

EVERSOURCE

RELIABILITY ENHANCEMENT PROGRAM

2016 Report to the NH Public Utilities Commission

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Eversource

Reliability Enhancement Program

Executive Summary

Executive Summary Eversource Reliability Enhancement Program

This report provides program-specific details for Eversource's Reliability Enhancement Program (REP). This includes Operation and Maintenance (O&M) expenditures from the initial REP program (Base REP) through the end of 2015, REP II through the program end date of June 30, 2015, and the first program year of REP 3 through June 30, 2016.

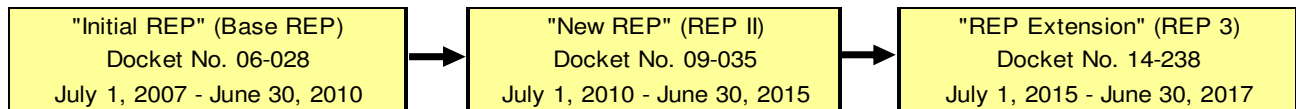
The initial REP was established under the settlement agreement approved by the Commission in Order No. 24,750 in Docket No. DE 06-028 and became effective July 1, 2007. The results of the reliability work under the initial REP were documented in the report submitted by Eversource on February 18, 2011.

As part of the Settlement Agreement on Permanent Distribution Rates approved by the Commission in Order No. 25,123 issued in Docket No. DE 09-035, the settling parties agreed that Eversource should continue its existing REP expenditures from the initial REP and incorporate the revenue requirement for the O&M portion into base distribution rates. Additionally, the Settlement Agreement provided for an additional \$4 million per year of revenue for the duration of the Settlement to support enhanced O&M and capital spending under a so-called "REP II" initiative.

The so-called "REP 3" initiative is a two year extension of REP and was included in the Generation Divestiture settlement agreement of Docket No. DE 14-238. It became effective July 1, 2015, and continues for two years through June 30, 2017.

This report marks the end of the REP II program, and is the first of two annual reports on the REP 3 program.

Reliability Enhancement Program (REP)



Actual O&M spending for the twelve months ended December 31, 2015 under the Base REP and REP II programs was \$8.0 million with 20,247 tasks completed. See Section 2 *Base REP 2015 O&M Summary* and Section 4 *REP II Program Final Report 2015 O&M Summary* for details on individual activity cost and unit count.

2015 O&M EXPENDITURES

<u>REP AREA</u>	<u>12-mo Ending Dec 2015</u>
Base REP O&M Programs	\$5,952,196
REP II O&M Programs	2,054,610
Total O&M	\$8,006,806

Actual O&M spending for the twelve months ended June 30, 2016 under REP 3 was \$5.0 million. See Section 6, *REP 3 Program Year 1 O&M Summary* for the detail spending by program.

Executive Summary Eversource Reliability Enhancement Program

Capital expenditures for the twelve months ended December 31, 2015 under the Base REP and REP II programs were \$9.7 million. See Section 3 *Base REP 2015 Capital Summary* and Section 5 *REP II Program Final Report 2015 Capital Summary* for details on budget item/project descriptions and expenditures by item or project.

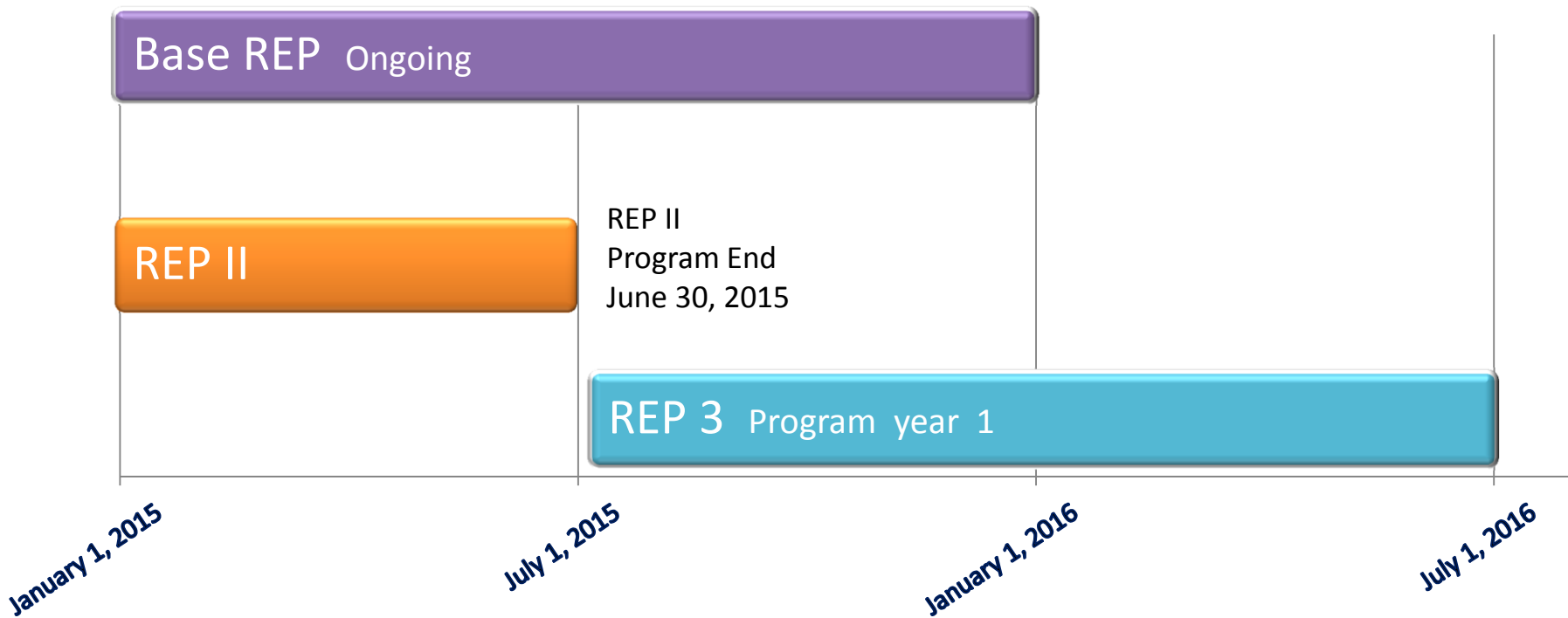
2015 Capital Expenditures

<u>REP AREA</u>	<u>12-mo Ending Dec 2015</u>
Base REP Capital	\$4,506,100
REP II Capital	5,158,262
Total Capital	\$9,664,362

For capital expenditures under the REP 3 program for the 12 months ended June 30, 2016, Eversource spent \$58.9 million, with \$33.3 million placed in service. See Section 7, *REP 3 Program Year 1 Capital Summary* for details on budget item/project descriptions and expenditures by item or project.

Storm related impacts to the electric system affected Eversource's absolute SAIDI performance. There were no declared Major Storms during 2015. There were, however, 6 minor storm days which contributed 30.25 minutes to Eversource SAIDI. However, since the REP was implemented, the trend from 2006 onward has been improved on a weather normalized basis. Eversource and customers continue to see benefits from the REP activities and REP programs are preventing problems from occurring and reducing repair effort and outage times by having the Eversource electric system work as designed. The REP activities are critical and important in concert with Eversource's continued efforts to maintain the system in the normal course of business. See Section 1 *NHPUC Reliability Graphs*.

Periods and programs in this report



Base REP started January 1 2007 and is ongoing
REP 2 ran July 1 2010 through June 30 2015
REP 3 started July 1 2015 and ends June 30 2017

Section 1

NHPUC

RELIABILITY GRAPHS

NHPUC SAIDI Graphs Summary Reliability Enhancement Program

The following is a brief description of the SAIDI Graphs contained in this section and the related REP activities for them. Note that all graphs represent data through the end of 2015 even though the REP II program ended June 30, 2015. This is because comparing mid-year reliability statistics to year end does not provide an accurate representation of trends over time.

