

**THE STATE OF NEW HAMPSHIRE
BEFORE THE
PUBLIC UTILITIES COMMISSION**

Unitil Energy Systems, Inc.

**RELIABILITY ENHANCEMENT PROGRAM
AND
VEGETATION MANAGEMENT PROGRAM
ANNUAL REPORT - FISCAL YEAR 2016**

1. Introduction

Pursuant to the Settlement Agreement approved by the New Hampshire Public Utilities Commission (“Commission”) in Docket No. DE 10-055, and as proposed to continue in the Settlement Agreement pending approval in DE 16-384,¹ Unitil Energy Systems, Inc. (“UES” or “Company”) is submitting the results of the Reliability Enhancement Plan (“REP”) and Vegetation Management Plan (“VMP”) for Fiscal Year 2016 (“FY 2016”), representing the period, January 1, 2016 – December 31, 2016.

The Settlement Agreement provides that in an annual compliance filing, the Company will continue to reconcile actual calendar year vegetation management and reliability enhancement O&M expenses with test year costs. Any over- or under-collection will be reflected in the Company’s Schedule EDC (External Delivery Charge) on May 1 of the following year or with approval of the Commission, the Company may credit unspent amounts to future vegetation management program expenditures. This report includes the following information:

- (A) A description of Unitil’s VMP;
- (B) A comparison of FY2016 actual to budgeted spending on O&M activities related to the VMP
- (C) Detail on the O&M spending related to the FY2016 VMP estimated expenditures and work to be completed;

¹ On February 22, 2017, the Company, the Staff of the New Hampshire Public Utilities Commission, and the Office of the Consumer Advocate filed a Settlement Agreement in DE 16-384. Paragraph 7.2 of the Agreement addresses the requirement for the Company to continue the annual VMP and REP compliance filing.

- (D) A summary of the reliability performance tracking for pruning, hazard tree and storm pilot program components;
- (E) A summary of the Vegetation Management Storm Resiliency Program (“SRP”) results;
- (F) Detail on the O&M spending related to Exacter Inspection survey;
- (G) Detail on the O&M spending related to Enhanced Tree Trimming;

2. Vegetation Management Plan

The VMP is based upon the recommended program provided in the report of Unitil’s consultant Environmental Consultants, Inc. (“ECI”)², modified to incorporate a 5-year prune cycle with 10-foot side and 15-foot top prune zones.

2.1. Plan Description

Unitil’s VMP is comprised of five components; 1) circuit pruning; 2) hazard tree mitigation; 3) mid-cycle review; 4) forestry reliability assessment; and 5) storm resiliency work. This program is designed to support favorable reliability performance, reduce damage to lines and equipment, as well as provide a measure of public safety. The main benefits and risks addressed by these programs are reliability, regulatory, efficiency, safety and customer satisfaction.

2.1.1. Circuit Pruning

Vegetation maintenance pruning is done on a cyclical schedule by circuit. The optimal cycle length was calculated by balancing five important aspects: 1) clearance to be created at time of pruning; 2) growth rates of predominant species; 3) risk to system performance; 4) aesthetics / public acceptance of pruning; and 5) cost to implement. For New Hampshire, this optimal cycle length was calculated as 5 years for all lines.

²A copy of the ECI report, originally provided in response to data request Staff 1-29 (Confidential), was made part of the record in DE 10-055, UES’s 2010 base rate case, as a Confidential Exhibit, accompanied by a public redacted version, during the hearing before the Commission.

2.1.2. Hazard Tree Mitigation

The Hazard Tree Mitigation program (“HTM”) consolidates tree removal activities into a formalized program with risk tree assessment. This program is aimed at developing a more resistant electrical system that is more resilient under the impacts of typical wind, rain and snow events. The intention is to accomplish this through minimizing the incidence and resulting damage of large tree and limb failures from above and alongside the conductors through removal of biologically unhealthy or structurally unstable trees and limbs.

HTM circuits are identified and prioritized through reliability assessment risk ranking, identification as a worst performing circuit, field problem identification, and time since last worked. Once circuits are identified they are scheduled in two ways: 1) while the circuit is undergoing cycle pruning; or 2) scheduled independently of cycle pruning. In New Hampshire, HTM circuit selection corresponds closely with cycle pruning, as both pruning and HTM are on a 5 year cycle.

In order to produce the greatest reliability impact quickly and cost effectively, HTM circuit hazard tree assessment and removal is focused primarily on the three phase only, with most emphasis on the portion of the circuit from the substation to the first protection device. In circuits that have undergone storm resiliency work, the HTM focus also includes single phase circuitry.

