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) for calendar year 2018.

O&M

Actual O&M spending for the twelve months ended December 31, 2018 under 2018 REP program was $2.03 million. See Section 2 *REP O&M Summary* for details on individual activity cost.

Capital

Capital plant in service for the twelve months ended December 31, 2018 under the 2018 REP program was $2.66 million. See section 3 *Capital Summary* for details on the individual projects.

Reliability

Eversource's SAIDI performance improved in 2018, despite having experienced more storms than in 2017. See Section 1 *NHPUC Reliability Graphs.*

Since the REP was implemented, the trend from 2006 onward has been improved reliability on a weather normalized basis. Eversource's customers continue to see benefits from the REP activities. REP programs are preventing problems from occurring (improving SAIFI) and reducing outage times (improving SAIDI). The REP activities are critical and important in concert with Eversource's continued efforts to maintain and improve the system in the normal course of business.

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. All graphs represent data through the end of 2018.

1. Graphs 1 and 2 depict the Eversource SAIDI – NHPUC Criteria. The Company SAIDI improved in 2018 compared to 2017. The pre-REP trend lines shown are based on data for 1989 through 2005 and are intended to show where SAIDI might have been without the REP program. The second chart shows a trend line for SAIDI for the period since the implementation of REP.

2. Graphs 3 and 4 depict the Eversource SAIDI – NHPUC Criteria With and Without Storms. NHPUC SAIDI (pink line) does not include emergency events which are classified as PUC Major Storms. A Major Storm is defined as an event that results in either: a) 10% or more of Eversource's retail customers being without power in conjunction with more than 200 reported troubles; or b) more than 300 reported troubles during the event. See *Order No. 25,465* at 1. Eversource experienced a total of 9 major storms in 2018 compared to 4 in 2017, and one in 2016. These larger events are shown on this chart over and above the NHPUC reported SAIDI as the dark blue line. Off-scale impacts are shown for the December Ice Storm in 2008, the February wind storm in 2010, Tropical Storm Irene in August 2011, a major snowstorm in October 2011, Hurricane Sandy in 2012, the Thanksgiving weekend storm in 2014, and the October windstorm in 2017.

   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 a total of 21 minor storm days in 2018 compared to 25 in 2017, and 20 in 2016[(1)]. These storms contributed 33 minutes to Eversource's SAIDI performance in 2018, compared to 50 minutes in 2017, and 53 minutes in 2016.

   Subtracting major and minor storm impacts from NHPUC reported SAIDI leaves a Weather normalized SAIDI, which is the yellow line on the graph. As shown, that component continues to be below levels present when REP was initiated in July 2007 and continues to be on a downward trend since that time.

3. Eversource Tree Related SAIDI (graph 5). 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, although it did dip downward slightly in 2018. There is a cumulative effect for vegetation management and we believe the effort from the last half of 2007 through year end 2018 is showing results. Our efforts to establish the target 4.5 year trimming cycle for the distribution system have succeeded. Eversource's trimming cycle remains at approximately 3.9 years, well below the maximum five year cycle required by Puc 307.10 Tree-Pruning Standards. REP activities relating to this are Enhanced Tree Trimming specifications for establishing larger clearance zones and Hazard Tree Removals for trees outside the trim zone identified as having the potential to fall into the lines. Both of these activities were capital work in 2018.

4. Eversource Equipment Related SAIDI (graph 6). The second largest cause group for SAIDI is equipment failures in substations and on distribution lines. These outages have very low correlation to weather so the difference between NHPUC criteria performance and weather normalized performance is small. Results in this area showed a slight uptick in 2018, mostly due to a manufacturing defect on a particular model of recloser. All the affected units were replaced with refurbished units in the first quarter of 2018.

