region

Malone Metalclad and Transformer (C069306 - $6.3M & C059673 $0.4M)

The loss of the 115/13.8kV transformer TR#3 at the Malone substation will result in outage exposure in excess of distribution planning criteria. To address this criterion violation, a 115/13.8kV transformer TR#4 will be added at the Malone substation with additional distribution feeders.

Drivers:
Presently, the contingency loss of the Malone 115/13.8kV Transformer TR#3 will result in 14.8 MW load at risk (356MWh), exceeding the criteria, as there are no 13.2kV feeder ties available in the area that could be used as back-up.

Customer Benefits:
This project provides continued reliable service for customer load under contingent scenarios.

2019 to 2020 Variance:
This project is proceeding as planned.

Table 2-13
Malone Metalclad and Transformer
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.2	2.2	4.2	-	6.6
2020	-	0.0	0.2	2.2	4.2	0.1	6.7

2 C.4 NYPSC Ordered Project in Support of NYISO Public Policy Planning Process

On July 20, 2015, the PSC issued an order identifying congestion relief in Western NY as a public policy requirement. Over the course of the next year, the NYISO solicited potential solutions for resolving the identified congestion in WNY and recommended that certain non-bulk transmission issues be addressed. Specifically, the NYISO recommended mitigation of the Niagara-Packard 115 kV #193 and #194-line overloads by reconductoring the lines. The Commission issued an order on October 13, 2016, which required that the Company "undertake the upgrades necessary on the non-bulk system, such as those identified by the NYISO[.]"

In May 2017, NYISO/Niagara Mohawk filed a new Rate Schedule with FERC in the NYISO OATT ("RS17") to establish the WNY Facilities Charge ("WNYFC"), which allows the Company to recover costs related to certain upgrades to non-bulk transmission facilities recommended by the NYISO and the PSC. The filing explicitly indicated that the costs associated with the upgrades would be recovered through FERC wholesale transmission rates. FERC approved RS17 on July 20, 2017. RS17 is to be allocated to appropriate load-serving entities ("LSEs") consistent with the cost allocation methodology to be approved by FERC for recovering the costs of the developer selected to build a specified WNY PPPTN Project. The costs of these projects will be allocated and recovered by the NYISO.

2. D. Asset Condition

Asset Condition investments, such as replacing elements of overhead circuits, underground cable or substation equipment, are required to reduce the likelihood and consequence of the failure of transmission assets. This Plan also relies on the purchase of spare equipment to replace damaged equipment that may fail while in service for certain elements of the transmission and distribution system. This approach calls for more targeted replacement of assets based on their condition versus wholesale replacement of aged based "end of useful life" criteria

For overhead circuits specifically, this Plan seeks to achieve compliance with National Electrical Safety Code ("NESC") requirements, and will continue to implement DPS Staff's recommendation from the Company's 2010 rate case to refurbish overhead transmission circuit facilities that are in unacceptably severe deteriorated condition (*i.e.* Niagara Mohawk's defined Level 1, Level 2 and

Level 3 conditions), as opposed to entire circuits, unless a compelling justification can be provided for the full refurbishment. Any overhead circuit proposed for a refurbishment will undergo a field inspection by qualified transmission line engineers and will usually be supported by comprehensive aerial inspection. As part of the conceptual engineering process refurbishment options will be thoroughly evaluated on a case-by-case basis and the engineering economics of various options such as a complete reconductoring versus a life extension are reviewed in the project sanctioning process. In addition, longer term impacts such as a greater number of visits to the same right-of-way, improved access to rights-of-way with roads, multiple site establishment costs, increased storm hardening, additional permitting and licensing costs, greater levels of environmental impact, and more disturbance to property abutters, among other things will be assessed. Further detail on specific asset condition programs and projects is given below.

NY Inspection Repairs - Capital

The goal of this program (C026923 - $52.9M), is to replace damaged or failed components on the transmission overhead line system identified during field inspections (five-year foot patrols).

Drivers:
This program ensures that both steel tower and wood pole transmission lines meet the governing NESC standards by replacing hardware, wood poles, and structure components that no longer meet the code requirements. This follows standard industry practice and the Commission's *Order Instituting Safety Standards* ("Safety Order") issued January 5, 2005 in Case 04-M-0159.

Customer Benefits:
This program enhances public safety by assuring that damaged or failed transmission overhead line components are replaced and continue to meet the governing NESC under which they were built. Replacement of damaged and failed components discovered during inspection also promotes reliable service performance.

2019 to 2020 Variance:
The decrease in forecasted capital spend is due to the pole population inspections are in their third five-year cycle and it is anticipated that repairs will begin to trend down.

Table 2-14
Transmission – New York Inspection Projects
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	14.7	14.7	12.0	12.0	12.0	-	65.4
2020	-	12.9	10.0	10.0	10.0	10.0	52.9

Wood Pole Management

This program (C011640 - $10.0M) assures that wood transmission circuits meet the governing NESC under which they were constructed by replacing wood poles and wooden structures that no longer meet the governing code requirements due to damage or failure of the pole or structure.

Drivers:
As discussed in the 2019 Asset Condition Report filed on October 1, 2019 in Case 17-E-0238, wood poles that are either priority rejects or reject poles (as classified following a wood pole ground line inspection and treatment) as well as those severely damaged by woodpecker or insect activity need to be replaced. The ground line inspection and treatment of wood poles is performed approximately every ten (10) years. These inspections are in addition to the five-year foot patrol which is required under the Safety Order. The wood pole replacement identified through this initiative are deemed to be beyond restoration by either re-treatment or placement of some form of additional pole support, usually at the ground line. Similarly, "reject equivalent" refers to deteriorated wood poles from such things as severe woodpecker damage, insect damage, or rotting. Reject Equivalents are also included in the Wood Pole Management Program.

Reject and priority reject poles generally do not meet NESC requirements. In a limited number of cases when an extra margin of safety was added into the design, some of this margin may still be available before failing to meet the code. However, this usually provides only a limited amount of extra time to replace the damaged or deteriorated wood pole(s) or structures before potential failure.

Customer Benefits:
Customers will benefit from the maintenance of the appropriate level of public safety by replacing deteriorated transmission wood structures. In addition to the public safety benefit, unplanned failures of wood poles or structures can reduce service reliability and may reduce overall system integrity making the transmission system vulnerable to widespread disruption.

2019 to 2020 Variance:
Future spending levels are based on an annual inspection rate of 10 percent of the Company's wood pole plant and 1 percent pole reject rate.

Table 2-15
Transmission – Wood Pole Management
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	2.0	2.0	2.5	2.5	2.5	-	11.5
2020	-	1.0	0.5	3.5	2.5	2.5	10.0

Battery Replacement Program (C033847 - $2.8M)

Battery and charger systems provide power to operate substation relay and control systems which allow station breakers to operate.

Drivers:
The Company's policy is to replace all battery sets that are twenty (20) years old, or sooner if battery conditions determined through testing and inspection warrant replacement. The twenty (20) year asset life is based on industry best practice and Company experience managing battery systems.

Customer Benefits:
Battery systems are important for the proper operation and control of the protection schemes for transmission switchyards.

2019 to 2020 Variance:
Future spending levels are expected to remain mostly consistent to the prior Plan. The variations are due to the number of 20-year old batteries being replaced per the business plan.

Table 2-16
Transmission – Battery Replacement Program
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.5	0.6	0.3	0.2	0.2	-	2.2
2020	-	0.6	0.6	0.5	0.6	0.5	2.8

Relay Replacement Program

Protective relays are maintained in accordance with Company substation maintenance standards and NERC or NPCC requirements, where applicable. Overall, the population of approximately 4,000 relay packages remains adequate, but approximately 6 percent of the population requires investment based on condition, performance or obsolescence. This program will commence by replacing the worst 6 percent of the relays over the next ten years. Beyond that, studies and pilot programs will be initiated to explore the most efficient and cost-effective approach to addressing the remaining population. The long-term objective is to have an asset management approach that allows a more commoditized approach to relay replacement. This approach will be necessary for modern microprocessor relays that are expected to have only 15 to 20-year asset lives.

The Company is projecting relay replacement projects being completed in this Plan:

- Menands (C049601 - $9.9M) - includes control building replacement
- Seneca Terminal (C049613 - $0.4M)
- Carr Street/East Syracuse Co-Gen (C049739 - $0.2M)
- Packard Relays Line 191 to 195 (C051423 - $0.2M)
- Batavia (C073587 - $0.4M)
- Southeast Batavia (C073588 - $0.3M)
- Walck RD (C049628 - $0.2M)

Drivers:
This strategy ensures that reliable protective relay systems are in place to preserve the integrity and stability of the transmission system following a fault. This strategy is needed now because

properly functioning protective relays are essential for rapid isolation of faults on the system thus protecting customers from potential outages and protecting equipment from damage.

Customer Benefits:
Properly functioning elements of relay protection schemes limit the extent and duration of outages. Further, the protection system is designed to protect high value assets against failure in the event of system anomalies thereby reducing the potential investment needed to recover from an event. The primary benefit of this strategy will be to maintain the reliability performance of the system and customer satisfaction as known poor performing relay families are replaced with modern microprocessor-based relays.

2019 to 2020 Variance:
Some relay replacements have been deferred to manage investment priorities and/or incorporated into other substation work to create efficiencies.

Table 2-17
Transmission Relay Replacement Strategy
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	2.5	3.3	3.5	2.2	0.08	-	11.5
2020	-	1.7	4.2	5.6	0.1	0.0	11.6

Substation Rebuilds

Most of the Company's transmission substations are in satisfactory condition; however, investment is recommended to rebuild substations whose overall condition has deteriorated to the point that wholesale refurbishment is required. In these circumstances, a standard substation design layout will typically be utilized to provide greater operational flexibility and increase reliability for customers served in the area. Where substation rebuilds are proposed, creative and innovative solutions and improvements, such as re-configuration of the layout, will be evaluated.

The, Lighthouse Hill, Inghams, Oswego, Lockport, Huntley, Dunkirk, Boonville, Oneida, Terminal, Greenbush, North Troy and Homer Hill substations are proposed to be rebuilt, or engineering started, during the FY20 – FY25 period, with most of the spending occurring in the later years of the Plan as the Company continues to study alternatives. At remaining substation sites, the Company will only replace those assets that cannot be repaired economically.

Gardenville Substation (C005156 & C030084) - $1.2M

Gardenville is a 230/115kV station south of Buffalo that has two (2) stations in close proximity that are referred to respectively as New Gardenville and Old Gardenville, and which both serve over 750MW of regional load. New Gardenville was built between 1959 and 1969 and has asset condition issues such as faulty control cables, deteriorated foundations and many disconnects which have deteriorated beyond repair. Old Gardenville, built in the 1930s, supplies regional load via eleven 115kV lines. The station has significant asset condition issues including, but not limited to, control cable, breaker, disconnect and foundation problems. The station has had no major updates since it was built.

A new breaker-and-a-half 115kV station has been built between the two (2) existing stations to replace the Old Gardenville portion of the station. The new 115kV switchyard will be rerouting approximately seventeen 115kV lines to eliminate the existing “crisscross” arrangement outside of the station and eliminate line to ground clearance issues. The 115kV projects C005156 and C030084 are expected to be completed by the end of fiscal year 2021 and are being completed prior to the 230kV portion of the yard known as New Gardenville due to the present asset conditions.

Lockport Substation (C035464 and C073991) - $15.4M

Lockport is a 115kV transmission station with thirteen 115kV transmission lines tying through the East and West bus sections and serving the 115kV system in Western New York. The overall condition of the station yard and control room is poor. Work is required on control cable duct banks, breaker operators, structure painting and concrete equipment foundations that are significantly deteriorated.

The control room building is also in poor condition and requires significant repairs. Existing peeling paint is likely lead contaminated. It is an oversized building with continued maintenance costs for the original roof and the intricate brickwork. It contains a 90-ton overhead crane in the old twenty-five (25) cycle frequency changer portion of the building which is presently used only to store material. The control house roof was repaired in the 1990s and brick pointing was also done to limit deterioration within the last five (5) years.

The Lockport Substation project is to replace all the deteriorated assets at the 115kV and 12kV voltage levels which includes Oil Circuit Breakers (OCBs), Disconnects, Potential Transformers, Insulators and the 115kV – 12kV Transformer. The project will also include a new Control House installation.

Huntley Substation (C049902) - $3.6M

Huntley is an asset separation/replacement project to separate the Company’s assets from the NRG-owned Huntley generating plant, which include the relays, controls, telecommunication, and station service equipment as well as site security upgrades.

The asset replacement portion of the project, meant to address asset condition and other system needs issues includes: permanent capacitor banks at the Huntley 115kV bus to replace the mobile banks; improved grounding in the switchyard; removal of all Company controls, batteries and communications equipment from inside the Huntley Generating Station owned by NRG to a control house in the yard (both 115kV & 230kV); adding a second station service supply; refurbishing the existing OCBs; replacing the potential transformers; installing new CCVTs for 115kV and 230kV relaying; and refurbishing the 230kV cable pumping plant.

Inghams Station Re-Vitalization (C050917, C060240 and C074000) $28.7M

Inghams station is in the Town of Oppenheim, New York and is a connection between a hydro generating station and the transmission and distribution electric system. The transmission voltage at Inghams is 115kV, with sub-transmission at 46kV, and the distribution at 13.2kV. The Inghams station helps to moderate the electrical system as it has a phase angle regulator ("PAR") type transformer and was installed in 1979.

The Company plans to improve the capabilities of the PAR by specifying a replacement unit with a wider adjustment range.

The Inghams station was flooded in 2006 and remains a flood concern. After the station was repaired a new stone wall approximately five (5) feet tall was constructed along the station perimeter that is shared with the river boundary. The stone wall is considered a temporary measure as it will limit the current flow of the river if the river rises to flood heights again but will not keep the station from being flooded.

The recommendation for the station is to replace the PAR with a new unit and keep the existing PAR as a spare for emergency use, and to relocate the station to be above the 500-year flood zone level.

The Inghams Substation project is to relocate the substation with the same straight bus configuration and existing layout to a Greenfield location. A new PAR with a wider range will be procured and the existing kept as a spare. A new control house will be installed at the new location.

Oswego Substation (C043426, C061991, C076218 and C076983) - $36.8M

Three (3) substation yards are located on the generation site owned by NRG which include a large 345kV switchyard (that was recently upgraded and is in overall very good asset condition, except for the control house which is scheduled for future replacement) and 115kV and 34.5kV yards originally designed and integrated when the generating station and substations were owned by Niagara Mohawk.

The 115kV substation is in poor condition with out-of-service equipment that has not been formally retired. Bus sections have been cut, rerouted, and breakers out of service with yellow hold cards. The disconnect switches to the OCBs are original to the station and are the pin and cap design that has an industry recommendation for replacement. The electro-mechanical relays and batteries for this yard and the 34.5kV yard are still inside the generation plant which limits the Company's control and access to these assets.

The 34.5kV yard is original to the 1940s Plant 1 & 2 (retired decades ago). All equipment in the yard is of original vintage, obsolete, and is in poor condition.

The Oswego Substation project is to replace all the deteriorated assets at the 115kV and 34.5kV voltage levels which includes the OCBs, Vacuum Circuit Breakers (VCBs), Disconnects, Insulators, Potential Transformers and two (2) 115kV-34.5kV Power Transformers. A new control house is to be installed on-site.

Lighthouse Hill Substation (C031662, C073996 and C073997) $23.2M

The Lighthouse Hill facility consists of a switching station with two (2) 115kV buses and seven (7) transmission lines connecting to the station, allowing power to flow from generation located on Lake Ontario to the Watertown area and Clay Station in the Syracuse area.

The station has seven (7) OCBs located 200 feet from the Salmon River and is the Salmon River is located seventy (70) feet below the yard elevation. The station is also located about one (1) mile upstream of the New York State Wildlife Fish Hatchery. Although the risk is low, any significant oil spill in the station could have a detrimental environmental impact. In addition, the disconnect switches are in a very poor condition.

Another significant issue at Lighthouse Hill is that the land is owned by Brookfield Power and operated as a shared facility under a contractual agreement. The lack of direct access to Brookfield's control room at Lighthouse Hill limits the Company's control over the housing conditions for the battery and relay systems. The Company has controls on the first floor of the control house, which is immediately adjacent and downstream of Brookfield's hydroelectric dam. An uncontrolled release from the dam could flood the control room area.

The recommended option of a conceptual engineering analysis is to build a new substation located about 1.5 miles west, adjacent to Tar Hill Road in the clearing on land already owned in fee by the Company. This will eliminate the risks of oil contamination to the Salmon River and greatly reduce the likelihood. The new substation will include 115kV breaker and a half bays, one (1) 115kV – 34.5kV Power Transformer, one (1) 115kV – 12kV Power Transformer, and a control house.

Dunkirk Substation (C005155 and C073999) - $34.6M

Dunkirk Station is a joint substation at Dunkirk Steam Station shared by NRG and the Company. The substation serves as an interconnection to the electrical grid at the 230, 115 and 34.5kV levels. The plant was originally constructed in the early 1950s by Niagara Mohawk as the owner of generation, transmission and distribution assets. The Company's major equipment includes four (4) transformers (two (2) new 230/120/13.2kV 125MVA autotransformers and two (2) 115/34.5kV 41.7MVA transformers supplying four 230kV), five (5) 115kV and two (2) 34.5kV lines as well as NRG's station service. The Company retains ownership of most of the 230kV and 115kV switch yard; however, the controls are in the generation control room owned by NRG.

There are many asset condition issues at the Dunkirk substation. The foundations are in poor condition in the 230kV yard, including many structure foundations, affecting the integrity of the structure itself.

Some circuit breaker foundations are in very poor condition raising the possibility that an OCB could move during a severe fault leading to more damage and/or causing safety issues.

The five (5) 230kV OCBs are Westinghouse type GW design (1958 through 1961) and would be part of the OCB replacement strategy, if not for this project. The 230kV Westinghouse Type O bushings are a concern as the power factor and capacitance results are trending upwards.

The 230/120/13.2kV autotransformers differential relaying requires upgrading to address inadequate relaying (presently there is no tertiary differential). The 230, 115 and 34.5kV disconnects have become more problematic and are at the end of their lives. The 230kV bushing potential devices ("BPDs") have become problematic as they age and the remaining BPDs will likely have to be replaced in the near future. Fencing around the yard is not compliant with Company standards and requires repair at the base or a berm built up to restrict animal entrance.

The control cable system in the 230kV yard is of particular concern. The conduit system carrying control wires has degraded to the point that the integrity of the control wires has been compromised. Control wires inside the plant also have degraded insulation. In some cases, the wiring is so poor that troubleshooting abilities are limited for fear of handling control wires with degraded insulation. Grounds, alarms or breaker misoperations happen more frequently during periods of heavy rain, indicating poor insulation below ground.

The plant was originally constructed with generation, transmission and distribution assets combined, including station service, battery, relaying, alarm / annunciation, control and communications. All troubleshooting, maintenance testing, equipment replacement and upgrades require excellent knowledge of the plant operation. NRG and the Company must maintain good lines of communication and share updated prints to preserve operation continuance. The separation of assets would help avoid inadvertent trips to the generators and / or line breakers, and possible equipment failures.

Conceptual engineering has been completed for a new control house that will accommodate the replacement of assets located within the retired generating station. Other equipment, such as disconnects, and potential transformers deemed to be at end of life, will be replaced in place during a project to install a second bus tie breaker.

The Dunkirk Substation project is to replace all deteriorated assets at the 230kV, 115kV and 34.5kV voltage levels, which includes OCBs, VCBs, Disconnects, Insulators, Potential Transformers two (2) 230kV – 115kV Power Transformers, and two (2) 115kV – 34.5kV Power Transformers. A new control house will be installed, along with a new metal-clad for the 34.5kV voltage level.

Boonville Substation (C049903, C082487, C082488) - $20.6M

The Boonville substation was constructed in the 1950s and originally designed as a switching station for several 115kV transmission lines and the single source of the radial 46kV line to Alder Creek, White Lake, Old Forge, Eagle Bay and Raquette Lake. The use has not changed except for the addition of a 23kV terminal for hydro generation.

The structural steel and foundations are deteriorated. The station was built alongside highway 12D in a farm field. Over the years, it has sunk to an elevation lower than the highway and farm fields resulting in a lack of drainage. This drainage issue is also present in the underground manhole and conduit system. The water surface level at the station causes the underground control cables to continuously be under water leading to their deterioration.

The station was designed electrically with minimal redundancy and has antiquated relaying protection. The design has the single source transformer for the 46kV line to the Old Forge area connected off the south 115kV bus with no alternate method to supply the transformer if the south bus is out of service. The 115kV to 46kV transformer was replaced in the 1990s but is still the only source and cannot be maintained properly due to outage restrictions. With no distribution at Boonville there is little need for a mobile sub connection; but there is a spare transformer for the 115/46kV TB#3 located at the station.

All electrical components at the station such as oil breakers, oil filled potential transformers and switches require replacement. The station control building is brick and needs reconditioning. The size of the building has also become an issue with the addition of energy management system (EMS) and relay upgrades over time, and the station perimeter fencing needs replacement on three sides.

The Boonville Substation project will relocate the substation with the same straight bus configuration and existing layout. The substation will include a new control house and be located about directly west of the existing substation.

Oneida Substation (C034443, C084674, C084809) - $30.1M

Oneida substation is a 115kV–13.8kV substation located in Verona, New York originally constructed in the 1940s. The substation includes two (2) load tap changers (LTCs) power transformers, nine (9) 115kV circuit breakers, one (1) 115kV capacitor bank with circuit switcher, a metal-clad switchgear with eight (8) 13.8kV feeders, and two (2) 13.8kV capacitor banks.

The physical and electrical layout of the 115kV yard makes it difficult to maintain or repair equipment. Outages to maintain the 115kV breakers are difficult because a line outage is required. The two (2) 1959 Federal Pacific Equipment circuit breakers are candidates for replacement due to maintenance issues and a lack of replacement parts. The lines to Rome and Yahnundasis are difficult to get out due to voltage support issues and taking the line associated with the R40 breaker out requires a customer outage. The vertical phase configuration of the East/West 115kV busses is a concern from a maintenance standpoint as the configuration makes tasks such as disconnect repair or replacement difficult due to problems maintaining safe working clearances. A majority of the 115kV structure foundations are failing and need repair or replacement.

One of the 115kV circuit breakers is a 1961 vintage Westinghouse GM-6B. This breaker model has a complex arcing chamber and has on multiple occasions seen high resistance forming in the contacts. These breakers are being replaced on a system wide basis.

Conceptual engineering for the Oneida Station rebuild suggests two (2) phases pertaining to the substation rebuild. The first phase to replace the two (2) LTC power transformers and the 13.8kV metal-clad switchgear was completed. The second phase of the project is to replace the 115kV portion of the substation and is scheduled to start in FY21.

The Oneida Substation project is to replace deteriorated assets at the 115kV voltage level, which includes OCBs, Disconnects, Insulators, and Potential Transformers. The station will be staged construction for the project and install a 115kV breaker and a half layout with a new control house.

Terminal Station Relocation (C076242 and C080493) $25.4M

Terminal Station was constructed in 1962 and is a 115kV to 13.2kV two-transformer distribution station with seven (7) distribution feeders and four (4) network feeders. Westinghouse metal-clads are arranged in a breaker and a half scheme. The station is supplied from the 115kV Porter #6 transmission line and the 115kV Schuyler #7 transmission line.

The station is located within a 100-year flood plain and it is also located in a major Manufactured Gas Plant ("MGP") environmental clean-up site. The soil under the station is assumed to be contaminated.

An asset condition report completed in 2013 identified numerous issues with the substation electrical equipment, recommending replacement of 115kV OCBs R60, R70 and all 115kV switches and motor-operated disconnects. All 15kV circuit breakers are roll-in Westinghouse type 15-DH-750E circuit breakers that have been targeted for replacement with new and modern design. Replacement of TR#2 was also recommenced due to oil leakage and signs of possible coking. Its sister unit failed in 2008 due to shorted winding.

The recommended plan consists of completely rebuilding the station at a new location south of the existing station on land currently owned by the Company, and above the 100-year flood plain, using open air 115kV breaker and a half configuration and a 115kV ring bus. This is the recommended alternative due to the ability to construct the entire station at a higher elevation to mitigate flooding concerns. This alternative also reduces the scope and associated cost of the distribution feeder work by eliminating a significant portion of the underground feeder duct-bank. By rebuilding the station at a new location, the opportunity to build a 115kV ring bus configuration increases reliability as well.

Greenbush Substation (C079224) - $20.2M

The Greenbush Substation contains 115kV, 34.5kV and 13.2kV voltage levels. The substation was originally constructed in the mid-1960s and has since had some assets replaced due to poor condition, oil leaks, gas leaks and obsolete parts. This asset replacement project would target the assets that have not been replaced which include the 115kV OCBs, the 34.5kV gas circuit breakers ("GCBs"), the 115kV pin and cap insulators, 115kV and 34.5kV disconnects, and potential transformers ("PTs") for station service.

The OCBs are part of an overall strategy for replacement due to poor condition, obsolete parts and lack original equipment manufacturer ("OEM") support. The GCBs have had leaks and have limited spare parts. There have been two (2) 34.5kV GCBs that have recently been replaced for VCBs and they are in good condition.

The cap and pin insulators are original to the station and some have already been replaced due to damage failure circumstances. The remaining ones should be replaced since from industry experience, the cement around the core starts to deteriorate after being in service for thirty (30) years. The disconnects that need to be replaced are those still with the cap and pin insulators.

The control house and equipment inside have recently been replaced and are in good condition. Presently, the 13.2kV material has not indicated any issues but will be re-evaluated during conceptual engineering.

The Greenbush Substation project is planning to replace the deteriorated assets at the 115kV, 34.5kV and 13.2kV voltage levels which includes OCBs, VCBs, Disconnects, Insulators, Potential Transformers and install a new control house.

Homer Hill Substation (C075942) - $7.9M

The Homer Hill Substation contains 115kV and 34.5kV voltage levels. The substation has 115kV and 34.5kV voltage level asset concerns.

The 115kV assets were installed in 1950 and many are original to the substation. The OCBs, oil filled potential transformers, cap and pin insulators, and disconnects are assets planned for replacement. The oil filled equipment has indicated leaks and limited spare parts.

The 115kV – 34.5kV, 7.5/9.375MVA transformers were installed in 1950 and are original to the substation. The equipment for the Load Tap Changer (LTC) were replaced, but the remaining LTC and operating mechanism are original parts, have no spare parts and limited Original Manufacture (OEM) support.

The 34.5kV assets were installed in 1986 and many are original to the substation. The OCBs, oil filled potential transformers, cap and pin insulators, and disconnects are assets planned for replacement. The oil filled equipment has indicated leaks and limited spare parts.

The cap and pin insulators are original to the station and some have already been replaced due to damage failure circumstances. The remaining insulators should be replaced because, based on industry experience, the cement around the core starts to deteriorate after being in service for thirty (30) years. The disconnects that need to be replaced are those still with the cap and pin insulators.

There are two (2) control houses on-site and the 115kV control house is intermixed with microprocessors and electromechanical relays, while the 34.5kV control house has electromechanical relays. The electromechanical relays have limited spare parts and limited OEM support.

The Homer Hill Substation project is planned to replace the deteriorated assets at the 115kV and 34.5kV voltage levels which includes OCBs, VCBs, Disconnects, Insulators, Potential Transformers, and two (2) 115kV – 34.5kV Power Transformers. A new control house is planned to be installed for this project.

Drivers:
The substations mentioned above have all been identified as having asset condition or configuration issues that warrant a major station rebuild or upgrade.[8] Included with the station name is the forecasted spend amount within this Plan.

Customer Benefits:
The planned replacement of these stations reduces the likelihood of an in-service failure which can lead to long-term interruptions of the transmission system as well as significant customer outages.

[8] *See* 2019 Asset Condition Report, Pages 64-73.

2019 to 2020 Variance:
Substation rebuilds continue with some projects being deferred to manage short term capital spending.

Table 2-18
Transmission – Substation Rebuilds
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	28.3	22.8	51.3	93.2	90.0	-	237.4
2020	-	30.0	41.4	48.6	72.4	55.2	247.6

Overhead Line Refurbishment Program

Over the next five (5) years, the Company will refurbish a number of overhead circuits based on their condition. During this period, we will continue to work towards an overhead line refurbishment approach that, to the greatest extent possible, addresses only equipment in the most deteriorated condition. This approach only considers refurbishing an entire line when the conductor requires replacement. In general, as part of conceptual engineering, conductor testing will determine whether the conductor tensile strength fails to meet appropriate NESC heavy loading requirements. When possible, shield wire testing will also be performed.

For overhead lines with acceptable conductor strength, this program will assure that transmission circuits meet the minimum governing NESC under which they were built. This will be accomplished through the replacement of deteriorating structures and line components that no longer structurally or electrically adhere to the governing NESC.

The costs projected for lines prior to the completion of the conceptual engineering process are preliminary in nature. As part of conceptual engineering process, a line will be field evaluated and refurbishment options more thoroughly evaluated on case-by-case basis. The value of various options (*e.g.*, complete reconductoring versus a life extension) will be reviewed; however, cost estimates may continue to differ due to unforeseen circumstances, such as additional swamp matting needs due to weather conditions or environmental requirements.

To reduce costs during the period of this Plan, the Company is implementing an approach recommended by DPS Staff in the Company's 2010 rate case to refurbish only those overhead transmission circuit facilities that are in unacceptably deteriorated condition (*i.e.*, Niagara Mohawk's defined Level 1, Level 2 and Level 3 condition). Although this approach allows for reduced investment amounts in the five years covered by this Plan, the approach must be evaluated against longer term issues such as a greater number of visits to the same right-of-way, multiple site establishment costs, increased susceptibility to storm damage, additional permitting and licensing costs, greater levels of environmental impact, more disturbance to abutters, and other considerations to determine the most economical solution for the benefit of customers. Therefore, for certain overhead line condition projects, a larger work scope to replace assets that are deteriorated, yet serviceable, may be more appropriate and cost effective.

This Plan assumes that issues identified during routine foot patrols (Level 1, 2 or 3 issues) will be addressed through the Damage / Failure program. Where the Company suspects a systemic problem, an engineering inspection and an aerial comprehensive survey will be initiated. Any issues arising from these condition assessments will be addressed through this overhead line refurbishment program.

The more significant overhead line refurbishment projects in this Plan are listed below. Additional details are included in Exhibit 6 – Overhead Line Refurbishment Projects.

- Border City-Elbridge #15 (C075723 - $2.2M)
- Gardenville-Dunkirk #141 & #142 (C003389 - $103.8M)
- Land - Gardenville-N. Angola #141 (C076951 - $4.5M)
- Gardenville-Homer Hill #151 & #152 (C027425 - $1.2M)
- Lockport-Batavia #112 (C003422 - $8.9M)
- Mortimer-Pannell #24 & #25 (C047816 - $2.5M)
- Pannell-Geneva #4 & #4A (C030889 - $2.3M)
- Ticonderoga #2 & #3 (C039521 - $18.9M & C084017 - $3.9M)
- Frontier #180 & #182 ACR/Reconductor (C027436 - $6.6M)
- Spier-Rotterdam #2 Shield wire Replacement (C050744 - $3.4M)
- Brockport Tap #111 & #113 Refurbishment (C055531 - $20.2M)
- Batavia-Golah #119 ACR (C060217 - $6.9M)
- Mortimer-Golah #110 ACR (C060220 - $6.8M)
- Huntley-Gardenville #38 & #39 Rebuild (C075543 - $3.0M)
- South Oswego-Clay #4 T-334 Rebuild (C075544 - $3.0M)
- Gloversville - Marshville #6 69kV Refurbish (C081458 - $6.5M)
- Amsterdam-Rotterdam #3 & #4 69kV Relocation (C081471 - $2.9M)
- Gardenville-Dunkirk #141 & #142 ACR (C081744 - $14.0M, C081750 - $0.1M)
- Lockport-Mortimer #103 & #104 STR (C027432 - $2.4M)
- Gardenville-Dunkirk #141 #142 ACR Seneca Nation (C034193 – $1.3M)

- Lighthouse Hill - Clay #7 ACR (C069533 - $5.2M, C084074 - $11.1M, C084077 - $2.1M, C084078 – $10.1M)
- Mortimer-Golah #109 69kV refurb (C081474 - $23.8M)
- Lockport-Mortimer #113 & #114 ACR/CCR (C081664 - $1.5M)
- Thompson-N Troy-Greenbush Corridor ACR (C081667 - $1.5M)
- Laona-Falconer #172 & #173 ACR/CCR (C083216 - $9.8M)
- Curtis St - Teall #13 ACR (C084496 - $5.2M)
- Elbridge-Gears Lock #3 / Elbridge-Woodard #4 ACR (C084521 - $5.2M)
- Elbridge-Geres Lock #18 & #19 ACR (C084522 - $4.2M)
- Whitehall-Mohican #13 / Whitehall-Cedar #6 Ph. 2 (C084552 - $5.1M)
- New Scotland-Feura Bush #9 / New Scotland-Long Lane #7 ACR (C084554 - $8.7M)
- Huntley-Lockport #36 & #37 Ayer Rd ACR (C081670 - $5.1M)

Drivers:
The Company has over 6,517 circuit miles of transmission overhead lines and many of these overhead line assets are approaching, and some are beyond, the end of their anticipated lives. The program will ensure the Company's transmission circuits meet the minimum requirements of the governing code under which they were built as required by the Commission's 2005 Safety Order (Case 04-M-0159).

Customer Benefits:
This program promotes safety and reliability by assuring transmission lines meet the governing NESC under which they were built by replacing deteriorating structures and line components that no longer structurally or electrically conform to the NESC.

2019 to 2020 Variance:
The Company re-phased some of the overhead line refurbishment projects to manage short term capital investment. Overhead line equipment failures will be managed through the Damage / Failure budget and any Level 1, 2 or 3 issues identified during foot patrols will also be addressed through the Damage / Failure budget.

Table 2-19
Transmission – Overhead Line Refurbishment Program
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	27.3	43.4	44.2	51.8	80.4	-	247.1
2020	-	23.3	49.8	61.5	72.4	116.9	323.9

NY Transmission UG Strategy (C084550)

Across New York State, Niagara Mohawk has roughly 53 miles of UG transmission cable from 115kv to 345kv. These 53 miles are divided into two types of cable; 43 miles of high-pressure fluid filled (HPFF) pipe type cable and 10 miles of solid (extruded) dielectric cable. The average age of the HPFF pipe type cable is 47 years with the oldest install dating to 1959. The average age of the solid dielectric cable is 26 years with the oldest install dating to 1988.

These assets have been kept in service since their in-service date and the Company has taken the approach of fixing problems as they arise. However, as these assets continue to experience increased condition issues, the ability to maintain them has also become increasing difficult and costly. The current condition and difficulty to repair and replace obsolete pipe-type cable equipment places electrical service to our customers and safety for our employees and contractors at risk. Increased inspection and maintenance is required to assure these assets continue to provide reliable electric service to our customers based in the deteriorating asset condition.

The goal of this program is address asset condition as these assets reach, or already reached, the end of their useful life and failure risk is high. The determination of the need for cable replacements will be through critical load assessments and the increased inspection and maintenance program results.

Drivers:
This program is driven by aging UG infrastructure, risk mitigation, and the obsolescence of assets. Increasing the inspections and maintenance of the UG transmission system will provide a better picture of asset health and enable improved investment decisions moving forward.

Customer Benefits:
Addressing asset condition issues on our aging transmission UG infrastructure as condition deteriorates is necessary to maintain safe and reliable electric service. When necessary, replacing pipe-type cables with solid dielectric cables mitigates risks associated with single cable manufacturer, limited resources to repair the cable, and difficulty in obtaining spare equipment.

2019 to 2020 Variance:
The program was not in the 2019 plan.

Table 2-20
Transmission – NY Transmission UG Strategy
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.0	0.2	0.5	1.0	1.7

Worst Performing Circuits - NY (C084553)

This program addresses the worst performing 115kv (and above) circuits across New York State. The rankings are based on 5-year non-storm data and are targeted on the impact to our customers; rank ordered based on highest to lowest lost customer minutes. These rankings are run once a year in order to catch new poor performers and to remove circuits that have been addressed during the prior year. Each year the top 20 circuits are identified along with the primary performance driver for each circuit. This driver of poor performance can range from lightning strikes to failed line equipment to wind events. Various inspections and patrols are preformed to identify the deficiencies that are causing these primary drivers. An improvement plan that is formulated to address the deficiencies will be funded through this program.

Drivers:
The primary goal of this program is to address reliability concerns on the transmission system across New York State. The circuits identified have the biggest impacts to our customers in both total SAIFI and lost customer minutes.

Customer Benefits:
This program is designed to provide better reliability on the transmission lines that were the worst performers from the prior 5 years. The Company will be investing directly on the lines that impact customer reliability the most. These lines feed both large industrial customers as well as the substations that feed our distribution system and serve residential and commercial customers.

2019 to 2020 Variance:
The program was not in the 2019 plan.

Table 2-21
Transmission – Worst Performing Circuits - NY
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	7.0	5.0	8.0	8.0	8.0	36.0

Transformer Replacement Strategy

Power transformers are managed through routine visual inspection, annual dissolved gas analysis (”DGA”) and electrical testing where required. Transformers with tap-changers are also maintained in accordance with our substation maintenance standards.

In this context, failure means either DGA results that suggest an immediate need for replacement or actual physical/electrical failure. Sufficient strategic spares are available to cover the probability of failure for the majority of the fleet.

Seneca Station TB#5 (C069427 - $6.5M) – There is a family history of failure of this transformer design. The #4 transformer at Seneca failed in 2014, the #2 transformer failed in 2018, and the #1 transformer is in the process of being replaced. The #5 transformer is being replaced due to their asset condition and to maintain the future reliability of the 23kV system in the Buffalo area.

Elm Street Station #2 TRF (C069426 - $4.8M) - The #4 transformer at Elm Street station failed in 2013 and the #1 and #2 transformers are sister units identified by O&M Services testing as being unreliable and following the same failure history symptoms as the #4 transformer damage/failure.

Kensington Terminal Station #4 & #5 TRFs (C069429 - $7.3M) - These two (2) transformers have been on the New York watch list due to indications of hotspots, gassing from arcing under oil and high moisture-in-oil levels from maintenance reviews of the transformers. The other two (2) transformers #2 and #3 have recently been replaced due to similar asset conditions.

Woodlawn Station (C051986 & C082919 - $12.8M) – TB1 has had hotspots and arcing under oil in the past. The oil quality is below the acceptable threshold with inter-facial tension, moisture and dielectric strength being outside expected in-service values. The main tank appears to be taking in moisture at a slow rate. Electrical tests show deterioration of the winding insulation. The tight physical clearances between the low voltage and high voltage structure make an emergency replacement difficult. TB2 A, B and C phase units all have partial discharge problems as indicated by increased Hydrogen in DGA results. All three (3) have high moisture-in-oil levels, which can lead to low dielectric strength and contribute to chemical reactions that degrade the oil quality. The three (3) single-phase transformer design makes emergency replacement with a three-phase unit very difficult.

Hoosick Station (C053132 & C081115 - $10.6M) and Mohican Station (C053133 & C080755 - $20.2M) The 115kV-34.5kV transformers at Mohican (2) and Hoosick (1) have indications of hotspots, gassing from arcing under oil, and high moisture-in-oil levels from maintenance reviews of the transformers. The transformers were placed on the watch list in New York.

Ash Street Station (C076282 - $1.1M) - Replace both 115-12kV 24/32/40 MVA transformers with new 115-11.5kV 24/32/40 MVA transformers due to their DGA analysis showing hot spots within transformer windings and combustible gasses beginning to increase putting the transformers at risk of failure.

Mortimer Station TB#3 (C076283 - $5.8M) - The station has one Westinghouse 115/69/12kV 20/3.43 MVA autotransformer manufactured in 1935. This transformer supplies the 69kV Mortimer-Golah #109 to Golah and supplies the Mortimer station service from the tertiary winding. The transformer is rusted, leaking and has leaking bushings. Bushings show signs of heating. DGA test results are showing increasing combustible gases. There is not a system spare 115-69kV auto transformer in the New York system.

Drivers:
In the next five (5) years, the investment plan is to replace these twelve (12) transformers with anomalous DGA results that have been indicated for immediate replacement or are expected to be confirmed as in poor condition through electrical testing.

Customer Benefits:
The failure of an average sized distribution station transformer could lead to a loss of power for approximately 17,000 residential customers. The prolonged time needed for restoration (either through the installation of a spare or a mobile sub) can translate into millions of customer minutes interrupted.

2019 to 2020 Variance:
The variance is due to timing adjustments to accommodate other capital projects.

Table 2-22
Transmission – Transformer Replacement Program
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	9.6	14.6	22.0	14.3	1.5	-	62.0
2020	-	16.1	23.0	16.1	9.7	4.4	69.3

Edic Station Protection Migration (C076214 - $4.9M)

This project upgrades and relocate obsolete assets and remove the old control house in order to create an efficient working environment.

Drivers:
The replacement and relocation of obsolete relays, deteriorated protection equipment, and the associated equipment from the original Edic substation control house to the new control house will return the Edic substation back to its original intended operation instead of it operating between two (2) separate control houses.

Customer Benefits:
The planned replacement of the obsolete relays, deteriorating protection equipment, and associated equipment will keep properly functioning elements of relay protection schemes to help limit the extent and duration of outages. Further, the protection system is designed to protect high value assets against failure in the event of system anomalies thereby reducing the potential investment needed to recover from an event.

2019 to 2020 Variance:
The project is presently moving forward as scheduled and the cost indications efficiencies in the process.

Table 2-23
Transmission – Edic Station Protection Migration
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.4	1.9	2.6	0.3	0.0	-	5.2
2020	-	0.5	0.5	2.4	1.4	0.1	4.9

Circuit Breaker Replacements

The circuit breaker population is managed through ongoing inspection and maintenance activity along with routine preventative maintenance activities and electrical testing. In general, the circuit breaker population continues to be adequate; however, there are a number of obsolete circuit breakers that require investment. During the Plan, obsolete OCBs will be replaced with modern equivalent circuit breakers. Typically, these breakers will be replaced with circuit breakers employing SF6 gas as an arc interrupting medium. SF6 will be employed until a replacement arc interrupting gas with a lower global warming potential is identified.

Drivers:
The types of circuit breakers used in the service territory are categorized as gas and oil for 69kV and above voltage levels, which totals 793. There are OCBs and GCBs which indicate poor condition due to oil leaks, bushing hot spots, high power factors, limited/no spare parts, and limited/no OEM support. There have also been failures of gasket, pressure valves, hoses, gauges, motors, compressors, pulleys, O-rings, control cables, trip coils, close coils, lift rods and contacts.

Customer Benefits:
The planned replacement of circuit breakers reduces the likelihood of an in-service failure which can lead to long-term interruptions of the transmission system as well as significant customer outages. The circuit breaker replacement strategy promotes reliability of the transmission network.

2019 to 2020 Variance:
The Company is committed to planned replacement of circuit breakers to maintain the reliability of its transmission system through its OCB Replacement Program. The variance is due to some of these projects being bundled with other station upgrades. Projects in this Plan include:

- Whitehall Station (C075885 - $0.3M)
- Teall Station (C075902 - $0.8M)
- Woodard Station (C075903 - $0.4M)
- Batavia Station (C075904 - $3.7M)
- Yahnundasis Station (C079010 - $0.8M)
- Queensbury Station 34.5KV OCB&TB2 CH (C080871 - $0.9M)
- Queensbury Station - Rplc 34.5kV OCB & TB2 (C080869 - $5.0M)
- Breaker T Repl Program 4-69kV NYW (C049260 - $3.5M)
- Breaker T Repl Program 4-69kV NYE (C049257 - $3.1M)
- Breaker T Repl Program 4-69kV NYC (C049258 - $3.7M)
- Packard Station (C079222 - $4.5M)
- Kensington Station (C083645 - $0.04M)

Table 2-24
Transmission – Circuit Breaker Replacements
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	6.4	5.2	2.9	5.6	9.4	-	29.4
2020	-	7.4	8.3	4.0	2.3	4.8	26.8

345kV Laminated Cross-Arm Replacement Program (C060365 - $6.0M)

The New Scotland – Alps #2 345kV line has experienced two (2) failures on tangent (D-1501) structures within three (3) years. The root cause has been identified as the aging wood laminated cross arms used to support the suspension insulators. These specific laminated cross arms were used by Niagara Mohawk prior to approximately 1975.

Drivers:
Several D1501 wood cross arm samples were obtained from structures that were being replaced on the New Scotland-Alps #2 line due to normal maintenance. These cross arms were destructively examined in the field by forcing a shear failure parallel to their lamination. Once split, the lamination was examined for glue adhesion quality. Concurrently, samples were sent to SUNY-ESF for laboratory analysis. SUNY-ESF performed mechanical testing on large length samples to measure their bending strengths and compare them to their original design specifications. The results were that the in-service cross arms were weaker than what was specified.

An aerial inspection also was undertaken to identify deteriorated cross arms and overstressed vee braces in the field for D-1501 structures constructed prior to 1975. This multi-year Plan will investigate road crossing initially then systematically evaluate remaining structures.

Customer Benefits:
This program promotes safety and reliability of transmission lines by replacing laminated cross arms that are deteriorated and no longer structurally or electrically conform to their design specifications.

2019 to 2020 Variance:
This program is progressing as planned.

Table 2-25
Transmission – Laminated Cross-Arm Replacement
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	3.0	2.0	2.0	2.0	2.0	-	11.0
2020	-	1.5	0.5	2.0	1.0	1.0	6.0

NY Trans Line Bonding and Grounding Program (C080523 - $1.0M)

There have been a number of pole fires on wood 230kV and 345kV circuits. Some of the circuits that have experienced repeated pole fires include 230kV Rotterdam-Eastover Rd-Bear Swamp #38/#E205W, 230kV Gardenville to Dunkirk #73/#74, and 230kV Adirondack to Porter #11/#12/#13. The root cause has been identified as a lack of bonding and grounding on the 230kV and 345kV wood structures.

Drivers:
Update 230kV and 345kV structures to current standards to bond and ground metallic hardware to eliminate poles fires caused by metallic hardware isolation.

Customer Benefits:
The benefit of this program is enhanced customer reliability on our 230kV and 345kV system and reduction in damage/failure associated work that results in rescheduling of existing work. Damage/failure associated work is sometimes costly from a company standpoint as it usually only addresses the one structure involved in the incident and not a comprehensive plan for the circuit.

2019 to 2020 Variance:
This program is progressing as planned.

Table 2-26
Transmission – Bonding and Grounding
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.2	0.2	0.2	0.2	0.2	-	1.0
2020	-	0.2	0.2	0.2	0.2	0.2	1.0

Priority Overhead Line Transmission Switch Replacement Program (C076621 - $4.8M)

This program will address switches in need of replacement, prior to failure, for better system reliability. These switches are identified and prioritized by the Transmission Control Center (TCC).

Drivers:
The TCC has advised of the operational importance of maintaining full load break capabilities with our key switches. Leaving tagged switches inoperable for long periods of time, or removing them, leaves the transmission system operationally deficient and less flexible. In many cases, this is not acceptable for emergency system operations.

Customer Benefits:
Properly operating transmission line switches allow for the most efficient operation of the transmission system and quicker emergency restoration.

2019 to 2020 Variance:
This program continues to proceed as planned.

Table 2-27
Transmission – Priority Line Switch Replacements
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.6	0.6	0.6	0.6	0.6	-	3.1
2020	-	0.8	1.0	1.0	1.0	1.0	4.8

Substation Equipment Replacement Requests (“SERRs”) (C031545 - $1.0M)

The Company employs a process called Substation Equipment Replacement Request (“SERR”), formerly Problem Identification Worksheets (“PIW”), to document faults and defects with in-service substation and overhead line equipment identified through normal maintenance activities or through inspection routines (often called 'trouble' work). Typically, the issues identified through the SERR process cannot be corrected immediately and require investigation, engineering analysis and solution design. These activities and the solutions proposed often lead to low cost capital projects to replace or refurbish items of equipment.

Drivers:
Historically, issues identified during inspection or maintenance were added to the capital Plan in outer years to avoid reprioritizing other planned projects. A budgetary line for SERRs was introduced to recognize that a number of high priority, low cost, capital projects will inevitably arise during the year and these should be undertaken to address found-on-inspection issues. This work is over-and-above that required during normal Inspection and Maintenance (“I&M”).

Issues arising from SERRs are prioritized and engineering solutions for the highest priority are developed within year. Utilizing this approach, the Company can make progress on low cost capital investments that might otherwise be lost in the Plan.

Customer Benefits:
The SERR approach benefits the overall health of the system by identifying important issues that are high priority, but that may not fall into the scope of ongoing strategies and are not yet Damage / Failure projects. SERRs also help identify trends throughout the system and provide feedback on how to better manage the system as a whole.

2019 to 2020 Variance:
The reduction was to account for other projects at the same substation bundling the work to create efficiencies.

Table 2-28
Transmission – Substation Equipment Replacement Request (SERR)
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.25	0.25	0.25	0.25	0.25	-	1.3
2020	-	0.2	0.2	0.2	0.2	0.2	1.0

Albany Steam Substation – 115kV Asset Replacement (C079461 - $4.7M)

The Albany Steam plant contains multiple large OCBs that were part of the circuit breaker replacement program. These were removed from the program and combined with the replacement of the pin and cap bus insulators, as well as the disconnects with pin and cap insulators. This was done to help with efficiencies in planning a single project for the substation.

Drivers:
The OCBs have been problematic, with two (2) units already having been replaced. The OCBs also have deteriorated insulation and have had leaks.

The pin and cap insulators, bus and disconnect usage, have historically been problematic due to the core cement break down over time which reduces the strength of the insulator.

Customer Benefits:
The planned replacement of the OCBs and pin and cap insulators reduces the likelihood of failures and lengthy outages.

2019 to 2020 Variance:
The estimate was updated from d to during preliminary engineering.

Table 2-29
Transmission – Albany Steam – 115kV Asset Replacement
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.07	0.4	3.3	1.2	0.0	-	5.0
2020	-	0.7	1.9	2.1	0.0	0.0	4.7

Browns Falls Station – Asset Separation/Replacement (C081427 - $8.8M)

The Browns Falls substation is a 115kV – 34.5kV interconnection point with Brookfield Power. The 34.5kV assets in the lower 34.5kV yard are in poor condition and have raised safety/clearance concerns recently by field personnel. There are four (4) 34.5kV OCBs still in service that are in poor condition, lack OEM support, have mechanism issues, and are part of the New York 69kV to 4kV OCB Replacement Strategy.

This project will expand the 115kV yard fence to allow for installation of a new metalclad for the 34.5kV equipment as well as the relocation of the 115kV relay and controls from the Brookfield Power House. The 115kV circuit breakers were recently replaced and are in good condition.

Drivers:
The OCBs have been problematic and lack spare parts and the support necessary to properly maintain them. The separation of the assets allows for an efficient access to the equipment in the event of an emergency or regularly planned maintenance, as the equipment will not be installed in a foreign owned building.

Customer Benefits:
The planned replacement of these assets reduces the likelihood of failures and lengthy outages.

2019 to 2020 Variance:
The estimate was updated during preliminary engineering.

Table 2-30
Transmission – Browns Falls – 115kV Asset Replacement
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.07	0.7	5.0	2.0	0.5	-	8.2
2020	-	0.9	5.0	2.5	0.4	0.0	8.8

Rochester Airport Cable Refurbishment (C080543 - $6.4M)

The objective of this project is to address the pressurizing plant asset condition (a vintage from 1960s). The plant pressurizes the three (3) underground cables on the 115kV Lockport – Mortimer #111, #113, and #114 transmission lines. The scope of work consists of reconductoring all three circuits with solid dielectric cables, replacing existing terminations and retiring the oil equipment. Solid dielectric cables are also less maintenance intensive than high pressure oil filled cable systems.

Drivers:
The pumping plant has operational issues which increase the risk of asset failure.

As solid dielectric systems gain in popularity, the industry knowledge and experience of oil filled systems is diminishing. The highly qualified work is expensive and can be hard to schedule since the number of qualified workers is limited.

Customer Benefits:
The new cable system requires less ongoing maintenance. It also removes pressurized oil from the system and therefore the risk of any environmental pollution is reduced.

2019 to 2020 Variance:
This project is progressing as planned.

Table 2-31
Transmission – Rochester Airport Cable Refurb
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.3	3.5	2.8	0.0	0.0	-	6.6
2020	-	2.4	4.0	0.1	0.0	0.0	6.5

Inspections Identified Replacement Program (C082106 - $18.1M)

This program addresses replacement of overhead line items found by inspections other than mandatory foot patrol inspections and the wood pole management program. For example, aerial comprehensive inspection, shakedown or climbing inspection.

Drivers:
This program addresses deteriorated overhead line items found through alternative inspection methods thus preventing future failure and increases public safety and customer reliability.

Customer Benefits:
The benefit of this program is enhanced customer reliability on our 115kV system.

2019 to 2020 Variance:
This program was not in the 2019 plan.

Table 2-32
Transmission – Inspections Identified Replacement
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	3.1	3.0	4.0	4.0	4.0	18.1

Taylorville Substation: Asset Replacement/Separation (C081782 - $9.8M)

This project replaces deteriorated assets, that have limited spare parts and no OEM support which includes; twenty-seven (27) 115kV bus insulators, six (6) 115kV surge arresters, one (1) 115kV – 23kV 20/26/33MVA power transformer, four (4) 23kV OCBs, one (1) 23kV Station Service Transformer, twenty-one (21) bus supports and eighteen (18) surge arrestors.

This project will also facilitate the separation of assets from Brookfield Power and the Company at the shared facility. A new control house will be installed with IEC-61850 communication protocol, and an emergency generator.

Drivers:
The OCBs have been problematic and lack spare parts and the support necessary to properly maintain them. The separation of the assets allows for an efficient access to the equipment in the event of an emergency or regularly planned maintenance, as the equipment will not be installed in a building not owned by the Company.

Customer Benefits:
The project replaces assets in poor condition and maintain the reliability of the system.

2019 to 2020 Variance:
This program was not in the 2019 plan.

Table 2-33
Transmission – Taylorville: Asset Replacement/Separation
Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.0	0.1	0.5	9.2	9.8

Coffeen Substation: Asset Replacements (C081787 - $7.8M)

Coffeen Street Substation is a 115kV, 23kV and 13.2kV substation. The 115kV bus presently is designed as a straight bus without a tie-circuit breaker which creates operational concerns.

The assets located at the substation are in deteriorated condition, have limited spare parts and limited to no OEM support. In additional the original oil filled assets have had a history of leaks.

The 115kV, 23kV and 13.2kV relays and controls in the control house are obsolete, have limited spare parts and limited to no OEM support.

The Coffeen Substation project is planned to replace deteriorated assets at the 115kV, 23kV and 13.2kV voltage levels which includes OCBs, VCBs, Disconnects, Insulators, Potential Transformers, two (2) 115kV – 23kV Power Transformers, and two (2) 115kV – 13.2kV Power Transformers. A new control house is planned to be installed.

