nationalgrid

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Senior Counsel II

October 1, 2012

Via Electronic Filing

Hon. Jaclyn A. Brilling
Secretary to the Commission
New York State Public Service Commission
Empire State Plaza
Agency Building 3
Albany, NY 12223-1350

Re: Case 06-M-0878 – Joint Petition of National Grid PLC and KeySpan Corporation for Approval of Stock Acquisition and Other Regulatory Authorizations – Annual Asset Condition Report Filing by Niagara Mohawk Power Corporation d/b/a National Grid

Dear Secretary Brilling:

Pursuant to the Commission's September 17, 2007 Order in this proceeding, Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid" or "Company") hereby submits a copy of its annual "Report on the Condition of Physical Elements of Transmission and Distribution Systems" ("Asset Condition Report"). The Asset Condition Report details the condition of the Company's electric transmission, sub-transmission and distribution systems and describes system capacity and performance issues affecting the system. The version of the Asset Condition Report provided here has been redacted to remove confidential information. A confidential version of the Asset Condition Report has been submitted to the Records Access Officer along with a request for protective treatment, and has also been provided simultaneously to Christian Bonvin of Staff with direction to treat the information as confidential absent a contrary determination from the Records Access Officer or the Commission.

A copy of this letter and the redacted version of the Asset Condition Report have been provided to all persons on the service list in this proceeding pursuant to the Commission's Document and Matter Management ("DMM") system. Thank you for your attention to this matter.

Respectfully submitted,

/s/ *Carlos A. Gavilondo*
Carlos A. Gavilondo

Enclosure
cc: Service List Case 06-M-0878 (via DMM)
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REPORT ON THE CONDITION OF PHYSICAL ELEMENTS OF TRANSMISSION AND DISTRIBUTION SYSTEMS

CASE 06-M-0878

PREPARED FOR:

THE STATE OF NEW YORK PUBLIC SERVICE COMMISSION

THREE EMPIRE STATE PLAZA

ALBANY, NY 12223

OCTOBER 1, 2012

nationalgrid

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Chapter 1. Executive Summary

Niagara Mohawk Power Corporation d/b/a National Grid ("National Grid" or the "Company") submits this annual report on the physical condition of its transmission and distribution ("T&D") facilities pursuant to the September 17, 2007 Order of the New York Public Service Commission (PSC) in Case 06-M-0878.

The Company's primary focus is the safe and adequate delivery of electricity to businesses, homes, and wholesale customers in its service area and the transmission of electricity through its service area to support regional electricity markets and reliable service of other utilities. This report outlines the results of inspections and analysis of the Company's assets. Presently, the physical elements of National Grid's T&D infrastructure are generally adequate to provide safe and reliable service. However, this report highlights asset and system conditions that require continued monitoring and evaluation, and also highlights asset and system conditions that require present and future investment to ensure continued safe and reliable service. The asset and system conditions identified in this report guide the development of the Company's capital and maintenance investment plans. The Company's investment plans are focused on meeting our regulatory and statutory requirements, maintaining the reliability and safety of the system, and reducing environmental impact.

This executive summary highlights some of the key results for Asset Condition and System Capacity and Performance. Unless noted otherwise, information in the report is based on system conditions and plans as of June 30, 2012.

Chapter 1 A. Asset Condition Chapter 2

The purpose of evaluating the condition of assets is to determine those assets whose condition necessitates their replacement before their performance negatively impacts the ability to provide safe and adequate service.

Some elements of the T&D system were installed nearly a century ago and, based upon industry knowledge and experience, certain classes of assets are at or past their projected useful service life. While age is not dispositive of the condition of an asset, it is often used to identify populations of assets where condition may be a concern. Similarly, while it is not necessarily the case that every asset should be replaced at the end of its projected service life, in some cases the relative age of National Grid's T&D facilities increases the likelihood that an element will fail when stressed. Thus, an asset's projected service life is sometimes used to identify assets requiring further engineering analysis and, in asset planning, it is a factor that can help predict the volume of assets that will require replacement in the future.

Transmission System

This section provides a detailed condition report of the Company's transmission assets. Overall, the condition of National Grid's bulk power transmission system (345kV and 230kV) is safe and adequate to provide service, though there are issues in each asset class that present condition and obsolescence concerns. Likewise, the 115kV system is generally safe and adequate for service; however there are specific areas of poor condition. Some specific areas of interest are as follows.

Structures

There are nearly 91 steel structures, predominantly on the 115kV system, that are graded at condition levels that require replacement or reconditioning. The overhead line refurbishment strategy will address these structures. Approximately 138 reject and priority reject poles are identified as pending in the Company's Computapole database. The wood pole strategy or ongoing maintenance program will address these poles.

Phase Conductors

Conductor, static wire and splice issues and failures pose safety and reliability risks. The overhead line refurbishment strategy provides a systematic long-term approach to address issues related to conductor condition, shield wires and splices. A NERC recommendation, first issued on October 17, 2010 and later updated on November 30, 2010, directed utilities to verify conductor clearances based on maximum operating temperature. It further directed utilities to prioritize the evaluation of circuits on a reliability basis over a 3-year period for all bulk facilities. As a result, the Company has utilized LiDAR information collected from the original conductor clearance strategy to verify clearances and take appropriate action which includes re-rating individual lines, temporary measures such as restrictive fencing, structure modifications or replacement, or relocation of conflicting structures below the affected transmission line.

Substations

Several substations have significant condition issues, including degradation of equipment, obsolete design and equipment and reliability concerns based upon performance. National Grid has approved substation rebuild strategies for Gardenville and Rome and will develop strategies for Dunkirk, Huntley, Rotterdam, Lockport, Lighthouse Hill, Booneville and Oswego.

Circuit Breakers

A portion of the oil circuit breakers on the 115kV system are deteriorated and need to be replaced. The number of oil circuit breaker trouble reports has been trending upward. Sixty-five percent of the nearly 400 oil circuit breakers in service are between 40 years old and 60 years old and ninety percent of these breakers are used on the 115kV system.

Transformers

There are currently 70 power transformers on the transmission system that have been placed on a "watch list" which provides for closer monitoring of their condition and performance. The Company is procuring additional spare units to provide adequate coverage in the event of a failure.

Protection and Controls

National Grid maintains approximately 14,000 individual protection relays on the transmission system. Approximately 85% of the relay population are electro-mechanical relays which can expect degradation such as worn contacts and frayed insulation of wiring due to heat. In addition, calibration drift was also found in electromechanical and solid state relays, indicating electrical/mechanical component failures (i.e., capacitors, coils, resistors). Further, in solid state relays, there are problems with card failures and obsolescence.

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

Sub-Transmission System

Elements of the sub-transmission system include overhead and underground segments. With certain exceptions noted in this report, the physical elements of National Grid's sub-transmission infrastructure are safe and adequate, although many sub-transmission assets have been in service for nearly a century.

Inspection and Maintenance program activities generate asset condition information and remediate asset condition issues.

If a significant number of condition concerns are identified on a particular circuit, a detailed engineering review may be conducted leading to a comprehensive line refurbishment project. Figure 2-39 contains a list of sub-transmission projects completed from July 1, 2011 to June 30, 2012. Future work is identified in the annual five-year capital investment plan.

Overhead System Assets

National Grid has approximately 63,400 wood structures and 2,600 steel towers on its sub-transmission system. Visual inspections carried out this year up to June 30, 2012 indicate approximately 1,100 wood poles are in need of maintenance or replacement within a three year timeframe. Based on visual inspections thus far this year, 25 steel towers require further maintenance or replacement.

Underground System Assets

Underground cables that have been identified as poor performers and verified as being in poor condition continue to be replaced. There are approximately 1,100 circuit miles of sub-transmission cable. Approximately one-half is more than 47 years old and one-third is more than 60 years old.

Distribution System

This section of the report provides a detailed description of the condition of the distribution system assets, further divided into overhead and underground system assets. With certain exceptions noted in this report, the distribution system is generally in safe and adequate condition to provide electric service. National Grid continues to gather data and monitor assets in a proactive manner to ensure that any adverse trends are identified.

Inspection and Maintenance program activities generate asset condition information and remediate asset condition issues. Exhibit 3 summarizes program work on the distribution system.

Figure 2-56 contains a list of distribution projects completed from July 1, 2011 to June 30, 2012. Figure 2-57 shows the quantity of equipment installed during the same time period. Future work is identified in the annual five-year capital investment plan.

Overhead System Assets

This calendar year, through June 30, approximately 163,000 distribution pole inspections were completed, representing approximately 13 percent of the population. Based on these inspections, approximately 5,000 poles, 3% of the poles, have been identified as requiring replacement over the next three years.

Also based on inspections through June 30, 87 out of a total population of 332,000 transformers were identified as candidates for replacement over the next three years. Additionally, the Distribution Line Transformer Upgrade program replaces overloaded transformers or relieves load via the installation of a second transformer. Between July 1, 2011 and June 30, 2012, 1,196 transformers were installed as part of the upgrade program.

National Grid has identified potted porcelain cutouts for replacement. During the last three years, the Inspection and Maintenance program has identified 15,999 potted porcelain cutouts and replaced 32% percent of them. A Side Tap Fusing program has installed approximately 290 new cutouts between July 1, 2011 and June 30, 2012 to improve customer reliability.

Underground System Assets

There were 1,567 manholes and 24 vaults inspected this calendar year up to June 30, 2012. The inspection results can be found in Exhibit 3.

Sub-Transmission and Distribution Substations

This section of the report provides a detailed description of the sub-transmission and distribution substations. While generally adequate for providing safe and reliable service, these systems require investment to address condition related degradation in the areas of (1) primary equipment and (2) secondary protection and control cabling insulation.

Indoor Substations

National Grid has thirty-four (34) 23-4.16kV indoor substations in Buffalo and nine substations in other cities that were built in the 1920s through the 1940s which have been targeted for replacement.[1] These stations present a number of reliability and safety concerns. Fifteen substation rebuilds in Buffalo had been completed, and an additional one station was completed between July 1, 2011 and June 30, 2012. The five-year capital investment plan discusses on-going and proposed indoor substation work.

Metal-Clad Substations

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

Power Transformers

There are currently fifty-nine power transformers on the sub-transmission and distribution system that have been placed on a “watch list” and are being monitored more closely. A contingency plan has been identified for transformers on the watch list.

Circuit Breakers

National Grid has approximately has 3,978 circuit breakers and 154 spares on the distribution system. Based upon condition and either obsolescence or poor performance, certain families of breakers are targeted for replacement or refurbishment.

Protection and Controls

Similar to the transmission system, many of the in-service relay systems on the sub-transmission and distribution systems are electro-mechanical types that do not support modern fault recording and analysis, and moreover; a number of these relays are no longer supported by the manufacturer, and replacement parts are no longer available.

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

[1] The original indoor substation strategy count of 26 substations did not include substations completed prior to the strategy, nor substations outside Buffalo.

Chapter 1 B. System Capacity and Performance Chapter 3

This chapter describes the condition of the transmission and distribution system as it relates to system capacity and performance by transmission study area. Transmission and distribution system capacity and performance issues arise from causes such as changes in system load, changes in bulk power transfers and improvements to system configuration.

Transmission System

National Grid's transmission system comprises transmission lines and substations operating at 115kV, 230kV and 345kV. National Grid has 4,808 circuit miles of 115kV lines, 504 miles of 230kV, and 691 miles of 345kV. These facilities are extensively interconnected with facilities owned by others in New York, surrounding states, and Canada.

With respect to the capacity related performance of the bulk power transmission system, the New York ISO's 2011 Comprehensive Reliability Plan did not identify any reliability needs for the Company's transmission system. This study's results are designed to ensure adequate capability on the major transmission interfaces to support the resource adequacy standards, but does not address local transmission reliability needs or condition problems.

With respect to local transmission reliability needs, this section discusses specific concerns by geographic area served by National Grid. Planned System Capacity and Performance projects that address these concerns are described for each area and when practical these projects are designed to address multiple concerns. For study purposes, the transmission system is divided into eight geographic study areas. The following are some of the most significant issues currently being addressed by National Grid:

- Transmission line overloading and low voltages in both central and western New York.

- The exacerbation of thermal and voltage issues in Southwest New York as a result of the scheduled mothballing of four generators at Dunkirk.

- Adequacy of the 115kV system in the area north of Rotterdam and North Troy in eastern New York, especially with respect to service to the new Global Foundries (AMD) manufacturing plant at Luther Forest and the associated area load growth.

- Upgrading of two major 115kV substations to comply with Northeast Power Coordinating Council (NPCC) requirements.

Sub-Transmission and Distribution Systems

National Grid's sub-transmission system comprises lines and substations typically operating at voltages at or below 69kV. National Grid has 3,204 circuit miles of sub-transmission lines. The Company's distribution system comprises lines and substations operating at 15kV and below. There are approximately 36,270 circuit miles of overhead primary wire and 7,350 circuit miles of underground primary cable[2] on the system supplying nearly 400,000 overhead, padmount and underground transformer locations. Additionally, there are 421 substations providing service to customers.

To develop a capital investment plan that meets system requirements and customer needs as effectively and economically as possible, National Grid utilizes an annual capacity planning assessment that involves identifying thermal capacity constraints or inadequate delivery voltages by assessing the capability of the network to respond to normal conditions and contingencies that might occur.

In order to execute the annual assessment, the delivery system is segregated into 43 planning study areas. Several distribution study areas map to each of the transmission study areas. In this chapter of the report, each transmission study area section will include summaries of each related distribution study area including: a quantification of the capacity issues forecasted, a brief overview of concerns, and a list of project proposals to address forecasted concerns. These project proposals are prioritized and evaluated for inclusion in upcoming capital investment plans.

Project proposals to be implemented over a five-year planning horizon are detailed within each planning study area. These project recommendations include a wide range of possible solutions, including: simple feeder reconfiguration via switching, upgrading an existing circuit by replacing its limiting element, establishing new feeder ties and/or second substation transformers, and brand new distribution substations supplied by the 115kV transmission system.

[2] National Grid will be reporting user entered cable lengths where available. User entered length is generally considered more accurate than "GIS calculated" lengths. The GIS calculated underground cable length is 7,510 circuit miles, matching previous reports.

1 C. Organization of the Filing

The remainder of this document consists of the following:

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

- Chapter 3 - System Capacity and Performance describes in detail the transmission, sub-transmission and distribution systems regarding capacity, reliability and regulatory needs.

- Chapter 4 - Exhibits that support this Asset Condition report.

Chapter 2. Asset Condition

This chapter reports on the condition of National Grid's Transmission, Sub-transmission, and Distribution assets. Specifically, the report describes physical condition information, the age profile of assets and an explanation of how the information is used to identify high risk facilities that may require intervention. Where programs are proposed to address specific problem areas, a description of the proposed remedial actions is provided.

Chapter 2 A. Transmission System

This section provides a detailed condition report of the Company's transmission assets. Figure 2-1 provides an inventory of key system elements.

Figure 2-1
Transmission Asset Types (115kV and above)

Main Asset	Inventory 2012
Steel Structures (Towers and Poles)	20,320
Wood Poles	35,700
Phase Conductor (Circuit miles)	6,000 miles
Cables (Circuit miles)	53 miles
Substations (including transmission line locations with motorized switches)	310
Oil Circuit Breakers	364
SF6 Circuit Breakers	365
Vacuum circuit breakers	1
Transformers	509
Batteries	260
Chargers	340
Surge Arrestors	700
Sensing Devices	830
Reactors	10
Disconnect Switches	1,383
- Circuit Switchers	266
Relays	13,650

Summary of Condition Concerns

Steel Structures / Wood Poles
There are 91 steel structures (78 in 2011) graded at visual level 5 and requiring investment (Figure 2-7). There are 138 reject wood poles (266 in 2011) (Figure 2-13).

Phase Conductors
Conductors, static wire and splice failures pose potential safety and reliability concerns. The conductor clearance (SG029) and static wire (SG073) strategies were developed to address these concerns. The overhead line refurbishment strategy (SG080) provides a long-term approach designed to address issues regarding conductor condition, shield wires and splices.

Of the overhead line refurbishment, static wire and conductor clearance projects listed in this document, only five projects involve 230 or 345kV circuits, with the remainder associated with the older 115kV system.

Substations
A number of transmission substations have significant asset condition issues that will require major refurbishment projects rather than individual asset replacement projects. National Grid has approved substation rebuild strategies for Gardenville 115kV and Rome 115kV and will develop strategies for Dunkirk, Huntley, Rotterdam, Lockport 115kV, Lighthouse Hill 115kV, Boonville and Oswego 115kV.

Circuit Breakers
The oil circuit breaker population is experiencing degradation requiring additional maintenance and creates system reliability and customer service concerns. A ten year circuit breaker replacement strategy was approved in December 2010 to address 87 Oil Circuit breakers which pose the greatest safety and reliability concerns (Figure 2-33).

Transformers
National Grid has approximately 509 transformers in service. Figure 2-37 provides a list of 70 transformers that are currently being monitored. In some instances, further evaluation is necessary to properly understand the condition. Surveillance and regular DGA sampling will enable the Company to prioritize replacement appropriately.

Chapter 4, Exhibit 2 contains the Second Quarter, 2012, Inspection and Maintenance Report summarizing program results from January 1, 2010 to June 30, 2012. Program activities generate asset condition information and remediate asset condition issues. The report does not include quantities of assets found in acceptable condition. More detailed analysis of asset condition for certain assets follows below.

Transmission Overhead System

Overhead Lines

The Company has over 6,000 circuit miles of transmission overhead lines and many of these overhead line assets have been in service for decades. Overhead line assets experience declining reliability as the effects of environmental, mechanical and electrical degradation results in a failure to meet their original design requirements.

The Overhead Line Refurbishment Strategy assures that the Company's transmission lines meet the governing National Electrical Safety Code (NESC) under which they were constructed, requires mitigation when they have a history of failure, or repairs or replacements that follow good utility practice. Line refurbishments occur following in-depth condition assessments and engineering evaluations. Actual physical condition and the severity of equipment deterioration determine whether and when overhead transmission refurbishment will proceed.

Many of the existing candidates for refurbishment were initially screened using five-year average reliability statistics. A new screening process is under development that will likely blend (1) condition based inspection data from foot patrols, (2) line importance factor (LIF)[1], and (3) condition related reliability. This new methodology is expected to be finalized with the revision of the Overhead Line Strategy during FY2012/13.

In general, the approach for refurbishing overhead lines involves only the replacement of overhead line components deemed to be in poor condition or failing to meet appropriate NESC requirements. If components are unlikely to last at least 15 years, they may also be replaced when justified by an engineering evaluation considering their incremental cost. Condition is determined by an engineering field inspection and, when appropriate, testing and analysis is also performed. For example, samples of older conductors obtained by field crews may be tested to determine loss of strength and ductility. Ground line inspection data may also be analyzed to determine if the NESC strength requirements are still being met.

Before significant levels of line component replacements are pursued, system re-configuration options are reviewed by Transmission Planning. For example, a line upgrade may be considered if transmission planning studies show (1) that a system re-configuration is a better option than a straight one-for-one in-kind replacement or (2) another line might be cost effectively decommissioned as a result of the upgrade. Larger refurbishment projects may also undergo an Article VII process requiring aggregate regulatory as well as public review of potential reconfiguration options.

Unless noted differently, overhead inventory numbers in this section are based upon Transmission Geographic Information System (GIS) extracts. The age profiles presented are based upon information extracted from the Company's Plant Accounting Records.

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[1] The LIF is defined as an indicator of the relative importance of a transmission line to the overall system as measured by its potential to impact system reliability and security, and by the number of customers and generation capability the line serves. For load circuits LIF factors include system security, number of customers, stranded load, peak load, generation and congestion. For bulk circuits LIF factors include system security, load flow, generation, and congestion.

Condition and Performance Issues
Transmission lines are inspected on a recurring basis as follows.

- Aerial Visual Patrol: Once each year
- Aerial Infrared Patrol: One to three years which varies based upon voltage
- Ground Based (Foot) Visual Patrol: Once every 5 years
- Wood Pole Inspection and Treatment: Once every 10 years (guideline)
- Steel Tower Footing Inspection and Repair: Once every 20 years (guideline)

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

Figure 2-2
Priority Codes

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

Remedial Actions Performed and Planned
The Overhead Line Refurbishment Strategy (SG080) established a systematic refurbishment approach for addressing overhead lines. This strategy envisions a major asset replacement program projected over a 25 year period.

Reliability improvements resulting from the Overhead Line Refurbishment Strategy will be gradual and long term in nature. This strategy targets both wood pole and steel structure lines. Standard refurbishment categories have been established: safety, life extension, and full refurbishments. Life extension refurbishments seek to improve reliability and extend the useful life of a line 15-20 years. Safety refurbishments seek to safely secure a line for approximately 5 years until a more comprehensive refurbishment or replacement project can be completed. The focus of a safety refurbishment is mostly at critical crossings (such as over roadways, parking lots, railways, and navigable waterways) where potential public safety concerns are the highest. A safety refurbishment is often pursued when severe degradation issues need to be addressed and will sometimes precede more comprehensive Article VII or Part 102 refurbishments. More comprehensive refurbishments will be based upon condition and typically are targeted to last beyond 15-20 years.

The initial set of overhead line refurbishment candidates was selected from a list of least reliable transmission lines based on a five year average. These circuits were subjected to an engineering field survey to identify physical deterioration and to classify the level of that deterioration (Level 1 through 4). Only circuits with Level 1 through 3 physical deterioration levels identified during the field survey remain candidates for refurbishment. The following overhead line refurbishment projects are underway or recently completed.[2]

Figure 2-3
Existing Line Refurbishment Projects

Project Number	Driver Strategy	Title[3]	Voltage	Typical Installation Date (Before)	Status
C03389 & C34193	SG080	Gardenville-Dunkirk 141-142 T1260-T1270 ACR	115kV	1930s	Scoping
C03417	SG080	Lockport-Mortimer 111 T1530 ACR	115kV	1906	Construction
C04718	SG080	Gardenville-Homer Hill 151-152 T1950-T1280 North ACR	115kV	1920s	Completed
C21694	SG080	Spier-West 9 T5770 ACR	115kV	1920s	Scoping
C24359	SG080	Browns Falls-Taylorville 3-4 T3080-T3090 ACR	115kV	1920s	Engineering
C24361	SG080	Taylorville-Moshier 7 T3340 LER	115kV	1925	Engineering
C24360	SG080	Coffeen-Black River-Lighthouse Hill 5 T2120	115kV	1940s	Construction
C39487	SG080	Ticonderoga 2-3 T5810-T5830 SXR [C19530]	115kV	1920s-30s	Engineering

The following projects are in conceptual engineering (E2E Step 0). During this part of the process an engineering condition evaluation, which includes a field survey, will be completed. Based upon this condition assessment, an appropriate refurbishment scope and schedule will be determined.

Figure 2-4
Line Refurbishment Projects in Conceptual Engineering

Project Number	Driver Strategy	Title	Voltage	Typical Installation Date
C03422	SG080	Lockport-Batavia 112 T1510 ACR	115kV	1930s-40s
C27425	SG080	Gardenville-Homer Hill 151-152 T1950-T1280 South ACR	115kV	1920s
C27422	SG080	Falconer-Homer Hill 153-154 T1160-T1170 ACR	115kV	1930s
C27437	SG080	Taylorville-Boonville 5-6 T3320-T3330 ACR	115kV	1920s-30s
C27436	SG080	Packard - Gardenville 180-182 T1660-T1780 ACR	115kV	1930s
C27429	SG080	Homer Hill-Bennett Rd 157 T1340 ACR	115kV	1950s
C30890	SG080	Porter-Rotterdam 31 T4210 ACR	230kV	1940s
C30889	SG080	Pannell-Geneva 4-4A T1860 ACR	115kV	1900s-20s
C36164	SG080	Colton - Browns Falls 1-2 T3140-T3150 ACR	115kV	1920s

[2] Excluding lightning enhancement projects see Figure 2 Figure 2-8.
[3] Note that ACR stands for Asset Condition [and Reliability] Refurbishment and LER for Life Extension Refurbishment.

The following projects are proposed to begin conceptual engineering.

Figure 2-5
Planned Line Refurbishment Projects[4]

Project Number	Driver Strategy	Title	Voltage
CNYAS57	SG080	Lake Colby - Lake Placid 3 T3210	115kV
CNYAS60	SG080	Gardenville - Buffalo Sw 145-146 T1210-T1220 ACR	115kV
CNYAS88	SG080	Gardenville - Depew 54 T1230 ACR	115kV
CNYAS75	SG080	Gardenville - Dunkirk 73-74 T1240-T1250 ACR	230kV
CNYAS51	SG080	Huntley - Praxair 46 T1420 ACR	115kV
CNYAS53	SG080	Huntley - Lockport 36-37 T1440-T1450 ACR	115kV
CNYAS56	SG080	Indeck Oswego - Lighthouse Hill 2 T2300 ACR	115kV
CNYAS70	SG080	Lighthouse Hill - Clay 7 T2320 ACR	115kV
CNYAS62	SG080	Dunkirk - Falconer 161 & 162 T1090-T1100	115kV
CNYAS86	SG080	Coffeen - Black River 5 T3120	115kV
CNYAS58	SG080	Hook Road - Elbridge 7 T6150 ACR	115kV
CNYAS48	SG080	Boonville - Porter 1-2 T4020-T4030 ACR	115kV
CNYAS55	SG080	Boonville - Rome 4 T4040 ACR	115kV
CNYAS54	SG080	Boonville - Rome 3 T4060 ACR	115kV
CNYAS77	SG080	Porter - Rotterdam 30 T4200	230kV
CNYAS85	SG080	New Scotland - Alps 2	345kV
CNYAS76	SG080	Rotterdam - Bear Swamp E205 T5630 ACR	230kV
C39521	SG080	Ticonderoga Lines 2-3 T5810-T5830 ACR[5]	115kV
CNYAS50	SG080	Warrensburg - Scofield Road 10 T5880 ACR	115kV
CNYAS87	SG080	Sleight Road - Auburn 3 T2560	115kV

[4] Before formal initiation, the projects will be subject to a new screening process (under development) that is expected to use (1) condition based inspection data from the Computapole inspection patrols, (2) the line importance factor (LIF), and (3) condition related reliability. The list of planned refurbishment projects is expected to change after the overhead line refurbishment strategy is updated in FY2012/13.

[5] These circuits are currently undergoing a short-term safety refurbishment ahead of a proposed full refurbishment.

New Scotland – Leeds – Pleasant Valley Transmission Corridor

The Company completed a condition assessment report on the transmission corridor between New Scotland – Leeds – Pleasant Valley. This corridor facilitates considerable transfer capability between New York's upstate and downstate transmission system. This report reviewed issues that may impact this corridor's reliability performance such as:

- opportunities for reducing exposure to cascading Type 3A/3B structure failure;
- opportunities for reducing the number of transmission crossings;
- tensile and torsional ductility tests on phase conductors;
- assessment of lightning performance; and
- wind analysis to determine whether the current design criterion is still valid.

The following action items were recommended in the report:

- Conductor Condition – Tests on samples of conductor demonstrated that the conductor for the New Scotland – Leeds – Pleasant Valley lines may remain in-service for the foreseeable future. The Company will continue to monitor the condition of these conductors as opportunities arise in any during future projects on these lines.

- Splice Condition - Infrared measurements should continue on a six month basis. The measurements should be assessed to determine if any actions are necessary to improve line performance.

- Shield Wire Condition - Further attempts should be made to secure shield wire samples for laboratory analysis. Visual inspections should be performed on all shield wire fittings and all worn fittings replaced over the next 3 to 5 years.

- Steelwork and Foundation Condition - The towers should be painted within the next 5 years to maintain their condition. The 15 foundations that have a condition rating of 5 or greater should be replaced within the next 5 years.

- Insulator Condition - Insulator samples should be obtained during maintenance work or future construction projects to test insulator basic insulation levels (BIL), surface contamination, overall integrity, and other appropriate tests.

- Exposure to Cascading Structure Failure - The introduction of a dead-end structure at every 16th tower location is recommended. Additionally, a tower "shakedown" (which includes tower climbing inspection and repair of all loose and missing members on towers) will be performed on the remaining structures.

- Reducing the Number of Transmission Crossings - In order to mitigate the risk of failure at these locations, it is recommended that fourteen (14) 3A and 3B towers be replaced with steel H-frame suspension structures. Concurrently, the structures at the Hudson River crossing should also be considered for replacement based upon the overall deteriorating condition of these structures.

- Wind Analysis – The analysis of wind speeds in this area determined that the current design specification for withstanding 90 mph winds is adequate in this region.

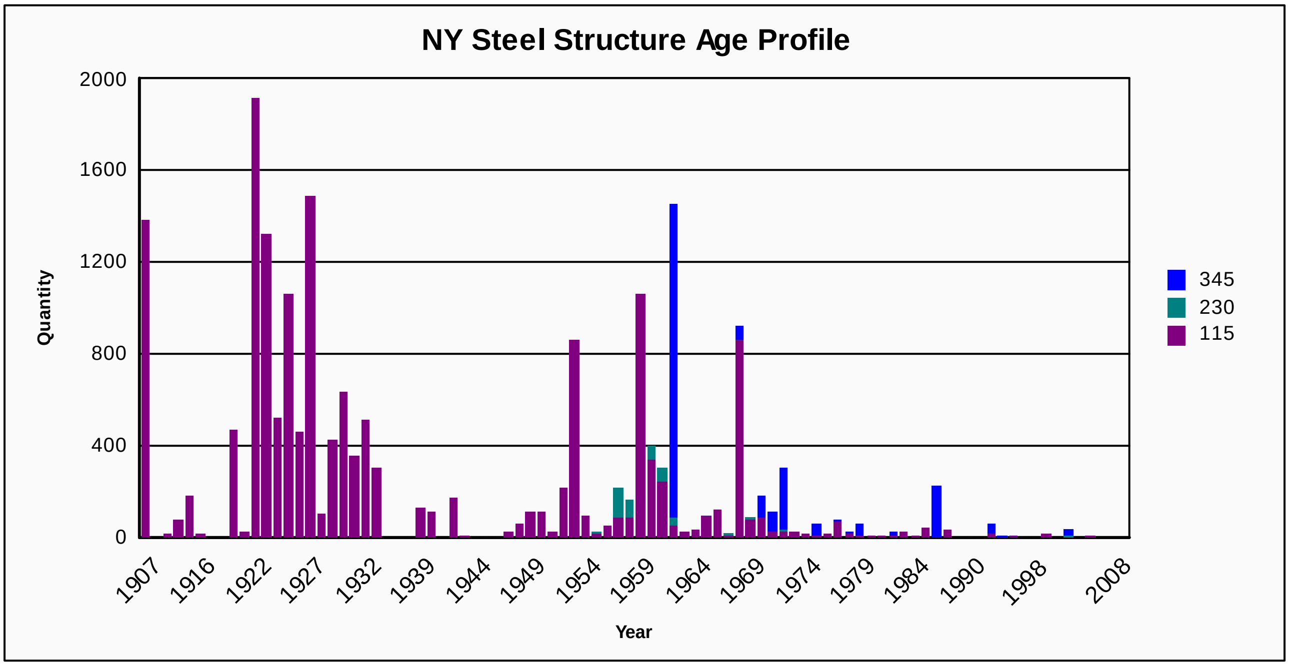
The Company continues to evaluate the need for the installation of a third line for the Leeds-Pleasant Valley part of this transmission corridor, and is working with other New York State Transmission owners (TOs) to determine what is needed and how to fund any system changes.

Remedial Actions
Comprehensive inspections have been performed in advance of capital projects to provide an initial scope of work and also to address any immediate threats to reliability or safety; Gardenville-Homer Hill 151-152, Pannell-Geneva 4-4A, Gardenville-Buffalo River Switch 145-146, Huntley-Praxair 36-37, and Dunkirk-Falconer 161-162 all used comprehensive inspections for this purpose. After each inspection, the results were graded according to their severity. In general, Level 1 Priority Codes were addressed immediately to make the assets safe; Level 2 and 3 Priority Codes were scheduled for work within 1-3 years. Level 2, 3, and 4 Priority Codes, when appropriate, were incorporated into the scope of work for the refurbishment project scheduled on that circuit.

Steel Structures

The age distribution of the Company's steel transmission structures is given in Figure 2-6. A significant portion of these assets are over 70 years (installed in 1941 or earlier) with a number of steel structures over 100 years.

Figure 2-6



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

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

Figure 2-7 provides a list of current visual grading levels for steel structures entered into Computapole over an approximately 5 year time frame (through June 2012).

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Figure 2-7
Steel Structure Visual Grades

Steel Towers		Inspection Results	
Visual Grade	1	8,909	54.6%
Visual Grade	2	2,854	17.5%
Visual Grade	3	3,042	18.6%
Visual Grade	4	1,416	8.7%
Visual Grade	5	91	0.6%
Visual Grade	6	0	0.0%
Total		16,312	

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

Condition and Performance Issues
Steel tower failures are infrequent, however, over the last 10 years, a number of steel tower failures on the New York Transmission system attributable to poor condition have occurred which demonstrates the need to evaluate and manage this asset class:

- April 2011 – Tower 133 failed on the T1780 Packard-Gardenville 182 line. This structure failed due to a combination of a bent primary leg member, a detached reinforcement member due to deterioration, and above average winds.

- March 2009 - the T2240 GE–Geres Lock 8 115kV circuit tripped and locked out due to the failure of tower #435. Tower #435 is a square based steel lattice tangent suspension tower. The failed tower was located in a detention pond at a former chemical manufacturing plant in approximately four feet of water. Thus, the base of the tower could not be removed for examination. The water limited the effectiveness of routine inspections and the initiation of appropriate actions. An interim inspection of the structures was done during the replacement of Tower 435 and the line appropriately secured. However, access was limited; a long term project will more comprehensively assess the condition of the remaining structures.

- October 2006 – Steel tower 96 on the T1260-T1270 Gardenville-Dunkirk 141-142 failed due to a combination of a deteriorated steel based and poor weather conditions.

- June 2004 - the 115kV Gardenville-Homer Hill 151 line, tripped and locked out due to failed cross arms on two towers.

- February 2004 - a line mechanic climbing on a tower on the Niagara-Gardenville 180 line nearly fell when a corroded steel support gave way

- September 2003 - National Grid replaced a severely deteriorated steel tower on the 115kV Gardenville-Homer Hill 151-152 transmission line.

- April 2003 - a tower on the Pannell-Geneva 4-4A 115kV Line in Western NY toppled during an ice storm. Deterioration at the base of the tower contributed to this failure.

Remedial Actions Performed and Planned

As a result of the Mott MacDonald study of earlier inspection data and aerial photographs of targeted steel structure transmission lines, the Company's Steel Tower Strategy (SG018) concentrated initially on critical crossings and the circuits believed to be in the worst condition.

The South Oswego- Lighthouse Hill project scope includes approximately 40 structure replacements, some of which are critical crossing structures. This project (C21693) is now in the construction phase and should be completed by the next asset condition report.

Figure 2-8 shows recent refurbishment projects under the Steel Tower Strategy (SG018).

Figure 2-8
Existing SG018 Driven Projects

Project Number	Driver or Strategy	Title[6]	Status
C21376	SG018	Packard-Urban 181 T1850 STR	Safety Refurbishment Only (Completed)- Note 1
C21693	SG018	S Oswego - Lighthouse Hill Circuits T2630-T2300-T2220-T2610	Under Construction

Note 1 - Funding Project C21376 was reduced to a safety project in anticipation of the potential Transmission Planning work on this line. As a result of the cancellation of the Tonawanda and Frontier projects, potential additional work on this line is being considered.

The following projects in Figure 2-9 are in conceptual engineering (E2E Step 0):

[6] STR means Steel Tower Refurbishment.

Figure 2-9
Existing SG018 Driven Projects in Conceptual Engineering

Project Number	Driver or Strategy	Title	Voltage
C27432	SG018	Mountain-Lockport 103 T1620 and Beck-Lockport 104 T1060 STR	115kV
C27431	SG018	Lockport-Batavia 108 T1500 STR	115kV

During this part of the process an engineering condition evaluation which will include field walk-down will be completed. Based upon this condition assessment, an appropriate refurbishment scope and schedule will be determined. When possible, life extension refurbishment projects will be utilized to minimize overall costs. Some projects have also been cancelled altogether based on findings from the engineering field walk down.

The following projects are being considered for initiation of conceptual engineering. This table may change after the overhead line refurbishment strategy prioritization methodology is updated in FY2012/13.

Figure 2-10
Planned SG018 Driven Projects

Project Number	Strategy	Title	Voltage (kV)
CNYAS63	SG018	Huntley-Gardenville 38 & 39 T1380-T1390 ACR	115
CNYAS66	SG018	Mortimer - Pannell Road 24 & 25 T1600 ACR	115
CNYAS67	SG018	Clay - Teall 10 T2090 ACR	115
CNYAS68	SG018	Geres Lock - Solvay 2 T2270 ACR	115
CNYAS69	SG018	Geres Lock - Tilden 16 T2290 ACR	115
CNYAS70	SG018	Lighthouse Hill - Clay 7 T2320 ACR	115
CNYAS71	SG018	Bethlehem - Albany 18 T5070 ACR	115
CNYAS72	SG018	Greenbush - Hudson 15 T5180 STR - ACR	115
CNYAS73	SG018	Hudson - Pleasant Valley 12 T5230 STR - ACR	115
CNYAS74	SG018	Mohican-Battenkill 15 T5430 ACR	115
QUEUE	SG018	Mountain-Lockport 103 ACR	115
QUEUE	SG018	Terminal - Schuyler 7 T4260 ACR	115
QUEUE	SG018	Packard - Urban(Erie St.) 181 T1850[7]	115
QUEUE	SG018	Spier - Rotterdam 1 & 2 T5750-T5760[8]	115
QUEUE	FA0033	GE - Geres Lock 8 T2240	115

[7] Project C21376 was an interim safety refurbishment but long term work is still required.
[8] Potential refurbishment follow-up work on the portion of the line not impacted by the Luther Forest initiative.

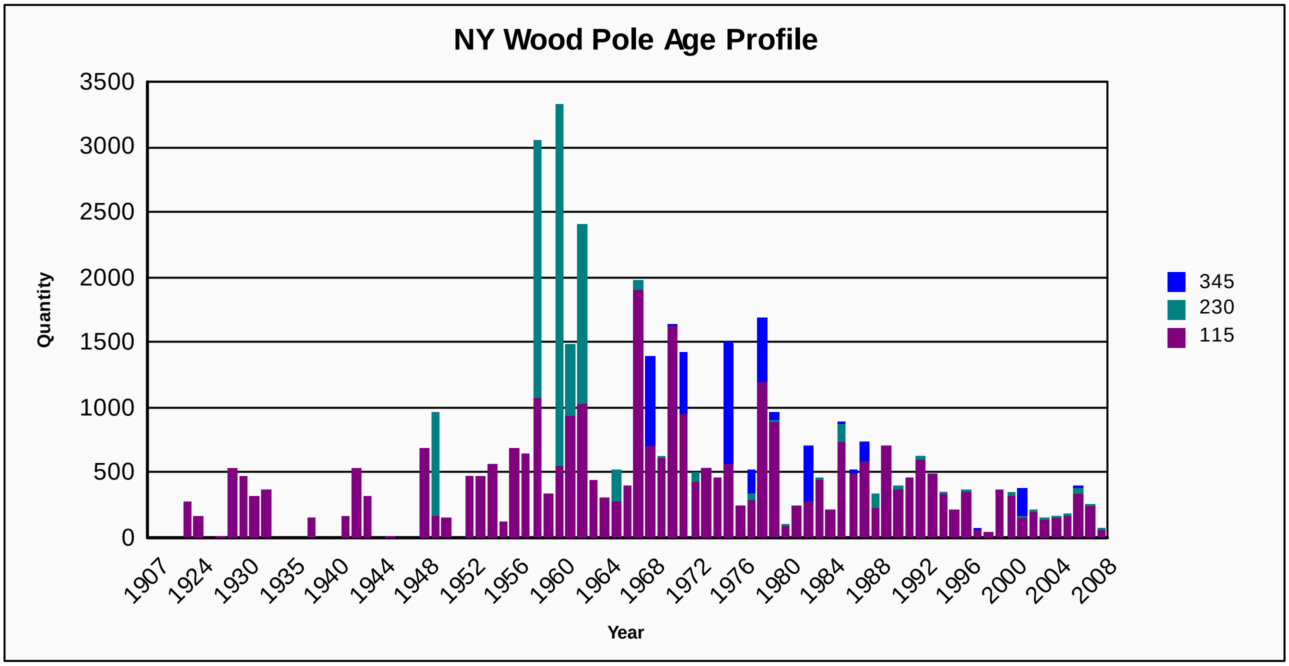
The Steel Tower Painting and Replacement Strategy (SG052) guides the painting and replacement of steel structures. This strategy looks at the long-term steel tower replacement needs for the remainder of circuits not covered by the Steel Tower Strategy. The steel tower painting portion of program looks to extend the lives of towers rated visual category 4 or better.

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

Wood Poles

The age profile of transmission wood poles is provided in Figure 2-12.

Figure 2-12



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

In general, reject poles and structures have two-thirds or less of their original design strength. The greatest risk from reject poles and structures is the likelihood of failure during severe weather conditions. Failures can hamper service restoration efforts, increase outage durations and raise public safety concerns.

Priority reject poles and structures potentially can fail during "normal" weather conditions. For this type of reject pole, the residual strength may be below one-third of its original design strength. It is important to replace these poles and structures expeditiously as the potential safety and reliability risks from priority rejects can be significant.

An increasing population of woodpeckers is contributing to an increase in damage on wood poles. A US Geological Survey map shows that the pileated woodpecker population has increased in the Northeast at a rate greater than 1.5% each year from

1966-2003[9]. Wood pole and structure inspection criteria (per Strategy SG009, Version 2) were implemented at the end of 2007. As woodpecker damaged poles are identified, an appropriate priority code (i.e., maintenance code 526) and repair timeframe (generally within three years) is assigned. Progress is then tracked on an overall basis via Computapole monitoring.

Below is a brief summary of key pole failures that occurred over the last 3 years:

- April 2011 - structures 62 through 69 on the T1690 Niagara – Lockport 101 Line failed during strong wind gusts. The wood structures were installed around 1982. Structure 63 is believed to have failed due to combination of some deterioration when combined with the strong wind gusts. The other structures failed as a consequence of the first failure.

- July 2010 - six consecutive structures failed on the Black-River Taylorville 1 & 2 T3050-T3060 115kV transmission line failed. Five of these structures (155½, 156, 156½, 157, and 158) were wood structures and one structure (155) was steel. The steel structure was installed in 1925 and the wood structures were installed in 1974. The cause of the structure failure was wood deterioration and wind.

- June 2009 - the T6400 South Oswego–Clay #4 115kV line tripped and locked out due to the static wire making phase contact as the result of a pole top failure.

- February 2009 - a pole fire at structure #574 on the Porter – Rotterdam #30 line lead to a cross-arm failure which resulted in a line lockout.

Deteriorating wood cross arms are a potential issue that is being monitored. Below is a brief summary of recent wood cross-arm failures:

- May 2012 – The cross arm and v-brace on Structure 156 of the T5450 New Scotland-Alp 2 345 kV line failed. The initial failure mechanism/root cause for this failure is still under investigation. National Grid is working with SUNY College of Environmental Science and Forestry to assist with the forensics.

- November 2009 - The T1210 Gardenville-Buffalo River Switch 145 line tripped and locked out at tower #19 due to a cross arm failure. This failure appears to be a one off event since this is the only recorded failure of a cross-arm on this line.

At this time, the frequency of wood cross arm failures is insufficient to warrant an accelerated remediation/replacement program.

[9] US Geological Survey (USGS) website: http://www.mbr-pwrc.usgs.gov/bbs/htm03/trn2003/tr04050.htm

Remedial Actions Performed and Planned

A comprehensive wood pole management strategy ensures ground line “reject” poles, woodpecker and insect damaged poles, and rotting wood structures are replaced in a timely manner. The pending levels of priority and reject poles (as of August 2012) are provided in the figure below.

Figure 2-13
Reject Poles Totals (Pending Replacement in Computapole)

Division	Identified Priority Rejects	Identified Rejects	Total
Totals	12	126	138

Management of the Company’s large stock of in-service wood poles requires more than the wood pole management strategy, particularly with increasing average age profile. Minimizing the number of “reject” poles is important to provide safe and reliable service. The wood pole management strategy is designed to replace “priority rejects” within one year of identification and “rejects” within three years of identification.

The Overhead Line Refurbishment Strategy is complementary to the wood pole management strategy. Both strategies manage wood pole structures as the wood pole population deteriorates. As the wood pole population ages, the percentage of “rejects” is expected to increase. A separate, comprehensive line refurbishment effort based upon condition of a line is the recommended approach for mitigating an aging wood pole structure population.

Foundations

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

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

Concrete foundations are categorized by the following scale:

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

Figures 2-14 and 2-15 include inspection results over approximately 5 years (through June 2012) on steel and concrete foundations, respectively, for structures that had foundation ratings.

Figure 2-14
Steel Foundation Inspection Results

Steel Foundations		Inspection Results	
Visual Grade	1	6,825	61.5%
Visual Grade	2	2,831	25.5%
Visual Grade	3	1,009	9.1%
Visual Grade	4	396	3.6%
Visual Grade	5	29	0.3%
Visual Grade	6	5	0.0%
Total		11,095	

Figure 2-15
Concrete Foundation Inspection Results

Concrete Foundations		Inspection Results	
Visual Grade	1	4,252	81.5%
Visual Grade	2	798	15.3%
Visual Grade	3	116	2.2%
Visual Grade	4	38	0.7%
Visual Grade	5	10	0.2%
Visual Grade	6	0	0.0%
Total		5,214	

The results provided in Tables 2-14 and 2-15 from standard Computapole field inspections, which are above the ground line, may differ from those inspections performed by the footer inspection and maintenance program which inspect the foundations below the ground line and repair those that are defective.

Steel grillage foundation usage started in the 1920s. This type of steel foundation comprises the majority of lattice structure foundation types.[10] However, approximately five to ten percent of the lattice towers that were constructed prior to the use of the steel grillage design use a battered type concrete foundation which has a limited amount of concrete exposed above the ground line. The remaining foundations (five to ten percent) are associated with steel poles and tend to be reinforced concrete.

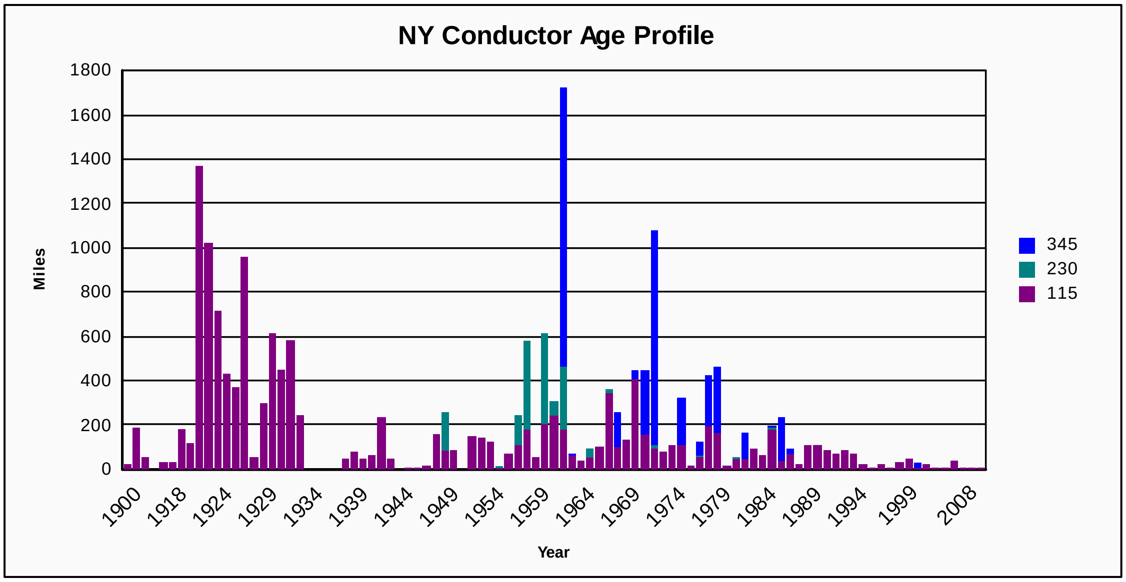
[10] Approximately 80 to 90 percent of steel structures in New York.

Phase Conductor and Shield Wire

The phase conductor and shield wire asset group includes conductors, shield wires and splices. There are 18,687 conductor miles across the service territory at voltage levels 115kV and greater. Specific inventory information regarding miles of static wires and splices is not available at this time.

Figure 2-16 shows the age profile of conductors in the service territory by voltage. Many thousands of miles of conductors are over 70 years old (installed in 1941 or earlier). The 115kV network is by far the oldest, with the oldest circuits being over 100 years old.

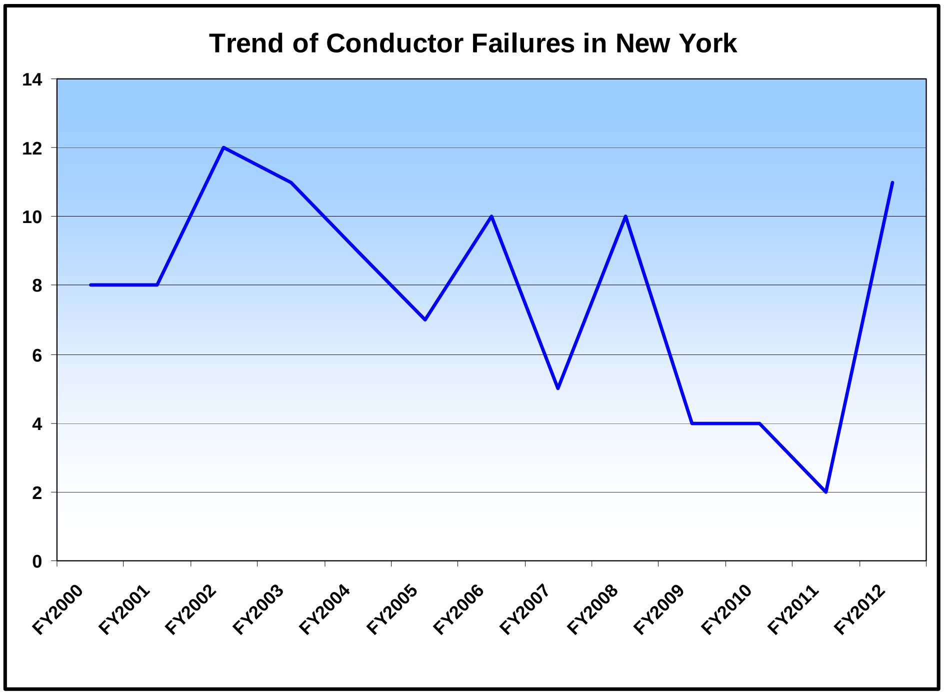
Figure 2-16



Condition and Performance Issues

The trend of conductor failures from FY1999/00 to FY2010/12 (Figure 2-17) shows a recent increase in conductor failures but still within recent historical variations.

Figure 2-17
Transmission Conductor Failures Long Term Trend



The total outage duration due to conductor failures shown in Figure 2-18 shows a small rise in duration but an overall downward trend in customer interruptions.[11]

[11] Ranging from no loss of customer minutes to significant levels in millions of lost customer minutes, MLCM.

Figure 2-18
Lost Customer Minutes Due to Conductor Failures

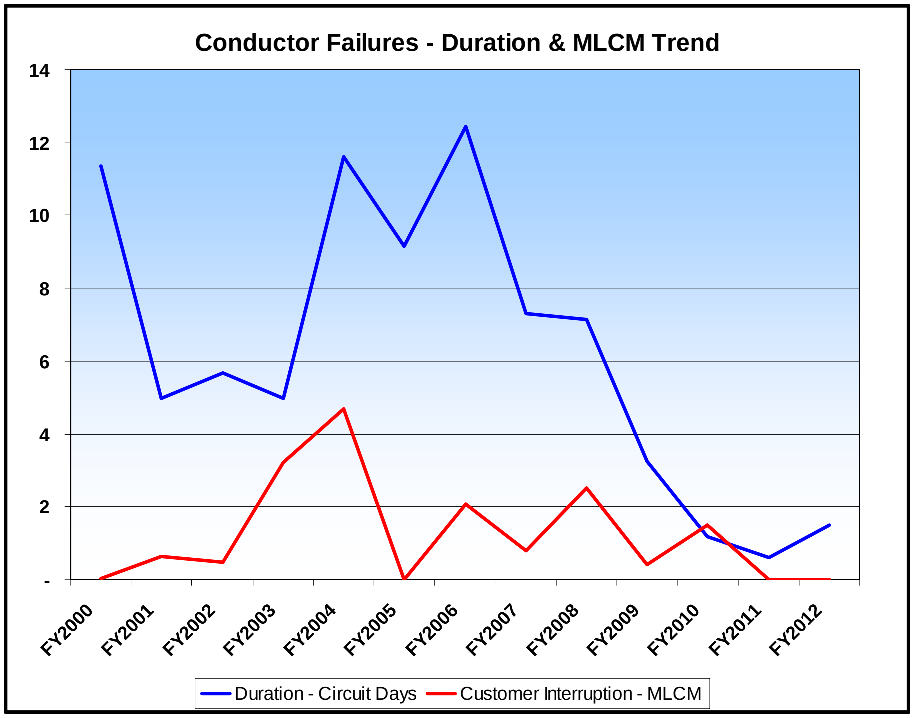


Figure 2-19 lists those circuits with two or more phase conductor failures between FY2007 and FY2011. This may be an indication that conductor condition is a concern.

Figure 2-19
Lines with Multiple Phase Conductor Failures FY2007 to FY2012

Circuit ID	Circuit Name	kV	Failures
T1490	Lockport - Batavia #107	115	8
T5760	Spier - Rotterdam #2	115	4
T1860	Pannell (Sta.122) - Geneva (Border City) #4	115	2
T4040	Boonville - Rome #4	230	2
T5940	Feura Bush - North Catskill #2	115	2
T1260	Gardenville - Dunkirk #141	115	2

As part of the Northeast Reinforcement Project, reconductoring of some of the Spier-Rotterdam 2 line has occurred and may improve the conductor failures. The Pannell-Geneva 4 line has a refurbishment project in Step 0 (Conceptual Engineering). A future project has been allotted for an assessment of the Boonville-Rome 4 line. The Lockport-Batavia 107 will be targeted for conductor testing. It is anticipated that a placeholder refurbishment project will be included in the next 15-year system plan. The remaining circuits with two failures will be monitored.

Figure 2-20 below shows that splice failures on transmission lines still appear to be trending down from FY2006/07 (FY2007) following a sharp increase from FY2003/04 to FY2006/07.

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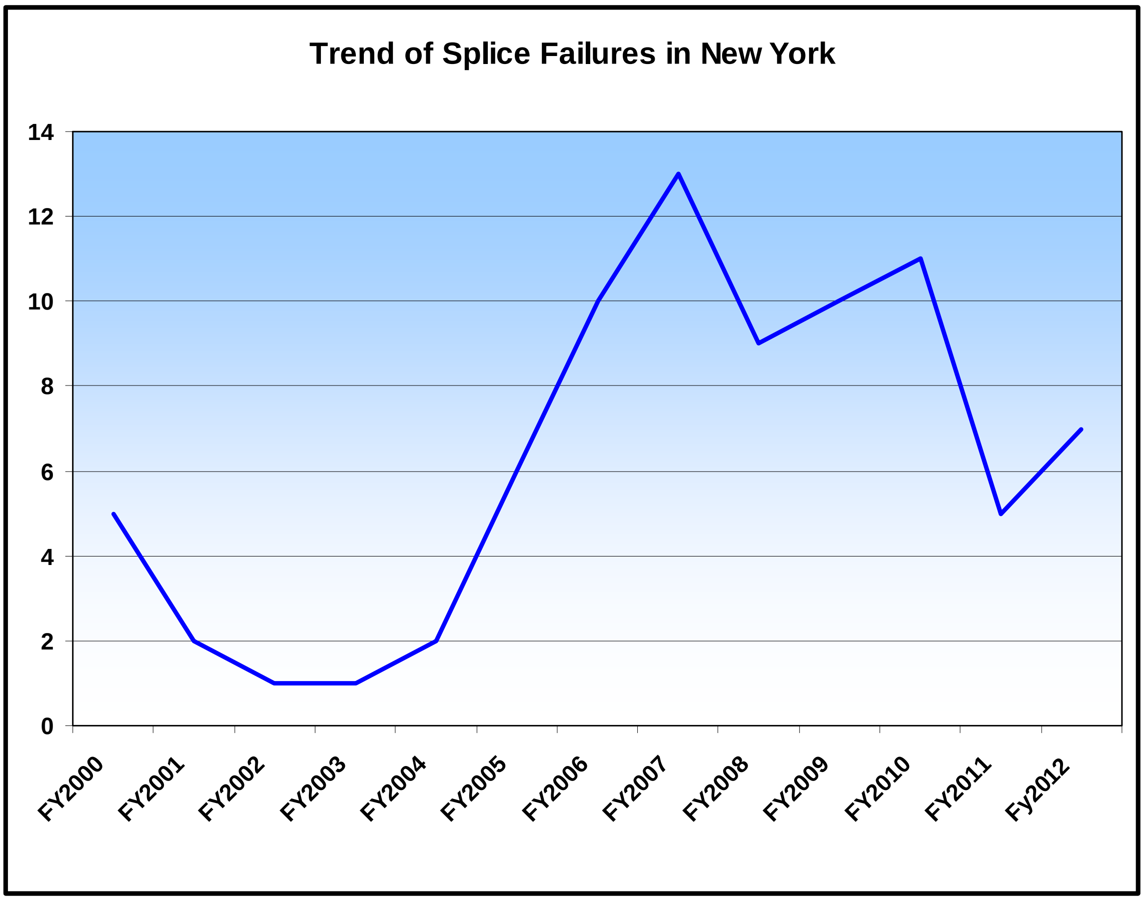
There are three general types of conductor splices used in the NY transmission system for ACSR (Aluminum Conductor Steel Support), AAC (All Aluminum Conductor), and copper conductor. Over time, expansion and contraction of a splice due to heating and cooling eventually allows for the penetration of oxygen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

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

Figure 2-20



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Conductor Clearance Program

The Transmission Ground Line Clearance Strategy, "Strategy for Transmission Overhead Line Ground Clearance Improvements" (SG029, Version 3) was initiated to bring up to code the transmission lines with the highest overall clearance risk based primarily on safety.

A NERC recommendation, first issued October 17, 2010 and updated November 30, 2010, directed utilities to verify conductor clearances based on maximum operating temperature. It further directed utilities to prioritize the evaluation of circuits on a reliability basis over a 3-year period for all bulk facilities. As a result, a subsequent strategy was written, SG163 for the A-10 bulk circuits. This Strategy (SG163) superseded the previous clearance Strategy SG 029 to allow the advancement of the North American Electric Reliability Corporation (NERC) recommendation entitled "Consideration of Actual Field Conditions in Determination of Facility Ratings." For non-bulk circuits, SG163 suspended SG029 Version 3. The Company has utilized Aerial Laser Survey (ALS) information collected from the original conductor clearance strategy to verify clearances and take appropriate action which includes re-rating individual lines, structure modifications or replacement, temporary measures (such as restrictive fencing), or relocation of conflicting structures below the affected transmission line.

A new strategy (under development) outlines an approach for addressing the remainder of the substandard spans (115 kV and above) to replace SG029. This is consistent with the original intent of SG029 but proposes a selection and execution methodology similar to that followed in SG163.

The new strategy also acknowledges that NERC is planning to implement a program redefining circuits rated at 100 kV, or higher, such that most become a part of the Bulk Electric System (BES). If that initiative is approved, the circuits impacted by this BES definition will be prioritized.

Shield Wire Strategy Actions

As a result of the Shield Wire Strategy (SG073), the following projects have been initiated:

Figure 2-21
Initiated SG073 Driven Projects

Project Number	Driver or Strategy	Title	Voltage (kV)
C28676	SG073	Huntley-Gardenville 38-39 T1380-T1390 Shieldwire	115
C28678, C38125	SG073	LaFarge-Pleasant Valley 8 T5080 Shieldwire	115
C28681	SG073	Mountain-Lockport 103 T1620 Shieldwire	115
C28683	SG073	Gardenville-Buffalo 145-146 T1210-T1220 Shieldwire	115
C28706	SG073	Gardenville-Depew 54 T1230 Shieldwire	115
C28707	SG073	Huntley - Lockport 36-37 T1440-T1450 Shieldwire	115
C28709	SG073	Clay-Dewitt 3 T2040 Shieldwire	115
C28710	SG073	Dupont-Packard 183-184 T1120-T1130 Shieldwire	115

C28712	SG073	Walck Road-Huntley 133 T6020 Shieldwire	115
C38125	SG073	LaFarge-PV 8 T5080 Shieldwire Completion	115

Figure 2-22
Shield Wire Strategy Incorporated into Existing Projects

Project Number	Driver or Strategy	Line	Voltage
C03389, C34193	SG080	Gardenville-Dunkirk 141-142	115
C03417	SG080	Lockport-Mortimer 111	115
C21693	SG018	South Oswego-Nine Mile Unit 1 T2630	115
C28679	SG080	Gardenville-Homer Hill 151-152 T1950-T1280	115

Insulators and Fittings

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

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

- Older lines frequently have shield wire configurations that provide limited lightning protection resulting in repeated lightning strikes over the years. This causes tracking and flashovers; over time, the ceramic glazing becomes deteriorated reducing both the electrical and structural properties of the insulator.
- Avian use of the transmission lines for perching contributes to insulator contamination; the corrosive nature of the avian waste wears away at the glazing. In addition, the contaminants themselves cause tracking and flashovers; over time, the ceramic glazing comes off reducing both the electrical and structural properties of the insulator.
- In rural areas, insulator strings are sometimes used for "target" practice by hunters.
- Continued exposure to the elements and severe weather wear away at the insulator glazing. Eventually the ceramic glazing wears off reducing both the electrical and structural properties of the insulator.
- Though not a prominent issue, conductor galloping can cause structural damage to an insulator string.

Remedial Action Planned

Insulators and fittings are examined to determine if replacement is needed during the field engineering walk-down of the Step 0 process which is performed prior to line refurbishment projects. Depending upon condition, insulators and/or fittings may be replaced or fortified on a targeted or complete line basis. During comprehensive helicopter inspections, insulator damage believed has been observed on many transmission lines. Damaged insulators are identified for replacement as part of planned refurbishment projects or as routine maintenance through the Computapole system.

Retired and De-energized Overhead Lines

There are a number of retired and de-energized transmission lines across the service territory. The Company is currently considering options to address these assets. The Company has developed a strategy (USSC-12-048) and a prioritization method to address lines that are permanently de-energized. The prioritization includes an assessment of some initial circuits and a methodology for continuing with future assessments. The initial set of prioritized de-energized lines includes the following:

Figure 2-23
Initial List of Prioritized De-Energized Lines

Group	Region	Line	Length (mi)	Voltage (kV)
	Northeast	Sherman Isle-Fenimore	6.57	115
		Ticonderoga-Sanford Lake 4	22.20	115
	Northern	Browns Falls-Benson Mines 5	3.79	115
	Frontier	Beck-Lockport 104: Olin Tap	2.38	115
	Northern	Dennison Colton 4/5: Andrews Tap	1.00	115
		McIntyre-Colton 8 (a.k.a. McIntyre-Kraft Canton 7 & Kraft Canton 7-Colton 8): Megan-Racine Tap	5.20	115
	Southwest	Roberts Rd-Roblin Steel 163	0.17	115

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Underground Cables and Related Equipment

Cables

National Grid's underground transmission cable network is comprised of high pressure fluid filled (HPFF) pipe-type cable operating at 115, 230, and 345kV, and solid dielectric cable systems operating at 115kV. National Grid has 53.3 miles of underground transmission cable in service, approximately 80 percent of which are high-pressure fluid filled pipe-type, as shown in Figure 2-24. The installation year, by voltage and mileage, is shown in Figure 2-25. An age distribution by number of circuits is shown in Figure 2-26.

Figure 2-24
Underground Cable Miles by Voltage

	115kV	230kV	345kV	Total
HPFF Pipe Type	22.1	20.2	0.7	43.0
Solid Dielectric	10.3	0	0	10.3
Total	**32.4**	**20.2**	**0.7**	**53.3**

Figure 2-25
Underground Cable Age Profile

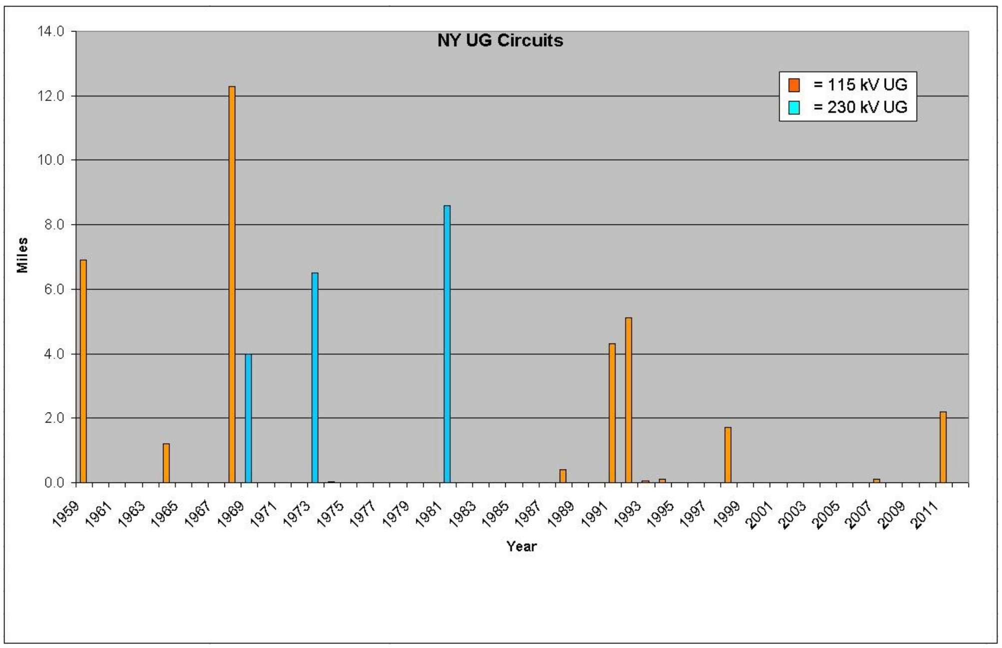


Figure 2-26
Asset/Age Profile Underground Cables (Circuits)

Asset/Age Profile (Years)	0-19	20-39	40-59	60+	Total
Underground Cables	7	18	11	0	36

Condition and Performance Issues

<u>Pipe Type Cables</u>

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

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

Regarding pressurizing plant and equipment, a pressurizing plant condition assessment has begun and is expected to be an on-going effort. This condition assessment is being undertaken by a combination of in-house personnel and external vendors and will form the basis of any future remedial work. Many of the current projects are a result of conditions identified during these assessments.

Figure 2-27 lists the locations of the pressurizing plants, cables served, manufacturer, and reservoir size.

Figure 2-27
Pipe Type Cables – Pressurizing Plants, Gas Cabinets, Crossover Assemblies

Station	City	Cables Served	Manufacturer	Reservoir Size (Gal)
Huntley Station	Tonawanda	Huntley-Elm #70	Jerome	15,000
Elm St	Buffalo	Elm-Seneca #71 Elm-Seneca #72 Elm St Bus Tie	Jerome	5,500
Seneca	Buffalo	Elm-Seneca #71 Elm-Seneca #72 Seneca-Gardenville #71 Seneca-Gardenville #72	Jerome	NA - Crossover Cabinet
Gardenville	W. Seneca	Seneca-Gardenville #71 Seneca-Gardenville #72	Jerome	5,500
Rochester Airport - East Portal	Rochester	Rochester #111 Rochester #113 Rochester #114	Jerome	3,500
E. Conklin	Onondaga	Conklin-Bailey #17A	Salter	2,500

Station	City	Cables Served	Manufacturer	Reservoir Size (Gal)
		Conklin-Bailey #17B 10” Circulation Pipe		
Teall Ave	Syracuse	Ash-Teall #7 Ash-Teall #8	Jerome	4,000
Temple St	Syracuse	Ash-Temple #9 Temple-Peat #10	Jerome	4,000
Oswego Steam	Oswego	Oswego-S Oswego #3 Oswego-S Oswego #5	Pikwit	4,000
Trinity	Albany	Trinity-Albany Steam #5 Trinity-Albany Steam #9 Riverside-Trinity #18 Riverside-Trinity #19	Pikwit	8,000

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

Another critical component of any pipe type cable is the cathodic protection system. The cathodic protection system provides protection against corrosion of the steel pipe. Pipe corrosion can result in fluid leakage and potentially lead to electrical failure. There are two primary types of cathodic protection systems installed on the National Grid pipe type cables. These include the older “Rectifier and Polarizing Resistor” systems, and the more modern “Rectifier and Polarization Cell” systems. The polarization cell is a battery-like device that is used to ground the cable pipe and to allow for a DC voltage to be impressed on the pipe. The polarization cell contains a liquid electrolyte (typically potassium hydroxide). A replacement for the polarization cell that doesn’t require use of caustic chemicals has been developed in recent years. This is referred to as a “Solid State Isolator” (SSI). National Grid has been replacing polarization cells with solid state isolators as deterioration of cells has been identified, or as part of specific cathodic protection system upgrades. Figure 2-28 provides a list of the type of cathodic protection systems installed on each of the high pressure fluid filled pipe type cable systems.

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

Figure 2-28
Cathodic Protection System Summary

Cable	Location	Rectifier and Polarizing Resistor	Rectifier and Polarization Cell	Rectifier & Solid State Isolator (SSI)	Notes
Huntley-Elm #70	West			X	
Elm St Bus Tie	West			X	
Elm-Seneca #71 Elm-Seneca #72	West West			X X	
Seneca-Gardenville #71 Seneca-Gardenville #72	West West			X X	
Rochester #111 Rochester #113 Rochester #114	West West West			X X X	
Conklin-Bailey #17A Conklin-Bailey #17B	Central Central		X X		To be converted to SSI
Ash-Teall #7 Ash-Teall #8	Central Central	X X			
Ash-Temple #9	Central	X			
Temple – Peat #10	Central	X			
Oswego-S Oswego #3 Oswego-S Oswego #5	Central Central	X X			
Trinity-Albany Steam #5 Trinity-Albany Steam #9	East East		X X		To be converted to SSI
Riverside-Trinity #18 Riverside-Trinity #19	East East		X X		To be converted to SSI

Solid Dielectric Transmission Cables
Solid dielectric transmission cables were installed beginning in the late 1980s. The solid dielectric cables represent a relatively low mile weighted average age profile. National Grid inspects transmission cable terminations and above ground cable equipment as part of the Substation V&O inspections. A small population of transmission cable terminations has been identified recently with cracks and/or fluid leaks. National Grid has replaced damaged terminations, and has increased sensitivity to a potential issue

with transmission terminations as part of the V&O inspection process. Manhole inspections are also performed periodically. At this time, with the exception of a limited number of cable termination troubles, the installed solid dielectric transmission cables do not appear to have major condition issues.

Remedial Actions Performed and Planned

Pipe Type Cables

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

In the 2008 and 2009 Asset Condition reports, the Company identified a pressurizing plant at the Rochester Airport as being in a deteriorated condition and presenting a possible reliability risk. To address immediate issues, maintenance and replacement of failed components was performed in 2009. Conceptual engineering has been completed and the design for a replacement pressurizing skid within the existing pressurizing plant is currently being planned.

Conceptual engineering for a project to add a pressurizing plant to the Trinity-Albany Steam #5 & #9 circuits has also been completed. Addition of a pressurizing plant to these cables will reduce a “common-mode failure” reliability issue with these circuits and with the Riverside-Trinity #18 & #19 circuits.

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

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

Projects have also been initiated to replace the remaining polarization cells with solid state isolators.

Several projects to improve the underground transmission equipment in western New York have been initiated and are currently in the engineering phase. These projects will replace the existing annunciators and improve alarming systems at the Elm Street, Gardenville, and Huntley pressurizing plants. A separate project is presently in engineering to improve the protective relaying scheme for the underground cable portion (located in Rochester) of the mixed overhead/underground 115 kV Lockport to Mortimer #111, #113, and #114 lines.

During bimonthly inspections of the Trinity-Albany Steam and Riverside-Trinity cathodic protection system, a steady rise in AC leakage current levels has been observed as well as a noticeable defacement to the nickel plates. In addition, it was also observed that the color of the potassium hydroxide solution has a purple tint. These are indications that the cells have reached their end-of-service-life. A project is underway to replace the

Trinity-Albany Steam and Riverside-Trinity cathodic protection system polarization cells with solid state isolators.

Solid Dielectric Transmission

In 2009, a crack in the bottom casting of a 115kV cable termination on the North Creek to Warrensburg #5 115kV solid dielectric cable was identified, and the termination was replaced. Recently, a crack in another termination has been identified on this same circuit. A project has been initiated to repair the second termination, inspect the remaining terminations, and determine if additional work will be required. National Grid also experienced casting cracks and/or fluid leaks on three 115kV solid dielectric cable terminations at the Ash Street substation in Syracuse. Given that this represented a 50 % failure rate on this particular circuit, all six cable terminations were replaced.

National Grid has a population of approximately 126 terminations of this type installed at 115kV. The Company will monitor this population of transmission terminations as part of the V&O inspection process to determine whether this is an isolated issue, or whether there is a concern with this type of cable termination.

Transmission Right of Way Vegetation Management

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

National Grid's strategic approach to vegetation management is to establish and maintain rights-of-way that are largely clear of all incompatible vegetation while maintaining a stable low-growing plant community that is pleasing to the eye and beneficial to wildlife. National Grid's strategic approach to manage vegetation adjacent to the right-of-way is to prune or remove danger trees where property rights allow.

Vegetation management work on transmission and sub-transmission right-of-ways is organized into two programs:

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

Floor Program

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

After using the IVM approach for more than two decades, a portion of the shrub community has become too tall and dense in certain areas, invading the mid-span "wire security zone." The shrub community may hide or mask undesirable tall growing species from the sight of treatment crews and patrols. As shrub communities become denser over time, they restrict access to large areas of the ROW, further increasing the chance of skips or missed stems during treatment. Shrub intrusion into the wire security zone reduces the vegetation free space between the conductor and brush. This increases the risk that as undesirable tree species emerge above the shrub canopy, or "escapes," a stem can quickly grow into the wire security zone and cause an interruption. In the last decade, transmission interruptions caused by trees growing into the lines on either the 115kV or the bulk transmission systems were all attributed to the masking of an undesirable stem by a shrub community. Due to this relatively new risk, the Company has made a recent revision to the Program which includes the removal of shrub communities through mowing and follow-up application of herbicide in selected mid-spans where clearances are judged to be inadequate to allow the shrub communities to remain.

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

Danger Tree Program

The utility forest contains vegetation adjacent to the ROW floor where trees tall enough and close enough to electric conductors are capable of growing or falling into the conductors or structures. These trees are classified as danger trees and hazard trees. A danger tree is any tree on or off the right-of-way that, if it fell, could contact electric lines. A hazard tree is a danger tree which due to species and/or structural defect is likely to fall into the electric facility. National Grid prunes or removes danger trees and hazard trees to reduce the risk of off right-of-way tree-caused interruptions. Trees are pruned to achieve At Time of Vegetation Management (ATVM) clearance distance from vegetation, measured as a radius around the conductor. Danger tree cycles for transmission and sub-transmission line right-of-ways range from five to 16 years. The danger tree work is prioritized and scheduled based on historic interruption history, line importance prioritization, tree risk factor computed using tree height, conductor height and distance to line, and danger tree maintenance cycles.

Patrols

The Company conducts a variety of patrols throughout the year to identify hazardous conditions that can compromise reliability of the electric system. National Grid Transmission Forestry personnel conduct one foot patrol and one aerial patrol each year on all 230kV and 345kV ROWs. They also conduct aerial patrols on all 115kV ROWs once every two years (generally one-half of the circuits are patrolled annually). In addition, Operations personnel carry out periodic ground patrols, and annual aerial patrols, of all 115kV and higher circuits. These patrols include identification of vegetation conditions as well.

Substations

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

Substation Equipment Assessments and Asset Condition Codes
A common substation condition assessment approach has been initiated across all Transmission and Distribution substations. This includes, on a targeted basis, a visit to select substations by subject matter experts (SMEs) in the Substation O&M Services department to review the condition of the assets. The result is a report which gives each asset a condition code of 1 through 4, with 1 being acceptable and becoming less acceptable the higher the number, based on manufacturer family, condition, age and other relevant data (Figure 2-29).

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

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

Figure 2-29
Substation Condition Codes

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

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

Circuit Breakers

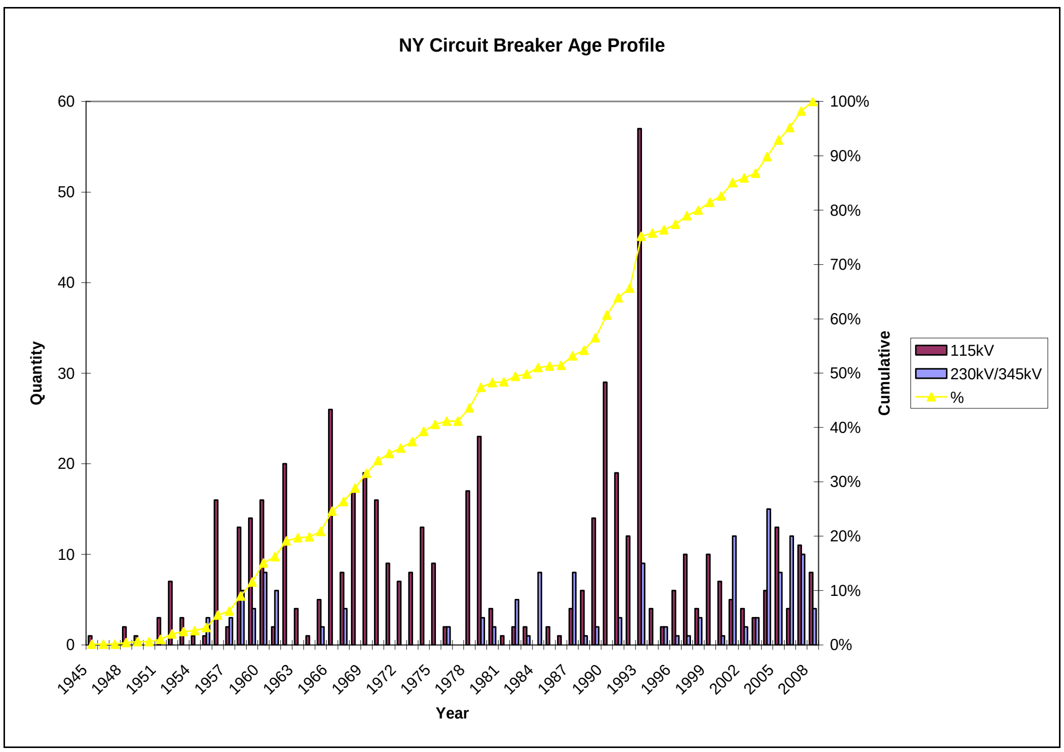
There are 730 circuit breakers located in transmission substations. The types of circuit breakers used in the service territory are categorized as gas, oil and vacuum. The majority of circuit breakers in the service territory are 115kV. The following provides a brief summary of each type.

- Gas Circuit Breakers (GCB) – There are 365 (50%) newer technology GCBs. The population of GCBs are all within their anticipated service life with all but the earliest vintage (1979) in excellent condition.