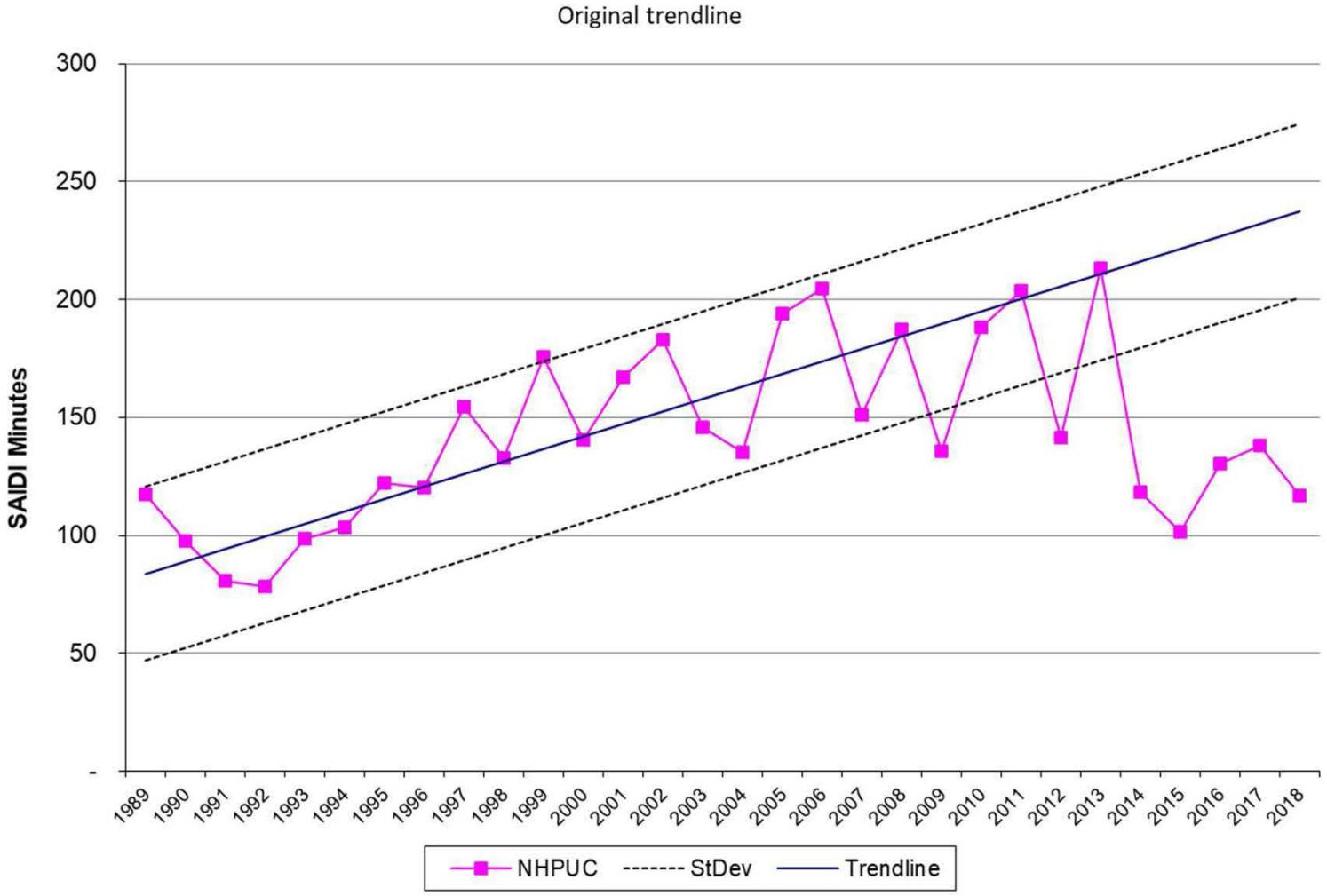
[(1)] For internal reporting purposes, these are referred to as "minor" and "work order" storm days. There were 14 minor storm days plus 7 work order storm days in 2018. These storms are included in reliability reporting statistics.

NHPUC SAIDI Graphs Summary
Reliability Enhancement Program

5. Eversource SAIDI – NHPUC Criteria Substation Reliability (graph 7). 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. Substation SAIDI increased in 2018 due in large part to an instrumentation potential transformer failure at Monadnock Substation in Troy. This event impacted 8,396 customers for up to 83 minutes. Despite this increase substation SAIDI remains below the levels before implementation of the REP. There were a total of six substation events in 2018, four of which were animal related.

6. Top 50 Hit List SAIDI Contribution from Year to Year (graph 8). Each year Eversource reviews SAIDI by circuit and determines which circuits 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. The Top 50 contributed slightly more than 60 minutes to company SAIDI in 2018 (yellow bar). This compares to less than 60 minutes in 2017 and almost 70 minutes in 2015. Two thirds of these minutes (pink line) were due to circuits which were also on the 2017 Top 50 list (purple bar).