Drivers:
Asset in poor condition will be replaced specifically, OCBs that have been problematic and lack spare parts and the support necessary to properly maintain them.

Customer Benefits:
The project replaces assets in poor condition and will maintain the reliability of the system.

2019 to 2020 Variance:
This program was not in the 2019 plan.

Table 2-34
Transmission – Coffeen: Asset Replacements
Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.0	0.1	0.4	7.3	7.8

South Oswego: 115kV Asset Replacements (C081781 - $2.8M)

The nine (9) 115kV OCBs at South Oswego substation have had a history of leaking and the operating mechanism failures either as a component or the whole mechanism. There are limited spare parts and OEM support for these circuit breakers.

This project replaces all OCBs and associated protection and controls devices. Additional protection and control devices which are obsolete and have limited spare parts and lack of OEM support will also be replaced.

Drivers:
The OCBs have been problematic and lack spare parts and the support necessary to properly maintain them.

Customer Benefits:
The project replaces assets in poor condition and will maintain the reliability of the system.

2019 to 2020 Variance:
This program was not in the 2019 plan.

Table 2-35
Transmission – South Oswego: 115kV Asset Replacements
Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.0	0.1	0.7	2.0	2.8

Queensbury - Capacitor Replacement (C082649 - $1.6M)

Description
This project replaces a poor performing capacitor bank that has repeated operating issues over the past five years. The capacitor is not a standard design and there are limited spare capacitor cans.

Drivers:
The replacement of a poor performing capacitor that cannot be adequately repaired.

Customer Benefits:
The project replaces an asset in poor condition used to l maintain the reliability of the system.

2019 to 2020 Variance:
This program was not in the 2019 plan.

Table 2-36
Transmission – Queensbury - Capacitor Replacement
Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	1.2	0.4	0.0	0.0	0.0	1.6

New Harper Substation (“Royal Ave Station”) (C044874 & C044594 - $10.3M)

This project builds a new 115-13.2kV substation with two (2) 24/32/40 MVA transformers and eight (8) 13.2kV feeders, which will replace the existing Harper station. This substation will become the supply to two (2) industrial customers as well as three (3) new distribution substations to replace three indoor substations.

Drivers:
The project is driven by the deteriorated asset condition of the transformers, breakers, support structure and other items at the existing Harper 115-12kV station located in Niagara Falls.

Customer Benefits:
This project will improve reliability by removing deteriorated assets from the system and, by utilizing standard distribution voltages, allow for the use of system spare equipment in the event of a failure.

2019 to 2020 Variance:
The project investment continues as planned.

Table 2-37
Transmission – New Harper Substation ("Royal Ave Station")
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.0	7.8	0.04	0.0	0.0	-	8.8
2020	-	10.2	0.04	0.0	0.0	0.0	10.3

103 and 104 Mountain Lockport (C082394 - $1.1M)

Description
This project reconfigures the existing crossing of Lines 103 and 104 to eliminate a section of small conductor.

Drivers:
A section of small conductor is the thermal limitation of the circuit and was identified as constraining renewable generation as part of NextERA's WNY 345kV project in the NYISO Interconnection process for the WNY Public Policy Need.

Customer Benefits:
This project improves the ability of renewable energy to supply customers in New York.

2019 to 2020 Variance:
This program was not in the 2019 plan.

Table 2-38
Transmission – 103 and 104 Mountain Lockport
Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.1	1.0	0.0	0.0	0.0	1.1

Spier-Rotterdam 2 Re-insulate (C081676 - $8.7M)

This project will address asset condition related issues on the second phase of the 115kV Spier-Rotterdam #2 (T5760) from structure 113 to Rotterdam station. The budgeted scope of this project includes a full aerial comprehensive inspection including UV and corona, steel tower climbing inspection, and Osmose PIT inspection for the wood. This project replaces degraded hardware and re-insulates line from structure 113 to Rotterdam station.

Drivers:
This circuit still has insulators and hardware from the original line installation in 1923. There have been spot replacements when equipment has failed on this line, but a total refurbishment has not been completed.

In the past five years this line has had 12 operations: 10 being momentary and 2 being lockouts.

Customer Benefits:
Refurbishment of this line is necessary to provide reliable service to the Company's customers.

2019 to 2020 Variance:
This program was not in the 2019 plan.

Table 2-39
Transmission – Spier-Rotterdam 2 Re-insulate
Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.0	0.4	6.9	1.4	8.7

2. E. Reliability

Reliability capital expenditures are required to improve power quality and reliability performance.

Transmission Substation Physical Security - ($1.3M)

This program provides security measures to deter and/or detect unauthorized access to substations.

Drivers:
This program is driven by the need for additional physical security measures at certain substations to mitigate break-ins and the increasing risk that unauthorized access may lead to potential injury or death of a trespasser who comes in contact with energized equipment. Reducing and detecting unauthorized access also reduces risk of vandalism and damage to electric system equipment. The projects to add physical security measures in this Plan are designed to meet NERC CIP-14 standards.

Customer Benefits:
Deterring and detecting unauthorized access to certain substations would result in:

Avoided or reduced physical and personal injury to unauthorized third parties as well as Company personnel at the substations.

Reduced potential for service interruptions or equipment damage/loss from vandalism or theft.

Protection of transmission stations against physical attack

2019 to 2020 Variance:
The forecasted investment shown and variation year on year is due to project scope updates and timing of the program.

Table 2-40
Transmission Substation Security
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	3.0	1.5	0.0	0.0	0.0	-	4.5
2020	-	1.3	0.0	0.0	0.0	0.0	1.3

Conductor Clearance Program (C048678 - $49.9M)

The conductor clearance correction program (C048678) will increase the clearance of certain overhead conductors to address locations that may not meet clearance standards prescribed by the NESC under certain loading conditions. The need for greater clearances has been identified as a result of an ongoing Aerial Laser Survey ("ALS"), also known as LiDAR for Light Detection and Ranging, being conducted on the transmission system. Clearances are in the process of being measured with aerial surveys providing an accuracy which was previously available by ground inspection only. The project will continue beyond FY24 to address conductor clearance issues for 115kV lines. This timeline assumes there will be no further directives from FERC similar to the October 7, 2010 NERC Alert (Recommendation to Industry: Consideration of Actual Field Conditions in Determination of Facility Ratings) that would prescribe a specific correction period.

Drivers:
The primary driver for this work is safety of the public and Company personnel as they work and travel under the overhead lines. The NESC sets conductor clearances of overhead lines from the ground and other ground-based objects. This program addresses transmission lines that do not meet current NESC standards by improving ground to conductor clearances in substandard

spans. This follows standard industry practice and the Commission's Safety Order (Case 04-M-0159).

Customer Benefits:
While safety events caused by substandard clearance conductors are rare, their consequences can be very serious and are difficult to quantify. Application of the NESC criteria provides a reasonable means to manage the issue and mitigate the risk from such events.

2019 and 2020 Variance:
Future spend is expected to remain consistent with levels in the prior plan.

Table 2-41
Transmission – Conductor Clearance Strategy
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	8.8	7.9	8.9	10.0	9.6	-	45.3
2020	-	11.9	8.0	10.0	10.0	10.0	49.9

Osprey Mitigation/Avian Protection (C076662 - $1.8M)

To reduce interruptions on the Company's transmission network due to the growing population of Ospreys between the months of April-September, an Osprey Mitigation/Avian Protection Program is being implemented to add nesting platforms either to existing structures or adjacent wood poles. This program will be in addition to including Osprey mitigation efforts in project scopes of transmission line refurbishment projects for lines in active Osprey regions.

Drivers:
Ospreys are birds of prey that build large nests of sticks atop transmission structures which can reach 4-7 feet in diameter and similar height. The nests typically weigh four hundred pounds, although larger ones have been reported at up to seven hundred pounds. Interruptions can occur when the nests come into contact with energized conductor or the bird droppings cause an arc between phase conductors.

There are growing populations of Ospreys in the Adirondack, Central and Southwest regions of New York.

There are trips listed in the Incident Data System as Osprey related and some are without a direct correlation, but patrols suspected were Osprey related. Without further monitoring and mitigation efforts, interruptions caused by Osprey nests will continue to increase in frequency.

Customer Benefits:
Osprey are considered "of special concern" by the Department of Environmental Conservation (DEC) and should be protected. An Osprey Mitigation Program will reduce the risk of osprey deaths. Additionally, this program will reduce avian related interruptions which improve system reliability.

2019 to 2020 Variance:
This project is progressing as planned.

Table 2-42
Transmission – Osprey Mitigation/Avian Protection
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.25	0.25	0.25	0.25	0.25	-	1.3
2020	-	0.25	0.25	0.25	0.5	0.5	1.8

Mobile Capacitor Bank (C081351 - $2.3M)

This project will procure a 115kV, 30MVAR mobile capacitor bank that will be utilized as a stop gap measure at substations where a need for voltage support has been identified based on system studies until a permanent solution can be implemented, and for emergency situations. This mobile will be stored in the Western New York (WNY) region but can be utilized across Upstate New York.

Drivers:
The mobile capacitor is being procured to maintain the capacitor bank fleet for proper availability in the event of the loss of a capacitor bank due to damage/failure or support projects.

Customer Benefits:
The planned replacement of the system mobiles reduces the lead time to long-term interruptions of the transmission system in the event of a failure and can assist as planning support till a permanent solution is installed.

2019 to 2020 Variance:
The estimate was updated during preliminary engineering.

Table 2-43
Transmission – Mobile Capacitor Bank
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.4	0.0	0.0	0.0	0.0	-	1.4
2020	-	0.6	1.7	0.0	0.0	0.0	2.3

Coffeen Cap Bank (C084547 - $1.8M)

Installation of a single-stage 25 MVAR 115kV capacitor bank at Coffeen.

Drivers:
Under certain system conditions, voltage will be below our criteria.

Customer Benefits:
This project provides for improved voltage control in the Coffeen area for various system conditions.

2019 to 2020 Variance:
This project was not in the 2019 plan.

Table 2-44
Transmission – Coffeen Cap Bank
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.0	0.0	0.1	1.7	1.8

Oneida Cap Bank (C084549 - $1.8M)

Installation of a single-stage, 27 MVAR capacitor bank at Oneida.

Drivers:
Under certain system conditions, voltage will be below our criteria.

Customer Benefits:
This project provides for improved voltage in the Oneida area for various system conditions.

2019 to 2020 Variance:
This project was not in the 2019 plan.

Table 2-45
Transmission – Oneida Cap Bank
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.0	0.0	0.1	1.7	1.8

Golah Line 116 By-pass Switch (C084293 - $2.5M)

The 115kV Golah- North Lakeville Line 116 is radial and cannot be taken out of service. Installing a by-pass switch will serve the Golah Station rebuild project and any future project at Golah station that requires an outage on the 115kV bus.

Drivers:
Part of the Golah Station rebuild requires a bus outage. The existing 115kV bus cannot be taken out without tying the Golah Line 116 with Line 110.

Customer Benefits:
This project will provide operational flexibility, reduce outage exposure and maintain reliability for the customers on Line 116.

2019 to 2020 Variance:
This project was not in the 2019 plan.

Table 2-46
Transmission – Golah Line 116 By-pass Switch
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.02	2.0	0.5	0.0	0.0	2.5

High Priority Switches & RC-MOD (C083864 - $16.0M)

Adding a Remote-Controlled, Motor Operator (RC-MOD) to a field switch provides supervisory control functionality. This gives the Transmission Control Center (TCC) operators the ability to operate a field switch remotely, which has the potential to isolate faults and bring back customers as quickly as possible.

TCC has identified strategic locations on the 115kV system to add RC-MODs.
This program will add RC-MODs to the 115kV system by installing new switches with supervisory control capability and by fitting existing field switches with supervisory control capabilities.

Drivers:
Numerous circuits on the 115kV system have taps off a mainline to bring additional customers onto the system. However, these taps add exposure to the system for faults to occur. Without field switches, any fault on the circuit would take out the entire circuit and its taps.

Customer Benefits:
The main benefit will be the improved reliability to the customers. Adding switches to the system reduces the exposure of faults affecting customers and the supervisory decreases the response time to isolate faults.

2019 to 2020 Variance:
This program was not in the 2019 plan.

Table 2-47
Transmission – High Priority Switches & RC-MOD
Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	5.0	2.0	3.0	3.0	3.0	16.0

Smart Fault Indicator Program-NY (C082281 - $5.0M)

The program will install "smart" fault indicators on the 115kv transmission system. Transmission Control Center identifies select circuits that will benefit from the installation of fault indicators based on historic reliability data and any current needs.

Drivers:
Smart fault indicators are a useful tool for utilities. Currently, the Company uses fault indicators that do not communicate with any of our systems and must be viewed in the field to determine their reading. With the advancements of technology, access to fault information can be viewed remotely. This allows the Company to more accurately dispatch field personal, expedite switching operations, decrease the length of patrol for field personnel and ultimately reduces restoration times.

Customer Benefits:
The main benefit of this program is reduced outage times. Crews are dispatched closer to the fault location, have less line to patrol, switching operations are streamlined. This has the additional benefit of reducing costs for patrols and inspections.

2019 to 2020 Variance:
This program was not in the 2019 plan.

Table 2-48
Transmission – Smart Fault Indicator Program-NY
Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	1.0	0.8	1.2	1.0	1.0	5.0

2. F. Communications / Control Systems

Communications and control system projects are required for building-to-building communications, microwave replacements, fiber optic installations and associated equipment.

Migrate and Update Communications Equipment (C069570, C083766, C083767 and C083768)

This program migrates analog leased communication circuits to a Company owned digital network.

Drivers:
Analog leased circuits used by the Company are being phased out by communication providers. The protection of Company transmission circuits requires a secure, high-speed communication path. The Company has seen increases in monthly recurring costs and a steady decline in circuit repair services from communication providers for these analog circuits.

The Company will start migrating these analog protection circuits to Verizon digital DS1 circuits and/or the Company's own private fiber/microwave networks to maintain protection and communication needs.

Historically, communication providers give customers 18-24 months to migrate the circuits after announcing their phase-out plans.

A solution proposed by communication providers to lease their digital circuits does not meet all of the Company's communications needs. Furthermore, communication providers do not have assets available at some Company substations. In addition, on those circuits designated as BPS, the protection package A and B need different communications paths for compliance and reliability. The Company therefore plans to expand its current private/microwave network.

Customer Benefits:
Upgrade communication circuits is needed to enable secure, high-speed communications for continued and enhanced grid operation as well as comply with reliability standards.

2019 to 2020 Variance:
The variance is due to additional scope of the work associated with installation of a private telecom network.

Table 2-49
Upgrade Communications Equipment Due to Verizon Retirements
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	2.0	2.5	2.5	2.5	2.5	-	12.0
2020	-	3.1	4.2	11.1	11.4	15.5	45.3

RTU M9000 Protocol Upgrades (C069437 - $6.4M)

This program is to replace an outdated RTU protocol M9000 with a new DNP3 protocol.

Drivers:
RTUs with an M9000 protocol do not match the Transmission Control Center EMS DNP3 protocol. This can lead to a loss of communications that allow equipment in substations to be operated remotely. This program is driven by the need to create a reliable communication link between the control centers and the substations.

Customer Benefits:
Upgrade of M9000 protocol RTUs to DNP3 is consistent with the Company's goal of improving reliability across its system. Proper communication between substation equipment and the Transmission Control Center is critical in reducing the potential for service interruptions, equipment damage, and line overloads due to faults and the most efficient operation of the transmission network.

2019 to 2020 Variance:
This spend for this program was leveled over a longer timeframe to help reduce overall short-term capital spending in the Plan.

Table 2-50
Transmission - RTU M9000 Protocol Upgrades
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.4	1.4	2.1	2.8	1.5	-	9.2
2020	-	1.6	0.9	2.0	1.5	0.4	6.4

Transmission EMS/RTU for DSCADA (C081809 - $4.5M)

This project is for the upgrade of existing RTUs at stations with both distribution and transmission voltages to make ready for a Distribution Management System ("DMS"). To accomplish this, a second SCADA network will be operated through a separate port on the RTU. Older RTUs that cannot be dual ported will be upgraded or replaced. This project is directly related to project funding number C077972 that is covered in Chapter 4.

Drivers:
A DMS, which includes Distribution Supervisory Control and Data Acquisition ("DSCADA"), Outage Management System ("OMS"), and advanced applications ("ADMS"), is a set of hardware and software that allows for greater visibility, control, and situation awareness of the distribution electric grid. The DMS is a foundational platform for the management of increasing numbers of remote telemetered equipment and DER (as required by REV) and supporting Distributed System Implementation Plan ("DSIP"). In order to implement the DMS, a second DSCADA network is required for the distribution voltage level equipment. To accomplish this at stations with both transmission and distribution voltages, two (2) separate SCADA configurations will be run out of one (1) RTU. It will be required that the Company utilize two (2) communication ports of the RTU involving varying upgrades to RTUs and equipment at stations with both transmission and distribution voltages.

Customer Benefits:
This strategy provides the means to leverage operational intelligence and significantly reduce response time to abnormal conditions through real time monitoring and control. The strategy also enables the distribution automation, sub-transmission automation, and future modernization strategies which will improve service to customers. When used to monitor and control the distribution feeder breakers and associated feeder equipment, RTUs and EMS facilitate the isolation of faulted equipment and the time required to reconfigure the distribution system to re-energize customers in non-faulted segments of the distribution system.

2019 to 2020 Variance:
The program is updated as work continues to move forward with the replacement of these assets.

Table 2-51
Transmission - EMS/RTU for DSCADA
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.5	1.9	1.9	0.0	0.0	-	4.2
2020	-	1.3	2.0	1.2	0.0	0.0	4.5

Transmission - DMX Projects (C084525 - $20.0M)

This program is to replace an outdated Nokia DMX multiplexer at 97 nodes that are part of the telecommunication system. The OEM has announced they will no longer be available for procurement and will provide limited support.

To bridge the timeframe from the current End-of-Life (EoL) to the implementation of replacement technology / equipment, the Company purchased an inventory of spare equipment in June 2018 that is estimated to cover a three to five-year timeframe if the equipment does not experience any increase in typical failure rates.

Clean Leadership Community Protection Act (CLCPA) Alignment:

- A robust telecommunications infrastructure will allow the Company to achieve effective integration with DERs.
- A strong telecommunications infrastructure will facilitate providing customers better and more timely information, allowing them to make more efficient energy choices.
- A robust telecommunications infrastructure provides the ability to transport information from the grid to back office systems that can drive towards system efficiency goals.
- Upgrading key communications to customer substations provides resiliency benefits for our larger customers.
- This facilitates innovative technologies that encourage distributed energy, two-way communications between customers and utilities, and more advanced metering solutions.
- This project supports in-flight cybersecurity projects and aims to raise the security level for all communications to a common standard.

Drivers:
The replacement of obsolete assets that have limited spare parts and limited OEM support.

Customer Benefits:
Proper communication between substation equipment and the Control Centers are critical in reducing the potential for service interruptions, equipment damage, and line overloads due to faults and the most efficient operation of the transmission network.

2019 to 2020 Variance:
This project was not in the 2019 plan.

Table 2-52
Transmission - DMX Projects
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.05	3.0	5.0	12.0	20.0

2. G. DER – Electric System Access

Because transmission DER Electric System Access projects are typically reimbursable (*i.e.*, costs incurred by the Company are paid for by the customer), there is little net effect to the Plan from such projects.

2. H. Non-Infrastructure

Non-Infrastructure capital expenditures are for items that are not part of the electric power system but are required to run the power system such as tools, communications, and other general plant.

Table 2-53
Transmission - IHC Capital Small Tools
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.2	0.1	0.3	0.3	0.2	1.1

2019 to 2020 Variance:
This project was not in the 2019 plan.

2. I. Multi-Value Transmission

MVT projects are designed to address the Company's system needs as well as broader State transmission needs. This MVT approach takes a holistic view in designing solutions that advance existing system/asset capabilities issues and leverages the Company's expertise to design efficient solutions to 69 and 115kV issues. These projects will advance the development of system upgrades and create additional system benefits by increasing transmission capability for renewable energy deliverability.

MVT – Mohawk (Gloversville/Amsterdam/Cobleskill Area)

This program involves significant capital expenditure over the next five years and beyond to construct reinforcements to the Mohawk Area 115 and 69kV system. This infrastructure development work will strengthen the transmission network, ensure adherence to reliability standards and provide for the unbottling of approximately 115GWh of solar (photovoltaic) generation annually.

The major components in this program with investment levels greater than $1 million (costs shown are for the period covered by this Plan) include:

- MVT Inghams lines 6 and 7 rebuild (C084528 - $10.5M) rebuilds approximately 3 miles of double circuit 115kV.
- MVT Rotterdam 69kV Rebuild & New TB (C082180 - $25.4M) rebuilds the 69kV portion of the Rotterdam substation and adds a second 115-69kV transformer.
- MVT Schoharie/Schenectady International-Rotterdam 18/4 Rebuild (C082182 - $4.2M) rebuilds approximately 1 mile of double circuit 69kV to 115kV standards, energized at 69kV.

Drivers:
Between June 2017 and July 2019, 15 large solar generation projects totaling 510MW proposed to interconnect to Niagara Mohawk's 115kV transmission and 69kV sub transmission networks between the Inghams and Rotterdam substations in the Capital Region. An additional 155MW of distributed generation proposed to interconnect to the distribution stations served by these transmission and sub transmission networks. NYISO Interconnection studies for the proposed large-scale solar considered impacts to the local system, but only considered a lightly stressed case, and did not consider the impact of all 15 projects in aggregate. The Company conducted a planning analysis to model all proposed projects, consequently identifying local transmission and sub transmission elements which have the potential to become overloaded under certain system conditions with the added generation. To address these overloads, large-scale generation would require significant and frequent curtailment by system operators.

Customer Benefits:
Production cost modeling found that transmission and sub transmission constraints would result in an estimated 136GWh of annual curtailment. Increasing the capacity of the most binding transmission and sub transmission elements, through select equipment upgrades and reconductoring, is expected to unbottle 115GWh annually of curtailed renewable energy while simultaneously mitigating future asset condition needs.

2019 to 2020 Variance:
The variance is due to a re-phasing of the projects.

Table 2-54
Transmission – Mohawk Area Multi-Value Transmission
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	1.1	11.4	11.3	16.4	-	40.2
2020	-	0.1	1.1	12.0	16.7	10.2	40.1

MVT – Northern Area

- FlatRock Terminal Equip Upgrades (C081789 - $0.5M)
- Black River Terminal Equip Upgrades (C081285 - $0.2M)
- Browns Falls Terminal Equip Upgrades (C082925 - $0.5M)
- Browns Falls Taylorville Line Upgrades (C082926 - $0.1M)
- Colton-Browns Falls Taylorville Line Upgrades (C082928 - $0.1M)
- Taylorville-Porter Reconductor (C084596 - $0.3M)
- Malone Par (C084542 - $16.3M)

This program involves significant capital expenditure over the next five (5) years to construct reinforcements to the Northern Area 115kV system. This infrastructure development work will promote the goals of the Climate Leadership and Community Protection Act by improving the ability of renewable energy from Northern New York to supply customers in the State. A Phase Angle Regulating Transformer will be installed at Malone as well as a number of relatively small equipment upgrades along the Dennison-Colton-Taylorville-Boonville Corridor.

Drivers:
Congestion on the Colton-Browns Falls-Taylorville circuits is a result of equipment other than the conductors and the free-flow of power from the 230kV system to the 115kV system.

Customer Benefits:
Replacing the limiting non-conductor equipment on the Colton-Browns Falls-Taylorville circuits will increase capacity of the circuits. The installation of a Phase Angle Regulating Transformer at Malone will provide relief to the 115kV backbone. These capacity improvements increase the ability of the transmission system to deliver clean renewable energy.

2019 to 2020 Variance:
These scope and timing of the projects differs from the 2019 Plan due to renewable generation changes in the area.

Table 2-55
Transmission – Northern Area Multi-Value Transmission
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.2	5.0	10.6	9.9	-	25.7
2020	-	0.2	1.2	0.3	1.9	14.3	17.9

MVT – Southwest Area
This program involves significant capital expenditure over the next four (4) years to construct reinforcements to the Southwest Area 115kV system. This infrastructure development work will replace deteriorating assets, ensure adherence to reliability standards, and provide for the “unbottling” of renewable energy sources in Chautauqua County.

Moon Rd-Falconer 175/176 Rctor Inst (C082184 - $3.5M)

Drivers:
The existing Dunkirk-Laona-Falconer corridor contains two (2) 115kV circuits with a series reactor located at New Road on each circuit. The existing reactors are nearing their expected end of life

and with the installation of new clean energy generation, they will create a restriction in the amount of energy that can be delivered.

Customer Benefits:
Advancing the replacement of the existing reactors by removing the reactors at New Road and installing two (2) new reactors near Moons Station will change the division of power flow on the circuits and allow additional renewable energy to be delivered, which will support the Clean Energy Standard while replacing vintage assets.

2019 to 2020 Variance:
The variance is due to a re-phasing of the projects.

Table 2-56
Transmission – Southwest Area Multi-Value Transmission
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.6	2.4	0.0	0.0	-	3.0
2020	-	0.0	0.0	0.3	3.2	0.0	3.5

2. J. Resiliency

The Company strives to maintain its assets and networks to the criteria under which they were built. But most of the system was not designed to withstand today's climate and still meet reliability demands. The frequency and severity of extreme weather events are increasing. Between March and May 2018, there were five events in New York that impacted over 100,000 customers. The increasing severity for these major events is driving not only an increased number of customer outages but also causing longer durations.

The initial identification of opportunities was performed by reviewing single supply stations that serve over 5,000 customers, areas where loss of a single transmission line would interrupt over 10,000 customers, and areas where loss of two circuits would interrupt over 20,000 customers.

Resiliency – Eastern Area (Capital Hudson and Northeast)

- New Krumkill Resiliency (C084543 - $2.0M) provides for the installation of an Automatic Line Sectionalizing (ALS) Scheme at New Krumkill.

- Rotterdam - Maplewood Resiliency (C084589 - $0.3M) provides for initial engineering to build a new station and split the existing circuit.

- North Troy - Hoosick Resiliency (C084532 - $1.0M) provides for the engineering to install remote control capability to the existing switches at Boyntonville.

Drivers:
The increasing severity of major events is driving increased risk to the number of customer outages and extended durations.

Customer Benefits:
These projects will improve transmission system sectionalizing and will result in fewer sustained outages to customers due to events on the 115kV system. These projects will limit the effect of a fault to a smaller section of the line, so it will be possible to identify and rectify the problem area quicker.

2019 to 2020 Variance:
These projects were not in the 2019 plan.

Table 2-57
Transmission – Eastern Area Resiliency
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.05	2.0	0.9	0.3	3.3

Resiliency – Western Area (Southwest, Frontier)

Project description

- Dunkirk - Falconer Resiliency (C084537 - $7.0M) provides for the installation of two 115kV breakers at Berry Rd and the installation of two 115kV breakers at Baker Street to improve automatic line sectionalizing.

- Huntley - Lockport Resiliency (C0845328 - $4.0M) The project provides for the installation of in-line 115kV breakers to each of the Huntley-Lockport lines to split them into two sections. Also, change the location of the tap connections for the Ayer Road and Renaissance Drive Substations to balance customer exposure between each line section.

Drivers:
The increasing severity of major events is driving increased risk to the number of customer outages and extended durations.

Customer Benefits:
These projects will improve transmission system sectionalizing and will result in fewer sustained outages to customers due to events on the 115kV system. These projects will limit the effect of a fault to a smaller section of the line, so it will be possible to identify and rectify the problem area quicker.

2019 to 2020 Variance:
These projects were not in the 2019 plan.

Table 2-58
Transmission – Western Area Resiliency
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.0	0.2	3.4	7.3	10.9

Resiliency - Central Area (Syracuse, Oswego, Cortland, Northern, Utica/Rome)

- Dewitt-Tilden Resiliency (C084535 - $7.0M) provides for the installation of two 115kV breakers at Southwood Station and two 115kV breakers at Pebble Hill Station to split the lines into three sections.

- Clay - Dewitt Resiliency (C084533 - $4.0M) Reconnects the approximately 7-mile-long Duguid Station Tap from DeWitt-Tilden Line to a new breaker on the DeWitt Station bus.

- Teall - Oneida Resiliency (C084541 - $3.0M) provides for the reconfiguration of the supplies to Peterboro substation such that the substation will be supplied from both Teall-Oneida lines with an automatic transfer scheme. The project also reconfigures the connection of the Bridgeport Tap and adds supervisory (remote) control of the existing switches at the tap point.

- Lighthouse Hill - Clay Resiliency (C084539 - $2.0M) reconnects the Wetzel Road tap from a long transmission line and onto its own breaker at Clay Substation.

- South Oswego – Clay Resiliency (C084540 - $2.0M) adds Automatic Line Sectionalizing (ALS) schemes at Whitaker and Gilbert Mills.

- South Oswego - LHH Resiliency (C084544 - $1.0M) adds remote control capability to the existing switches at the East Pulaski Tap and to the existing switches at Wine creek.

- Indian River-Lyme Junction Land (C082202 - $2.0M); Indian River-Lyme Junction Line (C082190 - $1.0M); Indian River-Lyme Junction Station (C082192 - $0.5M) projects provide for a new line between Indian River and Lyme Junction to connect to two existing radial circuits. A new breaker will be installed at Indian River and a new ring-bus station at Lyme Junction.

- Coffeen Bus Split – Resiliency (C084534 - $1.8M) provides for the splitting of the existing Coffeen bus into two sections to improve resiliency.

- Yahnundasis – Porter Resiliency (C084545 - $2.0M) installs a switch with remote control capability to the Porter side of the Debalso Tap.

Drivers:
The increasing severity of major events is driving increased risk to the number of customer outages and extended durations.

In particular for the area north of Watertown, there are two (2) radial 115kV circuits, one from Coffeen substation and one from the Black River substation and radial circuits by their nature have greater negative reliability impact to the customers connected to them than networked circuits.

Customer Benefits:
These projects will improve transmission system sectionalizing and will result in fewer sustained outages to customers due to events on the 115kV system. These projects will limit the effect of a fault to a smaller section of the line, so it will be possible to identify and rectify the problem area quicker. For the area north of Watertown, the creation of a networked system with better sectionalizing will improve the customer experience.

2019 to 2020 Variance:
These projects were not in the 2019 plan.

Table 2-59
Transmission – Central Area Resiliency
Program Variance ($ millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.05	2.4	11.4	12.3	26.1

Chapter 3. Sub-Transmission System

The sub-transmission system is comprised of lines and substations typically operating at voltages at or below 46kV. The Company has approximately 2,900 circuit miles of overhead sub-transmission lines and 344 circuit miles of sub-transmission underground cable. Over the five-year period covered by this Plan, the Company expects to invest approximately $271 million on the sub-transmission system, as shown in Table 3-1 below.

Table 3-1
Sub-Transmission System Capital Expenditure by Spending Rationale ($millions)

Spend Rationale	FY21	FY22	FY23	FY24	FY25	Total
Customer Request / Public Requirement	2.7	3.5	(1.1)	1.1	1.2	7.4
Damage / Failure	4.1	4.2	4.3	4.4	4.5	21.4
System Capacity	0.1	0.6	0.1	0.1	1.2	2.1
Asset Condition	29.5	44.6	54.5	45.1	49.3	223.0
Reliability	0.7	1.2	0.7	3.1	0.4	6.1
Resiliency	2.8	2.0	2.6	2.2	1.3	10.8
Total	**39.8**	**56.2**	**61.0**	**56.0**	**57.8**	**270.9**

A list of sub-transmission projects in the Plan can be found in Exhibit 2.

3. A. Customer Request / Public Requirement

Customer Request/Public Requirements investment levels are based primarily on forecasted spending based on specific trending as well as known specific projects. These estimates reflect consideration of inflation, estimates of materials, labor, indirect cost, market sector analysis, overall economic conditions and historical activity.

2019 to 2020 Variance:
Variances in planned program spending between the 2019 and 2020 Plans are shown in Table 3-2.

Table 3-2
Customer Request/Public Requirements Variance Summary ($millions)

	CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
Blankets	2019	0.3	0.3	0.3	0.3	0.3	-	1.6
	2020	-	0.2	0.2	0.2	0.2	0.2	1.1
Specific Projects	2019	1.6	1.6	2.9	1.9	1.9	-	10.0
	2020	-	2.5	3.3	(1.3)	0.9	0.9	6.3
Total	2019	2.0	2.0	3.3	2.3	2.3	-	11.9
	2020	-	2.7	3.5	(1.1)	1.1	1.2	7.4

There is no specific project in this category estimated to have spending in excess of $1 million in any fiscal year.

3. B. Damage / Failure

Damage/Failure projects are required to replace equipment and restore the electric system to its original configuration and capability following a damage or failure incident. Damage may be caused by storms, vehicle accidents, vandalism, or other unplanned events. Damage/Failure spending is typically mandatory work that is non-discretionary in terms of scope and timing.

The Damage/Failure investment level for the sub-transmission system is primarily based on historical costs for such work. Where condition renders an asset unable to perform its intended electrical or mechanical function on the delivery system, the Company initiates the timely replacement of such asset under the Damage/Failure spending rationale.

2019 to 2020 Variance:
The variance between the 2019 and 2020 Plans is based on recent historical spending.

Table 3-3
Damage/Failure
Variance Summary ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	4.8	4.2	4.3	4.4	4.5	-	22.3
2020	-	4.1	4.2	4.3	4.4	4.5	21.4

There is no specific project in this category estimated to have spending in excess of $1 million in any fiscal year.

3. C. System Capacity

The projected investment for sub-transmission work in the System Capacity spending rationale over the Plan period is shown in Table 3-4 below.

2019 to 2020 Variance:

The projected program investment is based on the specific projects discussed in the Load Relief portion of this chapter. Comparison of the overall spend in sub-transmission between the 2019 and 2020 Plans is shown in Table 3-4.

Table 3-4
System Capacity
Variance Summary ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	2.3	3.7	2.3	1.3	0.0	-	9.5
2020	-	0.1	0.6	0.1	0.1	1.2	2.1

Load Relief

Drivers:

An annual review of the sub-transmission system, including substation and circuit loading, is performed to review equipment utilization. The reviews take into account both normal equipment loading and Load at Risk following an N-1 contingency. Forecast load additions are applied to historical data and the system is analyzed to determine where and when constraints are expected to develop. Recommendations for system reconfiguration or system infrastructure development are created as part of this annual review to ensure load can be served during peak demand periods and is documented in the Annual Capacity Plan.

The normal loading assessment identifies load relief plans for facilities that are projected to exceed 100 percent of normal capability (*i.e.*, maximum peak loading allowed assuming no system contingencies). Projects created as a result of the review are intended to be in-service during the year the violation is identified. N-1 reviews are conducted as well to identify facilities that are anticipated to exceed emergency ratings. Over the next ten years, load growth is expected to be relatively flat at zero percent per year after weather normalization to the 95/5 forecast. The forecast incorporates demand effects from solar and energy efficiency installations. Although we expect minimal load growth across the Company's service territory as a whole, it is anticipated that localized load increases will occur due to new service requests.

Customer Benefits:

The benefit to customers of completing the work identified in capacity planning studies includes less exposure to service interruptions due to overloaded cables and transformers.

The projects resulting from these studies are typically classified as Load Relief. Other program classifications are possible. Even though a project is classified in one program such as Load Relief it may have multiple drivers which include reliability.

2019 to 2020 Variance:
The projected investment in this program is shown below. The variation year on year is due to the scope and timing of specific projects. In addition, Station-related sub-transmission capacity improvements are discussed in Chapter 2, Transmission, due to their FERC classification. Many of the projects in the Sub-transmission Asset Replacement and Overhead Line programs have multiple drivers and provide load relief and reliability improvements as well. Load Relief programs are detailed in Table 3-5 below to provide a comparison between the 2019 and 2020 Plans.

Table 3-5
Load Relief
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	2.3	3.7	2.3	1.3	0.0	-	9.5
2020	-	0.1	0.6	0.1	0.1	1.2	2.1

There is no specific project in this category estimated to have spending in excess of $1 million in any fiscal year:

3. D. Asset Condition

Planned asset condition investment levels for the sub-transmission system are described below.

2019 to 2020 Variance:
The projected investments for asset condition driven projects are shown in Table 3-6 below and the variation year on year is due to the scope and timing of the individual specific projects.

Table 3-6
Asset Condition
Variance Summary ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	29.2	32.8	44.1	39.2	44.1	-	189.4
2020	-	29.5	44.6	54.5	45.1	49.3	223.0

Inspection and Maintenance
Under this program, the Company performs visual inspections on all overhead and underground sub-transmission assets once every five years. Each inspection identifies and categorizes all necessary repairs, or asset replacements, against a standard and in terms of criticality to improve customer reliability in compliance with the Safety Order.

In addition, the following types of inspections are conducted by the Company:

- Aerial assessments of sub-transmission lines on an annual basis, and
- Infra-red inspection of sub-transmission lines on a three-year schedule.

The Company also performs annual elevated voltage testing per the Commission's Safety Order on all facilities capable of conducting electricity that are publicly accessible.

Drivers:
The Company implements the Inspection and Maintenance program in accordance with the Safety Order. The Company's annual Asset Condition Report details the application of the Inspection and Maintenance program to sub-transmission assets.

Customer Benefits:
This program is designed to ensure the Company fulfills its obligation to provide safe and adequate service by inspecting it facilities and repairing identified safety and reliability issues in a timely fashion.

2019 to 2020 Variance:
Current investment forecasts are based on actual expenditures incurred under the Inspection and Maintenance program.

Table 3-7
Inspection and Maintenance
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	7.5	7.5	7.5	7.5	7.5	-	37.5
2020	-	7.5	7.5	7.5	7.5	7.5	37.5

Overhead Line
Various projects are in place to refurbish or replace sub-transmission overhead assets to ensure the system continues to perform in a safe and reliable manner. This includes pole, tower, overhead ground wire, and conductor replacement in addition to the work generated via the Inspection and Maintenance program discussed above.

Drivers:
Although spending is categorized by spending rationale, all drivers are considered in determining the optimum project solution. Reliability and asset condition are the main drivers for these projects. Historically, the number of reliability events that are initiated on the sub-transmission system is low; however, these events can result in a significant number of customers being interrupted where the lines are radial.

Physical condition of the sub-transmission system is being assessed through the Inspection and Maintenance program, helicopter surveys, and by engineering reviews and 'walk downs'.

Customer Benefits:
Refurbishment and replacement of sub-transmission system components can have a significant impact on regional CAIDI/SAIFI and Customer Minutes Interrupted ("CMI") since they typically supply distribution stations.

2019 to 2020 Variance:
The projected investment is shown in the table below. Existing identified work under this program will be continued. New projects are being identified on lines where work is needed due to significant deterioration.

Table 3-8
Overhead Line
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	15.9	18.0	25.1	21.3	21.7	-	102.1
2020	-	13.4	25.7	34.3	23.3	5.1	101.9

The following specific projects have forecasted spending that exceeds $1 million in any fiscal year:

- Project C046436, Carthage – Taylorville 21/22/26 – 23kV Refurbishment.
- Project C046441, Lighthouse Hill – Mallory 22, 34.5kV Refurbishment.
- Project C046449, Yahnundasis-Clinton 24-46kV Refurbishment. Refurbish 7.25 miles of 46kV including wood pole replacements. Remove part of the segment still going to the Westmorland substation site.
- Project C046457, Ballston – Shore Rd. Refurbishment.
- Project C046459, Deerfield-Whitesboro 26-46kV Refurbishment. Refurbish 5.3 miles of line including steel towers, wood poles and overhead ground wire due to deterioration.
- Project C046460, Varick – Bristol Hill 202 – 34.5kV Refurbishment.
- Project C046465, Phillips – Barker 301 34.5kV Refurbishment. Refurbish 7.5 miles of 34.5kV line by replacing/modifying approximately 173 structures.
- Project C046466 Phillips-Telegraph Road 304 34.5kV Refurbishment. Replace wood poles.
- Project C046469, Dake Hill-W. Salamanca 816-34.5kV Refurbishment. Refurbish 16.3 miles of 34.5 kV line including pole replacements and overhead conductor.
- Project C050292, Bagdad – Drake Hill 815 – 34.5kV Refurbishment and reconductor small copper conductor.
- Project C050320, Union-Ausable Forks 36-46kV Refurbishment. Replace wood poles on 10-mile radial circuit.
- Project C050322, Woodard – Teall 32 – 34.5kV Refurbishment/line feeds Central Regional Control Center along the 24 line.
- Project C050323, Mechanicville-Schuylerville 4 Retirement. Retire part of line after Schuylerville Station retirement.
- Project C050324, Union – Lake Colby 35 46kV Refurbishment. Refurbishing 46kV line by replacing structures.
- Project C050326 Homer Hill – Nile 811 – 34.5kV – Line Refurbishment

- Project C050959, Elbridge-Jewett 31 34.5kV Refurbishment. Replace steel towers crossings and wood poles.
- Project C052511, Barker-Lyndonville 301 Refurbishment. Refurbish 9.7 miles of 34.5kV line including 185 structures.
- Project C052512, Lyndonvile – Medina 301 34.5kV Refurbishment. Refurbishing 7.6 miles of 34.5kV line. Also, reconductoring in select places.
- Project C058579, Trenton-Whitesboro 25-46kV Refurbishment. Refurbish a 12-mile section of this 46kV line from Marcy Hospital to Trenton Station to address reoccurring momentaries within this section.
- Project C074003, Old Forge-Raquette Lake 22-46kV. Partial relocation of line using tree wire.
- Project C074322, Lighthouse Hill Sub-T Line Relocation. Relocating the Lighthouse Hill to Mallory 22 & the Lighthouse Hill to Camden 21 34.5kV lines due to the rebuild of the Lighthouse Hill Substation
- Project C074485, Relocate 46kV lines to new Inghams substation location as part of the Inghams Station Revitalization project.
- Project C074502, Hartfield-S. Dow 859-34.5kV. Refurbish 34.5kV line. Scope removed from mainline refurbishment Project C033180.
- Project C075852, McIntyre – Hammond 24 23kV Relocation. Relocate 2 sections of 23kV line for better access.
- Project C077028, Boonville – Alder Creek 21 46kV Refurbishment/Relocate. Refurbish/Relocate and improve access for 46kV line.
- Project C078197, Ridge – Shaleton 610 34.5kV Relocation. Ridge-Shaleton 610 tap to Slade Rd. and Shaleton-North Angola 856 Relocation due to transmission line refurbishment project. Relocating 34.5kV line due to T-Line refurbishment project of the 141 & 142 Gardenville to Dunkirk 115kV lines.
- Project C081634, Telegraph-Medina 302&303 Refurbish 34.5kV
- Project C081705, Attica-Wethersfield 209 34.5kV Refurbishment
- Project CD00898, West Milton Tap – 34.5kV new line to West Milton from Rock City Falls to allow the retirement of existing line which is in poor condition and is solely used to serve this customer.
- Project C046439:Solvay/Woodard-Ash st 27&27&28- Line Refurbishment
- Project C046442: Queensbury-Henry Street 14-34.5kv Line Refurbishment
- Project C046451:Tonawanda Lines 601-604-23kv Line Refurbishment, Areal Cable and static wire replacement.
- Project C046452: Tonawanda Lines 622-624-23kv Line Refurbishment, and Areal Cable replacement
- Project C046456: Epratah-Caroga 2-23kV Line Refurbishment
- Project C050197: Fort Covington-Malone 26-34.5kV Line Refurbishment
- Project C055164: Scotia-Rosa Rd 6, 34.5kV Line Refurbishment
- Project C060445: Woodard 24 Refurb N.-I90 Line Refurbishment

- Project C083835: Trenton Middleville24- Structure Relocation
- Project C083971: Pebble Hill-Tilden 32 34.5kV Line Refurbishment
- Project C083975: Oakfield-Caledonia 201 34.5 Line Refurbishment
- Project C084009: Chestertown-Schroon 3 34.5kV Line Refurbishment
- Project C084012: Warrensburg-Chestertown 6 Line Refurbishment
- Project C084014: North Lakeville-Ridge 218 Line Refurbishment
- Project C084016: Golah-N. Lakeville 216-217 Line Refurbishment
- Project C084020: N.Akron-Attica 225 34.5kV Line Refurbishment
- Project C084068: Saratoga-Ballston 10 34.5kV Line Refurbishment
- Project C084189: Ransomville-Phillips 402 Line Refurbishment
- Project C084194: Mallory-Cleveland 31 34.5kV Line Refurbishment
- Project C084250: WHITESBORO-SCHUYLER No 29 Line Refurbishment

Underground Cable

Various projects are completed each year to refurbish or replace sub-transmission underground assets to ensure the system continues to perform in a safe and reliable manner.

Buffalo

A major program is on-going to replace 23kV cables in the City of Buffalo. The existing distribution system in the City of Buffalo was built starting in the 1920s and is supplied by four terminal stations: Sawyer, Seneca, Kensington and Elm Street. The 23kV cable system represents about 144 miles of underground cables and supplies over forty 4.16kV distribution substations. Approximately 128 miles of the original 1-3/C-350kcmil CU PILC (paper in lead covered cable) installed in the late 1930s are still in service. As time progresses, the aging cables experience continued mechanical stress due to annual loading cycles and eventually fail, causing interruptions.

Drivers:

Failures of individual sub-transmission cables do not typically impact customer reliability since the portions of the system where they are utilized are generally networked. However, because these systems are located below ground and are out of sight, failures of underground sub-transmission cables can be difficult to locate and time-consuming to repair leaving the system at risk.

There are approximately 344 miles of sub-transmission underground cable. Approximately one-half are more than 48 years old, and one-third are more than 60 years old. The sub-transmission underground cable asset replacement program replaces cables that are in poor condition, have a history of failure or of a type known to have performance issues.

Customer Benefits:

Cable replacement projects reduce the likelihood of in-service cable failures and resulting exposure to the risk of extended outages.

2019 to 2020 Variance:

The projected program investment is shown in the table below. The variation year on year is due to the scope and timing of specific projects and load growth in the area.

Table 3-9
Underground Cable
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.6	0.0	3.8	3.2	5.2	-	13.7
2020	-	1.4	1.0	1.1	1.4	2.4	7.3

The following specific projects have forecasted spending that exceeds $1 million in any fiscal year:

- Project C081761, 23kV UG Cable 10E replacement of target sections of cable starting at Elm Street Station.
- Project C079450, Buffalo 23kV Reconductor – Huntley replacement of Cable 11H along with targeted section of 12, 14 and 15H

3. E. Reliability

Reliability
Reliability projects are required to ensure the electric network has sufficient operability to meet the demands of the system and our customers. Projects in this spending rationale are intended to improve performance of facilities where design standards have changed over time, and to provide appropriate degrees of system configuration flexibility to limit adverse reliability impacts of contingencies. The Company has instituted planning criteria for Load at Risk following an N-1 contingency that sets MW and MWh interruption exposure thresholds (“MWh Violations”) for various supply and feeder contingencies for the purpose of setting a standard for minimum electrical system performance. These thresholds are applied in conjunction with other criteria—such as maintaining acceptable delivery voltage and observing equipment capacity ratings—to ensure the system operates in a reliable manner while managing risk of customer interruptions to an acceptable level.

MWh thresholds have been identified for three specific contingencies. For loss of a single substation supply line, a maximum interruption load limit of 20MW and/or 240MWh is specified, assuming that the line can be returned to service within 12 hours. For loss of a single substation power transformer, a maximum interruption load limit of 10MW and/or 240MWh is specified, assuming that the transformer can either be replaced or a mobile unit installed within 24 hours. Analysis of the interruptions under these criteria assume that any and all practical means are used to return load to service including use of mobile transformers and field switching via other area supply lines and/or area feeder ties. MWh analysis recognizes the approximate times required to install mobile/back-up equipment as well as stepped field switching, *i.e.*, moving load from the adjoining in-service station with feeder ties, that will be used to pick up customers experiencing an interruption, to a second adjoining station to increase the capability of the feeder ties.

The projected investment for sub-transmission work in the Reliability spending rationale over the Plan period is shown in Table 3-10 below.

2019 to 2020 Variance:
The variances between the 2019 and 2020 Plans shown in the table below, as well as variances in the scope and timing of specific projects in this category are described below.

Table 3-10
Reliability
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	4.4	0.7	1.0	2.8	0.3	-	9.1
2020	-	0.7	1.2	0.7	3.1	0.4	6.1

The following specific projects classified as Reliability are estimated to have spending in excess of $1 million in any fiscal year:

- Project C046510 LN863 Findley Lake – French Creek – Peek'n Peak requested to transfer service supply from distribution to sub-transmission. To increase the reliability and feed to Peek'n Peak, it is recommended to close the sub-transmission loop between Findley Lake and French Creek substations. This project extends line 863 between Findley Lake and French Creek substations to create a closed loop.

3. F. Resiliency

Resiliency:
Resiliency projects are intended to ensure the electric power system can recover quickly following a disaster or, more generally, the ability to prepare for extraordinary and high-impact, low-probability events and rapidly recovering from these disruptive events. Historically, reliability and resiliency projects were detailed under the Reliability spending rationale. In 2020, the Company recognized the importance of highlighting Resiliency as its own category with three core concepts; damage prevention, system recovery, and survivability. Damage prevention refers to the application of engineering designs and advanced technologies that harden the distribution system to limit damage. System recovery refers to the use of tools and techniques to quickly restore service to as many affected customers as practical. Survivability refers to the enhanced system planning or use of innovative technologies to aid customers, communities, and institutions in continuing some level of normal function without limited access to the grid. The main program within this rationale is Sub-Transmission Automation. Sub-Transmission Automation is a method of systematically installing devices upon the Sub-Transmission system which will reduce the number of customers interrupted for an extended period from a disruptive event.

2019 to 2020 Variance:
The variances between the 2019 and 2020 Plans shown in the table below, as well as variances in the scope and timing of specific projects in this category, are described below. As the Resiliency spending rationale is new, the variance will be the total amount shifted from the Reliability rationale with increased scope.

Table 3-11
Resiliency
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	2.8	2.0	2.6	2.2	1.3	10.8

Sub-Transmission Automation

The Sub-Transmission Automation Strategy includes advanced distribution automation methodologies as well as SCADA for reclosers, fault locators, and switches; and the interface of distribution automation enabled line devices with substation feeder breakers. It also encompasses the communication of these devices with each other and to central operations centers and database warehouses. Such devices and communications technology are referred to as Advanced Grid Applications.

Drivers:
The installation of modernized switching schemes will provide increased reliability to the sub-transmission system. The number of Advanced Grid Application switches per circuit or installation will vary depending on the number of substations the circuit supplies, the desired segmentation of the line, and the configuration of the supply system. Many of the automation schemes are unique and are developed considering an analysis of expected costs and benefits.

Customer Benefits:
Distribution lines or substations not equipped with automated sectionalizing or throw over schemes may be subject to extended service interruptions as Operations personnel must travel to the field locations to perform switching. This program provides an opportunity to continue to modernize the grid for the benefit of customers by reducing the number of customer interruptions that result from a given contingency and the time required to reconfigure the system to restore service to as many customers as possible while a faulted section of the system is being repaired.

2019 to 2020 Variance:
The projected investment is shown in the table below. Approximately $1.6M in projects have been identified. The prioritization of projects and the timing of their implementation will be based on the performance of the various individual circuits.

Table 3-12
Sub-Transmission Automation
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total

2019	0.6	0.4	0.6	0.0	0.0	-	1.6
2020	-	2.7	2.0	2.6	2.2	1.2	10.6

There are no specific projects over $1 million. The following circuits have been identified for Sub-transmission Automation:

- Akwesasne-Fort Covington #26 Line
- Malone-Fort Covington #26 Line
- Akwesasne-Nicholville #23 Line
- Nicholville-Malone #21 Line
- Phillips Rd-Medina Line 301
- Phillips Rd-Telegraph Line 304
- Albion-Brockport Line 308
- Gasport-Telegraph Line 312
- Ransomville-Phillips Line 402
- Youngstown-Sanborn Line 403
- Amherst-Sanborn Line 701
- Delavan-Machias- Line 801
- Cold Springs-Salamanca Line 804
- W Salamanca-Homer Hill Line 805
- Homer-Nile Line 811
- Sherman-Ashville 863
- Oakfield-Caledonia Line 201
- Spier-Brook Rd Line 3

3. G. Communications / Control Systems

There are no Communications/Control Systems costs currently expected for the sub-transmission system.

3. H. DER – Electric System Access

DER - Electric System Access
The DER Electric System Access rationale is being used to capture work where the Company will be supporting DG interconnections and other third party and market driven needs. DER projects in this spending rationale at the sub-transmission level include customer reimbursable DG interconnection projects.

2019 to 2020 Variance:
The projected variance in program investment is shown in the table below.

**Table 3-12
DER – Electric System Access
Program Variance ($millions)**

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.5	0.0	0.0	0.0	0.0	-	0.5
2020	-	0.0	0.0	0.0	0.0	0.0	0.0

There is no specific project in this category estimated to have spending in excess of $1 million in any fiscal year.

3. I. Non-Infrastructure

There are no Non-Infrastructure costs currently expected for the sub-transmission system.

Chapter 4. Distribution System

The Company's distribution system consists of lines and substations typically operating at 15kV and below. There are over 36,000 circuit miles of overhead primary wire and over 7,500 circuit miles of underground primary cable on the system supplying approximately 410,000 overhead, padmount and underground distribution transformers. Additionally, there are 524 substations providing service to the Company's 1.6 million electric customers.[9] The current five-year plan for distribution is shown in Table 4-1.

Table 4-1
Distribution System Capital Expenditure by Spending Rationale ($millions)

Spend Rationale	FY21	FY22	FY23	FY24	FY25	Total
Customer Request / Public Requirement	115.8	114.5	118.2	127.4	128.4	604.3
Damage / Failure	62.3	58.9	59.4	62.7	63.4	306.7
System Capacity	19.9	32.1	31.7	26.9	23.5	143.0
Asset Condition	99.2	111.2	141.4	126.4	134.2	612.4
Reliability	29.5	27.2	26.6	23.0	26.5	132.8
Resiliency	11.6	31.6	33.0	40.1	43.9	160.2
Communications / Control Systems	15.8	25.4	59.9	102.6	116.9	320.6
DER - Electric System Access	0.0	2.1	5.0	5.3	7.1	19.5
Non-Infrastructure	3.5	3.6	3.6	3.7	3.8	18.2
Total	**357.8**	**406.6**	**478.7**	**518.1**	**556.6**	**2,317.8**

4. A. Customer Requests/Public Requirements

Distribution Customer Requests/Public Requirements projects include capital expenditures for new business residential, new business commercial, outdoor lighting, and third-party attachments, among other things. Customer Requests/Public Requirements investment levels are based primarily on review of historical blanket spending and forecasted spending on known specific work. These estimates reflect consideration of inflation, estimates of materials, labor, indirect cost, market sector analysis, overall economic conditions and historical activity.

[9] The distribution system data were retrieved from the National Grid Asset Information Website at: http://infonet2/OurOrganisation/NetworkStrategyUS/AssetManagement/Pages/BlueCard.aspx?mid=15 (last accessed January 7, 2019). Substation data were retrieved from the Substation Engineering Services Website at: http://us3infonet/sites/sed/Pages/SubstationStats.aspx (last accessed January 7, 2019).