2.1.3. Mid-Cycle Review

The mid-cycle review program targets circuits for inspection and pruning based on time since last circuit pruning and forecasted next circuit pruning. The aim of this program is to address the fastest growing tree species that will grow into the conductors prior to the next cyclic pruning, potentially causing reliability, restoration and safety issues. As the first full circuit pruning cycle is underway, mid-cycle review will be used to address only 13.8kV and above, three-phase portions of selected circuits. Circuit selection is based on number of years since last prune and field assessment.

2.1.4. Forestry Reliability Assessment

The Forestry Reliability Assessment program targets circuits for inspection, pruning, and hazard tree removal based on recent historic reliability performance. The goal of this program is to allow reactive flexibility to address immediate reliability issues not addressed by the scheduled maintenance programs.

Using recent historic interruption data, poor performing circuits are selected for analysis of tree related interruptions. Circuits or portions of circuits showing a high number of tree related events per mile, customers interrupted per event, and/or customer minutes interrupted per event are selected for field assessment. After field assessment, suitable circuits are scheduled and a forestry work prescription is written for selected circuits or areas.

2.1.5. Storm Resiliency Work

The SRP targets critical sections of circuits for tree exposure reduction by removing all overhanging vegetation or pruning “ground to sky”, as well as performing intensive hazard tree review and removal along these critical sections and the remaining three phase of the circuit. The goal of this program is to reduce tree related incidents and resulting customers interrupted along these portions in minor and major weather events. In turn, the aim is to reduce the overall cost of storm preparation and response, and improve restoration.

2.2. 2016 Actual Expenditures and Work Completed

Table 1 depicts the 2016 VMP expenditures by activity in relation to the anticipated budget expenditures. As the program progressed in 2016 there were some deviations in the anticipated expenditures. In the VMP spending, the Police/Flagging, and the Sub-Transmission work activity required the most deviation in spending relative to anticipated costs. Mid-Cycle work cost was below the anticipated level, however all 2016 Mid-Cycle was completed. An additional cost for VMP Planning was also incurred for updates to software which more efficiently and effectively schedules, manages, implements and monitors the VMP components and the SRP work. Sub-Transmission work spending was above anticipated as all bid prices to complete the required work were much larger than expected. The Company did not immediately award the bid and sought out additional vendors. Even with this action, all prices came in significantly higher than anticipated. As shown in the table below, the program total was \$180,261 over budget. The work spending for the SRP was below the anticipated level. This was due to favorable pricing, reduction in the use of police details and flagging, and some restriction of work along the selected circuits. As shown in the table below, total spending for all VMP and SRP component was below the budget by \$186,685.

Table 1

| 2016 VMP O&M Activities | | |
|------------------------------------|---------------------------|-------------------------|
| VM Activity | 2016 Cost Proposal | 2016 Actual Cost |
| Cycle Prune | \$ 1,163,894 | \$ 1,170,984 |
| Hazard Tree Mitigation | \$ 800,000 | \$ 796,995 |
| Forestry Reliability Work | \$ 24,857 | \$ - |
| Mid-Cycle Review | \$ 112,000 | \$ 43,505 |
| Police / Flagger | \$ 616,852 | \$ 485,107 |
| Core Work | \$ 150,000 | \$ 120,811 |
| VMP Planning | \$ - | \$ 21,017 |
| Distribution Total | \$ 2,867,603 | \$ 2,638,419 |
| Sub-T | \$ 362,221 | \$ 745,387 |
| VM Staff | \$ 265,527 | \$ 291,805 |
| Program Total | \$ 3,495,351 | \$ 3,675,612 |
| Storm Resiliency Program | \$ 1,423,000 | \$ 1,056,055 |
| Grand Total | \$ 4,918,351 | \$ 4,731,666 |

The following tables detail the 2016 VMP work completed by activity. Table 2 details the cycle pruning work. A total of 242.7 miles of cycle pruning was completed in 2016.