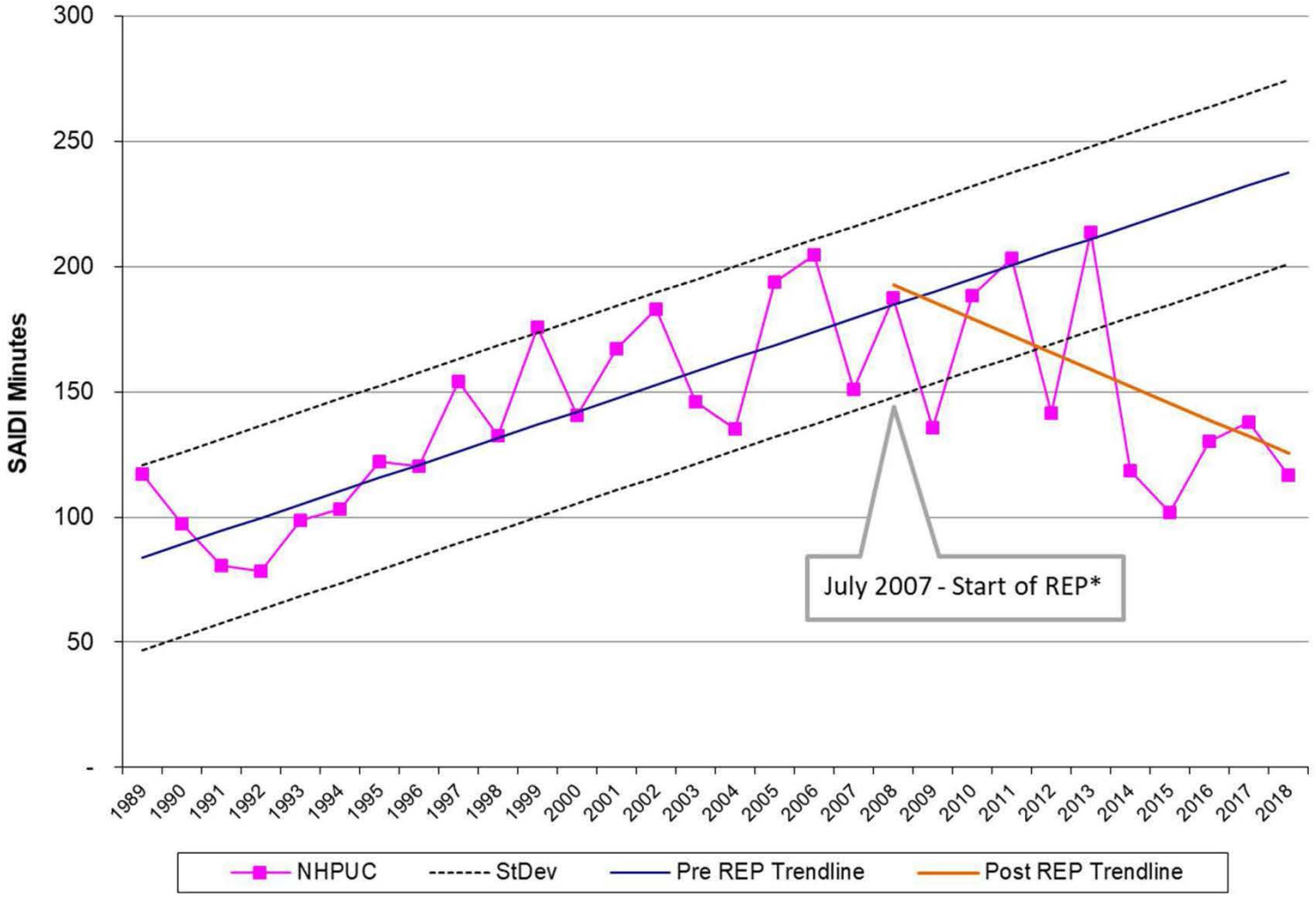
PSNH SAIDI - NHPUC Criteria



Trend Lines are based upon 1989 - 2005 data and are intended to depict where SAIDI might have tracked without the REP Program