The projected investment is shown below.

Table 4-2
Customer Requests/Public Requirements Spending Rationale
Variance Summary ($millions)

	CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
Blankets	2019	82.6	84.1	86.1	87.9	89.7	-	430.4
	2020	-	115.8	114.5	118.2	127.4	128.4	604.3
Specific Projects	2019	30.3	22.3	24.5	24.1	26.9	-	128.2
	2020	-	30.2	25.8	27.0	34.3	33.0	150.3
Advanced Metering Infrastructure (AMI)[10]	2019	1.3	7.2	58.0	85.7	87.5	-	239.7
	2020	-	0.0	0.0	0.0	0.0	0.0	0.0
Total	2019	114.3	113.6	168.5	197.7	204.1	-	798.2
	2020	-	145.9	140.3	145.3	161.7	161.4	754.6

Blankets:
The distribution Customer Requests/Public Requirements blankets include items such as New Business Residential, New Business Commercial, Outdoor Lighting, Public Requirements, Transformer Purchase and Installation, Meter Purchase and Installation, Third Party Attachments, and Land Rights. Exhibit 3 shows the detailed investment for all blankets in this rationale. Blankets are described in more detail below.

New Business Residential
Installation of new overhead or underground services to residential customers, reconnections as well as miscellaneous equipment related to providing or upgrading services based on customer requests. Project spending can also include costs for the extension of distribution feeders directly related to providing service to a new residential customer or development; and actual spending is net of any contribution in aid of construction ("CIAC").

New Business Commercial
Installation of new services to commercial customers, reconnections as well as miscellaneous equipment related to providing or upgrading services based on customer requests. Project spending can also include costs for the extension of distribution feeders directly related to providing service to a new commercial or industrial customer or development; and actual spending is net of any CIAC.

The following specific projects are classified as New Business Commercial and are forecasted with planned spending in excess of $1 million in any fiscal year.

[10] Advanced Metering Infrastructure (AMI) changed spending rationale from Customer Request / Public Requirement in the 2019 Plan to Communications / Control Systems in the 2020 Plan.

- Projects C069927 NEW LED WEST NY, C069886 NEW LED CENTRAL NY, C069947 NEW LED EAST NY for converting street lights to light-emitting diode (“LED”) technology.
- Project C080805: Electric Transport Initiative: This Plan includes a comprehensive EV program to be proposed in the Company’s upcoming Rate Case. This comprehensive Program addresses two key areas for capital investment needed to help meet the state’s CLCPA and Zero Emission Vehicle goals. This includes: A Commercial/Multi-User “make-ready” program to significantly increase the number of charging ports at multi-user sites such as workplaces, retail locations, and public parking areas, in the Company’s service territory, a Fleet program to assist fleet operators in electrifying their light duty and medium-heavy duty vehicles through advisory services, and “make ready” infrastructure support.
- C081864: Schenectady Smart City: This Project will complete remaining installations from Phase 1 and plan to begin work for the remainder of the city, which comprises of approximately 1,800 streetlights and smart city technologies.

Table 4-3
LED Investment Plan ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	7.0	7.0	7.0	7.0	7.0	-	35.0
2020	-	7.0	7.0	7.0	7.0	7.0	35.0

Transformer Purchase
Transformers are purchased and shipped to Company locations where they are put into stores.

Meter Purchase
Meters are purchased and shipped to Company locations where they are put into stores.

Meter Installation
Meters are installed or replaced at customer metering points to maintain equipment compatibility and readout accuracy.

Public Outdoor Lighting
Street lighting or private area lighting and related equipment is installed or replaced.

Public Requirements
Overhead and underground facility relocations resulting from bridge or roadway rebuilds, expansions, or relocations; municipal requests to relocate overhead facilities underground; and other public authorities requesting or performing work that requires equipment or facilities to be relocated.

Third Party Attachments
Rework or installation of facilities on poles to fit new or third party attachments; also used for cable company requests.

Specific Projects:
The following specific project is classified as Customer Requests/Public Requirements and is forecasted with planned spending in excess of $1 million in any fiscal year.

- Project C053443 Village of Clayton Downtown – OH – UG is the Village asked the company for this project to enhance the downtown aesthetics for tourism. Removing sections of Overhead and replacing with Underground and upgrading services to customers.

4. B. Damage/Failure

Damage/Failure projects are required to replace equipment and restore the electric system to its original configuration and capability following a damage or failure incident.

Damage may be caused by storms, vehicle accidents, vandalism, or other unplanned events. Damage/Failure spending is typically mandatory work that is non-discretionary in terms of scope and timing.

The Damage/Failure investment level for the distribution system is primarily based on historical actual costs for such work. Where condition renders an asset unable to perform its intended electrical or mechanical function on the delivery system, the Company initiates the timely replacement of such asset under the Damage/Failure spending rationale.

2019 to 2020 Variance:
Comparison of the distribution Damage/Failure investment levels from the 2019 and 2020 Plans is set forth below.

Table 4-4
Damage/Failure Spending Rationale
Variance Summary ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	49.1	48.8	51.5	52.0	57.8	-	259.3
2020	-	62.3	58.9	59.4	62.7	63.4	306.7

The following specific projects are classified as Damage/Failure and have planned spending in excess of $1 million in any fiscal year. Details on the planned spending profiles for these projects are included in Exhibit 3.

- Project C054834: Install 3x3-5” duct line from MH 8-1E to MH 8-3 along South State Street between Harrison Street and West Adams Street, Syracuse.
- Project C083648, Cobleskill TB2. This project is for the replacement of one transformer at Cobleskill Substation due to equipment failure.
- Project C083337, Grand Island Station 64 Transformer 2. This project will provide the replacement of one transformer at Grand Island Substation.

4. C. System Capacity

System Capacity projects are required to ensure the electric network has sufficient capacity, resiliency, or operability to meet the growing and/or shifting demands of the system and our customers. Projects in this spending rationale are intended to reduce degradation of equipment service lives due to thermal stress and to improve performance of facilities where design standards have changed over time. In addition to accommodating load growth, the expenditures in this rationale support the installation of new equipment such as capacitor banks to maintain the requisite power quality required by customers. Volt-Var Optimization ("VVO") investments also are included in the System Capacity spending rationale. The projected distribution investment in the System Capacity spending rationale over the Plan period is shown in the table below.

2019 to 2020 Variance:
The projected investment is shown in the table below. The variances between the 2019 and 2020 plans shown in Table 4-5, below, reflect variation in the scope and timing of specific projects in this category.

Table 4-5
System Capacity Spending Rationale
Variance Summary ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	23.8	29.9	39.2	35.1	34.4	-	162.4
2020	-	19.9	32.1	31.7	26.9	32.5	143.0

Load Relief:

Drivers:
Reviews of the distribution system, including substation and feeder loading, are performed annually to assess equipment utilization. The reviews take into account normal equipment loading to identify anticipated violations. Forecasted load additions are applied to historical data and the system is analyzed to determine where and when constraints are expected to develop. Recommendations for system reconfiguration or system infrastructure development are created as part of these annual reviews to ensure load can be served during peak demand periods and are documented in the Annual Capacity Plan.

The normal loading assessment identifies load relief plans for facilities that are projected to exceed 100 percent of normal capability (*i.e.*, maximum peak loading allowed assuming no system contingencies). Projects created as a result of the review are intended to be in-service during the year the violation is identified. Over the next ten years, load growth is expected to be relatively flat at 0 percent per year after weather normalization to the 95/5 forecast. The forecast incorporates anticipated effects on demand due to solar and energy efficiency investments. Although we expect minimal load growth across the Company's service territory as a whole, it is anticipated that localized load increases will occur due to new service requests.

The Annual Capacity Plan reviews loading on over 2,000 feeders and more than 400 substations and results in numerous upgrade projects that range in scope from switching load between feeders and/or substations to new lines or substations.

Customer Benefits:
The benefit to customers of completing the work identified in capacity planning studies includes less exposure to service interruptions due to overloaded cables and transformers.

The projects resulting from these studies are typically classified as Load Relief. Other program classifications are possible. Even though a project is classified in one program, it may have multiple drivers.

2019 to 2020 Variance:
The projected investment is shown in the table below and variation year on year is due to the scope and timing of specific projects.

Table 4-6
Load Relief
Program Variance ($millions)

	CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
Specific Projects	2019	19.3	22.8	29.9	24.6	23.9	-	120.6
	2020	-	12.7	24.9	23.6	18.6	24.1	103.9
Load Relief Blankets	2019	1.9	2.0	2.0	2.1	2.1	-	10.1
	2020	-	1.9	1.9	2.0	2.0	2.1	9.8
Total	2019	21.2	24.8	32.0	26.7	26.0	-	130.7
	2020	-	14.6	26.8	25.6	20.7	26.1	113.8

The following specific projects are classified as Load Relief and have planned spending in excess of $1 million in any fiscal year. Details on the planned spending profiles for these projects are included in Exhibit 3.

- Projects C076785 and C076797, Sodeman Road 51 and 54 feeder construction. These projects provide for the feeder reconductoring, reconfiguration, and associated work for two new feeders at Sodeman Road substation. These projects and associated projects will resolve loading above the summer normal rating of the existing substation transformer, MWh criteria violations, and distribution feeder loading issues.
- Projects C046538, and C048015, Eden Switch Structure. This project and associated projects provide the installation of a new 34.5-13.2kV station near the existing Eden Switch Structure as well as the construction of new feeders to address loading and reliability concerns in the area.

- Projects C074909, and C074911, 3012 substation. This project and associated projects will provide for substation, sub transmission line, and distribution line work to address loading concerns in the area.
- Projects C053137, and CD00893, Forbes Ave substation. These projects will provide for a new 115/13.2kV substation and four distribution feeders in the City of Rensselaer, NY for the relief of load growth due to the proposed underground commercial development in the area.
- Project C052344, Thousand Islands 81452 rebuild. This project will provide for the conversion of sections of single phase 7.62kV and 4.8kV to 3 phase 13.2kV to address the overloading on a step-down ratio transformer.
- Project C046563, Gilbert Mills substation. This project provides for the upgrade of transformer bank one (1) to a 15/20/25MVA transformer and includes the installation of EMS at the station.
- Project C084001, this project is to create a 3-phase, 13.2kV tie between the Johnson Rd 53 feeder and the Maplewood 51 feeder along US Rte. 9.
- Projects C083927, C083911, C083928, and C083929, these projects will provide for a new substation transformer, feeder getaways, express feeds, and the conversion and replacement of two existing 4.16kV feeders at New Krumkill substation. This project and associated projects will resolve loading issues and MWh criteria violations in the area.
- Project C078428, Union Falls substation rebuild. This project and associated projects will provide for the installation of new circuit breakers, disconnect switches, and a new substation transformer.
- Project C083844, this project encompasses the rebuild and conversion to 13.2kV of overhead feeders from the Liberty St substation in downtown Troy, NY.
- Projects C083916, and C083920, these projects will provide for a station rebuild with a new station transformer as well as new feeder getaways at Delmar substation. This project and associated projects will resolve loading issues and MWh criteria violations in the area.
- Project C084110, this project will provide for a new second transformer bank at West Adams substation to eliminate MWh violations and provide additional capacity.
- Project C082332, this project will provide for a new second transformer bank at Malone substation to eliminate MWh violations.

Volt-Var Optimization / Conservation Voltage Reduction (“VVO/CVR”):
VVO/CVR is a distribution level program where voltage control devices, such as capacitors and voltage regulators, are intelligently controlled in a coordinated manner to optimize the performance of the distribution system. This program is designed to reduce both customer and system power and energy consumption.

VVO refers to a process whereby the voltage and reactive power flow of the distribution system are optimized to improve the voltage management and power factor on a distribution feeder and potentially increase hosting capacity for DER. CVR refers to a process whereby voltage regulating devices are controlled to operate the feeder at the lowest possible voltage range within allowable standards to generate customer energy savings.

The first VVO/CVR efforts are incorporated into the Company's Clifton Park demonstration project with an in-service date of April 2019. The Company also initiated a statewide rollout in FY20, deploying VVO/CVR on three substations and 12 feeders due for completion by summer 2020 and a further. 4 substations and 26 feeders are planned for FY21 As an extension of the program, an additional 94 distribution circuits from 21 substations across the NY divisions (West, Central, and East) could be targeted between FY22-25 for enhancement through the installation of capacitors, voltage regulators, and line voltage monitors and the addition of telecommunications and control through a centralized server, depending on the relative costs and benefits of such deployments. In addition, the company plans to deploy greater numbers of standalone switched shunt capacitor banks in areas with poor power factor to relieve capacity and reduce system losses. Over time it is expected the controls of the capacitor bank additions will be integrated into ADMS for optimal real time control.

Drivers:
The Company has historically managed voltage primarily with the use of autonomously controlled Load Tap Changing Transformers ("LTC"), line regulators, and capacitors. When installed, regulators are typically programmed to maintain a specific voltage at its location as specified by a distribution planning engineer. Capacitors, when installed, are typically switched per settings programmed by a distribution planning engineer. Historically capacitors were fixed and manually switched on and off the circuit seasonally or as needed.

The primary driver of this project is to provide more efficient and higher quality power by monitoring the voltage performance across the system in real time and automating the control of the various voltage regulating devices through an integrated centralized control scheme. The VVO/CVR program adds a layer of coordination, via communication and control, to optimize the use of regulators, capacitors, and line voltage monitors to respond to system dynamics in real time. Over time smart inverters are likely to also form part of the VVO/CVR scheme as more DER is integrated into the system and will be evaluated through a NYSERDA PON 4128 project.

Customer Benefits:
There are several anticipated benefits of a VVO/CVR deployment:

- Improved feeder power factor, flatter voltage profiles, reduced feeder losses, reduced peak demand, and reduced energy consumption by customers. The estimated reduction in power and energy consumption is expected to be approximately 3% but will vary based on the individual feeder characteristics.
- The increased near real time operational data made available to the regional control centers, via data collected from automated capacitors and regulators as well as line voltage monitors, will support the improved management of the distribution system and assist in the integration of future distributed energy resources.
- Actively maintaining proper voltage via an automated and centralized control will improve feeder voltage performance, keeping the voltage flat and low, potentially increasing hosting capacity and allowing for greater levels of DER.
- Modern electrical equipment, including air conditioning, refrigeration, appliances, and lighting are designed to operate most efficiently at 114V. Delivering voltages at the optimal levels will reduce energy consumption, improve service quality, and lower costs.

2019 to 2020 Variance:
The projected capital investment is shown in the table below. The Company continues to observe the performance of initial VVO efforts and expects to continue statewide deployment on select feeders each year through FY25.

Table 4-7
Volt-Var Optimization / Conservation Voltage Reduction ("VVO/CVR")
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	2.5	5.2	7.3	8.4	8.4	-	31.7
2020	-	5.2	5.3	6.1	6.2	6.4	29.1

The following specific projects are classified as Volt-Var Optimization / Conservation Voltage Reduction and have planned spending in excess of $1 million in any fiscal year. Details on the planned spending profiles for these projects are included in Exhibit 3.

- Projects C077098, C077097 and C082361, NY VVO Central, East and West – D line and projects C076103, C076088 and C076105, NY VVO Central, East and West – Substation. These projects cover the NY VVO program across the Company's New York service territory which will improve distribution system efficiency and reduce both peak demand and energy consumption where deployed.

4. D. Asset Condition

Planned asset condition investment levels for the distribution system, and comparison to investment levels from last year's Plan, are shown below.

2019 to 2020 Variance:
The variance between the 2019 and 2020 Plans is based on the scope and timing of the specific projects in this category as discussed following the table below.

Table 4-8
Asset Condition Spending Rationale
Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	82.9	98.9	104.6	101.8	97.8	-	485.8
2020	-	99.2	111.2	141.4	126.4	134.2	612.4

Funding levels for the programs and projects included in the Asset Condition rationale are presented below.

Inspection and Maintenance:

The Company performs visual inspections on all overhead and underground distribution line assets once every five years. Each inspection identifies and categorizes all necessary repairs, or asset replacements, against a standard and in terms of criticality to maintain customer safety and reliability in compliance with the Commission's Safety Order in Case 04-M-0159.[11] The Company also performs annual contact voltage testing per the Commission's Safety Order on all facilities that are capable of conducting electricity and are publicly accessible, such as street lights.

2019 to 2020 Variance:

Current investment forecasts are based on actual expenditures being incurred with the on-going Inspection and Maintenance program. The decrease in future variance in this year's Plan compared to last year relates primarily to an expected decrease in the amount of work identified in the third inspection cycle.

Table 4-9
Inspection and Maintenance
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	34.3	34.3	34.9	34.9	34.9	-	173.3
2020	-	34.3	35.3	33.2	33.0	35.9	171.7

Primary and Secondary Underground Cable:

A strategy has been implemented for the proactive replacement of underground cable on the Sub-Transmission, Distribution Primary and Distribution Secondary systems in all three divisions of the upstate New York service territory. Sub-transmission and Distribution cable replacements will be completed through a series of specific projects targeting cables based on their past performance, history of failures, asset age, cable construction, design deficiencies, loading, and critical customers served. A single program funding number in each Division will be used for secondary cable replacement. Additionally, cable replacements in support of new customer development and public works projects are also anticipated.

Drivers:

The proactive replacement of electric utility assets such as aged underground cable is expected to reduce the risk of failures or unplanned events and enhance the reliability and capacity of the overall system.

Customer Benefits:

Cable systems are often designed with greater redundancy than overhead systems, and cable failure often has a limited impact on customer reliability statistics. However, if cable performance deteriorates significantly, the likelihood of concurrent failures increases. Cable failures can result in increased operation and loading on parallel equipment, further increasing the risk of failure on the rest of the system. The consequences of multiple secondary network failures or multiple sub-

[11] Case 04-M-0159, Proceeding on Motion of the Commission to Examine the Safety of Electric Transmission and Distribution Systems, Order Adopting Changes in the Electric Safety Standards (issued and effective Dec. 15, 2008, revised in March 2013) ("Safety Order").

transmission failures would be significant. Proactive replacement of aged cable in these systems is expected to reduce the risk of concurrent failures and the potential for large scale customer outages in urban areas, including critical loads such as police, fire and hospitals.

2019 to 2020 Variance:
The projected program investment is shown below.

Table 4-10
Primary and Secondary Underground Cable
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	5.5	5.6	7.6	5.5	6.0	-	30.1
2020	-	5.5	5.4	16.1	12.8	12.8	52.6

The following specific projects are classified as Primary and Secondary Underground Cable program and have planned spending in excess of $1 million in any fiscal year. Details on the planned spending profiles for these projects are included in Exhibit 3.

- Project C036468, Riverside 28855 UG Cable replacement. This project provides for the replacement of approximately 4 miles of cable and conduit and manhole system to address deterioration and reliability concerns.
- Project C077338, Cable Replacement Ntwk Sec NYW. This project provides for the proactive replacement of targeted sections of low voltage network cable in Western NY.
- Project C078270, Cable Replacement Ntwk Sec NYE. This project provides for the proactive replacement of targeted sections of low voltage network cable in Eastern NY.

Buffalo Streetlight Cable Replacement:
This program promotes safe and reliable underground street light service by replacing faulty street light cables and conduit.

Drivers:
This program systematically replaces deteriorated street light circuit cable in the Buffalo area to address repetitive incidents of elevated voltage as determined through periodic testing under electric operating procedure NG-EOP G016. The underground street light cable system in the Buffalo metropolitan area is comprised of a variety of electrical cable types and wiring configurations that have been in service for more than 50 years. In areas with old street light cable, elevated voltage testing continues to identify elevated voltage incident rates that are from 2 to 20 times the rates measured in other areas in the Company's service territory. Areas that have had the street light cable replaced through this program are not experiencing Elevated Voltage incidents.

The primary driver for elevated voltage in this area is the deteriorated physical condition of the street light cable, and installation of new circuitry has resulted in a dramatic reduction of Elevated Voltage incidents associated with that street light infrastructure.[12]

Customer Benefits:
This work will provide more reliable street light service and reduce the incidence of elevated voltages in the Buffalo area.

2019 to 2020 Variance:
The Company expects to spend approximately $2.5M annually under this program. This is a slight increase from the prior plan. The projected investment is shown in the table below.

Table 4-11
Buffalo Streetlight Cable Replacement
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	2.5	2.5	2.5	2.5	2.5	-	12.5
2020	-	2.5	2.5	2.5	2.5	2.5	12.5

<u>Substation Asset Condition Programs:</u>
Substation assets frequently have long lead times and require significant projects in terms of cost, complexity and project duration for replacement or refurbishment. Consequently, it is often more efficient as well as cost effective to review an entire substation. Further, where there are asset condition issues that indicate replacement as an option, the Company reviews planning and capacity requirements to ensure alternative solutions are evaluated, such as system reconfiguration to retire a substation.

<u>Substation Power Transformers:</u>
Power transformers are large capital items with long lead times. Their performance can have a significant impact on reliability and system capacity. Condition data and condition assessment are the key drivers for identifying replacement candidates. Replacements are prioritized through a risk analysis which includes feedback from operations personnel. The distribution element covers transformers which are identified as replacement candidates through the test and assessment procedure. A 'Watch List' of candidate transformers has been identified and recorded in the 2019 Asset Condition Report.

Drivers:
Power transformers are evaluated based on visual inspections and routine testing performed per the Company's Electric operating and maintenance procedures. Each unit is given a condition code based on individual transformer test and assessment data, manufacture/design and available operating history. Higher codes relate to transformers which may have anomalous condition; units with a higher code are subject to more frequent monitoring and assessment and are candidates for replacement on the Watch List.

[12] Electrical connections associated with unauthorized 3rd party attachments to the street lighting electrical system recently have been determined to be the source of an increasing number of elevated voltage incidents in Buffalo.

Customer Benefits:
The impact of power transformer failure events on customers is historically substantial. By proactively replacing units in poor condition there will be direct benefits to customers in reduced impact of power transformers on performance.

2019 to 2020 Variance:
The projected program investment is shown below. Through on-going review of the distribution substation transformer fleet, new problems are identified. Replacement costs and related annual investment will vary based upon the size of the transformer to be replaced. In addition, re-phasing of projects and their timelines has contributed to the variance.

Table 4-12
Substation Power Transformers
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	3.7	4.9	4.2	3.5	5.4	-	21.7
2020	-	5.1	7.8	6.9	3.1	1.5	24.4

The capital investment plan in Exhibit 3 shows the current list of transformers expected to be replaced within the next five years. The following specific projects are expected to exceed $1 million in any fiscal year:

- Project C046670, Station 124 Transformer Replacement. This project provides for the replacement of four transformers.
- Project C050746, Galeville Station Rebuild. Several asset condition issues were identified at Galeville Substation. Transformer with LTC is 1958 vintage with slight increase in gas.
- Project C081420, Liberty St 34.5/13.8kV Subs Transformer. This project provides for the replacement of one power transformer. This project will also address other asset condition issues at the substation, replacing targeted and deteriorated equipment.
- Project CD01139, Raquette Lake Transformer Upgrade, will replace the existing (3)-333KVA 46:4.8kV substation transformer with 46/4.8 kV 2.5 MVA padmouted transformers.
- Project C083223, Stoner Station TB1. This project will replace one transformer based on test results that indicate a trend towards equipment failure.
- Project C082713, Station 79 Rebuild. This project will rebuild Station 79 due to asset condition concerns of the transformers, circuit breakers, bus, and disconnects.
- C081418, Smith Bridge Station Transformer & Metalclad. This project provides for the replacement of one power transformer and replacement of the switchgear.

Indoor Substations:
The purpose of this strategy is to replace, retrofit, or retire the twenty-one remaining indoor distribution substations. The indoor substations were built in the 1920s through the 1940s. These substations have inherent safety risks due to design and equipment condition. Fourteen of these indoor substations remain to be rebuilt in the City of Buffalo and five are in Niagara Falls. The

remaining two substations are located in Gloversville and Albany. Details of the asset condition issues and key drivers are outlined in the Asset Condition Report.

Drivers:
These indoor substations are obsolete. Their outmoded design does not meet current accepted safety criteria. Equipment and protection schemes are becoming unreliable in their function of interrupting faults, and in general the condition of equipment shows signs of deterioration.

Customer Benefits:
Under normal conditions, failure of obsolete indoor substation equipment could result in sustained customer interruptions until some type of replacement is installed. Equipment outages can result in increased operation and loading on parallel equipment. Indoor substations typically supply urban environments, including critical loads such as police, fire and hospitals. This program mitigates the risk for a long-term, sustained, customer interruptions occurring in these urban areas.

2019 to 2020 Variance:
The projected program investment is shown below. The spending has been modified based on a redistribution of projects and further development of the plan for each substation.

Table 4-13
Indoor Substations
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	2.6	9.3	11.2	13.4	15.6	-	52.0
2020	0.4	3.9	5.0	13.6	11.8	11.9	46.7

- In Buffalo, six indoor substation projects are expected to exceed $1 million: Buffalo Stations #30, #31, #32, #35, #38 and #53. Additional Buffalo Indoor Stations will need rebuilding after the FY21-25timeframe.
- In Niagara Falls, one indoor project is in progress: Stephenson Ave #85, and three indoor substation rebuilds are expected to exceed $1 million: Eighth Street #80, Eleventh Street #82, and Welch Station #83.

Metal-Clad Switchgear:
Deteriorated metal-clad switchgear can be prone to water and animal ingress, which lead to failures. Visual surveys will detect such degradation but cannot identify surface tracking where hidden behind metal enclosures. Identification of these concerns is more likely with electro-acoustic detection techniques. By using sensors to detect anomalous sound (acoustic) waves or electric signals in the metal-clad switchgear, it is possible to identify equipment condition concerns before failure. An initial review using this technique identified a number of locations for further action as part of this strategy. This program work is coordinated with other asset replacement programs where appropriate.

For each substation, an analysis will be conducted to determine if direct replacement is the best course of action or if there is an alternate means of supplying the load.

Drivers:
Metal-clad switchgear installed prior to 1970 has several factors that can lead to component failure. Electrical insulation voids were more prevalent in earlier vintage switchgear. Higher temperatures due to poor ventilation systems can degrade lubrication in moving parts such as breaker mechanisms. Gaskets and caulking also deteriorate over time leading to ingress of moisture.

Customer Benefits:
The impact of each metal-clad switchgear event on local customers is usually substantial, with nearly 3,000 customers interrupted for over three hours per event. This program would reduce the risk of such events and provide significant benefit to the affected customers.

2019 to 2020 Variance:
The projected program investment is shown below. The capital forecast reflects new condition assessment data and analyses that helped identify and prioritize replacement candidates. Multiple stations are in progress with a program underway to prioritize additional stations.

Table 4-14
Metal-Clad Switchgear
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	14.2	12.2	14.9	10.6	6.3	-	58.2
2020	-	6.8	10.2	20.1	22.1	22.6	81.7

The following specific projects are expected to exceed $1 million in any fiscal year:

- Project C046741, Hopkins 253 Substation Replace Metal-Clad Switchgear. This project provides for the replacement of the existing metal-clad switchgear with new equipment.
- Project C056616, Station 140 Metal-clad Switchgear. This project replaces the existing metal-clad switchgear and two power transformers with new equipment due to asset condition.
- Project C056611, Tuller Hill 246. This project replaces the existing unit substation with new equipment including a new transformer.
- Project C068290, Chrisler Station Rebuild. This project rebuilds the station, including new transformers to address deteriorated metal-clad switchgear, as well as normal and contingency loadings in the area.
- Project C056609, Avenue A 291 Metal-clad Switchgear. This project replaces two metal-clad switchgear and two stations transformers with new equipment.
- Project C056614, Pine Grove Metal-clad Switchgear. This project replaces the existing metal-clad switchgear with new equipment.
- Project C046747, Johnson Road Metal-clad Switchgear. This project replaces the existing metal-clad switchgear with new equipment.
- Project C052706, Station 162 Metal-clad Replacement. This project replaces the existing metal-clad switchgear and two power transformers with new equipment.

- Project C056612, McKnownville Metal-clad Replacement. This project replaces the existing metal-clad switchgear and one power transformer with new equipment.
- Project C080223, Prospect Hill - Replace Metalclad. This project replaces the existing metal-clad switchgear and circuit switcher with new equipment.
- Project C079534, Temple Distribution Rebuild. Rebuild Temple's distribution metal-clads to address asset condition.
- Project C081611, Blue Stores Substation. This project replaces the metal-clad switchgear, circuit switcher, and transformer with new equipment due to asset condition.
- Project C081613, Ruth Road Sta – Replace Metal-clad. This project replaces the metalclad switchgear and circuit switcher to address asset condition.
- Project C081630, Sycaway – Metalclad Replacement. This project is the replacement of the 13.2kV metalclad due to asset condition issues.
- Project C051707, Station 61 Metal-Clad Switchgear. This project is for the replacement of existing circuit breakers, transformers, and bus-work due to asset condition.
- Project C083445, Rock Cut Metalclad. This project is to replace the metalclad at Rock Cut due to asset condition issues.
- Project C084936, Metalclad Replacement Program. This program is to replace metalclad switchgear that is in poor condition. Individual units will be evaluated through various inspection or testing methods and prioritized based on condition.

Substation Circuit Breakers and Reclosers:

Certain types, or families, of breakers have been specifically identified for replacement in the next ten years. Breaker families are typically older, obsolete units that are less safe or less reliable. Certain breaker families that are targeted for replacement contain parts that must be custom machined or units that contain asbestos in the interrupting systems and require extra precautions during maintenance, refurbishment, and overhaul.

Drivers:

The approach for breaker condition coding was based on engineering judgment and experience which was supported by discussion with local Operations personnel. The units are prioritized for replacement based on the condition coding; units in poorer condition are given a higher score. Many of these breakers are obsolete.

Aged units have been specifically identified for replacement because they are difficult to repair due to the lack of available spare parts. Likewise, unreliable units have been identified for replacement to reduce the number of customer interruptions.

Customer Benefits:

In addition to providing reliability benefits, several of the targeted breaker families present opportunities to reduce hazards associated with safety and the environment (*i.e.*, oil and asbestos).

2019 to 2020 Variance:
The projected program investment is shown below. The overall spend has been modified based on lessons learned regarding scheduling, availability of resources, and a more accurate identification of breakers per station location.

Table 4-15
Circuit Breakers and Reclosers
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	3.1	2.2	2.3	2.1	2.1	-	11.8
2020	-	2.5	2.2	2.2	2.2	2.2	11.3

There is no specific project in this category forecasted with planned spending in excess of $1 million in any fiscal year.

Substation Batteries and Related:
This program mirrors the Transmission Substation Batteries and Chargers program. Battery and charger systems are needed to ensure substation operational capability during both normal and abnormal system conditions. The intent of this program is to replace battery and charger systems that are twenty years old. The 20-year limit is based on industry best practice and experience in managing battery systems. This program work is coordinated with other asset replacement programs where appropriate.

Currently, there are over 341 substation battery banks in service spread throughout all the distribution substations. To bring all battery systems to less than twenty years old within ten years would require a replacement rate of approximately thirteen per year.

Individual battery problems may be identified at any time during Visual and Operational inspections or periodic testing. Problems identified through these methods are addressed under the Damage/Failure spending rationale.

Drivers:
Failure of batteries and charger systems may result in substation protective relays and/or circuit breakers not operating as designed.

Customer Benefits:
Battery and charger system failures can result in additional customers being interrupted as back-up relay schemes at remote substations will have to isolate a fault. It may also result in equipment damage if a fault is not cleared in a timely fashion. Interruptions related to battery incidents are uncommon at this time as the replacement program is working as desired.

2019 to 2020 Variance:
The projected program investment is shown below. The budget has been adjusted to reflect the population of batteries approaching industry best practice replacement age over the next several years.

Table 4-16
Substation Battery and Related
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.6	0.7	0.6	0.6	0.7	-	3.1
2020	-	0.7	0.6	0.6	0.6	0.6	3.1

There is no specific project in this category forecasted with planned spending in excess of $1 million in any fiscal year.

Mobile Substation:
Mobile substations are key elements for ensuring continued reliability and supporting the system during serious incidents.

Drivers:
To improve the management of the mobile substation fleet, the Company conducted a review which considered system requirements, the amount of mobile usage, and the uniqueness of individual units to better understand the condition of all members of the fleet and their associated risks. Highly utilized units may present a risk if they are not properly maintained or refurbished. Further, uniquely configured units or very highly utilized units in which there is only one available unit on the system, present some risk since they may not be available for an emergency due to utilization elsewhere. Based on the review, mobile substation protection upgrades, rewinds and replacement units were recommended.

Customer Benefits:
A mobile substation or transformer is the quickest method for restoring service to customers when an outage occurs in a substation, typically occurring within sixteen to twenty-four hours. By refurbishing, upgrading, replacing and purchasing new mobile substations, as necessary, via system reviews and condition assessments, the risk of extended customer outages will be significantly reduced. In addition, properly addressing the needs of the mobile fleet will allow us to schedule maintenance for substation transformers in a timely manner since they are one of the most valuable assets on the system. Lastly, having an adequate number of mobile substations on hand will promote the completion of new construction projects on-time and on-budget.

2019 to 2020 Variance:
The projected investment is shown below. Projects have been redistributed based upon changes in asset condition and the availability of the units so that upgrade work can be performed. Also, new mobile substations are now classified as reliability.

Table 4-17
Mobile Substation
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.4	1.0	1.0	0.0	1.0	-	3.4
2020	-	0.7	0.0	0.0	1.0	1.0	2.7

The following specific projects are expected to spend in excess of $1 million in any fiscal year:

- Project C046410, NY New Mobile Substation 34.5KV. This project provides for a replacement to the 34.5kV-5.04kV 2/4 MVA MSID#3W.
- Project C066566, Rebuild 6W Mobile Substation. This project provides for replacement of the circuit switch, low voltage breaker, and upgrades to the existing control cabinet.

4. E. Reliability

Reliability:

Reliability projects are intended to ensure the electric network has sufficient operability to meet the demands of the system and our customers. Projects in this spending rationale are intended to improve performance of facilities where design standards have changed over time, and to provide appropriate degrees of system configuration flexibility to limit adverse reliability impacts of contingencies. The Company has instituted planning criteria for Load at Risk following an N-1 contingency that sets MW and MWh interruption exposure thresholds ("MWh Violations") for various supply and feeder contingencies for the purpose of setting a standard for minimum electrical system performance. These thresholds are applied in conjunction with other criteria - such as maintaining acceptable delivery voltage and observing equipment capacity ratings - to ensure the system operates in a reliable manner while managing risk of customer interruptions to an acceptable level. MWh thresholds have been identified for three specific contingencies. For loss of a single substation supply line, a maximum interruption load limit of 20MW and/or 240MWh is specified, assuming that the line can be returned to service within 12 hours. For loss of a single substation power transformer, a maximum interruption load limit of 10MW and/or 240MWh is specified, assuming that the transformer can either be replaced or a mobile unit installed within 24 hours. Finally, for loss of any single distribution feeder element, a maximum interruption of 16MWh is specified.

Analysis of the interruptions under these criteria assume that any and all practical means are used to return load to service including use of mobile transformers and field switching via other area supply lines and/or area feeder ties. MWh analysis recognizes the approximate times required to install mobile/back-up equipment as well as stepped field switching, *i.e.*, moving load from the adjoining in-service station with feeder ties, that will be used to pick up customers experiencing an interruption, to a second adjoining station to increase the capability of the feeder ties. In addition, the expenditures in this rationale are used to install reclosers that limit the customer impact associated with an interruption. It also includes investment to improve performance of the network through the reconfiguration of feeders and the installation of feeder ties. The projected distribution investment in the reliability spending rationale over the Plan period is shown below.

2019 to 2020 Variance:

The variances between the 2019 and 2020 Plans shown in the table below, as well as variances in the scope and timing of specific projects in this category, along with the shift in some funding to the new Resiliency Rationale, are described below.

Table 4-18
Reliability
Spending Rationale
Variance Summary ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	35.9	34.2	38.5	56.1	57.1	-	221.7
2020	-	29.5	27.2	26.6	23.0	26.5	132.8

The following specific projects are classified as Reliability program and have planned spending in excess of $1 million in any fiscal year. Details on the planned spending profiles for these projects are included in Exhibit 3.

- Projects C046536, Delameter Install two 20/26/33MVA transformers and Reconfigure F9352 Layout. Existing station transformer is leaking. The station transformer also violates the 240MWh criteria. The station has only one tie to an adjacent 13.2kV station (Lakeview).
- Projects C046590 Mumford 50 – Install transformer and new feeder. Mumford TB1 had 334MWh of load at risk which violated criteria in 2011. Mumford 5051, 5052 MWh criteria violation in 2011. Mumford 5051 projected overload in 2015. Brockport 7457, 7459 MWh criteria violation in 2021. Brockport Station loaded to 119% of N-1 rating in 2011. West Hamlin TB1 had 416MWh of load at risk which violated criteria in 2011. West Hamlin F8253 MWh violation in 2021.
- Projects CD00977 and CD00964, Long Road 209 Install transformer and new feeder.
- Project C079532, Underground for Temple station rebuild. Re-route underground cable for the rebuild of Temple stations.
- Projects C029186 and C029187, Station 214 – Install transformer and new feeder. In 2014, five out of the ten substations that encompass the Tonawanda Study area, exceed their transformers summer emergency rating for N-1 contingent operations. There are also multiple 23kV supply contingencies that will place three stations over their transformers' summer emergency ratings for N-1 contingent operations. Station 214 had forecasted unserved load of 8.8MVA in 2014 for a transformer or bus outage due to limited capacity at adjacent substations.
- Project C046605 and C046606, Poland 62258 Route 8 reconductor. Poland 62258 has been on the Reliability Top 5% Worst Performing feeders every year for the last 10 years. Overhead three-phase portions of Poland 62258 beyond SW X62-11 (pole 87) is small conductor that is old and brittle. Sections break free and come down at least once per year due to weather-related or equipment-related problems. Difficult for crews to repair because of the small size for its voltage class (8.32kV). Some of the sections are off road which increases restoration time.
- Project C046553, Baker St - install second transformer - Install second transformer to alleviate MWh violation.

- Project C074342, Lighthouse Hill Relocation-Distribution Line - Presently Lighthouse Hill Station is a shared facility with Brookfield Hydro Power. Assets are comingled throughout the existing stations with mutual dependencies, and there are access and operational issues at the site for both parties. The Company also has 34.5kV sub transmission and 12kV distribution circuits that originate at the station. Recommendations (from the original EDIS Request) for consideration in the Lighthouse Hill Station include: 1) Complete separation from the Brookfield Hydro assets by building a new 115kV transmission switching station; 2) Replace TB #6; 3) Upgrade the 34.5kV distribution equipment (if required); and 4) As an alternative to asset separation with a new 115kV switching station, replace all disconnect switches and lightning arrestors and the R-60 OCB.
- Project C077170, Sorrell Hill Rebuild - To relieve MWh violations at Sorrell Hill.
- Project C082032, Rebuild Ash 4160 and put on Fayette St - Ash St. 4,160 substation has multiple asset issues. Fayette St and Galeville also have asset issues and are being rebuilt to 13.2kV. Ash 4,160 will be retired, and the load placed on Fayette and Galeville.
- Project C082953, Riverside HPFF Pressurization Plant. This project will install a second pressurizing plant at Riverside substation. Allowing the Trinity-Riverside #18 and #19 115kV UG cables to remain in service in event of failure at the Trinity Sub. This project will address a potential common mode failure at existing Trinity pressurizing plant location that could affect all four UG circuits.
- Project C081423, Scotia/Glenville Industrial Park. This project will install a new 115kV/13.2kV substation inside the Glenville Business & Technology Park.
- Project C084106, Coffeen Regulators. This project would increase the capacity between East Watertown and Coffeen/West Adams to meet the remaining need.
- Project C036639, Buffalo Station 139 – Replace Transformers. This project will replace the existing 3.75/4.687MVA transformer with a 7.5/9.375MVA transformer.
- Project C046606, MV – Poland 62258 Route

Engineering Reliability Review:

An Engineering Reliability Review ("ERR") can be completed for any feeder experiencing reliability problems or any localized pocket of poor performance. ERRs are often performed on those feeders defined as Worst Performing Feeders ("WPF") as described in the Electric Service Reliability Report, filed annually in accordance with Case 90-E-1119. The scope of an ERR is typically involves:

- Review of one-year and multi-year historical reliability data for issues and trends.
- Review of recently completed and/or planned work expected to impact reliability.
- Review the need for the installation of radial and/or loop scheme reclosers.
- Review for additional line fuses to improve feeder sectionalization.
- Review of the coordination of protective devices to ensure proper operation.
- Review for equipment in poor condition.

- Review of heavily loaded equipment.
- Review for other feeder improvements such as fault indicators, feeder ties, capacitor banks, load balancing, additional switches and reconductoring (overhead and/or underground).

Drivers:
The ERR recommendations are utilized as a basis to improve reliability on circuits experiencing recent poor reliability performance.

Customer Benefits:
The ERR program improves customer reliability in areas where performance has been substandard. The ERR work also helps harden the feeder and make it more resilient.

2019 to 2020 Variance:
Projects associated with the ERR program are reactionary and are identified as reliability concerns arise. As such, specific projects are only identified in the early years of the plan. A future spending plan is created and reviewed annually to target priority projects. The planned spend for the ERR program has been reduced to accommodate higher priority projects for the next several years.

Table 4-19
Engineering Reliability Review
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	6.5	3.6	3.8	0.0	0.0	-	14.1
2020	-	2.3	1.2	0.4	0.0	0.8	4.7

There is no specific project in this category forecasted with planned spending in excess of $1 million in any fiscal year.

Minor Storm Hardening:
The Minor Storm Hardening program increases the resilience of the distribution system in areas that have experienced repeated outages during adverse weather to improve reliability performance and customer satisfaction. Work in these projects includes: reconductoring with tree resistant conductors, review of pole size and class as well as the use of Grade B construction at critical poles (junction poles, switch poles and road/rail/water crossings), additional sectionalizing points (reclosers, fuses and switches), enhanced lightning protection and enhanced vegetation management.

Drivers:
The Storm hardening recommendations are utilized as a basis to improve reliability in targeted areas that have experienced poor performance during adverse weather events.

Customer Benefits:
The Minor Storm Hardening program will enhance distribution resiliency in targeted areas.

2019 to 2020 Variance:
The projected investment and the variation between the 2019 and 2020 Plans are shown in the table below. Variance is largely due to reclassification of existing projects to align with newly developed Resiliency spending rationale.

Table 4-20
Storm Hardening
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.5	1.9	0.5	0.5	3.4	-	7.8
2020	-	0.8	0.4	0.3	0.0	0.0	1.6

There are no specific projects in this category forecasted with planned spending in excess of $1 million in any fiscal year.

Substation Flood Mitigation:
Major flood events, floodwater heights associated with such events, and specific time and location of events are inherently difficult to predict. Extensive research, analysis, examination of historical events, and Federal Emergency Management Agency ("FEMA") flood maps have been used to assess risks and facilitate the substation flood mitigation program. Substantial investment has occurred in recent years to mitigate flood risk and increase substation resiliency in accordance with FEMA recommendations and sound engineering practices. Mitigation efforts have included raising the height of vulnerable equipment, constructing barrier floodwalls surrounding substations, relocating substations out of flood-zones altogether, and the purchase of emergency flood deployment materials. The Company's Distribution Substation Flood Mitigation Program attempts to economically increase the reliability and resiliency of the electric system. Flood risks are examined with each project scope of work to improve flood mitigation when feasible.

Drivers:
Severe storms and flooding in past years have highlighted the potential vulnerability of the Company's substations. Several events in the Company's service territory have exceeded FEMA's 100-year flood height elevation and are a driving force for the program.

Customer Benefits:
Reliable power to communities during a flood event is important and has the potential to preserve extensive real and personal property (*i.e.*, individual customers' sump-pump systems, *etc.*).

2019 to 2020 Variance:
The projected investment is shown in the table below.

Table 4-21
Substation Flood Mitigation
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.1	0.0	0.0	0.0	-	0.1
2020	-	0.4	1.1	1.2	0.1	-	2.8

The following specific projects are expected to spend in excess of $1 million in any fiscal year:

- Project C078428, Union Falls – Flood Mitigation. This project will install a platform mounted 46/2.4kV step down transformer to pick up Union Falls feeder 84461. This project is part of the Union Falls flood mitigation effort since the existing station is in a high-risk flood zone.

4. F. Resiliency

Resiliency projects are intended to ensure the electric power system has the ability to recover quickly following a disaster or, more generally, the ability of preparing for extraordinary and high-impact, low-probability events and rapidly recovering from these disruptive events. Historically, reliability and resiliency projects were detailed under the Reliability spending rationale. In 2020, the Company recognized the importance of highlighting Resiliency as its own category with three core concepts; damage prevention, system recovery, and survivability. Damage prevention refers to the application of engineering designs and advanced technologies that harden the distribution system to limit damage. System recovery refers to the use of tools and techniques to quickly restore service to as many affected customers as practical. Survivability refers to the enhanced system planning or use of innovative technologies to aid customers, communities, and institutions in continuing some level of normal function without limited access to the grid. The main programs within this rationale are Fault Location, Isolation, and Service Restoration, Distribution Line Sensors/Monitors, Network Transformer DGA Monitors, and Targeted Feeder Ties.

Fault Location, Isolation, and Service Restoration is a method of installing switching devices to limit the customer impact associated with an interruption by automatically reconfiguring a feeder without the intervention of personnel to bring customers back on-line automatically and quickly. Distribution Line Sensors/Monitors will provide greater detail and in-sight into the real time information of the electric power system so that circuit capabilities can be maximized in a cost-effective method and reduce the potential emergency response. Network Transformer DGA Monitors creates a system to improve the tracking of transformer health which will assist in maximizing equipment lifespan and help avoid unplanned failures. Targeted Feeder Tie installations will create opportunities to quickly recover the service to customers affected by an event which did not exist before.

2019 to 2020 Variance:
The variances between the 2019 and 2020 Plans shown in the table below, as well as variances in the scope and timing of specific projects in this category, described below. The Resiliency

spending rationale is new therefore the variance will be the total amount shifted from the Reliability rationale with increased scope.

Table 4-22
Resiliency
Spending Rationale
Variance Summary ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	11.6	31.6	33.0	40.1	43.9	160.2

Fault, Location, Isolation, and Service Restoration ("FLISR"):
Traditional distribution design utilizes several types of sectionalizing devices. For radial distribution feeders, there is typically a three-phase breaker at the substation, which acts as the primary disconnecting means for the whole feeder. From the substation, there are three-phase reclosers and switches which are used to sectionalize the mainline of the feeder. Three-phase reclosers are designed to autonomously interrupt fault currents and isolate the faulted area of the feeder following a contingency event. Restoration of unfaulted segments of the feeder is generally performed through the manual operation of field switches.

All new and existing reclosers will be integrated with D-SCADA to allow control center operators to monitor and control the devices remotely. For lateral taps off the mainline, fuses and manual switches are used for sectionalization without remote monitoring or control capability.

For contingency and maintenance purposes, "feeder ties" are created where feasible. These feeder ties generally employ manual switches that are normally left in the open position.

In the event of a fault, traditionally implemented distribution systems will attempt to isolate the faulted section of the feeder through the fuse, recloser, or breaker protection capabilities. Once isolated, crews will manually find the fault, isolate, and then reconfigure the circuit using switches and feeder ties (in addition to reclosers and fuses). This 'human in the loop' method of service restoration necessarily takes time to implement, which results in additional customers interrupted and customer minutes interrupted ("CMI") as compared to a system where the field devices are automated.

Drivers:
FLISR is a control scheme which incorporates telecommunications and advanced capability of key switching devices to provide remote monitoring and operator control of field devices for normal operations and maintenance. At the same time, FLISR provides an automated response to system contingencies for minimizing customer interruptions and expediting system reconfiguration to facilitate service restoration. This greatly impacts the resulting customers interrupted and CMI performance from a fault event that occurs within a zone of protection. As part of a FLISR system, manual switches and feeder ties would be upgraded to automated switches (i.e.: reclosers) at three phase mainline locations. In addition, these devices would be integrated with the Company's D-SCADA system and the future ADMS.

The Company has completed several such schemes and plans to continue to install new automation schemes on the Sub Transmission system. This distribution FLISR program development began in FY20 and is proposed for deployment to start in FY22 and continue beyond FY25 starting with high value locations.

Customer Benefits:
The Company anticipates improved main line CMI performance on the feeders targeted for FLISR deployment. The additional operational data collected by the automated reclosers will also support the improved management of the distribution system, assisting in demand optimization, DER integration, and operational efficiency.

2019 to 2020 Variance:
The projected investment is shown in the table below.

Table 4-23
Fault Location, Isolation, and Service Restoration ("FLISR") Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	2.9	5.8	5.8	-	14.6
2020	-	0.0	3.4	12.1	12.1	12.1	39.6

The following specific projects are classified as FLISR and have planned spending in excess of $1 million in any fiscal year. Details on the planned spending profiles for these projects are included in Exhibit 3.

- Project C080088, C080089 and C080090, NY FLISR Central, East and West – D line. These project numbers cover the NY FLISR program across the Company's entire New York service territory which will help improve CMI performance and reduce the number of customers interrupted as a result of a fault within a zone of protection.

<u>Distribution Line Sensors/Monitors:</u>
This program deploys overhead line sensors throughout the Distribution electric system in Upstate NY, providing near real-time measurements of system performance to enable engineering and operations personnel to better manage the electric delivery system. Sensor measurements will yield interval feeder loading and voltage information that will foster more granular evaluations of system performance in support of distribution system planning, hosting capacity analysis and consideration of non-wires alternative solutions.

Drivers:
The primary driver of this program is to provide more reliable and higher quality power at an overall lower cost to our customers by enabling engineering and operational personnel to have greater insight into the electric delivery system.

Achieving the ability to monitor the loading and voltage of distribution feeders in near real time will provide the necessary data to evaluate and initiate system improvement opportunities that will reduce premature failures, mitigate voltage irregularities, reduce emergency manpower response, increase customer satisfaction and improve reliability indices. Feeder monitoring will provide essential loading to allow engineers and system control personnel to maximize circuit capabilities by providing a cost-effective method of measuring current, voltage, real and reactive power.

Customer Benefits:
Sensor technology will provide operational benefits; allow the distribution system to be operated in a more efficient manner resulting in lower costs to customers (*e.g.*, lower average voltage) and in a greener fashion by lowering system losses. The available data will allow for better decisions regarding diagnosing and localizing a fault or load swapping during peak load conditions.

2019 to 2020 Variance:
This is a new Program in the 2020 Plan, resulting in no comparison to the 2019 Plan.

Table 4-24
Distribution Line Sensors/Monitors
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.5	1.5	3.0	3.0	3.0	-	12.0
2020	-	1.5	3.2	4.0	4.0	4.5	17.1

The following specific projects are classified as Distribution Line Sensors/Monitors and have planned spending in excess of $1 million in any fiscal year. Details on the planned spending profiles for these projects are included in Exhibit 3.

- Projects C076144, C076143, and C076142, Feeder Monitors/Sensors – NY West, NY Central, and NY East. These projects install distribution line sensors in the Western, Central, and Eastern service territories which will allow for near real-time loading and voltage measurements on distribution feeders.

<u>Network Transformer DGA Monitors</u>
This program will introduce remote Dissolved Gas Analysis (“DGA”) Monitors to underground network transformers throughout the Company’s service territory.

Drivers:
As transformers age, they endure various stresses that can contribute to a variety of failure mechanisms. Remote DGA provides the ability to track transformer health by providing early warning signs of problems such as overheating, insulation degradation or mechanical movement within the transformer. Installation of remote DGA Monitors will reduce the need for manual readings and increase the ability to sample equipment.

Customer Benefits:
Remote DGA Monitoring and diagnostics can help avoid unplanned failures and extend the useful life of network transformers.

2019 to 2020 Variance:
The projected investment is shown in the table below.

Table 4-25
Network Transformer DGA Monitors
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.9	0.9	0.9	0.9	0.9	-	4.5
2020	-	0.9	0.9	0.9	0.9	0.9	4.5

There is no specific project in this category forecasted with planned spending in excess of $1 million in any fiscal year.

<u>Microgrids:</u>
The Department of Energy (DOE) defines the microgrid as ‘‘a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island mode.” This program is primarily made up of energy storage projects to limit customer exposure during major events.

Drivers:
At this time the microgrid program consists of one project. This project will provide service to the Gilmantown Substation following a loss of supply contingency, creating an electrical island isolated from the bulk system. It consists of a 3MW/12MWh Energy Storage System connected to the distribution system. This substation is served by a radial sub transmission line, approximately 9 miles long, that has high outage exposure. There are limited feasible options to provide a redundant supply to Gilmantown in a cost effective manner with traditional solutions. The Company plans to procure an energy storage system for this need by competitive solicitation through a technology and ownership agnostic RFP. Estimated costs included in this plan assume the system will be Company-owned, but the Company may instead procure a contract to fully or partially operate a 3rd party owned system if solicitation reveals that third-party ownership is a more beneficial model for customers for this specific project.

Customer Benefits:
The ability to island the Gilmantown substation gives customers a lower risk of exposure during a major event.

2019 to 2020 Variance:
This is a new Program in the 2020 Plan, resulting in no comparison to the 2019 Plan.

Table 4-26
Microgrids
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.0	0.0	4.4	4.4	8.8

The following specific project is classified as Microgrids and has planned spending in excess of $1 million in any fiscal year. Details on the planned spending profiles for these projects are included in Exhibit 3.

- Project C084937 Gilmantown Energy Storage: is a project to install a 3MW/12MWh Energy Storage system on the distribution system, to island the Gilmantown substation following a loss of supply contingency.

Targeted Feeder Enhancement:
This program is intended to create new high value feeder ties. New feeder ties are established to make substations/feeders more resilient and to remove the need for a mobile substation by bolstering up feeder capability. In the event of an outage, feeder ties are utilized to reconfigure the system for rapid restoration of customers. Many times, during a station interruption, the installation of a mobile substation can take multiple hours leaving customers out of service when amble feeder tie capacity does not exist. Targeted feeder ties can eliminate the need to deploy a mobile substation by establishing adequate feeder capabilities to offload an entire interrupted station to adjacent stations via ties.

Drivers:
Targeted feeder enhancements are used to improve resiliency in targeted areas. New ties create benefits in contingency response and recovery and thus improving performance and resiliency of the distribution system.

Customer Benefits:
The Company anticipates improved restoration times for future outages in targeted areas.

2019 to 2020 Variance:
This is a new Program in the 2020 Plan, resulting in no comparison to the 2019 Plan.

Table 4-27
Targeted Feeder Enhancement
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	-	-	-	-	-	-	-
2020	-	9.2	24.1	16.0	18.7	22.1	90.0

The following specific projects are classified as Resiliency program and have planned spending in excess of $1 million in any fiscal year. Details on the planned spending profiles for these projects are included in Exhibit 3.

- Project C032446, Harris 54 Relief. This Project Provides for a rebuild and conversion to 13.2kV of feeders from the Glenwood substation.
- Project C046643, Milton Ave D-Line. This project will convert and rebuild both Camillus and Hinsdale feeders to 132kV. Protective fusing will be upgraded, and the duct system will be installed at the existing Milton Avenue substation for four new feeder getaways.