- Oil Circuit Breakers (OCB) – There are 364 (50%) older technology OCBs.[12] The average age of OCBs is 44 years. Approximately four percent are greater than 60 years old. These circuit breakers are located at the Maplewood, Browns Falls, Battle Hill, Ingham's, Tilden and Homer Hill substations. Strategies to replace the OCBs are in progress.

- Vacuum Circuit Breakers - There is one vacuum breaker in the system used for 115KV capacitor bank protection at the Homer Hill substation.

Figure 2-30
NY Circuit Breaker Age Profile



[12] Ninety percent, nine percent and one percent of 115kV, 230kV and 345kV circuit breakers respectively

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Figure 2-31
Asset/Age Profile

Asset/ Age Profile (Years)	0-19	20-39	40-59	60+	Total
Oil Circuit Breakers	2	113	232	17	364
Gas Circuit Breakers	275	90	0	0	365

The predicted asset life of OCBs is 45 years with the earliest onset of poor performance predicted by age 40. The OCBs were manufactured and installed over a forty-nine year period (from 1945 through to 1994). Based upon known deterioration modes, 180 of the earliest installed circuit breakers would be expected to be currently at, or approaching, the end of their asset life. There is evidence of deterioration through known failure mechanisms and in some cases circuit breakers are being kept in service using serviceable parts from retired equipment. This approach is not considered sustainable.

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

Condition and Performance Issues
In both Transmission and Distribution, circuit breakers are given a condition code based on manufacturer family and age data. Manufacturer family ratings are based on historical performance of that family. The condition codes are further refined by a visual site surveys and operational tests performed on the specific assets. Circuit breakers are also given a Replacement Priority as shown in Figure 2-32, with 4 being the highest priority and 1 the lowest. The condition codes define the requirement to replace or refurbish based solely on the condition and performance of the asset while the replacement priorities also include criticality in terms of safety, environmental or reliability consequences of asset failure. This distinction recognizes that two assets, both with the same condition code, can have a different replacement priority due to the consequence of failure.

Figure 2-32
Asset/Replacement Priority

Asset/ Replacement Priority	1	2	3	4	Total
Circuit Breakers (2008)	326	114	216	40	696
Circuit Breakers (2009)	480	50	156	22	708
Circuit Breakers (2010)	491	50	156	22	718
Circuit Breakers (2011)	498	50	156	22	726
Circuit Breakers (2012)	504	53	146	27	730

The Company is improving its knowledge of the asset population's condition issues. As a result, the Company has reassessed replacement priority scores for circuit breaker populations and the number of highest priority units for replacement has been reduced since the 2008 filing.

A review of 'follow-up' work orders shows that in the period from January 2005 through August 2012 there were 2,525 follow-up work orders created on circuit breakers. Of these, 1452 were associated with OCBs. The majority of the remaining follow up work orders, were associated with the replenishment of SF6 gas in GCBs.

Approximately 80 percent of all the follow-up work orders on OCBs are attributable to just three circuit breakers types, namely the Allis Chalmers Type BZO, the Westinghouse Type GM and the General Electric Type FK.

- **Allis Chalmers Type BZO –** The operating mechanisms in this family of breakers, manufactured in the 1950s through 1980s, are showing an increase in accumulator pump and o-ring failures. Design changes and changes in component manufacturers over the years require different replacement parts for various vintages and these parts are difficult to obtain. Mechanism wear has resulted in reduced levels of reliability, increased maintenance costs and a number of failures. There are currently 108 Allis Chalmers Type BZO circuit breakers on the system.

- **Westinghouse GM -** Test results from this family of breakers indicate contact timing problems and questionable insulation integrity. There are currently 38 Westinghouse GM circuit breakers on the system.

- **General Electric Type FK –** There have been problems with bushing oil leaks and lift rods issues due to moisture ingress with these circuit breakers. In addition lead paint is prevalent in this family of breakers. There are currently 113 General Electric Type FK circuit breakers on the system.

The average age of SF6 Gas Circuit Breakers is approximately 14 years old. However, there are three Westinghouse 362SFA40 SF6 Gas Circuit Breakers (362kV) that are 33 years old (1979) in service at Dewitt substation and two that are 36 years old (1976) at New Scotland substation. These are the oldest SF6 breakers in the system and experience gas leaks in the operating mechanism. This contributes to pole discrepancies which have resulted in reported instances of the breakers failing to close.

The SF6 gas leakage has been reduced through maintenance on these five Westinghouse breakers. There are no plans to replace these breakers at this time and maintenance will continue to be performed to lessen the SF6 gas release to the atmosphere. As discussed in the 2009 Asset Condition Report, the last of the Dewitt substation SF6 circuit breakers have been rebuilt which should extend the life of these breakers by 15 to 20 years.

Figure 2-33
Potential Breaker Replacement Candidates

Location	Qty	Voltage (kV)	Type
Batavia Station 01	4	115	FK-439 & BZO-115
Homer Hill Switch Structure	6	115	GM-6, FK-439 & BZO
Packard Stataion	11	115	1150GM10000 & BZO-121
Ash Street Station 223	5	115	BZO-115, FK-115 & GM-6
Battle Hill Station 949	3	115	FK-439 & BZO-115
Browns Falls Station 711	6	115	GM-6 & FK-439
Maplewood Station 307	2	115	FK-230
Oneida Station 501	5	115	RHE-64, FK-115 & GM-6
Oswego Switchyard	5	115	FK-439 & FK-115
Porter Station 657	9	230	BZO-230 & FGK-230
Rotterdam Station 138	6	230	RHE-84
Whitehall Station 187	3	115	GM-6
Colton Station 471	7	115	BZO-115, BZO-160, FK-439 & GM-5
Inghams Station 20	9	115	AA10, GM-6 & BZO-121
Lighthouse Hill Station 61	6	115	FK-115 & RHE-64
Rome Station 762	5	115	FK-115, FK-439 & BZO-115
Tilden Station 73	3	115	GM-6
Alcoa Station 902	3	115	FK-439, GM-6 & FK-115
Boonville Station 707	6	115	BZO-115 & GM-6
Cortland Station 502	4	115	FK-115, FK-439 & GO-3A
Dunkirk Station	5	230	2300GW
New Gardenville Station	9	230	2300GW & FGK-230
Huntley Station	8	230	FK-439, 2300GW & FK-115
New Scotland Station 325	3	345	FGK-345
North Troy Station 123	5	115	GM-6B & FK-115
Temple Station 243	4	115	GM-6B
Terminal Station 651	3	115	FK-115
Woodard Station 233	3	115	FK-115
Yahnundasis Station 646	3	115	FK-439
Curtis Street 224	2	115	FK-439
Schuyler Station 663	2	115	FK-115
Golah Station	3	115	FK-115 & FK-439
Teal Avenue Station	2	115	FK-439

Disconnect Switches

There are approximately 1,383 disconnect switches on the system.

Condition and Performance Issues

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

There were approximately 116 follow-up work orders generated in the period from January 2011 through August 2012. A number of disconnect switches were identified as being inoperable, difficult to adjust due to mechanical and electrical wear, having manual operating linkage problems, vulnerable to hot spots, or having lubrication problems. In the past year, National Grid's transmission system has experienced disconnect switch failures at the Porter Volney, Higley, New Gardenville, and Buffalo 60 substations.

However, due to the relatively minor function of disconnects there are, with the exception of Porter 230kV, no proactive plans for their replacement or refurbishment. A failure to operate generally poses no system or safety risk. Disconnect switches will typically be replaced at the same time as their associated circuit breaker replacement (as previously noted) or when defective units are identified by operations personnel through the Problem Identification Worksheet (PIW) process.

A description of disconnect switches with condition issues are provided below.

- ITE MO-10 Disconnects – 115kV, 230kV, 345kV - There are nineteen of these disconnects in the service territory. These disconnects, installed between 1970 and 1984, have experienced a higher than normal rate of required hot spot repairs. The oldest two (1970) are at Bristol Hill substation. The remaining units include:

    - Seven disconnect switches located at the Elbridge substation
    - Six disconnect switches located at Dewitt substation
    - The remaining ITE disconnect switches at Elm substation (3) and Reynolds Rd. substation (1).

- Haefly-Trench Disconnects- 115kV - Twelve sets of these vertically mounted gang operated switches have had insulator failure at various locations. The insulators are post type and failed where the porcelain and cap are bonded together.

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

- R&IE Type TTR-49 – 115kV & 230kV - There is one R&IE Type TTR-49 disconnect switch located in the Packard 230kV yard and five sets located at the Adams Switch station. These disconnects are old and in poor overall condition.

- Flying Ground Switches - This type of switch is primarily utilized in the Western Division (17 switches in service in the Buffalo area & two switches in service in the Albany area) as a transformer protective device and is manufactured by Haefly Trench and Delta Star. They are used as part of the transformer protection package where they apply a bolted fault to the system such that the relays at remote stations can sense it and isolate the station. These switches were installed in the mid to late 1950s and have experienced decreased operating times due to worn linkages and mechanism components. Further, these switches subject the transmission system to a second fault and interrupt more of the system than necessary. The time to operate the ground switch to initiate the line relays to remove the fault increases the amount of time the transformer is subjected to the fault possibly increasing damage to the transformer as well as increasing the likelihood of recordable events. Re-opening the ground switch to re-cock after an operation is also difficult due to adjustment problems. The units to be replaced are at Ridge Station, North Angola, Buffalo Station #55, Buffalo Station #54, Buffalo Station #61, Buffalo Station #129, Buffalo Station #60, Buffalo Station #78 and Trinity substation.

Remedial Actions Performed and Planned

- ITE MO-10 Disconnects – 115kV, 230kV, 345kV - These disconnect switches are monitored through annual thermo-vision inspections. Problems are corrected individually when identified. There were 7 sets of these replaced since the 2009 Annual Condition Filing.

- General Electric RF-2 Disconnects – 115kV & 230kV - All eighteen sets of GE RF-2 disconnect switches installed in 1963 on the 115kV & 230kV bus at Porter substation have been replaced as part of substation upgrades.

- Haefly-Trench Disconnect switches - 115kV - A review was performed in August 2008 that was the basis for possible replacement projects at Alcoa, Colton, Norfolk, and Parishville substations. The disconnects located at the Colton station have since been replaced

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

- R&IE Type TTR-49 – 115kV & 230kV - Issues with these disconnect switches are being addressed as they are identified. Five sets of these disconnects have been replaced at the Packard 230kV station and two sets have been replaced at the Adams switch station.

- Flying Ground Switches - The most problematic switch, #3 at Ridge substation, was replaced, tested, and commissioned in July 2010. A strategy was approved in September 2009 to replace the remaining flying ground switches. Six of the seventeen identified flying ground switches have been replaced.

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

Circuit Switchers

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

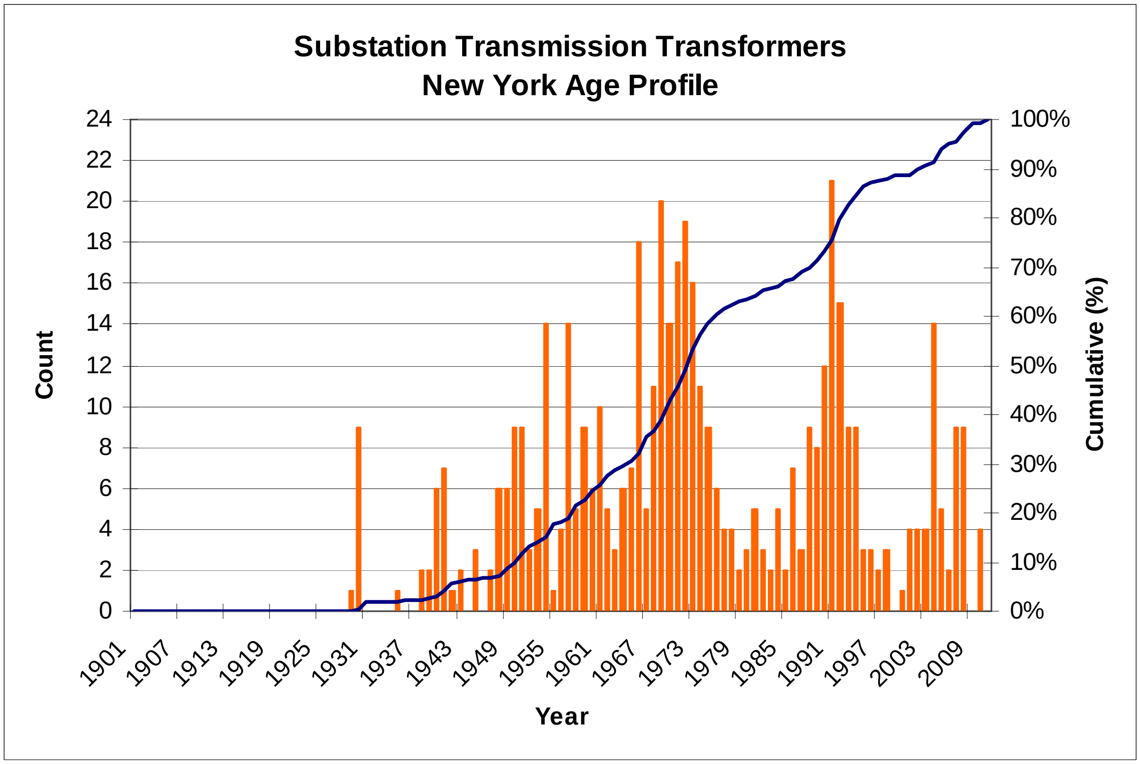
A strategy was approved to replace thirty-nine of these circuit switches at the most critical locations. Also approved in the strategy are the purchase of 3 spare circuit switchers and one mobile circuit switcher to help mitigate the reliability and safety concerns associated with the twenty-seven switches remaining in service. These will be reviewed annually to review replacement priority and the possibility of expanding the strategy to include some of the remaining switches.

Flying grounds are no longer considered a suitable method of fault clearance. Their arrangement introduces additional faults on the transmission system, creates a hazard to personnel, and may lead to additional transformer failures.

Transformers

The transmission system has a transformer population of 509 units of various manufacture, type, and power rating at primary voltages greater than 69kV. An age profile is provided in Figure 2-34. There are currently 31 system spares for the transmission transformer fleet.

Figure 2-34
NY Transformer Age Profile



The numbers of transformers organized by age group are shown in Figure 2-35.

Figure 2-35
Transformer Age Profile

Age (Yrs)	0-19	20 - 39	40 - 59	60 - 79	80 +	Total
Transformers	98	150	192	59	10	509

Fifty-one percent of the total population of transformers is greater than 40 years old and the average age of transformers on the system is 35 years. Transformers installed in the 1950s and 1960s are approaching the end of their useful life based on known deterioration modes.

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

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

Condition and Performance Issues

National Grid's maintenance program includes performing Dissolved Gas Analysis (DGA) on transmission transformers annually. DGA is a cost effective condition assessment tool that detects anomalous behaviors within transformers which may indicate a developing fault. Analysis of this data is performed using the IEEE Standard C57.104.1991. Suspect units are placed on an enhanced sampling schedule. Power factor tests are performed on the transformers and their associated bushings, and an assessment of the load tap-changer is performed during routine maintenance. Additional transformer testing such as Winding Impedance, Leakage Reactance, Transformer Turns Ratio (TTR), Excitation, and Sweep Frequency Response Analysis (SFRA) may be recommended if a review of DGA results indicate that anomalous results need to be investigated further.

Figure 2-36 provides condition codes based on the most recent review. In 2012, twenty-three transformers were identified as condition code 4 (highest priority) due to elevated combustible gasses, poor transformer design, inadequate thermal capability or no known available spares. In addition, these units are aging and may be better served by replacement rather than maintenance or repair. One of the units experienced an internal fault and was removed from the system in a controlled manner.

Figure 2-36
Transformer Condition Codes

Year	Code	1	2	3	4	Total
2012	TRF	440	25	22	23	509

Most of the transformers in condition 4 are single-phase units, and if identified for replacement, will be replaced with three-phase units.

The transformer condition codes are described as follows:

- Condition Code 1 – The transformer is expected to operate as designed for more than 10 years;

- Condition Code 2 – There is some deterioration or known type/design issues. There is obsolescence of equipment such that spares or replacement parts are not available. The system may require a different capability at the asset location;

- Condition Code 3 – The transformer condition is such that there is an increased risk of failure. Test and assessment identifies definite deterioration which is ongoing;

- Condition Code 4 – The transformer has sudden and unexpected change in condition such that it is of immediate concern; this may be detected through routine diagnostics, including inspections, annual testing, maintenance or following an event.

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

Remedial Actions Performed

The transformer watch list is based on condition and operational information, and is used to monitor those transformers of concern and to plan for a rapid replacement of the unit if its condition worsens. Figure 2-37 provides a list of transformers currently being monitored. In some instances, further evaluation is necessary to properly understand the condition. Power transformers are managed through routine visual inspection, regular dissolved gas analysis ("DGA") sampling, and electrical testing. Transformers with tap-changers are also maintained in accordance with substation maintenance standards. Continuous surveillance enables the Company to prioritize replacements appropriately. The Company completes a small number of pre-emptive transformer replacements. However, this approach may be revised in the future based on failure rates or improved tools to determine the condition of the fleet of transformers.

There are 70 transformers identified in the 2012 "watch list". Of the 68 identified in the 2011 Asset Condition Report, 1 condition code 4 transformer at the North Akron Station was removed from service in a controlled manner. The transformer suffered a sudden increase in combustible gases detected during periodic review. Electrical diagnostic tests confirmed a turn-turn fault on phase three and a system spare was installed. Since the 2011 filing, four transformers have failed.[13]

Sixty-seven units remain on the present watch list and an additional 3 have been added totaling 70 to be watched. Many of the transformers have several condition issues.

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[13] Malone Station #3 transformer failed on 09/11/2011; Teall Avenue Station # 7 transformer failed on 06/15/2012; Hopkins Road Station transformer failed on 07/13/2012; and Cloverbank Station transformer LTC failed on 07/18/2012.

Figure 2-37
"Watch" List of Transmission Transformers

Substation	Equipment Description	Max MVA	High Side kV	Low Side kV	Tertiary kV	Age	Condition Code
Altamont	Bank 1	5	115	34	4.8	61	4
Altamont	Bank 1	5	115	34	4.8	61	4
Altamont	Bank 1	5	115	34	4.8	61	4
Boyntonville 333	1 LTC TRF	7.5	115	13.8		49	3
East Oswegatchie 982	1 TRF	9.375	115	23		59	3
Edic	4 LTC TRF	448	345	115	13.8	30	4
Greenbush Station 78	3 LTC TRF	26.7	115	34.5	13.8	58	3
Harper	30 LTC TRF	40	115	12		69	3
Harper	40 LTC TRF	40	115	12		64	3
Hoosick	Bank 1	8.33	115	34	13.8	39	4
Hoosick	Bank 1	8.33	115	34	13.8	39	4
Hoosick	Bank 1	8.33	115	34	13.8	39	3
Huntley Station	120 LTC TRF	63	115	23.8		16	3
Kensington Terminal	4 LTC TRF	40	115	23		58	2
Kensington Terminal	5 LTC TRF	44.8	115	23		46	2
Lighthouse Hill #61	6B	9.375	115	34.5		61	3
McIntyre	2	20	115	23		51	2
Mohican	Bank 1	6.67	115	34	13.8	62	4
Mohican	Bank 1	6.67	115	34	13.8	62	4
Mohican	Bank 1	6.67	115	34	13.8	62	4
New Gardenville	4 LTC TRF	125	230	120	13.8	55	4
New Gardenville	3 LTC TRF	125	230	120	13.8	55	4
New Krumkill Station 421	1 LTC TRF	30	115	13.8		40	4
North LeRoy Station 04	2 Trf	12.5	115	13.8		59	4
Oneida	4 LTC TRF	25	115	13.8		46	2
Porter Station 657	1 LTC Auto	266	230	115	13.8	54	4
Porter Station 657	2 LTC Auto	266	230	115	13.8	54	4
Rotterdam	7 LTC TRF	298	230	115	13.8	47	3
Rotterdam	8 LTC TRF	298	230	115	13.8	40	3
Rotterdam	Bank 4	8.9	115	34	13.8	65	3
Rotterdam	Bank 4	8.9	115	34	13.8	65	3
Rotterdam	Bank 4	8.9	115	34	13.8	58	3
Scofield Road Station 450	1 LTC TRF	9.375	115	13.8		44	3
Seneca Terminal	3 LTC TRF	40	115	23		74	3
Seneca Terminal	4 LTC TRF	40	115	23		74	3
Seneca Terminal	2 LTC TRF	40	115	23		73	2
Seneca Terminal	5 LTC TRF	40	115	23		62	2

Substation	Equipment Description	Max MVA	High Side kV	Low Side kV	Tertiary kV	Age	Condition Code
Solvay 57	Bank 2	7.5	115	34		82	4
Solvay 57	Bank 2	7.5	115	34		82	4
Solvay 57	Bank 2	7.5	115	34		82	4
Solvay 57	Bank 4	6.67	115	34		83	3
Solvay 57	Bank 3	7.5	115	34		73	2
Solvay 57	Bank 3	7.5	115	34		73	2
Solvay 57	Bank 3	7.5	115	34		73	2
Solvay 57	Bank 4	6.67	115	34		73	2
Solvay 57	Bank 4	6.67	115	34		63	2
Solvay 57	Bank 1	7	115	34		82	2
Solvay 57	Bank 1	7	115	34		82	2
Solvay 57	Bank 1	7	115	34		82	2
Station 142	6 TRF	3.75	115	4.16		70	3
Teall Avenue	Bank 1	7.5	115	34		82	4
Teall Avenue	Bank 1	7.5	115	34		82	4
Teall Avenue	Bank 1	7.5	115	34		82	4
Teall Avenue	Bank 2	6.67	115	34		67	2
Teall Avenue	Bank 2	6.67	115	34		67	2
Teall Avenue	Bank 2	6.67	115	34		67	2
Teall Avenue	Bank 3	7	115	34		71	2
Teall Avenue	Bank 3	7	115	34		71	2
Teall Avenue	Bank 3	7	115	34		71	2
Teall Avenue	Bank 4	6.67	115	34		71	2
Teall Avenue	Bank 4	6.67	115	34		71	2
Teall Avenue	Bank 4	6.67	115	34		71	2
Terminal Station	2 LTC TRF	45	115	13.8		50	2
Vail Mills Station 392	3 TRF	56	115	69		40	3
Valley Sta 594	3-A	9.375	115	46		58	2
Whitaker Station 296	1 LTC TRF	30	115	13.8		35	4
Woodlawn	Bank 2	8.33	115	34	13.2	62	4
Woodlawn	1 LTC TRF	40	115	34.5	13.2	53	3
Woodlawn	Bank 2	8.33	115	34	13.2	62	3
Woodlawn	Bank 2	8.33	115	34	13.2	62	3

Battery Systems

Battery and charger systems provide power to operate substation relay and control systems which allow station breakers to operate as designed. National Grid has a battery replacement policy requiring the replacement of all battery sets that are 20 years old, or sooner if battery conditions determined through testing and inspection warrant replacement. The 20 year asset life is based on industry best practice and Company experience managing battery systems. Forty-five battery sets will be over twenty years old between 2013 and 2016.

Figure 2-38
Battery Age Profile

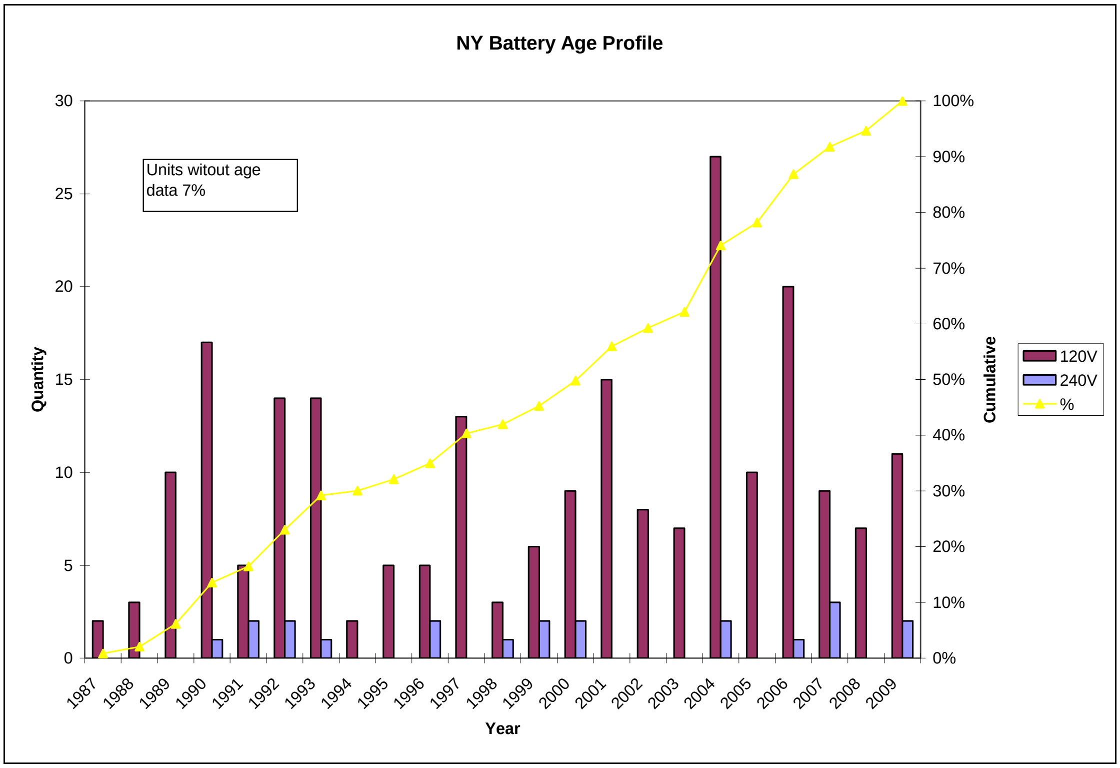


Figure 2-39
Charger Age Profile

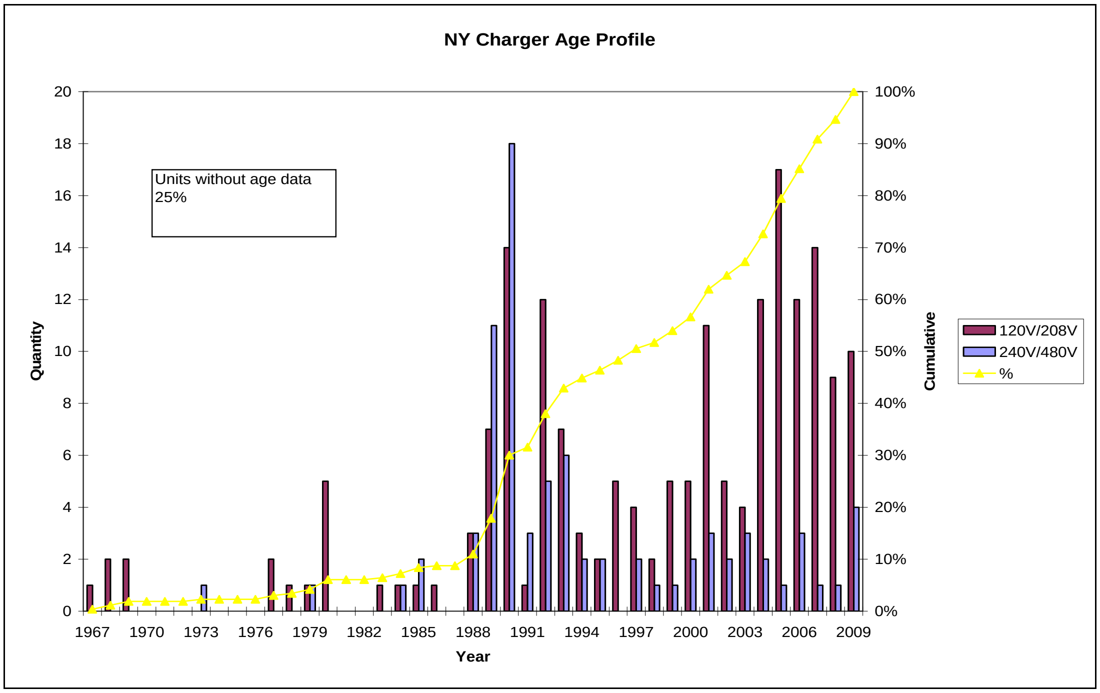


Figure 2-40
Asset/Age Profile

Asset/ Age Profile (Years)	0-4	5-9	10-14	15-19	20+	Total
Batteries[14]	56	81	41	31	17	244

[14] The number of batteries without age data is 17.

Surge Arrestors

The silicon carbide (SiC) surge arrestors at 115kV and above installed in the service territory are no longer an effective means of high side protection for transformers. Original installation dates are largely incomplete as surge arrestors were typically classified as part of transformer installations. Available information suggests more than 70 percent of surge arrestors installed in the system are of silicon carbide (SiC) type with a large volume estimated to be over thirty years-old.

Condition and Performance Issues

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

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

Remedial Actions Performed and Planned

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

Relays

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

Figure 2-41
Count of Relays by Type

Design Type	# of Relays	% of Total
Electro-mechanical	11,306	83
Solid State	574	4
Microprocessor	1,772	13
Total	**13,652**	**100%**

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

With the advent of digital technologies, facilities can be upgraded resulting in greater capability and increased reliability. The first priority is to identify the worst performers and establish the appropriate remedial action. Secondly, we are reviewing solutions that enable the “Smart Grid” with interoperability and increased insight into the stability of the electric transmission system.

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

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

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

Condition and Performance Issues

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

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

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

- **GE (GCX13/17, CEY14/15/16GEYG, CEB) –** contact wear and bearing damage, setting drift.
- **GE (CFD, CPD, Type 40, MOD10, CFF, CR61/CT61, CS28A) –** resistor, capacitor, transistor and diode decomposition. Failed power supplies.
- **ABB (MDAR, REL301, REL302, SKDU/SBFU, HCB, LCBII) –** metal degradation, contact wear and setting drift.
- **ABB (KF) –** setting drift, metal degradation, bearing damage.
- **AREVA (OPTIMHO) -** resistor, capacitor, transistor and diode decomposition.
- **RFL (3253, 6710, 6745, 9300) –** metal degradation, setting drift.

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

Remedial Actions Performed and Planned

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

The study identified approximately 245 relays and 54 communication packages requiring replacement. Strategy paper SG157 was approved to replace the relays under a five year program. In general, the replacement plan will be implemented on a line-by-line basis. The relays to be replaced are included in Figure 2-42 below:

Figure 2-42
Relays to be Replaced under Strategy SG157

Substation	Priority	Packages	Communication
Dewitt	1	6	0
Mortimer	2	8	0
Lockport	3	7	0
Batavia	4	5	0
Cortland	5	2	0
Gardenville - New	6	4	0
Tilden	7	5	0
Rotterdam	8	10	3
Huntley	9	13	0
Homer Hill Sw. Str.	10	10	0
Gardenville – Old	11	7	0
Golah	12	2	0
Temple	13	3	1
Watkins	14	3	0
Porter	15	4	1
Reynolds Rd	16	2	1
North Troy	17	2	1
Sta 64 Grand Island	18	2	2
Schuyler	29	4	0
Curtis	20	4	0
New Scotland	21	1	1
Packard	22	25	2
Woodlawn	23	2	1
Edic	24	4	0
Volney	25	4	2
Trinity	26	3	1
SE Batavia	27	2	0
Elbridge	28	3	0
Scriba	29	4	2
Walck Rd	30	1	0
Ash	31	3	3
Greenbush	32	2	0
S. Ripley	33	2	0
Terminal	34	4	0
Long Lane	35	2	3
Carr St.	36	4	0
Feura Bush	37	3	3
McIntyre	38	1	0
North Ogdensburg	39	1	0
Seneca Terminal St.	40	4	0
Riverside	41	7	3
Rosa Road	42	4	2

Independence	43	4	0
Grooms Road	44	0	1
Indian River	45	1	0
Lowville	46	1	0
Malone	47	1	0
N. Carthage	48	1	0
Ogdensburg	49	1	0
Total		**199**	**33**
Control House	**Priority**	**Packages**	**Communication**
Boonville	1	12	0
Geres Lock	2	18	0
Menands	3	4	1
Woodard	4	2	0
Mountain	5	4	0
Teall	6	2	2
Yahundasis	7	4	0
Total		**46**	**3**
Single Comm Packages	**Priority**	**Packages**	**Communication**
Rotterdam			1
Edic			1
New Scotland			7
North Troy			3
Reynolds Road			2
Alps			1
Altamont			1
Bethlehem			1
Grooms Rd			1
Total			**18**
Grand Total		**245**	**54**

Digital Fault Recorders (DFR)

National Grid currently has 20 digital fault recorders deployed that capture and store data from the power system during times of instability or system anomalies. The data is then downloaded to perform post-event analysis. The analysis yields detailed information about the state of the system before, during and after the event. Because of their benefits in understanding system incidents the Company has a strategy to increase the use of digital fault recorders on the system. Since 2011, the Company has added 17 new DFRs and replaced 2 of the existing units. Within the last year, the Elbridge and Huntley DFR installations have been completed. The DFR Replacement Strategy is now complete and there are 20 digital fault recorders deployed throughout the service territory.

Condition and Performance Issues

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

Remedial Actions Performed and Planned

National Grid has been awarded funding under the American Recovery and Reinvestment Act (ARRA) as a sub-awardee to NYISO and in collaboration with other Transmission Owners in the state to deploy Phasor Measurement Units (PMU) that provide data relating to electric system stability. The Federal funding (DoE FOA-0000058) provides 50 percent of the cost of deploying PMUs at up to twelve transmission substation locations. The deployments will occur over a three year period with an effective start date of July, 2010.

As PMU capability can easily be added to newer DFRs, we expect to upgrade several DFRs to deliver PMU data and, where necessary, add stand-alone PMUs in cases where existing DFRs are of an older vintage.

Remote Terminal Units (RTU)

NERC Recommendation 28, released in response to the August 2003 blackout, requires the use of more modern, time-synchronized data recorders. Many in-service RTUs do not satisfy this requirement and obsolete RTUs will not work with modern Energy Management Systems ("EMS").

There are approximately 550 operating RTUs under the Company's control, of which 158 transmission and distribution units are being replaced under an ongoing RTU replacement program (SG002). To date 107 projects are complete, 35 have completed engineering (Step 2b) and are waiting to be installed (Step 3), 15 are in engineering (Step 2b) and 1 is in conceptual engineering (Step 0).

Condition and Performance Issues

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

- The target RTUs do not meet the criteria outlined in NERC Recommendation 28,[15] which places the Company at risk for being unable to provide synchronized system data during a system emergency.
- The target RTUs and equipment are obsolete and in most cases no longer supported by the manufacturer. Replacement parts are either difficult to obtain or unavailable.[16] Failure of the RTU may be un-repairable, requiring a complete unplanned replacement with short notice. This situation could occur when data from the failing RTU are most critical, such as during system events, resulting in reduced reliability performance.
- Test equipment is obsolete and cannot be readily obtained or maintained. The PC based test equipment required for maintenance was acquired in the early 1990s and uses a DOS software platform. Both the RTUs and test sets utilize the M9000s communication protocol. This protocol is the legacy protocol of the original Energy Management System ("EMS") and cannot be upgraded to be compatible with the planned EMS system replacement.
- The target RTUs are not suitable for future integration of new substation devices and technology. The equipment does not have and cannot be modified to provide the capabilities required for modern supervisory control and data acquisition.[17] This type of functionality is becoming standard to meet current reliability needs.

Remedial Actions Performed and Planned

The new RTUs being installed will provide more timely and reliable data than their predecessors. In the event of a minor or major system disturbance that may affect the ability of the system to withstand further contingencies or customers directly, accurate data received in a timely manner is a necessity in the restoration process. Data received from the new RTUs will quickly identify key devices that have failed or have been

[15] North American Electric Reliability Council (NERC) "Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations," April 5, 2004 Page-162
[16] SG002 – Revised Asset Replacement Strategy for RTUs, October 31, 2005.
[17] SG002 – Revised Asset Replacement Strategy for RTUs, October 31, 2005.

affected by the event. The data will expedite isolation of the problem, reduce the duration of the interruption and in some cases avoid spread of the outage to other system components.

Station Rebuilds

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

Gardenville (Project C05156)
Gardenville is a 230/115kV complex south of the Buffalo area with two 115kV stations in close proximity referred to respectively as New Gardenville and Old Gardenville which both serve regional load. New Gardenville was built between 1959 and 1969 and has some minor to moderate asset issues. Old Gardenville feeds regional load via eleven 115kV lines and was built in the 1930s. It has serious asset condition issues including, but not limited to: control cable, circuit breaker, disconnect and foundation problems.

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

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

At New Gardenville there are 19 oil circuit breakers anticipated to be either at or above their interrupting rating by 2013.

Due to low voltage problems on the 230kV system in the area, three 75MVAr capacitor banks are needed at the station with all Dunkirk generation available. However, with the shutdown of all but one of the Dunkirk generators, there is an additional need for a fourth 75MVAr capacitor bank. All four capacitor banks will be in service by June 1, 2013.

Strategy paper SG 112 to rebuild the Gardenville 115kV Station was approved on March 10, 2009 and is due to begin detailed engineering in FY12.

Dunkirk (Project C05155)
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 cause safety issues.

The five 230kV oil circuit breakers are Westinghouse type GW design (1958 through 1961) and have reached the end of their useful life. 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 life. The 230kV bushing potential devices (BPDs) have become problematic as they age and the remaining BPDs will likely have to be replaced in the near future. Fencing around the yard is not compliant with National Grid standards and requires repair at the base or a berm built up to prevent animal entrance.

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

Within the last four years National Grid has replaced both 230-120-13.2kV 125MVA GE autotransformers with new ABB 230-120-13.2kV 125MVA autotransformers and all 115kV OCB's with new SF6 breakers, foundations and control cable.

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

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

The shutdown of Dunkirk generation has added to the scope of work originally recommended in the Dunkirk substation. Two 52.5 MVAr 115kV mobile capacitor banks currently installed at Huntley substation will be moved to Dunkirk by June 1, 2013 in order to mitigate the shutdown of all but one of the Dunkirk generators. However, it is recommended that the two mobile capacitor banks be replaced by two 33.3 MVAr permanent capacitor banks in order to mitigate a complete shutdown of Dunkirk generation. The permanent capacitor banks will be installed as soon as possible.

Rome Substation

The 115kV system at the Rome Station experiences periods of low voltage particularly if the tie-breaker is open. The latest station condition assessment was performed in 2008 and significant asset health concerns were noted: the 115kV disconnects are degraded and often fail upon operation; 115kV instrument transformers were built in the 1930s and have weakened foundations; batteries and chargers have failed during bus outages; the control house has asbestos and deteriorated windows and doors; and the steel structure is heavily corroded with degraded footers.

The 115kV radial Levitt-Rome #8 line feeds approximately 100MW of load in the surrounding area and has had several outages resulting in lost customer minutes due to slow closing breakers which in prior condition assessments have been noted to be rusted and have compressor oil leaks.

Furthermore, station property near the north bus section has been under environmental remediation the past several years due to a former coke plant that produced natural gas which contaminated the site. Moving assets currently located in the North yard further from the site remediation and Mohawk River side of the yard would reduce the Company's exposure to involving them in future environmental clean-up plans.

A strategy paper SG123 proposing a station rebuild within the footprint of the current yard was approved in January 2010. Sanctioning was approved for the ordering of materials in August 2011 and sanction for final design is expected for November 2012. The solution includes moving the South bus capacitor bank, building a new control house and new north bus, relocating 115kV lines such that Rome - Oneida #1 and Levitt - Rome #8 terminate at the south bus and Boonville - Rome #3 and Boonville - Rome #4 terminate at the north bus, replacing assets deemed in poor condition in the south yard, and adding a line bypass switch between the Levitt-Rome #8 and Rome-Oneida #1 lines to reduce line outages due to substation faults or planned maintenance at the station. Targeted in service date for the new substation is fall of 2014.

Rotterdam (Projects C32849 & C34850)

Rotterdam is a large substation with 230kV, 115kV, 69kV, 34.5kV, and 13.2kV sections spread out over multiple tiers on a hillside. The 230kV yard is on the highest tier and the main source for Schenectady, NY and the Northeast Region [redacted] he 230kV yard has had performance issues and one catastrophic failure of a Federal Pacific Electric ("FPE") breaker. These breakers have horizontal rotational contacts inside their tank as compared to vertical lift contacts in newer style circuit breakers. FPE breakers are no longer manufactured and spare parts are not available. There are two spare SF6 gas circuit breakers stored at Rotterdam to replace the FPE breakers if one were to fail at this station.

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

All of the Thyrite (Silicon Carbide) style of surge arrestors in the 230kV yard should be replaced with the newer MCOV (Metal Oxide) style arrestors (refer to Surge Arrester section above). This will improve the voltage performance of the arrestors that protect the station equipment.

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

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

There are many factors that will help determine the appropriate configuration of the 230kV yard in the future that are still being identified and studied, therefore it is premature to recommend a 230kV rebuild alternative at this time. Studies need to be performed to determine which voltage classes should remain at the station, retired, or relocated, to simplify the overall rebuild project to minimize costs.

Lockport (Project C35464)
Lockport is a major 115KV transmission Station with thirteen 115kV transmission lines tying through the East and West Bus sections. [redacted] The overall condition of the station yard and control room is poor. Work is required on control cable duct banks, breaker operators, structure painting and concrete equipment foundations that are significantly deteriorated.

Lockport was originally part of the 25 cycle system dating back to the 1910’s. There are still 25 cycle oil filled equipment remaining at the station including an OCB and three transformers. The equipment was determined to be non-PCB and the OCB drained July 27, 2012. The transformers and OCB will be disposed of in November 2012.

The structures are severely rusted and in need of painting before the steel is compromised. Typical conditions of the structural steel at the station along with column and breaker foundations are deteriorated and need to be repaired with several potentially needing full replacements.

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

There are two new 115kV SF6 breakers while the remaining forty-year old 115kV, oil filled, BZ0 breakers show exterior rust and oil stains. Three of the 115kV oil breakers have continued hydraulic mechanism leaks common to the BZO style breakers. Failures of hydraulic system components have been notably increasing. Each of the oil BZO breakers has bushing potential devices which have been another source of failure.
Transformer #60 is a 115-12kV 7.5MVA transformer manufactured in 1941 which supplies Lockport's station service and Race Street Line 751. Race Street Line 751 is tied to the Race Street seasonal hydraulic unit. An alternate station service should be provided should TR #60 or station service fail.

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

Line 103 & Line 104 transfer trip communication equipment needs to be upgraded and is a continuous source of problems. The communication equipment should be relocated to the communication building adjacent to the microwave tower on site. This would then allow for the demolition of the frequency changer building independent of the main building.

Conceptual engineering to rebuild the station in place was completed in June 2010. The project has been deferred for further consideration in FY2017.

Lighthouse Hill (C31662)
Lighthouse Hill is a significant switching station in northern NY. It has two 115kV buses and seven transmission lines connecting to the station allowing delivery of power from the Oswego generating complex to the Watertown area in the north and Clay station in Syracuse.

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

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

The 6B transformer has a history of gassing and replacement should be considered in the next few years. It is included on the transformer watch list in Figure 2-37.

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

Conceptual engineering for a new substation, relocated to a greenfield site along an adjacent road in the clearing near the transmission right-of-way and away from any flooding risk, was completed June 2010.

Huntley

In 2005, NRG (the owners of the Huntley Generating Station) announced the retirement of the four 115kV connected generators at Huntley. Due to this, the Company began planning for area reinforcements which included the construction of the Tonawanda substation. For the period 2006 – 2009 National Grid continually reviewed available load data and confirmed that reinforcements were still necessary.

In 2010 new load data showed the economic recession had adversely impacted the Western New York area with significant reductions in load and future load forecasts.. The need for the Company's Tonawanda substation and Frontier Rebuild projects no longer existed (though other previously identified projects in the Frontier, Genesee and Southwest region were still needed).

Based on the condition of assets at the Huntley Station and circuits in the region, the Company updated its plan and decided to proceed with condition based improvements at the Huntley substation and some area transmission lines.

Huntley substation asset condition needs and transmission capacity needs were also reviewed in 2011. Among these needs were the addition of a 75MVAr 115kV capacitor bank to replace two mobile banks currently installed there, improvement of the grounding in the switchyard, remove all of National Grid's controls, batteries and communications equipment from inside the Huntley Generating Station to a control house in the yard (both 115kV & 230kV), adding a second station service supply, refurbishing the existing oil circuit breakers, replace the potential transformers, install new CCVT's for 115kV and 230kV relaying, and improving annunciators and alarming at the Huntley to Elm #70 230kV cable pressurizing plant.

Additional transmission needs have been identified in a study to mitigate the shutdown of all but one of the Dunkirk generators. These needs include the removal of an existing

230kV bus tie breaker, the addition of two new bus tie breakers, and a rearrangement of line and generator connections amongst the 230kV bus sections. This work will be completed by June 1, 2013. Furthermore, in order to mitigate the complete shutdown of all Dunkirk generators, a second 75MVAr 115kV capacitor bank will be installed as soon as possible.

Boonville

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

The structural steel and foundations are deteriorated. The foundations have deteriorated due to the poor station drainage. The station was built alongside highway 12D in a farm field. Over the years it has sunk to an elevation lower than the highway and farm fields leaving drainage to no longer exist. This drainage issue is also present in the underground manhole and conduit system. The water surface level at the station causes the underground control cables to continuously be under water leading to their deterioration.

Electrically the station was designed with minimal redundancy and has antiquated relaying protection. The design has the single source transformer for the 46kV line to the Old Forge area connected off the south 115kV bus with no alternate method to supply the transformer if the south bus is out of service. The 115kV to 46kV transformer was replaced in the 1990's, but is still the only source and can not be maintained properly due to outage restrictions. With no distribution at Boonville there is little need for a mobile sub connection. But there is a spare transformer for the 115/46kV TB#3 located at the station.

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

Oswego

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

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

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

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

Chapter 2 B. Sub-Transmission System

This section provides the condition of overhead and underground elements of the sub-transmission system.[1]

Figure 2-43 summarizes the key overhead and underground sub-transmission assets.

Figure 2-43
Sub-Transmission Assets[2]

Sub-Transmission Main Assets	Inventory
Towers/Poles	63,400
Line Circuit Miles	4,800
Underground Cable Circuit Miles	1,100

Overhead System

Figure 2-44 provides a breakdown of the sub-transmission system structures.

Figure 2-44
Structure Types

Asset	Inventory
Steel Structures	2,598
Wood Structures	60,662
Unknown/Other	102
Total	**63,362**

A more thorough review of system structures was performed as information was entered into the geographic information system (GIS). As a result, the number of "unknown" type structures was reduced from 736 last year to 102 this year. On-going work in the Inspection and Maintenance program is expected to continue reducing the number of "Unknown Type" structures in future asset condition reports.

[1] Substation assets defined as sub-transmission are covered in Section D of Chapter 2.
[2] National Grid Electric Distribution Asset Report downloaded 8-21-12.

Steel Towers and Steel Poles

Figure 2-45 shows a breakdown of the Inspection and Maintenance program results for sub-transmission steel towers and poles. The visual grading system described previously for transmission structures is also used for sub-transmission towers.

Figure 2-45
Sub-Transmission Steel Towers and Steel Poles Inspection Results

Level	Loose Bolts – 534	Structural Damage – 537	Tower Legs Broken - 531	Vegetation on Towers – 536	Total	Percentage Codes Completed
2010 Summary						
1	0	0	0	0	0	-%
2	0	0	0	0	0	-%
3	1	1	0	0	2	0%
2011 Summary						
1	0	0	0	0	0	-
2	0	2	1	0	3	0%
3	7	33	0	0	40	0%
2012 Progress to Date (6/30/2012)						
1	0	0	0	0	0	-
2	0	10	0	0	10	0%
3	1	14	0	0	15	0%

In addition to the Inspection and Maintenance program, supplemental inspections are performed by the Company to determine if towers in the most deteriorated condition should be repaired or replaced. An additional 14 towers were reviewed and replaced/removed since the last report due to their poor condition. Footing inspections on some lines have also been undertaken along with completing reinforcing and footing repairs. In a few cases, the estimated cost to repair deteriorated tower footings was excessive relative to the total condition of the tower which resulted in tower replacement. In other cases, inspection contractors reported to the Company the poor condition of a tower superstructure. In these cases, the footing was either temporarily supported until the tower could be replaced or repaired. Typical superstructure problems included corroded, bent, detached or twisted members, tilted towers, past vehicular or storm damage and failed crossarms. In some cases, falling trees caused broken conductors or differential tensions on the towers causing permanent bending or failure of members which required replacement. In some of these cases, the towers continue to function normally.

Wood Poles

Figure 2-46 shows a more detailed breakdown of the Inspection and Maintenance program results for sub-transmission wood poles. The most frequent four asset condition codes are shown in the table. After a decrease between 2009 and 2010, a significant increase in visual rotting poles is shown from 2010 to present. A summary of all categories is shown in Exhibit 3.

Figure 2-46
Sub-Transmission Wood Pole Inspection Results[3]

Level	Visual Rotting – 511	Wood Pecker – 526	Insects – 527	Leaning Pole – 512	Total	Percentage Code Completed
2010 Summary						
1	0	0	0	0	0	-%
2	13	8	0	0	21	90%
3	377	60	28	6	471	10%
2011 Summary						
1	0	0	0	0	0	-%
2	115	31	0	2	148	50%
3	699	179	74	15	967	3%
2012 Progress to Date (6/30/2012)						
1	0	0	0	0	0	-%
2	120	26	5	1	152	1%
3	756	178	28	23	985	1%

Most pole issues do not contribute significantly to interruptions but often do present safety and environmental issues. Poles are replaced based on condition as identified through the inspection and maintenance process described above, and during overhead line refurbishment projects. Additional poles may be added or done concurrently based on engineering and line operations field walk-downs or based on the 2007/2008 helicopter aerial surveys and later aerial reviews which identify rotted pole tops as well as other concerns which can be seen from the aerial viewer or from the helicopter.

Overhead Line Refurbishment

There are approximately 3,000 circuit miles of sub-transmission conductor. In addition to the Inspection and Maintenance program, the condition of circuit conductors, hardware, poles, overhead ground wires, drainage (in some cases) and towers is evaluated by Engineering personnel as related work is considered. Related work can include projects to improve reliability, upgrading circuits that are identified as being near their thermal limit or in poor condition. Conductor size and number of splices in a conductor are also reviewed to determine if replacement is warranted. Typically, #4 copper, #3 copper, #2 copper, #1 copper and Copper Copperweld conductors will be replaced on main lines and important tap lines. In all cases, these smaller conductors are over 65 years old and have had numerous splices installed on them due to past field

[3] The total and percentages in this table represent the four most frequent codes. All categories of wood pole asset condition codes are found in Exhibit 3. Data taken from 3030 Transmission Computapole Report.

problems. In addition, these conductors are no longer standard relative to inventories available to fix or replace them.

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

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

Overhead Line Removals

The Company has identified approximately 40 de-energized transmission and sub-transmission lines (or sections of older lines) to be removed. Typically, sub-transmission and transmission lines are “retired-in-place” as National Grid reconfigures its system based on planning studies or the retirement of service laterals due to the departure of transmission customers. De-energized lines have remained in place in anticipation of future need due to load growth and new industry, or to maintain property rights in certain areas. Removal of de-energized lines has typically been pursued as part of damage/failure type projects or in response to a problem identification worksheet (PIW) safety concern. A recent strategy has identified and prioritized existing de-energized lines for removal and proposes a plan for the future removal or inspection of lines once de-energized.

The primary driver of the retirement strategy is safety. National Grid adheres to the National Electrical Safety Code’s General Requirements for the inspection and tests of in-service and out-of-service lines (NESC Safety Rules for Overhead Lines, Rule 214). This rule requires the removal or maintenance in a safe condition of all assets that are permanently retired, which will maintain the safety of the public and field personnel when in proximity to de-energized lines. Additional benefits include decreased opportunities for damage to adjacent lines and the potential sale of rights-of-way.

Sub-Transmission Automation

One sub-transmission automation project in the Eastern Division was completed since the last asset condition report. Additional line sectionalizing automation schemes are planned for the Western Division in FY14.

Vegetation Management

Rights-Of-Way Widths

National Grid has extensive sub-transmission overhead line facilities on cross-country rights-of-ways (ROW). A critical factor in the reliability of the sub-transmission assets is the relatively narrow width of the ROW as well as the lower conductor heights making the danger tree issue very important. Beginning in late 2005, National Grid reinitiated a sub-transmission ROW widening program. The program strives to increase the overall width of the sub-transmission ROW from fifty feet on a majority of lines to a width of seventy-five feet wherever feasible.

Per unit costs for the ROW widening program vary based on attributes such as tree density, topography and land use. Costs per unit are increasing due to physical constraints becoming more restrictive and complex. The Company will continue with the program until all rights-of-ways have been addressed while monitoring costs to ensure practical benefits will be achieved.

The most current reliability data will be used to maintain and prioritize the list of widening candidates in conjunction with the patrol reports from helicopter surveys and forester knowledge of the condition of the line. Once completed, widened sub-transmission ROWs are placed on regular cycles for floor maintenance and danger/hazard tree reviews. Some lines have easement restrictions that prevent establishment of an optimal right-of-way width and so the Company may investigate the acquisition of additional rights in these situations.

Underground System

Underground Cables

There are approximately 1,100 miles of sub-transmission underground cable. Planned cable replacements are driven by cable condition and performance history. The underground sub-transmission system consists primarily of paper-insulated lead-covered (PILC) and ethylene propylene rubber (EPR) type cables. There are also some Low Pressure Gas Filled (LPGF) type cables in the underground system.

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

Of particular concern is the sub-transmission cable system in the Buffalo area. There are approximately 200 miles of cable that supply the 23-4kV Buffalo stations many of which are nearly 80 years in age. Immediate projects include reconductoring certain sections of cable which have been identified as thermal constraints during planning studies. Additional review will be conducted to develop a pro-active plan for replacement of the remaining cable over a 15+ year time frame.

Remedial Actions Performed

Figure 2-47 lists completed sub-transmission projects since the last asset condition report that are not in the Inspection and Maintenance category.

Figure 2-47
Completed Sub-Transmission Projects as of June 30, 2012

Division	Line Name	kV	Scope
West	Tonawanda Coke Tap 27H,607	23	Rearrange Wickwire Switch Structures
Central	Rathbun-Labrador 39	34.5	Refurbishment
Central	Solvay 22	34.5	New Tap to Tessy Plastics
West	General Mills-Ridge 611/612	34.5	Replace Aerial Cable over Railroad
West	International Salt Tap 853	69	Remove Tap Line
Central	Woodward 24, Ley Creek Tap	34.5	Replace Structures for Landfill Capping
Central	Lake Clear-Tupper Lake 38	46	Refurbish and Reconductor
Central	Norfolk-Norwood 21	23	Rearrange Line for Clearance
West	N. Ellicottville Tap 803	34.5	Remove Tap Line
Central	Solvay 35	34.5	New Tap to Honeywell
East	Hoag-Brainard 1	34.5	Refurbishment
Central	Tilden-Tully 24	34.5	New Tap to Johnson Bros.
East	Spier-Glens Falls 8	34.5	Refurbishment
East	N. Creek –Indian Lake 1	34.5	Install 3 reclosers
Central	Valley-Inghams 26/27	46	Add Switching
West	Caledonia-Golah 213	34.5	Refurbishment
West	W. Salamanca-Homer Hill 805	34.5	Refurbishment
West	Hartfield-Sherman 855	34.5	Refurbishment
West	Bagdad-Dake Hill 815	34.5	Refurbishment
West	Tonawanda 601, 602, 603	23	Line Rearrangement and Rebuild
West	Regeneron/SUNY Tap 2	34.5	Install Line Switch
East	Indian Lake-North Creak 34.5	34.5	Install Reclosers
West	Donner Hanna Tap 613	34.5	Remove Tap Line
West	Gibson Line 73 and Harper-Station 104 Line 32	12	Refurbish Line and Replace Towers College Ave
East	N. Electric Power-Mohican 4	34.5	Install Line Capacitor Bank
West	Huntley-Military 36H/25H	23	Clearance Adjustment
Central	Woodward 24	34.5	Clearance Adjustment
Central	Solvay 22	34.5	Replace Tower 477
East	School Street-Champlain/Watervliet 3, 4, 9	13.2	Remove Partial Lines across Mohawk River
East	Skybell Tap 2	34.5	Remove Tap Line

Chapter 2 C. Distribution System

This section provides the condition of overhead and underground distribution system assets.[1] Because the population of certain distribution assets can be very large, even a small portion of a population requiring maintenance or replacement can be a significant annual management issue.

Figure 2-48 is an inventory of distribution overhead and underground system assets.

Figure 2-48
Distribution Line Assets[2]

Asset	Quantity
Overhead Distribution Circuit Miles	36,270
Underground Distribution Circuit Miles	7,350
Blade Cutout	14,282
Capacitor Installation	5,099
Elbow	34,684
Fuse Cutout	173,325
Handhole	71,263
In Line Fuse	347
Manhole	12,035
OH Regulator	2,222
Pole	1,237,053
Pullbox	5,087
Recloser	1,331
Switch Bypass	3,543
Switchgear	3,123
Switch Installation OH	24,437
Switch Installation UG	63
Transformer Distribution OH	331,980
Transformer Distribution UG	66,757
Transformer Ratio OH	12,475
Transformer Ratio UG	115
Vault	1,766

[1] Substation assets are covered in Section 2 D of this chapter.
[2] The majority of table data is from the weekly National Grid Distribution Device & Structure Counts by Location downloaded 8-21-12. The reporting is by location rather than units (except for elbows). Each location can contain more than one unit. As an example, a count of "one" transformer location can include three single-phase distribution transformers that comprise a single three-phase bank. The data in the tables has not been rounded and the precision of the information should not be assumed to the degree of significant digits. Overhead and underground distribution circuit miles were taken from National Grid Blue Card Statistics - New York and New England downloaded on 8-21-12.

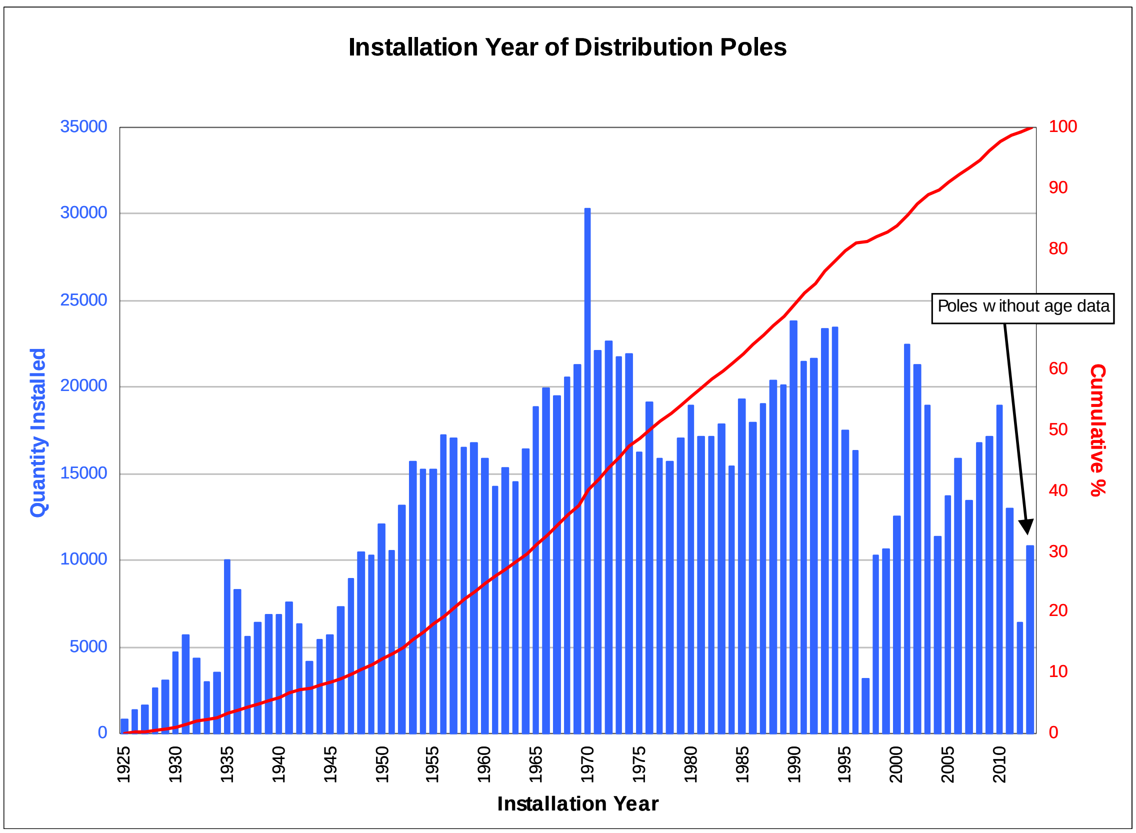
Chapter 4, Exhibit 3 contains the Second Quarter, 2012, Inspection and Maintenance Report summarizing program results from January 1, 2010 to June 30, 2012. Program activities generate asset condition information and remediate asset condition issues. The report does not include quantities of assets found in acceptable condition. More detailed analysis of asset condition for certain assets follows below.

Overhead System Assets

Wood Poles

Distribution structures include poles, system grounding, anchors and guying, crossarms, and riser pole equipment. There are approximately 1.24 million distribution poles on the system with an average age of 36 years (Figure 2-49). Distribution structures are in generally good condition, with 97 percent of structures inspected found in acceptable condition.[3] The following information addresses all poles regardless of material.[4] Some of the distribution assets are also attached to transmission or sub-transmission structures. The condition of those structures is discussed in either the transmission or sub-transmission section of this report rather than this section, as the distribution component is ancillary to the structure.

Figure 2-49
Age Profile of Distribution Poles[5]



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[3] A total of 162,649 poles were inspected (PSC Quarterly Report, Inspections Summary Report, Distribution Unique Inspections, Units Completed Table (June 30, 2012)). Separate Computapole query indicates 157,629 poles had no maintenance codes of any kind.
[4] Fewer than 1,000 (0.08 percent) of distribution poles are made of a material other than wood (e.g., concrete, fiberglass, or steel).
[5] Approximately 11,000 poles without age data were listed. Poles with installation dates prior to 1925 are included as without age data.

Condition and Performance Issues

In Exhibit 3, the Distribution Overhead Facilities, Poles, Pole Condition heading summarizes the results of the Inspection and Maintenance program. Figure 2-50 shows a breakdown of the program results, including the four most frequent maintenance codes found.

Figure 2-50
Distribution Wood Pole Inspection Results[6]

Level	Visual Rotting – Top 116	Visual Rotting – Ground 111	Leaning Pole 117	Wood Pecker 114	Other 110, 112, 113, 115	Total	Percentage Completed
2010							
1	3	12	0	0	11	26	100%
2	960	924	145	116	136	2,281	99%
3	3,968	1,707	357	0	1,463	7,495	23%
2011							
1	3	6	0	0	11	20	100%
2	2082	718	670	178	76	3724	66%
3	1225	397	0	0	148	1770	17%
2012 Progress to Date (6/30/2012)							
1	1	3	0	0	11	15	100%
2	2408	556	461	191	68	3684	2%
3	1747	273	0	0	95	2115	0%

Figures 2-51 and 2-52 compare the installation year profiles of poles inspected this year (to June 30, 2012) against poles that are candidates for replacement based on those same inspection results.[7] This profile is consistent with past years. A small percentage of the poles inspected were candidates for replacement, typically those poles between 50 and 80 years old. There has been a shift between level 2 and level 3 poles identified for replacement. This is attributed to a different sample of poles and updates to the criteria and codes.

[6] Data source is Distribution Computapole Report 1030. The four most frequent codes are shown on this table. Exhibit 4, Distribution Overhead Facilities, Poles, Pole Condition heading summarizes all the wood pole asset condition codes.

[7] The following asset condition codes were considered as most likely resulting in pole replacement: 110 - Broken/Severely Damaged, 111 - Visual Rotting Ground Line, 113 - CuNap Treated, 114 - Woodpecker Holes, 116 - Visual Rotting Pole Top, 801 - Osmose Identified Priority Pole and 802 - Osmose Indentified Reject Pole. The poles considered candidates for replacement also had the following Priority Level codes: 1 (one week), 2 (one year), 3 (three years), P (performed during inspection), 9 (temporary repair) and 7 (emergency).

Figure 2-51
Install Year Profiles of Poles Inspected Versus Replacement Candidates

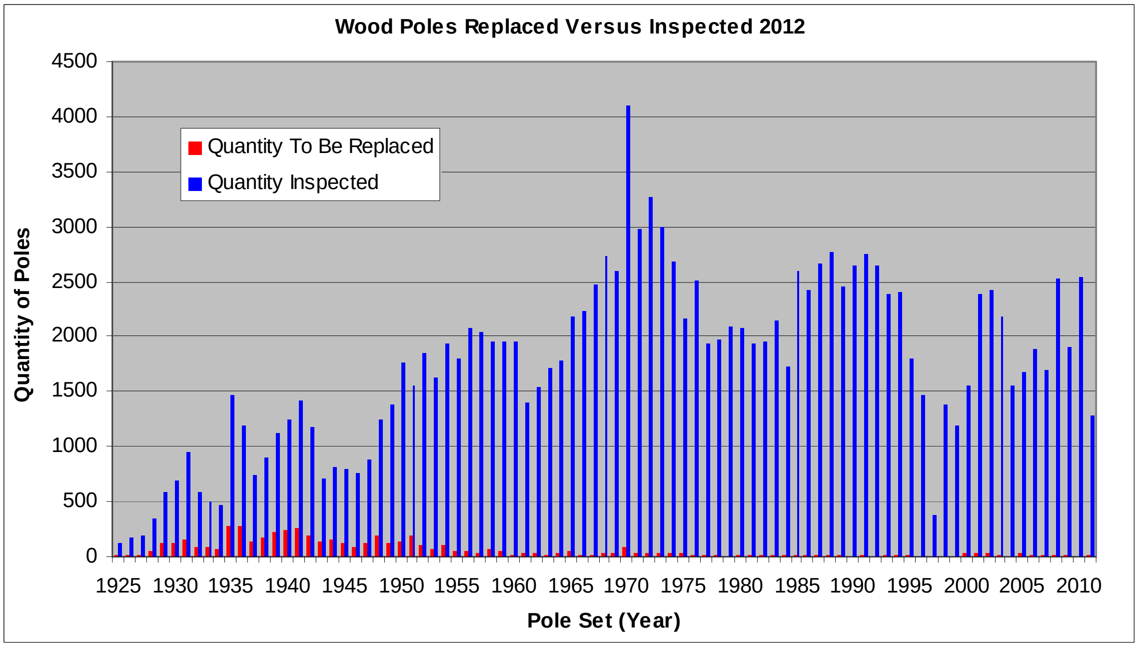
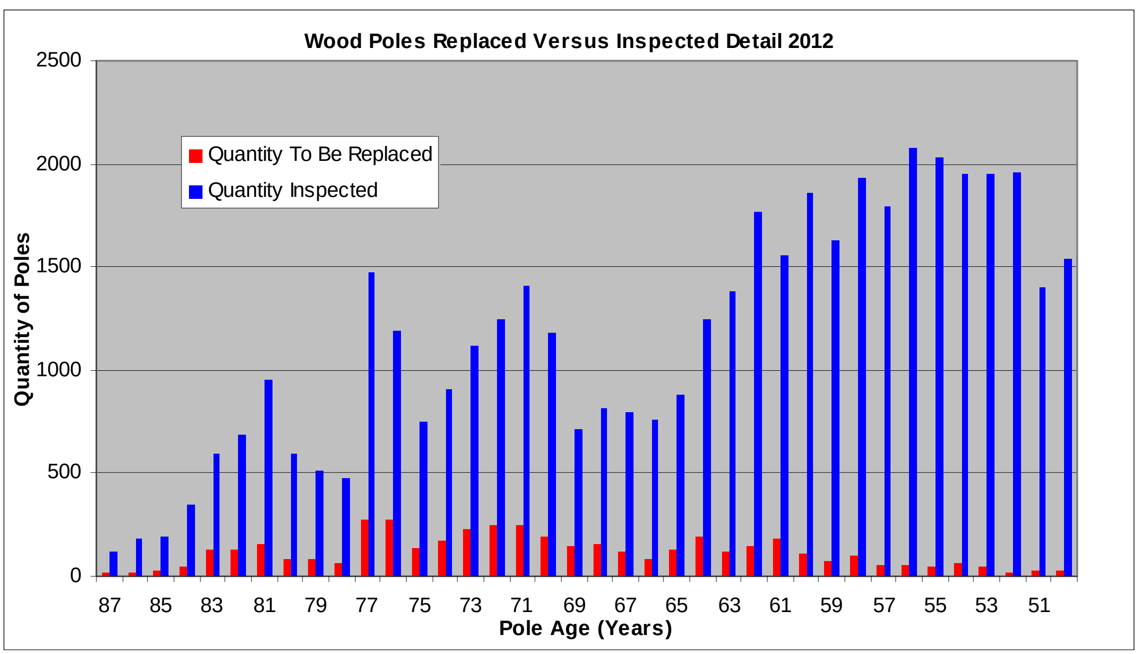


Figure 2-52
Inspected versus Replaced Detail



Remedial Actions Performed

As shown in Figure 2-65, a total of 14,394 poles were installed on the distribution system, including poles installed as part of the Inspection and Maintenance program and for other reasons such as new business.

Figure 2-53 shows the Inspection and Maintenance program results specific to distribution wood poles, further broken down by codes considered to require replacement. There can be multiple codes recorded per pole. The total number of inspected poles where no maintenance codes were found is also shown.

Figure 2-53[8]
Distribution Wood Poles Replace and Repair Codes

Level	Replace Codes			Repair Codes		
	Number of Poles	**Percent Codes vs. Inspections**	**Percent Completed**	**Number of Poles**	**Percent Codes vs. Inspections**	**Percent Completed**
2010 Summary						
1	22	0.01%	100%	4	0.00%	100.00%
2	2,124	0.91%	100%	149	0.06%	100.00%
3	5,893	2.53%	24%	1,589	0.68%	35.05%
No Codes	226,037	97%				
Total Poles Inspected	232,604					
2011 Summary						
1	13	0.01%	100%	7	0.00%	100.00%
2	3,048	1.23%	63%	689	0.27%	79.24%
3	1,684	0.68%	16%	1,206	0.48%	14.34%
No Codes	241,661	92%				
Total Poles Inspected	264,005					
2012 Progress to Date (6/30/2012)						
1	7	0.00%	100%	8		100.00%
2	3,232	1.98%	1.73%	473		6.76%
3	2,060	1.26%	0.48%	974		0.30%
No Codes	157,629	97%				
Total Poles Inspected	162,649					

Between January 1 and June 30, 2012, inspections were completed on 162,649 distribution poles, representing 13 percent of the population.[9] Based on inspection

[8] The replace codes used for this table are: 110 - Broken/Severely Damaged, 111 - Visual Rotting Ground Line, 113 - CU NAP Treated, 114 - Woodpecker Holes, 116 - Visual Rotting Pole Top, 801 - Osmose Priority Pole, and 802 - Osmose Reject Pole. The repair codes used for the report are the balance of pole codes available in the Distribution Field Survey Worksheet. The total number of poles inspected is per the June 30, 2012 PSC Quarterly Report, Inspections Summary Report, Distribution Unique Inspections, Units Completed Table. Separate Computapole query indicates poles that had no maintenance codes of any kind.

codes[10] approximately 5,299 poles (3%) are candidates for replacement over the next three years. The majority of the listed codes will not result in pole replacement. Multiple asset condition codes can be recorded for each pole.

9

10 Data source is Computapole Report 1030 from January 1, 2012 to June 30,2012 taking counts of the following maintenance codes considered as most likely resulting in pole replacement: 110 - Broken/Severely Damaged, 111 - Visual Rotting Ground Line, 113 - CuNap Treated, 114 - Woodpecker Holes, 116 - Visual Rotting Pole Top, 801 - Osmose Identified Priority Pole, and 802 - Osmose Indentified Reject Pole.

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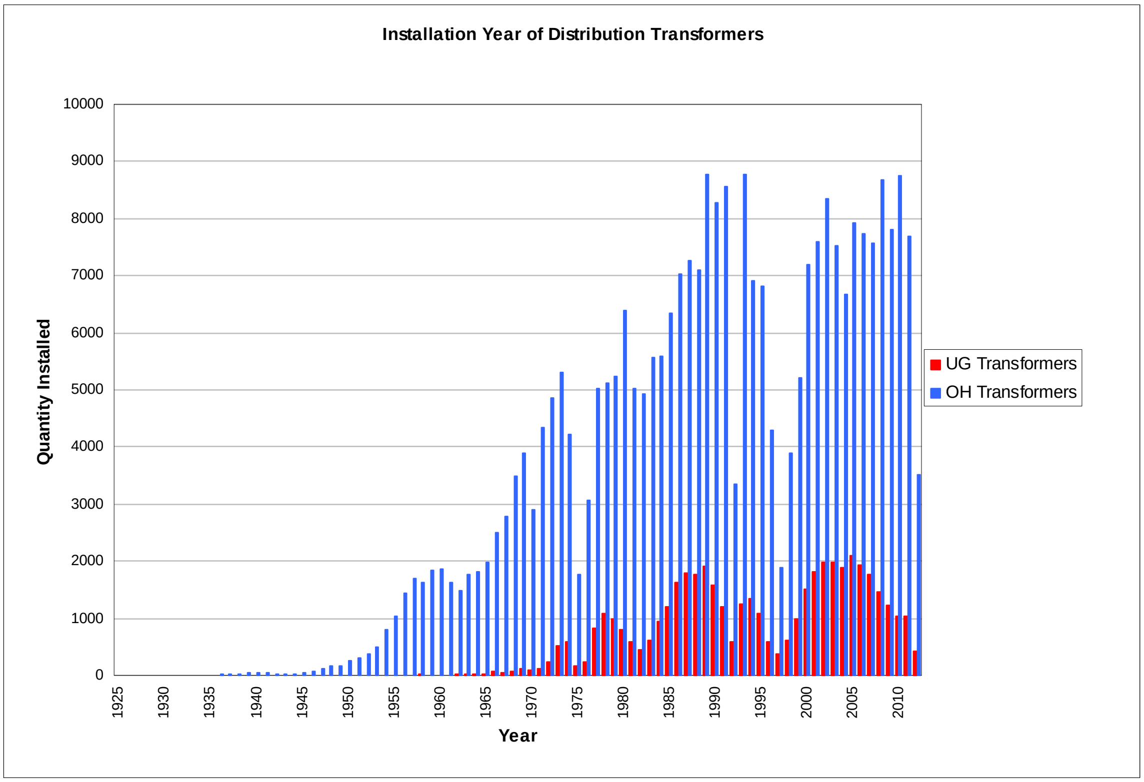
Distribution Overhead and Padmounted Transformers

As shown in Figure 2-48, there are approximately 332,000 overhead and 67,000 padmounted transformer locations. Figure 2-54 shows the installation year profile data for overhead and underground distribution transformers on a per unit basis. The average age of overhead transformers is 23 years for the 70 percent of transformers with age data. The average age of underground transformers is 17 years for the 57 percent of transformers with age data. The term underground transformers includes padmounted transformers and transformers located in manholes.

Figure 2-54
Age Profile of Distribution Transformers[11]



Condition and Performance Issues

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

Remedial Actions Performed

Remedial action performed as part of the Inspection and Maintenance program is contained in Exhibit 3. Figure 2-55 shows program results specific to distribution

[11] A total of 88,077 overhead transformers and 19,976 underground transformers without age data are not shown. Transformers with installation dates prior to 1925 are included as without age data.

overhead transformers, further broken down by codes considered to require replacement.

Figure 2-55[12]
Distribution Overhead Transformer Replace and Repair Codes

	Replace Codes		Repair Codes	
Level	Number of Codes	Percent Codes Completed	Number of Codes	Percent Codes Completed
2010 Summary				
1	3	100%	0	100.00%
2	195	100%	9,727	100.00%
3	56	26%	1,702	56.99%
2011 Summary				
1	2	100%	0	100.00%
2	217	58%	7,905	83.52%
3	0	100%	1,702	46.65%
2012 Progress to Date (6/30/2012)				
1	4	100%	0	100.00%
2	83	0%	6,619	6.63%
3	0	100%	1,574	9.21%

The majority of the Priority Level 2 and Priority Level 3 maintenance codes reported were for 157 - Improper or Missing Bond, and 156 - Non Standard Installation, respectively.

In addition to the Inspection and Maintenance program, the Distribution Line Transformer Upgrade program replaces overloaded transformers. Figure 2-56 shows the quantity of replaced transformers by division.

Figure 2-56
Distribution Line Transformer Upgrade Program
July 1, 2011 to June 30, 2012

Division	Funding Project	Quantity Replaced
East	C15828	429
Central	C14846	370
West	C10967	397

As shown in Figure 2-65, 9,345 overhead distribution transformer units were installed under various programs such as Inspection and Maintenance, Distribution Line Transformer Upgrade and new business activities. Figure 2-65 also shows that 1,127 padmounted transformer units were installed.

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

Conductors

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

Condition and Performance Issues

From January 1, 2012 through June 30, 2012, approximately 4,706 circuit miles were inspected. In Exhibit 3, the Distribution Overhead Facilities, Conductor, Primary Wires/Broken Ties heading summarizes the results of the Inspection and Maintenance program for primary conductor. In 2012, the majority of the Priority Level 1 maintenance codes (92%) were for 127 - Primary on Crossarm. Priority Level 2 maintenance codes were typically for 145 - Primary - Damaged Stirrups/Connector (50.95%) and 141 - Damaged Conductor/Broken Strands (20.38%). Priority Level 3 maintenance codes were typically for 146 - Improper Sag (62.5%) and 141 – Damaged Conductor/Broken Strands (37.5%).

Figure 2-57
Recorded Maintenance Codes Per Circuit Mile Inspected

Year	Circuit Miles Inspected	Percent of System	Conductor Codes[13]
2010	7,244	18.96%	1,579
2011	7,140	18.69%	1,388
2012 (to 06/30/12)	4,706	12.31%	862

Remedial Actions Performed

Remedial actions performed as part of the Inspection and Maintenance program are provided in Exhibit 3. As shown in Figure 2-65, a total of 177 circuit miles of new conductor was installed on the distribution system, including conductor installed as part of the Inspection and Maintenance program, the Engineering Reliability Review program, the Planning Criteria program and new business. Specific projects completed under other programs are found in Figure 2-64.

Cutouts

There are approximately 187,000 cutout locations on the distribution system.

Condition and Performance Issues

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

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

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

In the past three years of the Inspection and Maintenance program, maintenance code 281 - Cutout Potted Porcelain was the majority (98%) of reported cutout related codes. The Priority Level 1 codes for 280 - Defective Cutout were at 45, 46 and 37 units in years 2010, 2011 and 2012 (through June 30) respectively.

Remedial Actions Performed
Remedial actions performed as part of the Inspection and Maintenance program are provided in Exhibit 3. As shown in Figure 2-58, the Inspection and Maintenance program has identified 15,999 potted porcelain cutouts from January 1, 2010 through June 30, 2012 and replaced 32% percent of them.

Figure 2-58
Potted Porcelain Cutout in the Inspection and Maintenance Program

	2010		**2011**		**2012 (through 06/30/12)**		**Total**	
Status	**Units**	**%**	**Units**	**%**	**Units**	**%**	**Units**	**%**
Replaced	1,113	15.37%	3,918	76.15%	154	4.26%	5,185	32.40%
Pending	6,126	84.62%	1,227	23.84%	3,461	95.73%	10,814	67.59%
Total	7,239		5,145		3,615		15,999	

Side Tap Fusing
In addition to the Inspection and Maintenance program, the Side Tap Fusing program adds additional fuses to the distribution system. Figure 2-59 shows the number of fuses added under the program. Prior to FY13 (04/01/2012 – 03/31/2013), the side tap fusing program did not account for significant installations of new fuses. Thus far in FY13, 398 feeders have been reviewed and over 2,400 side tap fuse locations have been identified.

