THE STATE OF NEW HAMPSHIRE
BEFORE THE
PUBLIC UTILITIES COMMISSION

Unitil Energy Systems, Inc.

RELIABILITY ENHANCEMENT PROGRAM AND VEGETATION MANAGEMENT PROGRAM ANNUAL REPORT 2014

1. Introduction

Pursuant to the Settlement Agreement approved by the New Hampshire Public Utilities Commission ("Commission") in Docket No. DE 10-055[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 2014 ("FY 2014"), representing the period, January 1, 2014 – December 31, 2014.

The Settlement Agreement provides that Unitil should implement a REP beginning in calendar year 2011 and allowed Unitil to spend a target amount of $1,750,000 annually and is subject to a cap of $2,000,000 on REP capital spending in any given year. The Step Adjustments for REP capital spending were limited to the years May 1st of the years 2012, 2013, and 2014 to recover the revenue requirements attributable to REP capital expenditures of the preceding year. Unitil is also to increase its annual REP operation and maintenance expense by $300,000 effective May 1, 2012. The Settlement Agreement also provides that Unitil implement an augmented VMP. The revenue requirement for the permanent rates effective May 1, 2011 included $200,000 of augmented VMP spending above the test year amount and the Step Adjustment effective May 1, 2011 provided for an additional increase of $1,250,000 for annual VMP spending. The Step Adjustment effective May 1, 2012 provided for a further increase of $950,000.

The Settlement Agreement also provides that on or before the last day of February of each year following approval, Unitil will provide an annual report to the Commission, Staff and OCA showing actual REP and VMP activities and costs for the previous calendar year, and its planned activities and costs for the current calendar year. Actual and planned REP and VMP costs shown in the report will be reconciled along with the revenue requirements associated with the actual and planned capital additions and expenses. This report includes the following information:

[1] Order 25,214 dated April 26, 2011

(A) A description of Unitil's VMP;
(B) A comparison of FY2014 actual to budgeted spending on O&M activities related to the VMP
(C) Detail on the O&M spending related to the FY2015 VMP estimated expenditures and work to be completed;
(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 Hardening Pilot Program 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;
(H) Detail on the REP capital spending for 2014 and 2015 budget; and
(I) Reliability performance of the UES Capital and UES Seacoast systems.

2. Vegetation Management Plan

The Settlement Agreement provides that Unitil will implement an augmented Vegetation Management Program (VMP). The VMP shall be based upon the recommended program provided in the report of Unitil's consultant Environmental Consultants, Inc. ("ECI")[2], modified to incorporate a 5-year multi-phase and 5-year single phase trim cycle with 10-foot side and 15-foot top trim zones. In addition, the VMP will be conducted in a manner that addresses fast growing species, and will provide that deadwood will be removed above the primary, and that deadwood outside the trim zone will be removed if service could be impacted. The VMP shall also comply with the requirements of NESC Rule 218.B regarding overhanging vegetation at railroad and limited access highway crossings[3].

2.1. Plan Description

Unitil's Vegetation Management Program ("VMP") is comprised of six components; 1) circuit pruning; 2) hazard tree mitigation; 3) mid-cycle review; 4) forestry reliability assessment; 5) brush removal; and 6) 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] A 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 as a Confidential Exhibit, accompanied by a public redacted version, during the hearing before the Commission.
[3] Reference Settlement Agreement Section 7.3 Page 14 of 26

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.

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.

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 flexibly 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. Brush Removal

The Brush Removal program targets removal of healthy trees growing under or directly adjacent to conductors to realize benefits of avoided cost of future pruning and future hazard limb or tree removal. Tree removal will be paired with a selective stump treatment program to inhibit sprouting and re-growth and provide short and long-term benefits. The program targets small diameter trees to maximize cost effectiveness.

Due to program prioritization in relation to the VMP ramp up of funding, this program was not selected for implementation in 2014.

2.1.6. Storm Resiliency Work

The Storm Resiliency program 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. 2014 Actual Expenditures and Work Completed

Table 1 depicts the 2014 VMP expenditures by activity in relation to the anticipated budget expenditures. As the program progressed in 2014 there were some deviations in the anticipated expenditures. The Mid-Cycle Review, the Police/Flagging, and the Sub-T work activity required the most deviation in spending relative to anticipated costs. Mid-Cycle work cost was above the anticipated level due to the carry-over of some 2013 work, however all 2014 Mid-Cycle was completed. An additional cost for VMP Planning was also incurred for software to more efficiently and effectively schedule, manage, implement and monitor the VM program components. Due to these unanticipated costs, Hazard Tree Mitigation and Forestry Reliability Work spending was below the level anticipated. As shown in the table below, total spending was above the budget by $377,264.

Table 1

2014 VMP O&M Activities		
VM Activity	**2014 Cost Proposal**	**2014 Actual Cost**
Cycle Prune	$ 1,156,000	$ 1,167,630
Hazard Tree Mitigation	$ 800,000	$ 758,556
Forestry Reliability Work	$ 81,845	$ 59,891
Mid-Cycle Review	$ 112,000	$ 257,049
Police / Flagger	$ 526,094	$ 588,291
Core Work	$ 100,000	$ 150,001
VMP Planning	$ -	$ 21,987
Distribution Total	**$ 2,815,939**	**$ 3,003,405**
Sub-T	$ 140,000	$ 187,847
VM Staff	$ 219,800	$ 319,577
Program Total	**$ 3,135,739**	**$ 3,510,829**
Storm Pilot Program	$ 1,423,000	$ 1,425,175
Grand Total	**$ 4,558,739**[4]	**$ 4,936,003**

The following tables detail the 2014 VMP work completed by activity. Table 2 details the cycle pruning work. Two circuits had small mileage that was not completed in 2014, noted with an asterisk, and is a planned carry-over into 2015. A total of 223.5 miles of cycle pruning was completed in 2014.

[4] Test year amount of $735,739 + $200,000 augmented VMP spending in permanent rates + $2,200,000 ($1,250,000 + $950,000) included in step adjustments.

Table 2

2014 VMP Planned Cycle Pruning Details				
District	**Feeder**	**Overhead Miles**	**Scheduled Miles**	**Completed Miles**
Capital	C13W1	33.5	29	24.7*
Capital	C4X1	34.4	30.6	30.6
Capital	C4W4	14.2	14.2	14.2
Capital	C22W1	4.4	4.4	4.4
Capital	C22W2	0.9	0.9	0.9
Capital	C7W4	7.4	7.4	7.4
Capital	C8H1	1.2	1.2	1.2
Capital	C8H2	4.7	4.7	4.7
Capital	C8X5	7.3	7.3	7.3
Capital	C38E	4.1	4.1	4.1
Capital	C38W	3.7	3.7	3.7
Seacoast	E21W1	28.5	28.5	14.3*
Seacoast	E21W2	21.6	21.6	21.6
Seacoast	E13W1	18.5	18.5	18.5
Seacoast	E7X2	19.1	19.1	19.1
Seacoast	E18X1	18	18	18.0
Seacoast	E17W1	8.7	8.7	8.7
Seacoast	E47X1	15.4	15.4	15.4
Seacoast	E19H1	4.7	4.7	4.7
Total			**242**	**233.5**

Table 3 details the hazard tree mitigation work. A total of 92.7 miles of line across 19 circuits were mitigated for hazard tree risk. Unitil had estimated approximately 1,942 hazard tree removals in the budget. The actual results indicate 1,973 total hazard trees were removed on these circuits and various other circuits as found through the course of work over the year.