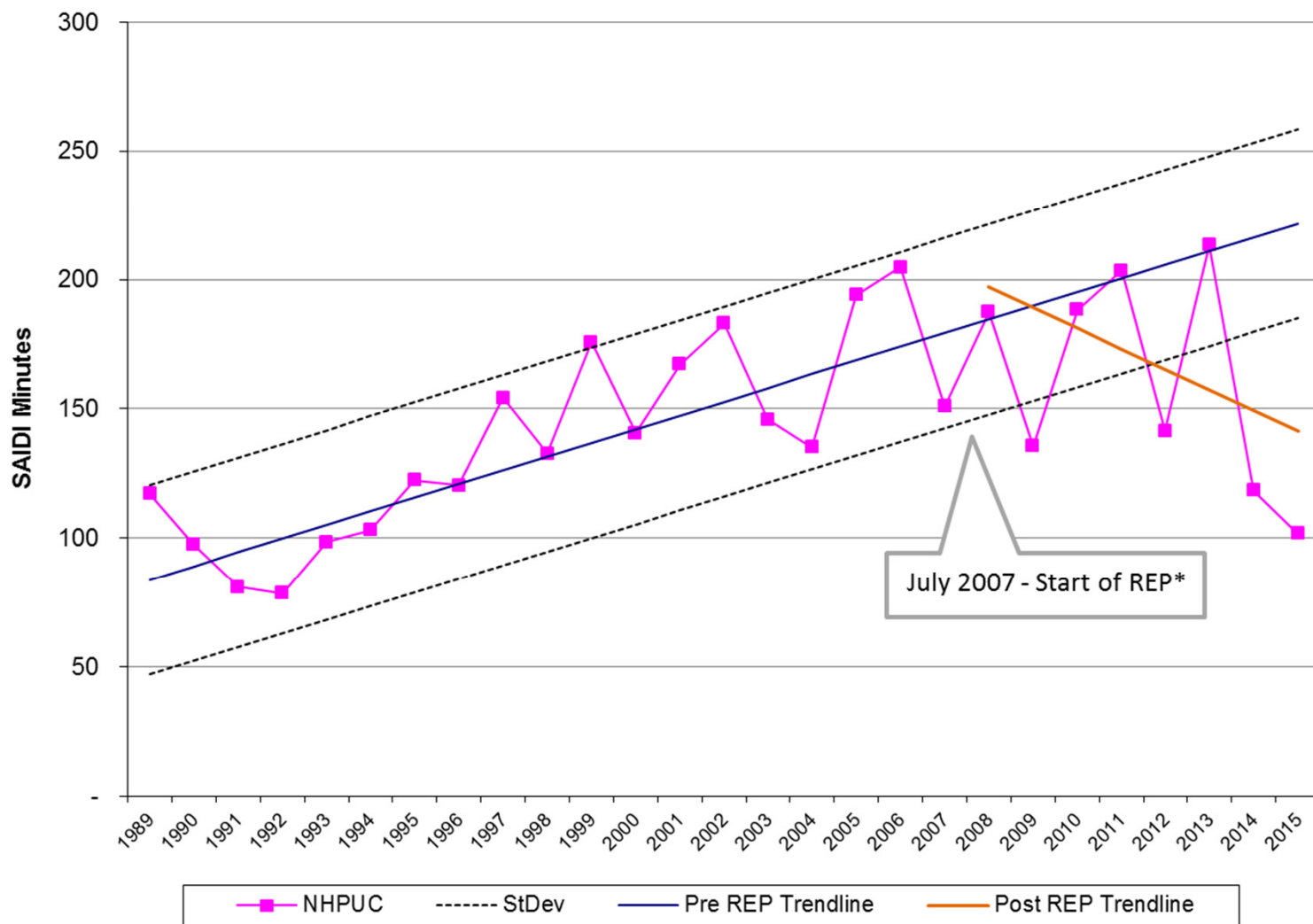
1. Eversource SAIDI – NHPUC Criteria. The Company SAIDI was again reduced in 2015 compared with 2014. The pre-REP trend lines shown are based on data for 1989 through 2005.
2. Top 50 Hit List SAIDI Contribution from Year to Year. Each year Eversource reviews SAIDI by circuit and determines which have contributed the most minutes according to the NHPUC Criteria. Shown on this graphic are the total SAIDI minutes for the top 50 circuits in a year, the amount of SAIDI minutes for those circuits remaining on the top 50 list from the previous year, and the percentage of SAIDI these carry forward circuits represent compared to the Top 50 total. In 2015 the Company had a small decrease in SAIDI contribution coming from the top 50. There was a slight increase in percent SAIDI from circuits remaining in the top 50 from 2014 to 2015. For the last two years, top 50 circuits have contributed less than half of Eversource's overall SAIDI. See section 8 Other Activities for specific actions taken on each circuit.
3. Eversource SAIDI – NHPUC Criteria With and Without Storms. NHPUC SAIDI does not include emergency events which are booked to the storm reserve. These are catastrophic events and are shown on this chart over and above the NHPUC reported SAIDI. Off-scale impacts are shown for the December Ice Storm in 2008; the February wind storm in 2010; the two major storms declared in 2011, Tropical Storm Irene in August and a major snowstorm in October; Hurricane Sandy in 2012; and the Thanksgiving weekend storm in 2014. There were no major storm declarations in 2015. A major storm is declared when there are 200 concurrent power outages affecting 10% of customers served or 300 concurrent power outages. Eversource also tracks minor storms when 100 or more primary power outages occur within a storm timeframe and not deemed a NHPUC major storm. Eversource experienced 6 minor storm events in 2015, contributing 30.25 SAIDI minutes to Eversource's performance. This minor storm component subtracted from NHPUC reported SAIDI leaves a Weather normalized SAIDI. As shown, that component continues to be below levels present when REP was initiated in July, 2007.
4. Eversource Tree Related SAIDI. The largest cause group for SAIDI is trees and limbs, primarily from outside of the clearance area. Tree related SAIDI and the NHPUC reported SAIDI trend very closely and are sensitive to weather. Weather Normalized Tree SAIDI had been trending upward slightly with a slowing and improving trend in recent years. There is a cumulative effect for vegetation management and we believe the effort from last half of 2007 through year end 2015 is showing results. Our efforts to establish the target 4.5 year trimming cycle for the distribution system have succeeded. Eversource's current trimming cycle is approximately 3.8 years, well below the maximum five year cycle required by Puc 307.10 Tree-Pruning Standards. REP activities relating to this are:
 - a. O&M expense Vegetation Management activities including Scheduled Maintenance trimming to shorten the maintenance cycle, Hazard tree removals, Mid cycle trimming
 - b. Capital trimming at Enhanced Tree Trimming specifications for establishing larger clearance both for existing lines and whenever new additions and upgrades are made to the system.

NHPUC SAIDI Graphs Summary Reliability Enhancement Program

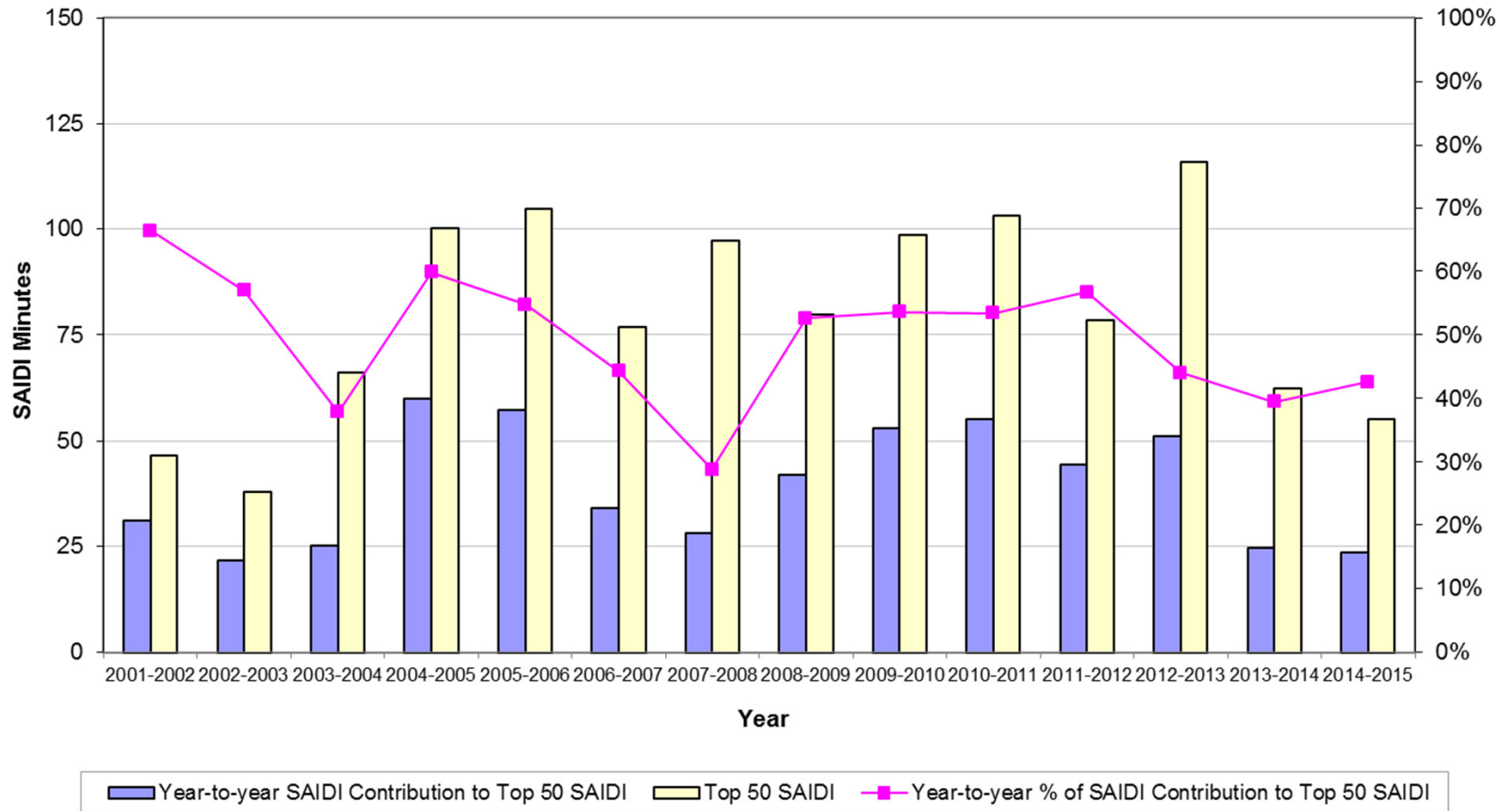
5. Eversource Equipment Related SAIDI. The second largest cause group for SAIDI is equipment failures in substations and on distribution lines. There is much less weather effect to these outages so the difference between NHPUC criteria performance and weather normalized performance is small. A decrease has occurred in this area in 2015 compared with 2014, resulting in performance similar to 2010, which was the lowest since 2002. A variety of REP actions affect this and include:
 - a. Porcelain changeouts
 - b. Switch maintenance and replacement programs
 - c. Recloser maintenance
 - d. Cable testing and replacement

6. Eversource SAIDI – NHPUC Criteria Substation Reliability. Power outages caused by actions or problems inside substations are typically large and widespread. The amount of SAIDI minutes relating to these events is generally declining and there is essentially no difference due to weather. Performance from 2014 to 2015 was essentially flat at approximately two SAIDI minutes. This performance can be associated with REP activities such as:
 - a. 34.5 kV Substation Breaker replacement program
 - b. Animal Protection in Substations
 - c. Efforts made reducing the corrective maintenance backlog.