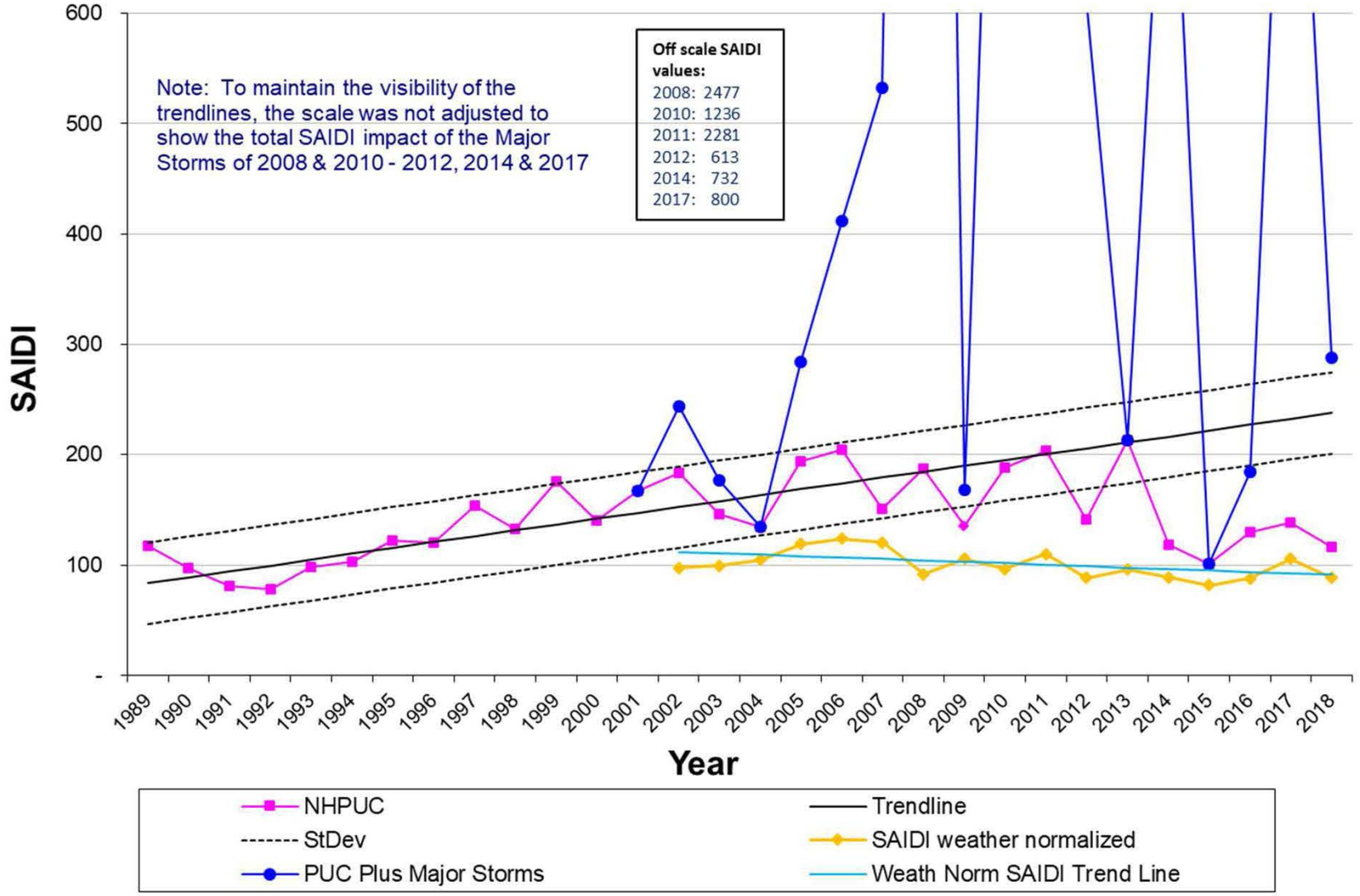
Eversource SAIDI - NHPUC Criteria

Post REP Trendline



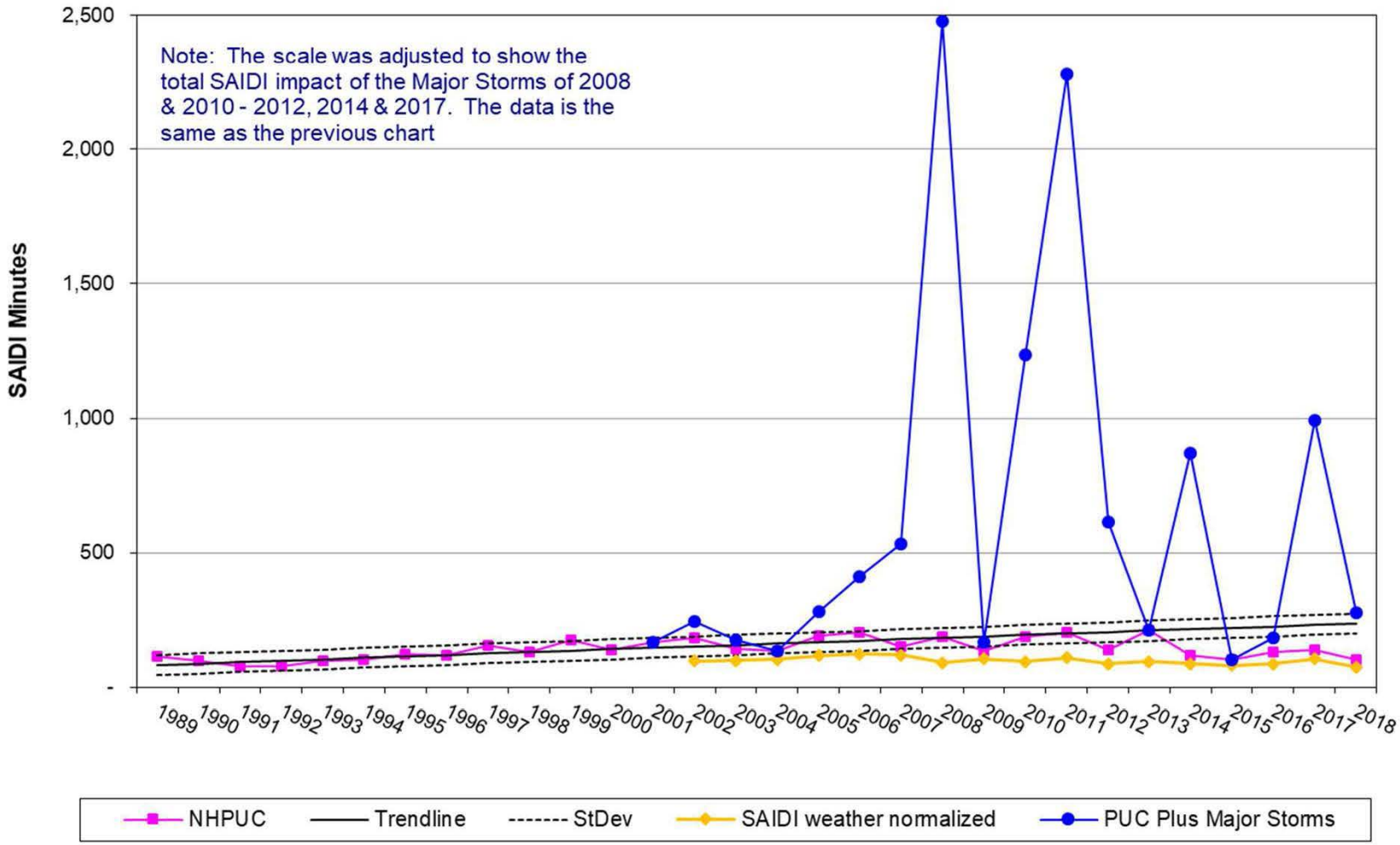
Eversource SAIDI - NHPUC Criteria