Table 3

2014 VMP Planned Hazard Tree Mitigation Details					
District	**Feeder**	**Overhead Miles**	**Scheduled Miles**	**Completed Miles**	**# of Removals**
Capital	C13W3	7.0	3.2	3.2	140
Capital	C6X3	15.1	4.7	4.7	82
Capital	C14H2	3.9	1.6	0	0*
Capital	C4W4	14.2	4.0	4.0	86
Capital	C22W1	4.4	3.2	3.2	33
Capital	C7W4	7.4	4.2	4.2	43
Capital	C8H2	4.7	2.3	2.3	95
Capital	C8X5	7.3	6.8	6.8	60
Capital	C38E	4.1	2.3	2.3	35
Capital	C38W	3.7	3.0	3.0	29
Capital	Various				526
Seacoast	E23X1	27.5	10.6	10.6	73
Seacoast	E6W1	26.9	5.8	5.8	106
Seacoast	E6W2	18.9	4.9	4.9	8*
Seacoast	E21W1	28.5	8.9	8.9	1*
Seacoast	E13W1	18.5	4.6	4.6	174
Seacoast	E7X2	19.1	6.3	6.3	64
Seacoast	E17W1	8.7	3.5	3.5	26
Seacoast	E47X1	15.4	6.2	6.2	11*
Seacoast	E19H1	4.7	3.3	0	0*
Seacoast	Various				381
Total			**92.7**	**87.8**	**1973**

* All hazard trees identified, marked, and approved for removal but not yet completed in the field – removals to carry over to 2015

Tables 4 and 5 detail the forestry reliability work and mid-cycle work respectively. A total of 16.3 miles of line underwent forestry reliability work and 49.8 miles of line were completed for mid-cycle work.

Table 4

2014 VMP Planned Reliability Analysis Details				
District	**Feeder**	**Overhead Miles**	**Scheduled Miles**	**Completed Miles**
Capital	C22W2	39.7	11.3	11.3
Capital	C15W1	16.7	5.0	5.0
Seacoast				
Total			**16.3**	**16.3**

Table 5

2014 VMP Planned Mid-Cycle Review Details				
District	**Feeder**	**Overhead Miles**	**Scheduled Miles**	**Completed Miles**
Capital	C6X3	15.1	4.7	4.7
Capital	C13W3	82.9	7.4	7.4
Capital	C37X1	6.3	1.1	1.1
Seacoast	E19X3	37.8	15.4	15.4
Seacoast	E6W1	26.8	5.7	5.7
Seacoast	E6W2	19.0	4.9	4.9
Seacoast	E23X1	27.5	10.6	10.6
Total			**49.8**	**49.8**

Table 6 details the sub-transmission right-of-way clearing work. A total of 186 acres were cleared.

Table 6

2014 Sub Transmission Planned Clearing Details				
District	**Feeder**	**Scheduled Miles**	**Scheduled Acres**	**Completed Acres**
Capital	34/36	3.5	43.5	43.5
Capital	37	3.6	44.5	44.5
Seacoast	3359	7.7	61.9	61.9
Seacoast	3348/3350	4.5	36.1	36.1
Total		**19.3**	**186**	**186**

2.3. 2015 VMP Estimated Expenditures and Work To Be Completed

Table 7 depicts the 2015 VMP expenditures by activity and the proposed VMP activity details. Unitil proposes to spend $3,235,516 on VMP activities and another $1,423,000 on vegetation storm resiliency, explained in more detail below, for a total of $4,658,516.

Table 7 **(Revised)**

2015 VMP O&M Activities Cost Proposal		
VM Activity		**2015 Cost Proposal**
Cycle Prune	$	1,156,000
Hazard Tree Mitigation	$	800,000
Forestry Reliability Work	$	32,751
Mid-Cycle Review	$	112,000
Brush Control	$	-
Police / Flagger	$	525,188
Core Work	$	150,000
Distribution Total	**$**	**2,775,939**
Sub-T (Revised)	$	362,221
VM Staff	$	319,577
Program Total	**$**	**3,457,737**
Storm Resiliency Work	$	1,423,000
Grand Total	**$**	**4,880,737**

Tables 8 through 12 provide more detail on each of the VMP activities planned for 2015. The activities include 245.2 miles of cycle pruning (Table 8), 132.6 miles of hazard tree mitigation (Table 9) which estimates 1,942 hazard tree removals, 3.5 miles of forestry reliability work (Table 10), 67.8 miles of mid-cycle pruning (Table 11), and 13.7 miles of sub-transmission clearing.

Table 8

2015 VMP Planned Cycle Pruning Details			
District	**Feeder**	**Overhead Miles**	**Scheduled Miles**
Capital	C13W1	33.5	4.3*
Capital	C15W1	16.8	16.8
Capital	C15W2	5.9	5.9
Capital	C14H1	1.0	1.0
Capital	C14H2	3.9	3.9
Capital	C14X3	0.3	0.3
Capital	C1H1	0.8	0.8
Capital	C1H2	0.6	0.6
Capital	C1H3	2.3	2.3
Capital	C1H4	1.6	1.6
Capital	C1H5	0.9	0.9
Capital	C1H6	1.6	1.6
Capital	C3H1	2.7	2.7
Capital	C3H2	2.3	2.3
Capital	C3H3	1.0	1.0
Capital	C7X1	2.6	2.6
Capital	C22W3	39.8	39.8
Capital	C7W3	23.2	23.2
Seacoast	E21W1	28.5	14.2*
Seacoast	E1H3	1.8	1.8
Seacoast	E1H4	3.3	3.3
Seacoast	E23X1	23.8	23.8
Seacoast	E6W1	27	27
Seacoast	E22X1	44.3	44.3
Seacoast	E6W2	19.2	19.2
Total			**245.2**

*carry-over

Table 9

2015 VMP Planned Hazard Tree Mitigation Details			
District	**Feeder**	**Overhead Miles**	**Scheduled Miles**
Capital	C14H2	3.9	3.9*
Capital	C8X3	104.9	23.4
Capital	C15W1	16.8	5.0
Capital	C22W3	39.8	11.3
Capital	C7W3	23.2	14.8
Capital	C13W2	17.9	3.7
Seacoast	E6W2	18.9	4.9*
Seacoast	E21W1	28.5	8.9*
Seacoast	E47X1	15.4	6.2*
Seacoast	E19H1	4.7	3.3*
Seacoast	E27X1	16.1	3.5
Seacoast	E23X1	23.8	10.0
Seacoast	E6W1	27.0	5.8
Seacoast	E22X1	44.3	11.4
Seacoast	E59X1	15.5	7.3
Seacoast	E54X1	30.1	7.8
Seacoast	E56X1	16.8	3.7
Total			**132.6**

*carry-over

Table 10

2015 VMP Planned Reliability Analysis Details			
District	**Feeder**	**Overhead Miles**	**Scheduled Miles**
Seacoast	E27X1	16.1	3.5
Total			**16.3**