Eversource SAIDI - NHPUC Criteria



Top 50 Hit List SAIDI Contribution from year to year NHPUC Criteria

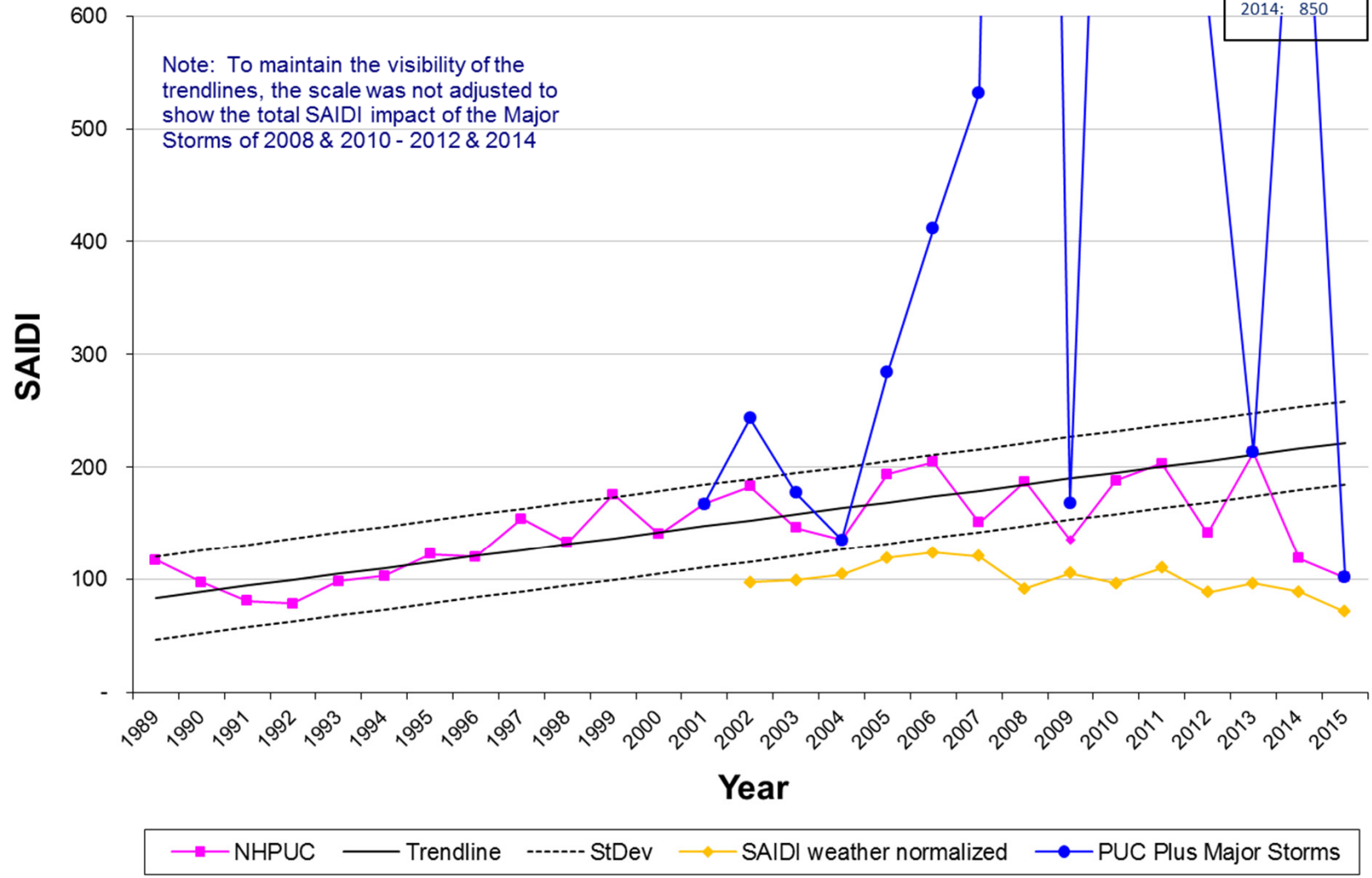


Eversource SAIDI - NHPUC Criteria

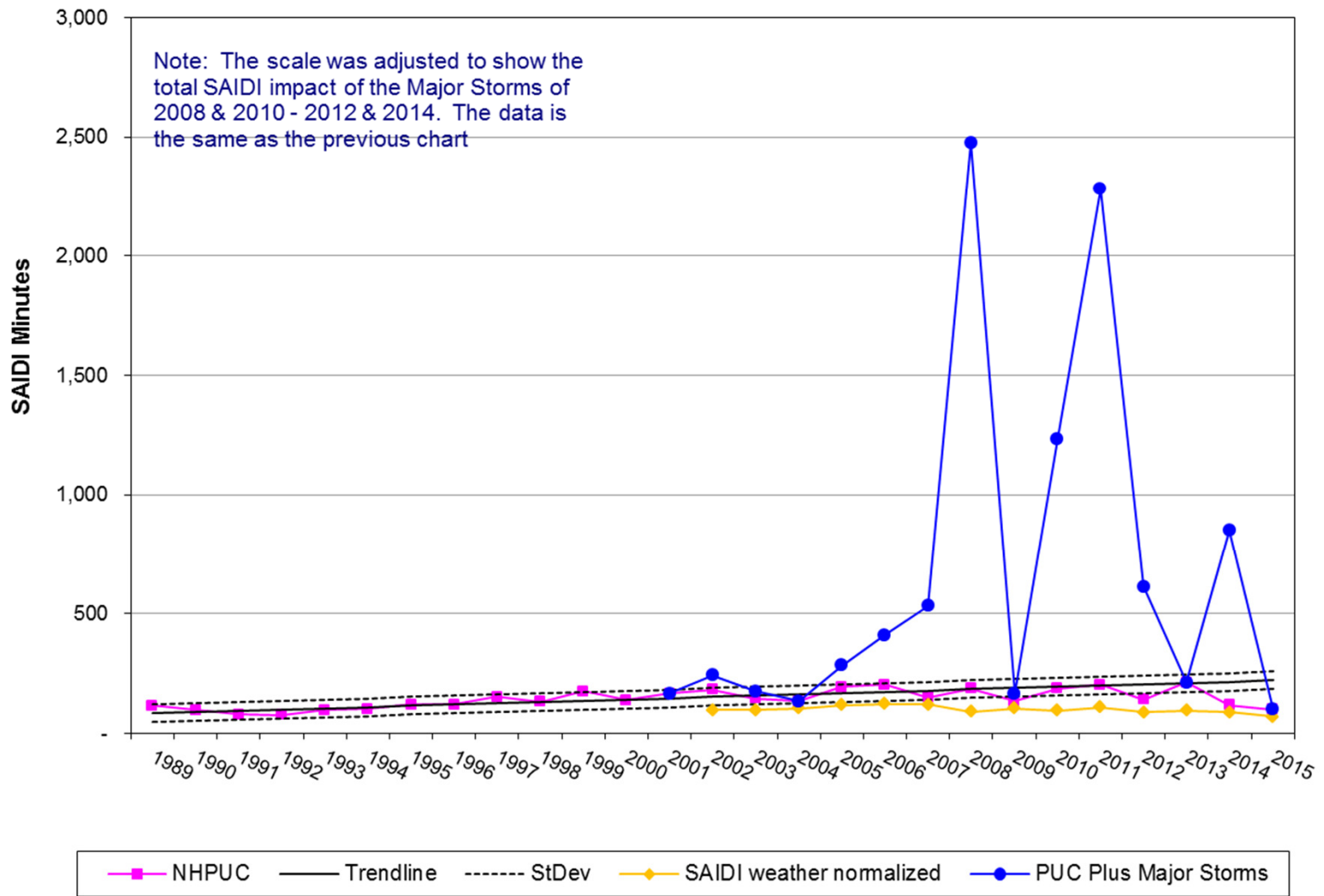
With and Without Storms

Off scale SAIDI values:
 2008: 2477
 2010: 1236
 2011: 2281
 2012: 613
 2014: 850

Note: To maintain the visibility of the trendlines, the scale was not adjusted to show the total SAIDI impact of the Major Storms of 2008 & 2010 - 2012 & 2014



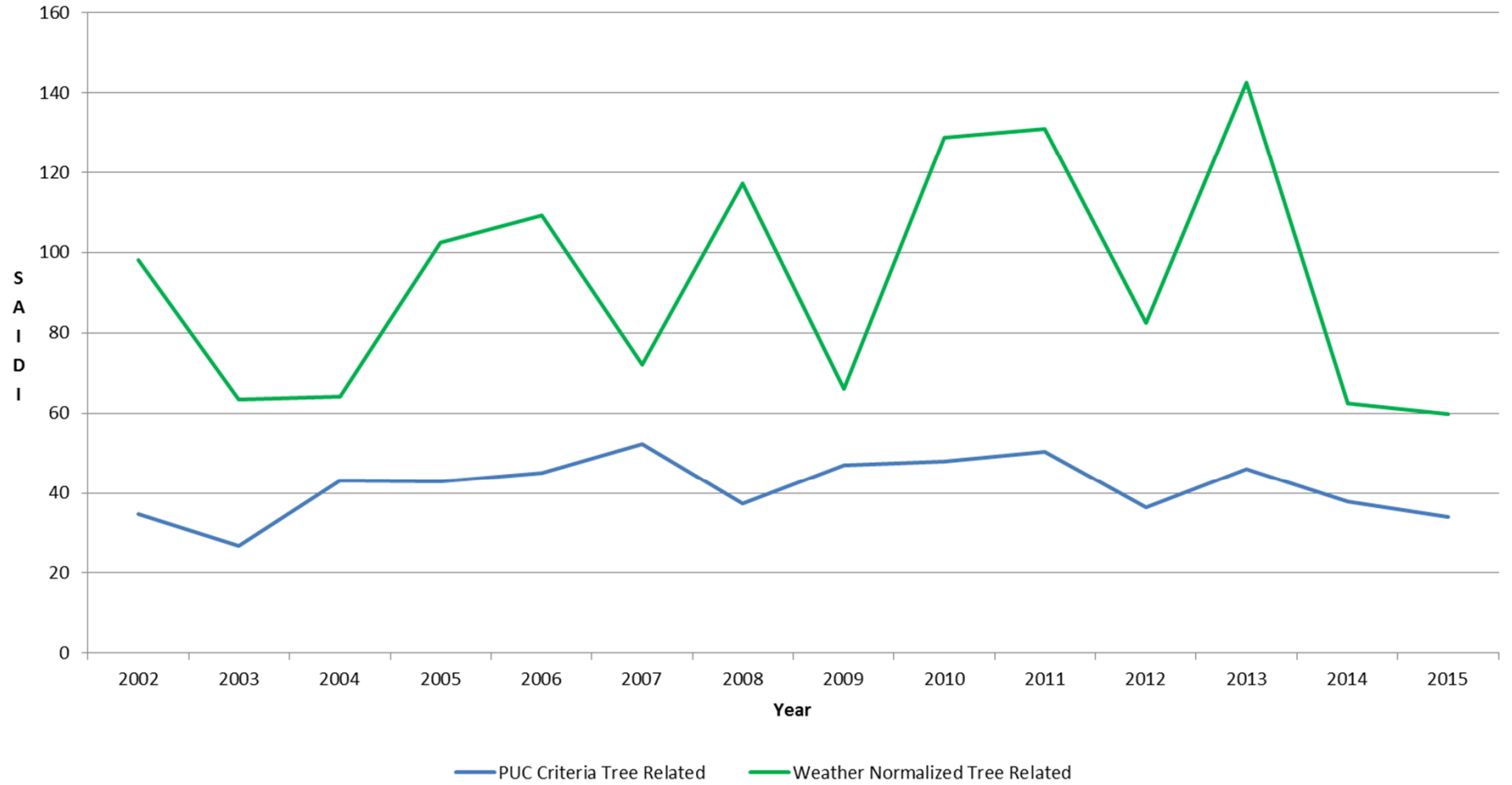
Eversource SAIDI - NHPUC Criteria With and Without Storms