Table 2

| 2016 VMP Completed Cycle Pruning Details | | | | |
|---|---------------|---------------------------|----------------------------|----------------------------|
| District | Feeder | Overhead Miles | Scheduled Miles | Completed Miles |
| Capital | C4W3 | 18.6 | 14.8 | 14.8 |
| Capital | C13X4 | 1.7 | 1.7 | 1.7 |
| Capital | C37X1 | 6.8 | 6.8 | 6.8 |
| Capital | C16H1 | 3.2 | 3.2 | 3.2 |
| Capital | C16H3 | 1.4 | 1.4 | 1.4 |
| Capital | C16X4 | 6.7 | 6.7 | 6.7 |
| Capital | C16X5 | 0.5 | 0.5 | 0.5 |
| Capital | C16X6 | 0.1 | 0.1 | 0.1 |
| Capital | C375X1 | 0.1 | 0.1 | 0.1 |
| Capital | C15H3 | 1.3 | 1.3 | 1.3 |
| Capital | C35X1 | 0.5 | 0.5 | 0.5 |
| Capital | C35X2 | 0.03 | 0.0 | 0.0 |
| Capital | C35X3 | 0.03 | 0.0 | 0.0 |
| Capital | C35X4 | 0.04 | 0.0 | 0.0 |
| Capital | C374X1 | 0.5 | 0.5 | 0.5 |
| Capital | C6X3 | 15.1 | 13.3 | 13.3 |
| Capital | C21W1P | 1.8 | 1.8 | 1.8 |
| Capital | C2H1 | 3.3 | 3.3 | 3.3 |
| Capital | C2H2 | 8.7 | 8.7 | 8.7 |
| Capital | C2H4 | 1.8 | 1.8 | 1.8 |
| Capital | C34X1 | 0.2 | 0.2 | 0.2 |
| Capital | C34X2 | 0.4 | 0.4 | 0.4 |
| Capital | C34X3 | 0.04 | 0.04 | 0.04 |
| Capital | C18W2 | 33.7 | 33.7 | 33.7 |
| Seacoast | E22X1 | 44.3 | 10.0* | 10.0 |
| Seacoast | E19X3 | 37.9 | 37.9 | 37.9 |
| Seacoast | E43X1 | 30.7 | 30.7 | 30.7 |
| Seacoast | E51X1 | 29.9 | 29.9 | 29.9 |
| Seacoast | E3H1 | 2.0 | 2.0 | 2.0 |
| Seacoast | E3H2 | 1.5 | 1.5 | 1.5 |
| Seacoast | E3H3 | 1.6 | 1.6 | 1.6 |
| Seacoast | E3W4 | 5.6 | 5.6 | 5.6 |
| Seacoast | E7W1 | 7.4 | 7.4 | 7.4 |
| Seacoast | E59X1 | 15.4 | 15.4 | 15.4 |
| Total | | | 242.7 | 242.7 |

Table 3 details the hazard tree mitigation work. A total of 202 miles of line across 16 circuits were mitigated for hazard tree risk. Unitil had estimated approximately 1,942 hazard tree removals in the

budget. The actual results indicate 2,660 total hazard trees were removed on these circuits and various other circuits as found through the course of work over the year.

Table 3

| 2016 VMP Completed Hazard Tree Mitigation Details | | | | | |
|--|----------------|-----------------------|------------------------|------------------------|----------------------|
| District | Feeder | Overhead Miles | Scheduled Miles | Completed Miles | # of Removals |
| Capital | C13W3 | 82.7 | 17.9 | 17.9 | 702 |
| Capital | C4W3 | 18.6 | 11.0 | 8.0 | 90* |
| Capital | C37X1 | 6.8 | 1.2 | 1.2 | 68 |
| Capital | C6X3 | 15.1 | 16.0 | 16.0 | 61 |
| Capital | C18W2 | 33.7 | 28.7 | 24.7 | 218* |
| Capital | C22W3 | 40.0 | 0 | 9.2 | 156 |
| Capital | C13W2 | 17.9 | 0 | 3.7 | 86 |
| Capital | <i>Various</i> | | | | 229 |
| Seacoast | E22X1 | 53.5 | 10.0 | 10.0 | 199 |
| Seacoast | E13W2 | 29.0 | 10.7 | 8.7 | 130* |
| Seacoast | E15X1 | 9.8 | 6.3 | 6.3 | 67 |
| Seacoast | E27X1 | 16.1 | 5.1 | 5.1 | 3 |
| Seacoast | E58X1 | 31.1 | 17.9 | 17.9 | 35 |
| Seacoast | E19X3 | 37.9 | 22.5 | 22.5 | 155 |
| Seacoast | E43X1 | 30.7 | 22.9 | 22.9 | 122 |
| Seacoast | E51X1 | 29.9 | 19.74 | 19.74 | 24 |
| Seacoast | E59X1 | 15.4 | 8.2 | 8.2 | 71 |
| Seacoast | <i>Various</i> | | | | 244 |
| Total | | | 198.1 | 202.0 | 2,660 |

* All hazard trees identified, marked, and approved for removal but not yet completed in the field – removals to carry over to 2017

Tables 4 and 5 detail the forestry reliability work and mid-cycle work respectively. A total of 3.0 miles of line underwent forestry reliability work and 70.5 miles of line were completed for mid-cycle work. There was no work completed on the 0.9 miles of C15W1 line identified for reliability work due to customer restrictions. The section of circuit E6W1 identified for work had 9 hazard trees removed and deadwood removed in the overhang. Due to the nature of the work, it was charged to hazard tree.