Table 11

2015 VMP Planned Mid-Cycle Review Details			
District	**Feeder**	**Overhead Miles**	**Scheduled Miles**
Capital	C13W2	17.9	3.7
Seacoast	E27X2	8.7	3.4
Seacoast	E59X1	15.5	7.3
Seacoast	E2X3	13.2	7.2
Seacoast	E28X1	10.2	5.1
Seacoast	E2X2	20.1	12.9
Seacoast	E46X1	3.8	1.9
Seacoast	E20H1	4.5	2.2
Seacoast	E19X2	2.8	1.7
Seacoast	E11X2	11.8	6.6
Seacoast	E11X1	11.8	4.3
Seacoast	E54X1	30.1	7.8
Seacoast	E56X1	16.8	3.7
Total			**67.8**

Table 12

2015 Sub Transmission Planned Clearing Details		
District	**Feeder**	**Scheduled Miles**
Capital	34	1.7
Capital	374	2.7
Capital	375	1.5
Seacoast	3342/3353	3.7
Seacoast	3346	2
Seacoast	3341/3352	2.1
Total		**13.7**

2.4. Vegetation Management Storm Resiliency Program Results

In 2014, Unitil shifted the Storm Hardening Pilot into the Storm Resiliency Program, continuing the resiliency efforts in communities in the Seacoast area. As in previous pilot program years, the 2014 circuits were selected through analysis of tree related reliability performance. The 2014 circuits are shown below in Table 13. In 2014, 34.7 miles of critical three phase line were mitigated and 2,056 hazard trees were removed along this portion of line.

Table 13

2014 Storm Pilot Work Details			
Circuit	**Scheduled Miles**	**Completed Miles**	**# of Removals**
E22X1	11.4	11.4	1,138
E43X1	7.9	7.9	423
E19X3	15.4	15.4	495
Total	**34.7**	**34.7**	**2,056**

This program was met with success, again in its third year. All program work in 2014 was completed within 3% of the estimated budget, with final expenditures totaling $1,425,175, just above the $1,423,000 budget estimate. While this year was met with some customer opposition, most desired work was allowed and all work was completed without significant complaints.

In November of 2014, Unitil was able to see how previous year's work responded to a storm event. On November 26-27, 2014 the company's Capital region experienced a heavy wet snow event that was forecasted as an EII 3 event with snow totals over 10 inches. During this event, Unitil's electric system experienced significant damage. However, there were limited tree related damage events on the portions that underwent storm resiliency work in 2013. To document and analyze the performance of these circuits, the Company employed a vendor to record vehicle mounted high definition video during restoration portions of the storm, after snowfall was completed. The results of this video capture and analysis can be viewed in the attached short film titled "SRP Video 2014", provided as Attachment 1. The video may also be viewed on line. The link and password are located in the Attachment.

From this storm experience and favorable results of the 2012 and 2013 storm resiliency pilot circuits over the last three years, it is apparent 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, in turn reduces the overall storm costs and expedites the restoration.

2.5. Vegetation Management Storm Resiliency Program Recommendation

For 2015, storm resiliency work on 34.4 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

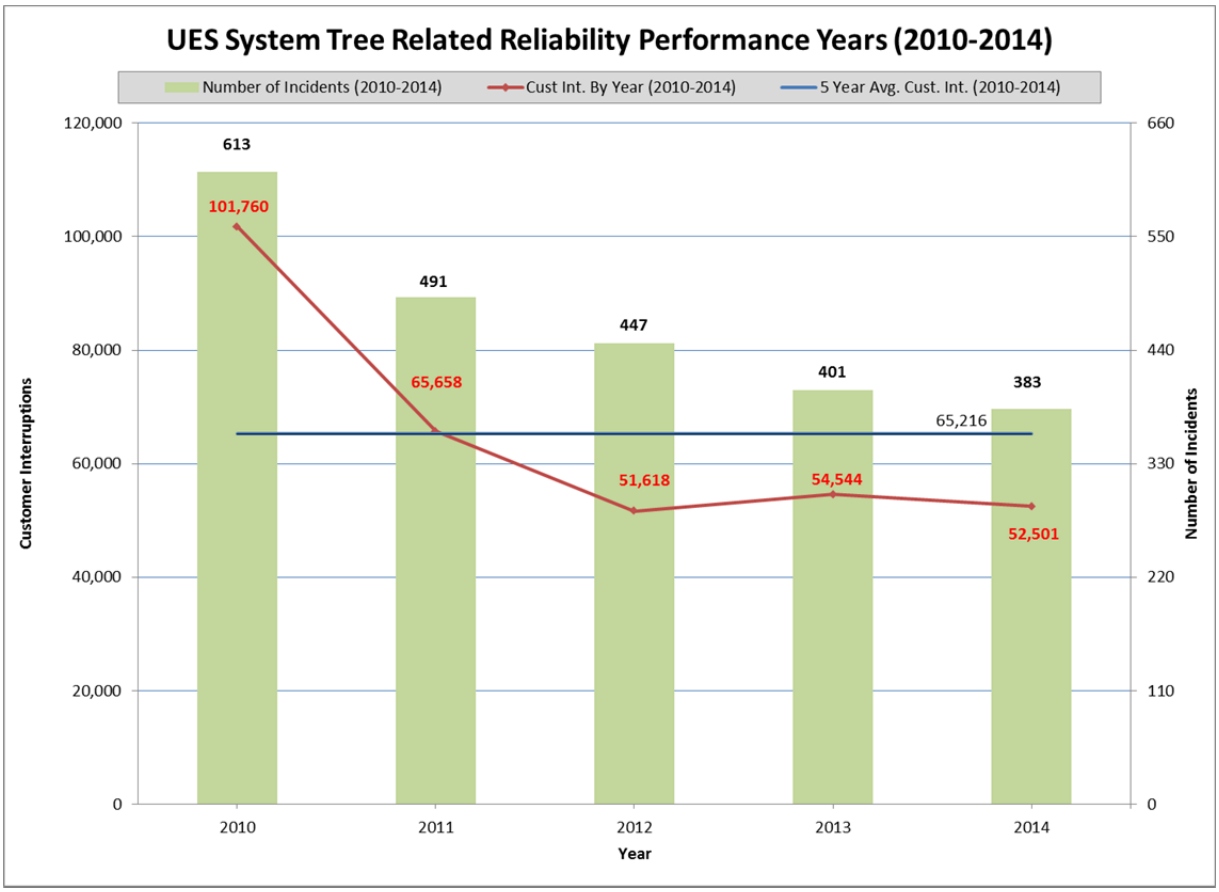
2015 Storm Pilot Planned Work Details		
Circuit	**Overhead Miles**	**Scheduled Miles**
C8X3	104.9	26.8
C4W3	18.6	7.6
Total		**34.4**

2.6. Vegetation Management Reliability Performance Tracking

As the Vegetation Management Program 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, as well as the individual circuits and program components that were undertaken. 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 2010 to 2014 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 2014. In 2014, the NH PUC adopted the IEEE 1366 methodology for identifying major event days. However this data set was not used for 2014 in order to maintain consistency.

Chart 1 shows a declining trend in customers interrupted as well as a decline in tree related incidents from 2010 through 2014. The number of tree related incidents and the number of customers interrupted were at their lowest point in 2014 over this five year period. Both measures were also below their respective 5 year average for the third year in a row. Although the VM program is still not through its first full management cycle, the Company believes this trend is indicative of overall positive program results.