- Project C046671, Rock City Station 623 - Transformer. This project provides for the replacement of one power transformer and rebuild/conversion of the substation to 13.2kV.
- Project C050522, Hague Rd 53 Submarine Cable replacement. This project provides for the replacement of the Submarine cable across Lake George from Friends Point Dr. to Glen Burnie Rd to address aging infrastructure concerns.

4. G. Communications/ Control Systems

Communications and Control Systems projects ensure that the proper communications equipment is in place to modernize and efficiently operate the electric system. Projects in this spending rationale include monitoring, communications infrastructure for company equipment and customer metering, and installation of private fiber across our system. These projects enhance automation and allow for better visibility of the operation of the electric system.

Drivers:
Communications and control systems allow for remote ability to gain operational status and control of existing assets.

Customer Benefits:
The communications and control systems installations and upgrades will lead to the automation and modernization of electric system infrastructure, improving performance and reliability.

2019 to 2020 Variance:
The projected investment is shown in the table below. The forecast has increased based primarily on the shift of the AMI program from Customer Request / Public requirement spending rationale in the 2019 Plan to Communications / Control Systems spending rationale in the 2020 Plan. Additionally, the Company is proposing a suite of Operational Telecommunication (OpTel) projects to address both existing business needs and build future capabilities and service for our customers.

Table 4-28
Communications / Control Systems Spending Rationale
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	16.7	13.8	14.9	11.8	11.8	-	69.1
2020	-	15.8	25.4	59.9	102.6	116.9	320.6

Remote Terminal Unit ("RTU"):
This strategy covers the addition or upgrade of RTUs and related infrastructure at substations presently lacking remote monitoring and control capabilities. RTUs in substations communicate with the EMS (Energy Management System) and provide the means to leverage substation data that provides operational intelligence and significantly reduces response time to abnormal conditions through real time monitoring and control.

There is an additional investment to replace outdated RTUs based on asset condition. That investment is documented in the Asset Condition spending rationale section.

Drivers:
RTUs will allow for remote operation and management of the system at stations providing benefits in contingency response and recovery and thus improving performance and reliability. In addition, RTUs are key components of automation and modernization of the Company's infrastructure.

Customer Benefits:
This strategy provides the means to leverage operational intelligence and significantly reduce response time to abnormal conditions through real time monitoring and control. The strategy also enables the distribution automation, sub-transmission automation, and future modernization strategies which will improve service to customers. When used to monitor and control the distribution feeder breakers and associated feeder equipment, RTUs and EMS facilitate the isolation of faulted equipment and the time required to reconfigure the distribution system to re-energize customers in non-faulted segments of the distribution system.

2019 to 2020 Variance:
The projected investment is shown in the table below. The spending has been modified based on further development of the plan for each substation.

Table 4-29
Remote Terminal Unit
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	11.5	8.7	7.7	3.0	3.0	-	33.9
2020	-	10.5	8.4	10.6	10.1	10.0	49.7

The following specific projects are expected to exceed $1 million in any fiscal year:

- Project C069687, RTU M9000- This program is to replace an outdated protocol with a new state-of-the-art protocol to create accurate and timely communications between substations and the control centers. The existing protocol for some RTUs does not match the control center protocol and can lead to a loss of communications.
- Projects C076123 EMS/RTU Installs - NY East, C076124 EMS/RTU Installs - NY Central and C076125 EMS/RTU Installs - NY West. These programs are to install new RTUs or expand the existing EMS at a substation for the purpose of system modernization.
- Project C077972, EMS/RTU FOR DSCADA. This project is for the upgrade of existing RTUs at stations with both distribution and transmission voltages to make ready for a Distribution Management System ("DMS"). To accomplish this, a second SCADA network will be operated through a separate port on the RTU. Older RTUs that cannot be dual ported will be upgraded or replaced.

Telecom:

This section was previously referred to as substation communications expansion. One of the larger investments in the Telecom portion of the plan is the OpTel suite of projects. These projects upgrade and extend the statewide substation communications network. It includes providing private fiber connectivity to several larger stations and provides new public or private communications capability to stations that currently have no connection.

Drivers:

The more complex distribution systems needed to support grid modernization objectives will require multiple new systems and technologies in the field that in many cases rely on some type of communications capability. As new systems are deployed, the data load on backhaul networks that transport data from the field increases. By expanding the fiber network, we can increase capacity and decrease the need for services from public telecommunications providers, lowering the cost and complexity of deploying substation automation and distribution system technologies. By leveraging existing fiber and fiber rights, and tactical deployment of new fiber segments, we can upgrade our existing fiber infrastructure to provide significant new capabilities now and for years to come. However, in locations where private network expansion is not cost effective, the Company will continue to leverage public telecommunications offerings. This project directly supports the EMS RTU expansion proposed above. In addition to substation and grid facing systems, the expanded substation network can provide data backhaul for advanced metering system deployments and demand response messaging.

Customer Benefits:

This project supports multiple other projects and initiatives. Each of those projects has its own customer benefits which are enabled by the new telecom infrastructure deployed by this project. Customers benefit directly through the reduction in on-going telecommunications costs when converting substations from public carriers to a private solution. In addition, a private solution offers more utility control in operations, maintenance, troubleshooting and repair resulting in improved reliability and security. The Company's proposed hybrid communications solution includes a mix of private and public communications to provide a balance between operational needs and cost effectiveness. This will result in the flexibility to implement the capabilities required at the lowest cost possible.

2019 to 2020 Variance:

The projected investment is shown in the table below. The variance is largely due to the addition of the OpTel suite of projects. These projects require a multi-year, phased approach under a Company ownership model.

Table 4-30
Telcom
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	4.5	4.5	5.1	5.8	5.8	-	25.9
2020	-	3.8	9.9	12.2	12.2	11.1	49.2

The following specific projects are expected to exceed $1 million in any fiscal year:

- Projects C076108 EMS/RTU Telecom - Stations NY Cent, C076107 EMS/RTU Telecom - Stations NY East, and C076110 EMS/RTU Telecom - Stations NY West. These programs are to support the EMS/RTU Stations Programs above by installing or upgrading the communication line to a station when required for the new equipment.
- Project C084103 Communications for Regs & Caps – NYW – This program will deploy communications via GE Orbit cellular radios to existing switched capacitors and voltage regulators throughout the distribution electric system in upstate NY. The added communications will be integrated with the Company's SCADA system and be used in providing near real-time measurements of system performance to enable engineering and operations personnel to better manage the electric distribution system.
- Project C084926 OpTel – SCADA Analog Replacement - The SCADA Communications Project aims to upgrade communications circuits in locations with analog circuits and replace them with private fiber, not covered under other projects. These locations will be prioritized based on need and align with other substation projects.
- Project C084927 OpTel – DMX Replacement - The purpose of this project is to identify, design, procure, and implement equipment to replace the existing Nokia (formerly Alcatel-Lucent) Data Multiplexer (DMX) Synchronous Optical NETwork (SONET) equipment. The SONET provides a redundant ring communication topology network linking critical transmission substations and corporate facilities over both private and leased fiber with microwave linkage as well.
- Project C084929 OpTel – Critical and Key Facilities - The Critical and Key Facilities Communications Project aims to upgrade substation and critical NG-US locations from antiquated leased circuits to modern private fiber which will provide enhanced backhaul capabilities for current operational needs, but also provide communications for digital substations, backhaul capabilities for Tier 3 operations in support of grid modernization efforts proposed as well as DERs.

Advanced Metering Infrastructure:

Pursuant to the Joint Proposal approved by the Commission in Case 17-E-0238,[13] the Company, Staff and other stakeholders participated in a comprehensive AMI collaborative process. The AMI collaborative culminated in the Company filing of a Report on November 15, 2018, which proposes a six-year AMI deployment. This report was supplemented on September 4, 2019 and the Company is currently awaiting Commission decision.

Drivers:

AMI implementation will position the Company to develop and deploy solutions aimed at achieving the State's clean energy policy goals. Among other benefits, AMI will support grid modernization and distributed system platform ("DSP") planning functions, including demand modeling, load

[13] Cases 17-E-0238 and 17-G-0239, Proceedings on Motion of the Commission as to the Rates, Charges, Rules and Regulations of Niagara Mohawk Power Corporation for Electric and Gas Service ("Rate Case Proceeding"), *Joint Proposal* (filed January 19, 2018) (the "Joint Proposal") at page 114.

forecasting, hosting capacity analysis, and capital investment planning. AMI will also enable time-varying pricing ("TVP") rate designs necessary to support DER valuation, new innovative services, and distribution system efficiency. Implementation of AMI will help bring the Company in line with previous deployments throughout the country, with 90+ million smart meter installations projected by the end of 2020. The Company's customers expect, and the Company is committed to delivering continuously expanding service and benefits that AMI is capable of providing.

When AMI meters are deployed, and the associated back-office infrastructure is in place, customers will have access to more granular usage data in near real-time. The frequency of the readings combined with the granularity of data will enable customers to control their energy usage through energy efficiency, conservation, demand response, and new pricing programs. AMI will allow customers to monitor their energy consumption and better manage their energy bills.

Customer Benefits:
In addition to the foregoing, AMI implementation can also support the following advances:

Innovative Rate Design Options:
AMI lays the foundation for innovative rate design structures that can reward customers for optimizing their energy usage (*e.g.*, time-of-use rates and critical peak pricing programs, "Smart Home" rates).

Enablement of Smart Home Devices:
AMI will enable customers to manage their energy consumption through use of smart home devices such as thermostats, water heaters, and other appliances that can be integrated with AMI. Home energy management systems will be able to send and receive secure communications from the Company or third-party market entities. Based on the customer's preference, the system can automatically adjust energy consumption in response to pricing signals and calls for curtailment.

Outage Management:
AMI can decrease outage notification through autonomous alerts. This presents a reduction from initial outage to Company notification, resulting in a decrease of total customer outage time, from occurrence of the initial outage to resolution. AMI functionality also allows the Company to send a signal to AMI meters to identify areas that still require restoration and confirm when all outages have been restored. This functionality will improve situational awareness contributing to reduced restoration costs and improved outage response.

Customer Service Enhancements:
AMI data can be used by call center representatives to enhance customer interactions. For example, AMI will:

- Allow call center representatives to send a signal to the meter to determine voltage levels or whether an outage is due to customer-owned equipment
- Allow for real-time reconnects of electric meters
- Provide historic information about prior outages and voltages
- Provide for additional rate plans and options for customers seeking flexibility for their energy management needs

2019 to 2020 Variance:
The projected investment for the Advanced Metering Infrastructure project is shown in Table 4-30. The variance shown in the table below is due to a change in the scope and timing of this program.

Table 4-31
Advanced Metering Infrastructure ("AMI")
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	1.3	7.2	60	88.6	90.6	-	274.7
2020	-	0.7	4.4	33.8	77.7	93.1	209.7

The following specific projects are expected to exceed $1 million in any fiscal year:

- Project C083340 AMI – NY Electric Advanced Metering Infrastructure meters
- Project C084958 AMI – Field Area Networks (FANs) – Communications network between meters and central data repositories.

4. H. DER – Electric System Access

DER - Electric System Access:
The DER Electric System Access rationale is used to capture work where the Company will be supporting items such as DG interconnections, storage, NWA, microgrids, and other third party and market driven needs. Distributed generation interconnections generally are reimbursable and therefore have little effect on net program spending. This spending rationale also includes projects that are non-reimbursable by the customer, such as farm digester projects; however, no such project is included in the Plan horizon.

2019 to 2020 Variance:
The projected investment is shown in the table below. The forecast has decreased from 2019 primarily due to the Electric Vehicle initiative moving to the Customer Requests / Public Requirements spending rationale.

Table 4-32
DER - Electric System Access
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	6.7	0.4	10.0	15.0	15.0	-	47.1
2020	-	0.0	2.1	5.0	5.3	7.1	19.5

DER - Electric System Access Solar:
In addition to the customer reimbursable solar DG interconnections under this program, spending will target the Proactive 3V0 and LTC program.

Drivers:
The Company implemented a REV Demonstration project in two phases to proactively install 3V0 and LTC to animate the market and attract distributed generation developers to stations where large cost substation upgrades were already completed. The cost allocation for this demonstration charges developers a contribution commensurate with their project size rather than basing cost contribution on their place in the Interconnection Queue. The REV Demonstration is evaluated as a success, and additional stations will be targeted in the Capital Plan using this cost allocation methodology.

Customer Benefits:
This program aligns with CLCPA goals to interconnect 6,000 MW of solar energy by 2025, along with 70 percent of the state's electricity coming from renewable energy by 2030 and 100 percent of the state's electricity supply emissions free by 2040. The program animates the distributed generation market, attracting solar developers, while assuring that developers contribute costs based on their project size in relation to the hosting capacity enabled by the station upgrades.

2019 to 2020 Variance:
The variance in the table below is attributed to the addition of the Company's Proactive 3V0 and LTC program being proposed starting in FY22.

Table 4-33
DER – Electric System Access Solar
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	2.3	0.0	0.0	0.0	0.0	-	2.3
2020	-	0.0	0.5	4.1	4.5	4.4	13.5

The following specific project is classified as DER-Electric System Access Solar projects and has planned spending in excess of $1 million in any fiscal year.

- C084930: Proactive 3V0 and LTC. This program will identify ~26 substations for proactive upgrades, including 3V0 and LTCs, to accommodate distributed generation projects seeking to interconnect on the targeted substations. The Company will collect contributions from developers based on the distributed generation project size and the hosting capacity enabled by the substation upgrades.

<u>DER - Electric System Access Other:</u>
This program under the DER – Electric System Access spending rationale is comprised primarily of the new Clean Innovation Projects program.

Drivers:
The Company's Clean Innovation Hub is a corporate-wide initiative to implement transformative innovation projects. These include unique projects to New York that align with the CLCPA and Earnings Adjustment Mechanisms ("EAMs").

Customer Benefits:
The projects selected for this program have BCAs based on the future system wide roll out with benefits greater than the costs.

2019 to 2020 Variance:
The variance in the table below is attributed to the shift of the Electric Transport Initiate Project from the DER – Electric System Access spending Rationale in the 2019 Plan to Customer Request / Public Requirement Spending Rationale in the 2020 Plan.

Table 4-34
DER - Electric System Access Other
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	4.8	0.4	10.0	15.0	15.0	-	45.3
2020	-	0.0	1.0	0.9	0.3	0.3	2.5

The following specific project is classified as DER-Electric System Access Other projects and has planned spending in excess of $1 million in any fiscal year.

- Project C084928: Clean Innovation Hub. This program funds four Innovation Focused Pilots (“IFPs”):
  - Syracuse Net Zero Energy
  - North Troy Storage Islanding
  - Flexible interconnection
  - Switched Source Tie Controller

The projects in this program target the innovation focus areas of DSP markets, novel distribution technology, beneficial electrification, and islanding for reliability. The Company will gain lessons learned from these IFPs and successful pilots will route to scale.

DER - Electric System Access Company Owned DER:
This program under the DER – Electric System Access spending rationale is comprised primarily of Company-owned battery storage. It is important to note that the Company’s position is to procure these projects through competitive solicitation similar to a non-wires alternative approach. However, the Company may propose a Company-ownership model consistent the criteria established by the Commission if such a solicitation fails.

Drivers:
Company-owned battery storage can be used as a non-wires alternative to address electrical stress on the stations and lines of the electrical power system. Storage solutions can also be considered for reliability concerns.

Customer Benefits:
The Company evaluates least cost to serve options when determining the appropriate solution to address concerns on the system. A battery storage solution provides another option to consider addressing concerns.

Table 4-35
DER - Electric System Access Company Owned DER
Program Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	0.0	0.0	0.0	0.0	0.0	-	0.0
2020	-	0.0	0.1	0.0	0.5	2.3	2.9

The following specific project is classified as DER-Electric System Access Company Owned DER project and has planned spending in excess of $1 million in any fiscal year.

- Project C078752: Kenmore Station 22 Battery Storage. An energy storage asset on the distribution system would provide capacity relief to the sub transmission lines supplying the Kenmore area by discharging during peak hours to alleviate this operating constraint. In addition, the asset will provide capacity relief during zonal peak periods and services into the wholesale markets, providing supplemental system benefits during periods where capacity relief is not needed by the sub transmission lines. This project will be procured through competitive solicitation, similar to non-wires alternatives. However, the Company may propose a Company-ownership model consistent the criteria established by the Commission if such a solicitation fails.

4. I. Non-Infrastructure

This spending rationale includes items that do not fit into the other spending rationale but are necessary for the operation of the distribution system. They include capitalized tools such as micro-processor-based relay test equipment and SF6 gas handling carts. In addition, Land Mobile Radio ("LMR") systems not associated with T&D system are included in this spending rationale.

Drivers:
Specialized tools are required by Operations personnel to perform equipment maintenance and complete capital projects. Radio communication systems upgrades, and replacements are necessary for real time communications while performing switching and for other operational needs.

Customer Benefits:
The proper tools allow Operations personnel to work safely and efficiently thus reducing overall costs. Radio communications promote personnel safety by allowing the control centers to direct Operations personnel during field switching. In addition, timely communications allow a coordinated response to interruptions thereby limiting customer interruption durations.

2019 to 2020 Variance:
The projected investment is shown below. The forecast has been updated to reflect latest spending trend.

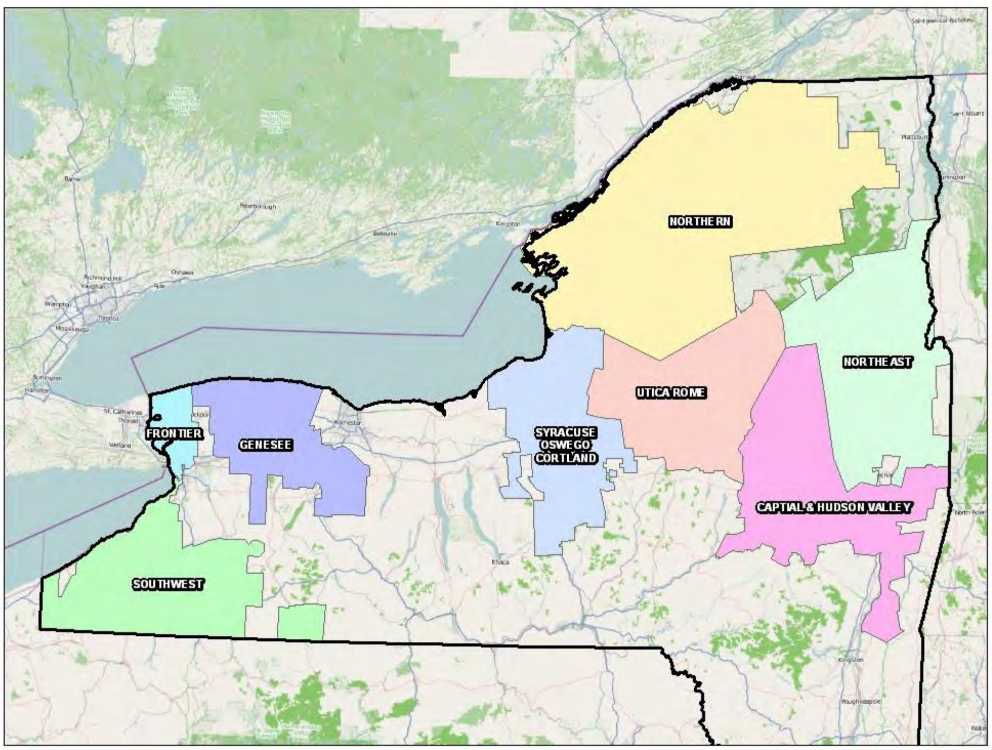
Table 4-35
Non-Infrastructure Spending Rationale
Variance ($millions)

CIP	FY20	FY21	FY22	FY23	FY24	FY25	Total
2019	3.3	3.4	3.4	3.5	3.6	-	17.2
2020	-	3.5	3.6	3.6	3.7	3.8	18.2

Chapter 5. Investment by Transmission Study Area

For regional analysis, the Company's service territory is divided into eight (8) transmission study areas. The transmission study areas are shown in Figure 5-1. Within the eight (8) transmission study areas, the sub-transmission and distribution networks are further subdivided into forty-three (43) distribution study areas.

Figure 5-1
Transmission Study Areas



Each of the transmission study areas is described separately below in the following format:

- Area Summary
- Area Description
- Major Project Table

5. A. Northeast Transmission Study Area

Area Summary

Key drivers behind the transmission capacity related projects in this transmission study area include the following:

- Thermal needs due to area load growth associated with Luther Forest, and the general area distribution load growth stimulated by the economic impact of the Luther Forest development during the period from 2012-2019 required significant reinforcement; most recently with the completion of Lasher Road and Schaghticoke Switching Stations.

Key sub-transmission and distribution drivers include the following:

- The Sodeman Road substation will be constructed to address the continuing distribution load growth in and around Saratoga Springs some of which is the result of ancillary load associated with Luther Forest Technology Park .

Area Description

The Northeast transmission study area serves approximately 133,900 customers. The study area extends approximately ninety (90) miles north along the western Vermont border, from Cambridge in the south to Westport in the north and extends approximately forty-five (45) miles to the west at its widest point to Indian Lake. The area incorporates the southeastern section of the Adirondack State Park. Much of the area load is concentrated in the southern portion of the study area, along Interstate I-87 and US Route 9, particularly in the Towns of Ballston Spa, Lake George, and Queensbury and the Cities of Saratoga Springs and Glens Falls. Some of the areas offer summer recreation and see a spike in load during the summer months, while some of the northern section of the Northeast area is winter peaking.

The Northeast transmission area consists primarily of 115kV rated facilities. The 115kV system runs primarily in a north-south direction on both sides of the Hudson River. There is a single radial 115 kV line, east of Lake George, which runs north from the Whitehall substation through Ticonderoga and Crown Point north to the Port Henry substation and then extends to the NYSEG system north of Port Henry. The western 115kV radial line extends from the Spier Falls substation to the North Creek substation in the Adirondack State Park. There is an extensive 34.5kV system in the study area supplying smaller towns along interstate I-87 and Route 28.

In the Northeast transmission study area, there is one (1) distribution study area, also called Northeast. The Northeast distribution study area has a total of 112 distribution feeders that supply customers in this area. There are ninety (90) 13.2kV feeders, with twenty-five (25) being supplied from 34.5-13.2kV transformers, and the rest supplied by 115-13.2kV transformers; thirty-five (35) 34.5kV sub-transmission lines that supply the distribution step down transformers in the area; eight (8) 4.8kV feeders with six supplied by 34.5-4.8kV transformers; and fourteen (14) 4.16kV feeders all supplied by 34.5-4.16kV transformers.

Major Project Table

The following table identifies major projects by spending rationale for this study area.

Table 5-1
Northeast Major Projects

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Asset Condition	Asset Replacement	Dist	Northeast	Mohican SE Feeder	C081408
				Smith Bridge - New TB2 Getaways	C083483
				Smith Bridge 56 & 57 -Build Feeders	C083485
		Sub-T	Northeast	Chestertown-Schroon 3 34.5kV Refurb	C084009
				Saratoga-Ballston 10 34.5kV refurb	C084068
				Warrensburg-Chestertown 6-refurb	C084012
	Component Fatigue/Deterioration	Tran	None	Mohican - Control House	C080755
				Mohican - Rplc 115kV, 34.5kV assets	C053133
				Mt. Defiance Road	C084017
				Queensbury - Capacitor Replacement	C082649
				Queensbury - Rplc 34.5kV OCB & TB2	C080869
				Spier-Rott 2 Shield wire Replace	C050744
				Ticonderoga 2-3 T5810-T5830 ACR	C039521
	Substation Power Transformer	Dist	Northeast	Smith Bridge 2nd Bank & Metalclad	C081418
	Sub-T Overhead Line	Sub-T	Northeast	Ballston-Shore Rd 8-34.5 kV	C046457
				Queensbury-Henry Street 14-34.5kv	C046442
				Schuylerville Retirement - Sub-T	C050323
Customer Request/Public Requirement	Customer Interconnections	Tran	None	East Point Solar Project Stations	CNYCS18
				Easton Solar 1 Project Line	CNYCS59

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Easton Solar 1 Project Stations	CNYCS58
				Easton Solar 2 Project Line	CNYCS61
				Heritage Wind Project Line	CNYCS15
				Heritage Wind Project Stations	CNYCS14
				High River Solar Project Line	CNYCS41
				High River Solar Project Stations	CNYCS40
				Mohawk Solar Project Line	CNYCS11
				Mohawk Solar Project Stations	CNYCS10
				Pattersonville Solar Line	CNYCS45
				Pattersonville Solar Station	CNYCS44
				Rock District Solar Project Line	CNYCS27
				Rock District Solar Project Stations	CNYCS26
				Stillwater Solar Project Line	CNYCS63
				Tayandenega Solar Project Stations	CNYCS28
				Tayandenga Solar Project Line	CNYCS29
Resiliency	Microgrid	Dist	Northeast	Gilmantown Energy Storage	C084937
	Sub-T Automation	Sub-T	Northeast	DA - NE SubT Automation Wilton Sub	C035863
	Targeted Feeder Enhancement	Dist	Northeast	Hague Rd 53 - Submarine Cable.	C050522
System Capacity - NY	Load Relief	Dist	Northeast	*Hague Rd 52 - Convert Route 22	C050717
				Sodeman Rd 51 Feeder Construction	C076785

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Sodeman Rd 54 Feeder Construction	C076797

3. B. Capital and Hudson Valley Transmission Study Area

Area Summary

Key drivers behind the transmission capacity related projects in this transmission study area include the following:

- During the summer peak periods, post contingency thermal overloads exist within this region resulting in the recommended reconductoring and rebuild of lines as detailed in the project table.
- Projected New York Energy Solution (NYES) and NY's Energy Highway Initiatives will implement transmission upgrades to relieve historic congestion on NY's bulk electric power system. These plans will trigger projects to upgrade the transmission system in the Capital and Hudson Valley regions.

Key sub-transmission and distribution drivers include the following:

- Customer growth in the City of Rensselaer will require construction of a new substation at Forbes Avenue to supply the area. This new substation will also address flooding concerns at Rensselaer substation.
- Van Dyke Road Station is a new 115-13.2kV station that will be used to address load growth at Vista Tech Park and loading and asset concerns at adjacent stations. If the Van Dyke station is blocked by the Town, then the loading issues will be resolved with Delmar Station rebuild under C053683, C046482, C049692 and C050241.
- Project C081420 – Downtown Troy. This project will provide for an upgrade to the TB1 transformer bank at Liberty Street substation as well as related bus work and 13.2kV breakers. In addition, C081421 is for associated conversion work in downtown Troy.
- Project C081262 – Corliss Park. This project will provide for an upgrade to the transformer bank at Corliss Park substation as well as related bus extension and 13.2kV breakers. In addition, C081262, C081385, C081414, and C081415 are for Corliss Park conversions and Lansingburgh conversions are under C079475 and C080462.
- Maple Avenue is a new 115-13.2kV station that will be used to address asset condition issues at Market Hill substation and loading in the Amsterdam area.
- Chrisler Ave Station will be rebuilt from 34.5-4.16kV to a 34.5-13.2kV station that will be used to address asset condition issues at its station as well as eliminate a 4kV island in the middle of the City of Schenectady, improving reliability in the area.
- While Lasher Road Station's primary driver is transmission related load relief (*see* Section 5.A. Area Summary), it will also provide a 115-13.2kV, 15/20/25 MVA power transformer

with three (3) distribution feeders that will be used to address asset condition issues at Shore Road substation and loading in the Ballston Spa area.

Area Description

The Capital and Hudson Valley study area is connected to the Utica Rome study area in the west at Inghams 115 kV substation, the New England system in the east, the Central Hudson Gas and Electric (CHG&E) and Consolidated Edison (Con Ed) systems in the south, and the Northeast study are in the north. The transmission system consists primarily of 115kV and 345kV transmission lines. There are also several 230kV lines emanating from Rotterdam Substation. The Capital and Hudson Valley study area is the east end of the Central-East interface, which is a power interface between central New York and eastern New York. Several transmission lines in the area are also important facilities to the UPNY-SENY interface between the eastern NY system and the downstate system.

The Company has three (3) 345-115kV transformers in the region: two (2) at New Scotland and one (1) at Reynolds Road. There are five (5) existing 230-115kV transformers; three (3) at Rotterdam, and two (2) at Eastover Road. In addition, Con Ed has one (1) 345-115kV transformer at Pleasant Valley and CHG&E has one (1) 345-115kV transformer at Hurley Ave. Station, all of which impact the Company's system.

Within the Capital and Hudson Valley study area, there are six (6) distribution study areas: Capital-Central, Capital-East, Capital-North, Mohawk, Schenectady and Schoharie.

The Capital-Central study area serves approximately 89,000 customers. The study area encompasses the greater Albany area, including a mixture of commercial customers heavily concentrated in downtown Albany, and industrial and residential customers spread across downtown to the suburban areas. The primary distribution system in Capital-Central is predominantly 13.2kV with pockets of 4.16kV primarily in the City of Albany and 4.8kV south of the City of Albany. Most 4kV distribution substations are supplied from the local 34.5kV sub-transmission system, whereas most 13.2kV distribution substations are supplied from the local 115kV transmission system.

The Capital-East study area serves approximately 84,100 customers. The study area is located east of the Hudson River, with the center approximately adjacent to Albany. This area extends approximately from Valley Falls in the north to Tivoli in the south. The larger load concentrations are in the cities of Rensselaer and Troy and in the towns along US Route 9. There is a 345kV source into the area at Reynolds Road substation and a 115kV corridor running in a north-south direction supplying approximately 90% of the distribution load in the area. There is also a 34.5kV sub-transmission system in the central area with the 115kV sources from Greenbush, North Troy, Hudson and Hoosick substations. In addition, there is scattered generation on the 34.5kV system in the area.

The Capital-North study area serves approximately 86,600 customers. The study area encompasses the suburban area north of the City of Albany, including a mixture of industrial, commercial and residential customers throughout Colonie, Cohoes, Watervliet, Clifton Park, Halfmoon, Waterford, Niskayuna, and Ballston. The primary distribution system in Capital-North is predominantly 13.2kV with a few pockets of 4.16kV in the Newtonville area and 4.8kV in the Town of Ballston. All 4kV distribution substations are supplied from the 34.5kV sub-transmission system, whereas most 13.2kV distribution substations are supplied from the 115kV transmission system. Maplewood and Patroon substations are the main sources for the 34.5kV sub-transmission system in this area, which is operated in loop configuration. Along with these facilities, a group of hydro and cogeneration power plants located along the Mohawk River (School St, Crescent, Vischer Ferry, Colonie Landfill, etc.) form the backbone of the local 34.5kV sub-transmission system. In addition to supplying power to all 4kV and a few 13.2kV distribution substations, the 34.5kV sub-transmission system serves several industrial customers such as Mohawk Paper, Honeywell, Norlite, and Cascade Tissue. Major distribution customers in this area include the Albany International Airport, which is supplied by feeders from Forts Ferry, Sand Creek, Wolf Road and Inman Road substations.

The Mohawk study area serves approximately 61,200 customers. The study area includes the City of Amsterdam and the rural areas west of the city. This area is comprised of mostly residential customers and farms with some commercial and industrial customers located in areas such as the City of Amsterdam, Gloversville, Johnstown, Northville, and Canajoharie. The primary distribution system in Mohawk is predominantly 13.2kV with areas of 4.16kV (Gloversville and Johnstown areas) and 4.8kV (Canajoharie). Most 4kV distribution substations are supplied from the 23kV and 69kV sub-transmission system, whereas most 13.2kV distribution substations are supplied from the 115kV transmission system.

The Schenectady study area serves approximately 57,900 customers. The study area is defined by the region that includes the City of Schenectady and the surrounding suburban areas. This area includes a mixture of industrial, commercial and residential customers spread across downtown to suburban areas such as Niskayuna, Glenville, and Rotterdam. The primary distribution system in Schenectady area is predominantly 13.2kV with a few pockets of 4.16kV (Schenectady, Scotia and Rotterdam areas). All 4kV distribution substations are supplied from the local 34.5kV sub-transmission system, whereas most 13.2kV distribution substations are supplied from the local 115kV transmission system. In addition, the downtown areas of Schenectady are served by a general network that is supplied by the Front Street Substation. Rotterdam, Woodlawn and Rosa Rd. are the main sources for the local 34.5kV sub-transmission system, which is operated in loop configuration.

The Schoharie study area serves approximately 20,600 customers. The study area is defined by the region west and south of Schenectady that include towns and villages along the I-88 and Route 20 corridors such as Delanson, Schoharie, Cobleskill, Schenevus, and Sharon Springs. This area is mostly rural comprised mainly of residential customers and farms with few commercial and industrial customers. The primary distribution system in Schoharie is predominantly 13.2kV with areas of 4.8kV (Cobleskill, Worcester, and Schenevus areas). Most distribution substations in this region are supplied from the local 23kV and 69kV sub-transmission system. Marshville and Rotterdam are the main sources for the local 69kV sub-transmission system which is operated in loop configuration. The 69kV sub-transmission system supplies power to both 4kV and 13.2kV distribution substations, besides a few industrial and commercial customers, such as Guilford Mills and SUNY Cobleskill. The existing 23kV sub-transmission system in Schoharie, which supplies power to East Worcester, Worcester, and Schenevus substations, is operated in radial configuration from Summit substation.

Major Project Table

The following table identifies major projects by spending rationale for this study area.

Table 5-2
Capital and Hudson Valley Major Projects

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Asset Condition	Asset Replacement	Dist	Capital East	Corliss Park South Feeder Conversio	C081414
				Corliss Park West Feeder Conversion	C081385
				CORLISS PARK XFMR 2 & BUS INSTALL	C081991
			Capital North	Lasher Road - 53 Feeder OH	C068348
			Schenectady	Ruth Road TB2 & MC	C083963
			Schoharie	Middleburgh 51 - Route 145 Extend/C	CD01010
		Sub-T	Capital Central	Delmar Elsemere 34.5 kV Tap Rebuild	C081606
			Mohawk	Inghams 46kV relocation	C074485
	Component Fatigue/Deterioration	Tran	None	Albany Steam - 115kV asset rplc	C079461
				Amsterdam-Rotterdam3/4 Relocation	C081471
				Gloversville - Marshville #6 Refurb	C081458
				Greenbush - 115kV & 34.5kV refurb	C079224
				Hoosick - Control House	C081115
				Hoosick - Replace Bank 1 & relays	C053132
				Inghams Station - Assoc Line work	C060240
				Inghams Station Re-vitalization	C050917
				Inghams Station Revitalization CH	C074000
				Menands Cntrl Bldg & Relay Replcmt	C049601
				N.Scotland-Feura Bush/Long Lane ACR	C084554
				Spier-Rotterdam 2 Re-insulate	C081676
				Thompson-N Troy-Greenbush Corridor	C081667
				Whitehall-Mohican13/Cedar6-P2	C084552
				Woodlawn - Asset Replc CH	C082919
				Woodlawn Transformer Replacement	C051986
	Inspection & Maintenance	Dist	Schenectady	Ruth Road Conversion and Rebuild	C083961

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
	Overhead Line (Program)	Dist	Mohawk	Maple Ave - New Feeder 52	C069909
	Primary UG Cable Replacement	Dist	Capital Central	Riverside 28855 UG Cable Replaceme.	C036468
	Station Metal Clad Switchgear	Dist	Capital Central	Avenue A 291 Metalclad Replacement	C056609
				McKnownville 327 Metalclad Replacem	C056612
			Capital East	Blue Stores - Replace IMCS and XMFR	C081611
				Sycaway - Metalclad Replacement	C081630
			Capital North	Johnson Rd - Replace Metalclad Gear	C046747
				Prospect Hill - Replace Metalclad	C080223
			Schenectady	Chrisler Rebuilt Station - Station	C068290
				Ruth Road Sta - Replace Metalclad	C081613
	Substation Power Transformer	Dist	Capital East	Liberty St TB5 Install 34.5/13.8kV	C081420
			Mohawk	Stoner Station Replace TB1	C083223
	Sub-T Overhead Line	Sub-T	Capital North	Shore Road-Rosa Road 5 34.5 kV	C074503
				W. Milton Tap-34.5kV new line	CD00898
			Mohawk	Epratah-Caroga 2-23kv	C046456
			Schenectady	Scotia-Rosa Rd 6, 34.5kV Refurb	C055164
Customer Request/Public Requirement	Customer Interconnections	Tran	None	Albany County I Solar Project Line	CNYCS31
				Albany County II Solar Project Line	CNYCS33
				Energy Hwy Segment A Project Line	CNYCS09
				Energy Hwy Segment A Project Stations	CNYCS08
				Energy Hwy Segment B Project Line	CNYCS23
				Energy Hwy Segment B Project Stations	CNYCS22
				Flint Mine Solar Project Line	CNYCS43
				Flint Mine Solar Project Stations	CNYCS42
				Hills Solar Project Line	CNYCS35
				Hills Solar Project Stations	CNYCS34
	New Business	Dist	Schenectady	Schenectady Smart City REV Demo	C081846
	Public Requirements	Tran	None	Lafarge Relocation	C079454

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Damage/Failure	**Damage/Failure**	Dist	**Schoharie**	Cobleskill TB2 D/F	C083648
Multi-Value Transmission (MVT)	**MVT Reliability**	Tran	**Mohawk**	MVT INGHAMS LINES 6 AND 7 REBUILD	C084528
Multi-Value Transmission (MVT)	**MVT Reliability**	Tran	**Mohawk**	MVT ROTT 69KV REBUILD & NEW TB	C082180
Multi-Value Transmission (MVT)	**MVT Reliability**	Tran	**Mohawk**	MVT SCHO/SCH INT-ROTT 18/4 REBLD	C082182
Reliability	**Reliability**	Dist	**Capital Central**	Riverside HPFF Pressurization Plant	C082953
			Schenectady	Scotia/Glenville Industrial Park	C081423
Resiliency	**Survivability**	Tran	**None**	New Krumkill Resiliency	C084543
System Capacity - NY	**Load Relief**	Dist	**Capital Central**	Delmar - Feeder Getaways	C083920
				Delmar Rebuild Substation	C083916
				New Krumkill - Feeder Getaways	C083927
				New Krumkill 42127 & 26 conversions	C083929
				New Krumkill Add Second Transformer	C083911
				New Krumkill Getaway &express feeds	C083928
			Capital East	DeLaet's Landing DxD	CD00893
				Forbes Ave - New Substation	C053137
				Liberty St D-Line Overhead Rebuild	C083844
				Seventh Ave North Feeder Conversion	C080476
			Capital North	Johnson Rd 53/Maplewood 51 Tie	C084001
	TO Led System Studies	Tran	**None**	Leeds 345kV breaker replacement	C084546
				Maplewood #19/#31Reconductoring	C069466
				N.Scotland 115kV Brk Replacement	C084555
				Riverside-Reynolds Rd#4 Forbes Tap	C043592

5. C. Northern Transmission Study Area

Area Summary
Key drivers behind the transmission capacity related projects in this study area include:

- Reinforcements to the Northern Area 115kV system are needed due to increased wind generation and declining area load. This infrastructure development work will strengthen the transmission network, ensure adherence to reliability standards and provide for the deradialization (new networking) of two transmission circuits, and provide additional capacity to interconnect generation.
- Area load growth resulting in the need for a second transformer and metalclad at the Malone substation.
- All overloads resulting from contingencies can be mitigated by reducing hydro generation, wind generation, or imports from Hydro Quebec.

Key sub-transmission and distribution drivers include the following:

- Distribution construction to allow for the retirement of State Street Substation due to deteriorated assets.
- Relocating Union Falls substation and the associated sub-transmission lines and distribution feeders due to risk of flooding.

Area Description
The Northern transmission study area includes the 115kV transmission facilities in the Northern Region south to Boonville and Lighthouse Hill.

The backbone of the 115kV Northern area system runs from ALCOA substation to Boonville substation. The important substations along the 115kV transmission corridor are Browns Falls, Colton, Dennison and Taylorville.

The Jefferson/Lewis county area is bounded by the Lighthouse Hill-Black River #5 and Lighthouse Hill – Middle Road #6 lines to the west and the #5 – #6 Boonville-Taylorville lines to the east. The Ogdensburg-Gouverneur area is served by the #7 Colton-Battle Hill, #8 Colton-McIntyre and the #13 ALCOA-North Ogdensburg 115kV lines. The #1 – #2 Taylorville-Black River lines and the #3 Black River-Coffeen support the load in the Watertown area. The Thousand Island region is served by the #4 Coffeen-Thousand Island 115kV radial line. The Colton-Malone #3, Malone-Lake Colby #5, and Willis-Malone #1 (NYSEG) 115kV lines serves the Tri Lakes region. The Akwesasne #21 115kV Tap served from the Reynolds/GM #1 (NYPA) 115kV line supplies part of the Nicholville-Malone area.

Within the Northern study area, there are four distribution study areas: Nicholville-Malone, St. Lawrence, Tri-Lakes and WLOF (Watertown, Lowville, Old Forge). The Nicholville-Malone study area serves approximately 16,100 customers. There are total of twenty-seven (27) feeders (twenty (20) 4.8kV and seven (7) 13.2kV feeders) in the study area. The distribution substations are primarily supplied from the 34.5kV system with exception of Malone 13.2kV and Akwesasne 4.8kV substations that are served by the 115kV system. The main supplies for the 34.5kV sub-transmission system are Akwesasne, Malone, and Nicholville substations. It is operated as a radial system due to loading issues although the system is constructed as a loop design. There are also two hydroelectric facilities connected to the system (Macomb and Chasm substations).

The St. Lawrence area serves approximately 39,600 customers. There are twenty-six 4.8kV feeders and thirty 13.2kV feeders in the study area. The distribution substations are supplied from 23kV and 34.5kV sub-transmission lines with exception of four substations, Corning, Higley, North Gouverneur and Ogdensburg substations that are served from the 115kV system. The main supplies for the 23kV sub-transmission system are Balmat, Little River, McIntyre, Mine Rd. and Norfolk substations. Browns Falls substation is the main supply for the 34.5kV sub-transmission system.

The Tri-Lakes area serves approximately 8,800 customers. There are two (2) 2.4kV feeders, twenty-nine (29) 4.8kV feeders, and six (6) 13.2kV feeders in the study area. Most of the distribution substations are supplied from the 46kV sub-transmission system with the exception of Lake Colby and Ray Brook substations that are served from the 115kV system. The supply for 46kV sub-transmission system in the area is Lake Colby substation. There are two (2) municipal electric companies supplied via the 46kV sub-transmission in the Tri-Lakes area and Tupper Lake.

The WLOF area serves approximately 70,100 customers. There are nine (9) 23-4.8kV substations supplying twenty-seven (27) 4.8kV feeders; and ten (10) 115-13.2kV substations supplying thirty-eight (38) 13.2kV feeders. The 23kV sub-transmission system is supplied from the Boonville, Black River, Coffeen, Indian River, North Carthage and Taylorville substations.

Major Project Table

The following table identifies major projects by spending rationale for this study area.

Table 5-3
Northern Major Projects

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Asset Condition	**Asset Replacement**	Dist	**WLOF**	Coffeen TB3 Replacement	C084109
				Dexter Station Maintenance	C084107
				Leray Station Maintenance	C084108
				Mill St Station Rebuild	C084102
				West Adams 2nd Bank	C084111
		Sub-T	**St. Lawrence**	McIntyre-Hammond 24 23kV refurb	C084261
				McIntyre-Hammond 24 reloc/refurb	C075852
			WLOF	Boonville - Rebuild SubT assc Line	C081425
	Component Fatigue/Deterioration	Tran	**None**	Coffeen: Asset Replacments	C081787
				Taylorville: Asset Rplc/Separation	C081782
	Sub-T Overhead Line	Sub-T	**Nicholville-Malone**	Fort Covington-Malone 26-34.5kV	C050197
			Tri-Lakes	Union-Ausable Forks 36-46kV ref	C050320
				Union-Lake Clear 35-46kV refurb	C050324
			WLOF	Boonville-Alder Creek 21 46 kV	C077028
				Carthage-N. Carthage-Deferiet 23kv	C046435
				Carthage-Taylorville 21/22/26-23kv	C046436
				Old Forge-Raquette Lake 22 46kV	C074003
Customer Request/Public Requirement	**Customer Interconnections**	Tran	**None**	Cedar Rapids - Stations	C083605
				Cedar Rapids-Transmission Line	C083606
				Deer River Wind Project Line	CNYCS13
				Deer River Wind Project Stations	CNYCS12

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
	Public Requirements	Dist	**WLOF**	Village of Clayton Downtown - OH-UG	C053443
Multi-Value Transmission (MVT)	**MVT Reliability**	Tran	**None**	Malone PAR	C084542
Reliability	**Performance**	Tran	**None**	Coffeen Cap Bank	C084547
	Reliability	Dist	**Nicholville-Malone**	North Bangor new 34.5/13.2kV Statio	C046423
			WLOF	Coffeen Regulators	C084106
				Mill St_LVAC_2014 Upgrades-N-2	C053903
	Substation Flood Mitigation	Dist	**Tri-Lakes**	Union Fall - Flood Mitigation -DSub	C078428
Resiliency	**Survivability**	Tran	**None**	Coffeen Bus Split - Resiliency	C084534
				Indian River-Lyme Junction Land	C082202
				Indian River-Lyme Junction Line	C082190
System Capacity - NY	**Load Relief**	Dist	**Nicholville-Malone**	Malone 2nd Bank Feeders (D-Line)	C082332
			WLOF	81452 Westminster Park Rd - Rebuild	C052344
				West Adams New Feeders TB2	C084110
	TO Led System Studies	Tran	**None**	Malone Substation Rebuild_T_Sub	C069306

5. D. Syracuse Oswego Cortland Transmission Study Area

Area Summary

The drivers behind the transmission capacity related projects in the Syracuse Oswego Cortland ("SOC") study area are:

- Area load has, over time, reached levels that result in potential post-contingency overloading of multiple 115kV circuits in the Syracuse area.
- Post-contingency overloading driving the reconductoring of the Clay-DeWitt #3, Clay-Teall #10 and GE-Geres Lock #8 lines.

Key sub-transmission and distribution drivers include the following:

- Load growth in the Syracuse University and the North Syracuse areas are major drivers of distribution capacity work.
- The addition of second transformers and new feeders at several substations are major drivers of reliability work.

Area Description

The SOC study area includes the 345kV and 115kV transmission facilities in the Central Region and all of the 115kV and above transmission facilities around the Oswego Complex area, including the 345kV Scriba and Volney stations.

The SOC area is bordered by Elbridge substation in the West, Cortland substation in the South, Oneida substation in the East, and Clay substation in the North. The important substations in the area include Clay, South Oswego, Dewitt, and Geres Lock. This area also includes some of the assets stretching between Mortimer and Elbridge.

Within the SOC study area, there are eight distribution study areas: Cazenovia, Cortland, East Syracuse, Manilus-Fayetteville, North Syracuse, Syracuse, Volney and West Syracuse.

The Cazenovia study area serves approximately 5,000 customers. The study area is a very rural region, with the Village of Cazenovia and the Cazenovia Industrial Park being the only large loads. The distribution system consists of one 34.5-13.2kV, three 34.5kV-4.8kV substations and one 34.5-4.16V substation. The only physical constraint is Cazenovia Lake and the residential load, which is spread around Cazenovia Lake.

The Cortland study area serves approximately 26,200 customers. The study area is defined by the region that includes the City of Cortland and the surrounding towns and villages. It is located in central New York between Syracuse and Binghamton. The primary distribution system voltages in Cortland are 13.2kV and 4.8kV. Most of the area is fed from a 34.5kV sub-transmission system supplied out of the Cortland and Labrador substations.

The East Syracuse study area serves approximately 9,900 customers. The study area is an industrial suburb of the City of Syracuse. The distribution system consists of one (1) 115-34.5kV, three (3) 115-13.2kV, one (1) 34.5-4.8kV and one (1) 34.5-4.16kV substations. The transmission supply is adequate, and the only physical barriers are Interstate 690 and Interstate 481 going through the area. Customers are served via twelve (12) 13.2kV feeders and two (2) 4.8kV.

The Manlius Fayetteville study area serves approximately 24,300 customers. The study area is a residential suburb of Syracuse. The distribution system consists of one (1) 115-34.5kV and four (4) 115-13.2kV substation. Most new load additions to the area are residential developments.

The North Syracuse study area serves approximately 71,800 customers. The study area is the northern suburb of the City of Syracuse. It has experienced the majority of the new housing which has been built in the Syracuse metropolitan area. The distribution system consists of one (1) 115-34.5kV, nine (9) 115-13.2kV, three (3) 34.5-4.8kV and one (1) 34.5-4.16kV stations. The physical barriers in the North Syracuse area are the two (2) interstates highways, I-81 and I-90.

The Syracuse study area serves approximately 61,400 customers. The study area is made up of the City of Syracuse as well as the Town of Skaneateles about 20 miles southwest of the city. The primary distribution system voltages in Syracuse are 13.2kV and 4.16kV. There is also a 12kV network fed out of Ash St. substation. Most of the area is fed from a 34.5kV sub transmission system supplied by Ash St, Elbridge, Solvay, Teall Ave., and Tilden substations. There is also some 13.2kV fed directly from the 115kV transmission system.

The Volney study area serves approximately 55,300 customers. The study area includes the cities of Oswego and Fulton. The distribution system consists of four (4) 115-34.5kV, seven (7) 115-13.2kV, five (5) 34.5-13.2kV, eight (8) 34.5-4.8kV and one (1) 34.5-4.16kV substations. A physical barrier in this area is the Oswego River, which is also a canal.

The West Syracuse study area serves approximately 22,700 customers. The study area is a suburb west of the City of Syracuse. The distribution system consists of one (1) 115-34.5kV, two (2) 115-13.2kV, and four (4) 34.5-4.16kV substations.

Major Project Table

The following table identifies major projects by spending rationale for this study area.

Table 5-4
Syracuse Oswego Cortland Major Projects

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Asset Condition	Asset Replacement	Dist	North Syracuse	Galeville Station Rebuild	C050746
			Syracuse	Fayette St Line	C081980
				Fayette St Substation	C081981
				N State St-Ash to James-MH Failures	C081071
				Rebuild Ash 4160 and plut on Fayett	C082032
				Temple Distribution Rebuild	C079534
				Temple Substation Rebuild - buildin	C083385
				UG for Temple Rebuild	C079532
			Volney	LighthouseHill Relocation-Dist Line	C074342
		Sub-T	Syracuse	Pebble Hill-Tilden 32 34.5kV Refurb	C083971
			Volney	Mallory-Cleveland 31 34.5kV Refurb	C084194
	Component Fatigue/Deterioration	Tran	None	Ash St. 115-12kV TRF1 Asset replace	C076282
				Border City-Elbridge #10/#5 ACR	C075723
				Browns Falls - Asst Sep/Rplc	C081427
				Clay Substation 115kV Spare Bay Tap	C084077
				Curtis St - Teall #13 ACR	C084496
				Elbridge-Gears Lock 3 Woodard 4 ACR	C084521
				Elbridge-Geres Lock 18/19 ACR	C084522
				Hastings 3 Breaker Ring Substation	C084074
				LightHH 115kV CH	C073996
				LightHH Trans Lines Reconnect	C073997
				Lighthouse Hill - Clay #7 ACR	C069533
				New 345kV/115kV Substation (Parish)	C084078
				Oswego - 115kV & 34.5kV - Rebuild	C043426

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Oswego: 345kV Asset Sep/Repl	C076218
				S Oswego-Clay #4 T-334 Rebuild	C075544
				South Oswego: 115kV Asset Rplc	C081781
	Station Metal Clad Switchgear	Dist	Cortland	Tuller Hill 246 Unit Metalclad Repl	C056611
			North Syracuse	Hopkins 253 - Replace Metalclad Gea	C046741
				Pine Grove Metalclad Replacement	C056614
			Syracuse	Rock Cut Metalclad	C083445
	Substation Power Transformer	Dist	North Syracuse	Galeville 71,72&73 fdrs conversion	C050749
	Sub-T Overhead Line	Sub-T	Syracuse	Elbridge-Jewitt 31-34.5kV refurb	C050959
				Solvay/Woodard-Ash st 27&27&28-34.	C046439
				Woodard 24 Refurb N.-I90	C060445
				Woodard-Teall 32-34.5kV refurbish	C050322
			Volney	Bristol Hill-Phoenix 23-34.5kv	C046474
				LHH-Mallory 22-34.5kv	C046441
				LighthouseHill Sub-TLine Relocation	C074322
				Varick-Bristol Hill 202-34.5kv	C046460
Customer Request/Public Requirement	Customer Interconnections	Tran	None	Cortland Energy Ctr Solar Project Line	CNYCS55
				Homer Solar Energy Center Line	CNYCS21
				Homer Solar Energy Center Storage Stations	CNYCS20
				Sky High Solar Project Line	CNYCS06
				Sky High Solar Project Station Mods	CNYCS05
Damage/Failure	Damage/Failure	Dist	Syracuse	S State St_James to Adams-Duct Line	C054834
Reliability	NERC/NPCC Standards	Tran	None	Clay - Physical Security	C073349
	Reliability	Dist	North Syracuse	Sorrell Hill Rebuild	C077170
Resiliency	Survivability	Tran	None	Clay - Dewitt Resiliency	C084533

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Dewitt-Tilden Resiliency	C084535
				Lighthouse Hill - Clay Resiliency	C084539
				South Oswego - Clay Resiliency	C084540
				Teall - Oneida Resiliency	C084541
	Targeted Feeder Enhancement	Dist	West Syracuse	Harris 54 Relief	C032446
				Milton Ave DLine	C046643
System Capacity - NY	Load Relief	Dist	Volney	Gilbert Mills Xfmr Upgrade-Xfmr	C046563
	TO Led System Studies	Tran	None	Clay-Teall#10,Clay-Dewitt#3 Record	C043995
				Dewitt Station 115kV Rebuild	C081783

5. E. Utica Rome Transmission Study Area

Area Summary

The drivers behind the transmission capacity related projects in this study area include the need to address thermal and voltage issues in area substations.

Key sub-transmission and distribution drivers include the following:

- Rebuilding of the Poland 62258 feeder along NYS Route 8 to improve reliability and loading profile.
- Refurbishment of several 46kV sub-transmission circuits to address asset condition concerns.
- Rebuilding of Terminal Substation to address asset condition, reliability and environmental concerns.

Area Description

The Utica Rome transmission study area includes the 115kV and above transmission system with the northern boundary at Boonville substation, west at Oneida, and east ending before Inghams substation. Within the Utica Rome study area, there are four (4) distribution study areas: Oneida, Rome, Utica and WLOF.

The Oneida study area serves approximately 18,500 customers. The study area includes the City of Oneida and the Village of Canastota. In the City of Oneida, the Oneida Hospital has dual distribution supplies. Across the street from the hospital is the H.P.Hood Dairy Products Inc. facility which represents 4MVA of the load and also has dual distribution supplies. The Village of Canastota, which is located in western section of the Oneida area, has several large commercial and industrial customers including Canastota Industrial Park, Owl Wire and Cable, Inc. and Die Molding Inc. A geographic constraint is the distance to other substations and the lack of feeder ties. There have been improvements to feeder ties between the Oneida and Peterboro substations. Developing these ties was challenging due to the New York State Thruway which has stringent road crossing regulations, which is located between the two substations.

