2013 Asset Management Distribution Program Update

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This is a review of all the Asset Management Programs evaluated by Asset Management. While many AM plans have been created and reviewed, only a portion of the plans discussed have been implemented.

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Introduction

As Avista incorporates more work and Asset Management (AM) Plans each year, Asset Management is committed to monitor how these activities impact our systems and document the value created by the programs. Reviewing the results of AM activities and system responses provides us with the feedback necessary to learn and improve our plans and processes. These outcomes also help drive future work when actions don't yield the desired results or we find there is even more value of further work. In the end, our commitment to continuous improvement require us to examine how we have impacted our systems and learn from what has happened to make tomorrow's plans and work better.

Purpose

This report documents the KPIs and metrics AM uses for the Distribution system and provides the results for 2012. Some of the metrics provide a basis for comparing how an asset performed with a program and how it would have performed without a program. The difference in performance provides an estimate of the cost saving of the program. The estimated savings is only a snapshot in time and may not represent the exact savings; it provides a relative comparison and supporting justification for AM decisions made in the past. Other KPIs and metrics provide indications of how well an asset is performing and help determine when further work is required. KPIs and metrics tracking also help evaluate the accuracy of different AM models and determine when or if a model should be revised.

Data Sources

Information used in this report's metrics comes from three sources: Annual Sustained and Momentary outage data; Outage Management Tool (OMT) events; and Discoverer. The annual Sustained and Momentary outage data is generated by the Distribution Dispatch Engineer each month in a spreadsheet. The Sustained and Momentary outage data for years 2001 – 2007 was modified by AM to align the reasons and sub-reasons to coincide with the current descriptions. While the Sustained and Momentary outage data comes from OMT data and is a subset of OMT data, this data has been scrubbed by the Distribution Dispatch Engineer to improve its accuracy.

The OMT tracks outages and customer reports of problems on the Distribution system, Substations, and Transmission events that cause outages on the Distribution system. This data includes sustained outages, momentary outages, and events without outages. Events that only cause a partial outage or no outage at all do not show up in the Sustained and Momentary outage data, because the data does not fit the definition of a sustained outage or a momentary outage. However, the OMT data is subject to reporting an event more than once. The Distribution Dispatch Engineer reviews the data and strives to prevent duplication by rolling events up and editing the data. However, some duplication still occurs. OMT data is used to calculate number of outages, number of OMT events (outages, partial outages, and non-outage events), outage duration, number of customers impacted, response times, System Average

Interruption Frequency Index (SAIFI) impacts, and System Average Interruption Duration Index (SAIDI) impacts.

Discoverer provides financial, customer information, and material usage information from our warehouse and financial systems. Spending and material can be tracked to the ER and BI level for capital work and the MAC and Task for Operations and Maintenance (O&M) work.

Standard Calculations

See reference the "2013 General Metrics Data Collection and Analysis for System Reviews" for the details and examples of how different measures and metrics are calculated.

Review of OMT Data and Trends

Examining the data in OMT reveals a lot of information helps Avista understand the condition of our assets and shows some trends we can address. Below, we will examine various trends within OMT Events per Year, SAIFI trends by OMT Sub-Reasons,

OMT Events per Year

Table 1 shows the past seven years of data out of OMT by Sub-Reason and allows trend analysis. OMT Events represents cost and action for Avista, so it was selected as a basis for much of our trending. However, OMT Outage data (shown in Table 2) can have a different trend than OMT Events. Since the SAIFI analysis already includes outage data, AM selected to trend OMT Events and SAIFI contribution. Based on Table 1, we identified the top 10 increasing and decreasing trends in OMT Sub-Reasons. The Top 10 increasing trends in the number of OMT events by year is shown in Table 3 and the Top 10 decreasing trends in the number of OMT events by year is shown in Table 4.

Table 1, OMT Events by Sub-Reason and Year

OMT SUB-REASON	2006	2007	2008	2009	2010	2011	2012
Arrester	29	26	26	19	32	30	36
Bird	207	220	187	218	179	332	231
Bus Insulator	3	0	0	0	0	2	1
Capacitor	2	6	4	4	2	0	4
Car Hit Pad	70	88	129	139	105	98	105
Car Hit Pole	234	231	202	217	298	339	355
Conductor - Pri	68	59	51	42	64	81	110
Conductor - Sec	247	231	252	286	273	310	286
Connector - Pri	75	89	99	111	101	100	79
Connector - Sec	323	340	395	429	410	408	390
Crossarm-rotten	28	46	38	23	25	28	19
Customer Equipment	1047	1182	1475	1626	1458	1384	1434
Cutout/Fuse	263	272	234	197	217	176	209
Dig In	138	132	152	164	149	123	109