Chart 1



3. Reliability Enhancement Plan

The Settlement Agreement provides that Unitil should implement a Reliability Enhancement Program. Pursuant to the Agreement and beginning in 2011, the Company has planned to spend a target amount of $1,750,000 annually and is subject to a cap of $2,000,000 in REP capital expenditures in a given year and $300,000 in operation and maintenance expense effective May 1, 2012.[5]

As described in Mr. Meissner's Direct Testimony in Docket DE 10-055[6], the REP covers capital and O&M activities and projects intended to maintain or improve the reliability of the electric system including: (1) system hardening measures, i.e., equipment upgrades; installation of additional fuses, sectionalizers and reclosers; SCADA and automation projects; improvements to lightning protection; installation of animal guards; and other activities to mitigate the specific causes of outages; (2) enhanced

[5] Reference Settlement Agreement Section 7.1 Page 14 of 26
[6] Direct Testimony of Thomas P. Meissner, Jr., DE 10-055, pages 20-29.

tree trimming, i.e., aggressive trimming and clearing involving an expanded trim zone or more aggressive removal beyond what is normally included in maintenance trimming, typically in localized areas of poor reliability; (3) asset replacement, which targets aging electrical components at increased risk of failure, including porcelain cutouts and insulators, transformers, circuit breakers, underground cable, wood poles and other equipment, and includes conductor replacement and reconductoring of select mainlines with spacer cable; and (4) reliability-based inspections and maintenance, which will include enhanced inspection methods to detect and mitigate outage causes before they occur, including surveys using new or improved technology such as thermography (IR) and radiofrequency (RF) sensor technology to identify and mitigate failing electrical equipment, as well as software applications to better manage inspection, maintenance, and reliability programs and data.

3.1. Reliability Studies

The Settlement Agreement provides that the Company will complete the following fuse and recloser studies and reviews: 1) Un-fused Lateral Study; 2) Fuse Coordination Studies; and 3) Recloser Studies[7]. Each of these studies is described below.

3.1.1. Un-fused Lateral Study

The Settlement Agreement provides that the Company would complete a review of un-fused lateral on distribution circuits.

In 2011, the Company completed a review of all distribution circuits in order to identify laterals tapped directly to the main line of distribution circuits without fusing or some other type of protective device. [8] The study was provided as part of the Reliability Enhancement Program and Vegetation Management Program Annual Report 2011.

Distribution Engineering developed a prioritized list of unprotected laterals based upon number of customers which could be affected by an outage event. As identified in the 2011 Annual Report, the Company issued Engineering Work Requests (EWRs) to address all the identified locations over a three year period or as other work was performed on these circuits as part of planned system upgrades or modifications. In 2013, EWR's were issued to install fusing at 24 locations on eleven circuits. In 2014,

[7] Reference Settlement Agreement Section 7.6.1 Page 15 of 26
[8] Reference Unitil Energy Systems Unprotected Lateral Study, November 29, 2011.

EWR's were issued to install fusing at fifty locations on twenty-one circuits. This completed addressing all unfused laterals off the main-line.

3.1.2. Fuse Coordination Studies

The Settlement Agreement provides that the Company complete fuse coordination studies on distribution circuits where they are out of date and ensure that fuses are coordinated and of the proper size.

The Company conducts distribution planning studies on an annual basis. The purpose of this study is to identify when system load growth is likely to cause main elements of the distribution system to reach their operating limits, and to prepare plans for the most cost-effective system improvements.

Circuit analysis provides the basis for the distribution planning study. Circuit analysis is completed on a three year rotating cycle with the objective to review one-third of the entire system each year. The Milsoft WindMil software application is used to perform circuit analysis to identify potential problem areas and to evaluate available alternatives for system improvements. Circuit analysis includes the following: 1) update of circuit model from GIS; 2) circuit diagnostics; 3) load allocation and overload analysis; 4) voltage drop analysis; 5) fault current and coordination analysis. Engineering work requests are initiated for any apparent miscoordination identified during this analysis. Protection device coordination analysis is an automated function within the WindMil application. This function is included each year as part of the circuit analysis performed on the circuits evaluated.

In addition to the fuse coordination completed as part of circuit analysis, the Company reviews trouble interruption reports on a daily basis. Any outage in which the fuse did not appear to operate correctly is further analyzed to determine the cause. Engineering Work Requests are issued to implement upgrades or changes on the system identified by the circuit analysis or an evaluation of an outage. In 2014, twenty-three Engineering Work Requests were initiated specific to fuse installation or fuse size changes due to the coordination analysis performed.

3.1.3. Recloser Studies

The Settlement Agreement provides that the Company would complete a review of locations on distribution circuits where reclosers could be applied in an economic manner to improve reliability.

Each year, Unitil completes annual reliability studies for each of its operating areas. The purpose of these studies is to report on the overall reliability performance of the electric systems from January 1

through December 31 of the previous year (12 months total). The scope of this report also evaluates substation, subtransmission and individual circuit reliability performance over the same time period. The analysis also identifies common trends or themes based upon type of outage (i.e. tree, equipment failure, etc.). The Annual Reliability Analysis and Recommendations report for the UES Capital Operating Area and UES Seacoast Operating Area are attached to this report as Attachment 2 and Attachment 3 respectively.

The recommendations provided in the study are focused on improving the worst performing circuits as well as the overall system reliability. These recommendations are provided for budget consideration and will be further developed with the intention of incorporation into the capital budget development process.

There are several common solutions which can improve reliability depending upon the circumstance: 1) installation of reclosers or sectionalizers; 2) addition of fusing locations; 3) tree trimming; and 4) installation of tree wire or spacer cable. These solutions are recommended most commonly; however, other solutions are also recommended for the specific situation. For instance, in the 2015 capital budget, there are projects budgeted to install reclosers or sectionalizers installed to improve fault isolation at five locations, install fault indicators to communicate to the remote SCADA system, and a project to install automatic sectionalizing scheme with SCADA communication to reduce the number of outages due to faults on a subtransmission line.

3.2. REP O&M Expenditures

The Settlement Agreement provides that Unitil will increase its annual REP O&M expense by $300,000 effective May 1, 2012.[9] The order does not specify, however, the allocation of the expense. The Company has allocated the $300,000 increase on enhanced tree trimming in areas recommended by the Distribution Engineering Department and Reliability Inspections and Maintenance. The Enhanced Tree Trimming funding is intended to target “problem” areas identified through engineering analysis.

The annual budget year increases over the test year amounts for the Company are shown in Table 15 below:

[9] Reference Settlement Agreement Section 7.1 Page 14 of 26

Table 15

REP O&M Category	Budgeted Spending Above Test Year Amounts			
	2012[10]	2013	2014	2015
Enhanced Tree Trimming	$133,333	$200,000	$200,000	$80,000
Reliability Inspection and Maintenance	$ 66,667	$100,000	$100,000	$220,000
Totals	$200,000	$300,000	$300,000	$300,000

3.2.1. Enhanced Tree Trimming

Each year, the Company completes reliability analysis on the distribution and subtransmission system. The reliability analysis (as shown in Attachments 2 and 3) 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 2014, Distribution Engineering recommended the sub-transmission Line 3359 in Hampton Falls and Seabrook to receive enhanced tree trimming. In total, $84,082 was spent on Enhanced Tree Trimming on this line. The 3359 line underwent enhanced risk tree assessment, and 164 hazard tree removals were completed along with sideline clearing on selected portions.