With and Without Storms



Eversource SAIDI - NHPUC Criteria

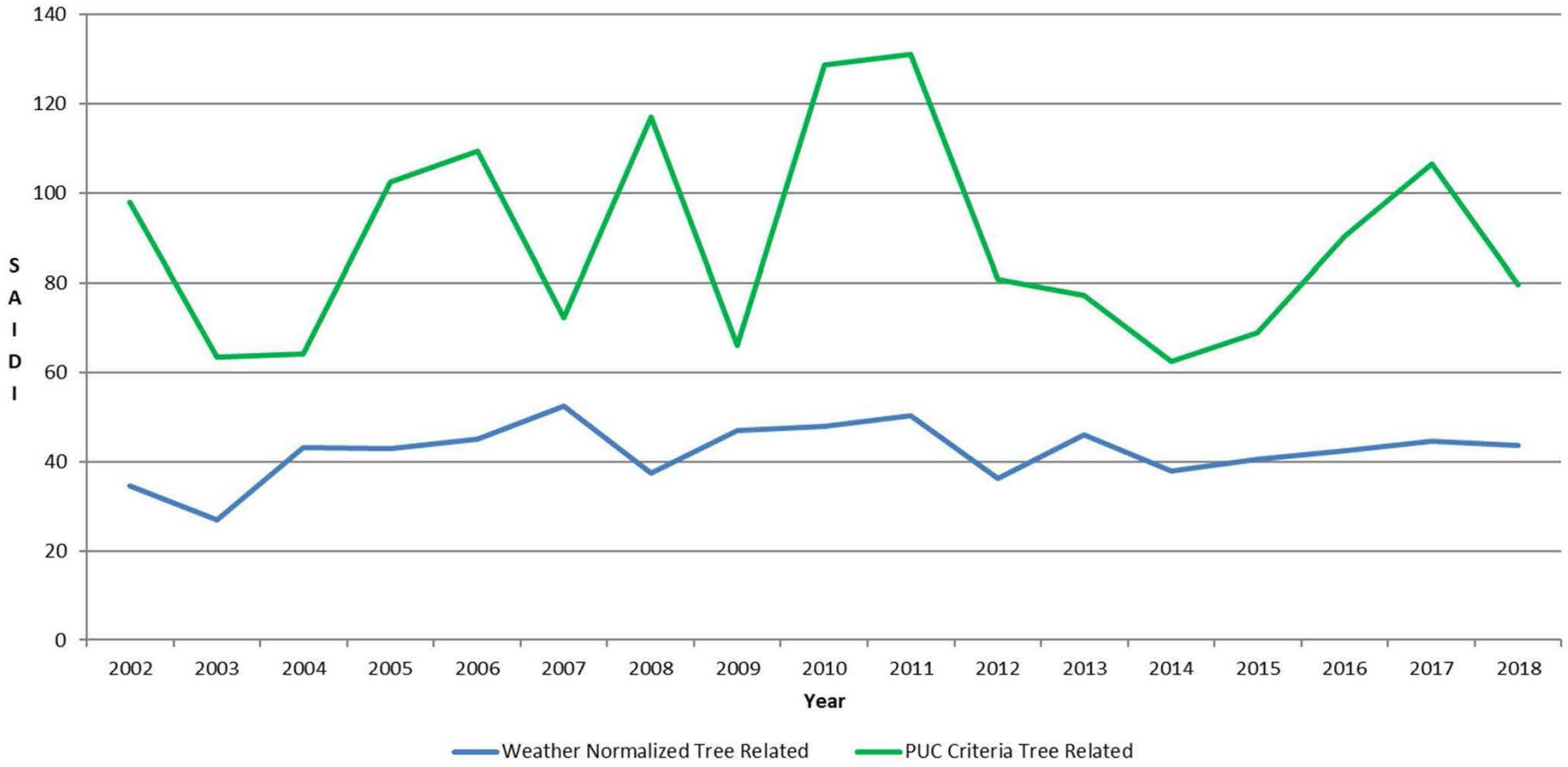
With and Without Storms



Eversource Tree Related SAIDI