Table 4

| 2016 VMP Completed Reliability Analysis Details | | | | |
|--|---------------|---------------------------|----------------------------|----------------------------|
| District | Feeder | Overhead Miles | Scheduled Miles | Completed Miles |
| Capital | C15W1 | 16.8 | 0.9 | 0 |
| Seacoast | E6W1 | 26.9 | 2.1 | 2.1 |
| Total | | | 3.0 | 2.1 |

Table 5

| 2016 VMP Completed Mid-Cycle Review Details | | | | |
|--|---------------|---------------------------|----------------------------|----------------------------|
| District | Feeder | Overhead Miles | Scheduled Miles | Completed Miles |
| Capital | C13W3 | 82.7 | 17.9 | 17.9 |
| Capital | C24H1 | 2.0 | .8 | .8 |
| Capital | C24H2 | 1.9 | 1.5 | 1.5 |
| Capital | C33X4 | 2.0 | .1 | .1 |
| Capital | C34X4 | .2 | .2 | .2 |
| Seacoast | E13W2 | 29.0 | 10.7 | 10.7 |
| Seacoast | E13X3 | 3.8 | 2.5 | 2.5 |
| Seacoast | E15X1 | 9.8 | 6.3 | 6.3 |
| Seacoast | E17W2 | 4.8 | 2.0 | 2.0 |
| Seacoast | E27X1 | 16.1 | 5.1 | 5.1 |
| Seacoast | E27X2 | 8.7 | 1.4 | 1.4 |
| Seacoast | E2H1 | 2.4 | 1.4 | 1.4 |
| Seacoast | E56X2 | 2.4 | 2.1 | 2.1 |
| Seacoast | E58X1 | 31.1 | 13.2 | 13.2 |
| Seacoast | E5H1 | 4.5 | 3.2 | 3.2 |
| Seacoast | E5H2 | 4.8 | 2.2 | 2.2 |
| Total | | | 70.5 | 70.5 |

Table 6 details the sub-transmission right-of-way clearing work. A total of 18.1 linear miles of right-of-way floor were cleared.

Table 6

| 2016 Sub Transmission Clearing Details | | | |
|---|---------------|----------------------------|----------------------------|
| District | Feeder | Scheduled Miles | Completed Miles |
| Capital | 33 | 8.1 | 8.1 |
| Seacoast | 3341/3352 | 3.2 | 3.2 |
| Seacoast | 3347 | 2.5 | 2.5 |
| Seacoast | 3351/3362 | 4.3 | 4.3 |
| Total | | 18.1 | 18.1 |

Additionally the sub-transmission right-of-way that was cleared in both Capital and Seacoast in 2015 underwent the integrated vegetation management (IVM) program's low-volume foliar herbicide application work in 2015. A total of approximately 165 acres were managed with IVM chemical control.

2.3. 2017 VMP Estimated Expenditures and Work To Be Completed

Table 7 depicts the 2017 VMP expenditures by activity and the proposed VMP activity details. Unitil proposes to spend \$3,656,903 on VMP activities and another \$1,423,000 on vegetation storm resiliency, explained in more detail below, for a total of \$5,079,903.

Table 7

| 2017 VMP O&M Activities Cost Proposal | |
|--|---------------------------|
| VM Activity | 2017 Cost Proposal |
| Cycle Prune | \$ 1,163,000 |
| Hazard Tree Mitigation | \$ 800,000 |
| Forestry Reliability Work | \$ 24,857 |
| Mid-Cycle Review | \$ 112,000 |
| Brush Control | \$ - |
| Police / Flagger | \$ 616,852 |
| Core Work | \$ 150,000 |
| Distribution Total | \$ 2,867,603 |
| Sub-T | \$ 484,543 |
| VM Staff | \$ 304,757 |
| Program Total | \$ 3,656,903 |
| Storm Resiliency Work | \$ 1,423,000 |
| Grand Total | \$ 5,079,903 |

Tables 8 through 12 provide more detail on each of the VMP activities planned for 2017. The activities include 224 miles of cycle pruning (Table 8), 162.4 miles of hazard tree mitigation (Table 9) which estimates 2,312 hazard tree removals, 2.3 miles of forestry reliability work (Table 10), 86.1 miles of mid-cycle pruning (Table 11), and 17.5 miles of sub-transmission clearing.