For 2015, Distribution Engineering is recommending enhanced tree trimming/ hazard tree removal be performed on the subtransmission Line 33 in the UES Capital area. In 2014 this circuit experienced 6 tree related outages, during major storms, accounting for outages to approximately 7,800 customers. The trimming on this line will be prioritized and is budgeted not to exceed $80,000 in 2015.

3.2.2. Reliability Inspection and Maintenance

In 2014, 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. After the first year of this program, Davey Resource Group, quoted an annual cost of $220,000 to perform the field survey work and analysis, and to provide the company with a report of their findings. Unitil has extended the contract with Davey Resources through 2015. The results of this survey initiate capital replacement work each year. In 2014, the company spent approximately $58,000 in capital, to replace equipment that the survey indicated as possibly failing in the near future. The Company expects to continue with this level of spending in the future. . A summary of the 2014 program is provided below.

3.2.2.1. Exacter Overview

[10] Prorated annual amounts assuming May 1, 2012 increase

As explained in our previous 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 2014.

3.2.2.2. Project Overview and Results

Unitil completed a survey of all our overhead, three-phase circuitry, or a total of 428 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 identified 58 pieces of equipment that displayed the immanent failure signature and requires repair or replacement. As was the case in 2013, 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 2014 program identified a repair every 7.9 miles, and an average of 393 customers impacted by each failure event if it occurred. The estimated number of customers impacted by potential failures of all identified locations is 22,841. The estimated customer minutes of interruption would be 2,093,437, calculated using 2014 system CAIDI values. The total opportunity for avoided system SAIDI would be 27.6 minutes, which represents 16.7 % of UES' most recent 10-year average annual SAIDI of 165.4 minutes.

This data compliments our findings in 2013, which estimated 39.4 SAIDI minutes of savings. We continue to believe the program has significant benefits to our customers.

3.2.2.3. Summary

The survey identified 58 different pieces of equipment of the distribution system that were in need of replacement. Absent this technology, this faulty equipment would have been discovered only after it failed, and in addition, resulted in an outage to customers. The Exacter® program is a preventative maintenance program that allows for identification and replacement of equipment before failure, resulting in a reduction in customer outages due to equipment failure. The 2014 program avoided 58 outages, and saved 2,093,437 customer minutes of interruption and resulted in an avoided 27.6 SAIDI

minutes. Unitil's proactive use of this technology reduces interruptions to customers, as well as improves the reliability and resiliency of the UES distribution system.

3.2.2.4. 2015 Plan Proposal

Based upon the success of the program, as defined by avoiding outages due to equipment failure, Unitil is continuing the Exacter® preventative maintenance program. 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 $50,000 annually. Given the potential impact on system SAIDI, the company believes these expenditures are prudent and beneficial to customers.

3.3. REP Capital Expenditures

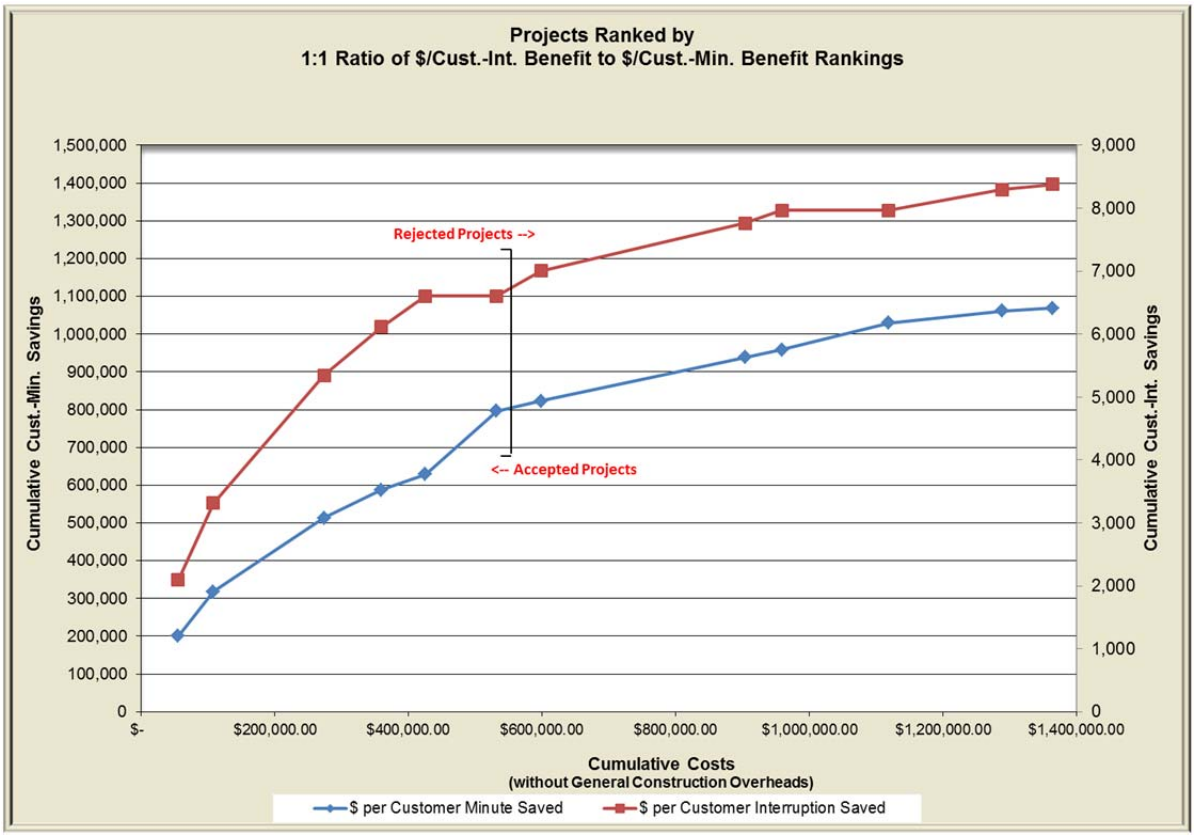
As described in section 3.1 above, in addition to the annual pole inspection and replacement program, each year Unitil completes annual reliability studies for each of its operating areas. The recommendations provided in the study are focused on improving the worst performing circuits as well as the overall system reliability. These REP projects count for the majority or all of the "System Hardening/Reliability" spending for each year.

The REP projects recommended for the budget include a project scope, construction cost estimate and estimated reliability improvements (annualized saved customer minutes and saved customer interruptions). All of the recommended projects are ranked against each other based upon two cost benefit comparisons (cost per saved customer minute and cost per saved customer interruption).

An overall project rank is derived from the sum of these two cost benefit rankings. In general, projects with low construction cost and high saved customer minutes or high saved customer interruptions are ranked highest on the list while those projects with high construction cost and low saved customer minutes or saved customer interruptions are ranked low on the list. Another way these projects are analyzed by Distribution Engineering is shown in Chart 10 below. This chart displays the cumulative project cost compared to the anticipated reliability benefits of all projects. Each data point pair represents a specific project and its associated reliability benefits (saved customer minutes and saved customer interruptions). This chart is used to determine when there is a diminishing return of reliability benefits

associated with project cost as indicated by the “knee” of the curve. Proposed projects to the left of the cutoff line are accepted into the Capital Budget and those to the right have been rejected.