Eversource Tree Related SAIDI

NHPUC Criteria

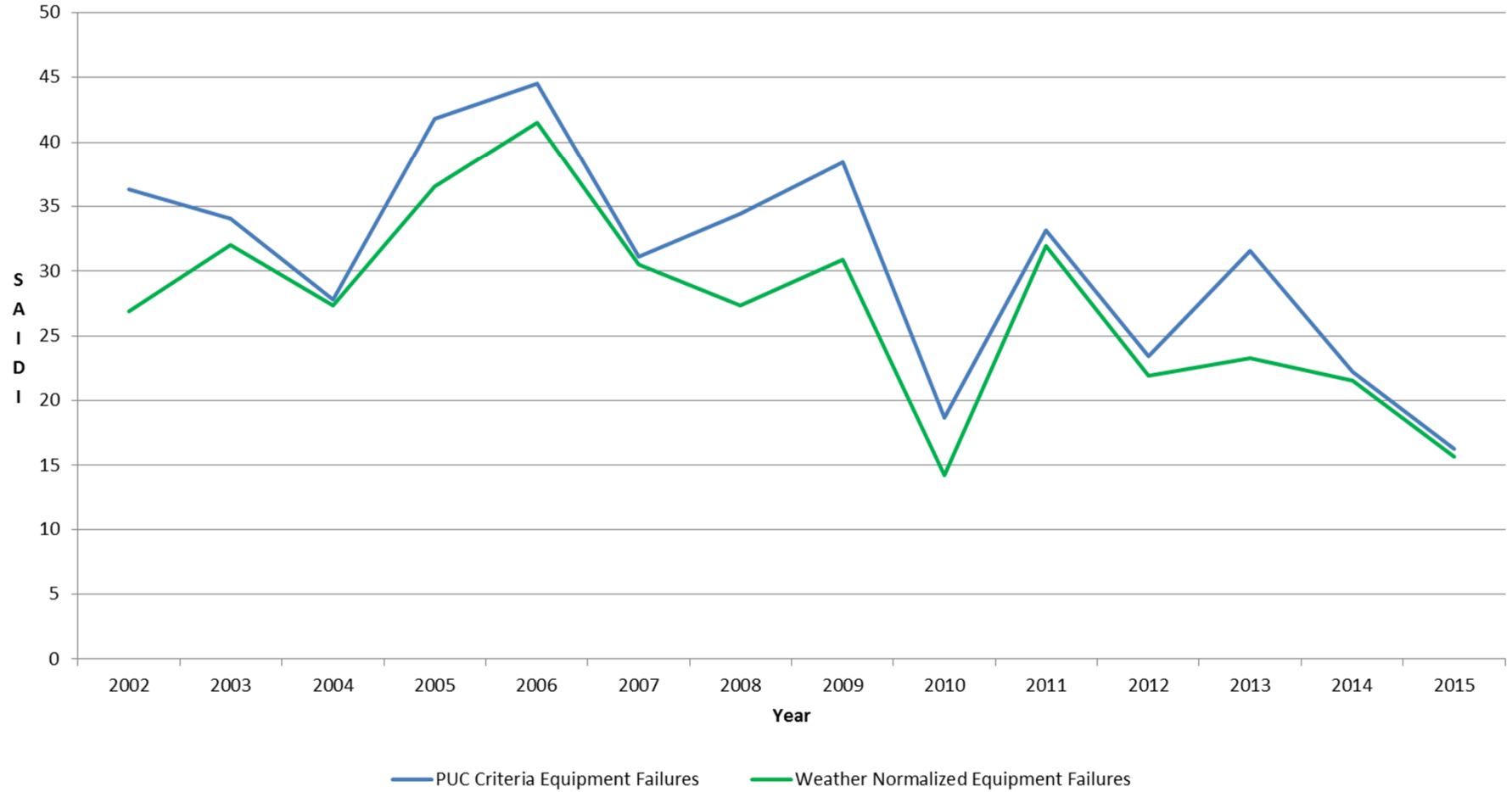
100% of Trees/Limbs, 50% of Snow/Ice Loading, 40% of Patrolled Nothing Found related troubles)



Eversource Equipment Failure Related SAIDI

NHPUC Criteria

100% Equipment Failure and Overload Events - the new OMS no longer contains Improper Install, Loose Connection or Open Neutral Causes



Eversource SAIDI - NHPUC Criteria

Substation Reliability



Section 2

Base REP

2015 O&M Summary

Year End 2015 - Base REP
Summary of Eversource Reliability Enhancement Program – O&M

EVERSOURCE Jan 1 2015 - Dec 31 2015

TRIMRC - VEGETATION MANAGEMENT (O&M)						
	Units	\$ Planned	\$ Expended	Units Planned	Units Completed	Cost Per Unit
Reduce Scheduled Maintenance Trim Cycle	Miles	\$4,580,000	\$4,580,000		1,419	\$3,228
Hot Spot Trimming	Locations	0	\$0	0	0	N/A
Mid Cycle Trimming	Miles	N/A	\$5,636		12	\$470
Inspect Contractor	Miles	N/A ⁽¹⁾	N/A ⁽¹⁾		1,419	N/A
Distribution Rights-of-Way Maintenance Cycle	Acres	\$600,000	\$304,374		1,325	\$230
Total TRIMRC		\$ 5,180,000	\$4,890,010	0	4,175	

NESCRC - National Electrical Safety Code (O&M)						
	Units	\$ Planned	\$ Expended	Units Planned	Units Completed	Cost Per Unit
Full Circuit Patrol	Miles	\$50,000	\$106,268	0	28	\$3,795
Inspect and Repair Underground Systems	Maps	\$400,000	\$7,288	32	89	\$82
Inspect Manholes	Manholes	N/A ⁽¹⁾	N/A ⁽¹⁾	N/A ⁽¹⁾	N/A ⁽¹⁾	N/A
Pole Inspection and Treatment	Poles	\$420,000	\$625,682	24,000	15,681	\$40
Overhead Repair Activity	Repair Orders	\$750,000	\$199,431	N/A	55	\$3,626
Foot Patrol ROW	Miles	\$125,000	\$20,834	0	53.6	\$389
Total NESCRC		\$1,745,000	\$959,503	24,032	15,907	

RELIOM - RELIABILITY (O&M)						
	Units	\$ Planned	\$ Expended	Units Planned	Units Completed	Cost Per Unit
Overhead Switch Maintenance	Switches	\$250,000	\$55,080	48	48	\$1,148
Recloser Maintenance	Reclosers	\$200,000	\$20,946	70	71	\$295
Fault Indicators	Units	\$225,000	\$26,657	5	5	\$5,331
Test & Repair Direct Buried Unjacketed Cable	Runs	\$0	\$0	0	0	N/A
Total RELIOM		\$675,000	\$102,683	123	124	

TOTAL O&M ONGOING FROM BASE REP		\$ 7,600,000	\$ 5,952,196	24,155	20,206	
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(1) Data is embedded in another category as specified in O&M Briefing Sections.

O&M – BASE REP

REDUCE SCHEDULED MAINTENANCE TRIM CYCLE (BASE REP):

Program Description:	Eversource is responsible for trimming approximately 11,000 miles of overhead distribution lines. Reduce the schedule maintenance trimming (SMT) cycle to a system average of less than 4.5 years.
Maintenance Cycle:	For 2015, the trim cycle is 3.8 years – 2,788 miles of regular maintenance, 41 miles of ETT Maintenance (METT) and 100.6 miles of ETT.
Results:	1,419 miles were trimmed under this program in 2015.

HOT SPOT TRIMMING (BASE REP)

Program Description:	Trim locations identified outside normal maintenance cycle that have been identified during reliability improvement inspections.
Maintenance Cycle:	None.
Results:	Hot spot trimming is incorporated into the mid-cycle trimming program.

MID CYCLE TRIMMING (BASE REP):

Program Description:	Perform mid-cycle trimming in areas where vegetation problems develop between maintenance cycles.
Maintenance Cycle:	Prior to 2010, the maintenance trimming program did not identify areas that could benefit from trimming between cycles. The Reliability Enhancement Program targeted a limited mid-cycle program of approximately 50 miles in 2010 and 100 miles annually thereafter. By reducing the maintenance trimming cycle to less than four years, mid-cycle trimming needs have been significantly reduced.
Results:	Twelve miles of mid-cycle trimming were completed in 2015

INSPECT ALL CONTRACTOR WORK (BASE REP):

Program Description:	Inspect 100% scheduled maintenance trimming to ensure that the contractor is trimming to specification within the bounds of owner permissions.
Inspection Cycle:	The quality assurance program currently targets inspections on approximately 80% of the circuit miles. The Reliability Enhancement Program will target inspecting 100% of the circuit miles trimmed annually. The cost of this program is included within the maintenance trimming budget

REDUCE DISTRIBUTION RIGHTS-OF-WAY (ROW) MOWING CYCLE (BASE REP):

Program Description: Reduce the average maintenance mowing cycle of 34.5 kV rights-of-way to an average of 4 years.

Total Unit Population: Eversource is responsible for mowing approximately 7,930 acres of 34.5 kV right-of-ways. Approximately 6,641 acres are in “distribution only” rights-of-way and approximately 1,289 acres in rights-of-way shared with transmission lines.

Inspection Cycle: ROW mowing averages 1,660 acres per year, which results in a four year cycle.

Results: In 2015, 1,325 acres were completed.

FULL CIRCUIT PATROL (BASE REP):

Program Description: Establish a full circuit patrol cycle for distribution lines to inspect for adherence to the National Electrical Safety Code including primary distribution lines, secondaries and services. Identify and log all issues requiring maintenance, additions or replacement, including animal protection, within a reasonable time period. This provides proactive identification of potential problems related to safety, grounding, clearance, attachments, asset maintenance and replacement.

Total Unit Population: Eversource is responsible for approximately 11,000 circuit miles of distribution lines.

Maintenance Cycle: A full circuit patrol of the 11,000 miles was completed in four years. Beyond the initial cycle, perform full circuit patrols on a cycle similar to scheduled maintenance trimming (SMT).

Results: Twenty eight (28) circuits were patrolled in 2015.

INSPECT & REPAIR UNDERGROUND SYSTEMS (BASE REP):

Program Description: Establish an inspection cycle for underground systems to identify and repair any issues and to install fault indicators.

Total Unit Population: Eversource is responsible for approximately 2,142 underground development system maps in addition to underground facilities providing service from the company’s overhead system.

Maintenance Cycle: A complete cycle of the underground system maps was completed in 2014. Eversource Maintenance requirements were revised in 2013 incorporating a 10 year inspection cycle, so 32 inspections were required in 2015.

Results: Thirty two inspections and 57 repairs were completed in 2015.

INSPECT MANHOLES (BASE REP):

Program Description: Establish a cycle program to inspect manholes. A rating is given to each manhole to indicate the structural condition. A program has been established to replace the structurally deficient manholes.

Total Unit Population: Eversource has approximately 634 manholes.

Maintenance Cycle: Inspect on a cycle not to exceed ten years per NU Maintenance Manual, except those requiring inspection more frequently. This program is now part of Inspect and Repair Underground Systems.

POLE INSPECT AND TREAT (BASE REP):

Program Description: Establish a long-term preventive maintenance cycle for roadside distribution poles to inspect, treat, reinforce or replace decayed or damaged poles to ensure reliable and safe use of this asset.

Total Unit Population: Eversource is responsible for approximately 240,000 poles to inspect and treat. Eversource performs pole inspect and treatment in Eversource set areas only.

Maintenance Cycle: 10 years at 24,000 poles annually to inspect and treat (240,000 divided by 10).

Results: Of the approximately 240,000 poles, only 15,681 poles remained to be inspected to complete the inspection of all Eversource poles in the first ten year cycle. These 15,681 poles were inspected in 2015.

OVERHEAD REPAIR ACTIVITY (BASE REP):

Program Description: Complete O&M maintenance orders generated from National Electrical Safety Code (NESC) inspection including work associated with animal guards. This provides proactive identification of potential problems related to safety, grounding, clearance, attachments, asset maintenance and replacement.

Total Unit Population: Dependent on program inspection results.

Maintenance Cycle: Complete maintenance orders within a reasonable period of time from initial identification.

Results: In 2015, 55 NESC repair orders were completed.

FOOT PATROL RIGHT-OF-WAY (BASE REP):

Program Description: Inspect from the ground the 862 miles of overhead line in ROW. Identify for correction all NESC code violations and reliability issues.

Total Unit Population: 862 miles

Maintenance Cycle: Starting in 2015, the Eversource Maintenance Manual recommends an annual helicopter patrol or foot patrol.