Table 8

| 2017 VMP Planned Cycle Pruning Details | | | |
|---|---------------|-----------------------|------------------------|
| District | Feeder | Overhead Miles | Scheduled Miles |
| Capital | C8X3 | 105.5 | 105.5 |
| Seacoast | E11X1 | 11.9 | 11.9 |
| Seacoast | E11X2 | 11.9 | 11.9 |
| Seacoast | E19X2 | 2.8 | 2.8 |
| Seacoast | E20H1 | 4.5 | 4.5 |
| Seacoast | E28X1 | 10.2 | 10.2 |
| Seacoast | E2X3 | 13.2 | 13.2 |
| Seacoast | E2X2 | 20.1 | 20.1 |
| Seacoast | E46X1 | 3.8 | 3.8 |
| Seacoast | E54X1 | 21.5 | 17.5 |
| Seacoast | E54X2 | 8.7 | 7.0 |
| Seacoast | E56X1 | 17.0 | 15.6 |
| Total | | | 224.0 |

Table 9

| 2017 VMP Planned Hazard Tree Mitigation Details | | | |
|--|---------------|-----------------------|------------------------|
| District | Feeder | Overhead Miles | Scheduled Miles |
| Capital | C4W3 | 18.6 | 3.0* |
| Capital | C18W2 | 33.7 | 4.0* |
| Capital | C13W1 | 33.7 | 6.2 |
| Capital | C13W2 | 17.9 | 3.7 |
| Capital | C4X1 | 23.7 | 16.1 |
| Capital | C4W4 | 14.2 | 4.0 |
| Capital | C8X3 | 105.5 | 42.5 |
| Seacoast | E13W2 | 29.0 | 2.0* |
| Seacoast | E21W1 | 29.7 | 9.9 |
| Seacoast | E21W2 | 21.6 | 8.5 |
| Seacoast | E7X2 | 19.2 | 6.6 |
| Seacoast | E18X1 | 17.9 | 8.5 |
| Seacoast | E19X2 | 2.8 | 1.7 |
| Seacoast | E2X3 | 13.2 | 7.2 |
| Seacoast | E2X2 | 20.1 | 12.9 |
| Seacoast | E54X1 | 21.5 | 16.2 |
| Seacoast | E54X2 | 8.7 | 4.6 |
| Seacoast | E56X1 | 17.0 | 11.8 |
| Total | | | 162.4 |

*carry-over

Table 10

| 2017 VMP Planned Reliability Analysis Details | | | |
|--|---------------|---------------------------|----------------------------|
| District | Feeder | Overhead Miles | Scheduled Miles |
| Seacoast | E58X1 | 31.1 | 2.3 |
| Total | | | 2.3 |

Table 11

| 2017 VMP Planned Mid-Cycle Review Details | | | |
|--|---------------|---------------------------|----------------------------|
| District | Feeder | Overhead Miles | Scheduled Miles |
| Capital | C13W1 | 33.7 | 6.2 |
| Capital | C13W2 | 17.9 | 3.7 |
| Capital | C4X1 | 23.7 | 7.6 |
| Capital | C4W4 | 14.2 | 4.0 |
| Capital | C22W1 | 4.4 | 3.1 |
| Capital | C22W2 | 0.9 | 0.9 |
| Capital | C7W4 | 7.4 | 4.2 |
| Capital | C8H1 | 1.2 | 1.2 |
| Capital | C8H2 | 4.6 | 2.8 |
| Capital | C8X5 | 7.4 | 6.8 |
| Capital | C38E | 4.1 | 2.3 |
| Capital | C38W | 3.7 | 3.1 |
| Seacoast | E21W1 | 29.7 | 9.9 |
| Seacoast | E21W2 | 21.6 | 8.5 |
| Seacoast | E7X2 | 19.2 | 6.6 |
| Seacoast | E18X1 | 17.9 | 8.5 |
| Seacoast | E17W1 | 8.9 | 3.5 |
| Seacoast | E19H1 | 4.7 | 3.3 |
| Total | | | 86.1 |