The Rome area serves approximately 26,400 customers. There are sixteen (16) 13.2kV feeders and ten (10) 4.8kV feeders in the study area. All distribution substations are supplied from the 115kV system. As a result, there are no sub-transmission lines in the area.

The Utica study area serves approximately 81,500 customers. The study area includes the City of Utica. The distribution system consists of four (4) 115-46kV, ten 115-13.2kV, six (6) 46-13.2kV and eight (8) 46-5kV substations. Rock City substation will be converted to 46-13.2kV to address loading concerns at So. Washington and Salisbury substations.

The WLOF study area serves approximately 7,900 customers in Old Forge. There are five (5) 46-4.8kV substations supplying nine (9) 4.8kV feeders and one (1) 13.2kV substation supplied out of Alder Creek substation. The 46kV sub-transmission system is supplied out of the Boonville substation. The 46kV sub-transmissions system also serves approximately 1,800 NYSEG customers in Long Lake.

Major Project Table

The following table identifies major projects by spending rationale for this study area.

Table 5-5
Utica Rome Major Projects

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Asset Condition	**Asset Replacement**	Dist	**Utica**	Terminal Station Relocation_DLine	C059671
		Sub-T	**Utica**	Trenton Middleville24- Struct Reloc	C083835
				WHITESBORO-SCHUYLER No 29 Refurb	C084250
	Component Fatigue/Deterioration	Tran	**None**	Boonville - Rebuild Assc Tline work	C082488
				Boonville - Rebuild CH	C082487
				Boonville Rebuild	C049903
				Edic: Protection Migration	C076214
				LightHH 115kV Yard Repl & cntrl hs.	C031662
				Oneida - Sub Rebuild T-line	C084674
				Oneida - Substation Rebuild CH	C084809
				Oneida Substation Rebuild	C034443
				Terminal Station Relocation	C076242
				Terminal Station Relocation_TLine	C080493
	Sub-T Overhead Line	Sub-T	**Utica**	Deerfield-whitesboro 26-46kv	C046459
				Trenton-Whitesboro 25, 46kV	C058579
				Yahnundasis-Clinton 24 -46kv	C046449
Customer Request/Public Requirement	**Customer Interconnections**	Tran	**None**	North Country Solar Project Stations	CNYCS38
				Number 3 Wind: Line	C083419
				Number 3 Wind: Stations	C083418
				SUNY POLY 115KV LN6 TAP	C083667
Damage/Failure	**Damage/Failure**	Tran	**None**	Str# 42 Levitt - Rome Replacement	C083619
Reliability	**Performance**	Tran	**None**	Oneida Cap Bank	C084549
	Reliability	Dist	**Utica**	MV- Poland 62258 Route 8 Reconducto	C046606

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				MV-Poland 62258 Route 8 Reconductor	C046605
Resiliency	**Survivability**	Tran	**None**	Yahnundasis - Porter Resiliency	C084545
	Targeted Feeder Enhancement	Dist	**Utica**	Rock City Station - 13.2kV Rebuild	C046671

5. F. Genesee Transmission Study Area

Area Summary

Key transmission projects in the Genesee study area have the following drivers:

- Past projects have addressed the capacity needs in this area, leaving the main driver for the remaining projects as Asset Condition.

Key sub-transmission and distribution drivers include the following:

- Capacity load relief concerns in the Geneseo / Livonia areas will be addressed with new distribution feeders supplied from Sonora Way substation.

Area Description

The Genesee transmission study area includes Company assets within NYISO Zone B. The area includes assets as far west as Lockport and as far east as Mortimer. The system consists of several 115kV circuits between Lockport and Mortimer stations. Three (3) circuits go directly from Lockport to Mortimer, three (3) circuits go from Lockport to Batavia and several circuits in series connect Batavia and Golah. Today, one (1) 115kV line and one (1) 69kV line connect between Mortimer and Golah.

Two (2) 345kV circuits owned by NYPA travel through this area from Niagara to Rochester. At Rochester Station 80, RG&E has four (4) 345-115kV transformers with 115kV connections to Rochester Station 82. Station 82 is the RG&E 115kV station adjacent to and tied to the Company's Mortimer Station.

This area also includes some of the assets stretching between Mortimer in the Western Region and Elbridge in the Central Region.

Within the Genesee study area, there are three (3) distribution study areas: Genesee North, Genesee South and Livingston.

The Genesee North study area serves approximately 41,200 customers. There is a total of fifty-one (51) distribution feeders that supply customers in this area. There are twenty (20) 13.2kV feeders, with four (4) being supplied from 34.5-13.2kV transformers, and the rest are fed from 115-13.2kV transformers. The thirty-one (31) 4.8kV feeders are all fed from 34.5-4.8kV transformers. There are ten (10) 34.5kV sub-transmission lines that supply the distribution step down transformers in the area.

The Genesee South study serves approximately 32,300 customers. The study area is defined by the region that includes the City of Batavia and the surrounding towns and villages. It is located east of Buffalo and southwest of the City of Rochester. The primary distribution system voltages in Genesee South are 13.2kV and 4.8kV. Most of the 13.2kV system is supplied by the area 115kV transmission system. The rest of the 13.2kV system, as well as the 4.8kV system, are fed from a 34.5kV sub-transmission system supplied out of the North Akron, Batavia, North Leroy, and Oakfield substations. There are several customers supplied directly from the sub-transmission system.

The Livingston study area serves approximately 28,700 customers. The study area is largely made up of Livingston County, which is south of Rochester and east of Batavia. The primary distribution system voltages in Livingston are 13.2kV and 4.8kV. Half of the load is supplied from the 115-13.2kV East Golah, Mumford and Sonora Way substations. The remainder is supplied from 69kV at York Center and the 34.5kV sub-transmission system supplied out of the Golah and North Lakeville substations. Two customers are supplied directly from the 115kV system.

Major Project Table

The following table identifies major projects by spending rationale for this study area.

Table 5-6
Genesee Major Projects

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Asset Condition	**Asset Replacement**	Dist	**Livingston**	Sonora Way F438153	C046552
Asset Condition	**Asset Replacement**	Dist	**Livingston**	Sonora Way F438154	C051690
Asset Condition	**Asset Replacement**	Dist	**Livingston**	Sonora Way Substation with 6 fders	C060141
Asset Condition	**Asset Replacement**	Sub-T	**Genesee North**	Telegraph-Medina 302 &303 34.5 kV	C081634
Asset Condition	**Asset Replacement**	Sub-T	**Genesee South**	Attica-Wethersfield 209 34.5 kV ref	C081705
Asset Condition	**Asset Replacement**	Sub-T	**Genesee South**	N.Akron-Attica 225 34.5kV Refurb	C084020
Asset Condition	**Asset Replacement**	Sub-T	**Genesee South**	Oakfield-Caledonia 201 34.5 Refurb	C083975
Asset Condition	**Asset Replacement**	Sub-T	**Livingston**	Golah-N. Lakeville 216-217 refurb	C084016
Asset Condition	**Asset Replacement**	Sub-T	**Livingston**	N.Lakeville - Ridge LN 218 Refurbis	C046766
Asset Condition	**Asset Replacement**	Sub-T	**Livingston**	North Lakeville-Ridge 218 refurb	C084014
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	Batavia - Replace five OCBs	C075904
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	Brockport Taps ACR	C055531
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	Lockport-Batavia 112 T1510 ACR	C003422
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	Mortimer #3 Auto TRF Replace	C076283
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	Mortimer - Pannell 24/25 ACR	C047816
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	Mortimer-Golah #110 ACR	C060220
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	Mortimer-Golah 109-69kV refurb	C081474
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	Pannell-Geneva 4-4A T1860 ACR	C030889
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	Rochester Airport Cable Refurb	C080543
Asset Condition	**Component Fatigue/Deterioration**	Tran	**None**	SE Batavia-Golah 119 ACR	C060217
Asset Condition	**Sub-T Overhead Line**	Dist	**Genesee North**	Barker Station 78	C083749
Asset Condition	**Sub-T Overhead Line**	Sub-T	**Genesee North**	Barker-Lyndonville 301-34.5kV	C052511
Asset Condition	**Sub-T Overhead Line**	Sub-T	**Genesee North**	Lyndonville-Medina 301-34.5kV	C052512
Asset Condition	**Sub-T Overhead Line**	Sub-T	**Genesee North**	Phillips-Barker 301-34.5kv	C046465
Asset Condition	**Sub-T Overhead Line**	Sub-T	**Genesee North**	Phillips-Telegraph 304-34.5kv	C046466

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Reliability	**Performance**	Tran	**None**	Golah Line 116 By-pass Switch	C084293
	Reliability	Dist	**Genesee South**	Mumford #50 - Install Transformer #2	C046590
System Capacity - NY	**TO Led System Studies**	Tran	**None**	Golah Sub rebuild	C051831

5. G. Frontier Transmission Study Area

Area Summary

The principal drivers for transmission projects in this area are:

- Fault current levels that result in overdutied breakers at Gardenville.
- High post-contingency 115kV line loadings on lines extending south and east from Niagara, Packard, and Gardenville.
- Recommended major projects that address capacity issues include reconductoring of the #181, #191/ and #192 lines, the addition of a 115-kV capacitor bank and bus tie breaker at Huntley, and some reconfiguration and upgrading of limiting elements at Lockport and Mountain stations.
- The NYISO selected project, in accordance with the Public Policy Transmission Planning Process (PPTPP), does not address overloads on the local transmission system. This results in the need for multiple area projects to relieve thermal constraints.
- The replacement of Old Gardenville Station to address station configuration issues as well as asset condition issues will also partially address capacity needs.

Key sub-transmission and distribution drivers include the following:

- Load growth in the Tonawanda area. A new 115-13.2kV substation (Two Mile Creek Road) will be used to supply the new commerce/industrial parks.
- Load growth by at the Buffalo Niagara Medical Campus as well as across downtown will be served by Elm Street substation.
- Area loading requiring the upgrade of multiple Buffalo area substations, including Buffalo Stations 59, and 124.
- Indoor substations are an asset condition issue and there are several replacement projects in progress in Buffalo, Stations 53 & 32 are next in queue. The condition of Harper 115-12kV station and several indoor substations in Niagara Falls are driving a new 115-13.2kV substation and other new projects in Niagara Falls.

Area Description

The Frontier transmission study area includes assets within NYISO Zone A. The area includes assets as far east as Lockport, the Niagara and Buffalo areas and the system stretching south to

Gardenville. The system consists primarily of 115kV and 230kV double circuit transmission lines. The important substations are Packard (230 and 115kV), Huntley (230 and 115kV), and Lockport (115kV). There is a joint National Grid and NYSEG substation at Gardenville (230 and 115kV). The Company has three (3) 230/115kV transformers at Gardenville and two (2) at Packard. NYSEG and NYPA also have their own substations in the area.

Within the Frontier study area there are ten distribution study areas: Amherst, Cheektowaga, Elm, Grand Island, Kensington, Niagara, Niagara Falls, Sawyer, Seneca and Tonawanda.

The Amherst study area serves approximately 65,100 customers. The study area is located east of Tonawanda and Niagara, and north of the City of Buffalo and encompasses the towns of Amherst, Pendleton, Wheatfield, Wilson and Lewiston. The Erie Canal divides the study area and may present challenges in creating new feeder ties and recommended supply expansion. The primary distribution system in Amherst is 13.2kV and 4.16kV, with a few small pockets of 4.8kV. The area substations are supplied by the 115kV transmission system with the exception of Buffalo Station 58 and Buffalo Station 124, which are supplied by 34.5kV sub-transmission lines originating from Youngman Terminal Station and Buffalo Station 67, which is supplied by the 34.5kV sub-transmission lines originating from Walden substation.

The Cheektowaga study area serves approximately 7,900 customers. The area is located east of the City of Buffalo. There are several stations in this area that are supplied by 115kV transmission lines. Walden is the largest and has two transformers that serve the 34.5kV sub-transmission system. Dale Rd. substation is 115-13.2kV, while Buffalo substations 61 and 154 are 115-4.16kV. Buffalo Substation 66 is a 34.5-4.8kV Substation. The remaining substations in the area are 34.5-4.16kV. Buffalo Substation 146 has a 34.5-4.8kV and a 34.5-13.2kV transformer.

The Elm study area serves approximately 3,300 customers and is part of the City of Buffalo. It contains the downtown area as well as surrounding urban areas with a mix of residential, commercial and industrial loads. Elm Street Substation is a 230-23kV station that supplies the Buffalo network as well as the sub-transmission supply to several distribution stations. The Elm Street Substation supplies approximately 120MW of load. Most of the load is served by a low voltage AC general network which is supplied by multiple paralleled transformers with multiple 23kV supply cables thus providing very high reliability.

The Grand Island study area serves approximately 8,700 customers. The study area is made up of Grand Island which is between the City of Buffalo and Niagara Falls. It is primarily suburban and rural residential with areas of commercial and industrial parks. There are two (2) National Grid substations supplied from 115kV lines with distribution feeders at 13.2kV.

The Kensington study area serves approximately 35,600 customers. There are eighty (80) 4.16kV feeders; all fed from thirty-eight (38) 23-4.16kV transformers and nineteen (19) 23kV sub-transmission lines. The Kensington Substation has four (4) 115-23kV transformers and provides the supply to the 23kV sub-transmission system. This substation is located in the City of Buffalo and the study area contains significant amounts of underground distribution mainlines and overhead laterals. The Kenmore Terminal Station supplies several smaller commercial customers and the South Campus of the SUNY at Buffalo.

The Niagara study area serves approximately 12,800 customers. The study area encompasses the towns of Lewiston, Porter, and Wilson. The study area is bordered to the west by Niagara River, to the North by Lake Ontario, and to the south by Power Reservoir. Area distribution is served primarily at 4.8kV and supplied by a 34.5kV sub-transmission network. The 34.5kV sub-transmission network operates in a loop system that is supplied by both Mountain and Sanborn 115-34.5kV substations. Swann Road supplies a significant portion of this area and is 115-13.2kV.

The Niagara Falls study area serves approximately 38,700 customers. The study area is bordered to the north, south, and west by the Niagara River. The Power Reservoir also borders the area to the north, east of the Niagara River. Interstate 190 runs from the north to the south along the eastern section of the study area. The CSX Railroad runs from the east to the west along the northern section of the area. The Niagara Falls International Airport lies east of the city. These boundaries limit feeder ties and distribution supply expansion in the area. The area is supplied primarily by the 115kV transmission system; however, a 12kV sub-transmission system is supplied by Harper and Gibson substations. Distribution load is served by 13.2kV, 4.8kV, and 4.16kV circuits.

The Sawyer study area serves approximately 63,700 customers. The study area contains portions of the City of Buffalo and the Town of Tonawanda. There are 154 4.16kV feeders supplying the area which are supplied by 23kV supply cables and multiple, paralleled transformers.

The Seneca study area serves approximately 44,100 customers. The study area is the southeast section of Buffalo. It is served primarily from the Seneca Terminal Station which has four 115-23kV transformers and serves twenty-five (25) supply lines at 23kV. Most of the distribution substations are served by four (4) supply cables and have four (4) 23-4.16kV transformers. As throughout the City of Buffalo, almost all distribution load is served at 4.16kV.

The Tonawanda study area serves approximately 27,400 customers. The study area encompasses the City of North Tonawanda as well as a portion of the City and Town of Tonawanda. Bordering the western section of the area is the Niagara River. Ellicott Creek flows parallel to Tonawanda Creek in the northern part of the town of Tonawanda, with a confluence just east of the Niagara River. These creeks flow through the central part of the area from east to west. The eastern section of the area is bordered by the Town of Amherst and forming the southern border is the Village of Kenmore and the City of Buffalo. The area is served primarily by the 115kV transmission system and the 23kV sub-transmission system. Distribution voltage is served primarily by 4.16kV feeders.

Major Project Table

The following table identifies major projects by spending rationale for this study area.

Table 5-7
Frontier Major Projects

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Asset Condition	**Asset Replacement**	Dist	**Grand Island**	Grand Island Station Build	C081485
			Kensington	Buffalo Station 31 Rebuild - Line	C046943
				Buffalo Station 32 Rebuild - Line	C036461
			Niagara Falls	New Harper Substation D Line	C046417
			Seneca	Buffalo Station 38 Rebuild - Line	C046936
			Tonawanda	Buffalo Station 122 Rebuild - Sub	CD00782
				Station 79 Rebuild	C082713
		Sub-T	**Erie South**	Ohio St Duct Bank Interconnetion	C081704
			Niagara	Ransomville-Phillips 402 refurb	C084189
			Sawyer	Buffalo 23kV Reconductor - Huntley	C079450
	Buffalo St Light Replacement	Dist	**None**	Buffalo Street Light Cable Replacem	CD00851
	Component Fatigue/Deterioration	Tran	**None**	103 and 104 Mountain Lockport	C082394
				Elm St #2 TRF Asset Replacement	C069426
				Frontier 180 182 ACR/Recond	C027436
				Gardenville Rebuild	C005156
				Huntley - Asset Rplc/Sep	C049902
				Huntley-Gardenville 38/39 Rebuild	C075543
				Huntley-Lockport 36/37 Ayer Rd ACR	C081670
				Kensington #4 & #5 TRF asset replac	C069429
				Laona-Falconer 172/173 ACR/CCR	C083216
				Lockport 103-104 T1620-T1060 STR	C027432
				Lockport Sub Rebuild CH	C073991
				LockportSubstationRebuildCo36TxT	C035464
				Packard - Rplc three 115kV OCBs	C079222
				Royal (New Harper) 115 kV line taps	C044594
				Royal (New Harper) TxT Substation	C044874
				Seneca #5 TRF asset Replace	C069427
	Station Metal Clad Switchgear	Dist	**Amherst**	Station 140 Metalclad Replacement	C056616
			Cheektowaga	Station 61 - Metalclad Replacement	C051707
			Kensington	Station 162 Metalclad Replacement	C052706
	Substation Indoor	Dist	**Kensington**	Buffalo Station 30 - Rebuild - Fdrs	C015754
				Buffalo Station 30 Rebuild - Sta	C046519
				Buffalo Station 31 Rebuild - Sub	C046952
				Buffalo Station 32 Rebuild - Sta	C036459

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Buffalo Station 53 Rebuild - Line	C046929
				Buffalo Station 53 Rebuild - Sub	C046945
			Niagara Falls	Eighth St 80 - Indoor Substation Re	C046585
				Eighth St 80 - Sub Refurb D-Line	C046586
				Eleventh St 82 - Indoor Substation	C046582
				Stephenson 85 - Indoor Substation R	C046581
				Stephenson 85 - Sub Refurb D-Line	C046580
				Welch 83 - Sub Refurb D-Line	C046584
				Welch 83 Indoor Substation Refurbis	C046583
			Seneca	Buffalo Station 38 Rebuild - Sub	C046955
	Substation Power Transformer	Dist	**Amherst**	Station 124 - Almeda Ave Transforme	C046670
	Sub-T Overhead Line	Sub-T	**Sawyer**	Refurbish H lines 26H, 33H, 34H	C048911
			Tonawanda	Tonawanda Lines 601-604-23kv	C046451
				Tonawanda Lines 622-624-23kv	C046452
Customer Request/Public Requirement	**Customer Interconnections**	Tran	**None**	Bear Ridge Solar Project Line	CNYCS53
				Bear Ridge Solar Project Stations	CNYCS52
	Public Requirements	Tran	**None**	GCEDC STAMP LINE 112 RELOCATION	C080692
Damage/Failure	**Damage/Failure**	Dist	**Grand Island**	Grand Island Station 64 TB2 D/F	C083337
DER Electric System Access	**Company Owned DER**	Dist	**Sawyer**	Kenmore Station 22 Battery Storage	C078752
Reliability	**Performance**	Tran	**None**	Mobile Capacitor Bank	C081351
	Reliability	Dist	**Grand Island**	Long Rd 209 - New F20955	CD00964
				Long Road 209 - Install TB2	CD00977
			Tonawanda	Station 214 - Install TB2	C029186
				Station 214 - New F21467	C029187
Resiliency	**Survivability**	Tran	**None**	Huntley - Lockport Resiliency	C084538
System Capacity - NY	**Load Relief**	Dist	**Seneca**	Station 3012 D-line	C074911
				Station 3012 Substation	C074909
	TO Led System Studies	Tran	**None**	Elm St Relief_Add 4th Xfer	C049594
				Frontier 181 ACR/Record	C060215
				Niagara-Packard 191 Reconductor	C079489
				Niagara-Packard 192 Reconductor	C079488
				Packard-Gardenville Rctrs & Brkrs	C079506
				Pack-Gardenville Reconfiguration	C081799
				Pack-Hunt 130 Walk-Hunt 133 Record	C079500
				Ridge Substation - 34.5kV System Re	C046693

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Youngs St Sta 214 -115kV tap-Tline	C054963

5. H. Southwest Transmission Study Area

Area Summary

The primary drivers of the transmission capacity related projects in the Southwest study area are:

- The future interconnection of several wind generation projects.
- Due to lower load levels, generation retirements, and higher imports from Ontario in Western NY, more power flow is going in a north-to-south direction causing 115 kV circuit overloads. Thus, the Gardenville #141/142 115 kV circuits will be rebuilt.

Key sub-transmission and distribution drivers include the following:

- The 34.5kV sub-transmission system, which consists of several very long loops that traverse rugged territory.
- Load growth and reliability concerns in the South Chautauqua portion of the area are driving new station projects.
- Load growth and asset condition issues at Stations in the Eden/Evans area that are being addressed by a new substation and expansion/upgrade of Delameter Road Substation.

Area Description

The Southwest transmission study area includes the system as far north as Gardenville station, east into Wellsville and the system stretching south into Pennsylvania. The transmission system consists primarily of 115kV and 230kV double circuit transmission lines. The important stations are Gardenville (230 and 115kV), a joint National Grid and NYSEG station, Dunkirk (230 and 115kV), Falconer (115kV), Homer Hill (115kV) and the newly constructed Five Mile Road (345 and 115 kV). National Grid has one (1) 345-115 kV transformer located at Five Mile Road and five (5) 230-115kV transformers at Gardenville (3) and Dunkirk (2). NYSEG also has two (2) 230-115kV transformers at Gardenville.

Within the Southwest study area, there are six (6) distribution study areas: Cattaraugus-North, Chautauqua North, Chautauqua South, Erie South, Olean and Wellsville.

The North Cattaraugus study area serves approximately 15,200 customers. There are seven (7) 13.2kV feeders, five (5) of which are fed via two (2) 115-13.2kV transformers at the Valley substation. The remaining two (2) 13.2kV feeders are fed from a 34.5-13.2kV transformer at the Price Corners substation. There are also twenty-one (21) 4.8kV feeders, all supplied by 34.5-4.8kV transformers at various area substations. There are seven (7) 34.5kV sub-transmission lines that provide supply for the 34.5-4.8kV transformers and a minimal number of industrial customers that are supplied directly from the 34.5kV system. There are several NYSEG substations and municipal electric departments supplied from the 34.5kV system.

The Chautauqua North study area serves approximately 22,900 customers. There are ten (10) 4.8kV feeders, which are all fed from 34.5-4.8kV transformers. There are also twenty (2) 13.2kV distribution feeders with all but one (1) fed by 115-13.2kV transformers at various substations in the area. One (1) 13.2kV feeder is supplied by a 34.5-13.2kV transformer at the West Portland substation. There are also eight (8) 34.5kV sub-transmission lines, which provide the supply to the 34.5-4.8kV step-down transformers in the area.

The Chautauqua South study area serves approximately 17,900. Customers are supplied by twenty (20) 4.8kV delta feeders, all of which are fed from 34.5-4.8kV transformers. There are four (4) 13.2kV feeders with three (3) fed by the Baker Street 115-13.2kV transformer and one (1) fed by the French Creek 34.5-13.2kV transformer. There are five (5) 34.5kV sub-transmission lines that are supplied from Hartsfield and South Dow 115kV substations.

The Erie South study area serves approximately 34,100 customers. The study area includes the Buffalo outer harbor area and those areas south of the City of Buffalo with approximately half the feeders served at 13.2kV. The 115kV system supplies the 13.2kV stations. The rest of the feeders operate at 4.8kV or 4.16kV.

The Olean study area serves approximately 18,500 customers. There are twenty (20) distribution feeders that provide service to area customers. There are eight (8) 4.8kV feeders supplied by 34.5-4.8kV transformers at various stations. Eleven (11) of the area's twelve (12) 13.2kV feeders are fed from 115-13.2kV transformers. The remaining single feeder is served from a 34.5-13.2kV transformer at the Vandalia substation.

The Wellsville study area serves approximately 4,400 customers. This study area is a small, rural region located near the Pennsylvania border and is supplied by the 115-34.5kV Andover and Nile substations. There are two (2) 34.5kV supply lines in the area. The load is served by five (5) substations serving nine (9) 4.8kV feeders.

Major Project Table

The following table identifies major projects by spending rationale for this study area.

Table 5-8
Southwest Major Projects

Capex Spending Rationale	Capex Program Name	Budget	Distribution Planning Region	Project Description	Project Number
Asset Condition	Asset Replacement	Sub-T	Chautauqua North	W Portland-Hartfield 866 ref 34.5 k	C081637
			Chautauqua South	Sherman-Ashville 863-Ref/Rec	C079096
	Component Fatigue/Deterioration	Tran	None	Dunkirk Rebuild	C005155
				Dunkirk Substation Rebuild CH	C073999
				Gard-Dun 141-142 N Phase Rebuild	C003389
				Gard-Dun 141-142 T1260-70 ACR	C081744
				Gard-Dun 141-142 T1260-70 ACR Senec	C034193
				Gard-HH 151-152 T1950-T1280 S ACR	C027425
				Homer Hill - 115kV 34.5kV Asset Rpl	C075942
				Land - Gardenville-N. Angola #141/	C076951
	Sub-T Overhead Line	Sub-T	Cattaraugus North	Dake Hill-W. Salamanca 816-34.5kv	C046469
			Chautauqua North	Hartfield-S. Dow 859 34.5 kV prt 3	C074502
			Erie South	Bagdad-Dake Hill 815-34.5kV refurb.	C050292
				Gard-Dun 141-142 SubT Line Relocate	C078197
			Olean	HH-Ceres 809 flood plain reloc.	C075854
				Homer Hill-Nile 811-34.5kV	C050326
Customer Request/Public Requirement	Customer Interconnections	Tran	None	Alle Catt II - Transmission Line	C083612
				Alle Catt II Wind - Stations	C083615

Capex Spending Rationale	Capex Program Name	Budget	Distribution Planning Region	Project Description	Project Number
				Bakerstand Solar Project Stations	CNYCS50
				Ball Hill Wind Project - Line	C082372
				Ball Hill Wind Project - Stations	C082373
				Cassadaga Wind Project - Line	C082024
				Cassadaga Wind Project - Stations	C082021
				Lake Erie Connector (S. Ripley PAR) Station Mods	CNYCS07
				Martin Road Solar Project Line	CNYCS49
				SW Energy Storage Project Stations	CNYCS16
Damage/Failure	**Damage/Failure**	Tran	**None**	Gard-5 Mile 151/152 Erosion&Road	C082708
				Machias - Replace TB#1 D/F	C083642
Multi-Value Transmission (MVT)	**MVT Reliability**	Tran	**None**	MoonRd-Falconer 175/176 Rctor Inst	C082184
Reliability	**Reliability**	Dist	**Chautauqua South**	Baker St - Install 2nd xfmr	C046553
			Erie South	Bflo Sta 139 - Replace Transformers	C036639
				Delameter Install two 20/26/33MVA	C046536
		Sub-T	**Chautauqua South**	LN863 Findley Lake - French Creek e	C046510
Resiliency	**Survivability**	Tran	**None**	Dunkirk - Falconer Resiliency	C084537
	Targeted Feeder Enhancement	Dist	**Chautauqua South**	MSH Reconductor 5561 & 5651	C082060
System Capacity - NY	**Load Relief**	Dist	**Erie South**	Eden switch structure -install 2-10	C046538

Capex Spending Rationale	Capex Program Name	Budget	Distribution Planning Region	Project Description	Project Number
				Eden Switch Structure- New Fdr 1	C048015
				Eden Switch Structure- New fdr# 2	C048016

Exhibit 1 - Transmission Capital Investment Plan

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
Asset Condition	Asset Condition I&M	NY Inspection Repairs - Capital	C026923	12,900	10,000	10,000	10,000	10,000	52,900
	Asset Condition I&M Total			12,900	10,000	10,000	10,000	10,000	52,900
	Component Fatigue/Deterioration	103 and 104 Mountain Lockport	C082394	120	1,040	-	-	-	1,160
		345KV HUDSON RIV. VIBRATION MITI.	C084213	420	-	-	-	-	420
		345kV Laminated Cross-arm-Program	C060365	1,500	500	2,000	1,000	1,000	6,000
		69kV supply to Market Hill retireme	C081473	-	-	-	-	-	-
		73&74 Gardenville-Dunkirk Str repla	C083937	280	-	-	-	-	280
		Albany Steam - 115kV asset rplc	C079461	719	1,850	2,142	-	-	4,711
		Amsterdam-Rotterdam3/4 Relocation	C081471	2,887	-	-	-	-	2,887
		AMT PIW/SERR - NIMO	C031545	200	200	200	200	200	1,000
		AMT PS&I - NMPC	C042663	1,000	1,000	3,000	3,000	3,000	11,000
		Ash St. 115-12kV TRF1 Asset replace	C076282	1,135	-	-	-	-	1,135
		Balmat - Repl liquid filled fuse	C076189	25	-	-	-	-	25

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Batavia - Obsolete Relays	C073587	459	-	-	-	-	459
		Batavia - Replace five OCBs	C075904	1,814	1,761	124	-	-	3,699
		BatteryRplStrategyCo36TxT	C033847	600	600	500	600	525	2,825
		Benetts Bridge - Geres Lock 6 Remov	C081493	-	-	-	-	-	-
		Boonville - Rebuild Assc Tline work	C082488	250	1,200	2,147	250	-	3,847
		Boonville - Rebuild CH	C082487	150	500	990	194	-	1,834
		Boonville Rebuild	C049903	120	180	4,796	7,200	2,621	14,917
		Boonvill-Portr 1-2 T4020-T4030 ACR	C047818	-	-	-	-	288	288
		Border City-Elbridge #10/#5 ACR	C075723	-	-	200	2,000	-	2,200
		Breaker T Repl Program 4-69kV NYC	C049258	1,260	900	625	625	300	3,710
		Breaker T Repl Program 4-69kV NYE	C049257	600	800	825	600	300	3,125
		Breaker T Repl Program 4-69kV NYW	C049260	900	1,050	900	349	300	3,499
		Brockport Taps ACR	C055531	75	100	5,000	8,000	7,000	20,175
		Browns Falls - Asst Sep/Rplc	C081427	900	4,950	2,511	455	-	8,816

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Capital Reserve - Asset Condition	CNYX31AC	-	-	-	-	-	-
		Carr St./E.Syracuse CO-Gen Relays	C049739	165	-	-	-	-	165
		Clay Substation 115kV Spare Bay Tap	C084077	100	500	1,000	500	-	2,100
		COFFEEN - BLACK RIVER WOODPECKER	C084018	394	-	-	-	-	394
		Coffeen: Asset Replacments	C081787	-	-	100	440	7,268	7,808
		Colton-BF 1-2 T3140-T3150 ACR	C036164	-	-	-	-	288	288
		Curtis St - Teall #13 ACR	C084496	-	100	300	983	3,836	5,219
		Deerfield: Asset Replacements	C081797	-	-	-	98	339	437
		Dunkirk Rebuild	C005155	5,291	13,293	7,979	5,957	38	32,558
		Dunkirk Substation Rebuild CH	C073999	1,543	482	-	-	-	2,025
		Easement - Hartfield-South Dow 859	C083685	470	102	-	-	-	572
		Edic: Protection Migration	C076214	505	470	2,350	1,421	140	4,886
		Elbridge-Gears Lock 3 Woodard 4 ACR	C084521	-	100	300	983	3,836	5,219
		Elbridge-Geres Lock 18/19 ACR	C084522	-	-	300	98	3,836	4,234

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Elm St #2 TRF Asset Replacement	C069426	2,983	1,624	228	-	-	4,835
		Frontier 180 182 ACR/Recond	C027436	-	250	1,000	1,475	3,836	6,561
		Gard-Dun 141-142 N Phase Rebuild	C003389	2,685	24,000	30,458	30,260	16,425	103,828
		Gard-Dun 141-142 S Phase Land	C081750	-	-	20	30	55	105
		Gard-Dun 141-142 South Struct Repl	C077024	13	-	-	-	-	13
		Gard-Dun 141-142 T1260-70 ACR	C081744	50	70	50	50	13,800	14,020
		Gard-Dun 141-142 T1260-70 ACR Senec	C034193	5	7	5	5	1,250	1,272
		Gardenville Rebuild	C005156	1,101	33	-	-	-	1,134
		Gardenville-Rebuild Line Relocation	C030084	23	-	-	-	-	23
		Gard-HH 151-152 T1950-T1280 S ACR	C027425	-	-	-	200	1,000	1,200
		GE Butyl Rubber VT Replacement	C049002	49	-	-	-	-	49
		Gloversville - Marshville #6 Refurb	C081458	905	5,490	100	-	-	6,495
		Greenbush - 115kV & 34.5kV refurb	C079224	-	50	1,200	5,374	13,566	20,190

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Harper Station Storage Building	C083819	300	-	-	-	-	300
		Hastings 3 Breaker Ring Substation	C084074	350	250	7,000	3,000	500	11,100
		Homer Hill - 115kV 34.5kV Asset Rpl	C075942	30	800	4,000	3,009	25	7,864
		Hoosick - Control House	C081115	-	300	1,200	-	-	1,500
		Hoosick - Replace Bank 1 & relays	C053132	544	2,400	2,880	2,825	480	9,129
		Huntley - Asset Rplc/Sep	C049902	3,592	-	-	-	-	3,592
		Huntley-Gardenville 38/39 Rebuild	C075543	-	300	250	983	1,439	2,972
		Huntley-Lockport 36 37 ACR	C069538	917	-	-	-	-	917
		Huntley-Lockport 36/37 Ayer Rd ACR	C081670	-	-	200	98	4,795	5,093
		Indeck-Spier Str & Foundation Replc	C083672	150	161	-	-	-	311
		Inghams Station - Assoc Line work	C060240	400	1,300	1,300	2,600	8,105	13,705
		Inghams Station Re-vitalization	C050917	516	1,100	1,000	6,387	3,961	12,964
		Inghams Station Revitalization CH	C074000	100	250	250	1,350	40	1,990

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Inspection Identified Replac Progra	C082106	3,078	3,000	4,000	4,000	4,000	18,078
		Johnstown-Market Hill Sws#811 & 844	C081478	161	-	-	-	-	161
		Kensington #4 & #5 TRF asset replac	C069429	595	3,431	3,173	100	-	7,299
		Kensington Sta - Replace OCB R1523	C083645	42	-	-	-	-	42
		Land - Gardenville-N. Angola #141/	C076951	4,500	-	-	-	-	4,500
		Laona-Falconer 172/173 ACR/CCR	C083216	300	250	1,000	4,000	4,228	9,778
		LightHH 115kV CH	C073996	100	250	500	2,000	100	2,950
		LightHH 115kV Yard Repl & cntrl hs.	C031662	721	1,100	1,500	7,621	4,944	15,886
		LightHH Trans Lines Reconnect	C073997	150	900	20	20	3,302	4,392
		Lighthouse Hill - Clay #7 ACR	C069533	200	500	500	2,000	2,000	5,200
		Lockport / Hinman Rd Storage Bldg	C083804	300	-	-	-	-	300
		Lockport 103-104 T1620-T1060 STR	C027432	-	300	200	983	959	2,442
		Lockport Sub Rebuild CH	C073991	15	350	1,200	10	10	1,585
		Lockport-Batavia 112 T1510 ACR	C003422	950	1,000	915	2,000	4,000	8,865

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Lockport-Mortimer 113/114 ACR/CCR	C081664	-	-	300	246	959	1,505
		LockportSubstationRebuildCo36TxT	C035464	313	750	700	6,100	5,936	13,799
		Mallory - Rplc Switch 228	C081942	166	-	-	-	-	166
		Maplewood-Norton-Replace Pilot Wire	C036006	88	-	-	-	-	88
		Mayfield - Vail Mills Str# 634	C084448	42	-	-	-	-	42
		Menands Cntrl Bldg & Relay Replcmt	C049601	220	3,980	5,595	100	-	9,895
		Mohican - Control House	C080755	10	290	1,110	-	-	1,410
		Mohican - Rplc 115kV, 34.5kV assets	C053133	760	2,842	4,489	6,815	3,927	18,833
		Mortimer #3 Auto TRF Replace	C076283	5,228	576	-	-	-	5,804
		Mortimer - Pannell 24/25 ACR	C047816	500	750	500	300	500	2,550
		Mortimer-Golah #110 ACR	C060220	300	200	1,000	1,475	3,836	6,811
		Mortimer-Golah 109-69kV refurb	C081474	-	100	500	6,881	16,303	23,784
		Mt. Defiance Road	C084017	130	3,742	-	-	-	3,872

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		N.Scotland-Feura Bush/Long Lane ACR	C084554	-	-	300	98	8,344	8,742
		New 345kV/115kV Substation (Parish)	C084078	100	400	700	1,000	7,864	10,064
		NEW SCOTLAND R93&R94 ASSET REPLACE	C062752	-	-	-	-	48	48
		Norwood - Repl liquid filled fuse	C076187	64	-	-	-	-	64
		NY Priority OHL Tran Switch program	C076621	750	1,000	1,000	1,000	1,000	4,750
		NY Transmission UG Strategy	C084550	-	-	250	492	959	1,701
		Olean Station - Removal	C083415	-	-	-	-	-	-
		Oneida - Sub Rebuild T-line	C084674	425	900	10	2,945	2,881	7,161
		Oneida - Substation Rebuild CH	C084809	15	400	1,055	10	10	1,490
		Oneida Substation Rebuild	C034443	545	2,100	2,500	8,775	7,519	21,439
		Oswego - 115kV & 34.5kV - Rebuild	C043426	10,293	95	-	-	-	10,388
		Oswego: 115kV Control House	C061991	49	-	-	-	-	49
		Oswego: 345kV Asset Sep/Repl	C076218	2,772	6,443	7,183	6,926	2,185	25,509

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Oswego: 345kV Asset Sep/Repl CH	C076983	535	363	-	-	-	898
		Packard - Rplc three 115kV OCBs	C079222	-	-	75	586	3,883	4,544
		Packard Relays line 191 to 195	C051423	-	172	-	-	-	172
		Packard-Huntley 130 Bergholtz Tap	C081674	917	-	-	-	-	917
		Packard-Walck 129 Bergholtz Tap	C081673	707	-	-	-	-	707
		Pannell-Geneva 4-4A T1860 ACR	C030889	-	-	200	2,000	100	2,300
		Queensbury - Capacitor Replacement	C082649	1,157	425	-	-	-	1,582
		Queensbury - Rplc 34.5kV OCB & TB2	C080869	720	3,282	960	-	-	4,962
		QUEENSBURY-RPLC 34.5KV OCB&TB2 CH	C080871	540	360	-	-	-	900
		Rem 115kV Deferiet Paper Tap 2	C058560	764	-	-	-	-	764
		REMOVE OWENS ILLINOIS TAP 4-115KV	C072746	-	-	-	-	-	-
		Reynolds Rd-115&13.2kV asset Rplc	C077616	-	-	-	-	125	125
		Rochester Airport Cable Refurb	C080543	2,354	3,982	100	-	-	6,436

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Rotterdam - New Scotland 19 ACR	C084588	-	-	-	295	96	391
		Rotterdam 115kV SubRebuild(AIS)	C034850	-	-	-	-	320	320
		Royal (New Harper) 115 kV line taps	C044594	2,026	-	-	-	-	2,026
		Royal (New Harper) TxT Substation	C044874	8,193	42	-	-	-	8,235
		S Oswego - Clay Str# 87 Replacement	C083769	98	-	-	-	-	98
		S Oswego-Clay #4 T-334 Rebuild	C075544	-	300	250	983	1,439	2,972
		S. Oswego-LHH ACR/CCR	C081666	-	-	-	295	96	391
		SE Batavia-Golah #119 Level 1	C083143	910	-	-	-	-	910
		SE Batavia-Golah 119 ACR	C060217	300	250	1,000	1,475	3,836	6,861
		Seneca #5 TRF asset Replace	C069427	3,063	3,324	100	-	-	6,487
		Seneca Reactor 71E asset replace	C065766	302	-	-	-	-	302
		Seneca Term Relay Replacement	C049613	451	-	-	-	-	451
		Solvay: Rplc Circuit Switchers	C079463	-	-	-	-	100	100

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		South Oswego: 115kV Asset Rplc	C081781	-	-	75	684	2,035	2,794
		Southeast Batavia - Obsolete Relays	C073588	297	-	-	-	-	297
		Spare 5kV CB	C079586	51	-	-	-	-	51
		Spier Falls: Asset Rplc/Separation	C081788	-	-	-	98	436	534
		Spier-Rott 2 Shieldwire Replac	C050744	3,410	11	-	-	-	3,421
		Spier-Rotterdam 2 Re-insulate	C081676	-	-	405	6,881	1,439	8,725
		Taylorville: Asset Rplc/Separation	C081782	-	-	100	489	9,206	9,795
		Teall - Reconfigure 115kV line #6	C075902	-	109	541	171	-	821
		Telegraph Road TRF #2 Asset Replace	C069346	6	-	-	-	-	6
		TERMINAL STATION D - 25 CYCLE RETIR	CD00963	-	-	-	-	-	-
		Terminal Station Relocation	C076242	852	8,108	9,454	5,640	-	24,054
		Terminal Station Relocation_TLine	C080493	100	466	792	-	-	1,358
		Thompson-N Troy-Greenbush Corridor	C081667	-	-	300	246	959	1,505

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Ticonderoga 2-3 T5810-T5830 ACR	C039521	566	10,720	7,635	54	-	18,975
		Ticonderoga-Sanford T6410R Removal	C032309	-	-	-	-	-	-
		Tilden: Asset Replacement	C081785	-	-	-	98	485	583
		Tuller Hill 115kV Tap Replacement	C065087	-	135	-	-	-	135
		Turner D Switch Replacements (36)	C052603	515	-	-	-	-	515
		Volney - DFR Replace	C083417	172	75	-	-	-	247
		W Hamlin Tap Pole Replacements	C081672	763	-	-	-	-	763
		Walck RD Relay Replacement	C049628	178	-	-	-	-	178
		Whitehall - Replace three OCBs	C075885	325	-	-	-	-	325
		Whitehall-Mohican13/Cedar6-P2	C084552	5,000	100	-	-	-	5,100
		Wood Pole Mgmt Prgm (Osmose)	C011640	1,000	500	3,503	2,500	2,500	10,003
		Woodard - Replace three OCBs	C075903	439	-	-	-	-	439
		Woodlawn - Asset Replc CH	C082919	360	800	-	-	-	1,160

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Woodlawn Transformer Replacement	C051986	1,395	7,400	2,880	-	-	11,675
		Worst Performing Circuits - NY	C084553	7,000	5,000	8,000	8,000	8,000	36,000
		WPC Coffeen-B River-LHH 5/6	C084587	-	-	-	295	96	391
		Yahnundasis: Asset Replacement	C081794	-	-	-	98	485	583
		Yahnundasis: Rplc OCB R30 & R60	C079010	750	-	-	-	-	750
	Component Fatigue/Deterioration Total			118,693	151,636	166,000	189,384	225,842	851,555
	Failure Trend	91,92,93,94 Dead-end Replacement	C081073	345	-	-	-	-	345
		Central Div Sta - Shielded Cable	C058003	120	-	-	-	-	120
		NYTRANS LINE BONDING&GROUNDING PRGM	C080523	200	200	200	200	200	1,000
	Failure Trend Total			665	200	200	200	200	1,465
Asset Condition Total				132,258	161,836	176,200	199,584	236,042	905,920
Communications/Control Systems	EMS/SCADA	EMS/RTU FOR DSCADA TRANS	C081809	1,273	1,957	1,246	-	-	4,476
		EMS/RTU Install Transmission	C083365	304	-	-	-	-	304
		New Road - EMS to MODs	C081779	-	-	-	49	242	291

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		NMP1 - RTU REPLACEMENT	C077127	96	5	-	-	-	101
		RTUs M9000 protocol upgrades Trans	C069437	1,630	900	2,000	1,500	400	6,430
	EMS/SCADA Total			3,303	2,862	3,246	1,549	642	11,602
		DMX projects	C084525	-	50	3,000	5,000	12,000	20,050
		Maplewood - Microwave Tower	C083416	120	75	-	-	-	195
		Telecomm Migration - NY Central	C083767	1,276	2,872	7,318	7,552	10,393	29,411
		Telecomm Migration - NY East	C083766	180	400	1,558	1,295	2,330	5,763
		Telecomm Migration - NY West	C083768	407	916	2,137	2,544	2,738	8,742
	Telecom	Upgrade Comm Equip Verizon Retireme	C069570	1,191	50	50	50	50	1,391
	Telecom Total			3,174	4,363	14,063	16,441	27,511	65,552
Communications/Control Systems Total				6,477	7,225	17,309	17,990	28,153	77,154
		Albany County I Solar Project Line	CNYCS31	2,000	943	-	-	-	2,943
		Albany County I Solar Project Line Reimb	CNYCS31R	(2,000)	(943)	-	-	-	(2,943)
Customer Request/Public Requirement	Customer Interconnections	Albany County I Solar Project Stations	CNYCS30	381	100	-	-	-	481

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Albany County I Solar Project Stations Reimb	CNYCS30R	(381)	(100)	-	-	-	(481)
		Albany County II Solar Project Line	CNYCS33	2,000	899	-	-	-	2,899
		Albany County II Solar Project Line Reimb	CNYCS33R	(2,000)	(899)	-	-	-	(2,899)
		Albany County II Solar Project Stations	CNYCS32	381	100	-	-	-	481
		Albany County II Solar Project Stations Reimb	CNYCS32R	(381)	(100)	-	-	-	(481)
		Alle Catt II - Transmission Line	C083612	1,561	3,048	100	-	-	4,709
		Alle Catt II - Transmission Line Reimb	C083612R	(1,561)	(3,048)	(100)	-	-	(4,709)
		Alle Catt II Wind - Stations	C083615	1,143	810	-	-	-	1,953
		Alle Catt II Wind - Stations Reimb	C083615R	(1,151)	(810)	-	-	-	(1,961)
		Bakerstand Solar Project Line	CNYCS51	150	300	-	-	-	450
		Bakerstand Solar Project Line Reimb	CNYCS51R	(150)	(300)	-	-	-	(450)
		Bakerstand Solar Project Stations	CNYCS50	525	525	-	-	-	1,050
		Bakerstand Solar Project Stations Reimb	CNYCS50R	(525)	(525)	-	-	-	(1,050)

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Ball Hill Wind Project - Line	C082372	478	1,933	-	-	-	2,411
		Ball Hill Wind Project - Line Reimb	C082372R	(478)	(1,933)	-	-	-	(2,411)
		Ball Hill Wind Project - Stations	C082373	1,879	1,474	-	-	-	3,353
		Ball Hill Wind Project - Stations Reimb	C082373R	(1,879)	(1,474)	-	-	-	(3,353)
		Bear Ridge Solar Project Line	CNYCS53	300	700	-	-	-	1,000
		Bear Ridge Solar Project Line Reimb	CNYCS53R	(300)	(700)	-	-	-	(1,000)
		Bear Ridge Solar Project Stations	CNYCS52	550	900	-	-	-	1,450
		Bear Ridge Solar Project Stations Reimb	CNYCS52R	(550)	(900)	-	-	-	(1,450)
		Big Tree Interconnect	C083460	360	40	-	-	-	400
		Big Tree Interconnect Reimb	C083460R	(360)	(40)	-	-	-	(400)
		Cassadaga Wind Project - Line	C082024	3,511	-	-	-	-	3,511
		Cassadaga Wind Project - Line Reimb	C082024R	(3,511)	-	-	-	-	(3,511)
		Cassadaga Wind Project - Stations	C082021	1,409	42	-	-	-	1,451

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Cassadaga Wind Project - Stations Reimb	C082021R	(1,409)	(42)	-	-	-	(1,451)
		Cedar Rapids - Stations	C083605	729	1,800	-	-	-	2,529
		Cedar Rapids - Stations Reimb	C083605R	(729)	(1,725)	-	-	-	(2,454)
		Cedar Rapids- Transmission Line	C083606	3,185	1,197	-	-	-	4,382
		Cedar Rapids- Transmission Line Reimb	C083606R	(3,185)	(1,197)	-	-	-	(4,382)
		Cortland Energy Ctr Solar Project Line	CNYCS55	300	900	-	-	-	1,200
		Cortland Energy Ctr Solar Project Line Reimb	CNYCS55R	(300)	(900)	-	-	-	(1,200)
		Deer River Wind Project Line	CNYCS13	875	875	-	-	-	1,750
		Deer River Wind Project Line Reimb	CNYCS13R	(875)	(875)	-	-	-	(1,750)
		Deer River Wind Project Stations	CNYCS12	1,845	1,845	-	-	-	3,690
		Deer River Wind Project Stations Reimb	CNYCS12R	(1,845)	(1,845)	-	-	-	(3,690)
		East Point Solar Project Line	CNYCS19	370	370	-	-	-	740
		East Point Solar Project Line Reimb	CNYCS19R	(370)	(370)	-	-	-	(740)

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		East Point Solar Project Stations	CNYCS18	1,275	1,275	-	-	-	2,550
		East Point Solar Project Stations Reimb	CNYCS18R	(1,275)	(1,275)	-	-	-	(2,550)
		Easton Solar 1 Project Line	CNYCS59	300	900	-	-	-	1,200
		Easton Solar 1 Project Line Reimb	CNYCS59R	(300)	(900)	-	-	-	(1,200)
		Easton Solar 1 Project Stations	CNYCS58	350	850	-	-	-	1,200
		Easton Solar 1 Project Stations Reimb	CNYCS58R	(350)	(850)	-	-	-	(1,200)
		Easton Solar 2 Project Line	CNYCS61	300	900	-	-	-	1,200
		Easton Solar 2 Project Line Reimb	CNYCS61R	(300)	(900)	-	-	-	(1,200)
		Easton Solar 2 Project Stations	CNYCS60	300	650	-	-	-	950
		Easton Solar 2 Project Stations Reimb	CNYCS60R	(300)	(650)	-	-	-	(950)
		Edic-MVEdge Customer Connection	C066166	(755)	-	-	-	-	(755)
		Empire State Alternative Stations	CNYCS24	50	216	-	-	-	266
		Empire State Alternative Stations Reimb	CNYCS24R	(50)	(216)	-	-	-	(266)

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Energy Hwy Segment A Project Line	CNYCS09	2,663	2,663	2,663	-	-	7,989
		Energy Hwy Segment A Project Line Reimb	CNYCS09R	(2,663)	(2,663)	(2,663)	-	-	(7,989)
		Energy Hwy Segment A Project Stations	CNYCS08	5,900	5,900	5,900	-	-	17,700
		Energy Hwy Segment A Project Stations Reimb	CNYCS08R	(5,900)	(5,900)	(5,900)	-	-	(17,700)
		Energy Hwy Segment B Project Line	CNYCS23	3,866	3,866	3,866	-	-	11,598
		Energy Hwy Segment B Project Line Reimb	CNYCS23R	(3,866)	(3,866)	(3,866)	-	-	(11,598)
		Energy Hwy Segment B Project Stations	CNYCS22	1,740	1,740	1,740	-	-	5,220
		Energy Hwy Segment B Project Stations Reimb	CNYCS22R	(1,740)	(1,740)	(1,740)	-	-	(5,220)
		Falls park NYSEG Tx Load Interconct	C081720	(4)	-	-	-	-	(4)
		FALLS PARK NYSEG TX LOADINTERCONNET	C081608	(121)	-	-	-	-	(121)
		Flint Mine Solar Project Line	CNYCS43	1,200	1,200	-	-	-	2,400
		Flint Mine Solar Project Line Reimb	CNYCS43R	(1,200)	(1,200)	-	-	-	(2,400)
		Flint Mine Solar Project Stations	CNYCS42	595	595	-	-	-	1,190

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Flint Mine Solar Project Stations Reimb	CNYCS42R	(595)	(595)	-	-	-	(1,190)
		Heritage Wind Project Line	CNYCS15	1,209	1,209	-	-	-	2,418
		Heritage Wind Project Line Reimb	CNYCS15R	(1,209)	(1,209)	-	-	-	(2,418)
		Heritage Wind Project Stations	CNYCS14	919	919	-	-	-	1,838
		Heritage Wind Project Stations Reimb	CNYCS14R	(919)	(919)	-	-	-	(1,838)
		High River Solar Project Line	CNYCS41	1,010	1,010	-	-	-	2,020
		High River Solar Project Line Reimb	CNYCS41R	(1,010)	(1,010)	-	-	-	(2,020)
		High River Solar Project Stations	CNYCS40	719	719	-	-	-	1,438
		High River Solar Project Stations Reimb	CNYCS40R	(719)	(719)	-	-	-	(1,438)
		Hills Solar Project Line	CNYCS35	1,200	637	-	-	-	1,837
		Hills Solar Project Stations	CNYCS34	706	353	-	-	-	1,059
		Hills Solar Project Stations Reimb	CNYCS34R	(706)	(353)	-	-	-	(1,059)
		Hills Solar Projet Line Reimb	CNYCS35R	(1,200)	(637)	-	-	-	(1,837)

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Homer Solar Energy Center Line	CNYCS21	50	525	525	-	-	1,100
		Homer Solar Energy Center Line Reimb	CNYCS21R	(50)	(525)	(525)	-	-	(1,100)
		Homer Solar Energy Center Storage Stations	CNYCS20	100	1,200	1,200	-	-	2,500
		Homer Solar Energy Center Storage Stations Reimb	CNYCS20R	(100)	(1,200)	(1,200)	-	-	(2,500)
		Lake Erie Connector (S. Ripley PAR) Station Mods	CNYCS07	500	18,662	4,574	100	-	23,836
		Lake Erie Connector (S. Ripley PAR) Station Mods Reimb	CNYCS07R	(500)	(18,662)	(4,574)	(100)	-	(23,836)
		Leeds 345kV breaker replacement	C084546	-	-	100	2,800	100	3,000
		Leeds 345kV breaker replacement - REIMB	C084546R			(100)	(2,800)	(100)	(3,000)
		Martin Road Solar Project Line	CNYCS49	1,000	1,074	-	-	-	2,074
		Martin Road Solar Project Line Reimb	CNYCS49R	(1,000)	(1,074)	-	-	-	(2,074)
		Martin Road Solar Project Stations	CNYCS48	348	348	-	-	-	696
		Martin Road Solar Project Stations Reimb	CNYCS48R	(348)	(348)	-	-	-	(696)