Chart 10



The REP projects for 2014 presented in Table 17 below provide an illustration of the process used to identify REP projects. Table 17 is a listing of REP projects recommended by Distribution Engineering as part of the 2014 annual reliability studies for the UES system which have been accepted into the 2015 Capital Budget. This project listing details the overall project ranking, scope, cost, and anticipated reliability benefits.

Table 17

Project Ranking	DOC / Budget No.	Description	Project Cost	Cumulative Cost	Customer Interruptions Saved Annually	Customer Minutes Saved Annually
1	DRBE06	Circuit 43X1 - Add Recloser and Relocate Fuses	$ 54,943	$ 54,942.89	2,093	200,973
2	DRBE03	Circuit 2X2 - Install Recloser on Lafayette Road	$ 52,693	$ 107,635.78	1,221	117,174
3	DRBE04	New Boston Road Tap - Install Reclosers	$ 166,064	$ 273,700.23	2,032	195,114
4	DRBC02	375 Line Automatic Sectionalizing at Terrill Park	$ 85,276	$ 358,976.23	769	73,803
5	DRBC01	33 Line Remote Fault Indication and Motor Operators at Iron Works Road	$ 65,925	$ 424,902.01	492	42,344
6	DRBE08	3359 Line - Remote Fault Indication	$ 106,877	$ 531,779.34	0	167,391
PROPOSED NH REP PROJECTS			$ 531,778		6,607	796,799

Note the project list above has been sorted by project rank in ascending order beginning with the project having the best composite cost benefit ranking. This list is used by Distribution Engineering as a guide for recommending projects to be included in the Capital Budget as REP projects. The list above is those projects that were accepted into the 2015 capital budget. However, it should be noted not all projects identified in the annual reliability analysis are accepted in the Capital Budget.

3.3.1. 2014 Actual REP Expenditures

The 2014 capital expenditures of completed projects for the Company total $1,221,156[11]. In addition to the projects recommended as part of the annual reliability analysis (and listed in Table 17), this total includes the annual pole replacement project. The actual spending was below the budgeted amount due to projects that were completed for less than original budget estimate and two projects that were started, but not completed in 2014 due to issues with the equipment. Table 18 is a list of projects completed in the field and closed to plant as of December 31, 2014 and the final expenditures.

Table 18 - Projects initiated in 2014

Project	**Description/Comment**	**Total Expenditures**
Distribution Pole Replacement	Replacement of distribution poles which were identified during annual pole inspections. (Various Towns)	$ 1,109,260
Replace 59X1 Recloser at Stard Road Tap	Replacement of the 59X1 recloser at Stard Road Tap. This type of recloser is known for premature failure due to insulation breakdown	$ 64,539
13W1 – Install Recloser and Sectionalizer Crystal Hill	Install single-phase electronic recloser and replace existing fuses with cut-out mounted sectionalizer	$ 15,457
Cut-out installation and Fusing Changes	Install cut-outs at unfused lateral locations and replace various fuses with updated size	$ 31,900
Total		**$ 1,221,156**

3.3.2. 2015 REP Estimated Capital Expenditures and Work To Be Completed

The Settlement Agreement provides for Step Adjustments on May 1st of 2012, 2013, and 2014 for REP capital expenditures in the preceding years. Therefore, the Company understands that REP capital expenditures initiated in 2015 will not be included in a May 1st Step Adjustment in 2015. Regardless, the company plans to continue to invest in reliability enhancement projects and has included its 2015 REP capital spending plan.

[11] Reference Attachment 3 for schedule of 2014 REP project spending

The 2015 REP capital spending plan was developed from the recommendations identified in the annual reliability studies. The projects shown below provide the best cost benefit ratio based upon project cost and estimated reliability improvement. The proposed 2015 REP capital spending for Asset Replacement and System Hardening/Reliability is $1,771,000. The proposed projects are identified below.

The Asset Replacement projects identified for 2015 include distribution pole replacement of $1,239,222. Distribution pole replacements are based upon field inspections and are defined as poles that are not expected to last until the next inspection cycle. Distribution pole replacements are prioritized based upon their condition. Other smaller projects may be identified throughout the year such as insulator or cutout replacements identified during normal inspections. At this time, the cost of those replacements is unknown.

The 2015 System Hardening/Reliability projects are shown below in order of the ranking described in section 3.3 and total $531,778. Other System Hardening/Reliability projects may be identified throughout the year which may provide a better cost benefit than the projects presently identified. If such projects are identified, the Company generally attempts to maintain flexibility and complete the project with the better cost benefit ratio.

(1) *Circuit 43X1 - Add Recloser and Relocate Fuses*– This project consists of replacing the 150 QA fuses at pole 55 Exeter Road with an electronically controlled recloser, with the intent of relocating the 150 QA fuses to the vicinity of pole 64 Exeter Road.

(2) *Circuit 2X2 - Install Recloser on Lafayette Road*– This project will consist of installing a new electronically controlled recloser along Lafayette Road just north of the High Street intersection.

(3) *New Boston Road Tap - Install Reclosers* - This project will consist of installing two new electronically controlled reclosers along New Boston Road and splitting circuit 54X1 into two circuits, 54X1 and 54X2. The two new reclosers will be integrated in the New Boston Road tap RTU to provide SCADA control, telemetry and status.

(4) *375 Line Automatic Sectionalizing at Terrill Park* – This project will consist of Installing automatic sectionalizing capability on the 375J3 switch (which already has remote operation capability). This scheme would operate to automatically restore of Terrill Park Substation and 375X1for a fault on the 375line between Garvin's and Terrill Park, leaving no customers without power.

(5) *33 Line Remote Fault Indication and Motor Operators at Iron Works Road* – This project will consist of Installing SCADA monitored fault sensing devices on the Bow Junction side

of the 33J6 switch and the Pleasant Street side of the 33J7 switch. Also, install motor operators on the same two switches with SCADA control. This will allow central dispatch to isolate the faulted section of line and restore customers remotely.

(6) *3359 Line - Remote Fault Indication* - This project will consist of installing six sets of wireless fault indicators, two each at Cemetery Lane substation, Stard Road tap and Mill Lane tap.

4. 2014 Reliability Performance

4.1. Historical Performance (2010-2014)

The historical reliability performance for the UES system for the time period from 2010-2014 is outlined in Charts 11-13 below. These charts display annual SAIDI and SAIFI for the combined UES systems as well as separate charts for each of the UES-Capital and UES-Seacoast service territories.