Results: In 2015, 53.6 miles of ROW were foot patrolled, but all 862 miles were patrolled by helicopter.

OVERHEAD LINE SWITCH MAINTENANCE (BASE REP):

Program Description: Establish program to maintain and exercise overhead switches to ensure reliable operation when needed. Bypass switching will be installed as needed to facilitate this program going forward.

Total Unit Population: Eversource has approximately 775 switches to be included in this program. Switches are being replaced with reclosers as part of the Distribution Automation program, so the population of switches decreases every year.

Maintenance Cycle: Eversource Maintenance Manual specifies a six year maintenance cycle.

Results: In 2015, 48 switches were maintained.

OVERHEAD RECLOSER MAINTENANCE (BASE REP):

Program Description: Reclosers are scheduled to be maintained on a time and fault operation based frequency or based on remaining contact life.

Total Unit Population: Eversource has 1,713 reclosers installed.

Maintenance Cycle: Starting in 2013, Eversource Maintenance Manual specifies 12 years for oil type reclosers and $\leq 5\%$ contact life or duty cycle for reclosers with contacts under vacuum and modern electronic controls.

Results: In 2015, 71 reclosers were maintained.

INSTALL FAULT INDICATORS (BASE REP):

Program Description: Install fault indicators on equipment and at locations which will facilitate identifying the locations of faults on the distribution system. Installation will reduce the outage duration.

Total Unit Population: Underground - 1:1 ratio with single phase padmount transformers, overhead to be determined.

Maintenance Cycle: Battery life is in excess of 20 years. Fault indicators will be replaced before the end of their useful lives. Underground fault indicator battery replacement will be performed during underground inspections, within an appropriate timeframe. Overhead fault indicator locations will be entered into CASCADE maintenance data base with an appropriate trigger for replacement.

Results: Only five fault indicators required replacement in 2015 and these were completed.

TEST & REPAIR DIRECT BURIED UNJACKETED CABLE - CONCENTRIC NEUTRALS (BASE REP):

Program Description: Testing of direct buried unjacketed cable concentric neutral to determine if there is a sufficient neutral path. If the neutral has degraded to an inadequate level, the cable will be replaced.

Total Unit Population: Eversource has approximately 2,000,000 feet or 5,764 runs of direct buried cable.

Maintenance Cycle: Once.

Results: Testing of unjacketed cable has been incorporated into the REP 3 program. Cable with adequate neutral integrity is now considered as a candidate for rejuvenation.

Section 3

Base REP

2015 Capital Summary

Year End 2015 - Base REP
Summary of Eversource Reliability Enhancement Program – CAPITAL



Jan 1 2015 - Dec 30 2015

CAPITAL - DUE TO BASE REP			
	\$ PLAN	\$ ACTUAL	\$ VARIANCE
Reject Pole Replacement	\$1,187,400	\$828,000	(\$359,400)
Pole Reinforcement	\$0	\$0	\$0
NESC Capital Work	\$967,100	\$825,200	(\$141,900)
Airbreak Switch Replacement	\$0	\$1,600	\$1,600
Direct Buried Cable Replacement	\$991,800	\$2,382,700	\$1,390,900
Direct Buried Cable Injection	\$1,130,500	\$468,600	(\$661,900)
TOTAL BASE REP CAPITAL	\$4,276,800	\$4,506,100	\$229,300

CAPITAL - BASE REP

REJECT POLE REPLACEMENT (BASE REP):

Program Description:	<p>The preventive maintenance cycle for distribution poles to inspect, treat, reinforce or replace decayed or damaged poles to ensure reliable and safe use of this asset will generate approximately 2% of the poles inspected for replacement.</p> <p>Eversource maintains 240,000 poles on its system. These are inspected every 10 years or an average of 24,000 poles per year. 2015 was the final year of the 10 year cycle so fewer poles needed to be inspected. Estimated reject rate is 2% requiring 480 poles to be replaced.</p>
Total Unit Population:	Dependent upon inspection results, estimate 4,800 poles to replace.
Results:	In 2015, 15,681 poles were inspected with 327 found to be defective and requiring replacement (2.1 % defective rate). In 2015, 274 poles were replaced. The remainder will be replaced in 2016.

POLE REINFORCEMENT (BASE REP):

Program Description:	<p>Inspection of poles generates approximately 0.6% of poles that require being made safe or replaced within five working days, approximately 0.8% of poles must be replaced within one year and approximately 0.5% are eligible for reinforcement. Each of the poles eligible for reinforcement are reviewed in the field to determine if they will be reinforced.</p> <p>Eversource maintains 240,000 poles on its system. These are inspected every 10 years or 24,000 poles per year. Approximately 120 poles are reviewed each year in the field to determine if they will be reinforced.</p>
Total Unit Population:	Dependent upon inspection results.
Results:	Due to the change in standard pole from a Class 4 to a Class 2 in order to improve system hardness, the decision was made to replace rather than reinforce the smaller poles. Therefore in 2015 no poles were reinforced.

NATIONAL ELECTRICAL SAFETY CODE (NESC) GENERATED CAPITAL WORK (BASE REP):

Program Description:	<p>Replace distribution plant units with deficiencies identified during NESC inspections which are required to conform to the National Electrical Safety Code (NESC).</p> <p>Correct NESC violations by installing plant units. Most often, the installation of poles and conductors are required to meet clearance problems to buildings, communications conductors, or over streets and roadways.</p>
Total Unit Population:	As of December 30, 2015 the backlog of NESC maintenance orders was 3,689 plant units, up from 3,202 at year end 2014. Additional units are identified during the Overhead Plant inspections.
Results:	The most common requirement is to replace poles to gain additional height to meet clearance to communications conductors or clearance to buildings or structures. In 2015, 51 plant units were replaced.

AIRBREAK SWITCH REPLACEMENT (BASE REP):

Program Description: Of the 725 airbreak switches on the system, 535 are on distribution lines. They are of various manufacturers, models, type, and vintage. This project accounts for the replacement of distribution line switches that are not suitable to be maintained, but remain in service. Replace with a new switch or recloser.

Total Unit Population: 535

Maintenance Cycle: Airbreak Switches are maintained on a six year cycle with inspection every year.

Results: No switches required replacement under this program in 2015.

DIRECT BURIED CABLE REPLACEMENT (BASE REP):

Program Description: Replace direct buried cable with cable in conduit.

2,000,000 feet of direct buried cable was installed at Eversource until 1985 with earliest vintages from 1970. Cable insulation is subject to age failure and bare concentric neutral conductors are subject to corrosion. Testing has indicated that in many locations the concentric neutral is no longer sufficient to provide a path to ground for the electric system. This project is to replace unjacketed direct buried cable in specific developments which have experienced a high failure rate or where cable has been rejected as a candidate for cable injection. Live front transformers and/or pre-1987 elbows are replaced along with the cable.

Total Unit Population: 2,000,000 feet

Results: An estimated 1,676 feet of direct buried cable was replaced with new cable in conduit as part of this project in 2015.

DIRECT BURIED CABLE INJECTION (BASE REP):

Program Description: 2,000,000 feet of direct buried cable was installed at Eversource until 1985 with earliest vintages from 1970. The cable insulation is subject to age failure and the bare concentric neutral is subject to corrosion. This project is to inject unjacketed direct buried cable if it has shown by test that the concentric neutral has the majority of its integrity remaining.

Total Unit Population: 2,000,000 feet of direct buried cable. The actual amount eligible for injection is determined after concentric neutral testing.

Maintenance Cycle: None.

Results: Approximately 21,261 feet of cable was injected in 2015. The cost was \$22.04 per foot, compared to \$1,422 per foot for cable replacement in conduit.

Section 4

REP II - Program Final Report

Period ending December 31, 2015

2015 O&M Summary

Program End - REP II
Summary of Eversource Reliability Enhancement Program – O&M



Jan 1 2015 -Dec 31 2015

TRIMRC - VEGETATION MANAGEMENT (O&M)

	Units	\$ Planned	\$ Expended	Units Planned	Units Completed	Cost Per Unit
Cycle Impact	N/A		N/A ⁽¹⁾		N/A ⁽¹⁾	N/A
ETT Maintenance Trimming	Miles	\$300,000	\$670,537	50	41	\$16,355
Total TRIMRC		\$ 300,000	\$670,537	50	41	

RELIOM - RELIABILITY (O&M)

	Units	\$ Planned	\$ Expended	Units Planned	Units Completed	Cost Per Unit
Install CLFs on 12 kV Main Lines	Fuses	0	\$0	0	0	N/A
GIS O&M	N/A	0	\$397	0	N/A	N/A
O&M Portion of Capital	N/A	0	\$1,383,676	0	N/A	N/A
TOTAL RELIOM		\$ -	\$1,384,073	0	0	

TOTAL O&M FOR REP II		\$ 300,000	\$2,054,610	50	41	
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(1) Data is embedded in the cost of Scheduled Maintenance Trimming.

O&M – REP II

ETT MAINTENANCE TRIMMING (REP II):

Program Description:	The specification and bid price for scheduled maintenance trimming is insufficient to meet Enhanced Tree Trimming (ETT) specifications. The program is to perform maintenance trimming to ETT specifications on lines that ETT has been performed and are on cycle for maintenance trimming.
Total Unit Population:	Total of 573 miles through 2012. Eversource is adding approximately 70 miles per year.
Maintenance Cycle:	Trimming cycle is identical to the maintenance trimming cycle of approximately 4 years.
Results:	41 miles of ETT was performed.

INSTALL CLFS ON 12 KV MAIN LINES (REP II):

Program Description:	Install full range current limiting fuses (CLFs) on 12 kV transformers on circuit main lines.
Total Unit Population:	122 12 kV circuits
Maintenance Cycle:	One time
Results:	No CLFs were installed in 2015 as part of this program.

GEOSPACIAL INFORMATION SYSTEM (GIS) O&M PORTION OF CAPITAL (REP II):

Program Description:	This item represents the O&M portion (allocation) from Capital work related to the GIS project at Eversource.
Results:	2015 work was the completion of the elimination of duplicate circuit numbers in preparation for implementation of OMS. This project is complete.

O&M PORTION OF CAPITAL (REP II):

Program Description:	This represents the O&M portion (allocation) from Capital work related to the Reliability Enhancement Program.
Results:	The O&M portion of REP II capital projects averaged 10.4% in 2015.