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Mohawk Solar Project Line	CNYCS11	680	680	-	-	-	1,360
		Mohawk Solar Project Line Reimb	CNYCS11R	(680)	(680)	-	-	-	(1,360)
		Mohawk Solar Project Stations	CNYCS10	1,332	1,332	-	-	-	2,664
		Mohawk Solar Project Stations Reimb	CNYCS10R	(1,332)	(1,332)	-	-	-	(2,664)
		N.Scotland 115kV Brk Replacement	C084555	-	-	-	147	3,585	3,732
		N.Scotland 115kV Brk Replacement - REIMB	C084555R				(147)	(3,585)	(3,732)
		North Country Solar Project Line	CNYCS39	262	131	-	-	-	393
		North Country Solar Project Line Reimb	CNYCS39R	(262)	(131)	-	-	-	(393)
		North Country Solar Project Stations	CNYCS38	943	471	-	-	-	1,414
		North Country Solar Project Stations Reimb	CNYCS38R	(943)	(471)	-	-	-	(1,414)
		Number 3 Wind: Line	C083419	3,248	200	-	-	-	3,448
		Number 3 Wind: Line Reimb	C083419R	(2,155)	(873)	-	-	-	(3,028)
		Number 3 Wind: Station Reimb	C083418R	(1,010)	(1,210)	-	-	-	(2,220)

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Number 3 Wind: Stations	C083418	2,613	90	-	-	-	2,703
		Pattersonville Solar Line	CNYCS45	682	682	-	-	-	1,364
		Pattersonville Solar Project Line Reimb	CNYCS45R	(682)	(682)	-	-	-	(1,364)
		Pattersonville Solar Station	CNYCS44	646	646	-	-	-	1,292
		Pattersonville Solar Station Reimb	CNYCS44R	(646)	(646)	-	-	-	(1,292)
		Roaring Brook Wind Stations	CNYCS25	200	200	-	-	-	400
		Roaring Brook Wind Stations Reimb	CNYCS25R	(200)	(200)	-	-	-	(400)
		Rock Distrct Solar Project Line Reimb	CNYCS27R	(1,000)	(200)	-	-	-	(1,200)
		Rock District Solar Project Line	CNYCS27	1,000	200	-	-	-	1,200
		Rock District Solar Project Stations	CNYCS26	1,000	300	-	-	-	1,300
		Rock District Solar Project Stations Reimb	CNYCS26R	(1,000)	(300)	-	-	-	(1,300)
		Sky High Solar Project Line	CNYCS06	971	470	-	-	-	1,441
		Sky High Solar Project Line Reimb	CNYCS06R	(971)	(470)	-	-	-	(1,441)

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Sky High Solar Project Station Mods	CNYCS05	1,274	408	-	-	-	1,682
		Sky High Solar Project Station Mods Reimb	CNYCS05R	(1,274)	(408)	-	-	-	(1,682)
		Stillwater Solar Project Line	CNYCS63	300	900	-	-	-	1,200
		Stillwater Solar Project Line Reimb	CNYCS63R	(300)	(900)	-	-	-	(1,200)
		Stillwater Solar Project Stations	CNYCS62	300	650	-	-	-	950
		Stillwater Solar Project Stations Reimb	CNYCS62R	(300)	(650)	-	-	-	(950)
		SUNY POLY 115KV LN6 TAP	C083667	1,435	-	-	-	-	1,435
		SUNY POLY 115KV LN6 TAP Reimb	C083667R	(1,435)	-	-	-	-	(1,435)
		SW Energy Storage Project Line	CNYCS17	243	244	-	-	-	487
		SW Energy Storage Project Line Reimb	CNYCS17R	(243)	(244)	-	-	-	(487)
		SW Energy Storage Project Stations	CNYCS16	1,569	1,569	-	-	-	3,138
		SW Energy Storage Project Stations Reimb	CNYCS16R	(1,569)	(1,569)	-	-	-	(3,138)
		Tayandenega Solar Project Stations	CNYCS28	1,000	150	-	-	-	1,150

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Tayandenega Solar Project Stations Reimb	CNYCS28R	(1,000)	(150)	-	-	-	(1,150)
		Tayandenga Solar Project Line	CNYCS29	1,000	200	-	-	-	1,200
		Tayandenga Solar Project Line Reimb	CNYCS29R	(1,000)	(200)	-	-	-	(1,200)
		Watkins Rd Solar Project Line	CNYCS37	231	200	-	-	-	431
		Watkins Rd Solar Project Line Reimb	CNYCS37R	(231)	(200)	-	-	-	(431)
		Watkins Rd Solar Project Stations	CNYCS36	500	351	-	-	-	851
		Watkins Rd Solar Project Stations Reimb	CNYCS36R	(500)	(351)	-	-	-	(851)
	Customer Interconnections Total			1,808	(1,718)	-	-	-	90
		GCEDC STAMP LINE 112 RELOCATION	C080692	2,832	-	-	-	-	2,832
		GCEDC STAMP LINE 112 RELOCATION Reimb	C080692R	(2,800)	-	-	-	-	(2,800)
		Lafarge Relocation	C079454	632	7,226	250	-	-	8,108
		Lafarge Relocation Reimb	C079454R	(668)	-	-	-	-	(668)
		METALLICO 115KV SERVICE	C080973	30	949	-	-	-	979
	Public Requirements	METALLICO 115KV SERVICE Reimb	C080973R	-	(990)	-	-	-	(990)

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Niagara-Packard 193/194 REMOVAL	C079485	-	-	-	-	-	-
		Packard 193/194 Terminal Equipment	C079484	60	409	-	-	-	469
	Public Requirements Total			86	7,594	250	-	-	7,930
	Request From External TO	Upgrade Mortimer Station	C064567	935	-	-	-	-	935
		Upgrade Mortimer Station Reimb	C064567R	(500)	-	-	-	-	(500)
	Request From External TO Total			435	-	-	-	-	435
Customer Request/Public Requirement Total				2,329	5,876	250	-	-	8,455
Damage/Failure	Damage/Failure	D/F Sws# 155 Bergholtz Tap #129	C082762	244	-	-	-	-	244
		D/F Sws# 1833 Mohican - Butler	C084450	242	-	-	-	-	242
		D/F Sws# 822 #8 LaFarge - PV	C083446	165	-	-	-	-	165
		D/F Sws# X3-3 Fenner - Cortland	C082268	87	-	-	-	-	87
		EAST CONKLIN LN17 COMM EQUIPMENT	C054843	22	-	-	-	-	22
		GARD DUNK 141 142 CULVERT STR 281	C084226	450	-	-	-	-	450
		Gard-5 Mile 151/152 Erosion&Road	C082708	6,368	2,000	2,100	4,947	5,685	21,100

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Machias - Replace TB#1 D/F	C083642	1,159	-	-	-	-	1,159
		Machias - TB#3 Rplc	C083458	415	-	-	-	-	415
		Patroon - Cb R4 replacement	C084217	10	-	-	-	-	10
		Station 217 - Cable Replacement	C082786	44	-	-	-	-	44
		Storm Budgetary Blanket - NMPC	C003481	500	500	500	500	500	2,500
		Str# 42 Levitt - Rome Replacement	C083619	2,856	-	-	-	-	2,856
		Trans Line Failure Reserve	C079452	2,700	2,700	2,700	2,700	2,700	13,500
		Trans Station Failure Budget Blankt	C003792	1,900	1,900	1,900	1,900	1,900	9,500
		Trans Station Failure Reserve	C073870	4,400	4,400	4,400	4,400	4,400	22,000
		TransLine D/F Budget Blanket	C003278	1,300	1,300	1,300	1,300	1,300	6,500
	Damage/Failure Total			22,862	12,800	12,900	15,747	16,485	80,794
Damage/Failure Total				22,862	12,800	12,900	15,747	16,485	80,794
DER Electric System Access	Customer Interconnections	DG 102002 Albany VA RTU	C080740	(52)	-	-	-	-	(52)
		DG NY 183955 SOLITUDE LOWVILLE SUB	C082718	426	-	-	-	-	426

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY 203564 Borrego State Route 40	C083608	7	-	-	-	-	7
		DG NY 213284 Borrego N Troy 53 LTC	C083960	16	-	-	-	-	16
		DG NY171574 Borrego Solar Systems	C081274	270	-	-	-	-	270
		DG NY171646 - Borrego Bliss Rd 3V0	C082491	305	-	-	-	-	305
		DG NY190334 Eden Humane Society Rd	C084062	446	-	-	-	-	446
		DG NY196061&196062 BORREGO SOLAR	C084097	8	-	-	-	-	8
		DG NY-209907 EDF RENEWABLE TRAN-SUB	C084272	25	-	-	-	-	25
		DG-194894 - BROCKPORT 13.2 LTCS	C083934	72	-	-	-	-	72
		DGNY170011 Monolith Landfill Rd LTC	C083040	3	-	-	-	-	3
		Gloversville Area 5 Station DTT	C083561	15	-	-	-	-	15
		Reserve for DER	CNYDER	(1,564)	-	-	-	-	(1,564)
		Sutliff Rd South 1910kW PV RTU	C067211	38	-	-	-	-	38
	Customer Interconnections Total			15	-	-	-	-	15
DER Electric System Access Total				15	-	-	-	-	15

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	MVT Generator Additions	MVT Inghams lines 6 and 7 rebuild	C084528	100	400	4,000	5,898	96	10,494
	MVT Generator Additions Total			100	400	4,000	5,898	96	10,494
		Black River Terminal Equipment	C082185	15	150	-	-	-	165
		Browns Falls Taylorville Ln Upgra	C082926	15	81	-	-	-	96
		Browns Falls Terminal Equipment	C082925	45	410	-	-	-	455
		Colton Terminal Equipment	C082927	54	-	-	-	-	54
		Colton-Browns Falls Line Upgrades	C082928	35	89	-	-	-	124
		Dunkirk-Laona 161/162 Reactor Remov	C082183	-	-	-	-	-	-
		FlatRock Terminal Equip Upgrades	C081789	20	480	-	-	-	500
		Malone Par	C084542	-	-	300	1,954	14,051	16,305
		MoonRd-Falconer 175/176 Rctor Inst	C082184	-	-	330	3,190	-	3,520
		MVT Rott 69kV Rebuild & New TB	C082180	-	400	5,000	10,000	10,000	25,400
		MVT Scho/Sch Int-Rott 18/4 Rebld	C082182	-	265	3,000	800	100	4,165
Multi-Value Transmission (MVT)	MVT Reliability	Taylorville - Porter Reconductor	C084596	-	-	-	-	288	288

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	MVT Reliability Total			184	1,875	8,630	15,944	24,439	51,072
Multi-Value Transmission (MVT) Total				284	2,275	12,630	21,842	24,535	61,566
Non-Infrastructure	General Equipment	IHC Capital Small Tools 5210-T NY	C054605	200	100	300	300	200	1,100
	General Equipment Total			200	100	300	300	200	1,100
Non-Infrastructure Total				200	100	300	300	200	1,100
Reliability	NERC/NPCC Standards	Clay - Physical Security	C073349	1,260	-	-	-	-	1,260
		Conductor Clearance - NY Program	C048678	11,930	8,000	10,000	10,000	10,000	49,930
		Elbridge - Physical Security	C073352	50	-	-	-	-	50
	NERC/NPCC Standards Total			13,240	8,000	10,000	10,000	10,000	51,240
	Performance	180,181,182 Line Monitoring	C083409	240	-	-	-	-	240
		Coffeen Cap Bank	C084547	-	-	-	98	1,744	1,842
		Golah Line 116 By-pass Switch	C084293	24	1,960	495	-	-	2,479
		Greenbush R993 Relay Replacement	C083831	248	-	-	-	-	248
		High Priority Sws & RC-MOD	C083864	5,000	2,000	3,000	3,000	3,000	16,000

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Mobile Capacitor Bank	C081351	608	1,685	-	-	-	2,293
		N Creek-Warrensburg 5 GW Term Repl	C082709	141	-	-	-	-	141
		NY - CENT TRANS STA ANML FENCES	C081142	120	120	120	120	120	600
		NY - EAST TRANS STA FENCES	C081137	175	120	120	120	120	655
		Oneida Cap Bank	C084549	-	-	-	98	1,744	1,842
		Osprey Mitigation/Avian Protection	C076662	252	250	250	500	500	1,752
		Sawyer Sub - Install Bird Deterrent	C083678	80	-	-	-	-	80
		Smart Fault Indicator Program-NY	C082281	1,000	800	1,200	1,000	1,000	5,000
	Performance Total			7,888	6,935	5,185	4,936	8,228	33,172
Reliability Total				21,128	14,935	15,185	14,936	18,228	84,412
Resiliency	Survivability	Clay - Dewitt Resiliency	C084533	-	-	150	3,322	436	3,908
		Coffeen Bus Split - Resiliency	C084534	-	-	-	98	1,744	1,842
		Dewitt-Tilden Resiliency	C084535	-	-	-	195	6,783	6,978
		Dunkirk - Falconer Resiliency	C084537	-	-	-	98	6,880	6,978

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Huntley - Lockport Resiliency	C084538	-	-	150	3,322	436	3,908
		Indian River-Lyme Junction Land	C082202	-	-	-	20	2,000	2,020
		Indian River-Lyme Junction Line	C082190	-	-	-	246	777	1,023
		Indian River-Lyme Junction Station	C082192	-	-	-	293	242	535
		Lighthouse Hill - Clay Resiliency	C084539	-	-	100	1,759	97	1,956
		New Krumkill Resiliency	C084543	-	50	1,900	49	-	1,999
		North Troy - Hoosick Resiliency	C084532	-	-	50	885	48	983
		Rotterdam - Maplewood Resiliency	C084589	-	-	-	-	291	291
		S Oswego - LHH Resiliency	C084544	-	-	50	885	48	983
		South Oswego - Clay Resiliency	C084540	-	-	100	1,759	97	1,956
		Teall - Oneida Resiliency	C084541	-	-	100	2,753	96	2,949
		Yahnundasis - Porter Resiliency	C084545	-	50	1,900	49	-	1,999
	Survivability Total			-	100	4,500	15,733	19,975	40,308
Resiliency Total				-	100	4,500	15,733	19,975	40,308

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Airco-Bffl Rvr147 Adv Metal Tap	C054711	7	-	-	-	-	7
		Clay-Teall#10,Clay-Dewitt#3 Recond	C043995	19,162	11,858	500	-	-	31,520
		Coffeen Terminal Equipment Upgrades	C081772	50	500	-	-	-	550
		Construct Five Mile Station	C024015	114	-	-	-	-	114
		Dewitt Station 115kV Rebuild	C081783	-	-	300	537	1,841	2,678
		Dewitt Station 115kV Rebuild LAB	C081784	-	-	-	-	400	400
		Dewitt Station Relocate 115kV Line	C082023	-	-	-	29	710	739
		EASEMENT - FORBES AVE SUBSTATION	C083949	48	428	-	-	-	476
		Elm St Relief_Add 4th Xfer	C049594	749	751	-	-	-	1,500
		Frontier 181 ACR/Recond	C060215	900	480	5,260	3,140	90	9,870
		GE-Geres Lock 8 T2240 Reconductor	C047835	120	-	-	-	-	120
		Golah Sub rebuild	C051831	60	2,437	4,484	1,321	100	8,402
		Land Rights/Acquisition - Tran-NY	CNYT350	225	125	325	325	225	1,225
System Capacity - NY	TO Led System Studies	Lasher Rd Transmission Line	C043672	263	-	-	-	-	263

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Lasher Road Substation	C064726	370	-	-	-	-	370
		Lasher Road Substation - LAB	C064727	53	-	-	-	-	53
		Malone Station Rebuild_Tline	C059673	-	40	240	120	-	400
		Malone Substation Rebuild_T_Sub	C069306	-	165	1,982	4,048	101	6,296
		Maplewood #19/#31Reconductoring	C069466	60	3,206	1,847	10	-	5,123
		Menands Terminal Equipment Upgrade	C079071	60	638	20	-	-	718
		Mortimer line Re-Arrangement	C060248	41	-	-	-	-	41
		MORTIMER LINE REARRANGMENT - TSUB	C078115	-	-	-	-	-	-
		Mplwd 19/31 Mnands Term Equip Upgrd	C078287	36	397	10	-	-	443
		New Two Mile Creek Sub T-Line Taps	C053156	20	-	-	-	-	20
		New Watertown 115-13.2kV T - Line	C053155	84	-	-	-	-	84
		Niagara Packard 192 Terminal Equip	C079503	75	189	-	-	-	264
		Niagara-Packard 191 Reconductor	C079489	220	7,868	100	-	-	8,188

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Niagara-Packard 191 Terminal Equip	C079501	75	190	-	-	-	265
		Niagara-Packard 192 Reconductor	C079488	220	4,870	50	-	-	5,140
		NY VVO Central - T Sub	C084065	-	150	150	2	2	304
		NY VVO East - T Sub	C083329	150	2	300	150	150	752
		NY VVO West - T Sub	C084063	-	-	5	150	2	157
		Packard-Gardenville Rctrs & Brkrs	C079506	330	4,140	3,430	310	60	8,270
		Pack-Gardenville Reconfiguration	C081799	900	420	7,110	4,240	120	12,790
		Pack-Hunt 130 Walk-Hunt 133 Recond	C079500	400	2,330	5,670	1,140	-	9,540
		Recond Cortland Clarks Corners	C053141	100	603	20	-	-	723
		Ridge Substation - 34.5kV System Re	C046693	658	950	-	-	-	1,608
		Riverside-Reynolds Rd#4 Forbes Tap	C043592	34	360	2,468	1,257	-	4,119
		Rosa Rd add 115kV Cap Bank	C069467	5	-	-	-	-	5
		Rotterdam - Add Reactors LN19/20	C069548	143	-	-	-	-	143
		Rotterdam - Curry #11 recond	C060243	300	-	-	-	-	300

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		ROTTERDAM 17 19 REACTORS	C078883	30	-	-	-	-	30
		Rottrdm 17 Reactors-New Scot Relay	C078879	50	-	-	-	-	50
		Schaghticoke Switching Station	C060252	165	-	-	-	-	165
		Schaghticoke Tap Sw St - Line taps	C060253	48	-	-	-	-	48
		Taylorville-Boonville Reactors-SUB	C081769	-	-	-	-	50	50
		Ticonderoga- Inst Cap Bank, Rpl OCB	C060254	50	-	-	-	-	50
		Trans Study Budgetary Blanket NY	C008376	125	125	125	125	125	625
		W. Ashville substation TxT	C043833	734	-	-	-	-	734
		Youngs St Sta 214 -115kV tap- Tline	C054963	-	50	1,080	69	-	1,199
	TO Led System Studies Total			27,234	43,272	35,476	16,973	3,976	126,931
System Capacity - NY Total				27,234	43,272	35,476	16,973	3,976	126,931
Grand Total				212,787	248,419	274,750	303,105	347,594	1,386,655

Exhibit 2 - Sub-Transmission Capital Investment Plan

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
Asset Condition	Asset Replacement	34.5kV Tap Fairdale Transf. Upgrade	C075584	34	-	-	-	-	34
		Attica-Wethersfield 209 34.5 kV ref	C081705	-	-	100	1,305	-	1,405
		BALMAT-FOWLER NO. 27 (23kV) Refurb	C084262	-	-	50	50	252	352
		Boonville - Rebuild SubT assc Line	C081425	-	300	976	-	-	1,276
		Browns Falls - Asst R/S SubT line	C081426	252	477	-	-	-	729
		Buffalo 23kV Reconductor - Huntley	C079450	-	-	-	50	4,900	4,950
		Buffalo Station 122 Rebuild - 23kV.	CD00780	64	239	90	-	-	393
		Buffalo Station 31 Rebuild - 23 kV	C046942	-	-	9	30	150	189
		Buffalo Station 32 Rebuild - 23 kV	C036460	36	60	113	113	54	376
		Chestertown-Schroon 3 34.5kV Refurb	C084009	-	-	50	50	1,009	1,109

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Cortland 20 refurbish 34.5 kV	C081639	-	50	750	-	-	800
		Cortland 21 34.5 kv Refurbish	C081646	-	-	50	650	-	700
		Cortland 23 34.5 kv Refurbish	C081647	-	-	-	50	750	800
		DEERFIELD-SCHUYLER 22 (46kV) refurb	C084266	-	-	50	50	757	857
		Deerfield-Schuyler 46 kV Partial Rb	C078246	37	-	-	-	-	37
		Delmar Elsemere 34.5 kV Tap Rebuild	C081606	165	1,450	650	-	-	2,265
		Dunkirk Steam-Rel/repl 34.5 kV lns	C076185	-	18	125	-	-	143
		Fairdale Transformer Upgrade: Sub T	C082766	902	3	-	-	-	905
		Gasport-Telegraph 312 34.5kV Refurb	C084019	-	-	50	50	505	605
		Golah-N. Lakeville 216-217 refurb	C084016	-	-	75	75	1,072	1,222
		Inghams 46kV relocation	C074485	50	500	-	1,100	15	1,665
		Mallory-Cleveland 31 34.5kV Refurb	C084194	-	-	75	75	1,670	1,820

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		McIntyre-Hammond 24 23kV refurb	C084261	25	500	500	-	-	1,025
		McIntyre-Hammond 24 reloc/refurb	C075852	195	1,763	302	-	-	2,260
		N.Akron-Attica 225 34.5kV Refurb	C084020	-	-	100	100	2,650	2,850
		N.Lakeville - Ridge LN 218 Refurbis	C046766	60	572	531	-	-	1,163
		Newark-Maplewood #6 refurb	C083888	680	-	-	-	-	680
		North Lakeville-Ridge 218 refurb	C084014	-	-	100	100	2,271	2,471
		Northville-Wells 1-23 kV Ins.	C075062	40	-	-	-	-	40
		Oakfield-Caledonia 201 34.5 Refurb	C083975	-	-	100	100	2,902	3,102
		Ohio St Duct Bank Interconnetion	C081704	247	1,173	1,777	6	-	3,203
		Ohio Street Getaway Cables	C082033	233	-	-	-	-	233
		Pebble Hill-Rathbun 27 Reloc.	C078515	300	-	-	-	-	300
		Pebble Hill-Tilden 32 34.5kV Refurb	C083971	-	100	100	2,380	-	2,580

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		PebbleHill-Tilden32Headsn-Bright38	C083368	35	-	-	-	-	35
		Pleasant-Schuyler No26(46kV) refurb	C084268	-	-	50	50	442	542
		Rankine - Adams - 25 Cycle Line Ret	C046620	3	-	-	-	-	3
		Ransomville-Phillips 402 refurb	C084189	-	-	50	50	1,429	1,529
		Raquette Lake Padmount Xfmer	C082716	873	15	-	-	-	888
		Saratoga-Ballston 10 34.5kV refurb	C084068	-	-	75	75	1,703	1,853
		Sherman-Ashville 863-Ref/Rec	C079096	275	900	948	-	-	2,123
		SubT Line Ins Repl Program West	C078518	448	562	896	1,000	1,500	4,406
		SubT Line Ins. Repl Program Central	C078621	448	562	896	1,000	1,500	4,406
		SubT Line Ins. Repl Program East	C078624	448	563	896	1,000	1,500	4,407
		Teall 23 34.5kV Refurb	C084196	-	-	50	50	356	456
		Telegraph-Medina 302 &303 34.5 kV	C081634	-	-	100	1,301	-	1,401
		Trenton Middleville24-Struct Reloc	C083835	-	-	15	130	1,148	1,293

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		W Portland-Hartfield 866 ref 34.5 k	C081637	-	-	75	948	-	1,023
		W,Ashville-Ashville 868 and 863 tap	C081141	575	-	-	-	-	575
		Warrensburg-Chestertown 6-refurb	C084012	-	-	75	75	1,703	1,853
		Warrensburg-Ft Gage 8-34.5kVrefurb	C084013	-	-	50	50	883	983
		WHITESBORO-SCHUYLER No 29 Refurb	C084250	-	-	75	75	2,019	2,169
		Yahnundasis-Pleasant 25(46kV)refurb	C084269	-	-	50	50	479	579
	Asset Replacement Total			6,425	9,807	11,023	12,189	33,620	73,064
	Blanket	CNY Sub Trans-Line Asset Replace.	CNC0075	320	327	334	341	348	1,670
		ENY Sub Trans-Line Asset Replace.	CNE0075	12	12	12	12	12	60
		WNY Sub Trans-Line Asset Replace.	CNW0075	146	149	152	156	160	763

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Blanket Total			478	488	498	509	520	2,493
	De-Energized T Line Strategy	Balstn-Randall-W. Milton 34.5kV rem	C048968	-	-	-	50	-	50
		S Niagara Falls Sub-T Line Remove	C053426	1	4	4	4	-	12
	De-Energized T Line Strategy Total			1	4	4	54	-	62
	Inspection & Maintenance	I&M - NC Sub-T Line Work From Insp.	C026166	2,513	2,513	2,513	2,513	2,513	12,564
		I&M - NE Sub-T Line Work From Insp.	C026165	2,500	2,500	2,500	2,500	2,500	12,500
		I&M - NW Sub-T Line Work From Insp.	C026167	2,500	2,500	2,500	2,500	2,500	12,498
	Inspection & Maintenance Total			7,512	7,512	7,512	7,512	7,512	37,562
	Sub T UG Cable Replacement	10E Cable Replacement	C081761	-	200	1,000	1,000	2,000	4,200
		34 and 36H UG taps to Sta 126	C083185	-	323	-	-	-	323
		701 Line - Kensington Expwy UG	C053243	425	-	-	-	-	425
		Buffalo Station 35 Rebuild - 23 kV	C046933	-	-	-	9	30	39

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Buffalo Station 38 Rebuild - 23 kV	C046935	25	50	100	370	395	940
		Replace portion of L612	C083190	-	425	-	-	-	425
		Rotterdam #34 #36 34.5kV Cable Repl	C077065	996	-	-	-	-	996
	Sub T UG Cable Replacement Total			1,446	998	1,100	1,379	2,425	7,348
	Substation Indoor	Buffalo Station 25 Rebuild - 23 kV	C036457	-	-	-	-	9	9
		Buffalo Station 30 - Rebuild - 23kV	C015755	-	9	30	150	150	339
		Buffalo Station 53 Rebuild - 23 kV	C046928	150	150	-	-	-	300
	Substation Indoor Total			150	159	30	150	159	647
	Sub-T Overhead Line	"Refurbish H-Lns 27h,28h,33h pt 1"	C046470	334	-	-	-	-	334
		Bagdad-Dake Hill 815-34.5kV refurb.	C050292	-	75	779	1,500	-	2,354
		Ballston-Mechanicville 6-34.5kv	C046472	35	-	-	-	-	35
		Ballston-Shore Rd 8-34.5 kV	C046457	-	122	1,450	50	-	1,622
		Barker-Lyndonville 301-34.5kV	C052511	15	85	2,748	100	-	2,948

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Bethlehem-Selkirk 5-34.5kV	C048817	967	-	-	-	-	967
		Boonville-Alder Creek 21 46 kV	C077028	230	2,426	493	-	-	3,149
		Boonville-Racquette Lake 46 KV	C076449	16	-	-	-	-	16
		Bristol Hill-Phoenix 23-34.5kv	C046474	-	103	1,000	-	-	1,103
		Burnett-Headson 34-34.5kV	C050199	50	598	20	-	-	668
		Callanan Tap - Rebuild exist 34.5ln	C046641	406	-	-	-	-	406
		Carthage-N. Carthage-Deferiet 23kv	C046435	-	-	75	908	35	1,018
		Carthage-Taylorville 21/22/26-23kv	C046436	-	-	88	1,840	50	1,978
		Cottrell Paper Tap 11-34.5kv	C046443	371	-	-	-	-	371
		Dake Hill-W. Salamanca 816-34.5kv	C046469	120	282	2,865	-	-	3,267
		Deerfield-Schuyler 22-46kV	C050288	983	-	-	-	-	983

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Deerfield-whitesboro 26-46kv	C046459	10	175	3,333	-	-	3,518
		Elbridge-Jewitt 31-34.5kV refurb	C050959	27	222	1,120	140	-	1,509
		Elbridge-Marcellus 30 Refurbishment	C054927	593	21	-	-	-	614
		Epratah-Caroga 2-23kv	C046456	-	25	50	2,583	50	2,708
		Fort Covington-Malone 26-34.5kV	C050197	1,132	21	-	-	-	1,152
		Gard-Dun 141-142 SubT Line Relocate	C078197	107	1,144	1,251	770	-	3,272
		Hartfield-S. Dow 859 34.5 kV prt 3	C074502	1,629	120	-	-	-	1,749
		Hartfield-S. Dow 859-Relocate Part	C052209	43	-	-	-	-	43
		HH-Ceres 809 flood plain reloc.	C075854	-	289	708	53	-	1,050
		Homer Hill-Nile 811-34.5kV	C050326	65	500	1,276	-	-	1,841
		Kenmore-Winspear 630/631-ref	C050318	65	864	-	-	-	929
		LHH-Mallory 22-34.5kv	C046441	-	-	79	3,350	50	3,479
		LighthouseHill Sub-TLine Relocation	C074322	50	500	1,000	-	1,500	3,050

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Lyndonville-Medina 301-34.5kV	C052512	-	-	-	75	2,698	2,773
		Maplewood-Menands 17/18 d/c-34.5kv	C046432	-	-	-	100	483	583
		Nassau-Hudson #9, 34.5kV Refurb	C058581	156	19	-	-	-	175
		Nile-S. Wellsville 812-34.5kV refur	C051765	-	-	75	705	-	780
		Old Forge-Raquette Lake 22 46kV	C074003	68	1,268	-	-	-	1,336
		Phillips-Barker 301-34.5kv	C046465	55	3,614	1,231	-	-	4,900
		Phillips-Telegraph 304-34.5kv	C046466	24	74	82	3,567	-	3,747
		Queensbury-Henry Street 14-34.5kv	C046442	55	1,208	800	-	-	2,063
		Refurbish H lines 26H, 33H, 34H	C048911	-	59	390	750	-	1,199
		Refurbish H Lns 26H, 34H	C048910	375	-	-	-	-	375
		Refurbish H-Lns 27h,25h,33h,36h	C048909	364	-	-	-	-	364
		Re-furbish Teall 25-34.5	C046446	672	8	-	-	-	681

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Rotterdam-Scotia Road 32 34.5	C046455	100	600	32	-	-	732
		Schuylerville Retirement - Sub-T	C050323	-	100	1,330	1,330	-	2,760
		Scotia-Rosa Rd 6, 34.5kV Refurb	C055164	104	1,278	52	-	-	1,434
		Shaleton-Ridge 610, Station 207 Tap	C046779	100	150	90	-	-	340
		Shore Road-Rosa Road 5 34.5 kV	C074503	-	123	123	897	-	1,143
		Solvay/Woodard-Ash st 27&27&28-34.	C046439	-	-	45	1,003	50	1,098
		Station 126 taps 34h/36h-23kv	C046450	48	390	22	-	-	460
		Taylorville-Effley 24-23kv	C046437	387	-	-	-	-	387
		Tonawanda 601-604, 23kV - T22&T23	C067266	129	101	12	-	-	242
		Tonawanda Lines 601-604-23kv	C046451	98	1,736	1,369	-	-	3,203
		Tonawanda Lines 622-624-23kv	C046452	90	200	1,917	-	-	2,207
		Trenton-Prospect 23-46kv	C046448	341	-	-	-	-	341

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Trenton-Whitesboro 25, 46kV	C058579	2,293	2,786	-	-	-	5,079
		Union-Ausable Forks 36-46kV ref	C050320	-	75	1,188	-	-	1,263
		Union-Lake Clear 35-46kV refurb	C050324	-	125	1,329	1,500	-	2,954
		Varick-Bristol Hill 202-34.5kv	C046460	-	95	748	1,000	-	1,843
		W. Milton Tap-34.5kV new line	CD00898	266	3,396	2,233	-	-	5,896
		W. Portland-Sherman Relocate on Cen	C055118	56	-	-	-	-	56
		Waterport tap 301-34.5kV	C052515	-	-	-	75	75	150
		Woodard 24 Refurb N.-I90	C060445	50	70	1,049	-	-	1,169
		Woodard 28-34.5kv	C046440	348	-	-	-	-	348
		Woodard 29-34.5kv	C046473	-	-	-	-	100	100
		Woodard-Teall 32-34.5kV refurbish	C050322	-	100	850	1,000	-	1,950
		Yahnundasis-Clinton 24 -46kv	C046449	15	85	1,002	50	-	1,152
		Yahnundasis-Clinton 27, 46kV	C055143	-	450	-	-	-	450

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Sub-T Overhead Line Total			13,441	25,682	34,304	23,346	5,091	101,864
Asset Condition Total				29,453	44,650	54,472	45,138	49,327	223,039
Customer Request/Public Requirement	3rd Party Attachments	SubT Broadband Expansion	C079603	234	-	-	-	-	234
	3rd Party Attachments Total			234	-	-	-	-	234
	Blanket	CNY Sub Trans-Line New Business.	CNC0071	10	10	10	10	10	50
		CNY Sub Trans-Line Public Require.	CNC0072	10	10	10	10	10	50
		ENY Sub Trans-Line New Business.	CNE0071	10	10	10	10	10	50
		ENY Sub Trans-Line Public Require.	CNE0072	10	10	10	10	10	50
		NY Central Sub T Line Third Party	CNC0078	26	27	28	29	30	140
		NY East Sub T Line Third Party	CNE0078	10	10	10	10	10	50
		NY West Sub T Line Third Party	CNW0078	87	89	91	93	95	455
		WNY Sub Trans-Line New Business.	CNW0071	42	43	44	45	46	220

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		WNY Sub Trans-Line Public Require.	CNW0072	10	10	10	10	10	50
	Blanket Total			215	219	223	227	231	1,115
	New Business	CryoMech 34.5kV tap to NGrid Xfmrs	C083770	273	-	-	-	-	273
	New Business	Philips Medical 34.5kV service	C083535	44	2,456	(2,500)	-	-	0
	New Business	Reconductor 1/0 ACSR Solvay LN22	C084218	250	-	-	-	-	250
	New Business	TxD RESERVE for New Business Commer	C046913	1,400	852	1,160	921	939	5,271
	New Business Total			1,967	3,308	(1,340)	921	939	5,794
	Public Requirements	DOTR NYSRt28 White Lk-McKeever SubT	C034722	94	-	-	-	-	94
	Public Requirements	Mechanicville School St 1 Reloc	C084021	145	-	-	-	-	145
	Public Requirements	Pin#2805.77 Otter Lake Lighthouse R	C080427	6	-	-	-	-	6
	Public Requirements	Skaneateles 34.5kV Tap frm NYSEG508	C058559	13	-	-	-	-	13
	Public Requirements Total			258	-	-	-	-	258

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
Customer Request/Public Requirement Total				2,674	3,527	(1,117)	1,148	1,170	7,401
Damage/Failure	Blanket	CNY Sub Trans-Line Damage Failure.	CNC0073	320	327	334	341	348	1,670
		ENY Sub Trans-Line Damage Failure.	CNE0073	1,158	1,184	1,210	1,237	1,264	6,053
		WNY Sub Trans-Line Damage Failure.	CNW0073	2,620	2,679	2,739	2,800	2,863	13,701
	Blanket Total			4,098	4,190	4,283	4,378	4,475	21,424
Damage/Failure Total				4,098	4,190	4,283	4,378	4,475	21,424
DER Electric System Access	Other	Offset to Sub-T DER (non-Company Owned)	CNYSDER	(992)	(100)	-	-	-	(1,092)
	Other Total			(992)	(100)	-	-	-	(1,092)
	Solar	DG 172172: OYA Solar NY LP 5MW PV	C082157	45	-	-	-	-	45
		DG 172846 - Riverview Solar Park	C083353	195	-	-	-	-	195
		DG 194050 West Valley - West Solar	C083659	51	-	-	-	-	51

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG 194084 West Valley East Solar	C083660	51	-	-	-	-	51
		DG NY 16848 Dimon Solar 2.2 MW PV	C077887	249	-	-	-	-	249
		DG NY16694 Town of Tonawanda 34H	C077970	135	-	-	-	-	135
		DG NY213829 Philadelphia Sub-T Line	C084263	102	-	-	-	-	102
		DG NY213833 Philadelphia Sub-T Line	C084264	99	-	-	-	-	99
		DG NY-231911 Nextera Sub-t Line#32	C084354	66	-	-	-	-	66
	Solar Total			992	-	-	-	-	992
	Wind	Cassadaga Wind SubT	C082595	-	100	-	-	-	100
	Wind Total			-	100	-	-	-	100
DER Electric System Access Total				0	-	-	-	-	(0)
Reliability	Blanket	CNY Sub Trans-Line Reliability.	CNC0076	253	259	265	271	277	1,325
		ENY Sub Trans-Line Reliability.	CNE0076	100	102	104	106	108	520

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		WNY Sub Trans-Line Reliability.	CNW0076	56	57	58	59	60	290
	Blanket Total			409	418	427	436	445	2,135
	Reliability	Corliss Park Tap Work for Station	C083661	30	100	-	-	-	130
		LN863 Findley Lake - French Creek e	C046510	-	-	100	2,641	-	2,741
		Oswego L207 Load Break Installation	C081632	196	-	-	-	-	196
	Reliability Total			226	100	100	2,641	-	3,067
	Substation Flood Mitigation	Union Falls Flood Mitigation_SubT	C068247	52	136	173	19	-	380
	Substation Flood Mitigation Total			52	136	173	19	-	380
	Sub-T Automation	DA Scheme 804 Cold Spring Salamanca	C083900	-	550	-	-	-	550
	Sub-T Automation Total			-	550	-	-	-	550
Reliability Total				687	1,204	700	3,096	445	6,132
Resiliency	FLISR	South St. FLISR	C084414	-	-	-	-	50	50
	FLISR Total			-	-	-	-	50	50

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Sub-T Automation	DA - NE SubT Automation Wilton Sub	C035863	821	797	-	-	-	1,618
		DA Scheme 304 Phillips Rd-Telegraph	C083865	-	-	500	-	-	500
		DA Scheme 308 Albion-Brockport	C083866	100	-	-	-	-	100
		DA Scheme 402 Ransomville-Phillips	C083867	450	-	-	-	-	450
		DA Scheme 403 Youngstown-Sanborn	C083871	-	200	-	-	-	200
		DA Scheme 811 Homer Hill-Nile	C083901	-	-	-	425	-	425
		DA Scheme 863 Sherman-Ashville	C083902	-	-	-	530	-	530
		DA Scheme Line 701 Amherst-Walden	C083899	-	-	100	-	-	100
		GR- Install DA on the 312 Line	C065706	332	-	-	-	-	332
		Install DA on 201Line	C069692	20	605	-	-	-	625
		NR- Install DA on 26 Line akw-fort	C083247	288	-	-	-	-	288
		NR- Install DA on 26 Line mal-fort	C083242	288	-	-	-	-	288

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		NR- Install DA on the 23 Line	C064026	383	-	-	-	-	383
		Sub-Transmission Automation Program	C084935	-	400	2,000	1,200	1,200	4,800
	Sub-T Automation Total			2,683	2,002	2,600	2,155	1,200	10,639
	Targeted Feeder Enhancement	Lynn St.- Woodlawn 1 Sectionalizer	C083946	138	12	-	-	-	150
	Targeted Feeder Enhancement Total			138	12	-	-	-	150
Resiliency Total				2,821	2,014	2,600	2,155	1,250	10,839
System Capacity - NY	Load Relief	Delmar 34.5kV Reconfiguration	C083917	-	-	-	50	365	415
		Eden Switch Structure -SubT	C052023	100	600	100	-	-	800
		Golah Avon 217 line reconductoring	C036054	-	-	-	-	21	21
		LHH - Mallory 34.5 kV #22 Line Reg.	C073226	-	-	-	50	775	825
	Load Relief Total			100	600	100	100	1,161	2,061
System Capacity - NY Total				100	600	100	100	1,161	2,061
Grand Total				39,833	56,184	61,038	56,015	57,828	270,897

Exhibit 3 – Distribution Capital Investment Plan

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
Asset Condition	Asset Replacement	*NR-81452-Jolly Island Grp-Upgrade	C049780	-	-	-	14	400	414
		Avenue A 29112 Reconductor	C078281	88	-	-	-	-	88
		Avenue A Feeder conversions	C081583	15	405	-	-	-	420
		Buffalo Station 12 - 25 Cycle Retir	CD00969	-	-	-	-	-	-
		Buffalo Station 122 Rebuild - Line	CD00779	36	366	300	-	-	702
		Buffalo Station 122 Rebuild - Sub	CD00782	1,556	2,818	1,432	-	-	5,806
		Buffalo Station 14 - 25 Cycle Retir	CD00974	5	-	-	-	-	5
		Buffalo Station 31 Rebuild - Line	C046943	-	-	86	600	600	1,286
		Buffalo Station 32 Rebuild - Line	C036461	120	158	651	651	143	1,724
		Buffalo Station 35 Rebuild - Line	C046934	-	-	-	86	600	686
		Buffalo Station 38 Rebuild - Line	C046936	100	1,496	1,460	115	15	3,185
		Burgoyne 51 - Rebuild Durkeetown Rd	CD00222	41	-	-	-	-	41
		Caledonia sub 44 - Line Relay Rep	C052444	-	-	-	36	192	228
		Chrisler Ave 25735 Conversion	C057133	119	125	36	-	-	280

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Chrisler Ave 25737 Conversion	C057132	119	447	72	-	-	638
		Chrisler Rebuilt Station - Dist get	C064766	33	150	24	-	-	207
		Coffeen TB3 Replacement	C084109	-	500	3,000	-	-	3,500
		Corliss Park South Feeder Conversio	C081414	722	1,055	50	-	-	1,827
		Corliss Park West Feeder Conversion	C081385	304	969	350	-	-	1,623
		CORLISS PARK XFMR 2 & BUS INSTALL	C081991	1,240	2,650	500	-	-	4,390
		Crown Pt. 51 - Creek Rd Gap Closing	C048906	107	-	-	-	-	107
		Dexter Station Maintenance	C084107	-	-	-	500	1,000	1,500
		DLINE trf for Burnett-Headson 34	C084567	3	10	3	-	-	16
		DLINE trf for Woodard-Ash 27/28	C084566	-	-	5	21	5	31
		Duguid Road- CS replacement	C079703	2	-	-	-	-	2
		F1662 Reconductor Rt20 Broadway	C048615	157	-	-	-	-	157
		F7955 Hartfield-Transfer #3 to L859	C080281	69	181	-	-	-	249
		Fayette St Line	C081980	-	-	150	2,000	4,000	6,149

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Fayette St Substation	C081981	-	50	1,400	2,488	5,442	9,380
		Galeville Station Rebuild	C050746	-	50	1,516	2,262	-	3,828
		Grand Island Station Build	C081485	-	-	1,050	2,488	6,442	9,980
		Henry St 31636 - River Crossing	C029432	678	300	-	-	-	978
		Inghams Dist Line Relocation	C074489	20	100	-	700	10	830
		Karner Station Retirement	C052309	-	24	-	392	-	416
		Lasher Road - 52 Feeder OH	C068326	900	-	-	-	-	900
		Lasher Road - 53 Feeder OH	C068348	1,625	1,333	-	-	-	2,958
		Leray Station Maintenance	C084108	-	-	-	500	1,000	1,500
		Liberty St 13.2kV Getaways	C081421	15	-	-	105	-	120
		LighthouseHill Relocation-Dist Line	C074342	25	200	800	-	1,000	2,025
		Line 301 DLine Underbuilt Transfer	C084600	-	15	64	15	-	94
		Line 811 D Line Transfer	C084585	5	12	12	-	-	29
		Machias F1362 Replace Steel Wire	C056619	11	-	-	-	-	11

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		McCrea Station Retirement	C046790	-	-	-	-	40	40
		Memory Lane URD-subsurface tx	C082378	132	-	-	-	-	132
		Middleburgh 51 - Route 145 Extend/C	CD01010	-	-	-	-	1,104	1,104
		Mill St Station Rebuild	C084102	-	-	-	500	1,442	1,942
		Mohican Getaways	C081399	-	-	50	627	285	962
		Mohican NE Feeder	C081407	-	-	-	50	559	609
		Mohican NW Feeder	C081404	-	100	294	294	294	982
		Mohican SE Feeder	C081408	-	100	491	491	385	1,468
		Mohican SW Feeder	C081406	-	-	-	-	186	186
		MV-Rome 76254-HWY 49 Reconductor	C050005	-	249	269	-	-	518
		N State St-Ash to James-MH Failures	C081071	120	1,428	50	-	-	1,598
		New Harper Substation D Line	C046417	170	1,531	8	-	-	1,709
		North Bangor - Driveway Improvement	C082004	108	-	-	-	-	108
		Norton Street UG Civil Rebuild	C050138	256	-	-	-	-	256

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		NR-Fine 97866-NYS Hwy 3-Rolcation	C049754	-	13	290	-	-	303
		NR-Hammond 37061-T.I.Transformers	C026988	15	465	-	-	-	480
		NY GE Butyl Rubber PT Replacement	C051745	97	-	-	-	-	97
		Ogden Brook 52 - Getaway & Overhead	C081396	263	699	-	-	-	962
		Ogden Brook 55-Henry St 34 Transfer	C081398	10	64	-	-	-	74
		Ohio St - Buffalo River Tunnel/Bore	C050400	623	-	-	-	-	623
		Raquette Lake Sub - Recloser & Regs	C080904	330	-	-	-	-	330
		Raquette Lake Transformer Upgrade	CD01139	-	-	-	-	-	-
		Rebuild Ash 4160 and plut on Fayett	C082032	-	-	-	50	2,237	2,287
		Ruth Road TB2 & MC	C083963	-	2,000	2,595	-	-	4,595
		Smith Bridge - New TB2 Getaways	C083483	-	40	1,800	-	-	1,840
		Smith Bridge 55 - Build New Feeder	C083484	-	20	270	88	-	378
		Smith Bridge 56 & 57 -Build Feeders	C083485	-	38	700	826	-	1,564
		Sonora Way F438153	C046552	42	422	2,490	157	34	3,145

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Sonora Way F438154	C051690	18	53	1,142	33	12	1,258
		Sonora Way F438155	C051692	12	6	13	77	10	117
		Sonora Way Substation with 6 fders	C060141	44	782	1,382	301	16	2,525
		Station 124 - Building and Roof	C082809	84	98	-	-	-	182
		Station 79 Rebuild	C082713	-	120	600	1,493	2,852	5,065
		Sycaway 37256 Pawling Conversion	C082395	-	-	90	563	-	653
		Syr-State St - Secondary Cables	C083237	-	-	-	39	216	255
		Temple Distribution Rebuild	C079534	840	6,209	5,688	1,679	107	14,523
		Temple Substation Rebuild - buildin	C083385	900	1,100	-	-	-	2,000
		Terminal Station Relocation_DLine	C059671	100	1,411	2,507	-	-	4,018
		Tuller Hill DLine-13kV Getaway	C064446	-	50	-	-	-	50
		UG for Temple Rebuild	C079532	40	80	1,408	5,038	-	6,566
		VO Gouverneur_Main St_UCD	C082452	24	-	-	-	-	24
		West Adams 2nd Bank	C084111	-	-	500	1,000	1,942	3,442

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Asset Replacement Total			12,342	30,494	35,596	26,280	32,569	137,279
	Blanket	Cent NY-Dist-Asset Replace Blanket.	CNC0017	2,225	2,273	2,322	2,372	2,423	11,615
		East NY-Dist-Asset Replace Blanket.	CNE0017	1,121	1,146	1,171	1,197	1,223	5,858
		West NY-Dist-Asset Replace Blanket.	CNW0017	2,920	2,984	3,049	3,116	3,184	15,254
	Blanket Total			6,266	6,404	6,542	6,684	6,831	32,727
	Buffalo St Light Replacement	Buffalo Street Light Cable Replacem	CD00851	2,500	2,500	2,500	2,500	2,500	12,500
	Buffalo St Light Replacement Total			2,500	2,500	2,500	2,500	2,500	12,500
	Inspection & Maintenance	I&M - NC D-Line OH Work From Insp.	C026160	10,000	9,994	9,250	9,250	10,017	48,511
		I&M - NC D-Line UG Work From Insp.	C026163	629	629	629	629	629	3,143
		I&M - NE D-Line OH Work From Insp.	C026159	8,150	8,655	7,400	7,400	8,655	40,261
		I&M - NE D-Line UG Work From Insp.	C026162	500	500	500	500	500	2,500
		I&M - NW D-Line OH Work From Insp.	C026161	13,973	13,351	13,223	13,223	14,124	67,894
		I&M - NW D-Line UG Work From Insp.	C026164	1,000	1,000	1,000	1,000	1,000	5,002

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Otten 41213- Crusher Hill Rd	C053629	63	-	-	-	-	63
		Ruth Road Conversion and Rebuild	C083961	-	1,170	1,000	1,000	1,000	4,170
		Ruth Road TB2 Civil	C083962	-	14	150	-	-	164
	Inspection & Maintenance Total			34,315	35,313	33,153	33,002	35,926	171,709
	Network Secondary UG Cable Replacement	Cable Replacement - Ntwk Sec NYE	C078270	2,500	2,000	6,000	4,500	4,500	19,500
		Cable Replacement - Ntwk Sec NYW	C077338	2,500	2,800	8,500	6,500	6,500	26,800
	Network Secondary UG Cable Replacement Total			5,000	4,800	14,500	11,000	11,000	46,300
	Overhead Line (Program)	Dist Underbuild Teall 25 relocation	C058051	73	-	-	-	-	73
		Maple Ave - New Feeder 52	C069909	336	970	-	-	-	1,306
		Maple Ave - New Feeder 53	C069911	955	-	-	-	-	955
		Maple Ave - New Feeders 51 & 54	C069907	53	-	-	-	-	53
		Maple Ave. - Convert 32422 & 32423	C069912	13	394	-	-	-	407
		Phillips-Barker D-Line Transfer	C084449	15	26	15	-	-	56

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Overhead Line (Program) Total			1,443	1,390	15	-	-	2,848
	Primary UG Cable Replacement	MV Island XFMR repl. - Central Div	C026977	499	500	500	500	500	2,499
		Riverside 28855 UG Cable Replaceme.	C036468	-	63	1,120	1,120	-	2,303
		Syr-State St-Network Primary Cables	C083235	-	-	-	120	680	800
		Syr-State St-Radial Primary Cables	C083236	-	-	-	100	600	700
	Primary UG Cable Replacement Total			499	563	1,620	1,840	1,780	6,302
	Station Metal Clad Switchgear	Avenue A 291 Metalclad Replacement	C056609	-	-	100	1,188	4,681	5,969
		Blue Stores - Replace IMCS and XMFR	C081611	120	500	2,379	2,367	-	5,367
		Chrisler Rebuilt Station - Station	C068290	683	2,771	19	-	-	3,472
		Hopkins 253 - Replace Metalclad Gea	C046741	3,671	20	-	-	-	3,691
		Hopkins Rd Metalclad Repl DLINE.	C054383	319	-	-	-	-	319
		Johnson Rd - Replace Metalclad Gear	C046747	-	-	200	1,988	1,968	4,156
		Market Hill substation retirement	C046367	8	6	-	-	-	14
		McKnownville 327 Metalclad Replacem	C056612	-	-	-	150	1,728	1,878

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Metal Clad Replacement Program	C084936	-	500	4,000	3,988	8,000	16,488
		New Maple Ave Substation	C073527	210	-	-	-	-	210
		Pine Grove Metalclad Replacement	C056614	-	230	300	1,627	2,870	5,027
		Pinebush - Replace Metalclad Gear	C046744	-	-	-	-	200	200
		Prospect Hill - Replace Metalclad	C080223	59	549	3,127	217	-	3,951
		Rock Cut Metalclad	C083445	100	267	1,074	1,858	68	3,366
		Ruth Road Sta - Replace Metalclad	C081613	-	120	1,300	1,988	-	3,408
		Saratoga Substation Retirement	C083487	-	-	-	-	-	-
		Station 140 Metalclad Replacement	C056616	-	221	2,302	1,738	250	4,511
		Station 162 Metalclad Replacement	C052706	1,560	2,899	-	-	-	4,459
		Station 61 - Metalclad Replacement	C051707	50	2,000	4,010	1,458	-	7,518
		Sycaway - Metalclad Replacement	C081630	-	-	120	1,288	1,942	3,350
		Tuller Hill 246 Unit Metalclad Repl	C056611	-	78	1,164	2,219	888	4,348
	Station Metal Clad Switchgear Total			6,778	10,160	20,095	22,074	22,594	81,702

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Substation Battery&Related	Batts/Charg- NY Central	C032013	150	183	183	183	183	884
		Batts/Charg- NY West	C032014	340	193	193	235	235	1,196
		Batts/Charg--NY East	C032012	200	200	200	200	200	1,000
	Substation Battery&Related Total			691	577	577	618	618	3,080
	Substation Breaker	Dekalb Sub- Replace R540 & R550	C080966	4	-	-	-	-	4
		NC ARP Breakers & Reclosers	C032253	751	773	773	774	774	3,846
		NE ARP Breakers & Reclosers	C032252	680	680	680	680	680	3,400
		NW ARP Breakers & Reclosers	C032261	884	698	698	698	698	3,674
		Peat St - replace R825 OCB	C049550	207	-	-	-	-	207
		St Johnsville R510 & R540 Rpl	C083319	10	-	-	-	-	10
	Substation Breaker Total			2,536	2,151	2,151	2,152	2,152	11,140
	Substation Cicuit Switchgear	Circuit Switcher Strategy Co:36	C051845	370	-	-	-	-	370
	Substation Cicuit Switchgear Total			370	-	-	-	-	370
	Substation Indoor	Buffalo Station 25 Rebuild - Line	C036458	-	-	-	-	86	86

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Buffalo Station 25 Rebuild - Sta	C036456	-	-	-	-	94	94
		Buffalo Station 30 - Rebuild - Fdrs	C015754	-	86	600	600	100	1,385
		Buffalo Station 30 Rebuild - Sta	C046519	-	94	900	2,688	3,514	7,196
		Buffalo Station 31 Rebuild - Sub	C046952	-	-	94	900	2,642	3,636
		Buffalo Station 32 Rebuild - Sta	C036459	180	1,523	2,829	2,452	568	7,552
		Buffalo Station 35 Rebuild - Sub	C046954	-	-	-	94	900	994
		Buffalo Station 38 Rebuild - Sub	C046955	120	200	5,300	2,500	1,611	9,730
		Buffalo Station 53 Rebuild - Line	C046929	1,640	129	-	-	-	1,769
		Buffalo Station 53 Rebuild - Sub	C046945	1,519	2,691	1,443	371	93	6,117
		Eighth St 80 - Indoor Substation Re	C046585	893	844	4,383	2	-	6,122
		Eighth St 80 - Sub Refurb D-Line	C046586	99	437	525	353	-	1,414
		Eleventh St 82 - Indoor Substation	C046582	-	20	45	2,131	50	2,246
		Stephenson 85 - Indoor Substation R	C046581	6,375	2,187	-	-	-	8,562
		Stephenson 85 - Sub Refurb D-Line	C046580	9,494	428	6	-	-	9,928