Table 12

| 2017 Sub Transmission Planned Clearing Details | | |
|---|---------------|------------------------|
| District | Feeder | Scheduled Miles |
| Capital | 396 | 3.3 |
| Capital | 375 | 3.2 |
| Capital | 374 | 1.6 |
| Seacoast | 3358 | 1.2 |
| Seacoast | 3345/3356 | 4.5 |
| Seacoast | 3343/3354 | 3.7 |
| Total | | 17.5 |

2.4. Vegetation Management Storm Resiliency Program Results

In 2016, Unitil continued the SRP, targeting the resiliency efforts in communities in the Seacoast area. As in previous program years, the 2016 circuits were selected through analysis of tree related reliability performance. The 2016 circuits are shown below in Table 13. In 2016, 33.8 miles of critical three phase line were mitigated and 1,741 hazard trees were removed along this portion of line.

Table 13

| 2016 Storm Program Work Details | | | |
|--|------------------------|------------------------|----------------------|
| Circuit | Scheduled Miles | Completed Miles | # of Removals |
| E51X1 | 10.2 | 10.2 | 476 |
| E47X1 | 14.8 | 6.2 | 315 |
| E54X1 | 7.8 | 4.9 | 553 |
| E54X2 | 0 | 2.9 | 209 |
| E56X1 | 4.8 | 4.8 | 86 |
| E13W1 | 18.6 | 4.8 | 102 |
| Total | 33.8 | 33.8 | 1,741 |

This program, now in its fifth year, has been very successful. All program work in 2016 was completed below the estimated budget, with final expenditures totaling \$1,056,055, which is \$366,945

under the \$1,423,000 budget estimate. The reason for the underspending was due to the lesser number of identified hazard trees, most prominently seen on the E56X1 and E13W1 circuits. In previous years, the average number of removals per mile was approximately 82 trees per mile, ranging from 115 trees per mile down to 26 trees per mile. With the E56X1 only having 86 removals identified over 4.8 miles, the number of removals identified was low at 17.9 trees per mile, and the same with the E13W1 at 21.3 trees per mile. This anomaly, perhaps due to the circuit location and adjacent tree density, was noticed during the work planning phase. Even with the lower number of trees removed on these sections of circuits, it is important to note that the risk was still mitigated.

New for 2016, Unitil implemented an additional measure to improve the health of the adjacent trees along the overhead electric line corridor. Trees remaining and being pruned were treated with a tree growth regulator chemical in order to reduce the resulting tree growth after pruning and positively affect the tree's health. The Cambistat tree growth regulator treatment creates other plant growth effects that are beneficial for tree health including increased root density, improved drought and heat resistance, and higher tolerance to insects and diseases.³ 734 trees along the 2016 SRP corridor were treated with the tree growth regulator.

Due to the varying nature of storm resiliency work and traffic control, the Company expects costs may continue to experience minor variances, with final annual costs being slightly above or below the estimated budget. The Company believes that the annual program funding level of \$1,423,000 remains an appropriate and reasonable estimate of the Company's targeted spending for its SRP.

Although the Company did not experience any major storms in 2016, it is evident from the 2014 Thanksgiving storm experience and favorable results of the 2012 and 2013 storm resiliency pilot circuits over the last four years, that the Storm Resiliency work has the ability to and was successful at preventing tree related failures and subsequent electric incidents. This reduction in incidents reduces damage to the electric infrastructure and the need for crews to respond, which reduces the overall storm costs and expedites the restoration.

³ 2014 Rainbow Treecare Scientific Advancements, Cambistat Customer Literature

2.5. Vegetation Management Storm Resiliency Program Recommendation

For 2017, storm resiliency work on 34.2 miles of line in the Capital service area is proposed, at a total cost of \$1,423,000. These circuits, shown in Table 14, were chosen for their recent historic reliability performance, number of customers served, field conditions, and location.

