Carlos Gavilondo
Acting Assistant General Counsel & Director

VIA ELECTRONIC DELIVERY

January 31, 2018

Hon. Kathleen H. Burgess, Secretary
New York State Department of Public Service
3 Empire State Plaza
Albany, New York 12223-1350

Re: Case 12-E-0201, 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;
Five-Year Transmission and Distribution Capital Investment Plan, FY19-FY23

Dear Secretary Burgess:

Pursuant to the Public Service Commission's Order Approving Electric and Gas Rate Plans in Accord with Joint Proposal, issued and effective March 15, 2013 in Case 12-E-0201, Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid" or "Company") hereby submits its annual Transmission and Distribution Capital Investment Plan ("Plan"). The Plan sets forth the Company's projected capital spending on the electric transmission and distribution system for the 5-year period from April 1, 2018 through March 31, 2023 (fiscal years 2019 -2023). Please contact me if you have any questions regarding this filing.

Thank you for your attention to this matter.

Respectfully submitted,

/s/ Carlos Gavilondo

Carlos Gavilondo

Enc.

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This document has been reviewed for Critical Energy Infrastructure Information (CEII). 1/31/2018

nationalgrid

Electric Transmission & Distribution System

TRANSMISSION AND DISTRIBUTION CAPITAL INVESTMENT PLAN

CASE 12-E-0201

JANUARY 31, 2018

PREPARED FOR:

THE STATE OF NEW YORK PUBLIC SERVICE COMMISSION

THREE EMPIRE STATE PLAZA

ALBANY, NY 12223

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Chapter 1. Executive Summary

Niagara Mohawk Power Corporation d/b/a National Grid ("Niagara Mohawk" or the "Company") 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, 2013, in Case 12-E-0201.[1] The Plan submitted here relates to fiscal years 2019 to 2023 (FY19 to FY23).[2] The investment levels in the Plan 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, and continue to modernize the electric system to address the evolving needs of customers.

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

System	FY19	FY20	FY21	FY22	FY23	Total
Transmission	193.2	197.4	204.3	224.7	231.4	1,051.0
Sub-transmission	36.4	42.9	49.8	55.0	54.5	238.7
Distribution	294.3	326.5	338.1	423.2	462.5	1,844.5
Total	**523.9**	**566.8**	**592.2**	**702.9**	**748.4**	**3,134.2**

The investment levels for FY19 – FY21 reflect the amounts included in the Joint Proposal filed January 19, 2018 in the Company's pending electric rate case.[3]

The five-year investment plan presented here balances the need to constrain infrastructure cost while simultaneously mitigating some of the significant risks on the system. The Company continuously reviews the Plan relative to current risks and information and will revise the Plan as required to meet emergent needs while continuing to provide safe and adequate service at reasonable cost.

[1] Case 12-E-0201, *Proceeding on the Motion of the Commission as to the Rates, Charges, Rules and Regulations of Niagara Mohawk Power Corporation for Electric Service*, Order Approving Electric and Gas Rate Plans in Accord with Joint Proposal, issued and effective March 15, 2013 ("Rate Case Order"). Under Section 12.6.1(b) of the December 7, 2012 Joint Proposal adopted by the Rate Case Order, the Company agreed to continue to submit periodic reports as provided in Case 06-M-0878, *Joint Petition of National Grid PLC and KeySpan Corporation for Approval of Stock Acquisition and Other Regulatory Authorizations,* including the annual five-year investment plan.
[2] The period FY19 to FY23 covers April 1, 2018 - March 31, 2023.
[3] Case 17-E-0238, *Proceeding on the 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*.

1. A. Capital Investment Plan Summary

The Company's capital investment plan is presented by system and by spending rationale. A view of planned investments segmented by system is presented in Table 1-1 above, while a view of planned investments segmented by spending rationale is summarized below.

Investment by Spending Rationale

The Company classifies capital projects into eight spending rationales based on their primary investment driver: (A) Customer Requests/Public Requirements; (B) Damage/Failure; (C) System Capacity; (D) Asset Condition; (E) Reliability; (F) Communications/Control Systems; (G) DER Electric Systems Access; and (H) 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), new metering installations, outdoor lighting, third-party attachments, land rights, municipal relocations, generator interconnections, 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 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 failures of T&D 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 are required to improve power quality, reliability and resiliency performance.

Communications/Control Systems
Communication/Control Systems projects are required for monitoring and controlling the distribution system, and include such things as installing EMS/RTU 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, DG interconnections, and other third-party and market driven needs.

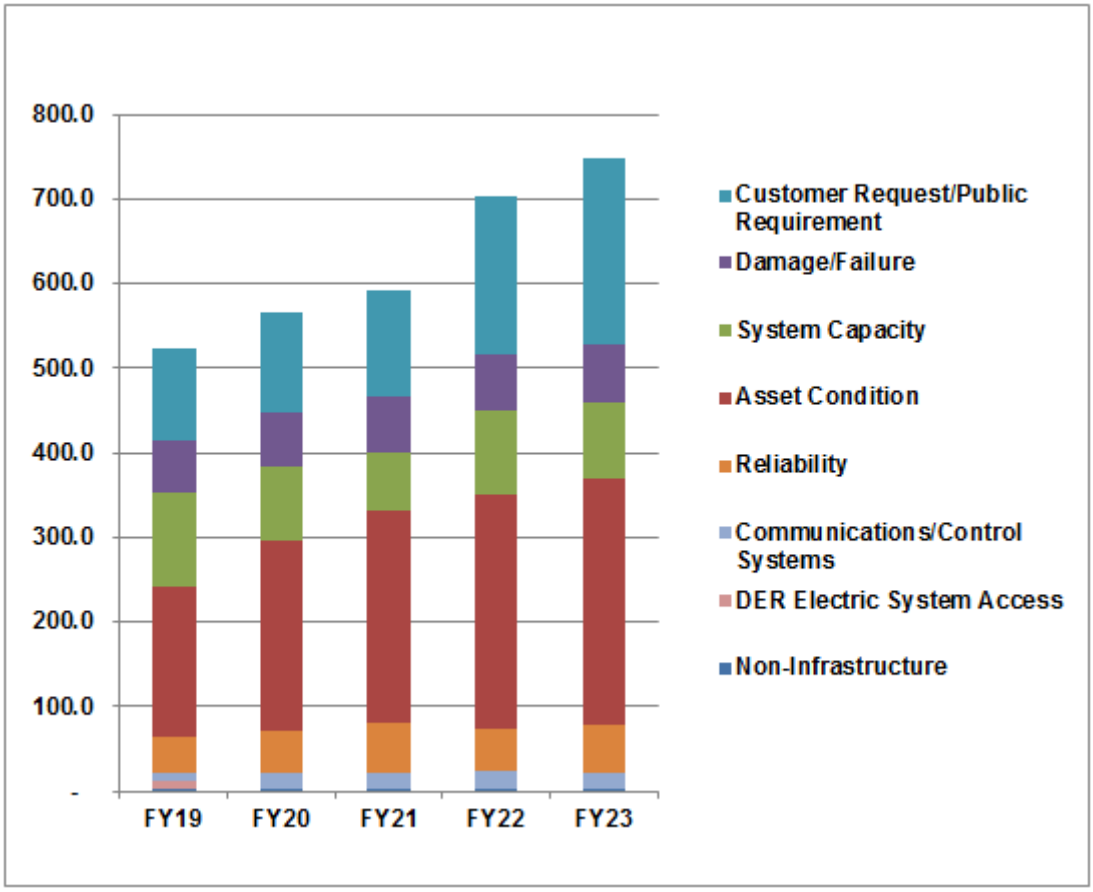
Non-Infrastructure
Non-Infrastructure projects are ones that do not fit into one of the foregoing categories, but which are necessary to run the electric system. Examples in this rationale include substation physical security, radio system upgrades and the purchase of test equipment.

Investment by spending rationale for fiscal years FY19 to FY23 is provided in Table 1-2, and shown in Figure 1-1.

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

Spend Rationale	FY19	FY20	FY21	FY22	FY23	Total
Customer Request/Public Requirement	110.2	119.4	125.8	185.7	220.0	761.0
Damage/Failure	60.5	64.3	65.8	68.1	69.4	328.2
System Capacity	110.5	86.8	67.7	98.2	89.3	452.5
Asset Condition	179.1	225.5	251.3	277.0	291.6	1,224.6
Reliability	41.0	48.8	60.3	49.2	57.0	256.3
Communications/ Control Systems	9.2	19.0	18.1	21.3	17.8	85.4
DER Electric System Access	10.3	0.0	0.0	0.0	0.0	10.3
Non-Infrastructure	3.1	3.1	3.2	3.2	3.3	15.9
Grand Total	**523.9**	**566.8**	**592.2**	**702.9**	**748.4**	**3,134.2**

Figure 1-1
Investment by Spending Rationale by Year FY19-FY23 ($ millions)



Spending Rationale Totals

Approximately thirty-five (35) percent ($1,089.2 million) of planned infrastructure investment is in the Customer Requests/Public Requirements and Damage/Failure spending rationales. This work is required to address items that are generally mandatory and non-discretionary in terms of timing. Examples of such work include new business requests, municipal interconnections, capital work done to repair a portion of a distribution feeder damaged in a storm event, and facility relocations to accommodate municipal public works projects.

The System Capacity spending rationale accounts for approximately fourteen (14) percent ($452.5 million) of the total investment in the Plan, and includes investments undertaken to upgrade the capability of the T&D delivery system to provide adequate or improved thermal loading, and voltage. 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 eight (8) percent ($256.3 million) of the total investment in the Plan, and includes investments undertaken to improve stability, power quality, and reliability performance. 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 thirty-nine (39) percent ($1,224.6 million) of total planned investment. Programs in this rationale aim to mitigate future risks and consequences of potential failures caused by deteriorated assets. 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 three (3) percent ($85.4 million) of the total investment in the Plan. This spending rationale includes investments undertaken to complete work associated with installing EMS/RTU (installation of fiber optic cables and other telecommunication systems), as well as the RTU installations on the Distribution system.

The DER – Electric System Access spending rationale accounts for approximately point three (0.3) percent ($10.3 million) of the total investment in the Plan. DER-Electric System Access investments are intended to support items such as NWA implementation, microgrids, storage, DG interconnections, and other third party and market driven needs.

1. B. Investment by System

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 6,000 miles of transmission line, 310[4] transmission substations, more than 533 large power transformers, and over 809 circuit breakers at operating voltages above 69kV. To serve the needs of customers over the five-year period covered by this Plan, the Company expects to invest approximately $1,051 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	FY19	FY20	FY21	FY22	FY23	Total
Customer Requests/Public Requirements	(0.5)	2.3	3.8	0.5	0.0	6.1
Damage/ Failure	10.0	9.2	10.2	9.9	9.9	49.3
System Capacity	86.6	53.9	35.4	54.6	47.2	277.6
Asset Condition	82.6	115.0	118.6	132.7	155.3	604.2
Reliability	12.0	13.5	29.8	19.3	11.2	85.8
Communications/ Control Systems	2.2	3.5	6.5	7.7	7.8	27.7
DER – Electric System	0.3	0.0	0.0	0.0	0.0	0.3
Grand Total	**193.2**	**197.4**	**204.3**	**224.7**	**231.4**	**1,051.0**

[4] The 310 transmission substations include transmission line locations with motorized switches.

Sub-Transmission System Summary

The sub-transmission system comprises lines and substations typically operating at voltages at or below 69kV. National Grid has approximately 4,800 circuit miles of overhead sub-transmission lines and 1,100 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 $239 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	FY19	FY20	FY21	FY22	FY23	Total
Customer Request/Public Requirement	2.0	2.0	3.3	2.3	2.3	11.9
Damage/Failure	4.6	4.9	4.5	4.6	4.7	23.2
System Capacity	1.0	2.3	2.4	1.3	4.5	11.4
Asset Condition	25.6	30.7	38.5	44.3	40.2	179.2
Reliability	3.2	3.1	1.2	2.5	2.8	12.9
DER Electric System Access	0.1	0.0	0.0	0.0	0.0	0.1
Grand Total	**36.4**	**42.9**	**49.8**	**55.0**	**54.5**	**238.7**

This five-year Plan envisions significant expenditures on the sub-transmission system in the area of Asset Condition. Projects previously classified as sub-transmission station projects have now been redirected into transmission or distribution budgets.

Distribution System Summary

The Company's distribution system consists of lines and substations typically operating at 15kV and below. There are nearly 36,000 circuit miles of overhead primary wire and nearly 7,500 circuit miles of underground primary cable on the system supplying approximately 400,000 overhead, padmount and underground distribution transformers. Additionally, there are 527 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	FY19	FY20	FY21	FY22	FY23	Total
Customer Request/Public Requirement	108.7	115.1	118.7	182.9	217.6	743.0
Damage/Failure	45.9	50.2	51.1	53.6	54.8	255.6
System Capacity	22.9	30.6	30.0	42.3	37.6	163.5
Asset Condition	71.0	79.8	94.2	100.1	96.1	441.2
Reliability	25.7	32.2	29.3	27.4	43.0	157.6
Communications/Control Systems	7.0	15.5	11.7	13.7	10.0	57.8
DER Electric System Access	10.0	0.0	0.0	0.0	0.0	10.0
Non-Infrastructure	3.1	3.1	3.2	3.2	3.3	15.9
Grand Total	**294.3**	**326.5**	**338.1**	**423.2**	**462.5**	**1,844.5**

This Plan envisions the majority of investment in the distribution system will be in the Customer Requests/Public Requirements, Asset Condition, and Damage/Failure spending rationales.

1. C. Significant Investment Areas Addressed by 2018 Plan

The 2018 Plan is designed to effectively address system investment needs, which include emergent as well as long-term issues. Among the significant investment areas addressed in this year's Plan are:

- Asset Condition
- Generator Retirements
- Storm Resilience
- Reforming the Energy Vision
- Non-Wires Alternatives

Asset Condition
Asset Condition issues represent over 40 percent of the total capital investment in the Plan. Asset Condition investments proactively addressing deteriorated assets before they fail, 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.

Generator Retirements
The Plan includes several generator retirement related projects in the System Capacity spending rationale that 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, capital projects to address unannounced retirements are difficult to develop. To the extent future generator retirement announcements affect the Company's investment needs, the Company will adjust subsequent investment Plans.

Storm Resilience Investments
The Plan includes several projects specifically intended to address storm hardening and resiliency efforts. In addition to specific storm hardening projects, storm hardening-related costs also are reflected in other projects and programs in the form of enhanced standards or equipment costs. A hardened system will reduce reliability impacts caused by increasingly volatile weather and storm events, but will take many years to implement.

Reforming the Energy Vision ("REV")
Since initiation of the REV proceeding in April, 2014, the Company has actively participated in many collaborative forums and technical conferences. On June 30, 2016 the Company filed its initial Distributed System Implementation Plan ("DSIP"). Many of the T&D capital investments identified in the initial DSIP are included in this capital plan, including investments in telecommunications, additional system monitoring and distribution automation for reliability and volt-var optimization. The Company expects to issue its next DSIP by June 30, 2018 describing plans to continue to progress at the Distributed System Platform ("DSP") provider.

A key enabling element identified in the DSIP is a program to implement Advanced Metering Infrastructure ("AMI") meters. As part of the Joint Proposal filed in Case 17-E-0238, the Company committed to convene a collaborative with Department of Public Service Staff and other interested parties to refine and update its AMI business plan, with one objective being the presentation of an updated AMI business plan to the Commission by October 2018.

This CIP also includes the Company's capital costs for the demonstration projects being developed and implemented to test various elements associated new market based opportunities for DER and develop the Company's DSP capabilities.

Non-Wires Alternatives
The non-wires alternative ("NWA") processes/guidelines are continuously under review and are periodically updated in conjunction with new REV, NYS Joint Utility or internal input. Implementing the NWA process internally and socializing it externally will create necessary consistency with the other NYS utilities and move toward a cohesive NWA process that helps animate markets, create realistic expectations for Distributed Energy Resources ("DER") stakeholders, increase DER sourcing and ultimately save money for National Grid customers. Exhibit 5 lists over one dozen projects being evaluated for potential NWA solutions.

Rate Impacts
The Company prepared a simplified analysis to estimate the isolated revenue requirement effects in fiscal years 2019, 2020 and 2021 associated with the proposed capital investment levels included here, as well as an estimate of the associated per kWh rate impact on a residential SC1 customer assuming the resulting revenue requirement were reflected in rates. For a typical residential SC1 customer, the allocated per kWh cost resulting from the investment levels included in the Plan would be $0.00212/kWh in FY2019; $0.00408/kWh in FY2020; and $0.00621/kWh in FY2021. Details of the simplified analysis are included in Exhibit 4 of this filing.

1. D. Developing the Capital Investment Plan

The Capital Investment Plan is based on the Company's current assessment of the needs of the electric delivery system over the Plan period. Investment plan levels for FY19-FY21 are also reflected in the Joint Proposal filed January 19, 2018 in Case 17-E-0238.

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 (i.e., 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 for any given project is based on several different factors including, but not limited to: project in-progress status, risk score, scalability, and resource availability. In addition, when it can be accomplished, the bundling of work and/or projects is analyzed to optimize the total cost and outage planning.

Because of the time horizon over which the Company must budget its infrastructure investments, there are inevitable changes in budgets and project estimates over time. 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, also drive changes in the Plan budget.

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, and the budgets for those projects are accordingly less refined and are 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 Staff.

The Company uses different approaches to deliver the investment 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.

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 that include substantial financial consequences, results in a capital investment 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 Five Year Capital Investment Plan. The document is segmented 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 6,000 miles of transmission line, 310 transmission substations,[1] 533 large power transformers, and 809 circuit breakers at operating voltages above 69kV. The Company expects to invest approximately $1,051 million on the transmission system over the next five years as shown in Table 2-1 below.

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

Spend Rationale	FY19	FY20	FY21	FY22	FY23	Total
Customer Requests/Public Requirements	-0.5	2.3	3.8	0.5	0	6.1
Damage/ Failure	10	9.2	10.2	9.9	9.9	49.3
System Capacity	86.6	53.9	35.4	54.6	47.2	277.6
Asset Condition	82.6	115	118.6	132.7	155.3	604.2
Reliability	12	13.5	29.8	19.3	11.2	85.8
Communications/ Control Systems	2.2	3.5	6.5	7.7	7.8	27.7
DER – Electric System	0.3	0	0	0	0	0.3
Total	**193.2**	**197.4**	**204.3**	**224.7**	**231.4**	**1,051.00**

The remainder of this chapter briefly describes major investment programs that comprise a significant portion of the Company's overall five-year transmission Capital Investment Plan ("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 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 filing to the PSC, most recently filed October 1, 2017.

[1] The 310 transmission substations include transmission line locations with motorized switches.

2. A. Customer Requests/Public Requirements

Transmission investments in this spending rationale can include 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. The Company does not anticipate any significant non-reimbursable Customer Requests/Public Requirements transmission projects over the 5-year period of this Plan.

LaFarge Relocation (C079454)

Drivers:
The customer, LaFarge Holcim US LTD, notified National Grid that they will be exercising their right to have approximately 2 miles of the 115kV T5080 Lafarge-Pleasant Valley #8/T5940 Feura Bush-North Catskill #2 transmission circuit that currently crosses their property relocated due to quarry expansion plans. National Grid crosses the LaFarge property under an agreement from 1962.

Customer Benefits:
The relocation will accommodate the customer's plan to expand the mine footprint. Currently the double-circuit 115kV transmission line encumbers the western edge of the proposed mine expansion area.

The customer will provide National Grid with a substitute line location across a reclaimed portion of the mine, thus avoiding future relocations.

2017 to 2018 Variance:
This project was not in the 2017 Plan.

Table 2-2
Transmission – LaFarge Relocation
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	0.0	0.0	0.0	-	0.0
2018	-	0.2	1.5	3.8	0.5	0.0	6.0

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 5-year period of this Plan.

Leeds – LS2 Reactor Replacement (C078782 - $1.7M)

This damage/failure project was created to replace the LS2 reactor that failed at Leeds substation due to arcing.

Drivers:
The reactor failed and needed to be replaced.

Customer Benefits:
The replacement of the reactor helps maintain the reliability of the system.

2017 to 2018 Variance:
This project was not in the 2017 Plan.

Table 2-3
Transmission – Leeds-LS2 Reactor Replacement (C078782)
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	0.0	0.0	0.0	-	0.0
2018	-	1.7	0.0	0.0	0.0	0.0	1.7

2. C. System Capacity

There are three significant areas of transmission system investment in the System Capacity spending rationale in the next five years: generator retirements, NERC/NPCC standards, and transmission owner led system studies.

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. In this Plan, the Company has included several transmission projects

intended to mitigate impacts of the closure or potential closure of the Huntley and Cayuga generating facilities.[2] Projects related to Dunkirk were completed in FY16.
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 participates actively in NYISO working groups that monitor generator retirements, and is working with the NYISO and other transmission owners in an effort to assess impacts of potential generator retirements across the state. To the extent future generator retirement announcements affect the Company's investment needs, the Company's subsequent investment Plans will reflect those investment needs.

2 C.2 Transmission Owner Led System Studies

These projects are the result of studies performed by the Company's Transmission Planning department. 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 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.

Eastern NY Division Reinforcements

Reinforcements in the Northeast region are focused on the Saratoga and Glens Falls areas of the Company's eastern division. These reinforcements address thermal and voltage needs that arise from accelerated load growth, particularly at Luther Forest Technology Campus ("LFTC"). The major components in this program include:

- Rebuild the Mohican-Battenkill #3 and #15 lines between Mohican and Battenkill substations and reconductor 14.2 miles of the #15. This is an Article VII project presently under construction. (C034528 - $1.3M)
- Installation of the Lasher Road Switching Station and line tap (C064726 & C064727 - $15.0M, and C043672 - $1.2M, respectively) and the Schaghticoke Switching Station and line tap (C060252 & C062925 - $8.4M, and C060253 - $.8M, respectively). These switching stations are associated with the load growth at LFTC. The Company is presently in the Article VII Amendment process.
- Installation of a cap bank at Ticonderoga. (C060254 - $2.9M)

Other reinforcements in the Company's eastern division are focused in the Capital and Hudson areas. The major components in this program include:

[2] The Huntley retirement gives rise to the need for a new control house in the switchyard to relocate National Grid owned controls and batteries from NRG's plant. This is being combined with other asset condition work and discussed in more detail in the Asset Condition section of this Plan.

- Installation of reactors on #19 and #20 lines at Rotterdam. The reactors will increase the impedance of these lines, thus reducing power flow on them to a level that is within their thermal rating. (C069548 - $1.8M)
- Reconductor twelve miles of the Rotterdam-Curry line #11 to relieve potential contingency overloads. (C060243 - $9.7M)
- Replacing breakers at North Troy (C069438 - $0.3M) and Rotterdam (C049605 - $1.2M) due to inadequate interrupting capability.
- Reconfigure the Rotterdam 115kV connections of the TB6 and TB7 transformers on the 99G and 33G buses. This reconfiguration will relieve stress on all the Rotterdam 230/115kV transformer banks. (C060255 - $0.3M)
- Reconductor/Rebuild the thermally-limited portion of the Maplewood #19/#31 lines (C069466 - $13.1M). Reconductor/Rebuild the thermally-limited portion of the Menands #10/#15 Lines (C068850 - $0.7M).
- Add a 35 MVAR 115kV capacitor bank at Rosa Rd to correct post contingency voltage (C069467 - $1.3M).
- Conversion of the normally open 115 kV bus-tie to create a three-terminal circuit, Grooms Rd – North Troy – Maplewood 115 kV, to resolve area thermal constraints. (C069452 - $1.4M)
- Reconductoring of the thermally limited Albany – Greenbush #1 & 2 115 kV circuits. (C077034 - $3.0M)

Drivers:
The transmission system serving the Northeast Region is currently exposed to post contingency thermal overloads on certain transformers at Rotterdam and the Mohican-Battenkill 115kV Circuit during summer peak periods. These conditions present a need to relieve 115kV thermal overloads which affect the transmission supply to the Northeast Region and to add transformation capacity.

Projected load growth at the Global Foundries (GF) chip-manufacturing plant at the Luther Forest Technology Campus (LFTC) site and the surrounding area further stresses transmission system performance issues within the Northeast Region, and drives the addition of the second Eastover transformer and of the Lasher Road and Schaghticoke Tap Switching Stations.

The transmission system serving the Capital/Hudson area is also currently exposed to post contingency thermal overloads during summer peak periods. These overloads affect the #19 and #20 lines, the #11/8/10 Rotterdam–Menands line, the Maplewood #19/31, and the Menands #10/15 lines.

The eastern division experiences some post contingency low voltage concerns. To mitigate these voltage issues, a capacitor bank will be installed at the Rosa Road station.

Customer Benefits:
These improvements will strengthen the transmission network and ensure adherence to reliability standards. They will correct existing asset condition, safety, and environmental concerns, and resolve existing thermal and voltage problems, and allow for the load

growth currently projected at LFTC. Significant load shedding would otherwise be necessary to relieve projected overloads without the proposed projects.

In addition, the reinforcements in eastern New York will reduce dependence on local generation for reliability of service within the region. Without local generation available during the summer periods, the Spier-Rotterdam 115 kV circuits will be exposed to single contingency overloads until the local generation is returned to service. This in turn could require load shedding at or near LFTC for relief. This situation will be resolved with the Mohican-Battenkill reconductoring.

2017 to 2018 Variance:
The variance between the 2017 and the 2018 Plans is due in part from partial completion of the Mohican-Battenkill #3 & #15 rebuild project. Additionally, many area reconductoring projects have made significant progress, thus decreasing the capital spend.

Table 2-4
Transmission – Eastern NY Region Reinforcement
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	25.4	32.7	21.9	4.5	0.0	-	84.6
2018	-	36.3	13.0	7.2	4.7	1.1	62.3

Western NY Region Reinforcements

This program involves significant capital expenditure over the next five years and beyond to construct reinforcements of the 115kV transmission system in western New York, including the Southwest and Genesee regions that extend from the Buffalo area east to Mortimer Station and south to the Pennsylvania border. This program will strengthen the transmission network and ensure adherence to reliability standards. It will correct existing asset condition, safety, operational and environmental concerns resulting in improved reliability of several circuits.

The major components in this program with investment levels greater than $1 million (costs shown are for the period covered by this Plan) include:

- Install Capacitor Bank at Golah Substation (C064868 - $1.3M)
- Install 2nd Capacitor Bank at Batavia Substation (C031478 - $2.8M)
- Swap terminal positions of Lockport – Mortimer #113 & #114 115 kV circuits at Mortimer to prevent contingent low voltage conditions. (C060248 - $1.1M)
- Reconductor 3.7 miles of the Niagara-Packard #191 circuit to resolve thermal constraints.(C079489 - $6.2M)
- Reconductor/Rebuild the thermally constrained portions of the Packard-Huntley 130 and Walck-Huntley 133 circuits. (C079500 - $13.0M)
- Reconductor 3.4 miles of the Niagara-Packard #192 circuit. (C079503 - $5.4M)

- Reconductor 16.9 miles of the Packard – Erie #181 115 kV circuit to alleviate area thermal overloads (C060215 - $65.1M)

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. Studies initially performed in 2007 and repeated in 2012, 2013, 2014 and 2015 evaluated the system for existing load levels up to a 15 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 Southwest Region, multiple reinforcement projects are required to correct all N-1 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. The NYISO selected project does not address overloads on the National Grid local area 115 kV 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.

2017 to 2018 Variance:
The variance between the 2017 and 2018 Plans is largely a result of reconductoring a significant portion of the Packard – Erie #181-922 circuit. This project causes major spend increase throughout the CIP timeframe, with major capital investments in FY22-23. Additionally, several other reconductoring projects have been added to the current CIP timeframe in response to the NYISO Public Policy project selection.

Table 2-5
Transmission – Western NY Region Reinforcements
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.4	0.8	0.0	0.0	0.0		3.2
2018	-	5.9	2.9	2.8	43.3	39.8	94.7

Central NY Region Reinforcements

Syracuse Area Reinforcements

The Syracuse Area Reinforcements program is focused on system improvements in and around the Syracuse area that resulted from annual studies performed prior to 2015. 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 NERC standards (C043995 - $47.1M).
- Reconductoring 8.6 miles of the GE-Geres Lock #8 115kV line to replace the 4/0 AWG 7 strand copper and 336.4 KCM ACSR 18/1 “Merlin” which have been identified as limiting elements. Also replacing HS copperweld and steel shield wire will with 3/8” EHS shield wire (C047835 - $9.7M).
- Replacement of five overdutied circuit breakers at Ash Street 115 kV substation.(C043424 - $1.2M)

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 and reconfiguration of the Clay substation 345/115kV transformer capacity. 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.

2017 to 2018 Variance:
The primary variance between the 2017 and 2018 Plans is due to a change in the forecasted years of the Clay-Teall #10 and Clay – Dewitt #3 reconductoring and updated planning grade project estimates. Additionally, a breaker replacement project was added to the CIP timeframe to alleviate overdutied breakers.

Table 2-6
Transmission – Syracuse Area Reinforcements
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	28.4	12.6	5.2	0.0	0.0		46.1
2018	-	20.1	29.0	9.0	0.0	0.0	58.1

Elbridge WoS Reactors (C069531 - $5.2M)

Generation changes in the western half of the state will result in significant thermal constraints on its local 115 kV facilities. These constraints are due to an additional flow on the western 115 kV network from the Oswego complex to accommodate for the generation loss. To alleviate these overloads, five reactors of various sizes will be installed on each of the 115 kV circuits listed below:

- Hook Road – Elbridge #7
- Mortimer – Elbridge #2
- Border City – Elbridge #15
- Slight Road – State St #3
- Woodard – Elbridge # 4

Drivers:
Currently, the transmission system for the western half of the state is sensitive to topology and generation changes, resulting in constraints. This sensitivity drives the need for system reinforcements to mitigate these issues.

Customer Benefits:
This project would allow for continued reliable operation of the western transmission system under contingent scenarios.

2017 to 2018 Variance:
This project continues to proceed as planned.

Table 2-7
Transmission – Elbridge WoS Reactors
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.25	0.25	0.5	4.5	-	-	5.5
2018	-	0.2	0.5	4.5	0.0	0.0	5.2

Porter #3/#7 Reactors (C060241 - $0.1M)

The Porter – Yahnundasis #3 line was found to be overloaded for N-1 conditions and above STE for N-1-1 conditions. In addition, the Oneida – Yahnundasis #7 line was found to be overloaded above LTE for N-1-1 contingencies. To address these overloads, a reactor will be installed on the #3 line, and a second reactor installed on the #7 line.

Drivers:
Presently, a number of contingencies, including single-element outages, result in thermal overloads on the Oneida – Porter #7 and Porter - Yahnundasis #3 lines.

Customer Benefits:
This project will resolve normal loading and contingency outage exposure and improve reliability of the Oneida 115kV transmission system.

2017 to 2018 Variance:
The project investment forecast years have changed, but the investment total remains the same.

Table 2-8
Transmission – Porter #3/#7 Reactors
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	1.8	0.1	0.0	0.0	0.0	-	1.9
2018	-	0.1	0.0	0.0	0.0	0.0	0.1

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 – Frontier Region

Golah Substation Rebuild (C051831 – 2.7M)

E. Golah 2nd 115kV Tap (C051829 – 1.0M)

The E. Golah substation is fed off a 115 kV radial tap emanating from the Golah substation. The loss of this radial tap will result in an 806 MWh outage criteria violation. To address this criterion violation, the 115 kV Golah substation will be reconfigured into a straight bus and a second 115 kV tap will added at the E. Golah substation.

Drivers:
Presently, the loss of the single 115 kV radial tap at the E. Golah substation results in a loss of all load at the substation and a 806 MWh criterion violation.

Customer Benefits:
This project will improve the service reliability at the E. Golah substation by adding a second service feed to the substation.

2017 to 2018 Variance:
This project now includes the addition of the $1.0M E. Golah second 115kV tap.

Table 2-9
Transmission – Golah Substation Rebuild
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	-	0.0	0.06	0.6	2.0	0.0	2.7
2018	-	0.07	0.9	1.8	1.0	0.0	3.8

Western Division – Southwest Region

West Ashville Substation (C043833 - $6.7M)

This project provides a 115-34.5kV station with one 15/20/25 MVA transformer and two 34.5kV circuits. The 115kV supply will be looped in-and-out of the new station and require less than 1 mile of new construction. There is a related sub-transmission project to connect the new station to the existing Ashville-Sherman Line 863 (C043832 - $0.9M).

Drivers:
The sub-transmission network in Chautauqua County is supplied by three 115-34.5kV stations. Certain line or transformer outages will result in voltages below 31kV on parts of the system.

Customer Benefits:
These projects will resolve contingency outage and voltage exposure and improve reliability of the Chautauqua South 34.5kV sub-transmission system. The project will also add approximately 14MVA of capacity to the system to provide for future load growth.

2017 to 2018 Variance:
The projected investment is shown in the table below and variation year on year is due to the scope and timing of the specific project.

Table 2-10
Transmission – West Ashville Substation
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.9	5.7	1.8	0.0	0.0	-	8.5
2018	-	5.2	2.4	0.0	0.0	0.0	7.6

Western Division – Frontier Region

New Harper Substation ("Royal Ave Station") (C044874 & C044594 - $10.7M)

This project and associated projects relate to a new 115-13.2kV substation with two 24/32/40 MVA transformers and eight 13.2kV feeders which will replace the existing Harper station. This substation will become the supply to two industrial customers as well as three 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.

2017 to 2018 Variance:
The project investment continues as planned.

Table 2-11
Transmission – New Harper Substation ("Royal Ave Station")
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	1.7	6.8	2.2	-	10.7
2018	-	0.0	1.7	6.8	2.1	0.0	10.7

Elm Street Relief – Add 4th Transformer (C049594 - $3.3M)

This project adds a fourth 230-23kV transformer to Elm Street station in downtown Buffalo as well as replaces all 23kV breakers with an interrupting rating of less than 40kA.

Drivers:
Elm Street station supplies the Buffalo LVAC network, spot network loads and several distribution stations. The station has three transformers 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 one transformer.

Customer Benefits:
This project restores the capability of the station to supply load for two transformers in service and provides for some limited load growth.

2017 to 2018 Variance:
The variation year on year is due to the scope and timing of the specific project.

Table 2-12
Transmission – Elm Street Relief – Add 4th Transformer
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.0	0.05	0.0	0.0	0.0	-	2.0
2018	-	3.1	0.2	0.0	0.0	0.0	3.3

Riverbend Area Reinforcements

These projects reinforce 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 projects. The transmission line projects and Ohio Street 115-34.5kV station with two 30/40/50MVA transformers and six (6) 34.5kV feeders will provide a new supply to the existing and future sub-transmission customers and new distribution station in the area. The existing 34.5kV as supplied from Ridge is not capable of supplying the new loads. The existing 34.5kV system also has reliability issues due to trees and animals as it crosses wetlands in a nature preserve near the Lake Erie shore. These projects will provide limited relief to the 23kV system supplied from Seneca Terminal Station.

The suite of projects includes:

- Airco-Buffalo River 147 Adv Metal Tap (C054711 - $1.1M)
- Gardenville-Buffalo River 146 Tap Ohio Station (C054713 - $2.4M)
- Ohio Street New 115-34.5kV Substation (C055263 - $7.9M)
- Ridge Substation – 34.5kV System Relay Upgrades (C046693 - $1.2M)

Customer Benefits:
These projects will 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 will improve 34.5kV system reliability by completing a new supply on the customer side of the nature preserve.

2017 to 2018 Variance:
The variation year on year is due to the scope and timing of the project.

Table 2-14
Transmission – Riverbend Area Reinforcements
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	7.6	5.6	0.0	0.0	0.0	-	13.2
2018	-	10.8	1.2	0.6	0.0	0.0	12.6

Central Division – NorthernRegion

Malone Metalclad and Transformer (C069306 - $6.2M & C059673 $0.4M)

The loss of the 115/13.8 kV transformer TR#3 at the Malone substation will result in a violation of MWh service criteria. To address this criterion violation, a 115/13.8 kV transformer TR#4 will be added at the Malone substation with additional service 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), violating the 240 MWh criteria, since there are no 13.2 kV 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.

2017 to 2018 Variance:
This project is proceeding as planned.

Table 2-13
Malone Metalclad and Transformer
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	0.04	0.4	2.1	-	2.5
2018	-	0.0	0.04	0.4	2.1	4.0	6.6

2. D. Asset Condition

Asset Condition expenditures are investments required to reduce the likelihood and consequence of the failure of transmission assets, such as replacing elements of overhead lines, underground cable or substation equipment. This Plan reflects greater reliance on the purchase of spare equipment to replace damaged equipment that may fail 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 based on "end of useful life" criteria, especially for transmission line refurbishment projects. Close monitoring of system performance as it relates to asset condition causes will remain necessary.