Figure 2-59
Side Tap Fusing Program
July 1, 2011 to June 30, 2012

Division	Funding Project	Quantity Installed
East	C15510	4
Central	C15511	38
West	C15509	247

Switchgear

There are approximately 3,100 switchgear on the system. Switchgear are generally in good condition with only a minimal number of issues discovered from the Inspection and Maintenance program.

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

Between January 1, 2012 and June 30, 2012, inspections were completed on an estimated 492 switchgear. There were two Priority Level 1 maintenance codes reported: (1) for 651 – Bollard broken/damaged and (1) for 652 – Base Broken/Damaged. During that period, one Priority Level 2 maintenance code was reported: (1) for 651 - Bollard broken/damaged. There was also one Priority Level 3 maintenance code report for 740 – Enclosures – Base Broken/Cracked.

Remedial Actions Performed
Between January 1, 2012 and June 30, 2012, none of the Priority Level 2 and 3 work has been done. As shown in Figure 2-65, a total of 84 switchgear units were installed on the distribution system.

Capacitors

There are approximately 5,095 capacitor banks on the distribution system providing approximately 206MVAr of reactive support. Capacitor banks are in generally good condition based on the number of maintenance codes recorded during inspections.

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

Between January 1, 2012 and June 30, 2012, inspections were completed on an estimated 351 capacitor banks. Figure 2-60 shows the inspection results.

Figure 2-60
Capacitor Inspection Results

Level	Animal Guard Missing - 166	Improper / Missing Bonding - 165	LA Missing/ Blown - 167	Blown Fuse - 164	Missing Ground - 163	Total	Percent Complete
2010							
1	0	0	0	0	0	0	-
2	0	0	0	47	30	77	100.00%
3	545	68	51	0	0	664	24.84%
2011							
1	0	0	0	0	0	0	-
2	0	0	0	59	36	95	77.89%
3	546	36	53	0	0	635	37.79%
2012 Progress to Date (6/30/2012)							
1	0	0	0	0	0	0	-
2	0	0	0	41	23	64	6.25%
3	421	13	46	0	0	480	2.08%

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

Remedial Actions Performed
Figure 2-60 above shows the remedial action performed under the Inspection and Maintenance program. Capacitor maintenance is performed within the Inspection and Maintenance Program. Additionally, small capital projects are budgeted to address feeder level capacity and voltage support issues on the distribution system. As shown in Figure 2-65, a total of 157 capacitor units were installed on the distribution system, including those related to asset condition, feeder loading and voltage support.

Regulators/Reclosers/Sectionalizers

There are approximately 1,331 reclosers, and 2,222 voltage regulator locations on the distribution system. Reclosers and regulators are generally in good condition, with only a minimal number of issues identified in the inspection program.

Condition and Performance Issues

There are no unique headings for this equipment in Exhibit 3. The equipment is reported under various headings in the Distribution Overhead Facilities table.

An estimated 103 reclosers were inspected this calendar year through June 30, 2012. There was no Priority Level 1 maintenance code reported. There was one Priority Level 2 maintenance code for 192 – Missing ground wire. There were seven Priority Level 3 maintenance codes for 195 - Animal Guard Missing. Since 2010, there has been no Priority Level 1 maintenance code reported for reclosers. Since 2010, the majority of all maintenance codes are for 195 - Animal Guard Missing (47.93%) and 193 – Control Cab Height/Ground (42.97%).

An estimated 175 line regulators were inspected this calendar year to June 30, 2012. In 2011, only Priority Level 3 maintenance codes were reported: 105 instances for 176 - Animal Guard Missing, eight for 177 - LA Blown/Missing/Improper, and four for 175 - Improper/Missing Ground. This was consistent with past years, with 176 - Animal Guard Missing accounting for 64.74% of the maintenance codes reported for regulators.

Remedial Actions Performed

As shown in Figure 2-65, a total of 107 and 134 units of line recloser and line regulator were installed, respectively. These installations include reclosers installed as part of the Recloser Application Strategy to improve feeder reliability. Figure 2-61 shows reclosers installed as part of the Recloser Application Program by division.

Figure 2-61
Recloser Application Program
July 1, 2011 to June 30, 2012

Division	Funding Project	Quantity Installed
East	C13266	30
Central	C13267	23
West	C13268	22

Vegetation Management

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

The cycle pruning program, nearly two-thirds of the distribution VM budget, has a interval of approximately 5 years which is based on the length of the growing season, the growth characteristics of the predominant tree species and the amount of pruning clearance to be obtained. National Grid schedules the distribution circuit vegetation pruning maintenance using this cycle and adjusts for actual field growth conditions to yield an average 5 year cycle with a range of circuit schedules from 4 to 6 years.

Stable and consistent circuit pruning provides a measure of reliability maintenance and is also important in maintaining public safety regarding climbable trees and tree/wire contact risks. In addition, consistent circuit pruning improves line crew accessibility therefore improving efficiency in restoration and maintenance and in addition enhances the accuracy and efficiency of the line inspection process.

National Grid's hazard tree program uses tree interruption prediction modeling based on historic tree interruption data. This model takes into account customers served, events per three phase mile, customers interrupted per event and cost to reduce the number of customers interrupted. The ranking provides a primary listing of circuits which are then field reviewed by arborists to develop a final list of circuits expected to provide the most efficient and effective response to the mitigation. Once a circuit is chosen an industry leading risk ranking assessment protocol is utilized to divide the circuit into prioritized segments based on number of customers served. Hazard tree inspection intensity is then applied to the circuit segment accordingly. For example, within the main line portion of the circuit where future tree failures may cause a station breaker operation (lock-out) for the entire feeder, the highest inspection intensity is performed. For 2011, hazard tree mitigation work was performed on 38 poor performing circuits.

Underground System Assets

National Grid's underground distribution system includes primary and secondary cables, secondary network cables, network protectors and transformers, manholes, vaults, and handholes. The Inspection and Maintenance Program inspected 10,537 unique underground facilities between January 1, 2012 and June 30, 2012.[14] Items inspected include the condition of the underground structures themselves, and the condition of equipment within the structure, such as cables, splices, and network protectors. Padmounted transformers and switchgear are inspected with the overhead system and are discussed in the Overhead System Assets section above. Network system assets, a small portion of the underground system, are detailed in a separate section below.

Primary Underground Cables

There are approximately 7,350 circuit miles of distribution cable in the distribution system. The underground distribution system consists primarily of paper-insulated lead-covered (PILC) and ethylene propylene rubber (EPR) type cables. There are also some cross-linked polyethylene (XLPE) type cables in the underground system. Planned cable replacements are driven by cable condition and performance history. Though actual cable life can vary widely, the Company generally expects distribution cables to have a nominal life expectancy of 40 years.

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

Remedial Actions Performed
Remedial action performed as part of the Inspection and Maintenance program is shown in Exhibit 3, Distribution Underground Facilities. Figure 2-64 shows completed underground system projects. Figure 2-65 shows that 251 circuit miles of underground cable were installed for various reasons including new business.

[14] PSC Quarterly Report, Inspections Summary Report, Underground Facilities - Unique Inspections, Units Completed Table (June 30, 2012).

Buffalo Streetlight Cable Replacement

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

Condition and Performance Issues
Elevated Voltage Testing has identified contact voltage incident rates that are two to twenty times the rates measured in other areas in the Company's service territory.

Remedial Actions Performed
Spot repairs have only marginally reduced the incident rates. In consideration of the root cause, a pilot was conducted to replace cable on a portion of a poor performing street light circuit. Following completion of the pilot project, test results revealed no incidents of elevated voltage.

Manholes, Vaults and Handholes

There are an estimated 12,000 manholes, 1,800 vaults and 71,000 handholes in the underground system.

Condition and Performance Issues
There were 1,567 manholes and 24 vaults inspected from this calendar year through June 30, 2012. The results of the Inspection and Maintenance program can be found in Exhibit 3, Distribution Underground Facilities.

In 2012, all Priority Level 1 maintenance codes were completed as follows: 30 instances for 600 - Handhole Broken/Damaged, one for 625 – Manholes – Secondary Needs Repair; and two for 621 Manhole Ring/Cover Repair/Replace. This type of work is consistent with past results. As noted below, a significant amount of work was completed during inspection and listed as Priority Level P - performed during inspection.

Up to June 30, 2012, 909 Priority Level 2 maintenance codes have been reported as follows: 139 instances for 600 - Handholes Broken/Damaged; 461 for 610 - Manholes Ground Rods Missing, five for 611 - Manhole Cable/Joint Leaking; 38 for 612 - Manhole Cable Bonding/Grid Defective; 52 for 616 - Manhole Improper Grading, 212 for 620 - Manhole Rerack, one for 685 – Transformer – Pad Broken/Damaged, and one for 705 – Vaults – Damaged/broken ladder. Approximately 1.8% of Level 2 work has been completed.

Remedial Actions Performed
Remedial work performed as part of the Inspection and Maintenance program can be found in Exhibit 3. Up to June 30, 2012, 447 maintenance codes were considered Priority Level P and performed during inspection. These included the following significant issues: one for 611 - Manhole Cable/Joint Leaking and six for 612 - Manhole Cable Bond/Grid Defective. The majority of Level P repairs performed during inspections involved replacing nomenclature on manholes and handholes.

Network Systems

National Grid's network system is not extensive; however, the system is diverse and spread out among many communities. Figure 2-62 lists the networks including location (City & Division), peak load, number of supply substations, substation names, number of supply feeders and number of network protectors (on Grid or in Spot Networks).

Figure 2-62
Network Listing

City	Peak Load (MVA)	# of Supply Substations	Substation Names	# of Supply Feeders	# of Network Protectors	# of NWP on Grid	# of NWP in Spots	Last Updated	Last Studied
Buffalo (Broadway)	0.3	1	Seneca Terminal Sta	3	8	5	3	08/11/2009	No record
Buffalo (Elm St.)	109	1	Elm St.	16	280	160	120	08/11/2009	October 2008 Mark Boeing
Niagara Falls	0.3	1	Gibson	3	8	8	0	08/11/2009	No record
Albany	32	2	Riverside, Trinity	10	116	85	32	03/21/2012	April 2010 Dan Mungovan
Albany (34.5kV)	14.2	2	Riverside, Partridge	5	32	0	32	03/21/2012	April 2010 Dan Mungovan
Glens Falls	5.4	2	Glensfalls, Henry St.	4	12	12	0	03/21/2012	2000 E. A. Horgan Jr.
Schenectady	13	1	Front St.	5	54	45	9	03/21/2012	June 2000 Daniele D'Aquila
Troy	14	1	Liberty St.	8	37	33	4	03/21/2012	Dec 2008 & Jan 2009 Dan Mungovan, Marleny Lopez-Sanchez
Cortland	2.1	2	Cortland, Miller St.	3	11	11	0		No record
Syracuse (Ash St.)	32.3	1	Ash St.	10	130	92	38	12/01/2008	December 2008 Jason Austin
Syracuse (Temple St.)	20.3	1	Temple St.	7	76	24	52	10/01/2008	October 2008 Jason Austin
Utica	9.15	1	Terminal St.	4	36	25	11		Feb 2009 Draft Jason Austin
Watertown	4.9	1	Mill St.	5	24	22	2	01/01/2009	January 2009 Jason Austin

Condition and Performance Issues

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

Figure 2-63 contains a summary of the results from the Inspection and Maintenance System on two Network System assets: network protectors and network transformers.

Figure 2-63
Network System Assets Inspection Results

	Network Protector		Network Transformer				
Level	Barrier Broken - 630	Oil Leak - 632	Bushing Broken /Cracked - 635	Low Oil - 637	Oil Weeping - 642	Other[15] 633, 638, 639, 643	Total
2010 Summary							
1	-	-	-	-	-	-	-
2	1	-	1	2	2	2	8
3	-	-	-	-	-	-	-
4	-	-	-	-	-	49	49
P	-	-	-	-	-	8	8
Total	1	-	1	2	2	59	65
2011 Summary							
1	-	-	-	-	-	-	-
2	-	-	1	-	2	2	5
3	-	-	-	-	-	-	-
4	-	-	-	-	-	11	11
P	-	-	-	-	-	-	-
Total	-	-	1	-	2	13	16
2012 Progress to Date (6/30/2012)							
1	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-
3	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-

To June 30, 2012, 24 vaults had been inspected with no maintenance codes related to network transformers and protectors reported. Maintenance codes found were related to the vault structure and are included in the manhole and vault section above.

[15] Other maintenance codes are not expected to affect reliability: 633 Network Protector Worn/Damaged Gasket, 638 Network Transformer Missing Ground, 639 Network Transformer Missing Nomenclature, and 643 Network Transformer Rusted/Peeling Paint.

Network assets are typically inspected on a shorter cycle than required for the Inspection and Maintenance program. National Grid Standard Maintenance Procedure SMP421.01.2 currently requires extensive visual inspections of network protectors and transformers annually. Depending on the network protector style, diagnostic overhauls are required every two to five years including cleaning, adjusting, lubricating and replacing broken or worn parts. Network protectors are also operationally tested annually, with improperly functioning units replaced or repaired. According to an internal scorecard, 1,342 manholes and vaults were inspected so far in 2012, with many containing network equipment.

Remedial Actions Performed

Remedial action performed on vaults containing network equipment is covered above in the Manholes, Vaults and Handholes section. Work specific to network vaults include replacing nine vault ceilings this calendar year. Also so far this calendar year, 19 network protectors and 16 network transformers have been replaced.

Arc Hazard Analysis

The 2012 edition of the National Electrical Safety Code requires an arc flash hazard analysis for work assignments within distribution secondary network systems. The Company has completed the required analysis and has recommended the installation of engineering controls to mitigate the calculated incident energy levels within 480 volt spot network installations. The program is scheduled to address all 480 volt network protectors within a five year period, starting in fiscal year.

Completed Distribution Projects and Installations, July 1, 2011 – June 30, 2012

Completed distribution projects and distribution equipment installed from July 1, 2011 to June 30, 2012, can be found in Figures 2-64 and 2-65, respectively.

Figure 2-64
Completed Distribution Projects July 1, 2011 to June 30, 2012

Division	Funding Number	Project Name	Program or Strategy
Central	C15727	06326 NR-Gilpin Bay 95661-Fish Creek Pond	ERR
Central	C15910	06171 Madsion 71 5kV Rebuild	Capacity Planning
Central	C27850	06843 VA Hospital Upgrade	New Business
Central	C28616	06874 Walesville Reconductor Utica St	Conductor Replacement
Central	C28622	06438 Poland Convert Old State Rd Rd	Capacity Planning
Central	C31177	06662 St. Joe's Underground Relocation	New Business
Central	C31554	05740 DOT PIN3045.55 Rt104 Osw-Scriba	Public Requirements
Central	C34547	06316 NR-Brasher 85162-Maple Ridge Rd-VC	
Central	C34802	06307 NR_81652_RogersCrossingRd_Rebuild	
Central	C34803	06305 NR_81652_CoRte26_StepDown	ERR
Central	CD0015	06696 SU Hill Area Upgrades	New Business
Central	CD0039	09413 Lighting Improvement City of Utica	S or R Other
Central	CD0056	09420 NR-T.I.81458-Carnegie Bay Road-Overloaded Ratio	Capacity Planning
Central	CD0091	11079 Milton Ave 58 - Voltage Improvement	
Central	CD0101	11106 Duguid 54 - Orchard Ratio Relief	
Central	CD0106	11089 NR-Lowville Area Feeder Tie Upgrade	
Central	CD0114	11073 NR-McAdoo 91451 V/O Heuvelton-Conversion	
Central	CD0123	11155 DOT Beverly Dr / W. Genesee St., T. Camillus	
Central	CD0158	11241 MV - Fulmer Creek Rd Relocate	
Central	CD0165	11305 Wine Creek 54 - Install Regulators	
Central	CD0182	09776 Rathbun-Labrador Phase 2 DxD	
Central	CD0192	11391 Eagles Ridge URD Section 4, Evans Mills, NY	
Central	CD0195	11419 DOT Murphy Rd, little Falls	
Central	CD0235	11418 Stevedore Lofts LLC	
Central	CD0241	11377 CR_LHH 06141_NYS Route 13_Rebuild	
Central	CD0250	11608 Country Oaks URD, Section 4 - Warners, NY	
Central	CD0262	11524 CR-Fingerlakes East Business Park	
Central	CD0264	11600 MV Humphrey Rd Rebuild	ERR
Central	CD0283	11810 DOT Genesee St/Oneida Sq. Utica	
Central	CD0285	11509 Euclid 26754 Reconductoring	
Central	CD0295	12787 Lowe's Home Improvement Center, Cortland, NY	
Central	CD0296	12729 CR-Replace regulators on Phoenix 65	
Central	CD0300	12744 MV - Frankfort 67761 - Replace R610	
Central	CD0302	12803 Kildare Meadows URD, Brewerton, NY	New Business
Central	CD0333	11832 Onondaga Lake Pkwy - UG St Light Circuit Rebuild	S or R Other
Central	CD0334	12882 Faith Ridge URD - Baldwinsville, NY	New Business
Central	CD0345	13335 DOT W. Genesee@ Erie Blvd W. UG Dist relocation	
Central	CD0358	11354 East Norfo k 91361 line reconductoring	Capacity Planning
Central	CD0361	15730 DOT Lemoyne Av & Factory Av OH relocation	New Business
Central	CD0381	17179 CR-Replace Belmont 51 Damaged Getaway C	
Central	CD0426	17286 CR-Autum Ridge URD replacement	
Central	CD0445	17320 Birdseye Rd, Illion	
Central	CD0449	17335 Newbury Woods URD	
Central	CD0478	15739 NR_Dexter_72661_NYSHwy189_Rebuild	
Central	CD0511	17668 North Clay Apartments - Clay, NY	
Central	CD0626	17915 Riverwalk URD, Section 1 - Brewerton, NY	
Central	CD0633	17925 NR_T.I.81458-CoRt13-Overloaded Step-down	
Central	CD0673	12847 Arnold Regulator Installation	
Central	CD0707	17612 Lighthouse Hill - Feeder Metering	
Eastern	C06698	05547 Clinton 53 - Convert Ft Plain	ERR

Division	Funding Number	Project Name	Program or Strategy
Eastern	C18991	06441 Port Henry 51 - Convert Westport	ERR
Eastern	C18991	06441 Port Henry 51 - Convert Westport	ERR
Eastern	C18991	06441 Port Henry 51 - Convert Westport	ERR
Eastern	C21511	05747 DOT Queensbury Exit 18	Public Requirements
Eastern	C28022	06735 Sycaway-add new feeders	Capacity Planning
Eastern	C28023	06527 Reynolds Rd - add new feeders	Capacity Planning
Eastern	C28288	05474 Canajoharie 03124 Clinton Rd	AC Other
Eastern	C28837	05475 Canajoharie D-Line Work	AC Other
Eastern	C29433	06054 Inghams 51 - Route 108	ERR
Eastern	C30944	06452 Queensbury 56 - Twicwood URD	Cable Replacement
Eastern	C31598	06293 North Troy - Install Feeder Getaway	Capacity Planning
Eastern	C31992	05535 Chestertown 52 - Palisades Rd	Capacity Planning
Eastern	C32286	05749 DOT Saratoga, Rte. 9P Bridge	Public Requirements
Eastern	C33908	06828 V2325 Albany NY Roof Replacement	Asset Condition I&M
Eastern	C33909	06829 V2326 Albany NY Roof Replacement	Asset Condition I&M
Eastern	C33910	06830 V2327 Albany NY Roof Replacement	Asset Condition I&M
Eastern	C33911	06840 V-6 Albany NY Roof Replacement	Asset Condition I&M
Eastern	C35083	06212 Middleburgh 52 - Kelsey Hill Road	AC Other
Eastern	C35271	09228 Warrensburg 51 - E Schroon River Rd	AC Other
Eastern	C35543	06877 Warrensburg 32152 - River Rd - JPP	ERR
Eastern	C35725	06593 Scofield 53 Warrensburg Stony Creek	ERR
Eastern	C36058	05732 DOT PIN 1757.15 Reconstruction of B	Public Requirements
Eastern	C36191	06408 Otten F41213 - Cat Den Poles Reloc.	AC Other
Eastern	C36567	06126 Liberty 9453 relief 2011	Capacity Planning
Eastern	C36703	05584 Corinth 52 - Main St Gap Closing	ERR
Eastern	C36841	07010 Railroad Place Pole Relocation	New Business
Eastern	C36852	07012 SCCC Street Light Replacments	S or R Other
Eastern	C36852	07012 SCCC Street Light Replacments	S or R Other
Eastern	CD0012	06989 DOT PIN 2125.15 Route 30 over CSX	Public Requirements
Eastern	CD0021	09280 Ellsworth Commons URD	New Business
Eastern	CD0054	09610 DOT PIN 1758.86 Glens Falls South St	Public Requirements
Eastern	CD0063	09605 City of Albany Rehabilitation of State Street between	Public Requirements
Eastern	CD0111	09347 Eastwyck Village Apartments	
Eastern	CD0119	11111 Spiney at Pondview Phase 1URD - Schodack, NY	
Eastern	CD0124	11125 Brook Road 55 - Convert Middle Grove Road	
Eastern	CD0126	11123 Whitehall 51 - Convert Route 4	
Eastern	CD0128	11065 Queensbury 54 - Rebuild Garrison Rd	
Eastern	CD0130	11120 Bridge St Amsterdam UG St Lighting	S or R Other
Eastern	CD0133	09343 Lake at Sylvan Way	
Eastern	CD0139	11166 Butler 51 - Route 32 Rebuild	
Eastern	CD0145	11184 Butler 51 - Gansevoort Road Rebuild (QRS #803679)	
Eastern	CD0153	11095 330 oakridge dr	
Eastern	CD0166	11207 Garbis Relocatiion of Facilities	
Eastern	CD0209	11490 Inman 37055 -- Lisha Kill Road Conversion (4.	Capacity Planning
Eastern	CD0214	11420 URD- Preserve at Timber Creek	
Eastern	CD0233	11542 Karner 31717 -- Central Ave Conversion (Adding Load to Ruth Road 38152)	
Eastern	CD0234	11543 Orchard Creek URD- phases 3&4, Niskayuna, NY	
Eastern	CD0257	11591 NYS OGS Parking Lot Sheridan Ave (Elk)	
Eastern	CD0313	11537 CURRYTOWN ROAD	
Eastern	CD0338	13240 Newark 30057 - Continental Ave Conversion (4	

Division	Funding Number	Project Name	Program or Strategy
Eastern	CD0343	11510 Everett Rd 42052 - Wilkins Ave - Overloaded Ratio	
Eastern	CD0367	17082 Hidden Pond URD, Nassau, NY	
Eastern	CD0368	17080 Meadow Vista URD, Saratoga Springs	
Eastern	CD0369	15728 Ski Bowl Village URD Phase 1	
Eastern	CD0384	17192 The Gables at Delmar URD	
Eastern	CD0386	17188 Mill Hill Townhouses Phase I	
Eastern	CD0390	17182 Logistic One OH Line Extension & UGPrimary	
Eastern	CD0398	17184 Northway Mobile Home Park	
Eastern	CD0403	17216 Pastures URD, Phase 2 - Troy, NY	
Eastern	CD0404	13278 Hudson 08753 - Hudson Terrace Apartments - UG Cable Replacements	
Eastern	CD0429	17316 TechValley Flex Park UCD	
Eastern	CD0429	17316 TechValley Flex Park UCD	
Eastern	CD0457	17367 Kaydeross Village Phase 3	
Eastern	CD0457	17367 Kaydeross Village Phase 3	
Eastern	CD0457	17367 Kaydeross Village Phase 3	
Eastern	CD0494	17447 NERC Alert-Transmission Clearance to Catenary Crossing	
Eastern	CD0494	17447 NERC Alert-Transmission Clearance to Catenary Crossing	
Eastern	CD0499	17491 69kV tap to Florida Station	
Eastern	CD0499	17491 69kV tap to Florida Station	
Eastern	CD0501	17514 Bradford Point URD	
Eastern	CD0501	17514 Bradford Point URD	
Eastern	CD0502	17508 Partridge Hill Phase II URD	
Eastern	CD0502	17508 Partridge Hill Phase II URD	
Eastern	CD0546	17776 Weibel Apartments URD - Saratoga Springs, NY	
Eastern	CD0546	17776 Weibel Apartments URD - Saratoga Springs, NY	
Eastern	CD0548	17420 Rotterdam 13853 - Route 5S Conversion (4.16 / 13.2kV)	
Eastern	CD0548	17420 Rotterdam 13853 - Route 5S Conversion (4.16 / 13.2kV)	
Eastern	CD0607	17189 Parkside Estates Phase II URD	
Eastern	CD0607	17189 Parkside Estates Phase II URD	
Eastern	CD0705	18250 Spinney at Pond View: Schodack, NY	
Eastern	CD0705	18250 Spinney at Pond View: Schodack, NY	
Eastern	CD0794	18483 Saratoga County Fairgrounds Upgrade	
Eastern	CD0794	18483 Saratoga County Fairgrounds Upgrade	
Eastern	PPM ID 171	17131 School St-Watervliet #3/#4 T#6 & Mohawk River Retirement	
Eastern	PPM ID 171	17131 School St-Watervliet #3/#4 T#6 & Mohawk River Retirement	
Eastern	PPM ID 171	17131 School St-Watervliet #3/#4 T#6 & Mohawk River Retirement	
Eastern	PPM ID 171	17131 School St-Watervliet #3/#4 T#6 & Mohawk River Retirement	
Western	C22173	06373 NYS DOT Route 5	Public Requirements
Western	C26379	05283 Attica12-Rebuild,Xfer F1263 to 0158	Capacity Planning
Western	C27947	05404 Buffalo Station 23 Rebuild - Fdrs	Substation Indoor
Western	C27948	05438 Buffalo Station 43 Rebuild - Fdrs	Substation Indoor
Western	C29044	06152 Long Road 209 - New FDR 20954	Capacity Planning
Western	C30685	06875 Wal-Mart Sheridan Dr. - New Service	New Business
Western	C32280	06278 NIAGARA FALLS-RT. 104-Lewiston Rd.	Public Requirements
Western	C32413	06756 Tonawanda 4.16 kV 57 Recon UG Getaway	Capacity Planning
Western	C32850	05714 DOT 4098.04- Rt 98 & 238 Attica	Public Requirements
Western	C33928	05762 DOT-Distribution Town of Brockport	Public Requirements
Western	C35002	Town of Cheektowage-333 MV/HPS Conv	S or R Other
Western	C35767	05935 Genesee Agri-Business new UCD	New Business
Western	C35789	05760 DOT-Beebe Road Niagara County	Public Requirements
Western	C36462	South Park SL	

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Division	Funding Number	Project Name	Program or Strategy
Western	C36511	05857 Erie County IDA - Bethelhem Steel	Public Requirements
Western	C36512	Benderson Development - Walmart	New Business
Western	C36991	07014 Sheridan Drive SL	S or R Other
Western	CD0099	11104 Northview Section 2 - URD	New Business
Western	CD0132	11060 West Salamanca-Homer Hill 805 Rebuild - Distr bution Underbuild	AC Other
Western	CD0172	11243 NYS DOT 4031.09- Village of Medina	
Western	CD0175	11297 Colvin Estates URD Phase 1, Buffalo	
Western	CD0191	11415 mumford fdr. 5053 upgrade	
Western	CD0202	11471 Synergy Biogas Distribution Line Upgrades	
Western	CD0215	11470 Lighting Construction Town of Tonawanda	
Western	CD0253	11197 Buffalo Station 46 & 44 - F4672/F4468 Relief	Capacity Planning
Western	CD0265	11765 Vanadium Corp. - Niagara Falls, NY	
Western	CD0267	11755 Walmart - Relocation of Facilities, North Tonawonda, NY	
Western	CD0278	11746 Sunny Knoll Farm	
Western	CD0280	11507 Basom transformer relief Sum 2011	
Western	CD0298	11199 Buffalo Station 44 - F4472 Relief	
Western	CD0309	12802 Buffalo Lakeside Commerce Park UCD	
Western	CD0311	12751 USL Klein	
Western	CD0327	12876 Intergrow Greenhouse	
Western	CD0335	13274 Grand Park Vue VI URD (Havenwood LN)	
Western	CD0339	13207 E. Batavia F2851 - Load Relief (Overloaded	
Western	CD0341	11323 Getaway upgrade overloaded section	Capacity Planning
Western	CD0342	13198 Olean F3352 - Replace Overloaded Ratio Bank	
Western	CD0385	17180 Villas on Rensch URD	
Western	CD0405	12881 Street Light Install- Harrison Ave- Tonawanda	
Western	CD0407	17215 Orchard Grove Residence URD, Jamestown, NY	
Western	CD0471	17379 9778 Creek Road, Batavia	
Western	CD0479	17419 Buffalo Station 29 - F2968 Reconductoring	
Western	CD0485	17410 Buffalo Public School #17	
Western	CD0488	17446 Rebuild Wilcox St - Lamb Farms Inc	
Western	CD0571	17841 Villages at Mission Hills URD Phase 1, Hamburg	
Western	CD0573	17842 Havenwood URD Newstead, NY	
Western	CD0583	17485 Pine Ave Street Lighting - Niagara Falls	
Western	CD0602	17800 Huntley-Gardenville 79 Line-Dist Clearance CCC	
Western	CD0602	17800 Huntley-Gardenville 79 Line-Dist Clearance CCC	
Western	CD0672	17858 Delevan 1161 Relief	
Western	CD0675	17900 Newtown Sewage Svc -Seneca Nation	
Western	CD0718	18224 Center Court - NF Street Lighting	
Western	CD0733	18337 Lafayette Hotel - Spot Network	
Western	CD0811	18616 Maple Rd Traffic Signals - Amherst, NY	
Western	CD0854	18681 Colvin-Highland UGSL Relocation	

Figure 2-65
Distribution System Overhead and Underground Equipment
Installed July 1, 2011 to June 30, 2012

Equipment	Project Type	Unit Quantity
Wood Poles	Blanket	9,507
(Units)	Program	4,051
	Specific	836
	Total	**14,394**
Overhead Transformers	Blanket	6,037
(Units)	Program	2,536
	Specific	772
	Total	**9,345**
Primary Conductor	Blanket	506,534
(Feet)	Program	163,884
	Specific	261,859
	Total	**932,277**
Capacitor Banks (1Ph/3Ph)	Blanket	105
Locations	Program	17
	Specific	35
	Total	**157**
Line Reclosers	Blanket	19
(Units)	Program	76
	Specific	12
	Total	**107**
Line Regulators	Blanket	114
(Units)	Program	0
	Specific	20
	Total	**134**
Switchgear	Blanket	48
(Units)	Program	0
	Specific	36
	Total	**84**
Primary Underground Cable	Blanket	965,104
(Feet)	Program	43,777
	Specific	316,313
	Total	**1,325,194**
Padmount/Sub/Net Transformers	Blanket	803
(Units)	Program	58
	Specific	266
	Total	**1,127**
Manholes and Vaults	Blanket	1
(Units)	Program	4
	Specific	43
	Total	**48**

Chapter 2 D. Distribution and Sub-Transmission Substations

This section addresses substations that contain Distribution or Sub-Transmission assets, beginning at the station level (i.e., those being rebuilt or replaced), and then addressing individual assets.

A summary of the equipment types and populations for key substation assets is provided in Figure 2-66. Figure 2-85 contains a listing of substation projects completed since the last asset condition report.

Figure 2-66
Substation Asset Inventory

Main Asset	Inventory
Substations	421
Circuit Breakers	3,978
Power Transformers	779
Batteries/Chargers	207
Surge Arresters	1,088
Sensing Devices	2,253
Voltage Regulators/Reactors	658
Capacitor Banks	60

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

Substation Equipment Assessments and Asset Condition Codes
The Company continues to use an approach across all substations which classifies substations by condition and impact codes as shown in Figure 2-67.

Figure 2-67
Substation Condition Codes

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

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

Indoor Substations

Indoor substations were built in the 1920s through 1940s and are considered obsolete. The outmoded design does not meet accepted safety practices such as guarding and the protection and control systems have been superseded by new technology. Some indoor substation equipment is also in poor and/or overloaded condition. There are 26 indoor substations in Buffalo, five in Niagara Falls, one in Brighton, one in Albany and one in Gloversville.

By law, the City of Buffalo has limited distribution voltage to 4.16kV. Distribution within the City is often backyard construction. Given the local requirements and cost of conversion, converting the load is not a preferred option. The Niagara Falls indoor substations are supplied from an underground 11.5kV system. That system and the substations that supply it are of the same vintage and poor condition as the indoor substations. Several 115-13.2kV substations and feeders have been constructed in the area, so conversion is an option being considered.

Condition and Performance Issues

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

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

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

- The existing protection scheme has limited the ability to connect some customer loads, cannot be upgraded, and must be replaced.
- Wear of 4.16kV breaker operating mechanisms has resulted in mis-operations.
- In some locations, transformer banks are overloaded and poor ventilation in transformer bays has led to transformer overheating.
- The 23kV substation supply is overloaded on contingency.
- Given the obsolete protection scheme and equipment, equipment failures can escalate leading to extended customer outages.

Remedial Actions Performed

Between July 1, 2011 and June 30, 2012, the Buffalo #43 substation rebuild has been completed. Seventeen Buffalo indoor substations have now been rebuilt.

Metal-Clad Substations

Metal-clad equipment is prone to water and animal ingress which leads to failures from moisture, dust or animals. V&O surveys help detect such degradation but do not identify poorly performing electrical equipment unless there is significant deterioration or failure, such identification being more likely with electro-acoustic detection techniques.[1] An initial review using this technique identified a number of locations for further action. For example, the North Troy substation was recently replaced after being identified using this technique.

Condition and Performance Issues

A further selection of metal-clad stations was assessed using electro-acoustic techniques leading to identification of deterioration at Ash Street, which is presently in engineering for replacement. Progress continues on Altamont Station 283 and Ash Street Station. Emmet Street Station, Hopkins Road Station 253, McCrea Street Station 272 and Chrisler Avenue Station 257 were assessed and identified for replacement.

Table 2-68 identifies those metal-clad stations which are of most concern with respect to performance and risk mitigation, and will either be replaced or retired.

Figure 2-68
Metal-Clad Substations with Performance Issues

Station ID	Station Description	Watch
NY09-1730	Market Hill Station 324	Cancelled; to be retired
NY08-0140	Ash Street	In progress
NY09-0100	Altamont Station 283	In progress
NY09-0930	Emmet Street Station	Conceptual
NY08-2690	Hopkins Road Station 253	Conceptual
NY09-0580	Chrisler Avenue Station 257	Conceptual
NY09-1780	McCrea Street Station 272	Conceptual

Overall, the use of the electrical partial discharge survey has been beneficial, with probable failures avoided and action plans in place for deteriorated equipment. The Company continues to evaluate metal-clad equipment via V & O inspections and Infrared Thermovision to provide base line information. Electrical partial discharge surveys are performed as needed for individual cases involving suspect assets.

Remedial Actions Performed

Replacement of North Troy substation metal-clad has been completed. The plan to replace the Market Hill Station 324 metal-Clad was re-evaluated based on recent flooding in the station. The new plan is to retire Market Hill Station and replace it with a new 115-13.2kV station on Maple Ave.

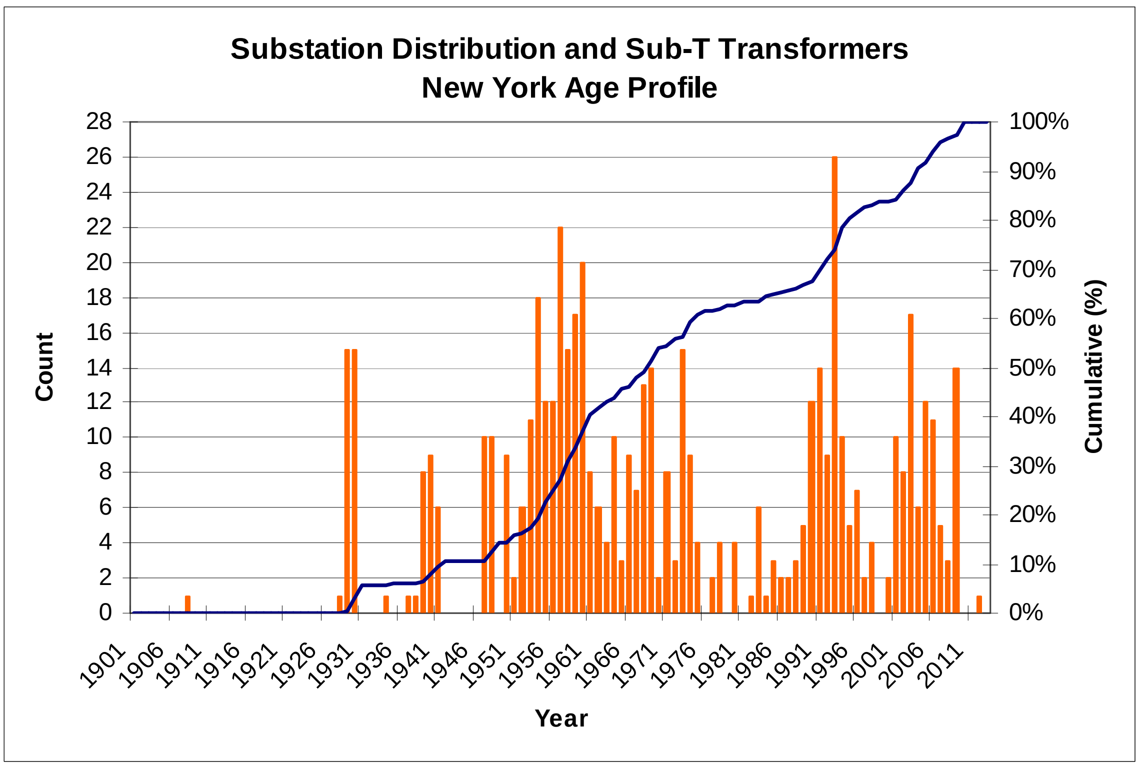
[1] A simple visual or thermovision inspection does not pick up issues with hidden insulation or surface tracking effects within the metal-clad. By using sensors to detect anomalous sound (acoustic) waves or electric signals in the metal-clad it is possible to detect equipment condition before it reaches a point to cause a failure.

Power Transformers

National Grid has 779 distribution power transformers plus 22 spares with primary voltages 69kV and below. The population of power transformers is generally sound, with some exceptions discussed in this section. Most power transformers range in size from less than 1MVA to about 20MVA and may have several MVA ratings depending on available cooling options.

The average age of the distribution power transformer population is 39 years, which is displayed in Figure 2-69. There are 230 power transformers greater than 50 years of age based on stored nameplate data. However, 29 percent of the total population of transformers have no year of manufacture indicated in the Cascade database, which implies that there may be a further 231 units greater than 50 years of age.

Figure 2-69
Age Profile of Transformers



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

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

Condition and Performance Issues

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

Figure 2-70 provides condition codes for 2011 and 2012 year-to-date based on this review. In 2012, ten transformers remain as condition code 4 due to elevated gasses, poor insulation test results, inadequate thermal capability and no known available spares. In addition, these units are mature in age and may be better served by replacement rather than maintenance or repair.

In comparison to 2011, two transformers were identified as condition code 3 based on deteriorated winding insulation and elevated gasses. One transformer was identified as condition code 2 due to a slight elevation in combustible gasses.

The No. 2 transformer at Station 082, Eleventh Street, was removed from service and replaced with a system spare. An animal contact resulted in a through fault which failed the transformer. Elevated gasses and diagnostic electrical tests confirmed failure of one phase of the high side voltage winding.

The No. 3 transformer at Station 082, Eleventh Street, was removed from service and replaced with a used spare as a temporary solution. During a high side bushing replacement, it was noted that the secondary bushing was damaged and leaking oil. These bushings are a 1937 cluster type design and no viable replacement was available. A new permanent transformer and system spare are presently being procured.

The No. 1 transformer at Station 83, Welch Street, suffered a bushing failure and was removed from service for a short duration until a suitable bushing replacement was found.

The No. 1 transformer at Delanson Substation failed unexpectedly due to a fault in the load tap changer (LTC). A mobile substation was installed as the emergency response, and a larger MVA transformer and system spare have been placed on order.

Figure 2-70
Condition Code of Transformers

Year	Code	1	2	3	4	Grand Total
2011	TRF	723	30	16	10	779
2012	TRF	720	31	18	10	779

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

Remedial Actions Performed

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

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

There were 55 transformers identified in the “watch list” in the 2011 Asset Condition Report. Fifty-five units remain on the present watch list, and an additional four have been added totaling 59 transformers to be watched. The condition issues associated with these units are as follows:

- Twenty-six units have deteriorated winding insulation. In addition, two are overheating, while four show signs of contamination in the oil and windings. Furthermore, nineteen of the twenty-six units are near their end of life being greater than 69 years of age.
- Twenty-three of the units have elevated combustible gasses. Two of the units are also overloaded, and three have contaminated windings. One unit has a hot spot, and another is wet and the insulation is thermally degraded. However, the gassing is stable on two of the twenty-three units, but they will continue to be monitored. One unit has issues with the Load Tap Changer (LTC).
- Eight units have elevated hydrogen. Hydrogen is an indicator of partial discharge. Three of the eight units also contain moisture and contaminated windings. Another unit is old and near its end of life.
- Two units contain moisture and show signs of contaminated winding insulation. One unit has mechanical deformation consisting of a wavy core and a loose yoke.

The 2012 transformer review identified 59 transformers to watch. A review of possible transformer spares and mobile capability has been performed and documented for the transformers on the list. In addition, the ability to perform field ties and operate units as an open delta on single-bank units with delta high side windings[2] is reviewed as a possible solution if a problem arises. Further, an increase in DGA sampling will occur, where needed, to closely monitor the transformer condition.

Figure 2-71 provides the current list of the 59 transformers that are on the “watch list”.

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

Figure 2-71
"Watch" List of Distribution and Sub-Transmission Transformers

Station Location	Equipment Description	MVA	Voltage	Age	Condition Code
Brighton Ave. Sta. 8	Bank 1	2	34.5-4.16 kV 2 MVA	79	4.00
Brighton Ave. Sta. 8	Bank 1	2	34.5-4.16 kV 2 MVA	79	4.00
Brighton Ave. Sta. 8	Bank 1	2	34.5-4.16 kV 2 MVA	79	4.00
Brighton Ave. Sta. 8	Bank 2	2	34.5-4.16 kV 2 MVA	79	4.00
Brighton Ave. Sta. 8	Bank 2	2	34.5-4.16 kV 2 MVA	79	4.00
Brighton Ave. Sta. 8	Bank 2	2	34.5-4.16 kV 2 MVA	79	4.00
Chrisler Avenue Station 257	2 LTC TRF	3	34.5-4.16 kV 3/3.65 MVA	52	3.00
Collins Station 83	1 LTC TRF	3.75/4.69	34.5-4.8 kV	29	2.00
Cuyler Station 24	Bank 1	0.2	34.5-4.16 kV .2 MVA	80	3.00
Cuyler Station 24	Bank 1	0.2	34.5-4.16 kV .2 MVA	80	3.00
Cuyler Station 24	Bank 1	0.2	34.5-4.16 kV .2 MVA	80	3.00
Cuyler Station 24	Bank 2	0.2	34.5-4.16 kV .2 MVA	80	3.00
Cuyler Station 24	Bank 2	0.2	34.5-4.16 kV .2 MVA	80	3.00
Cuyler Station 24	Bank 2	0.2	34.5-4.16 kV .2 MVA	80	3.00
Delmar Station 279	2 LTC TRF	11	34.5-4.8 kV 5/6.25 MVA	49	2.00
Eagle Harbor Station 92	1 TRF	2.5	34.5-4.8 kV 2.5 MVA D-D	?	3.00
East Syracuse	1 LTC TRF	6.3	34.5-4.16 kV 5/6.3 MVA	53	2.00
Elm Street Station	2 GRD TRF	22.5	23 kV 22.5 MVA	42	2.00
Elm Street Station	1 GRD TRF	22.5	23 kV 22.5 MVA	42	2.00
Fisher Avenue Station 270	1 LTC TRF	6.25	34.5-13.8 kV 5/6.25 MVA	39	3.00
French Creek Station 56	1 TRF	3.75	34.5-13.8 kV 3.75 MVA	36	3.00
Glens Falls Hospital Station 414	2 TRF	3.2	34.5-4.16 kV 2.83/3.2 MVA	35	2.00
Glenwood Station 227	1 LTC TRF	6.25	34.5-4.16 kV 5/6.25 MVA	49	3.00
Golah Station	3 TRF	7.5	69-34.5 kV 7.5 MVA	71	2.00
Hancock Station 137	1-TRF-A	0.5	34.5-4.16 kV .5 MVA	84	3.00
Hancock Station 137	1-TRF-B	0.5	34.5-4.16 kV .5 MVA	72	3.00
Hancock Station 137	1-TRF-C	0.5	34.5-4.16 kV .5 MVA	59	3.00
Hudson Falls Station 88	2 TRF	5	34.5-13.8 kV 5 MVA	21	2.00
Karner Station 317	2 LTC TRF	6.25	34.5-4.16 kV 5/6.25 MVA	75	2.00
Karner Station 317	1 LTC TRF	6.25	34.5-4.16 kV 5/6.25 MVA	50	2.00
Lenox Station 513	1 LTC TRF	6.25	13.2-4.16 kV 5/6.25 MVA	46	2.00
Liberty Street Sta 94	2 LTC TRF	5	34.5-4.16 kV 5 MVA	55	2.00
Lima Station	1 TRF	2.5	34.5-4.8 kV 2.5 MVA	52	2.00
McCrea Street Station 272	1 LTC TRF	3.75	34.5-4.8 kV 3/3.75 MVA	59	2.00
Mill Street Station 748	1 LTC TRF	6.25	23-4.8 kV 5/6.25 MVA	54	4.00
Mill Street Station 748	2 LTC TRF	6.25	23-4.8 kV 5/6.25 MVA	54	2.00
Mill Street Station 748	3 LTC TRF	6.25	23-4.8 kV 5/6.25 MVA	54	2.00
Miller Street Station 117	Bank 1	3.1	34.5-4.8	69	2.00
Miller Street Station 118	Bank 1	3.1	34.5-4.9	69	2.00
Miller Street Station 119	Bank 1	3.1	34.5-4.10	69	2.00
Newtonville Station 305	2 LTC TRF	5.6	34.5-4.16 kV 5/5.6 MVA	47	3.00
Oak Hill Station 62	1 TRF	2.5	34.5-4.8 kV 2.5 MVA		3.00
Rock City Station 623	4 LTC TRF	7	46-4.16 kV 5.6/7 MVA	55	4.00

Station Location	Equipment Description	MVA	Voltage	Age	Condition Code
Shore Road Station 281	1 LTC TRF	6.3	34.5-4.8 kV 5/6.25 MVA	52	2.00
State Street Station 954	1 LTC TRF	3.75	23-4.8 kV 3/3.75 MVA	55	2.00
State Street Station 954	2 LTC TRF	3.75	23-4.8 kV 3/3.75 MVA	55	2.00
Station 025	2 TRF	2.5	23-4.16 kV 2.5 MVA		2.00
Station 034	1 TRF	2.5	23-4.16 kV 2.5 MVA	79	2.00
Station 037	2 TRF	2.5	23-4.16 kV 2.5 MVA	79	2.00
Station 037	4 TRF	2.5	23-4.16 kV 2.5 MVA	81	2.00
Station 038	4 TRF	2.5	23-4.16 kV 2.5 MVA	79	2.00
Station 040	1 LTC TRF	4.8	23-4.16 kV 3.75/4.8 MVA	30	3.00
Station 056	3 LTC TRF	3.13	23-4.16 kV 2.5/3.13	53	4.00
Station 056	4 LTC TRF	2.5/3.1	23-4.16 kV 2.5/3.1 MVA	109	3.00
Station 057	2 LTC TRF	5.3	23-4.16 kV 3.75/4.2/4.7/5 MVA	36	2.00
Station 124 - Almeda Ave	4 LTC TRF	3.75	34.5-4.16 kV 3.75 MVA	47	3.00
Station 124 - Almeda Ave	2 LTC TRF	5.25	34.5-4.16 kV 5.25 MVA	47	2.00
Station 124 - Almeda Ave	1 LTC TRF	4.687	34.5-4.16 kV 4.687 MVA	47	2.00
Summit Station 347	1 TRF	10.5	69-4.8 kV 7.5/8.4/10.5 MVA	40	2.00

Programs are in place to replace substation power transformers. Of the 59 transformers identified to be watched, all have been prioritized for future replacement or retirement based on condition and risk. Figure 2-72 describes transformers that will be addressed within five years.

Figure 2-72
Transformers to be Replaced or Retired within Five Years

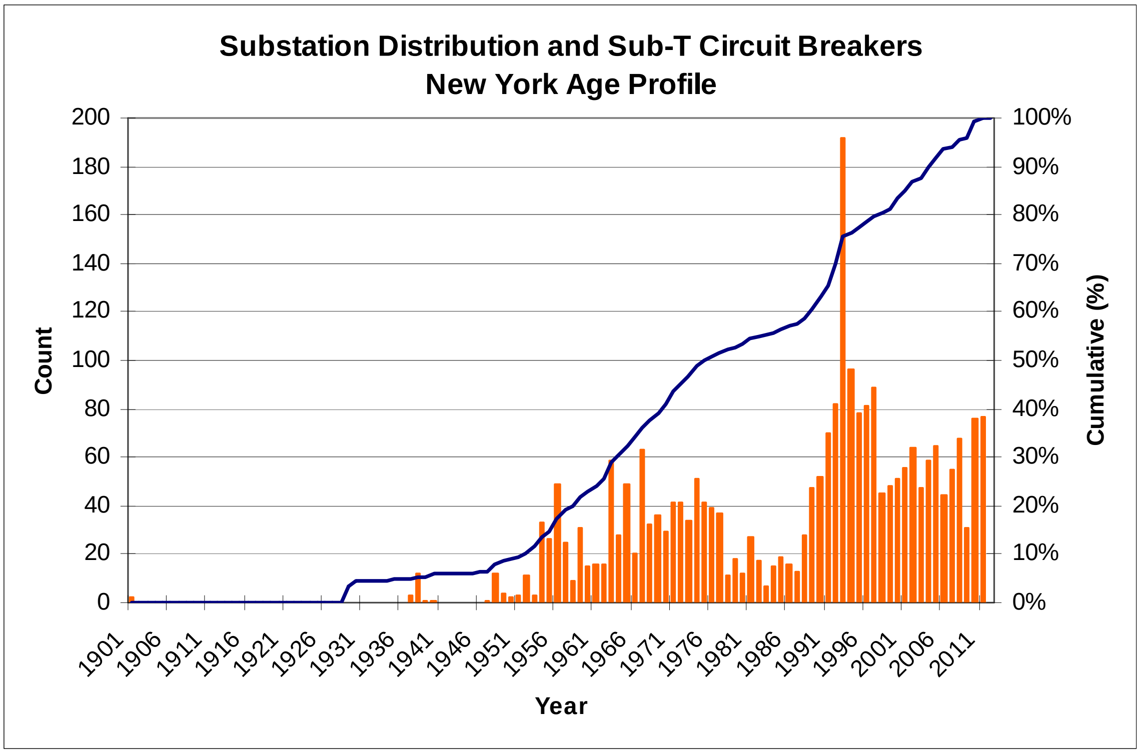
Station Location	MVA	Status
Fisher Avenue Station 270	6.25	Preliminary Engineering
Cuyler Avenue Station 24 (Qty 6)	2	Conceptual Engineering
Brighton Avenue Station 8 (Qty 6)	2	Preliminary Engineering
French Creek Station 56	3.75	Preliminary Engineering
Elm Street Station	22.5	Procure Spare
Station 56 (Qty 4)	2.5	Preliminary Engineering
McCrea Street Station 272	3.75	Conceptual
Delmar Station 279 (Qty 2)	5	Conceptual
Hudson Falls Station 88	5	Conceptual
Hancock Station 137 (Qty 3)	0.5	In Progress

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

Circuit Breakers

National Grid has 3,978 circuit breakers and 154 spares on the distribution system, with an average age of 33 years as shown in Figure 2-72. The substation circuit breaker population is generally sound and reliable; however, there are certain units which will be addressed as described below.

Figure 2-73
Age Profile of Circuit Breakers



Condition and Performance Issues

There are relatively few gas circuit breakers (GCB) in the breaker population, but similar numbers of Air Magnetic Circuit Breakers (AMCB), Oil Circuit Breakers (OCB) and Vacuum Circuit Breakers (VCB) as shown in Figure 2-74. This analysis includes breakers and reclosers.

Figure 2-74
Breakers Types

Breaker Type	Percentage of Total Population 2011	Percentage of Total Population 2012
AMCB	25.5%	24.2
GCB	3.6	3.7
OCB	28.6	28.4
VCB	38.9	43.7

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

Breaker condition coding was based on engineering experience and supported by discussion with local operations staff and Subject Matter Experts (SMEs). Condition codes have been applied to the operating population as shown in Figure 2-75.

Figure 2-75
Condition Code of Circuit Breakers

Condition Code	1	2	3	4	Grand Total
2011	2162	1662	161	0	3,985
2012	2155	1717	106	0	3,978

The decrease in Code 3 breakers reflects the approach to particular asset families described below.

Actions Performed
Eighty-one breakers have been added to the system or replaced since the last report.

Certain types of breakers with condition codes 2 and 3 are targeted for replacement/refurbishment over the next ten years due to either obsolescence or poor performance, and are listed in Figure 2-76. Since there are many General Electric Type AM breakers of various condition codes, these breakers are reviewed annually for replacement.

In addition, the following quantities of the targeted breakers were removed from the system

- Thirty-six Condit
- Seven Federal Pacific
- Two General Electric Type VIR
- Sixty-six Air Magnetic Circuit Breakers (GE Type AM; WE Type DHP; and ITE Type HK)
- One McGraw Edison Type VSA

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

Figure 2-76
Circuit Breakers to be Replaced/Refurbished

Type or Family	Quantity	Average Age (Years)
Condit (Code 3)	0	N/A
Federal Pacific (Code 3)	12	53
General Electric Type AM –(Code 2)	37	44
General Electric Type VIR (Code 3)	0	N/A
ITE Type HK –(73 Code 2, 28 Code 3)	101	46
ITE Type KS (Code 2)	38	41
McGraw-Edison Type VSA (Code 2)	1	21
Westinghouse Type DHP (Code 2)	98	44
Other (Code 3)	11	43

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

Protection and Controls

Relays Condition

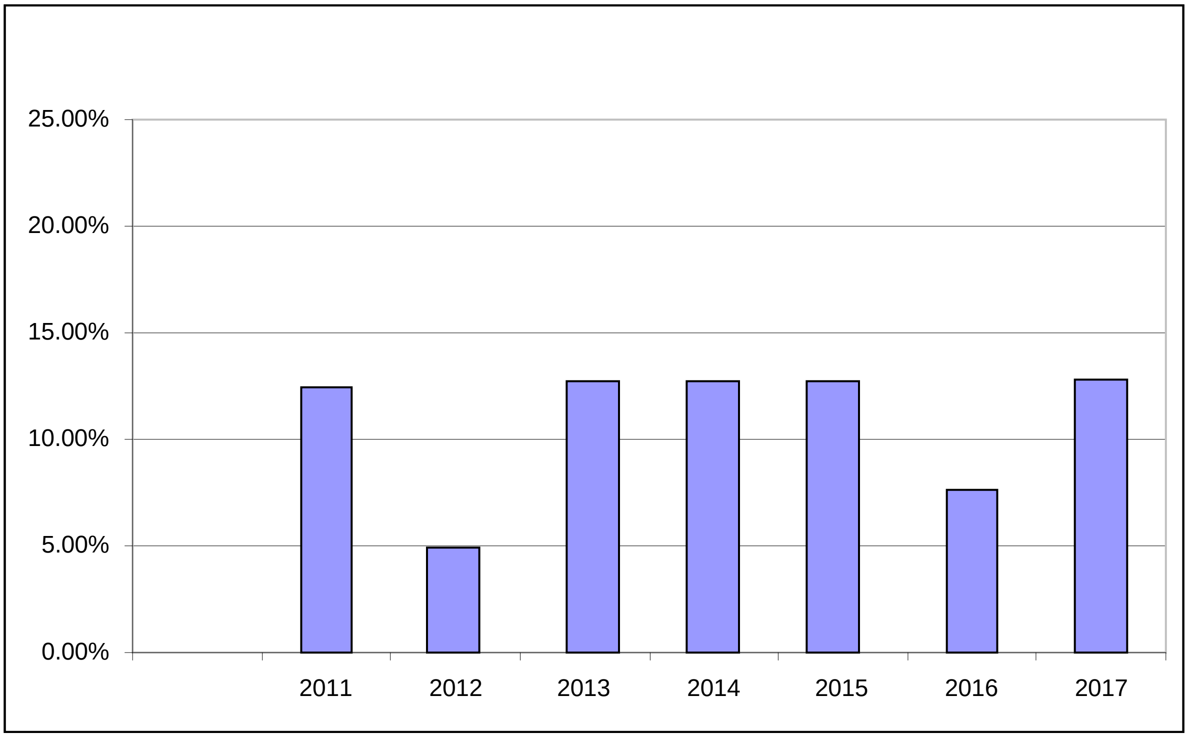
The following figure indicates the number and type of relays currently installed on the sub-transmission and distribution systems.

Figure 2-77
Sub-Transmission and Distribution Relay Inventory

Class	Sub-Transmission	Distribution
Electro-mechanical	6,002	11,792
Microprocessor	929	1830
Solid State	60	332

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

Figure 2-78
Forecasted Percent of Relay Population to be Tested (by Year)



The 2012 data shows testing through part of the year. The Company expects to complete testing on an additional 5% of relays during the remainder of 2012.

Actions Performed
As explained in 2010, National Grid has completed an assessment of existing protective relaying and substation control systems considered critical.

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

In summary, National Grid's protection and control systems rely on older technologies which have created issues in the operation of the system. With the advent of digital technologies, facilities can be upgraded to gain greater capability and increased reliability. We have identified the worst performers and are currently working on remedial actions.

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

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

Installation of Remote Terminal Units (RTUs)

Currently, 43 percent of the 421 New York distribution substations have SCADA. The total number of additional stations that need SCADA in New York is estimated to be 155. Five RTU installations and one upgrade have been completed at the following substations:

- New Krumkill #421
- Selkirk #149
- Middleburgh #390
- Butternut #255
- Lehigh #669
- Liberty Street Station

Engineering has been completed, and installations planned in New York to install remote terminal units (RTU), wiring, control, and data acquisition capability at the substations listed below:

- Richmond #32
- Barker #78
- Chautauqua #57
- Clinton
- Station #127 – Delaware Rd
- Schuylerville #39
- Indian Lake
- French Creek
- Niles
- Ballina
- Station 68 Elmwood
- Station 124 Alameda
- Madison
- Wolf Road

Engineering is completed at Glenwood #277, but the RTU installation is on hold due to operational issues at this station. RTU installations and expansions are incorporated into the workscope of larger substation projects.

Obsolete Remote Terminal Units (RTUs)

There are approximately 550 operating RTUs under the Company's control, of which 158 transmission and distribution units are being replaced under an ongoing RTU replacement program (SG002). To date 96 projects are complete and 21 either in engineering or waiting to be installed.

See Section A (Transmission), page 2-58 for more information on RTU replacements.

Batteries and Chargers

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

Figure 2-79 provides current condition codes for the battery population.

Figure 2-79
Condition of Battery Population

COND	1	2	3	4	Grand Total
BATT	154	33	20	0	207

Actions Performed
Seven station batteries and chargers have been replaced since the last report.. Thirty-one batteries have been decommissioned since the previous report.

National Grid has a battery replacement policy requiring the replacement of all battery sets that are 20 years old, or sooner if warranted based on battery condition determined through testing and inspection per National Grid Substation Maintenance standards. The 20 year asset life is based on industry best practice and experience in managing battery systems.

Where needed, the battery charger is replaced at the same time as the battery system.

Other Substation Assets

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

Substation Structures and Foundations

Generally substation structures are sound, but some significant issues at particular stations may be identified and require remedial action.

Surge Arresters

There are no significant issues with relation to surge arresters in distribution substations.

Cap-Pin Insulators

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

Sensing Devices

The term sensing devices is used to identify current transformers (CTs) and Voltage Transformers (VTs) / Potential Transformers (PTs). As indicated in Figure 2-80 below, the population of sensing devices has remained fairly static at approximately 2,240 units, and are generally in good condition.

Figure 2-80
Condition Codes of Sensing Devices

TYPE	1	2	3	4	Grand Total
2011	1,833	412	0	0	2,245
2012	1837	260	152	0	2,249

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

GE Type Butyl PTs and CTs that are more than 30 years old are replaced when the opportunity arises as they are known to be less reliable than the general population. However, GE Type Butyl PTs rated 34.5kV and 23kV have been identified and prioritized for replacement due to recent failures. There are 152 identified GE Type Butyl PTs at these voltage ratings.

Capacitor Banks and Switches

Figure 2-81 provides the distribution capacitor bank population, showing that the bulk of the population is in good condition. A capacitor bank was replaced at Station 88 Youngstown due to a station rebuild.

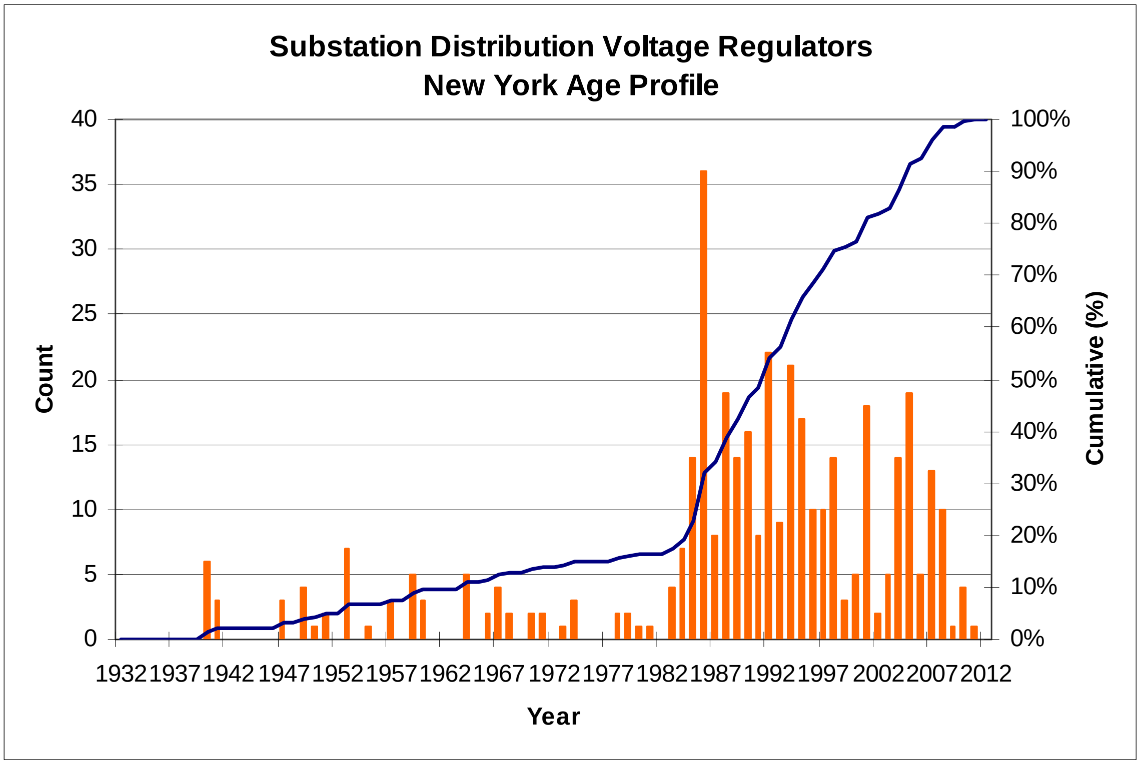
Figure 2-81
Capacitor Bank Condition Code

TYPE	1	2	3	4	Grand Total
CAP	60	0	0	0	60

Reactors and Regulators

Regulators and reactors provide voltage control and power flow management capability. There are approximately 638 regulators, and 143 spares in distribution and sub-transmission substations. The average age of the operating regulator population is 28 years, however 38% do not have an age, therefore, the average age may be older. The regulator age profile is shown in Figure 2-82 below).

Figure 2-82
New York Regulator Age Profile



There are approximately 20 air-core substation reactors. Eight are five years old and the remaining reactors are much older, but are missing age data information due to the fact that manufacturers did not provide manufacture dates on their nameplates on older units. In addition, reactors with a concrete base tend to be more than 40 years old.

Condition and Performance Issues

Regulators of specific manufacturer and design that are considered to be less reliable are listed in Figure 2-83. There has been a high failure rate of Siemens JFR regulators purchased between 1988 and 1993. The most common failure mode is burning and failure of the moveable or stationary contacts. The General Electric IRS and IRT Induction regulators and the Westinghouse IRT regulators also have known switching problems, parts are obsolete, and are less likely to sustain a through fault when compared to more modern type regulators.

Voltage regulators are monitored via V&O inspections and infrared surveys. Other problematic regulators may be identified from these inspections and PIW submission.

Figure 2-83
Voltage Regulator Types

Manufacturer	Type	Count
Siemens	JFR (Code 2)	11
GE	IRS/IRT (Code 2)	91[3]

Air core reactors rated 23kV at Seneca Station in Buffalo have deteriorating concrete bases which are being addressed through the Seneca Reactor Program. The program details are in the project close-out stages.

Air-cooled reactors are monitored via V&O inspections and infrared surveys. Older concrete base type reactors are problematic but do not result in adverse reliability consequences. Replacement of these reactors will be based on condition, age and opportunity. Figure 2-84 summarizes asset conditions for regulators and reactors.

Figure 2-84
Condition Code of Regulators and Reactors

TYPE	1	2	3	4	Grand Total
VREG	500	171	0	0	638
REAC	20	0	0	0	20

Actions Performed
All voltage regulators receive regular maintenance per Company standards. In addition, there is an approved strategy in effect to replace Siemens JFR and GE IRS/IRT Voltage Regulators. Approximately 36 regulators have been retired due to station rebuilds or station retirements. Ten voltage regulators were replaced with newer modern step regulators due to damage or failure. One GE Type IRS/IRT voltage regulator bank was removed from the system.

A Reactor (Non-transformer) Strategy has also been approved. As part of the strategy, nine air core reactors located at Seneca substation are in the process of being replaced. The units have concrete frames that are deteriorating and breaking apart. Since the coils are wound around the frame, this weakens their condition and may cause a problem if a system disturbance occurs.

[3]Westinghouse IRT is the same design as the General Electric IRT

Figure 2-85
Completed Distribution and Sub-transmission Substation Projects

Division	System	Funding Number	Project Name
Central	SUB-T	C00411	BOONVILLE - RELAY UPGRADE TO SUPPORT R210 BREAKER REPLACEMENT (TxD) - C00411
Central	DIST	C08435	WHITE LAKE - STATION UPGRADES - C08435
Central	DIST	C19851	BUTTERNUT (SUB 255) - INSTALL RTU - C19851P
Central	DIST	C19851	LEHIGH (SUB 669) - INSTALL RTU - C19851P
Central	DIST	C22151	INDIAN RIVER - UPGRADE RTU (DxT) - C22151
Central	DIST	C22151	EAST WATERTOWN - UPGRADE RTU (DxT) - C22151
Central	DIST	C22151	BRIDGE STREET - RTU UPGRADE (DxT) - C22151
Central	DIST	C25559	SOUTHWOOD - 115KV MOBILE YARD INSTALLATION (DxT) - C25559
Central	DIST	C29952	LEHIGH STATION - INSTALL MOBILE SUB TAP (DxT) - C29952
Central	DIST	C32013	SORRELL HILL SUB - REPLACE BATTERY & CHARGER - C32013P
Central	DIST	C32013	JEWETT SUB - REPLACE BATTERY & CHARGER - C32013P
Central	DIST	C32253	BRIDGE ST - AMCB (6) REPLACEMENT - C32253
Central	DIST	C32253	MCGRAW - VCR (R690) REPLACEMENT - C32253
Central	DIST	C32253	WHITAKER - AMCB (6) REPLACEMENT - C32253
Central	DIST	C33624	WHITAKER - ANIMAL FENCE INSTALLATION - C33624
Central	DIST	C33624	PALOMA - ANIMAL FENCE INSTALLATION - C33624
Central	DIST	C33624	BUTTERNUT - ANIMAL FENCE INSTALLATION - C33624
Central	DIST	C34607	COLOSSE - REPLACE R510 RECLOSER - C34607
Central	DIST	CD0249	ST. ELIZABETH'S DEBALSO SUBSTATION - CD0249
Eastern	DIST	C19851	NEW KRUMKILL (SUB 421) - INSTALL RTU - C19851P
Eastern	DIST	C19851	SELKIRK (SUB 149) - INSTALL RTU - C19851P
Eastern	DIST	C19851	MIDDLEBURG (SUB 390) - INSTALL RTU - C19851P
Eastern	DIST	C20173	LIBERTY STREET - RTU UPGRADE (LARGE SCALE) - C20173P
Eastern	DIST	C26418	SYCAWAY - ADD METALCLAD & 13.2KV BUS (M/C) (DxD) - C26418
Eastern	SUB-T	C28485	NORTH TROY - METALCLAD REPLACEMENT (M/C) (TxD) - C28485
Eastern	DIST	C28770	Inman Rd -Add M/C & 13.2kV Bus work - C28770
Eastern	DIST	C32012	BROOK ROAD - REPLACE BATTERIES & CHARGER - C32012
Eastern	DIST	C32252	MIDDLEBURG - BREAKER REPLACEMENTS (R520, R530) (ARP)- C32252
Eastern	DIST	C32252	COMMERCE AVE - AMCB REPLACEMENT (R510, R520) (ARP)- C32252
Eastern	DIST	C32252	BURDECK - AMCB (6) REPLACEMENT - C32252
Eastern	DIST	C32252	NEW KRUMKILL - AMCB (6) REPLACEMENT - C32252
Eastern	SUB-T	C33410	ROTTERDAM-WEAVER #36 CABLE RELOCATION - C33410
Eastern	DIST	C33627	SAND CREEK - ANIMAL FENCE INSTALLATION - C33627
Eastern	DIST	C33627	EMMET ST. - ANIMAL FENCE INSTALLATION - C33627
Eastern	DIST	C33627	PINEBUSH - ANIMAL FENCE INSTALLATION (2 fences)- C33627
Eastern	DIST	C33627	SCOTIA - ANIMAL FENCE INSTALLATION - C33627
Eastern	DIST	C35223	OLD KRUMKILL - RETIRE STATION - C35223
Eastern	DIST	C35928	BROOK ROAD - RPL FAILED 115KV CIRCUIT SWITCHER 6277 (DxT) - C35928
Eastern	DIST	CD0009	BIRCH AVE EMS - CD0009
Eastern	DIST	CD0150	SCHOHARIE STATION REPLACE BATTERIES - CD0150
Eastern	DIST	CD0568	DELANSON STATION TRANSFORMER TB1 FAILURE - CD0568
Eastern	DIST	CD0639	CHURCH ST. STATION - ADD 2ND TRANSFORMER - CD0639
Eastern	DIST	CD0897	SYCAWAY - ADD A SECOND 115-13.2KV BANK & ASSOC 115KV EQUIP (DxT) - C26819
Eastern	DIST	CD0897	INMAN ROAD - ADD 115-13.2kV TRANSFORMER & C/S - C35270

Division	System	Funding Number	Project Name
Western	SUB-T	C03831	BUFFALO (ELM) - REPLACE 23KV SHUNT REACTOR CABLE 18E (TxD) - C03831
Western	DIST	C06533	EAST GOLAH - ADD 2ND BANK & (2) FEEDERS (DxT) - C06533
Western	DIST	C15765	SHEPPARD ROAD 29 - SECOND BANK - C15765
Western	DIST	C22151	STATION 41 (PERRY STREET) - UPGRADE RTU (DxT) - C22151
Western	DIST	C22151	NORTH LAKEVILLE - UPGRADE RTU (DxT) - C22151
Western	DIST	C25660	STATION 43 (BUFFALO) - REBUILD - C25660
Western	SUB-T	C26382	BROCKPORT 74 - CAP BANK TO STATION BUS (TxD) - C26382
Western	DIST	C27062	EAST GOLAH - D-STATION EXPAND WORK - C27062
Western	DIST	C27449	SWANN ROAD - REPLACE BANK #2 W/ A 115-13.2KV 15/20/25 MVA BANK (DxT) - C27449
Western	DIST	C29049	YOUNGSTOWN 88 - BANK REPLACEMENT (STATION REBUILD) - C29049
Western	SUB-T	C29100	SENECA - REPLACE SERIES REACTORS (TxD) - C29100
Western	DIST	C29205	V697 - REPLACE TRANSFORMER & HVS V697 - C29205
Western	DIST	C29205	V597 - REPLACE TRANSFORMER & HVS V597 - C29205
Western	DIST	C29206	V697 - REPLACE PROTECTOR - C29206
Western	DIST	C29206	V597 - REPLACE PROTECTOR - C29206
Western	DIST	C32014	STATION 59 - REPLACE CHARGER ONLY - C32014P
Western	DIST	C32014	ALBION (STATION 80) - REPLACE 48V. BATTERIES - C32014P
Western	DIST	C32014	STATION 205 - REPLACE BATTERIES ONLY - C32014P
Western	DIST	C32014	STATION 39 - REPLACE BATTERIES & CHARGER - C32014P
Western	DIST	C32014	STATION 67- REPLACE BATTERIES - C32014P
Western	DIST	C32014	STATION 40 - REPLACE BATTERIES ONLY - C32014P
Western	DIST	C32014	STATION 53 - REPLACE BATTERIES & CHARGER - C32014P
Western	DIST	C32014	STATION 63 - REPLACE BATTERIES - C32014P
Western	DIST	C32014	STATION 46 - REPLACE BATTERIES & CHARGER - C32014P
Western	DIST	C32261	SWANN RD (STATION 105) - AMCB (7) REPLACEMENT - C32261
Western	DIST	C32261	AVON STATION 043 - AMCB BREAKER REPLACEMENT (R4305, R4308) (ARP)- C32261
Western	DIST	C32261	EAST BATAVIA - AMCB (1) REPLACEMENT (FY12) - C32261
Western	DIST	C32261	STATION 130 (NIAGARA FALLS) - AMCB (11) REPLACEMENT - C32261
Western	DIST	C32261	STATION 097 SUMMIT PARK - AMCB (10) REPLACEMENT FY11 - C32261
Western	DIST	C32261	STATION 126 (GIBSON ST) - AMCB (7) REPLACEMENT - C32261
Western	DIST	C32261	ELLICOTT STATION - VCR (1) REPLACEMENT (R6502) FY12 - C32261
Western	DIST	C32552	MUMFORD - REPLACE 401 & 405 DISCONNECTS (DxT) - C32552
Western	SUB-T	C33631	BROCKPORT - REPLACE FAILED 34.5KV REGULATOR (TxD) - C33631
Western	DIST	C34666	STATION 54 - REPLACE MOD's 101 & 201 (DxT) - C34666
Western	DIST	C35588	V597 & V697 - REPLACE VAULT ROOFS & GRATING - C35588
Western	DIST	C36636	V4111 - REPLACE TRANSFORMER & HVS V4111 - C36636
Western	DIST	C36651	V4111 - REPLACE PROTECTOR - C36651
Western	DIST	C36651	V4112 - REPLACE PROTECTOR - C36651
Western	DIST	C36651	V4109 - REPLACE PROTECTOR - C36651
Western	DIST	CD0121	STEEL WINDS I & II - INSTALL METERING - CD0121
Western	DIST	CD0168	MOUNTAIN STATION COMMUNICATION BUILDING - COMM INTERFACE FOR DA SCHEME LINE 401-CD0168
Western	DIST	CD0206	SYNERGY BIOGAS INTERCONNECTION PROJECT-SHEPARD ROAD SUBSTATION MODIFICATIONS - CD0206
Western	DIST	CD0273	SENECA TS - REPLACE SERIES REACTORS 5S, 12S, 17S, 14S, 30S, 32S, 33S - CD0273
Western	DIST	CD0417	CHAUTAUQUA STATION 57 - REPLACE FAILED TRANSFORMER - CD0417

Chapter 3. Regional Discussion by Transmission Study Area

Network Review Process

This chapter reports on the principal capacity and reliability issues on the transmission, sub-transmission and distribution systems. The Company performs system-wide and regional analysis of capacity and performance issues, which are evaluated along side asset condition issues to form an effective mitigation plan. When practical, projects are designed to address multiple concerns. For study purposes, the transmission system is divided into eight transmission study areas. The transmission study areas are further divided into forty-three distribution study areas.

Effective planning of the transmission and distribution system requires the Company to consider and evaluate issues on a system-wide, regional and local basis. For example, system-wide planning is needed to address power flows throughout the transmission system so that future demands are met and to ensure adequate facilities to transport power from generators within and outside of the Company's service territory. Likewise, a system-wide view is necessary to evaluate the ability to maintain reliable service during specified contingencies, including during the transfer of power through the service territory by others. System-wide planning is characterized by long-term forecasts of overall system demand, regional growth patterns within the service territory, and proposed generation interconnections.

In comparison, regional planning is necessary to ensure that transmission facilities are placed close enough to load centers such that expected demand growth in specific areas can be accommodated efficiently and reliably. Regional planning is characterized by greater volatility of customer additions/reductions, demand requirements, and more specific information of growth locations and performance issues. Forecasts of customer actions and demands generally do not extend more than five to seven years. Regional planning information serves as an input to system-wide planning efforts.

Local planning deals with the discrete portions of the electric delivery system and is driven by the need to ensure distribution facilities are adequate and flexible enough to meet individual customer requirements, local customer mix, and on-going population drift (i.e., urban to suburban, rural to suburban, suburban to urban). Local planning is characterized by short-term forecasts, and emergent and unforeseen customer needs, i.e., spot load additions. Details at the local planning level are input to the regional planning effort.

The Company also integrates asset health assessments into its planning efforts. Long-term plans are often developed to replace related assets. These asset replacement plans can provide solutions to system limitations noted in the planning studies. Clearly, eliminating equipment based reliability, safety or faulty operational conditions assists system planners in meeting their goals of providing a system to meet customer capacity and performance requirements.

The network review process assesses potential risks and impacts to system reliability. It analyzes and assesses asset condition, performance and capabilities of individual assets and the entire system, and determines future system risks. Network review includes studies of the current and future ability of the system to meet demand, reliability performance reviews, operational feedback, and benchmarking. Several contributing departments carry out the work in the network review. Through this structure, National Grid distinguishes and provides a high level of focus on its transmission and distribution assets and on two distinct needs. First, load-related investments that are driven primarily by the need to satisfy the changing needs of our customers, e.g., load growth, new business and generator requirements. Second, investments required to maintain the condition and improve the effectiveness of the assets. A more detailed description of these types of investments is provided below.

Load-related investment, also known as customer driven investment, is required to serve changes in the pattern of generation and demand through direct interaction with customers through connection applications and through the need to ensure that the interconnected T&D system fulfills certain system security requirements given existing levels of generation and demand. The system security requirements to which National Grid is obliged to adhere are governed by operating and planning standards set out by the various reliability organizations that are involved with the power system in New York.[1] The need for these projects is determined by forces largely outside National Grid's control.

Non load-related investment includes replacing assets whose condition has deteriorated to maintain the reliability, safety or environmental performance of the network. While these issues drive the need for non load-related projects, the timing of these projects is more within the control of National Grid. This investment is also referred to as asset-driven investment.