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Welch 83 - Sub Refurb D-Line	C046584	-	-	51	164	1,300	1,515
		Welch 83 Indoor Substation Refurbis	C046583	122	234	1,323	3,331	448	5,458
	Substation Indoor Total			20,441	8,872	17,499	15,585	11,405	73,803
	Substation Mobile	NY Mobile Substation Program	C051744	-	-	-	1,000	1,000	2,000
	Substation Mobile	Rebuild 6W mobile substation	C066566	740	-	-	-	-	740
	Substation Mobile Total			740	-	-	1,000	1,000	2,740
	Substation Power Transformer	Altamont TB1 Replacement	C066227	-	-	-	-	-	-
	Substation Power Transformer	Galeville 71,72&73 fdrs conversion	C050749	-	63	405	622	-	1,090
	Substation Power Transformer	IE - NY ARP Transformers	C025801	-	900	900	900	900	3,600
	Substation Power Transformer	Liberty St TB5 Install 34.5/13.8kV	C081420	399	2,200	2,200	943	-	5,741
	Substation Power Transformer	NY ARP Spare Substation Transformer	C026055	599	599	599	599	599	2,997
	Substation Power Transformer	Smith Bridge 2nd Bank & Metalclad	C081418	530	2,540	2,534	40	-	5,644
	Substation Power Transformer	Station 124 - Almeda Ave Transforme	C046670	2,081	1,482	280	-	-	3,843
	Substation Power Transformer	Stoner Station Replace TB1	C083223	1,455	-	-	-	-	1,455

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Substation Power Transformer Total			5,065	7,784	6,918	3,104	1,499	24,372
	Sub-T Overhead Line	Barker Station 78	C083749	-	-	-	600	4,342	4,942
		Gard-Dun 141-142 D Line Relocation	C079005	167	200	207	-	-	574
	Sub-T Overhead Line Total			167	200	207	600	4,342	5,516
Asset Condition Total				99,154	111,207	141,372	126,439	134,215	612,387
Communications/Control Systems	Advanced Metering	AMI - NY Electric	C083340	676	4,402	32,883	75,415	90,345	203,721
		NY Landline Meter Replacement	C083651	272	412	420	289	289	1,682
	Advanced Metering Total			949	4,814	33,303	75,704	90,634	205,403
	Radios	AMI - Field Area Networks (FANs	C084958	-	-	942	2,318	2,766	6,026
		Communications For Regs & Caps-NYC	C084104	-	731	731	731	731	2,924
		Communications For Regs & Caps-NYE	C084105	-	650	650	650	650	2,600
		Communications For Regs & Caps-NYW	C084103	-	867	1,000	867	1,000	3,734
		D-Line Comms Redundancy	C084931	-	100	404	-	-	504

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		RECLOSER COMMUNICATION INSTALL NYW	C081358	100	-	-	-	-	100
		RECLOSER COMMUNICATION INSTALL_NYC	C081356	225	-	-	-	-	225
		RECLOSER COMMUNICATION INSTALL_NYE	C081357	300	-	-	-	-	300
	Radios Total			625	2,348	3,727	4,566	5,147	16,413
	Substation RTU	EMS/RTU INSTALLS - NY CENTRAL	C076124	632	1,253	4,659	4,647	5,102	16,293
		EMS/RTU INSTALLS - NY EAST	C076123	580	2,475	3,386	3,374	1,335	11,150
		EMS/RTU INSTALLS - NY WEST	C076125	3,187	1,545	2,120	2,108	3,555	12,515
		Alder Creek-Add EMS/MOD	C075024	47	-	-	-	-	47
		EMS/RTU for DSCADA	C077972	3,676	2,200	481	-	-	6,357
		RTU M9000 Distribution	C069687	2,188	903	-	-	-	3,091
		Station 129 Brompton Rd - EMS Expan	C053086	206	-	-	-	-	206
	Substation RTU Total			10,516	8,375	10,646	10,129	9,992	49,658
	Telecom	Bald Mountain - Dish Installation	C084148	54	-	-	-	-	54
		EMS/RTU TELECOM - DLINE NY CENT	C076112	17	281	281	281	311	1,171

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		EMS/RTU TELECOM - DLINE NY EAST	C076111	-	202	202	202	83	689
		EMS/RTU TELECOM - DLINE NY WEST	C076122	111	131	131	131	216	720
		EMS/RTU TELECOM - STATIONS NY CENT	C076108	777	1,280	1,130	1,118	1,244	5,549
		EMS/RTU TELECOM - STATIONS NY EAST	C076107	825	760	834	834	376	3,629
		EMS/RTU TELECOM - STATIONS NY WEST	C076110	676	653	739	739	921	3,728
		Front St - Microwave Installation	C084149	88	-	-	-	-	88
		Malta - Fiber Installation	C084151	216	-	-	-	-	216
		OpTel - DMX Replacement	C084927	-	1,250	3,000	2,488	750	7,488
		Optel - SCADA Analog Replacement	C084926	-	3,793	4,003	4,242	4,500	16,538
		OpTel- Critical and Key Facilities	C084929	-	547	866	1,179	1,729	4,321
		Telecom and Radio Equipment	C004157	995	995	995	995	995	4,975
	Telecom Total			3,758	9,892	12,181	12,209	11,125	49,165
Communications/Control Systems Total				15,848	25,429	59,857	102,607	116,899	320,640

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
Customer Request/Public Requirement	3rd Party Attachments	NYS Broadband Expansion	C075964	286	-	-	-	-	286
		Spectrum Broadband Expansion	C077091	882	451	-	-	-	1,333
	3rd Party Attachments Total			1,169	451	-	-	-	1,620
	Blanket	Cent NY-Dist-3rd Party Attch Blnkt	CNC0022	1,199	1,224	1,250	1,276	1,300	6,249
		Cent NY-Dist-Meter Blanket	CNC0004	1,842	1,904	1,968	2,034	2,102	9,850
		Cent NY-Dist-New Bus-Comm Blanket.	CNC0011	4,901	5,059	5,222	5,391	5,565	26,138
		Cent NY-Dist-New Bus-Resid Blanket	CNC0010	7,588	7,834	8,087	8,349	8,619	40,478
		Cent NY-Dist-Public Require Blankt	CNC0013	1,260	1,300	1,342	1,385	1,430	6,717
		Cent NY-Dist-St Light Blanket.	CNC0012	2,156	2,201	2,247	2,294	2,342	11,239
		East NY-Dist-3rd Party Attch Blnkt	CNE0022	788	806	821	838	856	4,109
		East NY-Dist-Meter Blanket	CNE0004	1,910	1,974	2,040	2,109	2,180	10,212
		East NY-Dist-New Bus-Comm Blanket.	CNE0011	4,513	4,660	4,812	4,969	5,131	24,085
		East NY-Dist-New Bus-Resid Blanket.	CNE0010	7,446	7,687	7,936	8,193	8,459	39,721
		East NY-Dist-Public Require Blankt	CNE0013	887	916	946	977	1,009	4,735

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		East NY-Dist-St Light Blanket.	CNE0012	1,420	1,451	1,483	1,515	1,548	7,417
		Land and Land Rights NY Central.	CNC0091	1,209	1,237	1,266	1,295	1,325	6,332
		Land and Land Rights NY East	CNE0091	1,301	1,331	1,362	1,394	1,427	6,815
		Land and Land Rights NY West	CNW009 1	619	633	648	663	678	3,241
		NiMo Meter Purchases	CN03604	3,787	3,669	3,542	2,859	2,453	16,310
		NiMo Transformer Purchases	CN03620	24,70 4	25,45 0	26,21 8	27,01 0	27,82 6	131,208
		West NY-Dist-3rd Party Attch Blnkt	CNW002 2	512	524	535	544	556	2,671
		West NY-Dist-Meter Blanket	CNW000 4	2,326	2,404	2,485	2,568	2,654	12,438
		West NY-Dist-New Bus-Comm Blanket.	CNW001 1	4,468	5,387	5,562	5,742	5,928	27,087
		West NY-Dist-New Bus-Resid Blanket.	CNW001 0	4,860	5,019	5,183	5,352	5,527	25,942
		West NY-Dist-Public Require Blankt	CNW001 3	737	761	786	811	837	3,932
		West NY-Dist-St Light Blanket.	CNW001 2	5,205	5,316	5,429	5,544	5,662	27,156
	Blanket Total			85,63 7	88,74 5	91,17 2	93,11 3	95,41 1	454,080

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	New Business	Ballston 51 - Route 50 Conversion	C083314	107	-	-	-	-	107
		Birch Ave 51 - Route 9N Conversion	C053127	170	-	-	-	-	170
		Extend F101151 Fletcher St	C084485	70	-	-	-	-	70
		Extend F215451 to Ohio Street	C080466	88	-	-	-	-	88
		F7656 to relieve F20653 for Cust	C081500	50	400	-	-	-	450
		Glens Falls Hospital Retire Station	C082758	-	43	-	-	-	43
		LED Decorative Central NY	C084981	-	610	610	610	610	2,440
		LED Decorative East NY	C084979	-	627	627	627	627	2,509
		LED Decorative West NY	C084982	-	506	506	506	506	2,022
		New LED Central NY	C069886	2,509	1,882	1,882	1,882	1,882	10,036
		New LED East NY	C069947	2,022	1,517	1,517	1,517	1,517	8,089
		New LED West NY	C069927	2,440	1,830	1,830	1,830	1,830	9,759
		NMPC Electric Transport Initiative	C080805	2,307	666	4,876	8,833	6,106	22,788
		Reserve for New Business Commercial	C046920	3,500	6,604	4,635	6,133	6,766	27,638

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Reserve for New Business Residentia	C046921	5,000	5,855	6,412	6,036	6,666	29,968
		Schenectady Smart City REV Demo	C081846	2,950	-	-	-	-	2,950
		Upgrade F10552 for new cust load	C081502	-	-	60	470	-	530
		UpperMohNewUticaNY	C080300	441	-	-	-	-	441
		Weibel 56 - Putnam Lane Rebuild	C081966	259	-	-	-	-	259
	New Business Total			21,914	20,539	22,953	28,442	26,509	120,358
	Other	East Batavia Substation - DLine Upg	CD00587	224	-	-	-	-	224
	Other Total			224	-	-	-	-	224
	Public Requirements	AHET Investigation and Design	C080396	12	35	-	-	-	47
		Caledoina-Golah 213 DDT Removal	C084497	-	-	-	-	-	-
		ECWA Relocate F6661 to Padmount	C077293	700	-	-	-	-	700
		Liberty 09451 to 09456 Load Relief	C081026	225	-	-	-	-	225
		Pin#1085.40 Route 146 (Carman Rd) G	C083010	206	-	-	-	-	206
		Pin#2754.27 Middle Settlement Rd Ne	C083653	158	-	-	-	-	158

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Pin#3043.65 Bridge over Oneida Rive	C081174	275	-	-	-	-	275
		Port Henry 51 - Route 9N Relocation	C079022	192	-	-	-	-	192
		RalphNohle_UPG_AdamsNY	C082755	94	-	-	-	-	94
		Reserve for Public Requirements Uni	C046922	2,000	4,644	4,092	5,852	6,479	23,067
		Village of Clayton Downtown - OH-UG	C053443	2,981	118	-	-	-	3,099
	Public Requirements Total			6,844	4,797	4,092	5,852	6,479	28,064
Customer Request/Public Requirement Total				115,787	114,533	118,217	127,408	128,399	604,344
Damage/Failure	Blanket	Cent NY-Dist-Damage/Failure Blankt	CNC0014	17,511	17,903	18,304	18,714	19,133	91,565
		Cent NY-Dist-Subs Blanket.	CNC0002	900	920	941	962	983	4,705
		East NY-Dist-Damage/Failure Blankt	CNE0014	15,631	15,983	16,343	16,711	17,087	81,755
		East NY-Dist-Subs Blanket.	CNE0002	900	920	940	961	982	4,703
		West NY-Dist-Damage/Failure Blankt	CNW0014	10,960	11,207	11,459	11,717	11,981	57,324

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		West NY-Dist-Subs Blanket.	CNW0002	900	920	940	961	982	4,703
	Blanket Total			46,802	47,853	48,926	50,026	51,148	244,755
	Damage/Failure	Bartell Road Station TB2 D/F	C083583	265	-	-	-	-	265
		Brook Road 528 Switch D/F	C084582	140	-	-	-	-	140
		Cobleskill TB2 D/F	C083648	1,445	-	-	-	-	1,445
		DF Cattaraugus High Side Switch	C082397	42	-	-	-	-	42
		Grand Island Station 64 TB2 D/F	C083337	1,494	-	-	-	-	1,494
		Madison Sub - Trans and Reg D/F	C081849	352	-	-	-	-	352
		North Troy 53 - Highpoint URD cable	C083478	150	-	-	-	-	150
		Radisson Cable - Swgr 11_15_56	C083570	353	277	-	-	-	630
		Reserve for Damage/Failure Unidenti	C046918	1,108	2,668	2,136	4,188	4,272	14,372
			C046948	6,944	8,000	8,242	8,488	7,942	39,617
		S State St_James to Adams-Duct Line	C054834	2,014	100	50	-	-	2,164
		Scotia TB1 D/F	C083995	221	-	-	-	-	221

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Station 212 MOD D/F	C083811	250	-	-	-	-	250
		Station 34 - MOD SW 801 D/F	C079874	58	-	-	-	-	58
		Station 54 - Replace R103 D/F	C080840	205	-	-	-	-	205
		Station 55 - Rep Regulator #1 D/F	C080630	11	-	-	-	-	11
		West Monroe TB1 D/F	C084092	488	-	-	-	-	488
	Damage/Failure Total			15,539	11,046	10,428	12,677	12,215	61,904
Damage/Failure Total				62,341	58,899	59,354	62,703	63,363	306,659
DER Electric System Access	CHP	DG 102002 Albany VA Riverside DTT	C080646	(170)	-	-	-	-	(170)
		DG NY 17991 Turning Stone	C077944	50	-	-	-	-	50
	CHP Total			(120)	-	-	-	-	(120)
	Company Owned DER	Kenmore Station 22 Battery Storage	C078752	-	114	-	500	2,342	2,956
	Company Owned DER Total			-	114	-	500	2,342	2,956
	Other	Clean Innovation Project - Grid Mod	C084928	-	1,020	1,020	270	270	2,580

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Gloversville Area 5 Station DTT	C083310	56	-	-	-	-	56
		Offset to Dist DER (non-Conpany Owned)	CNYLDER	(22,199)	(25)	(74)	(15)	-	(22,313)
	Other Total			(22,143)	995	946	255	270	(19,677)
	Solar	DG - 169478 Solar Park 4-A	C081082	168	-	-	-	-	168
		DG 108583 ABA Clean Energy Pulaski	C081238	211	-	-	-	-	211
		DG 108584 ABA Silver Creek Solar	C081481	158	-	-	-	-	158
		DG 167026 - Rensola Wellsville	C083828	22	-	-	-	-	22
		DG 168256 - Boreggo Solar Hamlin NY	C081175	31	-	-	-	-	31
		DG 168256 3V0 Installation W Hamlin	C081178	(76)	-	-	-	-	(76)
		DG 169583 Nexamp - Eden	C083006	460	-	-	-	-	460
		DG 169583 Nexamp - Eden 2	C083007	172	-	-	-	-	172
		DG 171687 Helios Rush (North)	C080914	156	-	-	-	-	156
		DG 171907 Helios Rush (South)	C080916	155	-	-	-	-	155

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG 172238 - ForeFront Rush	C082249	85	-	-	-	-	85
		DG 173171 - Helios W Hamlin Solar 1	C083355	39	-	-	-	-	39
		DG 173173 - Helios West Hamlin 2	C083357	57	-	-	-	-	57
		DG 187820 Nextamp Honeoye Falls	C083789	80	-	-	-	-	80
		DG 194894 Nextamp Brockport Solar	C083798	26	-	-	-	-	26
		DG 196061 Borrego Solar	C083111	44	-	-	-	-	44
		DG 196184 - Borrego Redman Rd North	C083061	52	-	-	-	-	52
		DG 196186 Borrego Redman Rd South	C083067	64	-	-	-	-	64
		DG 229994 AES Dunkirk DLine	C084594	9	-	-	-	-	9
		DG 239550 Dimension Allegany	C084586	5	10	10	-	-	24
		DG 3V0 Protection at Selkirk	C075522	15	-	-	-	-	15
		DG NY - 187608 - RER Energy - SUB	C083378	151	-	-	-	-	151
		DG NY - 213630 Borrego Batavia	C084425	47	-	-	-	-	47
		DG NY #106164 RER Energy Sub	C081559	213	-	-	-	-	213

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY 105491 Brian Hart Phillips Rd	C080745	81	-	-	-	-	81
		DG NY 106164 Sunvestment Energy	C081558	106	-	-	-	-	106
		DG NY 108713 Nexamp-Herkimer	C080417	30	-	-	-	-	30
		DG NY 108713 Nexamp-Salisbury	C080419	61	-	-	-	-	61
		DG NY 11535 - GE Global Sharon 3V0	C077695	77	-	-	-	-	77
		DG NY 165990 Oak Hill Solar Site 1	C083106	184	-	-	-	-	184
		DG NY 166610 Oak Hill Solar 2	C083107	106	-	-	-	-	106
		DG NY 168448 Castleton	C083673	86	-	-	-	-	86
		DG NY 168774 Eden-White River DLine	C083060	29	-	-	-	-	29
		DG NY 168774 Eden-White River-3V0	C083069	307	-	-	-	-	307
		DG NY 169960 Cypress Marcy	C083099	267	-	-	-	-	267
		DG NY 169960 Cypress Marcy 2	C083100	98	-	-	-	-	98
		DG NY 170011 Monolith Reynolds Rd	C083037	240	-	-	-	-	240
		DG NY 170284 Nexamp Hollenbeck	C082275	38	-	-	-	-	38

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY 172236 Forefront Burgoyne 3V0	C083519	447	-	-	-	-	447
		DG NY 172236 Forefront Burgoyne 52	C083518	32	-	-	-	-	32
		DG NY 172437 OYA Great Lakes - Line	C082042	34	-	-	-	-	34
		DG NY 172437 OYA Great Lakes - Sub	C082029	323	-	-	-	-	323
		DG NY 172438 OYA Blanchard Rd - Sub	C082039	389	-	-	-	-	389
		DG NY 172438 OYA Blanchard Rd Line	C082040	77	-	-	-	-	77
		DG NY 172439 OYA NYS Rte 12 - Line	C082045	(18)	-	-	-	-	(18)
		DG NY 172442 OYA Blanchard 2 - Line	C082034	(70)	-	-	-	-	(70)
		DG NY 173052 Borrego Vail Mills	C082997	973	-	-	-	-	973
		DG NY 173381 - Borrego Solar - Sub	C081386	159	-	-	-	-	159
		DG NY 173381 - Borrego Solar - DLine	C081397	320	-	-	-	-	320
		DG NY 173582 ELP Greenport - Dline	C083248	159	-	-	-	-	159
		DG NY 183955 Solitude Lowville Line	C082519	118	-	-	-	-	118
		DG NY 185060 Eden-Elmbrook - DLine	C083077	90	-	-	-	-	90

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY 186056 at 2 Rice Rd Rotterdam	C082229	7	-	-	-	-	7
		DG NY 186064 GE Interna Anth St Sch	C082454	35	-	-	-	-	35
		DG NY 186117 GE Rynex Corners	C083117	351	-	-	-	-	351
		DG NY 186134 Weaver Street	C082459	467	-	-	-	-	467
		DG NY 188378 Hetcheltown Rd D Line	C082253	18	-	-	-	-	18
		DG NY 188994 - Prowind Inc.	C083278	36	-	-	-	-	36
		DG NY 18991 New Scotland LLC 1	C080831	15	-	-	-	-	15
		DG NY 192130 Omni-Navitas PH Line	C084211	55	-	-	-	-	55
		DG NY 192254 Omni King Rd (Line)	C083744	64	-	-	-	-	64
		DG NY 192254 Omni King Rd (Station)	C083745	18	-	-	-	-	18
		DG NY 194524 New PowerCo Dowmont Rd	C083631	52	-	-	-	-	52
		DG NY 195264 Tamarac Road	C083002	59	-	-	-	-	59
		DG NY 195570 omni Dekalb Dist_line	C083700	21	-	-	-	-	21
		DG NY 195570 omni Dekalb Dist_Sub	C083701	416	-	-	-	-	416

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY 196764 Omin Mcadoo Dist_line	C083878	65	-	-	-	-	65
		DG NY 196764 Omin Mcadoo Dist_Sub	C083882	396	-	-	-	-	396
		DG NY 196798 onmi N_Gouv Dist_line	C083703	41	-	-	-	-	41
		DG NY 196805 omni N-Gouv Dist-Sub	C083706	418	-	-	-	-	418
		DG NY 197190 ELP KINDERHOOK - DLINE	C083243	42	-	-	-	-	42
		DG NY 197190 ELP KINDERHOOK 3V0 SUB	C083245	410	-	-	-	-	410
		DG NY 197574 Borrego Solar - DIS	C083842	99	-	-	-	-	99
		DG NY 198681 Nexamp Caswell 3V0	C083808	447	-	-	-	-	447
		DG NY 198681 Nexamp Clinton East	C083807	252	-	-	-	-	252
		DG NY 203564 Borrego State Route 40	C083597	113	-	-	-	-	113
		DG NY 206012 Omni Sherman Ln	C084370	51	-	-	-	-	51
		DG NY 206375 Solitude-Indian River	C084222	164	-	-	-	-	164
		DG NY 210124 Nextera Harris dist	C083541	24	-	-	-	-	24
		DG NY 213284 Borrego NTroy 53 Dusen	C083919	61	-	-	-	-	61

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY 219855-Borrego Solar - Akron	C084429	27	-	-	-	-	27
		DG NY 239550 Dimension Allegany	C084416	103	-	-	-	-	103
		DG NY 242287-GreenSpark-TotmanRd	C084437	33	-	-	-	-	33
		DG NY 245613-GreenSpark-Island	C084441	29	-	-	-	-	29
		DG NY#170433 TM MONTANTE D-line	C081510	94	-	-	-	-	94
		DG NY#170444 TM MONTANTE D-line	C081520	94	-	-	-	-	94
		DG NY11334 GE 19th Hole(SW) DTT/3V0	C074666	156	-	-	-	-	156
		DG NY11510 HoosickFalls CSD A D-Sub	C078748	290	-	-	-	-	290
		DG NY11991 Owens Corning Sub	C077756	289	-	-	-	-	289
		DG NY12432 St Lawrence University	C077724	106	-	-	-	-	106
		DG NY13666 Oswego County Landfill	C077466	27	-	-	-	-	27
		DG NY169786 Nexamp watertown Dist	C082322	98	-	-	-	-	98
		DG NY169964 State Rte 67	C083071	98	-	-	-	-	98
		DG NY169974 Cypress woodstock dist	C083020	107	-	-	-	-	107

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY169974 Cypress woodstock Sub	C083021	372	-	-	-	-	372
		DG NY170779 Ashdown Rd Sub	C081371	182	-	-	-	-	182
		DG NY170971 Midline Rd	C083074	98	-	-	-	-	98
		DG NY171574 Borrego - Lockport Rd	C081168	79	-	-	-	-	79
		DG NY171646 - Borrego Bliss D-Line	C082496	94	-	-	-	-	94
		DG NY-171666 Helios Avon Solar	C081108	72	-	-	-	-	72
		DG NY172200 EastState St	C081734	14	-	-	-	-	14
		DG NY173052 Borrego Route 29 3V0	C082996	23	-	-	-	-	23
		DG NY173286 F7459 - Brockport HS1	C082669	32	-	-	-	-	32
		DG NY173288 F7459 - Brockport HS2	C082693	50	-	-	-	-	50
		DG NY17351 Lewis Custom Homes	C077907	111	-	-	-	-	111
		DG NY17393 Cortland Community Solar	C078863	68	-	-	-	-	68
		DG NY17393 Starr Rd 3v0	C078865	109	-	-	-	-	109
		DG NY-173939 Nexamp Solar LLC	C082946	9	-	-	-	-	9

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY-173942 Nexamp Solar LLC	C082949	64	-	-	-	-	64
		DG NY17455 Solar City Johnstown	C078835	137	-	-	-	-	137
		DG NY17762 - Livingston 4	C078906	25	-	-	-	-	25
		DG NY17850 VILLAGE OF ST JOHNSVILLE	C077871	13	-	-	-	-	13
		DG NY18253 CYPRESS CREEK RENEWABLES	C077873	546	-	-	-	-	546
		DG NY183966 Sol Solar-Carthage_dist	C082426	56	-	-	-	-	56
		DG NY183966 Sol Solar-Carthage_sub	C082427	22	-	-	-	-	22
		DG NY186075 GE - Barhydt - Line	C082497	616	-	-	-	-	616
		DG NY186134 GE Helderberg 3V0	C082515	98	-	-	-	-	98
		DG NY186147 GE Main St - Line	C082508	47	-	-	-	-	47
		DG NY187481 - Helios Wheatland 2A	C083627	53	-	-	-	-	53
		DG NY187483 Helios Wheatland 2B	C083641	38	-	-	-	-	38
		DG NY-187608 - RER Energy - DIS	C083377	47	-	-	-	-	47
		DG NY18898 Cypress Creek Queensbury	C077895	308	-	-	-	-	308

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY190778 GE Commerce Park Line	C083115	142	-	-	-	-	142
		DG NY19530 High Peaks Solar Station	C078223	244	-	-	-	-	244
		DG NY19530 High Peaks Solar Troy NY	C078008	20	-	-	-	-	20
		DG NY195434 Omni Dekalb Dist_Line	C083694	21	-	-	-	-	21
		DG NY196062 Borrego Solar	C083113	126	-	-	-	-	126
		DG NY197660 - Pine Brook Solar	C083931	136	-	-	-	-	136
		DG NY197711 - Ameresco Solar	C083323	82	-	-	-	-	82
		DG NY198332 - Borrego - Sugar Hill	C083406	8	-	-	-	-	8
		DG NY198522 Renesola Middle Grove	C084597	-	15	64	15	-	94
		DG NY-199552 Abundant sol syrcause	C083516	173	-	-	-	-	173
		DG NY-201774 Omni-Navitas_Dist Line	C083942	48	-	-	-	-	48
		DG NY20342 Grand Island Solar 20952	C078987	25	-	-	-	-	25
		DG NY-203745 GreenSpark Dist-line	C084069	25	-	-	-	-	25
		DG NY-204896 GreenSpark Dist-line	C084075	101	-	-	-	-	101

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY-206335 GreenSpark Dist-line	C084085	24	-	-	-	-	24
		DG NY206376 Philadelphia D-Line	C084247	90	-	-	-	-	90
		DG NY206459 Dist-line	C084215	83	-	-	-	-	83
		DG NY206724 Omni-Fulton Dist-Line	C083989	24	-	-	-	-	24
		DG NY-207355 GreenSpark Dist-line	C084086	24	-	-	-	-	24
		DG NY-207359 GreenSpark Dist-line	C084088	25	-	-	-	-	25
		DG NY207475 Saratoga Solar 5MW	C083490	18	-	-	-	-	18
		DG NY-207957 TM Montante Dist-Line	C084401	41	-	-	-	-	41
		DG NY-209758 Solitude Dist-line	C084301	92	-	-	-	-	92
		DG NY-209909 EDF Renewable Dist-lin	C084284	143	-	-	-	-	143
		DG NY21218 Cortland Community Solar	C078872	80	-	-	-	-	80
		DG NY21219 Cortland Community Solar	C078874	114	-	-	-	-	114
		DG NY21257 Gutchess Lumber Solar	C078880	29	-	-	-	-	29
		DG NY21257 Lorings 3V0	C078885	9	-	-	-	-	9

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG NY-214967 Nextera Clay Dist-line	C084057	24	-	-	-	-	24
		DG NY-214967 Nextera Clay Dist-sub	C084058	688	-	-	-	-	688
		DG NY216931- Nextera Syr Dist-Line	C084173	67	-	-	-	-	67
		DG NY21914 Cortland Community Solar	C078875	4	-	-	-	-	4
		DG NY21914-SUB SolarCity Cortland	C082298	271	-	-	-	-	271
		DG NY22040 High Peaks Solar	C078886	180	-	-	-	-	180
		DG NY22663 F6454 Ext - Grand Island	C079997	78	-	-	-	-	78
		DG NY244500 Forefront Rome Line	C084375	61	-	-	-	-	61
		DG#165199 NEXAMP Littlefalls	C081265	12	-	-	-	-	12
		DG_NY172193_Highpeak-Canastota_dist	C082656	307	-	-	-	-	307
		DG_NY190582 High Peaks Roberts Rd	C082883	328	-	-	-	-	328
		DG-105725 Cypress Creek Trousdale D	C081483	142	-	-	-	-	142
		DG108583 ABA Clean E Pulaski sub	C081239	27	-	-	-	-	27
		DG-173382-5 MW Borrego Solar - DIS	C082413	82	-	-	-	-	82

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		DG-190121-5 MW Borrego Solar - DIS	C082417	122	-	-	-	-	122
		DG-190121-5 MW Borrego Solar - SUB	C082418	20	-	-	-	-	20
		DG-198731 ProWind Solar - Olean	C083500	72	-	-	-	-	72
		DG-223799 F22651 Interconnection	C084515	25	-	-	-	-	25
		DG-223801 F22651 Interconnection	C084516	25	-	-	-	-	25
		DGNY 171992 - Borrego Grooms Site 1	C081763	24	-	-	-	-	24
		DGNY 171993 - Borrego Grooms Site 2	C081765	25	-	-	-	-	25
		DG-NY:170289 Nexamp E. Wat DistLine	C083533	54	-	-	-	-	54
		DGNY169955 CypressCreek Cnty Rd 151	C083068	441	-	-	-	-	441
		DG-NY-188910-5MW Borrego Solar	C082482	329	-	-	-	-	329
		DG-NY-189798-5MW Borrego Solar	C082483	157	-	-	-	-	157
		DG-NY218596 Nextera Dist-line	C084228	68	-	-	-	-	68
		Proactive 3V0 and LTC	C084930	-	500	4,000	4,488	4,442	13,430
	Solar Total			21,794	525	4,074	4,503	4,442	35,337

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Storage	NWA Interconnection - Pine Grove	C084925	-	500	-	-	-	500
	Storage Total			-	500	-	-	-	500
	Wind	DG 186138 - 2 MW Wind Turbine DER	C083758	53	-	-	-	-	53
		DG-106008 - 3V0 at Berry Road	C081939	325	-	-	-	-	325
		DG-106008 EWT Wind Church St	C081936	53	-	-	-	-	53
		DG-106013 EWT Wind Onthank Road	C081937	66	-	-	-	-	66
		DG-109592 EWT Wind St-Route 20	C081938	27	-	-	-	-	27
	Wind Total			524	-	-	-	-	524
DER Electric System Access Total				56	2,134	5,020	5,258	7,054	19,521
Non-Infrastructure	Blanket	Cent NY-General-Genl Equip Blanket	CNC0070	1,167	1,190	1,214	1,238	1,263	6,072
		East NY-Genl Equip Budgetary Reserv	CNE0070	1,167	1,190	1,214	1,238	1,263	6,072
		West NY-General-Genl Equip Blanket	CNW0070	1,167	1,190	1,214	1,238	1,263	6,072
	Blanket Total			3,501	3,570	3,642	3,714	3,789	18,216
	General Dist	Oil Storage Tank Station 162	C080962	23	-	-	-	-	23

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	General Dist Total			23	-	-	-	-	23
Non-Infrastructure Total				3,524	3,570	3,642	3,714	3,789	18,239
Reliability	Blanket	Cent NY-Dist-Reliability Blanket.	CNC0015	1,827	1,867	1,908	1,949	1,991	9,542
		East NY-Dist-Reliability Blanket.	CNE0015	2,393	2,444	2,496	2,549	2,604	12,485
		West NY-Dist-Reliability Blanket.	CNW0015	2,105	2,152	2,200	2,249	2,299	11,005
	Blanket Total			6,325	6,463	6,603	6,746	6,894	33,032
	CIP	Add UFLS Relay to Buffalo St 129	C075810	-	33	131	-	-	164
		Add UFLS Relay to Buffalo St 21	C075802	72	-	-	-	-	72
		Add UFLS Relay to Buffalo St 23	C075803	136	-	-	-	-	136
		Add UFLS Relay to Buffalo St 33	C075809	-	33	158	-	-	191
		Add UFLS Relay to Buffalo St 43	C075805	33	162	-	-	-	195
		Add UFLS Relay to Buffalo St 54	C075807	33	153	-	-	-	186
		Add UFLS Relay to Buffalo St 68	C075804	169	-	-	-	-	169
		Add UFLS Relay to Clinton	C075847	28	90	-	-	-	118

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Add UFLS Relay to Delmar	C076962	-	31	181	-	-	212
		Add UFLS Relay to Middleburg	C075850	-	28	96	-	-	124
		Add UFLS Relay to New Krumkill	C075843	8	-	-	-	-	8
		Add UFLS Relay to Prospect Hill	C075846	28	125	-	-	-	153
		Add UFLS Relay to Wolf Road	C075845	143	-	-	-	-	143
	CIP Total			650	655	566	-	-	1,871
	Engineering Reliability Review	*Ashley 51 - Baldwin Corners Rd Ph4	C056711	-	11	396	-	-	407
		*Brook Rd 57 - Braim Rd Conversion	C049791	111	-	-	-	-	111
		*Church St 53 - Cnty Hwy 132 Convrt	C049652	-	603	-	-	-	603
		*Grooms Rd 34556 - Rte 146 Reconduc	C050105	38	154	-	-	-	192
		*NR-Parishville 93961-Relocate Fdr	C049751	283	-	-	-	-	283
		*Union St 54-Lincoln Hill Rd Ph 2	C056627	-	-	-	10	325	335
		*Vail Mills 53 - Union Mills Rd.	C019352	-	-	-	-	470	470
		Battenkill 56 ERR Fusing	C060285	162	-	-	-	-	162

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Brook Rd 54 - Route 50 Conversion	C048584	262	-	-	-	-	262
		Center St 52 - Hickory Hill Rd Conv	C056808	94	-	-	-	-	94
		Center St 54 - Hyney Hill Road Rebu	CD00357	200	-	-	-	-	200
		Florida 51 - Mead Road	C050692	-	288	-	-	-	288
		NR_Lyme 73351_T.I. 81455-NYSHwy12E_	CD01295	490	-	-	-	-	490
		Schoharie 52 - State Route 443 Rebu	CD00424	339	165	-	-	-	504
		Union St 52 - Content Farm Rd.	C056710	110	-	-	-	-	110
		Union St 54 - Lincoln Hill Rd Ph 1	C056625	117	-	-	-	-	117
		Vail Mills 52 - County Hwy 16 Convt	C055530	55	-	-	-	-	55
	Engineering Reliability Review Total			2,259	1,220	396	10	795	4,681
	Reliability	*Byron F1863 - Rebuild /Reconductor	C049762	-	-	-	-	870	870
		*Rebuild portion of E.Otto F2861	C049718	224	-	-	-	-	224
		07-18252 Pleasant Avenue Conversion	C083552	201	240	-	-	-	441
		10-10161 Harrigan Gully Rd Rebuild	C083753	31	-	-	-	-	31

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		81453-Ellis Road Rebuild&Relocation	C054930	96	-	-	-	-	96
		81458 Dingman Point Road Rebuild_RR	C054533	73	-	-	-	-	73
		81653 Cross Arm Conversion	C077879	-	8	264	-	-	272
		89552 Dyke Road - Rebuild	C052447	228	-	-	-	-	228
		91453 Rte 11 Relocation	C057007	-	-	-	16	675	691
		BaileySettlement-Gore Rd_Rebuild	C054583	275	-	-	-	-	275
		Baker St - Install 2nd xfmr	C046553	-	-	100	2,518	1,942	4,560
		Balmat Co Rte 24 Relocation	C081831	-	-	7	160	-	167
		Battenkill 57 - Sullivan Rd	C056323	70	-	-	-	-	70
		Bflo Sta 139 - Replace Transformers	C036639	-	-	-	10	1,717	1,727
		Black Lake Rd (Sout) Rebuild	C081835	-	-	7	464	-	471
		Black Lake Rd (South) Rebuild	C081811	-	-	-	405	-	405
		Blue Stores 52 Rear Lot Relocation	C081571	-	-	10	273	-	283
		Brook Road 54 - Old Ballston Ave.	C068126	86	-	-	-	-	86

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Brook Road 55 - Coy Rd Conversion	C064989	-	-	123	-	-	123
		Brook Road 55 - Lake Desolation Rd	C050691	294	-	-	-	-	294
		Buckbee Mears - Substation Removal	C080710	-	-	-	-	-	-
		Burgoyne 53 - Moss St. Conversion	C081410	14	-	-	-	377	391
		Caledonia Sub 44 - Add a 34.5 Bker	C052446	-	-	-	60	624	684
		Callanan Tap - Distribution transfe	C046413	403	-	-	-	-	403
		Camillus Dsub	C046637	-	13	-	-	-	13
		Cell Tower Line Rd Relocation 84661	C078048	-	-	8	424	-	432
		Chestertown 51 - Rebuild Cnty Hwy 8	C081454	10	172	-	-	-	182
		Chestertown 52 - Hayesburg Road	C081460	-	-	5	174	-	179
		Chestertown 52 - Rebuild US Hwy 9	C081455	-	10	347	-	-	357
		Chippewa Bay Rebuild	C077857	-	-	-	-	128	128
		Cleveland-Lehigh	C081845	-	-	50	500	-	550
		Cleveland-Lehigh Tie #2	C081847	-	-	50	424	-	474

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Coffeen Regulators	C084106	-	-	-	200	1,300	1,500
		Colonie Center SWGR addition	C084458	594	-	-	-	-	594
		Cook Road Rebuild Hammond	C077858	-	-	50	560	-	610
		Corinth 52-Main St Rebuild/Convert	C058899	112	-	-	-	-	112
		Corliss Park East OH Work	C081415	180	199	-	-	-	379
		County Route 3 Rebuild Hammond 62	C077859	-	8	328	-	-	336
		CR- LHH44-N Osceola Rd	C055443	89	-	-	-	-	89
		CR- Niles 51 Dolphin Point QRS	C053106	189	-	-	-	-	189
		Create Feeder Tie F2172 & F2167	C084519	70	-	-	-	-	70
		Crown Pt 51 - Creek Rd Conversion	C078667	110	-	-	-	-	110
		Crown Pt 51 - Pearl St Conversion	C081829	-	10	175	-	-	185
		Crown Pt 51 - Route 9N Conversion	C081834	-	-	10	350	-	360
		Crown Pt. 51 - Creek Rd Conversion	C081827	-	10	175	-	-	185
		Delameter - 115kV circuit switchers	C051492	-	272	-	-	-	272

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Delameter Install two 20/26/33MVA	C046536	50	2,000	500	-	-	2,550
		Delameter F9352 reconfigured layou	C047886	413	-	-	-	-	413
		Delameter F9352 Reconfigured Layout	C083575	257	-	-	-	-	257
		Delameter new F9355 - express..	C047885	-	240	-	-	-	240
		Delanson51 Mtn View Rear lot retire	C083896	92	-	-	-	-	92
		Eagle Bay 7th Lake Rd Cable Replace	C082145	300	273	-	-	-	573
		Elnora 56 - Kingsbury Rd	C084209	15	355	-	-	-	370
		Emmet St Station - Dx Retirement	C080418	38	140	20	-	-	198
		F0153 - Walker Rd PIW	C048179	152	-	-	-	-	152
		F7863 Carmen Rd PIW	C048146	-	500	-	-	-	500
		F9263 - Route 31 PIW	C049084	187	-	-	-	-	187
		Fayette Rd Conversion #2 85251	C081826	-	-	-	175	392	567
		Fayette Rd Conversion 85251	C081825	-	-	7	480	-	487
		Fort Covington-Malone26 Rebuild	C057288	448	-	-	-	-	448

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		French Road Relocation 89552	C078049	-	-	73	-	-	73
		FY20 D5D Porcelain Replacement NYC	C082233	500	560	985	500	600	3,145
		FY20 D5D Porcelain Replacement NYE	C082234	435	496	920	500	600	2,951
		FY20 D5D Porcelain Replacement NYW	C082232	490	551	975	500	600	3,116
		G&W Viper Replacement Program (East	C081837	50	133	50	50	50	333
		G&W Viper Replacement Program (West	C081839	64	132	50	50	50	346
		G&W Viper Replacement Program-NY	C080931	50	132	50	50	50	332
		Gilmantown 51 - Lake Pleasant 5kV	C082694	50	539	-	-	-	589
		Groveland St. F4161 - small wire	C049909	159	-	-	-	-	159
		Hague Rd 53 - Alexandria Ave	C081836	-	-	-	343	10	353
		Harborfront 212 Spare Breaker	C082912	22	-	-	-	-	22
		High Market Road Rebuild 71661	C078050	328	-	-	-	-	328
		Hinsdale Dsub	C046638	-	-	-	13	-	13
		Hoosick 31451 Carey Ave Tie	C084000	-	-	215	-	-	215

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Hudson 53 - Downtown Conversion	C081568	10	180	-	-	-	190
		Hudson 54 - Downtown Conversion	C081562	10	168	-	-	-	178
		HWY 37 Rebuild Hammond 62	C077860	-	-	-	40	166	206
		Lockport Road 216 - Install TB#2	C036057	-	-	-	-	75	75
		Lockport Road 216 - Install TB#2 -	CD01252	-	10	300	-	-	310
		Long Rd 209 - New F20955	CD00964	-	100	1,454	-	-	1,554
		Long Road 209 - Install TB2	CD00977	50	1,200	1,200	-	-	2,450
		McIntyre-Hammond #24 Dist. Taps	C083853	-	-	-	440	-	440
		Mill St_LVAC_2014 Upgrades-N-2	C053903	651	531	-	-	-	1,182
		Mill ST_LVAC_2014 Upgrades-Newell	C054438	-	8	398	-	-	406
		Minor Storm Hardening - 32451	C056486	-	-	-	225	-	225
		Mount Arab Relocation	C078016	74	-	-	-	-	74
		MSH- Barker F7863 - Bring to the Rd	C082086	-	520	-	-	-	520
		Mumford #50 - TB2 - Install New Fdr	C046589	-	-	400	400	-	800

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Mumford #50 -Install Transformer #2	C046590	-	20	550	2,513	-	3,083
		MV- Poland 62258 Route 8 Reconducto	C046606	1,608	-	-	-	-	1,608
		MV-Lehigh 66954 Reconductoring	C050003	291	268	-	-	-	559
		MV-Poland 62258 Route 8 Reconductor	C046605	1,238	1,125	-	-	-	2,363
		MV-Rome 54 -Hogsback Rd Reconductor	C050097	-	100	100	-	-	200
		MV-Rome 54-Lauther Rd - Reconductor	C050086	-	317	-	-	-	317
		New Two Mile Creek Dist Sub	C051266	231	-	-	-	-	231
		Newark St 30051 Broadway Conversion	C080917	15	167	-	-	-	182
		North Bangor Conversion (D-Line)	C046418	-	-	353	44	-	396
		North Bangor new 34.5/13.2kV Statio	C046423	-	372	760	41	-	1,173
		North Creek 52 - Convert Route 28	C050685	28	61	-	-	-	88
		North Creek 52 - Edwards Hill Road	C050688	34	-	133	-	-	166
		North Creek 52 - Peaceful Valley Rd	C049622	75	425	-	-	-	500
		NR-Lowville-SW528 Replacement	CD00959	35	-	-	-	-	35

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		NY - Central Animal Fences	C081093	200	-	-	-	-	200
		NY - East Animal Fences	C081092	240	-	-	-	-	240
		NY - East_1 ph cutout mounted Rclrs	C053928	125	125	125	125	125	627
		NY_Central_1ph_Cutout_Mnt_Reclosers	C059620	122	124	124	124	124	616
		NY_West_1 PH Cutout Mnted Reclosers	C059607	122	122	122	122	122	608
		NY12-Homer 61&62 to Fisher	C081747	-	50	250	-	-	300
		NYS Rte 37 Rebuild 32358	C081818	-	-	-	146	326	473
		NYS Rte 37 Rebuild Part 2 32358	C081821	-	-	-	187	7	194
		NYS Rte 37 Rebuild Part3 32358	C081823	-	-	-	144	7	151
		OgdenBrook 51-Convert Aviation Road	C053381	207	310	-	-	-	517
		Overbluff Rd Rebuild 73351	C081815	-	-	50	500	-	550
		Port Henry 52 - Convert Broad St.	C081530	-	175	350	-	-	525
		Port Henry 52 - Dalton Hill Rd	C054284	151	-	-	-	-	151
		Randall Rd 57 - Root Rd Relocation	C080595	76	-	-	-	-	76

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Reynolds 33458 - North Rd 3phase	C059641	-	-	100	-	-	100
		Riparius - Rebuild State Hwy 8	C081449	227	295	-	-	-	522
		Riverside HPFF Pressurization Plant	C082953	2,190	815	-	-	-	3,005
		Rosewood URD - GE xfmr replacements	C081913	-	75	-	-	-	75
		Scotia/Glenville Industrial Park	C081423	-	-	-	500	4,192	4,692
		Sherman-Ashville 863 DLine Transfer	C083948	81	97	57	-	-	235
		Sorrell Hill Rebuild	C077170	-	-	-	400	2,542	2,942
		South Creek Road Conversion	C077880	8	374	-	-	-	382
		State HWY 58 Relocation 98352	C077861	-	-	-	40	440	480
		Station 214 - Install TB2	C029186	-	50	2,400	-	-	2,450
		Station 214 - New F21467	C029187	-	100	1,310	-	-	1,410
		Stittville 67052 Tie Part 2	C081841	-	7	250	-	-	257
		Substation Fencing - NYE	C079345	174	-	-	-	-	174
		Swaggertown 52 - Charlton Rd Conver	C084210	10	160	-	-	-	170

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		SWGR 7681 Resupply - Albany, NY	C083330	196	-	-	-	-	196
		Trinity 42-Dove St Recloser Install	C083682	107	-	-	-	-	107
		Union St 52 - Greene/King Rd Conver	C056649	-	-	12	300	-	312
		Union St 53 - Kenyon Hill Road	C050779	30	-	-	-	-	30
		Union St 54 - Brownell Corner Rd	C081741	-	383	-	-	-	383
		Valkin 54 Running Creek Conversion	C081570	-	10	443	-	-	453
		Watertown New 115/13.2 Sub D-line	C046610	30	-	-	-	-	30
		Wells 81 Windfall Rd Rear-Lot Move	C082894	95	-	-	-	-	95
		West Hamlin #82 - New TB2 - Install	CD01090	489	-	-	-	-	489
	Reliability Total			16,674	15,838	16,792	15,490	18,112	82,905
	Reliability	Delameter F9356-express& rebuild	C047877	-	720	-	-	-	720
	Reliability Total			-	720	-	-	-	720
	Side Tap Fusing	IE - NC Side Tap Fusing	C015511	400	400	400	400	400	2,000
		IE - NE Side Tap Fusing	C015510	120	150	150	150	150	721

nationalgrid

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		IE - NW Side Tap Fusing	C015509	150	150	150	150	150	752
	Side Tap Fusing Total			670	701	701	701	701	3,473
	Storm Hardening	42951-Blue Ridge Rd Storm Hardening	C052248	-	414	-	-	-	414
		Battenkill 57-FY17 Storm Hardening	C057386	264	-	-	-	-	264
		Greenhurst State Hwy 430 Extension	C083386	75	-	-	-	-	75
		MSH-F1362 Reloc Portion to NYS16	C082100	-	10	335	-	-	345
		Scofield 53 - FY16 Storm Hardening	C057289	313	-	-	-	-	313
		Sheppard Rd 2951 - Storm Hardening	C057429	171	-	-	-	-	171
	Storm Hardening Total			822	424	335	-	-	1,581
	Substation Flood Mitigation	Union Fall - Flood Mitigation - DSub	C078428	418	1,131	1,151	45	-	2,745
		Union Falls - Flood mitigation	C053167	-	-	-	-	-	-
		Union Falls Flood Mitigation_Dline	C068248	15	15	35	40	-	105
	Substation Flood Mitigation Total			433	1,146	1,186	85	-	2,850
	Substation Mobile	NY New Mobile Substation 34.5 kV -	C046410	1,700	-	-	-	-	1,700

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Substation Mobile Total			1,700	-	-	-	-	1,700
Reliability Total				29,534	27,166	26,579	23,032	26,502	132,813
Resiliency	Distribution Line Sensors / Monitors	FEEDER MONITORS / SENSORS-NY CENTR	C076143	630	1,228	1,316	1,316	1,315	5,805
		FEEDER MONITORS / SENSORS-NY EAST	C076142	193	386	1,316	1,316	1,316	4,528
		FEEDER MONITORS / SENSORS-NY WEST	C076144	676	1,347	1,319	1,319	1,850	6,512
		Middleburgh 51/Schoharie 51 LS	C050764	21	235	-	-	-	256
	Distribution Line Sensors / Monitors Total			1,521	3,196	3,951	3,951	4,481	17,100
	FLISR	NY FLISR Central - D-line	C080088	-	1,643	4,978	4,978	5,358	16,957
		NY FLISR East - D-line	C080089	-	1,249	5,076	5,076	2,358	13,759
		NY FLISR West - D-line	C080090	-	516	2,021	2,021	4,358	8,916
	FLISR Total			-	3,408	12,075	12,075	12,074	39,632
	Microgrid	Gilmantown Energy Storage	C084937	-	-	100	4,426	4,405	8,931
	Microgrid Total			-	-	100	4,426	4,405	8,931

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
	Network Transformer DGA Monitors	Network Transformer DGA - NYC	C077021	300	300	300	300	300	1,500
		Network Transformer DGA - NYE	C077022	300	300	300	300	300	1,500
		Network Transformer DGA - NYW	C077020	341	300	300	300	300	1,541
	Network Transformer DGA Monitors Total			941	900	900	900	900	4,541
	Targeted Feeder Enhancement	*Blue Stores 30352 - Conversion	C050107	133	566	-	-	-	699
		*Create Full Tie F15351 to F15352	C049720	252	-	-	-	-	252
		*E.Golah 5157 Tie w/Lakeville 19752	C049880	16	-	-	-	-	16
		*Firehouse Rd Station - New Feeder	C050081	113	-	-	-	-	113
		*Hoosick 31451 - Conversion	C050082	57	79	-	-	-	137
		*Hoosick 31452 Conversion-High St.	C050083	111	-	527	-	-	637
		*Hudson 08753 - Rte 9G Conversion	C050108	272	-	-	-	-	272
		*McClellan 51 - Union ST Conversion	C050085	5	750	-	-	-	755
		*Middleport F7765 Tie w/Shelby 7656	C049711	-	-	-	16	550	566
		*Mumford 5052 - Reconductor/Convert	C049885	222	-	-	-	-	222

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		*Rbld/Conv F15352 to full tie F6353	C049878	227	-	-	-	-	227
		*Rbld/Conv to Create tie F7652-7651	C049802	-	352	-	-	-	352
		*Rebuild Darien F1662 Limited Tie	C049634	-	338	-	-	-	338
		*Rebuild portions of Catt. F1562	C049686	339	-	-	-	-	339
		*Selkirk 14951 -Thatcher/River Conv	C049985	-	-	-	-	510	510
		*Union St. 53/54 - Route 22 Tie	C056620	192	-	-	-	-	192
		*Weibel 56 - Wall Street Rebuild	C051325	-	-	-	13	924	937
		*Wilton 52 - Rt 32 3 Phase Ext.	C019570	-	-	-	12	750	762
		07-18151 Brant Reservation Rd Tie	C083399	-	298	-	-	-	298
		Antwerp Feeder Tie Part 1	C081806	-	-	24	560	-	584
		Antwerp Feeder Tie Part 2	C081807	-	-	-	472	-	472
		Bethlehem 02155 Conversion	C081885	-	-	10	80	-	90
		Bloomingdale HWY 3 FDR tie part 2	C078203	-	-	-	20	650	670
		Bloomingdale State HWY 3 FDR Tie	C078202	-	-	20	550	-	570

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Bolton 51 - Trout Lake Rd 3 Phase	C049560	75	425	-	-	-	500
		Build full tie for Fabius	C081692	-	-	-	7	245	252
		Burdeck 26552 - Burnett St Conversi	C046632	95	541	-	-	-	637
		Burdeck 26552 - Westcott / Curry Rd	CD01226	-	155	-	-	-	155
		CAZ 22077 tie with Delphi	C082031	-	-	-	41	642	683
		Chasm Falls Internal Tie Part 1	C081808	-	-	15	270	210	495
		Chasm Falls Internal Tie Part 2	C081810	-	-	-	100	231	331
		Clinton 36653-54 Conversion Tie	C053628	37	-	-	-	-	37
		Convert Westval 73&74 to Harris	C082047	-	-	-	144	706	849
		CR- Paloma 55 convert NYS 48	C051832	-	-	-	525	-	525
		Create Fdr Tie F7958-F15351&F6161	C082074	-	250	150	-	-	400
		Delanson 51-Burdeck 54 Tie	C083540	9	446	-	-	-	455
		Delaware 33035 conversion	C081895	20	450	-	-	-	470
		Dexter 72661 Feeder Tie	C081813	9	228	-	-	-	237

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Extention to Fdr Tie F7261-F6161	C082080	-	-	50	500	-	550
		F0456/0457 Build feeder tie	C049540	411	-	-	-	-	411
		F23251 Create Ties with 20653&7656	C081498	39	350	-	-	-	389
		F5261 Summer Prep-Rbld F5271	C082507	100	-	-	-	-	100
		Florida 51 - Fort Hunter Road	C050693	-	-	-	253	-	253
		Fort Covington-N Bombay Fdr Tie2	C077856	15	757	-	-	-	772
		Fort Gage 54 - Route 9L Rebuild	C050680	575	425	-	-	-	1,000
		Gensee St. Feeder Conversions	C051873	-	-	-	15	500	515
		Hague Rd 53 - Submarine Cable.	C050522	75	2,000	-	-	-	2,075
		Harris 54 Relief	C032446	995	2,624	-	-	-	3,619
		Henry St. Network Feeder LS	C081409	-	-	-	50	245	295
		Knapp Rd 22651 Feeder Tie	C028716	-	507	-	-	-	507
		Make Ready Fdr Tie F15151-15351	C082069	431	318	-	-	-	749
		Make Ready Fdr Tie F7261-F6161	C082079	-	-	25	775	-	800