For overhead lines specifically, this Plan seeks to achieve compliance with National Electrical Safety Code ("NESC") requirements, and will continue to implement the recommendation from Staff's 2010 rate case testimony to refurbish overhead transmission line 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 lines, unless a compelling justification can be provided for the full refurbishment. Any overhead line 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 right-of-ways 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 evaluated to determine if it is the most economical scope of work for the benefit of customers. Further detail on specific asset condition programs and projects is given below.

NY Inspection Repairs - Capital

The goal of this program (C026923 - $60M), is to replace damaged or failed components on the transmission overhead line system identified during field inspections (five-year foot patrols).

Drivers:
These programs assure 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 2005 Safety Order 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.

2017 to 2018 Variance:
The increase in forecasted capital spend is due to average actual spend for the NY Inspection program being $11.5M per year for the period FY14 – FY16. With aging transmission infrastructure the Company expects the amount of work from the inspection program remaining at a consistent level.

Table 2-15
Transmission – New York Inspection Projects
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	12.0	15.0	12.0	12.0	12.0	-	63.0
2018	-	12.0	12.0	12.0	12.0	12.0	60.0

Wood Pole Management

This program (C011640 - $11.0M) assures that wood transmission lines 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 Report on the Condition of Physical Elements of Transmission and Distribution Systems, Case 12-E-0201, October 1, 2017, 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 damaged by woodpecker or insect activity will be replaced. The ground line inspection and treatment of wood poles is performed approximately every 10 years. These inspections are in addition to the five-year foot patrol which is required under the Commission's 2005 Safety Order in Case 04-M-0159. The wood poles targeted 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 woodpecker damage, insect damage, or rotting and therefore these poles are 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.

2017 to 2018 Variance:
Future spending levels are based on an annual inspection rate of 10% of the Company's wood pole plant and 1% pole reject rate.

Table 2-16
Transmission – Wood Pole Management
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	1.5	2.5	2.5	2.5	2.5	-	11.5
2018	-	2.0	2.0	2.0	2.5	2.5	11.0

Battery Replacement Program (C033847 - $2.3M)

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

Drivers:
National Grid'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.

2017 to 2018 Variance:
Future spending levels are expected to remain mostly consistent to the prior Plan with added battery replacements forecasted to be needed in FY20 and FY21.

Table 2-17
Transmission – Battery Replacement Program
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.2	0.7	0.5	0.6	0.3	-	2.2
2018	-	0.7	0.5	0.6	0.3	0.2	2.3

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% of the population requires investment based on condition, performance or obsolescence. This program will commence by replacing the worst 6% 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:

- New Scotland 345kV & 115kV (C047861 - $0.02M)
- Woodard (C047863 - $0.01M)
- Alps (C049296 - $0.005M)
- Feura Bush (C049585 - $0.5M)
- Greenbush (C049587 - $0.2M)
- Independence (C049598 - $0.3M)
- Long Lane (C049600 - $0.01M)
- Menands (C049601 - $10.2M) - includes control building replacement
- Scriba (C049611 - $0.6M)
- Seneca Terminal (C049613 - $0.2M)
- Volney Station (C049626 - $0.5M)
- Carr Street/East Syracuse Co-Gen (C049739 - $0.1M)
- Batavia (C073587 - $0.2M)
- Southeast Batavia (C073588 - $0.1M)

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.

2017 to 2018 Variance:
Some relay replacements have been deferred to manage investment priorities.

Table 2-18
Transmission Relay Replacement Strategy
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	4.8	3.1	3.2	3.4	2.1	-	16.6
2018	-	2.9	1.5	3.1	3.4	2.2	13.1

Substation Rebuilds

The vast majority 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 Gardenville, Lighthouse Hill, Rotterdam, Inghams, Oswego, Lockport, Huntley, Dunkirk, Boonville, and Oneida substations are proposed to be rebuilt, or engineering started, during the FY19 – FY23 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. Although a more coordinated, integrated approach is more consistent with long-term sustainability of the system, the ad hoc "fix on fail" approach results in lower capital costs in the short term.

Gardenville (C005156 & C030084) $13.1M

Gardenville is a 230/115kV station south of Buffalo that has two 115kV 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, feeds 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. There have been a number of misoperations that can be directly attributed to control cable issues alone in the past several years.

A new breaker-and-a-half 115kV station is to be built between the two existing stations to replace them. A new 115kV switchyard will be constructed in the western section of the site and there will be rerouting of approximately seventeen 115kV lines for the

project to eliminate the existing "criss-cross" arrangement outside of the station and eliminate line to ground clearance issues.

Rotterdam (C034850) $26.0M

The Rotterdam substation is a supply source to the surrounding transmission and sub-transmission system. A number of alternative plans for rebuilding the Rotterdam substation are under consideration. Studies of the long term transmission and sub-transmission needs of the areas east and west of Rotterdam are beginning to examine the impact of removing the Rotterdam 69kV and 34.5kV supplies.

Given the uncertainty over the 230kV station as it relates to the Energy Highway projects and the possible need to supply large loads in the Luther Forest campus, the scope and timing of the 230kV and 115kV rebuilds at Rotterdam may be impacted. Any asset issues that arise in the short term will now be managed through the normal damage / failure process.

Lockport (C035464 and C073991) $5.7M

Lockport is a 115 kV transmission station with thirteen 115 kV transmission lines tying through the East and West bus sections and serving the 115 kV 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 very poor condition and requires 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 material. The control house roof was repaired in the 1990s and brick pointing was also done to limit deterioration within the last 5 years.

Huntley (C049902 and) $13.3M

Among the Huntley substation asset condition needs are: permanent capacitor banks at the Huntley 115 kV bus to replace the mobile banks; improved grounding in the switchyard; removal of all National Grid 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 oil circuit breakers; replacing the potential transformers; installing new CCVTs for 115 kV and 230 kV relaying; and refurbishing the 230 kV cable pumping plant.

Inghams Station Re-Vitalization (C050917, C060240 and C074000) $7.2M

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 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.

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 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 500year flood zone line.

Oswego (C043426, C061991, C076218 and C076983) $31.3M

Three 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, is obsolete, and is in poor condition.

Lighthouse Hill (C031662, C073996 and C073997) $26.4M

The Lighthouse Hill facility consists of a switching station with two 115 kV buses and seven transmission lines connecting to the station, allowing power to flow from generation located on Lake Ontario to the Watertown area and Clay Station in Syracuse.

Seven OCBs are located 200 feet from the Salmon River, which is located about 70 feet below the yard elevation. The station is located about one mile up-stream of the New York State Wildlife Fish Hatchery. Although the risk is low, any significant oil spill in the station would have a detrimental environmental impact. Even at 70 feet above the river level there is also the risk of a flooding event at the station. 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. Flooding in the area occurred as recently as October 1, 2010 due to a rain event.

The recommended option of a conceptual engineering analysis is 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 of station flooding.

Dunkirk (C005155 and C073999) $31.6M

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.

The 230/120/13.2kV autotransformers differential relaying is in need of upgrading to address inadequate relaying (presently there is no tertiary differential). The 230, 115 & 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 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. 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 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 the generators and / or line breakers, and possible equipment failures.
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.

Boonville (C049903) $4.5M

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 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.

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 brick and needs reconditioning. The size of the building has also become an issue with the

addition of EMS and relay upgrades over time, and the station perimeter fencing needs replacement on 3 sides.

Oneida (C034443) $6.5M

Oneida substation is a 115kV–13.8kV substation located in Verona, NY originally constructed in the 1940s. The substation includes two LTC power transformers, nine 115kV circuit breakers, one 115kV capacitor bank with circuit switcher, a metal-clad switchgear with eight 13.8 kV feeders, and two 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 since a line outage is required. The two 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 suggested two phases pertaining to the substation rebuild. The first phase to replace the two 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 FY20.

Terminal Station Relocation (C076242) $10.9M

Terminal Station was constructed in 1962 and is a 115kV to 13.2kV two-bank distribution station with seven (7) distribution feeders and four (4) network feeders. Due to its history as a transmission station, the station is listed as a FERC transmission station. All of its distribution feeders derive from a Westinghouse metal-clad arranged in a breaker and a half scheme. The station is fed from the 115kV Porter #6 transmission line and the 115kV Schuyler #7 transmission line.

The station is below the 100 years 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 oil circuit breakers 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 TB2 was also recommenced due to oil leaking issues 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 National Grid using open air 15kV 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 in order 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.

Drivers:
The substations mentioned above have all been identified as having asset condition or configuration issues that warrant a major station rebuild or upgrade.[3] 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.

2017 to 2018 Variance:
Substation rebuilds continue with some projects being deferred to manage short term capital spending.

Table 2-19
Transmission – Substation Rebuilds
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	43.1	38.8	43.5	45.4	66.6	-	237.4
2018	-	30.6	27.6	27.0	25.0	66.2	176.4

Overhead Line Refurbishment Program

Over the next five years, the Company will refurbish a number of overhead lines 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

[3] "Report on the Condition of Physical Elements of Transmission and Distribution Systems," October 1, 2017, Pages 57-64.

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 or not 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 lines 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 five-year Plan, the Company is implementing an approach recommended by DPS Staff in the Company's 2010 rate case to refurbish only those overhead transmission line 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 is based on the assumption that issues identified during routine foot patrols (Level 1, 2 or 3 issues) will be addressed through the Damage / Failure program. Where we suspect 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 OHL refurbishment projects in this Plan are listed below; details are included in Exhibit 6 – Overhead Line Refurbishment Projects.

- Alabama-Telegraph 115 (C033014 - $6.1m)
- Border City-Elbridge 15 (C075723 - $4.3M)

- Gardenville-Dunkirk 141 & 142 (C003389 - $73.6M)[4]
- Gardenville-Homer Hill 151 152 (C027425 - $4.4M)
- Greenbush-Stephentown #993 (C060208 – $5.6M)
- Huntley-Lockport 36 37 (C069538 - $16.6M)
- Lockport-Batavia 112 (C003422 - $15.5M)
- Mortimer-Pannell 24 25 (C047816 - $14.3M)
- Pannell-Geneva 4 4A (C030889 - $41.2M)
- Ticonderoga 2 & 3 (C039521 - $20.1M)
- Frontier 180/182 ACR/Reconductor (C027436 - $2.5M)
- Dunkirk-Falconer 161/162 ACR (C047831 - $1.2M)
- Spier-Rotterdam 2 Shieldwire Replacement (C050744 - $2.2M)
- Brockport Tap Refurbishment (C055531 - $2.0M)
- Batavia-Golah 119 ACR (C060217 - $3.6M)
- Ticonderoga-Whitehall 3 Mt Defiance Relocation/Rebuild (C078570 - $1.6M)

Drivers:
The Company has over 6,000 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 lines 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.

2017 to 2018 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 2-20
Transmission – Overhead Line Refurbishment Program
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	7.4	27.2	45.6	73.4	90.7	-	244.3
2018	-	18.5	47.2	48.2	59.0	47.4	220.3

[4] $4.5M was transferred from project C003389 into project C076951 for land acquisition in the Gardenville to N. Angola #141 and #142 rebuild.

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.

With the previous exceptions, this Plan utilizes a replace on fail approach with failures managed through the use of strategic spares. 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.

Teall Ave (C047865 - $0.6M) - Two 115/34.5kV 24/33/40MVA transformers are needed to replace the existing single phase 1930, 1941, & 1945 transformers due to their asset condition and DGA analysis. This upgrade would also provide adequate capacity for future load as determined by distribution planning. This is currently in preliminary engineering and the transformers should be in service in FY18.

Seneca TB#2 and #5 (C069427 - $5.5M) – There is a family history of failure of this transformer design. The #4 transformer at Seneca failed in 2014 and the #1 transformer is in the process of being replaced. The #2 & #5 transformers are 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 - $8.3M) - 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 - $5.4M) - both are transformers on the NY watch list; they have hotspots and arcing under oil and high moisture-in-oil levels.

Inghams (C047864 - $4.5M) –The allowable phase shifting transformer angle range is limited during high Central-East transfer conditions with Fairfield wind generation at full output. For certain design contingencies, and if Fairfield generation is at full output, line #3 becomes overloaded and the phase shifting transformer is out of adjusting range. Under an N-1-1 condition, with a long term outage of the phase shifting transformer, and when breaker R81 cannot be closed separating the Ingham's 77G and 99G buses, voltages at various 115kV buses east of Ingham's station will be at 0.91~0.92 pu. This is not acceptable if the outage lasts for an extended period.

There is not a spare phase shifting transformer in the New York system and if it were to fail it would take between 18-24 months to replace due to its specialty internal design. This would not be acceptable for system reliability and system stability. Asset Management will purchase a spare phase shifting transformer that will be designed to meet the needs of the Transmission Planning study for future growth of the 115kV system east of Ingham's.

Woodlawn (C051986 - $4.8M) – 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 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 single-phase transformer design makes emergency replacement with a three-phase unit very difficult.

Hoosick (C053132 - $6.6M) and Mohican (C053133 - $6.8M) – both are transformers on the NY watch list due to hotspots and arcing under oil and high moisture-in-oil levels.

Ash Street (C076282 - $1.6M) - 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 TB#3 (C076283 - $5.4M) - The station has one Westinghouse 115/69/12kV 20/3.43 MVA autotransformer manufactured in 1935. This transformer feeds one 69kV line #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 115-69 kV auto transformer in the NY system.

Telegraph Road TB#2 (C069346 - $1.3M) - The scope of work for this project includes the purchase and installation of a new 115-34.5kV 30/40/50 MVA transformer, high side protection, and transformer relay protection upgrades at the Telegraph Road station. Also in the workscope is replacing the high side circuit-switcher on the #1 transformer due to its asset condition.

Drivers:
In the next five years the investment plan is to replace twelve transformers with anomalous DGA results that have been 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.

2017 to 2018 Variance:
The variance is due to timing adjustments to accommodate other capital projects.

Table 2-21
Transmission – Transformer Replacement Program
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.7	11.9	16.8	12.7	3.0	-	47.1
2018	-	2.8	10.4	9.3	16.0	12.4	50.9

Spare Transformers Purchase (C053135 - $12.5M)

Drivers:
The Company is purchasing the following spare system transformers to maintain the transformer fleet for proper availability in the event of the loss of a transformer due to damage/failure:

- 345-230kV 332 MVA Auto
- 345-115kV 448 MVA Auto
- 115-13.8kV LTC 25 MVA
- 115-13.8kV LTC 40 MVA
- 115-34.5kV LTC 25 MVA
- 115-34.5kV LTC 40 MVA
- 240-24kV 100 MVA Auto

Customer Benefits:
The planned replacement of the system spares reduces the lead time to long-term interruptions of the transmission system in the event of a failure.

2017 to 2018 Variance:
This project is proceeding as planned.

Table 2-22
Transmission – Spare Transformer Replacements
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	4.7	8.0	5.8	0.0	0.0	-	18.5
2018	-	2.0	3.4	5.4	0.4	1.3	12.5

Seneca Reactor 71E Replacement (C065766 - $1.2M)

Drivers:
The GE 230kV 27.5MVA 71E shunt reactor is failing as determined by the Company's O&M Services department and Doble testing. The symptoms are the same as the 72E reactor that failed in 2008.

Customer Benefits:
The planned replacement of the Seneca Reactor 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.

2017 to 2018 Variance:
This project is proceeding as planned.

Table 2-23
Transmission – Seneca Reactor 71E Replacement
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	1.0	1.3	0.0	0.0	-	2.3
2018	-	0.1	1.1	0.0	0.0	0.0	1.2

Edic Station Protection Migration (C076214 - $6.2M)

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.

2017 to 2018 Variance:
The additional cost for the project was updating the estimate from an Investment grade level, which also included taking into account time-frames from the existing Edic substation projects to migrate similar assets.

Table 2-24
Transmission – Edic Station Protection Migration
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.6	1.1	0.5	0.0	-	2.2
2018	-	0.05	0.8	2.1	2.9	0.3	6.2

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 oil circuit breakers 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 developed.

Drivers:
There are 700 circuit breakers installed on the transmission system. Of these, 316 are large oil volume types. Most of the circuit breakers addressed in the circuit breaker replacement strategy were installed between 1948 and 1969, are in poor condition or are the last remaining members of problematic families. There is an increasing trend of problems associated with the large volume oil circuit breaker population. Common problems include oil leaks, air leaks, bushing hot spots, high power factors and poor insulation. There have also been failures of 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.

2017 to 2018 Variance:
The Company is committed to planned replacement of circuit breakers to maintain the reliability of its transmission system through its NY Oil Circuit Breaker Replacement Program. Projects in this Plan include:

- Battle Hill (C049543 - $0.02M)
- Queensbury (C049554 - $0.4M)
- Schuyler (C049562 - $0.5M)
- Maplewood (C075867 - $0.4M)
- Whitehall (C075885 - $1.1M)
- Teall (C075902 - $0.8M)
- Woodard (C075903 - $0.3M)
- Batavia (C075904 - $2.0M)
- Homer Hill (C075942 - $2.1M)
- Packard (C075943 - $1.2M)

Table 2-25
Transmission – Circuit Breaker Replacements
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.4	1.2	3.6	2.5	1.4	-	11.0
2018	-	2.7	1.7	2.3	1.5	0.6	8.8

345kV Laminated Cross-Arm Replacement Program (C060365 - $10.0M)

The New Scotland – Alps #2 345kV line has experienced two failures on tangent (D-1501) structures within the past three years. The root cause has been identified as the ageing 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 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.

2017 to 2018 Variance:
Scheduling changes resulted in $2M deferred from FY17 to manage investment priorities.

Table 2-26
Transmission – Laminated Cross-Arm Replacement
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.4	3.0	3.0	3.0	3.0	-	14.4
2018	-	2.0	2.0	2.0	2.0	2.0	10.0

Turner Type D Switch Replacements (C052603 - $3.1M)

This project will replace all Turner Electric Company (Turner) Type D sidebreak disconnect switches. This switch model suffers from reliability problems due to incomplete closure of the switch blades during operation. The blades on this type of switch are difficult to properly latch within the switch jaw and improper closure cannot be seen from the ground. If not properly latched, over time, the blades of the switch can gradually work free from the jaw, resulting in poor contact and eventual failure.

Drivers:
The primary drivers of this strategy include both reliability and safety. The potential failure of switches during service is a risk to employees. It is not feasible to ensure that all phases of a switch are fully closed after each operation due to the variables of switch design, installation, and operation. Harsh weather, especially during winter months, poses the greatest concern for the safe operation of Turner D switches. High winds and icy conditions put strong mechanical forces on the switch arm. If the jaw is not correctly locked, a build-up of ice can push the blade out of the contact area, resulting in an arc failure.

Customer Benefits:
It has been determined that the Type D Turner switch presents a potential safety and reliability risk due to its design and problems inherent in its operation. Improperly functioning line switches prevent the transmission system from being operated most efficiently and, in some cases, not acceptable for emergency system operations.

2017 to 2018 Variance:
The program has been re-forecasted in order to spread out the installation of replacement switches over time and allow for proper outage planning and thorough engineering designs. The plan is to install 2 to 3 switch replacements per year until all Turner Type D switch have been removed from the system.

Table 2-27
Transmission – Turner Type D Switch Replacements
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	1.4	1.4	0.0	0.0	-	2.8
2018	-	0.6	0.6	0.6	0.6	0.6	3.1

Priority Overhead Line Transmission Switch Replacement Program (C076621 - $3.1M)

Drivers:
The Transmission Control Center has identified several overhead line switches that are operationally important for system stability and reliability that have been yellow-tagged as inoperable or difficult to operate. Leaving tagged switches inoperable for long periods

of time, or removing them, leaves the transmission system operationally deficient and less flexible, which is generally unacceptable for emergency system operations.
The Transmission Control Center has advised of the operational importance of maintaining full load break capabilities with our key switches. This program will address the need for replacement of key switches that have failed in the field and are considered to be a priority by the TCC.

Customer Benefits:
Properly operating transmission line switches allow for the most efficient operation of the transmission system and quicker emergency restoration.

2017 to 2018 Variance:
This program continues to proceed as planned.

Table 2-28
Transmission – Priority Line Switch Replacements
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.6	0.6	0.6	0.6	0.6	-	3.1
2018	-	0.6	0.6	0.6	0.6	0.6	3.1

Substation Equipment Replacement Requests (SERRs) (C031545 - $1.3M)

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. In FY10 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. SERRs typically require some degree of investigation and engineering to identify a solution. SERRs are also used to identify and correct transmission overhead line components that no longer meet minimum NESC requirements. This work is over-and-above that required during normal 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 capital 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.

2017 to 2018 Variance:
There is no variance from last year's Plan.

Table 2-29
Transmission – Substation Equipment Replacement Request (SERR)
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.25	0.25	0.25	0.25	0.25	-	1.3
2018	-	0.25	0.25	0.25	0.25	0.25	1.3

New Scotland R93 and R94 Asset Replacement (C062752 - $1.3M)

The circuit breakers were originally installed in 1976 and manufactured by Westinghouse, and there is limited Original Equipment Manufacturer (OEM) support and spare parts.

Drivers:
The replacement of two(2) 345kV SF6 Gas Circuit Breakers (GCB) that have been problematic due to operating mechanisms, deterioration, and overall poor condition.

Customer Benefits:
The planned replacement of the circuit breakers reduces the likelihood of an in-service failure and lengthy outage.

2017 to 2018 Variance:
This project was not in the 2017 Plan.

Table 2-30
Transmission – New Scotland R93 and R94 Asset Replacement
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	0.0	0.0	0.0	-	0.0
2018	-	0.0	0.0	0.05	0.6	0.7	1.3

Albany Steam – 115kV Asset Replacement (C079461 - $4.2M)

The Albany Steam plant contains multiple large oil circuit breakers (OCB) 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 one project for the substation.

Drivers:
The OCBs have been problematic, with two 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.

2017 to 2018 Variance:
This program was not in the 2017 Plan.

Table 2-31
Transmission – Albany Steam – 115kV Asset Replacement
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	0.0	0.0	0.0	-	0.0
2018	-	0.0	0.05	0.4	2.0	1.8	4.2

2. E. Reliability

Reliability capital expenditures are required to improve power quality and reliability performance.

Transmission Substation Physical Security ($6.5M)

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 comply with 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.

2017 to 2018 Variance:
The forecasted investment shown and variation year on year is due to project scope updates and timing of the program.

Table 2-32
Transmission Substation Security
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	4.4	1.5	1.8	1.0	0.0	-	8.7
2018	-	2.7	2.5	1.2	0.0	0.0	6.5

Porter 230kV Station Upgrade Breakers, Disconnects and Potential Transformers (C036866 - $24.0M)

Upgrades to 230kV circuit breakers and relay protection schemes at the Porter 230kV station are needed to comply with applicable NPCC system standards.

Drivers: In accordance with NPCC criteria adopted in April 2007, testing of qualifying substations across New York State was performed by the NYISO, which identified upgrades needed at the Company's Porter 230 kV station. In addition, asset condition issues related to protective relaying packages, disconnect switches potential

transformers and the 230-115kV transformer banks have been incorporated into a single station rebuild project for efficiency.

Customer Benefits:
In addition to compliance with NPCC and NYSRC requirements, the benefits of completing these projects are reductions in system vulnerability to certain severe contingencies identified in system studies. Customers throughout central New York will benefit from reduced vulnerability of the transmission system to such contingencies.

2017 to 2018 Variance:
This project continues to proceed as planned.

Table 2-33
Transmission – Porter 230kV Substation Compliance Upgrades
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.4	1.0	1.3	15.6	6.2	-	24.3
2018	-	1.0	1.3	15.5	6.2	0.05	24.0

Conductor Clearance Program (C048678 - $49.0M)

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 FY22 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 allows transmission lines meet the governing NESC under which they were constructed by improving ground to conductor clearances in substandard spans. This follows standard industry practice and the Public Service 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.

2017 and 2018 Variance:
Future spend is expected to remain consistent with levels in the prior Plan.

Table 2-34
Transmission – Conductor Clearance Strategy
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	9.4	10.0	12.1	9.8	10.2	-	51.5
2018	-	7.5	7.5	12.0	12.0	10.0	49.0

Backup Underground Pumping Plant for Trinity Line 5 & 9 (C062469 - $2.2M)

The objective of this project is to install a second (back-up) pressurizing plant at Binghamton Street (Pearl Street) for the Trinity-Albany Stream #5 and #9 circuits to eliminate the risk of a "common mode failure" of the existing pressurizing plant at Trinity Substation which would impact all four underground cables supplying Trinity substation.

Drivers:
The driver for this project is primarily reliability due to the potential risk of a common mode failure; specifically, the loss of the Trinity pressurization plant. By providing a means to maintain the Trinity to Albany Steam #5 and #9 cables in the event of a potential failure, service can be maintained to the Trinity substation. This can be accomplished by adding a second pressurizing plant at the Binghamton Street (Pearl Street) overhead to underground transition station in Albany, New York.

Customer Benefits:
Customers in the Albany area will have a decreased reliability risk resulting from a "common mode failure" at the Trinity pressurization plant that could take the Riverside to Trinity #18 and #19 as well as the Trinity to Albany Steam #5 and #9 115 kV cables out of service for an extended period of time. The second pressurizing plant would resolve the common mode failure and reduce the cost of unexpected repairs, expensive urgent restoration efforts, and offers the lowest lifetime cost approach for customers.

2017 and 2018 Variance:
This project is proceeding as planned.

Table 2-35
Transmission – Backup UG Pump Plant Trinity Line 5 & 9
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.3	1.8	0.1	0.0	-	2.2
2018	-	0.3	1.8	0.1	0.0	0.0	2.2

Elm Street: Doble ARMs Install (C079462 - $2.1M)

The Doble ARMs technology is planned to be installed at Elm Street substation as a "Proof of Concept" project. The technology is to be utilized for real-time asset health assessment for circuit breakers, and power transformers. The data is to be monitored from the equipment sent back to a database to be stored and reviewed.

Drivers:
The continuous health monitoring of the assets will allow equipment to be reviewed in an efficient manner so as to figure out if it should be replaced or stay in-service. Instead of manually having to wait for an individual to visit the substation on a time-basis and upload data on the asset to the database.

Customer Benefits:
The real-time data allows for a continuous review of the assets to make a decision on whether or not to take the equipment out of service prior to a failure.

2017 to 2018 Variance:
This program was not in the 2017 Plan.

Table 2-36
Transmission – Elm Street: Doble ARMs Install
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	0.0	0.0	0.0	-	0.0
2018	-	0.0	0.05	0.2	0.9	0.9	2.1

Osprey Mitigation/Avian Protection (C076662 - $1.5M)

To lessen continued line interruptions on the Company's transmission network due to the growing population of Ospreys between the months of April – September, when they are active in New York State, 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. The Company has addressed line outages caused by Ospreys on the Sleight-Auburn #3 115kV line by adding ten new platforms atop wood H-frame structures which is a proven alternative for the Ospreys to nest on as long as that nesting site is the highest point in the area. The Ticonderoga-Whitehall #3 and Ticonderoga-Republic #2 115kV lines also had platforms added to address interruptions.
In the last two years the Company has seen seventeen interruptions directly related to Osprey nests and many more trips listed in the Incident Data System without a direct correlation, but patrols suspected were Osprey related. Aerial patrols in the fall of 2016 found approximately 80 Osprey nests atop transmission structures in the West, Central and Eastern regions of the Company's service territory. Without further monitoring and mitigation efforts, interruptions caused by Osprey nests will continue to increase in frequency.

Customer Benefits:
With Osprey populations increasing in New York, the bird is no longer classified as 'endangered', but still considered 'of special concern' by the Department of Environmental Conservation ("DEC") and should be protected. An Osprey Mitigation Program will reduce the risk of avian related interruptions and improve system reliability.

2017 to 2018 Variance:
This program was not in the 2017 Plan.

Table 2-37
Transmission – Osprey Mitigation/Avian Protection
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	0.0	0.0	0.0	-	0.0
2018	-	0.50	0.25	0.25	0.25	0.25	1.5

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.

Upgrade Communications Equipment Due to Verizon Retirements (C069570 - $18.1M)

This program is for migrating analog leased communication circuits owned by Verizon to a National Grid owned digital network.

Drivers:
Verizon will be phasing out analog leased circuits used by National Grid for the protection of its transmission lines. The Company has seen increases in monthly recurring costs and a steady decline in circuit repair services from Verizon for analog circuits.

National Grid will start migrating these analog protection circuits to Verizon digital DS1 circuits and/or our own private fiber/microwave networks to maintain protection and communication needs.

National Grid has requested verification from Verizon on their timeline, but has not received a response as to when they will terminate these analog protection circuits. Historically, Verizon customers typically had about 18 to 24 months to migrate the circuits after Verizon announced phase out plans.

A solution proposed by Verizon to convert analog to their digital circuits does not meet all of the communications requirements outlined by National Grid's Protection Engineering. Furthermore, Verizon Fiber is not available everywhere so at some Company substations we would not have access to Verizon Fiber, giving rise to the need for a Company-owned private/microwave network.

Customer Benefits:
Upgrade of analog communication circuits is consistent with National Grid's goal of improving reliability across the system. Digital circuits enhance disaster recovery abilities, allowing communication circuits to be restored and rerouted faster during outages.

2017 to 2018 Variance:
This program is proceeding as planned.

Table 2-38
Upgrade Communications Equipment Due to Verizon Retirements
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.2	0.5	5.0	5.0	7.0	-	17.7
2018	-	0.5	2.0	5.0	5.6	5.0	18.1

RTU M9000 Protocol Upgrades (C069437 - $8.7M)

This program is to replace an outdated Remote Terminal Unit (RTU) protocol M9000 with a new DNP3 protocol.

Drivers:
RTUs with an M9000 protocol do not match the Transmission Control Center Energy Management System's (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 National Grid'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.

2017 to 2018 Variance:
This spend for this program was leveled over a longer timeframe to help reduce overall short term capital spending in the Plan.

Table 2-39
Transmission - RTU M9000 Protocol Upgrades
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.3	1.2	1.2	1.1	1.1	-	4.9
2018	-	1.1	1.3	1.4	2.1	2.8	8.7

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

There are no Non-Infrastructure costs currently expected for the transmission system.

Chapter 3. Sub-Transmission System

The sub-transmission system comprises lines and substations typically operating at voltages at or below 69kV. National Grid has approximately 4,800 circuit miles of overhead sub-transmission lines and 1,100 circuit miles of sub-transmission underground cable. Over the five-year period covered by this Plan, the Company expects to invest approximately $239 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	FY19	FY20	FY21	FY22	FY23	Total
Customer Request/Public Requirement	2.0	2.0	3.3	2.3	2.3	11.9
Damage/Failure	4.6	4.9	4.5	4.6	4.7	23.2
System Capacity	1.0	2.3	2.4	1.3	4.5	11.4
Asset Condition	25.6	30.7	38.5	44.3	40.2	179.2
Reliability	3.2	3.1	1.2	2.5	2.8	12.9
DER Electric System Access	0.1	0.0	0.0	0.0	0.0	0.1
Grand Total	**36.4**	**42.9**	**49.8**	**55.0**	**54.5**	**238.7**

A list of sub-transmission projects in the Plan can be found in Exhibit 2.

3. A. Customer Requests/Public Requirements

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 given to inflation, estimates of materials, labor, indirect cost, market sector analysis, overall economic conditions and historical activity.

Variances in planned program spending between the 2017 and 2018 plans are shown in Table 3-2.

Table 3-2
Customer Request/Public Requirements Variance Summary ($millions)

	CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
Blankets	2017	0.3	0.3	0.3	0.3	0.3	-	1.5
	2018	-	0.4	0.4	0.4	0.4	0.4	1.9
Specific Projects	2017	1.8	1.8	1.8	2	1.9	-	9.2
	2018	-	1.6	1.6	2.9	1.9	1.9	10.0
Total	2017	2.1	2.1	2.1	2.3	2.2	-	10.8
	2018	-	2.0	2.0	3.3	2.3	2.3	11.9

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, among other causes. 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 the 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.

2017 to 2018 Variance:
The variance between the 2017 and 2018 Plans is based on recent historical spending.

Table 3-3
Damage/Failure
Variance Summary ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	4.1	4.2	4.2	4.2	4.3	-	21.0
2018	-	4.6	4.9	4.5	4.6	4.7	23.2

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.

2017 to 2018 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 2017 and 2018 Plans is shown in Table 3-4.

Table 3-4
System Capacity
Variance Summary ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.9	3.8	2.2	0.8	1.0	-	8.8
2018	-	1.0	2.3	2.4	1.3	4.5	11.4

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. 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 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 0 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 National Grid'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.

2017 to 2018 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. Several cable replacement projects with load relief drivers have been removed in favor of the sub-transmission cable replacement program. 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 2017 and 2018 Plans.

Table 3-5
Load Relief
Program Variance ($millions)

	CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
Specific Projects	2017	0.9	3.8	2.2	0.8	1.0	-	8.7
	2018	-	1.0	2.3	2.4	1.3	4.5	11.4
Load Relief Blankets	2017	0.0	0.0	0.0	0.0	0.0	-	0.1
	2018	-	0.0	0.0	0.0	0.0	0.0	0.0
Total	2017	0.9	3.8	2.2	0.8	1.0	-	8.8
	2018	-	1.0	2.3	2.4	1.3	4.5	11.4

The following specific projects are classified as Load Relief and are estimated to have spending in excess of $1 million in any fiscal year:

- Project C052023 Eden Switch Structure – SubT. This project will replace the existing Eden Switch Structure and install new sub-transmission overhead lines

to connect to a new Distribution Station and provide load relief to existing distribution substations in the vicinity.

- Project C074906 Station 3012 23/13.2kV Sub-T work. The overall effort calls for the construction of a new Station 3012 with two standard 23-13.2kV / 10MVA transformers, with a provision for a third transformer using metal-clad switchgear and with four feeder positions. The station will be supplied by Seneca 23kV Sub Transmission lines.
- Project C079450 Buffalo 23KV Reconductor. Project C079450 is for the replacement of 18,000 circuit feet of cable 11H from Sawyer Transmission Station to Station 52 with 500 kcmil Cu. The project also provides for the replacement of another 15,000 circuit feet of cable to replace portions of the remaining length of 11H and the four (4) other cables 10H, 12H, 14H, and15H.

3. D. Asset Condition

Planned asset condition investment levels for the sub-transmission system are described below.

2017 to 2018 Variance:
The projected investments for asset condition driven projects is 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	10.0	32.6	33.3	34.5	32.8	-	143.2
2018	-	25.6	30.7	38.5	44.3	40.2	179.2

Inspection and Maintenance
Under this program, the Company performs visual inspections on all overhead and underground distribution 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 Commission's Safety Order in Case 04-M-0159.[1]

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.

[1] 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").

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 Commission's Safety Order in Case 04-M-0159. The Company's annual Asset Condition Report details the application of the Inspection and Maintenance program to sub-transmission assets.[2]

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.

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	4.4	6.1	6.1	6.1	6.1	-	28.8
2018	-	7.0	7.3	7.3	7.3	7.3	36.0

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'.

[2] Report on the Condition of Physical Elements of Transmission and Distribution Systems, Case 12-E-0201, most recently filed on October 1, 2017.

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.

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	4.0	18.5	21.5	26	23.7	-	93.7
2018	-	13.9	16.3	25.6	29.7	25.9	111.4

The following specific projects have forecasted spending that exceeds $1 million in any fiscal year:

- Project C016236, Gloversville-Canajoharie 6 Refurbishment. Refurbish 40 miles of 69 kV line including steel tower, wood pole and overhead ground wire replacement.
- Project C033182, Amsterdam-Rotterdam 3/4-69kV Relocation. Relocate 0.75 mile section of double circuit 69kV lines carried on steel lattice towers currently located in the center of an abandoned section of the Erie Canal.
- Project C046449, Yahnundasis-Clinton 24-46 kV Refurbishment. Refurbish 7.25 miles of 46 kV including wood pole replacements.
- Project C046459, Deerfield-Whitesboro 26-46 kV Refurbishment. Refurbish 5.3 miles of line including steel towers, wood poles and overhead ground wire due to deterioration.
- 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 34.5 kV Refurbishment. Replace wood poles.
- Project C046468, W. Portland-Sherman 867-34.5kV Refurbishment. Refurbish 23 miles of 34.5kV line including the replacement 192 wood poles and 8.3 miles of overhead conductor.
- 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 C046472, Ballston-Mechanicville 6-34.5kV Refurbishment. Refurbish 15 miles of 34.5kV line including the removal of 68 steel towers and 10 wood poles to be replaced with 80 wood pole structures, and installation of 7.7 miles of overhead shieldwire to replace existing deteriorated/damaged shieldwire and reinstall in locations where it is missing.
- Project C046474 Bristol Hill-Phoenix 23-34.5 kV Refurbishment. Replace wood poles and undersized conductor.
- Project C050177, S. Dow-Poland 865-34.5kV Relocation. Relocate 2.4 miles of 34.5kV line located in wetlands with limited access to an adjacent retired railroad bed including the removal of 38 wood pole structures to be replaced with 55 wood pole structures on the new alignment, as well as replacement of 18 existing wood pole structures.
- Project C050288, Deerfield-Schuyler 22-46kV Relocation. Relocate 2.1 miles of 34.5kV line located in wetlands with limited access, the proposed relocation will be primarily roadside; the scope includes the removal of 45 wood pole structures, installation of 21 new wood pole structures, and rebuild of 26 sole-distribution wood poles that will be overbuilt with the 34.5kV circuit.
- Project C050320 Union-Ausable Forks 36-46 kV Refurbishment. Replace wood poles on 10 mile radial circuit.
- Project C050321, Mortimer – Golah 109 69kV Refurbishment. Reconductoring 9.6 miles of 69kV line and replacing approximately 155 strucutres. Also, replacing 1 mile of static wire.
- Project C050323 Mechanicville-Schuylerville 4 Refurbishment. Replace wood poles.
- Project C050324, Union – Lake Colby 35 46kV Refurbishment. Refurbishing 46kV line by replacing strucutres and changing out insulators.
- Project C050326, Homer Hill – Nile 811 34.5kV Refurbishment. Reconductoring 5 miles of 34.5kV line.
- Project C050959, Elbridge-Jewitt 31 34.5 kV Refurbishment. Replace steel towers crossings and wood poles.
- Project C052511 Barker-Lyndonville 301 Refurbishment. Refurbish 9.7 miles of 34.5 kV 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 C055118, West Portland-Sherman 867- 34.5kV Relocation / Refurbishment. Relocate/refurbish 3 miles of 34.5 kV line for accessibility and reliability between structures 156 and 225.