NHPUC Criteria

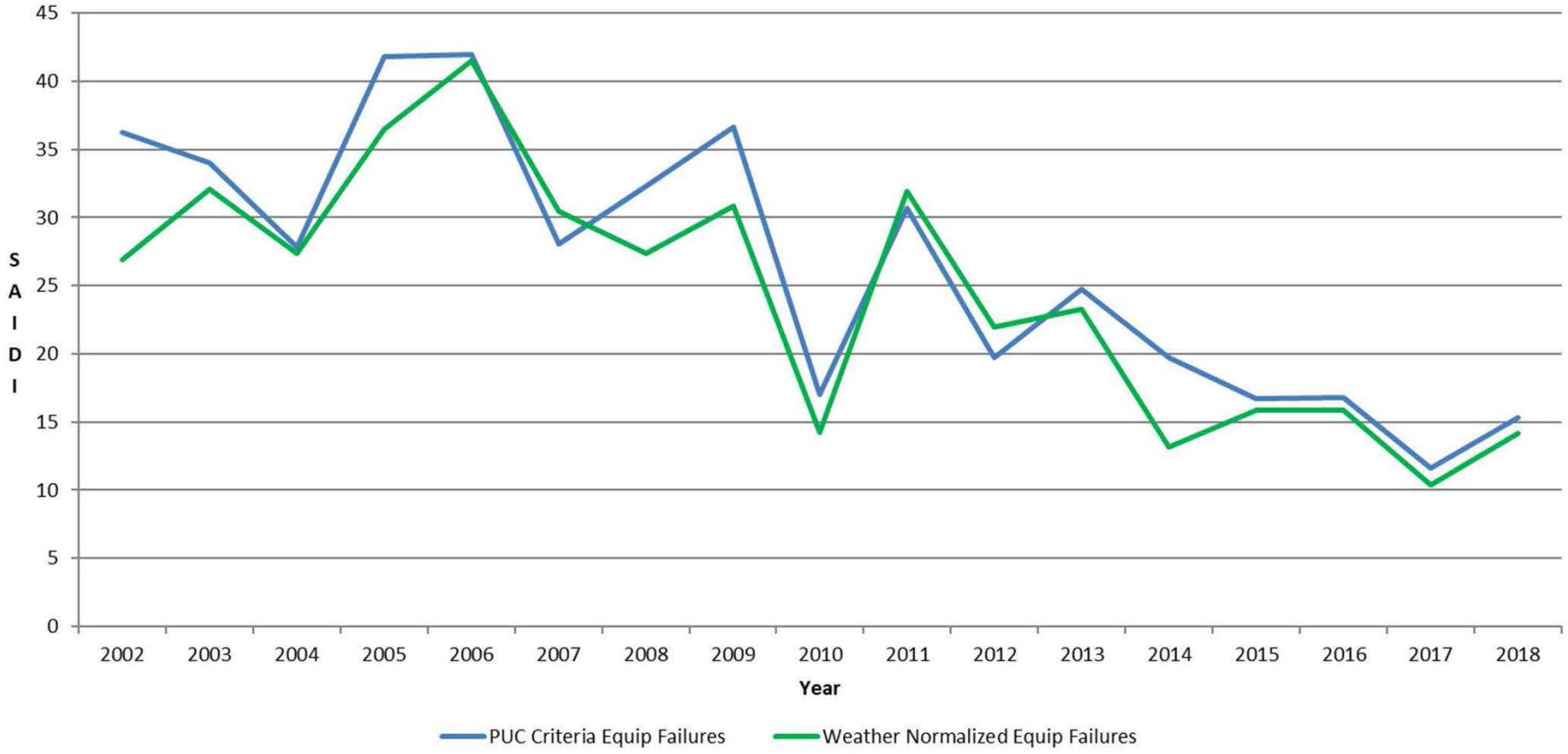
100% of Trees/Limbs, 50% of Snow/Ice Loading, 40% of Patrolled Nothing Found related troubles)