Chart 11

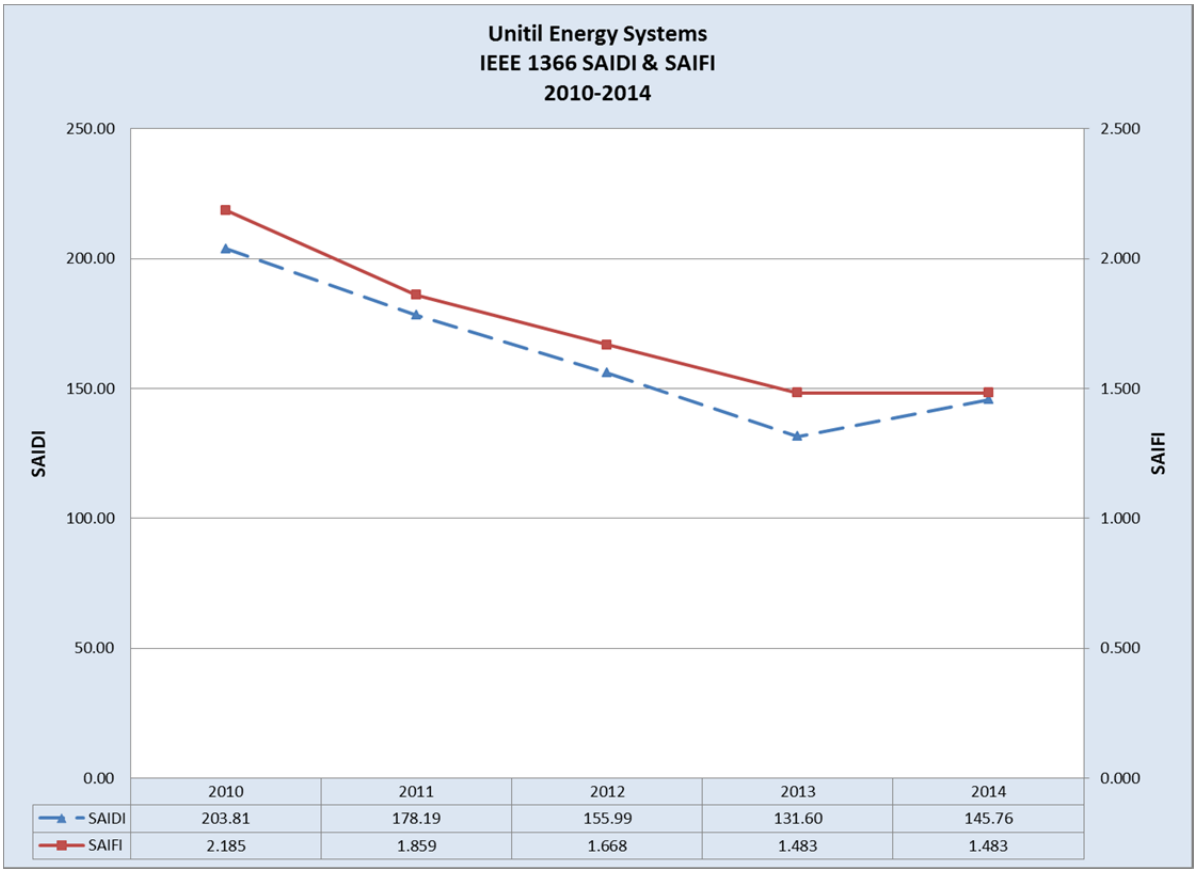


Chart 12

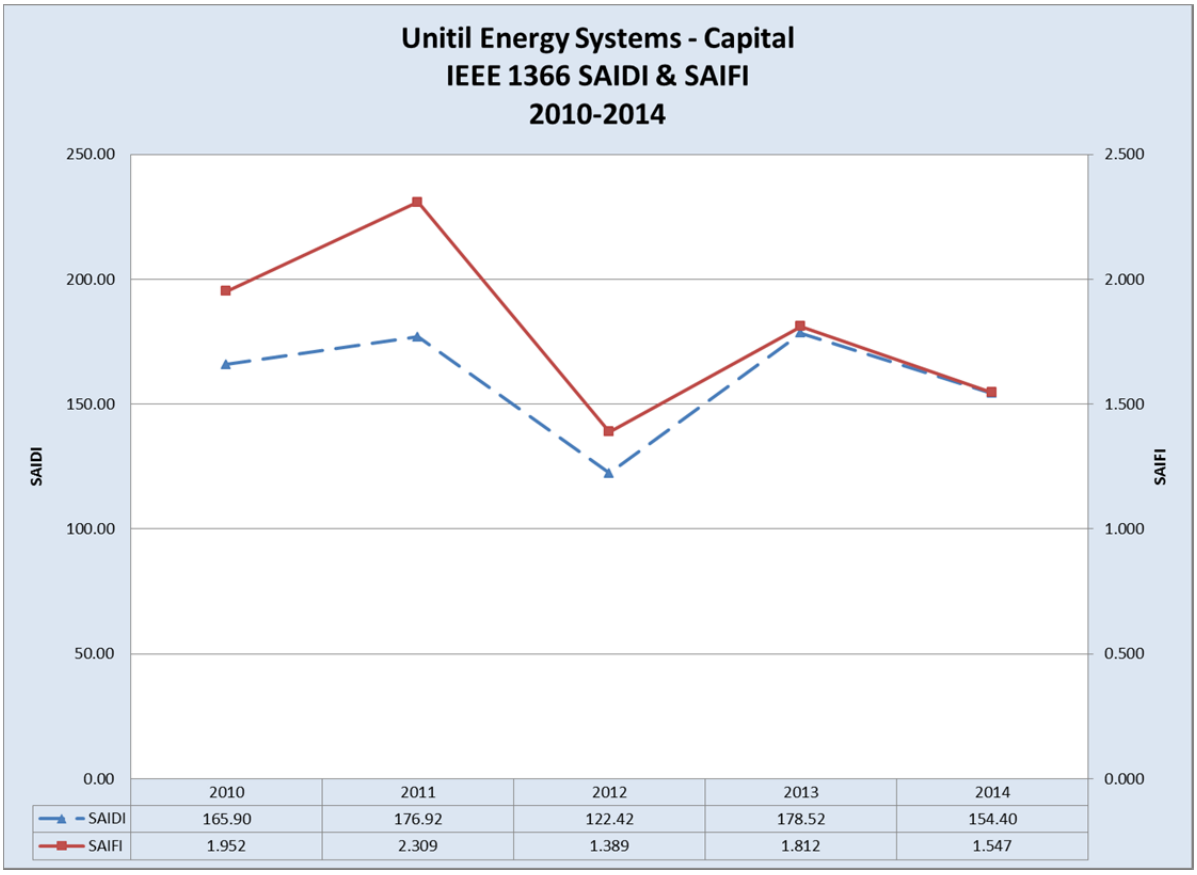
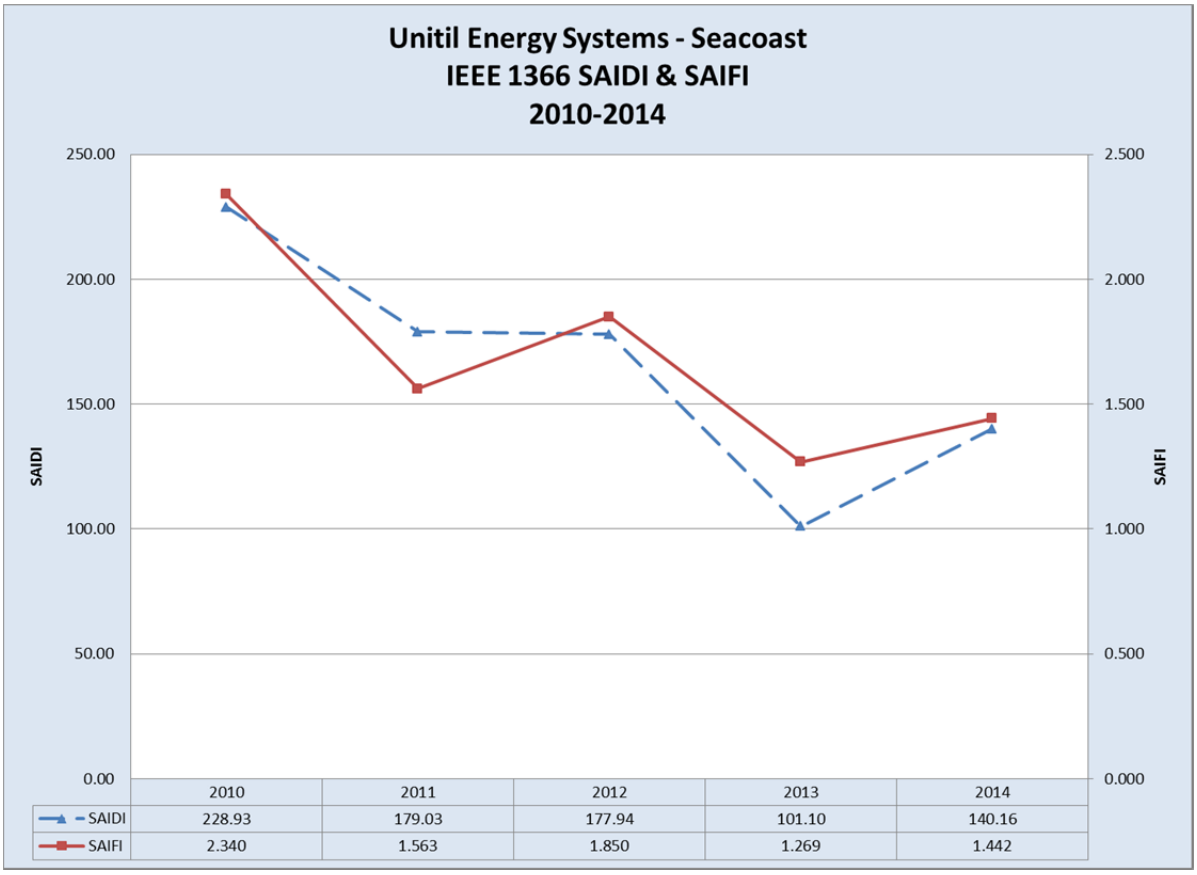