Section 5

REP II - Program Final Report

Period ending June 30, 2015

2015 Capital Summary

Program End - REP II
Summary of Eversource Reliability Enhancement Program – CAPITAL



Jan 1 2015 - Jun 30 2015

CAPITAL - REP II			
	\$ PLAN	\$ ACTUAL	\$ VARIANCE
Distribution Line Porcelain Changeout	\$957,500	\$1,005,000	\$47,500
34.5kV Substation Breaker Replacement	\$930,100	\$711,400	(\$218,700)
Enhanced Tree Trimming	\$1,400,000	\$1,226,430	(\$173,570)
Pole Top DSCADA Replacement	\$113,500	(\$16,400)	(\$129,900)
Substation RTU Replacement	\$0	\$9,800	\$9,800
Enable SCADA to Windsor Backup	\$0	\$0	\$0
Distrib. Line Wire Upgrade/Eliminate Narrow ROW	\$0	\$28,100	\$28,100
Reliability Improvements Annual (Ongoing)	\$453,400	\$367,600	(\$85,800)
GIS Capital Project	\$0	\$800	\$800
Hazard Tree Removal	\$1,000,000	\$1,640,872	\$640,872
Full Width ROW Clearing	\$600,400	\$184,660	(\$415,740)
TOTAL REP CAPITAL	\$5,454,900	\$5,158,262	(\$296,638)

CAPITAL – REP II

DISTRIBUTION LINE PORCELAIN PRODUCT CHANGEOUT (REP II):

Program Description:	<p>This targeted capital project, addressing safety and reliability, is a proactive program aimed at eliminating distribution line porcelain equipment with a known impact on the System Average Interruption Duration Index (SAIDI).</p> <p>The specific goal is to replace all designated porcelain equipment with polymer in ten years. The program will specifically replace porcelain 4 1/4" disc insulators, cutouts, non-transformer lightning arrestors, and solid core in-line disconnect switches with new polymer equipment.</p>
Total Unit Population:	Estimate of 150,000 porcelain units to change out. Eversource has 11,000 miles of line so this equates to 13.6 pieces of porcelain per mile on average.
Maintenance Cycle:	150,000 pieces of porcelain divided by 10 years equals 15,000 units per year, in order to complete in 10 years.
Reliability Benefit:	Reduced failure of this product.
Results:	An estimated 2,218 porcelain cutouts, insulators, lightning arrestors and in-line disconnect were replaced with polymer in 2015 through June 30. Failures of polymer insulators and cutouts have been very low.

34.5 KV SUBSTATION BREAKER REPLACEMENT (REP II):

Program Description:	This program addresses the replacement of existing substation 34.5 kV breakers which are old, problematic to repair or operate, unique, or no longer supported by vendors for parts and repair material. There are 251- 34.5 kV breakers on the system of various manufacturers, models, types and vintage.
Total Unit Population:	251- 34.5 kV breakers (replace 2 breakers first program year)
Maintenance Cycle:	Breakers are maintained on a 10 year cycle
Reliability Benefit:	Reduce failure to operate of breakers. Reduce maintenance costs.
Results:	In the first half of 2015, two breakers were replaced as part of REP. An additional two were replaced as part of non-REP projects.

ENHANCED TREE TRIMMING (ETT) (REP II):

Program Description:	<p>Trim main lines for reliability using an enhanced tree trimming (ETT) specification to create ground to sky clearance versus the smaller maintenance trim zone. Expanded clearance is obtained by performing greater off zone takedowns and clearing, and higher than normal vertical clearing. Approximately 11,000 miles of overhead line exists with the project targeted up to 50 miles per year on circuits with highest tree related reliability (top 50 list).</p>
Total Unit Population:	Eversource is responsible for trimming approximately 11,000 miles of overhead distribution line. A portion of these miles are candidates for ETT to improve reliability on main lines.
Reliability Benefit:	Increasing the trim zone at targeted main line locations significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.
Results:	In the first half of 2015, 40.9 miles of ETT was performed.

POLE TOP DSCADA REPLACEMENT (REP II):

Program Description: Replace obsolete remote terminal units (RTUs) at the same time the radios are upgraded to 220 MHz.

Total Unit Population: 135 total unit population. Replace approximately 20 units per year.

Reliability Benefit: Existing RTUs have reliability issues and parts are no longer available for repair. Additionally, the existing hardware at the Electric System Control Center (ESCC) will not accept the installation of any additional units in the field. New RTUs provide advanced technology e.g. time stamped events, line readings, and connection of multiple devices with different communication protocols.

Results: No units were replaced under this program in the first half of 2015. Replacements were rolled into the larger Distribution Automation program.

SUBSTATION RTU REPLACEMENT (REP II):

Program Description: This project is to replace the remaining estimated 15 of 23 older Remote Terminal Units (RTUs) at various substations. Older units are not supported by vendors for repair and utilize single REDAC 70 communication protocol. New RTUs provide time stamp, line reading data, and connection to devices with different communication protocols.

Total Unit Population: 15 of 23 older Remote Terminal Units (replace 3 first program year).

Maintenance Cycle: Substation RTUs normally are repaired or replaced when they fail to operate.

Reliability Benefit: Fewer failures to communicate with substation SCADA controlled devices.

Results: One substation RTU was replaced in the first half of 2015.

ENABLE SCADA TO WINDSOR BACKUP (REP II):

Program Description: Connect existing remote terminal units (RTUs) to the backup computer server in Windsor, CT. Supervisory Control and Data Acquisition (SCADA) refers to a centralized control system to perform automated activities through RTUs.

Total Unit Population: 33 total unit population.

Reliability Benefit: In the event of a computer server failure at the Electric System Control Center in Manchester, NH, all RTUs will be able to be accessed via the backup server at Windsor, CT, providing redundant/reliable operations. This also meets NERC and ISO requirements.

Results: This program was completed in 2014.

DISTRIBUTION LINE WIRE UPGRADE/ELIMINATE NARROW RIGHT-OF-WAY (REP II):

Program Description: Replace #6 and #4 copper conductor in locations where it is susceptible to burn down by tree limbs. Bring overhead lines out onto the street. These lines are currently located in narrow rights-of-way (ROW) which are difficult to patrol and repair and expensive to maintain.

Total Unit Population: Unknown.

Reliability Benefit: Reduce repair time by replacing small copper conductor that burns down and relocating lines out of narrow inaccessible ROWs.

Results: No projects were completed in 2015. Expenditures in 2015 are related to record keeping and administration for 2014 projects.

RELIABILITY IMPROVEMENTS ANNUAL (REP II):

Program Description: This project provides funding for a variety of activities relating to reliability of service, each of which costs less than \$50,000. This includes unfused lateral protection, recloser upgrades and installs, line construction to provide added phases or alternate feeds, switch and manual disconnect installations, and other specific capital work to improve circuit and area reliability. Average cost per typical Engineering Work Request (EWR) is about \$8,900.

Total Unit Population: N/A

Maintenance Cycle: None.

Reliability Benefit: Reduce the number of customers affected by outages by fusing laterals and adding additional sectionalizing devices. Reduce permanent outages by installing reclosers. Perform other activities as identified.

Results: Reliability projects were completed on most hit list (top 50) circuits. .

GIS CAPITAL PROJECT (REP II):

Program Description: Define overall scope and desired end products; determine technology requirements, select vendors and define overall implementation plan to establish a GIS at Eversource. Initial deliverables include establishing Eversource's overhead maps onto a land base, connecting the new GIS to existing internal databases including Customer Information and Vegetation Management with outputs to automate engineering models and analysis tools. Next steps would include capturing underground systems, incorporating switching and distribution operating information (DSCADA), as well as right-of-way lines. Integration with other readily available GIS data from other entities would also be performed such as for wetlands and property ownership information that is available from federal, state and municipal agencies. Eversource would also explore ways to share our information with others. Subsequent steps are to move the GIS to desktop/infield design of line extensions and system upgrades. An outage management system and work management opportunities would then become practical expansions of this system.

Reliability Benefit: Provide a single location for data that can be easily accessed to analyze the distribution system, provide a base for future Outage Management System and provide mapping of the distribution system that is geographically correct.

Results: GIS system is functional and in production. Charges in 2015 were due to post-project accounting reconciliations.

HAZARD TREE REMOVAL (REP II):

- Program Description:** Remove trees greater than 16 inches in diameter within the trim zone and others outside the trim zone that are identified as a hazard to falling onto primary conductors.
- Total Unit Population:** Population is unknown. Candidates are identified during maintenance trimming and by employees during reliability investigations.
- Reliability Benefit:** Identifying and removing trees that have a high likelihood of contacting primary conductors significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.
- Results:** In the first half of 2015, 4,457 trees were removed.

RECLAIM ROWS TO FULL WIDTH (REP II):

- Program Description:** Research easements, determine the easement boundaries and clear ROWs to the full extent of the easements.
- Total Unit Population:** Distribution in ROW is approximately 841 miles. ROWs are prioritized based upon outage histories.
- Reliability Benefit:** Clearing ROWs to the full width of the easements will reduce the risk of tree outages associated with significant SAIDI (customer) impact.
- Results:** In the first half of 2015, 5.7 miles of ROWs were cleared to full width.

Section 6

REP 3 Program Year 1

July 1 2015 – June 30 2016

O&M Summary

Program Year 1 - REP 3
Summary of Eversource Reliability Enhancement Program – O&M



July 1 2015 - Jun 30 2016

REP 3 O&M			
	\$ Planned	\$ Expended	Variance
O&M Portion of Capital	\$1,500,000	\$2,647,849	(\$1,147,849)
Troubleshooter Organization	\$2,400,000	\$2,316,276	\$83,724
Maintenance of DA and Rights-Of-Way	\$750,000	\$63,419	\$686,581

TOTAL O&M REP 3	\$ 4,650,000	\$ 5,027,544
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O&M – REP 3

O&M PORTION OF CAPITAL:

Program Description: This represents the O&M portion (allocation) from Capital work related to the Reliability Enhancement Program.

Results: The O&M portion of REP 3 capital projects averaged 7.95% over the program year.

TROUBLESHOOTER ORGANIZATION:

Program Description: The Troubleshooter Organization consists of two supervisors and 18 Troubleshooter positions, broken up into three six person teams working twelve hour shifts providing coverage 24 hours a day, 365 days a year to the primary coverage area. The primary coverage area consists of the Bedford, Derry, Hooksett, Milford, and Nashua Area Work Centers (AWCs). This coverage area includes 235,704 customers across 1,052 square miles. When available, the Troubleshooters also provide coverage to a secondary coverage area consisting of the Epping, Keene, Newport, Portsmouth, Rochester and Tilton AWCs. This secondary coverage area includes 229,341 customers across 2,642 square miles.

Results: Eversource has utilized this organization to provide improved response times to emergency situations for both customers and municipal partners.

MAINTENANCE OF DISTRIBUTION AUTOMATION (DA) AND RIGHT OF WAY (ROW):

Program Description: This program consists of performing maintenance of distribution lines in ROW to address items such as damaged insulators and heating connectors or splices and maintenance of equipment associated with the significant increase in deployment of distribution automation

Results: In the first program year, maintenance was performed on 48 Distribution Automation devices. Maintenance was also performed on one ROW switch.