Every investment will not fall cleanly into one type of investment or the other, nor do all investments resolve a single capacity, performance or asset condition issue. The respective planning and asset strategy organizations ensure that transmission and distribution system investments are coordinated between asset condition and customer driven investments, and between the two systems. All investments are integrated to form a single system plan, known as the T&D Capital Investment Plan.

Wide Area Protection Coordination

The Wide Area Protection Coordination Project is an in depth study of National Grid's protective relaying systems across the 115kV, 230kV and 345kV transmission system. Recognizing that the traditional approach to protective relaying coordination was on a per-project rather than system-wide basis, the Wide Area Coordination Project was initiated to improve the accuracy of power system models used for protection coordination. This ensured a solid foundation on which to make the necessary protective relay changes associated with the capital investment program.

The initial phase of the project included updating the short circuit model of all 115kV, 230kV and 345kV transmission lines, and all power transformers connected at these voltages. Self and mutually coupled overhead line impedances were also re-calculated based on actual physical characteristics. Transformer impedances were recalculated based on test data, connections and phasing. Relaying data was collected, verified and added to the model. Relay types studied included distance, overcurrent, and fault detectors utilized for distance relay supervision. Breaker failure and high speed protection schemes were analyzed utilizing fiber optic, power line carrier or audio tone communications.

Computer macros were developed specifically for this project based on industry standards and extensive best practice interviews with National Grid's protection engineering subject matter experts. The macros allow automated simulation of relay sensitivity and coordination, utilizing a 'sequence of events' approach under various fault conditions and contingencies. This is followed by intensive

[1] Organizations impacting reliability decisions include: North American Electric Reliability Corporation (NERC), Northeast Power Coordinating Council (NPCC), the New York State Electric Reliability Council (NYSERC), and the New York Independent System Operator (NYISO).

interpretation and analysis of the resulting data to identify improperly set relay elements and develop correct settings. The project is currently underway with some early discrepancies identified associated with line impedances and coordination between devices.

It is expected that interpretation and analysis of the 230kV and 345kV systems will be complete in 2012 with all issues of relay sensitivity and coordination errors identified along with proposed solutions. New relay settings will then be developed and/or new equipment identified as needed. Longer term plans are to continue with automated simulation, interpretation and corrective action for the 115kV system.

Under Frequency Load Shedding

Under frequency load shedding schemes are employed as a means to shed large quantities of load under emergency conditions in an effort to avoid wide area black outs. Historically, the Company has planned to shed load in two frequency blocks in the event of an under-frequency condition: [redacted] In 2009, the Northeast Power Coordinating Council (NPCC) through its Regional Reliability Reference Directory #12 enacted a requirement to modify the scope of the frequency response schemes from two frequency blocks to six frequency blocks. Transmission Owners are expected to implement the new scheme within a six-year period. In addition to defining new frequency set points, the response time of the relay schemes will be adjusted. Each frequency block should be armed to trip with an average total relay clearing time [redacted]

The NPCC provided a six-year schedule to complete the plan and requires participating entities to report, through their respective ISO, annual progress against this schedule. The Company has implemented relay settings changes that have successfully met requirements for the end of the sixth and final year of the Under Frequency Load Shed implementation plan. These changes were complete as of the end of June 2012 and comply with the required load shed steps set by the NPCC Directory #12 implementation plan.

Summer Preparedness

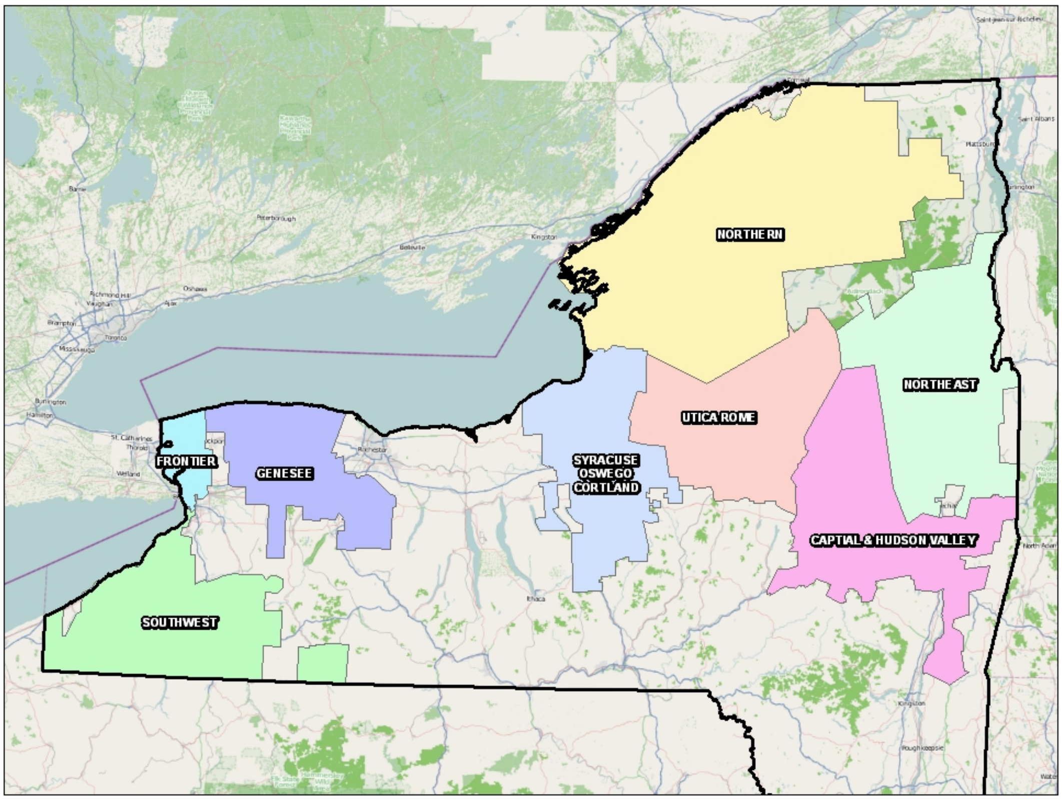
The hot weather months of summer are generally the period of time in which the majority of National Grid's electric facilities are most stressed from a capacity perspective. Preparing for these stresses is a critical element of the Company's operational efforts to maintain reliable service for customers. Following annual distribution capacity assessments, engineering and operations personnel work jointly to identify the short-term constraints on the system and discuss both mitigation and response plans for potential contingency scenarios at varying load levels. The results have been documented in the 2012 summer preparedness plan which was completed in March 2012 and submitted to Staff on March 30, 2012. The plan discussed potentially overloaded assets serving distribution load in a normal configuration.

In the summer of 2012, New York peak load reached 93% of forecasted peak demand based on 90/10 criteria. This was 6.5% lower than the summer of 2011 peak. A review of reliability performance (SAIFI) over the course of the peak load week (July 15 – 21) was conducted to quantify the impact of the system under the stresses of high load demand. The overall SAIFI during this week was 9% below the three-year average for the same period of previous years. In response, Summer 2013 preparedness activities include a review of ratio/step down transformer loading, upgrades to several feeders, and recommendations for voltage conversions.

Regional Analysis

For regional analysis, the Company's service territory is divided into eight transmission study areas. The transmission study areas are shown in Figure 3-1. Within the eight transmission study areas, the sub-transmission and distribution networks are further subdivided into 43 distribution study areas.

Figure 3-1
Transmission Study Areas



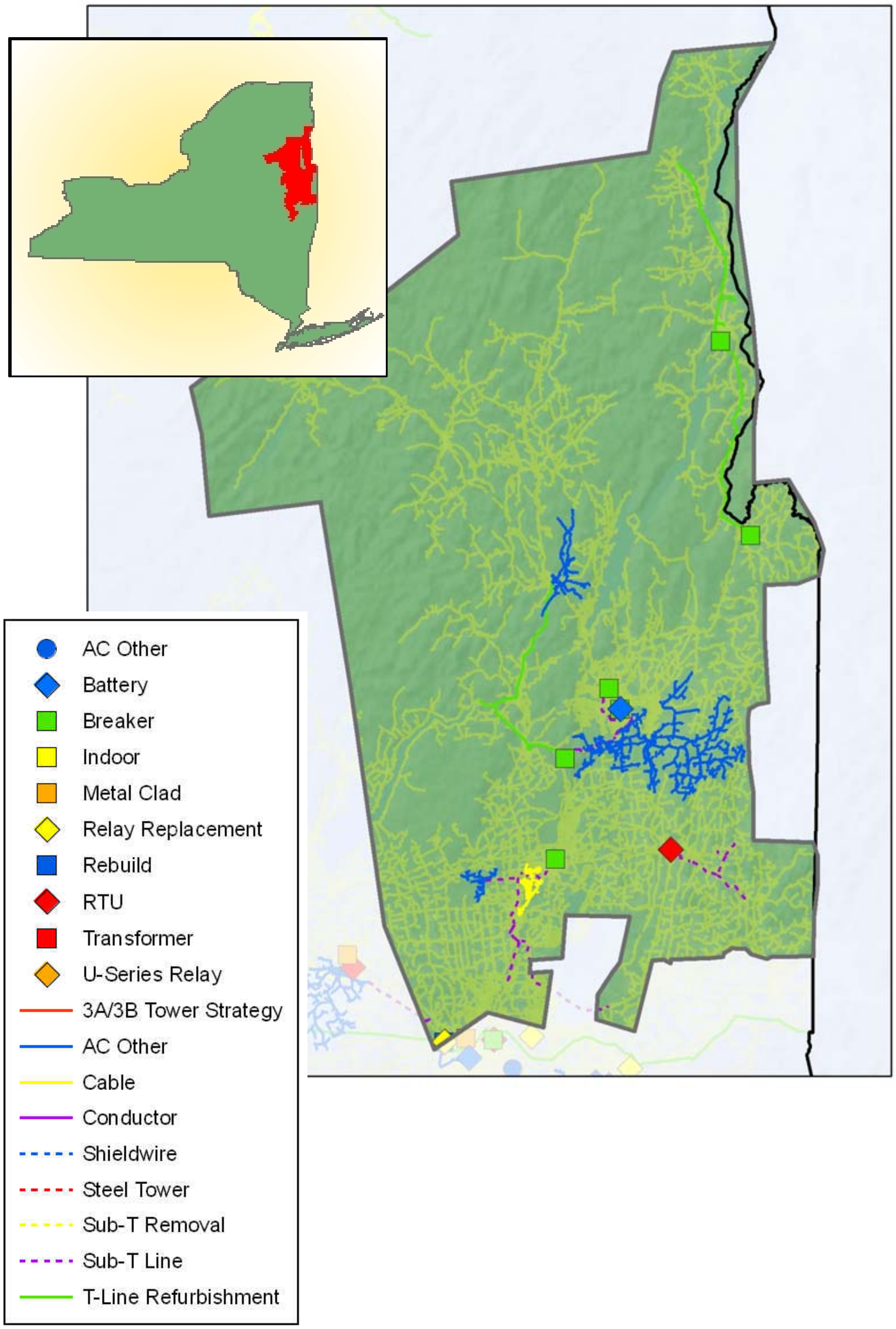
Due to the changing nature of the system and customer load patterns, projected overloads on the distribution and sub-transmission system are monitored but may not be addressed with solutions until the year the overload is projected. The projected overloads are included in a separate table.

Each of the transmission study areas is described separately below in the following format:

- Area Summary
- Area Description
- Area Load Forecast
- Asset Condition Programs
- Forecasted Capacity Constraints

The tables of Transmission Capacity Constraints list transmission assets within each region on which voltage, thermal, or short circuit problems occur under normal or contingency conditions - problems which require capital investment to resolve. There are other problems and circumstances identified during planning studies which can be resolved by permissible (as defined by the governing planning criteria) operator actions such as generation redispatch, switching, or load shedding which do not require capital investment. The latter problems are not included in the Transmission Capacity Constraints tables. Note that operational actions involving generation redispatch make use of generating units currently available. The effectiveness of such actions in the future can be critically affected by future generator retirements. Future planning studies will identify capacity constraints and mitigating capital investments that are needed when such retirements occur, or when revisions to planning criteria - such as the BES definition and TPL standards, change the circumstances under which operator actions are permissible solutions.

Figure 3-2
Northeast Study Area Asset Condition Program Work



Area Summary

The principal driver for the transmission and distribution capacity projects in the Northeast transmission study area is load growth associated with Luther Forest industrial load, specifically Global Foundries, and the general area distribution load growth that is stimulated by the economic impact of the Luther Forest development during the period from 2012-2019. A new 230-115 kV Eastover substation is recommended to avoid 115kV line overloads, Rotterdam 230-115 kV transformer overloads, and to support adequate system post-contingency voltage levels.

Area Description

The Northeast transmission study area serves approximately 144,200 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, Saratoga Springs and Glen Falls. Some of the areas offer summer recreation and see a spike in load during the summer months.

The 115kV system runs primarily in a north-south direction on both sides of Lake George. There is a single radial line, east of Lake George, which runs north from Whitehall substation, which extends to the NYSEG system and also continues north to the Port Henry substation. 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 111 distribution feeders that supply customers in this area. There are eighty-seven 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; Ten 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.

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Area Load Forecast

The Northeast transmission study area load forecast comprises approximately 20% of the Albany-Glens Falls Region (NYISO Zone F) forecast. The summary of the load forecast thru 2026 is detailed in the figures below.

In addition to the transmission area forecast, a forecast specific to the greater Saratoga area has been performed. This area, represented by about 200MW of load, is expected to have considerably larger growth (approximately 5% annually) with respect to the rest of the Northeast study area load for 2011-2015. The addition of Global Foundries is also not included in the zonal forecast below. [redacted]

Figure 3-3
Zone F Non-Coincident Summer Peak Demand
Including Energy Efficiency Reductions

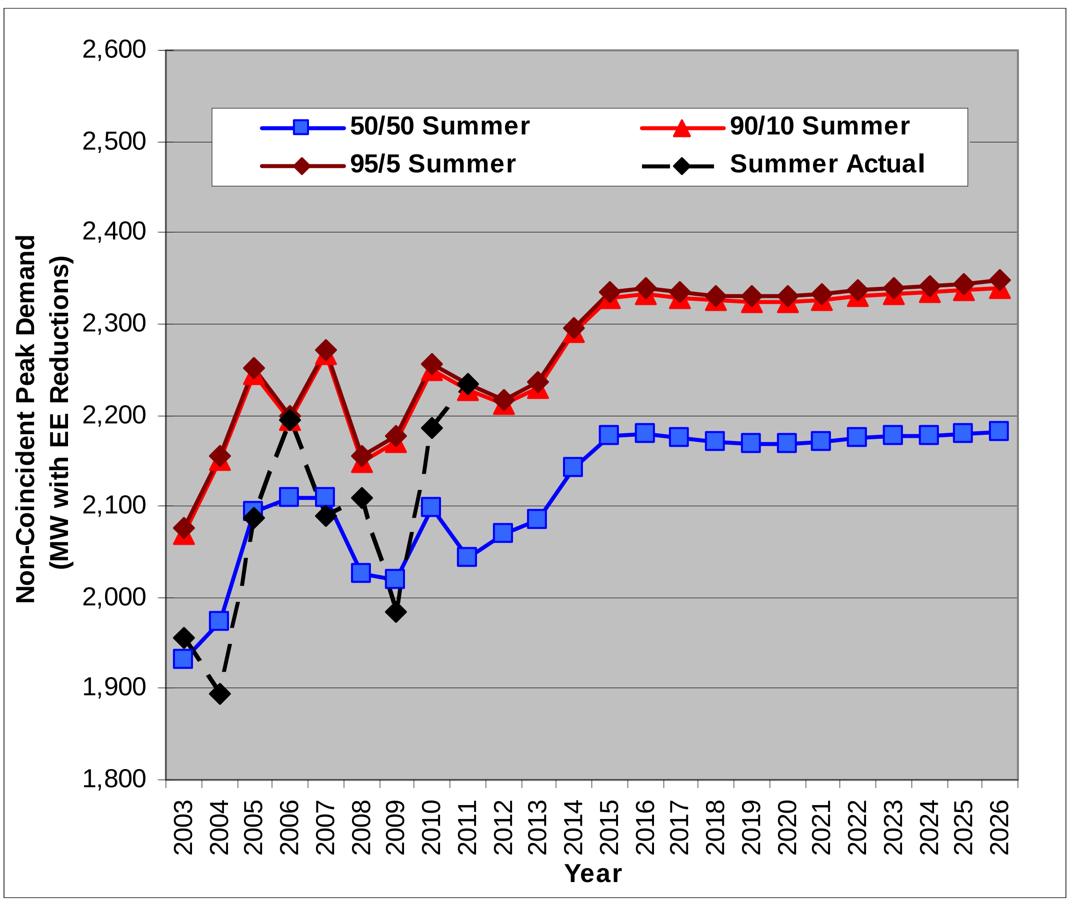

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Figure 3-4
Zone F Non-Coincident Summer Peak Demand Including Energy Efficiency Reductions Table

ZONE F (Albany - Glen Falls Region) - SUMMER w/EE Reductions

	SUMMER PEAKS (MWs)								Wthi's			
YEAR	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2003	1,955		1,928		2,070		2,076		81.7	81.2	84.1	84.2
2004	1,895	-3.0%	2,008	4.1%	2,150	3.8%	2,156	3.8%	78.9	81.2	84.1	84.2
2005	2,088	10.2%	2,103	4.7%	2,245	4.4%	2,251	4.4%	80.9	81.2	84.1	84.2
2006	2,194	5.1%	2,052	-2.4%	2,194	-2.3%	2,200	-2.3%	84.1	81.2	84.1	84.2
2007	2,089	-4.8%	2,125	3.6%	2,267	3.3%	2,272	3.3%	80.5	81.2	84.1	84.2
2008	2,110	1.0%	2,007	-5.5%	2,149	-5.2%	2,155	-5.2%	83.3	81.2	84.1	84.2
2009	1,985	-5.9%	2,029	1.1%	2,171	1.0%	2,177	1.0%	80.3	81.2	84.1	84.2
2010	2,186	10.1%	2,108	3.9%	2,250	3.6%	2,256	3.6%	82.7	81.2	84.1	84.2
2011	2,234	2.2%	2,087	-1.0%	2,228	-1.0%	2,234	-1.0%	84.2	81.2	84.1	84.2
2012			2,069	-0.9%	2,211	-0.8%	2,217	-0.8%		81.2	84.1	84.2
2013			2,086	0.8%	2,230	0.9%	2,236	0.9%		81.2	84.1	84.2
2014			2,141	2.6%	2,290	2.7%	2,296	2.7%		81.2	84.1	84.2
2015			2,176	1.6%	2,328	1.7%	2,335	1.7%		81.2	84.1	84.2
2016			2,179	0.1%	2,332	0.2%	2,339	0.2%		81.2	84.1	84.2
2017			2,175	-0.2%	2,329	-0.2%	2,335	-0.2%		81.2	84.1	84.2
2018			2,170	-0.2%	2,325	-0.2%	2,331	-0.2%		81.2	84.1	84.2
2019			2,168	-0.1%	2,324	-0.1%	2,330	-0.1%		81.2	84.1	84.2
2020			2,168	0.0%	2,323	0.0%	2,330	0.0%		81.2	84.1	84.2
2021			2,171	0.1%	2,327	0.2%	2,333	0.2%		81.2	84.1	84.2
2022			2,174	0.1%	2,330	0.2%	2,337	0.2%		81.2	84.1	84.2
2023			2,176	0.1%	2,333	0.1%	2,339	0.1%		81.2	84.1	84.2
2024			2,178	0.1%	2,335	0.1%	2,342	0.1%		81.2	84.1	84.2
2025			2,180	0.1%	2,337	0.1%	2,344	0.1%		81.2	84.1	84.2
2026			2,182	0.1%	2,340	0.1%	2,347	0.1%		81.2	84.1	84.2
Compound Avg. 8 yr ('03 to '11)		1.7%		1.0%		0.9%		0.9%				
Compound Avg. 5 yr ('06 to '11)		0.4%		0.3%		0.3%		0.3%				
Compound Avg. 5 yr ('11 to '16)				**0.9%**		**0.9%**		**0.9%**				
Compound Avg. 10 yr ('11 to '21)				**0.4%**		**0.4%**		**0.4%**				
Compound Avg. 15 yr ('11 to '26)				**0.3%**		**0.3%**		**0.3%**				

Figure 3-5
Zone F Non-Coincident Winter Peak Demand Including Energy Efficiency Reductions Table

ZONE F (Albany - Glen Falls Region) - WINTER w/EE Reductions

	WINTER PEAKS (MWs)								hdd			
YEAR (season)	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2002-2003	1,758		1,689		1,793		1,801		63.4	53.8	68.1	69 3
2003-2004	1,831	4.1%	1,767	4.6%	1,870	4.3%	1,879	4.3%	69.3	53.8	68.1	69 3
2004-2005	1,777	-2.9%	1,737	-1.7%	1,818	-2.8%	1,822	-3.0%	62.8	53.8	68.1	69 3
2005-2006	1,625	-8.6%	1,609	-7.4%	1,696	-6.7%	1,727	-5.2%	55.1	53.8	68.1	69 3
2006-2007	1,724	6.1%	1,802	12.0%	1,905	12.3%	1,914	10.8%	55.3	53.8	68.1	69 3
2007-2008	1,705	-1.1%	1,682	-6.6%	1,763	-7.5%	1,767	-7.7%	43.5	53.8	68.1	69 3
2008-2009	1,653	-3.1%	1,676	-0.3%	1,779	1.0%	1,788	1.2%	56.0	53.8	68.1	69 3
2009-2010	1,669	1.0%	1,655	-1.3%	1,750	-1.6%	1,770	-1.0%	50.9	53.8	68.1	69 3
2010-2011	1,732	3.7%	1,629	-1.6%	1,732	-1.0%	1,741	-1.7%	68.1	53.8	68.1	69 3
2011-2012			1,639	0.6%	1,734	0.1%	1,754	0.7%		53.8	68.1	69 3
2012-2013			1,668	1.8%	1,765	1.8%	1,785	1.8%		53.8	68.1	69 3
2013-2014			1,709	2.5%	1,809	2.5%	1,830	2.5%		53.8	68.1	69 3
2014-2015			1,719	0.6%	1,820	0.6%	1,841	0.6%		53.8	68.1	69 3
2015-2016			1,712	-0.5%	1,812	-0.4%	1,833	-0.4%		53.8	68.1	69 3
2016-2017			1,704	-0.5%	1,803	-0.5%	1,824	-0.5%		53.8	68.1	69 3
2017-2018			1,696	-0.4%	1,795	-0.4%	1,816	-0.4%		53.8	68.1	69 3
2018-2019			1,689	-0.4%	1,788	-0.4%	1,809	-0.4%		53.8	68.1	69 3
2019-2020			1,682	-0.4%	1,781	-0.4%	1,802	-0.4%		53.8	68.1	69 3
2020-2021			1,676	-0.4%	1,774	-0.4%	1,795	-0.3%		53.8	68.1	69 3
2021-2022			1,669	-0.4%	1,767	-0.4%	1,788	-0.4%		53.8	68.1	69 3
2022-2023			1,662	-0.4%	1,760	-0.4%	1,781	-0.4%		53.8	68.1	69 3
2023-2024			1,656	-0.4%	1,753	-0.4%	1,774	-0.4%		53.8	68.1	69 3
2024-2025			1,649	-0.4%	1,746	-0.4%	1,766	-0.4%		53.8	68.1	69 3
2025-2026			1,643	-0.4%	1,740	-0.4%	1,760	-0.4%		53.8	68.1	69 3
Compound Avg. 8 yr ('03 to '11)		-0.2%		-0.5%		-0.4%		-0.4%				
Compound Avg. 5 yr ('06 to '11)		1.3%		0.2%		0.4%		0.2%				
Compound Avg. 5 yr ('11 to '16)				**1.0%**		**0.9%**		**1.0%**				
Compound Avg. 10 yr ('11 to '21)				**0.3%**		**0.2%**		**0.3%**				
Compound Avg. 15 yr ('11 to '26)				**0.1%**		**0.0%**		**0.1%**				

Asset Condition Programs

Figure 3-2 shows a map of the planned asset condition projects in the study area. Figure 3-6 shows a listing of the projects in tabular form.

Figure 3-6
Northeast Study Area Planned Asset Condition Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Northeast	AC Other	DIST	Northeast	06543 Rock City Falls 40415 - Armer Road	C20071
				09228 Warrensburg 51 - E Schroon River Rd	C35271
				11496 Burgoyne 51 - Rebuild Durkeetown Rd.	CD0222
				11184 Butler 51 - Gansevoort Road Rebuild (QRS #803679)	CD0145
				17608 Henry St. 31637 - Rebuild/Convert Caroline St.	CD0508
				17756 Farnan Road 51 - Bluebird Road Conversion	CD0545
				19263 Wilton 52 - Route 9 Rebuild/Convert	CD1021
				18622 Whitehall 51 Conversion	CD0831
		SUB-T	Northeast	19306 Warrensburg-Queensbury 9 34.5kv	-
	Cable Replacement	DIST	Northeast	05365 Brook Road 36954 Getaway cable repl	C29113
				05982 Henry St 36 - River Crossing	C29432
	Overhead Line Refurbishment Program - Asset Condition	TRAN	None	Lake Colby - Lake Placid 3 T3210	CNYAS57
				Rotterdam - Bear Swamp E205 T5630 ACR	CNYAS76
				Spier-West 9 Refurbishment T5770 ACR	C21694
				Ticonderoga 2-3 T5810-T5830 ACR	C39521
				Ticonderoga 2-3 T5810-T5830 SXR2	C39487
				Warrensburg - Scofield Road 10 T5880 ACR	CNYAS50
	Substa ion Battery and Related	DIST	Northeast	Battery - Henry Street Station 316	(blank)
	Substa ion Breaker	DIST	Northeast	Breaker - Henry Street	(blank)
				Breaker - Saratoga 142	(blank)
				Breaker - Spier Falls	(blank)
		TRAN	None	Trans Breaker Replacement - Battle Hill Station 949	(blank)
				Trans Breaker Replacement - Marshville Station 299	(blank)
				Trans Breaker Replacement - Queensbury Station 295	(blank)
				Trans Breaker Replacement - Ticonderoga Station 163	(blank)
				Trans Breaker Replacement - Whitehall Station 187	(blank)
	Substation Metal-Clad Switchgear	DIST	Northeast	05024 Rebuild Saratoga Substation	C29436
	Substa ion Power Transformer	DIST	Northeast	17807 Indian Lake - Replace Transformers	-
	Substa ion RTU	DIST	Northeast	RTU - Battenkill	(blank)
				RTU - Birch Ave	(blank)
	Sub-T Overhead Line	SUB-T	Northeast	06653 Spier-Glens Falls 8-pls	C27583
				19319 Cottrell Paper Tap 11-34.5kv	-
				19318 Queensbury-Henry Street 14-34.5kv	-
				19290 Ballston-Mechanicville 6-34.5kv	-
				19238 Tap to H&V Greenwich-34.5kv	-
	Switchgear Replacement	DIST	Northeast	13341 Union St 376 - Replace Metalclad Gear	-
				17828 Henry Street Station 316 - Replace Metalclad	-

Forecasted Capacity Constraints

Figure 3-7 maps the forecasted capacity constraints on the transmission system. Figure 3-8 lists the forecasted transmission capacity constraints. Figure 3-9 maps the forecasted capacity constraints on the distribution system and capacity planning solutions proposed in the study area for the next five years. Figures 3-10 and 3-11 list the distribution system forecasted capacity constraints, and system capacity and performance solutions, respectively.

Figure 3-7
Northeast Study Area Forecasted Transmission Capacity Constraints Map

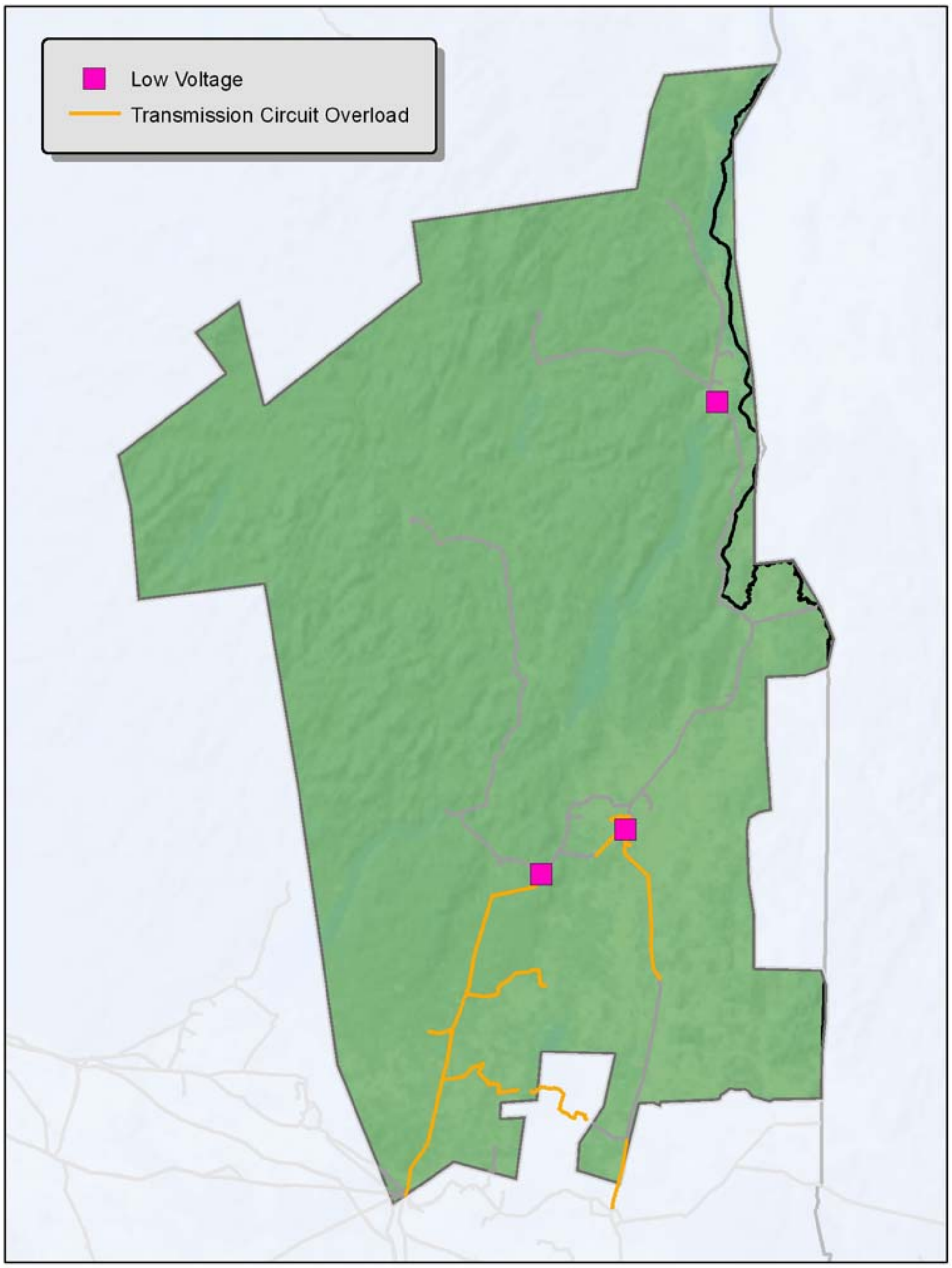

Figure 3-8
Northeast Study Area Forecasted Transmission Capacity Constraints Table

Impacted Asset	kV	Contingency	Need Year	Power Flow Case	Driving Issue	Project Number (s)	Comments / Mitigation / Corrective Action
Spier-Rotterdam #1/#2 Double Circuit	115	Loss of South end of #1/#2 Double Circuit	2012	CY07 & CY08 ATRA	125% SLTE, and 103% of SSTE	C31418	The recommended solution is addition of a new Spier-Rotterdam 115kV on separate structures from existing #1/#2, and bussing of existing #1/#2 to create two high capacity circuits between Spier and Rotterdam.
Mohican-Battenkill #15	115	Loss or Opening of Rotterdam 115kV R1 with Indeck Corinth Gen Out of Service.	2012	CY07 & CY08 ATRA	113% SLTE	C34528	The recommended solution is to reconductor/rebuild the #15 line.
Various Stations in Northeast Region	115, 34.5	Loss of LF/ Battenkill-Eastover Rd #3/#10 115kV South End; for example.	2013-2019	CY07 & CY08 ATRA	<90% Voltage	C35773	The recommended solution is to add a total of 150 MVAr of 115 kV shunt capacitance at three stations (Ticonderoga, Spier, and Mohican) in Northeast Region to improve post-contingency voltage performance.
Luther Forest-Rotterdam (Ballston #2 Tap: Main Tap-Ballston)	115	Loss of LF/Battenkill-Eastover Rd #3/#10 South End Double Circuit	2013	CY07 & CY08 ATRA	106% SLTE	C35771	The recommended solution is to reconductor 3.9 miles of existing #2 tap; between Main Tap and Ballston.
Luther Forest-Rotterdam (Ballston #2 Tap: Main	115	Loss of LF/Battenkill-Eastover Rd #3/#10 South End	2017	CY07 & CY08 ATRA	101% SLTE	C35771	The recommended solution is to reconductor 5.1

Impacted Asset	kV	Contingency	Need Year	Power Flow Case	Driving Issue	Project Number (s)	Comments / Mitigation / Corrective Action
Tap-Ballston)		Double Circuit					miles of existing #2 tap; between Ballston and Malta.
Eastover Road-Luther Forest	115	Loss or Opening of Rotterdam 115kV R1 with Indeck Corinth Gen Out of Service.	2017	CY07 & CY08 ATRA	101% SLTE	C35771	The recommended solution is to reconductor 10.4 miles of the affected circuit.
Mohican-Butler #18	115	Loss or Opening of Rotterdam 115kV R1 with Indeck Corinth Gen Out of Service.	2019	CY07 & CY08 ATRA	101% SLTE	C35771	The recommended solution is to reconductor 3.5 miles of the affected circuit.

Figure 3-9
Northeast Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints Map

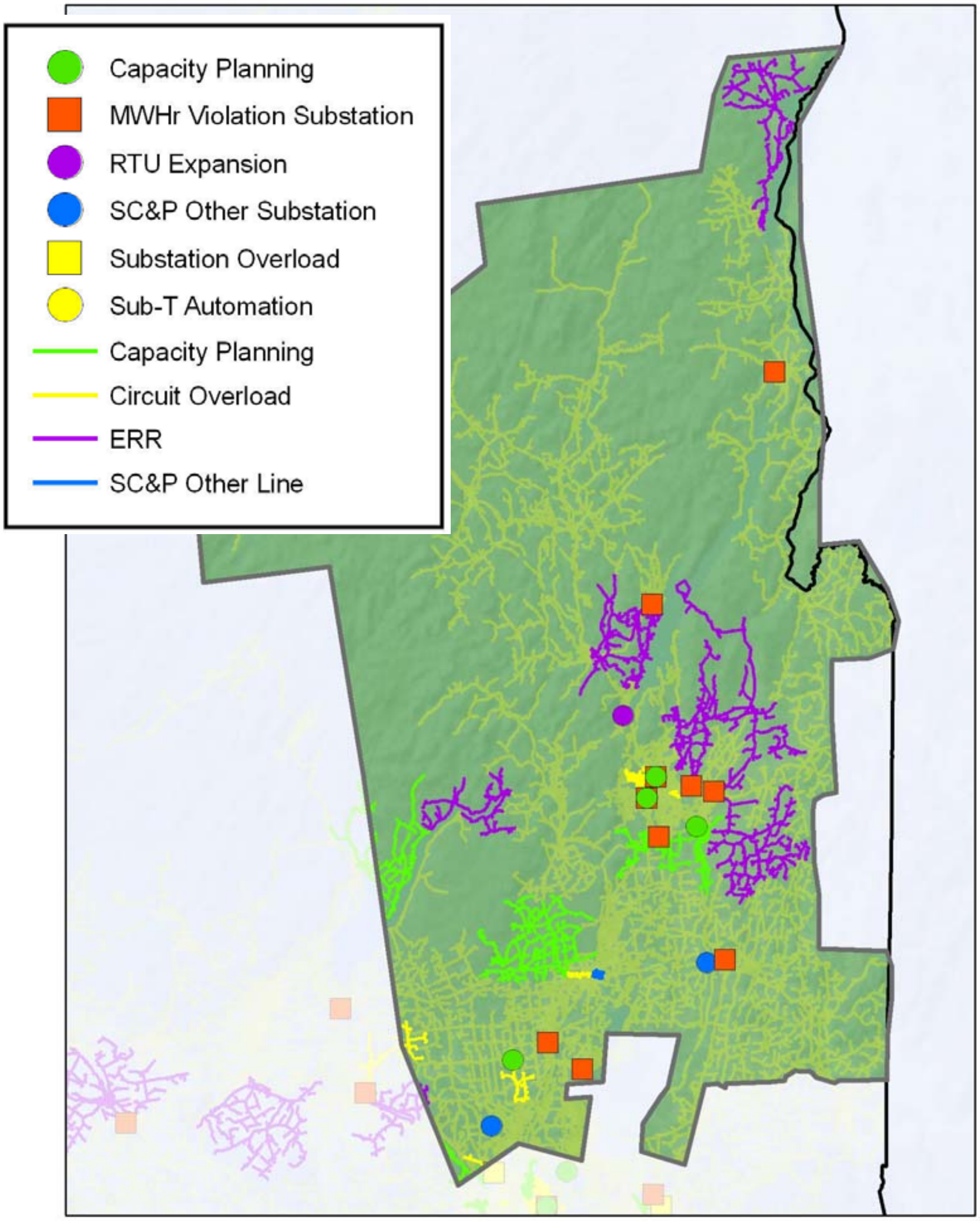

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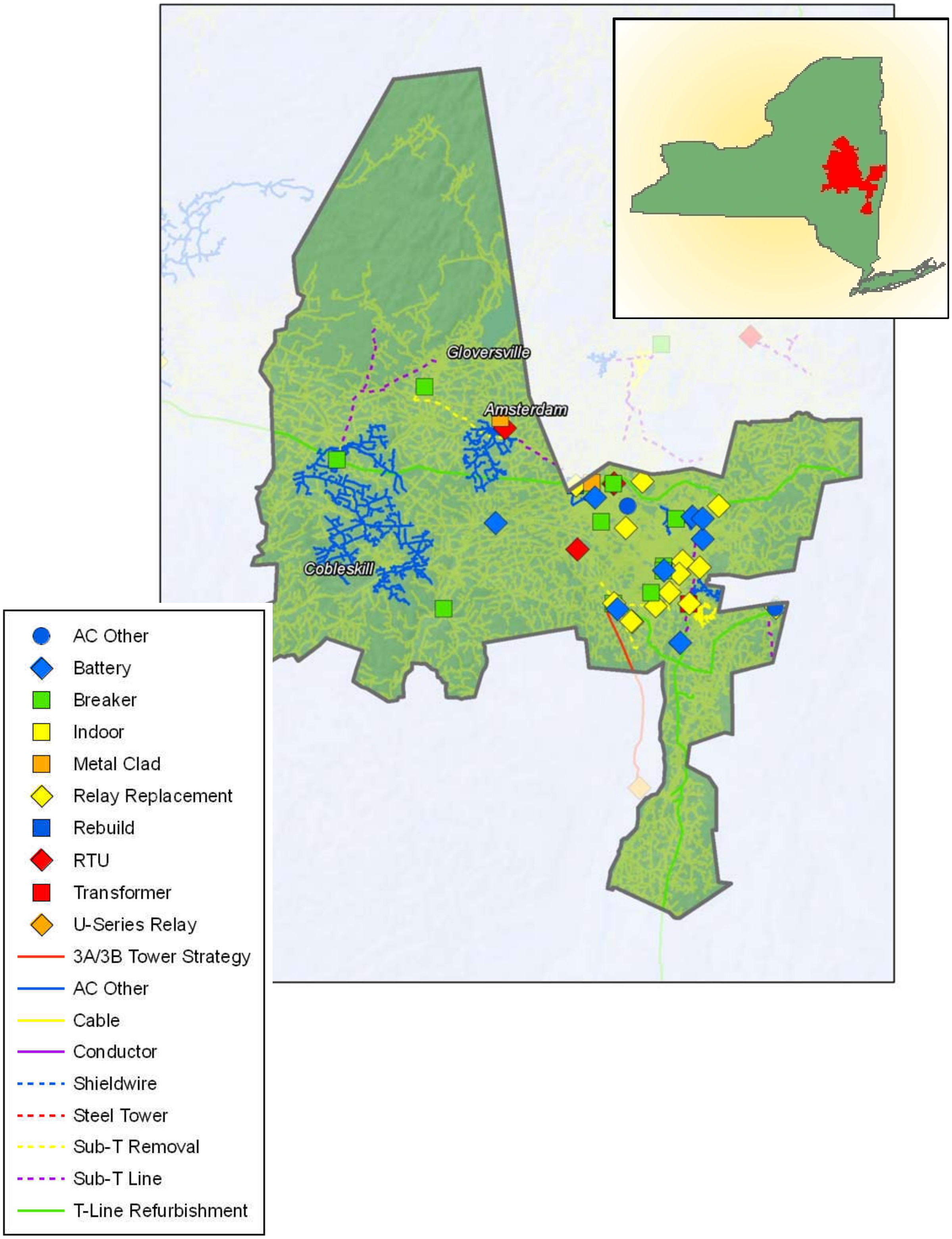
Figure 3-10
Northeast Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints

Identified Problem	System	Distribution Study Area	Substation	Supply Line	Feeder
MWHr Violations - BALLSTON	DIST	Northeast	BALLSTON		
MWHr Violations - BATTENKILL	DIST	Northeast	BATTENKILL		
MWHr Violations - BOLTON	DIST	Northeast	BOLTON		
MWHr Violations - BURGOYNE	DIST	Northeast	BURGOYNE		
MWHr Violations - BUTLER	DIST	Northeast	BUTLER		
MWHr Violations - CEDAR	DIST	Northeast	CEDAR		
MWHr Violations - HAGUE	DIST	Northeast	HAGUE		
MWHr Violations - MALTA	DIST	Northeast	MALTA		
MWHr Violations - OGDENBROOK	DIST	Northeast	OGDENBROOK		
MWHr Violations - QUEENSBURY	DIST	Northeast	QUEENSBURY		

Figure 3-11
Northeast Study Area
Planned Distribution and Sub-transmission System Capacity and Performance Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Northeast	Capacity Planning	DIST	Northeast	11956 Queensbury Station - Reroute getaways to new M/C S/G units.	CD0895
				05367 Brook Road 55/57 - Daniels Rd	C29425
				05462 Butler - Construct Feeder 36253	C28878
				11959 McCrea Station - New station - Getaways, etc.	-
				06393 Ogden Brook - Install new feeders	C32598
				11943 Sodeman Rd - New station - dist getaways, reconductoring, etc.	-
				04989 Ogden Brook- install 13.2 kV s/gear	C32597
				11958 McCrea Station - New station - Install M/C & cap bank	-
				Duplicate 05367 Brook Road 55/57 - Daniels Rd	C29425
	ERR	DIST	Northeast	17119 Ashley 51 - Baldwin Corners Road Phase 1	CD0389
				11498 Burgoyne 51 - Close Gaps on County Hwy 46	CD0208
				17122 Ashley 51 - Baldwin Corners Road Phase 2	CD0505
				12761 Port Henry 51 - Rebuild Route 9N from P148-158	CD0306
				12773 Port Henry 51 - Rebuild Route 9N from P195-205	CD0326
				17123 Ashley 51 - Baldwin Corners Road Phase 3	-
				05488 Cedar 51 - Rebuild Hadlock Pond Rd.	C07432
				17887 Bolton 51/Warrensburg 51 Feeder Tie	CD0606
				Duplicate 17887 Bolton 51/Warrensburg 51 Feeder Tie	CD0606
	RTU Expansion	DIST	Northeast	07037 Birch Ave Sub EMS Modifications	CD0009
	SC&P Other	DIST	Northeast	05366 Brook Road 55 - Murray Road	C35729
				11166 Butler 51 - Route 32 Rebuild	CD0139
				17074 Cedar 51 - Tripoli Road Gap Closing	CD0683
				11922 Brook Road 55 - Young Road Rebuild	CD0299
				05832 EJ West 03841 - Convert to 13 2kV	C07798
				11633 EJ West 51 - Scofield Rd. 53 Single Phase Tie	CD0256
				05095 Schuylerville Station - Bus Changes	C35226
				06573 Saratoga 4.16 kV Conversion	C29437
				11318 Spier-Rotterdam Project - Dist relocations	CD0187
				Duplicate 06573 Saratoga 4.16 kV Conversion	C29437

Figure 3-12
Capital and Hudson Valley Study Area Asset Condition Program Work



Area Summary

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

- Thermal issues observed on the Rotterdam 230-115 kV transformer banks drive the recommended new 230-115 kV Eastover substation in the Northeast Region, which also addresses issues in the Capital & Hudson Valley Region. This substation is expected to be in service in 2016.
- 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.
- Thermal issues observed on the Reynolds Rd 345-115 kV in 2026 will drive the addition of a second transformer bank in the Eastover substation.
- Thermal issues observed on 115kV lines in the Rotterdam-New Scotland corridor in 2026 will drive the recommendation to install a reactor in the Altamont-New Scotland #20 line and the Rotterdam-New Scotland #19 line.

Key sub-transmission and distribution drivers include the following:

- DeLaet's Landing is a proposed Underground Commercial Development (UCD) in the City of Rensselaer with a full build out of 19MW. The developer has requested service for an initial phase which represents 2MW.
- Projects such as the substation expansions at Reynolds Road and Sycaway substations are supporting general load growth in the area, including the expansion of RPI Tech Park.

Area Description

The Capital and Hudson Valley study area is connected to the Utica Rome study area in the west, the New England system in the east, and the Central Hudson Gas and Electric (CHG&E) and Consolidated Edison (ConEd) systems in the south. 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 major interface that carries power from central NY to eastern NY. [redacted]

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. [redacted]

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 88,400 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 88,200 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 80,900 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 55,600 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 58,100 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 21,500 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.

Area Load Forecast

The Capital Hudson Valley transmission study area load forecast is part of (about 80%) the Zone F forecast. The summary of the load forecast thru 2026 is detailed in the figures below.

Figure 3-13
Zone F Non-Coincident Summer Peak Demand
Including Energy Efficiency Reductions Graph

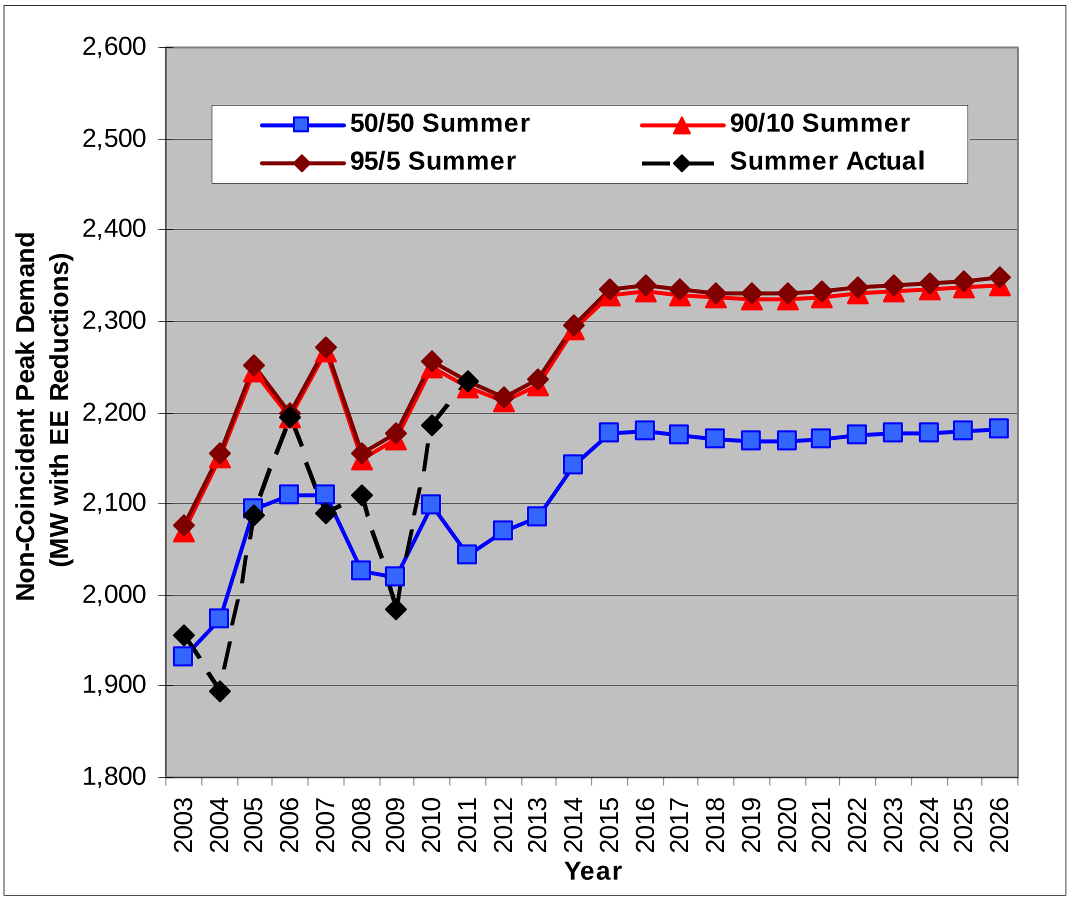


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Figure 3-14
Zone F Non-Coincident Summer Peak Demand
Including Energy Efficiency Reductions Table

ZONE F (Albany - Glen Falls Region) - SUMMER w/EE Reductions

	SUMMER PEAKS (MWs)								Wthi's			
YEAR	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2003	1,955		1,928		2,070		2,076		81.7	81.2	84.1	84.2
2004	1,895	-3.0%	2,008	4.1%	2,150	3.8%	2,156	3.8%	78.9	81.2	84.1	84.2
2005	2,088	10.2%	2,103	4.7%	2,245	4.4%	2,251	4.4%	80.9	81.2	84.1	84.2
2006	2,194	5.1%	2,052	-2.4%	2,194	-2.3%	2,200	-2.3%	84.1	81.2	84.1	84.2
2007	2,089	-4.8%	2,125	3.6%	2,267	3.3%	2,272	3.3%	80.5	81.2	84.1	84.2
2008	2,110	1.0%	2,007	-5.5%	2,149	-5.2%	2,155	-5.2%	83.3	81.2	84.1	84.2
2009	1,985	-5.9%	2,029	1.1%	2,171	1.0%	2,177	1.0%	80.3	81.2	84.1	84.2
2010	2,186	10.1%	2,108	3.9%	2,250	3.6%	2,256	3.6%	82.7	81.2	84.1	84.2
2011	2,234	2.2%	2,087	-1.0%	2,228	-1.0%	2,234	-1.0%	84.2	81.2	84.1	84.2
2012			2,069	-0.9%	2,211	-0.8%	2,217	-0.8%		81.2	84.1	84.2
2013			2,086	0.8%	2,230	0.9%	2,236	0.9%		81.2	84.1	84.2
2014			2,141	2.6%	2,290	2.7%	2,296	2.7%		81.2	84.1	84.2
2015			2,176	1.6%	2,328	1.7%	2,335	1.7%		81.2	84.1	84.2
2016			2,179	0.1%	2,332	0.2%	2,339	0.2%		81.2	84.1	84.2
2017			2,175	-0.2%	2,329	-0.2%	2,335	-0.2%		81.2	84.1	84.2
2018			2,170	-0.2%	2,325	-0.2%	2,331	-0.2%		81.2	84.1	84.2
2019			2,168	-0.1%	2,324	-0.1%	2,330	-0.1%		81.2	84.1	84.2
2020			2,168	0.0%	2,323	0.0%	2,330	0.0%		81.2	84.1	84.2
2021			2,171	0.1%	2,327	0.2%	2,333	0.2%		81.2	84.1	84.2
2022			2,174	0.1%	2,330	0.2%	2,337	0.2%		81.2	84.1	84.2
2023			2,176	0.1%	2,333	0.1%	2,339	0.1%		81.2	84.1	84.2
2024			2,178	0.1%	2,335	0.1%	2,342	0.1%		81.2	84.1	84.2
2025			2,180	0.1%	2,337	0.1%	2,344	0.1%		81.2	84.1	84.2
2026			2,182	0.1%	2,340	0.1%	2,347	0.1%		81.2	84.1	84.2
Compound Avg. 8 yr ('03 to '11)		1.7%		1.0%		0.9%		0.9%				
Compound Avg. 5 yr ('06 to '11)		0.4%		0.3%		0.3%		0.3%				
Compound Avg. 5 yr ('11 to '16)				**0.9%**		**0.9%**		**0.9%**				
Compound Avg. 10 yr ('11 to '21)				**0.4%**		**0.4%**		**0.4%**				
Compound Avg. 15 yr ('11 to '26)				**0.3%**		**0.3%**		**0.3%**				

Figure 3-15
Zone F Non-Coincident Winter Peak Demand
Including Energy Efficiency Reductions

ZONE F (Albany - Glen Falls Region) - WINTER w/EE Reductions

	WINTER PEAKS (MWs)								hdd			
YEAR (season)	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2002-2003	1,758		1,689		1,793		1,801		63.4	53.8	68.1	69 3
2003-2004	1,831	4.1%	1,767	4.6%	1,870	4.3%	1,879	4.3%	69.3	53.8	68.1	69 3
2004-2005	1,777	-2.9%	1,737	-1.7%	1,818	-2.8%	1,822	-3.0%	62.8	53.8	68.1	69 3
2005-2006	1,625	-8.6%	1,609	-7.4%	1,696	-6.7%	1,727	-5.2%	55.1	53.8	68.1	69 3
2006-2007	1,724	6.1%	1,802	12.0%	1,905	12.3%	1,914	10.8%	55.3	53.8	68.1	69 3
2007-2008	1,705	-1.1%	1,682	-6.6%	1,763	-7.5%	1,767	-7.7%	43.5	53.8	68.1	69 3
2008-2009	1,653	-3.1%	1,676	-0.3%	1,779	1.0%	1,788	1.2%	56.0	53.8	68.1	69 3
2009-2010	1,669	1.0%	1,655	-1.3%	1,750	-1.6%	1,770	-1.0%	50.9	53.8	68.1	69 3
2010-2011	1,732	3.7%	1,629	-1.6%	1,732	-1.0%	1,741	-1.7%	68.1	53.8	68.1	69 3
2011-2012			1,639	0.6%	1,734	0.1%	1,754	0.7%		53.8	68.1	69 3
2012-2013			1,668	1.8%	1,765	1.8%	1,785	1.8%		53.8	68.1	69 3
2013-2014			1,709	2.5%	1,809	2.5%	1,830	2.5%		53.8	68.1	69 3
2014-2015			1,719	0.6%	1,820	0.6%	1,841	0.6%		53.8	68.1	69 3
2015-2016			1 712	-0.5%	1 812	-0.4%	1 833	-0.4%		53.8	68.1	69 3
2016-2017			1,704	-0.5%	1,803	-0.5%	1,824	-0.5%		53.8	68.1	69 3
2017-2018			1,696	-0.4%	1,795	-0.4%	1,816	-0.4%		53.8	68.1	69 3
2018-2019			1,689	-0.4%	1,788	-0.4%	1,809	-0.4%		53.8	68.1	69 3
2019-2020			1,682	-0.4%	1,781	-0.4%	1,802	-0.4%		53.8	68.1	69 3
2020-2021			1,676	-0.4%	1,774	-0.4%	1,795	-0.3%		53.8	68.1	69 3
2021-2022			1,669	-0.4%	1,767	-0.4%	1,788	-0.4%		53.8	68.1	69 3
2022-2023			1,662	-0.4%	1,760	-0.4%	1,781	-0.4%		53.8	68.1	69 3
2023-2024			1,656	-0.4%	1,753	-0.4%	1,774	-0.4%		53.8	68.1	69 3
2024-2025			1,649	-0.4%	1,746	-0.4%	1,766	-0.4%		53.8	68.1	69 3
2025-2026			1,643	-0.4%	1,740	-0.4%	1,760	-0.4%		53.8	68.1	69 3
Compound Avg. 8 yr ('03 to '11)		-0.2%		-0.5%		-0.4%		-0.4%				
Compound Avg. 5 yr ('06 to '11)		1.3%		0.2%		0.4%		0.2%				
Compound Avg. 5 yr ('11 to '16)				**1.0%**		**0.9%**		**1.0%**				
Compound Avg. 10 yr ('11 to '21)				**0.3%**		**0.2%**		**0.3%**				
Compound Avg. 15 yr ('11 to '26)				**0.1%**		**0.0%**		**0.1%**				

Asset Condition Programs

Figure 3-12 shows a map of the planned asset condition projects in the study area. Figure 3-16 shows a listing of the projects in tabular form.

Figure 3-16
Capital and Hudson Valley Study Area Planned Asset Condition Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Capital and Hudson Valley	3A/3B Tower Strategy	TRAN	None	New Scotland - Leeds 93/94 Tower Reinforcement - Public Safety	C07918
	AC Other	DIST	Capital Central	04615 Bethlehem L10, L14 Relay Upgrades	C36193
			Capital East	11122 Greenbush 07854 - Best Road Conversion	CD0152
				17902 Troy LVAC Network - William St	CD0628
			Mohawk	11314 Amsterdam 54 - Langley Rd 3Ø Extension	CD0169
				05474 Canajoharie 03124 Clinton Rd	C28288
				05473 Canajoharie 03122 - Rebuild Rt 162	C00329
				19410 Florida 52 - Bulls Head Rd Rebuild	CD1100
			Schoharie	06623 Sharon 52 - Rebuild Routes 20 & 145	C06680
				17054 Grand St. 51 - Route 7 Gap Closing	CD0374
				06273 Newtonville 30568 - Trailer Park	C36084
				19196 Middleburgh 51 - Route 145 Extend/Convert	CD1010
				19423 Delanson 51 - Route 7 Rebuild/Conversion	-
		SUB-T	Capital North	11457 Maplewood-Latham#9 Mapleview Tap Relocation	CD0832
			Schenectady	05078 Rotterdam - Weaver # 36 relocation	C33410
		TRAN	None	Alps #188 Obsolete Circuit Switcher	C28304
				Inman Rd - Install Circuit Switcher	C30765
				Replace NG ALCOA 115 kV Breakers	C30545
	Cable Replacement	DIST	Capital Central	09276 Trinity TB4 UG Cables	C36390
				09224 Riverside 28855 UG Cable Replacement	C36468
			Capital East	11064 South Mall cables replacements	CD0086
				18878 Greenbush 07852 - Huntswood Estates / Bella Vista URD Cable Replacement	CD0913
			Capital East Hudson Valley	09220 Liberty St. UG Cable Replacement	C36469
			Mohawk	05475 Canajoharie D-Line Work	C28837
		SUB-T	Capital Central	09222 Menands-Liberty #9 Cable Replacemen	C36276
				09223 Partridge-Ave A # 5 Cable Replaceme	C36273
				09207 Bethlehem-Rensselaer #13 cable rep	C36275
	Overhead Line Refurbishment Program - Asset Condition	TRAN	None	Bethlehem - Albany 18 T5070 ACR	CNYAS71
				Greenbush - Hudson #15	CNYAS72
				Hudson - Pleasant Valley 12 T5230 STR - ACR	CNYAS73
				Porter - Rotterdam 30 T4200	CNYAS77
				Taylorville - Boonville 5-6 T3320-T3330 ACR	C27437
				Taylorville-Moshier 7, T3340 LER - Central Div.	C24361
	Relay Replacement	SUB-T	Capital Central	09269 Partridge St.-Riverside-Repl PW	C36007
			Capital North	09259 Maplewood-Norton-Replace Pilot Wire	C36006
				09271 Repl Pilot Wire-Central Ave-Patroon	C36031
			Schenectady	09278 Weaver St. - Emmet -Repl Pilot Wire	C36009
		TRAN	None	Trans Relay Replacement - Alps Substation	(blank)
				Trans Relay Replacement - Altamont Substation	(blank)
				Trans Relay Replacement - Bethlehem Substation	(blank)
				Trans Relay Replacement - Feura Bush Substation	(blank)
				Trans Relay Replacement - Greenbush Substation	(blank)
				Trans Relay Replacement - Grooms Road Substation	(blank)
				Trans Relay Replacement - Long Lane Substation	(blank)
				Trans Relay Replacement - Lowville Substation	(blank)
				Trans Relay Replacement - Menands Substation	(blank)
				Trans Relay Replacement - New Scotland Substation	(blank)
				Trans Relay Replacement - North Troy Substation	(blank)
				Trans Relay Replacement - Reynolds Road Substation	(blank)
				Trans Relay Replacement - Riverside Substation	(blank)
				Trans Relay Replacement - Rosa Road Substation	(blank)
				Trans Relay Replacement - Rotterdam Substation	(blank)
				Trans Relay Replacement - Trinity Substation	(blank)
				Trans Relay Replacement - Woodlawn Substation	(blank)
	Substation Battery and Related	DIST	Capital Central	Battery - Newark Station 300	(blank)
				Battery - Partridge Street Station 128	(blank)
				Battery - Unionville Station 276	(blank)
			Capital East	Battery - Lansingburgh Station 93	(blank)
				Battery - Tibbits Avenue Station 292	(blank)
			Capital East Hudson Valley	Battery - Castleton Station 36	(blank)
			Schenectady	Battery - Weaver Street Station	(blank)
			Schoharie	Battery - Delanson Station 269	(blank)

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
	Substation Breaker	DIST	Capital Central	Breaker - Commerce Avenue Station 235	(blank)
				Breaker - Elsmere Station 407	(blank)
				Breaker - Partridge St.	(blank)
			Capital North	Breaker - Johnson Road Station 352	(blank)
			Mohawk	Breaker - Johnstown Station 61	(blank)
			Schenectady	Breaker - Curry Road Station 365	(blank)
				Breaker - Rosa Road	(blank)
			Schoharie	Breaker - Middleburg Station 390	(blank)
		TRAN	None	Trans Breaker Replacement - New Scotland Station 325	(blank)
	Substation Metal-Clad Switchgear	DIST	Capital Central	13340 Avenue A - Replace Metalclad Gear	-
				17875 Delmar Station 279 - Metalclad Replacement	-
			Mohawk	09221 Market Hill Convert Load	C36638
			Schenectady	13339 Scotia 255 - Replace Metalclad Gear	-
	Substation Power Transformer	DIST	Capital East	17796 Liberty Street Station 94-Replace Transformer	-
			Capital East Hudson Valley	09254 Hoag Station Rehab	C36050
			Schoharie	17798 Summit Station Transformer Replacement	-
		SUB-T	Schoharie	19212 Middleburg TB2 replacement	-
		TRAN	None	Greenbush - Replace TB3	C31663
	Substation Rebuild	TRAN	None	Rotterdam 115kV SubRebuild(AIS)	C34850
				Rotterdam 230kV Sub Rebuild (GIS) old C17849	C34849
	Substation RTU	DIST	Capital Central	RTU - Altamont	(blank)
			Capital North	RTU - Wolf Road	(blank)
			Mohawk	RTU - Church Street	(blank)
			Schenectady	RTU - Rosa Road	(blank)
			Schoharie	RTU - Cobleskill	(blank)
	Sub-T Line Removal	SUB-T	Capital Central	05324 Beth-Voorheesville-Retire Callanan	C27582
			Mohawk	05476 Canajoharie Sub Retirem-Sub-T Line	C35502
				11315 Johnstown-Market Hill #8 69kV Tribes Hill Tap Retirement	CD0179
	Sub-T Overhead Line	DIST	Capital East Hudson Valley	09213 Castleton Line Work	C36323
		SUB-T	Capital Central	06205 Menands-Liberty 9 Relocation	C33172
			Capital East Hudson Valley	05957 Greenbush-Defreesville 7 Rebuild	C07519
				05989 Hoag Station and Supply Line Rehab	C36334
			Capital North	11888 Randall Rd - New station - Inst/Rem sub-T lines	CD0898
				19316 Trenton-Prospect 23-46kv	-
				19329 Maplewood-Menands 17/18 d/c-34 5kv	-
				19309 Ballston-Shore Rd-Rosa Rd 5 and 8-34.5kv	-
				18347 Callanan Tap - Install new Sub-T line from Selkirk Sta.	-
			Mohawk	05275 Amsterdam-Rotterdam 3/4 Relocation	C33182
				05948 Gloversville - Canaj. #6 Refurbish	C16236
				19308 Epratah-Caroga 2-23kv	-
			Schenectady	19307 Rotterdam-Scotia-Rosa Road 32/6 -34 5kv	-
	U-Series Relay Strategy	TRAN	None	Leeds - Replace U Series Relays	C24663
				Rotterdam-Repl E205 U Series Relays	C05150
	Switchgear Replacement	DIST	Capital Central	04582 Altamont Sub Metalclad Replacement	C32296
				05269 Altamont Switchgear Replacmt D_Line	C33746
				13343 Pinebush - Replace Metalclad Gear	-
			Capital North	13342 Johnson Rd - Replace Metalclad Gear	-
			Mohawk	04867 Market Hill Sub Metalclad Replacemt	C32298
			Schenectady	05846 Emmet St - Repl TB1 and mclad	C17952
				09244 Chrisler Metal Clad Replacement	C36213
	ISO Capacitor Banks	DIST	Capital East	06977 NE NYISO 13.2kV Sub Cap Banks	C36827
				07004 NE NYISO Dist Line Cap Banks	C36831

Forecasted Capacity Constraints

Figure 3-17 maps the forecasted capacity constraints on the transmission system. Figure 3-18 lists the forecasted transmission capacity constraints. Figure 3-19 maps the forecasted capacity constraints on the distribution and sub-transmission systems and capacity planning solutions proposed in the study area for the next five years. Figures 3-20 and 3-21 list the distribution and sub-transmission system forecasted capacity constraints, and system capacity and performance solutions, respectively.

Figure 3-17
Capital and Hudson Valley Area Forecasted Transmission Capacity Constraints Map

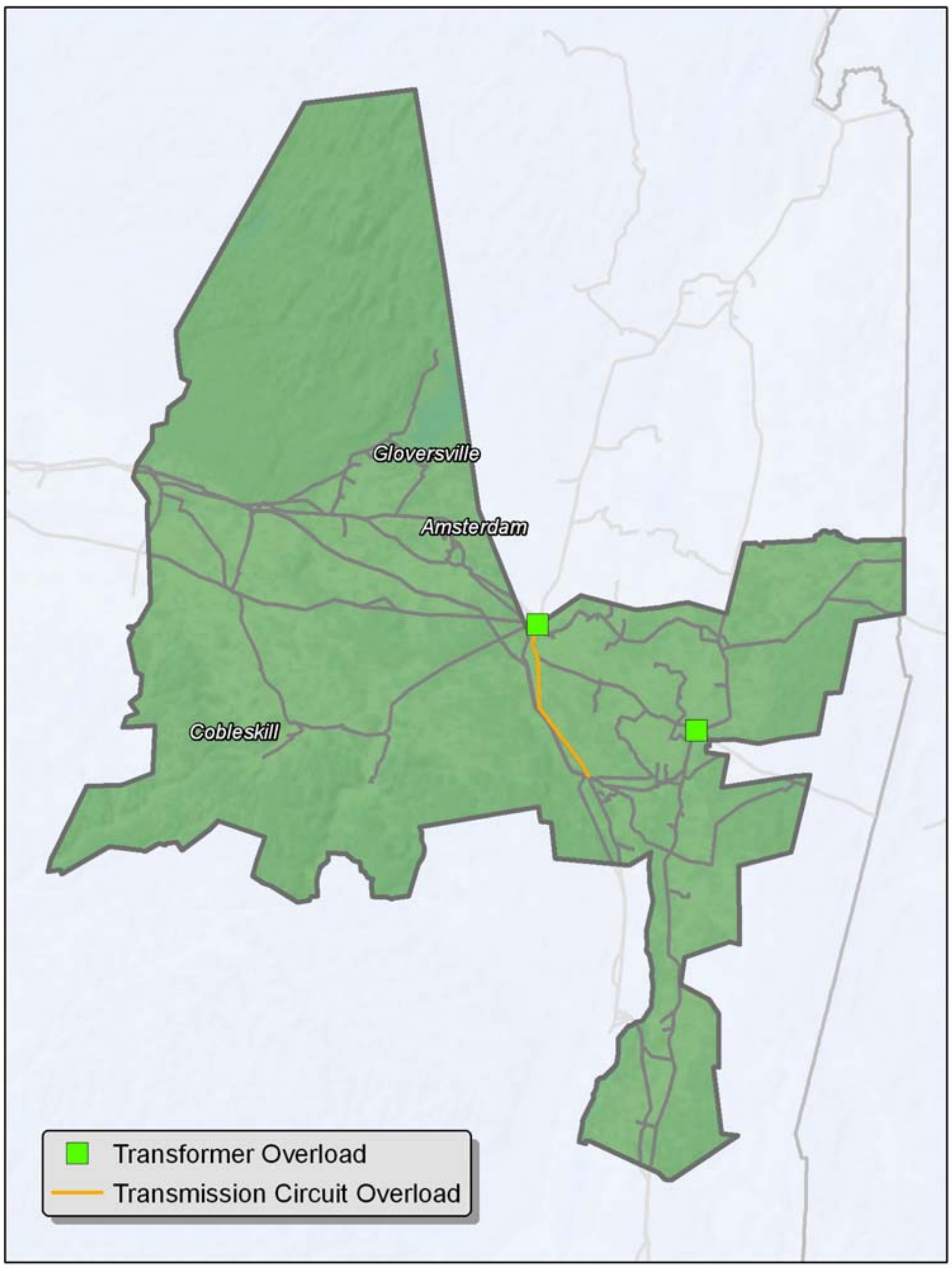

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Figure 3-18
Capital and Hudson Valley Area Forecasted Transmission Capacity Constraints Table

Impacted Asset	kV	Contingency	Need Year	Power Flow Case	Driving Issue	Project Number (s)	Comments / Mitigation / Corrective Action
Rotterdam 230-115 kV transformer TB8	230-115	Bus fault at Rotterdam with stuck breaker R82	2012	sum12_90_10_NRRP_Final_x_x	118% LTE 104% STE	C34523	The recommended solution is the new 230-115 kV Eastover substation in the Northeast Region.
Altamont-New Scotland #20	115	Rotterdam-Jordan #31	2026	Sum26_90_10_NRRP_final_x_x	117% LTE		The preferred alternative is to install a reactor in the #20 line. Since this problem is beyond the mid term planning horizon, load developments in the area will be monitored in the interim.
Reynolds Rd 345-115 kV transformer	345-115	bus section 99 at Albany	2026	Sum26_90_10_NRRP_final_x_x	112% LTE		The preferred alternative is to install the second 230-115 kV transformer at Eastover Rd. Because this problem is beyond the mid term planning horizon, load developments in the area will be monitored in the interim.
Rotterdam-New Scotland #19	115	Rotterdam-Jordan #31	2026	Sum26_90_10_NRRP_final_x_x	116% LTE		The preferred alternative is to install a reactor in the #19 line. Because this problem is beyond the mid term planning horizon, load developments in the area will be monitored in the interim.