Eversource Equipment Failure Related SAIDI

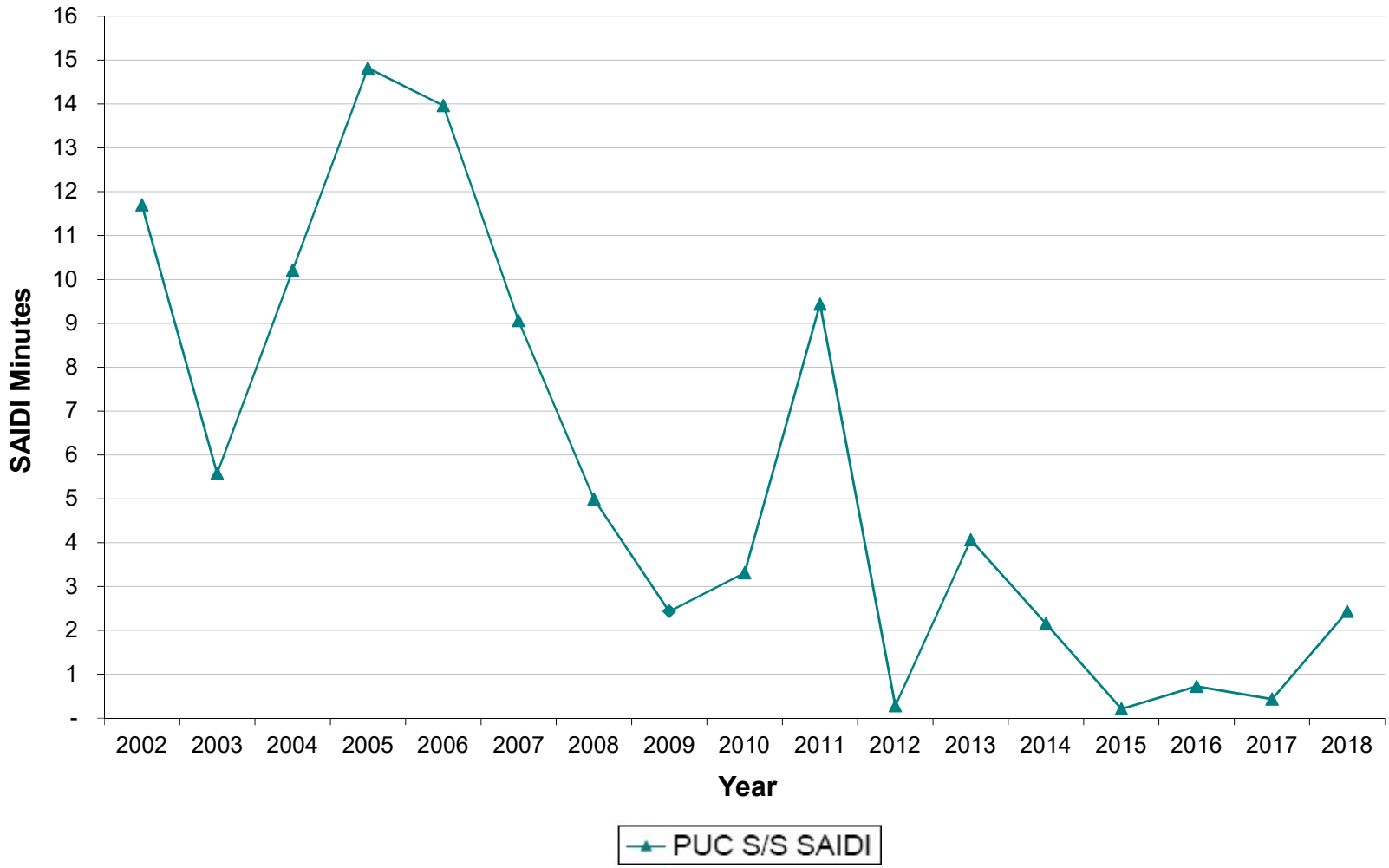
NHPUC Criteria

100% Equipment Failure and Overload Events



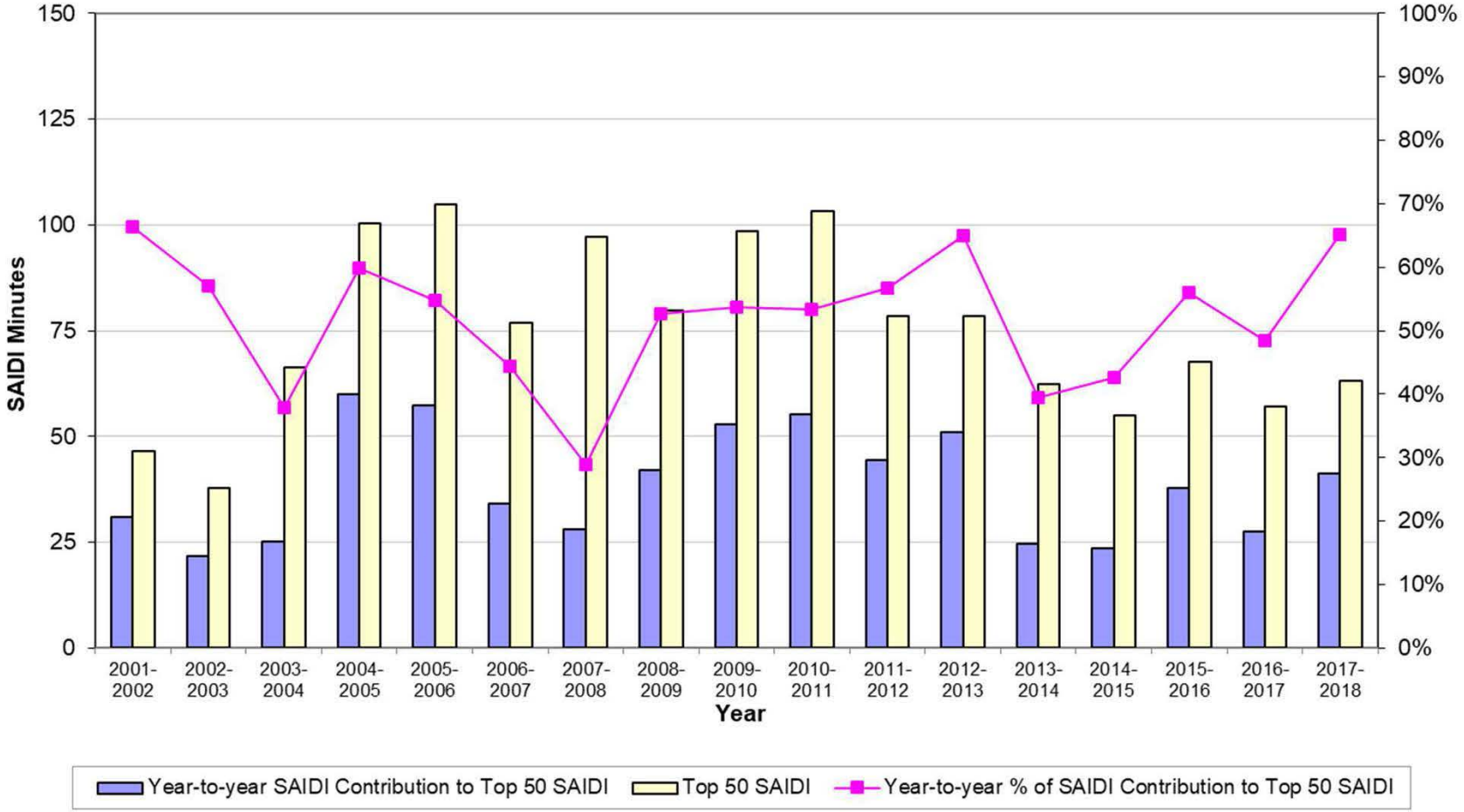
Eversource SAIDI - NHPUC Criteria

Substation Reliability



Top 50 Hit List SAIDI Contribution from year to year

NHPUC Criteria



Section 2

REP O&M Summary

January 1 2018 – December 31 2018

Summary of Eversource Reliability Enhancement Program – O&M

EVERSOURCE

January 1 2018 - December 31 2018

2018 REP O&M			
	$ Planned	**$ Expended**	**Variance**
O&M Portion of Capital	$350,000	$196,864	($153,136)
Troubleshooter Organization	$2,000,000	$1,829,603	($170,397)

TOTAL O&M	**$ 2,350,000**	**$ 2,026,467**	**$ (323,533)**

O&M

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 2018 REP capital projects averaged 6.88% in 2018. Costs were lower than estimated due to the nature of the Capital work completed. New installations have a lower O&M component than relocations of existing facilities and the two capital circuit tie projects consisted of significant new capital plant additions.