- Project C058579, Trenton-Whitesboro 25-46kV Refurbishment. Refurbish a 12 mile section of this 46kV line from Marcy Hospital to Trenton Station to address recent reoccurring momentaries within this section.

- Project C058581, Nassau-Hudson 9-34.kV Refurbishment. Refurbish 8 miles of 34.5kV line from Hudson Station to the Stuyvesant Substation tap including 50 wood pole replacements.

- Project C069307, McIntyre – Hammond 24 23kV Refurbishment. Refurbishing 23kV line by replacing approximately 200 strucutres.

- Project C074003 Old Forge-Racquette Lake 22-46 kV. Relocate line using tree wire and/ Hendrix wire for 6 miles.

- 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 C074502, Hartfield-S. Dow 859-34.5kV Relocation. Relocate 6 circuit miles of 34.kV line due to access and tree trimming constraints. 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. Refurbish and improve access for 46kV line.

- Project C078197, Ridge – Shaleton 610 34.5kV Relocation. Relocating 34.5 kV line due to T-Line refurbishment project. 34.5kV line will be installed on new T-Line structures to create triple circuited structures with the 141 & 142 Gardenville to Dunkirk lines.

- Project C078516, Woodard – Ash 27 34.5kV Relocation. Relocate 34.5kV line from overhead to underground.

- Project CD00898, West Milton Tap – 34.5kV new line, provides for the installation of an approximately 3 miles of new supply line to West Milton from Rock City Falls to allow the retirement of approximately 9 miles of existing line which is in poor condition, and is solely used to serve this customer.

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 433 miles of underground cables and supplies over forty 4.16kV distribution substations. Approximately 385 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 1,100 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.

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.3	4.1	3	0.6	1.6	-	9.6
2018	-	1.5	2.7	0.6	1.6	4.3	10.8

The following specific projects have forecasted spending that exceeds $1 million in any fiscal year:

Project C052483, Buffalo 23kV UG Cable replacement program provides for the replacement of high risk cables.

3. E. Reliability

Reliability

Reliability projects are required to ensure the electric network has sufficient resiliency, or 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 this 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 3-11 below.

2017 to 2018 Variance:

The variances between the 2017 and 2018 Plans shown in the table below, and as well as variances in the scope and timing of specific projects in this category as described below.

Table 3-10
Reliability
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	1.9	4.3	0.7	0.8	3.8	-	11.6
2018	-	3.2	3.1	1.2	2.5	2.8	12.9

The following specific projects classified as Reliability are estimated to have spending in excess of $1 million in any fiscal year:

Project C048152 West Ashville Substation TxD LN863 Tap - The sub- transmission system experiences low voltage in excess of criteria for various (n-1) scenarios. The worst contingency is an outage of the breaker for Line 864 at South Dow. The Chautauqua County Industrial Development Agency is marketing several areas in the County as shovel-ready commerce parks and the 34.5kV system requires expansion to support their efforts. This project provides one new 34.5kV sub-transmission line tap to feed the 34.5kV system. The line will tap existing 34.5kV Sherman-Ashville Line 863.

Project C046510 LN863 Findley Lake – French Creek - Peak and Peak requested to transfer service supply from distribution to sub-transmission. To increase the reliability and feed to Peak and 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.

Project C051583 Line 216 Reconductoring. As part of the S.Livingston relief, it is recommended to improve the 34.5kV capacity, allowing for future load growth.

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.

2017 to 2018 Variance:
The projected investment is shown in the table below. Approximately $5.0M 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 3-11
Sub-Transmission Automation
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.5	1.5	0.5	0.4	0.6	-	3.5
2018	-	1.5	0.5	0.4	0.6	0.0	3.0

There are no projects over $1 million. The following circuits have been identified for Sub-transmission Automation:

- Akwesasne-Nicholville #23 Line
- Nicholville-Malone #21 Line
- Gasport-Telegraph Line 312
- Delavan-Machias- Line 801
- Nassau-Hudson Line 9
- Phillips-Medina Line 301
- Rathburn-Labrodor Line 39
- Oakfield-Caledonia Line 201
- Brook Road-Ballston Line 11

3. F. Communications/ Control Systems

There are no Communications/Control Systems costs currently expected for the sub-transmission system.

3. G. DER – Electric System Access

There are no DER Electric System Access costs currently expected for the sub-transmission system.

3. H. 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 nearly 7,500 circuit miles of underground primary cable on the system supplying approximately 400,000 overhead, padmount and underground distribution transformers. Additionally, there are 527 substations providing service to the Company's 1.6 million electric customers.[1] The current five-year plan for distribution is represented in Table 4-1.

Table 4-1
Distribution System Capital Expenditure by Spending Rationale ($millions)

Spend Rationale	FY19	FY20	FY21	FY22	FY23	Total
Customer Request/ Public Requirement	108.7	115.1	118.7	182.9	217.6	743.0
Damage/ Failure	45.9	50.2	51.1	53.6	54.8	255.6
System Capacity	22.9	30.6	30.0	42.3	37.6	163.5
Asset Condition	71.0	79.8	94.2	100.1	96.1	441.2
Reliability	25.7	32.2	29.3	27.4	43.0	157.6
Communications/ Control Systems	7.0	15.5	11.7	13.7	10.0	57.8
DER Electric System Access	10.0	0.0	0.0	0.0	0.0	10.0
Non-Infrastructure	3.1	3.1	3.2	3.2	3.3	15.9
Grand Total	294.3	326.5	338.1	423.2	462.5	1,844.5

[1] 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 11, 2017). Substation data were retrieved from the Substation Engineering Services Website at: http://us3infonet/sites/sed/Pages/SubstationStats.aspx (last accessed January 11, 2017).

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 given to inflation, estimates of materials, labor, indirect cost, market sector analysis, overall economic conditions and historical activity.

The projected investment is shown below.

Table 4-2
Customer Requests/Public Requirements Spending Rationale
Variance Summary ($millions)

	CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
Blankets	2017	78.5	86.3	86.2	86.6	88.3	-	425.8
	2018	-	81.5	88.7	91.9	95.7	99.4	457.2
Specific Projects	2017	34.5	33.4	30.8	30	30.2	-	158.8
	2018	-	27.2	26.4	24.5	25.5	26.2	129.7
Advanced Metering Infrastructure (AMI)	2017	0.0	3.8	5.8	59.7	60.7	-	129.9
	2018	-	0.0	0.0	2.3	61.8	92.0	156.1
Total	2017	113	123.4	122.7	176.2	179.1	-	714.5
	2018	-	108.7	115.1	118.7	182.9	217.6	743.0

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 project is classified as New Business and is forecasted with planned spending in excess of $1 million in any fiscal year.

> 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

Table 4-3
LED Investment Plan ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	7.0	7.0	7.0	7.0	7.0	-	34.9
2018	-	7.0	7.0	7.0	7.0	7.0	34.9

Transformer Purchase
Transformers are purchased and are shipped to locations within the Company where these items are put into stores.

Meter Purchase
Meters are purchased and shipped to locations within the Company where these items 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 3rd party attachments; also used for cable company requests.

Advanced Metering Infrastructure:
National Grid developed and filed an Advanced Metering Infrastructure (AMI) Business Case as part of its June 30, 2016 DSIP filing.[2] The Business Case for full electric and gas smart meter technology deployment was then updated and filed as part of the Company's April 2017 rate case.[3] As part of the Joint Proposal filed January 19, 2018 in the rate case, National Grid will convene a collaborative with Staff and interested parties to continue to refine and update its AMI business plan. The collaborative will provide parties with an opportunity to review and provide input on the Company's plan to implement AMI. The goal will be to present to the Commission a report with a revised AMI business plan, no later than October 1, 2018, for Commission review and action. Resulting from the agreement to conduct the collaborative and refile the business case, the costs reflected in this Plan represent a one-year delay from the proposal filed in April 2017.

Drivers:
By investing in AMI, National Grid will be taking a key step toward achieving Reforming the Energy Vision (REV) objectives as well as enabling the Company to assume the role of Distributed System Platform Provider (DSP). In this role, the Company will construct, operate, and maintain highly integrated technology platforms, allowing the incorporation of third-party owned DERs, which can include DR, EE, storage, and on-site generation. These technologies will be tightly integrated into the Company's distribution infrastructure. Ultimately, enhanced monitoring and control of these resources may support the establishment of a marketplace where services from these resources can be exchanged between Energy Service Companies ("ESCOs"), aggregators, customers, and other interested parties.

When AMI meters have been deployed and the associated back-office infrastructure is in place, customers will have access to their more granular usage data in near real-time. The frequency of the readings combined with the granularity of the data will enable customers to take control of their energy usage through energy efficiency, conservation, demand response, and new pricing programs. AMI will also allow customers to monitor their energy consumption through new solutions being proposed in the Company's rate filing (e.g., Green Button Connect My Data and Energy Insights Portal) that will allow customers to better manage their energy bills.

[2] Case 14-M-0101, Proceeding on Motion of the Commission in Regard to Reforming the Energy Vision (REV), *Niagara Mohawk Power Corporation d/b/a National Grid Initial Distributed System Implementation Plan (DSIP),* filed June 30, 2016.
[3] Case 17-E-0238 and 17-G-0239, 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 and Gas Service, filed April 28, 2017.

Customer Benefits:
There are multiple incremental customer benefits through AMI implementation to those described above. Examples include, but are not limited to:

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 allow 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 has the ability to report a customer outage in near real-time, without the need to rely on notification from a customer or substation monitoring. The 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.

2017 to 2018 Variance:
The projected investment for the Advanced Meter project is shown in Table 4-2, above.

The implementation schedule has been pushed out one year to accommodate the collaborative with Staff and interested parties. In parallel with the collaborative, the Company will continue planning and procurement exercises which will assist with a re-filed AMI plan. If regulatory approval is granted, detailed design and back-office systems installation would commence in FY20 followed by a multi-year electric meter, gas ERT and communication network deployment.

The Advanced Meter project includes the cost of the meter and its deployment, while the Advanced Metering Infrastructure project (described below in Section 4.F, Communications/Control Systems spending rationale, and in Table 4-32) includes communications and smart metering process management costs.

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, among other causes. 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.

2017 to 2018 Variance:
Comparison of the distribution Damage/Failure investment levels from the 2017 and 2018 Plans is set forth below. The increase in forecast spend in this year's Plan compared to last year is based on an increase in actual spending that is projected to continue into future years.

Table 4-4
Damage/Failure Spending Rationale
Variance Summary ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	43.4	47.6	45.3	46.2	47.2	-	229.7
2018	-	45.9	50.2	51.1	53.6	54.8	255.6

There is no specific project in this category forecasted with planned spending in excess of $1 million in any fiscal year.

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.

2017 to 2018 Variance:
The projected investment is shown in the table below. The variances between the 2017 and 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	15.5	19.5	34.2	40.3	43.8	-	153.3
2018	-	22.9	30.6	30.0	42.3	37.6	163.5

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 National Grid'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.

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
Specific Projects	2017	13.7	15.2	27.2	31.1	33.6	-	120.8
	2018	-	20.8	25.8	22.5	32.7	26.8	128.6
Load Relief Blankets	2017	1.8	1.8	1.8	1.8	1.9	-	9.1
	2018	-	2.1	2.3	2.3	2.4	2.4	11.5
Total	2017	15.5	17	29	33	35.5	-	129.9
	2018	-	22.9	28.1	24.8	35.1	29.3	140.1

The following specific projects are classified as Load Relief and are forecasted with 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 C046643, Milton Ave install several new feeders and upgrade getaway. This project provides for the resolution of normal loading concerns as well as MWh violations for contingency loss of the existing substation transformer.

- Project C046511, Teall Substation Rebuild, provides for replacing the existing metalclad switchgear with higher rated switchgear and installing a second transformer to address loading and asset condition issues.

- Projects C046798, C046796, C076785 and C076797 Sodeman Road New Substation, Distribution Getaways and construction of the two new distribution feeders respectively. These projects provide for a new 15kV switchgear and capacitor bank at a new 115-13.2 kV station as well as distribution feeder getaways, feeder reconductoring and associated feeder work. These projects will resolve loading above summer normal rating of the existing substation transformer, MWh criteria violations and distribution feeder loading issues.

- Projects C046490 and C044173, Van Dyke Station and 115kV Taps respectively. These projects install a new 115-13.2kV station to address loading, asset condition and reliability concerns in and adjacent to the Town of Bethlehem.

- Projects C016087, C046487, C046488, C046495 and C052098 Van Dyke Feeders. These projects provide for distribution line work associated with Project C046490 described above.
- Projects C049692, C050241 and C053683 for Delmar Station will be performed for Delmar Station rebuild.
- Project C046761, Grooms Rd 24557 provides for the rebuild and conversion of Saratoga Road from 4.8kV to 13.2kV to address loading concerns.
- Project C028929 – Frankhauser. This project provides for new distribution feeder construction to be supplied by the Frankhauser Substation to address distribution and sub transmission capacity issues.
- Project C036502, Buffalo Station 56 Upgrade Four Transformers. This project replaces four 23-4.16kV transformers with larger transformers to address loading above summer normal ratings.
- Projects C046538 and C048015, Eden Switch Structure. This 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.
- Project C060141, Sonora Way 115-13.2kV Substation. This and associated projects provide for the relief of loading concerns at area substations and address outage exposure concerns.
- Project C046640, Fairdale DSub. This project and associated projects provide for the rebuilding of the existing 34.5-4.8kV substation with a 34.5-13.2kV substation to address loading and reliability concerns in the area.
- Projects C070392 and C070393, New Collamer Crossing. These projects and associated projects will provide for the 115/13.2kV New Collamer Crossing distribution substation as well as the underground costs for the station distribution 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. 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 C032446, Harris Rd station. This project will provide for the upgrade of four existing feeder getaways, as well as the installation of a new duck bank and the install of 2 new feeders to address loading concerns.
- Project C051690, North Lakeville station. This project will provide for a new feeder out of the North Lakeville substation to address loading concerns in the area.

- Project C079382, 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. As well as C079383 Corliss Park getaway work and Lansingburgh conversions under C079475 and C079656.
- Project C052344, Thousand Islands 81452. 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 ration transformer.
- Project C055735, Union Street 37654. This project will provide for the conversion of sections on Turnpike Road to address the loading concerns on feeder 37654.
- Project C050717, Hague Rd feeder 41852. This project will provide for the conversion of sections of feeder on Route 22 to address the loading concerns on feeder 41852.

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 customer load and energy use, which may also reduce system losses.

VVO refers to a process whereby the voltage and reactive power flows of the distribution system are managed to reduce the magnitude of voltage drop on a distribution feeder. CVR refers to a process whereby if the magnitude of voltage drop is reduced, voltage regulating devices will be controlled to operate the feeder at the lowest possible range within allowable standards to foster customer energy savings.

The first VVO/CVR efforts are incorporated into the Company's on-going Clifton Park demonstration project with an expected construction completion date of April 2018. As part of the program, an additional 100 distribution circuits from 37 substations between FY20-23 will be targeted for enhancement through the installation of capacitors and voltage regulators and the addition of telecommunications and control through a centralized server.

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 usually fixed and manually switched on and off of the circuit seasonally or as needed.

The primary driver of this project is to provide more reliable 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. This proposed 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.

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 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, will support the improved management of the distribution system and assist in the integration of future distributed resources.
- Actively maintaining proper voltage via intelligent centralized control will improve feeder voltage performance, keeping the voltage flat and low, allowing for higher DER penetration.

Modern electrical equipment, including air conditioning, refrigeration, appliances, and lighting are designed to operate most efficiently at 114V. Delivering voltages at the optimal levels reduces energy consumption, improves service quality, and lowers costs.

2017 to 2018 Variance:
The projected investment is shown in the table below. The costs will be shifted one fiscal year as National Grid observes the performance of our initial VVO efforts, which consists of the Clifton Park REV Demonstration Project on the Elnora and Grooms Road Substations and feeders.

Table 4-7
Volt-Var Optimization / Conservation Voltage Reduction (VVO/CVR)
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	2.5	5.2	7.3	8.4	-	23.4
2018	-	0.0	2.5	5.2	7.3	8.4	23.4

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.

2017 to 2018 Variance:
The variance between the 2017 and 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	76.1	76.7	77.8	82.3	92.2	-	405.1
2018	-	71.0	79.8	94.2	100.1	96.1	441.2

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.[4] 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.

2017 to 2018 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.

[4] 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").

Table 4-9
Inspection and Maintenance
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	39.5	40.7	40.7	40.7	40.7	-	202.3
2018	-	31.3	36.1	35.6	35.6	35.6	174.2

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-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.

2017 to 2018 Variance:

The projected program investment is shown below. Increased spending is due to the focus on replacing degraded underground assets and addressing service reliability issues.

Table 4-10
Primary and Secondary Underground Cable
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	1.7	4.9	4.5	6.8	3.3	-	21.2
2018	-	7.2	7.7	7.8	5.9	3.8	32.3

The following specific projects are classified as Primary and Secondary Underground Cable program and are forecast with 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 C048826, South Park Cable Replacements. This project provides for the replacement of approximately 8 miles of cable to address aging infrastructure and loading issues.
- Project C050522, Hague Rd 53 Submarine Cable replacements. 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.
- Project C077065, Rotterdam #34 and #36 34.5kV Cable replacements. This project provides for the upgrade of existing 350 MCM gas filled cable in the #34 & #36 lines to 750 MCM Cu, to address asset condition concerns.
- Project C036273, Partridge Ave A. #5 Cable replacements. This project provides for the replacement of 0.34 mile of 350 Cu gas filled cable with 3-1/C 500 kcmil Cu EPR 35kV cable class to resolve asset condition concerns.

Buffalo Streetlight Cable Replacement

This program will re-establish safe and reliable underground street light service by replacing faulty street light cables and conduit, and removing temporary overhead conductors.

Drivers:

FY 2017 is the fifth year of a planned 10-year, $2.5 million per year, program to systematically replace deteriorated street light circuit cable in the Buffalo area to address repetitive incidents of elevated voltage (EV) 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 EV incidents.

Analyses have determined the primary driver for the elevated voltages 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 EV incidents associated with that street light infrastructure.[5]

Customer Benefits:
This work will provide more reliable street light service and reduce the incidence of elevated voltages in the Buffalo area.

2017 to 2018 Variance:
The Company expects to spend approximately $2.2M annually under this program to replace an estimated 14% of the city's existing street light cable system over the 10 year program period. This is a slight decrease from the prior plan. The projected investment is shown in the table below.

Table 4-11
Buffalo Streetlight Cable Replacement
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.2	2.2	2.2	2.2	2.2	-	11.0
2018	-	2.1	2.2	2.2	2.2	2.2	10.9

Substation Asset Condition Programs
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.

Substation Power Transformers
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 Asset Condition Report.[6]

[5] 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 EV incidents in Buffalo.
[6] Report on the Condition of Physical Elements of Transmission and Distribution Systems, Case 12-E-0201, filed most recently October 1, 2017.

Drivers:
There are approximately 804 power transformers plus 59 spares with primary voltages 69kV and below. 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.

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.

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	4.2	5.2	4.7	2.6	1.6	-	18.3
2018	-	5.3	5.1	5.3	3.6	3.4	22.7

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 C066227, Altamont Station Transformer Replacement. This project provides for the replacement of one transformer.
- Project C050746, Galeville Station Rebuild. This project provides for the replacement of one transformer.
- Project C077170, Lysander Traditional Solution C-NY. This project provides for the replacement of one power transformer.

- Project C077628, Tully Center Replace TB1. This project provides for the replacement of one power transformer.

Indoor Substations

The purpose of this strategy is to replace, retrofit, or retire the twenty-two 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. Fifteen 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 currently accepted safety practices. 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.

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	5.9	1.4	0.7	2.7	10.3	-	20.9
2018	-	1.3	0.7	2.4	9.2	9.6	23.3

- In Buffalo, two indoor projects are in progress: Buffalo Station #37 and Buffalo Station #59. Three indoor substation projects are expected to exceed $1 million: Buffalo Stations #30, #34, and #53. Additional Buffalo Indoor Stations will need rebuilding after the FY19-23 timeframe.

- In Niagara Falls, three indoor substation rebuilds (Eighth Street #80, Eleventh Street #82 and Stephenson Ave #85) are expected to exceed $1 million. However, most of this spend is outside the next five years.

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.

For each substation, an analysis will be conducted to determine if direct replacement is the best course of action or if an alternate means of supplying the load will be constructed.

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.

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.3	6.3	11.1	10.1	11.2	-	39.1
2018	-	3.9	12.0	13.4	8.9	9.6	47.7

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 C052706, Station 61 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 provides for the replacement of the existing metal-clad switchgear with new equipment, however, much of this spend is beyond FY23.
- Project C046478, New Maple Ave Substation, Project C046479, Maple Ave Feeder Getaways and Project C053153 New Maple Ave 115kV Taps. These projects build a new 115-13.2kV substation on a new site and associated feeder construction to replace the existing metal-clad Market Hill 69-4.16kV substation (Project C046367).
- Project C056611, Tuller Hill 246. This project provides for the replacement of the existing unit substation with new equipment including a new transformer.
- Project C068290, Chrisler Station Rebuild. This project provides for the rebuild of the station due to 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 provides for the replacement of two metal-clad switchgear and two station service transformers with new equipment.
- Project C056614, Pine Grove Metal-clad Switchgear. This project provides for the replacement of the existing metal-clad switchgear with new equipment, however, much of this spend is beyond FY22.
- Project C046744, Pine Bush Metal-clad Switchgear. This project provides for the replacement of the existing metal-clad switchgear with new equipment.
- Project C046747, Johnson Road Metal-clad Switchgear. This project provides for the replacement of the existing metal-clad switchgear with new equipment.
- Project C052706, Station 162 Metal-clad Switchgear. This project provides for the replacement of the existing metal-clad switchgear with new equipment.
- Project C056612, McKnownville Metal-clad Switchgear. This project provides for the replacement of the existing metal-clad switchgear with new equipment.

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).

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	1.9	2.2	1.9	1.9	1.9	-	9.9
2018	-	2.4	2.6	1.8	2.2	3.2	12.2

The following specific projects are expected to exceed $1 million in any fiscal year:

Project C032253 and C032261, ARP Breakers and Reclosers - These programs are to replace certain types, or families, of breakers that have been specifically identified due to obsolete parts and poor asset condition.

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 20 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 332 substation battery banks in service spread throughout the total of all substations. To bring all battery systems to less than twenty years old within ten years would require a replacement rate of approximately nine 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.

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.9	0.7	0.6	0.8	0.7	-	3.8
2018	-	0.8	0.7	0.9	0.8	0.8	3.9

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.

2017 to 2018 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	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	1.7	1.2	1.2	1.0	1.0	-	6.1
2018	-	1.7	1.4	1.0	1.0	0.0	5.1

4. E. Reliability

Reliability

The Reliability spending rationale is new for the 2017 Plan. Reliability projects are intended to ensure the electric network has sufficient resiliency or 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 this 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.

2017 to 2018 Variance:
The variances between the 2017 and 2018 Plans shown in table below, and as well as variances in the scope and timing of specific projects in this category as described below.

Table 4-18
Reliability
Spending Rationale
Variance Summary ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	18.5	29.4	40.5	46.6	35.4	-	170.4
2018	-	25.7	32.2	29.3	27.4	43.0	157.6

The following specific projects are classified as Reliability program and are forecasted with 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 C046475 and C046476, New Cicero Substation, distribution feeders and 115kV Taps, respectively. These projects provide for the resolution of MWh Violations for contingency loss of an existing substation transformer at Pine Grove Substation. In addition to addressing MWh violations, this project addresses normal loading concerns on several of the Pine Grove Feeders.
- Project CD01090 West Hamlin 82 - Install Transformer #2, additional feeders and 115kV Taps respectively. These projects provide for the resolution of MWh Violations for contingency loss of the existing substation transformer.

- Projects C051266 and C051265, New Tonawanda Station, Distribution Line Work, and 115kV Taps respectively. These projects provide for the installation of a new 115-13.2kV substation and feeders to supply the Riverview Development in Tonawanda and replace the existing temporary mini-substations.
- Projects C047886 and C046536, Delemeter Install two 20/26/33MVA transformers and Reconfigure F9352. Existing station transformer is leaking according to Substation O&M. The station transformer also violates the 240MWHr criteria. The station has only one tie to an adjacent 13.2kV station (Lakeview).
- Projects C046590 and C046589, Mumford 50 – Install transformer and new feeder. Mumford TB1 had 334MWHR of load at risk which violated criteria in 2011. Mumford 5051, 5052 MWHR criteria violation in 2011. Mumford 5051 projected overload in 2015. Brockport 7457, 7459 MWHR criteria violation in 2021. Brockport Station loaded to 119% of n-1 rating in 2011. West Hamlin TB1 had 416MWHR of load at risk which violated criteria in 2011. West Hamlin F8253 MWHR violation in 2021.
- Projects CD00977 and CD00964, Long Road 209 Install transformer and new feeder.
- Project C046423, New North Bangor station. Loss of Malone 115/13.2kV Transformer will result in 14.8 MW load at risk or 356MWhr, violating the 240 MWhr criteria. This project will address MWhr violation at Malone Substation and also add a new 13.2kV source to the area. The existing North Bangor 4.8kV feeder will be converted to 13.2kV and rearranged with Malone feeder. It will also provide backup capability in the event of loss of Malone 115/13.2kV Transformer.
- Project C050002 – Turin 65355 & 56 Tie creation. Create a 13.2kV tie between Turin 65355 & 65356 from Lee Valley Rd to Lee Center Rd using Kiwanis Rd. Limited ties available. This will reduce reliability numbers (CAIDI, etc.) by giving more switching opportunities.
- 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 rating for N-1 contingent operations. Station 214 is has a forecasted unserved load of 8.8MVA in 2014 for a transformer or bus outage due to limited capacity at adjacent substations.
- Project C046605, 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 the restoration time.

- Project C046636, Whitaker replace transformer. Whitaker substation is projected to be loaded at 27.1MVA. With loss of TB1 there will be approximately 16.4VA of un-served load. With an average of 24hrs to install a mobile, this produces 393.3MWh and is a violation of the Distribution Design Criteria Strategy. East Fulton is an islanded 4.8kV delta substation with no ties to other sources.
- Project C046610, Watertown new 115/13.2kV substation. Loss of Coffeen TB4 will result in 206 MWhr outage exposure in 2012 (8.6 MVA load at risk) and 252MWhr (10.5 MVA load at risk) in 2016 violating the 240 MWHr criteria. Two feeders (76053 and 76054) are loaded above 90% of its summer normal rating. This project will address MWHr violation on both Coffeen transformers TB3 and TB4 by transferring approximately 14 MVA from Coffeen to the new South Watertown Station and also addressing the normal loading issues on existing Coffeen feeders. The new feeders could also be reconfigured with 4 kV circuits in the area with possibility of retirement of Dexter 23/4.8kV and Leray 23/4.8kV substations. The area is being experiencing significant increase in load growth including new developments and also commercial and industrial loads.

Advanced Distribution Automation (ADA)

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.

Reclosers can be integrated with SCADA to allow control center operators to monitor and control the devices remotely. However, autonomous recloser operation without communications is common. 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 can be automated.

Drivers:
Distribution Automation, commonly referred to as Fault Location Isolation and Service Restoration (FLISR), is a control scheme which incorporates telecommunications and advanced control of key switching devices and provides remote monitoring and operator control of field devices for normal operations and maintenance, at the same time providing 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 the zone of protection. As part of a FLISR system, manual switches and feeder ties would be upgraded to automated switches at three phase mainline locations. In addition, these devices would be integrated with the Company's SCADA system and any future Distribution Management System.

National Grid has completed, and will continue to install automation schemes on the Sub transmission system. This distribution program will begin the automation of distribution circuits within the horizon of the CIP.

Customer Benefits:
National Grid anticipates improved main line CMI performance on the feeders targeted for ADA deployment. The additional operational data collected by the automated switches also will support the improved management of the distribution system, assisting in demand optimization, DER integration, and operational efficiency.

2017 to 2018 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 4-19
Advanced Distribution Automation (ADA)
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	5.6	11.3	10	-	27.0
2018	-	0.0	0.0	0.0	2.9	5.8	8.8

The following specific projects are classified as Advanced Distribution Automation and are forecasted with 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 C076104, NY FLIS Central – D-Line. This is a funding project for the NY FLISR program in the Central NY service territory which will help to improve CMI performance and reduce the number of customers interrupted as a result of a fault within a zone of protection.

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 a:

- Review of one-year and multi-year historical reliability data for current issues and trends.
- Review of recently completed and/or future planned work which is expected to impact reliability.
- Review the need for the installation of radial and/or loop scheme reclosers.
- Review for additional line fuses to improve the sectionalization of the feeder.
- Comprehensive 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 will improve customer reliability in areas where performance has been substandard. The ERR work also helps to harden the feeder and make it more resilient.

2017 to 2018 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 4-20
Engineering Reliability Review
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.3	4.1	5.2	4.8	2.1	-	18.5
2018	-	2.9	5.8	4.0	3.8	0.3	16.7

Minor Storm Hardening

The Minor Storm Hardening program proposes to increase the resilience of the distribution system in select areas of the service territory that have experienced repeated outages during adverse weather in an effort to improve reliability performance and customer satisfaction for those customers experiencing multiple interruptions. 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 as appropriate (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 recent poor performance during adverse weather events.

Customer Benefits:

The Minor Storm Hardening program will enhance distribution resiliency in targeted areas.

2017 to 2018 Variance:

The projected investment and the variation between the 2017 and 2018 Plans are shown in the table below. Variance is due to improved project scopes and estimates due to the analysis performed on the circuits identified for the program.

Table 4-21
Storm Hardening
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.3	1.8	1.5	0.0	0.0	-	5.6
2018	-	1.4	1.5	0.0	0.0	0.0	2.8

There are no specific projects in this category forecasted with planned spending in excess of $1 million in any fiscal year.

Arc Flash Mediation - 480 Volt Spot Networks

The installation of 480 volt spot network primary isolation equipment mitigates the arc flash hazard levels within 480 volt spot network systems.

Drivers:
The primary driver of this strategy is safety. National Grid adheres to the National Electrical Safety Code's Part 4: Work Rules for the Operation of Electric Supply and Communication Lines and Equipment. This strategy addresses the NESC 2012 revision which requires an arc flash hazard analysis for work assignments within distribution secondary network systems. This strategy mitigated the calculated incident energy levels by installing engineering controls such as primary and secondary isolation equipment, and incorporating applicable work practices.

Customer Benefits:
Installation of primary isolation equipment can help facilitate emergency and routine maintenance without interruption of service to other customers in certain applications and systems. The high side isolation switches can eliminate disruption to customers on the same primary circuit receiving service at primary voltage by eliminating the need for them to switch to back up sources or take an outage in the event a 480 volt network protector has an issue that requires it to be de-energized.

2017 to 2018 Variance:
The program has been discontinued with the 2018 plan, as we are designing Arc Flash equipment into all new and refurbished 480V vaults, and therefore a separate plan is not required.

Table 4-22
Arc Flash Mediation - 480 Volt Spot Networks Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.8	0.8	0.8	0.8	-	3.2
2018	-	0.0	0.0	0.0	0.0	0.0	0.0

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 past 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.

Flood events throughout the US continue to underscore the importance of protecting utility infrastructure for the benefit of communities. National Grid'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 National Grid's substations. Several events in the Company's service territory have exceeded FEMA's 100-year flood height elevation, and were a driving force for the development of the program nearly 10 years ago.

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.*).

2017 to 2018 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 4-23
Substation Flood Mitigation Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.2	0.6	0.0	0.0	0.0	-	0.7
2018	-	0.5	0.0	0.0	0.0	0.0	0.5

Distribution Line Sensors/Monitors

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 a greater degree of 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.

2017 to 2018 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 4-24
Distribution Line Sensors/Monitors
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	3.0	3.0	3.0	3.0	-	12.0
2018	-	1.5	1.5	1.5	3.0	3.0	10.5

The following specific projects are classified as Distribution Line Sensors/Monitors and are forecasted with 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, Feeder Monitors/Sensors – NY Central, and Feeder Monitors/Sensors – NY East. These projects provide for the installation of distribution line sensors in the Western, Central, and Eastern service territories which will allow for near real-time loading and voltage measurements n distribution feeders.

Network Transformer DGA Monitors
This program will introduce remote DGA (Dissolved Gas Analysis) 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 Company's ability to sample equipment.

Customer Benefits:
Remote DGA Monitoring and diagnostics can help avoid unplanned failures and extend the useful life of network transformers.

2017 to 2018 Variance:
This is a new program beginning in FY18. The initial focus will be network transformers in WNY. Beyond FY19, remote DGA monitors will also be installed in CNY & ENY.

Table 4-25
Network Transformer DGA Monitors
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.2	0.9	0.9	0.9	0.9	-	3.8
2018	-	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.

4. F. Communications/ Control Systems

Communications / Control Systems Spending Rationale
Communications and Control Systems projects are for grid modernization investments to ensure that the proper communications equipment is in place to efficiently operate the electric system. Projects in this spending rationale include monitoring and communications infrastructure for company equipment and customer metering. 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 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.

2017 to 2018 Variance:

The projected investment is shown in the table below. The forecast has been decreased based on a change in expected spend on the Advanced Metering Infrastructure (AMI) program.

Table 4-26
Communications / Control Systems Spending Rationale
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.7	4.1	18.1	20.3	20.2	-	65.5
2018	-	7.0	15.5	11.7	13.7	10.0	57.8

Remote Terminal Unit (RTU)

This strategy covers the addition of Remote Terminal Units (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.

2017 to 2018 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 4-27
Remote Terminal Unit
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.0	2.5	9.1	8.5	8.1	-	30.1
2018	-	5.3	10.9	6.6	7.7	3.0	33.6

The following specific projects are expected to exceed $1 million in any fiscal year:

Project C069687 - 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, C076124 and C076125 - These programs are to install new RTUs for the purpose of system modernization.

Substation Communications Expansion (Telcom)

This project upgrades and extends the statewide substation communications network. It includes providing private fiber connectivity to a number of 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 grid 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.

2017 to 2018 Variance:
The projected investment is shown in the table below.

Table 4-28
Substation Communications Expansion (Telcom)
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.8	1.7	5.2	5.1	5.1	-	18.0
2018	-	1.7	4.5	4.5	5.1	5.8	21.7

Advanced Metering Infrastructure (AMI):
The AMI project is described above in Section 4.B, Customer Requests/Public Requirements. The related investment described here pertains to the communications and smart metering process necessary to implement AMI.

Drivers:
AMI supports the modernization of the electric system and is a key element to building a robust, dynamic distribution grid that is well positioned to integrate DERs and implement greater market functionality. The communications and control systems investments included in this project are necessary to enable the operation of the AMI network and to implement the planning, grid operation and market function roles of the DSP. AMI can increase productivity and efficiency, faster and optimize grid performance, in combination with grid modernization investments.

Customer Benefits:
Anticipated benefits of AMI deployment include:

- Greater customer control over energy usage through participation in DR programs EE programs, and pricing programs;
- Availability of granular electric and gas consumption data to customers and approved third-party vendors in a timely and efficient basis;
- Customer access to a marketplace, and the ability to choose new and innovative energy solutions from third-party vendors; and
- Increased electric grid reliability and resiliency.

2017 to 2018 Variance:
As stated in Section 4.2, above, the Advanced Meter project includes the cost of the meter and its deployment, while the AMI project described here and shown in the table below includes communications and smart metering process management costs. These

costs have been pushed out a year from the April 2017 proposal to accommodate a collaborative with Staff and interested parties in FY19.