Figure 3-19
Capital and Hudson Valley Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints Map

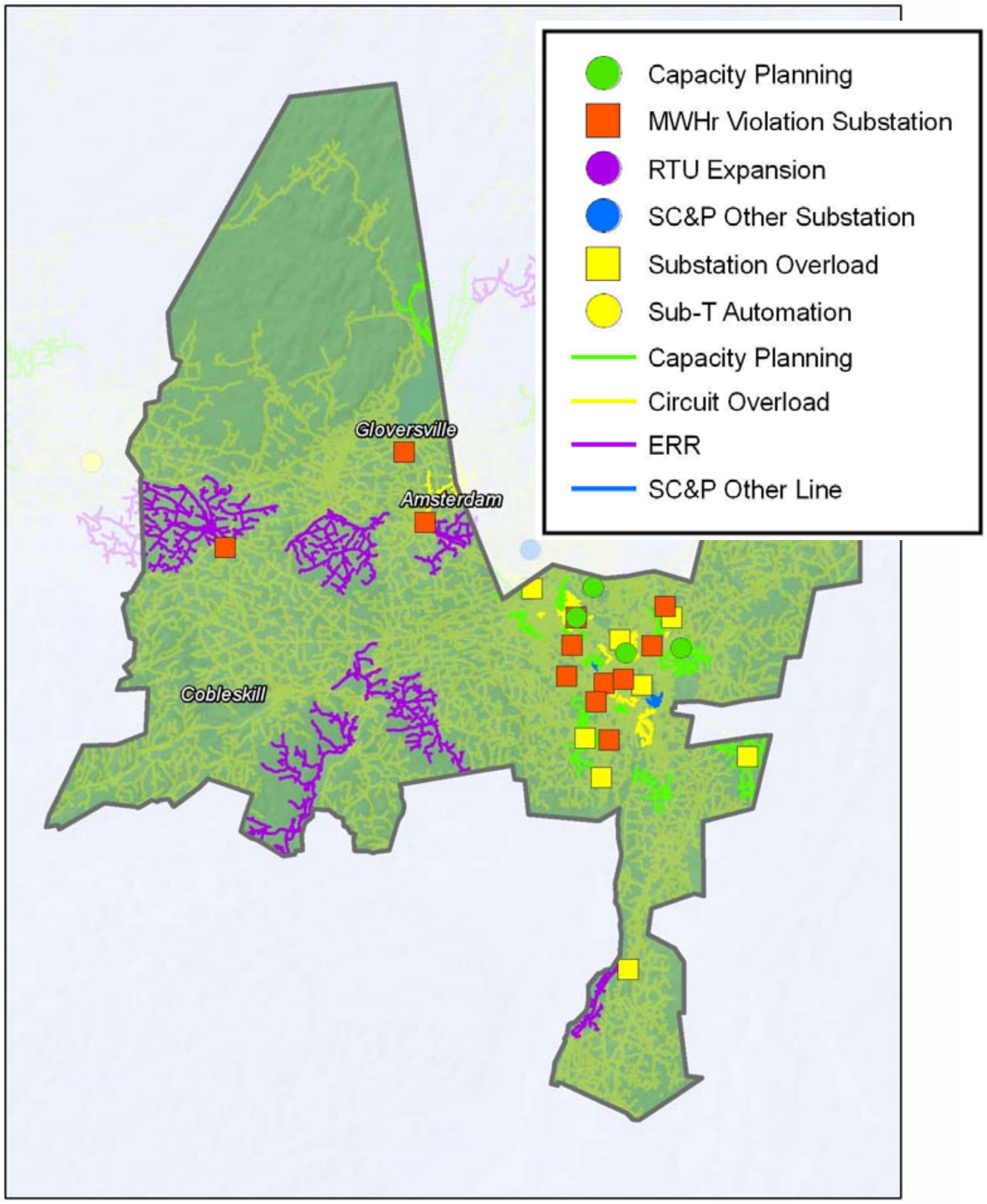

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Figure 3-20
Capital and Hudson Valley Study Area Forecasted Distribution and Sub-transmission Capacity Constraints Table

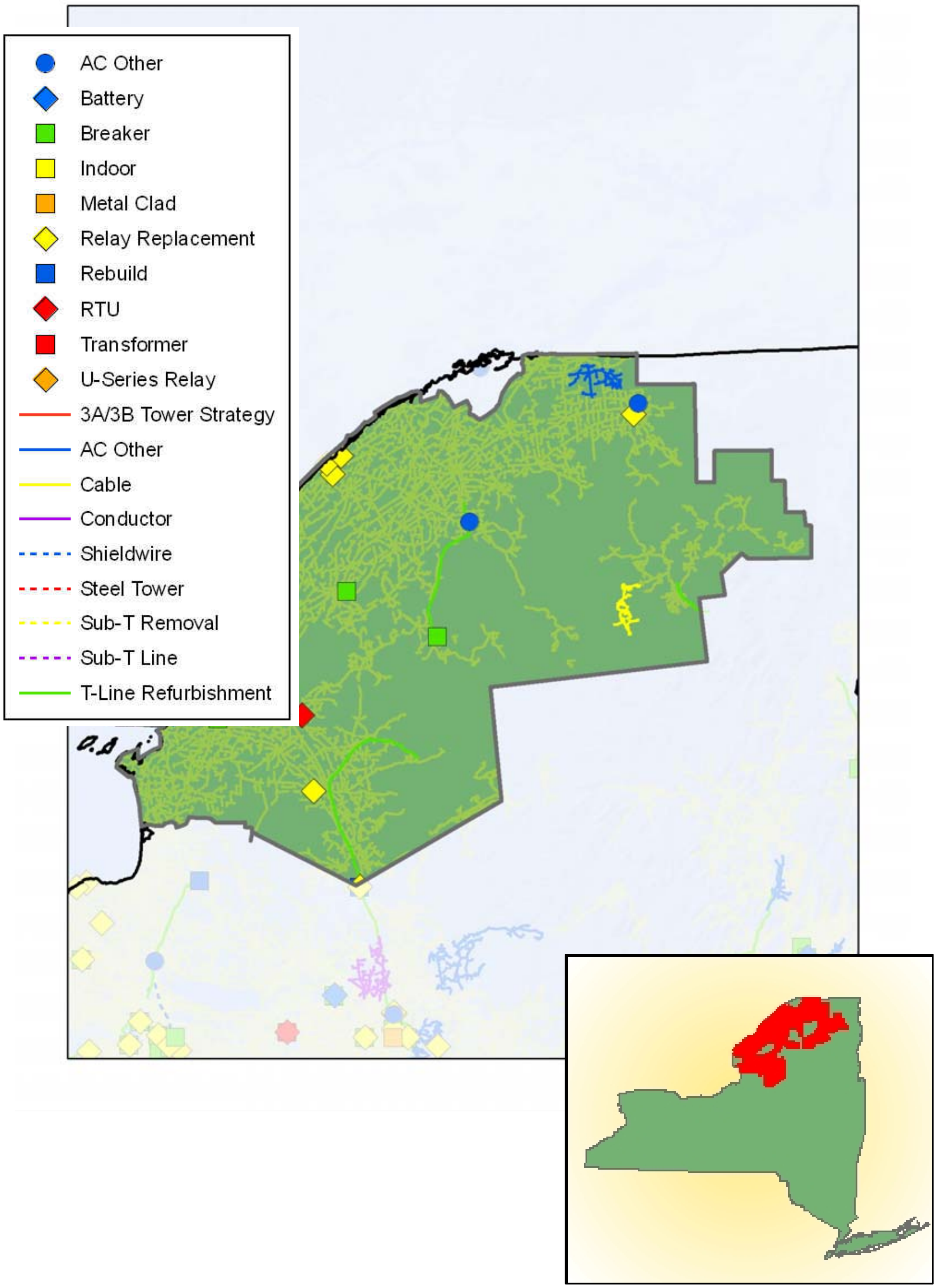
Identified Problem	System	Distribution Study Area	Substation	Supply Line	Feeder
Feeder Overload - COLVIN AVE Fdr 36 30 31386	DIST	Capital Central	COLVIN AVE		36 30 31386
Feeder Overload - COLVIN AVE., Fdr 36_30_31386	DIST	Capital Central	COLVIN AVE		36_30_31386
Feeder Overload - JUNIPER Fdr 36 30 44651	DIST	Capital Central	JUN PER		36 30 44651
Feeder Overload - L BERTY, Fdr 36_31_09450	DIST	Capital Central	LIBERTY		36_31_09450
Feeder Overload - RIVERSIDE Fdr 36 30 28855	DIST	Capital Central	RIVERSIDE		36 30 28855
MWHr Violations - BETHLEHEM	DIST	Capital Central	BETHLEHEM		
MWHr Violations - NEW KRUMKILL	DIST	Capital Central	NEW KRUMKILL		
MWHr Violations - PINEBUSH	DIST	Capital Central	PINEBUSH		
Transformer Overload - JUNIPER 34.5 - 13.2kV	DIST	Capital Central	JUN PER		
Transformer Overload - SELKIRK SUB 34 5 - 13 2kV	DIST	Capital Central	SELKIRK SUB		
Menands-Riverside #27 cable upgrade	SUB-T	Capital Central	MENANDS		
Newark-Maplewood #6 new parallel circuit	SUB-T	Capital Central	NEWARK ST	Newark #6	
Feeder Overload - GREENBUSH, Fdr 36_30_07853	DIST	Capital East	GREENBUSH		36_30_07853
Feeder Overload - GREENBUSH, Fdr 36_30_07856	DIST	Capital East	GREENBUSH		36_30_07856
Feeder Overload - HOAG, Fdr 36_30_22145	DIST	Capital East	HOAG		36_30_22145
Feeder Overload - LANSINGBURG, Fdr 36_31_09312	DIST	Capital East	LANS NGBURGH		36_31_09312
Feeder Overload - L BERTY ST., Fdr 36_31_09450	DIST	Capital East	LIBERTY		36_31_09450
Transformer Overload - CORLISS PARK 34 5 - 4.16kV	DIST	Capital East	CORLISS PARK		
Transformer Overload - HOAG 34.5-4.8kV	DIST	Capital East	HOAG		
Transformer Overload - 37 HUDSON AVE 23 - 4.16kV, T1-4	DIST	Capital East Hudson Valle	HUDSON		
Feeder Overload - INMAN RD., Fdr 36_32_37056	DIST	Capital North	INMAN RD		36_32_37056
Feeder Overload - INMAN RD., Fdr 36_32_37058	DIST	Capital North	INMAN RD		36_32_37058
Feeder Overload - JOHNSON RD., Fdr 36_31_35251	DIST	Capital North	JOHNSON		36_31_35251
Feeder Overload - NEWTONV LLE, Fdr 36_30_30584	DIST	Capital North	NEWTONVILLE		36_30_30584
Feeder Overload - RANDALL RD., Fdr 36_32_46357	DIST	Capital North	RANDALL RD		36_32_46357
Feeder Overload - WOLF RD., Fdr 36_30_34456	DIST	Capital North	WOLF RD.		36_30_34456
MWHr Violations - EVERETT RD	DIST	Capital North	EVERETT RD		
MWHr Violations - INMAN RD	DIST	Capital North	INMAN RD		
MWHr Violations - MAPLEWOOD	DIST	Capital North	MAPLEWOOD		
MWHr Violations - PATROON	DIST	Capital North	PATROON		
MWHr Violations - PROSPECT HILL	DIST	Capital North	PROSPECT HILL		
MWHr Violations - RUTH ROAD	DIST	Capital North	RUTH ROAD		
Transformer Overload - Latham 34.5-13.2kV	DIST	Capital North	LATHAM		
Feeder Overload - CHURCH ST, Fdr 36_35_04353	DIST	Mohawk	CHURCH ST		36_35_04353
MWHr Violations - CHURCH ST	DIST	Mohawk	CHURCH ST		
MWHr Violations - CLINTON ERCC	DIST	Mohawk	CL NTON ERCC		
MWHr Violations - VAIL MILLS	DIST	Mohawk	VAIL M LLS		
Feeder Overload - Brook Rd 36953	DIST	Northeast	BROOK ROAD		36 39 36953
Feeder Overload - Butler 36251	DIST	Northeast	BUTLER		36 38 36251
Feeder Overload - Glens Falls 7506	DIST	Northeast	GLENS FALLS		36 38 07506
Feeder Overload - Queensbury 29556	DIST	Northeast	QUEENSBURY		36 38 29556
Transformer Overload - Ogdenbrook 115 - 13.2kV	DIST	Northeast	OGDENBROOK		
Feeder Overload - CHRISLER AVE., Fdr 36_32_25735	DIST	Schenectady	CHRISLER AVE		36_32_25735
Feeder Overload - KARNER Fdr 36 30 31717	DIST	Schenectady	KARNER		36 30 31717
Feeder Overload - ROSA ROAD, Fdr 36_32_13757	DIST	Schenectady	ROSA ROAD		36_32_13757
Feeder Overload - SCOTIA Fdr 36 32 25571	DIST	Schenectady	SCOTIA		36 32 25571
Feeder Overload - SCOTIA, Fdr 36_32_25572	DIST	Schenectady	SCOTIA		36_32_25572
Transformer Overload - SCOTIA 115-13 2kV	DIST	Schenectady	SCOTIA		

Figure 3-21
Capital and Hudson Valley Study Area
Planned Distribution and Sub-transmission System Capacity and Performance Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Capital and Hudson Valley	Capacity Planning	DIST	Capital Central	13240 Newark 30057 - Continental Ave Conversion (4.16 to 13.2kV)	CD0338
				15749 DeLaet's Landing - Land and Civil Portion	CD0901
				19415 Trinity 16452 - Myrtle Ave Conversion (4.16 / 13.2kV)	-
				19416 New Krumkill 42153 - Getaway Replacement	-
				11147 Bethlehem 02158 - Juniper 44651 T E (02158 Conversion)	CD1067
				19217 Van Dyke Station - New 55 Dist Feeder	-
				19213 Van Dyke Station - New 52 dist feeder	-
				19216 Van Dyke Station - New 54 Dist Feeder	-
				19214 Van Dyke Station - New 53 Dist Feeder	-
				19219 Van Dyke Subst- New 57 Dist Feeder	-
				06855 Van Dyke Subst- New 51 Dist Feeder	C16087
				19218 Van Dyke Station - New 56 Dist Feeder	-
				19220 Van Dyke Station - New 115/13 2kV station	-
			Capital East	05168 Sycaway - Add M/C and 13.2kV Bus	C26418
				17232 Tibbits Ave 29254 - Getaway Replacement	CD0422
				06735 Sycaway-add new feeders	C28022
				15754 DeLaet's Landing DxD	CD0893
				19411 Sycaway 37253 - Brunswick Rd (Rte 2) Conversion (4.16/ 13.2kV)	-
				17731 Hoags Corner 22145 - Conversion (4.8/13.2kV)	CD0532
				06583 Schodack fdr rbld -retire castleton	C17957
				19412 Tibbits 29254 - 15th Ave Conversion (4.16 / 13.2kV) - Load Reallocation to Sycaway 37251	-
			Capital East Hudson Valley	06127 Liberty 9490 - replace getaway	C28786
			Capital North	11887 Randall Rd - New station - Dist getaways, etc	CD0897
				15713 Newtonville 30584 Load Relief	CD0388
				13280 Grooms Rd 34557 - Saratoga Rd Conversion (4.8 to 13.2kV)	-
				11490 Inman 37055 -- Lisha Kill Road Conversion (4.16kV to 13.2kV)	CD0209
				17510 Grooms Rd 34457 - Rosemary Drive Conversion - 4.16/13.2kV	CD0562
				06056 Inman Rd - add new feeders	C28772
				04827 Inman Rd -Add M/C & 13.2kV Bus work	C28770
				17513 Ruth Rd 38153 - Lisha Kill Rd Conversion	CD0563
				19413 Sand Creek 45253 - Bridle Path Reconductor & Convert single phase (2.4 / 7 62kV)	-
			Mohawk	06299 Northville 52 - Convert N. Shore Rd	C07477
			Schenectady	11542 Karner 31717 -- Central Ave Conversion (Adding Load to Ruth Road 38152)	CD0233
				18418 Burdeck 26552 - Westcott / Curry Rd Conversion (4.16 / 13.2kV)	-
				18417 Burdeck 26552 - Burnett St Conversion (4.16 / 13.2kV)	-
				17738 Curry Rd 36556 / Lynn St 32052 - Helderberg Ave Conversion (4.16/13 2kV)	-
				17420 Rotterdam 13853 - Route 5S Conversion (4.16 / 13.2kV)	CD0548
				19414 Rosa Rd 13757 - Grand Blvd - Conversion (4.16/13.2kV)	-
	ERR	DIST	Capital East	13278 Hudson 08753 - Hudson Terrace Apartments - UG Cable Replacement	CD0404
				13276 Hudson 08753 - Rhinebeck-Hudson Road - Reconductoring	CD0372
			Mohawk	06658 St Johnsville 51 - Casler Rd (ERR)	C35162
				05273 Amsterdam 51/53 - Widow Susan Rd Area	C28835
				12832 Center St 54 - Hyney Hill Road Rebuild	CD0357
				12834 Center St. 54 - Extend 3Ø on State Route 30A	CD0329
				06300 Northville 52 - EJ West 51 Tie	C29435
				05547 Clinton 53 - Convert Ft Plain	C06698
				06657 St Johnsville - Sanders Road	C29439
				Duplicate 05273 Amsterdam 51/53 - Widow Susan Rd Area	C28835
				Duplicate 06300 Northville 52 - EJ West 51 Tie	C29435
			Schoharie	12732 Middleburgh 51 - North Road Rebuild	CD0312
				12731 Middleburgh 51 - Relocate Route 30 Creek Crossing	CD0324
				17247 Schoharie 52 - State Route 443 Rebuild	CD0424
	SC&P Other	DIST	Capital Central	04991 Old Krumkill - Retire Station	C35223
			Capital East	17516 Reynolds Rd 33455 Line Extension (34.5kV to 13.2kV Conversion - Defreesville #7 line OOS)	-
				16879 Hudson 08753 - Route 9G - Reconductor - Tree Wire	CD0805
				05256 Albany Network Study Construction	CD0016
			Mohawk	05512 Center St 54 - Rebuild Route 5S	C29426
				17801 Church St Station - Add 2nd xfmr from Amsterdam Sta.	CD0639
			Schenectady	17515 Karner 31716 Conversion - New 13 2kV Tie	-

Chapter 3 C. Northern Transmission Study Area

Figure 3-22
Northern Study Area Asset Condition Program Work



Area Summary

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

- The interconnection of several wind generation projects.
- 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:

- The Little River - State St. 23kV sub-transmission system has seen increased customer expansion in recent years and has been the driver of capacity work.

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. There has been no activity from NCPA since the last filing of this report in October 2011.

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 major 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 and Lowville). The Nicholville-Malone study area serves approximately 18,500 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 44,100 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. Brown Falls substation is the main supply for the 34.5kV sub-transmission system.

The Tri-Lakes area serves approximately 11,300 customers. There are twenty nine 4.8kV, two 2.4kV 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 75,700 customers with a peak load of 235MW. 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.

Area Load Forecast

The Northern transmission study area load forecast is included in the East-North Central Region (NYISO Zone D & E) forecast. The summary of the load forecast thru 2026 is detailed in the figures below.

Figure 3-23
Zone D & E Non-Coincident Summer Peak Demand
Including energy Efficiency Reductions

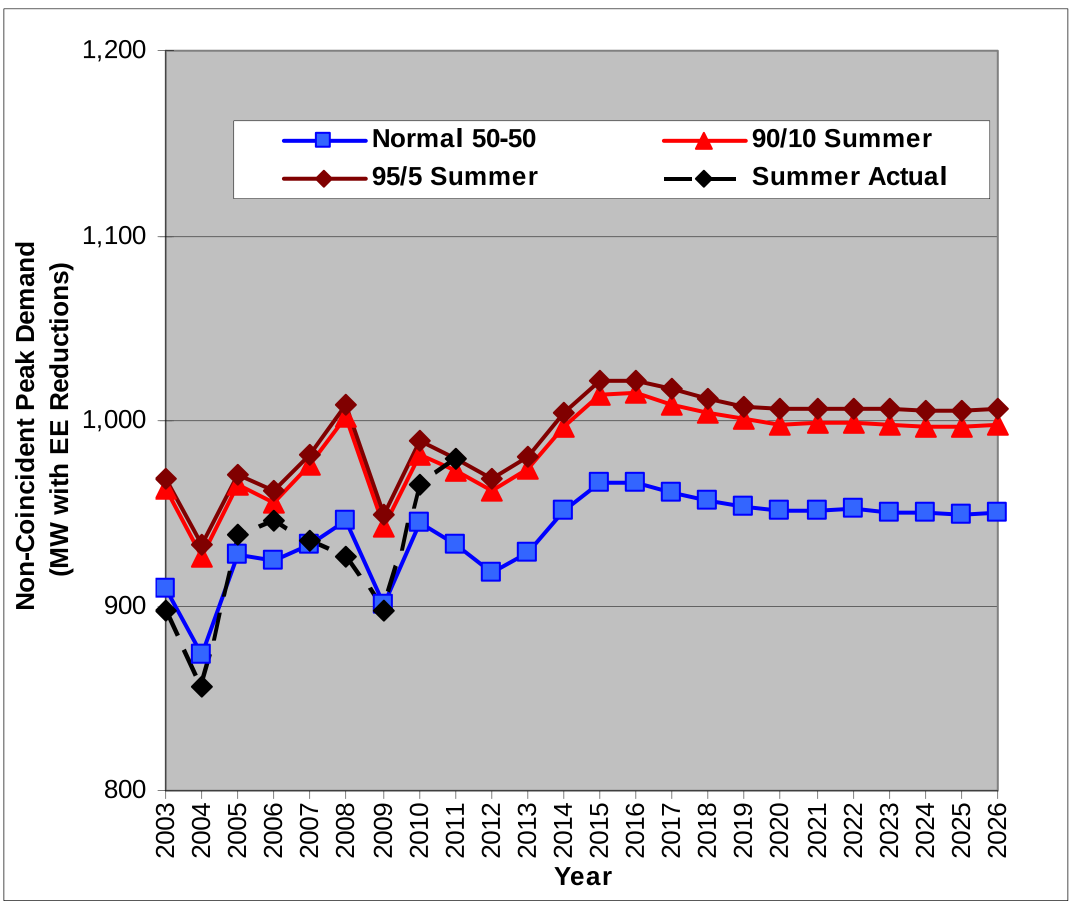


Figure 3-24
Zone D & E Non-Coincident Summer Peak Demand Including Energy Efficiency Reductions Table

ZONEs D&E (North & Utica Regions) - SUMMER w/EE Reductions												
	SUMMER PEAKS (MWs)								Wthi's			
YEAR	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2003	897		919		963		969		78.7	80.1	82.8	83.2
2004	856	-4.6%	882	-4.0%	926	-3.8%	933	-3.7%	78.5	80.1	82.8	83.2
2005	938	9.5%	921	4.5%	965	4.3%	971	4.1%	81.1	80.1	82.8	83.2
2006	946	0.9%	912	-1.0%	956	-0.9%	962	-0.9%	82.2	80.1	82.8	83.2
2007	935	-1.2%	932	2.2%	976	2.1%	982	2.1%	80.3	80.1	82.8	83.2
2008	926	-1.0%	958	2.8%	1,002	2.7%	1,009	2.8%	78.0	80.1	82.8	83.2
2009	897	-3.1%	899	-6.2%	943	-5.9%	949	-6.0%	79.9	80.1	82.8	83.2
2010	965	7.5%	938	4.3%	982	4.1%	989	4.2%	81.8	80.1	82.8	83.2
2011	979	1.5%	929	-0.9%	973	-0.9%	980	-0.9%	83.2	80.1	82.8	83.2
2012			918	-1.2%	962	-1.2%	969	-1.2%		80.1	82.8	83.2
2013			929	1.2%	974	1.3%	981	1.3%		80.1	82.8	83.2
2014			951	2.3%	997	2.4%	1,004	2.4%		80.1	82.8	83.2
2015			967	1.7%	1,014	1.7%	1,022	1.7%		80.1	82.8	83.2
2016			967	0.0%	1,015	0.1%	1,022	0.1%		80.1	82.8	83.2
2017			961	-0.6%	1,009	-0.6%	1,017	-0.6%		80.1	82.8	83.2
2018			957	-0.5%	1,004	-0.5%	1,012	-0.5%		80.1	82.8	83.2
2019			953	-0.3%	1,001	-0.3%	1,008	-0.3%		80.1	82.8	83.2
2020			951	-0.2%	998	-0.2%	1,006	-0.2%		80.1	82.8	83.2
2021			951	0.0%	999	0.0%	1,007	0.0%		80.1	82.8	83.2
2022			952	0.0%	999	0.0%	1,007	0.0%		80.1	82.8	83.2
2023			950	-0.1%	998	-0.1%	1,006	-0.1%		80.1	82.8	83.2
2024			950	0.0%	997	0.0%	1,005	0.0%		80.1	82.8	83.2
2025			949	-0.1%	997	-0.1%	1,005	0.0%		80.1	82.8	83.2
2026			950	0.1%	998	0.1%	1,006	0.1%		80.1	82.8	83.2
Compound Avg. 8 yr ('03 to '11)		1.1%		0.1%		0.1%		0.1%				
Compound Avg. 5 yr ('06 to '11)		0.7%		0.4%		0.4%		0.4%				
Compound Avg. 5 yr ('11 to '16)				**0.8%**		**0.8%**		**0.8%**				
Compound Avg. 10 yr ('11 to '21)				**0.2%**		**0.3%**		**0.3%**				
Compound Avg. 15 yr ('11 to '26)				**0.1%**		**0.2%**		**0.2%**				

Figure 3-25
Zone D & E Non-Coincident Winter Peak Demand Including Energy Efficiency Reductions Table

ZONEs D&E (North & Utica Regions) - WINTER w/EE Reductions												
	WINTER PEAKS (MWs)								hdd			
YEAR (season)	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2002-2003	887		845		893		903		65.5	54.4	67.0	69.7
2003-2004	1,049	18.2%	997	18.0%	1,049	17.4%	1,060	17.3%	36.6	54.4	67.0	69.7
2004-2005	945	-10.0%	910	-8.7%	959	-8.6%	969	-8.5%	69.7	54.4	67.0	69.7
2005-2006	852	-9.8%	855	-6.1%	893	-6.9%	904	-6.7%	63.3	54.4	67.0	69.7
2006-2007	953	11.9%	993	16.1%	1,041	16.6%	1,051	16.2%	57.7	54.4	67.0	69.7
2007-2008	919	-3.6%	900	-9.3%	938	-9.9%	949	-9.7%	44.1	54.4	67.0	69.7
2008-2009	915	-0.5%	876	-2.7%	924	-1.4%	935	-1.5%	64.5	54.4	67.0	69.7
2009-2010	876	-4.2%	862	-1.5%	936	1.2%	942	0.8%	50.8	54.4	67.0	69.7
2010-2011	927	5.9%	879	1.9%	927	-0.9%	938	-0.5%	67.0	54.4	67.0	69.7
2011-2012			880	0.2%	924	-0.3%	931	-0.7%		54.4	67.0	69.7
2012-2013			883	0.3%	928	0.4%	935	0.4%		54.4	67.0	69.7
2013-2014			886	0.3%	934	0.6%	940	0.6%		54.4	67.0	69.7
2014-2015			891	0.6%	928	-0.6%	934	-0.6%		54.4	67.0	69.7
2015-2016			886	-0.6%	911	-1.8%	921	-1.5%		54.4	67.0	69.7
2016-2017			872	-1.6%	896	-1.7%	906	-1.6%		54.4	67.0	69.7
2017-2018			856	-1.8%	880	-1.7%	890	-1.8%		54.4	67.0	69.7
2018-2019			842	-1.7%	866	-1.6%	875	-1.7%		54.4	67.0	69.7
2019-2020			828	-1.6%	852	-1.5%	861	-1.6%		54.4	67.0	69.7
2020-2021			816	-1.5%	841	-1.4%	848	-1.5%		54.4	67.0	69.7
2021-2022			805	-1.3%	828	-1.4%	837	-1.3%		54.4	67.0	69.7
2022-2023			793	-1.5%	816	-1.5%	825	-1.4%		54.4	67.0	69.7
2023-2024			782	-1.5%	805	-1.4%	813	-1.5%		54.4	67.0	69.7
2024-2025			770	-1.5%	794	-1.3%	801	-1.5%		54.4	67.0	69.7
2025-2026			760	-1.4%	784	-1.2%	791	-1.4%		54.4	67.0	69.7
Compound Avg. 8 yr ('03 to '11)		0.6%		0.5%		0.5%		0.5%				
Compound Avg. 5 yr ('06 to '11)		1.7%		0.5%		0.8%		0.7%				
Compound Avg. 5 yr ('11 to '16)				**0.2%**		**-0.4%**		**-0.4%**				
Compound Avg. 10 yr ('11 to '21)				**-0.7%**		**-1.0%**		**-1.0%**				
Compound Avg. 15 yr ('11 to '26)				**-1.0%**		**-1.1%**		**-1.1%**				

Asset Condition Programs

Figure 3-22 shows a map of the planned asset condition projects in the study area. Figure 3-26 shows a listing of the projects in tabular form.

Figure 3-26
Northern Study Area Planned Asset Condition Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Northern	AC Other	DIST	St. Lawrence	15739 NR_Dexter_72661_NYSHwy180_Rebuild	CD0478
				18651 NR_Dexter_72661-Canal Street-FdrTie	-
				18652 NR_Dexter_72661-NYS Route 3-FdrTie	-
			WLOF	05215 White Lake Station Upgrades	C08435
				09242 Carthage Reploace Struct Footings	C36183
				18416 NR-T.I.81452-County Route 100-Overload	-
				07009 NR-Samaritan Keep Nursing Home	C36846
			Nicholville-Malone	06353 NR-Westville 88561-Donovan Rd	C10695
		SUB-T	Tri-Lakes	18809 L. Clear-Tupper Lake 38-46kv-DANC Fiber Op ics	CD0887
		TRAN	None	ALCOA - Add Annunciator	C19934
				Higley-Repl Fuses w/Ckt Switcher	C34664
	Cable Replacement	DIST	WLOF	06338 NR-Mill St-Failed Ductline	C32650
			Tri-Lakes	06326 NR-Gilpin Bay 95661-Fish Creek Pond	C15727
	Overhead Line Refurbishment Program - Asset Condition	TRAN	None	Coffeen - Black River 3 T3120	CNYAS110
	Relay Replacement	TRAN	None	Trans Relay Replacement - Indian River Substation	(blank)
				Trans Relay Replacement - Malone Substation	(blank)
				Trans Relay Replacement - McIntyre Substation	(blank)
				Trans Relay Replacement - North Carthage Substa ion	(blank)
				Trans Relay Replacement - North Ogdensburg Substation	(blank)
				Trans Relay Replacement - Ogdensburg Substation	(blank)
	Substation Breaker	DIST	WLOF	Breaker - Mill Street	(blank)
		SUB-T	WLOF	04620 Boonville - Replace R210	C00411
		TRAN	None	Trans Breaker Replacement - Browns Falls Station 711	(blank)
	Substation Metal-Clad Switchgear	DIST	St. Lawrence	13344 Brady 957 - Replace Metalclad Gear	-
	Substation Power Transformer	DIST	St. Lawrence	09657 NR-State Street ES955-Failing TB#1(retirement)	CD0087
	Substation RTU	DIST	St. Lawrence	RTU - Lawrence Ave	(blank)
			WLOF	RTU - Indian River	(blank)
				RTU - North Carthage 1	(blank)
				RTU - Thousand Islands	(blank)
	Sub-T Overhead Line	SUB-T	St. Lawrence	06285 Norfolk-Norwood 23kv	C29443
			WLOF	05484 Carthage-N.Carthage 24/28 Refurbish	C29441
				19328 Taylorville-Effley 24-23kv	-
				19326 Carthage-N. Car hage-Deferiet 23kv	-
				19327 Carthage-Taylorville 21/22/26-23kv D/C	-
				Duplicate 19327 Carthage-Taylorville 21/22/26-23kv D/C	-
			Tri-Lakes	06103 Lake Clear-Tupper Lake #38 Rebuild	C13046

Forecasted Capacity Constraints

There are no transmission capacity constraints. Figure 3-27 maps the forecasted capacity constraints on the distribution system and capacity planning solutions proposed in the study area for the next five years. Figures 3-28 and 3-29 list the distribution system forecasted capacity constraints, and system capacity and performance solutions, respectively.

Figure 3-27
Northern Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints Map

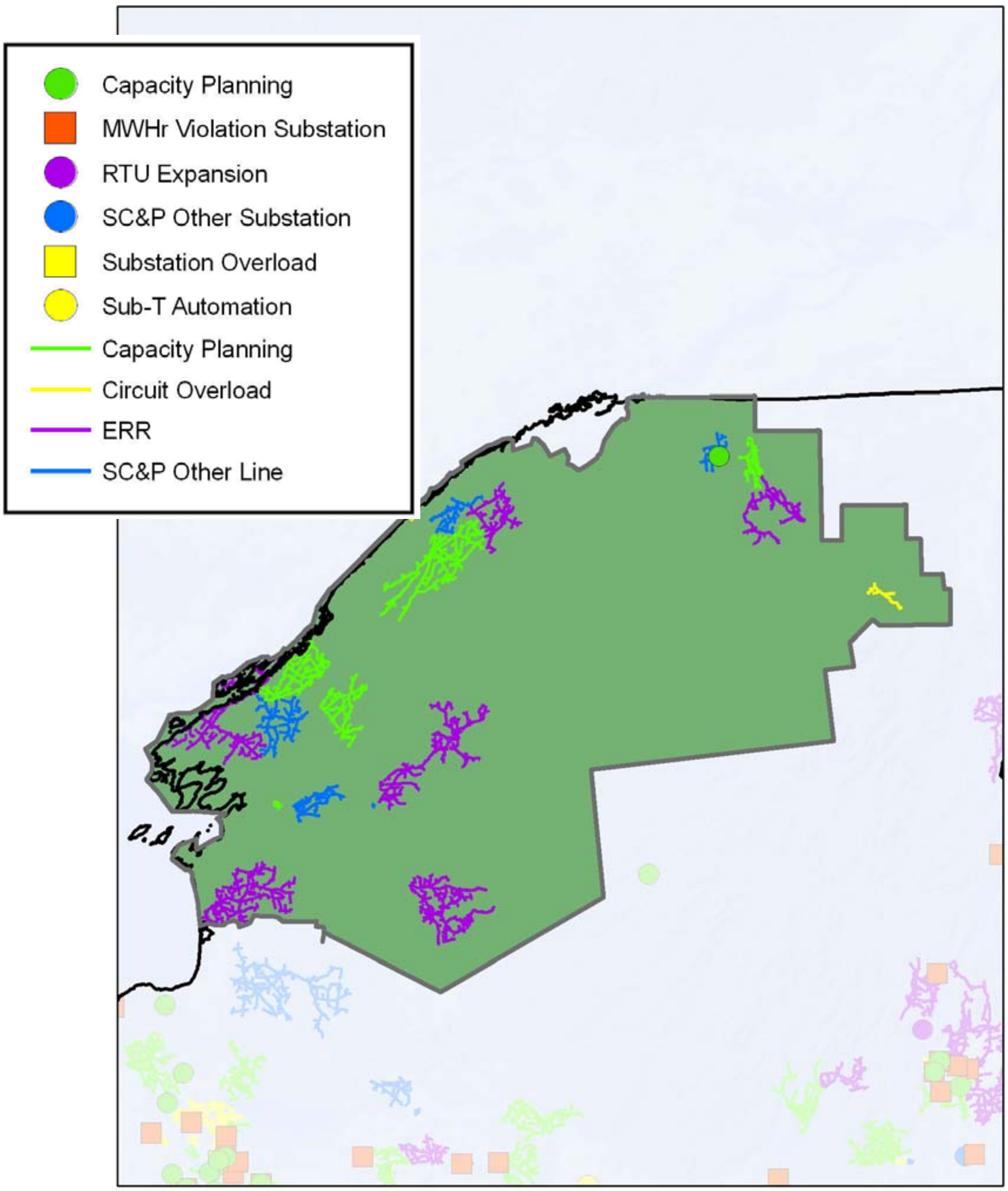


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Figure 3-28
Northern Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints

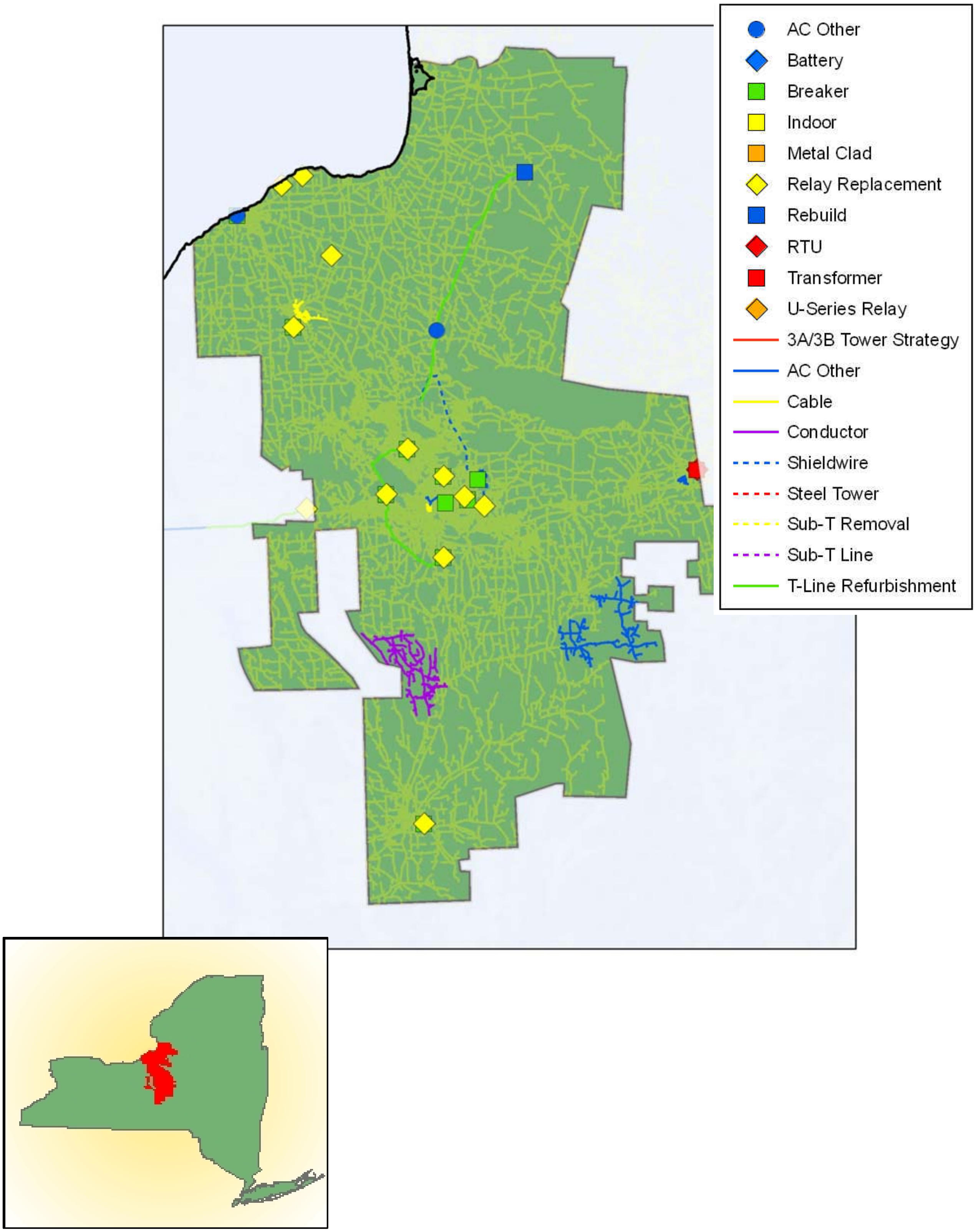
Identified Problem	System	Distribution Study Area	Substation	Supply Line	Feeder
Feeder Overload - MALONE, Fdr 36_27_89553	DIST	Malone/Nicholville	MALONE		36_27_89553
Feeder Overload - DAVID, Fdr 36_28_97967	DIST	St. Lawrence	DAVID		36_28_97967
Feeder Overload - SILVER LAKE Fdr 36_24_84561	DIST	Tri-Lakes	SILVER LAKE		36_24_84561
Feeder Overload - S. PHILADELPHIA, Fdr 36_13_76462	DIST	WLOF	S. PH LADELPHIA		36_13_76462

Figure 3-29
Northern Study Area
Planned Distribution and Sub-transmission System Capacity and Performance Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Northern	Capacity Planning	DIST	St. Lawrence	11073 NR-McAdoo 91451_V/O Heuvelton-Conversion	CD0114
			WLOF	17793 NR-Coffeen 76051_Gaffney St_Reconductor	CD1030
				11384 S.Philadelphia Transformer Upgrade	-
				19109 Raquette Lake Transformer Upgrade	-
				18522 Watertown New 115/13.2 kV Substation(D-Line)	-
				17925 NR_T.I.81458-CoRt13-Overloaded Step-down	CD0633
			Nicholville-Malone	17988 Elm St 89867 Load Relief	CD0709
				18406 Malone new feeder 89554 (Sta ion work)	-
				19422 North Bangor new 34.5/13.2kV Sta ion (D-Sub)	-
				18420 Malone new 89554 feeder (Line work)	-
	ERR	DIST	St. Lawrence	11146 NR-Brady 95757-CoRt27-FdrTie	-
				11145 NR-Brady 95757-Riverside Dr-FdrTie	-
			WLOF	06305 NR_81652_CoRte26_StepDown	C34803
				19468 NR_Lyme 73351-Breezy Point Rd-Overload	-
				12875 NR_Lyme 73351_T.I. 81455-NYSHwy12E_FdrTie	-
				11115 NR-Lowville 77354_Number Four Rd_Overload	CD0378
				06351 NR-W.Adams87554-Church St	C22959
				11103 NR-Lowville-77354-Burdick Crossing Road-FdrTie	CD1074
				11102 NR-Lowville 77354-Otter Creek Road-FdrTie	-
				11105 NR-Lowville 77354-Pine Grove Rd-Overloaded Step-down	CD0476
				06347 NR-T.I.81452-Cross Island Rd	C22912
				11101 NR-Lowville 77354-Pine Grove Road-FdrTie	-
				06341 NR-North Carthage 81652-53 Fdr Tie	C10693
				11597 NR_N Carthage_81652_NYSHwy3_InternalFdrTie	-
				19462 NR_T.I. 81455-Breezey Pines Rd-Overloaded Step-down	-
				19461 NR_T.I. 81455-Mils Road-Overloaded Step-down	-
				12883 NR_T.I._81455_NYSRte12E_Overloaded Step-down	CD0344
				19459 NR-T.I.81452-Grandview Park Rd-Rebuild	-
				19460 NR-T.I.81458-County Route 1-FdrTie	-
			Nicholville-Malone	11077 NR-Chasm Falls 85251-Indian Lake/Mtn View Lake-Rework	CD0088
	SC&P Other	DIST	St. Lawrence	09420 NR-T.I.81458-Carnegie Bay Road-Overloaded Ratio	CD0056
				17763 Lisbon 96361 feeder tie	CD0711
			WLOF	17733 NR-Coffeen 76052_E Watertown 81756_Inner Loop_FdrTie	CD0560
				18774 Carthage 71761, 71763 and 71764 feeder ie	CD0944
				18071 NR-T.I.81456_NYS Route 180_Relocation	CD0865
			Nicholville-Malone	19450 North Bangor Conversion (D-Line)	-

Chapter 3 D. Syracuse Oswego Cortland Transmission Study Area

Figure 3-30
Syracuse Oswego Cortland Study Area Asset Condition Program Work



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 one of the Clay 345-115kV autotransformers, as well as three 115kV circuits in the Syracuse area.
- Recommended projects to address post-contingency overloading include the replacement of the Clay 345-115kV TB1 autotransformer with an existing spare and the replacement of that spare, and the reconductoring of the Clay-DeWitt #3 and Clay-Teall #10 lines.
- Fault current levels have been identified in excess of the interrupting capability of breakers at four different substations in the area.

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 condition of the Ash St. substation is an asset condition driver.

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. [redacted] 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 6,500 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 consist one 34.5-13.2kV, three 34.5kV-4.8kV substations and one 34.5-4.16V substation. The only physical constraint is the Cazenovia Lake and the residential load which is spread around the Cazenovia Lake.

The Cortland study area serves approximately 32,800 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 16,000 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 and three 34.5-4.8kV 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 fifteen 13.2kV feeders and eleven 4.8kV feeders.

The Manlius Fayetteville study area serves approximately 22,400 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 65,800 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, eight 115-13.2kV and five 34.5-4.8kV 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 58,100 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 53,800 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 21,000 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.

Area Load Forecast

The SOC transmission study area load forecast is included in the Syracuse Region (NYISO Zone C) forecast. The summary of the load forecast thru 2026 is detailed in the figures below.

Figure 3-31
Zone C Non-Coincident Summer Peak Demand
Including Energy Efficiency Reductions

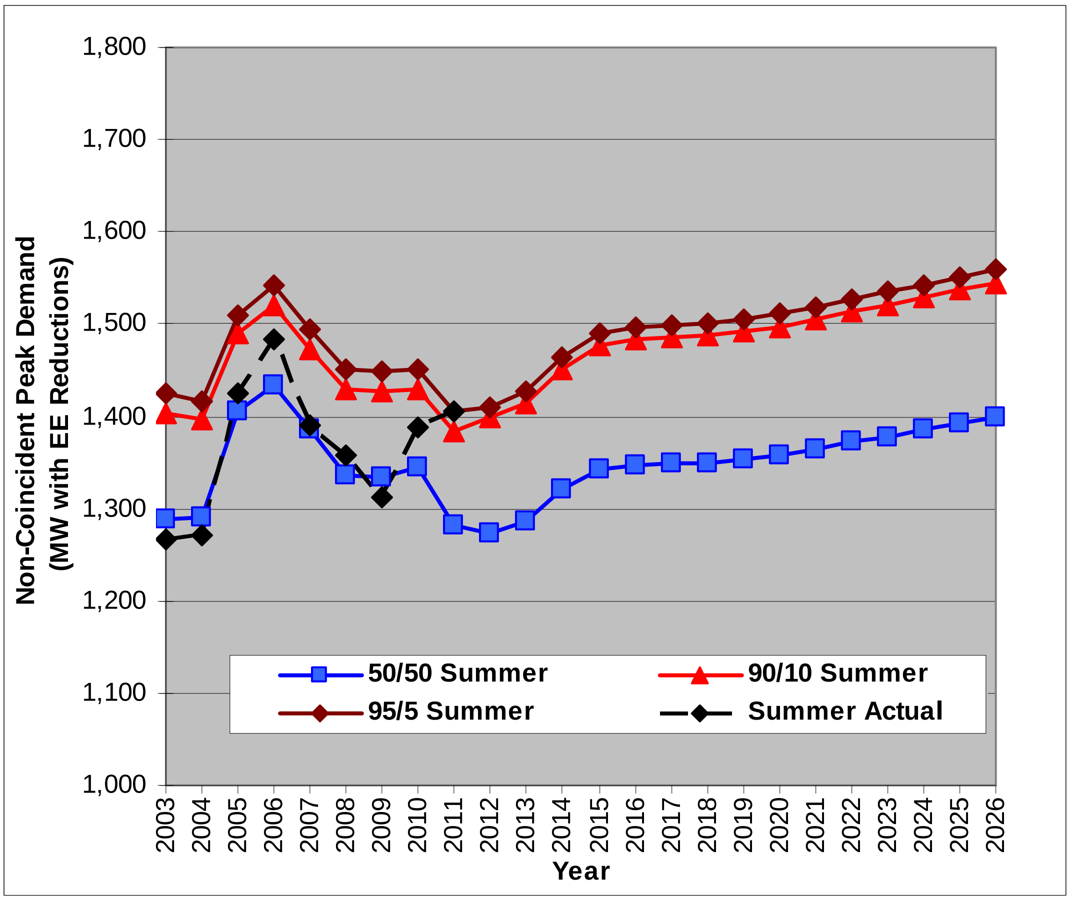


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Figure 3-32
Zone C Non-Coincident Summer Peak Demand
Including Energy Efficiency Reductions Table

ZONE C (Syracuse Region) - SUMMER w/EE Reductions

	SUMMER PEAKS (MWs)								Wthi's			
YEAR	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2003	1,266		1,309		1,404		1,425		79 6	81 0	84 3	85.1
2004	1,271	0.4%	1,301	-0.6%	1,396	-0.5%	1,417	-0.5%	80 0	81 0	84 3	85.1
2005	1,425	12.2%	1,394	7.1%	1,489	6.6%	1,510	6.5%	82.1	81 0	84 3	85.1
2006	1,483	4.1%	1,426	2.3%	1,521	2.2%	1,542	2.1%	83 0	81 0	84 3	85.1
2007	1,390	-6.3%	1,378	-3.4%	1,473	-3.2%	1,494	-3.1%	81.4	81 0	84 3	85.1
2008	1,358	-2.3%	1,335	-3.1%	1,430	-2.9%	1,451	-2.9%	81 8	81 0	84 3	85.1
2009	1,313	-3.3%	1,333	-0.2%	1,428	-0.2%	1,449	-0.2%	80.4	81 0	84 3	85.1
2010	1,387	5.6%	1,334	0.1%	1,429	0.1%	1,450	0.1%	82 9	81 0	84 3	85.1
2011	1,405	1.3%	1,289	-3.4%	1,384	-3.2%	1,405	-3.1%	85.1	81 0	84 3	85.1
2012			1,273	-1.2%	1,398	1.0%	1,410	0.4%		81 0	84 3	85.1
2013			1,287	1.1%	1,415	1.2%	1,427	1.2%		81 0	84 3	85.1
2014			1,320	2.6%	1,452	2.6%	1,465	2.6%		81 0	84 3	85.1
2015			1,342	1.7%	1,477	1.8%	1,490	1.8%		81 0	84 3	85.1
2016			1,347	0.3%	1,483	0.4%	1,496	0.4%		81 0	84 3	85.1
2017			1,349	0.1%	1,486	0.2%	1,499	0.2%		81 0	84 3	85.1
2018			1,350	0.1%	1,488	0.1%	1,501	0.2%		81 0	84 3	85.1
2019			1,353	0.2%	1,492	0.3%	1,505	0.3%		81 0	84 3	85.1
2020			1,357	0.3%	1,497	0.4%	1,511	0.4%		81 0	84 3	85.1
2021			1,364	0.5%	1,505	0.5%	1,519	0.5%		81 0	84 3	85.1
2022			1,372	0.5%	1,513	0.6%	1,527	0.6%		81 0	84 3	85.1
2023			1,378	0.5%	1,521	0.5%	1,535	0.5%		81 0	84 3	85.1
2024			1,385	0.5%	1,529	0.5%	1,543	0.5%		81 0	84 3	85.1
2025			1,392	0.5%	1,537	0.5%	1,551	0.5%		81 0	84 3	85.1
2026			1,400	0.5%	1,545	0.6%	1,559	0.6%		81 0	84 3	85.1
Compound Avg. 8 yr ('03 to '11)		1.3%		-0.2%		-0.2%		-0.2%				
Compound Avg. 5 yr ('06 to '11)		-1.1%		-2.0%		-1.9%		-1.8%				
Compound Avg. 5 yr ('11 to '16)				**0.9%**		**1.4%**		**1.3%**				
Compound Avg. 10 yr ('11 to '21)				**0.6%**		**0.8%**		**0.8%**				
Compound Avg. 15 yr ('11 to '26)				**0.6%**		**0.7%**		**0.7%**				

Figure 3-33
Zone C Non-Coincident Winter Peak Demand
Including Energy Efficiency Reductions Table

ZONE C (Syracuse Region) - WINTER w/EE Reductions

	WINTER PEAKS (MWs)								hdd			
YEAR (season)	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2002-2003	1,213		1,158		1,224		1,225		62.7	51.4	65 0	65.1
2003-2004	1,254	3.4%	1,131	-2.3%	1,228	0.3%	1,239	1.2%	41.8	51.4	65 0	65.1
2004-2005	1,214	-3.2%	1,160	2.5%	1,214	-1.1%	1,215	-2.0%	65.1	51.4	65 0	65.1
2005-2006	1,152	-5.1%	1,210	4.3%	1,296	6.8%	1,306	7.5%	59.5	51.4	65 0	65.1
2006-2007	1,211	5.1%	1,188	-1.8%	1,254	-3.2%	1,255	-4.0%	56.1	51.4	65 0	65.1
2007-2008	1,167	-3.6%	1,172	-1.4%	1,238	-1.3%	1,239	-1.3%	41.8	51.4	65 0	65.1
2008-2009	1,153	-1.2%	1,125	-4.0%	1,179	-4.7%	1,180	-4.7%	50.4	51.4	65 0	65.1
2009-2010	1,167	1.2%	1,175	4.4%	1,241	5.2%	1,242	5.2%	51.5	51.4	65 0	65.1
2010-2011	1,125	-3.5%	1,070	-8.9%	1,124	-9.4%	1,125	-9.4%	49.6	51.4	65 0	65.1
2011-2012			1,175	9.8%	1,242	10.5%	1,243	10.4%		51.4	65 0	65.1
2012-2013			1,189	1.2%	1,257	1.2%	1,258	1.2%		51.4	65 0	65.1
2013-2014			1,210	1.8%	1,281	1.9%	1,281	1.9%		51.4	65 0	65.1
2014-2015			1,216	0.4%	1,287	0.5%	1,288	0.5%		51.4	65 0	65.1
2015-2016			1 210	-0.4%	1 282	-0.4%	1 282	-0.4%		51.4	65 0	65.1
2016-2017			1,208	-0.2%	1,280	-0.2%	1,281	-0.2%		51.4	65 0	65.1
2017-2018			1,206	-0.2%	1,278	-0.2%	1,279	-0.2%		51.4	65 0	65.1
2018-2019			1,204	-0.2%	1,276	-0.1%	1,277	-0.1%		51.4	65 0	65.1
2019-2020			1,204	-0.1%	1,276	0.0%	1,276	0.0%		51.4	65 0	65.1
2020-2021			1,204	0.1%	1,277	0.1%	1,278	0.1%		51.4	65 0	65.1
2021-2022			1,206	0.2%	1,279	0.2%	1,280	0.2%		51.4	65 0	65.1
2022-2023			1,208	0.2%	1,282	0.2%	1,282	0.2%		51.4	65 0	65.1
2023-2024			1,210	0.2%	1,284	0.2%	1,284	0.2%		51.4	65 0	65.1
2024-2025			1,212	0.2%	1,286	0.2%	1,286	0.2%		51.4	65 0	65.1
2025-2026			1,215	0.2%	1,288	0.2%	1,289	0.2%		51.4	65 0	65.1
Compound Avg. 8 yr ('03 to '11)		-0.9%		-1.0%		-1.1%		-1.1%				
Compound Avg. 5 yr ('06 to '11)		-0.5%		-2.4%		-2.8%		-2.9%				
Compound Avg. 5 yr ('11 to '16)				**2.5%**		**2.7%**		**2.7%**				
Compound Avg. 10 yr ('11 to '21)				**1.2%**		**1.3%**		**1.3%**				
Compound Avg. 15 yr ('11 to '26)				**0.9%**		**0.9%**		**0.9%**				

Asset Condition Programs

Figure 3-30 shows a map of the planned asset condition projects in the study area. Figure 3-34 shows a listing of the projects in tabular form.

Figure 3-34
Syracuse Oswego Cortland Study Area Planned Asset Condition Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Syracuse Oswego Cortland	AC Other	DIST	East Syracuse	11833 Minoa Upgrade Station Regulator	-
			Syracuse	17435 CR_Syracuse_West St_MH 2-5_U_051_Concrete	CD0489
				18202 CR- Rebuild Midland Ave, Syracuse	CD0770
				Duplicate 17435 CR_Syracuse_West St_MH 2-5_U_051_Concrete	CD0489
			Manilus-Fayetteville	04747 Duguid 2nd Switchgear	C32338
			Cazenovia	11087 Delphi 26253 - Correct flicker problem (PSC Complaint)	CD0100
		SUB-T	Syracuse	05172 Teall Ave Upgrade 34 5kV Protection	C07808
		TRAN	None	Mallory Road Ground Protection	C37408
				OswegoPumpHouseAlarmsPIW012-2005	C36219
				Sleight-Auburn 3 T2560 Avian Mitigt	C39165
				Temple Pressuring Plant	CNYX26
	Cable Replacement	DIST	Syracuse	18758 UG Cable Repl Ash Street Fdr 22347	CD0915
				18759 UG Cable Repl Temple Street Fdr 24358	CD0914
			Volney	06917 Whitaker 51 River Crossing	C06850
		SUB-T	Syracuse	06018 Solvay Ash 27 Cable Repl SubT	C32147
	Conductor Replacement	DIST	Syracuse	17785 CR- Small & steel wire replacement on 27853	CD0551
	Overhead Line Refurbishment Program - Asset Condition	TRAN	None	GE - Geres Lock 8 T2240 D-F Refurb	CNYAS117
				Geres Lock - Solvay #2	CNYAS68
				Geres Lock - Tilden #16	CNYAS69
				Hook Road - Elbridge 7 T6150 ACR	CNYAS58
				Lighthouse Hill - Clay 7 T2320 ACR	CNYAS70
				Sleight Road - Auburn 3 T2560	CNYAS115
	Relay Replacement	TRAN	None	Trans Relay Replacement - Ash Substation	(blank)
				Trans Relay Replacement - Carr Street Substation	(blank)
				Trans Relay Replacement - Cortland Substation	(blank)
				Trans Relay Replacement - Curtis Substation	(blank)
				Trans Relay Replacement - Dewitt Substation	(blank)
				Trans Relay Replacement - Elbridge Substation	(blank)
				Trans Relay Replacement - Geres Lock Substation	(blank)
				Trans Relay Replacement - Independence Substation	(blank)
				Trans Relay Replacement - Scriba Substation	(blank)
				Trans Relay Replacement - Teall Substation	(blank)
				Trans Relay Replacement - Temple Substation	(blank)
				Trans Relay Replacement - Tilden Substation	(blank)
				Trans Relay Replacement - Volney Substation	(blank)
				Trans Relay Replacement - Woodard Substation	(blank)
	Shieldwire Strategy	TRAN	None	Shieldwire: Clay-Dewitt 3 - Central Div.	C28709
	Steel Tower Strategy	TRAN	None	S. Oswego Lighthouse Hill Circuits	C21693
	Substation Breaker	DIST	East Syracuse	Breaker - Fly Road	(blank)
		TRAN	None	Trans Breaker Replacement - Ash Street Station 223	(blank)
				Trans Breaker Replacement - Cortland Station 502	(blank)
				Trans Breaker Replacement - Curtis Street Station 224	(blank)
				Trans Breaker Replacement - Geres Lock Switching Station 30	(blank)
				Trans Breaker Replacement - Headson Station 146	(blank)
				Trans Breaker Replacement - Oswego Switch Yard	(blank)
				Trans Breaker Replacement - Peat Street Station 250	(blank)
				Trans Breaker Replacement - Teall Avenue Station 72	(blank)
				Trans Breaker Replacement - Temple Station 243	(blank)
				Trans Breaker Replacement - Tilden Station 73	(blank)
				Trans Breaker Replacement - Woodard Station 233	(blank)
	Substation Indoor	DIST	Syracuse	17328 Removal of Brighton Ave 4 kV Sub	CD0886
	Substation Power Transformer	DIST	Cortland	09248 Cuyler#24 Inst 34/4kV Substation	C36102
				09251 Fisher Ave Replace 34/13kV Trans	C36101
	Substation Rebuild	TRAN	None	Oswego Rebuild	CNYAS120
	Substation RTU	DIST	Manilus Fayetteville	RTU - Pebble Hill	(blank)
			North Syracuse	RTU - Sorrel Hill	(blank)
	Sub-T Line Removal	SUB-T	Cortland	05342 Booher Lumber Tap Remove	C35607
			North Syracuse	06965 Woodard-Whitacre Tap Remove	C33211
	Sub-T Overhead Line	SUB-T	Cortland	09777 Rathbun Labrador #39 Refubishment Phase II SubT	CD0183

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
			North Syracuse	19324 Woodard 28-34 5kv	-
				19291 Woodard 29-34 5kv	-
			Syracuse	17493 Solvay 22-34.5 kV line Refur.	-
				17494 Teall-Headson L31-L29-34.5 kV line Refurbishment	-
				19315 Woodard 24/Teall 28 -34 5kv	-
				19323 Solvay/Woodard-Ash st 27&27&28- 34 5kv	-
				19314 Re-arrange Teall 28/Woodard 24-34.5kv	-
				19322 Old Jewitt-Solvay 26(lns 30,31,26)-34 5kv towers	-
				Duplicate 19315 Woodard 24/Teall 28 -34 5kv	-
				Duplicate 19314 Re-arrange Teall 28/Woodard 24-34.5kv	-
				Duplicate 17494 Teall-Headson L31-L29-34.5 kV line Refurbishment	-
			Volney	17495 Mallory-Cicero L33-34 5 kV line Refurbishment	-
				19292 Bristol Hill-Phoenix 23-34.5kv	-
				19304 Varick-Bristol Hill 202-34.5kv	-
				19325 LHH-Mallory 22-34 5kv	-
	U-Series Relay Strategy	TRAN	None	LN17 - Replace Type U Series Relays	C24661
	Indoor Substation	DIST	Syracuse	11877 Rock Cut #286 2nd Tranf and Metalclad	CD0882
	Switchgear Replacement	DIST	North Syracuse	13345 Hopkins 253 - Replace Metalclad Gear	-
		SUB-T	Syracuse	04587 Ash Street-Replace Metal Clad Sub	C36104

Forecasted Capacity Constraints

Figure 3-35 maps the forecasted capacity constraints on the transmission system. Figure 3-36 lists the forecasted transmission capacity constraints. Figure 3-37 maps the forecasted capacity constraints on the distribution system and capacity planning solutions proposed in the study area for the next five years. Figures 3-38 and 3-39 list the distribution system forecasted capacity constraints, and system capacity and performance solutions, respectively.

Figure 3-35
Syracuse Oswego Cortland Study Area Forecasted Transmission Capacity Constraints Map

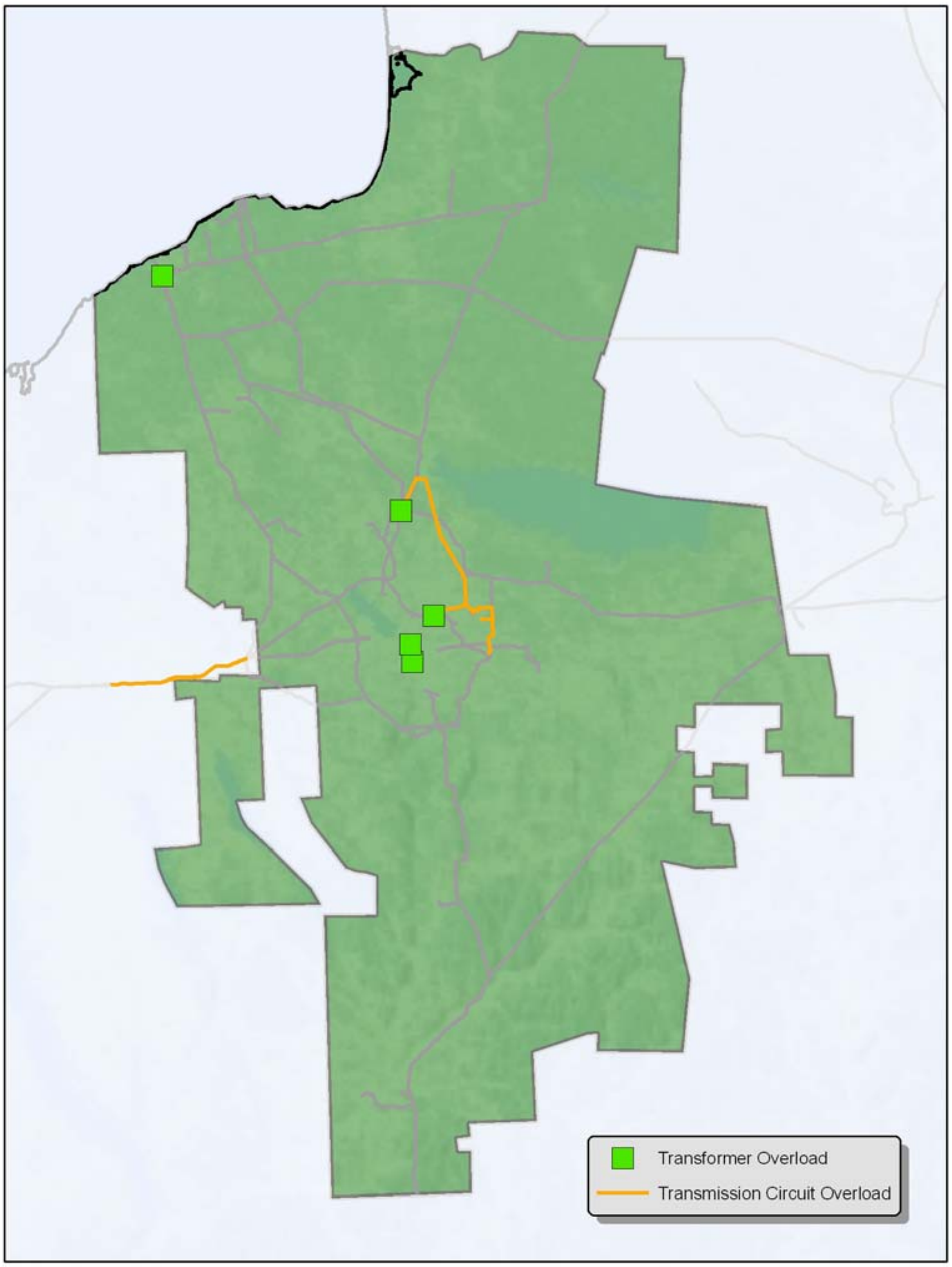


Figure 3-36
Syracuse Oswego Cortland Study Area Forecasted Transmission Capacity Constraints Table

Impacted Asset	kV	Contingency	Need Year	Power Flow Case	Driving Issue	Project Number (s)	Comments / Mitigation / Corrective Action
Clay Transformer Bank [redacted]	345	[redacted]	2012	2016 FERC base case	[redacted]		A spare transformer will be put into service [redacted] See Note1
Clay – Teall line [redacted]	115	[redacted]	2012	2016 FERC base case	[redacted]	CNYPL28	This line will be reconductored (12.83 miles). See Note 2
Clay – Dewitt line [redacted]	115	[redacted]	2012	2016 FERC base case	[redacted]	CNYPL28	This line will be reconductored (10.24 miles). See Note 3
Ash Street substation	115	3 Phase fault	2012	NYISO 2012	Over Duty (112%)	CNYPL26	Affected breakers will be replaced with higher rated units.
Oswego substation	115	3 Phase fault	2012	NYISO 2012	Over Duty (130%)	CNYPL26	Affected breakers will be replaced with higher rated units.
Teall substation	115	3 Phase fault	2012	NYISO 2012	Over Duty (125%)	CNYPL26	Affected breakers will be replaced with higher rated units.
Temple substation	115	3 Phase fault	2012	NYISO 2012	Over Duty (111%)	CNYPL26	Affected breakers will be replaced with higher rated units.
5 (State St– Elbridge)	115	Breaker Open: Quaker2 or Quaker-Sleight #13	2012	Summer 2015	110% LTE, 101% STE		This problem was identified in previous studies of the Mortimer – Elbridge area and will be addressed by a proposed NYSEG project. See Note 4

Note 1
Clay Substation Transformer Bank (TB) [redacted]
Presently, there is a spare transformer located at that station, which was intended to be put into service in place of the smaller TB [redacted] This bank is a part of Transmission Asset Strategy's Transformer Replacement Project, which will replace this bank with the existing spare and install a new spare. As this solution will take up to 12 weeks, it will need to be done during light load conditions. [redacted]

Note 2
Clay – Teall Line [redacted]
The recommended solution is to reconductor 12.83 miles of this line. Because this issue involves contingencies that produce overloads above STE, interim measures must be taken. It is

recommended that circuit breaker [redacted] Additional operating measures such as load switching, generation redispatch, or load shedding may also be necessary in the interim.

Note 3
Clay – Dewitt line [redacted]
The recommended solution is to reconductor 10.24 miles of this line. Interim operating measures such as load switching, generation redispatch, or load shedding may be necessary.

Note 4
State St (Auburn) – [redacted]
This problem was identified in previous studies of the Mortimer – Elbridge area and will be addressed by a proposed NYSEG project. While project is being implemented, risk can be reduced by [redacted]

Figure 3-37
Syracuse Oswego Cortland Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints Map

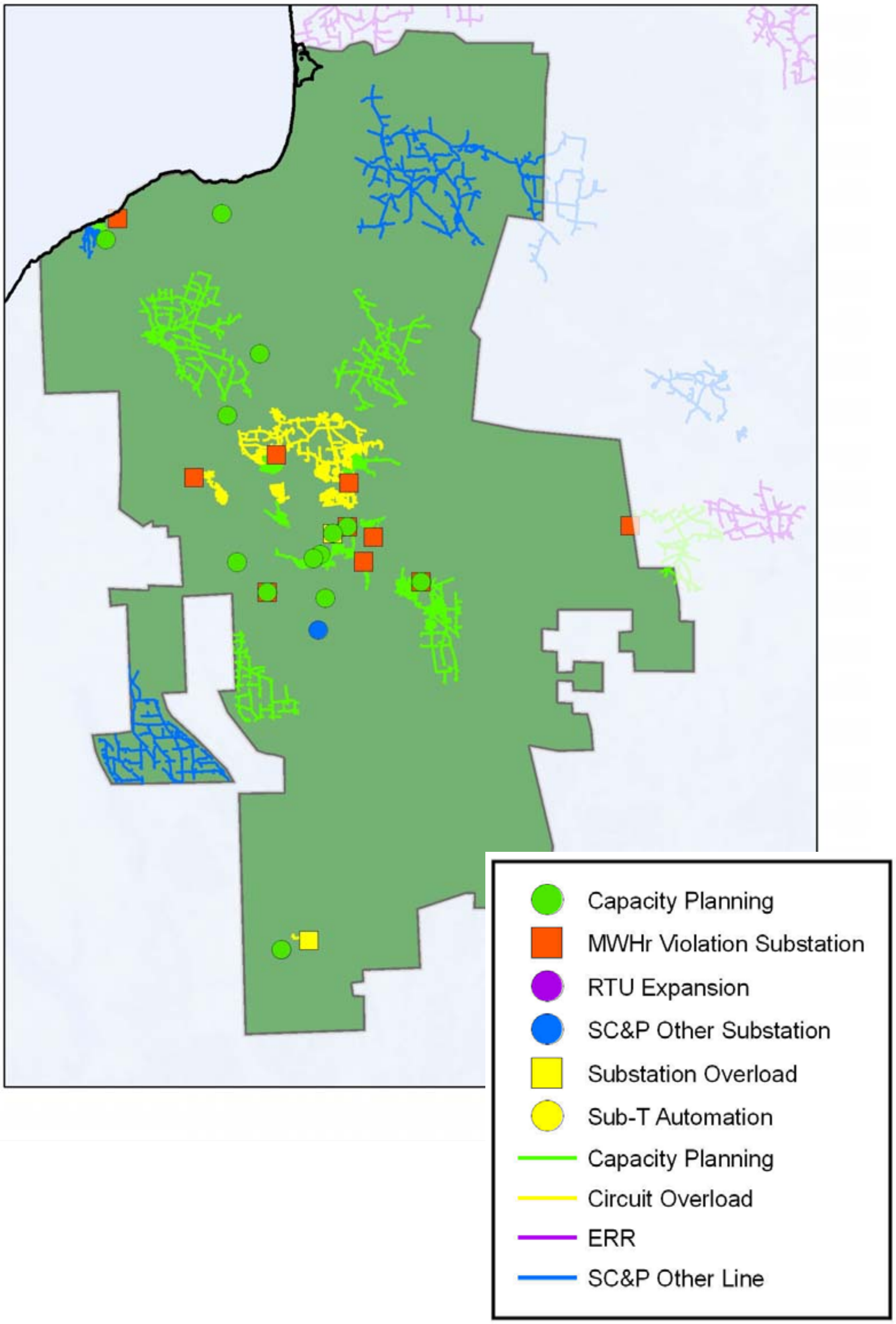


Figure 3-38
Syracuse Oswego Cortland Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints

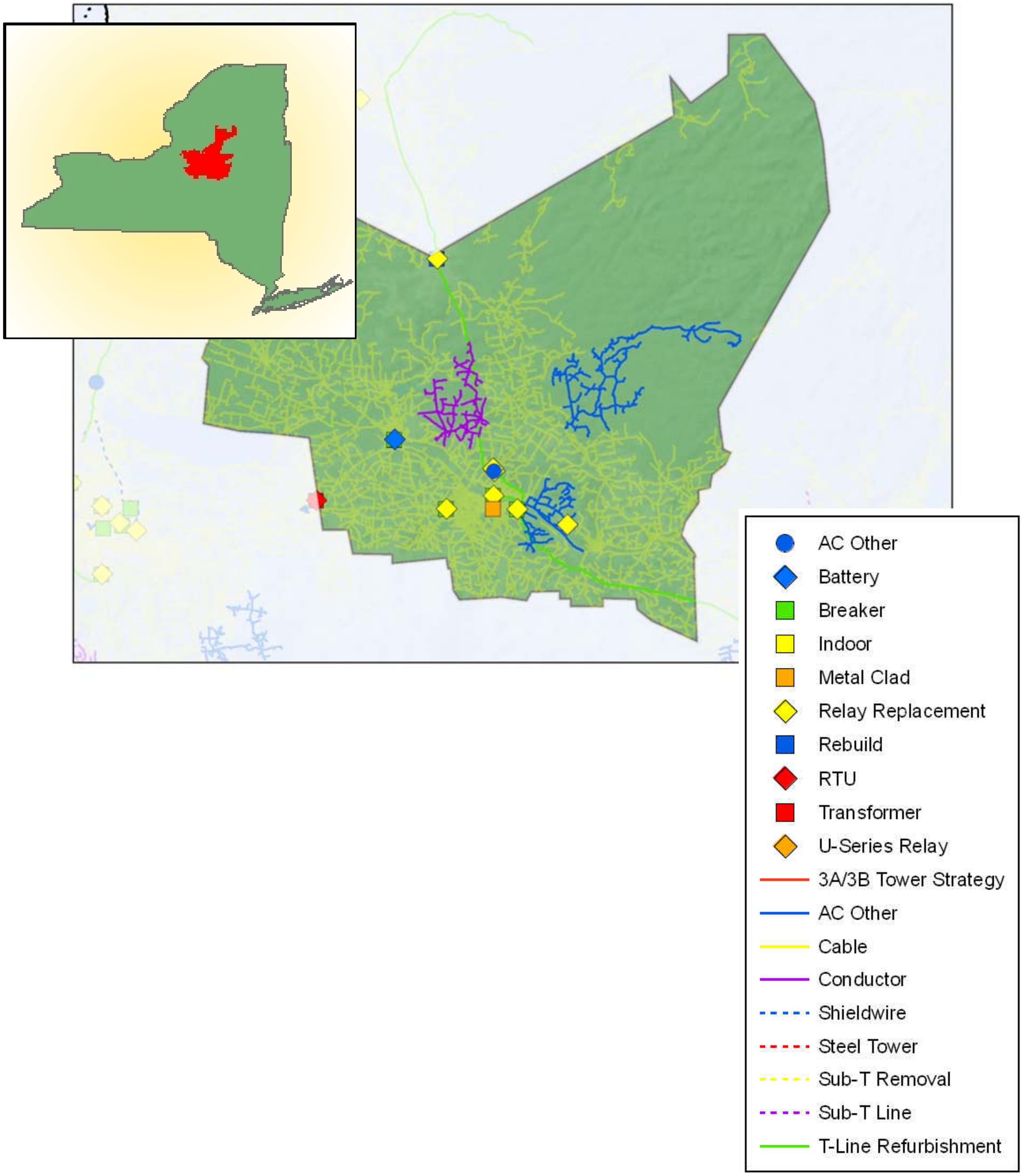
Identified Problem	System	Distribution Study Area	Substation	Supply Line	Feeder
Feeder Overload - CORTLAND, Fdr 36_12_50201	DIST	Cortland	CORTLAND		36_12_50201
Transformer Overload - Cortland 34.5 - 4 8kV	DIST	Cortland	CORTLAND		
MWHr Violations - BR DGE ST.	DIST	East Syracuse	BRIDGE ST.		
MWHr Violations - EAST MOLLOY ROAD	DIST	East Syracuse	EAST MOLLOY ROAD		
MWHr Violations - FLY RD.	DIST	East Syracuse	FLY RD.		
MWHr Violations - DUGUID	DIST	Manilus Fayetteville	DUGU D		
Feeder Overload - BARTELL, Fdr 36_11_32555	DIST	North Syracuse	BARTELL		36_11_32555
Feeder Overload - BARTELL Fdr 36 11 32556	DIST	North Syracuse	BARTELL		36 11 32556
Feeder Overload - BELMONT, Fdr 36_11_26054	DIST	North Syracuse	BELMONT		36_11_26054
Feeder Overload - EUCL D Fdr 36 11 26751	DIST	North Syracuse	EUCLID		36 11 26751
Feeder Overload - EUCL D, Fdr 36_11_26752	DIST	North Syracuse	EUCLID		36_11_26752
Feeder Overload - EUCL D Fdr 36 11 26754	DIST	North Syracuse	EUCLID		36 11 26754
Feeder Overload - PINE GROVE, Fdr 36_11_5951	DIST	North Syracuse	PINE GROVE		36_11_5951
Feeder Overload - PINE GROVE Fdr 36 11 5952	DIST	North Syracuse	PINE GROVE		36 11 5952
Feeder Overload - PINE GROVE, Fdr 36_11_5953	DIST	North Syracuse	PINE GROVE		36_11_5953
Feeder Overload - PINE GROVE Fdr 36 11 5957	DIST	North Syracuse	PINE GROVE		36 11 5957
Feeder Overload - SORRELL H LL, Fdr 36_11_26954	DIST	North Syracuse	SORRELL HILL		36_11_26954
MWHr Violations - EUCL D	DIST	North Syracuse	EUCLID		
MWHr Violations - PINE GROVE	DIST	North Syracuse	PINE GROVE		
MWHr Violations - SORRELL H LL	DIST	North Syracuse	SORRELL HILL		
Transformer Overload - TEALL AVE 115 - 13 2kV	DIST	Syracuse	TEALL AVE		
MWHr Violations - WINE CREEK	DIST	Volney	WINE CREEK		
MWHr Violations - HARRIS ROAD	DIST	West Syracuse	HARRIS ROAD		

Figure 3-39
Syracuse Oswego Cortland Study Area
Planned Distribution and Sub-transmission System Capacity and Performance Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Syracuse Oswego Cortland	Capacity Planning	DIST	Cortland	17871 CR- Starr Rd 51 Hwy 222 Conversion	CD0605
				19453 Lords Hill 67 Voltage violation corrections	-
				11486 Starr Rd 33453/Tuller Hill 24651	CD0861
				19065 Syracuse UG Study	-
				19064 Cortland Area Study	-
			East Syracuse	11541 E Malloy 15153 Aerial cable to open wire project	-
				13866 East Malloy- feeders and getaways	-
				13999 Fly Rd Low side substation equipment	-
				09250 East Malloy-low side sub equipment	C36188
				18719 Fly Rd Feeder Work	-
			North Syracuse	11509 Euclid 26754 Reconductoring	CD0285
				19234 New Cicero Substation Dline	-
				19233 New Cicero Substation DSub	-
				17853 CR- Pine Grove 56 NYS Hwy 31 conversion	CD0608
				09779 Pine Grove #59 UG Getaways	CD0217
				06532 River Rd Belmont 52	C30584
				06243 N Syracuse Sub Getaways	C30506
				04895 N Syracuse Capacity Inc	C28831
			Syracuse	11742 CR-Teall54 Lillian Ave Ratio	CD0269
				18626 CR- Ash Street 26 State St Reconductoring	CD0866
				17850 CR- Peat St 53 Mooney Ave Conversion	CD0613
				18375 CR_Temple St_LVAC_Network-2012 Cutovers	CD0911
				17827 CR- Rock Cut 53 Midland Ave conversion	CD0617
				11086 Ash St 12 kV Metalclad Replacement getaway cable	CD0134
				18584 Ash St_LVAC Network-Armory Square Area-Upgrades	CD0820
				17802 CR- Convert Peat St 52 Along Burnet Ave	CD0555
				19063 Park St Study	-
				19151 Teal Substation Rebuild-Feeders	-
			Volney	12729 CR-Replace regulators on Phoenix 65	CD0296
				17810 CR- Paloma 57 - Convert Schuyler St Ratio	CD0553
				18377 Gilbert Mills xfmr upgrade-buswork	-
				17819 CR- Convert CR 57 on Whitaker 53	CD0595
				17852 CR- W Monroe 51 CR 11 Conversion	CD0615
				18395 New Haven xfmr upgrade-Buswork	-
				18396 New Haven xfmr upgrade-Dline	-
				18394 Fairdale DLine	-
				06410 Paloma Feeder Getaway	C32498
				05637 Whitaker Dline work	C06848
				18393 Fairdale Dsub	-
				18397 Whitaker Dsub	-
				18720 Paloma new switchgear	-
				Duplicate 05637 Whitaker Dline work	C06848
			Manilus-Fayetteville	11107 Duguid 54 - Salt Springs Ratio Relief	CD0102
				17133 CR-Replace regulators on Duguid 51	CD0565
				11245 Pebble Hill 55 - Wellington ratio relief	CD0157
				11242 Duguid 54 - Brookside Ratio relief	CD0149
				06990 Duguid Second Transformer (D-line)	C36844
				Duplicate 06990 Duguid Second Transformer (D-line)	C36844
			West Syracuse	11191 Harris Rd 54 - Velakso Road Ratio relief	CD0155
				11164 Harris Rd 54 - Bryn Mawr Ratio Relief	CD0127
				18516 Milton Ave 2nd Switchgear	-
				18371 Milton Ave DLine	-
				18497 Harris Road Second SWGR	CD1088
	SC&P Other	DIST	Cortland	04903 Starr Road 13kV Bus Extension	C32368
			North Syracuse	13303 Pine Grove 5956/Bartell 32555 Feeder Tie	CD0475
				17480 Woodard 24 & 32 lines Relays	CD0576
			Syracuse	11377 CR_LHH 06141_NYS Route 13_Rebuild	CD0241
				17062 Midler Station Retirement	-
				17185 DLine -To expand Rock Cut Sub Retire Brighton 4kV	CD0881
				18413 CR- Nile 51 Glen Cove reconductoring (PPP)	CD0917
			Volney	05649 CR-PALOMA58 QRS FIX	C34846
				19031 CR- LHH 44 2012 NYS PSC action item - Noble Shores Rd	CD0987
				19077 CR- LHH 44 2012 NYS PSC Action item - CR47	CD0953
			Manilus-Fayetteville	17315 CR-Build tie between Duguid 54 & 55	CD0710

Chapter 3 E. Utica Rome Transmission Study Area

Figure 3-40
Utica Rome Study Area Asset Condition Program Work



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, Rome, and Inghams 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.
- Upon adoption of new NERC TPL Planning Criteria and the new BES definition (>= 100 kV), further study will determine permanent fixes for certain issues for which operational solutions are currently acceptable.

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 at 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 21,200 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 27,500 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.

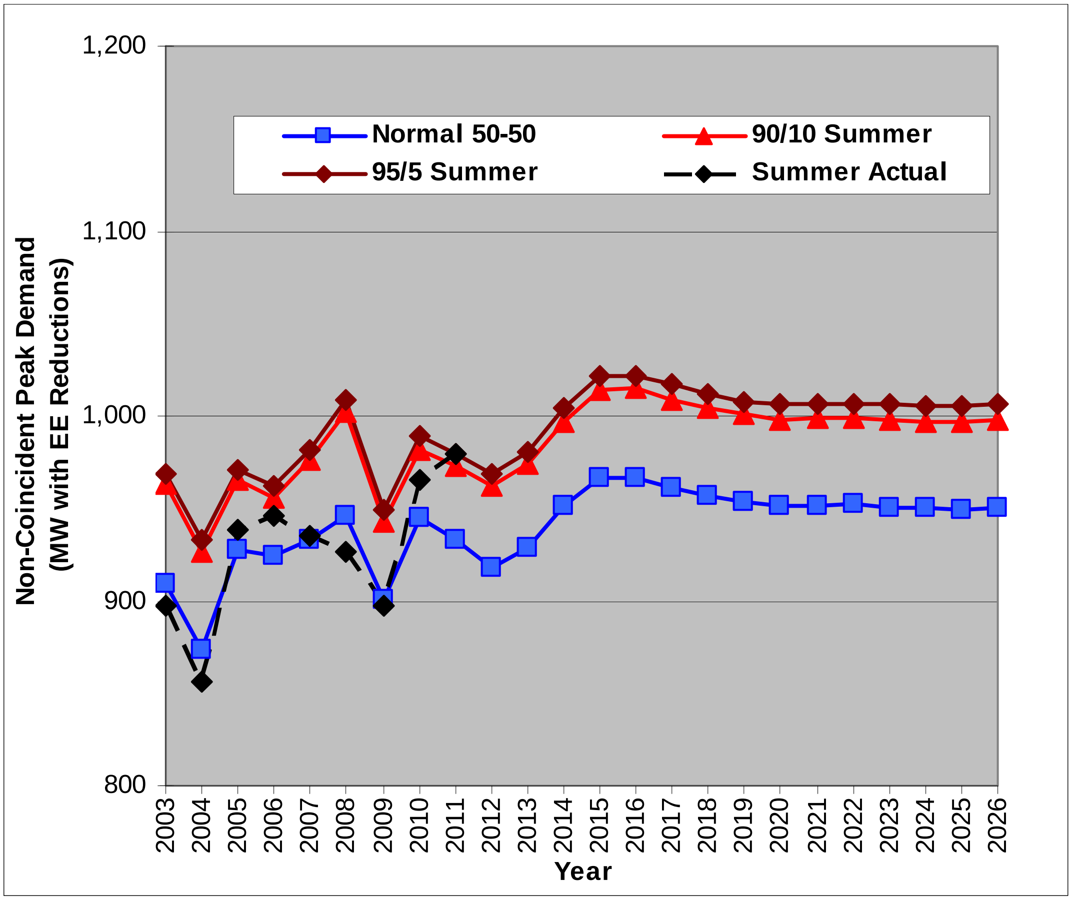
The Utica study area serves approximately 91,100 customers. The study area includes the City of Utica. The distribution system consist of four 115-46kV, ten 115-13.2kV, four 46-13.2kV and seven 46-5kV substations.

The WLOF-MV study area serves approximately 5,600 customers in Old Forge with 18MVA of load. There are five 46-4.16kV substations supplying nine 4.8kV feeders and one 13.2kV substation supplied out of Aldercreek substation. The 46kV sub-transmission system is supplied out of the Boonville substation.

Area Load Forecast

The Utica Rome transmission study area load forecast is included in the East-North Central Region (NYISO Zone D & E) forecast. The summary of the load forecast thru 2026 is detailed in the figures below.