Unitil Energy Systems - Capital
IEEE 1366 SAIDI & SAIFI
2010-2014
250.00
200.00
150.00
100.00
50.00
0.00
2.500
2.000
1.500
1.000
0.500
0.000
SAIDI
SAIFI
2010 2011 2012 2013 2014
SAIDI 165.90 176.92 122.42 178.52 154.40
SAIFI 1.952 2.309 1.389 1.812 1.547

Chart 13



NOTE: Only those events causing an outage to 1 or more customers and lasting more than 5 minutes in duration are included in the calculation of these indices. In addition, events meeting any of the following criteria have also been excluded from these calculations:

- PUC Major Storm: All outages occurring in any day classified as an IEEE-1366 Major Event Day
- Interruptions/outages involving the failure of customer owned equipment
- Off system power supply interruptions

4.2. Summary of 2014 Performance

The reported reliability performance of the UES systems in 2014 (based on IEEE-1366) was the second best performance in the last five years in terms of SAIDI and the number of interruption events experienced. The combined UES system SAIDI of 145.76 minutes is roughly 10.6% lower than the 5 year average of 163.07 minutes. The UES combined system SAIFI for 2013 and 2014 was identical at 1.483 interruptions which is tied for the best performance in the last five years. The system SAIFI over the last two years has been approximately 14.5% lower than the 5 year average of 1.736. The total

number of interruption events recorded in 2014 excluding the Major Event Days listed below was 1,029. This is approximately 8.4% lower than the 5 year average of 1,123 interruption events.

In 2014, there were several events that met the IEEE -1366 criteria for a Major Event Day which were therefore not included in the calculation of UES system SAIDI and SAIFI. These Major Event Days are listed below:

- July 2nd – Wind Storm (Capital Region)
- September 8th – Sub-transmission outage affecting multiple supply points into the Capital system (Capital Region)
- November 26th – Snowstorm (Seacoast Region)
- November 26-28th – Snowstorm (Capital Region)

Table 19 below shows a breakdown of the reliability performance of the UES system by individual cause codes.

Table 19

Cause of Outage	No of Troubles	Cust-Int	Cust-Hrs	SAIDI	% of Total	SAIFI	% of Total
Tree/Limb Contact - Broken Limb	323	37,572	67,797.49	53.66	36.82%	0.496	33.42%
Patrolled, Nothing Found	149	7,640	10,697.54	8.47	5.81%	0.101	6.79%
Equipment Failure Company	123	26,587	32,698.04	25.88	17.76%	0.351	23.65%
Scheduled, Planned Work	87	1,518	2,546.10	2.02	1.38%	0.020	1.35%
Tree/Limb Contact - Broken Trunk	87	14,597	23,168.88	18.34	12.58%	0.193	12.98%
Squirrel	86	3,013	4,698.42	3.72	2.55%	0.040	2.68%
Tree/Limb Contact - Growth into Line	45	1,789	2,907.20	2.30	1.58%	0.024	1.59%
Vehicle Accident	31	5,327	14,888.78	11.78	8.08%	0.070	4.74%
Bird	16	790	951.54	0.75	0.52%	0.010	0.70%
Lightning Strike	15	2,482	7,422.21	5.87	4.03%	0.033	2.21%
Loose/Failed Connection	15	2,037	3,922.49	3.10	2.13%	0.027	1.81%
Action by Others	13	355	775.66	0.61	0.42%	0.005	0.32%
Tree/Limb Contact - Vines	9	3,326	7,182.31	5.68	3.90%	0.044	2.96%
Other	8	633	465.12	0.37	0.25%	0.008	0.56%
Tree/Limb Contact - Uprooted Tree	8	160	600.27	0.48	0.33%	0.002	0.14%
Operator Error/System Malfunction	6	4,545	3,304.98	2.62	1.79%	0.060	4.04%
Corrosion/Contamination/Decay	4	51	98.32	0.08	0.05%	0.001	0.05%
Animal - Other	1	8	15.33	0.01	0.01%	0.000	0.01%
Civil Emergency (fire,flood,etc.)	1	8	10.67	0.01	0.01%	0.000	0.01%
Improper Installation	1	1	1.06	0.00	0.00%	0.000	0.00%
Overload	1	1	1.26	0.00	0.00%	0.000	0.00%
TOTALS	**1,029**	**112,440**	**184,154**	**145.76**	**100.00%**	**1.483**	**100.00%**

As observed from the preceding table, tree related outages and equipment failures had the greatest impact on the UES system reliability in terms of both SAIDI and SAIFI performance in 2014. Table 20 below shows how the top three causes during 2014 have trended over the last three years[12].

Table 20

	SAIDI (% Total)				SAIFI (% Total)		
Cause	**2014**	**2013**	**2012**		**2014**	**2013**	**2012**
Tree Related	55%	56%	39%		51%	51%	42%
Equipment Failure	18%	16%	21%		24%	20%	14%
Patrolled, Nothing Found	6%	7%	9%		7%	4%	9%

[12] Percentages based on reliability data after removing exclusionary events based on the PUC exclusionary criteria in effect for the respective year.