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Miller Rd Tie 73351	C081814	-	10	250	-	-	260
		Milton Ave DLine	C046643	-	-	-	1,200	2,700	3,900
		MSH - Vandalia tie W Olean S9 Mile	C082059	350	609	-	-	-	959
		MSH Create Fdr Tie F1162 to F2761	C082105	-	-	-	10	575	585
		MSH Create Fdr Tie F1361 to F1161	C082053	130	250	250	100	-	730
		MSH Create Fdr Tie F15151-15351	C082072	40	250	-	-	-	290
		MSH Create Fdr Tie F5052 to F5151	C082108	35	-	-	620	-	655
		MSH Create Fdr Tie F5151 to F5052	C082103	35	-	-	780	-	815
		MSH Create FDR Tie F7363 to F9261	C082094	-	250	250	300	-	800
		MSH- Create Fdr Tie F9263 to F7951	C082088	-	114	-	-	-	114
		MSH Create Tie F5157 toF438151	C082085	-	-	-	10	750	760
		MSH Reconductor 5561 & 5651	C082060	110	-	-	450	451	1,010
		MSH Reconductor 5762 Tie	C082092	116	250	250	100	-	716
		MSH Reconductor 7861 for Tie	C082091	-	-	-	-	675	675

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		MSH Upgrade Limited Tie F1361-F2761	C082051	50	-	-	-	-	50
		MSH Upgrade Limited Tie to F7656	C082089	-	-	-	10	650	660
		MSH Upgrade Limited Tie to F9562	C082104	-	-	64	500	-	564
		MSH Upgrade Ltd. Tie F4061 to F5261	C082102	-	250	250	100	-	600
		MSH-Angola Feeder Tie Upgrades	C082095	100	50	100	-	-	251
		MSH-Collins 8361 Tie N Collins 9262	C082083	-	-	-	10	700	710
		MSH-Delameter 9353 tie 9354 Lake St	C082084	-	201	150	-	-	351
		MSH-New Whitesville Tie Andover	C082063	-	-	250	700	-	949
		MSH-North Collins 07-9261 Tie 9262	C082097	-	-	50	250	-	300
		MSH-Remove N Angola from 07-9352	C082082	-	696	-	-	-	696
		MSH-SWellsville Tie New Whitesville	C082109	-	-	25	775	-	800
		MSH-W Olean tie to Dugan on S Union	C082077	-	150	-	-	-	150
		MSH-WOlean 3354 tie 10451 Chipmunk	C082098	201	100	-	-	-	301
		MV-Chadwicks feeder ties	C079560	-	10	352	-	-	362

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		MV-Lehigh 51 & 54 Tie Creation	C050004	-	386	-	-	-	386
		MV-Rome 54-Oswego Rd Reconductoring	C050098	-	-	-	247	-	247
		MV-Turin 65355 & 56 Tie creation	C050002	396	382	-	-	-	778
		New Thousand Islands 81457 Feeder	C081805	-	-	-	-	100	100
		NR Fort Covington-N Bombay Fdr Tie1	C077854	13	424	-	-	-	437
		NY12 build tie btwn Truxon and Lab	C082035	-	-	8	100	-	108
		NY12 new Starr fdr to retire Miller	C082037	-	-	8	100	-	108
		NY12-Homer 63 to Fisher 52	C081743	-	-	-	10	300	310
		NY14 Fairdale 64 tie with 25456	C082027	-	-	9	300	-	309
		NY14 Fairdale 65 tie with 29351	C082028	-	-	9	150	-	158
		NY16- New Haven-E Pulaski Tie	C081753	-	11	240	-	-	251
		NY16-E Pulaski-New Haven Tie	C081752	498	249	-	-	-	748
		NYC Feeder Resiliency	C084878	-	1,000	4,000	2,000	3,000	10,000
		NYE Feeder Resiliency	C084879	-	1,000	4,000	2,000	3,000	10,000

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		NYW Feeder Resiliency	C084876	-	1,000	4,000	2,000	3,000	10,000
		Prospect Hill 51 Davitt Rd 3ph Ext	C081950	10	585	-	-	-	595
		Reconductor 5552 tie to 5262	C048837	249	-	-	-	-	249
		Rock City Station - 13.2kV Rebuild	C046671	800	2,397	630	-	-	3,827
		Rock City Sub - Distribution Line	C082291	150	315	-	-	-	465
		Rome-Stittville Feeder Tie	C081840	-	250	-	-	-	250
		Rome-Stittville Tie Part 3	C081842	-	-	-	672	-	672
		Shore Rd 28185 - Saratoga Rd Conver	C054836	304	-	-	-	-	304
		Shore Rd 28186 / Elnora 44256 Tie	C067867	139	-	-	-	-	139
		Stuyvesant 3552 to Valkin 42753 tie	C081346	277	-	-	-	-	277
		Sycaway R570 Getaway	C081686	10	151	-	-	-	161
		Trinity 16452 conversion	C081896	-	-	15	201	-	216
		Trinity 16458 - McCarty Ave Conv	C050000	1	350	-	-	-	351
		Union St 52 - Brownell Rd. Rebuild	C056657	91	-	-	-	-	91

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		VAL KIN 42753 - STUY 03552 TIE	C058900	-	300	-	-	-	300
		West Adams 52 Internal Tie	C081812	228	228	-	-	-	455
		West Cleveland-Colosse Tie	C081844	-	-	22	630	-	652
	Targeted Feeder Enhancement Total			9,157	24,076	16,002	18,727	22,063	90,025
Resiliency Total				11,619	31,580	33,028	40,079	43,923	160,230
System Capacity - NY	Blanket	Cent NY-Dist-Load Relief Blanket.	CNC0016	924	944	964	985	1,006	4,822
		East NY-Dist-Load Relief Blanket.	CNE0016	769	786	804	822	840	4,022
		West NY-Dist-Load Relief Blanket.	CNW0016	189	193	197	201	205	985
	Blanket Total			1,882	1,923	1,965	2,008	2,051	9,829
	Load Relief	*Cedar 51 - Buttermilk Falls Rd	C049764	53	-	-	-	-	53
		*Firehouse 44953 - Dunsbach Rd Conv	C049864	24	-	-	-	-	24
		*Hague Rd 52 - Convert Route 22	C050717	366	707	-	-	-	1,073
		*Pawling Ave Conv (29252/37253)	C050103	14	791	-	-	-	805

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		*Vail Mills 51 - County Hwy 107	C049793	-	-	-	-	466	466
		81452 Westminster Park Rd - Rebuild	C052344	-	-	-	-	1,103	1,103
		87554 County RTE 189 & 95 - Rebuild	C052367	-	-	-	25	930	955
		89552 Crooks Road - Rebuild	C052443	366	-	-	-	-	366
		8th St Conversion Niagara Falls	C046841	132	-	-	-	-	132
		95554 HWY 11 - Rebuild	C052371	-	-	-	20	650	670
		95756 Linden Street - Rebuild	C052369	475	-	-	-	-	475
		97654 Skinnerville Road - Rebuild	C052370	187	-	-	-	-	187
		Beech Ave Conversion Niagara Falls	C032751	152	-	-	-	-	152
		Bethlehem 02158 Conversion	C081882	-	-	-	-	233	233
		Brook Road 55 - Barney Rd. Rebuild	C047978	341	-	-	-	-	341
		Brunswick 26453 - South Rd Conv	C045696	52	-	-	-	-	52
		Buffalo Station 129 - F12974 Recond	C046558	210	-	-	-	-	210
		Burgoyne 54 - Main St. Conversion	C081422	51	-	-	-	-	51

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Collamer Crossing_D_Sub_Work	C070393	1	-	-	-	-	1
		CR- 23553 Cedarvale ratio relief	C051803	260	-	-	-	-	260
		CR- Convert 29351 north of station	C049397	-	575	-	-	-	575
		CR- Pebble Hill Burke Rd Ratio	C051710	127	-	-	-	-	127
		Dekalb 98455 Town Line rd - Rebuild	C052106	-	10	560	-	-	570
		DeLaet's Landing DxD	CD00893	24	4,369	1,139	74	-	5,606
		Delaware Ave Feeder Getaway civil	C083930	15	398	-	-	-	413
		Delmar - Feeder Getaways	C083920	-	-	-	150	3,508	3,658
		Delmar Feeders Rebuild and Convert	C083926	-	-	-	150	502	652
		Delmar Rebuild Substation	C083916	-	-	-	90	5,942	6,032
		Eden switch structure -install 2-10	C046538	289	2,044	1,372	-	-	3,705
		Eden Switch Structure- New Fdr 1	C048015	40	1,000	400	-	-	1,440
		Eden Switch Structure- New fdr# 2	C048016	8	750	750	-	-	1,508
		Elm Street Retirement	C082668	-	-	-	-	5	5

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Extend F23251 to Relieve F20655	C081501	-	30	140	-	-	170
		F20655 Summer Prep Replcae Cable	C082485	80	-	-	-	-	80
		Fairdale DLine	C046633	303	-	-	-	-	303
		Fairdale Dsub	C046640	-	-	-	-	-	-
		Forbes Ave - New Substation	C053137	1,240	2,937	7,087	2,667	15	13,946
		Gilbert Mills Xfmr Upgrade-Xfmr	C046563	-	-	-	500	2,442	2,942
		Johnson Rd 53/Maplewood 51 Tie	C084001	-	-	50	1,000	-	1,050
		JohnsonRd 52-Columbia St Conversion	C081109	484	-	-	-	-	484
		Lakeville Substation Retirement	C046588	13	5	33	-	83	134
		Land-Cicero Substation	C071028	-	-	-	-	-	-
		Lansingburgh 13 - Conversion	C080462	343	-	-	-	-	343
		Liberty St D-Line Overhead Rebuild	C083844	71	-	1,242	2,067	-	3,380
		Malone 2nd Bank Feeders (D-Line)	C082332	-	162	5,220	18	-	5,400
		Maplewood 51 and 53 Getaway Replace	C082360	-	-	85	512	-	597

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Mayfield 51 - Paradise Point Rd	C050069	286	-	-	-	-	286
		Menands 10151 Conversion	C080883	91	169	-	-	-	260
		Military Rd New F21052 - N Falls	C054046	114	752	-	-	-	866
		New Krumkill - Feeder Getaways	C083927	-	-	150	2,416	5,416	7,982
		New Krumkill 42127 & 26 conversions	C083929	-	-	100	1,323	-	1,423
		New Krumkill Add Second Transformer	C083911	-	500	1,000	2,488	600	4,588
		New Krumkill Getaway &express feeds	C083928	-	-	-	150	1,589	1,739
		New Krumkill Sub new 15kV feeders	C081584	15	439	-	-	-	454
		Ogdensburg 93852 HWY 37 - Rebuild	C052143	115	-	-	-	-	115
		Panama Rebuild	C046509	-	-	335	-	-	335
		Port Henry 51 - Convert Port Henry	C081529	10	525	-	-	-	535
		Queensbury 53 - Glen Lake Rd Ratios	C081506	105	-	-	-	-	105
		Queensbury 54 - North Rd Conversion	C060005	77	-	-	-	-	77
		REYNOLDS RD 33452 3PH EXT NY43	C081968	-	-	36	327	-	363

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		RR-Menands 10157-Getaway Replacemen	C053966	29	456	-	-	-	485
		S.Livingston relief: Fd4 work	C051691	49	-	-	-	-	49
		S.Livingston rSlief: Dist Fder Work	C051694	13	108	343	8	-	472
		Selkirk 14952 Overloaded ratio	C080204	10	-	-	-	187	197
		Seventh Ave North Feeder Conversion	C080476	-	15	500	600	-	1,115
		Seventh Ave South Feeder Conversion	C080475	-	14	320	200	110	644
		Seventh Ave. 13.2kV Transformer	C080474	-	-	-	-	60	60
		Sodeman Rd 51 Feeder Construction	C076785	50	1,553	250	-	-	1,853
		Sodeman Rd 52 - Sodeman Road	C076794	690	-	-	-	-	690
		Sodeman Rd 53 - Route 29 East	C076796	123	-	-	-	-	123
		Sodeman Rd 54 Feeder Construction	C076797	1,673	-	-	-	-	1,673
		Station 3012 D-line	C074911	120	3,274	-	-	-	3,394
		Station 3012 Substation	C074909	3,117	2,774	571	-	-	6,462
		Tibbets 29254 - 15th Ave Conversion	C046425	108	-	-	-	-	108

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		Union St 52 - County Hwy 59	C056632	-	-	15	850	-	865
		Union St 54- Turnpike Rd Conversion	C055735	-	-	-	999	-	999
		W.Chautauqua Dline work	C055265	-	10	445	-	-	455
		W.Chautauqua new 34.5-4.8kV sub	C055264	-	-	-	10	50	60
		Warrensburg 52 - Glen Athol Road	C081457	-	-	-	5	174	179
		Watertown New115/13.2 kV Substation	C077720	100	-	-	-	-	100
		Welch Ave Conversion Load Relief	C046842	101	-	-	-	-	101
		West Adams New Feeders TB2	C084110	-	500	1,500	2,000	-	4,000
	Load Relief Total			12,71 5	24,86 7	23,64 3	18,64 7	24,06 4	103,936
	Transformer Replacement	Patroon 54-Overloaded Ratio Convert	C083687	128	-	-	-	-	128
	Transformer Replacement Total			128	-	-	-	-	128
	Volt Var Optimization/Conservation Voltage Reduction (VVO/CVR)	NY VVO Central - D-Line	C077098	1,182	1,325	1,158	1,308	1,308	6,281
		NY VVO Central - Substation	C076103	606	306	450	450	450	2,262
		NY VVO East - D-Line	C077097	900	1,570	1,088	1,241	1,308	6,107

Spending Rationale	Program Name	Project Description	Project Number	FY21	FY22	FY23	FY24	FY25	Total
		NY VVO East - Substation	C076088	606	753	600	450	450	2,859
		NY VVO West - D-Line	C082361	1,474	1,016	1,078	1,228	1,308	6,104
		NY VVO West - Substation	C076105	404	306	600	450	450	2,210
		Switched Capacitor Program	C084938	-	-	1,094	1,094	1,094	3,282
	Volt Var Optimization/Conservation Voltage Reduction (VVO/CVR) Total			5,172	5,276	6,068	6,221	6,368	29,105
System Capacity - NY Total				19,897	32,066	31,676	26,876	32,483	142,998
Grand Total				357,760	406,584	478,745	518,116	556,626	2,317,830

Exhibit 4: Non-Wires Alternatives Update

The Company has adopted guidelines for the review and consideration of Non-Wires Alternatives ("NWA") in its planning processes. The guidelines outline two stages of review: the first to identify potential areas of need where an NWA may be feasible, and the second to determine NWA feasibility and design, if applicable, for areas identified in the first stage. The first stage is completed by transmission and distribution planners as they review potential capital investment needs. The second stage is completed by the project managers in the Company's NWA Team who coordinate procuring solutions for the areas identified.

NWA Suitability Review

The initial review for projects with NWA potential takes place when the Company's transmission and distribution planning groups conduct their annual capital needs assessment. During the development of each year's CIP, the Company screens for potential NWA opportunities per the criteria in the table below.

Criteria	Potential Elements Addressed	
Project Type Suitability	Project types include Load Relief and Reliability. Other types have minimal suitability and will be reviewed as suitability changes due to State policy or technological changes.	
Timeline Suitability	Large Project	36-60 months
	Small Project	18-24 months
Cost Suitability	Large Project	Greater than or equal to $1M
	Small Project	Greater than or equal to $500K

NWA RFP Development

The Request for Proposal (RFP) development process involves compiling information to best describe the area electrical problem. Information provided in the RFP includes but is not limited to: historical electric load data, aggregated customer information, detailed description of equipment and stresses on said equipment, geographic data, circuitry, load forecasts (daily and yearly), project economics in the form of the value of the deferred traditional solution as well as other information that may help vendors understand and solve the area problem.

Once the circumstances and load drivers are developed, the RFP is filed then released to potential bidders through our procurement site - Ariba. The RFP is also available on the Company's NWA website page. The Company holds a pre-bid teleconference call during which the Company presents an overview of the NWA opportunity and requests potential bidders to ask questions. Answers and information for questions are compiled by our procurement team with the input of the appropriate subject matter expert then posted on the procurement site. Potential bidders develop non-wires proposed solutions and submit them into Ariba. Proposals are reviewed and ranked by the NWA review team which includes procurement, NWA, legal, operations, control center, permitting, transmission/distribution planning and other subject matter experts, as appropriate. Those projects that are most affordable and viable, *i.e.*, those that can solve the electrical problem described in the RFP, may be contacted for additional details and clarifications. A preliminary BCA score is calculated and revises the BCA as appropriate with additional information or adjustments to the solution. The NWA team then chooses the preferred vendor who offers the Non-Wires Solution that maintains electrical system reliability, delivery standards and safety, and scores a 1.0 or higher on the BCA assessment.

Projects Reviewed
In response to the "Order Adopting Regulatory Policy Framework and Implementation Plan" issued by the Commission in Case 14-M-0101 and with consideration of NWA discussions with Staff, the Company provided detailed information for an NWA area near Baldwinsville, NY. That NWA opportunity was sent out for RFP and 11 proposals were received. After review and analysis, the NWA team determined that none of the Baldwinsville NWA proposals were viable or affordable and that project has been closed.

The current project list is provided in the table below. In 2019 the Company reviewed all capital projects and created NWA opportunities for those that satisfied the criteria for potential NWA solutions described in the table above. Many of the projects reviewed did not pass the NWA suitability criteria because they were driven by asset condition issues or resiliency needs, had need dates that were too immediate, or had cost estimates that did not meet the criteria. The 2019 review identified no new NWA opportunity. At this time, the Company has identified eighteen NWA opportunities and is currently reviewing proposals for 3 project locations.

The table below lists current NWA projects and their status:

Project Name	Project Type	Status	Voltage Type	Projec t Size	Estimated RFP Timing (CY)
Baldwinsville	Load Relief	Project Closed	Distribution	Large	RFP Closed
Old Forge	Reliability	Project Closed	Distribution/ Sub-Transmission	Large	RFP Closed
Brooklea Dr, Fayetteville	Load Relief	Project Closed	Distribution	Small	RFP Closed
Gilbert Mills	Load Relief	Project Closed	Distribution	Small	RFP Closed
Van Dyke	Load Relief	Project Closed	Distribution	Large	RFP Closed
Golah-Avon	Load Relief	Project Closed	Sub-Transmission	Large	RFP Closed
Buffalo 53	Load Relief	Project Closed	Distribution / Sub-Transmission	Large	RFP Closed

Project Name	Project Type	Status	Voltage Type	Project Size	Estimated RFP Timing (CY)
Fairdale DSUB	Load Relief	Project Closed	Distribution	Large	RFP Closed
Pine Grove (New Cicero) Substation DSUB & D-LINE	Reliability	BCA Review	Distribution	Large	RFP Closed
Sawyer 11H Sub-T Line *Former Buffalo 23KV*	Load Relief	Planner Review	Sub-Transmission	Large	RFP Closed
Rensselaer (Forbes Ave) New Substation & D-LINE	Load Relief	BCA Review	Distribution / Sub-Transmission	Large	RFP Closed
LHH - Mallory 34.5 KV 22 Line Reg.	Reliability	Planner Review	Sub-Transmission	Small	Under planner evaluation
Watertown New 115/13.2 KV Substation	Reliability	BCA Review	Distribution	Large	RFP Closed
Byron F1863 - Rebuild / Reconductor	Reliability	Planner Review	Distribution	Small	Under planner evaluation
North Bangor Conversion (D-LINE)	Reliability	Project Closed	Distribution	Small	Project removed as an NWA opportunity.
Sonora Way Station & Feeders	Load Relief	Project Closed	Distribution	Large	Project removed as an NWA opportunity.
Grand Island	Load Relief / Reliability	Project Closed	Distribution	Large	Project removed as an NWA opportunity.

Active NWA/Demand Response Projects/Proposals

The residential/small business program called Direct Load Control ("DLC") equips customers with load control devices that the Company (or the customer) can remotely control during times of system stress. In addition, there are two commercial program offerings: (1) the Commercial System Relief Program ("CSRP") may be called for peak shaving, and (2) a contingency program - Distribution Load Relief Program ("DLRP") - may be called when identified equipment exceeds operational limits. Customers participating in these commercial programs manage their buildings' load control and reduction.

The residential/small business ("DLC") and commercial peak shaving ("CSRP") programs are offered system wide, both within and outside of electrically stressed areas. The contingency ("DLRP") program is offered only in identified electrically stressed areas. All three programs are tools that may be considered for inclusion in future NWA projects depending on results of the aforementioned analysis work and solution RFP responses. As new NWA areas are identified, the Company will seek to establish the most appropriate demand response program offering for the specific needs of that area.

Lessons Learned
The Company has evolved our process to incorporate lessons learned and create openness for NWA evaluation. We provide improved information about project needs in the problem statement, provide the value of deferred traditional solution to better compare with NWA solution costs, and have made improvements to our RFP including:

- Property acquisition responsibility
- Development of a template for pricing structure in proposals
- Additional electrical system information to help bidders develop more complete proposals
- Use of a standard template to provide a common format across all RFPs
- Inclusion of sample terms and conditions
- Continued improvements to the BCA tool to ensure NWA benefits are appropriately considered

Conclusion
NWA projects and processes are ever-evolving, and more projects will be considered, evaluated and developed in 2020-- and beyond. The Company will continue to work in conjunction with the JU and will adopt NWA processes that reflect lessons learned from the JU group. Demand Response programs continue to grow, and the existing NWA opportunities will be procured, evaluated and developed using outside vendors and/or additional internal resources, which will help animate New York's energy markets.

New NWA areas will be identified, and potential projects considered utilizing various DERs. In addition, the Company will continue to review its NWA criteria and process and the NWA criteria and processes of other NYS utilities to improve its NWA program and remain consistent with the JU.

Exhibit 5: Overhead Line Refurbishment Projects

Gardenville-Dunkirk 141 & 142 Northern Phase Rebuild (C003389 - $103.8M and C076951 - $4.5M)

The overhead line details:

Total length: Approximately 20 miles
Conductor: Varies – 250 BSCU, 400 BSCU, 4/0 BSCU, 336.4 ACSR, and 636 AAC, and 795 ACSR.
Total number of steel structures: 250 structures
Types of structures: Double circuit, primarily steel (Z type flex), structures
Typical Installation date: 1930s vintage

This project involves rebuilding the Gardenville-Dunkirk 141 (T1260) and the Gardenville-Dunkirk 142 (T1270) 115 kV transmission circuits between Gardenville and North Angola.

Planning needs require a larger conductor on the lines due to thermal overloads during periods of low Western NY load and high imports from Canada. The rebuild of the Northern Phase will be done first with an expected in-service date of FY22. The Southern phase will proceed the completion of the Northern phase. After climbing steel towers to perform conductor clearance work in advance of the line refurbishment, it was revealed that many towers were in worse condition than originally thought. Further climbing inspections and aerial photography were ordered and the results drove a decision to change the scope from a life extension project involving the targeted replacement of deteriorated structures, insulators and fittings, conductor splices, shield wire, tower painting, and footer repairs to a full line rebuild.. An Article VII application is currently underway. .

Lockport-Batavia 112 (C003422 - $8.9M)

The overhead line details:

Total length: Approximately 34 miles
Conductor: Varies - 250 BSCU 19-Strand, 795 ACSR 36/1 “Coot”, 336.4 ACSR 26/7 “Linnet”, 428 AAC 19-Strand, and 636 AAC “Orchid”
Total number of structures: 369
Number of wood structure units: 156
Number of steel structure units: 213
Types of structures: Steel towers (178 of which are tri-leg towers) and wood pole structures (111 of which are single pole with davit arms).
Typical Installation date: 1930-1940s

This project has undergoing scope development based upon an engineering field assessment, input from Transmission Planning, and local and state agencies. Conductor testing revealed all conductor types passed except 17.5 miles of 428 kcmil AAC (the shield wire passed testing also). The project scope is a full rebuild involving the replacement of deteriorated steel tri-leg structures that are 1907 vintage and conductor. . The section of the line through the Tonawanda Nature Preserve will be relocated to remove it from wetlands. This project will require Article VII.

Pannell – Geneva 4-977 (C030889 - $2.3M)

The overhead line details:

> Total length: Approximately 25 miles
> Conductor: 795 ACSR "Coot" and 336.4 ACSR 30/7 "Oriole" (installed in 1922)
> Number of wood structure units: 8
> Number of steel structure units: 265 (including 1 steel pole)
> Types of structures: predominantly the original 1906 Aeromotor towers except at angle points which were replaced with dead-end towers
> Typical Installation date: parts originally built in 1906 and operated at 66kv 25 cycle until upgraded to current 115kV 60 cycle in 1948. Circuits originally referred to as Mortimer-Geres Lock #3/Mortimer-Geneva #4.

Life extension project involving the targeted replacement of deteriorated structures, insulators and fittings, conductor and shield wire. Tower painting and footer repairs. Conductor testing on the Mortimer-Pannell 25 line, which is the same vintage and conductor type as the Pannell-Geneva 4-977 lines which has had multiple conductor failures in recent years, shows significant loss of the zinc protective coating.

This project will replace structures and conductor at (14) road crossings to ensure public safety and reliability. The existing suspension structures will be replaced with Direct Embedded Steel poles with guy wires. The conductor will be replaced across the road as well as all insulators and hardware.

Mortimer – Pannell 24 25 (C047816 - $2.5M)

The overhead line details:

> Total length: 15.7 miles
> Conductor: 795 ACSR 36/1 "Coot", 336.4 ACSR 30/7 "Oriole" (installed in 1922), 336.4 AL "Tulip" and 336.4 ACSR 18/1 "Merlin"
> Number of wood structure units: 78
> Number of steel structure units: 172
> Types of structures: predominantly the original 1906 Aermotor towers
> Typical Installation date: parts originally built in 1906 and operated at 66kv 25 cycle until upgraded to current 115kV 60 cycle in 1948. Circuits originally referred to as Mortimer-Geres Lock #3/Mortimer-Geneva #4.

Life extension project involving the targeted replacement of deteriorated structures, insulators, fittings, and conductor. Tower painting and footer repairs. Conductor testing revealed corrosion of the 336.4 ACSR conductor. The project is in conceptual engineering to further define scope within the term of this plan.

Border City – Elbridge 10-979 / 5 (C075723 - $2.2M)

The overhead line details:

> Total length: 31.4 miles total
> Conductor: 336.4 30/7 ACSR "Oriole" (installed in 1922)
> Total number of structures: 432
> Number of wood structure units: 117
> Number of steel structure units: 315
> Types of structures: Double circuit, primarily consisting of steel lattice towers
> Typical Installation date: parts originally built in 1906 and operated at 66kv 25 cycle until upgraded to current 115kV 60 cycle in 1948. Circuits originally referred to as Mortimer-Geres Lock #3/Geneva-Geres Lock #4.

This project targets the double circuit Border City – Elbridge #10-979 and the de-energized Mortimer - Solvay #5.

This is a life extension project involving the targeted replacement of deteriorated structures, insulators and fittings, conductor splices, shield wire, tower painting, and footer repairs. This project will replace structures and conductor at (17) significant road crossings to ensure public safety and reliability. The existing suspension structures will be replaced with Direct Embedded Steel poles with guy wires. The conductor will be replaced across the road as well as all insulators and hardware.

Ticonderoga 2 & 3 (C039521 - $18.9M and C078570 - $4.6M)

The overhead line details:

> Total length: Approximately 46 miles total with about 23 miles on the T5810 and 23 miles on the T5830
> Conductor: Ticonderoga-Republic 2 - 336.4 ACSR 30/7 "Oriole" and 4/0 Copper conductors. Ticonderoga-Whitehall 3 - 336.4 ACSR 30/7 "Oriole" conductor.
> Total number of structures: 350
> Number of wood structure units: #2 line has 581, #3 line has 462
> Number of steel structure units: #3 line has 13
> Types of structures: Single circuit, primarily consisting of wood pole H-frame structures and steel lattice towers
> Typical Installation date: 1920-1930s

These projects target the Ticonderoga-Republic 2 T5810 and the Ticonderoga-Whitehall 3 T5830 115 kV transmission circuits.

The project scope is the targeted replacement of deteriorated structures, insulator and fittings replacement, replacement of shield wire and conductor splices. This project is nearing completion of conceptual engineering to define scope development based upon the engineering field assessment performed, input from Transmission Planning, conductor testing, and shield wire testing.

The Mount Defiance portion is an approximately 1.25-mile segment of the Ticonderoga-Whitehall #3, which is essentially inaccessible and has structures dating back to the 1920s. It has been removed from the Whitehall-Ticonderoga-Republic 2-3 ACR because more time is needed to thoroughly develop access to the ROW on at this location. .

Batavia – Golah 119 (C060217 - $6.9M)

The overhead line details:

Total length: 28.6 miles total
Conductor: 795 ACSR conductor outside Batavia to N. LeRoy, 397.5 ACSR to Golah
Number of wood structure units: 323
Number of steel structure units: 0
Types of structures: H-frame
Typical Installation date: 1925

Life extension project involving the targeted replacement of deteriorated structures, insulators, fittings, grounding, and shield wire. This project is entering conceptual engineering.

Gardenville – Homer Hill 151 152 167 (C027425 - $1.2M)

The overhead line details:

Total length: 31.4 miles total
Conductor: 336.4 ACSR 30/7 “Oriole”
Total number of structures: 432
Number of wood structure units: 117
Number of steel structure units: 315
Types of structures: Double circuit, primarily consisting of steel lattice towers
Typical Installation date: 1910s

The Gardenville-Homer Hill 151/152/167 has been rebuilt from Gardenville to structure #200 and from Five Mile Road station (structure #548) to Homer Hill station. Following a failure in November 2015 where a structural vang eroded causing a conductor drop, additional inspections were performed. . Results of the comprehensive aerial inspection indicated that additional vangs were eroded and in need of replacement. Concurrently the 151/152/167 is undergoing conductor clearance evaluation. The vang replacement project and the conductor clearance project will be undertaken together to minimize multiple trips into the corridor.

This ACR project will replace the existing 336.4 30/7 ACSR "Oriole" with 795 ACSR Drake if further conductor testing shows failing results. Because of the vang replacement and conductor clearance work is in advance of the ACR project, the ACR project can be postponed several years to allow for other projects with higher need to be completed.

This project is entering conceptual engineering to define the ACR scope based upon additional engineering field assessment, input from Transmission Planning, conductor and shield wire testing.

Frontier 180/182 ACR/Reconductor (C027436 - $6.6M)

The overhead line details:

Total length: #180 is 31.4 miles total and #182 is 28.2 miles total
Conductor: predominantly copper, some ACSR
Total number of structures: 406 combined
Number of wood structure units: 89 combined
Number of steel structure units: 327 combined
Types of structures: Double circuit, primarily consisting of steel lattice towers
Typical Installation date: 1920s

The Niagara-Gardenville #180 and Packard-Gardenville #182 circuits were proposed to be rebuilt as part of the Western NY FERC 1000 project to address capacity issues in the western part of the state. Even though the circuits were not selected as part of the FERC 1000 project, each of the circuits still require a combined ACR/reconductoring/conductor clearance project to address typical asset type conditions for overhead lines of this vintage.

Spier-Rotterdam 2 Shield Wire Replacement (C050744 - $3.4M)

The overhead line details:

Total number of structures in project segment: 113
Number of wood structure units: 0
Number of steel structure units: 113
Types of structures: Sq. based steel lattice for tangent and dead-ends
Length of OPGW: 7.8-miles
Typical Installation date: 1920's

The segment from Spier Falls to the Brook Road Tap (structure #113) on the Spier-Rotterdam 2 line has copperweld shield wire deteriorated to the degree it can no longer be spliced when a failure occurs and needs replacement. OPGW is being installed for the shield wire replacement because communications to the Spier Falls station needs.

At Str. 113 a microwave disk will be installation and connected to the OPGW coming from the spier Falls substation. The microwave disk will be able to communicate with the NMPC Bald Mountain repeater site located near the North Troy substation.

Lockport-Mortimer 111 & 113 Brockport Tap (C055531 - $20.1M)

The overhead line details:

Total length: Approximately 7.5 miles
Conductor: 795 kcmil, 4/0 and 336.4 ACSR
Number of steel structure units: 1 (steel lattice switch structure)
Number of wood structure units: 39
Typical Installation Date: 1940s for the #111 tap, 1955 for the #113 tap

This project involves a 3-mile portion of the 7.5-mile tap between Sweden – Brockport Stations and taps off the Lockport-Mortimer 111 and 113 lines.

The project scope includes replacement of deteriorated structures, damaged insulators and fittings, replacement of conductor splices, and adding shield wire.

Mortimer-Golah #110 ACR (C060220 - $6.8M)

The overhead line details:

Total length: 9.58 miles
Conductor: Mix of 250 BSCU, 397.5 ACSR, and a small amount of 795 ACSR
Total number of structures: 91
Number of wood structure units: 91
Number of steel structure units: 0
Types of structures: H-frames w/ OH shieldwire
Typical Installation date: 1950

This project will be an ACR type project on this wood circuit. The ACR will also include evaluation of the 397.5 ACSR. As part of the ACR, transmission planning will be consulted to determine if the 250 BSCU and 397.5 ACSR are regionally limiting elements.

Huntley-Gardenville 38/39 Rebuild (C075543 - $3.0M)

The overhead line details:

Total length: 23.55 miles
Conductor: 636 AL, 300 BSCU, 400 BSCU, 636 ACSR, 795 ACSR
Total number of structures: 272
Number of wood structure units: 10
Number of steel structure units: 262
Types of structures: Typically, steel channels for flex, and sq. base steel lattice for dead-ends
Typical Installation date: Earliest 1907

This project is an ACR-type project to evaluate the structures and conductor. As part of the ACR transmission planning will be consulted to determine if there are any limiting elements on the circuit that should be replaced. In addition, there are several structures dating back to 1907 will require a thorough inspection.

South Oswego-Clay #4 T-334 Rebuild (C075544 - $3.0M)

The overhead line details:

Total length: 34.05 miles
Conductor: 336.4 ACSR 26/7, 336.4 ACSR 18/1, 795 ACSR 36/1,
Total number of structures: 382
Number of wood structure units: 298
Number of steel structure units: 84
Types of structures: Steel sq. base lattice, steel channel flex, wood H-frames
Typical Installation date: Between 1914-1938

This circuit consists of essentially four segments:

1. South Oswego substation to T#62:
    a. On double circuit steel lattice towers with the South Oswego-Curtis St. #10
    b. These structures date back to the late 1930's early 1940's.
2. Str. 63 to Str. 259:
    a. Single circuit wood H-frames. Original structures have bayonet for shield wire
3. T#260 to T#293:
    a. This segment of the circuit dates back to 1914 (T-411)
    b. On primarily double circuit steel lattice towers with the retired in place 69kV Bennett's Bridge-Geres Lock #6
4. Str. 294 to Str. 319 Clay substation:
    a. On single circuit wood H-frames

The project will be an ACR-type project to evaluate each of the four segments and recommend for each a refurbishment type option.

During a recent I&M project to replace structures between 63 and 258, the conductor at the hardware was discovered to have broken strands. Armor rod was used at these locations until a comprehensive program to address the conductor is developed.

Gloversville – Marshville #6 69kV Refurbish (C081458 - $6.5M)

The overhead line details:

Total length: 16.6 miles
Conductor: 2/0 7 stand copper, 3/0 7 strand copper, 4/0 7 strand copper, 336.4 ACSR “Merlin”
Total number of structures: 324
Number of wood structure units: 106
Number of steel structure units: 208
Types of structures: Single circuit; wood poles, double circuit; steel flex & steel box
Typical Installation date: 1910
ACR type project to refurb 16.6 miles of line between Gloversville to Marshville.

Amsterdam-Rotterdam 3/4 Relocation (C081471 - $2.9M)

The overhead line details:

Total length: 10.1 miles
Conductor: 4/0 AWG 7-Strand Copper
Total number of structures: 111
Number of wood structure units: 0
Number of steel structure units: 111
Types of structures: Double circuit; steel flex & steel box
Typical Installation date: 1921
ACR type project to refurb and relocate between structure #77-85 (0.9 mile) which is currently in the old Erie Canal bed.

Gardenville-Dunkirk 141-142 Southern Phase ACR (C081744 - $14.0M C081750 - $0.10M C034193 - $1.3M)

The overhead line details:

Total length: 25 miles
Conductor: 4/0 ACSR, 795 ACSR, 336.4 ACSR, 636 Al
Total number of structures: 326
Number of wood structure units: 18
Number of steel structure units: 308
Types of structures: Steel sq. base lattice for dead-ends and steel channels for flex.
Typical Installation date: 1920

This project is the second half of the 141/142 ACR project and it will address the southern portion from the North Angola Substation (T#249) to the Dunkirk substation (T#581). The Northern Phase from Gardenville to North Angola Substation is currently in final design/licensing and permitting.

Mountain-Lockport 103-104 T1620-T1060 STR (C027432 - $2.4M)

The overhead line details:

Total length: 17.6 miles
Conductor: 400 BSCU, 636 ACSR, 795 ACSR, 795 AL, 4/0 ACSR (Swann Rd)
Total number of structures: 268
Number of wood structure units: 85
Number of steel structure units: 183
Types of structures: Sq. based lattice dead-ends, steel channels for flex, and wood H-frames
Typical Installation date: 1922

This project will replace deteriorating insulators that are of 1922s vintage. Previous projects have replaced sections of insulators, leaving sections of line that still have old and deteriorated insulators. Due to the number of unknown faults on the 103/104 circuits, some remaining sections of line (27 structures) that are in the fault target regions need reinsulating.

The 103/104 has sustained 34 faults between 5/1/2012 and 9/25/2017 of which

1	Substation	3
2	Relay	1
3	Line equipment, splice	3
4	Weather, storm, wind	6
5	Lightning	8
6	Unknowns	12
9	Other, animal	1

The unknown faults could be attributed to failing porcelain insulators.

Lighthouse Hill - Clay #7 ACR (C069533 - $5.2M, C084074 - $11.1M, C084077 - $2.1M, C084078 – $10.1M)

The overhead line details:

Total length: 26.53 miles (Bussed 115kV Circuit)
Conductor: 4/0 BSCU
Total number of structures: 330
Number of wood structure units: 12
Number of steel structure units: 318
Types of structures: Single circuit; wood poles, bussed circuit; steel flex & steel box
Typical Installation date: 1924

The LHH-Clay #7 is currently a 26.53-mile bussed 115kV circuit. The Lighthouse Hill-Clay #7 is one of the Worst Performing NY circuits. In response to the number of momentaries on the 7-circuit, an aerial comprehensive inspection was commissioned to documents defects. Defects found have been several flashed and broken insulators, elongated vangs corroded shield wire and corroded steel structures.

The scope of this project is a system reconfiguration.

The reconfiguration will be 5 Line projects and 3 substation projects. 1) Wetzel Road tap into Clay Substation. The existing Wetzel Road tap associated with the Light House Hill – Clay #7 transmission line will become a new circuit between Clay Substation and Wetzel Road Substation. The existing tap will be re-routed into a spare bay on the western side of the existing Clay 115kV yard. The re-route is between structure 310 on Clay to General Electric (Lockheed) 14 and Structure 310 on the Lighthouse Hill to Clay 7 - Wetzel Tap The new structure will be constructed with direct embedded steel poles with angles and dead ends on foundations. The new section will use 795 ACSR Drake as the conductor and 3/8 steel as the shield wire. 2) Mallory Circuit to new 3 Breaker Ring Substation (“Hastings”) A new 115kV three breaker ring substation will be built in the general area near STR# 230 of the existing Lighthouse Hill – Clay #7 line. A new double circuit will be constructed from STR# 259 of the South Oswego – Clay #4 line to the new Hastings substation which will be approximately 0.5 mile north. A new single circuit will be built from the Hastings substation to the Mallory substation which will be approximately 1.0 mile north. The existing right of way associated with the Light House Hill – Clay #7 should be evaluated for the installation of the new circuits. It should be assumed that the existing #7 line will remain in place while constructed the new circuits but ultimately will be retired. Any potential right of way and or land acquisitions at a high level should be captured in the report. The new line will be constructed with direct embedded steel poles with angles and dead ends on foundations. The new line will use 795 ACSR Drake as the conductor and 3/8 steel as the shield wire. In addition to the new circuit, the existing #4 line will be routed into the new three breaker ring substation splitting the # 4 line into two lines. The Hastings – Clay line and the Hastings - South Oswego. 3) New Circuit from Lighthouse Hill Substation to the new 345kV/115kV substation (“Parish Substation”) A new 115kV circuit from the Lighthouse Hill substation to the new Parish 345kV/115kV substation will be constructed. The existing right of way associated with the Light House Hill – Clay #7 transmission line will be used. The new line will be constructed with direct embedded steel poles with angles and dead ends on foundations. The new line will use 795 ACSR Drake as the conductor and Company standard OPGW. 4) Two new 345kV taps splitting the existing Volney – Marcy #19 345kV Line The existing Volney Marcy #19 line will be split in two lines near structure 55 in Parish NY and will be terminated into the new 345kV / 115kV Parish Substation. 5) Retire Lighthouse Hill – Clay #7 Retire and remove the entire existing Light House Hill – Clay #7 circuit.

Curtis St - Teall #13 ACR (C084496 - $5.2M)

The overhead line details:

Total length: 28.83 miles
Conductor: 636 ACSR 18/1, 636 ACSR 26/7, 795 ACSR 26/7, 795 ACSR 36/1
Total number of structures: 203
Number of wood structure units: 201
Number of lattice structure units: 183

Types of structures: Sq. based lattice dead-ends, steel channels for flex, and single and H-frame wood
Typical Installation date: 1945

This ACR type project includes a full aerial comprehensive inspection including UV and corona, steel tower climbing inspection, and Osmose PIT inspection of the wood poles.

Based upon an engineering field evaluation, some tower and wood pole structure replacements are necessary along with some tower repairs due to deterioration. Engineering is in the process to identify all concerns of deterioration identified through field inspections and engineering analysis.

Elbridge-Gears Lock 3 Woodard 4 ACR (C084521 - $5.2M)

The overhead line details:

Total length: 11.38 miles (Double Circuit)
Conductor: 795 ACSR, 477 ACSR, 300 kcmil 19 Copper
Total number of structures: 137
Number of wood structure units: 19
Number of lattice structure units: 118
Types of structures: Sq. based lattice dead-ends, steel channels for flex, and davit arm wood
Typical Installation date: 1933 (Elbridge-Gears Lock 3), 1967 (Elbridge-Woodard 4)

This project is an ACR-type project. The steel assets will be thoroughly inspected. Conductor and shield wire will also be inspected. If the conductor passes mechanical and physical testing, at a minimum, the existing insulators and hardware will be replaced. As part of the ACR transmission planning will be consulted to determine if there are any limiting elements on the circuit that should be replaced.

Elbridge-Geres Lock 18/19 ACR (C084522 - $4.2M)

The overhead line details:

Total length: 8.12 miles (Double Circuit)
Conductor: 795 Alum 37 Strands, 795 ACSR 36/1, 336.4 ACSR, 4/0 Copper
Total number of structures: 89
Number of wood structure units: 3
Number of lattice structure units: 86
Types of structures: Sq. based lattice dead-ends, steel channels for flex, and davit arm wood
Typical Installation date: 1923 (Elbridge to Geres Lock 18), 1981 (Elbridge to Geres Lock 19)

This ACR type project includes a full aerial comprehensive inspection including UV and corona, steel tower climbing inspection.

Based upon an engineering field evaluation, some tower and wood pole structure replacements are necessary along with some tower repairs due to deterioration. Engineering is in the process to identify all concerns of deterioration identified through field inspections and engineering analysis.

Mortimer-Golah 109-69kV refurb (C081474 – $23.8M)

The overhead line details:

Total length: 10.29 miles
Conductor: 795 ACSR 36/1 "Coot", 214 Alum
Total number of structures: 235
Total number of wood structures: 189
Total number of steel structures: 46
Installation Date: 1920

Initially the project will address the critical road crossing. Then the refurbishment will target the remaining sections of the circuit.

Lockport-Mortimer 113/114 ACR/CCR (C081664 - $1.5M)

The overhead line details:

Total length: 55.51 miles (T1540) / 55.70 miles (T1550)
Conductor Types: 397.5 30/7 ACSR
Number of structures: 592
Total Steel: 574
Total Wood: 18
Installation Date: 1920 (oldest record in Power plant)

The mainline of the Lockport-Mortimer 111 (same corridor) was rebuilt approximately 5 years ago. The mainline of the Lockport-Mortimer 113/114 was partially rebuilt in the same timeframe. During the 113/114 partial rebuild, the insulators were replaced as well as the shield wire.

This project combines a Conductor Clearance Review (CCR) with an Asset Condition Refurbishment (ACR) to inspect the tower vangs, review condition of the Aluminum Conductor Steel Reinforced (ACSR) conductor and address any remaining condition issues.

The 113/114 support approximately 30,000 customers combined. The 113/114 are also on the Company's Worst Performing Circuits (WPC) list as of June 2019. These circuits have experienced many disturbances over the past years.

Thompson – N Troy – Greenbush Corridor (C081667 - $1.5M)

The overhead line details:

Lines:
T5570 Reynolds Rd. to Greenbush 9
T5930 Wynantskill to Reynolds Rd. 13
T5540 North Troy to Reynolds Rd. 16
T5550 North Troy to Wynantskill 14
T6550 Eastover Rd. to North Troy 307
T6540 Eastover Rd. to North Troy 306
T6810 Battenkill to Eastover Rd. 10
T6820 Luther Forest to Eastover Rd. 308
T6480 Mohican to Luther Forest 3
Total length: 37.53
Conductor Types: 795 MCM ACSR, 605 MCM ACSR
Total number of structures: 300
Total Steel: 280
Total Wood: 20
Types of structures: Steel Lattice (259), Steel Other (21), Wood (20)
Installation Date: 1923 to 1931

This project is an ACR-type project. All structures, conductor and shield wire will be thoroughly inspected. Partial inspections have been done in this corridor on the Mohican to Luther Forest #3 & Battenkill to Eastover Rd. #10 lines. The findings show that there are flashed and/or damaged insulators and excessive corrosion on the arms, braces and vangs. The mainline of this corridor is of the same vintage as the assets in the partial inspection and are presumed to be in similar condition. If the conductor and structures pass testing, we will proceed with a targeted refurbishment. It will include replacing deteriorated structures, insulators and hardware, adding improved grounding, and targeted replacement of conductor and shield wire on the mainline and taps. As part of the ACR, transmission planning will be consulted to determine if there are any limiting elements on the circuit that should be replaced.

Huntley – Lockport 36/37 Ayer Rd ACR (C081670 - $5.1M)

The overhead line details:

Total length: 1.17 miles (T1440-3) / 1.34 miles (T1450-3)
Conductor Types: 636 ACSR
Number of structures: 27
Total Steel: 26
Total Wood:1

This project addresses the asset condition related issues on the Huntley-Lockport 36/37 Taps to Ayer Rd.

The Huntley-Lockport 36/37 Taps to Ayer Rd are built overhead for 1.17 miles before transitioning underground for 2.5 miles to the Ayer Rd Station. The taps are operating on steel lattice towers from the retired 92E and 93W circuits. These towers are in poor condition and need replacement. The foundations are in crumbling condition, and the steel shows significant oxidation.

The preferred option to resolve the condition issue is to rebuild the overhead sections of the taps using direct embedded steel poles. Conductor, shield wire and insulators will all be replaced.

Laona-Falconer 172/173 ACR/CCR (C083216 - $9.8M)

The overhead line details:

> Total length: 23.67 miles (T6640) / 23.71 miles (T6620)
> Conductor Types: 4/0 ACSR, 795 ACSR 26/7
> Number of structures: 248
> Total Steel: 240
> Total Wood: 8

The 115kV Laona-Falconer #172/#173 are located in the Western Division of Upstate New York. The circuits were initially referred to as the Dunkirk-Falconer #161/#162 in 1918 and 1922 when they were initially placed into service. Recently, in 2018, the circuit was renamed when Laona substation was added to assume the Arkwright Wind Farm load.

This project is addressing the line section from the Laona Substation (Str. 121) to the Falconer Substation (Str. 356).

The 161/162 received an aerial comprehensive inspection in 2009, this together with momentary data prompted the ACR inspection. Several instances of flashed insulators and other insulator concerns were observed . The tower vangs appear to be elongated. The main supporting channels are corroded, and pitting is suspected. Several secondary tower members are bent.

Samples of the conductor and shield wire were harvested for destructive testing of tension, torsion, and corrosion. All (10) of the #4/0 6/1 ACSR Penguin coupons failed the tensile tests and averaged -4.58% below Rated Breaking Strength.

In May 2014, a shield wire replacement damage failure project was undertaken on the 161/162 to replace two shield wires from Str. 28 to 40, a one mile segment. In addition, replacement of (84) polymer insulators with porcelain and Str. 55 replacement was added. Both projects are currently in the Dunkirk-Laona 161/162 region.

Whitehall-Mohican13/Cedar6-P2 (C084552 - $5.1M)

The overhead line details:

> Total length: 22.91 miles (T5900) / 21.05 (T5910)
> Conductor Types: 4/0 Cu, 336.4 MCM 26/7 ACSR

Number of structures:
Total Steel: 194
Total Wood: 261
Installation Date: 1927 (oldest record in Power plant)

The project will focus on replacing deteriorating insulators from the Mohican station to structure 230 which is roughly the first 17 miles of the line. Insulator replacements from structure 230 to Whitehall substation are being replaced under a different project.

In the past 5 years there have been 16 momentary operations on the Whitehall Mohican #13 and 17 momentary operations on the Whitehall Cedars #6. All but 1 of these events have been attributed to unknown causes.

On 4/4/19 high concentration of corona defects were found from the Mohican station to structure 230. This observation correlates with our distance to fault data for the momentary operations seen on these lines.

N.Scotland-Feura Bush/Long Lane ACR (C084554 - $8.7M)

The overhead line details:

Total length: 4.16 miles (T5470) / 4.03 (T5500)
Conductor Types: 795 MCM ACSR, 4/0 7S CU, 336.4 MCM
Total number of structures: 68
Total Steel: 25
Total Wood: 43
Types of structures: Wood pole standoff (18), Wood pole H-Frame (4), Wood pole various (21), Steel lattice (20), Steel pole (5)
Installation Date: 1923 (oldest record in Power plant)

This project is an ACR-type project. All structures, conductor and shield wire will be thoroughly inspected. This line was originally built under the Unionville Atlantic Cement 6 major location. Recently, during inspections of a line of the same vintage under the same major location, severe deterioration of the shield wire was found. Many insulators were also found to be tracking and/or broken. If the conductor passes mechanical and physical testing, at a minimum, the existing insulators, shield wire and hardware will be replaced. As part of the ACR, transmission planning will be consulted to determine if there are any limiting elements on the circuit that should be replaced.

2019 NY 15 Year Electric T&D Planning Report

Table of Contents

Chapter 7: Topic Catalog

List of Abbreviations and Acronyms

$3V_0$:	Zero-Sequence Voltage (used to detect overvoltage conditions)
ADA:	Advanced Distribution Automation
ADMS:	Advanced Distribution Management System
AEO:	Annual Energy Outlook
AMI:	Advanced Metering Infrastructure
AMS:	Asset Management Standard
APAM:	Advanced Planning and Asset Management
BCA:	Benefit-Cost Analysis
BES:	Battery Energy Storage
BNMC:	Buffalo Niagara Medical Campus
C&I:	Commercial and Industrial
CAGR:	Compound Annual Growth Rate
Capex:	Capital Expenditure
CB:	Circuit Breaker
CES:	Clean Energy Standard (Case 15-E-0302)
CHP:	Combined Heat and Power
CIRP:	Commercial and Industrial Retrofit Program
CLCPA:	Climate Leadership and Community Protection Act of 2019
Commission:	New York State Public Service Commission
CSRP	Commercial System Relief Program
DER:	Distributed Energy Resources
DERMS:	Distributed Energy Resource Management System
DG:	Distributed Generation
DGA:	Dissolved Gas Analysis
DLC:	Direct Load Control
DLM:	Dynamic Load Management
DLMP:	Distribution Locational Marginal Price
DLRP:	Distribution Load Relief Program
DR:	Demand Response
DRMS:	Demand Response Management System
DSIP:	Distributed System Implementation Plan
DSO:	Distribution System Operators
DSP:	Distributed System Platform
DTT:	Direct Transfer Trip
EAB:	Emerald Ash Borer
EAM:	Earning Adjustment Mechanism
EE:	Energy Efficiency
EPRI:	Electric Power Research Institute
EPS:	Electric Power System
ERR:	Engineering Reliability Review
ESS:	Electric Storage Systems
EV:	Electric Vehicles

EVSE:	Electric Vehicle Supply Equipment
FES:	Flywheel Energy Storage
FLISR:	Fault Location, Isolation, and Service Restoration
GSHP:	Ground Source Heat Pump
GIS:	Geographic Information System
HCA:	Hosting-Capacity Analysis
HEV:	Hybrid Electric Vehicles
HID:	High-Intensity Discharge
HVAC:	Heating, Ventilation, and Air Conditioning
I&M:	Inspection and Maintenance
IOAP:	Interconnection Online Application Portal
IoT:	Internet of Things
IPCC:	Intergovernmental Panel on Climate Change
ISO:	Independent System Operator
IVM:	Integrated Vegetation Management
kV:	Kilovolt
kVARh:	Kilowatt Volt-Ampere Reactive Hour (referred to generally as reactive power)
kWh:	Kilowatt Hour
LED:	Light-Emitting Diode
LSR:	Large-Scale Renewable
LSRV:	Locational System Relief Value
M&C:	Monitoring and Control
MG:	Microgrids
MP:	Multi-Family Program
MT:	Metric Ton
MW:	Megawatt
nCAP:	New Connection Application Portal
NEM:	Net Energy Metering
NERC:	North American Electric Reliability Corporation
NESC:	National Electrical Safety Code
NPCC:	Northeast Power Coordinating Council
NPV:	Net Present Value
NWA:	Non-Wires Alternatives
NYBEST:	New York Battery Energy Storage Technology Consortium
NYCA:	New York Control Area
NYDPS:	New York Department of Public Service
NYISO:	New York Independent System Operator
NYSERDA:	New York State Energy Research and Development Authority
NYSRC:	New York State Reliability Council
OH:	Overhead
OMS:	Outage Management System
Opex:	Operational Expenditure
PCC:	Point of Common Coupling
Plan:	National Grid's 15-Year Electric Transmission and Distribution Planning Report (2019)

PLC:	Power Line Carrier
POC:	Point of Control
PSR:	Platform Services Revenue
PV:	Photovoltaic
RCPP:	Residential Consumer Products Program
REP:	Residential Engagement Program
RFP:	Request For Proposal
RG:	Renewable Generation
RTU:	Remote Terminal Unit
SBEEP:	Small Business Engagement and Efficiency Platform
SBS:	Small Business Services
SCADA:	Supervisory Control and Data Acquisition
SDP:	Self-Direct Program
SG:	Smart Grid
SIR:	Standardized Interconnection Requirements
SME:	Subject-Matter Expert
SOA:	Service-Oriented Architecture
T&D:	Transmission and Distribution
TOU:	Time of Use
UG:	Underground
XMFR:	Transformer
VAR:	Volt Ampere Reactive
VDER:	Value of Distributed Energy Resources (Case 15-E-0751)
VIPER:	Vegetation Inspection Planning Evaluation Reporting
VoIP:	Voiceover Internet Protocol
VTOU:	Voluntary Time of Use
VVO:	Volt-VAR Optimization
WPF:	Worst Performing Feeder
ZEV:	Zero-Emission Vehicle