Figure 3-41
Zone C Summer Non-Coincident Summer Peak Demand
Including Energy Efficiency Reductions



nationalgrid

Figure 3-42
Zone C Non-Coincident Summer Peak Demand Including Energy Efficiency Reductions Table

ZONEs D&E (North & Utica Regions) - SUMMER w/EE Reductions

YEAR	SUMMER PEAKS (MWs) ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		Wthi's ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2003	897		919		963		969		78.7	80.1	82.8	83.2
2004	856	-4.6%	882	-4.0%	926	-3.8%	933	-3.7%	78.5	80.1	82.8	83.2
2005	938	9.5%	921	4.5%	965	4.3%	971	4.1%	81.1	80.1	82.8	83.2
2006	946	0.9%	912	-1.0%	956	-0.9%	962	-0.9%	82.2	80.1	82.8	83.2
2007	935	-1.2%	932	2.2%	976	2.1%	982	2.1%	80.3	80.1	82.8	83.2
2008	926	-1.0%	958	2.8%	1,002	2.7%	1,009	2.8%	78.0	80.1	82.8	83.2
2009	897	-3.1%	899	-6.2%	943	-5.9%	949	-6.0%	79.9	80.1	82.8	83.2
2010	965	7.5%	938	4.3%	982	4.1%	989	4.2%	81.8	80.1	82.8	83.2
2011	979	1.5%	929	-0.9%	973	-0.9%	980	-0.9%	83.2	80.1	82.8	83.2
2012			918	-1.2%	962	-1.2%	969	-1.2%		80.1	82.8	83.2
2013			929	1.2%	974	1.3%	981	1.3%		80.1	82.8	83.2
2014			951	2.3%	997	2.4%	1,004	2.4%		80.1	82.8	83.2
2015			967	1.7%	1,014	1.7%	1,022	1.7%		80.1	82.8	83.2
2016			967	0.0%	1,015	0.1%	1,022	0.1%		80.1	82.8	83.2
2017			961	-0.6%	1,009	-0.6%	1,017	-0.6%		80.1	82.8	83.2
2018			957	-0.5%	1,004	-0.5%	1,012	-0.5%		80.1	82.8	83.2
2019			953	-0.3%	1,001	-0.3%	1,008	-0.3%		80.1	82.8	83.2
2020			951	-0.2%	998	-0.2%	1,006	-0.2%		80.1	82.8	83.2
2021			951	0.0%	999	0.0%	1,007	0.0%		80.1	82.8	83.2
2022			952	0.0%	999	0.0%	1,007	0.0%		80.1	82.8	83.2
2023			950	-0.1%	998	-0.1%	1,006	-0.1%		80.1	82.8	83.2
2024			950	0.0%	997	0.0%	1,005	0.0%		80.1	82.8	83.2
2025			949	-0.1%	997	-0.1%	1,005	0.0%		80.1	82.8	83.2
2026			950	0.1%	998	0.1%	1,006	0.1%		80.1	82.8	83.2
Compound Avg. 8 yr ('03 to '11)		1.1%		0.1%		0.1%		0.1%				
Compound Avg. 5 yr ('06 to '11)		0.7%		0.4%		0.4%		0.4%				
Compound Avg. 5 yr ('11 to '16)				**0.8%**		**0.8%**		**0.8%**				
Compound Avg. 10 yr ('11 to '21)				**0.2%**		**0.3%**		**0.3%**				
Compound Avg. 15 yr ('11 to '26)				**0.1%**		**0.2%**		**0.2%**				

Figure 3-43
Zone C Non-Coincident Winter Peak Demand Including Energy Efficiency Reductions Table

ZONEs D&E (North & Utica Regions) - WINTER w/EE Reductions

YEAR (season)	WINTER PEAKS (MWs) ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		hdd ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2002-2003	887		845		893		903		65.5	54.4	67.0	69.7
2003-2004	1,049	18.2%	997	18.0%	1,049	17.4%	1,060	17.3%	36.6	54.4	67.0	69.7
2004-2005	945	-10.0%	910	-8.7%	959	-8.6%	969	-8.5%	69.7	54.4	67.0	69.7
2005-2006	852	-9.8%	855	-6.1%	893	-6.9%	904	-6.7%	63.3	54.4	67.0	69.7
2006-2007	953	11.9%	993	16.1%	1,041	16.6%	1,051	16.2%	57.7	54.4	67.0	69.7
2007-2008	919	-3.6%	900	-9.3%	938	-9.9%	949	-9.7%	44.1	54.4	67.0	69.7
2008-2009	915	-0.5%	876	-2.7%	924	-1.4%	935	-1.5%	64.5	54.4	67.0	69.7
2009-2010	876	-4.2%	862	-1.5%	936	1.2%	942	0.8%	50.8	54.4	67.0	69.7
2010-2011	927	5.9%	879	1.9%	927	-0.9%	938	-0.5%	67.0	54.4	67.0	69.7
2011-2012			880	0.2%	924	-0.3%	931	-0.7%		54.4	67.0	69.7
2012-2013			883	0.3%	928	0.4%	935	0.4%		54.4	67.0	69.7
2013-2014			886	0.3%	934	0.6%	940	0.6%		54.4	67.0	69.7
2014-2015			891	0.6%	928	-0.6%	934	-0.6%		54.4	67.0	69.7
2015-2016			886	-0.6%	911	-1.8%	921	-1.5%		54.4	67.0	69.7
2016-2017			872	-1.6%	896	-1.7%	906	-1.6%		54.4	67.0	69.7
2017-2018			856	-1.8%	880	-1.7%	890	-1.8%		54.4	67.0	69.7
2018-2019			842	-1.7%	866	-1.6%	875	-1.7%		54.4	67.0	69.7
2019-2020			828	-1.6%	852	-1.5%	861	-1.6%		54.4	67.0	69.7
2020-2021			816	-1.5%	841	-1.4%	848	-1.5%		54.4	67.0	69.7
2021-2022			805	-1.3%	828	-1.4%	837	-1.3%		54.4	67.0	69.7
2022-2023			793	-1.5%	816	-1.5%	825	-1.4%		54.4	67.0	69.7
2023-2024			782	-1.5%	805	-1.4%	813	-1.5%		54.4	67.0	69.7
2024-2025			770	-1.5%	794	-1.3%	801	-1.5%		54.4	67.0	69.7
2025-2026			760	-1.4%	784	-1.2%	791	-1.4%		54.4	67.0	69.7
Compound Avg. 8 yr ('03 to '11)		0.6%		0.5%		0.5%		0.5%				
Compound Avg. 5 yr ('06 to '11)		1.7%		0.5%		0.8%		0.7%				
Compound Avg. 5 yr ('11 to '16)				**0.2%**		**-0.4%**		**-0.4%**				
Compound Avg. 10 yr ('11 to '21)				**-0.7%**		**-1.0%**		**-1.0%**				
Compound Avg. 15 yr ('11 to '26)				**-1.0%**		**-1.1%**		**-1.1%**				

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Asset Condition Programs

Figure 3-40 shows a map of the planned asset condition projects in the study area. Figure 3-44 shows a listing of the projects in tabular form.

Figure 3-44
Utica Rome Study Area Planned Asset Condition Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Utica Rome	AC Other	DIST	Oneida	11372 Lenox Station Retirement	CD0463
				13279 Lenox Station D Line Work	CD0464
				Duplicate 13279 Lenox Station D Line Work	CD0464
			Utica	13180 MV Dyke Rd - Schuyler 66356	CD1048
				17210 MV Hulser Rd Relocate OH Lines	CD0465
		TRAN	None	Porter 230kV - replace disconnects and PTs	CNYAS36
				Porter Replace 11 GE 230kV RF2 Discs	C20912
	Conductor Replacement	DIST	Utica	17788 MV- Replace steel conductor on Stittville 52	CD0604
	Overhead Line Refurbishment Program - Asset Condition	TRAN	None	Boonville - Porter [1]-2 [T4020]-T4030 ACR	CNYAS48
				Boonville - Rome #3	CNYAS54
				Porter Rotterdam 31, T4210 ACR	C30890
	Relay Replacement	TRAN	None	Trans Relay Replacement - Boonville Substation	(blank)
				Trans Relay Replacement - Edic Substation	(blank)
				Trans Relay Replacement - Porter Substation	(blank)
				Trans Relay Replacement - Terminal Substation	(blank)
				Trans Relay Replacement - Watkins Substation	(blank)
				Trans Relay Replacement - Yahundasis Substation	(blank)
	Substation Battery and Related	DIST	Rome	Battery - Rome Station 762	(blank)
	Substation Breaker	DIST	Rome	Breaker - Rome Station 762	(blank)
			Utica	12744 MV - Frankfort 67761 - Replace R610	CD0300
		TRAN	None	Trans Breaker Replacement - Schuyler Station 663	(blank)
				Trans Breaker Replacement - Terminal Station 651	(blank)
				Trans Breaker Replacement - Yahnundasis Station 646	(blank)
	Substation Metal-Clad Switchgear	DIST	Oneida	17183 Oneida SG replacement- feeder getaways	CD0504
			Utica	13348 Conkling 652 - Replace Metalclad Gear	-
	Substation Power Transformer	DIST	Utica	17806 Rock City Station 623 - Transformer Replacement	-
		TRAN	None	Oneida Transformer Replacement # 4	C37876
	Substation Rebuild	TRAN	None	Boonville Rebuild	CNYAS121
				LightHH 115kV Yard Repl & cntrl hse	C31662
				Oneida Substation Rebuild	C34443
				Rome 115 kV Station	C03778
				Rome Rebuild Line Portion	C34983
	Substation RTU	DIST	Oneida	RTU - Peterboro	(blank)
			Rome	RTU - Rome 1	(blank)
				RTU - Rome 2	(blank)
				RTU - Turin Road	(blank)
	Sub-T Overhead Line	SUB-T	Utica	06968 Yahnundasis-Schuyler 25/26 Refur.	C33174
				17492 Trenton-Whitesboro L25 N of Marcy Hosp Refr.	CD0619
				19303 Deerfield-whitesboro 26-46kv	-
				19301 Trenton-Deerfield 21/27-46kv	-
				19302 Trenton-Whitesboro 25-46kv	-
				19317 Yahnundasis-Clinton 24 and 27-46kv	-
				Duplicate 19301 Trenton-Deerfield 21/27-46kv	-
				Duplicate 19317 Yahnundasis-Clinton 24 and 27-46kv	-
				Duplicate 06968 Yahnundasis-Schuyler 25/26 Refur.	C33174
	U-Series Relay Strategy	TRAN	None	Edic FE1 - Replace U Series Relays	C24662
	Switchgear Replacement	DIST	Utica	13346 Whitesboro 632 - Replace Metalclad Gear	-
		SUB-T	Oneida	05059 Replace/Relocate 13 8kV SG @Oneida	C25139

Forecasted Capacity Constraints

Figure 3-45 maps the forecasted capacity constraints on the transmission system. Figure 3-46 lists the forecasted transmission capacity constraints. Figure 3-47 maps the forecasted capacity constraints on the distribution system and capacity planning solutions proposed in the study area for the next five years. Figures 3-48 and 3-49 list the distribution system forecasted capacity constraints, and system capacity and performance solutions, respectively.

Figure 3-45
Utica Rome Study Area Forecasted Transmission Capacity Constraints Map

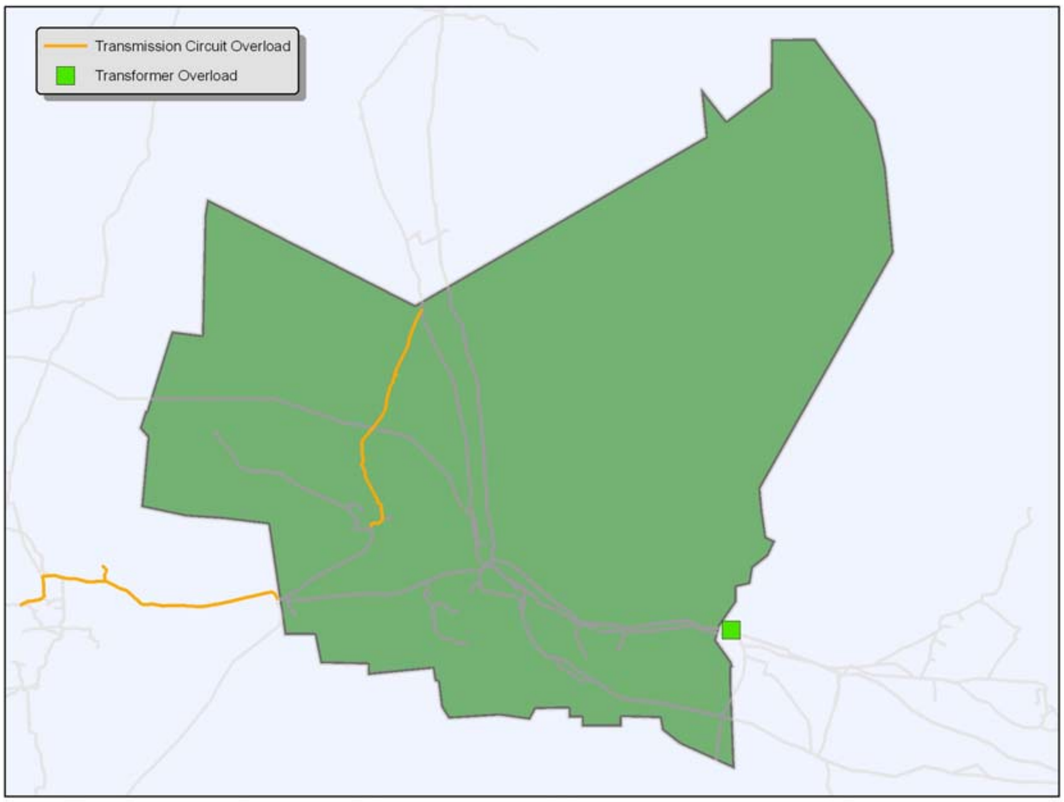

Figure 3-46
Utica Rome Study Area Forecasted Transmission Capacity Constraints Table

Impacted Asset	kV	Contingency	Need Year	Power Flow Case	Driving Issue	Project Number (s)	Comments / Mitigation / Corrective Action
3 (Boonville-Rome)	115	Rome south bus fault	2012	Summer 2012	101.9% of LTE	C03778	Rome Rebuild project will put line #3 and #4 on the same bus, which will eliminate the contingency of losing #1 and #4 together for a fault on the south bus.
8 (Rome – Camden wire)	115	Fault at Oneida on LN8 (Oneida-Ferner) with R80 breaker failure	2012	Summer 2012	Area Voltages at .83 pu		The recommended solution is to add a 25 MVAr capacitor bank at Rome.
5 (Teall – Oneida)	115	N-1-1: Edic 345/115 kV TB3 followed by 14 (Edic-New Scotland)	2016	Summer 2016	130% of LTE, 108% of STE		An operational solution exists. However, it is also recommended that the Edic 345/115 kV TB3 transformer be moved to a spare position with breaker R160 and R110. See Note 1.
14 (Boonville-Griffiss)	115	N-1-1: 1 (Rome-Oneida) followed by opening of breaker 30 at Boonville	2016	Summer 2016	119% of LTE, 104% of STE		A permanent solution must be determined by further study. See Note 2.
Inghams Phase Shifting Transformer	115	31 (Rotterdam-Porter) followed by DCT: 30 (Porter-Rotterdam) and EF 24-4- (Edic-Fraser)	2016	Summer 2016	101% of LTE	CNYPL3	An option being considered is to replace the phase shifting transformer with one having a larger range. See Note 3.

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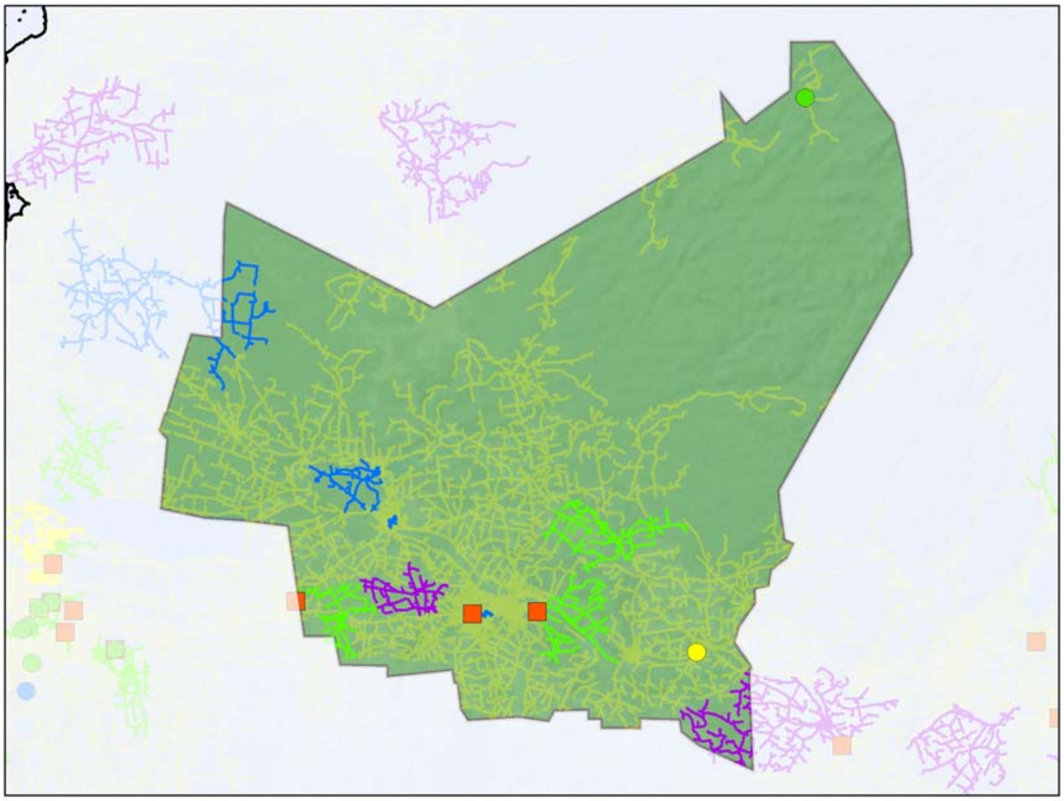
Note 1
Teall – Oneida #5
The recommended solution is to adjust the Inghams phase shifter to its maximum angle after the first contingency and to reduce Central-East transfer – focusing on the Oneida-Porter-Rotterdam 115kV path. It is also recommended that the Edic 345/115 kV TB3 transformer be moved to a spare position with breaker R160 and R110.

Note 2
Boonville – Griffiss #14
Load shedding after the second contingency is not an option. A permanent fix must be determined by further study. NERC requirements do not currently apply but are expected to apply upon change of the BES definition.

Note 3
Inghams Phase Shifting Transformer
While it is recommended for many contingencies that the phase shifter angle be increased to its maximum value, this action is often not sufficient to completely eliminate the problem and a reduction of Central-East transfer must also be made. Therefore, another option being considered is to replace the phase shifting transformer with one having a larger range.

Figure 3-47
Utica Rome Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints Map



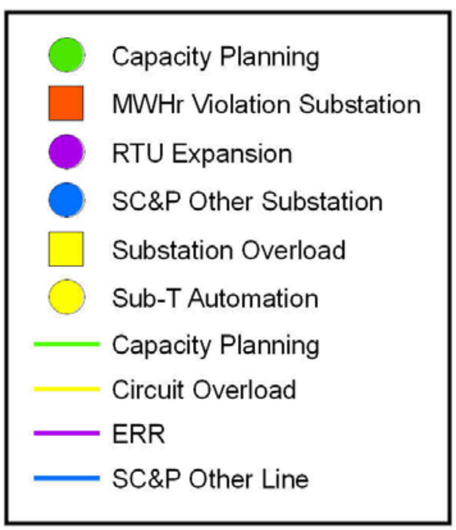


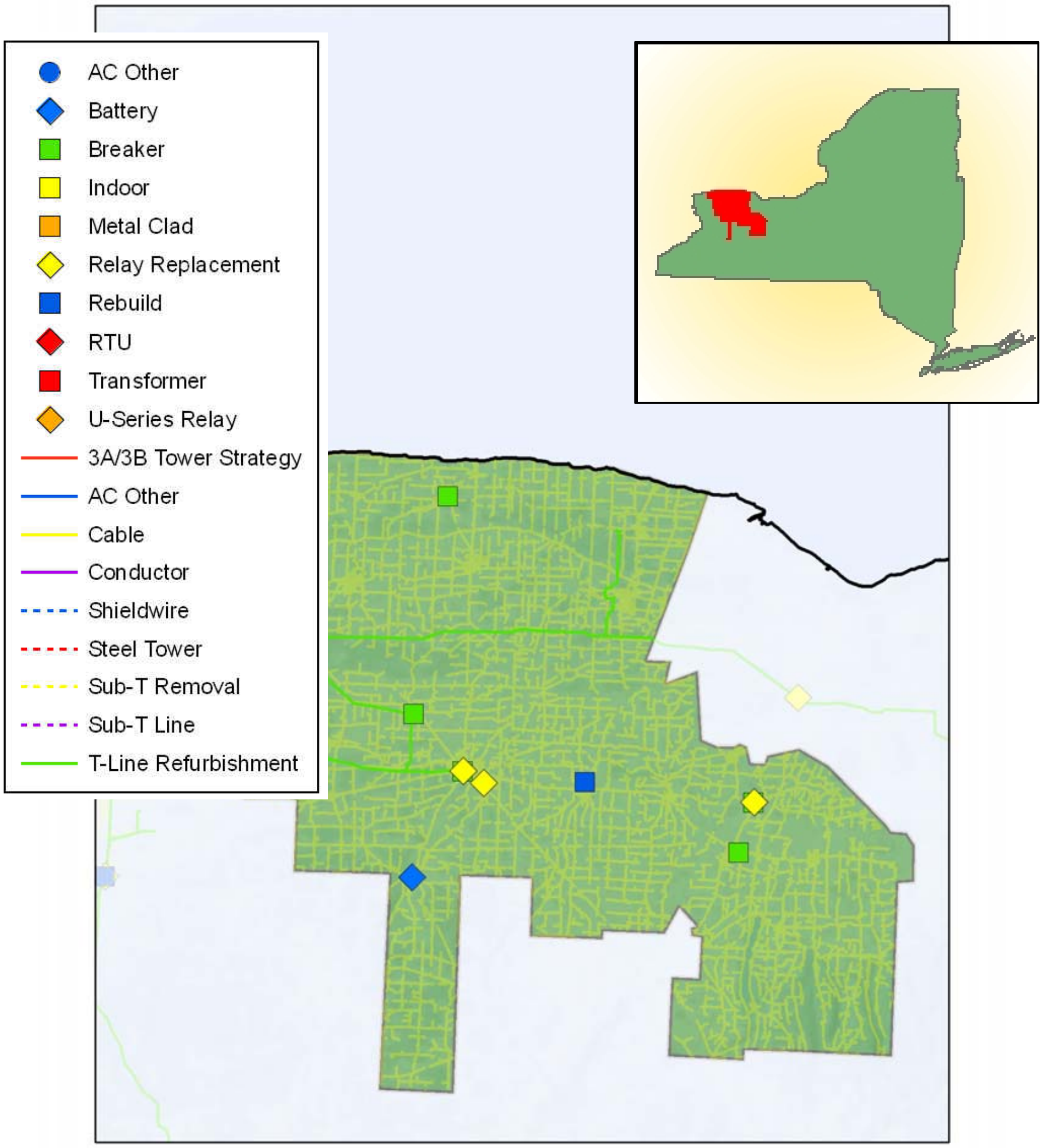
Figure 3-48
Utica Rome Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints

Identified Problem	System	Distribution Study Area	Substation	Supply Line	Feeder
MWHr Violations - ONE DA	DIST	Oneida	ONEIDA		
MWHr Violations - DEBALSO	DIST	Utica	DEBALSO		
MWHr Violations - SCHUYLER	DIST	Utica	SCHUYLER		

Figure 3-49
Utica Rome Study Area
Planned Distribution and Sub-transmission System Capacity and Performance Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Utica Rome	Capacity Planning	DIST	Oneida	19349 Oneida 50153-Arquint Rd-VC	CD1068
			Utica	11460 Conkling Station relief	CD0561
				05978 Hawthorne Rd Reconductor	C16333
	ERR	DIST	Utica	11600 MV Humphrey Rd Rebuild	CD0264
	SC&P Other	DIST	Rome	07003 MV-Kingsley Ave Convert 5kV	C36851
				05480 Capron Rd. Rebuild	C15901
			Utica	12847 Arnold Regulator Installation	CD0673
				18472 Terminal Station: Install Reactors for TB2 and TB3	-
				Duplicate 12847 Arnold Regulator Installation	CD0673
	Sub-T Automation	DIST	Utica	19060 Install EMS at Rock City Sub with DA head end	CD0949

Figure 3-50
Genesee Study Area Asset Condition Program Work



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 loadings in the Batavia Station (existing loads), on the Lockport-Batavia #107 line, and the Mortimer-Golah #110 line.
- In addition to the addition of tie breakers at Lockport and Mortimer, other recommended projects include construction of a four breaker ring splitting the National Grid #119 circuit and the RG&E #906 circuit.

Key sub-transmission and distribution drivers include the following:

- Capacity issues are being addressed with the East Golah, Sheppard Rd. and West Albion substation expansions.

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. [redacted] 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. [redacted]

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 44,300 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 37,100 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 21,700 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 substation. 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.

Area Load Forecast

The Genesee transmission study area load forecast is included in the West Region (NYISO Zone A & B) forecast. The summary of the load forecast thru 2026 is detailed in the figures below.

Figure 3-51
Zone A & B Non-Coincident Summer Peak Demand
Including Energy Efficiency Reductions

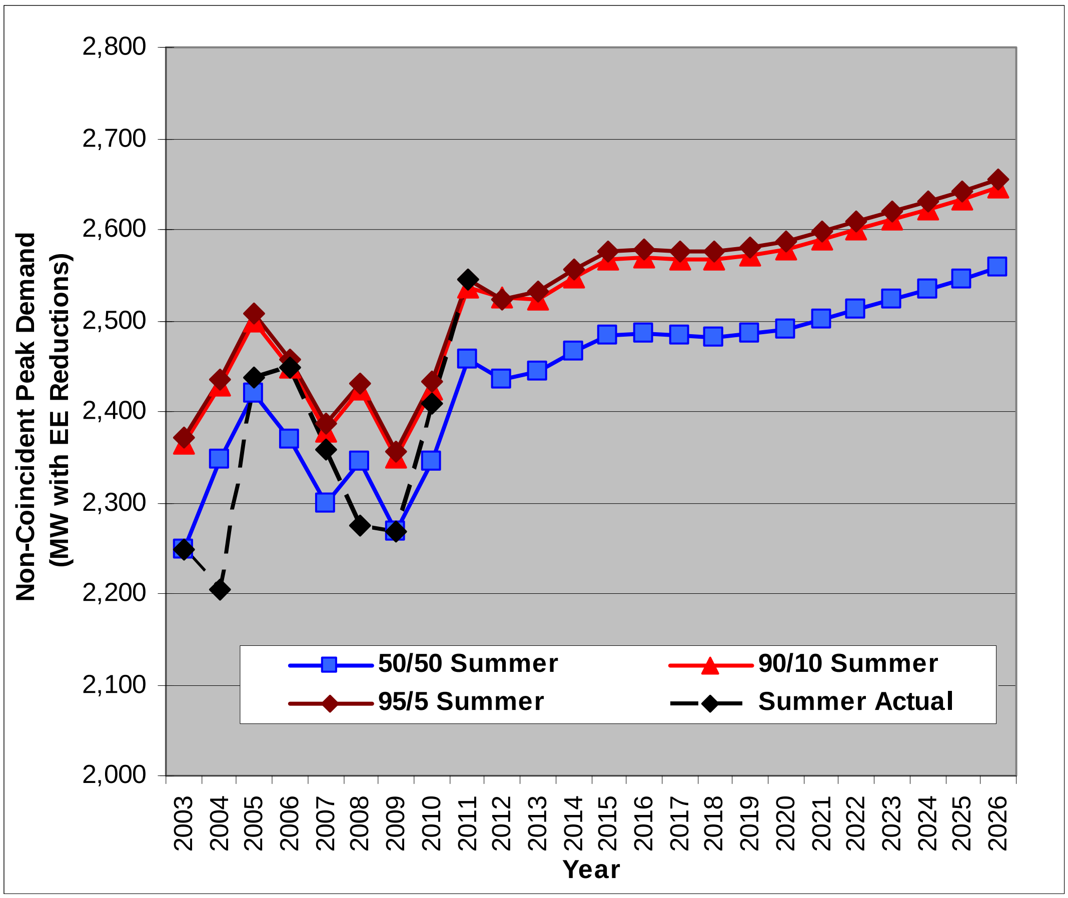


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Figure 3-52
Zone A & B Non-Coincident Summer Peak Demand Including Energy Efficiency Reductions Table

ZONEs A&B (West Region) - SUMMER w/EE Reductions

	SUMMER PEAKS (MWs)								Wthi's			
YEAR	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2003	2,248		2,284		2,364		2,372		77.9	78.9	81.1	81.4
2004	2,205	-1.9%	2,348	2.8%	2,428	2.7%	2,436	2.7%	75.0	78.9	81.1	81.4
2005	2,437	10.5%	2,420	3.1%	2,500	3.0%	2,508	3.0%	79.4	78.9	81.1	81.4
2006	2,449	0.5%	2,369	-2.1%	2,449	-2.0%	2,457	-2.0%	81.1	78.9	81.1	81.4
2007	2,358	-3.7%	2,298	-3.0%	2,378	-2.9%	2,386	-2.9%	80.6	78.9	81.1	81.4
2008	2,274	-3.6%	2,344	2.0%	2,424	1.9%	2,431	1.9%	77.0	78.9	81.1	81.4
2009	2,268	-0.3%	2,269	-3.2%	2,349	-3.1%	2,357	-3.1%	78.9	78.9	81.1	81.4
2010	2,408	6.2%	2,345	3.4%	2,425	3.2%	2,433	3.2%	80.7	78.9	81.1	81.4
2011	2,544	5.7%	2,457	4.7%	2,536	4.6%	2,544	4.6%	81.4	78.9	81.1	81.4
2012			2,435	-0.9%	2,515	-0.9%	2,523	-0.8%		78.9	81.1	81.4
2013			2,443	0.3%	2,524	0.4%	2,532	0.4%		78.9	81.1	81.4
2014			2,466	0.9%	2,548	1.0%	2,556	1.0%		78.9	81.1	81.4
2015			2,483	0.7%	2,567	0.7%	2,575	0.7%		78.9	81.1	81.4
2016			2,485	0.1%	2,569	0.1%	2,578	0.1%		78.9	81.1	81.4
2017			2,483	-0.1%	2,567	-0.1%	2,576	-0.1%		78.9	81.1	81.4
2018			2,482	0.0%	2,567	0.0%	2,576	0.0%		78.9	81.1	81.4
2019			2,486	0.1%	2,571	0.1%	2,580	0.1%		78.9	81.1	81.4
2020			2,491	0.2%	2,577	0.2%	2,586	0.2%		78.9	81.1	81.4
2021			2,502	0.4%	2,588	0.4%	2,597	0.4%		78.9	81.1	81.4
2022			2,513	0.5%	2,600	0.5%	2,609	0.5%		78.9	81.1	81.4
2023			2,523	0.4%	2,610	0.4%	2,619	0.4%		78.9	81.1	81.4
2024			2,533	0.4%	2,621	0.4%	2,630	0.4%		78.9	81.1	81.4
2025			2,544	0.4%	2,632	0.4%	2,641	0.4%		78.9	81.1	81.4
2026			2,558	0.5%	2,646	0.5%	2,655	0.5%		78.9	81.1	81.4
Compound Avg. 8 yr ('03 to '11)		1.6%		0.9%		0.9%		0.9%				
Compound Avg. 5 yr ('06 to '11)		0.8%		0.7%		0.7%		0.7%				
Compound Avg. 5 yr ('11 to '16)				**0.2%**		**0.3%**		**0.3%**				
Compound Avg. 10 yr ('11 to '21)				**0.2%**		**0.2%**		**0.2%**				
Compound Avg. 15 yr ('11 to '26)				**0.3%**		**0.3%**		**0.3%**				

Figure 3-53
Zone A & B Non-Coincident Winter Peak Demand Including Energy Efficiency Reductions Table

ZONEs A&B (West Region) - WINTER w/EE Reductions

	WINTER PEAKS (MWs)								hdd			
YEAR (season)	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2002-2003	2,218		2,201		2,259		2,262		62.7	51.4	65 0	65.1
2003-2004	2,239	1.0%	2,159	-1.9%	2,229	-1.3%	2,239	-1.0%	41.8	51.4	65 0	65.1
2004-2005	2,204	-1.6%	2,188	1.3%	2,258	1.3%	2,268	1.3%	65.1	51.4	65 0	65.1
2005-2006	2,127	-3.5%	2,153	-1.6%	2,260	0.1%	2,272	0.2%	59.5	51.4	65 0	65.1
2006-2007	2,163	1.7%	2,107	-2.1%	2,178	-3.7%	2,188	-3.7%	56.1	51.4	65 0	65.1
2007-2008	2,114	-2.2%	2,076	-1.5%	2,147	-1.4%	2,157	-1.4%	41.8	51.4	65 0	65.1
2008-2009	2,109	-0.2%	2,151	3.6%	2,222	3.5%	2,231	3.5%	50.4	51.4	65 0	65.1
2009-2010	2,177	3.2%	2,171	0.9%	2,242	0.9%	2,251	0.9%	51.5	51.4	65 0	65.1
2010-2011	2,126	-2.3%	2,091	-3.7%	2,149	-4.1%	2,152	-4.4%	49.6	51.4	65 0	65.1
2011-2012			2,211	5.7%	2,283	6.2%	2,293	6.5%		51.4	65 0	65.1
2012-2013			2,243	1.4%	2,316	1.4%	2,326	1.4%		51.4	65 0	65.1
2013-2014			2,278	1.6%	2,352	1.6%	2,363	1.6%		51.4	65 0	65.1
2014-2015			2,299	0.9%	2,374	0.9%	2,385	0.9%		51.4	65 0	65.1
2015-2016			2,307	0.3%	2,382	0.4%	2,393	0.4%		51.4	65 0	65.1
2016-2017			2,316	0.4%	2,392	0.4%	2,403	0.4%		51.4	65 0	65.1
2017-2018			2,327	0.5%	2,404	0.5%	2,415	0.5%		51.4	65 0	65.1
2018-2019			2,340	0.5%	2,417	0.5%	2,428	0.5%		51.4	65 0	65.1
2019-2020			2,352	0.5%	2,430	0.5%	2,441	0.5%		51.4	65 0	65.1
2020-2021			2,366	0.6%	2,444	0.6%	2,455	0.6%		51.4	65 0	65.1
2021-2022			2,379	0.5%	2,457	0.6%	2,468	0.6%		51.4	65 0	65.1
2022-2023			2,392	0.5%	2,471	0.5%	2,482	0.5%		51.4	65 0	65.1
2023-2024			2,405	0.6%	2,484	0.6%	2,496	0.6%		51.4	65 0	65.1
2024-2025			2,419	0.6%	2,499	0.6%	2,511	0.6%		51.4	65 0	65.1
2025-2026			2,436	0.7%	2,516	0.7%	2,528	0.7%		51.4	65 0	65.1
Compound Avg. 8 yr ('03 to '11)		-0.5%		-0.6%		-0.6%		-0.6%				
Compound Avg. 5 yr ('06 to '11)		0.0%		-0.6%		-1.0%		-1.1%				
Compound Avg. 5 yr ('11 to '16)				**2.0%**		**2.1%**		**2.1%**				
Compound Avg. 10 yr ('11 to '21)				**1.2%**		**1.3%**		**1.3%**				
Compound Avg. 15 yr ('11 to '26)				**1.0%**		**1.1%**		**1.1%**				

Asset Condition Programs

Figure 3-50 shows a map of the planned asset condition projects in the study area. Figure 3-54 shows a listing of the projects in tabular form.

Figure 3-54
Genesee Study Area Planned Asset Condition Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Genesee	AC Other	DIST	Genesee South	15684 Orangeville Substation - Upgrade Bypass Switch	CD0703
		SUB-T	Genesee North	04626 Brockport 74-Cap banks to sta bus - C26382	C26382
			Genesee South	15729 Oakfield - Caledonia LN201 reconductoring	-
				16881 Genesee South 34.5kV relief	-
			Livingston	06093 L226 - Extend line to N LVille Sta	C15766
		TRAN	None	Rochester - Generator & HPFF Alarms	C30532
				Rochester Pump - LPFF Trip Scheme	C29946
				Rochester UG Pumping Plant	C39846
				Rochester UG Pumping Plant	C15988
	Overhead Line Refurbishment Program - Asset Condition	TRAN	None	Huntley - Lockport #37	CNYAS53
				Lockport-Batavia 112, T1510 ACR	C03422
				Lockport-Bativa 108 Refurb	C27431
				Lockport-Mortimer 111 T1530 ACR	C03417
				Lockprt-Mort 111 Tap T1530-1 Refurb	C33014
				Mortimer - Pannell Road #24 &25	CNYAS65
				Pannell-Geneva 4-4A, T1860 ACR	C30889
	Relay Replacement	TRAN	None	Trans Relay Replacement - Batavia Substation	(blank)
				Trans Relay Replacement - Golah Substation	(blank)
				Trans Relay Replacement - Lockport Substation	(blank)
				Trans Relay Replacement - Mortimer Substation	(blank)
				Trans Relay Replacement - SE Batavia Substation	(blank)
	Steel Tower Strategy	TRAN	None	Lockport 103- 104 T1620-T106 STR	C27432
	Substation Battery and Related	DIST	Genesee South	Battery - Attica Station 12	(blank)
	Substation Breaker	DIST	Genesee North	Breaker - Waterport Station 73	(blank)
			Genesee South	Breaker - Oakfield Station 03	(blank)
			Livingston	Breaker - Avon Station	(blank)
		TRAN	None	Trans Breaker Replacement - Batavia Station 01	(blank)
				Trans Breaker Replacement - Golah Station	(blank)
	Substation Rebuild	TRAN	None	LockportSubstationRebuildCo36TxT	C35464
				N. Leroy Rebuild Station	C29180
	Substation RTU	DIST	Genesee South	RTU - Attica	(blank)
	Sub-T Line Removal	SUB-T	Genesee South	06110 Lancaster Stone Tap Remove	C35609
			Livingston	18428 Golah-S. Perry 853-69kv	CD0736
	Sub-T Overhead Line	DIST	Genesee North	10829 Distribution Transfers on Line #308 Rebuild	CD0082
		SUB-T	Genesee North	05259 Albion - Brockport 308 Refurbish	C33131
				19297 Phillips-Telegraph 304-34.5kv	-
				19296 Phillips-Medina 301-34 5kv	-
			Genesee South	05308 Batavia-Attica 206-34.5kv	C25940
				05469 Caledonia-Golah 213-refurbish	C27586
			Livingston	06240 N Lakeville-Richmond 224 Refurbish	C35503
				06246 N Lakeville-Richmond 226, 34 5kV	C36716
				13203 N Lakeville - Ridge LN 218 Refurbish	-

Forecasted Capacity Constraints

Figure 3-55 maps the forecasted capacity constraints on the transmission system. Figure 3-56 lists the forecasted transmission capacity constraints. Figure 3-57 maps the forecasted capacity constraints on the distribution system and capacity planning solutions proposed in the study area for the next five years. Figures 3-58 and 3-59 list the distribution system forecasted capacity constraints, and system capacity and performance solutions, respectively.

Figure 3-55
Genesee Study Area Forecasted Transmission Capacity Constraints Map

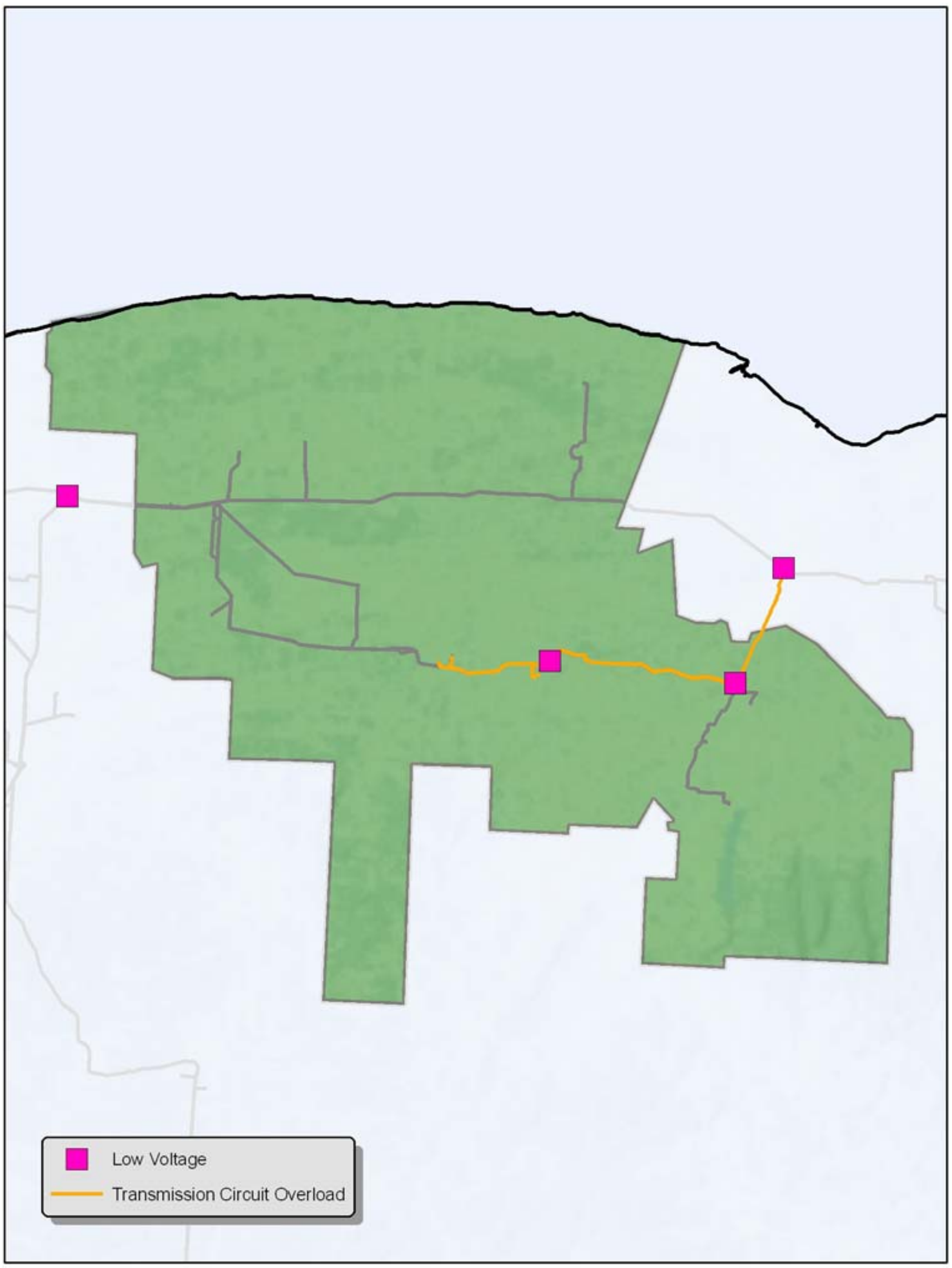

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Figure 3-56
Genesee Study Area Forecasted Transmission Capacity Constraints Table

Impacted Asset	kV	Contingency	Need Year	Power Flow Case	Driving Issue	Project Number (s)	Comments / Mitigation / Corrective Action
Golah and Brockport Area Voltages	115	Lockport Stuck Bus Tie Breaker	2012	Summer 2016	Voltages below 0.60 pu	C31482	The recommended solution is to add a second bus tie breaker at Lockport. See Note 1.
110 (Mortimer-Golah)	115	Lockport Stuck Bus Tie Breaker	2012	Summer 2016	232% LTE, 199% STE	C31482	The recommended solution is to add a second bus tie breaker at Lockport. See Note 1.
Mortimer bus tie breaker	115	Lockport Stuck Bus Tie Breaker	2012	Summer 2016	157% LTE, 137% STE	C31482	The recommended solution is to add a second bus tie breaker at Lockport. See Note 1.
119 (SE Batavia-Golah)	115	Lockport Stuck Bus Tie Breaker	2012	Summer 2016	142% LTE, 132% STE	C31482	The recommended solution is to add a second bus tie breaker at Lockport. See Note 1.
Golah Voltages	115	Mortimer Stuck Bus Tie Breaker	2012	Summer 2016	Voltages below 0.50 pu	C24629, C24631, C24631	The recommended solution is to add a second bus tie breaker at Mortimer. See Note 2
119 (SE Batavia-Golah)	115	Mortimer Stuck Bus Tie Breaker	2012	Summer 2016	142% LTE, 132	C24629, C24631, C24631	The recommended solution is to add a second bus tie breaker at Mortimer. See Note 2
Batavia Bus	115	All lines in	2012	Summer 2011	100% of Summer Normal Rating	C31479	The recommended solution is to replace the limiting bus conductor. See Note 3
Farmington	115	Outage of #2 or #4 line	2012	Summer 2011	NYSEG Reliability		NYSEG and National Grid are still in discussions on a solution to this problem. See Note 4
Golah voltages	115	N-1-1: 110 followed by 107	2012	Summer 2016	0.62 pu	CNYPL37	The recommended solution is to construct a four breaker ring station splitting National Grid circuit #119 and RG&E circuit #906.

Note 1
Area Voltages and Thermal Overloads
The voltages and overloads noted are with Seneca Power generation out of service. The recommended solution is to add a second bus tie breaker in series with the existing one to prevent an outage of the entire Lockport 115kV bus. While the project is being implemented, risk can be reduced by dispatching Seneca Power generation or fully corrected by shedding load.

Note 2
Area Voltages and Thermal Overloads
The voltages and overloads noted are with Seneca Power generation out of service. The recommended solution is to add a second bus tie breaker in series with the existing one to prevent an outage of the entire Mortimer 115kV bus. While the project is being implemented, risk can be reduced by dispatching Seneca Power generation or fully corrected by shedding load.

Note 3
Batavia Bus
Historical data shows that bus has been near its thermal limit with all lines in service. The recommended solution to address this is replacement of the limiting bus conductor. While project is being implemented, risk can be reduced by dispatching Seneca Power generation or fully corrected by shedding load.

Note 4
Farmington
This is a reimbursable project that is being done at the request of NYSEG. [redacted] NYSEG and National Grid are still in discussions on the solution.

Figure 3-57
Genesee Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints Map

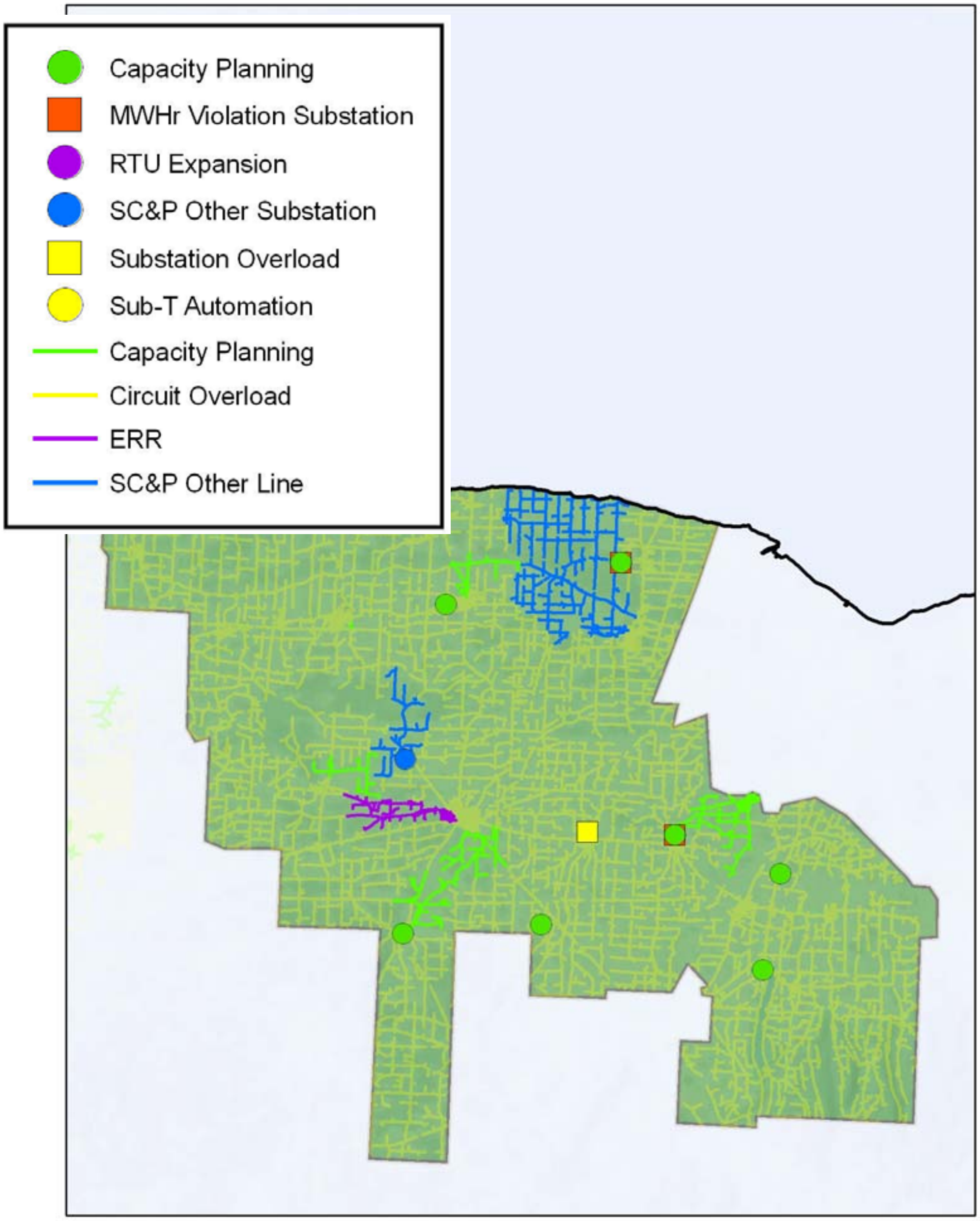


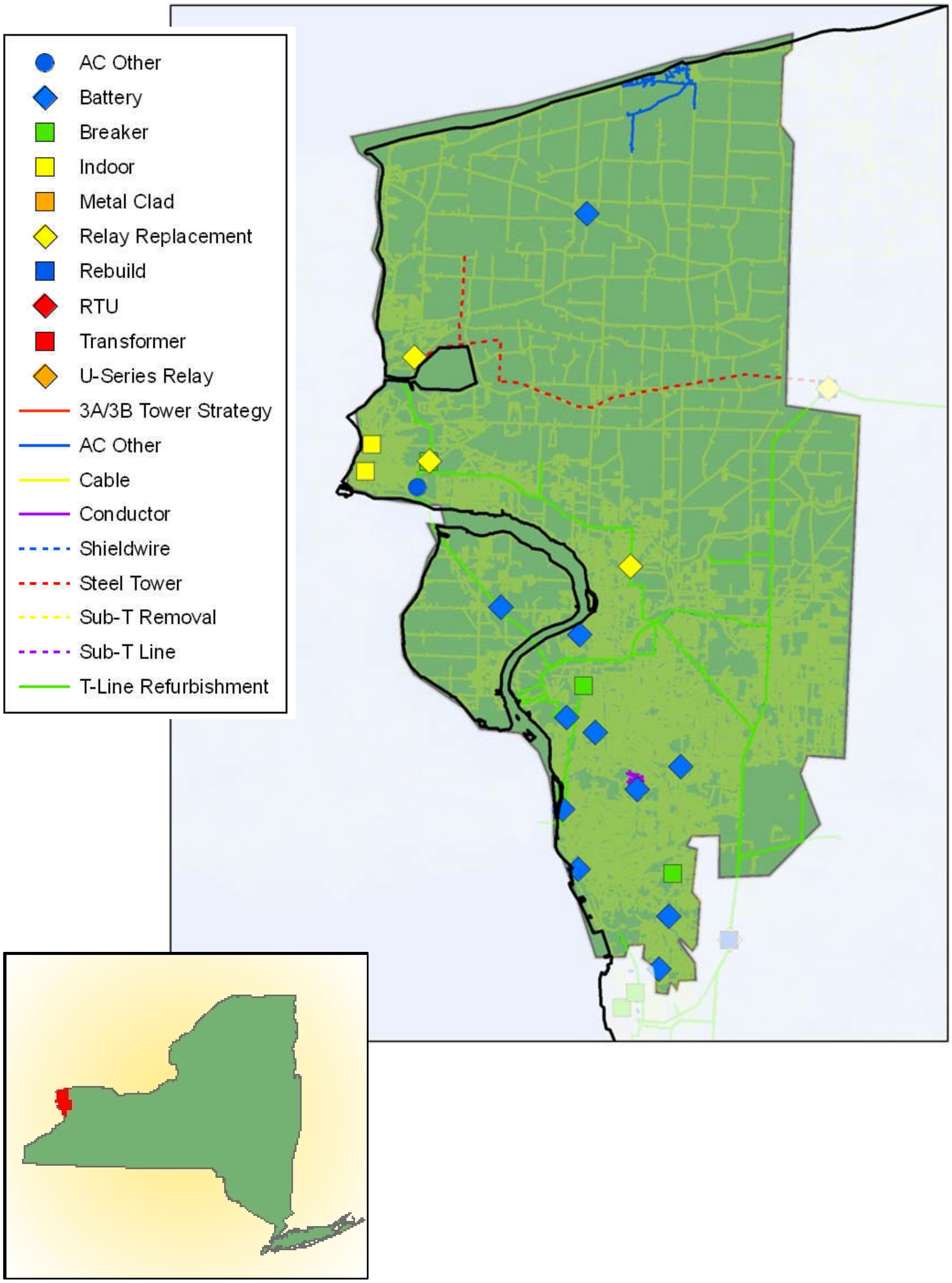
Figure 3-58
Genesee Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints

Identified Problem	System	Distribution Study Area	Substation	Supply Line	Feeder
MWHr Violations - W HAMLIN	DIST	Genesee North	W HAMLIN		
MWHr Violations - MUMFORD	DIST	Genesee South	MUMFORD		
Transformer Overload - N LEROY STATION 115 - 13.2kV	DIST	Genesee South	N LEROY STATION		
E Batavia F2856 - Load relief	SUB-T	Genesee South	E BATAVIA STATION		36_04_2856

Figure 3-59
Genesee Study Area
Planned Distribution and Sub-transmission System Capacity and Performance Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Genesee	Capacity Planning	DIST	Genesee North	13238 Albion 8064 Getaway Reconductor	-
				15746 Genesee North 34.5kV Relief	-
				06630 Shelby 7657 Reconductoring	C32344
				05194 W. Albion Transformer Addition	C32346
				18544 Attica Station Rebuild	-
				18709 West Hamlin #82 - Install Transformer #2	CD1089
				18710 West Hamlin #82 - New TB2 - Install new feeders	CD1090
				18763 West Sweden - New Station - Install new feeders	-
				18761 West Sweden - Install New Station	-
				Duplicate 15746 Genesee North 34.5kV Relief	-
			Genesee South	13207 E. Batavia F2851 - Load Relief (Overloaded Ratio Bank)	CD0339
				05106 Sheppard Rd. 29 - Second Bank	C15765
				11507 Basom transformer relief Sum 2011	CD0280
				18212 East Batavia Sta. Install Feeder Position	-
				05283 Attica12-Rebuild,Xfer F1263 to 0158	C26379
				18766 Mumford #50 - New TB2 - Install new feeder	-
				18765 Mumford #50 - Install Transformer #2	-
			Livingston	04759 East Golah 51 - Secondary Breakers	C27062
				05805 East Golah -F5151E, F5151W & F5151C	C06765
				13246 South Livingston relief - DLine Fdr 2 & Fdr 3	-
				18851 South Livingston relief - DLine Fdr 1 & Fdr 4	-
	ERR	DIST	Genesee South	05305 Batavia 0155 - Knapp Rd 22651 Tie	C28719
	SC&P Other	DIST	Genesee North	11914 UG Cable Replacements - NYS Lake Ontario State Parkway	CD0292
				06872 W.Hamlin 8254 - Tie w/F8252 & F7458	C28715
				Duplicate 06872 W Hamlin 8254 - Tie w/F8252 & F7458	C28715
			Genesee South	15685 Orangeville Substation - Modify Regulator Bank	CD0833
				17318 Oakfield feeder 0362 - Pole Replacement	CD0684

Chapter 3 G. Frontier Transmission Study Area
Figure 3-60
Frontier Study Area Asset Condition Program Work



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Area Summary

The principal drivers for transmission projects in this area, from a capacity and asset condition perspective, are:

- Low post-contingency voltages at Huntley and Gardenville.
- 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 reconfiguring or 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.
- The proposed rebuild of Old Gardenville Station to address station configuration issues as well as asset condition issues will also partially address capacity needs.
- Projects in the Frontier Region involving the Gardenville, Huntley, and Packard substations are accelerated or augmented in order to provide short-term mitigation of the shutdown of all but one 115kV Dunkirk generator.,
- Projects in the Frontier Region involving the Huntley substation, and the reconductoring of the #180 line between Niagara and Gardenville and the #181 line between Packard and Erie are recommended [redacted] Additional analysis is ongoing to review level of risk if the #181 reconductoring is not completed and all Dunkirk generation is shut down..

Key sub-transmission and distribution drivers include the following:

- Reliability issues and load growth in the Amherst area. There is approximately 10MVA of new load identified in the area. The new Frankhauser Substation will alleviate these issues.
- 5 to 10MW of load growth by the new Buffalo Niagara Medical Campus will be served by Elm Street substation.
- Area loading requiring the upgrade of multiple Buffalo area substations, including Buffalo Station 56 and Buffalo Station 127.
- Indoor substations are an asset condition issue and there are several replacement projects in progress.

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. [redacted] There is a joint National Grid and NYSEG substation at Gardenville (230 and 115kV). [redacted]

[redacted] National Grid has three 230/115kV transformers at Gardenville and two at Packard. [redacted]

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 58,900 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 predominantly 13.2kV and 4.16kV, with Buffalo Station 138 supplying two 4.8kV distribution feeders. 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 8,000 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 1,700 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 Buffalo network has 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 8,000 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 37,100 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 12,400 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 62,500 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 48,400 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. The majority 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 41,300 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.

Area Load Forecast

The Frontier transmission study area load forecast is included in the West Region (NYISO Zone A & B) forecast. The summary of the load forecast thru 2026 is detailed in the figures below.

Figure 3-61
Zone A & B Non-Coincident Summer Peak Demand
Including Energy Efficiency Reductions

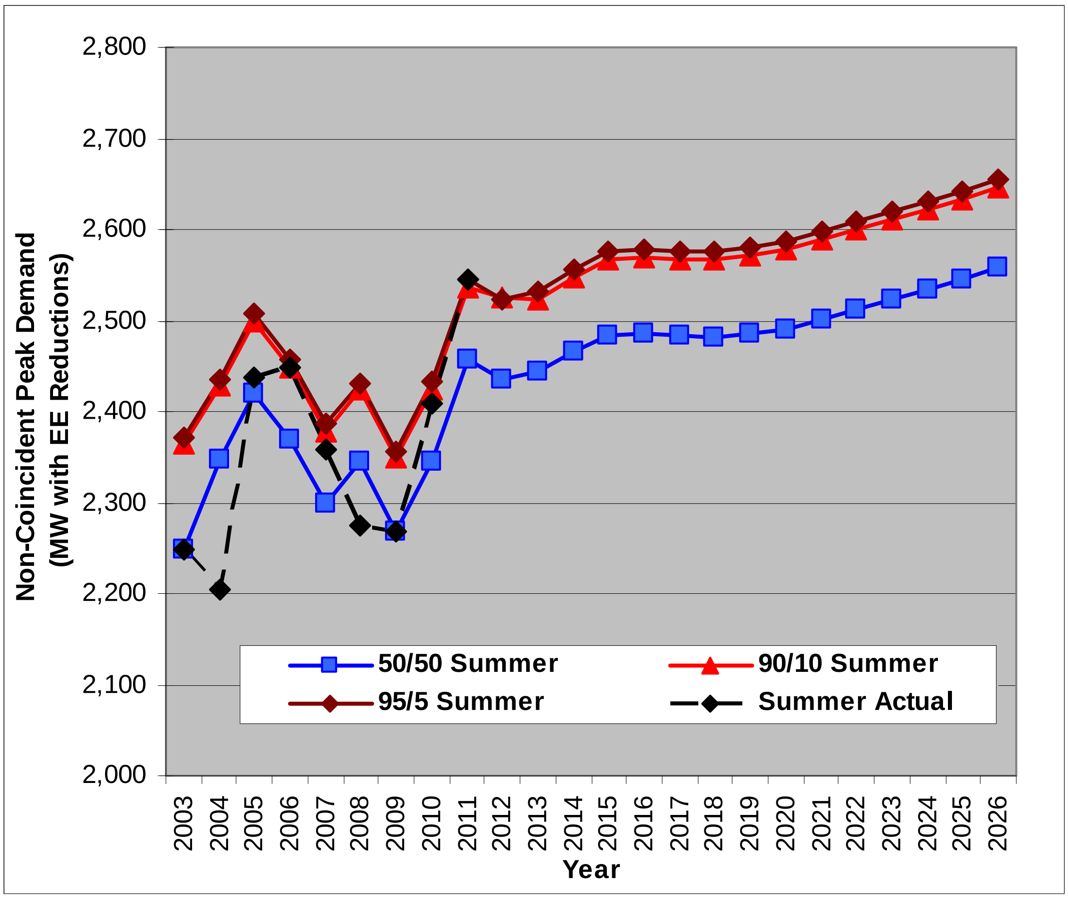

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Figure 3-62
Zone A & B Non-Coincident Summer Peak Demand Including Energy Efficiency Reductions Table

ZONEs A&B (West Region) - SUMMER w/EE Reductions												
	SUMMER PEAKS (MWs)								Wthi's			
YEAR	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2003	2,248		2,284		2,364		2,372		77.9	78.9	81.1	81.4
2004	2,205	-1.9%	2,348	2.8%	2,428	2.7%	2,436	2.7%	75.0	78.9	81.1	81.4
2005	2,437	10.5%	2,420	3.1%	2,500	3.0%	2,508	3.0%	79.4	78.9	81.1	81.4
2006	2,449	0.5%	2,369	-2.1%	2,449	-2.0%	2,457	-2.0%	81.1	78.9	81.1	81.4
2007	2,358	-3.7%	2,298	-3.0%	2,378	-2.9%	2,386	-2.9%	80.6	78.9	81.1	81.4
2008	2,274	-3.6%	2,344	2.0%	2,424	1.9%	2,431	1.9%	77.0	78.9	81.1	81.4
2009	2,268	-0.3%	2,269	-3.2%	2,349	-3.1%	2,357	-3.1%	78.9	78.9	81.1	81.4
2010	2,408	6.2%	2,345	3.4%	2,425	3.2%	2,433	3.2%	80.7	78.9	81.1	81.4
2011	2,544	5.7%	2,457	4.7%	2,536	4.6%	2,544	4.6%	81.4	78.9	81.1	81.4
2012			2,435	-0.9%	2,515	-0.9%	2,523	-0.8%		78.9	81.1	81.4
2013			2,443	0.3%	2,524	0.4%	2,532	0.4%		78.9	81.1	81.4
2014			2,466	0.9%	2,548	1.0%	2,556	1.0%		78.9	81.1	81.4
2015			2,483	0.7%	2,567	0.7%	2,575	0.7%		78.9	81.1	81.4
2016			2,485	0.1%	2,569	0.1%	2,578	0.1%		78.9	81.1	81.4
2017			2,483	-0.1%	2,567	-0.1%	2,576	-0.1%		78.9	81.1	81.4
2018			2,482	0.0%	2,567	0.0%	2,576	0.0%		78.9	81.1	81.4
2019			2,486	0.1%	2,571	0.1%	2,580	0.1%		78.9	81.1	81.4
2020			2,491	0.2%	2,577	0.2%	2,586	0.2%		78.9	81.1	81.4
2021			2,502	0.4%	2,588	0.4%	2,597	0.4%		78.9	81.1	81.4
2022			2,513	0.5%	2,600	0.5%	2,609	0.5%		78.9	81.1	81.4
2023			2,523	0.4%	2,610	0.4%	2,619	0.4%		78.9	81.1	81.4
2024			2,533	0.4%	2,621	0.4%	2,630	0.4%		78.9	81.1	81.4
2025			2,544	0.4%	2,632	0.4%	2,641	0.4%		78.9	81.1	81.4
2026			2,558	0.5%	2,646	0.5%	2,655	0.5%		78.9	81.1	81.4
Compound Avg. 8 yr ('03 to '11)		1.6%		0.9%		0.9%		0.9%				
Compound Avg. 5 yr ('06 to '11)		0.8%		0.7%		0.7%		0.7%				
Compound Avg. 5 yr ('11 to '16)				**0.2%**		**0.3%**		**0.3%**				
Compound Avg. 10 yr ('11 to '21)				**0.2%**		**0.2%**		**0.2%**				
Compound Avg. 15 yr ('11 to '26)				**0.3%**		**0.3%**		**0.3%**				

Figure 3-63
Zone A & B Non-Coincident Winter Peak Demand Including Energy Efficiency Reductions Table

ZONEs A&B (West Region) - WINTER w/EE Reductions												
	WINTER PEAKS (MWs)								hdd			
YEAR (season)	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2002-2003	2,218		2,201		2,259		2,262		62.7	51.4	65 0	65.1
2003-2004	2,239	1.0%	2,159	-1.9%	2,229	-1.3%	2,239	-1.0%	41.8	51.4	65 0	65.1
2004-2005	2,204	-1.6%	2,188	1.3%	2,258	1.3%	2,268	1.3%	65.1	51.4	65 0	65.1
2005-2006	2,127	-3.5%	2,153	-1.6%	2,260	0.1%	2,272	0.2%	59.5	51.4	65 0	65.1
2006-2007	2,163	1.7%	2,107	-2.1%	2,178	-3.7%	2,188	-3.7%	56.1	51.4	65 0	65.1
2007-2008	2,114	-2.2%	2,076	-1.5%	2,147	-1.4%	2,157	-1.4%	41.8	51.4	65 0	65.1
2008-2009	2,109	-0.2%	2,151	3.6%	2,222	3.5%	2,231	3.5%	50.4	51.4	65 0	65.1
2009-2010	2,177	3.2%	2,171	0.9%	2,242	0.9%	2,251	0.9%	51.5	51.4	65 0	65.1
2010-2011	2,126	-2.3%	2,091	-3.7%	2,149	-4.1%	2,152	-4.4%	49.6	51.4	65 0	65.1
2011-2012			2,211	5.7%	2,283	6.2%	2,293	6.5%		51.4	65 0	65.1
2012-2013			2,243	1.4%	2,316	1.4%	2,326	1.4%		51.4	65 0	65.1
2013-2014			2,278	1.6%	2,352	1.6%	2,363	1.6%		51.4	65 0	65.1
2014-2015			2,299	0.9%	2,374	0.9%	2,385	0.9%		51.4	65 0	65.1
2015-2016			2,307	0.3%	2,382	0.4%	2,393	0.4%		51.4	65 0	65.1
2016-2017			2,316	0.4%	2,392	0.4%	2,403	0.4%		51.4	65 0	65.1
2017-2018			2,327	0.5%	2,404	0.5%	2,415	0.5%		51.4	65 0	65.1
2018-2019			2,340	0.5%	2,417	0.5%	2,428	0.5%		51.4	65 0	65.1
2019-2020			2,352	0.5%	2,430	0.5%	2,441	0.5%		51.4	65 0	65.1
2020-2021			2,366	0.6%	2,444	0.6%	2,455	0.6%		51.4	65 0	65.1
2021-2022			2,379	0.5%	2,457	0.6%	2,468	0.6%		51.4	65 0	65.1
2022-2023			2,392	0.5%	2,471	0.5%	2,482	0.5%		51.4	65 0	65.1
2023-2024			2,405	0.6%	2,484	0.6%	2,496	0.6%		51.4	65 0	65.1
2024-2025			2,419	0.6%	2,499	0.6%	2,511	0.6%		51.4	65 0	65.1
2025-2026			2,436	0.7%	2,516	0.7%	2,528	0.7%		51.4	65 0	65.1
Compound Avg. 8 yr ('03 to '11)		-0.5%		-0.6%		-0.6%		-0.6%				
Compound Avg. 5 yr ('06 to '11)		0.0%		-0.6%		-1.0%		-1.1%				
Compound Avg. 5 yr ('11 to '16)				**2.0%**		**2.1%**		**2.1%**				
Compound Avg. 10 yr ('11 to '21)				**1.2%**		**1.3%**		**1.3%**				
Compound Avg. 15 yr ('11 to '26)				**1.0%**		**1.1%**		**1.1%**				

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Asset Condition Programs

Figure 3-60 shows a map of the planned asset condition projects in the study area. Figure 3-64 shows a listing of the projects in tabular form.

Figure 3-64
Frontier Study Area Planned Asset Condition Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Frontier	AC Other	DIST	Cheektowaga	12835 Station 66 (Union Rd) Rebuild - Sub	CD0681
				18012 Station 66 (Union Rd) Rebuild - DLine	CD0685
			Niagara	17446 Rebuild Wilcox St - Lamb Farms Inc	CD0488
			Niagara Falls	17826 Milpine Staton 96 - Station Retirement	CD0594
			Sawyer	09239 Buffalo Station 56 Transformer Replacement	C36502
			Seneca	11192 Buffalo Station 42 Rebuild - D Line	-
				11194 Buffalo Station 42 Rebuild - D Station	-
			Tonawanda	11300 Buffalo Station 122 Rebuild - Line	CD0779
				11299 Buffalo Station 122 Rebuild - Sub	CD0782
		SUB-T	Cheektowaga	17619 New Gardenville Substation-SubT Line work	CD0636
			Elm	11892 Russer Foods 23kV Service	CD0284
				17933 Elm St. Replace 67L Relays	CD0728
			Niagara Falls	19119 LN404 Moutain - Sanborn reconductoring	-
			Sawyer	11263 Terminal Station C - 25 Cycle Retirement	CD0976
			Seneca	11193 Buffalo Station 42 Rebuild - SubT Line	-
				09754 Seneca - Replace Series Reactors 5S, 12S, 17S, 14S, 30S, 32S, 33S	CD0273
				17355 Buffalo Station 42 Rebuild - Sub T Station	-
				Duplicate 11193 Buffalo Station 42 Rebuild - SubT Line	-
			Tonawanda	11301 Buffalo Station 122 Rebuild - 23kV	CD0780
		TRAN	None	BuffaloSta 64-Rpl LN182 RFL Tone Eq	C31950
				Elm Terminal Station - HPFF Alarms	C30528
				Gardenville Station - HPFF Alarms	C30530
				Harper Station	C37203
				Huntley Station - HPFF Alarms	C30531
	Cable Replacement	DIST	Sawyer	11500 Buffalo Station 22 - Recond 4 kV Getaways	CD0472
		SUB-T	Cheektowaga	18629 Galleria Mall Loop - 1/0 Cable Replacement	CD0869
			Seneca	18477 Buffalo 23kV Reconductor - Seneca/BNMC 16S, 17S, 18S, 27S	-
	Flying Ground Strategy	TRAN	None	Buffalo/AlbanyFlyingGroundsSwitcRpl	C33613
	Network	DIST	Niagara Falls	19204 Niagara Falls Network Retirement	-
			Seneca	15690 Broadway Network Retirement	-
	Overhead Line Refurbishment Program - Asset Condition	TRAN	None	Frontier Lines 180 & 181	CNYAS11-2
				Gard-Dun 141-142 T1260-70 ACR Senec	C34193
				Gardenville - Buffalo Sw #146 [145]	CNYAS60
				Gardenville - Depew 54 T1230	CNYAS114
				Gardenville -HH 151-152, T1950-T1280-S ACR	C27425
				Gardenville Lines 180-182, T1660-T1780 ACR	C27436
				Gardenville-Dunkirk 141-142 T1260-1270 ACR	C03389
				Gardenville-Homer Hill 151-152, T1950-T1280 N ACR - Western Division	C04718
				Huntley - Praxair 46 T1420 ACR	CNYAS51
				Huntley-Gardenville 38 [& 39] (refurb)	CNYAS63
				New Scotland - Alps 2	CNYAS111
				Packard - Walck Road 129 ACR	CNYAS113
				Packard-Urban 181 T1850 STR	CNYAS116
				Terminal - Schuyler 7 T4260 ACR	CNYAS112
	Relay Replacement	TRAN	None	Trans Relay Replacement - Gardenview New Substation	(blank)
				Trans Relay Replacement - Gardenville Old Substation	(blank)
				Trans Relay Replacement - Huntley Substation	(blank)
				Trans Relay Replacement - Mountain Substation	(blank)
				Trans Relay Replacement - Packard Substation	(blank)
				Trans Relay Replacement - Schuyler Substation	(blank)
				Trans Relay Replacement - Seneca Terminal Station Substation	(blank)
				Trans Relay Replacement - Station 64 Substation	(blank)
				Trans Relay Replacement - Walck Road Substation	(blank)
	Shieldwire Strategy	TRAN	None	Shieldwire: Gardenville-Buffalo 145-146	C28683
				Shieldwire: Huntley-Gardenville 38-39 - Western Div.	C28676
				Shieldwire: Gardenville-Depew 54	C28706
	Substation Battery and Related	DIST	Elm	Battery - Station 205	(blank)
			Grand Island	Battery - Station 064	(blank)
			Kensington	Battery - Station 053	(blank)
				Battery - Station 162	(blank)
			Niagara	Battery - Station 089 - Ransomville	(blank)
			Sawyer	Battery - Station 024	(blank)
				Battery - Station 048	(blank)
				Battery - Station 126 - Gibson St	(blank)
				Battery - Station 208	(blank)
			Seneca	Battery - Station 043	(blank)
				Battery - Station 046	(blank)

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
	Substation Breaker	DIST	Sawyer	Breaker - Station 056	(blank)
			Seneca	Breaker - Station 040	(blank)
			Tonawanda	19094 Buffalo Station 57 - Breaker Replacement	-
		TRAN	None	Trans Breaker Replacement - Gardenville Station - New	(blank)
				Trans Breaker Replacement - Packard Station	(blank)
				Trans Breaker Replacement - Station 064	(blank)
				Trans Breaker Replacement - Station 212	(blank)
	Substation Indoor	DIST	Kensington	19066 Buffalo Station 30 Rebuild - Sta	-
			Niagara Falls	Indoor Substation - Eighth St #80	(blank)
				Indoor Substation - Eleventh St #82	(blank)
				18798 Beech St 81 - Indoor Substation Refurbishment - DLine	-
				18797 Beech St 81 - Indoor Substation Refurbishment - DSub	-
				18787 Eighth St 80 - Indoor Substation Refurbishment - DLine	-
				18795 Eleventh St 82 - Indoor Substation Refurbishment - DLine	-
				18790 Stephenson 85 - Indoor Substation Refurbishment - DLine	-
				18786 Eighth St 80 - Indoor Substation Refurbishment - DSub	-
				18784 Welch 83 - Indoor Substation Refurbishment - DLine	-
				18783 Welch 83 Indoor Substation Refurbishment - DSub	-
				18789 Stephenson 85 - Indoor Substation Refurbishment - DSub	-
				18794 Eleventh St 82 - Indoor Substation Refurbishment - DSub	-
		SUB-T	Niagara Falls	18800 Gibson Substation Retirement	-
				18799 Beech St 81 - Indoor Substation Refurbishment - SubT Line	-
				18788 Eighth St 80 - Indoor Substation Refurbishment - SubT Line	-
				18785 Welch 83 - Indoor Substation Refurbishment - SubT Line	-
				18791 Stephenson 85 - Indoor Substation Refurbishment - SubT Line	-
				18796 Eleventh St 82 - Indoor Substation Refurbishment - SubT Line	-
				Duplicate 18791 Stephenson 85 - Indoor Substation Refurbishment - SubT Line	-
	Substation Power Transformer	DIST	Amherst	17805 Station 124 - Almeda Ave Transformer Replacement	-
		SUB-T	Niagara Falls	12846 New Harper Substation - TxD Sub	CD0310
	Substation Rebuild	TRAN	None	Gardenville - Rebuild Line Location	C30084
				Gardenville 115kV Station Rebuild	C05156
				Huntley Rebuild	CNYAS119
	Substation RTU	DIST	Amherst	RTU -Tonawanda Creek	(blank)
			Grand Island	RTU - Long Road Sta 209	(blank)
			Niagara	RTU - Ransomville	(blank)
				RTU - Swann Road	(blank)
	Sub-T Line Removal	SUB-T	Cheektowaga	05931 Gardenville-Symington 714 Remove	C33187
			Sawyer	11289 Dunlop Tap 12kV/25 Cycle R5/R7 Retirement	CD0178
	Sub-T Overhead Line	DIST	Niagara	18405 LN403 Youngstown/Sanborn Underbuild transfer	CD0758
			Seneca	15734 Raise F4261 for Clearance	CD0418
		SUB-T	Amherst	19299 M&T bank Tap 701-34 5kv	-
			Cheektowaga	17459 Station 66 (Union Rd) Rebuild - SubT Line	CD0544
			Niagara	06460 Ransom-Phillips Rd 402 Refurbish	C33181
				06971 Youngstown-Sanborn 403 Refurbish	C34462
			Sawyer	19310 Station 126 taps 33h/34h-23kv	-
				19295 Frontier H lines 23kv	-
				Duplicate 19310 Station 126 taps 33h/34h-23kv	-
			Tonawanda	06757 Tonawanda 601/603 Pole Replacements	C31577
				19312 Tonawanda Lines 622-624-23kv	-
				19311 Tonawanda Lines 601-604-23kv	-
				19305 Sta 122 taps 622/623-23kv	-
				Duplicate 06757 Tonawanda 601/603 Pole Replacements	C31577
				Duplicate 19312 Tonawanda Lines 622-624-23kv	-
				Duplicate 19311 Tonawanda Lines 601-604-23kv	-
				Duplicate 19305 Sta 122 taps 622/623-23kv	-

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
	Indoor Substation	DIST	Kensington	04654 Buffalo Station 27 Rebuild - Sta	C33473
				04657 Buffalo Station 31 Rebuild - Sub	-
				05411 Buffalo Station 27 Rebuild - Line	C33476
				05419 Buffalo Station 31 Rebuild - Line	-
			Sawyer	04635 Buffalo Indoor Sub. #29 Refurb.	C06722
				04637 Buffalo Indoor Sub. #52 Refurb.	C25659
				04663 Buffalo Station 37 Rebuild - Sub	C33474
				05413 Buffalo Station 29 Rebuild - Fdrs	C06723
				05430 Buffalo Station 37 Rebuild - Line	C33477
				05447 Buffalo Station 52 Rebuild - Fdrs	C27949
			Seneca	04636 Buffalo Indoor Sub. #43 Refurb.	C25660
				04665 Buffalo Station 41 Rebuild - Sub	-
				04670 Buffalo Station 59 Rebuild - Sub	C33475
				05434 Buffalo Station 41 Rebuild - Line	-
				05451 Buffalo Station 59 Rebuild - Line	C33478
		SUB-T	Kensington	05410 Buffalo Station 27 Rebuild - 23 kV	C33470
				05418 Buffalo Station 31 Rebuild - 23 kV	-
			Sawyer	05412 Buffalo Station 29 Rebuild - 23 kV	C06724
				05429 Buffalo Station 37 Rebuild - 23 kV	C33471
				05446 Buffalo Station 52 Rebuild - 23 kV	C27946
			Seneca	05433 Buffalo Station 41 Rebuild - 23 kV	-
				05437 Buffalo Station 43 Rebuild - 23kV	C27945
				05450 Buffalo Station 59 Rebuild - 23 kV	C33472

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Forecasted Capacity Constraints

Figure 3-65 maps the forecasted capacity constraints on the transmission system. Figure 3-66 lists the forecasted transmission capacity constraints. Figure 3-67 maps the forecasted capacity constraints on the distribution system and capacity planning solutions proposed in the study area for the next five years. Figures 3-68 and 3-69 list the distribution system forecasted capacity constraints, and system capacity and performance solutions, respectively.