OMT SUB-REASON	2006	2007	2008	2009	2010	2011	2012
Elbow	6	5	8	7	5	8	2
Fire	124	135	182	157	203	234	230
Forced	42	52	62	51	63	67	33
Foreign Utility	382	455	856	724	894	720	734
Highside Breaker	2	1	0	0	2	0	0
Highside Fuse	0	2	4	0	0	0	0
Highside Swt/Disconnect	0	0	4	0	0	0	0
Insulator	48	25	37	32	49	36	32
Insulator Pin	19	18	17	28	24	30	25
Junctions	2	1	0	2	2	1	4
Lightning	638	333	335	598	163	179	635
Lowside OCB/Recloser	1	1	2	6	8	4	0
Lowside Swt/Disconnect	1	0	0	2	0	0	0
Maint/Upgrade	222	331	350	539	1571	3334	2589
Other	422	409	434	394	414	426	483
Pole Fire	157	116	157	116	102	117	113
Pole-rotten	33	25	44	44	37	35	52
Primary Splice	0	3	1	0	1	1	0
Protected	9	10	23	18	10	4	5
Recloser	1	4	2	4	11	3	2
Regulator	11	8	13	14	20	17	13
Relay Misoperation	3	1	1	5	7	0	0
SEE REMARKS	711	747	849	821	892	543	487
Service	69	113	144	123	188	197	230
Snow/Ice	337	249	2093	988	565	167	352
Squirrel	902	801	747	700	390	395	358
Switch/Disconnect	10	1	15	9	3	0	3
Termination	10	9	18	7	7	9	12
Transformer	0	5	5	0	3	0	9
Transformer - OH	248	179	211	158	128	156	167
Transformer UG	61	47	46	57	53	51	50
Tree	65	92	66	55	53	51	56
Tree Fell	495	315	470	390	506	392	377
Tree Growth	261	273	443	375	330	335	335
Underground	0	5	2	0	3	1	3
Undetermined	724	1014	1116	1145	948	861	783
URD Cable - Pri	211	198	176	136	93	95	72
URD Cable - Sec	184	185	212	212	190	248	219
Weather	386	251	564	357	895	325	314
Wildlife Guard	0	0	0	3	0	1	2

OMT SUB-REASON	2006	2007	2008	2009	2010	2011	2012
Wind	2105	953	822	294	1309	256	1042

Table 2, OMT Outages and Partial Outages by Sub-Reason and Year

OMT SUB-REASON	2006	2007	2008	2009	2010	2011	2012
Arrester	28	25	22	18	31	30	32
Bird	204	215	178	213	175	322	225
Bus Insulator	3	0	0	0	0	2	1
Capacitor	0	3	2	4	1	0	3
Car Hit Pad	35	46	47	41	30	31	45
Car Hit Pole	132	133	104	104	135	131	158
Conductor - Pri	50	42	26	31	49	61	70
Conductor - Sec	128	102	107	117	104	126	124
Connector - Pri	62	71	88	102	84	82	59
Connector - Sec	189	224	246	272	263	270	267
Crossarm-rotten	20	38	28	11	20	24	17
Customer Equipment	764	897	1040	1205	1121	1034	1099
Cutout/Fuse	236	238	207	175	194	161	185
Dig In	95	99	103	104	88	75	64
Elbow	5	5	7	7	5	7	2
Fire	44	68	31	8	69	72	82
Forced	42	52	61	51	63	67	33
Foreign Utility	53	63	110	78	103	61	62
Highside Breaker	2	1	0	0	1	0	0
Highside Fuse	0	2	4	0	0	0	0
Highside Swt/Disconnect	0	0	0	0	0	0	0
Insulator	33	13	25	23	31	26	19
Insulator Pin	17	16	15	16	15	18	19
Junctions	2	1	0	0	1	0	2
Lightning	599	323	320	572	159	174	562
Lowside OCB/Recloser	1	1	2	6	8	3	0
Lowside Swt/Disconnect	1	0	0	2	0	0	0
Maint/Upgrade	222	331	342	534	1566	3331	2587
Other	293	301	252	247	275	261	282
Pole Fire	134	108	130	101	87	93	95
Pole-rotten	7	5	7	14	11	10	9
Primary Splice	0	3	1	0	1	1	0
Protected	8	9	16	17	7	4	5
Recloser	1	4	2	3	9	1	2
Regulator	10	8	11	10	16	14	10
Relay Misoperation	3	1	1	5	7	0	0