Table 4-29
Advanced Metering Infrastructure (AMI)
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.0	0.0	3.7	6.7	6.9	-	17.4
2018	-	0.0	0.0	0.5	0.9	1.1	2.5

4. G. 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 items such as NWA, microgrids, storage, DG interconnections, and other third party and market driven needs.

DER projects include distributed generation interconnections and REV demonstrations. Distributed generation interconnections in this spending rationale include projects that are non-reimbursable by the customer, such as farm digester projects.

2017 to 2018 Variance:

The projected investment is shown in the table below. The forecast has increased from 2017 due to use of this new spending rationale for battery storage and distributed generation projects in construction. Previously, some DER Electric System Access spend was included in the Customer Request/ Public Requirements category.

Table 4-30
DER - Electric System Access
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	7.5	0.6	0.0	0.0	0.0	-	8.1
2018	-	10.0	0.0	0.0	0.0	0.0	10.0

The energy storage projects discussed below were selected by the Company in response to the *Order on Distributed System Implementation Plan (DSIP) Filings*, issued on March 9, 2017, in Cases 14-M-0101 and 16-M-0411, in which the Commission directed each utility to implement at least two energy storage projects by December 31, 2018:

Project C078752, Kenmore Station 22 Battery Storage. This is for a Non Wires Alternatives demonstration to reduce the expected electrical stress on the Sub-Transmission lines in the Kenmore area. Battery storage at the Kenmore station 22 distribution bus breaker will help provide this relief.

Project C078753, East Pulaski 324 Battery Storage. This is for a Non Wires Alternatives demonstration to reduce the expected electrical stress on the Sub-Transmission lines in the Pulaski area. Battery storage at the East Pulaski station 324 distribution bus breaker will help provide this relief.

Waste Digester

Waste Digester projects are a specific class of distributed generation. Elements of these projects are non-reimbursable by the customer proposing the distributed generation.

Drivers:

The projects in this category are to cover non-reimbursable costs related to farm waste distributed generation projects.

Customer Benefits:

Farms that benefit from these non-reimbursable upgrades are better enabled to support statewide distributed generation goals.

2017 to 2018 Variance:

Table 4-31
Waste Digester
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	0.3	0.0	0.0	0.0	0.0	-	0.3
2018	-	0.3	0.0	0.0	0.0	0.0	0.3

There are no specific projects in this category forecasted with planned spending in excess of $1 million in any fiscal year

DER - Electric System Access Other

This program includes REV demonstration projects that implement the fundamentals of the New York REV strategy to promote clean energy, make the electric system more resilient, and improve customer choice and affordability. This also captures forecasted credits for distributed generation projects moving to construction.

Drivers:

The demonstration projects were selected to promote the goals of the REV initiative.

Customer Benefits:

REV demonstration projects are to pilot technologies and strategies to modernize the grid and enhance the customer experience. Benefits include making more informed

energy decisions, allowing a greater portion of the customer base to participate in green energy initiatives, and better balancing the energy usage on the electric system.

2017 to 2018 Variance:

Table 4-32
DER - Electric System Access Other
Program Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	7.2	0.6	0.0	0.0	0.0	-	7.8
2018	-	-1.8	0.0	0.0	0.0	0.0	-1.8

The following specific project is classified as DER- Electric System Access Other projects and is forecasted with planned spending in excess of $1 million in any fiscal year. Details on the planned spending profile for this project are included in Exhibit 3.

Project C075764, Distributed System Platform REV Demo. This project seeks to develop and test services based on a local, small-scale, but centralized Distributed System Platform ("DSP") that will communicate with network-connected points of control ("POCs") associated with the Buffalo Niagara Medical Campus (BNMC) DERs.

Project C051970, PS&I Activity Distributed Generation. This project captures reconcilable charges associated with engineering studies for proposed distributed generation projects, and forecasts the difference between developer contributions versus expected spend on specific DG projects in a fiscal year.

4. H. 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.

2017 to 2018 Variance:
The projected investment is shown below. The increase is due to a change in accounting methodology related to Capital Overheads which took effect in April 2017. Prior to this change, Capital Overheads were allocated to labor and contractor cost types only. Now Capital Overheads are allocated to all cost types including materials. The bulk of the dollars in the Non-Infrastructure group are related to materials – and as such are now subject to Capital Overhead allocation.

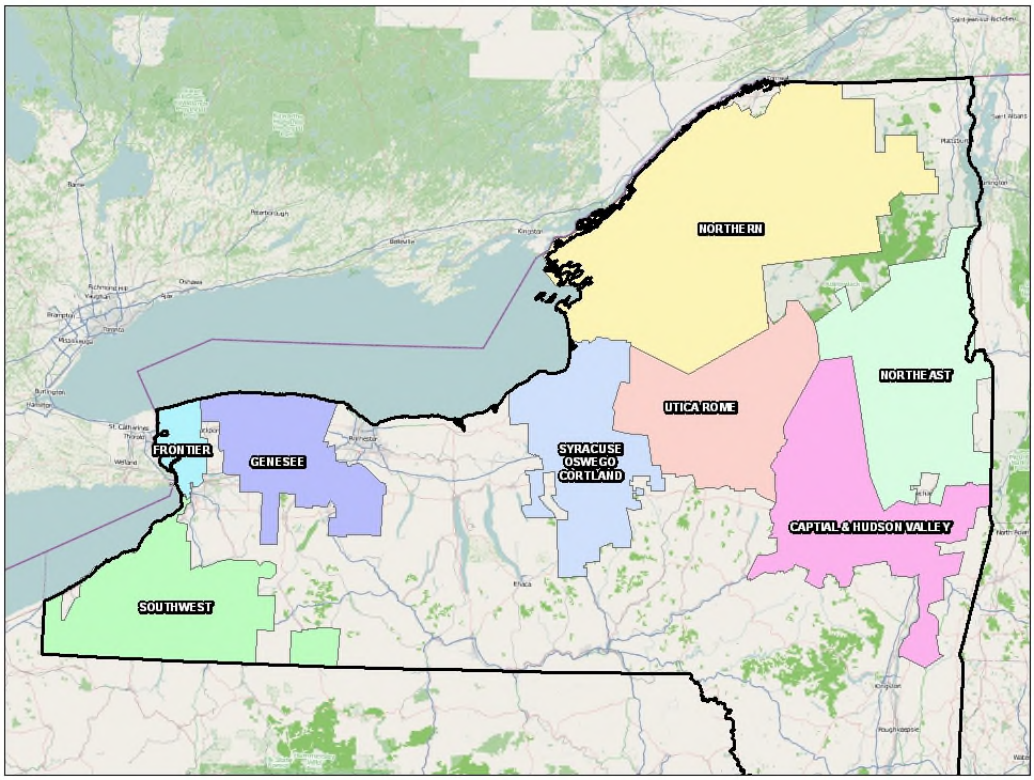
Table 4-33
Non-Infrastructure
Spending Rationale
Variance ($millions)

CIP	FY18	FY19	FY20	FY21	FY22	FY23	Total
2017	2.2	2.5	2.3	2.3	2.4	-	11.7
2018	-	3.1	3.1	3.2	3.2	3.3	15.9

Chapter 5. Investment by Transmission Study Area

For regional analysis, the Company's service territory is divided into eight transmission study areas. The transmission study areas are shown in Figure 5-1. Within the eight transmission study areas, the sub-transmission and distribution networks are further subdivided into 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, specifically Global Foundries and the general area distribution load growth stimulated by the economic impact of the Luther Forest development during the period from 2012-2019.
- To address load growth related to the Luther Forest facilities, two new 115-13.2 kV switching stations, Lasher Road and Schaghticoke, are to be constructed.
- Due to post contingency conductor thermal loadings, a rebuild of the Mohican – Luther Forest/Battenkill # 3 and #15 lines has been recommended.
- To address post contingency voltage issues, a capacitor bank will be installed at the Ticonderoga 115 kV facility.

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 Global Foundries.

Area Description

The Northeast transmission study area serves approximately 133,900 customers. The study area extends approximately 90 miles north along the western border of Vermont, from Cambridge in the south to Westport in the north, and extends approximately 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 are 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 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 13.2kV feeders, with twenty-five being

supplied from 34.5-13.2kV transformers, and the rest supplied by 115-13.2kV transformers; thirty-five 34.5kV sub-transmission lines that supply the distribution step down transformers in the area; eight 4.8kV feeders with six supplied by 34.5-4.8kV transformers; and fourteen 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	Component Fatigue/Deterioration	Tran	None	Mohican - Replace Bank 1 and Relays	C053133
				Spier-Rott 2 Shieldwire Replac	C050744
				Ticonderoga 2-3 T5810-T5830 ACR	C039521
				Ticonderoga-Whitehall 3 Mt Defiance	C078570
				Whitehall - Replace three OCBs	C075885
	Primary UG Cable Replacement	Dist	Northeast	HAGUE RD 53 - SUBMARINE CABLE.	C050522
	Sub-T Overhead Line	Sub-T		BALLSTON-MECHANICVILLE 6-34.5KV	C046472
				MECH-SCHUYLERVILLE 4-34.5KV REFURB	C050323
Reliability	Eng Reliability Review	Dist		BOLTON 51/WARRENSBURG 51 FEEDER TIE	CD00606
System Capacity	Load Relief			*HAGUE RD 52 - CONVERT ROUTE 22	C050717
				SODEMAN RD - FEEDER GETAWAYS, CIVIL	C046796

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				SODEMAN RD - SOUTH FEEDER PHASE 1	C076797
				SODEMAN RD - WEST FEEDER PHASE 1	C076785
				SODEMAN RD STATION - NEW STATION -	C046798
				UNION ST 54-TURNPIKE RD CONVERSION	C055735
	TO Led System Studies	Tran	None	Lasher Road Substation	C064726
				Lasher Road Substation - LAB	C064727
				Mohican Battenkill#15 Rebuild Recon	C034528
				Schaghticoke Switching Station	C060252
				Ticonderoga- Inst Cap Bank, Rpl OCB	C060254

5. 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 load growth in the area over the next 5 to10 years, and in the adjacent Northeast study area – particularly that associated with Luther Forest -- will trigger future projects.

Key sub-transmission and distribution drivers include the following:

- DeLaet's Landing is a proposed Underground Commercial Development (UCD) in the City of Rensselaer. In response, construction of a new substation at Forbes Avenue will be used 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.
- 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 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 (ConEd) 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 NY and eastern NY. Several transmission lines in the area are also important facilities to the UPNY-SENY interface between the eastern NY system and the downstate system.

National Grid has three 345-115kV transformers in the region; two at New Scotland and one

at Reynolds Road. There are three existing 230-115kV transformers at Rotterdam. In addition, Con Ed has one 345-115kV transformer at Pleasant Valley and CHG&E has one 345-115kV transformer at Hurley Ave. Station, all of which have impacts on the National Grid system.

Within the Capital and Hudson Valley study area, there are six 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	UG Cable Replacement	Sub-T	Capital Central	PARTRIDGE-AVE A 5 CABLE REPLACEME	C036273
			Schenectady	ROTTERDAM 34 36 34.5KV CABLE REPL	C077065

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
	Asset Replacement	Dist	Capital North	LASHER ROAD - GETAWAY CABLE	C068348
			Schoharie	MIDDLEBURGH 51 - ROUTE 145 EXTEND/C	CD01010
	Component Fatigue/Deterioration	Tran	None	Albany Steam - 115kV asset rplc	C079461
				Greenbush-Stephentown #993 ACR	C060208
				Hoosick - Replace Bank 1 & relays	C053132
				Inghams Phase Shifting Transformer	C047864
				Inghams Station - Assoc Line work	C060240
				Inghams Station Re-vitalization	C050917
				Inghams-E. Springfield #7 ACR	C060209
				Menands Cntrl Bldg & Relay Replcmt	C049601
				NEW SCOTLAND R93&R94 ASSET REPLACE	C062752
				Rotterdam 115kV SubRebuild(AIS)	C034850
				Woodlawn Transformer Replacement	C051986
	Dist. Overhead Line	Dist	Mohawk	MAPLE AVE - NEW FEEDER 52 PART 2	C069909
				MAPLE AVE FEEDER GETAWAYS - CABLE	C069906
	Primary UG Cable Replacement		Capital Central	RIVERSIDE 28855 UG CABLE REPLACEME.	C036468

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
	Sta Metal-Clad Switchgear			AVENUE A 291 METALCLAD REPLACEMENT	C056609
				MCKNOWNVILLE 327 METALCLAD REPLACEM	C056612
				PINEBUSH - REPLACE METALCLAD GEAR	C046744
			Capital North	JOHNSON RD - REPLACE METALCLAD GEAR	C046747
			Mohawk	NEW MAPLE AVE SUBSTATION	C073527
			Schenectady	CHRISLER REBUILT STATION - STATION	C068290
	Substation Power Transformer		Capital Central	ALTAMONT TB1 REPLACEMENT	C066227
	Sub-T Overhead Line	Sub-T		CALLANAN TAP - REBUILD EXIST 34.5LN	C046641
			Capital East	NASSAU-HUDSON 9, 34.5KV REFURB	C058581
			Capital North	W. MILTON TAP-34.5KV NEW LINE	CD00898
			Mohawk	AMSTERDAM-ROTTERDAM3/4 RELOCATION	C033182
				GLOVERSVILLE - CANAJ. 6 REFURBISH	C016236
				INGHAMS 46KV RELOCATION	C074485
			Schenectady	SCOTIA-ROSA RD 6, 34.5KV REFURB	C055164
Customer Request/Public Requirement	Customer Interconnections	Tran	None	BEC - Rx Station & T Remotes	C078441

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
	Public Requirements (additional need)			Lafarge Relocation	C079454
Damage/Failure	Damage/Failure			LEEDS - LS2 REACTOR REPLACEMENT	C078782
Reliability	Eng Reliability Review	Dist	Mohawk	*FLORIDA-STONER FEEDER TIE	C050438
			Schenectady	*MCCLELLAN 51 - UNION ST CONVERSION	C050085
	Performance	Tran	None	Backup UG Pump Plant-Trinity Ln 5&9	C062469
System Capacity	Load Relief	Dist	Capital Central	VAN DYKE - UG - CIVIL & ELEC WORK	C052098
				VAN DYKE STATION - NEW 115/13.2KV S	C046490
				VAN DYKE STATION - NEW 56 DIST FEED	C046487
				VAN DYKE STATION- NEW 54 DIST FEED.	C046495
				VAN DYKE SUBST- NEW 57 DIST FEEDER	C046488
				VAN DYKE SUBST- NEW FEEDERS	C016087
			Capital East	CORLISS PARK XFMR 2 & BUS INSTALL	C079382
				DELAET'S LANDING DXD	CD00893
				FORBES AVE - NEW SUBSTATION	C053137
	TO Led System Studies	Tran	None	Albany-Greenbush 1&2 Reconductoring	C077034
				Firehouse Rd 3 Terminal	C069452
				Lasher Rd Transmission Line	C043672

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Maplewood #19/#31Reconductoring	C069466
				Rosa Rd add 115kV Cap Bank	C069467
				Rotterdam - Add Reactors LN19/20	C069548
				Rotterdam - Curry #11 recond	C060243
				Rotterdam Breaker Replacement	C049605

5. C. Northern Transmission Study Area

Area Summary

Key drivers behind the transmission capacity related projects in this study area include the following:

- The interconnection of several wind generation projects.
- 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.

A potential major driver for the area is the possible North Country Power Authority (NCPA) takeover of the electrical system in portions of St. Lawrence and Franklin Counties. The Company is not aware of any activity regarding NCPA in the past year.

Area Description

The Northern transmission study area includes the 115kV transmission facilities in the Northern Region and the northeast portion of the Mohawk Valley Region.

The backbone of the 115kV Northern area system runs from National Grid 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 #5 – #6 Lighthouse Hill-Black River 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 (NYPA) 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 feeders (twenty 4.8kV and seven 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 2.4kV feeders, twenty-nine 4.8kV feeders, and six 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 municipal electric companies supplied via the 46kV sub-transmission in the Tri-Lakes area, Lake Placid and Tupper Lake.

The WLOF area serves approximately 70,100 customers. There are nine 23-4.8kV substations supplying twenty-seven 4.8kV feeders; and ten 115-13.2kV substations supplying thirty-eight 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	Sub-T Overhead Line	Sub-T	Nicholville-Malone	FORT COVINGTON-MALONE 26-34.5KV	C050197
			St. Lawrence	MCINTYRE-HAMMOND 24 23 KV RELOC.	C075852
				MCINTYRE-HAMMOND 24, 23KV ACR	C069307

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
			Tri-Lakes	UNION-AUSABLE FORKS 36-46KV REF	C050320
				UNION-LAKE CLEAR 35-46KV REFURB	C050324
			WLOF	OLD FORGE-RACQUETTE LAKE 22 46KV	C074003
Customer Request/Public Requirement	Customer Interconnections	Tran	None	Cedar Rapids TIP Project Tline	CNYCS17
				Copenhagen Wind Project - Stations	C076291
				Ogdensburg Cogen Repower Station Mods	CNYCS20
Reliability	Reliability	Dist	Nicholville-Malone	NORTH BANGOR NEW 34.5/13.2KV STATIO	C046423
			WLOF	MILL ST_LVAC_2014 UPGRADES-N-2	C053903
				WATERTOWN NEW 115/13.2 KV SUBSTATIO	C046610
System Capacity	Load Relief			81452 WESTMINSTER PARK RD - REBUILD	C052344
	TO Led System Studies	Tran	None	Malone Metalclad&Transformer	C069306

5. D. Syracuse Oswego Cortland Transmission 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.
- Fault current levels require replacement of overdutied breakers at Ash Street 115 kV station.
- System standards requiring upgrades at Porter 230kV station.

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 5,100 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 13,000 customers. The study area is an industrial suburb of the City of Syracuse. The distribution system consists of one 115-34.5kV, three 115-13.2kV, one 34.5-4.8kV and one 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 13.2kV feeders, two 4.8kV and five 4.1616kV feeders.

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 115-34.5kV, four 115-13.2kV and one 34.5-4.8kV 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 115-34.5kV, nine 115-13.2kV, three 34.5-4.8kV and one 34.5-4.16kV stations. The physical barriers in the North Syracuse area are the two 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 in central New York as well as the Village 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 115-34.5kV, seven 115-13.2kV, five 34.5-13.2kV, eight 34.5-4.8kV and one 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 115-34.5kV, two 115-13.2kV, and four 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	UG Cable Replacement	Sub-T	Syracuse	SOLVAY ASH 27 CABLE REPL SUBT	C032147
				SOLVAY-ASH 28 34.5KV REPLACE CABLE	C045629
	Asset Replacement			WOODARD-ASH 27-DESTINY RELOC.	C078516
		Dist		Temple Distribution Rebuild	C079534
	Component Fatigue/Deterioration	Tran	None	Ash St. 115-12kV TRF1 Asset replace	C076282
				Border City-Elbridge #15/#5 ACR	C075723
				LightHH 115kV CH	C073996
				LightHH Trans Lines Reconnect	C073997
				Oswego - 115kV & 34.5kV - Rebuild	C043426
				Oswego: 115kV Control House	C061991
				Oswego: 345kV Asset Sep/Repl	C076218
				Oswego: 345kV Asset Sep/Repl CH	C076983
	Sta 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
	Substation Power Transformer		Cortland	TULLY CENTER REPLACE TB1	C077628
			North Syracuse	GALEVILLE STATION REBUILD	C050746

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				LYSANDER TRADITIONAL SOLUTION C-NY	C077170
	Sub-T Overhead Line	Sub-T	Syracuse	ELBRIDGE-JEWITT 31-34.5KV REFURB	C050959
				SOLVAY 26	C046438
			Volney	BRISTOL HILL-PHOENIX 23-34.5KV	C046474
				LIGHTHOUSEHILL SUB-TLINE RELOCATION	C074322
Damage/Failure	Damage Failure Other		Syracuse	NY_35KV_FPC SWGR_CENTRAL_2 OF 4	C070712
DER Electric System Access	Storage	Dist	Volney	EAST PULASKI 324 BATTERY STORAGE	C078753
Reliability	NERC/NPCC Standards	Tran	None	Physical Security	C073349
	Reliability	Dist	North Syracuse	NEW CICERO SUBSTATION DLINE	C046476
				NEW CICERO SUBSTATION DSUB	C046475
			Syracuse	UG for Temple Rebuild	C079532
			Volney	WHITAKER DSUB	C046636
System Capacity	Load Relief		East Syracuse	COLLAMER CROSSING_D_LINE_UG_WORK	C070392
				COLLAMER CROSSING_D_SUB_WORK	C070393
			Syracuse	TEAL SUBSTATION REBUILD-SWGR	C046511
			West Syracuse	HARRIS 54 RELIEF	C032446
				MILTON AVE DLINE	C046643
	TO Led System Studies	Tran	None	Central Breaker Upgrades - Ash	C043424
				Clay-Teall#10,Clay-Dewitt#3 Recond	C043995

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Collamer Crossing_115kV_Line_TAP	C070394
				Elbridge WoS Reactors	C069531
				GE-Geres Lock 8 T2240 Reconductor	C047835

5. E. Utica Rome Transmission Study Area

Area Summary

The drivers behind the transmission capacity related projects in this study area are:

- The need to address thermal and voltage issues drive projects that will rebuild the Porter and Rome substations. This will include replacement of the Inghams phase shifting transformer with a new one that will have a larger range of variation in angle.
- Other issues found in this area are addressed by operational solutions, given current NERC TPL Planning Criteria and the current BES definition.

Key sub-transmission and distribution drivers include the following:

- Rebuilding of the Poland 62258 feeder along NYS Route 8 to improved 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 boundaries at Boonville and Lighthouse Hill substations, west at Oneida, and east ending before Inghams substation. Within the Utica Rome study area, there are four distribution study areas: Oneida, Rome, Utica and WLOF-MV (Old Forge area).

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 thirty 4.8kV feeders and seventeen 13.2kV 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 115-46kV, ten 115-13.2kV, four 46-13.2kV and seven 46-5kV substations.

The WLOF-MV study area serves approximately 7,900 customers in Old Forge. There are five 46-4.16kV substations supplying nine 4.8kV feeders and one 13.2kV substation supplied out of Alder Creek substation. The 46kV sub-transmission system is supplied out of the Boonville substation.

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
	Component Fatigue/Deterioration	Tran	None	Boonville Rebuild	C049903
				Edic: Protection Migration	C076214
				LightHH 115kV Yard Repl & cntrl hs.	C031662
				Oneida Substation Rebuild	C034443
				Terminal Station Relocation	C076242
	Substation Power Transformer	Dist	Utica	ROCK CITY STATION 623 - TRANSFORMER	C046671
	Sub-T Overhead Line	Sub-T		DEERFIELD-SCHUYLER 22-46KV	C050288
				DEERFIELD-WHITESBORO 26-46KV	C046459
				TRENTON-WHITESBORO 25, 46KV	C058579

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				YAHNUNDASIS-CLINTON 24 -46KV	C046449
			WLOF	BOONVILLE-ALDER CREEK 21 46 KV	C077028
Reliability	NERC/NPCC Standards	Tran	None	Upgrade Brks/Disc/PT's	C036866
	Reliability	Dist	Rome	MV-TURIN 65355 & 56 TIE CREATION	C050002
			Utica	MV-POLAND 62258 ROUTE 8 RECONDUCTOR	C046605
System Capacity	Load Relief		WLOF	WATERTOWN NEW115/13.2 KV SUBSTATION	C077720

5. F. Genesee Transmission Study Area

Area Summary

Key transmission projects in the Genesee study area have the following drivers:

- Low post-contingency voltages in the area in general and at Golah in particular, especially for bus faults at Lockport or Mortimer that affect the entire 115kV bus.
- Low post-contingency voltages developing in the 2016 to 2026 time frame in the Batavia and Brockport areas as a result of load growth.
- Heavy post-contingency conductor loading exists on the Mortimer-Golah #110 line.

Key sub-transmission and distribution drivers include the following:

- Reliability issues are being addressed with the addition of second transformers and new distribution feeders supplied from West Hamlin.
- Capacity concerns in the area are being addressed by the expansion of Sonora Way substation adjacent to North Lakeville Station.

Area Description

The Genesee transmission study area includes National Grid 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 circuits go directly from Lockport to Mortimer, three circuits go from Lockport to Batavia and several circuits in series connect Batavia and Golah. Today one 115kV line and one 69kV line travel between Mortimer and Golah.

Two 345kV circuits owned by NYPA travel parallel to this area from Niagara to Rochester. At Rochester Station 80, RG&E has four 345-115kV transformers with 115kV connections to Rochester Station 82. Station 82 is the RG&E 115kV station adjacent to National Grid's Mortimer Station.

At Lockport, one circuit connects the station to the NYSEG Hinman Rd. Station. Hinman Rd. is connected by a single circuit to Delphi, a load and generator, and Delphi is connected by a single line to Robinson Rd. Station. At Robinson Rd., a 230-115kV transformer is connected to the Niagara – Robinson #64 and Robinson – Stolle #65 230kV circuits.

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 distribution study areas: Genesee North, Genesee South and Livingston.

The Genesee North study area serves approximately 41,200 customers. There are a total

of 51 distribution feeders that supply customers in this area. There are twenty 13.2kV feeders, with four being supplied from 34.5-13.2kV transformers, and the rest are fed from 115-13.2kV transformers. The thirty-one 4.8kV feeders are all fed from 34.5-4.8kV transformers. There are ten 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 fed from 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 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 and 34.5kV sub-transmission system supplied out of the Golah and North Lakeville substations. Two customers are supplied directly from 115kV.

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	Sub-T	Livingston	N.LAKEVILLE - RIDGE LN 218 REFURBIS	C046766
	Component Fatigue/Deterioration	Tran	None	Alabama-Telegraph 115 T1040 ACR.	C033014
				Batavia - Replace five OCBs	C075904
				Batavia-Golah 119 ACR	C060217
				Brockport Tap Refurbishment	C055531
				Lockport-Batavia 112 T1510 ACR	C003422
				Mortimer #3 Auto TRF Replace	C076283

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Mortmr-Pannll 24-25 T1590-T1600 ACR	C047816
				Pannell-Geneva 4-4A T1860 ACR	C030889
				Telegraph Road TRF #2 Asset Replace	C069346
	Sub-T Overhead Line	Sub-T	Genesee North	BARKER-LYNDONVILLE 301-34.5KV	C052511
				LYNDONVILLE-MEDINA 301-34.5KV	C052512
				PHILLIPS-BARKER 301-34.5KV	C046465
				PHILLIPS-TELEGRAPH 304-34.5KV	C046466
			Livingston	MORTIMER-GOLAH 109-69KV REFURB	C050321
Customer Request/Public Requirement	Customer Interconnections	Tran	None	Alabama Ledge Wind Project Stations	CNYCS10
	Request From External TO			Upgrade Mortimer Station	C064567
Reliability	Reliability	Sub-T	Livingston	LINE 216 RECONDUCTORING	C051583
		Dist	Genesee North	WEST HAMLIN 82 - NEW TB2 - INSTALL	CD01090
			Livingston	MUMFORD 50 - TB2 - INSTALL NEW FDR	C046589
				MUMFORD 50 - INSTALL TRANSFORMER 2	C046590
System Capacity	Load Relief			S.LIVINGSTON RELIEF: FD3 WORK	C051690
				S.LIVINGSTON RELIEF: FD4 WORK	C051691
				SONORA WAY SUBSTATION WITH 6 FDERS	C060141

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				SOUTH LIVINGSTON RELIEF - DLINE FD2	C046552
	TO Led System Studies	Tran	None	Batavia Second 115 kV Cap Bank	C031478
				E.Golah 2nd 115kV tap	C051829
				Golah Cap Bank Installation	C064868
				Golah Sub rebuild	C051831
				Mortimer line Re-Arrangement	C060248

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 autotransformer loadings on the 230-115kV banks 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, #54, and #195 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. In addition, the #141/142 lines will be reconductored as part of an asset condition project.
- The NYISO selected project, in accordance with the Public Policy Transmission Planning Process (PPTPP), does not address overloads on the National Grid local transmission system. This results in the need for multiple area projects to relieve thermal constraints.
- The proposed rebuild 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.
- Planned development in the City of Buffalo in the outer harbor and Buffalo River areas will require an upgraded substation to supply that area.
- 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 56, 59, and 124.
- Indoor substations are an asset condition issue and there are several replacement projects in progress in Buffalo.
- 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). National Grid has three 230/115kV transformers at Gardenville and two 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. 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 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 4.16kV feeders; all fed from thirty-eight 23-4.16kV transformers and nineteen 23kV sub-transmission lines. The Kensington Substation has four 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 25 supply lines at 23kV. Most of the distribution substations are served by four supply cables and have four 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	UG Cable Replacement	Sub-T	None	BUFFALO 23KV UG CABLE REPLACEMENT	C052483
	Asset Replacement		Cheektowaga	NY_35KV_FPC SWGR_WEST_1 OF 3	C058985
		Dist	Niagara Falls	NEW HARPER SUBSTATION D LINE	C046417
			Tonawanda	BUFFALO STATION 122 REBUILD - LINE	CD00779
				BUFFALO STATION 122 REBUILD - SUB	CD00782
	Buffalo St Light Cable Repl		None	BUFFALO STREET LIGHT CABLE REPLACEM	CD00851
	Component Fatigue/Deterioration	Tran		Elm St #2 TRF Asset Replacement	C069426
				Frontier 180 182 ACR/Recond	C027436
				Gardenville Rebuild	C005156
				Gardenville-Rebuild Line Relocation	C030084
				Huntley-Lockport 36 37 ACR	C069538
				Kensington #4 & #5 TRF asset replac	C069429
				LockportSubstationRebuildCo36TxT	C035464
				Packard - Replace three OCBs	C075943
				Rebuild Huntley Station Asset Separ	C049902
				Seneca #2 & #5 TRF asset Replace	C069427

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Seneca Reactor 71E asset replace	C065766
	Sta Metal-Clad Switchgear	Dist	Amherst	STATION 140 METALCLAD REPLACEMENT	C056616
			Cheektowaga	STATION 61 - METALCLAD REPLACEMENT	C051707
			Kensington	STATION 162 METALCLAD REPLACEMENT	C052706
	Substation Indoor			BUFFALO STATION 30 - REBUILD - FDRS	C015754
				BUFFALO STATION 30 REBUILD - STA	C046519
				BUFFALO STATION 53 REBUILD - LINE	C046929
				BUFFALO STATION 53 REBUILD - SUB	C046945
			Niagara Falls	STEPHENSON 85 - INDOOR SUBSTATION R	C046581
				STEPHENSON 85 - SUB REFURB D-LINE	C046580
				WELCH 83 - SUB REFURB D-LINE	C046584
	Substation Power Transformer		Amherst	STATION 124 - ALMEDA AVE TRANSFORME	C046670
	Sub-T Overhead Line	Sub-T	Sawyer	STATION 126 TAPS 33H/34H-23KV	C046450
			Tonawanda	TONAWANDA LINES 601-604-23KV	C046451
DER Electric System Access	Storage	Dist	Sawyer	KENMORE STATION 22 BATTERY STORAGE	C078752
Reliability	Performance	Tran	None	Elm Street: Doble ARMs install	C079462

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
	Reliability	Dist	Grand Island	LONG RD 209 - NEW F20955	CD00964
				LONG ROAD 209 - INSTALL TB2	CD00977
			Tonawanda	NEW DIST SUB - TONAWANDA NYW DSUB	C051266
				NEW DIST SUB - TONAWANDA NYW DLINE	C051265
				STATION 214 - INSTALL TB2	C029186
				STATION 214 - NEW F21467	C029187
System Capacity	Load Relief	Sub-T	Sawyer	BUFFALO 23KV RECONDUCTOR - HUNTLEY2	C028893
			Seneca	STATION 3012 SUB-T	C074906
		Dist		STATION 3012 D-LINE	C074911
				STATION 3012 SUBSTATION	C074909
	TO Led System Studies	Tran	Niagara Falls	Royal (New Harper) TxT Substation	C044874
			None	Airco-Bffl Rvr147 Adv Metal Tap	C054711
				Elm St Relief_Add 4th Xfer	C049594
				Frontier 181 ACR/Recond	C060215
				Grdvll-Bffl Rvr146 2nd Tap Ohio Sta	C054713
				Niagara Packard 192 Terminal Equip	C079503
				Niagara-Packard 191 Reconductor	C079489
				Ohio Street new 115 - 34.5kV sub	C055263

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Pack-Hunt 130 Walk-Hunt 133 Recond	C079500
				Ridge Substation - 34.5kV System Re	C046693

5. H. Southwest Transmission Study Area

Area Summary

The primary drivers of the transmission capacity related projects in the Southwest study area are:

- A wide range of contingencies that can result in voltages well below criteria at various locations in this study area. The vulnerability of the area to these voltage issues is significantly amplified if certain key generators are not operating.
- The future interconnection of several wind generation projects.

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.
- Load growth in the Buffalo Outer Harbor area will require an expansion/upgrade of Buffalo Station 42.

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 345-115 kV transformer located at Five Mile Road and five 230-115kV transformers at Gardenville (3) and Dunkirk (2). NYSEG also has two 230-115kV transformers at Gardenville.