Table 14

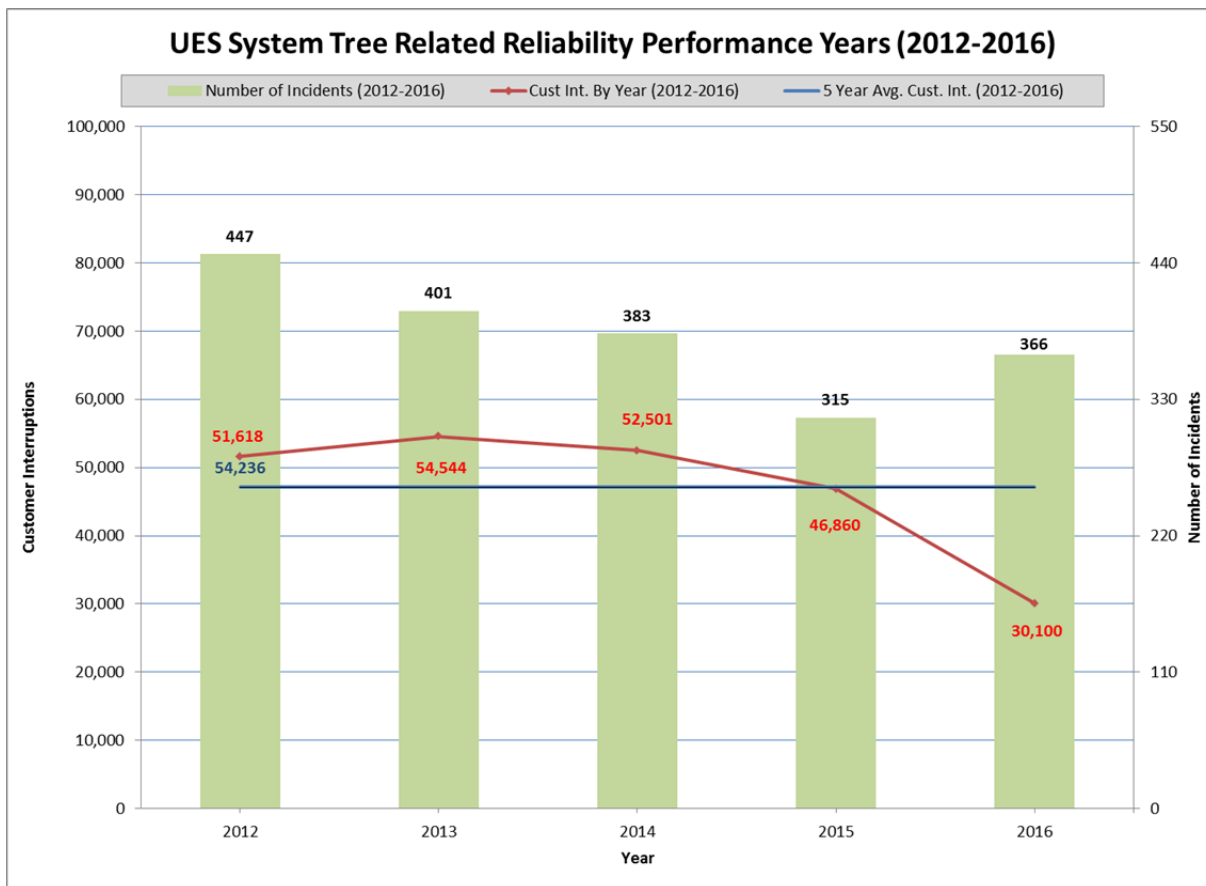
| 2017 Storm Pilot Planned Work Details | | |
|---------------------------------------|----------------|-----------------|
| Circuit | Overhead Miles | Scheduled Miles |
| C15W1 | 16.7 | 5.0 |
| C13W3 | 82.7 | 17.9 |
| C22W3 | 40.0 | 11.3 |
| Total | | 34.2 |

2.6. Vegetation Management Reliability Performance Tracking

As the VMP progresses through its first five year prune and hazard tree cycles, the effects of these programs on reliability have begun to emerge. Overall New Hampshire system tree related reliability performance was reviewed. Chart 1, shown below, displays the number of tree related incidents per year as well as the number of customers interrupted from tree related incidents from 2012 to 2016 against the 5 year average of tree related incidents during the same time period. The data used for this comparison excludes all major storm events identified by the NH PUC definition of a major storm in effect prior to 2015. The data for 2015 and 2016 uses IEEE 1366 methodology for identifying major event days. However there were no major event days during 2015 and 2016 that excluded tree related interruptions.

Chart 1 shows a steady declining trend in tree related incidents as well as in customers interrupted from 2012 through 2016. The number of customers interrupted was at the lowest point in 2016 over this five year period. The number of interruptions was below the five year average for the fourth year in a row while the number of customer interruptions was below the five year average for the third year in a row. These results clearly indicate that the VM program is producing positive results.