Section 7

REP 3 Program Year 1

July 1 2015 – June 30 2016

Capital Summary

Program Year 1 - REP 3
Summary of Eversource Reliability Enhancement Program – CAPITAL



July 1 2015 - June 30 2016

CAPITAL - REP 3				
	PLANT IN SERVICE PLAN	PLANT IN SERVICE ACTUAL	\$ VARIANCE	ADDITIONAL PLANT IN SERVICE July 2016
Distribution Automation/SCADA	\$14,000,000	\$12,709,685	(\$1,290,315)	\$1,916,864
Pole top Distribution Automation devices		\$12,487,670		\$1,912,168
Substation Automation		\$222,015		\$4,696
Line Sensor Project		\$0		
Telecom Expansion to Support Automation		\$0		
Field Connectivity Survey	\$3,000,000	\$0	(\$3,000,000)	
Direct Buried Cable Replacement/Rejuvenation	\$2,000,000	\$2,067,425	\$67,425	\$870,912
Direct Buried Cable Replacement		\$1,837,055		\$521,666
Direct Buried Cable Rejuvenation		\$230,370		\$349,246
Overhead System Reliability	\$9,800,000	\$5,837,205	(\$3,962,795)	\$1,506,956
Circuit Tie Construction		\$1,859,850		\$568,906
Worst Performing Circuits Reliability Impr.		\$1,287,446		\$82,363
Reject Pole Replacement		\$688,819		\$120,325
ROW System Hardening		\$114,229		\$608,501
NESC Capital Repairs		\$412,257		\$67,786
Heatherlite Replacement		\$749,403		\$54,948
Distribution Line Porcelain Replacement		\$725,201		\$4,127
Substation Aging Infrastructure	\$3,100,000	\$1,310,998	(\$1,789,002)	\$2,302,758
Oil Circuit Breaker Replacement		\$186,790		\$996,725
Substation Relay Upgrades		\$1,009,563		\$1,054,239
Eliminate 4 and 12 kV substations		\$114,645		\$251,794
Vegetation Management	\$7,000,000	\$11,375,080	\$4,375,080	\$1,050,827
Enhanced Tree Trimming		\$6,749,975		\$1,303,954
Hazard Tree Removal		\$4,347,169		(\$280,603)
Reclaim ROWs to Full Width		\$277,936		\$27,476
	\$38,900,000	\$33,300,395	(\$5,599,605)	\$7,648,317

Total REP 3 plant in service July 31 2016 is \$40,948,712



REP 3 Year One Plant In Service

July 1 2015 - June 30 2016

	Jul-15	Aug-15	Sep-15	Oct-15	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Total
Distribution Automation													
Central Region Pole Top DA Devices			\$ 236,406	\$ 137,237	\$ 52,022	\$ 158,095	\$ 191,700	\$ 2,156	\$ 154,732	\$ 154,232	\$ 343,847	\$ 310,309	\$ 1,740,737
Eastern Region Pole Top DA Devices			\$ 132,716	\$ 141,164	\$ 519	\$ 62,821	\$ 431,111	\$ 358,821	\$ 805,648	\$ 76,402	\$ 558,515	\$ 180,832	\$ 2,748,549
Northern Region Pole Top DA Devices					\$ 78,158	\$ (4,059)	\$ 122,526	\$ 113,234	\$ 441,148	\$ 23,747	\$ 247,935	\$ 354,807	\$ 1,377,494
Western Region Pole Top DA Devices			\$ 54,648	\$ 200,310	\$ 63,610	\$ 60,121	\$ 71,543	\$ 264,026	\$ 2,302,684	\$ 1,310,928	\$ 855,402	\$ 626,591	\$ 5,809,861
Southern Region Pole Top DA Devices										\$ 111,422	\$ 464,684	\$ 234,922	\$ 811,028
Substation Automation												\$ 222,015	\$ 222,015
Line Sensor Project													\$ -
Telecom Expansion to Support Automation													\$ -
Field Connectivity Survey													\$ -
Direct Buried Cable Replacement / Rejuvenation													
Direct Buried Cable Replacement							\$ 77,458	\$ 511,245	\$ 204,148	\$ 216,000	\$ 119,430	\$ 708,776	\$ 1,837,055
Direct Buried Cable Rejuvenation											\$ 56,847	\$ 173,523	\$ 230,370
OH System Reliability													
Circuit Tie Construction									\$ 200,567	\$ 21,743	\$ 444,422	\$ 1,193,118	\$ 1,859,850
Worst Performing Circuits Reliability Improvements						\$ 54,975	\$ 52,114	\$ 44,084	\$ 74,377	\$ 34,184	\$ 19,599	\$ 1,008,113	\$ 1,287,446
Reject Pole Replacement					\$ 220	\$ 532	\$ 108,222	\$ 133,414	\$ 115,077	\$ 146,966	\$ 79,856	\$ 104,531	\$ 688,819
ROW System Hardening			\$ 7,951	\$ 1,634	\$ 190	\$ (168)		\$ (0)			\$ 9,306	\$ 95,315	\$ 114,229
NESC Capital Repairs					\$ 7,125	\$ 27,343	\$ 12,213	\$ 11,250	\$ 113,453	\$ (6,260)	\$ 77,417	\$ 169,715	\$ 412,257
Heatherlite Replacement							\$ 17,864	\$ 54,067	\$ 157,689	\$ 3,812	\$ 268,705	\$ 247,266	\$ 749,403
Distribution Line Porcelain Replacement						\$ 838	\$ 27,583	\$ 25,839	\$ 41,806	\$ 429,917	\$ 169,304	\$ 29,914	\$ 725,201
Substation Aging Infrastructure													
Oil Circuit Breaker Replacement												\$ 186,790	\$ 186,790
Substation Relay Replacements							\$ 251,771	\$ 999	\$ 239,724		\$ 198	\$ 516,871	\$ 1,009,563
Eliminate 4 & 12 kV Substations								\$ 33,237	\$ 569	\$ 50,840	\$ 30,253	\$ (253)	\$ 114,645
Vegetation Management													
Enhanced Tree Trimming							\$ 1,211,071	\$ 52,448	\$ 231,300	\$ 3,699,003	\$ 750,333	\$ 805,820	\$ 6,749,975
Hazard Tree Removal							\$ 1,787,036	\$ 10,350	\$ 832,190	\$ 553,919	\$ 508,642	\$ 655,033	\$ 4,347,169
Reclaim ROWs to Full Width									\$ 78,659	\$ 128,475	\$ 49,207	\$ 21,594	\$ 277,936
Grand Total	\$0	\$0	\$ 431,721	\$ 480,344	\$ 201,845	\$ 360,498	\$ 4,362,212	\$ 1,615,168	\$ 5,993,772	\$ 6,955,330	\$ 5,053,901	\$ 7,845,602	\$ 33,300,393

CAPITAL – REP 3

DISTRIBUTION AUTOMATION/SCADA

Program Description: This program consists of Pole Top Distribution Automation Devices, Substation Automation, Line Sensor Project, and Telecom Expansion to Support Automation.

Pole Top Distribution Automation Devices:

Program Description: Install Pole-Top Devices with SCADA control.

Total Unit Population: Install devices to allow sectionalizing of customers into blocks of 500 or fewer.

Reliability Benefit: Remote control of sectionalizing devices allows operators in the company's dispatch centers to respond to troubles by sectionalizing down to the fewest number of customers impacted. This decreases the duration of outages experienced by customers by restoring power where possible and minimizing the area which responding crews have to patrol.

Results: A total of 227 units were placed in service.

Substation Automation:

Program Description: Expand SCADA control to 4 and 12 kV substations.

Total Unit Population: 162 substations

Reliability Benefit: Remote indication and control of substation circuit breakers allows quicker response to outages by providing operators with indication when the devices operate. Operators are then able to remotely operate the circuit breakers to assist crews working in the field

Results: SCADA control was added to a total of 27 substations.

Line Sensor Project:

Program Description: The Line Sensor program is a pilot program using the Tollgrade sensor. Sensors will be installed on distribution substation getaway conductors and on large step down transformer locations and report back to a central database using cellular communications.

Total Unit Population: N/A

Reliability Benefit: These sensors will provide circuit loading and fault indication in locations without automated devices at a lower cost than adding DA.

Results: No units were installed.

Telecom Expansion to Support Automation:

Program Description: Expand Eversource’s private radio network to support pole top DA equipment.

Total Unit Population: Install 25 new base station radios.

Reliability Benefit: Expansion of Eversource’s radio network is required in order to allow the remote control of distribution automation devices in areas not currently covered.

Results: No new base stations were placed in service in the first year of the program. Work is in progress at 25 locations and anticipated to be complete in the first quarter of 2017.

FIELD CONNECTIVITY STUDY:

Program Description: Accurately map each customer to the correct transformer, phase, and protective device in GIS which will enhance the accuracy and effectiveness of the OMS implementation and outage reporting to our customers.

Reliability Benefit: The increased accuracy following the Field Connectivity Survey significantly improves identification of fault locations and priorities for outage response, resulting in shorter outage durations and will provide better data to support post storm analysis and reporting.

Results: Field survey of Hooksett and Bedford AWCs is complete and undergoing QA/QC. Field survey of four additional AWCs has begun.

DIRECT BURIED CABLE REPLACEMENT AND REJUVENATION:

Program Description: This program consists of injecting aged but serviceable cable to extend its life and replacing cable which has reached the end of its useful life.

Direct Buried Cable Replacement:

Program Description: Replacement of direct buried (DB) unjacketed cable which has reached the end of its useful life. The DB cable is replaced with new jacketed cable in conduit to extend the life of the cable and shorten repair times should cable failure occur.

Total Unit Population: Eversource has approximately 2,000,000 feet of direct buried cable.

Reliability Benefit: Reduce the number of outages which customers served from the DB cable experience.

Results: Approximately 26,333 feet of DB cable was replaced.

Direct Buried Cable Rejuvenation:

Program Description: DB cable which maintains the integrity of the concentric neutral is injected to extend the useful life of the cable. This is a cost effective alternative to replacing the cable when conditions allow.

Total Unit Population: Eversource has approximately 2,000,000 feet of direct buried cable. Not all cable is suitable for injection.

Reliability Benefit: Reduce the number of outages which customers served from the DB cable experience.

Results: Approximately 42,472 feet of DB cable was injected.

OVERHEAD SYSTEM RELIABILITY:

Program Description: This program consists of Circuit Tie Construction, Worst Performing Circuits Reliability Improvements, Reject Pole Replacements, ROW System Hardening, NESC Capital Repairs, Heatherlite Replacement, and Distribution Line Porcelain Replacement.

Circuit Tie Construction:

Program Description: Construct circuit ties for large radial circuits which would allow a backup source of power with Distribution Automation.

Total Unit Population: N/A

Reliability Benefit: Constructing circuit ties and installing associated distribution automation devices allows for restoration of service to the majority of the customers fed from these circuits while repairs are made to the cause of the outage.

Results: Four projects impacting 8,768 customers were completed.

Worst Performing Circuits Reliability Improvements:

Program Description: This project provides funding for a variety of activities relating to reliability of electric service, each of which costs less than \$50,000. This includes unfused lateral protection, recloser upgrades and installs, line construction to provide added phases or alternate feeds, switch and manual disconnect installations, and other specific capital work to improve circuit and area reliability. Average cost per typical Engineering Work Request (EWR) is about \$8,900.

Total Unit Population: N/A

Maintenance Cycle: None.

Reliability Benefit: All projects are intended to reduce the number of outages and/or reduce the number of customers affected by an outage.

Results: 28 Reliability projects were completed on hit list (top 50) circuits.

Reject Pole Replacements:

Program Description: This project provides funding for the replacement of decayed or damaged poles identified through the annual pole inspection and treatment program, and includes the inspection of approximately 24,000 poles annually.