Within the Southwest study area, there are six 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 13.2kV feeders, five of which are fed via two 115-13.2kV transformers at the Valley substation. The remaining two 13.2kV feeders are fed from a 34.5-13.2kV transformer at the Price Corners substation. There are also twenty-one 4.8kV feeders, all supplied by 34.5-4.8kV transformers at various area substations. There are seven 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 4.8kV feeders, which are all fed from 34.5-4.8kV transformers. There are also twenty 13.2kV distribution feeders with all but one fed by 115-13.2kV transformers at various substations in the area. One 13.2kV feeder is supplied by a 34.5-13.2kV transformer at the West Portland substation. There are also eight 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 4.8kV delta feeders, which are all fed from 34.5-4.8kV transformers. There are four 13.2kV feeders with three fed by the Baker Street 115-13.2kV transformer and one fed by the French Creek 34.5-13.2kV transformer. There are five 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 distribution feeders that provide service to area customers. There are eight 4.8kV feeders supplied by 34.5-4.8kV transformers at various stations. Eleven of the area's twelve 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 34.5kV supply lines in the area. Load is served by five substations serving nine 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

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
Asset Condition	Asset Replacement	Sub-T	Chautauqua South	Sherman-Ashville 863-Ref/Rec	C079096
		Dist	Erie South	OHIO ST - BUFFALO RIVER TUNNEL/BORE	C050400
	Component	Tran	None	Dunkirk Rebuild	C005155

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
	Fatigue/Deterioration			Dunkirk Substation Rebuild CH	C073999
				Dunkrk-Falc 161-162 T1090-T1100 ACR	C047831
				Gard-Dun 141-142 N Phase Rebuild	C003389
				Gard-HH 151-152 T1950-T1280 S ACR	C027425
				Homer Hill - Replace five OCBs	C075942
				Land - Gardenville-N. Angola #141/	C076951
	Sub-T Overhead Line	Sub-T	Cattaraugus North	DAKE HILL-W. SALAMANCA 816-34.5KV	C046469
				WEST PORTLAND-SHERMAN 867 RELOCATIO	C055118
			Chautauqua North	HARTFIELD-S. DOW 859 34.5 KV PRT 3	C074502
				HARTFIELD-S. DOW 859-RELOCATE PART	C052209
			Chautauqua South	RELOCATE S. DOW-POLAND 865-34.5KV	C050177
				W. PORTLAND - SHERMAN 867-34.5KV	C046468
			Erie South	GARD-DUN 141-142 SUBT LINE RELOCATE	C078197
			Olean	HOMER HILL-NILE 811-34.5KV	C050326
Customer Request/Public Requirement	Customer Interconnections	Tran	None	ARKWRIGHT WIND LOOP IN/LOOP OUT	C078137
				Ball Hill Wind Project Stations	CNYCS12
				Ball Hill Wind Project Tline	CNYCS13
				Cassadaga Wind Project Stations	CNYCS08

Spending Rationale	Program	System	Distribution Study Area	Project Name	Project Number
				Dun-Falc 161/162 - Athenex	C074805
				Erie Cogen Stations	CNYCS05
				PJM RTEP b2371-S.Ripley Station Mods	CNYCS19
Reliability	Reliability	Sub-T	Chautauqua South	LN863 FINDLEY LAKE - FRENCH CREEK E	C046510
				W.ASHVILLE SUBSTATION TXD LN863 TAP	C048152
		Dist	Erie South	DELAMETER INSTALL TWO 20/26/33MVA	C046536
				DELAMETER F9352 RECONFIGURED LAYOU	C047886
System Capacity	Load Relief	Sub-T		EDEN SWITCH STRUCTURE -SUBT	C052023
		Dist		EDEN SWITCH STRUCTURE -INSTALL 2-10	C046538
				EDEN SWITCH STRUCTURE- NEW FDR 1	C048015
				EDEN SWITCH STRUCTURE- NEW FDR 2	C048016
	TO Led System Studies	Tran	None	W. Ashville substation TxT	C043833

Exhibit 1 - Transmission Capital Investment Plan

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
Asset Condition	Asset Condition I&M	NY Inspection Repairs - Capital	C026923	12,000,000	12,000,000	12,000,000	12,000,000	12,000,000	60,000,000
	Asset Condition I&M Total			12,000,000	12,000,000	12,000,000	12,000,000	12,000,000	60,000,000
	Component Fatigue/Deterioration	345kV Laminated Cross-arm-Program	C060365	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	10,000,000
		Alabama-Telegraph 115 T1040 ACR.	C033014	6,136,000	0	0	0	0	6,136,000
		Albany Steam - 115kV asset rplc	C079461	0	50,000	400,000	2,000,000	1,800,000	4,250,000
		Alps relay replacement	C049296	5,000	0	0	0	0	5,000
		AMT PIW/SERR - NIMO	C031545	250,000	250,000	250,000	250,000	250,000	1,250,000
		Ash St. 115-12kV TRF1 Asset replace	C076282	230,000	906,000	450,000	0	0	1,586,000
		Balmat - Repl liquid filled fuse	C076189	54,000	0	0	0	0	54,000
		Batavia - Obsolete Relays	C073587	233,000	0	0	0	0	233,000
		Batavia - Replace five OCBs	C075904	240,000	1,235,000	544,000	0	0	2,019,000
		Batavia-Golah 119 ACR	C060217	0	0	300,000	140,000	3,150,000	3,590,000
		BatteryRplStrategyCo36TxT	C033847	698,000	510,000	561,000	255,000	250,000	2,274,000
		Battle Hill - replace 3 OCBs	C049543	18,000	0	0	0	0	18,000
		Boonville Rebuild	C049903	0	50,000	300,000	934,000	3,210,000	4,494,000
		Border City-Elbridge #15/#5 ACR	C075723	0	0	300,000	1,000,000	3,000,000	4,300,000
		Breaker T Repl Program 4-69kV NYC	C049258	609,000	609,000	612,000	612,000	624,000	3,066,000
		Breaker T Repl Program 4-69kV NYE	C049257	376,000	598,000	600,000	600,000	600,000	2,774,000
		Breaker T Repl Program 4-69kV NYW	C049260	576,000	759,000	713,000	379,000	379,000	2,806,000
		Brockport Tap Refurbishment	C055531	0	0	75,000	350,000	1,575,000	2,000,000
		Carr St./E.Syracuse CO-Gen Relays	C049739	148,000	0	0	0	0	148,000
		Colton-BF 1-2 T3140-T3150 ACR	C036164	0	0	100,000	200,000	200,000	500,000
		Curtis St - Oil Breaker Replacement	C049584	7,000	0	0	0	0	7,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		Dewitt - Remote End Work	C075822	61,000	0	0	0	0	61,000
		Dunkirk Rebuild	C005155	3,595,000	12,392,000	12,447,000	751,000	0	29,185,000
		Dunkirk Substation Rebuild CH	C073999	400,000	2,000,000	0	0	0	2,400,000
		Dunkrk-Falc 161-162 T1090-T1100 ACR	C047831	0	100,000	200,000	200,000	700,000	1,200,000
		East Norfolk - Repl liq filled fuse	C076188	113,000	0	0	0	0	113,000
		East Syracuse Co-Gen Disconnects	C056726	70,000	0	0	0	0	70,000
		Edic: Protection Migration	C076214	50,000	830,000	2,112,000	2,919,000	311,000	6,222,000
		Elm St #2 TRF Asset Replacement	C069426	50,000	750,000	2,372,000	3,506,000	1,669,000	8,347,000
		Existing Control Bldg - Tran-NY	CNYT352	250,000	250,000	250,000	250,000	250,000	1,250,000
		Feura Bush Relay Replacement	C049585	486,000	0	0	0	0	486,000
		Frontier 180 182 ACR/Recond	C027436	0	0	300,000	200,000	2,000,000	2,500,000
		Gard-Dun 141-142 N Phase Rebuild	C003389	2,413,000	23,985,000	25,704,000	18,683,000	2,803,000	73,588,000
		Gard-Dun 141-142 South Struct Repl	C077024	900,000	0	0	0	0	900,000
		Gardenville Rebuild	C005156	5,225,000	547,000	321,000	8,000	0	6,101,000
		Gardenville-Rebuild Line Relocation	C030084	4,168,000	2,646,000	173,000	0	0	6,987,000
		Gard-HH 151-152 T1950-T1280 S ACR	C027425	0	200,000	200,000	1,000,000	3,000,000	4,400,000
		Greenbush - 115kV & 34.5kV refurb	C079224	0	0	0	50,000	300,000	350,000
		Greenbush Relay Replacement	C049587	188,000	0	0	0	0	188,000
		Greenbush-Stephentown #993 ACR	C060208	150,000	200,000	1,000,000	3,800,000	500,000	5,650,000
		Homer Hill - Replace five OCBs	C075942	0	0	240,000	1,228,000	600,000	2,068,000
		Hoosick - Replace Bank 1 & relays	C053132	0	100,000	734,000	3,705,000	2,036,000	6,575,000
		HUNTLEY - ASSET SEP/RPLC FIBER LINE	C078133	30,000	0	0	0	0	30,000
		Huntley-Gardenville 38/39 Rebuild	C075543	0	0	0	300,000	0	300,000
		Huntley-Lockport 36 37 ACR	C069538	7,665,000	8,837,000	100,000	0	0	16,602,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		Independence Station relay Replace	C049598	338,000	0	0	0	0	338,000
		Inghams Phase Shifting Transformer	C047864	0	0	200,000	2,130,000	2,130,000	4,460,000
		Inghams Station - Assoc Line work	C060240	0	0	0	100,000	900,000	1,000,000
		Inghams Station Re-vitalization	C050917	0	50,000	173,000	700,000	4,450,000	5,373,000
		Inghams Station Revitalization CH	C074000	0	0	0	100,000	700,000	800,000
		Inghams-E. Springfield #7 ACR	C060209	0	100,000	200,000	200,000	500,000	1,000,000
		Kensington #4 & #5 TRF asset replac	C069429	0	50,000	700,000	2,250,000	2,450,000	5,450,000
		Land - Gardenville-N. Angola #141/	C076951	0	4,500,000	0	0	0	4,500,000
		LightHH 115kV CH	C073996	0	0	866,000	866,000	1,154,000	2,886,000
		LightHH 115kV Yard Repl & cntrl hs.	C031662	25,000	300,000	1,637,000	4,905,000	9,811,000	16,678,000
		LightHH Trans Lines Reconnect	C073997	0	50,000	756,000	2,016,000	4,032,000	6,854,000
		Lockport 103-104 T1620-T1060 STR	C027432	0	0	0	300,000	200,000	500,000
		Lockport Sub Rebuild CH	C073991	0	0	0	0	635,000	635,000
		Lockport-Batavia 108 T1500 STR.	C027431	3,000	350,000	0	0	0	353,000
		Lockport-Batavia 112 T1510 ACR	C003422	50,000	500,000	5,000,000	5,000,000	5,000,000	15,550,000
		LockportSubstationRebuildCo 36TxT	C035464	0	50,000	400,000	990,000	3,600,000	5,040,000
		Long Lane Relay Replacement	C049600	6,000	0	0	0	0	6,000
		Maplewood - Replace one OCB	C075867	365,000	0	0	0	0	365,000
		Menands Cntrl Bldg & Relay Replcmt	C049601	121,000	1,475,000	3,070,000	3,388,000	2,194,000	10,248,000
		Mohican - Replace Bank 1 and Relays	C053133	0	50,000	752,000	2,006,000	4,012,000	6,820,000
		Mortimer #3 Auto TRF Replace	C076283	509,000	4,867,000	34,000	0	0	5,410,000
		Mortimer-Golah #110 ACR	C060220	0	0	300,000	200,000	200,000	700,000
		Mortmr-Pannll 24-25 T1590-T1600 ACR	C047816	100,000	200,000	1,000,000	3,000,000	10,000,000	14,300,000
		NEW SCOTLAND -	C077221	325,000	0	0	0	0	325,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		OBSOLETE RLY RPL LN3							
		New Scotland 345kV&115kV Relay Repl	C047861	15,000	0	0	0	0	15,000
		NEW SCOTLAND R93&R94 ASSET REPLACE	C062752	0	0	50,000	600,000	690,000	1,340,000
		North Ashford - Relay Work	C064472	9,000	0	0	0	0	9,000
		North Troy - 34.5kV refurb/rebuild	C079223	0	0	0	50,000	250,000	300,000
		Norwood - Repl liquid filled fuse	C076187	116,000	0	0	0	0	116,000
		NY Priority OHL Tran Switch Repl	C076621	630,000	630,000	630,000	630,000	630,000	3,150,000
		Oneida Substation Rebuild	C034443	0	30,000	250,000	1,567,000	4,617,000	6,464,000
		Oswego - 115kV & 34.5kV - Rebuild	C043426	6,358,000	2,353,000	904,000	0	0	9,615,000
		Oswego: 115kV Control House	C061991	3,780,000	289,000	104,000	0	0	4,173,000
		Oswego: 345kV Asset Sep/Repl	C076218	50,000	750,000	4,050,000	5,000,000	6,000,000	15,850,000
		Oswego: 345kV Asset Sep/Repl CH	C076983	0	487,000	487,000	650,000	0	1,624,000
		Packard - 115kV & 230kV refurb/reb	C079222	0	0	0	0	50,000	50,000
		Packard - Replace three OCBs	C075943	0	125,000	974,000	135,000	0	1,234,000
		Packard Relays line 191 to 195	C051423	81,000	0	0	0	0	81,000
		Packard-Walck Road 129 ACR	C060214	0	0	0	0	200,000	200,000
		Pannell-Geneva 4-4A T1860 ACR	C030889	125,000	1,500,000	2,500,000	23,000,000	14,000,000	41,125,000
		Purchase Spare Transformers	C053135	1,973,000	3,400,000	5,402,000	450,000	1,285,000	12,510,000
		Quaker-Sleight Road #13 ACR	C060219	0	0	0	0	200,000	200,000
		Queensbury - Repl GE PT EW450	C078793	10,000	0	0	0	0	10,000
		Queensbury - replace OCBs	C049554	387,000	0	0	0	0	387,000
		Rebuild Huntley Station Asset Separ	C049902	6,955,000	5,546,000	824,000	0	0	13,325,000
		Replacement of GE PTs EU11	C078794	15,000	0	0	0	0	15,000
		Reynolds Rd - Cap Bank Relay Inst	C077616	0	50,000	75,000	0	0	125,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		Rotterdam 115kV SubRebuild(AIS)	C034850	0	10,000	320,000	3,727,000	21,931,000	25,988,000
		S Oswego-Clay #4 T-334 Rebuild	C075544	0	0	0	300,000	0	300,000
		Schuyler - replace OCBs	C049562	493,000	0	0	0	0	493,000
		Scriba - Replace Insulators	C075962	126,000	65,000	0	0	0	191,000
		Scriba Relay Replacement	C049611	549,000	10,000	0	0	0	559,000
		Seneca #2 & #5 TRF asset Replace	C069427	50,000	700,000	2,250,000	2,450,000	100,000	5,550,000
		Seneca Reactor 71E asset replace	C065766	111,000	1,052,000	0	0	0	1,163,000
		Seneca Term Relay Replacement	C049613	204,000	0	0	0	0	204,000
		Sleight Rd-Auburn #3 ACR	C075566	0	0	0	0	200,000	200,000
		Solvay: Rplc Circuit Switchers	C079463	0	0	0	100,000	250,000	350,000
		Southeast Batavia - Obsolete Relays	C073588	174,000	0	0	0	0	174,000
		Spier-Rott 2 Shieldwire Replac	C050744	200,000	2,000,000	0	0	0	2,200,000
		Teall - Replace one OCBs	C075902	0	146,000	541,000	171,000	0	858,000
		Teall Ave. Transformer Replacement	C047865	630,000	0	0	0	0	630,000
		Telegraph Road TRF #2 Asset Replace	C069346	624,000	646,000	0	0	0	1,270,000
		Terminal Station Relocation	C076242	0	50,000	3,000,000	2,650,000	5,193,000	10,893,000
		Ticonderoga 2-3 T5810-T5830 ACR	C039521	1,590,000	4,557,000	10,293,000	2,468,000	1,176,000	20,084,000
		Ticonderoga-Sanford T6410R Removal	C032309	210,000	0	0	0	0	210,000
		Ticonderoga-Whitehall 3 Mt Defiance	C078570	100,000	500,000	1,000,000	0	0	1,600,000
		Tuller Hill 115kV Tap Replacement	C065087	20,000	0	50,000	0	0	70,000
		Turner D Switch Replacements (36)	C052603	630,000	630,000	630,000	630,000	630,000	3,150,000
		Volney station Relay Replacement	C049626	458,000	15,000	0	0	0	473,000
		Whitehall - Replace three OCBs	C075885	970,000	151,000	0	0	0	1,121,000
		Wood Pole Mgmt Prgm (Osmose)	C011640	2,002,000	2,002,000	2,002,000	2,503,000	2,503,000	11,012,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		Woodard - Replace three OCBs	C075903	269,000	0	0	0	0	269,000
		Woodard Relay Replacement	C047863	10,000	0	0	0	0	10,000
		Woodlawn Transformer Replacement	C051986	700,000	2,340,000	1,800,000	0	0	4,840,000
		Yahnundasis: Rplc OCB R30 & R60	C079010	335,000	480,000	10,000	0	0	825,000
		Youngman Term: Rplc Circ Switchers	C079465	0	0	0	100,000	250,000	350,000
	Component Fatigue/Deterioration Total			70,195,000	102,860,000	106,592,000	120,652,000	143,330,000	543,629,000
	Failure Trend	Central Div Sta - Shielded Cable	C058003	360,000	0	0	0	0	360,000
		West Div - Shielded Cables	C058130	70,000	60,000	75,000	0	0	205,000
	Failure Trend Total			430,000	60,000	75,000	0	0	565,000
Asset Condition Total				82,625,000	114,920,000	118,667,000	132,652,000	155,330,000	604,194,000
Communications/ Control Systems	EMS/SCADA	NMP1 - RTU REPLACEMENT	C077127	109,000	0	0	0	0	109,000
		Program-Remote Terminal Unit (RTU)	C003772	250,000	0	0	0	0	250,000
		RTUs M9000 Protocol Upgrades	C069437	1,140,000	1,307,000	1,436,000	2,056,000	2,794,000	8,733,000
	EMS/SCADA Total			1,499,000	1,307,000	1,436,000	2,056,000	2,794,000	9,092,000
	Telecom	NYISO Comm Protocols Support	C078688	200,000	225,000	50,000	0	0	475,000
		Upgrade Comm Equip Verizon Retireme	C069570	500,000	2,000,000	5,000,000	5,600,000	5,000,000	18,100,000
	Telecom Total			700,000	2,225,000	5,050,000	5,600,000	5,000,000	18,575,000
Communications/Control Systems Total				2,199,000	3,532,000	6,486,000	7,656,000	7,794,000	27,667,000
Customer Request/Public Requirement	Customer Interconnections	Alabama Ledge Wind Project Stations	CNYCS10	100,000	900,000	900,000	57,000	0	1,957,000
		Alabama Ledge Wind Project Stations Reimb	CNYCS10R	-100,000	-900,000	-900,000	-57,000	0	-1,957,000
		Alabama Ledge Wind Project Tline	CNYCS11	20,000	410,000	410,000	20,000	0	860,000
		Alabama Ledge Wind Project Tline Reimb	CNYCS11R	-20,000	-410,000	-410,000	-20,000	0	-860,000
		ARKWRIGHT WIND LOOP IN/LOOP OUT	C078137	1,400,000	0	0	0	0	1,400,000
		ARKWRIGHT WIND LOOP IN/LOOP OUT Reimb	C078137R	-1,400,000	0	0	0	0	-1,400,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		Arkwright Wind Project - Station	C078136	263,000	0	0	0	0	263,000
		Arkwright Wind Project - Station Reimb	C078136R	-263,000	0	0	0	0	-263,000
		Ball Hill Wind Project Stations	CNYCS12	1,000,000	1,000,000	55,000	0	0	2,055,000
		Ball Hill Wind Project Stations Reimb	CNYCS12R	-1,000,000	-1,000,000	-55,000	0	0	-2,055,000
		Ball Hill Wind Project Tline	CNYCS13	1,785,000	1,785,000	100,000	0	0	3,670,000
		Ball Hill Wind Project Tline Reimb	CNYCS13R	-1,785,000	-1,785,000	-100,000	0	0	-3,670,000
		BEC - Rx Station & T Remotes	C078441	1,261,000	158,000	0	0	0	1,419,000
		BEC - Rx Station & T Remotes Reimb	C078441R	-1,261,000	-158,000	0	0	0	-1,419,000
		Cassadaga Wind Project Stations	CNYCS08	500,000	650,000	145,000	0	0	1,295,000
		Cassadaga Wind Project Stations Reimb	CNYCS08R	-500,000	-650,000	-145,000	0	0	-1,295,000
		Cassadaga Wind Project Tline	CNYCS09	100,000	300,000	35,000	0	0	435,000
		Cassadaga Wind Project Tline Reimb	CNYCS09R	-100,000	-300,000	-35,000	0	0	-435,000
		Cedar Rapids TIP Project Stations	CNYCS16	200,000	600,000	176,000	0	0	976,000
		Cedar Rapids TIP Project Stations Reimb	CNYCS16R	-200,000	-600,000	-176,000	0	0	-976,000
		Cedar Rapids TIP Project Tline	CNYCS17	1,000,000	3,500,000	1,110,000	0	0	5,610,000
		Cedar Rapids TIP Project Tline Reimb	CNYCS17R	-1,000,000	-3,500,000	-1,110,000	0	0	-5,610,000
		Copenhagen Wind Loop In/Loop out	C076290	937,000	0	0	0	0	937,000
		Copenhagen Wind Loop In/Loop out Reimb	C076290R	-937,000	0	0	0	0	-937,000
		Copenhagen Wind Project - Stations	C076291	1,119,000	0	0	0	0	1,119,000
		Copenhagen Wind Project - Stations Reimb	C076291R	-1,119,000	0	0	0	0	-1,119,000
		Dun-Falc 161/162 - Athenex	C074805	1,863,000	0	0	0	0	1,863,000
		Dun-Falc 161/162 - Athenex Reimb	C074805R	-1,863,000	0	0	0	0	-1,863,000
		Edic-MVEdge Customer Connection Reimb	C066166R	-320,000	0	0	0	0	-320,000
		Erie Cogen Stations	CNYCS05	1,930,000	0	0	0	0	1,930,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		Erie Cogen Stations Reimb	CNYCS05R	-1,930,000	0	0	0	0	-1,930,000
		Galloo Island Wind Project Stations	CNYCS14	425,000	425,000	50,000	0	0	900,000
		Galloo Island Wind Project Stations Reimb	CNYCS14R	-425,000	-425,000	-50,000	0	0	-900,000
		Galloo Island Wind Project Tline	CNYCS15	410,000	410,000	40,000	0	0	860,000
		Galloo Island Wind Project Tline Reimb	CNYCS15R	-410,000	-410,000	-40,000	0	0	-860,000
		GNS-1 NYPA OPGW Stations	CNYCS18	480,000	0	0	0	0	480,000
		GNS-1 NYPA OPGW Stations Reimb	CNYCS18R	-480,000	0	0	0	0	-480,000
		Monroe County Mill Seat-TRAN	C067866	9,000	0	0	0	0	9,000
		Monroe County Mill Seat-TRAN Reimb	C067866R	-9,000	0	0	0	0	-9,000
		Ogdensburg Cogen Repower Line Mods	CNYCS21	480,000	20,000	0	0	0	500,000
		Ogdensburg Cogen Repower Line Mods Reimb	CNYCS21R	-480,000	-20,000	0	0	0	-500,000
		Ogdensburg Cogen Repower Station Mods	CNYCS20	1,400,000	42,000	0	0	0	1,442,000
		Ogdensburg Cogen Repower Station Mods Reimb	CNYCS20R	-1,400,000	-42,000	0	0	0	-1,442,000
		PJM RTEP b2371-S.Ripley Station Mods	CNYCS19	1,307,000	0	0	0	0	1,307,000
		PJM RTEP b2371-S.Ripley Station Mods Reimb	CNYCS19R	-1,307,000	0	0	0	0	-1,307,000
	Customer Interconnections Total			-320,000	0	0	0	0	-320,000
	Public Requirements (additional need)	Lafarge Relocation	C079454	200,000	1,500,000	3,800,000	500,000	0	6,000,000
	Public Requirements (additional need) Total			200,000	1,500,000	3,800,000	500,000	0	6,000,000
	Request From External TO	Upgrade Mortimer Station	C064567	116,000	933,000	0	0	0	1,049,000
		Upgrade Mortimer Station Reimb	C064567R	-500,000	-125,000	0	0	0	-625,000
	Request From External TO Total			-384,000	808,000	0	0	0	424,000
Customer Request/Public Requirement Total				-504,000	2,308,000	3,800,000	500,000	0	6,104,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
Damage/Failure	Damage/Failure	Harper Station #40 TRF D/F	C075622	142,000	0	0	0	0	142,000
		LEEDS - LS2 REACTOR REPLACEMENT	C078782	1,683,000	0	0	0	0	1,683,000
		Machias - Replace TB#2	C079179	191,000	0	0	0	0	191,000
		Storm Budgetary Blanket - NMPC	C003481	500,000	500,000	500,000	500,000	500,000	2,500,000
		Trans Line Failure Reserve	C079452	1,858,000	2,500,000	2,500,000	2,500,000	2,500,000	11,858,000
		Trans Station Failure Budget Blankt	C003792	1,700,000	1,700,000	1,700,000	1,700,000	1,700,000	8,500,000
		Trans Station Failure Reserve	C073870	3,262,008	3,899,500	4,839,000	4,590,000	4,598,000	21,188,508
		TransLine D/F Budget Blanket	C003278	650,000	650,000	650,000	650,000	650,000	3,250,000
	Damage/Failure Total			9,986,008	9,249,500	10,189,000	9,940,000	9,948,000	49,312,508
Damage/Failure Total				9,986,008	9,249,500	10,189,000	9,940,000	9,948,000	49,312,508
DER Electric System Access	Customer Interconnections	DG 10770/10771 ONEIDA CNT SHERIFF	C077230	36,000	0	0	0	0	36,000
		DG Integration 3V0 Trailer	C078989	200,000	0	0	0	0	200,000
		DG NY12806 OPPENHEIM A INGHAMS LTC	C079066	26,000	0	0	0	0	26,000
	Customer Interconnections Total			262,000	0	0	0	0	262,000
DER Electric System Access Total				262,000	0	0	0	0	262,000
Reliability	NERC/NPCC Standards	Physical Security	C073349	0	800,000	1,200,000	0	0	2,000,000
		Conductor Clearance - NY Program	C048678	7,500,000	7,500,000	12,000,000	12,000,000	10,000,000	49,000,000
		Physical Security	C073348	208,000	0	0	0	0	208,000
		Physical Security	C073352	63,000	822,000	0	0	0	885,000
		Physical Security	C073353	710,000	0	0	0	0	710,000
		Physical Security	C073354	906,000	0	0	0	0	906,000
		Physical Security	C073356	20,000	0	0	0	0	20,000
		Physical Security	C073648	80,000	906,000	0	0	0	986,000
		Porter 230kV-Upgrade Brks/Disc/PT's	C036866	1,000,000	1,259,000	15,550,000	6,185,000	50,000	24,044,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		Physical Security	C073351	784,000	0	0	0	0	784,000
	NERC/NPCC Standards Total			11,271,000	11,287,000	28,750,000	18,185,000	10,050,000	79,543,000
	Performance	Backup UG Pump Plant-Trinity Ln 5&9	C062469	250,000	1,847,000	100,000	0	0	2,197,000
		Elm Street: Doble ARMs install	C079462	0	50,000	250,000	900,000	900,000	2,100,000
		Mplwd 19/31 Mnands Term Equip Upgrd	C078287	25,000	70,000	405,000	0	0	500,000
		Osprey Mitigation/Avian Protection	C076662	500,000	250,000	250,000	250,000	250,000	1,500,000
	Performance Total			775,000	2,217,000	1,005,000	1,150,000	1,150,000	6,297,000
Reliability Total				12,046,000	13,504,000	29,755,000	19,335,000	11,200,000	85,840,000
System Capacity	ISO Led System Studies	Menands Terminal Equipment Upgrade	C079071	0	188,000	538,000	0	0	726,000
	ISO Led System Studies Total			0	188,000	538,000	0	0	726,000
	TO Led System Studies	Airco-Bffl Rvr147 Adv Metal Tap	C054711	1,103,000	0	0	0	0	1,103,000
		Albany-Greenbush 1&2 Reconductoring	C077034	5,626,000	848,000	0	0	0	6,474,000
		Albany-Greenbush 1&2 Reconductoring Reimb	C077034R	-3,037,000	-448,000	0	0	0	-3,485,000
		Batavia Second 115 kV Cap Bank	C031478	2,757,000	0	0	0	0	2,757,000
		Central Breaker Upgrades - Ash	C043424	1,163,000	75,000	0	0	0	1,238,000
		Clay-Teall#10,Clay-Dewitt#3 Recond	C043995	17,960,000	21,180,000	8,000,000	0	0	47,140,000
		Collamer Crossing_115kV_Line_TAP	C070394	1,000,000	0	0	0	0	1,000,000
		E.Golah 2nd 115kV tap	C051829	0	0	70,000	1,000,000	0	1,070,000
		Easement - Ohio-Ridge #613	C077205	16,000	0	0	0	0	16,000
		Elbridge WoS Reactors	C069531	250,000	500,000	4,500,000	0	0	5,250,000
		Elm St Relief_Add 4th Xfer	C049594	3,091,000	202,000	0	0	0	3,293,000
		Firehouse Rd 3 Terminal	C069452	0	0	0	292,000	1,116,000	1,408,000
		Frontier 181 ACR/Recond	C060215	1,135,000	1,590,000	1,390,000	33,459,000	27,550,000	65,124,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		GE-Geres Lock 8 T2240 Reconductor	C047835	1,000,000	7,737,000	1,000,000	0	0	9,737,000
		Golah Cap Bank Installation	C064868	1,320,000	0	0	0	0	1,320,000
		Golah Sub rebuild	C051831	72,000	906,000	1,771,000	0	0	2,749,000
		Grdvll-Bffl Rvr146 2nd Tap Ohio Sta	C054713	2,407,000	0	0	0	0	2,407,000
		Land Rights/Acquisition - Tran-NY	CNYT350	225,000	225,000	225,000	225,000	225,000	1,125,000
		Land-Clay-Teall#10,Clay-Dewitt #3	C068288	160,000	60,000	0	0	0	220,000
		Lasher Rd Transmission Line	C043672	445,000	733,000	0	0	0	1,178,000
		Lasher Road Substation	C064726	8,000,000	4,200,000	1,300,000	0	0	13,500,000
		Lasher Road Substation - LAB	C064727	1,350,000	90,000	0	0	0	1,440,000
		Line 853 - Rebuild & Conv to 115kV	C051828	0	0	0	0	850,000	850,000
		Line 853 Extension to N.Lakeville	C043532	0	0	0	0	850,000	850,000
		Malone 2nd Bank_Tline	C059673	0	40,000	240,000	120,000	0	400,000
		Malone Metalclad&Transformer	C069306	0	0	165,000	1,974,000	4,042,000	6,181,000
		Maplewood #19/#31Reconductoring	C069466	250,000	2,556,000	5,905,000	4,349,000	0	13,060,000
		Menands #10/#15 Reconductoring	C068850	721,000	0	0	0	0	721,000
		Mohican Battenkill#15 Rebuild Recon	C034528	735,000	600,000	0	0	0	1,335,000
		Mortimer line Re-Arrangement	C060248	570,000	500,000	0	0	0	1,070,000
		MORTIMER LINE REARRANGMENT - TSUB	C078115	1,000	8,000	0	0	0	9,000
		Mountain Station Relay Replacement	C049603	364,000	0	0	0	0	364,000
		NEW MAPLE AVE - LINE PORTION	C070395	23,000	135,000	225,000	0	0	383,000
		New Two Mile Creek Sub T-Line Taps	C053156	158,000	387,000	0	0	0	545,000
		New Watertown 115-13.2kV T - Line	C053155	0	0	84,000	0	0	84,000
		Niagara Packard 192 Terminal Equip	C079503	0	403,000	532,000	4,253,000	189,000	5,377,000
		Niagara-Packard 191 Reconductor	C079489	0	360,000	431,000	5,241,000	149,000	6,181,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		Niagara-Packard 191 Terminal Equip	C079501	0	0	75,000	189,000	0	264,000
		Niagara-Packard 192 Reconductor	C079488	0	0	75,000	189,000	0	264,000
		North Troy Brkr & Relay Repl	C069438	327,000	0	0	0	0	327,000
		Ohio Street new 115 - 34.5kV sub	C055263	7,011,000	901,000	0	0	0	7,912,000
		Packard 77/78 Series Reactors	C063627	700,000	0	0	0	0	700,000
		Packard Urban 181 Terminal Equip	C079506	3,000	3,000	2,000	78,000	1,000	87,000
		Packard-Gardenville 182 Reactor	C079486	0	0	56,000	95,000	72,000	223,000
		Packard-Gardenville 182 ReactorLine	C079569	0	0	1,000	18,000	11,000	30,000
		Pack-Hunt 130 Walk-Hunt 133 Recond	C079500	146,000	33,000	410,000	377,000	11,948,000	12,914,000
		Porter #3 / #7 Install Reactors	C060241	100,000	0	0	0	0	100,000
		Porter Reactors Trans Line Work	C073246	32,000	0	0	0	0	32,000
		Recond Cortland Clarks Corners	C053141	0	0	0	421,000	0	421,000
		Ridge Substation - 34.5kV System Re	C046693	312,000	329,000	560,000	0	0	1,201,000
		Rosa Rd add 115kV Cap Bank	C069467	1,269,000	0	0	0	0	1,269,000
		Rotterdam - Add Reactors LN19/20	C069548	1,745,000	80,000	0	0	0	1,825,000
		Rotterdam - Curry #11 recond	C060243	7,150,000	2,500,000	0	0	0	9,650,000
		ROTTERDAM 17 19 REACTORS	C078883	53,000	10,000	0	0	0	63,000
		Rotterdam Breaker Replacement	C049605	1,151,000	0	0	0	0	1,151,000
		Rotterdam-Reconfig Bus& add breaker	C060255	335,000	0	0	0	0	335,000
		Rottrdm 17 Reactors-New Scot Relay	C078879	509,000	10,000	0	0	0	519,000
		Royal (New Harper) 115 kV line taps	C044594	0	28,000	629,000	338,000	0	995,000
		Royal (New Harper) TxT Substation	C044874	0	1,657,000	6,185,000	1,833,000	0	9,675,000
		Schaghticoke Control House	C062925	698,000	120,000	0	0	0	818,000
		Schaghticoke Switching	C060252	6,155,000	1,447,000	0	0	0	7,602,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		Station							
		Schaghticoke Tap Sw St - Line taps	C060253	543,000	232,000	0	0	0	775,000
		Sodeman Rd Install New taps	C043755	242,000	480,000	94,000	0	0	816,000
		Taps to 115 kV new Cicero Sub	C050939	100,000	370,000	120,000	0	0	590,000
		Ticonderoga- Inst Cap Bank, Rpl OCB	C060254	2,838,000	65,000	0	0	0	2,903,000
		TP Mortimer Second Bus tie	C050696	977,000	14,000	0	0	0	991,000
		Trans Study Budgetary Blanket NY	C008376	150,000	150,000	150,000	150,000	150,000	750,000
		Van Dyke 115-13.2 Sub Taps	C044173	0	0	628,000	0	0	628,000
		W. Ashville sub 115kV ln 160 tap	C043832	100,000	807,000	0	0	0	907,000
		W. Ashville substation TxT	C043833	5,089,000	1,589,000	0	0	0	6,678,000
	TO Led System Studies Total			86,600,000	53,712,000	34,823,000	54,601,000	47,153,000	276,889,000
System Capacity Total				86,600,000	53,900,000	35,361,000	54,601,000	47,153,000	277,615,000
Grand Total				193,214,008	197,413,500	204,258,000	224,684,000	231,425,000	1,050,994,508