$ Plan	$ Actual	$ Variance
$350,000	$196,864	($153,136)

TROUBLESHOOTER ORGANIZATION:

Program Description:

Similar to prior years, the REP provides approximately half of the funding for the original group 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.

The Troubleshooter Organization was recently expanded and now consists of three supervisors and 30 Troubleshooter positions. In addition to the original coverage area, the organization now provides day shift coverage in Rochester and Keene and expanded second shift coverage in the Central region Monday through Friday. The expansion of the Troubleshooter program is not funded through REP.

Results:

Eversource has utilized this organization to provide improved response times to emergency situations for both customers and municipal partners. Actual charges to REP activities were 8.5% lower than estimated.

$ Plan	$ Actual	$ Variance
$2,000,000	$1,829,603	($170,397)

Section 3

Capital Summary

January 1 2018 – December 31 2018

Summary of Eversource Reliability Enhancement Program – CAPITAL

EVERSOURCE

January 1 2018 - December 31 2018

CAPITAL			
	PLANT IN SERVICE PLAN	**PLANT IN SERVICE ACTUAL**	**$ VARIANCE**
Overhead System Reliability	$3,000,000	$101,387	$2,898,613
Circuit Tie Construction	$3,000,000	$101,387	$2,898,613
Vegetation Management	$6,000,000	$2,558,341	$3,441,659
Enhanced Tree Trimming	$4,000,000	$858,348	$3,141,652
Hazard Tree Removal	$2,000,000	$1,699,993	$300,007
	$9,000,000	**$2,659,728**	**$6,340,272**

CAPITAL

Circuit Tie Construction:

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

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.

Plant in service:

$ Plan	$ Actual	$ Variance
$3,000,000	$101,387	($2,898,613)

Results: Two projects were planned under this program – a circuit tie from Keene to Swanzey and a tie in Hinsdale.

The Keene to Swanzey circuit tie was constructed by a combination of Eversource and contract crews. This project was placed in service in January 2019. The STORMS estimate for the work was $1,256,000. Actual cost of the work was $1,389,983 for a difference of $133,983 or 11%. A driver of the cost overrun on this project was Eversource labor. The labor to construct the off-road section by Eversource crews was nearly double the estimate due to the need to have specialized off-road crews travel from Hooksett to Swanzey. Contract labor charges on this project were lower than the estimate as a result of the bidding process. Both Keene and Swanzey are Consolidated Communications maintenance areas which delayed the work and added to costs as poles were not set in the proper location and had to be relocated.

The Hinsdale circuit tie was built by contractors, with the work awarded as a result of a competitive bid process. The project was placed in service in March 2019. The STORMS estimate for the work was $1,577,856. Actual cost of the work was $2,107,922 for a difference of $530,066 or 33%. Direct charges (labor, material, and contract labor) exceeded the estimate by only 5.5%. Changes in overhead rates between the time the project was estimated and when it was completed drove the majority of the cost overrun. There were a number of causes for the failure to complete by the end of 2018, but the major driver was over-commitment by the lowest price bidder, who was working on multiple projects and was unable to ramp up their workforce.

Only work placed in service by December 31, 2018 is included in the reconciliation, so for these two Circuit Tie projects that amounts to $101,387, reflecting the completion of the portion of the Keene to Swanzey circuit tie which was constructed by Eversource crews.

VEGETATION MANAGEMENT:

Program Description: This program consists of Enhanced tree trimming and Hazard tree removal.

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 at up to 115 miles per year on circuits with worst 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: 28.67 miles of ETT was performed under the program at an average cost of $29,939 per mile. Eversource was unable to complete the planned ETT work under this program due to several factors. A lack of contract tree crew resources hampered tree trimming activities. Eversource worked to address this by requesting up to 300 crews from outside New England. The Company was only able to secure approximately 50 additional crews, from as far away as Florida and Louisiana. In addition, significant storm impacts in Massachusetts and Connecticut in the spring of 2018 required the diversion of all available resources to assist in restoring power. Approximately eight weeks of crew resources were lost in NH due to these storm impacts. When the crews returned to NH they were directed to focus on completing scheduled maintenance trimming, rather than ETT, in order to maintain Eversource's overall trim cycle of four years or less. Actual work completed and the associated costs are as follows:

Town	Circuit	Miles	Cost
Nashua	3154x2	2.2	$91,421
Troy	3120	1.7	$29,542
Campton	27x1	6.78	$259,022
Northfield	37x4	5	$42,314
Freedom	346x1	4.67	$164,606
Portsmouth	71w1	0.57	$21,144
Lancaster	376x6	1.83	$34,902
Derry	32w3	5.2	$146,289
Derry	32w1	0.72	$69,108
		28.67	**$858,348**

Plant in service:

$ Plan	$ Actual	$ Variance
$4,000,000	$858,348	($3,141,652)

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: 1,259 trees were removed under the program. This work was performed primarily on the 23X5 and 23X6 circuits in the Milford area. These circuits were chosen due to their recent poor performance and as part of an initiative targeting circuits with zones of greater than 900 customers between protective devices (LZ 900). Tree crew availability was also a problem in this category of Vegetation Management, with crews brought into New Hampshire from out of state by our largest contractor performing Vegetation Management work.

Plant in service:

$ Plan	$ Actual	$ Variance
$2,000,000	$1,699,993	($300,007)