Figure 3-65
Frontier Study Area Forecasted Transmission Capacity Constraints Map

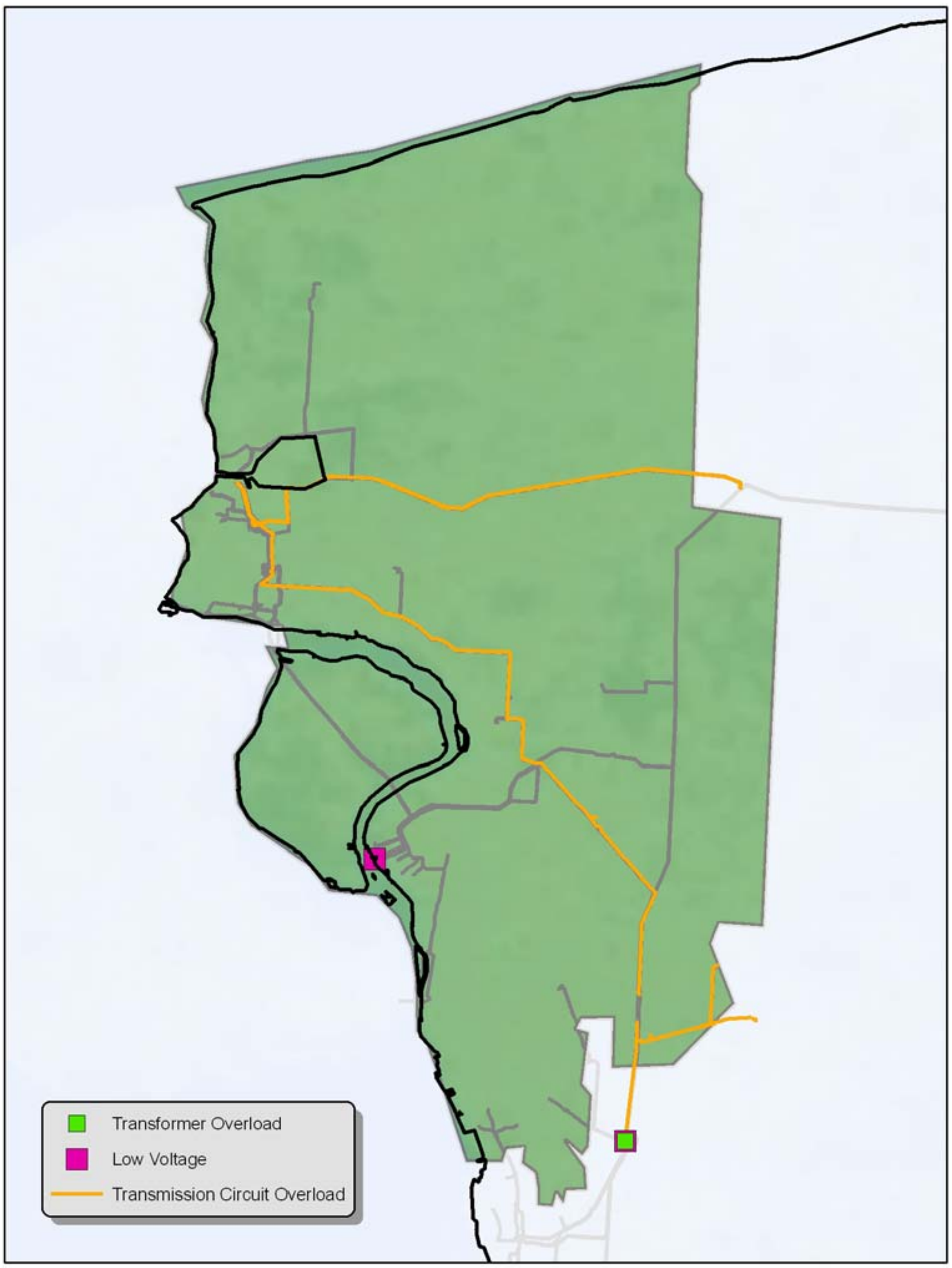


Figure 3-66
Frontier Study Area Forecasted Transmission Capacity Constraints Table

Impacted Asset	kV	Contingency	Need Year	Power Flow Case	Driving Issue	Project Number (s)	Comments / Mitigation / Corrective Action
54 (Gardenville-Erie)	115	Line 181	2012	Summer 2011	116% of LTE	C31463	The recommended solution is to reconductor 0.3 miles of this line. See Note 1
195 (Niagara-Packard)	115	193+194 DCT outage	2011	Summer 2013	122% of STE, 143% of LTE	C29945	The recommended solution is to reconductor this line. See Note 2
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
TB #3, TB #4 (Gardenville 115kV)	115	N-1-1: TB#2 outage followed by Gardenville 230kV bus fault	2011	Summer 2011	100% of STE, 140% of LTE	Asset Strategy	The recommended solution is to replace the existing transformer banks. See Note 4
101, 102 (Niagara-Lockport)	115	Lockport 115 Bus 2	2012	Summer 2011, 2015	114% of LTE	C38705	Operational switching changes are available but replacement of limiting elements is also recommended. See Note 5
181 (Packard-Urban)	115	180+182 DCT	2012	Summer 2015	112% of LTE		The recommended solution is to reconfigure and reconductor the 181 line. See Note 6
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted] See Note 7
Huntley Area Voltages	115	Bus fault at Packard	2012	Summer 2011	Voltage at 0.87 pu	C37522	The recommended solution is to install two 75MVAr permanent 115kV capacitor banks at Huntley and a bus tie breaker at Packard.

Impacted Asset	kV	Contingency	Need Year	Power Flow Case	Driving Issue	Project Number (s)	Comments / Mitigation / Corrective Action
							See Note 8
180 (Niagara-Gardenville)	115	N-1 and N-1-1 when all Dunkirk generators are shut down	2013	Summer and Winter 2016			The recommended solution is to reconductor this line. See Note 10
181 (Packard-Erie)	115	N-1 and N-1-1 when all Dunkirk generators are shut down	2013	Summer and Winter 2016			The recommended solution is to reconductor this line. See Note 11
Gardenville Circuit Breakers (14 number)	115	SLGF at Gardenville Bus 1	2012	Summer 2015	105% of breaker duty	C05156	The recommended solution as part of a rebuild project is to replace the existing breakers. See Note 9

Note 1
54 (Gardenville-Erie)
The contingency combination noted is the most severe contingency for this situation. Other contingencies include DCT 181+182, 705, 903 and Gardenville bus sections. 0.3 miles of Gardenville-Erie #54 is being reconductored with 795 ACSR

Note 2
195 (Niagara-Packard)
The contingency combination noted is the most severe contingency for this situation. Another contingency that also causes this overload is a bus fault at Packard. The recommended solution is to reconductor 195 with 2156 ACSS by 2013. A temporary solution would be to reduce generation on the Niagara West 115kV bus by about 250MW

Note 3
[redacted]

Note 4
Gardenville 115kV TB #3, TB #4
The contingency combinations noted are the most severe contingencies for this situation. These overloads will be addressed by Asset Strategy's station rebuild project. The recommended solution as part of the rebuild project is to replace the existing transformer banks with new 333MVA banks.

Note 5
Niagara-Lockport circuits
Operational change requires 104 to be closed at Mountain and Lockport, 103 opened at Mountain. Additional planning recommendations include replacing limiting elements at Lockport and Mountain stations

Note 6
181 (Packard-Urban)
The contingency combination noted is the most severe contingency for this situation. Other contingencies include single and double circuit Gardenville line outages. The recommended solution is to bus the retired #105 (Beck-Terminal C) line with the #181 line and reconductor 1.10 miles of #181

Note 7
[redacted]

Note 8
Huntley Area Voltages
The recommended solution is to install a 75MVAr permanent 115kV capacitor bank at Huntley, replacing the existing two portable 52.5MVAr units. A temporary solution would be to put Oxbow Power and Indeck Yerkes generators in service.

The impact of a bus tie fault or a bus tie breaker failure at Packard on the Huntley area is made worse by the mothballing of Dunkirk generation. Therefore, the addition of a bus tie breaker and a rearrangement of 230kV equipment at Packard will be done so that no breaker faults or breaker failure could result in an outage of all the lines connected to the bus. This work will be completed by June 1, 2013 to provide short-term mitigation of the shutdown of all but one of the Dunkirk generators. The addition of a second 75MVAr capacitor bank at Huntley is recommended to mitigate the shutdown of all Dunkirk generators.

Note 9
Gardenville Circuit Breakers (total of 14)
The contingency noted is the most severe contingency for this situation. Other contingencies include SLGF on lines originating in the Frontier Region. These over-duties will be addressed by Asset Strategy’s station rebuild project. A recommended solution as part of the rebuild project would be to replace the existing breakers with new 63kA breakers.

Note 10
180 (Niagara-Gardenville)
Long-term projects have been identified in the Review of Dunkirk Mothball Notice – Part 2 that will mitigate the complete shutdown of Dunkirk generation, These long-term projects will restore the system to a state similar to the state it would have been in after completion of the projects recommended in the 2011 area study, had Dunkirk not shutdown. The recommended projects include the reconductoring of one mile of the Niagara – Gardenville #180 line.

Note 11
181 (Packard-Erie)
Long-term projects have been identified in the Review of Dunkirk Mothball Notice – Part 2 that will mitigate the complete shutdown of Dunkirk generation, These long-term projects will restore the system to a state similar to the state it would have been in after completion of the projects recommended in the 2011 area study, had Dunkirk not shutdown. The recommended projects include the reconductoring of 14 miles of the Packard – Erie #181 line. Additional analysis is ongoing to review level of risk if this project is not completed and all Dunkirk generation is shut down.

Figure 3-67
Frontier Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints Map

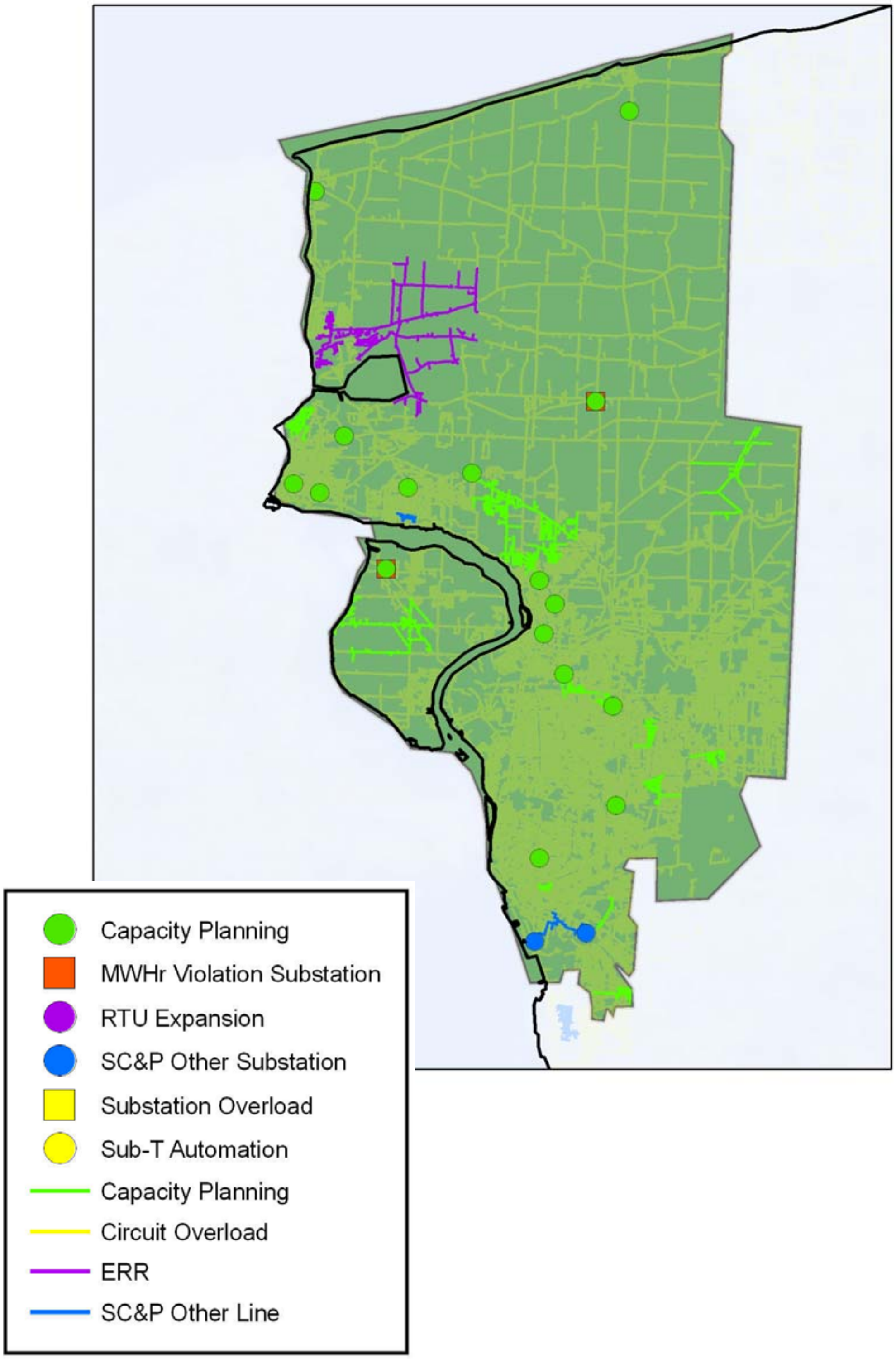


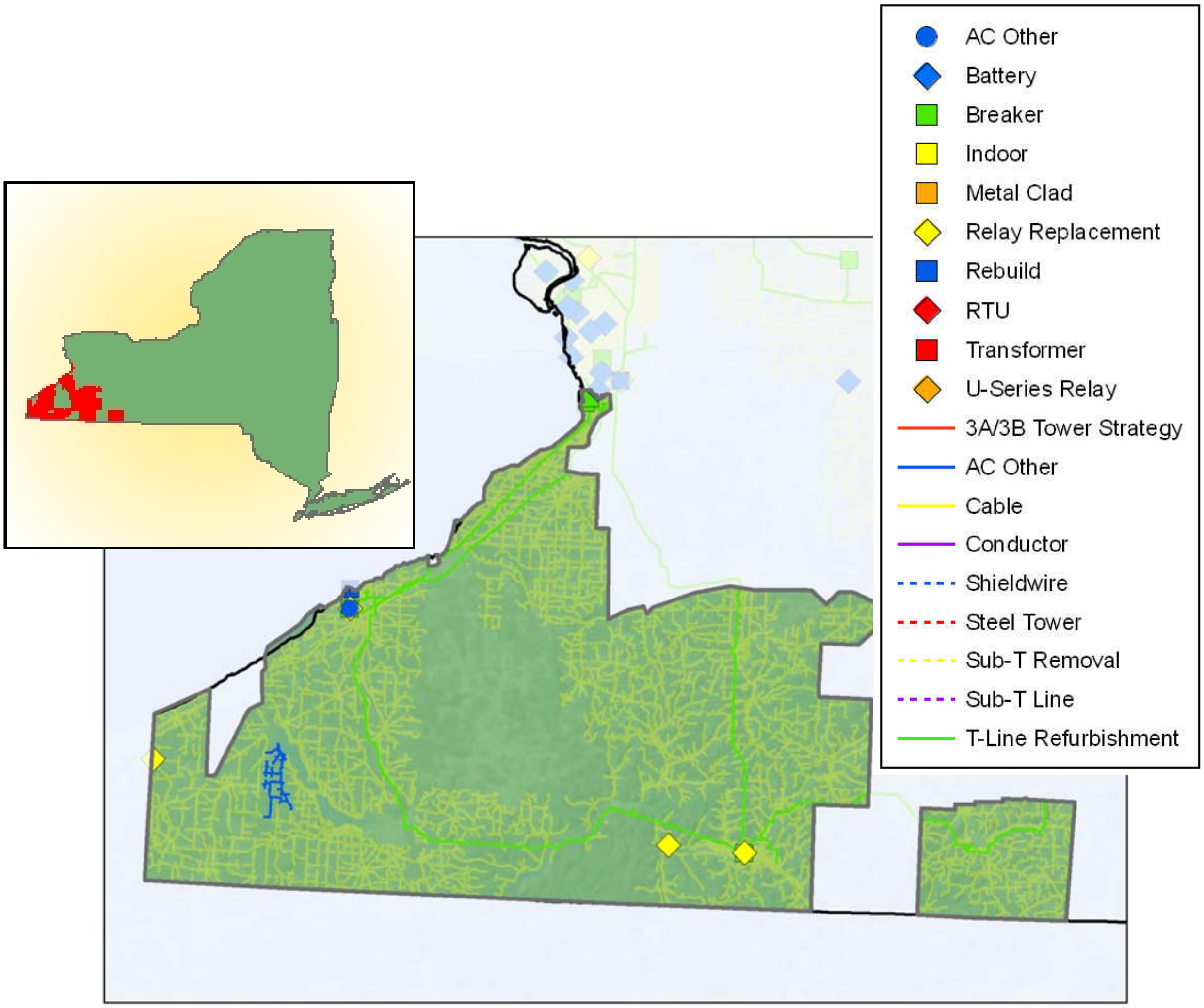
Figure 3-68
Frontier Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints

Identified Problem	System	Distribution Study Area	Substation	Supply Line	Feeder
MWHr Violations - 209 LONG ROAD	DIST	Grand Island	209 LONG ROAD		
MWHr Violations - 76 SHAWNEE	DIST	Amherst	76 SHAWNEE		

Figure 3-69
Frontier Study Area
Planned Distribution and Sub-transmission System Capacity and Performance Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Frontier	Capacity Planning	DIST	Amherst	05867 F13862 Extend & transfer to F23255	C26558
				17832 Buffalo 54 - F5461 Relief	CD0670
				17830 Alameda 124 - F12467/12475 Relief	CD0682
				16282 Shawnee Road 76 (DLine)	CD0967
				04793 Frankhauser-115-13.2KV- Bus & Bkrs	C28931
				09273 Shawnee Road 76 (DSub)	C36059
				05920 Frankhauser New Station - Line Work	C28929
				Duplicate 05867 F13862 Extend & transfer to F23255	C26558
			Cheektowaga	11323 Getaway upgrade overloaded section	CD0341
			Elm	19394 Buffalo Station 49 - UG Upgrades (D Sub)	-
				17837 Buffalo Station 49 - UG Upgrades	-
			Grand Island	17511 - Buffalo Station 64 - New F6453	CD0970
				17477 APP Pharmaceutical Expansion - DLine	CD0599
				17783 APP Pharmaceutical Expansion - DSub	CD0637
				18484 Long Road 209 - Install TB2	CD0977
				18570 Long Rd 209 - New F20955	CD0964
			Kensington	11838 2163 Load Relief	CD0543
			Niagara	17839 Youngstown 88 Relief	CD0638
				05224 Youngstown 88 - Station Rebuild	C29049
				09279 Wilson 93 Load Relief - Replace TB1	C35743
			Niagara Falls	09258 Lockport Road 216 - Install TB#2	C36057
				11361 8th St Conversion Niagara Falls	-
				05882 F9753 Rebuild/Conv tie w/F21754	C28689
				06681 Station 81 - Relieve F8164	C34526
				18666 Lockport Road 216 - Install TB#2 - D Line Project	-
				09227 Walmore 217 Contingency Load Relief - New F21055	C36566
				11358 Beech Ave Conversion Niagara Falls	C32751
				11380 Welch Ave Conversion Load Relief	-
				09263 Military Road 210 - Install TB#2	C36056
				Duplicate 05882 F9753 Rebuild/Conv tie w/F21754	C28689
			Seneca	11201 Buffalo Station 38 - F3864 Relief	CD0321
				11197 Buffalo Station 46 & 44 - F4672/F4468 Relief	CD0253
				11744 Buffalo Station 40 - F4067 Relief	-
				19206 New Abby Street Substation - DxD Line	-
				19205 New Abby Street Substation - DxD Sub	-
			Tonawanda	18856 Buffalo Station 78 and 79 - Relief Plan	CD0961
				18849 Buffalo Station 57 - F5768 Reconductoring	-
				19055 Buffalo Station 77 - Add TB3 (DxD Line)	-
				19053 Buffalo Station 56 - New F5664	-
				18850 Buffalo Station 129 - F12974 Reconductoring	-
				05139 Station 214 - Install TB2 (DxD Sub)	C29186
				06675 Station 214 - Install TB2 (DxD Line)	C29187
				18403 Buffalo 47 - New F4762	-
				19054 Buffalo Station 77 - Add TB3 (DxD Sub)	-
				19050 New Tonawanda Substation - DxD Line	-
				19051 New Tonawanda Substation - DxD Sub	-
				Duplicate 18856 Buffalo Station 78 and 79 - Relief Plan	CD0961
	ERR	DIST	Niagara	06731 Swann Rd F10552 tie with F10557	C28106
				Duplicate 06731 Swann Rd F10552 tie with F10557	C28106
	SC&P Other	DIST	Niagara Falls	05880 F8566 Rebuild Various Sections	C28692
			Seneca	11582 Buffalo Station #51 - 4 Bay Louver Install	-
				05400 Buffalo Station 12 - Fdr Rem & Ties	C36208
				17517 Buffalo Station 42 - Voltage Mitigation	CD0541
				Duplicate 05400 Buffalo Station 12 - Fdr Rem & Ties	C36208

Figure 3-70
Southwest Study Area Asset Condition Program Work



Area Summary

The driver behind the transmission capacity related projects in the Southwest study area is:

- A wide range of contingencies 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.
- Major projects that drive the solutions to capacity problems in this area, irrespective of Dunkirk generation mothballing, include the new Five-Mile Road 345/115kV station north of Homer Hill, the addition of a second capacitor bank at Homer Hill, the reconductoring of the Warren-Falconer #171 line, the closing of a normally open breaker at Andover, and the addition of a second bus tie breaker in the Dunkirk substation.
- Additional short-term projects in the Southwest Region that will allow all but one of the Dunkirk generators to be shut down include the addition of 115kV capacitor banks at Dunkirk and Homer Hill, changing the transmission line supply for several distribution stations, and upgrading of limiting terminal equipment at Dunkirk. Completion of these short-term projects is expected by June 1, 2013
- Long-term projects in the Southwest Region that will allow all Dunkirk generation to be shut down include two 33.3 MVAr capacitor banks at Dunkirk and reconductoring of two 115kV lines between Five Mile Rd and Homer Hill.

Key sub-transmission and distribution drivers include the following:

- The 34.5kV sub-transmission system that consists of several very long loops that traverse through rugged territory.

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. [redacted] National Grid has 230-115kV transformers at Gardenville (3) and Dunkirk (2). [redacted].

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 14,700 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 34.5-13.2kV transformers at the Price Corners and Reservoir substations. There are also twenty 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 North Chautauqua study area serves approximately 26,100 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 17,000. 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 36,800 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.

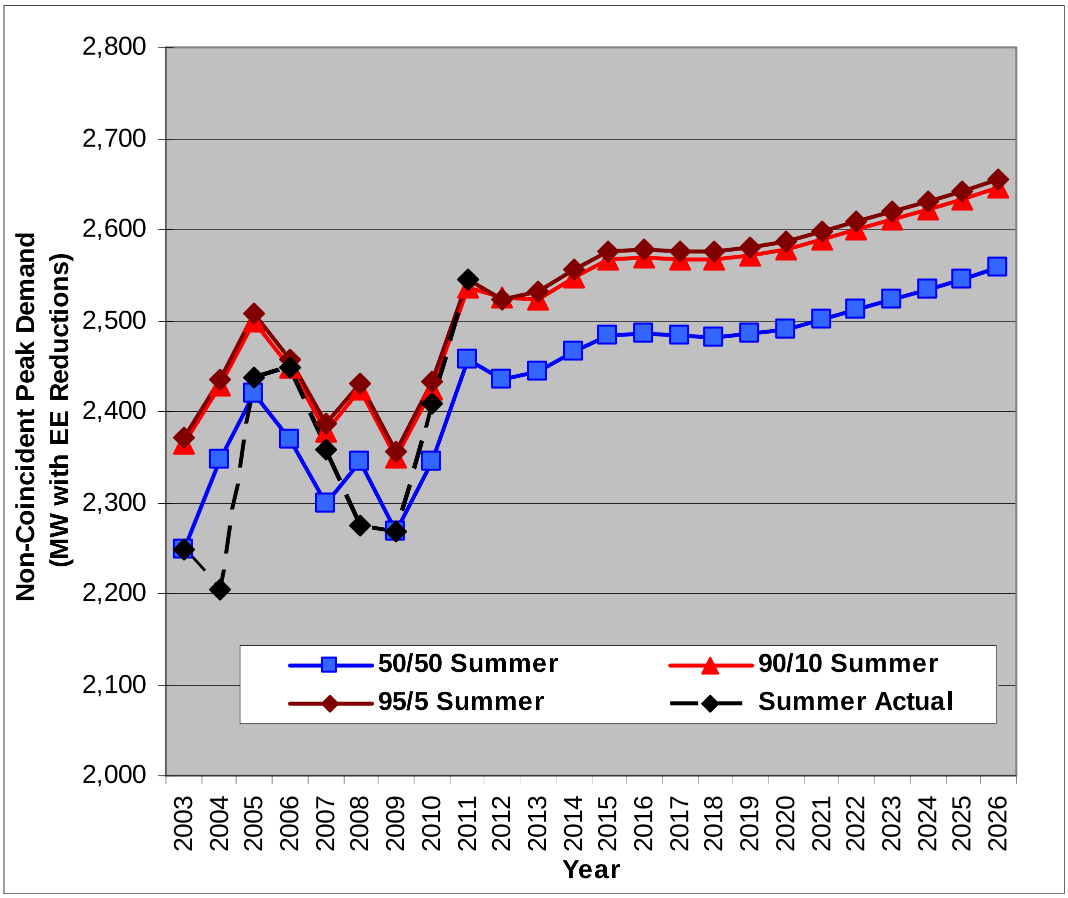
The Olean study area serves approximately 18,700 customers. There are twenty distribution feeders that provide service to area customers. There are eight 4.8kV feeders supplied by 34.5-4.8kV transformers at various stations. Eleven of the area's twelve 13.2kV feeders are fed from 115-13.2kV transformers. 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 5 substations serving nine 4.8kV feeders.

Area Load Forecast

The Southwest transmission study area load forecast is included in the West Region (Zone A & B) forecast. The summary of the load forecast thru 2026 is detailed in the figure below.

Figure 3-71
Zone A & B Non-Coincident Summer Peak Demand
Including Energy Efficiency Reductions[2]



[2] National Grid - Upstate New York Peak (Summer and Winter) MW Forecast by Region, November 2011, Revision 0, pages 105, 106 and 107.

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Figure 3-72
Zone A & B Non-Coincident Summer Peak Demand Including Energy Efficiency Reductions Table

ZONEs A&B (West Region) - SUMMER w/EE Reductions

	SUMMER PEAKS (MWs)								Wthi's			
YEAR	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2003	2,248		2,284		2,364		2,372		77.9	78.9	81.1	81.4
2004	2,205	-1.9%	2,348	2.8%	2,428	2.7%	2,436	2.7%	75.0	78.9	81.1	81.4
2005	2,437	10.5%	2,420	3.1%	2,500	3.0%	2,508	3.0%	79.4	78.9	81.1	81.4
2006	2,449	0.5%	2,369	-2.1%	2,449	-2.0%	2,457	-2.0%	81.1	78.9	81.1	81.4
2007	2,358	-3.7%	2,298	-3.0%	2,378	-2.9%	2,386	-2.9%	80.6	78.9	81.1	81.4
2008	2,274	-3.6%	2,344	2.0%	2,424	1.9%	2,431	1.9%	77.0	78.9	81.1	81.4
2009	2,268	-0.3%	2,269	-3.2%	2,349	-3.1%	2,357	-3.1%	78.9	78.9	81.1	81.4
2010	2,408	6.2%	2,345	3.4%	2,425	3.2%	2,433	3.2%	80.7	78.9	81.1	81.4
2011	2,544	5.7%	2,457	4.7%	2,536	4.6%	2,544	4.6%	81.4	78.9	81.1	81.4
2012			2,435	-0.9%	2,515	-0.9%	2,523	-0.8%		78.9	81.1	81.4
2013			2,443	0.3%	2,524	0.4%	2,532	0.4%		78.9	81.1	81.4
2014			2,466	0.9%	2,548	1.0%	2,556	1.0%		78.9	81.1	81.4
2015			2,483	0.7%	2,567	0.7%	2,575	0.7%		78.9	81.1	81.4
2016			2,485	0.1%	2,569	0.1%	2,578	0.1%		78.9	81.1	81.4
2017			2,483	-0.1%	2,567	-0.1%	2,576	-0.1%		78.9	81.1	81.4
2018			2,482	0.0%	2,567	0.0%	2,576	0.0%		78.9	81.1	81.4
2019			2,486	0.1%	2,571	0.1%	2,580	0.1%		78.9	81.1	81.4
2020			2,491	0.2%	2,577	0.2%	2,586	0.2%		78.9	81.1	81.4
2021			2,502	0.4%	2,588	0.4%	2,597	0.4%		78.9	81.1	81.4
2022			2,513	0.5%	2,600	0.5%	2,609	0.5%		78.9	81.1	81.4
2023			2,523	0.4%	2,610	0.4%	2,619	0.4%		78.9	81.1	81.4
2024			2,533	0.4%	2,621	0.4%	2,630	0.4%		78.9	81.1	81.4
2025			2,544	0.4%	2,632	0.4%	2,641	0.4%		78.9	81.1	81.4
2026			2,558	0.5%	2,646	0.5%	2,655	0.5%		78.9	81.1	81.4
Compound Avg. 8 yr ('03 to '11)		1.6%		0.9%		0.9%		0.9%				
Compound Avg. 5 yr ('06 to '11)		0.8%		0.7%		0.7%		0.7%				
Compound Avg. 5 yr ('11 to '16)				**0.2%**		**0.3%**		**0.3%**				
Compound Avg. 10 yr ('11 to '21)				**0.2%**		**0.2%**		**0.2%**				
Compound Avg. 15 yr ('11 to '26)				**0.3%**		**0.3%**		**0.3%**				

Figure 3-73
Zone A & B Non-Coincident Winter Peak Demand Including Energy Efficiency Reductions Table

ZONEs A&B (West Region) - WINTER w/EE Reductions

	WINTER PEAKS (MWs)								hdd			
YEAR (season)	ACTUAL		NORMAL (50/50)		EXTREME (90/10)		EXTREME (95/5)		ACTUAL	NORMAL	EXT 90/10	EXT 95/5
2002-2003	2,218		2,201		2,259		2,262		62.7	51.4	65 0	65.1
2003-2004	2,239	1.0%	2,159	-1.9%	2,229	-1.3%	2,239	-1.0%	41.8	51.4	65 0	65.1
2004-2005	2,204	-1.6%	2,188	1.3%	2,258	1.3%	2,268	1.3%	65.1	51.4	65 0	65.1
2005-2006	2,127	-3.5%	2,153	-1.6%	2,260	0.1%	2,272	0.2%	59.5	51.4	65 0	65.1
2006-2007	2,163	1.7%	2,107	-2.1%	2,178	-3.7%	2,188	-3.7%	56.1	51.4	65 0	65.1
2007-2008	2,114	-2.2%	2,076	-1.5%	2,147	-1.4%	2,157	-1.4%	41.8	51.4	65 0	65.1
2008-2009	2,109	-0.2%	2,151	3.6%	2,222	3.5%	2,231	3.5%	50.4	51.4	65 0	65.1
2009-2010	2,177	3.2%	2,171	0.9%	2,242	0.9%	2,251	0.9%	51.5	51.4	65 0	65.1
2010-2011	2,126	-2.3%	2,091	-3.7%	2,149	-4.1%	2,152	-4.4%	49.6	51.4	65 0	65.1
2011-2012			2,211	5.7%	2,283	6.2%	2,293	6.5%		51.4	65 0	65.1
2012-2013			2,243	1.4%	2,316	1.4%	2,326	1.4%		51.4	65 0	65.1
2013-2014			2,278	1.6%	2,352	1.6%	2,363	1.6%		51.4	65 0	65.1
2014-2015			2,299	0.9%	2,374	0.9%	2,385	0.9%		51.4	65 0	65.1
2015-2016			2 307	0.3%	2 382	0.4%	2 393	0.4%		51.4	65 0	65.1
2016-2017			2,316	0.4%	2,392	0.4%	2,403	0.4%		51.4	65 0	65.1
2017-2018			2,327	0.5%	2,404	0.5%	2,415	0.5%		51.4	65 0	65.1
2018-2019			2,340	0.5%	2,417	0.5%	2,428	0.5%		51.4	65 0	65.1
2019-2020			2,352	0.5%	2,430	0.5%	2,441	0.5%		51.4	65 0	65.1
2020-2021			2,366	0.6%	2,444	0.6%	2,455	0.6%		51.4	65 0	65.1
2021-2022			2,379	0.5%	2,457	0.6%	2,468	0.6%		51.4	65 0	65.1
2022-2023			2,392	0.5%	2,471	0.5%	2,482	0.5%		51.4	65 0	65.1
2023-2024			2,405	0.6%	2,484	0.6%	2,496	0.6%		51.4	65 0	65.1
2024-2025			2,419	0.6%	2,499	0.6%	2,511	0.6%		51.4	65 0	65.1
2025-2026			2,436	0.7%	2,516	0.7%	2,528	0.7%		51.4	65 0	65.1
Compound Avg. 8 yr ('03 to '11)		-0.5%		-0.6%		-0.6%		-0.6%				
Compound Avg. 5 yr ('06 to '11)		0.0%		-0.6%		-1.0%		-1.1%				
Compound Avg. 5 yr ('11 to '16)				**2.0%**		**2.1%**		**2.1%**				
Compound Avg. 10 yr ('11 to '21)				**1.2%**		**1.3%**		**1.3%**				
Compound Avg. 15 yr ('11 to '26)				**1.0%**		**1.1%**		**1.1%**				

Asset Condition Programs

Figure 3-70 shows a map of the planned asset condition projects in the study area. Figure 3-74 shows a listing of the projects in tabular form.

Figure 3-74
Southwest Study Area Planned Asset Condition Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Southwest	AC Other	DIST	Cattaraugus North	13273 Steamburg Rebuilt	-
				19046 Reservoir Staiton - Bank Replacement	-
			Chautauqua South	18568 MV-Poland 62258 Route 8 Reconductor Phase 2	CD0885
				18679 Chautauqua South - Feeder 5762 rebuild	CD0849
				11458 MV- Poland 62258 Route 8 Reconductor Phase 1	CD0883
				17795 French Creek Station 56 - Transformer Replacement	CD0862
				18571 MV-Poland 62258 Route 8 Reconductor Phase 3	-
				18572 MV- Poland 62258 Route 8 Reconductor Phase 4	-
		SUB-T	Erie South	17357 Ridge Substation - 34.5kV System Relay Updates	-
	Conductor Replacement	DIST	Cattaraugus North	11695 Feed 2762 - #6A reconductoring	CD0353
			Olean	17851 SW - Replace Steel Conductor on Cuba Lake 3761 - Branch Rd	CD0593
				17867 SW - Replace Steel Conductor on Cuba Lake 3761 - Jackson Hill Rd	CD0749
	Overhead Line Refurbishment Program - Asset Condition	TRAN	None	Colton-BF 1-2 T3140-T3150 ACR	C36164
				Dunkirk - Falconer #161 & 162	CNYAS62
				Falconer-HH 153-154, T1160-T1170 ACR	C27422
				Gardenville - Dunkirk [73]-74 T1250 ACR	CNYAS75
				Homer Hill Bennett Rd 157, T1340 ACR	C27429
	Relay Replacement	TRAN	None	Trans Relay Replacement - Homer Hill Substation	(blank)
				Trans Relay Replacement - South Ripley Substation	(blank)
	Substation Breaker	DIST	Erie South	Breaker - Ridge Station 142	(blank)
		TRAN	None	Trans Breaker Replacement - Homer Hill Switch Structure	(blank)
	Substation Power Transformer	DIST	Erie South	18581 Collins Station - Replace Transformer	-
	Substation Rebuild	TRAN	None	Dunkirk Rebuild	C05155
	Sub-T Line Removal	SUB-T	Cattaraugus North	06239 N Ellicottville Tap 803 Remove	C33030
			Olean	18487 Homer Hill-Ceres 809-34 5kv retire and remove	CD0825
	Sub-T Overhead Line	DIST	Chautauqua South	11805 Stow F5261 & Chautauqua F5762 transfer underbuilt on Hartfield-Ashville Line 854	CD0452
			Olean	11060 West Salamanca-Homer Hill 805 Rebuild - Distribution Underbuild	CD0132
		SUB-T	Cattaraugus North	19298 N. Ashford-Nuclear Fuel Services 817-34.5kv	-
				19294 Dake Hill-W. Salamanca 816-34 5kv	-
			Chautauqua South	05975 Hartfield-Ashvile 854 Refurbish	C33294
				05976 Hartfield-S. Dow 859 Refurbish	C33180
				19293 W. Portland-Sherman 867-34.5kv	-
			Erie South	05284 Bagdad-Dake Hill 815 Refurbishment	C33132
				19313 Ohio-Ridge 613-34.5kv	-
				12830 Shaleton-Ridge 610, Station 207 Tap Refurbishment	-
			Olean	06871 W. Salamanca-Homer Hill 805 ref	C29451
			Chautauqua North	05933 General Mills-Ridge 611/612 Ohio Sw	C27223
				06237 N Angola - Bagdad 862 Refurbishment	C27502
				Duplicate 05933 General Mills-Ridge 611/612 Ohio Sw	C27223

Forecasted Capacity Constraints

Figure 3-75 maps the forecasted capacity constraints on the transmission system. Figure 3-76 lists the forecasted transmission capacity constraints. Figure 3-77 maps the forecasted capacity constraints on the distribution system and capacity planning solutions proposed in the study area for the next five years. Figures 3-78 and 3-79 list the distribution system forecasted capacity constraints, and system capacity and performance solutions, respectively.

Figure 3-75
Southwest Study Area Forecasted Transmission Capacity Constraints Map

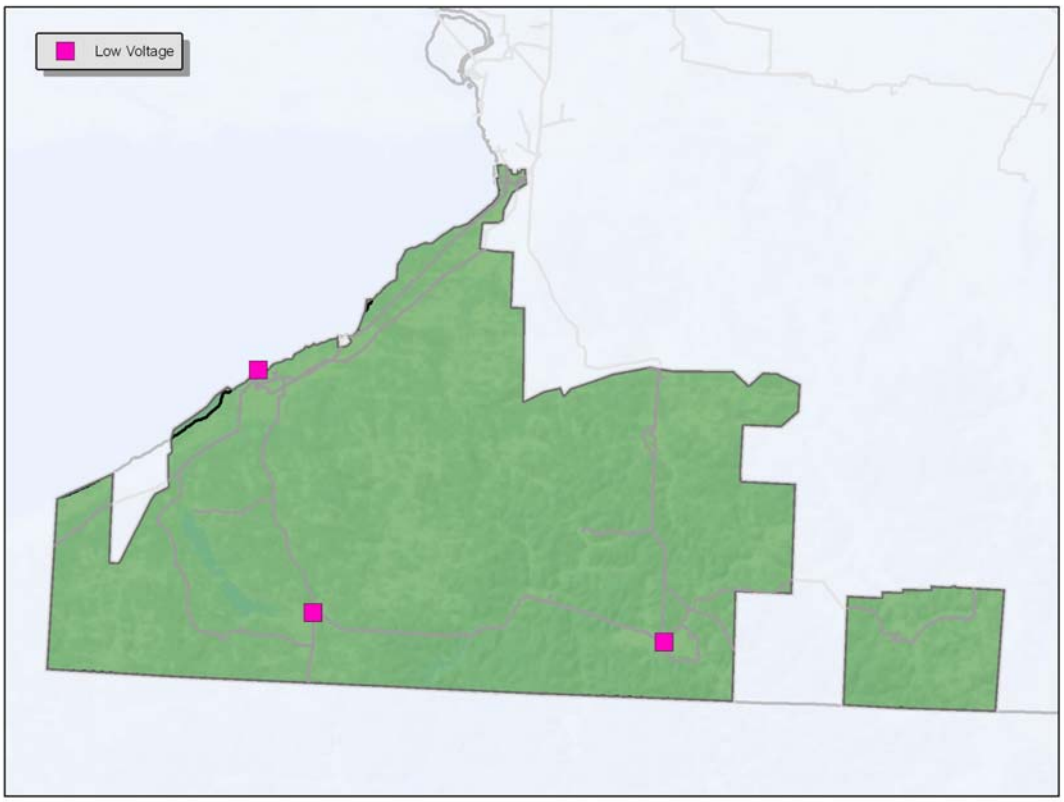

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Figure 3-76
Southwest Study Area Forecasted Transmission Capacity Constraints Table

Impacted Asset	kV	Contingency	Need Year	Power Flow Case	Driving Issue	Project Number (s)	Comments / Mitigation / Corrective Action
Southwest Region Voltages	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Southwest Region Voltages	115	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dunkirk 115kV substation	115	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dunkirk-Falconer 115kV region	115	[redacted]	[redacted]	[redacted]	[redacted]		[redacted] the region. See Note 4.
161, 162 Reactors (Dunkirk-Falconer)	115	[redacted]	[redacted]	[redacted]	[redacted]		[redacted] net load. See Note 5.
Southwest Region Voltages	230 and 115	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]
Southwest Region Voltages	230 and 115	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]

Note 1
Southwest Region Voltages
The contingency combination noted is the most severe contingency for this situation. [redacted] hese problems were identified in the Western Division Area Review, Part 1 [redacted] See Note 6.

The original solution set recommended prior to the Dunkirk Mothball Notice was identified as D2 in the Western Division Area Review, Part 2 – Solution Study. It included installation of a second 27MVAr 115kV capacitor bank at Homer Hill, the construction of the Southwest station - a new 345/115kV station near Homer Hill station tying into the Homer City-Stolle Road 345kV line #37 and the Gardenville-Homer Hill 115kV lines #151 and #152, and the closure of the normally open tie on the #157 line at Andover. A temporary solution was to run units at Jamestown and Indeck Olean

Note 2
Southwest Region Voltages
The contingency combination noted is the most severe contingency for this situation. [redacted] r. The recommended solution is to reconductor 6 miles of the Falconer-Warren 115kV #171 circuit. An operational solution before reconductoring would be to run generating units at Jamestown and Indeck Olean

Note 3
Dunkirk 115kV substation
The recommended solution is the addition of a second 115kV bus tie breaker in series with the existing breaker [redacted]. A temporary solution before the upgrade would be to run generating units at Jamestown and Indeck Olean

Note 4
Dunkirk-Falconer 115kV Region
The contingency combination noted is the most severe contingency for this situation. [redacted] The recommended solution is to improve the load power factor in the region by applying up to 25MVAr of reactive support to Bennett Road, Baker Street, Berry Road, Roberts Road, East Dunkirk and Hartfield stations.

Note 5
Dunkirk 230-115kV Transformer
The failure of the series reactor as the first contingency is a long lead time repair item. The recommended solution is to shed Jamestown load or a similar amount of other area load after the second contingency, or by bringing more Jamestown generation in service before the contingency.

Note 6
Southwest Voltages Without Dunkirk Generation
Southwest Region 230 kV and 115 kV post-contingency voltage problems identified in the Western Division Area Review, Part 1 will be made worse by the pending retirement of four generators at Dunkirk. As indicated in the Review of Dunkirk Mothball Notice – Part 1, the recommendation is to accelerate and augment the original solution set recommended in the Western Division Area Review, Part 1. The latter solution set will be augmented by short duration projects that include installation of 115kV capacitor bank at Dunkirk and Homer Hill, changing the transmission line supply for several distribution stations, and upgrading of limiting terminal equipment at Dunkirk. Completion of these

short duration projects is expected by June 1, 2013, upon which the number of Dunkirk generating units that must remain in service at Dunkirk can be reduced to one.

Note 7
Southwest Voltages Without Dunkirk Generation
Long-term projects have been identified in the Review of Dunkirk Mothball Notice – Part 2 that will mitigate the complete shutdown of Dunkirk generation. These long-term projects will restore the system to a state similar to the state it would have been in after completion of the projects recommended in the 2011 area study, had Dunkirk not shutdown. The recommended projects include two 33.3 MVAr capacitor banks at Dunkirk and reconductoring two 115kV lines between Five Mile Rd and Homer Hill

Figure 3-77
Southwest Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints Map

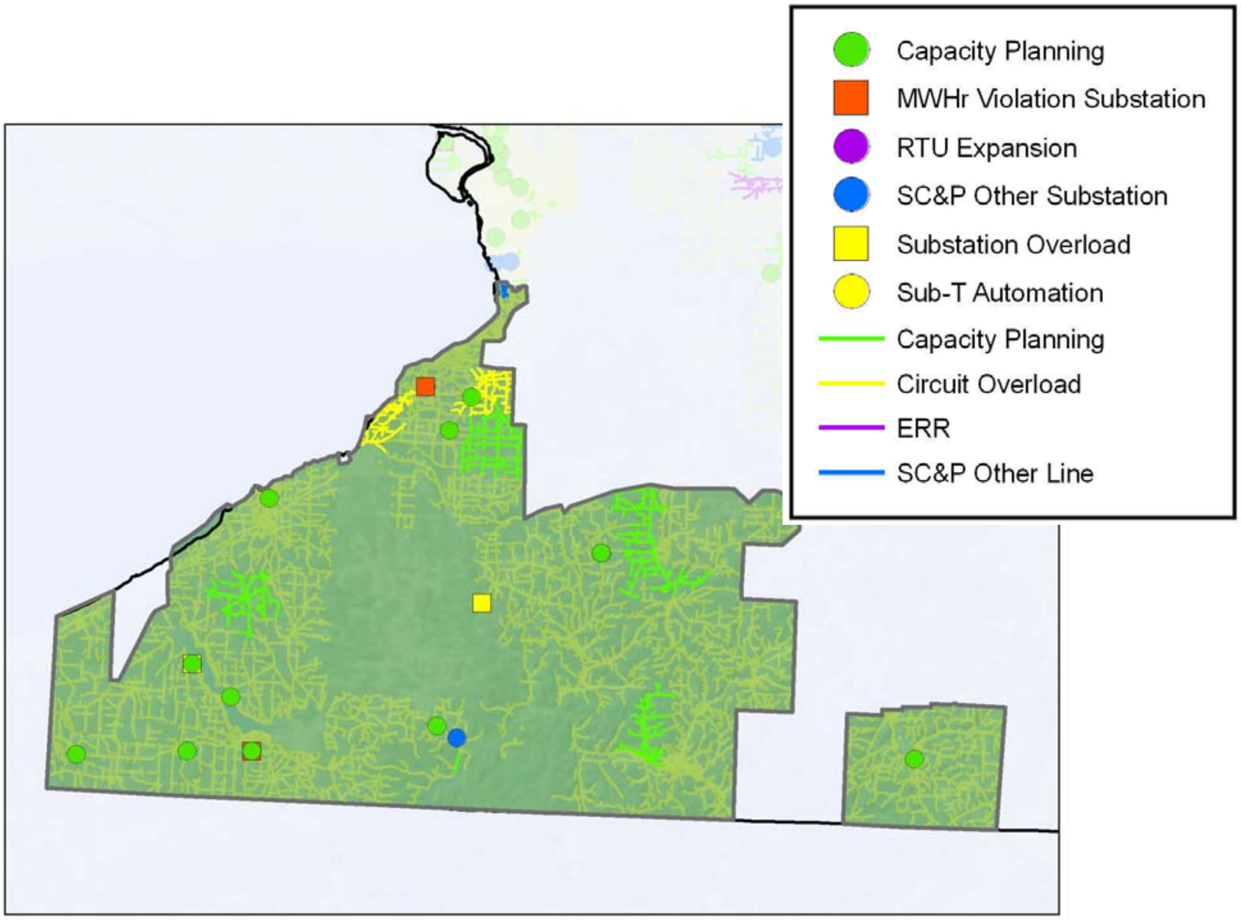

Figure 3-78
Southwest Study Area
Forecasted Distribution and Sub-transmission Capacity Constraints

Identified Problem	System	Distribution Study Area	Substation	Supply Line	Feeder
Transformer Overload - CATTARAUGUS 34.5 - 4 8kV	DIST	Cattaraugus North	CATTARAUGUS		
MWHr Violations - STATION 150	DIST	Chautauqua South	STATION 150		
Transformer Overload - CHAUTAUQUA 34.5 - 4.8kV	DIST	Chautauqua South	CHAUTAUQUA		
Feeder Overload - DELAMETER RD, Fdr 36_07_9354	DIST	Erie South	DELAMETER RD		36_07_9354
Feeder Overload - EDEN CENTER Fdr 36_07_8861	DIST	Erie South	EDEN CENTER		36_07_8861
Feeder Overload - N. EDEN, Fdr 36_07_8251	DIST	Erie South	N. EDEN		36_07_8251
MWHr Violations - DELAMETER RD	DIST	Erie South	DELAMETER RD		

Figure 3-79
Southwest Study Area
Planned Distribution and Sub-transmission System Capacity and Performance Projects

Transmission Study Area	Program	System	Distribution Study Area	Project/Issue Name	Project #
Southwest	Capacity Planning	DIST	Cattaraugus North	17858 Delevan 1162 Relief	CD0672
				17940 Reservoir Station - Dline work	-
				15717 Bennett Road Distribution Line Cap installations	CD0538
				18488 Price Corners Rebuild - Line 804	-
				17860 West Valley 25 Relief	CD0616
				17870 SW - Reconductor #6 Wire on Machias 1362 on State Hwy 16	CD0754
				17939 Price Corners Rebuild - New Feeder	-
				17938 Price Corners Rebuild - Upgrade transformer	-
			Chautauqua South	04953 NW Panama Retirement	C32306
				06438 Poland Convert Old State Rd	C28622
				17496 Baker St Distribution Line Cap Installations	CD0540
				17862 Cassadaga 61 Relief	CD0842
				19082 Chautauqua South: new Stedman 115 - 13.2kV substation DxD	-
				17471 Chautauqua South: Stedman Rd substation Dline work	-
			Erie South	04949 NW Langford 18061 Upgrade regs	C32310
				19033 Eden Switch Structure - New Feeders	-
				19032 Eden switch structure -install 2-10/12 5MVA XFMRS	-
				19345 North Collins New Feeder	-
				04950 N Collins Repl T1 Xfrm	C32313
			Olean	13198 Olean F3352 - Replace Overloaded Ratio Bank	CD0342
			Wellsville	19026 Wellsville Relief D-Line work	-
				19028 Wellsville Relief substation work	-
			Chautauqua North	17861 Bemus Point 159 Relief	CD0840
	ERR	DIST	Erie South	12912 Delameter - F9354 Load Relief	CD0354
	SC&P Other	DIST	Cattaraugus North	17934 Steamburg Station Retirement	-
				17922 Install EMS at West Valley Substation	CD0640
			Chautauqua South	18864 Baker St - Install 2nd xfmr	-
			Erie South	19287 Ridge Station 4kV Retirement-Dline	-
				19030 Delameter New Feeders	-
				19029 Delameter Install two 20/26/33MVA xfmrs	-
				Duplicate 19287 Ridge Station 4kV Retirement-Dline	-

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Chapter 4. Exhibits

The following contains the exhibits referenced in the Report.

1. Capital and Hudson Valley Study Area

Electrical Facilities

Substations

Albany Steam	E. Schodack 447	Leeds 377	Rosa Rd. 137
Alps 417	East Springfield 477	Liberty St. 94	Rotterdam 138
Altamont 283	East Worcester 60	Long Lane 504	Russell Rd 228
Amsterdam 326	Elnora 344	Lynn St 320	Ruth Rd. 381
Athens	Elnora 442	Maplewood 307	Sand Creek Rd. 452
Avenue A 291	Elsmere 407	Market Hill 324	Schenevus 261
Ballston 12	Emmet 256	Marshville 299	Schodack 451
Bennington Paperboard	Ephratah 18	Mayfield 356	Schoharie 234
Bethlehem 21	Everett Rd. 420	McClellan St. 304	School St.
Blue Stores 303	Feura Bush 503	McKownville 327	Scotia 255
Boyntonville 333	Fire House Rd. 449	Mechanicville 971	Selkirk 149
Brunswick 264	Forts Ferry 459	MECO 318	Seminole 339
Buckley Corners 454	Front St. 360	Menands 101	Seventh Ave. 244
Burdeck St 265	Genesee St	Menands-Partridge St	Sharon 363
Campus 1	Gilmantown Rd 154	Middleburg 390	Shore Rd. 281
Campus 2	Gloversville 72	Nassau 113	St. Johnsville 335
Canajoharie 31	Grand St 433	New Scotland	Stoner 358
Caroga Lake 219	Greenbush 78	New Krumkill 421	Stuyvesant 35
Castleton 36	Grooms Rd. 345	Newark St. 300	Summit 347
Central Ave. 235	Guy Park 239	Newtonville 305	Swaggertown Rd. 364
Center St. 379	Hemstreet 328	North Troy #123	Sycaway 372
Charlton 222	Hill St. 311	Northville 332	Tibbets Ave. 292
Charley Lake 41	Hoag 221	Old Krumkill	Trinity Riser 404
Chrisler Ave. 257	Hoosick 314	Oathout 402	Trinity 164
Clay Hill 251	Hudson 87	Partridge St. 128	Unionville 276
Church St. 43	Inman Rd. 370	Patroon 323	Vail Mills 392
Clinton 366	Johnson Rd. 352	Pinebush 371	Valkin 427
Cobleskill 214	Johnstown 61	Prospect Hill 413	Voorheesville 178
Colvin Ave. 313	Juniper 446	Quail Hollow 457	Watt St. 230
Commerce Ave. 434	Karner 317	Randall Rd. 463	Weaver St. 245
Corliss Park 338	Krumkill 238	Rensselaer 132	West Milton
Curry Rd. 365	Lansingburg 93	Reynolds Rd. 334	Wells 208
Delanson 269	Latham 282	Rifle Range 458	Wolf Rd. 344
Delaware Ave. 330		River Rd. 444	Woodlawn 188
Delmar 279		Riverside 288	Worcester 189
Depot 425		Rock City Falls 404	

Transmission Lines

Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T5000	Arsenal - Reynolds Road #31	main line	115
T5000-1 Tap	Arsenal - Reynolds Road #31	A-RR #31 - Rensselaer Waste Water tap	115
T5000-2 Tap	Arsenal - Reynolds Road #31	A-RR #31 - GE Healthcare tap	115

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Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T5010	Albany - Greenbush #1	main line	115
T5020	Albany - Greenbush #2	main line	115
T5030	Alps - Berkshire #393	main line	345
T5040	Altamont - New Scotland #20	main line	115
T5040-1 Tap	Altamont - New Scotland #20	A-NS #20 - Voorheesville Tap	115
T5060	Battenkill - North Troy #10	main line	115
T5060-1 Tap	Battenkill - North Troy #10	B-NT #10 - Mulberry (NYSEG) Tap	115
T5070	Bethlehem - Albany #18	main line	115
T5080	LaFarge Building Materials - Pleasant Valley #8	main line	115
T5080-1 Tap	LaFarge Building Materials - Pleasant Valley #8	LBM-PV #8 - Buckley Corners	115
T5080-2 Tap	LaFarge Building Materials - Pleasant Valley #8	LBM-PV #8 - Blue Stores Tap	115
T5090	Churchtown - Pleasant Valley #13	main line	115
T5090-1 Tap	Churchtown - Pleasant Valley #13	C-PV #13 - Blue Stores Tap	115
T5110	Curry Road - Wolf Road #8	main line	115
T5110-1 Tap	Curry Road - Wolf Road #8	CR-WR #8 - Ruth Road Tap	115
T5110-2 Tap	Curry Road - Wolf Road #8	CR-WR #8 - Sand Creek Tap	115
T5120	Firehouse Road - North Troy #15	main line	115
T5120-1 Tap	Firehouse Road - North Troy #16	FR-NT #15 - GE Silicone Tap	115
T5120-2 Tap	Firehouse Road - North Troy #15	FR-NT #15 - Prospect Hill Tap	115
T5130	Front St. - Rosa Road #11	main line	115
T5140	G.E. R&D - Inman Road #20	main line	115
T5140-1 Tap	G.E. R&D - Inman Road #20	GERD-IR #20 - Elnora Tap	115
T5170	Schodack - Churchtown #14	main line	115
T5170-1 Tap	Schodack - Churchtown #14	S-C #14 - Valkin Tap	115
T5180	Greenbush - Hudson #15	main line	115
T5180-1 Tap	Greenbush - Hudson #15	G-H #15 - Trans Canada Tap	115
T5180-2 Tap	Greenbush - Hudson #15	G-H #15 - ValkinTap	115
T5190	Greenbush - Stephentown #993	main line	115
T5200	Grooms Road - Inman Road #15	main line	115
T5220	Hoosick - Bennington #6	main line	115
T5230	Hudson - Pleasant Valley #12	main line	115
T5230-1 Tap	Hudson - Pleasant Valley #12	H-PV #12 - Adm Milling Tap	115
T5280	Long Lane - LaFarge Building Materials #6	main line	115
T5290	Johnson Road- Maplewood #12	main line	115
T5300	Krumkill - Albany #7	main line	115
T5310	Leeds - Hurley Avenue #301	main line	345
T5320	Athens - Pleasant Valley #91	main line	345
T5330	Leeds - Pleasant Valley #92	main line	345
T5340	Maplewood - Arsenal #15	main line	115
T5350	Maplewood - Menands #19	main line	115
T5370	McKownville - Krumkill #8	main line	115
T5390	Meco - Rotterdam #10	main line	115
T5390-1 Tap	Meco - Rotterdam #10	M-R #10 - Center St. Tap	115

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T5390-2 Tap	Meco - Rotterdam #10	M-R #10 - Church St. Tap	115
T5390-3 Tap	Meco - Rotterdam #10	M-R #10 - Amsterdam Tap	115
T5400	Menands - Reynolds Road #2	main line	115
T5400-1 Tap	Menands - Reynolds Road #2	M-RR#2 - GE Healthcare tap	115
T5410	Menands - Riverside #3	main line	115
T5410-1 Tap	Menands - Riverside #3	M-R #3 - Albany County Waste Tap	115
T5420	Milan - Pleasant Valley #10	main line	115
T5450	New Scotland - Alps #2	main line	345
T5460	New Scotland - Bethlehem #4	main line	115
T5470	New Scotland - Long Lane #7	main line	115
T5470-1 Tap	New Scotland - Long Lane #7	NS-LL#7 - Owens Corning Tap	115
T5470-2 Tap	New Scotland - Long Lane #7	NS-LL#7 - MG Industries Tap	115
T5470-3 Tap	New Scotland - Long Lane #7	NS-LL#7 - BOC GasTap	115
T5470-4 Tap	New Scotland - Long Lane #7	NS-LL#7 - GE Plastics Tap	115
T5480	New Scotland - Leeds #93	main line	345
T5490	New Scotland - Leeds #94	main line	345
T5500	New Scotland - Feura Bush #9	main line	115
T5500-1 Tap	New Scotland - Feura Bush #9	NS-FB #9 - Owens Corning Tap	115
T5500-2 Tap	New Scotland - Feura Bush #9	NS-FB #9 - MG Industries Tap	115
T5500-3 Tap	New Scotland - Feura Bush #9	NS-FB #9 - GE Plastics Tap	115
T5520	North Catskill - Milan #T7	main line	115
T5530	North Troy - Hoosick #5	main line	115
T5530-1 Tap	North Troy - Hoosick #5	NT-H #5 - Boyntonville Tap	115
T5540	North Troy - Reynolds Road #16	main line	115
T5540-1 Tap	North Troy - Reynolds Road #16	NT-RR #16 - Sycaway Tap	115
T5550	North Troy - Wynantskill #14	main line	115
T5550-1 Tap	North Troy - Wynantskill #14	NT-W #14 - Sycaway Tap	115
T5560	Reynolds Road - Alps #1	main line	345
T5570	Reynolds Road - Greenbush #9	main line	115
T5580	Riverside - Reynolds Road #4	main line	115
T5580-1 Tap	Riverside - Reynolds Road #4	R-R #4 - Greenbush Tap	115
T5590	Riverside - Trinity #18	main line	115
T5600	Riverside - Trinity #19	main line	115
T5610	Rosa Road - G.E.(R&D) #14	main line	115
T5620	Rotterdam - Altamont #17	main line	115
T5620-1 Tap	Rotterdam - Altamont #17	R-A #17 - Burdeck St. Tap	115
T5630	Rotterdam-Bear Swamp E205	main line	230
T5640	Rotterdam - Curry Road #11	main line	115
T5650	Rotterdam - Front St. #16	main line	115
T5660	Rotterdam - G.E. #14	main line	115
T5670	Rotterdam - G.E. #15	main line	115
T5680	Rotterdam - New Scotland #13	main line	115
T5690	Rotterdam - New Scotland #19	main line	115
T5690-1 Tap	Rotterdam - New Scotland #19	R-NS #19 - Burdeck St. Tap	115
T5690-2 Tap	Rotterdam - New Scotland #19	R-NS #19 - Voorheesville Tap	115
T5700	Rotterdam - Woodlawn #35	main line	115

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T5700-1 Tap	Rotterdam - Woodlawn #35	R-W #35 - Pinebush Tap	115
T5750-7 Tap	Spier - Rotterdam #1	S-R #1 - Swaggertown Tap	115
T5760-6 Tap	Spier - Rotterdam #2	S-R #2 - Swaggertown Tap	115
T5790	State Campus - Menands #15	main line	115
T5790-1 Tap	State Campus - Menands #15	SC-M #15 - Patroon Tap	115
T5790-2 Tap	State Campus - Menands #15	SC-M #15 - Everett Tap	115
T5800	Stoner - Rotterdam #12	main line	115
T5800-1 Tap	Stoner - Rotterdam #12	S-R #12 - Vail Mills Tap	115
T5800-2 Tap	Stoner - Rotterdam #12	S-R #12 – Church St. Tap	115
T5800-3 Tap	Stoner - Rotterdam #12	S-R #12 - Amsterdam Tap	115
T5840	Trinity - Albany #5	main line	115
T5850	Trinity - Albany #9	main line	115
T5920	Woodlawn - State Campus #12	main line	115
T5920-1 Tap	Woodlawn - State Campus #12	W-SC #12 - Pinebush Tap	115
T5920-2 Tap	Woodlawn - State Campus #12	W-SC #12 - Ruth Road Tap	115
T5920-3 Tap	Woodlawn - State Campus #12	W-SC #12 - Sand Creek Tap	115
T5930	Wynantskill - Reynolds Road #13	main line	115
T5940	Feura Bush - North Catskill #2	main line	115
T5940-1 Tap	Feura Bush - North Catskill #2	FB-NC #2 - BOC GAS Tap	115
T5960	Coastal Technology - Greenbush #16	main line	115
T5980	New Scotland - Albany #8	main line	115
T5980-1 Tap	New Scotland - Albany #8	NS-A #8 - Air Products Tap	115
T5990	New Scotland - Feura Bush #3	main line	115
T6000	Reynolds Road - Feura Bush #17	main line	115
T6010	Wolf Road - Menands #10	main line	115
T6010-1 Tap	Wolf Road - Menands #10	WR-M #10 - Everett Tap	115
T6090	Greenbush - Schodack #13	main line	115
T6160	Leeds - Athens #95	main line	345
T6360	Grooms Road - Forts Ferry #13	main line	115
T6360-1 Tap	Grooms Road - Forts Ferry #13	GR-FF #13 - Fire House Tap	115
T6370	Forts Ferry - Johnson Rd #14	main line	115
T6380	CESTM - Patroon #6	main line	115
T6390	McKownville - CESTM #2	main line	115
T6490-1Tap	Luther Forest - North Troy #308	LT-NT #308 - Mullberry (NYSEG) Tap	115

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

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

The following transmission line has portions in both the Capital Hudson Valley and Northeast transmission study areas:

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T5750	Spier - Rotterdam #1	main line	115
T5760	Spier - Rotterdam #2	main line	115
T6060R	Mohican - North Troy #3	main line	115
T6490	Luther Forest - North Troy #308	main line	115

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
10	Emmet	McCellan St	34.5
13	Emmet	Woodlawn	34.5
5	Karner	Patroon	34.5
5	Knolls	Vischer	34.5
1	Lynn St	Woodlawn	34.5
11	McCellan St	Bevis Hill	34.5
1	Rosa Rd	Knolls	34.5
2	Rosa Rd.	Bevis Hill	34.5
32	Rotterdam	Scotia	34.5
34	Rotterdam	Lynn St	34.5
36	Rotterdam	Weaver	34.5
6	Scotia	Rosa Rd.	34.5
3	Vischer	Woodlawn	34.5
9	Weaver St.	Emmet	34.5
14	Woodlawn	Karner	34.5
5	Cobleskill	Summit	69
6	Cobleskill	Schoharie	69
16	Marshville	Sharon	69
18	Rotterdam	Schoharie	69
3	Schenevus	Summit	23
17	Sharon	Cobleskill	69
3	Amsterdam	Schenectady International	69
7	Amsterdam	Ephratah	69
8	Canajoharie	Marshville	69
3	Gloversville	Hill St.	69
6	Gloversville	Canajoharie	69
4	Hill St.	Meco	69
8	Johnstown	Market Hill	69
11	Market Hill	Amsterdam	69
7	Mayfield	Meco	69
9	Mayfield	Vail Mills	69
12	Meco	Johnstown	69

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
8	Northville	Mayfield	69
4	Schenectady International	Rotterdam	69
2	Ephratah	Caroga	23
1	Northville	Wells	23
2	Wells	Gilmantown Rd.	23
7	Central Ave	Patroon	34.5
11	Latham	Newtonville	34.5
2	Maplewood	Liberty St	34.5
5	Maplewood	Norton	34.5
9	Maplewood	Latham	34.5
13	Maplewood	Liberty St	34.5
18	Maplewood	Menands	34.5
16	Newtonville	Patroon	34.5
3	Patroon	Krumkill	34.5
4	Patroon	Colvin Ave	34.5
5	Shore	Rosa	34.5
17	Crescent	School St	34.5
20	Crescent	North Troy	34.5
5	Greenbush	Castleton	34.5
6	Greenbush	Nassau	34.5
8	Greenbush	Snyders Lake	34.5
8	Hoosick	Clay Hill	34.5
4	Lansingburg	Seventh Ave	34.5
8	Liberty	Tibbits	34.5
5	Liberty	Seventh Ave	
9	Nassau	Hudson	34.5
1	North Troy	Lansingburg	34.5
2	North Troy	Tibbits	34.5
7	North Troy	Tibbits	
19	North Troy	School St	34.5
20	North Troy	Crescent	
10	Rensselaer	Greenbush	34.5
11	Rensselaer	Greenbush	34.5
2	Tibbits	North Troy	34.5
7	Tibbits	North Troy	34.5
8	Tibbits	Liberty St	34.5
10	RPI	Tibbits	34.5
5	Seventh Ave	Liberty	34.5
2	Altamont	Voorheesville	34.5
10	Bethlehem	Avenue A	34.5
13	Bethlehem	Rensselaer	34.5
5	Bethlehem	Selkirk	34.5

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
1	Bethlehem	Voorheesville	34.5
2	Colvin Ave	Partridge St	34.5
9	Colvin Ave	Seminole	34.5
14	Delaware	Bethlehem	34.5
37	Delaware	South Mall	34.5
6	Delmar	Bethlehem	34.5
9	Krumkill	Delmar	34.5
8	Menands	Central Ave	34.5
32	Menands	Genesee	34.5
9	Menands	Liberty St	34.5
27	Menands	Riverside	34.5
36	Menands	South Mall	34.5
6	Newark	Maplewood	34.5
17	Norton	Menands	34.5
5	Partridge	Avenue A	34.5
9	Partridge	Riverside	34.5
39	Partridge	Riverside	34.5
16	Riverside	Albany Medical Center	34.5
36	Riverside	Albany Medical Center	34.5
10	Riverside	Dewitt Apts	34.5
35	Riverside	South Mall	34.5
38	Riverside	South Mall	34.5
8	Riverside	Times Union Center	34.5
14	Riverside	Times Union Center	34.5
8	School	Newark	34.5

2. Frontier Study Area

Electrical Facilities			
Substations			
Alameda Ave 124	Main Street	Buffalo St 161	Buffalo St 46
Amherst	Maple Road 140	Buffalo St 162	Buffalo St 47
Ayer Rd 211	Martin Road 139	Buffalo St 201	Buffalo St 48
Beech Ave 81	Military Road 210	Buffalo St 202	Buffalo St 49
Brompton Rd 129	Milpine 96	Buffalo St 203	Buffalo St 51
Buffalo Ave 215	Mountain	Buffalo St 204	Buffalo St 52
Burt 171	Mountain Switching Str	Buffalo St 208	Buffalo St 53
Col Ward Pump 50	New Gardenville	Buffalo St 21	Buffalo St 56
Dale Rd 213	New Walden	Buffalo St 22	Buffalo St 57
Delaware Rd 127	Newfane 170	Buffalo St 23	Buffalo St 59
Dupont 133	Niagara Falls Blvd 130	Buffalo St 24	Buffalo St 63
E Cambria 100	Oakwood Ave 138	Buffalo St 24a	Buffalo St 66
Eight Ave 80	Oakwood 232	Buffalo St 25	Buffalo St 67
Electric Ave 55	Old Gardenville	Buffalo St 26	Buffalo St 68
Eleventh St 82	Packard	Buffalo St 27	Buffalo St 74
Elm	Phillips Rd Switching St	Buffalo St 28	Buffalo St 77
Galleria Switching St	Park Club Lane 219	Buffalo St 29	Buffalo St 78
George Urban 154	Ransomville 89	Buffalo St 30	Buffalo St 79
Getzville 60	Ridge 142	Buffalo St 31	Buffalo St 157
Gibson 106	Roberts 155	Buffalo St 32	Stephenson Ave 84
Grand Island 64	South Newfane 71	Buffalo St 33	Summit Park 97
Harbor Front 212	Sanborn	Buffalo St 34	Swann Rd 105
Harlem Rd 58	Sawyer Ave	Buffalo St 35	Sweet Home Rd 224
Harper	Seneca Shops 207	Buffalo St 36	Tonawanda Creek 206
Huntley	Seneca Terminal 447	Buffalo St 37	Walck Rd
Huth Rd 61	Shawnee Rd 76	Buffalo St 38	Walmore Rd 217
Kenmore Terminal	Buffalo St 121	Buffalo St 39	Waterfront 205
Kensington Terminal	Buffalo St 122	Buffalo St 40	Welch Ave 83
Lewiston Hts 86	Buffalo St 126	Buffalo St 41	Wilson 93
Lewiston 87	Buffalo St 132	Buffalo St 42	Young Street 214
Lockport Rd 216	Buffalo St 146	Buffalo St 43	Youngman 1
Lockport	Buffalo St 157	Buffalo St 44	Youngstown 88
Long Rd 209	Buffalo St 160	Buffalo St 45	

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

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T1010	Adams - Packard 187	main line	115
T1010-1 Tap	Adams - Packard #187	A-P #187 Niagara Falls Wastewater Tap	115

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T1010-2 Tap	Adams - Packard #187	A-P #187 Carbo-Wash. Mills Tap	115
T1010-3 Tap	Adams - Packard #187	A-P #187 Occidental Chemical Tap	115
T1010-4 Tap	Adams - Packard #187	A-P #187 Great Lakes Carbon Tap	115
T1010-5 Tap	Adams - Packard #187	A-P #187 Pyron Tap	115
T1010-6 Tap	Adams - Packard #187	A-P #187 Dupont Tap	115
T1010-7 Tap	Adams - Packard #187	A-P #187 Buffalo Av. 215 Tap	115
T1020	Adams - Packard 188	main line	115
T1020-1 Tap	Adams - Packard #188	A-P #188 Niagara Falls Wastewater Tap	115
T1020-2 Tap	Adams - Packard #188	A-P #188 Carbo-Wash. Mills Tap	115
T1020-3 Tap	Adams - Packard #188	A-P #188 Occidental Chemical Tap	115
T1020-4 Tap	Adams - Packard #188	A-P #188 Great Lakes Carbon Tap	115
T1020-5 Tap	Adams - Packard #188	A-P #188 Pyron Tap	115
T1020-6 Tap	Adams - Packard #188	A-P #188 Dupont Tap	115
T1020-7 Tap	Adams - Packard #188	A-P #188 Buffalo Av. 215 Tap	115
T1030	Airco - Buffalo River 147	main line	115
T1030-1 Tap	Airco - Buffalo River #147	A-BR #147 Co-Steel Recycling Tap	115
T1060	Beck - Lockport 104	main line	115
T1060-1 Tap	Beck - Lockport #104	B-L #104 - Mountain Switch Struc. Tap	115
T1060-2 Tap	Beck - Lockport #104	B-L #104 - Swann Road 105 Tap	115
T1070	Beck-Packard 76	main line	230
T1120	DuPont - Packard #183	main line	115
T1120-1 Tap	DuPont - Packard #183	D-P #183 - Carbon Graphite Tap	115
T1120-2 Tap	DuPont - Packard #183	D-P #183 - Harper Tap	115
T1120-3 Tap	DuPont - Packard #183	D-P #183 - Olin (NYPA) Tap	115
T1130	DuPont - Packard #184	main line	115
T1130-1 Tap	DuPont - Packard #184	D-P #184 - Carbon Graphite Tap	115
T1130-2 Tap	DuPont - Packard #184	D-P #184 - CH Resources Co-Gen Tap	115
T1130-3 Tap	DuPont - Packard #184	D-P #184 - Harper Tap	115
T1130-4 Tap	DuPont - Packard #184	D-P #184 - Olin (NYPA) Tap	115
T1140	Elm Street-Gardenville #71	main line	230
T1150	Elm Street-Gardenville #72	main line	230
T1190	Gardenville - Bethlehem #149	main line	115
T1190-1 Tap	Gardenville - Bethlehem #149	G-B #149 Harbor Front 212 Tap	115
T1190-2 Tap	Gardenville - Bethlehem #149	G-B #149 Ford Tap	115
T1190-3 Tap	Gardenville - Bethlehem #149	G-B #149 Bethlehem SWS	115
T1200	Gardenville - Bethlehem #150	main line	115
T1200-1 Tap	Gardenville - Bethlehem #150	G-B #150 Bethlehem SWS	115
T1200-2 Tap	Gardenville - Bethlehem #150	G-B #150 Harbor Front 212 Tap	115
T1210	Gardenville - Buffalo River Switch #145	main line	115
T1210-1 Tap	Gardenville - Buffalo River Switch #145	G-B #145 St Lawrence Cement Tap	115
T1210-3 Tap	Gardenville - Buffalo River Switch #145	G-B #145 Ridge Station 142 Tap	115
T1210-4 Tap	Gardenville - Buffalo River Switch #145	G-B #145 Great Lakes MDF	115

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

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T1420-7 Tap	Huntley - Praxair #46	H-L#46 - Encogen Tap	115
T1420-8 Tap	Huntley - Praxair #46	H-L#46 - CNP Station 18 Tap	115
T1420-9 Tap	Huntley - Praxair #46	H-L#46 - Buffalo Sewer Auth. Tap	115
T1430	Huntley - Praxair #47	main line	115
T1430-1 Tap	Huntley - Praxair #47	H-L#47 - Dunlop Tire Tap	115
T1430-2 Tap	Huntley - Praxair #47	H-L#47 - Dupont Tap	115
T1430-3 Tap	Huntley - Praxair #47	H-L#47 - Chevy Tap	115
T1430-4 Tap	Huntley - Praxair #47	H-L#47 - Kenmore Term Station Tap	115
T1430-5 Tap	Huntley - Praxair #47	H-L#47 – American Brass Tap	115
T1430-6 Tap	Huntley - Praxair #47	H-L#47 - Encogen Tap	115
T1430-7 Tap	Huntley - Praxair #47	H-L#47 - Buffalo Sewer Auth. Tap	115
T1440-1 Tap	Huntley - Lockport #36	H-L #36 - Station 138 Tap	115
T1440-2 Tap	Huntley - Lockport #36	H-L #36 - Station 206 Tap	115
T1440-3 Tap	Huntley - Lockport #36	H-L #36 - Ayer Rd Station 211 Tap	115
T1440-4 Tap	Huntley - Lockport #36	H-L #36 - Young Station 214 Tap	115
T1440-5 Tap	Huntley - Lockport #36	H-L #36 - Sweethome Station 224 Tap	115
T1450-1 Tap	Huntley - Lockport #37	H-L #37 - Station 138 Tap	115
T1450-2 Tap	Huntley - Lockport #37	H-L #37 - Station 206 Tap	115
T1450-3 Tap	Huntley - Lockport #37	H-L #37 - Ayer Rd Station 211 Tap	115
T1450-4 Tap	Huntley - Lockport #37	H-L #37 - Sweethome Station 224 Tap	115
T1470	Kensington - Gardenville #44	main line	115
T1470-1 Tap	Kensington - Gardenville #44	K-G #44 American Axle Tap	115
T1480	Kensington - Gardenville #45	main line	115
T1480-1 Tap	Kensington - Gardenville #45	K-G #45 American Axle Tap	115
T1620-1 Tap	Mountain - Lockport #103	M-L #103 Swann Road 105 Tap	115
T1620-2 Tap	Mountain - Lockport #103	M-L #103 Shawnee Station 76 Tap	115
T1630	Mountain - Niagara #120	main line	115
T1640	Mountain - Niagara #121	main line	115
T1650	Mountain - Niagara #122	main line	115
T1660	Niagara - Gardenville #180	main line	115
T1660-1 Tap	Niagara - Gardenville #180	N-G #180 - Long Road Station 209 Tap	115
T1670	Niagara - Gibson #197	main line	115
T1670-1 Tap	Niagara - Gibson #197	N-G #197 - Ferro Electronics Tap	115
T1670-2 Tap	Niagara - Gibson #197	N-G #197 - Global Metals Tap	115
T1670-3 Tap	Niagara - Gibson #197	N-G #197 - UCAR Carbon Tap	115
T1670-4 Tap	Niagara - Gibson #197	N-G #197 - Lockport Road 216 Tap	115
T1680	Niagara - Gibson #198	main line	115
T1680-1 Tap	Niagara - Gibson #198	N-G #198 - Ferro Electronics Tap	115
T1680-2 Tap	Niagara - Gibson #198	N-G #198 - Global Metals Tap	115
T1680-3 Tap	Niagara - Gibson #198	N-G #198 - UCAR Carbon Tap	115
T1680-4 Tap	Niagara - Gibson #198	N-G #198 - Lockport Road 216 Tap	115
T1690-1 Tap	Niagara - Lockport #101	N-L #101Sanborn Station Tap	115
T1700-1 Tap	Niagara - Lockport #102	N-L #102 Sanborn Station Tap	115
T1700-2 Tap	Niagara - Lockport #102	N-L #102 Shawnee Station 76 Tap	115
T1710	Niagara-Packard #61	main line	230
T1720	Niagara-Packard #62	main line	230