Exhibit 2 - Sub-Transmission Capital Investment Plan

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
Asset Condition	UG Cable Replacement	404 LINE - UG CABLE REPLACEMENT	C069646	670,000	0	0	0	0	670,000
		BUFFALO 23KV REC.-SEN. 1,2,3,19,31S	C048826	733,000	0	0	0	0	733,000
		BUFFALO 23KV UG CABLE REPLACEMENT	C052483	0	0	0	1,000,000	1,000,000	2,000,000
		BUFFALO STATION 59 REBUILD - 23 KV	C033472	76,440	0	0	0	0	76,440
		PARTRIDGE-AVE A 5 CABLE REPLACEME	C036273	0	1,002,000	0	0	0	1,002,000
		ROTTERDAM 34 36 34.5KV CABLE REPL	C077065	16,000	1,104,000	0	0	0	1,120,000
		SOLVAY ASH 27 CABLE REPL SUBT	C032147	0	639,100	616,690	616,690	732,890	2,605,370
		SOLVAY-ASH 28 34.5KV REPLACE CABLE	C045629	0	0	0	0	2,605,000	2,605,000
	UG Cable Replacement Total			1,495,440	2,745,100	616,690	1,616,690	4,337,890	10,811,810
	Asset Replacement	34.5KV TAP FAIRDALE TRANSF. UPGRADE	C075584	35,000	145,200	0	0	0	180,200
		BUFFALO STATION 122 REBUILD - 23KV	CD00780	0	0	18,000	107,900	0	125,900
		CUBA CHEESE TAP 811-34.5 KV INSUL.	C075229	149,940	0	0	0	0	149,940
		CUYLER24 SUBT TAP-SUB REPLACEMENT	C060019	73,061	0	0	0	0	73,061
		DEERFIELD-SCHUYLER 46 KV TWR REP	C078246	50,000	200,100	0	0	0	250,100
		DUNKIRK STEAM-REL/REPL 34.5 KV LNS	C076185	0	100,000	289,872	0	0	389,872
		LN404 MOUTAIN - SANBORN RECONDUCTOR	CD01276	571,500	0	0	0	0	571,500
		N.LAKEVILLE - RIDGE LN 218 REFURBIS	C046766	0	0	60,000	571,870	531,200	1,163,070
		NORTHVILLE-WELLS 1-23 KV INS.	C075062	985,615	0	0	0	0	985,615
		NY_35KV_FPC SWGR_WEST_1 OF 3	C058985	598,850	599,140	495,840	0	0	1,693,830
		PEBBLE HILL-RATHBUN 27 RELOC.	C078515	75,000	748,000	0	0	0	823,000
		RANKINE - ADAMS - 25 CYCLE LINE RET	C046620	4,615	4,615	0	0	0	9,230
		REMOVE CHILDS-MILLING 614 34.5 KV	C078452	100,000	0	0	0	0	100,000
		SCHUYLER -VALLEY 21/24 RECOND.	C078517	75,000	504,000	0	0	0	579,000
		Sherman-Ashville 863-Ref/Rec	C079096	0	150,000	2,000,000	1,500,000	45,000	3,695,000
		SUBT LINE INS REPL PROGRAM	C078518	0	450,000	450,000	450,000	450,000	1,800,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		WEST							
		SUBT LINE INS. REPL PROGRAM CENTRAL	C078621	0	450,000	450,000	450,000	450,000	1,800,000
		SUBT LINE INS. REPL PROGRAM EAST	C078624	0	450,000	450,000	450,000	450,000	1,800,000
		WOODARD-ASH 27-DESTINY RELOC.	C078516	0	0	100,000	1,505,000	45,000	1,650,000
	Asset Replacement Total			2,718,581	3,801,055	4,313,712	5,034,770	1,971,200	17,839,318
	Blanket	CNY SUB TRANS-LINE ASSET REPLACE	CNC0075	155,000	158,000	162,000	166,000	170,000	811,000
		ENY SUB TRANS-LINE ASSET REPLACE	CNE0075	118,000	121,000	124,000	127,000	130,000	620,000
		WNY SUB TRANS-LINE ASSET REPLACE	CNW0075	241,000	246,000	251,000	257,000	263,000	1,258,000
	Blanket Total			514,000	525,000	537,000	550,000	563,000	2,689,000
	De-Energized T Line Strategy	CAMBRIA-LOCKPORT 411, 12KV REMOVAL	C067246	500	0	0	0	0	500
		TERMINAL STA B - R48, R46, R25 REM.	C036204	1,560	0	0	0	0	1,560
	De-Energized T Line Strategy Total			2,060	0	0	0	0	2,060
	Inspection & Maintenance	I&M - NC SUB-T LINE WORK FROM INSP.	C026166	2,162,320	2,256,320	2,256,320	2,256,320	2,256,320	11,187,600
		I&M - NE SUB-T LINE WORK FROM INSP.	C026165	2,447,000	2,500,000	2,500,000	2,500,000	2,500,000	12,447,000
		I&M - NW SUB-T LINE WORK FROM INSP.	C026167	2,360,000	2,500,000	2,500,000	2,500,000	2,500,000	12,360,000
	Inspection & Maintenance Total			6,969,320	7,256,320	7,256,320	7,256,320	7,256,320	35,994,600
	Substation Indoor	BUFFALO STATION 30 - REBUILD - 23KV	C015755	0	0	0	12,000	155,200	167,200
		BUFFALO STATION 34 REBUILD - 23 KV	C046944	0	0	0	0	10,000	10,000
		BUFFALO STATION 53 REBUILD - 23 KV	C046928	0	30,000	150,450	150,450	0	330,900
	Substation Indoor Total			0	30,000	150,450	162,450	165,200	508,100
	Sub-T Overhead Line	AMSTERDAM-ROTTERDAM3/4 RELOCATION	C033182	0	0	2,887,200	0	0	2,887,200
		BAGDAD-DAKE HILL 815-34.5KV REFURB.	C050292	0	0	25,000	50,000	779,250	854,250
		BALLSTON-MECHANICVILLE 6-34.5KV	C046472	1,735,807	948,861	0	0	0	2,684,668
		BALLSTON-SHORE RD 8-34.5 KV	C046457	0	0	0	25,000	97,000	122,000
		BARKER-LYNDONVILLE 301-34.5KV	C052511	0	25,000	70,000	2,000,250	20,000	2,115,250
		BETHLEHEM-SELKIRK 5-34.5KV	C048817	304,500	54,600	0	0	0	359,100
		BOONVILLE-ALDER CREEK 21 46	C077028	50,000	1,650,000	45,000	0	0	1,745,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		KV							
		BRISTOL HILL-PHOENIX 23-34.5KV	C046474	0	0	0	77,000	1,000,000	1,077,000
		BURNETT-HEADSON 34-34.5KV	C050199	0	0	45,000	619,800	0	664,800
		CALLANAN TAP - REBUILD EXIST 34.5LN	C046641	818,000	830,000	0	0	0	1,648,000
		CARTHAGE-N. CARTHAGE-DEFERIET 23KV	C046435	0	0	0	25,000	50,000	75,000
		CARTHAGE-TAYLORVILLE 21/22/26-23KV	C046436	0	0	0	75,000	25,000	100,000
		COTTRELL PAPER TAP 11-34.5KV	C046443	592,090	0	0	0	0	592,090
		DAKE HILL-W. SALAMANCA 816-34.5KV	C046469	10,000	83,000	1,328,000	45,000	0	1,466,000
		DEERFIELD-SCHUYLER 22-46KV	C050288	1,253,820	0	0	0	0	1,253,820
		DEERFIELD-WHITESBORO 26-46KV	C046459	0	150,000	160,380	2,200,000	0	2,510,380
		ELBRIDGE-JEWITT 31-34.5KV REFURB	C050959	25,000	129,000	1,096,500	45,000	0	1,295,500
		ELBRIDGE-MARCELLUS 30 REFURBISHMENT	C054927	25,000	132,720	190,816	0	0	348,536
		EPRATAH-CAROGA 2-23KV	C046456	0	0	25,000	50,000	682,000	757,000
		FORT COVINGTON-MALONE 26-34.5KV	C050197	0	600,000	530,292	0	0	1,130,292
		GARD-DUN 141-142 SUBT LINE RELOCATE	C078197	0	1,143,000	2,500,000	3,857,000	0	7,500,000
		GLOVERSVILLE - CANAJ. 6 REFURBISH	C016236	50,000	100,000	2,900,250	1,998,750	45,000	5,094,000
		HARTFIELD-S. DOW 859 34.5 KV PRT 3	C074502	75,000	75,000	1,600,000	45,000	0	1,795,000
		HARTFIELD-S. DOW 859-RELOCATE PART	C052209	543,950	755,300	0	0	0	1,299,250
		HH-CERES 809 FLOOD PLAIN RELOC.	C075854	245,000	600,000	45,000	0	0	890,000
		HOMER HILL-NILE 811-34.5KV	C050326	0	25,000	47,000	842,000	1,000,000	1,914,000
		HOMER HILL-NILE 811-34.5KV ION	CD01216	0	0	172,640	0	0	172,640
		INGHAMS 46KV RELOCATION	C074485	0	0	50,000	300,000	800,000	1,150,000
		KENMORE-WINSPEAR 630/631-REF	C050318	0	25,000	65,000	700,000	45,000	835,000
		LHH-MALLORY 22-34.5KV	C046441	0	0	0	25,000	54,000	79,000
		LIGHTHOUSEHILL SUB-TLINE RELOCATION	C074322	0	50,000	200,000	1,000,000	335,000	1,585,000
		LYNDONVILLE-MEDINA 301-34.5KV	C052512	0	0	25,000	68,000	2,634,750	2,727,750
		MALLORY-CICERO L33-34.5 KV LINE REF	C046681	159,600	0	0	0	0	159,600

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		MAPLEWOOD-MENANDS 17/18 D/C-34.5KV	C046432	57,800	525,300	0	0	0	583,100
		MCINTYRE-HAMMOND 24 23 KV RELOC.	C075852	0	25,000	100,000	1,400,000	45,000	1,570,000
		MCINTYRE-HAMMOND 24, 23KV ACR	C069307	0	100,000	0	67,000	2,400,000	2,567,000
		MECH-SCHUYLERVILLE 4-34.5KV REFURB	C050323	0	25,000	129,000	1,590,750	999,750	2,744,500
		MORTIMER-GOLAH 109-69KV REFURB	C050321	0	0	50,000	100,000	5,300,250	5,450,250
		NASSAU-HUDSON 9, 34.5KV REFURB	C058581	0	0	88,000	1,659,750	50,000	1,797,750
		NILE-S. WELLSVILLE 812-34.5KV REFUR	C051765	0	0	0	25,000	55,000	80,000
		NUCLEAR FUELS 803/817 RELOCATION	C064168	831,832	0	0	0	0	831,832
		OHIO-RIDGE 613-34.5KV	C046453	865,000	0	0	0	0	865,000
		OLD FORGE-RACQUETTE LAKE 22 46KV	C074003	0	100,000	2,500,000	2,250,000	1,045,000	5,895,000
		PHILLIPS-BARKER 301-34.5KV	C046465	0	0	10,000	75,000	2,258,000	2,343,000
		PHILLIPS-TELEGRAPH 304-34.5KV	C046466	0	25,000	83,000	1,021,500	45,000	1,174,500
		QUEENSBURY-HENRY STREET 14-34.5KV	C046442	0	28,900	409,700	0	0	438,600
		REFURBISH H LINES 26H, 33H, 34H	C048911	0	0	25,000	34,000	390,000	449,000
		REFURBISH H LNS 26H, 34H	C048910	755,640	9,000	0	0	0	764,640
		REFURBISH H-LNS 27H,25H,33H,36H	C048909	400,000	7,000	0	0	0	407,000
		REFURBISH H-LNS 27H,28H,33H PT 1	C046470	4,560	0	0	0	0	4,560
		RE-FURBISH TEALL 25/WOODARD 24-34.5	C046446	340,000	608,000	0	0	0	948,000
		RELOCATE S. DOW-POLAND 865-34.5KV	C050177	1,232,000	1,450,000	0	0	0	2,682,000
		ROTTERDAM-SCOTIA-ROSA ROAD 32 34.5	C046455	64,800	0	65,000	554,250	9,000	693,050
		SCOTIA-ROSA RD 6 TWR 151/152	C077053	100,000	173,800	0	0	0	273,800
		SCOTIA-ROSA RD 6, 34.5KV REFURB	C055164	25,000	87,000	578,250	426,750	0	1,117,000
		SHALETON-RIDGE 610, STATION 207 TAP	C046779	5,000	5,000	0	0	0	10,000
		SHORE ROAD-ROSA ROAD 5 34.5 KV	C074503	0	25,000	75,000	450,000	45,000	595,000
		SOLVAY 26	C046438	0	92,000	551,000	627,000	0	1,270,000
		SOLVAY/WOODARD-ASH ST	C046439	73,000	457,300	115,000	0	0	645,300

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		27&27&28- 34.							
		STA 66 REPL./NEW SUBT POLE MTD STA.	CD00544	124,500	0	0	0	0	124,500
		STATE ST SUB-T RETIREMENT	C073600	0	2,000	0	0	0	2,000
		STATION 126 TAPS 33H/34H-23KV	C046450	25,000	50,000	900,000	45,000	0	1,020,000
		TAYLORVILLE-EFFLEY 24-23KV	C046437	643,000	0	0	0	0	643,000
		TONAWANDA 601-604, 23KV - T22&T23	C067266	48,000	150,150	0	0	0	198,150
		TONAWANDA LINES 601-604-23KV	C046451	25,000	83,000	860,250	515,250	45,000	1,528,500
		TONAWANDA LINES 622-624-23KV	C046452	0	25,000	80,000	471,000	40,000	616,000
		TRENTON-PROSPECT 23-46KV	C046448	0	34,030	435,000	0	0	469,030
		TRENTON-WHITESBORO 25, 46KV	C058579	92,000	1,749,750	207,500	0	0	2,049,250
		UNION-AUSABLE FORKS 36-46KV REF	C050320	0	0	25,000	97,000	1,096,000	1,218,000
		UNION-LAKE CLEAR 35-46KV REFURB	C050324	0	0	25,000	100,000	1,329,000	1,454,000
		VARICK-BRISTOL HILL 202-34.5KV	C046460	0	0	25,000	70,000	748,000	843,000
		W. MILTON TAP-34.5KV NEW LINE	CD00898	0	142,500	2,850,000	2,723,650	0	5,716,150
		W. PORTLAND -SHERMAN 867-34.5KV	C046468	2,169,000	600,000	0	0	0	2,769,000
		W. SALAMANCA-HOMER HILL 805-34.5KV	C050293	25,000	55,000	800,250	45,000	0	925,250
		WATERPORT TAP 301-34.5KV	C052515	0	0	0	25,000	70,000	95,000
		WEST PORTLAND-SHERMAN 867 RELOCATIO	C055118	70,000	2,280,000	50,000	0	0	2,400,000
		WOODARD 24/TEALL 25 REFURB N.-I90	C060445	0	0	10,000	50,000	939,000	999,000
		WOODARD 28-34.5KV	C046440	0	49,500	452,430	0	0	501,930
		WOODARD 29-34.5KV	C046473	0	0	0	25,000	75,000	100,000
		WOODARD-TEALL 32-34.5KV REFURBISH	C050322	0	0	25,000	75,000	850,000	950,000
		YAHNUNDASIS-CLINTON 24 -46KV	C046449	0	0	50,000	1,077,750	50,000	1,177,750
		YAHNUNDASIS-CLINTON 27, 46KV	C055143	0	0	0	50,020	419,840	469,860
	Sub-T Overhead Line Total			13,863,899	16,340,711	25,582,458	29,698,470	25,870,840	111,356,378
Asset Condition Total				25,563,300	30,698,186	38,456,630	44,318,700	40,164,450	179,201,266
Customer Request/Public Requirement	Blanket	CNY SUB TRANS-LINE NEW BUSINESS	CNC0071	10,000	10,000	10,000	10,000	10,000	50,000
		CNY SUB TRANS-LINE PUBLIC REQUIRE	CNC0072	31,000	32,000	33,000	34,000	35,000	165,000
		ENY SUB TRANS-LINE NEW BUSINESS	CNE0071	10,000	10,000	10,000	10,000	10,000	50,000
		ENY SUB TRANS-LINE PUBLIC REQUIRE	CNE0072	10,000	10,000	10,000	10,000	10,000	50,000
		NY CENTRAL SUB T LINE THIRD	CNC0078	77,000	79,000	81,000	83,000	85,000	405,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		PARTY							
		NY EAST SUB T LINE THIRD PARTY	CNE0078	1,000	1,000	1,000	1,000	1,000	5,000
		NY WEST SUB T LINE THIRD PARTY	CNW0078	118,000	121,000	124,000	127,000	130,000	620,000
		WNY SUB TRANS-LINE NEW BUSINESS	CNW0071	75,000	77,000	79,000	81,000	83,000	395,000
		WNY SUB TRANS-LINE PUBLIC REQUIRE	CNW0072	23,000	24,000	25,000	26,000	27,000	125,000
	Blanket Total			355,000	364,000	373,000	382,000	391,000	1,865,000
	New Business	TXD RESERVE FOR NEW BUSINESS COMMER	C046913	1,619,113	1,532,238	2,089,648	1,894,000	1,932,240	9,067,239
	New Business Total			1,619,113	1,532,238	2,089,648	1,894,000	1,932,240	9,067,239
	Public Requirements	DOT NYRT28 IN STATE FOREST PRESERVE	C034704	0	100,000	750,000	0	0	850,000
		DOTR NYSRT28 WHITE LK-MCKEEVER SUBT	C034722	0	0	93,960	0	0	93,960
	Public Requirements Total			0	100,000	843,960	0	0	943,960
Customer Request/Public Requirement Total				1,974,113	1,996,238	3,306,608	2,276,000	2,323,240	11,876,199
Damage/Failure	Blanket	CNY SUB TRANS-LINE DAMAGE FAILURE	CNC0073	774,000	826,000	845,000	864,000	883,000	4,192,000
		ENY SUB TRANS-LINE DAMAGE FAILURE	CNE0073	831,000	917,000	938,000	960,000	982,000	4,628,000
		WNY SUB TRANS-LINE DAMAGE FAILURE	CNW0073	2,391,547	2,644,000	2,705,000	2,768,000	2,832,000	13,340,547
	Blanket Total			3,996,547	4,387,000	4,488,000	4,592,000	4,697,000	22,160,547
	Damage Failure Other	NY_35KV_FPC SWGR_CENTRAL_2 OF 4	C070712	591,954	467,500	0	0	0	1,059,454
	Damage Failure Other Total			591,954	467,500	0	0	0	1,059,454
Damage/Failure Total				4,588,501	4,854,500	4,488,000	4,592,000	4,697,000	23,220,001
DER Electric System Access	Solar	DG 10770/10771 ONEIDA CNTY SHERIFF	C077228	52,000	0	0	0	0	52,000
	Solar Total			52,000	0	0	0	0	52,000
DER Electric System Access Total				52,000	0	0	0	0	52,000
Reliability	Blanket	CNY SUB TRANS-LINE RELIABILITY	CNC0076	16,000	16,000	16,000	16,000	16,000	80,000
		ENY SUB TRANS-LINE RELIABILITY	CNE0076	107,000	109,000	111,000	113,000	116,000	556,000
		WNY SUB TRANS-LINE RELIABILITY	CNW0076	151,000	154,000	157,000	161,000	165,000	788,000
	Blanket Total			274,000	279,000	284,000	290,000	297,000	1,424,000
	Reliability	ALDER CREEK-O.F. 23, PH.I HENDRIX	C074002	75,000	825,000	0	0	0	900,000
		LINE 216 RECONDUCTORING	C051583	0	50,000	499,800	1,500,250	0	2,050,050

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		LN863 FINDLEY LAKE - FRENCH CREEK E	C046510	0	0	0	145,500	2,499,690	2,645,190
		MORTIMER SUB-T LINE RELOCATION	C078961	357,000	106,250	0	0	0	463,250
		OHIO ST STATION - SUBT LINES	C055304	419,000	0	0	0	0	419,000
		W.ASHVILLE SUBSTATION TXD LN863 TAP	C048152	82,362	925,000	0	0	0	1,007,362
	Reliability Total			933,362	1,906,250	499,800	1,645,750	2,499,690	7,484,852
	Substaion Flood Mitigation	INDIAN CREEK RD STATION SUB-T	C061226	153,000	0	0	0	0	153,000
		UNION FALLS FLOOD MITIGATION_SUBT	C068247	393,000	439,530	0	0	0	832,530
	Substaion Flood Mitigation Total			546,000	439,530	0	0	0	985,530
	Sub-T Automation	DA - NE SUBT AUTOMATION WILTON SUB	C035863	127,070	0	0	0	0	127,070
		GR- INSTALL DA ON THE 312 LINE	C065706	16,600	0	415,000	0	0	431,600
		INSTALL DA ON 201LINE	C069692	0	0	20,000	605,000	0	625,000
		INSTALL DA ON BROOK-BALLSTON 11	C069691	596,000	0	0	0	0	596,000
		NR- INSTALL DA ON 21 LINE	C064006	616,000	0	0	0	0	616,000
		NR- INSTALL DA ON THE 23 LINE	C064026	0	500,000	0	0	0	500,000
		SW- INSTALL DA ON 801 LINE	C064027	129,600	0	0	0	0	129,600
	Sub-T Automation Total			1,485,270	500,000	435,000	605,000	0	3,025,270
Reliability Total				3,238,632	3,124,780	1,218,800	2,540,750	2,796,690	12,919,652
System Capacity	Blanket	CNY SUB TRANS-LINE LOAD RELIEF	CNC0077	1,000	1,000	1,000	1,000	1,000	5,000
		ENY SUB TRANS-LINE LOAD RELIEF	CNE0077	1,000	1,000	1,000	1,000	1,000	5,000
		WNY SUB TRANS-LINE LOAD RELIEF	CNW0077	1,000	1,000	1,000	1,000	1,000	5,000
	Blanket Total			3,000	3,000	3,000	3,000	3,000	15,000
	Load Relief	BUFFALO 23KV RECONDUCTOR - HUNTLEY2	C028893	0	0	0	49,500	4,499,550	4,549,050
		EDEN SWITCH STRUCTURE - SUBT	C052023	0	0	1,433,000	284,000	0	1,717,000
		GOLAH AVON 217 LINE RECONDUCTORING	C036054	0	50,000	675,750	187,000	0	912,750
		INSTALL PARALLEL CABLE OF NEWARK-MA	CD01121	52,000	646,400	0	0	0	698,400
		LHH - MALLORY 34.5 KV 22 LINE REG.	C073226	0	0	50,000	775,200	0	825,200
		STATION 3012 SUB-T	C074906	931,528	1,410,051	205,110	0	0	2,546,689
		VAN DYKE STATION - BETH-DELMAR 6 L	C046482	0	0	0	0	10,250	10,250

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		VAN DYKE-DELMARBYPASS EXTEN REBUILT	C053683	0	149,500	0	0	0	149,500
	Load Relief Total			983,528	2,255,951	2,363,860	1,295,700	4,509,800	11,408,839
System Capacity Total				986,528	2,258,951	2,366,860	1,298,700	4,512,800	11,423,839
Grand Total				36,403,074	42,932,655	49,836,898	55,026,150	54,494,180	238,692,957

Exhibit 3 – Distribution Capital Investment Plan

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
Asset Condition	Asset Replacement	*NR-81452-JOLLY ISLAND GRP-UPGRADE	C049780	0	0	0	0	500,000	500,000
		*NR-N GOUVERNEUR 98352-LEAD MINE RD	C049635	163,200	0	0	0	0	163,200
		BLUE STORES 30351 - PLEASANT VALE	C051985	90,100	0	0	0	0	90,100
		BROADWAY NETWORK RETIREMENT	C046712	21,000	0	0	0	0	21,000
		BUFFALO STA 121 POLE & DISC A/R	C073570	119,680	0	0	0	0	119,680
		BUFFALO STA 56- UPGRADE 4 XFMRS	C036502	141,965	0	0	0	0	141,965
		BUFFALO STATION 12 - 25 CYCLE RETIR	CD00969	14,850	0	0	0	0	14,850
		BUFFALO STATION 122 REBUILD - LINE	CD00779	0	59,000	1,704,300	361,400	0	2,124,700
		BUFFALO STATION 122 REBUILD - SUB	CD00782	0	0	3,012,000	1,325,000	0	4,337,000
		BUFFALO STATION 14 - 25 CYCLE RETIR	CD00974	15,370	0	0	0	0	15,370
		BUFFALO STATION 20 - 25 CYCLE FEEDE	C046618	1,100	0	0	0	0	1,100
		BUFFALO STATION 32 REBUILD - LINE	C036461	0	0	0	0	86,000	86,000
		BURGOYNE 51 - REBUILD DURKEETOWN RD	CD00222	0	396,800	0	0	0	396,800
		CHURCH ST 53 - WEST LINE RD RELOCAT	C054923	131,250	0	0	0	0	131,250
		CROWN PT. 51 - CREEK RD GAP CLOSING	C048906	0	106,250	0	0	0	106,250
		CUYLER DLINE - POLE MOUNTED EQUIP	C055354	232,092	0	0	0	0	232,092
		DELEVAN F1162 STEEL WIRE PIW	C056734	10,500	163,100	0	0	0	173,600
		F1662 RECONDUCTOR RT 20 BROADWAY	C048615	171,200	0	0	0	0	171,200
		F2761 STEEL WIRE PIW	C056621	10,500	262,500	0	0	0	273,000
		GRAND ST. 51 - ROUTE 7 GAP CLOSING	CD00374	177,000	0	0	0	0	177,000
		HENRY ST 31636 - RIVER CROSSING	C029432	0	0	447,100	0	0	447,100
		KARNER - PATROON RECONDUCTING 477	C052303	0	0	0	24,000	287,300	311,300
		KARNER - PATROON UG GETAWAYS	C052307	0	0	0	24,000	777,750	801,750
		KARNER - RUTH RD UG GETAWAYS	C052305	0	0	0	24,000	786,250	810,250
		KARNER - SAND CREEK RECONDUCTING477	C052304	0	0	0	24,000	511,700	535,700
		KARNER - SAND CREEK UG GETAWAYS	C052306	0	0	0	24,000	294,100	318,100
		KARNER 31707 FEEDER CONVERSION	C049958	0	0	0	24,000	203,310	227,310
		KARNER 31715 FEEDER CONVERSION	C049964	0	0	0	24,000	282,690	306,690
		KARNER 31716 FEEDER CONVERSION	C049979	0	0	0	24,000	291,600	315,600
		KARNER 31717 FEEDER CONVERSION	C049980	0	0	0	24,000	265,680	289,680
		KARNER 31718 FEEDER CONVERSION	C049984	0	0	0	24,000	266,490	290,490
		KARNER 31719 FEEDER CONVERSION	C049982	0	0	0	24,000	200,070	224,070
		KARNER- RUTH RD RECONDUCTING 477	C049989	0	0	0	24,000	609,120	633,120
		KARNER STATION RETIREMENT	C052309	0	0	0	24,000	0	24,000
		KARNER-PINEBUSH CONVERSION	C052308	0	0	0	24,000	269,450	293,450
		LASHER RD - NEW STATION - DIST GET	CD00897	366,930	0	0	0	0	366,930
		LASHER ROAD - 52 FEEDER OH - PH 1	C068326	451,150	315,000	0	0	0	766,150
		LASHER ROAD - GETAWAY CABLE	C068348	171,700	985,150	584,800	1,599,700	0	3,341,350
		MACHIAS F1362 REPLACE STEEL WIRE	C056619	0	0	10,500	0	0	10,500

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		MCCREA STATION - NEW STATION - INST	C046790	0	0	0	0	25,000	25,000
		MIDDLEBURGH 51 - ROUTE 145 EXTEND/C	CD01010	0	0	1,104,000	0	0	1,104,000
		MV-ROME 54-OSWEGO RD RECONDUCTORING	C050098	0	0	0	0	320,000	320,000
		MV-ROME 76254-HWY 49 RECONDUCTOR	C050005	0	0	320,000	320,000	0	640,000
		NEW HARPER SUBSTATION D LINE	C046417	0	0	1,652,000	1,550,000	0	3,202,000
		NIAGARA FALLS NETWORK RETIREMENT	C046502	127,500	0	0	0	0	127,500
		NORTON STREET UG CIVIL REBUILD	C050138	383,350	0	0	0	0	383,350
		NR-FINE 97866-NYS HWY 3-ROLCATION	C049754	0	0	0	0	289,850	289,850
		NY GE BUTYL RUBBER PT REPLACEMENT	C051745	31,000	0	0	0	0	31,000
		OHIO ST - BUFFALO RIVER TUNNEL/BORE	C050400	4,083,750	0	0	0	0	4,083,750
		Sandy Creek Green Point Relocation	C079199	115,000	0	0	0	0	115,000
		SHORE RD 28185 - SARATOGA RD CONVER	C054836	480,140	0	0	0	0	480,140
		STATION 01 - REMOVE 25 CYCLE FEEDER	C046624	18,950	3,080	0	0	0	22,030
		STATION 05 - 25 CYCLE FEEDER 0528 R	C046623	18,950	2,450	0	0	0	21,400
		STATION 08 - 25 CYCLE FEEDER REMOVA	C046625	170	0	0	0	0	170
		Temple Distribution Rebuild	C079534	15,000	85,000	2,500,000	10,000,000	10,000,000	22,600,000
		TERMINAL STATION RELOCATION_DLINE	C059671	0	50,000	100,000	3,900,000	4,108,000	8,158,000
		TONAWANDA - F7128 REMOVAL	C036206	2,600	0	0	0	0	2,600
		TULLER HILL DLINE-13KV GETAWAY	C064446	25,000	0	50,400	0	0	75,400
	Asset Replacement Total			7,590,997	2,428,330	11,485,100	19,392,100	20,374,360	61,270,887
	Blanket	CENT NY-DIST-ASSET REPLACE BLANKET.	CNC0017	2,196,000	2,403,000	2,456,000	2,510,000	2,566,000	12,131,000
		EAST NY-DIST-ASSET REPLACE BLANKET.	CNE0017	1,444,000	1,567,000	1,602,000	1,638,000	1,674,000	7,925,000
		WEST NY-DIST-ASSET REPLACE BLANKET.	CNW0017	2,852,000	3,134,000	3,203,000	3,273,000	3,345,000	15,807,000
	Blanket Total			6,492,000	7,104,000	7,261,000	7,421,000	7,585,000	35,863,000
	Buffalo St Light Cable Repl	BUFFALO STREET LIGHT CABLE REPLACEM	CD00851	2,130,245	2,208,245	2,208,245	2,199,500	2,199,500	10,945,735
	Buffalo St Light Cable Repl Total			2,130,245	2,208,245	2,208,245	2,199,500	2,199,500	10,945,735
	Dist. Overhead Line	MAPLE AVE - NEW FEEDER 51	C069907	10,000	50,000	250,000	0	0	310,000
		MAPLE AVE - NEW FEEDER 52 PART 2	C069909	25,000	275,000	1,550,000	819,000	0	2,669,000
		MAPLE AVE - NEW FEEDER 53 PART 2	C069911	50,000	100,000	350,000	0	0	500,000
		MAPLE AVE - NEW FEEDER 54	C069912	10,000	125,000	390,000	262,000	0	787,000
		MAPLE AVE FEEDER GETAWAYS - CABLE	C069906	20,000	1,080,000	2,257,000	2,500,000	0	5,857,000
	Dist. Overhead Line Total			115,000	1,630,000	4,797,000	3,581,000	0	10,123,000
	Dist. Overhead Line (Program)	L613 DIST UNDERBUILD F4462 TRANSFER	C077286	170,000	0	0	0	0	170,000
	Dist. Overhead Line (Program) Total			170,000	0	0	0	0	170,000
	Inspection & Maintenance	I&M - NC D-LINE OH WORK FROM INSP.	C026160	9,415,150	10,017,150	10,017,150	10,017,150	10,017,150	49,483,750
		I&M - NC D-LINE UG WORK FROM INSP.	C026163	500,240	500,240	500,240	500,240	500,240	2,501,200
		I&M - NE D-LINE OH WORK FROM INSP.	C026159	7,160,000	10,000,000	10,000,000	10,000,000	10,000,000	47,160,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		I&M - NE D-LINE UG WORK FROM INSP.	C026162	483,220	500,000	500,000	500,240	500,240	2,483,700
		I&M - NW D-LINE OH WORK FROM INSP.	C026161	13,233,060	14,037,060	14,037,060	14,037,060	14,037,060	69,381,300
		I&M - NW D-LINE UG WORK FROM INSP.	C026164	495,870	1,000,000	549,990	549,990	549,990	3,145,840
	Inspection & Maintenance Total			31,287,540	36,054,450	35,604,440	35,604,680	35,604,680	174,155,790
	Ntwk Secondary UG Cable Repl	CABLE REPLACEMENT - NTWK SEC NYC	C078269	150,000	150,000	150,000	150,000	150,000	750,000
		CABLE REPLACEMENT - NTWK SEC NYE	C078270	2,000,000	3,000,000	3,000,000	1,000,000	1,000,000	10,000,000
		CABLE REPLACEMENT - NTWK SECONDARY	C077338	4,000,000	4,000,000	4,000,000	1,038,050	1,038,050	14,076,100
		TROY LVAC NETWORK - WILLIAM ST	CD00628	112,800	0	0	0	0	112,800
	Ntwk Secondary UG Cable Repl Total			6,262,800	7,150,000	7,150,000	2,188,050	2,188,050	24,938,900
	Primary UG Cable Replacement	BUTLER 53 - BUILD 36253 FEEDER - UG	C028878	0	0	115,020	0	0	115,020
		CURRY RD 36552 UG GETAWAY REPLACE	C056406	289,850	0	0	0	0	289,850
		GROOMS 55 - DEER RUN CABLE REPLACE	C065947	105,000	0	0	0	0	105,000
		HAGUE RD 53 - SUBMARINE CABLE.	C050522	0	0	75,000	2,000,000	0	2,075,000
		MV ISLAND XFMR REPL. - CENTRAL DIV.	C026977	0	500,000	500,000	500,000	500,000	2,000,000
		NEW KRUMKILL 42153 - UG GETAWAY REP	C046648	350,200	0	0	0	0	350,200
		RIVERSIDE 28855 UG CABLE REPLACEME.	C036468	0	0	0	1,203,000	1,100,000	2,303,000
		SCHROON 51 - SUBMARINE CABLE REPAIR	C050333	155,000	0	0	0	0	155,000
	Primary UG Cable Replacement Total			900,050	500,000	690,020	3,703,000	1,600,000	7,393,070
	Sta Metal-Clad Switchgear	AVENUE A 291 METALCLAD REPLACEMENT	C056609	0	490,000	2,162,000	2,162,000	0	4,814,000
		CHRISLER REBUILT STATION - STATION	C068290	366,000	3,711,140	2,522,000	100,000	0	6,699,140
		DELMAR DISTRIBUTION REMOVAL	C050241	0	0	0	3,100	0	3,100
		DELMAR STATION RETIREMENT	C049692	0	0	0	12,550	0	12,550
		EMMET ST - REPL TB1 AND MCLAD	C017952	0	0	260,000	0	0	260,000
		HOPKINS 253 - REPLACE METALCLAD GEA	C046741	2,554,630	2,750,000	760,000	0	0	6,064,630
		HOPKINS RD METALCLAD REPL DLINE	C054383	219,620	147,050	0	0	0	366,670
		JOHNSON RD - REPLACE METALCLAD GEAR	C046747	0	0	327,000	1,403,000	0	1,730,000
		MARKET HILL SUBSTATION RETIREMENT	C046367	0	15,000	0	0	0	15,000
		MCKNOWNVILLE 327 METALCLAD REPLACEM	C056612	0	0	150,000	1,799,900	1,000,000	2,949,900
		NEW MAPLE AVE SUBSTATION	C073527	687,000	4,000,000	3,350,000	500,000	0	8,537,000
		PINE GROVE METALCLAD REPLACEMENT	C056614	0	0	0	154,000	2,505,510	2,659,510
		PINEBUSH - REPLACE METALCLAD GEAR	C046744	0	0	0	150,000	2,800,000	2,950,000
		STATION 140 METALCLAD REPLACEMENT	C056616	0	0	0	239,700	2,115,000	2,354,700
		STATION 162 METALCLAD REPLACEMENT	C052706	0	232,800	1,716,000	1,000,000	0	2,948,800
		STATION 61 - METALCLAD REPLACEMENT	C051707	0	0	150,000	1,380,000	1,150,000	2,680,000
		TULLER HILL 246 UNIT METALCLAD REPL	C056611	80,000	638,000	1,948,350	0	0	2,666,350
		WHITESBORO 632 - RETIREMENT	C046742	0	10,000	10,000	0	0	20,000
	Sta Metal-Clad Switchgear Total			3,907,250	11,993,990	13,355,350	8,904,250	9,570,510	47,731,350
	Substation Battery&Related	BATTS/CHARG- NY CENTRAL	C032013	372,480	372,480	372,480	372,480	372,480	1,862,400
		BATTS/CHARG- NY WEST	C032014	242,743	97,000	339,500	199,820	199,820	1,078,883