Chart 1



3. REP O&M Expenditures

The Company has allocated \$300,000 to REP O&M expenditures, split between reliability centered maintenance and inspection and enhanced tree trimming. The Enhanced Tree Trimming funding of \$80,000 is intended to target “problem” areas identified through engineering analysis, while \$220,000 is allocated to the Exacter® inspection program.

Table 16 below lists the amount of operation and maintenance expenditures budgeted for 2017 and past five years on Enhanced Tree Trimming and reliability centered inspection and maintenance programs.

Table 16

| REP O&M Category | Budgeted Spending Amounts | | | | | |
|--|---------------------------|-----------|-----------|-----------|-----------|-----------|
| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
| Enhanced Tree Trimming | \$133,333 | \$200,000 | \$200,000 | \$80,000 | \$80,000 | \$80,000 |
| Reliability Inspection and Maintenance | \$ 66,667 | \$100,000 | \$100,000 | \$220,000 | \$220,000 | \$220,000 |
| Totals | \$200,000 | \$300,000 | \$300,000 | \$300,000 | \$300,000 | \$300,000 |

3.1.1. Enhanced Tree Trimming

Each year, the Company completes reliability analysis on the distribution and subtransmission system. The reliability analysis identifies areas of the system which have experienced an abnormal or increasing amount of tree related outages in the previous year. Distribution Engineering provides the System Arborist a prioritized list of recommended subtransmission lines and/or distribution circuits which would benefit the most from enhanced tree trimming.

In 2016, Distribution Engineering recommended the sub-transmission 375 Line in the UES Capital area to receive enhanced tree trimming. In total, \$90,627 was spent on Enhanced Tree Trimming and 240 hazard tree removals were completed along with sideline clearing on selected portions.

For 2017, Distribution Engineering is recommending enhanced tree trimming/ hazard tree removal be performed on the 396 line in the UES Capital area in an effort to widen the narrow right-of-way. The work on this line will be prioritized and is budgeted not to exceed \$80,000 in 2017.

3.1.2. Reliability Inspection and Maintenance

In 2016, Unitil continued to inspect our distribution facilities utilizing Exacter® technology as described in the Unitil Energy Systems, Inc. Reliability Enhancement Program and Vegetation Management Report 2013. The scope of the 2016 program included Davey Resource Group performing field survey work and analysis, and providing the company with a report of their findings. In 2016, the Company spent \$220,000 in O&M expenditures and \$98,760 in capital, to replace equipment identified by the survey as possibly failing in the near future.

Unitil has budgeted \$220,000 again in 2017 for Reliability Inspection and maintenance.

3.1.2.1. Exacter Overview

As explained in our initial 2013 report, Exacter® technology is deployed by electric utilities to locate overhead distribution equipment showing signs of degradation and possible failure, thereby increasing overall system reliability by preventing failures before they occur. As a result of the successful pilot, Unitil continued the program in 2016.

3.1.2.2. Project Overview and Results

Unitil continued the inspection and survey program and completed a survey of all our overhead, three-phase circuitry, or a total of 419 pole miles of line. We believe this methodology provides the greatest impact to customers as a failure of equipment along these circuits would affect the greatest amount of customers and therefore have the greatest impact on system reliability, i.e. SAIDI.

The circuit survey performed in 2016 identified 94 pieces of equipment that displayed the immanent failure signature and required repair or replacement. As was the case in prior years, the types of facilities identified included transformers, insulators, lightning arrestors, bushings, and cutouts.

Utilizing Unitil's Outage Management System (OMS) which details customer counts and protective devices, we are able to develop potential system reliability impacts. The 2016 program identified a repair every 4.5 miles, and an average of 830 customers impacted by each failure event if it occurred. The estimated number of customers impacted by potential failures of all identified locations is 78,054. The estimated customer minutes of interruption would be 6,788,639, calculated using 2016 customer counts. The total opportunity for avoided system SAIDI is 89.6 minutes, which represents 60.5 % of UES' most recent 10-year average annual SAIDI of 148.0 minutes.

We continue to believe the program has significant benefits to our customers, and the Company plans to continue with the program for the foreseeable future.

3.1.2.3. 2017 Plan Proposal

Unitil is continuing the Exacter® preventative maintenance program in 2017. We will continue to perform an annual survey of all three-phase circuit miles of the UES distribution system, as failures of this equipment has the greatest impact on customer interruptions. The estimated cost to perform the annual survey and provide the analytics is \$220,000, and the cost to replace the identified equipment is expected to be approximately \$100,000 annually. Given the potential impact on system SAIDI, the company believes these expenditures are prudent and beneficial to customers.

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