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T1730	Niagara - Packard #191	main line	115
T1740	Niagara - Packard #192	main line	115
T1750	Niagara - Packard #193	main line	115
T1760	Niagara - Packard #194	main line	115
T1770	Niagara - Packard #195	main line	115
T1780	Packard - Gardenville #182	main line	115
T1780-1 Tap	Packard - Gardenville #182	P-G #182 - Long Road 209 Tap	115
T1780-2 Tap	Packard - Gardenville #182	P-G #182 - Niagara Falls Blvd. Station 130 Tap	115
T1780-3 Tap	Packard - Gardenville #182	P-G #182 - ECWA RF Ball Pump Tap	115
T1780-4 Tap	Packard - Gardenville #182	P-G #182 - Youngmann Term Tap	115
T1780-5 Tap	Packard - Gardenville #182	P-G #182 - Park Club Lane 219Tap	115
T1780-6 Tap	Packard - Gardenville #182	P-G #182 - Walden Sun Tap	115
T1780-7 Tap	Packard - Gardenville #182	P-G #182 - American Standard Tap	115
T1790	Packard-Huntley #77	main line	230
T1800	Packard-Huntley #78	main line	230
T1810	Packard - Walck Road #129	main line	115
T1810-1 Tap	Packard - Walck Road #129	P-W #129 - Military Rd. Sta. 210 Tap	115
T1810-2 Tap	Packard - Walck Road #129	P-W #129 - Milpine Sta. 96 Tap	115
T1810-3 Tap	Packard - Walck Road #129	P-W #129 - Summit Park Sta. 97 Tap	115
T1810-4 Tap	Packard - Walck Road #129	P-W #129 - Bergholtz Switch Str. Tap	115
T1820	Packard - Huntley #130	main line	115
T1820-1 Tap	Packard - Huntley #130	P-H #130 - Military R. Sta. 210 Tap	115
T1820-2 Tap	Packard - Huntley #130	P-H #130 - Milpine Sta. 96 Tap	115
T1820-3 Tap	Packard - Huntley #130	P-H #130 - Summit Park Sta. 97 Tap	115
T1820-4 Tap	Packard - Huntley #130	P-H #130 - Bergholtz Switch Str. Tap	115
T1820-5 Tap	Packard - Huntley #130	P-H #130 - Sta. 78 Tap	115
T1830	Packard - Union Carbide Met. (Linde) #185	main line	115
T1830-1 Tap	Packard - Union Carbide Met. (Linde) #185	P-U #185 - Cascades NF Inc Tap	115
T1830-2 Tap	Packard - Union Carbide Met. (Linde) #185	P-U #185 - American Refuel Tap	115
T1830-3 Tap	Packard - Union Carbide Met. (Linde) #185	P-U #185 - Occidental Chemical Tap	115
T1840	Packard - Union Carbide Met. (Linde) #186	main line	115
T1840-1 Tap	Packard - Union Carbide Met. (Linde) #186	P-U #186 - Cascades NF Inc Tap	115
T1840-2 Tap	Packard - Union Carbide Met. (Linde) #186	P-U #186 - American Refuel Tap	115
T1840-3 Tap	Packard - Union Carbide Met. (Linde) #186	P-U #186 - Occidental Chemical Tap	115
T1850	Packard - Urban(Erie St.) #181	main line	115
T1850-1 Tap	Packard - Urban(Erie St.) #181	P-U #181 - Niagara Falls Blvd Station 130 Tap	115
T1850-2 Tap	Packard - Urban(Erie St.) #181	P-U #181 - ECWA RF Ball Pump Tap	115
T1850-3 Tap	Packard - Urban(Erie St.) #181	P-U #181 - Youngman Term Tap	115

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T6020	Walck Road - Huntley #133	main line	115
T6020-1 Tap	Walck Road - Huntley #133	W-H #133 Youngs Station 214 Tap	115
T6020-2 Tap	Walck Road - Huntley #133	W-H #133 Station 78 Tap	115
T6260	Bell Aero - Bergholtz #99	main line	115
T6260-1 Tap	Bell Aero - Bergholtz #99	B-B #99 Carborundum Tap	115
T6260-2 Tap	Bell Aero - Bergholtz #99	B-B #99 Walmore Rd Tap	115
TNYSEG-1 Tap	Urban-Erie 922 (NYSEG)	U-E 922(NYSEG) - Veridian Tap	115

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

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

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

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

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

Sub-Transmission Lines			
Circuit ID	From	To	Voltage (kV)
605	Youngmann Terminal	Buffalo Station 58 Tap	34.5
605	Buffalo Station 58 Tap	Buffalo Station 124	34.5
605	Buffalo Station 58 Tap	Buffalo Station 58	34.5
606	Youngmann Terminal	Buffalo Station 58 Tap	34.5
606	Buffalo Station 58 Tap	Buffalo Station 124	34.5

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
606	Buffalo Station 58 Tap	Buffalo Station 58	34.5
701	Aero Commerce Park	Buffalo Station 67	34.5
701	Walden	Amherst	34.5
702	Walden	Ledyard Sw. Struct.	34.5
703	Walden	Galleria	34.5
1-E	Elm Station	Emerg. Hosp	23
2-E	Elm Station	Dunn Tire Park	23
3-E	Elm Station	--------	23
4-E	Elm Station	Station 48	23
5-E	Elm Station	Station 38	23
6-E	Elm Station	Station 38	23
7-E	Elm Station	Station 41	23
8-E	Elm Station	Station 41	23
9-E	Elm Station	Station 41	23
10-E	Elm Station	Dunn Tire Park	23
16-E	Elm Station	Station 34	23
17-E	Elm Station	Station 34	23
18-E	Elm Station	Station 34	23
23-E	Elm Station	Station 38	23
27-E	Elm Station	Station 34	23
35-E	Elm Station	Station 41	23
1-K	Kensington Station	Station 68	23
2-K	Kensington Station	Station 68	23
3-K	Kensington Station	Station 68	23
4-K	Kensington Station	Station 68	23
5-K	Kensington Station	SUNY Buffalo	23
6-K	Kensington Station	SUNY Buffalo	23
7-K	Kensington Station	Clearing Niagara	23
8-K	Kensington Station	Meyer Memorial Hosp	23
9-K	Kensington Station	Station 32	23
9-K	Station 32	Station 157	23
10-K	Kensington Station	Station 26	23
11-K	Kensington Station	Station 26	23
12-K	Kensington Station	Station 26	23
13-K	Kensington Station	Station 32	23
13-K	Station 32	Station 28	23
14-K	Kensington Station	Station 26	23
15-K	Kensington Station	Station 26	23
21-K	Kensington Station	Station 22	23
22-K	Kensington Station	Station 22	23
23-K	Kensington Station	Station 22	23
33-K	Kensington Station	Station 22	23
401	Youngstown 88	Lewiston 87	34.5

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
401	Lewiston 87	Mountain	34.5
402	Ransomville 89	Wilson 93	34.5
402	Wilson 93	Burt 171	34.5
402	Burt 171	Phillips Rd	34.5
403	Youngstown 88	Model City Landfill Tap	34.5
403	Model City Landfill Tap	Ransomville 89	34.5
403	Ransomville 89	Sanborn	34.5
404	Mountain	Lewiston Heights 86	34.5
404	Lewiston Heights	Niagara Stone Tap	34.5
404	Niagara Stone Tap	Graph Tap	34.5
404	Graph Tap	Graph	34.5
404	Graph Tap	Sanborn	34.5
405	Lewiston Heights	Mountain	34.5
52	Harper	Welch Ave 83	12.0
53	Harper	Welch Ave 83	12.0
54	Harper	Welch Ave 83	12.0
55	Harper	Welch Ave 83	12.0
60	Harper	Eighth Street 80	12.0
61	Harper	Eighth Street 80	12.0
62	Harper	Welch Ave 83	12.0
63	Harper	Welch Ave 83	12.0
65	Harper	Eighth Street 80	12.0
653	Harper	Stephenson Ave 85	12.0
654	Harper	Stephenson Ave 85	12.0
655	Harper	Stephenson Ave 85	12.0
71	Gibson	P24	12.0
71	P24	P31	12.0
71	P31	General Abrasive	12.0
71	P31	Titanium	12.0
73	Gibson	Globar	12.0
73	Globar	Beech Street 81	12.0
1-H	Sawyer	Station 22	23
2-H	Sawyer	Station 22	23
3-H	Sawyer	Station 22	23
4-H	Sawyer	Station 201	23
5-H	Sawyer	Station 201	23
6-H	Sawyer	Station 37	23
7-H	Sawyer	Station 48A	23
8-H	Sawyer	Station 48A	23
9-H	Sawyer	Station 33	23
10-H	Sawyer	Station 26	23
11-H	Sawyer	Station 26	23
12-H	Sawyer	Station 26	23

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
13-H	Sawyer	Station 22	23
14-H	Sawyer	Station 26	23
15-H	Sawyer	Station 26	23
16-H	Sawyer	Station 160	23
17-H	Sawyer	Station 160	23
18-H	Sawyer	Station 160	23
19-H	Sawyer	Station 37	23
20-H	Sawyer	Station 33	23
21-H	Sawyer	TOPS	23
22-H	Sawyer	Station 48A	23
26-H	Sawyer	Station 56	23
26-H	Station 56	Kenmore Mercy Hosp	23
27-H	Sawyer	Station 161	23
28-H	Sawyer	Station 56	23
28-H	Station 56	Kenmore Mercy Hosp	23
29-H	Sawyer	Station 48	23
33-H	Sawyer	Station 126	23
34-H	Sawyer	Station 126	23
35-H	Sawyer	Station 33	23
35-H	Station 33	Station 204	23
36-H	Sawyer	Switch 578	23
1-S	Seneca Station	Station 46	23
2-S	Seneca Station	Station 46	23
3-S	Seneca Station	Station 46	23
19-S	Seneca Station	OLV Hosp.	23
31-S	Seneca Station	Station 46	23
31-S	Station 46	OLV Hosp.	23
4-S	Seneca Station	Station 48	23
5-S	Seneca Station	Station 48	23
6-S	Seneca Station	Station 38	23
23-S	Seneca Station	Station 38	23
7-S	Seneca Station	Station 42	23
8-S	Seneca Station	Station 42	23
9-S	Seneca Station	Station 42	23
13-S	Seneca Station	Buffalo Color	23
14-S	Seneca Station	Buffalo Color	23
30-S	Seneca Station	Station 41	23
32-S	Seneca Station	Scrap Property	23
33-S	Seneca Station	Scrap Property	23
10-S	Kensington Station	Seneca Station	23
11-S	Kensington Station	Seneca Station	23
12-S	Kensington Station	Seneca Station	23
15-S	Kensington Station	Seneca Station	23

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
16-S	Seneca Station	Station 34	23
17-S	Seneca Station	Station 34	23
18-S	Seneca Station	Station 34	23
27-S	Seneca Station	Station 34	23
601	Buffalo Station 78	Buffalo Station 77 Tap	23
601	Buffalo Station 78	Buffalo Station 77 Tap	23
601	Buffalo Station 77 Tap	Buffalo Station 77	23
601	Buffalo Station 77 Tap	Buffalo Station 74 Tap	23
601	Buffalo Station 74 Tap	Buffalo Station 74	23
601	Buffalo Station 74 Tap	Buffalo Station 57	23
601	Buffalo Station 57	Buffalo Station 127 Tap	23
601	Buffalo Station 127 Tap	Buffalo Station 127	23
601	Buffalo Station 127 Tap	Buffalo Station 63	23
602	Buffalo Station 78	Buffalo Station 77 Tap	23
602	Buffalo Station 78	Buffalo Station 77 Tap	23
602	Buffalo Station 77 Tap	Buffalo Station 77	23
602	Buffalo Station 77 Tap	Buffalo Station 74 Tap	23
602	Buffalo Station 74 Tap	Buffalo Station 74	23
602	Buffalo Station 74 Tap	Buffalo Station 57	23
602	Buffalo Station 57	Buffalo Station 127 Tap	23
602	Buffalo Station 127 Tap	Buffalo Station 127	23
602	Buffalo Station 127 Tap	Buffalo Station 63	23
603	Buffalo Station 78	Buffalo Station 77 Tap	23
603	Buffalo Station 78	Buffalo Station 77 Tap	23
603	Buffalo Station 77 Tap	Buffalo Station 77	23
603	Buffalo Station 77 Tap	Buffalo Station 74 Tap	23
603	Buffalo Station 74 Tap	Buffalo Station 74	23
603	Buffalo Station 74 Tap	Buffalo Station 57	23
603	Buffalo Station 57	Buffalo Station 127 Tap	23
603	Buffalo Station 127 Tap	Buffalo Station 127	23
603	Buffalo Station 127 Tap	Buffalo Station 63	23
604	Buffalo Station 77 Tap	Buffalo Station 77	23
604	Buffalo Station 77 Tap	COLORFORMS Inc.	23
622	Buffalo Station 78	Buffalo Station 122 Tap	23
622	Buffalo Station 122 Tap	Buffalo Station 79	23
622	Buffalo Station 122 Tap	Buffalo Station 122	23
623	Buffalo Station 78	Buffalo Station 122 Tap	23
623	Buffalo Station 122 Tap	Buffalo Station 79	23
623	Buffalo Station 122 Tap	Buffalo Station 122	23
624	Buffalo Station 78	Waste Water Tap	23
624	Waste Water Tap	Buffalo Station 79	23
624	Waste Water Tap	Waste Water	23

3. Genesee Study Area

Electrical Facilities

Substations

Albion 80	E. Golah 51	Livonia 37	Sheppard 29
Attica 12	E. Newstead 6	Lyndonville 95	Sourssprings Switch
Avon 43	Eagle Harbor 92	Medina	South Newfane #71
Barker 78	Elba 20	Middleport 77	Southland 84
Basom 15	Gasport 90	Mortimer	Station 197
Batavia 01	Geneseo 55	Mumford 50	Telegraph Road
Brockport 74	Golah	N. Akron	University #81
Burt #171	Groveland 41	N. Leroy 04	Waterport 73
Butts Road 72	Hemlock 38	Newfane 170	West Albion 79
Byron 18	Industry 47	North Lakeville	West Hamlin 82
Caledonia 44	Iroquois Rock	Oakfield 03	Wethersfield 23
Canawagus	Knapp Rd. 226	Orangeville 19	Willow Specialties 24
Conesus 52	Lakeville 40	Richmond 32	York Center 53
Corfu 22	Lapp 26	Royalton 98	
Darien 16	Lima 36	Rush 34	
Dolomite 9	Linden 21	SE Batavia	
E. Batavia 28	Livingston 130	Shelby 76	

Transmission Lines

Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T1000	Brunner - Sour Springs 118	main line	115
T1000-1 Tap	Brunner - Sour Springs #118	B-SS #118 - Shelby Tap	115
T1040	Alabama - Telegraph 115	main line	115
T1050	Batavia - Southeast Batavia 117	main line	115
T1050-1 Tap	Batavia - Southeast Batavia #117	B-SEB #117 Oatka Dairy Tap	115
T1320	Golah - North Lakeville #116	main line	115
T1320-1 Tap	Golah - North Lakeville #116	G-NL #116 - E. Golah Tap	115
T1320-2 Tap	Golah - North Lakeville #116	G-NL #116 - Kraft Foods Tap	115
T1490	Lockport - Batavia #107	main line	115
T1490-1 Tap	Lockport - Batavia #107	L-B #107 - Alabama Switch Struc. Tap	115
T1490-2 Tap	Lockport - Batavia #107	L-B #107 - Akron Village Tap	115
T1490-3 Tap	Lockport - Batavia #107	L-B #107 - East Batavia Tap	115
T1500	Lockport - Batavia #108	main line	115
T1500-1 Tap	Lockport - Batavia #108	L-B #108 - North Akron Tap	115
T1510	Lockport - Batavia #112	main line	115
T1510-1 Tap	Lockport - Batavia #112	L-B #112 - Oakfield Tap	115
T1520	Lockport - Hinman #100	main line	115
T1530	Lockport - Mortimer #111	main line	115
T1530-1 Tap	Lockport - Mortimer #111	L-M #111 - Alabama Switch Tap	115
T1530-2 Tap	Lockport - Mortimer #111	L-M #111 - Sour Springs Switch Tap	115
T1530-3 Tap	Lockport - Mortimer #111	L-M #111 - University Sta. 81 Tap	115
T1530-4 Tap	Lockport - Mortimer #111	L-M #111 - Brockport Tap	115

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

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

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

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

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

Sub-Transmission Lines			
Circuit ID	Circuit ID	Circuit ID	Circuit ID
301	Phillips Road	Medina	34.5
302	Telegraph Road	Medina	34.5
303	Telegraph Road	Medina	34.5
304	Phillips Road	Telegraph Road	34.5
305	Medina	Albion	34.5
306	Waterport	Albion	34.5
307	Waterport	Brockport	34.5
308	Albion	Brockport	34.5
310	Brockport	Owens Illinois	34.5
312	Gasport	Telegraph Road	34.5
213	Caledonia	Golah	34.5
203	North Leroy	Caledonia	34.5
209	Attica	Wethersfield	34.5
208	North Leroy	Attica	34.5
206	Batavia	Attica	34.5
225	North Akron	Attica	34.5
223	Batavia	North Leroy	34.5
219	Oakfield	Batavia	34.5
201	Oakfield	Caledonia	34.5
227	North Akron	Oakfield	34.5
204	I2R Element	North Akron	34.5
205	I2R Element	North Akron	34.5
218	N. Lakeville	Ridge	34.5
224	N. Lakeville	Hemlock	34.5
226	N. Lakeville	Richmond	34.5
217	Golah	N. Lakeville	34.5
216	Golah	N. Lakeville	34.5
109	Mortimer	Golah	69
853	Golah	S. Perry	69

4. Northeast Study Area

Electrical Facilities			
Substations			
Amsterdam 326	Clinton 366	Knapp Road 432	Schoharie 234
Ashley 331	Cobleskill 214	Malta 443	Schroon Lake 429
Ballston 12	Comstock 48	Market Hill 324	Schuylerville 39
Battenkill 342	Corinth 285	Marshville 299	Scofield Rd. 450
Bay Street 233	Crown Point 249	Mayfield 356	Sharon 363
Bennett Switching St	Delanson 269	McCrea St. 272	Smith Bridge 464
Birch Ave. 322	East Worcester 60	Meco 318	South St. 297
Bolton 284	EJ West 38	Middleburg 390	Spier Falls
Brook Rd. 369	Ephratah 18	Mohican 247	St Johnsville 335
Burgoyne 337	Farnan Rd. 476	North Creek 122	Stoner 358
Butler 362	Fort Gage 319	North River	Summit 347
Cambridge 29	French Mountain	Northville	Ticonderoga 163
Canajoharie 31	Gilmantown Rd 154	Ogden Brook 423	Union St 376
Carboy Switching St	Glens Falls 75	Otten 412	Vail Mills 392
Caroga 219	Grand Street 433	Pallette Stone 385	Warrensburg 321
Cedar 453	Guy Park 239	Port Henry 385	Weibel Ave. 415
Cement Mt 455	Hague Rd. 418	Pottersville 424	Wells 208
Center Street 379	Hastings Switching St 439	Queensbury 295	West Milton
Charley Lake 254	Henry St. 316	Randall Road 463	Whitehall 187
Charlton 222	Hill 311	Riparius 293	Wilton 329
Cherry Valley 41	Hudson Falls 88	Rock City Falls 404	Worcester 189
Chestertown 42	Indian Lake 310	Saratoga 142	
Church Street 43	Johnstown 61	Schenevus 261	

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T5100	Clinton - Marshville #12	main line	115
T5240	Inghams - East Springfield #7	main line	115
T5250	Inghams - Meco #15	main line	115
T5250-1 Tap	Inghams - Meco #15	I-M#15 - Clinton Tap	115
T5260	Inghams - St. Johnsville #6	main line	115
T5260-1 Tap	Inghams - St. Johnsville #6	I-SJ #6 - Beardslee Tap	115
T5270	Inghams - Stoner #9	main line	115
T5270-1 Tap	Inghams - Stoner #9	I-S #9 - Center Street Tap	115
T5270-2 Tap	Inghams - Stoner #9	I-S #9 - Fage Dairy Tap	115
T5430	Mohican - Battenkill #15	main line	115
T5430-1 Tap	Mohican - Battenkill #15	M-B #15 - Irving Tissue Tap	115
T5440	Mohican - Butler #18	main line	115
T5440-1 Tap	Mohican - Butler #18	M-B #18 - GF Cement Tap	115
T5440-2 Tap	Mohican - Butler #18	M-B #18 - Finch Pruyn Tap	115
T5440-3 Tap	Mohican - Butler #18	M-B #18 - S. Glens Falls Energy Tap	115
T5710	Spier - Butler #4	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T5730	Spier - Queensbury #5	main line	115
T5730-1 Tap	Spier - Queensbury #5	S-Q #5 - Ogden Brook Tap	115
T5740	Spier - Queensbury #17	main line	115
T5740-1 Tap	Spier - Queensbury #17	S-Q #17 Sherman Island Tap	115
T5740-2 Tap	Spier - Queensbury #17	S-Q #17 Ogden Brook Tap	115
T5750-1 Tap	Spier - Rotterdam #1	S-R #1 - Weibel Ave Tap	115
T5750-2 Tap	Spier - Rotterdam #1	S-R #1 - Smith Bridge Tap	115
T5750-3 Tap	Spier - Rotterdam #1	S-R #1 - Brook Road Tap	115
T5750-4 Tap	Spier - Rotterdam #1	S-R #1 - West Milton Tap	115
T5750-5 Tap	Spier - Rotterdam #1	S-R #1 - Ballston Tap	115
T5750-6 Tap	Spier - Rotterdam #1	S-R #1 - Malta Sub Tap	115
T5760-1 Tap	Spier - Rotterdam #2	S-R #2 - Weibel Ave Tap	115
T5760-2 Tap	Spier - Rotterdam #2	S-R #2 - Smith Bridge Tap	115
T5760-3 Tap	Spier - Rotterdam #2	S-R #2 - Brook Road Tap	115
T5760-4 Tap	Spier - Rotterdam #2	S-R #2 - Ballston Tap	115
T5760-5 Tap	Spier - Rotterdam #2	S-R #2 - Malta Sub Tap	115
T5770	Spier - West #9	main line	115
T5770-1 Tap	Spier - West #9	S-W #9 - IP Corinth Tap	115
T5770-2 Tap	Spier - West #9	S-W #9 - Stewart's Bridge Tap	115
T5770-3 Tap	Spier - West #9	S-W #9 - Scofield Road Tap	115
T5770-4 Tap	Spier - West #9	S-W #9 - Palmer Curtis Tap	115
T5780	St. Johnsville - Marshville #11	main line	115
T5810	Ticonderoga - Republic #2	main line	115
T5810-1 Tap	Ticonderoga - Republic #2	R-T #2 - Hague Road Sub Tap	115
T5810-2 Tap	Ticonderoga - Republic #2	R-T #2 - Lachute Hydro Tap	115
T5810-3 Tap	Ticonderoga - Republic #2	R-T #2 - IP Ticonderoga Tap	115
T5810-4 Tap	Ticonderoga - Republic #2	R-T #2 - Crown Point Tap	115
T5810-5 Tap	Ticonderoga - Republic #2	R-T #2 - Port Henry Tap	115
T5820	Ticonderoga - Hague Road #4	main line	115
T5830	Ticonderoga - Whitehall #3	main line	115
T5830-1 Tap	Ticonderoga - Whitehall #3	T-W #3 - Otten Tap	115
T5870	Warrensburg - North Creek #5	main line	115
T5880	Warrensburg - Scofield Road #10	main line	115
T5890	Whitehall - Blissville #7	main line	115
T5900	Whitehall - Mohican #13	main line	115
T5900-1 Tap	Whitehall - Mohican #13	W-M #13 - Comstock (NYSEG) Tap	115
T5900-2 Tap	Whitehall - Mohican #13	W-M #13 - Comstock Tap	115
T5900-3 Tap	Whitehall - Mohican #13	W-M #13 - Burgoyne Tap	115
T5900-4 Tap	Whitehall - Mohican #13	W-M #13 - Adirondack Resources Tap	115
T5910	Whitehall - Cedar #6	main line	115
T5910-1 Tap	Whitehall - Cedar #6	W-C #6 - Great Meadow Tap	115
T5910-2 Tap	Whitehall - Cedar #6	W-C #6 - Burgoyne Tap	115
T5950	Indeck Corinth - Spier #18	main line	115
T5970	Queensbury - Cedar #10	main line	115
T6070	Spier - Mohican #7	main line	115
T6410R	Ticonderoga - Sanford Lake (retired)	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T6480-1 Tap	Mohican - Luther Forest #3	M-NT #3 - Hemstreet Tap	115
T6480-2 Tap	Mohican - Luther Forest #3	M-NT #3 - Mulberry (NYSEG) Tap	115
T6580	Global Foundries - Luther Forest #111	main line	115
T6590	Global Foundries - Luther Forest #222	main line	115
T6480	Mohican - Luther Forest #3	main line	115

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

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T5750	Spier - Rotterdam #1	main line	115
T5760	Spier - Rotterdam #2	main line	115
T6060R	Mohican - North Troy #3	main line	115
T6490	Luther Forest - North Troy #308	main line	115

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

Sub-Transmission Lines			
Circuit ID	From	To	Voltage (kV)
9	Queensbury	Warrensburg	34.5
9	Warrensburg	Queensbury	34.5
9	West Milton	Ballston	34.5
10	Glens Falls	Bay St.	34.5
10	Saratoga	Ballston	34.5
11	Brook Rd.	Ballston	34.5
11	Mohican	Glens Falls	34.5
11	Glens Falls	Mohican	34.5
12	Glens Falls	Mohican	34.5
12	Mohican	Glens Falls	34.5
12	Spier	Saratoga	34.5
14	Queensbury	Henry St.	34.5
17	Hudson Falls	McCrea St.	34.5

5. Northern Study Area

Electrical Facilities			
Substations			
Akwesasne 825	Dennison 960	Lisbon 963	Ogdensburg 938
Antwerp	Dexter 726	Little River 955	Parishville 939
Ausable Forks 846	E. Norfolk 913	Loon Lake 837	Paul Smith's 834
Balmat 904	E. Oswegatchie 982	Lowville 733	Piercefield 829
Battle Hill	E. Watertown 817	Lyme 733	Port Leyden
Black River	Edwards 916	Malone 895	Portage St. 754
Bloomingdale 841	Elm St. 898	McAdoo 914	Raybrook 839
Bombay 897	Emeryville	McIntyre	Riverview 847
Brady 957	Fine	Merrillville 838	S. Philadelphia 764
Brasher 851	Fort Covington 896	Mill St. 748	Sewalls Island 766
Bremen 815	Franklin Falls 843	Mine Rd.	Silver Lake 845
Brier Hill 953	Gabriels 835	Moira 859	Spencers Corner 863
Brown Falls	Gilpin Bay 956	Morristown 933	St. Regis 977
Carthage 717	Hammond 370	N. Bangor 864	Star Lake
Chasm Falls 852	Heuvelton	N. Carthage 816	State St. 954
Coffeen 760	Higley 924	N. Governeur 983	Sunday Creek 876
Collinsville 716	Hogansburg 855	N. Lawrence 861	Taylorville
Colony	Indian River 323	Newton Falls	Thousand Islands 814
Colton 909	Lake Clear 833	Nicholville 860	Tupper Lake 830
Corning	Lake Colby 927	Norfolk	Union 844
David 979	Lawrence Ave. 976	North Ogdensburg 878	W. Adams 875
Dekalb 984	Leray 813	Norwood 936	Westville 885

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T3000	Alcoa - Dennison #12	main line	115
T3020	Battle Hill - Balmat #5	main line	115
T3020-1 Tap	Battle Hill - Balmat #5	BH-B #5 - Zinco Tap	115
T3020-2 Tap	Battle Hill - Balmat #5	BH-B #5 - Gouverneur Talc Co. Tap	115
T3030	Colton - Battle Hill #7	main line	115
T3030-1 Tap	Colton - Battle Hill #7	C-BH #7 Little River Tap	115
T3030-2 Tap	Colton - Battle Hill #7	C-BH #7 Pyrites Tap	115
T3030-3 Tap	Colton - Battle Hill #7	C-BH #7 Dekalb Tap	115
T3050	Black River - North Carthage #1	main line	115
T3050-1 Tap	Black River - North Carthage #1	BR-NC #1 - Kamine-Carthage Co-Gen Tap	115
T3050-2 Tap	Black River - North Carthage #1	BR-NC#1 - Climax Co-Gen Tap	115
T3060	Black River - Taylorville #2	main line	115
T3060-1 Tap	Black River - Taylorville #2	BR-T #2 - Fort Drum Co-Gen Tap	115
T3060-2 Tap	Black River - Taylorville #2	BR-T #2 - Fort Drum #1 Tap	115
T3060-3 Tap	Black River - Taylorville #2	BR-T #2 - Deferiet Paper Tap	115
T3060-4 Tap	Black River - Taylorville #2	BR-T #2 - North Carthage Tap	115
T3070	Browns Falls - Newton Falls Pap.	main line	115

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
	Co. #6		
T3080	Browns Falls - Taylorville #3	main line	115
T3090	Browns Falls - Taylorville #4	main line	115
T3100	Boundary Road - Dennison #1	main line	115
T3100-1 Tap	Boundary Road - Dennison #1	BR-D #1 - Rosemount Tap (CE)	115
T3100-2 Tap	Boundary Road - Dennison #1	BR-D #1 - McConnell Tap (CE)	115
T3100-3 Tap	Boundary Road - Dennison #1	BR-D #1 - Aldophus Tap (CE)	115
T3100-4 Tap	Boundary Road - Dennison #1	BR-D #1 - Courtaulds Tap (CE)	115
T3100-5 Tap	Boundary Road - Dennison #1	BR-D #1 - Loyalist Tap (CE)	115
T3110	Boundary Road - Dennison #2	main line	115
T3110-1 Tap	Boundary Road - Dennison #2	BR-D #2 - Rosemount Tap (CE)	115
T3110-2 Tap	Boundary Road - Dennison #2	BR-D #2 - McConnell Tap (CE)	115
T3110-3 Tap	Boundary Road - Dennison #2	BR-D #2 - Aldophus Tap (CE)	115
T3110-4 Tap	Boundary Road - Dennison #2	BR-D #2 - Courtaulds Tap (CE)	115
T3110-5 Tap	Boundary Road - Dennison #2	BR-D #2 - Loyalist Tap (CE)	115
T3110-6 Tap	Boundary Road - Dennison #2	BR-D #2 - ICI Plant Tap (CE)	115
T3120	Coffeen - Black River #3	main line	115
T3120-1 Tap	Coffeen - Black River #3	C-BR #3 - Glen Park Hydro Tap	115
T3120-2 Tap	Coffeen - Black River #3	C-BR #3 - Air Brake Tap	115
T3130	Coffeen - West Adams #2	main line	115
T3140	Colton - Browns Falls #1	main line	115
T3150	Colton - Browns Falls #2	main line	115
T3160	Colton - Carry (Stark) #9	main line	115
T3160-1 Tap	Colton - Townline #9	C-T #9 - South Colton Hydro Tap	115
T3160-2 Tap	Colton - Townline #9	C-T #9 - Five Falls Hydro Tap	115
T3160-3 Tap	Colton - Townline #9	C-T #9 - Rainbow Hydro Tap	115
T3160-4 Tap	Colton - Townline #9	C-T #9 - Blake Hydro Tap	115
T3160-5 Tap	Colton - Townline #9	C-T #9 - Carry Tap	115
T3170	Colton - Malone #3	main line	115
T3170-1 Tap	Colton - Malone #3	C-M #3 - Allens Falls Hydro Tap	115
T3170-2 Tap	Colton - Malone #3	C-M #3 - Nicholville Tap	115
T3180	Dennison - Colton #4	main line	115
T3180-1 Tap	Dennison - Colton #4	D-C #4 - Norfolk Tap	115
T3180-2 Tap	Dennison - Colton #4	D-C #4 - Mead Paper Tap	115
T3180-3 Tap	Dennison - Colton #4	D-C #4 - Lawrence Ave. Tap	115
T3180-4 Tap	Dennison - Colton #4	D-C #4 - Sugar Island Hydro Tap	115
T3180-5 Tap	Dennison - Colton #4	D-C #4 - Unionville / Hewittville Hydros Tap	115
T3190	Dennison - Colton #5	main line	115
T3190-1 Tap	Dennison - Colton #5	D-C #5 - Lawrence Ave Tap	115
T3190-2 Tap	Dennison - Colton #5	D-C #5 - Hannawa Falls Tap	115
T3200	Fort Drum - Black River #9	Not a tap (main line)	115
T3200-1 Tap	Fort Drum - Black River #9	FD-BR #3 - Indian River Tap	115
T3210	Lake Colby - Lake Placid #3	main line	115
T3210-1 Tap	Lake Colby - Lake Placid #3	LC-LP #3 - Ray Brook Tap	115

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T3230	Malone - Lake Colby #5	main line	115
T3250	McIntyre - Corning #6	main line	115
T3270	M.E.F. - Alcoa #3	main line	115
T3280	McIntyre - Colton #8	main line	115
T3280-1 Tap	McIntyre - Colton #8	M-C #8 - Ogdensburg Tap	115
T3280-2 Tap	McIntyre - Colton #8	M-C #8 - McAdoo Sub Tap	115
T3280-3 Tap	McIntyre - Colton #8	M-C #8 - Little River Tap	115
T3290	North Gouverneur - Battle Hill #8	main line	115
T3300	Ogdensburg - McIntyre #2	main line	115
T3320	Taylorville - Boonville #5	main line	115
T3330	Taylorville - Boonville #6	main line	115
T3330-1 Tap	Taylorville - Boonville #6	T-B #6 - Northbrook Energy Tap	115
T3330-2 Tap	Taylorville - Boonville #6	T-B #6 - Moose River Hydro Tap	115
T3330-3 Tap	Taylorville - Boonville #6	T-B #6 - Lyonsdale Hydro/ Burrows Tap	115
T3330-4 Tap	Taylorville - Boonville #6	T-B #6 - Lyonsdale Co-Gen Tap	115
T3340	Taylorville - Moshier #7	main line	115
T3340-1 Tap	Taylorville - Moshier #7	T-M #7 - Eagle Tap	115
T3340-2 Tap	Taylorville - Moshier #7	T-M #7 - Sunday Creek Tap	115
T3350	Thousand Islands - Coffeen #4	main line	115
T3350-1 Tap	Thousand Islands - Coffeen #4	TI-C #4 - Lyme Tap	115
T3360	Willis - Malone #1	main line	115
T3380	Alcoa - North Ogdensburg #13	main line	115
T3390	East Oswegatchie - North Gouverneur #1	main line	115
T3400	North Ogdensburg - McIntyre #9	main line	115
T3410	O.E.F. - North Ogdensburg #1	main line	115
T6180	Corning - Battle Hill #4	main line	115
T6180-1 Tap	Corning - Battle Hill #4	C-B #4 - McAdoo Tap	115
T6180-2 Tap	Corning - Battle Hill #4	C-B #4 - Dekalb Tap	115
T6210	Raymondville - Norfolk #1	main line	115
T6210-1 Tap	Raymondville - Norfolk #1	R-N #1 - APC Paper Tap	115
T6270	North Carthage - Taylorville #8	main line	115
T6340	Adirondack-Chases Lake #13	main line	230
TNYPA-1 Tap	Moses-Reynolds-GM MRG1 (NYPA)	M-R-G MRG1 (NYPA) - Akwesasne Tap	115

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

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

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

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

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

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

6. Southwest Study Area

Electrical Facilities

Substations

Andover 09	Delameter Rd. 93	Ischua Switching St.	Reservoir
Angola Switch St	Delevan 11	Knights Creek 06	Ridge 142
Ashville Switch St	Dugan Rd. 22	Lakeview Rd.182	Ripley 53
Baker St.	Dunkirk	Langford 180	Roberts Rd. 154
Bemus Point	E. Dunkirk 63	Levant 98	Shaleton
Bennett Rd. 99	E. Otto 28	Machias 13	Sherman 54
Berry Rd. 153	Eden Center 88	Maplehurst 04	Sinclairville 72
Brigham Rd	Eden Switching St	N. Angola	South Dow
Buffalo Station 139	Ellicott 65	N. Ashford 36	South Randolph
Buffalo Station 149	Falconer	N. Chautauqua 78	South Wellsville 23
Busti 68	Farmersville 27	N. Collins 92	Steamburg 17
Cassadaga 61	Findley Lake 71	N. Eden 82	Stow 52
Cattaraugus 15	Finley Rd Switching St	N. Olean 30	Valley 44
Chautaqua 05	Franklinville 24	New Road Switching St	Vandalia 104
Cloverbank 91	French Creek	Niles	W. Olean 33
Clymer 55	Frewsburg 69	Oak Hill 62	W. Portland 151
Collins 83	Greenhurst 60	Panama 70	W. Salamanca 16
Cuba 05	Harborfront 212	Petrolia 19	W. Valley 25
Cuba Lake 37	Hartfield 79	Poland 66	West Perrysburg 181
Dake Hill Switching St	Homer Hill	Price Corners	Whitesville 101

Transmission Lines

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

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
		(NYSEG)	
T1160-3 Tap	Falconer - Homer Hill #153	F-HH #153 - Salamanca-Frank St. Tap	115
T1160-4 Tap	Falconer - Homer Hill #153	F-HH #153 - Salamanca-Rochester Tap	115
T1170	Falconer - Homer Hill #154	main line	115
T1170-1 Tap	Falconer - Homer Hill #154	F-HH #154 - South Dow Street Tap	115
T1170-2 Tap	Falconer - Homer Hill #154	F-HH #154 - Carrs Corners Switch Tap (NYSEG)	115
T1170-3 Tap	Falconer - Homer Hill #154	F-HH #154 – Salamanca-Frank St. Tap	115
T1170-4 Tap	Falconer - Homer Hill #154	F-HH #154 – Salamanca-Rochester Tap	115
T1180	South Ripley-Erie #69	main line	230
T1260-1 Tap	Gardenville - Dunkirk #141	G-D #141 Martin Road Station 139 Tap	115
T1260-2 Tap	Gardenville - Dunkirk #141	G-D #141 Station 55 Tap	115
T1260-3 Tap	Gardenville - Dunkirk #141	G-D #141 Cloverbank Station 91Tap	115
T1260-4 Tap	Gardenville - Dunkirk #141	G-D #141 Shaleton Station 81 Tap	115
T1260-5 Tap	Gardenville - Dunkirk #141	G-D #141 Delameter Station 93 Tap	115
T1260-6 Tap	Gardenville - Dunkirk #141	G-D #141 North Angola Tap	115
T1260-7 Tap	Gardenville - Dunkirk #141	G-D #141 Silver Creek (NYSEG) Tap	115
T1270-1 Tap	Gardenville - Dunkirk #142	G-D #142 Martin Road Station 139 Tap	115
T1270-2 Tap	Gardenville - Dunkirk #142	G-D #142 Station 55 Tap	115
T1270-3 Tap	Gardenville - Dunkirk #142	G-D #142 Ford Tap	115
T1270-4 Tap	Gardenville - Dunkirk #142	G-D #142 Cloverbank Station 91Tap	115
T1270-5 Tap	Gardenville - Dunkirk #142	G-D #142 Delameter Station 93 Tap	115
T1270-6 Tap	Gardenville - Dunkirk #142	G-D #142 Bennett Road Station 99 Tap	115
T1270-7 Tap	Gardenville - Dunkirk #142	G-D #142 North Angola Tap	115
T1270-8 Tap	Gardenville - Dunkirk #142	G-D #142 Silver Creek (NYSEG) Tap	115
T1280-1 Tap	Gardenville - Homer Hill #152	G-HH #152 Springville Station Tap	115
T1280-2 Tap	Gardenville - Homer Hill #152	G-HH #152 Cobble Hill Tap	115
T1280-3 Tap	Gardenville - Homer Hill #152	G-HH #152 Machias Tap	115
T1280-4 Tap	Gardenville - Homer Hill #152	G-HH #152 Ischua Switch Tap	115
T1330	Hartfield - Moons Switches #159	main line	115
T1340	Homer Hill - Bennett Road #157	main line	115
T1340-1 Tap	Hartfield - Moons Switches #159	HH-BR #157 - Dugan Road Tap	115
T1340-2 Tap	Homer Hill - Bennett Road #157	HH-BR #157 - Wellsville Tap	115
T1350	Homer Hill - Dugan Road #155	main line	115
T1350-1 Tap	Homer Hill - Dugan Road #155	HH-DR #155 - West Olean Tap	115
T1350-2 Tap	Homer Hill - Dugan Road #155	HH-DR #155 - Cooper-Power Sys. Tap	115
T1360	Homer Hill - West Olean #156	main line	115
T1360-1 Tap	Homer Hill - West Olean #156	HH-WO #156 - Dresser Tap	115
T1460	Homer Hill - Indeck Olean #166	main line	115
T1900	Valley (Station 44) - Ischua Switch #158	main line	115
T1910	Willowbrook Switch - Brigham #164	main line	115
T1950-1 Tap	Gardenville - Homer Hill #151	G-HH #151 Springville Station Tap	115
T1950-2 Tap	Gardenville - Homer Hill #151	G-HH #151 Cobble Hill Tap	115
T1950-3 Tap	Gardenville - Homer Hill #151	G-HH #151 Arcade Village (Muni) Tap	115

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T1950-4 Tap	Gardenville - Homer Hill #151	G-HH #151 Machias Tap	115
T1950-5 Tap	Gardenville - Homer Hill #151	G-HH #151 Ischua Switch Tap	115
T6080	Falconer - Warren #171	main line	115
T6110	Homer City - Stolle Road#37	main line	345
T6450	Archade - Homer Hill #167	main line	115

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

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

Sub-Transmission Lines			
Circuit ID	From	To	Voltage (kV)
803	Dake Hill	Machias	34.5
801	Delvan	Machias	34.5
816	Dake Hill	West Salamanca	34.5
804	Cold Spring	West Salamanca	34.5
802	Machias	Maplehurst	34.5
817	North Ashford	Nuclear Fuels	34.5
815	Bagdad	Dake Hill	34.5
856	Shaleton	North Angola	34.5
857	North Angola	Bagdad	34.5
862	North Angola	Bagdad	34.5
861	North Angola	North Ashford	34.5
851	Dunkirk	West Portland	34.5
852	Dunkirk	Hartfield	34.5
866	West Portland	Hartfield	34.5
859	Hartfield	South Dow	34.5
867	West Portland	Sherman	34.5
855	Hartfield	Sherman	34.5
863	Sherman	Ashville	34.5
854	Hartfield	Ashville	34.5
865	South Dow	Poland	34.5
860	North Eden	Eden	34.5
805	West Salamanca	Homer Hill	34.5
809	Homer Hill	Ceres	34.5

811	Homer Hill	Nile	34.5
541	Andover	South Wellsville	34.5
812	Nile	South Wellsville	34.5

7. Syracuse Oswego Cortland Study Area

Electrical Facilities			
Substations			
Ash St. 223	Drumlins 132	Labrador 230	Sandy Creek 66
Baily 313	Duguid 265	Lafayette 301	Scriba 319
Ballina 221	E. Fulton 100	Lake Rd. Two 299	Seneca Hill 206
Bartell 325	E. Molloy Rd. 151	Lords Hill 66	Sentinel Heights 128
Belmont 260	E. Pulaski 324	Lorings 276	Seventh North 231
Brewerton 07	E. Syracuse 27	Lysander 297	Solvay 57
Bridge St. 295	E. Conklin 314	Mallory 125	Sorrell Hill 269
Bridgeport 168	Elbridge 312	McGraw 228	South Bay 60
Brighton Ave. 08	Euclid 267	Messina 42	South Oswego 254
Bristol Hill 109	Fabius 55	Mexico 43	Southwood 244
Buckabee Mears 300	Fairdale 135	Midler 145	Springfield 167
Buckley 140	Fairmount 118	Miller St. 117	Starr Rd. 334
Butternut 255	Fay Street 103	Milton Ave. 266	Stiles 58
Camillus 10	Fayette St. 28	Minoa 44	Teall Ave. 72
Cardiff 13	Fayetteville 14	Nestle Company 245	Temple St. 243
Carr 387	Fisher Ave. 270	New Haven 256	Third St. 216
Carrier 268	Fly Rd. 261	Niles 294	Truxton 74
Cazenovia 220	FMR Carlyle 268	Oswego Steam	Tuller Hill 246
Central Square 15	Galeville 213	Paloma 254	Tully Center 278
Chittenango 16	Geres Lock 30	Parish 49	Varick 207
Cicero 17	Gilbert Mills 247	Park Street 144	Volney 296
Clay 229	Glenwood 227	Peat Street 250	W. Monroe 274
Cleveland 11	Granby Center 293	Pebble Hill 290	W. Cleveland 326
Colosse 321	Hancock #2 138	Perryville 50	West Oswego 209
Constantia 19	Hancock 137	Phoenix 51	Westvale 133
Cortland 502	Harris Road 235	Pine Grove 59	Whitaker 296
Crouse Hinds 239	Headson 146	Pompey 120	Wine Creek 283
Curtis St 224	Hinsdale 218	Pulaski 68	Woodard 233
Cuyler 24	Homer 129	Rathburn 160	
Delphi 262	Hopkins 253	Ridge Rd. 219	
Dewitt 241	Jamesville Recloser 152	Rock Cut 286	
Dorwin 26	Jewett 291	Sand Rd. 131	

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

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T2000	Ash - Teall #7	main line	115
T2010	Ash - Teall #8	main line	115
T2020	Ash - Temple #9	main line	115
T2030	Auburn (State St.) - Elbridge #5	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T2040	Clay - Dewitt #3	main line	115
T2040-1 Tap	Clay - Dewitt #3	C-D #3 - Bartell Tap	115
T2040-2 Tap	Clay - Dewitt #3	C-D #3 - Pine Grove Tap	115
T2040-3 Tap	Clay - Dewitt #3	C-D #3 - New Venture Gear Tap	115
T2040-4 Tap	Clay - Dewitt #3	C-D #3 - Fly Road Tap	115
T2040-5 Tap	Clay - Dewitt #3	C-D #3 - Butternut Tap	115
T2050	Clay - Dewitt #5	main line	115
T2050-1 Tap	Clay - Dewitt #5	C-D #5 - Duguid Tap	115
T2060	Clay - DeWitt #13	main line	345
T2090	Clay - Teall #10	main line	115
T2090-1 Tap	Clay - Teall #10	C-T #10 - Bartell / Pine Grove Tap	115
T2090-2 Tap	Clay - Teall #10	C-T #10 - E. Malloy	115
T2100	Clay - Teall #11	main line	115
T2100-1 Tap	Clay - Teall #11	C-T #11 - Euclid Tap	115
T2100-2 Tap	Clay - Teall #11	C-T #11 - Hopkins Tap	115
T2110	Clay - Woodard #17	main line	115
T2110-1 Tap	Clay - Woodard #17	C-W #17 - Euclid Tap	115
T2110-2 Tap	Clay - Woodard #17	C-W #17 - OCWA Tap	115
T2130	Cortland - Lapeer #1	main line	115
T2130-1 Tap	Cortland - Lapeer #1	C-L #1 - Tuller Hill Tap	115
T2140	Curtis Street - Teall #13	main line	115
T2140-1 Tap	Curtis Street - Teall #13	CS-T #13 - Lysander Tap	115
T2140-2 Tap	Curtis Street - Teall #13	CS-T #13 - Anheuser Busch Tap	115
T2140-3 Tap	Curtis Street - Teall #13	CS-T #13 - Belmont Tap	115
T2140-4 Tap	Curtis Street - Teall #13	CS-T #13 - Sorrell Hill Tap	115
T2140-5 Tap	Curtis Street - Teall #13	CS-T #13 - Crouse Hinds Tap	115
T2140-6 Tap	Curtis Street - Teall #13	CS-T #13 - Hopkins Tap	115
T2150	DeWitt - LaFayette #22	main line	345
T2160	Dewitt - Tilden #19	main line	115
T2170	Elbridge - Geres Lock #3	main line	115
T2180	Elbridge - Geres Lock #18	main line	115
T2180-1 Tap	Elbridge - Geres Lock #18	E-GL #18 - Milton Tap	115
T2190	Elbridge - Geres Lock #19	main line	115
T2190-1 Tap	Elbridge - Geres Lock #19	E-GL #19 - Milton Tap	115
T2200	Elbridge - Woodard #4	main line	115
T2200-1 Tap	Elbridge - Woodard #4	-W #4 - Belmont Tap	115
T2220	FitzPatrick - Lighthouse Hill #3	main line	115
T2220-1 Tap	FitzPatrick - Lighthouse Hill #3	F-LH #3 - Scriba Tap	115
T2220-2 Tap	FitzPatrick - Lighthouse Hill #3	F-LH #3 - New Haven Tap	115
T2230R	Fulton Co-Gen - Clay #4	main line	115
T2240	General Electric - Geres Lock #8	main line	115
T2240-1 Tap	GE (Electronics Park) - Geres Lock #8	GE-GL #8 - Solvay Muni. Bridge St. Tap	115
T2240-2 Tap	GE (Electronics Park) - Geres Lock #8	GE-GL #8 - Solvay Muni. Matthews Ave. Tap	115
T2260	Geneva (Border City) - Elbridge #15	main line	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T2260-1 Tap	Geneva (Border City) - Elbridge #15	G-E #15 - Hyatt Road Tap	115
T2270	Geres Lock - Solvay #2	main line	115
T2270-1 Tap	Geres Lock - Solvay #2	GL-S #2 - Solvay Muni. Matthews Ave. Tap	115
T2270-2 Tap	Geres Lock - Solvay #2	GL-S #2 - Crucible Steel	115
T2280	Geres Lock - Solvay #14	main line	115
T2280-1 Tap	Geres Lock - Solvay #14	GL-S #14 - Solvay Muni. Bridge St. Tap	115
T2280-2 Tap	Geres Lock - Solvay #14	GL-S #14 - TriGen Tap	115
T2280-3 Tap	Geres Lock - Solvay #14	GL-S #14 - Crucible Steel	115
T2290	Geres Lock - Tilden #16	main line	115
T2300	Indeck Oswego - Lighthouse Hill #2	main line	115
T2300-1 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 Wine Creek Tap	115
T2300-2 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 Alcan Tap	115
T2300-3 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 Scriba Tap	115
T2300-4 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 New Haven Tap	115
T2300-5 Tap	Indeck Oswego - Lighthouse Hill #2	IO-LHH #2 Schoeller Paper / E Pulaski Tap	115
T2310R	LaFayette - Oakdale #4 (36)	main line	345
T2320	Lighthouse Hill - Clay #7	main line	115
T2350	Nine Mile Point Unit One - Clay #8	main line	345
T2360	Nine Mile Pt. #1 - FitzPatrick #4	main line	115
T2370	Nine Mile Point Unit One - Scriba #9	main line	345
T2380	Nine Mile Pt. #2 - Scriba #5	main line	115
T2390	Nine Mile Pt. #2 - Scriba #6	main line	115
T2410-1 Tap	Oneida - Fenner #8	O-F #8 - Whitman Tap	115
T2420	Oswego - LaFayette #17	main line	345
T2430	Oswego - South Oswego #3	main line	115
T2440	Oswego - South Oswego #5	main line	115
T2450	Oswego - South Oswego #8	main line	115
T2470	Oswego - Volney #11	main line	345
T2480	Oswego - Volney #12	main line	345
T2520	Peat - Dewitt #7	main line	115
T2520-1 Tap	Peat - Dewitt #7	P-D #7 - Bridge St. Tap	115
T2520-2 Tap	Peat - Dewitt #7	P-D #7 - Headson Tap	115
T2540	Scriba - Volney #20	main line	345
T2550	Scriba - Volney #21	main line	345
T2560	Sleight Road - Auburn (State St.) #3	main line	115
T2580	South Oswego - Curtis St. #10	main line	115
T2590R	South Oswego - Fulton Co-Gen #7	main line	115
T2600	South Oswego - Geres Lock #9	main line	115
T2600-1 Tap	South Oswego - Geres Lock #9	SO-GL #9 - Clear water pump Tap	115
T2600-2 Tap	South Oswego - Geres Lock #9	SO-GL #9 - Anheuser Busch Tap	115
T2600-3 Tap	South Oswego - Geres Lock #9	SO-GL #9 - Lysander Tap	115
T2600-4 Tap	South Oswego - Geres Lock #9	SO-GL #9 - Sorrell Hill Tap	115
T2610	South Oswego - Indeck(Oswego) #6	main line	115

Transmission Lines			
Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T2610-1 Tap	South Oswego - Indeck(Oswego) #6	SO- I #6 - Paloma Tap	115
T2610-2 Tap	South Oswego - Indeck(Oswego) #6	SO- I #6 - Wine Creek Tap	115
T2610-3 Tap	South Oswego - Indeck(Oswego) #6	SO- I #6 – Hammermill Tap	115
T2630	South Oswego - Nine Mile Pt.#1 #1	main line	115
T2630-1 Tap	South Oswego - Nine Mile Pt.#1 #1	SO-NMP1 #1 - ALCAN Tap	115
T2630-2 Tap	South Oswego - Nine Mile Pt.#1 #1	SO-NMP1 #1 - Paloma Tap	115
T2630-3 Tap	South Oswego - Nine Mile Pt.#1 #1	SO-NMP1 #1 - Lake Road #2 Tap	115
T2640	SUNY Cortland - Cortland #2	Not a tap (main line)	115
T2640-1 Tap	SUNY Cortland - Cortland #2	C-SC #2 - Buckbee Mears Tap	115
T2640-2 Tap	SUNY Cortland - Cortland #2	C-SC #2 - Borg Warner Tap	115
T2650	Teall - Dewitt #4	main line	115
T2650-1 Tap	Teall - Dewitt #4	T-D #4 - East Malloy Tap	115
T2650-2 Tap	Teall - Dewitt #4	T-D #4 - New Venture Gear / Coolidge Ventures Tap	115
T2650-3 Tap	Teall - Dewitt #4	T-D #4 - Butternut Tap	115
T2650-4 Tap	Teall - Dewitt #4	T-D #4 - Fly Road Tap	115
T2660	Teall - Carr Street #6	main line	115
T2660-1 Tap	Teall - Carr Street #6	T-CS #6 - Carrier Tap	115
T2660-2 Tap	Teall - Carr Street #6	T-CS #6 - Bristol Myers Squibb #1 Tap	115
T2660-3 Tap	Teall - Carr Street #6	T-CS #6 - Bristol Myers Squibb #2 Tap	115
T2670	Teall - Oneida #2	main line	115
T2680	Teall - Oneida #5	main line	115
T2680-1 Tap	Teall - Oneida #5	T-O #5 - Bridgeport Tap	115
T2690	Temple - Dewitt #10	main line	115
T2690-1 Tap	Temple - Dewitt #10	T-D #10 Bridge St. Tap	115
T2690-2 Tap	Temple - Dewitt #10	T-D #10 Headson Tap	115
T2700	Temple - SU/Gas #11	main line	115
T2710	Tilden - Cortland #18	main line	115
T2720	Volney - Clay #6	main line	345
T2740	Carr Street - Dewitt #15	main line	115
T2740-1 Tap	Carr Street - Dewitt #15	CS-D #15 - Bristol-Myers Squibb #1 Tap	115
T2740-2 Tap	Carr Street - Dewitt #15	CS-D #15 - Bristol-Myers Squibb #2 Tap	115
T2750	Clay - General Electric (Electronics Park) #14	main line	115
T2760	Independence - Scriba #25	main line	345
T2770	O.C.R.R.A. - Tilden #15	main line	115
T2770-1 Tap	O.C.R.R.A. - Tilden #15	O-T #15 – Rock Cut Rd Tap	115
T6030	Independence - Clay #26	main line	345
T6120	Geres Lock - Onondaga Co-Gen #12	main line	115
T6130	Geres Lock - WPS Empire State Co-Gen #11	main line	115
T6140	Fenner - Cortland #3	main line	115
T6140-1 Tap	Fenner - Cortland #3	F-C #3 - Fenner Oneida Co-Op (NYPA) Tap	115

Transmission Lines			
Circuit ID	**Circuit Name**	**Main Line / Tap Name**	**Voltage**
T6140-2 Tap	Fenner - Cortland #3	F-C #3 - Labrador Tap	115
T6150	Hook Road - Elbridge #7	main line	115
T6150-1 Tap	Hook Road - Elbridge #7	HR - E #7 – Farmington Tap (NYSEG)	115
T6150-2 Tap	Hook Road - Elbridge #7	HR - E #7 - Hamilton Road Tap (NYSEG)	115
T6400	South Oswego - Clay #4	main line	115
T6400-1 Tap	South Oswego - Clay #4	SO-C #4 NY Chocolate Tap	115
T6400-2 Tap	South Oswego - Clay #4	SO-C #4 - NE Biofuels Tap	115
T6400-3 Tap	South Oswego - Clay #4	SO-C #4 - Owens Illinois Tap	115
T6400-4 Tap	South Oswego - Clay #4	SO-C #4 - Sealright Tap	115
T6470	Lafayette - Clarks Corners #4 (46)	main line	345

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

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

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

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

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

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

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
30	From	To	34.5
33	Ash St.	Burnet	34.5
25	Ash St.	Burnet	34.5
29	Ash St.	Carousel	34.5
24	Ash St.	Carousel	34.5

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
23	Ash St.	McBride	34.5
28	Ash St.	McBride	34.5
37	Ash St.	Solvay	34.5
38	Brighton	Tilden	34.5
39	Brighton	Tilden	34.5
38	Fayette	Ash St.	34.5
36	Fayette	Ash St.	34.5
37	Fayette	Solvay	34.5
20	Fayette	Solvay	34.5
22	McBride	Brighton	34.5
25	McBride	Brighton	34.5
33	McBride	University	34.5
26	McBride	University	34.5
27	Solvay		34.5
23	Solvay		34.5
25	Teall		34.5
28	Teall	Ley Creek Treat Plant	34.5
22	Teall	Syracuse China	34.5
33	Solvay		34.5
24	Mallory	Cicero	34.5
28	Woodard		34.5
29	Woodard		34.5
26	Woodard	Baldwinsville	34.5
32	Woodard	Crouse Hinds	34.5
32	Woodard	Teall	34.5
27	Teall		34.5
27	Woodard	Ash St.	34.5
28	Pebble Hill	Rathbun	34.5
38	Minoa	Whitman	34.5
33	Headson	Tilden	34.5
26	Headson	Minoa	34.5
28	Headson	Pebble Hill	34.5
34	Minoa	Whitman	34.5
29	Burnet Ave.	Headson	34.5
31	Teall		34.5
30	Teall	Headson	34.5
31	Elbridge	Marcellus	34.5
509	Elbridge	Jewett	34.5
33	Niles Tap		34.5
21	Harris Rd.	Tilden	34.5
20	Harris Rd.	Tilden	34.5
34	Solvay	Harris Rd	34.5
35	Solvay	Harris Rd	34.5

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage (kV)**
22	Solvay		34.5
20	Solvay		34.5
21	Cortland	Cortland	34.5
23	Cortland	Cortland	34.5
39	Cortland	Cortland	34.5
32	Labrador	Rathbun	34.5
24	Pebble Hill	Tilden-Tully Tap	34.5
30	Tilden	Tully Tap	34.5

8. Utica Rome Study Area

Electrical Facilities

Substations

Alder Creek 701	Inghams 20	Poland 621	Turin 653
Arnold 656	Lehigh 669	Porter 657	Turning Stone 640
Boonville 707	Lenox 513	Raquette Lake 398	Valley 594
Cavanaugh Rd. 616	Lighthouse Hill 61	Rock City 623	Voorhees 83
Chadwicks 668	Levitt 665	Rome 762	Walesville 331
Clinton 604	Madison 654	Salisbury 678	Watkins Road 528
Conkling 652	Middleville 666	Schuyler 663	West Herkimer 676
Debalso 684	Old Forge 383	Sherman 333	Whitman 671
Deerfield 606	Oneida 501	So. Washington 614	White Lake 399
Eagle Bay 382	Oriskany 648	Stittville 670	Whitesboro 632
Edic 662	Peterboro 514	Terminal 651	Yahnundasis 646
Frankfort 677	Pleasant 664	Trenton 627	

Transmission Lines

Circuit ID	Circuit Name	Main Line / Tap Name	Voltage
T2800	Watkins Road - Inghams #2	main line	115
T2800-1 Tap	Watkins Road - Inghams #2	WR-I #2 - Salisbury Tap	115
T4020	Boonville - Porter #1	main line	115
T4020-1 Tap	Boonville - Porter #1	B-P #1 - Stittville Tap	115
T4030	Boonville - Porter #2	main line	115
T4030-1 Tap	Boonville - Porter #2	B-P #2 - Stittville Tap	115
T4030-2 Tap	Boonville - Porter #2	B-P #2 - Boonville Muni. Tap	115
T4040	Boonville - Rome #4	main line	115
T4040-1 Tap	Boonville - Rome #4	B-R #4 - Madison Tap	115
T4040-2 Tap	Boonville - Rome #4	B-R #4 - Revere Copper & Brass Tap	115
T4060	Boonville - Rome #3	main line	115
T4060-1 Tap	Boonville - Rome #3	B-R #3 - Griffis AVA Tap	115
T4060-2 Tap	Boonville - Rome #3	B-R #3 - Madison Tap	115
T4080	Edic - Porter #10	main line	115
T4090	Edic-Porter #17	main line	230
T4100	Edic - Porter #20	main line	115
T4110	Levitt - Rome #8	main line	115
T4110-1 Tap	Levitt - Rome #8	L-R #8 - Lehigh Tap	115
T4110-2 Tap	Levitt - Rome #8	L-R #8 - Camden Wire Tap	115
T4110-3 Tap	Levitt - Rome #8	L-R #8 - Voorhees Ave Tap	115
T4110-4 Tap	Levitt - Rome #8	L-R #8 - Rome Cable Tap	115
T4140	Oneida - Oneida Energy (Sterling) #4	main line	115
T4150	Oneida - Porter #7	main line	115
T4150-1 Tap	Oneida - Porter #7	O-P #7 - Cavanaugh Road Tap	115
T4150-2 Tap	Oneida - Porter #7	O-P #7 - Walesville Tap	115
T4160	Oneida - Yahnundasis #6	main line	115
T4160-1 Tap	Oneida - Yahnundasis #6	O-Y #6 - Sherrill Power & Light Tap	115

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

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

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

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

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

Sub-Transmission Lines			
Circuit ID	**From**	**To**	**Voltage**
22	Deerfield	Schuyler	46

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

Exhibit 2 - Transmission Inspection and Maintenance Report
Second Quarter 2012 (June 30, 2012)

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

Transmission Facilities	2010				2011				2012			
Priority Level	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs
Repair Expected	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days
Towers/Poles												
Steel Towers												
Number of Deficiencies	0	12	45	0	0	8	121	0	1	13	46	0
Repaired in Time Frame	0	12	32	0	0	2	8	0	1	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	13	0	0	5	113	0	0	13	46	0
Not Repaired - Overdue	0	0	0	0	0	1	0	0	0	0	0	0
Poles												
Number of Deficiencies	0	35	637	0	1	200	1308	9	0	219	1491	2
Repaired in Time Frame	0	31	81	0	0	92	112	1	0	4	11	0
Repaired - Overdue	0	2	0	0	1	0	0	6	0	0	0	0
Not Repaired - Not Due	0	0	556	0	0	94	1196	0	0	215	1480	2
Not Repaired - Overdue	0	2	0	0	0	14	0	2	0	0	0	0
Anchors/Guy Wire												
Number of Deficiencies	0	9	123	0	0	9	170	0	0	14	113	0
Repaired in Time Frame	0	9	47	0	0	6	25	0	0	1	1	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	76	0	0	3	145	0	0	13	112	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Crossarm/Brace												
Number of Deficiencies	0	13	84	0	2	24	140	2	0	21	76	0
Repaired in Time Frame	0	12	34	0	2	8	15	1	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	50	0	0	16	125	0	0	21	76	0
Not Repaired - Overdue	0	1	0	0	0	0	0	1	0	0	0	0
Grounding System												
Number of Deficiencies	0	25	192	0	0	12	243	0	0	48	221	0
Repaired in Time Frame	0	2	145	0	0	10	164	0	0	5	0	0
Repaired - Overdue	0	23	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	47	0	0	2	79	0	0	43	221	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Conductors												
Cable												
Number of Deficiencies	0	2	6	0	6	6	37	1	1	3	1	0
Repaired in Time Frame	0	2	2	0	6	5	21	1	1	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	4	0	0	1	16	0	0	3	1	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Static/Neutral												
Number of Deficiencies	0	4	21	0	0	5	57	0	0	1	7	2
Repaired in Time Frame	0	4	14	0	0	2	44	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	7	0	0	3	13	0	0	1	7	1
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	1
Insulators												
Number of Deficiencies	1	42	193	0	4	35	498	0	1	26	253	0
Repaired in Time Frame	1	40	96	0	4	28	91	0	1	1	1	0
Repaired - Overdue	0	2	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	97	0	0	6	407	0	0	25	252	0
Not Repaired - Overdue	0	0	0	0	0	1	0	0	0	0	0	0
Miscellaneous												
Right of Way Condition												
Number of Deficiencies	0	0	6	0	0	0	8	0	0	0	34	0
Repaired in Time Frame	0	0	6	0	0	0	0	0	0	0	6	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	8	0	0	0	28	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0				
Temporary Repairs												
Number of Temp Repairs	0	0	0	6	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	2	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	4	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0

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

Transmission Facilities	2010				2011				2012			
Priority Level	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs
Repair Expected	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days
Other												
Number of Deficiencies	10	36	38	0	13	39	16	0	13	20	60	0
Repaired in Time Frame	9	32	16	0	12	30	2	0	13	3	2	0
Repaired - Overdue	1	4	0	0	1	4	0	0	0	0	0	0
Not Repaired - Not Due	0	0	22	0	0	5	14	0	0	17	58	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Transmission FacilitiesTotal												
Total												
Number of Deficiencies	11	178	1345	6	26	338	2598	12	16	365	2302	4
Repaired in Time Frame	10	144	473	2	24	183	482	3	16	14	21	0
Repaired - Overdue	1	31	0	4	2	4	0	6	0	0	0	0
Not Repaired - Not Due	0	0	872	0	0	135	2116	0	0	351	2281	3
Not Repaired - Overdue	0	3	0	0	0	16	0	3	0	0	0	1

Exhibit 3 - Distribution Inspection and Maintenance Report
Second Quarter 2012 (June 30, 2012)

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

Overhead Facilities	2010				2011				2012			
Priority Level	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs
Repair Expected	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days
Poles												
Pole Condition												
Number of Deficiencies	26	2282	7495	33	20	3741	2893	54	16	3695	3013	40
Repaired in Time Frame	25	1895	1793	30	19	2035	411	47	15	30	3	20
Repaired - Overdue	1	387	0	3	1	118	0	7	0	0	0	2
Not Repaired - Not Due	0	0	5702	0	0	1588	2482	0	1	3665	3010	18
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Grounding System												
Number of Deficiencies	50	3617	8253	0	61	3545	966	1	34	4691	1516	3
Repaired in Time Frame	50	3562	2748	0	61	2853	311	1	34	261	93	2
Repaired - Overdue	0	55	0	0	0	86	0	0	0	0	0	0
Not Repaired - Not Due	0	0	5505	0	0	598	655	0	0	4430	1423	1
Not Repaired - Overdue	0	0	0	0	0	8	0	0	0	0	0	0
Anchors/Guy Wire												
Number of Deficiencies	3	2093	5104	13	2	940	6901	16	2	523	5025	18
Repaired in Time Frame	3	1983	920	12	2	516	1049	16	2	7	94	6
Repaired - Overdue	0	110	0	1	0	103	0	0	0	0	0	0
Not Repaired - Not Due	0	0	4184	0	0	321	5852	0	0	516	4931	12
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Cross Arm/Bracing												
Number of Deficiencies	41	735	2994	0	30	940	81	5	20	526	107	4
Repaired in Time Frame	41	703	638	0	30	651	5	5	20	31	4	0
Repaired - Overdue	0	32	0	0	0	27	0	0	0	0	0	0
Not Repaired - Not Due	0	0	2356	0	0	260	76	0	0	495	103	4
Not Repaired - Overdue	0	0	0	0	0	2	0	0	0	0	0	0
Riser												
Number of Deficiencies	2	1235	538	0	11	1857	769	2	4	2052	387	1
Repaired in Time Frame	2	1207	134	0	11	1137	185	2	4	138	3	1
Repaired - Overdue	0	28	0	0	0	10	0	0	0	0	0	0
Not Repaired - Not Due	0	0	404	0	0	710	584	0	0	1914	384	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Conductors												
Primary Wire/Broken Ties												
Number of Deficiencies	104	203	87	2	90	211	40	4	40	157	16	1
Repaired in Time Frame	104	202	10	2	89	114	7	4	40	10	0	1
Repaired - Overdue	0	1	0	0	1	5	0	0	0	0	0	0
Not Repaired - Not Due	0	0	77	0	0	92	33	0	0	147	16	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Secondary Wire												
Number of Deficiencies	24	134	592	7	60	318	789	3	23	194	715	11
Repaired in Time Frame	23	132	170	7	58	205	61	3	23	6	3	8
Repaired - Overdue	1	2	0	0	2	5	0	0	0	0	0	0
Not Repaired - Not Due	0	0	422	0	0	108	728	0	0	188	712	3
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Neutral												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Insulators												
Number of Deficiencies	18	219	295	2	14	357	225	4	14	190	275	1
Repaired in Time Frame	17	211	60	1	14	237	43	4	14	13	3	1
Repaired - Overdue	1	8	0	1	0	2	0	0	0	0	0	0
Not Repaired - Not Due	0	0	235	0	0	117	182	0	0	177	272	0
Not Repaired - Overdue	0	0	0	0	0	1	0	0	0	0	0	0
Pole Equipment												
Transformers												
Number of Deficiencies	3	7546	1363	1	2	5862	1706	0	4	3478	1571	1
Repaired in Time Frame	3	6859	878	1	2	4146	681	0	4	147	43	1
Repaired - Overdue	0	687	0	0	0	56	0	0	0	0	0	0
Not Repaired - Not Due	0	0	485	0	0	1655	1025	0	0	3331	1528	0
Not Repaired - Overdue	0	0	0	0	0	5	0	0	0	0	0	0
Cutouts												
Number of Deficiencies	45	70	7260	2	46	5233	0	0	37	3668	0	3
Repaired in Time Frame	45	69	1099	2	45	3179	0	0	37	51	0	2
Repaired - Overdue	0	1	0	0	1	288	0	0	0	0	0	1
Not Repaired - Not Due	0	0	6161	0	0	1766	0	0	0	3617	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0

Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Distribution												
Overhead Facilities	**2010**				**2011**				**2012**			
Priority Level	**I**	**II**	**III**	**Temp Repairs**	**I**	**II**	**III**	**Temp Repairs**	**I**	**II**	**III**	**Temp Repairs**
Repair Expected	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**	**Within 1 week**	**Within 1 year**	**Within 3 years**	**Within 90 days**
Lightning Arrestors												
Number of Deficiencies	0	4	1267	0	0	99	577	0	0	100	357	0
Repaired in Time Frame	0	4	224	0	0	59	127	0	0	1	2	0
Repaired - Overdue	0	0	0	0	0	5	0	0	0	0	0	0
Not Repaired - Not Due	0	0	1043	0	0	35	450	0	0	99	355	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Other Equipment												
Number of Deficiencies	1	1061	1298	0	3	1807	1455	1	1	1222	997	1
Repaired in Time Frame	1	1049	258	0	3	1097	287	1	1	34	9	1
Repaired - Overdue	0	12	0	0	0	15	0	0	0	0	0	0
Not Repaired - Not Due	0	0	1040	0	0	695	1168	0	0	1188	988	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous												
Trimming Related												
Number of Deficiencies	20	0	2006	0	32	0	1669	0	13	0	958	0
Repaired in Time Frame	20	0	347	0	32	0	3	0	13	0	2	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	1659	0	0	0	1666	0	0	0	956	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Temporary Repairs	0	0	0	0	0	0	0	0	0	0	0	0
Number of Temp Repairs	0	0	0	13	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	8	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	5	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Other					0	0	0	0	0	0	0	0
Number of Deficiencies	0	1	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	1	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Overhead Facilities Total												
Total												
Number of Deficiencies	337	19200	38552	73	371	24910	18071	90	208	20496	14937	84
Repaired in Time Frame	334	17877	9279	63	366	16229	3170	83	207	729	259	43
Repaired - Overdue	3	1323	0	10	5	720	0	7	0	0	0	3
Not Repaired - Not Due	0	0	29273	0	0	7945	14901	0	1	19767	14678	38
Not Repaired - Overdue	0	0	0	0	0	16	0	0	0	0	0	0

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

Underground Facilities	2010				2011				2012			
Priority Level	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs
Repair Expected	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days
Underground Structures												
Damaged Cover												
Number of Deficiencies	0	12	85	0	1	3	43	1	2	0	34	0
Repaired in Time Frame	0	12	54	0	1	2	13	1	2	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	31	0	0	1	30	0	0	0	34	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Damaged Structure												
Number of Deficiencies	30	569	14	0	67	597	4	4	35	151	9	4
Repaired in Time Frame	30	568	1	0	67	382	0	3	35	8	0	3
Repaired - Overdue	0	1	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	13	0	0	214	4	0	0	143	9	1
Not Repaired - Overdue	0	0	0	0	0	1	0	1	0	0	0	0
Congested Structure												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Damaged Equipment												
Number of Deficiencies	1	15	0	0	1	9	0	0	1	4	0	0
Repaired in Time Frame	1	15	0	0	1	6	0	0	1	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	3	0	0	0	4	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Conductors												
Primary Cable												
Number of Deficiencies	0	49	0	0	0	13	0	0	0	5	0	0
Repaired in Time Frame	0	43	0	0	0	6	0	0	0	0	0	0
Repaired - Overdue	0	6	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	7	0	0	0	5	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Secondary Cable												
Number of Deficiencies	3	0	0	0	1	0	0	0	1	0	0	0
Repaired in Time Frame	3	0	0	0	1	0	0	0	1	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Neutral Cable					0	0	0	0				
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Racking Needed												
Number of Deficiencies	0	303	0	0	0	207	0	1	0	221	0	0
Repaired in Time Frame	0	278	0	0	0	77	0	0	0	1	0	0
Repaired - Overdue	0	25	0	0	0	41	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	72	0	0	0	220	0	0
Not Repaired - Overdue	0	0	0	0	0	17	0	1	0	0	0	0
Miscellaneous												
Temporary Repairs												
Number of Temp Repairs	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Other												
Number of Deficiencies	0	835	139	0	0	942	332	0	0	571	83	0
Repaired in Time Frame	0	753	38	0	0	291	29	0	0	0	0	0
Repaired - Overdue	0	82	0	0	0	203	0	0	0	0	0	0
Not Repaired - Not Due	0	0	101	0	0	419	303	0	0	571	83	0
Not Repaired - Overdue	0	0	0	0	0	29	0	0	0	0	0	0
Underground Facilities Total												
Total												
Number of Deficiencies	34	1783	238	0	70	1771	379	6	39	952	126	4
Repaired in Time Frame	34	1669	93	0	70	764	42	4	39	9	0	3
Repaired - Overdue	0	114	0	0	0	244	0	0	0	0	0	0
Not Repaired - Not Due	0	0	145	0	0	716	337	0	0	943	126	1
Not Repaired - Overdue	0	0	0	0	0	47	0	2	0	0	0	0

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Summary of Deficiencies and Repair Activity Resulting from the Inspection Process - Pad Mount Transformers

Pad Mount Transformers	2010				2011				2012				2013			
Priority Level	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs
Repair Expected	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days
Pad Mount Tansformers																
Damaged Structure																
Number of Deficiencies	11	119	43	0	10	118	43	0								
Repaired in Time Frame	11	119	3	0	10	76	1	0								
Repaired - Overdue	0	0	0	0	0	3	0	0								
Not Repaired - Not Due	0	0	40	0	0	39	42	0								
Not Repaired - Overdue	0	0	0	0	0	0	0	0								
Damaged Equipment																
Number of Deficiencies	0	0	0	0	0	0	1	0								
Repaired in Time Frame	0	0	0	0	0	0	0	0								
Repaired - Overdue	0	0	0	0	0	0	0	0								
Not Repaired - Not Due	0	0	0	0	0	0	1	0								
Not Repaired - Overdue	0	0	0	0	0	0	0	0								
Cable Condition																
Number of Deficiencies	0	0	0	0	0	0	0	0								
Repaired in Time Frame	0	0	0	0	0	0	0	0								
Repaired - Overdue	0	0	0	0	0	0	0	0								
Not Repaired - Not Due	0	0	0	0	0	0	0	0								
Not Repaired - Overdue	0	0	0	0	0	0	0	0								
Oil Leak																
Number of Deficiencies	2	41	0	0	3	74	0	0								
Repaired in Time Frame	2	41	0	0	3	25	0	0								
Repaired - Overdue	0	0	0	0	0	0	0	0								
Not Repaired - Not Due	0	0	0	0	0	49	0	0								
Not Repaired - Overdue	0	0	0	0	0	0	0	0								
Off Pad																
Number of Deficiencies	23	105	0	0	10	149	0	1								
Repaired in Time Frame	23	102	0	0	10	98	0	1								
Repaired - Overdue	0	3	0	0	0	1	0	0								
Not Repaired - Not Due	0	0	0	0	0	50	0	0								
Not Repaired - Overdue	0	0	0	0	0	0	0	0								
Lock/Latch/Penta																
Number of Deficiencies	0	0	0	0	0	0	0	0								
Repaired in Time Frame	0	0	0	0	0	0	0	0								
Repaired - Overdue	0	0	0	0	0	0	0	0								
Not Repaired - Not Due	0	0	0	0	0	0	0	0								
Not Repaired - Overdue	0	0	0	0	0	0	0	0								
Miscellaneous																
Temporary Repairs																
Number of Temp Repairs	0	0	0	1	0	0	0	0								
Repaired in Time Frame	0	0	0	1	0	0	0	0								
Repaired - Overdue	0	0	0	0	0	0	0	0								
Not Repaired - Not Due	0	0	0	0	0	0	0	0								
Not Repaired - Overdue	0	0	0	0	0	0	0	0								
Other																
Number of Deficiencies	0	3	881	0	0	1	1002	0								
Repaired in Time Frame	0	3	8	0	0	0	0	0								
Repaired - Overdue	0	0	0	0	0	0	0	0								
Not Repaired - Not Due	0	0	873	0	0	0	1002	0								
Not Repaired - Overdue	0	0	0	0	0	1	0	0								
Pad Mount Total																
Total																
Number of Deficiencies	36	268	924	1	23	342	1046	1								
Repaired in Time Frame	36	265	11	1	23	199	1	1								
Repaired - Overdue	0	3	0	0	0	4	0	0								
Not Repaired - Not Due	0	0	913	0	0	138	1045	0								
Not Repaired - Overdue	0	0	0	0	0	1	0	0								

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

Overhead Facilities	2010				2011				2012			
Priorty Level	I	II	III	Temp Repairs	I	II	III	Temp Repairs	I	II	III	Temp Repairs
Repair Expected	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days	Within 1 week	Within 1 year	Within 3 years	Within 90 days
Streetlight												
Base/Standard/Light												
Number of Deficiencies	0	0	0	0	0	683	7	0	0	397	0	0
Repaired in Time Frame	0	0	0	0	0	596	7	0	0	14	0	0
Repaired - Overdue	0	0	0	0	0	5	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	82	0	0	0	383	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Handhole/Service Box												
Number of Deficiencies	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Service/Internal Wiring												
Number of Deficiencies	2309	0	0	0	1	19	3	0	0	0	0	0
Repaired in Time Frame	2309	0	0	0	1	17	2	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	2	1	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Access Cover												
Number of Deficiencies	0	6	0	0	0	1	2	0	0	0	1	0
Repaired in Time Frame	0	6	0	0	0	1	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	2	0	0	0	1	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous												
Temporary Repairs												
Number of Temp Repairs	0	0	0	0	0	0	0	0	0	0	0	0
Repaired in Time Frame	0	0	0	0	0	0	0	0	0	0	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Other												
Number of Deficiencies	0	0	0	0	0	18	1	0	0	149	0	0
Repaired in Time Frame	0	0	0	0	0	6	1	0	0	2	0	0
Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	12	0	0	0	147	0	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0
Streetlight Total												
Total												
Number of Deficiencies	2309	6	0	0	1	721	13	0	0	546	1	0
Repaired in Time Frame	2309	6	0	0	1	620	10	0	0	16	0	0
Repaired - Overdue	0	0	0	0	0	5	0	0	0	0	0	0
Not Repaired - Not Due	0	0	0	0	0	96	3	0	0	530	1	0
Not Repaired - Overdue	0	0	0	0	0	0	0	0	0	0	0	0