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		BATTS/CHARG--NY EAST	C032012	199,820	199,820	199,820	199,820	199,820	999,100
	Substation Battery&Related Total			815,043	669,300	911,800	772,120	772,120	3,940,383
	Substation Breaker	NC ARP BREAKERS & RECLOSERS	C032253	1,143,000	804,889	804,889	803,315	803,315	4,359,408
		NE ARP BREAKERS & RECLOSERS	C032252	531,623	647,285	647,285	646,990	646,990	3,120,173
		NW ARP BREAKERS & RECLOSERS	C032261	366,510	1,163,430	374,790	774,690	1,708,410	4,387,830
		PEAT ST - REPLACE R825 OCB	C049550	367,033	0	0	0	0	367,033
	Substation Breaker Total			2,408,166	2,615,604	1,826,964	2,224,995	3,158,715	12,234,444
	Substation Cicuit Switchgear	OGDEN BROOK 115KV CKT SWITCHER 6177	C072491	10,000	0	0	0	0	10,000
	Substation Cicuit Switchgear Total			10,000	0	0	0	0	10,000
	Substation Indoor	BEECH ST 81 - INDOOR SUBSTATION REF	C046577	0	0	0	55,000	0	55,000
		BUFFALO STATION 30 - REBUILD - FDRS	C015754	0	0	86,000	600,000	600,000	1,286,000
		BUFFALO STATION 30 REBUILD - STA	C046519	0	0	0	93,000	1,754,000	1,847,000
		BUFFALO STATION 34 REBUILD - LINE	C046932	0	0	0	86,000	600,000	686,000
		BUFFALO STATION 34 REBUILD - SUB	C046953	0	0	0	0	93,000	93,000
		BUFFALO STATION 37 REBUILD - SUB	C033474	435,200	0	0	0	0	435,200
		BUFFALO STATION 53 REBUILD - LINE	C046929	86,000	600,100	600,100	100,300	0	1,386,500
		BUFFALO STATION 53 REBUILD - SUB	C046945	0	93,000	1,753,700	4,490,650	0	6,337,350
		BUFFALO STATION 59 REBUILD - LINE	C033478	419,380	0	0	0	0	419,380
		BUFFALO STATION 59 REBUILD - SUB	C033475	379,164	0	0	0	0	379,164
		EIGHTH ST 80 - INDOOR SUBSTATION RE	C046585	0	0	0	0	502,460	502,460
		EIGHTH ST 80 - SUB REFURB D-LINE	C046586	0	0	0	19,400	194,000	213,400
		ELEVENTH ST 82 - INDOOR SUBSTATION	C046582	0	0	0	65,000	0	65,000
		STEPHENSON 85 - INDOOR SUBSTATION R	C046581	0	0	0	2,500,000	3,500,000	6,000,000
		STEPHENSON 85 - SUB REFURB D-LINE	C046580	0	0	0	1,000,000	1,000,000	2,000,000
		WELCH 83 - SUB REFURB D-LINE	C046584	0	0	0	200,000	1,392,000	1,592,000
	Substation Indoor Total			1,319,744	693,100	2,439,800	9,209,350	9,635,460	23,297,454
	Substation Mobile	MOBILE SUBSTATION 2E - REPLACEMENT	C046666	0	0	1,000,070	1,000,070	0	2,000,140
		MOBILE SUBSTATION 4E - REFURBISH AN	C046667	366,000	400,000	0	0	0	766,000
		NEW 115-13.2KV MOBILE SUB 11W	C077119	250,000	0	0	0	0	250,000
		NY MOBILE SUBSTATION PROGRAM	C051744	0	1,000,000	0	0	0	1,000,000
		NYW MOBILE SUB 10 115-5KV/12MVA	C066487	384,000	0	0	0	0	384,000
		REBUILD 6W MOBILE SUBSTATION	C066566	733,000	0	0	0	0	733,000
	Substation Mobile Total			1,733,000	1,400,000	1,000,070	1,000,070	0	5,133,140
	Substation Power Transformer	ALTAMONT TB1 REPLACEMENT	C066227	1,121,195	250,000	0	0	0	1,371,195
		BUTLER SUBSTATION INSTALL BUS PTS	C070010	0	0	99,840	0	0	99,840
		CUYLER24 DSUB STATION REMOVAL	C036102	845	0	0	0	0	845
		EAST DUNKIRK STA 63 TB REPLACEMENTS	C066266	228,000	0	0	0	0	228,000
		GALEVILLE 71,72&73 FDRS CONVERSION	C050749	0	0	0	63,000	404,800	467,800
		GALEVILLE STATION REBUILD	C050746	0	0	0	50,000	1,516,000	1,566,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		IE - NY ARP TRANSFORMERS	C025801	899,190	899,190	899,190	899,190	899,190	4,495,950
		LYSANDER TRADITIONAL SOLUTION C-NY	C077170	0	400,000	2,600,000	2,000,000	0	5,000,000
		NY ARP SPARE SUBSTATION TRANSFORMER	C026055	1,185,260	599,460	599,460	599,460	599,460	3,583,100
		ROCK CITY STATION 623 - TRANSFORMER	C046671	50,000	600,000	700,000	0	0	1,350,000
		STATE ST 954 STATION RETIREMENT	C050640	10,500	9,450	0	0	0	19,950
		STATION 124 - ALMEDA AVE TRANSFORME	C046670	603,000	2,389,110	354,050	0	0	3,346,160
		TULLY CENTER REPLACE TB1	C077628	1,167,080	0	0	0	0	1,167,080
	Substation Power Transformer Total			5,265,070	5,147,210	5,252,540	3,611,650	3,419,450	22,695,920
	Substation Relay	RIVERSIDE RELAY REPLACEMENT	C049606	9,700	0	0	0	0	9,700
		TEMPLE STATION RELAY REPLACEMENT	C049616	341,000	0	0	0	0	341,000
		TRINITY STATION RELAY REPLACEMENT	C049625	8,400	0	0	0	0	8,400
	Substation Relay Total			359,100	0	0	0	0	359,100
	Substation RTU	NY RTU PROGRAM - DXT SUBS	C022151	61,000	0	0	0	0	61,000
	Substation RTU Total			61,000	0	0	0	0	61,000
	Sub-T Overhead Line	GARD-DUN 141-142 D-LINE RELOCATE	C079005	0	120,000	240,000	240,000	0	600,000
		L867 UNDERBUILT DISTRIBUTION	C057047	130,000	130,000	0	0	0	260,000
	Sub-T Overhead Line Total			130,000	250,000	240,000	240,000	0	860,000
Asset Condition Total				70,957,005	79,844,229	94,222,329	100,051,765	96,107,845	441,183,173
Communications/ Control Systems	Advanced Metering	ADVANCED METERING INFRASTRUCTURE NYC	C076383	0	0	151,483	288,266	378,272	818,021
		ADVANCED METERING INFRASTRUCTURE NYE	C076382	0	0	151,483	288,266	378,272	818,021
		ADVANCED METERING INFRASTRUCTURE NYW	C076384	0	0	151,483	288,266	378,272	818,021
	Advanced Metering Total			0	0	454,449	864,798	1,134,816	2,454,063
	Substation RTU	EMS/RTU INSTALLS - NY CENTRAL	C076124	0	1,260,000	1,260,000	2,163,000	798,000	5,481,000
		EMS/RTU INSTALLS - NY EAST	C076123	0	1,440,000	1,440,000	2,472,000	912,000	6,264,000
		EMS/RTU INSTALLS - NY WEST	C076125	0	900,000	900,000	1,545,000	570,000	3,915,000
		ALDER CREEK-ADD EMS/MOD	C075024	485,000	263,000	0	0	0	748,000
		EMS/RTU FOR DSCADA	C077972	2,830,000	4,720,000	930,000	0	0	8,480,000
		REP - DIST SUBS WITHOUT RTUS	C019851	679,054	678,758	678,758	678,758	678,758	3,394,086
		RTU M9000	C069687	1,094,625	1,644,370	1,440,040	817,320	63,000	5,059,355
		STATION 129 BROMPTON RD - EMS EXPAN	C053086	214,000	0	0	0	0	214,000
		STATION 139 MARTIN RD - EMS EXPAN	C053088	4,850	0	0	0	0	4,850
	Substation RTU Total			5,307,529	10,906,128	6,648,798	7,676,078	3,021,758	33,560,291
	Telcom	EMS/RTU TELECOM - DLINE NY CENT	C076112	0	241,250	241,250	241,250	241,250	965,000
		EMS/RTU TELECOM - DLINE NY EAST	C076111	0	181,500	181,500	181,500	181,500	726,000
		EMS/RTU TELECOM - DLINE NY WEST	C076122	0	110,500	110,500	110,500	110,500	442,000
		EMS/RTU TELECOM - STATIONS NY CENT	C076108	175,000	1,520,000	1,520,000	1,720,000	1,800,000	6,735,000
		EMS/RTU TELECOM - STATIONS NY EAST	C076107	325,000	825,000	825,000	1,025,000	1,325,000	4,325,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		EMS/RTU TELECOM - STATIONS NY WEST	C076110	175,000	676,250	676,250	876,250	1,176,000	3,579,750
		TELECOM AND RADIO EQUIPMENT	C004157	995,000	995,000	995,000	995,000	995,000	4,975,000
	Telcom Total			1,670,000	4,549,500	4,549,500	5,149,500	5,829,250	21,747,750
Communications/Control Systems Total				6,977,529	15,455,628	11,652,747	13,690,376	9,985,824	57,762,104
Customer Request/Public Requirement	3rd Party Attachments	NYS BROADBAND EXPANSION	C075964	250,000	250,000	0	0	0	500,000
		SPECTRUM BROADBAND EXPANSION	C077091	250,000	250,000	0	0	0	500,000
	3rd Party Attachments Total			500,000	500,000	0	0	0	1,000,000
	Blanket	CENT NY-DIST-3RD PARTY ATTCH BLNKT	CNC0022	867,000	928,000	948,000	968,000	989,000	4,700,000
		CENT NY-DIST-METER BLANKET	CNC0004	992,000	1,178,000	1,242,000	1,309,000	1,380,000	6,101,000
		CENT NY-DIST-NEW BUS-COMM BLANKET.	CNC0011	3,714,000	4,401,000	4,635,000	4,881,000	5,140,000	22,771,000
		CENT NY-DIST-NEW BUS-RESID BLANKET	CNC0010	7,747,718	8,862,000	9,332,000	9,827,000	10,348,000	46,116,718
		CENT NY-DIST-PUBLIC REQUIRE BLANKT	CNC0013	845,400	964,900	1,016,000	1,069,800	1,126,400	5,022,500
		CENT NY-DIST-ST LIGHT BLANKET.	CNC0012	1,841,000	1,995,000	2,039,000	2,084,000	2,129,000	10,088,000
		EAST NY-DIST-3RD PARTY ATTCH BLNKT	CNE0022	584,000	631,000	645,000	659,000	673,000	3,192,000
		EAST NY-DIST-METER BLANKET	CNE0004	1,474,000	1,723,000	1,816,000	1,915,000	2,019,000	8,947,000
		EAST NY-DIST-NEW BUS-COMM BLANKET.	CNE0011	3,772,000	4,487,000	4,725,000	4,976,000	5,240,000	23,200,000
		EAST NY-DIST-NEW BUS-RESID BLANKET.	CNE0010	7,163,600	8,234,000	8,672,000	9,133,000	9,619,000	42,821,600
		EAST NY-DIST-PUBLIC REQUIRE BLANKT	CNE0013	1,103,000	1,279,000	1,347,000	1,418,000	1,493,000	6,640,000
		EAST NY-DIST-ST LIGHT BLANKET.	CNE0012	1,424,000	1,524,000	1,557,000	1,591,000	1,626,000	7,722,000
		LAND AND LAND RIGHTS NY CENTRAL	CNC0091	1,320,000	1,351,000	1,382,000	1,414,000	1,447,000	6,914,000
		LAND AND LAND RIGHTS NY EAST	CNE0091	1,069,000	1,094,000	1,120,000	1,146,000	1,173,000	5,602,000
		LAND AND LAND RIGHTS NY WEST	CNW0091	338,000	346,000	354,000	362,000	370,000	1,770,000
		NIMO METER PURCHASES	CN03604	5,741,586	5,427,252	4,589,000	4,183,119	3,542,254	23,483,211
		NIMO TRANSFORMER PURCHASES	CN03620	25,428,600	25,991,300	27,335,100	28,741,300	30,218,400	137,714,700
		WEST NY-DIST-3RD PARTY ATTCH BLNKT	CNW0022	485,000	495,000	506,000	517,000	528,000	2,531,000
		WEST NY-DIST-METER BLANKET	CNW0004	1,582,000	1,879,000	1,981,000	2,088,000	2,201,000	9,731,000
		WEST NY-DIST-NEW BUS-COMM BLANKET.	CNW0011	4,099,000	4,853,000	5,111,000	5,383,000	5,669,000	25,115,000
		WEST NY-DIST-NEW BUS-RESID BLANKET.	CNW0010	4,853,000	5,597,000	5,895,000	6,209,000	6,539,000	29,093,000
		WEST NY-DIST-PUBLIC REQUIRE BLANKT	CNW0013	774,000	894,000	941,000	991,000	1,043,000	4,643,000
		WEST NY-DIST-ST LIGHT BLANKET.	CNW0012	4,317,000	4,592,000	4,691,000	4,792,000	4,895,000	23,287,000
	Blanket Total			81,534,904	88,726,452	91,879,100	95,657,219	99,408,054	457,205,729
	Land and Land Rights	LAND - NEW MAPLE AVE SUBSTATION	C061465	300,000	0	0	0	0	300,000
	Land and Land Rights Total			300,000	0	0	0	0	300,000
	Meter Installations	ADVANCED METERS NYC	C077177	0	0	760,714	20,587,764	30,681,690	52,030,169
		ADVANCED METERS NYE	C077176	0	0	760,714	20,587,764	30,681,690	52,030,169
		ADVANCED METERS NYW	C077178	0	0	760,714	20,587,764	30,681,690	52,030,169
	Meter Installations Total			0	0	2,282,142	61,763,292	92,045,070	156,090,507
	New Business	BIRCH AVE 51 - ROUTE 9N CONVERSION	C053127	180,200	0	0	0	0	180,200
		EAST BATAVIA SUBSTATION - DLINE UPG	CD00587	0	280,000	0	0	0	280,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		F18151 CONVERSION BUSH RD	C063987	0	0	233,350	0	0	233,350
		NEW LED CENTRAL NY	C069886	2,509,000	2,509,000	2,509,000	2,509,000	2,509,000	12,545,000
		NEW LED EAST NY	C069947	2,021,500	2,021,500	2,021,500	2,021,500	2,021,500	10,107,500
		NEW LED WEST NY	C069927	2,439,500	2,439,500	2,439,500	2,439,500	2,439,500	12,197,500
		OAK RUN ESTATES URD F10551 CONVSN	C055125	325,130	0	0	0	0	325,130
		RESERVE FOR NEW BUSINESS COMMERCIAL	C046920	5,999,742	6,299,729	6,299,729	6,499,920	6,699,840	31,798,960
		RESERVE FOR NEW BUSINESS RESIDENTIA	C046921	5,000,300	5,000,300	5,000,300	6,000,300	6,000,300	27,001,500
		TIMES UNION CEN SPOT NTWK INSTALL	C074674	216,810	0	0	0	0	216,810
	New Business Total			18,692,182	18,550,029	18,503,379	19,470,220	19,670,140	94,885,950
	Public Requirements	ECWA RELOCATE F6661 TO PADMOUNT	C077293	0	800,000	0	0	0	800,000
		LEHIGH ADD 2ND TRANSFORMER	C074607	641,000	0	0	0	0	641,000
		PIN 1460.32 RT 32 OVER MOHAWK RIVER	C054068	528,800	0	0	0	0	528,800
		RESERVE FOR PUBLIC REQUIREMENTS UNI	C046922	6,499,987	6,500,210	6,000,259	5,999,989	6,524,200	31,524,645
	Public Requirements Total			7,669,787	7,300,210	6,000,259	5,999,989	6,524,200	33,494,445
Customer Request/Public Requirement Total				108,696,873	115,076,691	118,664,880	182,890,720	217,647,464	742,976,631
Damage/Failure	Blanket	CENT NY-DIST-DAMAGE/FAILURE BLANKT	CNC0014	11,700,600	13,397,000	13,701,000	14,012,000	14,330,000	67,140,600
		CENT NY-DIST-SUBS BLANKET.	CNC0002	772,200	861,800	880,800	900,200	920,000	4,335,000
		EAST NY-DIST-DAMAGE/FAILURE BLANKT	CNE0014	12,121,600	13,898,000	14,215,000	14,539,000	14,870,000	69,643,600
		EAST NY-DIST-SUBS BLANKET.	CNE0002	761,000	861,000	880,000	899,000	919,000	4,320,000
		WEST NY-DIST-DAMAGE/FAILURE BLANKT	CNW0014	8,926,600	10,204,000	10,433,000	10,667,000	10,906,000	51,136,600
		WEST NY-DIST-SUBS BLANKET.	CNW0002	770,000	861,000	879,000	898,000	917,000	4,325,000
	Blanket Total			35,052,000	40,082,800	40,988,800	41,915,200	42,862,000	200,900,800
	Damage Failure Other	ASH ST_N44073_N47074_HDSTR-FAILURE	C075048	156,000	0	0	0	0	156,000
		COLOSSE - TB1 REPLACEMENT	C078956	305,000	0	0	0	0	305,000
		COLVIN R2 DF	C078135	120,000	0	0	0	0	120,000
		DELAMETER TB1 REPLACEMENT	C077337	350,000	0	0	0	0	350,000
		E SYRACUSE FAILURE REPLACEMENT	C078063	225,000	0	0	0	0	225,000
		GENESEE SUBSTATION RETIREMENT	C051871	0	0	0	0	168,000	168,000
		PAD 4059 TRANSFORMER REPLACEMENT	C079346	916,000	0	0	0	0	916,000
		RESERVE FOR DAMAGE/FAILURE UNIDENTI	C046918	2,813,780	3,150,007	3,166,270	3,657,596	3,556,149	16,343,802
			C046948	6,000,361	7,000,000	6,944,110	8,000,000	8,201,042	36,145,514
	Damage Failure Other Total			10,886,141	10,150,007	10,110,380	11,657,596	11,925,191	54,729,316
Damage/Failure Total				45,938,141	50,232,807	51,099,180	53,572,796	54,787,191	255,630,116
DER Electric System Access	CHP	DG NY 17991 TURNING STONE	C077944	11,000	0	0	0	0	11,000
	CHP Total			11,000	0	0	0	0	11,000
	Other	DG - Install 3V0 at Brook Rd	C079375	641,000	0	0	0	0	641,000
		DG Integration 3V0 Trailer	C078988	366,000	0	0	0	0	366,000
		DISTRIBUTED SYSTEM PLATFORM REV DEM	C075764	2,029,000	0	0	0	0	2,029,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		PS&I ACTIVITY DIST GEN NY.	C051970	-4,800,000	0	0	0	0	-4,800,000
	Other Total			-1,764,000	0	0	0	0	-1,764,000
	Solar	DG 3V0 PROTECTION AT SELKIRK	C075522	20,000	0	0	0	0	20,000
		DG NY 11535 - GE GLOBAL SHARON 3V0	C077695	30,000	0	0	0	0	30,000
		DG NY 11535 GE GLOBAL SHARON D-LINE	C077698	6,000	0	0	0	0	6,000
		DG NY 12663 GE AMSTERDAM 1 3V0	C077712	51,000	0	0	0	0	51,000
		DG NY 12667 - GE JOHNSTOWN D-LINE	C077675	60,160	0	0	0	0	60,160
		DG NY 12700 POLYTECH MVILLE A 3V0	C077838	22,000	0	0	0	0	22,000
		DG NY 12701 POLYTECH MVILLE B 3V0	C077837	22,000	0	0	0	0	22,000
		DG NY 12704 POLYTECH MVILLE E 3V0	C077836	22,000	0	0	0	0	22,000
		DG NY07667 TOWN OF GUILDERLAND	C077973	22,000	0	0	0	0	22,000
		DG NY11510 HOOSICKFALLS CSD A D-SUB	C078748	381,000	0	0	0	0	381,000
		DG NY11991 OWENS CORNING SUB	C077756	378,000	0	0	0	0	378,000
		DG NY12432 ST LAWRENCE UNIVERSITY	C077724	397,000	0	0	0	0	397,000
		DG NY12868 EMMI&SONS SUBSTATION	C077539	395,000	0	0	0	0	395,000
		DG NY13666 OSWEGO COUNTY LANDFILL	C077466	29,000	0	0	0	0	29,000
		DG NY17385 BETHLEHEM CSD D-SUB	C079086	380,000	0	0	0	0	380,000
		DG NY17850 VILLAGE OF ST JOHNSVILLE	C077985	22,000	0	0	0	0	22,000
		DG NY18253 CYPRESS CREEK RENEWABLES	C077873	140,000	0	0	0	0	140,000
		DG NY18378 CITY OF GLOVERSVILLE	C077987	22,000	0	0	0	0	22,000
		DG NY20420 SANDY CREEK 3V0	C078890	271,000	0	0	0	0	271,000
		DG NY20434 TRI COUNTY ENERGY	C077763	382,000	0	0	0	0	382,000
		DGNY 12629-NYS OLYMPIC STATION WORK	C078723	3,000	0	0	0	0	3,000
		NY DG 12666 GE DUANESBURG 3V0	C077730	75,000	0	0	0	0	75,000
		NY DG 12666 GE DUANESBURG D-LINE	C077729	2,000	0	0	0	0	2,000
	Solar Total			3,132,160	0	0	0	0	3,132,160
	Storage	EAST PULASKI 324 BATTERY STORAGE	C078753	4,171,000	0	0	0	0	4,171,000
		KENMORE STATION 22 BATTERY STORAGE	C078752	4,171,000	0	0	0	0	4,171,000
	Storage Total			8,342,000	0	0	0	0	8,342,000
	Waste Digester	DG NY10326 MILK STREET DAIRY	C077935	277,000	0	0	0	0	277,000
		NY DIST WASTE DIGESTER SUBSIDY	C069707	1,000	1,000	1,000	1,000	0	4,000
	Waste Digester Total			278,000	1,000	1,000	1,000	0	281,000
DER Electric System Access Total				9,999,160	1,000	1,000	1,000	0	10,002,160
Non-Infrastructure	Blanket	CENT NY-GENERAL-GENL EQUIP BLANKET	CNC0070	1,020,000	1,040,000	1,061,000	1,082,000	1,104,000	5,307,000
		EAST NY-GENL EQUIP BUDGETARY RESERV	CNE0070	1,020,000	1,040,000	1,061,000	1,082,000	1,104,000	5,307,000
		WEST NY-GENERAL-GENL EQUIP BLANKET	CNW0070	1,020,000	1,040,000	1,061,000	1,082,000	1,104,000	5,307,000
	Blanket Total			3,060,000	3,120,000	3,183,000	3,246,000	3,312,000	15,921,000
Non-Infrastructure Total				3,060,000	3,120,000	3,183,000	3,246,000	3,312,000	15,921,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
Reliability	Advanced Distribution Automation (ADA)	NY FLIS CENTRAL - D-LINE	C076104	0	0	0	1,642,602	1,865,136	3,507,738
		NY FLISR EAST - D-LINE	C076101	0	0	0	999,180	1,962,246	2,961,426
		NY FLISR WEST - D-LINE	C076106	0	0	0	266,448	2,020,512	2,286,960
	Advanced Distribution Automation (ADA) Total			0	0	0	2,908,230	5,847,894	8,756,124
	Blanket	CENT NY-DIST-RELIABILITY BLANKET.	CNC0015	971,000	1,044,500	1,067,500	1,091,000	1,115,000	5,289,000
		EAST NY-DIST-RELIABILITY BLANKET.	CNE0015	1,589,000	1,723,000	1,760,000	1,798,000	1,837,000	8,707,000
		WEST NY-DIST-RELIABILITY BLANKET.	CNW0015	1,586,000	1,735,000	1,773,000	1,812,000	1,852,000	8,758,000
	Blanket Total			4,146,000	4,502,500	4,600,500	4,701,000	4,804,000	22,754,000
	CIP	ADD UFLS RELAY TO BUFFALO ST 129	C075810	0	0	0	33,000	131,000	164,000
		ADD UFLS RELAY TO BUFFALO ST 21	C075802	149,000	0	0	0	0	149,000
		ADD UFLS RELAY TO BUFFALO ST 23	C075803	33,000	168,000	0	0	0	201,000
		ADD UFLS RELAY TO BUFFALO ST 33	C075809	0	0	0	33,000	158,000	191,000
		ADD UFLS RELAY TO BUFFALO ST 43	C075805	0	0	33,000	162,000	0	195,000
		ADD UFLS RELAY TO BUFFALO ST 54	C075807	0	0	33,000	153,000	0	186,000
		ADD UFLS RELAY TO BUFFALO ST 68	C075804	0	33,000	169,000	0	0	202,000
		ADD UFLS RELAY TO CLINTON	C075847	0	0	28,000	90,000	0	118,000
		ADD UFLS RELAY TO DELMAR	C076962	0	0	0	31,000	181,461	212,461
		ADD UFLS RELAY TO MIDDLEBURG	C075850	0	0	0	28,000	96,000	124,000
		ADD UFLS RELAY TO NEW KRUMKILL	C075843	28,312	138,364	0	0	0	166,676
		ADD UFLS RELAY TO PROSPECT HILL	C075846	0	0	28,000	125,000	0	153,000
		ADD UFLS RELAY TO SYCAWAY	C075844	105,000	0	0	0	0	105,000
		ADD UFLS RELAY TO WOLF ROAD	C075845	0	33,000	143,000	0	0	176,000
	CIP Total			315,312	372,364	434,000	655,000	566,461	2,343,137
	Distribution Line Sensors/Monitors	FEEDER MONITORS / SENSORS- NY CENTR	C076143	631,188	631,000	631,000	1,262,376	1,000,000	4,155,564
		FEEDER MONITORS / SENSORS- NY EAST	C076142	193,070	193,000	193,000	386,139	1,000,000	1,965,209
		FEEDER MONITORS / SENSORS- NY WEST	C076144	675,743	676,000	676,000	1,351,485	1,000,000	4,379,228
	Distribution Line Sensors/Monitors Total			1,500,001	1,500,000	1,500,000	3,000,000	3,000,000	10,500,001
	Eng Reliability Review	*ASHLEY 51 - BALDWIN CORNERS RD PH4	C056711	0	0	0	150,000	250,000	400,000
		*BROOK RD 52 - LEWIS RD CONVERSION	C049761	0	111,780	0	0	0	111,780
		*BROOK RD 57 - BRAIM RD CONVERSION	C049791	42,500	0	0	0	0	42,500
		*BURGOYNE 51 - COUNTY HWY 41	C049790	0	27,000	0	0	0	27,000
		*CHURCH ST 53 - CNTY HWY 132 CONVRT	C049652	0	0	602,640	0	0	602,640
		*FARNAN RD 51 - BLUEBIRD ROAD	C029431	0	490,400	0	0	0	490,400
		*FLORIDA-STONER FEEDER TIE	C050438	0	0	0	1,500,000	0	1,500,000
		*GROOMS RD 34556 - RTE 146 RECONDUC	C050105	0	190,400	0	0	0	190,400
		*MCCLELLAN 51 - UNION ST CONVERSION	C050085	0	1,000,000	0	0	0	1,000,000
		*MIDDLEBURGH 51 - MALLON ROAD	C049758	0	0	153,000	0	0	153,000
		*MUMFORD 5052 - RECONDUCTOR/CONVERT	C049885	0	490,000	0	0	0	490,000
		*NR-BREMEN 81556-BEECH HILL RD	C049789	143,200	0	0	0	0	143,200

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		*NR-HIGLEY 92451-JOE INDIAN AREA	C049745	403,000	0	0	0	0	403,000
		*NR-HIGLEY 92451-NYS HWY 56-FDRTIE	C046864	590,000	0	0	0	0	590,000
		*NR-PARISHVILLE 93961-RELOCATE FDR	C049751	0	0	396,100	0	0	396,100
		*SHARON 52 - STATE ROUTE 145	C049792	0	0	10,400	0	0	10,400
		*UNION ST 54-LINCOLN HILL RD PH 2	C056627	0	0	0	275,000	0	275,000
		*UNION ST. 53/54 - ROUTE 22 TIE	C056620	0	191,700	0	0	0	191,700
		*VAIL MILLS 53 - UNION MILLS RD.	C019352	0	0	0	470,400	0	470,400
		AMSTERDAM 51/53 WIDOW SUSAN AREA	C028835	0	0	306,850	0	0	306,850
		ASHLEY 51 - BALDWIN CORNERS RD PH3	CD01117	0	112,000	0	0	0	112,000
		BATTENKILL 56 - COUNTY HWY 46 ERR	C060327	90,300	0	0	0	0	90,300
		BATTENKILL 56 ERR FUSING	C060285	0	0	162,000	0	0	162,000
		BOLTON 51/WARRENSBURG 51 FEEDER TIE	CD00606	275,000	725,000	0	0	0	1,000,000
		BROOK RD 54 - ROUTE 50 CONVERSION	C048584	0	0	717,400	0	0	717,400
		BURDECK 26552 - WESTCOTT / CURRY RD	CD01226	0	0	0	154,700	0	154,700
		BURDECK 52 ERR FUSING	C060686	150,410	0	0	0	0	150,410
		BURDECK 54 - DUANESBURG RD CONVERT	C056558	0	17,500	280,000	0	0	297,500
		BURGOYNE 51 - CLOSE GAPS ON COUNTY	CD00208	0	76,680	0	0	0	76,680
		CENTER ST 52 - HICKORY HILL RD CONV	C056808	0	312,200	0	0	0	312,200
		CENTER ST 54 - HYNEY HILL ROAD REBU	CD00357	0	200,000	0	0	0	200,000
		CHRISLER AVE 25735 CONVERSION	C057133	0	14,400	300,240	0	0	314,640
		CHRISLER AVE 25737 CONVERSION	C057132	0	20,160	400,320	400,320	0	820,800
		CHRISLER REBUILT STATION - DIST GET	C064766	0	200,000	200,000	0	0	400,000
		CLINTON 36653-54 CONVERSION TIE	C053628	0	249,900	0	0	0	249,900
		CURRY RD 52 - ALTAMONT 55 TIE	C057249	0	81,200	0	0	0	81,200
		EPHRATAH 31 - MUD RD RELOCATION	C056866	70,000	0	0	0	0	70,000
		FLORIDA 51 - FORT HUNTER ROAD	C050693	0	0	0	253,300	0	253,300
		FLORIDA 51 - MEAD ROAD	C050692	0	0	0	288,150	0	288,150
		FRONT ST 52 - SCHERMERHORN ST RECON	C056746	0	0	0	279,510	0	279,510
		LYNN 55 - WEAVER ST 51 TIE CONVRT	C055708	208,600	0	0	0	0	208,600
		MIDDLEBURG 51 - SCHOHARIE CREEK REM	C056970	33,600	0	0	0	0	33,600
		NR_LYME 73351_T.I. 81455-NYSHWY12E_	CD01295	406,000	0	0	0	0	406,000
		NR-T.I.81458-COUNTY ROUTE 1-FDRTIE	CD01187	0	230,400	0	0	0	230,400
		OGDENBROOK 51 - COTTAGE HILL RD	C054983	0	100,000	0	0	0	100,000
		REYNOLDS RD 33455 CONVERSION	C046683	134,400	0	0	0	0	134,400
		SCHOHARIE 52 - STATE ROUTE 443 REBU	CD00424	0	298,400	0	0	0	298,400
		ST JOHNSVILLE - SANDERS ROAD (ERR)	C029439	0	0	372,000	0	0	372,000
		UNION ST 52 - BROWNELL RD. REBUILD	C056657	0	0	91,200	0	0	91,200
		UNION ST 52 - CONTENT FARM RD.	C056710	0	110,040	0	0	0	110,040
		UNION ST 54 - LINCOLN HILL RD PH 1	C056625	0	117,040	0	0	0	117,040
		VAIL MILLS 52 - COUNTY HWY 16 CONVT	C055530	0	196,000	0	0	0	196,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		VAIL MILLS 52 - HONEYWELL CORNERS	C055707	0	225,000	0	0	0	225,000
		WEAVER 51 - PLEASANT ST CONVERSION	C057110	322,630	0	0	0	0	322,630
	Eng Reliability Review Total			2,869,640	5,787,200	3,992,150	3,771,380	250,000	16,670,370
	Network Transformer DGA Monitors	NETWORK TRANSFORMER DGA - NYC	C077021	300,000	300,000	300,000	300,000	300,000	1,500,000
		NETWORK TRANSFORMER DGA - NYE	C077022	300,000	300,000	300,000	300,000	300,000	1,500,000
		NETWORK TRANSFORMER DGA - NYW	C077020	300,000	300,000	300,000	300,000	300,000	1,500,000
	Network Transformer DGA Monitors Total			900,000	900,000	900,000	900,000	900,000	4,500,000
	Reliability	*BETHLEHEM 02155 GLENMONT RD CONV	C049990	0	203,310	0	0	0	203,310
		*BLUE STORES 30352 - CONVERSION	C050107	0	699,840	0	0	0	699,840
		*BYRON F1863 - REBUILD /RECONDUCTOR	C049762	0	0	819,200	0	0	819,200
		*CREATE FULL TIE F15351 TO F15352	C049720	16,000	540,000	0	0	0	556,000
		*CREATE FULL TIE F18251 TO F18254	C049882	0	0	16,000	0	0	16,000
		*CREATE FULL TIE F9354 TO F9353	C049783	356,000	0	0	0	0	356,000
		*E.GOLAH 5157 TIE W/LAKEVILLE 19752	C049880	0	0	16,000	0	0	16,000
		*HOOSICK 31451 - CONVERSION	C050082	0	199,750	0	0	0	199,750
		*HOOSICK 31452 CONVERSION- HIGH ST.	C050083	0	585,630	0	0	0	585,630
		*HUDSON 08753 - RTE 9G CONVERSION	C050108	0	544,850	0	0	0	544,850
		*MIDDLEPORT F7765 TIE W/SHELBY 7656	C049711	0	0	16,000	0	0	16,000
		*RBLD/CONV F15352 TO FULL TIE F6353	C049878	458,000	0	0	0	0	458,000
		*RBLD/CONV TO CREATE TIE F7652-7651	C049802	0	16,000	440,000	0	0	456,000
		*REBUILD DARIEN F1662 LIMITED TIE	C049634	0	16,000	20,000	0	0	36,000
		*REBUILD PORTION OF E.OTTO F2861	C049718	0	16,000	224,000	0	0	240,000
		*REBUILD PORTIONS OF CATT. F1562	C049686	0	0	0	468,000	0	468,000
		*SELKIRK 14951 -THATCHER/RIVER CONV	C049985	0	10,530	511,110	0	0	521,640
		*SELKIRK 52/ BETH 58-CREBLE RD CONV	C050001	0	258,400	0	0	0	258,400
		*TRINITY 16458 - MCCARTY AVE CONV	C050000	0	10,530	318,330	0	0	328,860
		*TRINITY 52- DELAWARE/PARK AVE CONV	C049999	172,550	0	0	0	0	172,550
		*WEIBEL 56 - WALL STREET REBUILD	C051325	0	0	11,440	924,000	0	935,440
		81452-HOPEWELL HALL ROAD REBUILD	C054910	0	144,500	0	0	0	144,500
		81453-ELLIS ROAD REBUILD&RELOCATION	C054930	0	0	96,000	0	0	96,000
		81458 DINGMAN POINT ROAD REBUILD_RR	C054533	0	76,800	0	0	0	76,800
		89552 DYKE ROAD - REBUILD	C052447	0	326,400	0	0	0	326,400
		91453 RTE 11 RELOCATION	C057007	0	0	0	0	630,400	630,400
		BAILEYSETTLEMENT-GORE RD_REBUILD	C054583	0	332,000	0	0	0	332,000
		BAKER ST - INSTALL 2ND XFMR	C046553	0	0	0	0	100,000	100,000
		BATTENKILL 57 - SULLIVAN RD	C056323	0	0	70,000	0	0	70,000
		BATTENKILL 58 - CAMBRIDGE RD	C053182	0	125,800	0	0	0	125,800
		Bloomingdale HWY 3 FDR tie part 2	C078203	0	0	0	0	600,000	600,000
		Bloomingdale State HWY 3 FDR Tie	C078202	0	0	0	0	520,000	520,000
		BOLTON 51 - TROUT LAKE RD 3 PHASE	C049560	457,800	0	0	0	0	457,800

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		BROOK ROAD 54 - OLD BALLSTON AVE.	C068126	0	0	85,800	0	0	85,800
		BROOK ROAD 55 - LAKE DESOLATION RD	C050691	0	0	294,400	0	0	294,400
		CAMILLUS DSUB	C046637	0	0	0	13,200	0	13,200
		CHURCH ST 56 - CONVERT VROOMAN AVE	C048241	266,050	0	0	0	0	266,050
		CLINTON 53 - BAUM & BURRELL ROADS	C050684	0	0	0	234,600	0	234,600
		CORINTH 52-MAIN ST REBUILD/CONVERT	C058899	0	112,200	0	0	0	112,200
		CR- LHH 44 2012 NYS PSC ACTION ITEM	CD00953	0	348,800	0	0	0	348,800
		CR- LHH44-N OSCEOLA RD	C055443	0	192,000	0	0	0	192,000
		CR- LORDS HILL 66 WROK FOR TIE	C078276	577,000	0	0	0	0	577,000
		CR- NILES 51 DOLPHIN POINT QRS	C053106	0	300,050	0	0	0	300,050
		CR- SANDY CREEK 51 WART RD REBUILD	C050679	0	98,600	0	0	0	98,600
		CR- WINE CREEK 53 TIE	C055690	275,200	0	0	0	0	275,200
		DELAMETER - 115KV CIRCUIT SWITCHERS	C051492	0	0	0	272,000	0	272,000
		DELAMETER INSTALL TWO 20/26/33MVA	C046536	0	0	0	50,000	2,450,000	2,500,000
		DELAMETER F9352 RECONFIGURED LAYOU	C047886	0	766,400	412,800	0	0	1,179,200
		DELAMETER F9356-EXPRESS& REBUILD	C047877	0	0	0	720,000	0	720,000
		DELAMETER NEW F9355 - EXPRESS..	C047885	0	0	0	240,000	0	240,000
		F0153 - WALKER RD PIW	C048179	0	0	148,000	0	0	148,000
		F0456/0457 BUILD FEEDER TIE	C049540	0	0	500,000	0	0	500,000
		F4361 PIW - LITTLEVILLE ROAD	C047870	0	149,600	0	0	0	149,600
		F9263 - ROUTE 31 PIW	C049084	0	200,000	0	0	0	200,000
		F9354 NEW TIE	C056867	87,500	0	0	0	0	87,500
		FORT GAGE 54 - ROUTE 9L REBUILD	C050680	915,600	0	0	0	0	915,600
		GROVELAND ST. F4161 - SMALL WIRE	C049909	0	304,000	0	0	0	304,000
		HINSDALE DSUB	C046638	0	13,200	0	0	0	13,200
		KNAPP RD 22651 FEEDER TIE	C028716	0	0	0	663,000	0	663,000
		LAND-WATERTOWN - GREENFIELD SUBSTA	C061245	50,000	100,000	0	0	0	150,000
		LIGHTHOUSEHILL RELOCATION-DIST LINE	C074342	0	0	99,000	248,000	495,000	842,000
		LOCKPORT ROAD 216 - INSTALL TB2 -	CD01252	0	0	0	0	300,000	300,000
		LONG RD 209 - NEW F20955	CD00964	0	0	0	0	1,410,000	1,410,000
		LONG ROAD 209 - INSTALL TB2	CD00977	0	0	0	0	2,400,000	2,400,000
		Lord's Hill/Harris Field Tie	C079073	536,000	0	0	0	0	536,000
		MIDDLEBURGH 51/SCHOHARIE 51 LS	C050764	0	0	0	234,600	0	234,600
		MIDDLEPORT ST F7765- SMALL WIRE -2	C049905	216,000	0	0	0	0	216,000
		MILITARY RD NEW FEEDER 21055	C036566	41,000	364,500	0	0	0	405,500
		MILL ST_LVAC_2014 UPGRADES-N-2	C053903	0	155,200	500,000	500,000	0	1,155,200
		MILL ST_LVAC_2014 UPGRADES-NEWELL	C054438	0	0	0	0	397,000	397,000
		MILL ST_LVAC_2014_UPGRADES-N-1	C054385	104,800	0	0	0	0	104,800
		MUMFORD 50 - TB2 - INSTALL NEW FDR	C046589	0	0	0	0	1,000,000	1,000,000
		MUMFORD 50 -INSTALL TRANSFORMER 2	C046590	0	0	0	0	3,095,000	3,095,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		MV-Chadwicks feeder ties	C079560	0	0	0	0	350,000	350,000
		MV-LEHIGH 51 & 54 TIE CREATION	C050004	0	0	328,050	0	0	328,050
		MV-POLAND 62258 ROUTE 8 RECONDUCTOR	C046605	0	0	0	0	1,125,000	1,125,000
		MV-ROME 54 -HOGSBACK RD RECONDUCTOR	C050097	0	0	130,400	130,000	0	260,400
		MV-ROME 54-LAUTHER RD - RECONDUCTOR	C050086	0	0	432,800	0	0	432,800
		MV-SALISBURY 57/MIDDLEVILLE 71 TIE	C049966	320,000	0	0	0	0	320,000
		MV-TURIN 65355 & 56 TIE CREATION	C050002	0	700,000	700,000	0	0	1,400,000
		N LEROY F0455 - LINWOOD ROAD PIW	C056629	0	0	14,000	0	0	14,000
		NEW CICERO SUBSTATION DLINE	C046476	50,000	125,000	2,000,000	455,000	0	2,630,000
		NEW CICERO SUBSTATION DSUB	C046475	522,000	2,688,500	6,611,220	2,750,280	0	12,572,000
		NEW DIST SUB - TONAWANDA NYW DSUB	C051266	4,340,260	1,595,440	0	0	0	5,935,700
		NEW DIST SUB -TONAWANDA NYW DLINE	C051265	937,120	488,070	0	0	0	1,425,190
		NORTH BANGOR CONVERSION (D-LINE)	C046418	0	0	0	0	400,000	400,000
		NORTH BANGOR NEW 34.5/13.2KV STATIO	C046423	0	0	0	372,000	801,000	1,173,000
		NORTH CREEK 52 - CONVERT ROUTE 28	C050685	141,950	0	0	0	0	141,950
		NORTH CREEK 52 - EDWARDS HILL ROAD	C050688	0	166,400	0	0	0	166,400
		NORTH CREEK 52 - PEACEFUL VALLEY RD	C049622	0	499,800	0	0	0	499,800
		NORTH TROY 12353 - MSH - RELOCATION	C058224	270,400	0	0	0	0	270,400
		NY - EAST_1 PH CUTOUT MOUNTED RCLRS	C053928	102,234	102,234	102,234	102,234	102,234	511,168
		NY_CENTRAL_1PH_CUTOUT_MNT_RECLOSERS	C059620	102,234	102,234	102,234	102,234	102,234	511,168
		NY_WEST_1 PH CUTOUT MNTED RECLOSERS	C059607	102,234	102,234	102,234	102,234	102,234	511,168
		OGDENBROOK 51-CONVERT AVIATION ROAD	C053381	0	0	0	683,400	0	683,400
		PORT HENRY 52 - DALTON HILL RD	C054284	0	150,660	0	0	0	150,660
		POTTERSVILLE 51 - EAST SHORE DR	C050682	0	0	0	850,400	0	850,400
		RECONDUCTOR 5552 TIE TO 5262	C048837	0	0	297,500	0	0	297,500
		REYNOLDS 33458 - NORTH RD 3PHASE	C059641	0	0	0	0	100,000	100,000
		REYNOLDS RD 33455 - 3-PHASE LINE EX	C046646	0	265,200	0	0	0	265,200
		S LIMA RD PIW FEEDER TIE	C047788	225,250	0	0	0	0	225,250
		STATION 214 - INSTALL TB2	C029186	0	0	0	0	2,400,000	2,400,000
		STATION 214 - NEW F21467	C029187	0	0	0	0	1,545,000	1,545,000
		UG for Temple Rebuild	C079532	0	0	0	1,000,000	2,600,000	3,600,000
		UNION ST 52 - GREENE/KING RD CONVER	C056649	0	12,000	0	0	0	12,000
		UNION ST 53 - KENYON HILL ROAD	C050779	0	147,200	0	0	0	147,200
		UNION ST. 53 - COUNTY HWY 67	C050777	0	490,400	0	0	0	490,400
		VAIL MILLS 51 - NOONAN RD CONVERT	C051412	0	130,050	0	0	0	130,050