Total Unit Population: 240,000 poles

Maintenance Cycle: None.

Reliability Benefit: Reliable performance and safety of poles in high winds, heavy wet snow, pole accidents, or other events which cause undue stress in addition to normal service of this asset.

Results: During the program year from July 1 2015 through June 30 2016, 11,085 poles were inspected and 170 were found to be defective and required replacement (1.5% defective rate). A total of 232 poles were replaced.

ROW System Hardening:

Program Description: This project provides funding for rebuilding portions of lines in ROW to improve operational performance. Typical work involves replacing poles and crossarms, additional guying and replacing insulators.

Total Unit Population: N/A

Maintenance Cycle: None.

Reliability Benefit: Strengthening ROW lines reduces the frequency of outages on these lines which are often in locations which are difficult to reach without specialized equipment and construction methods such as portable matting for crossing wetlands.

Results: Projects were completed on the ROW portions of three lines.

NESC Capital Repairs:

Program Description: Replace distribution plant units with deficiencies identified during NESC inspections which are required to conform to the National Electrical Safety Code (NESC)

Total Unit Population: N/A

Maintenance Cycle: 10 year inspection cycle

Reliability Benefit: This work is required to conform to NESC requirements.

Results: The most common requirement is to replace poles to gain additional height to meet clearance to communication conductors or clearance to buildings or structures. 126 locations were addressed during the program year.

Heatherlite Replacement:

Program Description:	This targeted capital project, addressing safety and reliability, is a proactive program aimed at eliminating fiberglass "Heatherlite" brackets and installing crossarms.
Total Unit Population:	Estimate of 26 lines or sections of lines with Heatherlite brackets.
Maintenance Cycle:	None
Reliability Benefit:	Reduced failure of this product.
Results:	Heatherlite brackets were replaced with crossarms on approximately 275 structures.

Distribution Line Porcelain Replacement:

Program Description:	<p>This targeted capital project, addressing safety and reliability, is a proactive program aimed at eliminating distribution line porcelain equipment with a known impact on the System Average Interruption Duration Index (SAIDI).</p> <p>The specific goal is to replace all designated porcelain equipment with polymer in ten years. The program will specifically replace porcelain 4¼" disc insulators, cutouts, non-transformer lightning arrestors, and solid core in-line disconnect switches with new polymer equipment.</p>
Total Unit Population:	Estimate of 150,000 porcelain units to change out. Eversource has 11,000 miles of line so this equates to 13.6 pieces of porcelain per mile on average.
Maintenance Cycle:	150,000 pieces of porcelain divided by 10 years equals 15,000 units per year.
Reliability Benefit:	Reduced failure of this product.
Results:	An estimated 3,387 porcelain cutouts, insulators, lightning arresters and in-line disconnect were replaced with polymer units in the program year. Failures of polymer insulators and cutouts have been very low.

SUBSTATION AGING INFRASTRUCTURE:

Program Description: This program consists of Oil Circuit Breaker Replacement, Substation Relay Upgrades, and 4 & 12 kV Substation Elimination

Oil Circuit Breaker Replacement:

Program Description: This program addresses the replacement of existing substation oil circuit breakers which are old, problematic in repair or operation, unique or no longer supported by vendors for parts and repair material. There are 151 oil circuit breakers on the system of various voltages, manufacturers, models, types and vintage.

Total Unit Population: 151 oil circuit breakers

Maintenance Cycle: Breakers are maintained on a 12 year cycle at the time the substation is maintained.

Reliability Benefit: Reduce failure to operate of breakers.

Results: Six (6) oil circuit breakers were replaced as part of REP 3 during the program year. Note that 8 additional breakers were replaced under the program but the projects were not placed in service until July 2016.

Substation Relay Upgrades:

Program Description: This project is intended to replace obsolete electromechanical relays with new numerical relays. Electromechanical relays have limited setting flexibility, can be subject to calibration issues, and are affected by environmental conditions such as dust and vibration.

Total Unit Population: There are sixty-one 34.5 breakers that still have electromechanical relays installed for feeder protection.

Maintenance Cycle: Electromechanical relays are maintained on a cycle of between 2 and 6 years, depending on their function.

Reliability Benefit: The setting flexibility of numerical relays result in additional protection devices that can be installed and coordinated. Additional feeder protection devices reduce the outage zone and associated customer counts for a fault. The ability to help locate and analyze faults, especially in ROWs, can lessen outage times and provide dispatchers detailed information for use in operating the electric system during an event. Also, numerical relays can be integrated into the DMS design.

Results: Twenty-four (24) numerical relays were placed into service during the program year.

Eliminate 4 & 12 kV Substations:

Program Description:	This project is to eliminate old 4 and 12 kV substations by replacing with a new padmounted step transformer or converting to a higher voltage. Many of these stations are more than 50 years old and have obsolete equipment for which spare parts are no longer available.
Total Unit Population:	Eversource has 41 substations older than 50 years. Not all are candidates for elimination.
Maintenance Cycle:	Transformers and circuit breakers are normally maintained on a 12 year cycle.
Reliability Benefit:	Replacing obsolete equipment with new will reduce outages caused by equipment failure.
Results:	Two substations, Jaffrey and Ashuelot, were eliminated.

VEGETATION MANAGEMENT:

Program Description:	This program consists of Enhanced tree trimming, Hazard tree removal, and Full width ROW clearing
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Enhanced Tree Trimming (ETT):

Program Description:	Trim main lines for reliability using an enhanced tree trimming (ETT) specification to create ground to sky clearance versus the standard maintenance trim zone. Expanded clearance is obtained by performing greater off zone takedowns and clearing and higher than normal vertical clearing. Approximately 11,000 miles of overhead line exists with the project targeted up to 50 miles per year on circuits with highest tree related reliability (top 50 list).
Total Unit Population:	Eversource is responsible for trimming approximately 11,000 miles of overhead distribution line. A portion of these miles are candidates for ETT to improve reliability on main lines.
Reliability Benefit:	Increasing the trim zone at targeted main line locations significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.
Results:	161.5 miles of ETT was performed during the program year

Hazard Tree Removal:

Program Description:	Remove trees greater than 16 inches in diameter within the trim zone and others outside the trim zone that are identified as a hazard to falling onto primary conductors.
Total Unit Population:	Population is unknown. Candidates are identified during maintenance trimming and by employees during reliability investigations.
Reliability Benefit:	Identifying and removing trees that have a high likelihood of contacting primary conductors significantly reduces the risk of tree outages associated with significant SAIDI (customer) impact.
Results:	19,792 trees were removed during the program year

Reclaim ROWs to Full Width:

Program Description:	Research easements, determine the easement boundaries and clear ROWs to the full extent of the easements.
Total Unit Population:	Distribution in ROW is approximately 841 miles. ROWs are prioritized based upon outage histories.
Reliability Benefit:	Clearing ROWs to the full width of the easements will reduce the risk of tree outages associated with significant SAIDI (customer) impact.
Results:	13.2 miles of ROW were cleared to their full width during the program year

Section 8

2015 Other Activities

2015 ACTIVITIES ON TOP 50 RANKED BY COSAIDI IN 2013

2013 CoSAIDI Rank	2015 CoSAIDI Rank	Change in Rank Gain (Worse) from 2013	Circuit	AWC	SMT	ETT	NESC Full Circuit Patrol	NESC Repair Activity	Inspect URD Systems	Pole Inspect & Test	Pole Replace or Reinforce	ROW Patrol	Switch Maint	Recloser Maint	Recloser Additions	Test & Repair/ Replace DB Cable	DB Replace	Porcelain Change Out	Other Corrective Actions	Corrective Actions Comments
1	1	0	355X	LANCASTER								X								
2	7	5	316X1	NEWPORT	X			X							X			X	X	DA devices and upgrades.
3	2	(1)	355X10	LANCASTER																
4	12	8	316	NEWPORT								X	X		X			X	X	DA devices and upgrades. Fault indicator installs.
5	9	4	3133X	DERRY									X	X		X			X	4 DA devices. Cable injection.
6	92	86	30W1	LANCASTER																
7	NR	NR	310	LACONIA								X								
8	28	20	73W2	ROCHESTER	X					X										
9	252	243	3152X	EPPING								X								
10	44	34	18W1	FRANKLIN							X									
11	4	(7)	3141X	DERRY									X						X	Replace OCR 141 with vacuum recloser
12	84	72	3410	NEWPORT							X					X		X	X	New DA base radio installation
13	39	26	3128X	DERRY									X	X		X	X		X	4 DA devices. Cable injection.
14	22	8	W13	KEENE								X			X				X	Circuit configuration changes at Court St
15	184	169	63W1	EPPING												X				
16	35	19	1W2	LANCASTER	X	X												X		
17	50	33	42X3	NEWPORT											X				X	Automation added to the recloser feeding this circuit
18	102	84	336X1	CHOCORUA			X	X												
19	3	(16)	3115X12	EPPING		X					X									
20	276	256	3525X3	BERLIN		X														
21	32	11	392X	ROCHESTER								X								
22	NR	NR	311	BEDFORD								X	X						X	11 new DA devices, new circuit tie with Oak Hill S/S
23	31	8	3139X	KEENE			X				X								X	New feed to Plain Rd to improve reliability
24	42	18	25W1	BERLIN	X			X												
25	115	90	55W2	NEWPORT														X	X	Relocation of switch near ROW to improve reliability
26	8	(18)	23X5	MILFORD	X		X								X	X	X	X	X	Added DA devices
27	198	171	34W4	ROCHESTER																
28	473	445	3191	PORTSMOUTH								X								
29	226	197	319X1	PITTSFIELD																
30	289	259	1X4	FRANKLIN		X														
31	40	9	3116X1	CHOCORUA			X	X												
32	182	150	399X8	ROCHESTER														X		
33	122	89	346X1	CHOCORUA	X		X											X		
34	NR	NR	360	BEDFORD															X	4 new DA devices and additional fault indicators
35	103	68	348X1	LANCASTER								X						X		
36	181	145	348X2	LANCASTER								X	X							
37	110	73	336X	CHOCORUA								X								
38	176	138	3137X	EPPING								X				X				
39	568	529	32W2	ROCHESTER		X														
40	65	25	73W1	NEWPORT						X										
41	352	311	337X2	FRANKLIN																
42	55	13	392X1	ROCHESTER														X		
43	260	217	60W1	NEWPORT														X		
44	41	(3)	3120X2	KEENE		X	X				X							X		
45	45	0	313X1	MONADNOCK	X	X													X	DA devices and upgrades.
46	16	(30)	3525X5	BERLIN																
47	56	9	377	EPPING								X	X							
48	38	(10)	348X3	LANCASTER	X						X	X								
49	652	603	42H2	NEWPORT															X	Line removed from ROW to improve access
50	NR	NR	3392	BEDFORD																

37 # Circuits Improving in Rank
 7 # Circuits Worsening in Rank
 99 Avg improvement (change in position) in Rank for all 50 Circuits
 NR NR indicates this circuit had no outages so it is Not Ranked