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		VAL KIN 42753 - STUY 03552 TIE	C058900	0	0	300,000	0	0	300,000
		WATERTOWN NEW 115/13.2 KV SUBSTATIO	C046610	0	0	0	321,600	3,400,000	3,721,600
		WEST HAMLIN 82 - NEW TB2 - INSTALL	CD01090	1,473,500	1,609,500	1,131,000	0	0	4,214,000
		WHITAKER DSUB	C046636	0	0	0	0	1,238,800	1,238,800
		WHITESBORO 64, 65 AND 66 RETIREMENT	C050878	15,000	0	0	0	0	15,000
	Reliability Total			13,131,682	16,585,812	16,849,752	11,436,782	27,663,902	85,667,924
	Side Tap Fusing	WEAVER 51 - GUILDERLAND AVE RECON	C057032	0	0	18,750	0	0	18,750
	Side Tap Fusing Total			0	0	18,750	0	0	18,750
	Storm Hardening	42951-HOFFMAN ROAD STORM HARDENING	C052252	377,600	0	0	0	0	377,600
		COLUMBIAN ROAD REBUILD	C052072	300,000	0	0	0	0	300,000
		F2861 EAST OTTO STORM HARDENING	C052044	0	700,000	0	0	0	700,000
		F2862 STORM HARDENING	C057428	9,800	408,100	0	0	0	417,900
		SCOFIELD 53 - FY16 STORM HARDENING	C057289	0	351,090	0	0	0	351,090
		SHEPPARD RD 2951 - STORM HARDENING	C057429	385,000	0	0	0	0	385,000
		WETHERSFIELD 2361 - STORM HARDENING	C057411	315,700	0	0	0	0	315,700
	Storm Hardening Total			1,388,100	1,459,190	0	0	0	2,847,290
	Substaion Flood Mitigation	INDIAN CREEK RD SUBSTATION	C056566	449,000	0	0	0	0	449,000
		UNION FALLS FLOOD MITIGATION_DLINE	C068248	36,000	44,000	0	0	0	80,000
	Substaion Flood Mitigation Total			485,000	44,000	0	0	0	529,000
	Substation Mobile	NY NEW MOBILE SUBSTATION 23 KV - 13	C046402	1,000,000	1,000,000	0	0	0	2,000,000
		NY NEW MOBILE SUBSTATION 34.5 KV -	C046410	0	0	1,000,000	0	0	1,000,000
	Substation Mobile Total			1,000,000	1,000,000	1,000,000	0	0	3,000,000
Reliability Total				25,735,735	32,151,066	29,295,152	27,372,392	43,032,257	157,586,596
System Capacity	Blanket	CENT NY-DIST-LOAD RELIEF BLANKET.	CNC0016	708,000	784,000	801,000	819,000	837,000	3,949,000
		EAST NY-DIST-LOAD RELIEF BLANKET.	CNE0016	974,000	1,082,000	1,106,000	1,131,000	1,156,000	5,449,000
		WEST NY-DIST-LOAD RELIEF BLANKET.	CNW0016	409,000	418,000	427,000	436,000	446,000	2,136,000
	Blanket Total			2,091,000	2,284,000	2,334,000	2,386,000	2,439,000	11,534,000
	Load Relief	*CEDAR 51 - BUTTERMILK FALLS RD	C049764	0	250,290	455,220	0	0	705,510
		*FIREHOUSE 44953 - DUNSBACH RD CONV	C049864	207,360	0	0	0	0	207,360
		*FIREHOUSE RD STATION - NEW FEEDER	C050081	0	340,000	400,000	0	0	740,000
		*HAGUE RD 52 - CONVERT ROUTE 22	C050717	0	0	1,000,350	0	0	1,000,350
		*VAIL MILLS 51 - COUNTY HWY 107	C049793	0	0	0	465,750	0	465,750
		*WILTON 52 - RT 32 3 PHASE EXT.	C019570	0	0	0	649,620	0	649,620
		81452 WESTMINSTER PARK RD - REBUILD	C052344	0	0	0	1,190,000	0	1,190,000
		87554 COUNTY RTE 189 & 95 - REBUILD	C052367	0	0	0	0	699,550	699,550
		89552 CROOKS ROAD - REBUILD	C052443	0	0	459,850	0	0	459,850
		8TH ST CONVERSION NIAGARA FALLS	C046841	178,800	0	0	0	0	178,800
		95554 HWY 11 - REBUILD	C052371	0	0	0	0	632,400	632,400
		97654 SKINNERVILLE ROAD - REBUILD	C052370	0	0	236,300	0	0	236,300
		AVENUE A 29112 RECONDUCTOR	C078281	0	0	0	0	85,000	85,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		BATTENKILL 57-NORTH RD RATIO RELIEF	C057410	0	0	368,000	0	0	368,000
		BEECH AVE CONVERSION NIAGARA FALLS	C032751	778,000	0	0	0	0	778,000
		BROOK ROAD 55 - BARNEY RD. REBUILD	C047978	0	340,000	0	0	0	340,000
		BRUNSWICK 26453 - SOUTH RD CONV	C045696	0	272,160	0	0	0	272,160
		BUFFALO STATION 129 - F12974 RECOND	C046558	297,500	0	0	0	0	297,500
		BURDECK 26552 - BURNETT ST CONVERSI	C046632	0	730,150	0	0	0	730,150
		BUTLER 53 - ADD BREAKER FOR 53 CKT	C047481	0	0	53,350	0	0	53,350
		BUTLER 53 - BUILD 36253 FEEDER - OH	C047455	0	0	453,900	0	0	453,900
		CENTER ST 52 - ROUTE 5 REBUILD/CONV	C048833	0	0	0	589,900	0	589,900
		CLINTON 54 - E MAIN ST CONVERSION	C055366	74,900	0	0	0	0	74,900
		COLLAMER CROSSING_D_LINE_UG_WORK	C070392	1,600,000	1,750,000	1,424,000	0	0	4,774,000
		COLLAMER CROSSING_D_SUB_WORK	C070393	3,558,000	2,400,000	1,300,000	0	0	7,258,000
		CORLISS PARK XFMR 2 & BUS INSTALL	C079382	0	2,000,000	0	0	0	2,000,000
		CR- 23553 CEDARVALE RATIO RELIEF	C051803	0	407,200	0	0	0	407,200
		CR BREWTON RETIRE	C010751	3,270	0	0	0	0	3,270
		CR- CONVERT 26554 BROOKLEA DR	C052226	0	635,200	0	0	0	635,200
		CR- CONVERT 29351 NORTH OF STATION	C049397	0	0	0	680,000	0	680,000
		CR- PEBBLE HILL BURKE RD RATIO	C051710	0	160,000	0	0	0	160,000
		DEKALB 98455 TOWN LINE RD - REBUILD	C052106	0	0	0	0	595,000	595,000
		DELAET'S LANDING DXD	CD00893	0	0	15,390	9,720	2,108,430	2,133,540
		EDEN SWITCH STRUCTURE -INSTALL 2-10	C046538	0	0	288,800	2,044,400	1,371,800	3,705,000
		EDEN SWITCH STRUCTURE- NEW FDR 1	C048015	0	0	39,690	1,400,000	0	1,439,690
		EDEN SWITCH STRUCTURE- NEW FDR 2	C048016	0	0	8,100	750,060	750,060	1,508,220
		F21555 REPLACE 4/0 PLAC GETAWAYS	C057293	0	0	10,500	0	0	10,500
		F3864 SUMMER PREP REPLACE CABLE	C078076	93,750	0	0	0	0	93,750
		F4671 SUMMER PREP REPLACE CABLE	C078162	75,000	0	0	0	0	75,000
		FAIRDALE DLINE	C046633	34,800	145,200	0	0	0	180,000
		FAIRDALE DSUB	C046640	150,000	280,200	0	0	0	430,200
		FORBES AVE - NEW SUBSTATION	C053137	0	0	499,700	4,500,150	0	4,999,850
		FRANKHAUSER NEW STATION - LINE WORK	C028929	256,000	0	0	0	0	256,000
		GENSEE ST. FEEDER CONVERSIONS	C051873	0	0	500,000	0	0	500,000
		GILBERT MILLS XFMR UPGRADE-XFMR	C046563	0	0	0	0	414,200	414,200
		HARRIS 54 RELIEF	C032446	0	210,840	2,399,760	1,060,000	0	3,670,600
		Hoosick 31452 White Creek Rd 3phext	C079297	628,000	0	0	0	0	628,000
		JUNIPER DISTRIBUTION REMOVAL WORK	C050245	0	0	0	4,000	0	4,000
		LAKEVILLE SUBSTATION RETIREMENT	C046588	0	0	0	0	46,667	46,667
		LAND-CICERO SUBSTATION	C071028	458,000	0	0	0	0	458,000
		MALONE NEW 89554 FEEDER (LINE WORK	C046626	0	0	0	10,000	329,000	339,000
		MALTA 58 - ROWLEY ROAD CONVERSION	C061025	0	0	0	0	70,400	70,400
		MAYFIELD 51 - PARADISE POINT RD	C050069	0	288,360	0	0	0	288,360

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		MILITARY RD NEW F21052 - N FALLS	C054046	0	0	0	893,000	0	893,000
		MILTON AVE DLINE	C046643	487,980	763,460	1,005,550	935,780	122,250	3,315,020
		PANAMA REBUILD	C046509	0	0	0	0	335,000	335,000
		QUEENSBURY 54 - NORTH RD CONVERSION	C060005	0	0	0	0	98,000	98,000
		RAQUETTE LAKE TRANSFORMER UPGRADE	CD01139	300,000	399,840	0	0	0	699,840
		REPLACE RELAYS AT ASHVILLE STATION	C071466	100,000	0	0	0	0	100,000
		RETIREMENT OF JUNIPER SUB 500	C049685	0	0	0	8,650	0	8,650
		RR-MENANDS 10157-GETAWAY REPLACEMEN	C053966	0	0	499,550	0	0	499,550
		S.LIVINGSTON RELIEF: F5 WORK	C051692	0	0	0	29,000	580,000	609,000
		S.LIVINGSTON RELIEF: FD3 WORK	C051690	0	50,000	500,650	1,500,250	0	2,050,900
		S.LIVINGSTON RELIEF: FD4 WORK	C051691	805,660	852,930	0	0	0	1,658,590
		S.LIVINGSTON RSLIEF: DIST FDER WORK	C051694	0	60,000	310,230	468,180	0	838,410
		SHARON 51 / 52 FEEDER TIE	C075265	0	0	0	0	90,000	90,000
		SODEMAN RD - EAST FEEDER	C076796	690,000	0	0	0	0	690,000
		SODEMAN RD - FEEDER GETAWAYS, CIVIL	C046796	2,309,000	0	0	0	0	2,309,000
		SODEMAN RD - NORTH FEEDER	C076794	25,000	700,000	0	0	0	725,000
		SODEMAN RD - SOUTH FEEDER PHASE 1	C076797	0	45,000	1,813,000	0	0	1,858,000
		SODEMAN RD - WEST FEEDER PHASE 1	C076785	25,000	455,000	50,000	1,803,000	0	2,333,000
		SODEMAN RD STATION - NEW STATION -	C046798	4,370,000	1,999,800	499,700	0	0	6,869,500
		SONORA WAY SUBSTATION WITH 6 FDERS	C060141	0	100,000	1,275,000	3,740,000	2,380,000	7,495,000
		SOUTH LIVINGSTON RELIEF - DLINE FD2	C046552	0	40,500	890,190	549,990	0	1,480,680
		STATION 3012 D-LINE	C074911	1,386,920	2,008,989	450,000	0	0	3,845,909
		STATION 3012 SUBSTATION	C074909	641,000	2,439,979	2,500,000	500,000	0	6,080,979
		STONER 52 - MOHAWK DR CONVERSION	C050421	0	700,000	0	0	0	700,000
		TEAL SUBSTATION REBUILD-FEEDERS	C046505	0	20,000	747,968	0	0	767,968
		TEAL SUBSTATION REBUILD-SWGR	C046511	0	0	0	271,000	1,670,891	1,941,891
		TIBBETS 29254 - 15TH AVE CONVERSION	C046425	223,550	0	0	0	0	223,550
		UNION FALL - FLOOD MITIGATION -DSUB	C078428	210,000	127,000	0	0	0	337,000
		UNION ST 52 - COUNTY HWY 59	C056632	0	0	25,420	0	0	25,420
		UNION ST 54- TURNPIKE RD CONVERSION	C055735	10,000	1,000,000	0	0	0	1,010,000
		VAN DYKE - UG - CIVIL & ELEC WORK	C052098	521,000	3,800,000	0	0	0	4,321,000
		VAN DYKE STATION - NEW 115/13.2KV S	C046490	0	0	796,100	5,333,300	3,197,700	9,327,100
		VAN DYKE STATION - NEW 56 DIST FEED	C046487	0	0	0	1,167,500	1,000,000	2,167,500
		VAN DYKE STATION-NEW 54 DIST FEED.	C046495	0	0	0	0	3,276,750	3,276,750
		VAN DYKE SUBST- NEW 57 DIST FEEDER	C046488	0	0	0	1,853,000	1,096,500	2,949,500
		VAN DYKE SUBST- NEW FEEDERS	C016087	0	0	1,219,750	0	0	1,219,750
		WATERTOWN NEW115/13.2 KV SUBSTATION	C077720	0	0	0	271,000	5,879,280	6,150,280
		WATT ST 23051-HAMBURG ST CONVERSION	C051804	169,150	0	0	0	0	169,150
		WEAVER 52 - EMMET 02 FEEDER TIE	C065386	60,000	0	0	0	0	60,000

Spending Rationale	Program	Project Name	Project #	FY19	FY20	FY21	FY22	FY23	Total
		WELCH AVE CONVERSION LOAD RELIEF	C046842	77,760	0	0	0	0	77,760
	Load Relief Total			20,805,400	25,772,098	22,496,018	32,677,250	26,828,878	128,579,644
	Volt Var Optimization/Conservation Voltage Reduction(VVO/CVR)	NY VVO CENTRAL - D-LINE	C077098	0	758,700	1,179,200	1,840,100	2,041,700	5,819,700
		NY VVO CENTRAL - SUBSTATION	C076103	0	404,000	606,000	606,000	808,000	2,424,000
		NY VVO EAST - D-LINE	C077097	0	504,300	899,500	1,121,000	1,637,700	4,162,500
		NY VVO EAST - SUBSTATION	C076088	0	404,000	606,000	1,198,000	1,205,000	3,413,000
		NY VVO WEST - D-LINE	C077099	0	276,000	1,474,300	1,895,100	1,871,300	5,516,700
		NY VVO WEST - SUBSTATION	C076105	0	202,000	404,000	606,000	808,000	2,020,000
	Volt Var Optimization/Conservation Voltage Reduction(VVO/CVR) Total			0	2,549,000	5,169,000	7,266,200	8,371,700	23,355,900
System Capacity Total				22,896,400	30,605,098	29,999,018	42,329,450	37,639,578	163,469,544
Grand Total				294,260,843	326,486,519	338,117,306	423,154,499	462,512,159	1,844,531,324

Exhibit 4 – Revenue Requirement and Rate Impact

Exhibit 4

NIAGARA MOHAWK POWER CORPORATION
Summary of Bill Impact Associated with FY18 - FY21 T & D Capex Only
For Fiscal Years 2019, 2020 & 2021
($000's)

	FY 2019	FY 2020	FY 2021
Depreciation Expense	7,857	18,075	28,880
Rate Base:			
Net Utility Plant	543,396	1,112,600	1,709,144
Accumulated Deferred Taxes	-51,134	-87,899	-128,695
Total Rate Base	492,261	1,024,701	1,580,449
ROR	8.07%	8.02%	7.99%
Return on Rate Base	39,725	82,181	126,278
Total Revenue Requirement Impact of FY18 - FY21 Capex Only	47,582	100,256	155,158

Rate Base Impact of Depreciation on 3/31/17 Embedded Plant	-105,633	-316,898	-528,163
ROR	8.07%	8.02%	7.99%
Total Revenue Requirement Impact of 3/31/17 Embedded Plant	-8,525	-25,415	-42,200
Total Revenue Requirement Impact of Capex less impact of Embedded Plant	**$39,057**	**$74,840**	**$112,957**
Allocation of Revenue Requirement to SC1 Residential Customers	23,376	44,986	68,056
SC1 Residential Customers Cumulative Bill Impact per kWh	**$0.00212**	**$0.00408**	**$0.00621**

Assumptions:

1) FY18 - FY21 capex per the NMPC Joint Proposal filed January 19, 2018 in Case 17-E-0238 with slight modifications based on the 1/31/2018 CIP filing (Transmission, Distribution and Sub-Transmission)
2) Depreciation Rates per NMPC Joint Proposal in Case 17-E-0238
3) ROR based on 9.0% ROE per Appendix 1, Schedule 1, in NMPC Joint Proposal in Case 17-E-0238
4) Embedded historic plant generates depreciation expense that will reduce rate base (increase to depreciation reserve). Reduced the revenue requirement to include the inherent reduction to ratebase from depreciating embedded plant determined as follows:

March 31, 2017 Electric Depreciable Plant	9,036,826
Composite Electric Depreciation Rate	2.34%
Total Annual Electric Depreciation based on embedded plant	211,265

Ratebase impact determined by using a half year average of annual depreciation per year

5) Accumulated Deferred Taxes were calculated incorporating the new tax legislation " Tax Cuts and Jobs Act" issued in December 2017 eliminating bonus depreciation after September 2017. The new legislation included impact of Federal rate change from 35% to 21%.
6) Allocated revenue requirement to SC1 customers based on FY2019 - FY2021 T&D Revenue at Proposed Rates per Appendix 2, Schedule 2 filed in the Joint Proposal in Case No. 17-E-0238.
7) Determined bill impact based on FY2019 through FY2021 sales forecast per Appendix 2, Schedule 1.1 - 1.3, respectively, filed in the Joint Proposal in Case No. 17-E-0238.

Exhibit 5: Non-Wires Alternatives Update

National Grid has adopted guidelines for the review and consideration of non-wires-alternatives ("NWAs") in its planning processes. The guidelines outline two stages of review: the first to identify potential areas of need where NWAs 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, and the second stage is completed by the Company's Distribution Planning and Asset Management ("DPAM") function and project managers in the Company's New Energy Solutions organization, or by vendors selected by the Company.

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 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) 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 socialized. Developers review the RFP then the Company holds a "bidders call" which is a forum for developers to ask questions about the NWA opportunity. Answers/information is compiled by DPAM and NES and posted on National Grid's procurement site – Ariba. Vendors continue developing their proposals and submit them into Ariba. Proposals are reviewed and ranked by the NWA team which includes procurement, NES and DPAM and those projects that are most affordable and viable, i.e., those that can solve the electrical problem described in the RFP, are shortlisted. Questions and requests for information are developed by the NWA team and sent to the shortlisted vendors. While waiting for the responses, the NWA team applies the BCA to the shortlisted proposals creating a preliminary BCA score. The NWA team reviews the vendor responses and reapplies the BCA to the resubmittal. The NWA team then chooses the preferred vendor which is the vendor who offers the proposal that solves the electrical problem, maintaining 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.

The current project list is provided in the table below. More projects will be added based on the aforementioned CIP review criteria. NWA projects may be "walked out/walked in" based on the Company's CIP development process.

In 2017 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, had need dates that were too immediate, or had cost estimates that did not meet the criteria. In addition, the Company identified seven projects prior to the SDSIP suitability criteria development. There were 10 NWA opportunities identified by applying the SDSIP suitability criteria to the projects listed in the CIP. The 2017 review identified one new NWA opportunity (Sonora Way). Nine opportunities were previously identified in 2016. At this time, the Company has seventeen identified NWA opportunities (seven are in the RFP process).

The table below lists current NWA projects and their status:

Project Name/ Description	Project Type	Status	Loading Relief Needed	Voltage Type	Voltage (kV)	Project Size	Estimated RFP Timing
Baldwinsville	Load Relief	Closure	4-6 MW	Distribution	13.2kV	Large	RFP Closed

Project Name/ Description	Project Type	Status	Loading Relief Needed	Voltage Type	Voltage (kV)	Project Size	Estimated RFP Timing
Old Forge	Reliability	BCA Review	13 MW	Distribution/ Sub-Transmission	46kV / 13.2kV / 4.8kV	Large	RFP Closed
Brooklea Dr/Fayetteville	Load Relief	BCA Review	140 kW	Distribution	4.16kV	Small	RFP Closed
Gilbert Mills	Load Relief	BCA Review	1.7 MW	Distribution	13.2kV	Small	RFP Closed
Van Dyke	Load Relief	RFP Posted	8 MW	Distribution	13.2kV	Large	RFP Posted
Golah-Avon	Load Relief	RFP Posted	6 MW	Sub-Transmission	34.5kV	Large	RFP Posted
Buffalo 53	Load Relief	RFP Posted	1 MW+	Distribution / Sub-Transmission	4.16kV / 23kV	Large	RFP Posted
BEECH AVE CONVERSION NIAGARA FALLS	Load Relief	RFP Development	2MW	Distribution	4.16kV	Small	Jan-2018
FAIRDALE DSUB	Load Relief	RFP Development	500KW	Distribution	4.8kV	Large	Jan-2018
NEW CICERO SUBSTATION DSUB & D-LINE	Reliability	RFP Development	17MW	Distribution	13.2kV	Large	Jan-2018
BYRON F1863 - REBUILD /RECONDUCTOR	Reliability	Planner Review	1MW	Distribution	4.8kV	Small	Q1 - 2018
NORTH BANGOR CONVERSION (D-LINE)	Reliability	Planner Review	6MW	Distribution	4.8kV	Small	Q1 - 2018
BUFFALO 23KV RECONDUCTOR - HUNTLEY2	Load Relief	Planner Review	3MW	Sub-Transmission	23kV	Large	Q1 - 2018
LHH - MALLORY 34.5 KV 22 LINE REG.	Reliability	Planner Review	3MW	Sub-Transmission	34.5kV	Small	Q1 - 2018
WATERTOWN NEW 115/13.2 KV SUBSTATION	Reliability	Planner Review	10MW	Distribution	13.2kV / 4.8kV	Large	Q1 - 2018
FORBES AVE - NEW SUBSTATION & D-LINE	Load Relief	Planner Review	16MW	Distribution / Sub-Transmission	13.2kV / 34.5kV	Large	Q1 - 2018

Project Name/ Description	Project Type	Status	Loading Relief Needed	Voltage Type	Voltage (kV)	Project Size	Estimated RFP Timing
SONORA WAY STATION & FEEDERS	Load Relief	Planner Review	N/A	Distribution	13.2kV	Large	Q3 - 2018

Active NWA/Demand Response Projects/Proposals

In 2015, the Company developed an NWA project in Kenmore NY in compliance with the Commission's "Order Adopting Dynamic Load Management Filing with Modifications" (Case 15-E-0189). Kenmore is an electrically stressed area located just north of the City of Buffalo. Loads in the area are primarily comprised of homes and some small businesses. The Company developed a scalable three-tiered demand response program for Kenmore with expansion to future electrically stressed areas in mind.

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 was offered only in electrically stressed areas but will be expanded system wide for 2018. In addition, NEST Rush Hour Rewards was added to the ConnectedSolutions DLC program suite in 2017. 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.

Microgrid Projects

In addition to REV Demonstration micro-grid projects in the Potsdam/Clarkson University area, the Company identified and submitted to NYSERDA nine areas in upstate NY to be evaluated and considered for distributed generation/micro-grid projects in connection with NYSERDA's NY Prize competition. These "Opportunity Zones" were initially chosen based on outage exposure criteria.

National Grid managed 21 upstate NY Prize Stage 1 microgrid projects (in addition to Potsdam and including Buffalo Niagara Medical Center ("BNMC")). Stage 1 NY Prize microgrid project teams submitted feasibility studies and some have applied for a Stage 2 NY Prize award which is ~$1 million to fund detailed engineering design. The NY Prize selection committee approved up to $1 million funding for 11 designs across the

state in April 2017. Four microgrid projects located in National Grid's upstate New York territory were chosen for Stage 2 NY Prize: Syracuse, University Heights, Empire State Plaza and Buffalo Niagara Medical Center microgrid teams are currently developing detailed designs with hopes of a Stage 3 NY Prize award. Projects chosen for Stage 3 will receive approximately $7 million for project construction.

National Grid, in conjunction with the Joint Utilities Group ("JU"), is working with NYSERDA and DPS Staff on the numerous regulatory challenges microgrids have raised.

Conclusion

NWA projects and processes are ever-evolving and more projects will be considered, evaluated and developed in 2018 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 in an effort to improve its NWA program and remain consistent with the JU.

Exhibit 6: Overhead Line Refurbishment Projects

Alabama-Telegraph (C033014 - $6.1M)

The overhead line details:

Total length: Approximately 4 miles
Conductor: 4/0 ACSR 6/1 “Penguin”
Number of steel structure units: 0
Number of wood structure units: 44 H-Frame
Typical Installation date: 1940s (some Q-sheets indicate line may be as early as 1931)

Conductor test results were marginal and the Step 0 team concluded the conductor should be replaced due to falling Zinc levels which means ductility will further decrease over time. It is estimated that 5-10 years of conductor life expectancy remains.

Project scope is to reconductor with 795 ACSR Drake, install shieldwire on entire length of line and replace all structures with H-Frame or 3-pole dead-end pulloff structures on concrete foundations. Final engineering has been completed, project will begin construction and have an expected in service by FY19.

Gardenville-Dunkirk 141 & 142 Northern Phase Rebuild (C003389 - $73.6M and C076951 - $4.5M)

This project involves rebuilding the Gardenville-Dunkirk 141 (T1260) and the Gardenville-Dunkirk 142 (T1270) 115 kV transmission circuits between Gardenville and North Angola.

The overhead line details:

Total length: Approximately 20 miles
Conductor: Varies – 250 kcm CU, 400 CU, 4/0 CU, 336 kcm ACSR, and 636 kcm 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

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. Due to planning need for a larger conductor on the Northern Phase of the line due to thermal overloads during periods of low load in western NY and high imports from Canada, the rebuild of the Northern Phase will be done first with an expected in service date of FY22. An Article VII application is being prepared with anticipated filing in April 2018.

Lockport-Batavia 112 (C003422 - $15.6M)

The overhead line details:

Total length: Approximately 34 miles
Conductor: Varies - 250 Copper 19-Strand, 795 ACSR “Coot” 36/1, 336.4 ACSR “Linnet” 26/7, 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 is in Step 0 (conceptual engineering) and undergoing scope development based upon an engineering field assessment and input from Transmission Planning. Conductor testing revealed all conductor types passed except 17.5 miles of 428 kcmil AAC (the shieldwire passed testing also). The project scope is a life extension involving the targeted replacement of deteriorated steel tri-leg structures that are 1907 vintage, insulators and fittings, replacement of 428 kcmil conductor splices. The section of the line through the Tonawanda Nature Preserve will be relocated to remove it from wetlands.

Mortimer – Pannell 24 25 (C047816 - $14.3M)

The overhead line details:

Total length: 15.7 miles
Conductor: 795 ACSR “Coot”, 336.4 ACSR “Oriole”, 336.4 AL “Tulip” and 336.4 ACSR Merlin
Number of wood structure units: 78
Number of steel structure units: 172
Typical Installation date: parts originally built in 1920s, upgraded to current 115kV in 1948

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.

Pannell – Geneva 4 4A (C030889 - $41.1M)

The overhead line details:

Total length: Approximately 25 miles
Conductor: 795 ACSR “Coot” and 336.4 ACSR “Oriole”
Number of wood structure units: 8
Number of steel structure units: 265 (including 1 steel pole)
Types of structures: predominantly the original 1906 Aermoter towers except at angle points which were replaced with dead-end towers
Typical Installation date: parts originally built in 1906, upgraded to current 115kV in 1948

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 and 4A lines which has had multiple conductor failures in recent years, shows significant loss of the zinc protective coating. The project in conceptual engineering to further define scope within the term of this plan.

Ticonderoga 2 & 3 (C039521 - $20.1M and C078570 - $1.6M)

These projects target the Ticonderoga-Republic 2 T5810 and the Ticonderoga-Whitehall 3 T5830 115 kV transmission circuits.

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 kcmil ACSR 30/7 “Oriole” and 4/0 Copper conductors. Ticonderoga-Whitehall 3 - 336.4 kcmil 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

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 1920's. It has been removed from the Whitehall-Ticonderoga-Republic 2-3 ACR because more time is needed to thoroughly development a scope and the 2-3 ACR project is essentially a structure replacement in-kind type project.

The Mount Defiance project will most likely consist of construction of a new parallel 115kV line adjacent to the existing 115kV line, then cut-over, and the old line removed to reduce outage time.

Huntley - Lockport 36 37 (C069538 - $16.6M)

The double-circuit overhead line details:

Total length: 24.4 miles total
Conductor: 556.5 AL, 556.5 ACSR, 300 Cu and 400 Cu
Total number of structures: 268
Number of wood structure units: 43
Number of steel structure units: 225
Types of structures: Double circuit, primarily consisting of steel lattice towers
Typical Installation date: 1929 and 1942

Life extension project involving targeted replacement of eight (8) structures, insulators and fittings between structures #1 - #87, conductor between structures #153 - #222, and problematic Turner Type D overhead line switches. This project is entering final engineering with insulator and hardware replacement planned for FY18 and reconductoring and switch replacements in FY19.

Border City – Elbridge 15 / 5 (C075723 - $4.3M)

This project targets the Border City – Elbridge #15 T2260 (formerly known as Mortimer - Solvay #5) 115 kV transmission circuits.

The overhead line details:

Total length: 31.4 miles total
Conductor: 336.4 30/6 Oriole ACSR
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: 1910's

Life extension project involving the targeted replacement of deteriorated structures, insulators and fittings, conductor splices, shield wire, tower painting, and footer repairs. This project is entering conceptual engineering to define project scope based upon the engineering field assessment , input from Transmission Planning, conductor testing, and shield wire testing.

Batavia – Golah 119 (C060217 - $3.6M)

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 to define project scope based upon the engineering field assessment performed, input from Transmission Planning, conductor testing, and shield wire testing.

Greenbush – Stephentown 993 (C060208 - $5.7M)

The overhead line details:

Total length: 31.4 miles total
Conductor: 336.4 30/6 Oriole ACSR
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: 1910's

Life extension project involving the targeted replacement of deteriorated structures, insulators and fittings, conductor splices, shield wire, tower painting, and footer repairs. This project is entering conceptual engineering to define project scope based upon the engineering field assessment performed, input from Transmission Planning, conductor testing, and shield wire testing.

Gardenville – Homer Hill 151 152 167 (C027425 - $4.4M)

The overhead line details:

Total length: 31.4 miles total
Conductor: 336.4 30/6 Oriole ACSR
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: 1910's

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 (348 structures in total). Following a failure in November 2015 where a structural vang eroded causing a conductor drop, this 348 structure segment was inspected. 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/reconductoring project will replace the existing 336.4 30/7 ACSR Oriole with 795 ACSR Drake. Because of the vang replacement and conductor clearance work in advance, the ACR/reconductoring 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/reconductoring scope based upon engineering field assessment, input from Transmission Planning, conductor and shield wire testing.

Frontier 180/182 ACR/Reconductor (C027436 - $2.5M)

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: 1920's

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/recondutoring/conductor clearance project to address typical asset type conditions for overhead lines of this vintage.

Dunkirk-Falconer 161/162 ACR (C047831 - $1.2M)

The overhead line details:

Total length: 34 miles total
Conductor: 636 AAC "Orchid", 795 ACSR "Coot", 4/0 ACSR "Penguin" and 336.4 ACSR "Linnet"
Total number of structures: 426
Number of wood structure units: 117
Number of steel structure units: 309
Types of structures: Double circuit, primarily consisting of steel lattice towers
Typical Installation date: 1920's

The 161/162 has in recent years experienced a large number of trip-and-reclose (T/R) events with no apparent cause. Polymer insulators have been replaced with porcelain and several sections of the lines' shield wire replaced as well, but the T/R 's have continued. A combined ACR/conductor clearance project will be initiated to evaluate key components of the 161/162 in-order to replace deteriorated components that may be contributing to the large number of T/R and address any clearance issues. This ACR is also needed as a new customer, Athenex, is proposed to be added to the 161/162 lines in the Dunkirk area with a new cancer drug manufacturing facility.

Spier-Rotterdam 2 Shieldwire Replacement (C050744 - $2.2M)

The overhead line details:

Conductor: 4/0 BSCU, 954 ACSR, 795 ACRS and 397.5 ACSS
Total number of structures: 791
Number of wood structure units: 531
Number of steel structure units: 260
Types of structures: H-frame
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 is in need of replacement. OPGW is being considered for the shield wire replacement because communications to the Spier Falls station requires updating. As an alternative, the portion of the Spier Falls-Rotterdam #2 between Rotterdam and the Luther Forest Tap is also being evaluated for OPGW. It's believed that if the segment between Rotterdam and the Luther Forest tap are converted to OPGW a microwave installation can be constructed at the Luther Forest Tap to communicate with a proposed microwave installation at the Brook Road tap approximately 7.8 miles to the north.

Brockport Tap (C055531 - $2.0M)

This project involves a 3 mile portion of the 7.5 mile tap between Sweden – Brockport Stations, a taps off the Lockport-Mortimer 111 and 113 lines.

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

The project scope is a life extension project involving the targeted replacement of deteriorated structures, damaged insulators and fittings, replacement of conductor splices, and adding shield wire. The conductor was installed in 1983 and not being replaced at this time.