OMT SUB-REASON	2006	2007	2008	2009	2010	2011	2012
SEE REMARKS	351	406	318	420	443	286	255
Service	34	80	92	59	89	86	59
Snow/Ice	301	225	1176	592	347	135	291
Squirrel	890	786	725	694	380	389	351
Switch/Disconnect	9	1	6	7	3	0	1
Termination	10	9	16	7	6	8	12
Transformer	0	5	5	0	3	0	9
Transformer - OH	233	164	193	143	107	138	150
Transformer UG	55	45	38	42	44	36	42
Tree	54	71	46	42	39	36	39
Tree Fell	309	176	255	186	234	215	229
Tree Growth	76	107	101	101	77	71	93
Underground	0	5	2	0	1	1	3
Undetermined	659	914	956	1023	855	799	684
URD Cable - Pri	209	197	153	132	89	92	71
URD Cable - Sec	166	168	194	201	175	227	202
Weather	279	192	358	273	620	178	170
Wildlife Guard	0	0	0	3	0	0	2
Wind	1770	737	553	229	982	195	802

Table 3, Top Ten Trends Upward in OMT Data by Sub-Reason based on 2006-2012 data

Top Ten Upward Trends	
OMT Sub-Reason	Slope Change per Year
Maint/Upgrade	511
Customer Equipment	49
Connector - Sec	12
Bird	10
URD Cable - Sec	7
Fire	6
Conductor - Pri	4
Car Hit Pole	4
Service	3
Conductor - Sec	1

The largest upward trend is our increase in maintenance and upgrade outages. We have implemented many programs that increase our outages due to maintenance but decrease the number of outages due to failures. It appears that Planned Work has had an impact on our outages. The outages that are directly and indirectly affected by the Vegetation program, Wood Pole Management, and other planned work have dropped out of the table. All of the results in Table 3 are at a level that a program is probably not needed or outside the scope of an Asset Management Program.

Table 4 shows the Top 10 OMT Sub-Reasons with a downward trend. The largest downward trend is in Wind event driven largely by the calmer storm seasons our region has experienced over the past few years. The trend for Squirrel related outages in Table 4 show the results of adding Wildlife Guards (WLG) on new installs and adding them to existing transformers as part of a WLG program and Wood Pole Management. Our Cutout Replacement programs for Chance cutouts and bad cutouts identified by Wood Pole Management have made a great impact on the number of cutout events. The URD cable Replacement program for the first generation of unjacketed cable has paid great dividends when compared to where it could have been without taking action at reducing URD Cable – Pri events. Adding Lightning arresters on existing transformers as part of Wood Pole Management and other planned work has aided in reducing the number of Lightning related outages. However, we have also experienced mild storm years as well that has also impacted the lightning related events. Pole Fire events have several sources but replacing cutouts, replacing wood arms with fiberglass, and the work of the Wood Pole Management have had an impact on this Sub-Reason. The remaining Sub Reasons in the table have trend downward but the changes are not material at this point in time.

Table 4, Top Ten Trends Downward in OMT Data by Sub-Reason based on 2005-2010 data

Top Ten Downward Trends	
OMT Sub-Reason	Slope Change per Year
Wind	-127
Squirrel	-98
Snow/Ice	-37
URD Cable - Pri	-25
Lightning	-20
SEE REMARKS	-14
Transformer - OH	-14
Cutout/Fuse	-11
Undetermined	-9
Pole Fire	-7

The overall trends in OMT Events are shown in Figure 1 along with the trends in AM related OMT Events (see Appendix A of the "2013 Asset Management Electrical Distribution Program Review and Metrics" and the table titled "List of AM Related OMT Sub-Reasons" to see which OMT Sub-Reasons are considered AM Related). Based on Figure 1, Avista sees the number of events stabilizing compared to 5 years ago. The overall trend still shows an increase, but the trend for the past 4 appears to be stabilizing around 13,000 events per year. However, Figure 2 shows that the number of OMT events representing failures is actually on a downward trend over the past 5 years (see OMT Events w/o Maint/Upgrades for this trend).

AM related OMT events are actually decreasing at a rate around 4%. Since the regional growth rates are less than 2%, the decrease is most probably due to the increase in maintenance in the system and replacement of aged infrastructure.

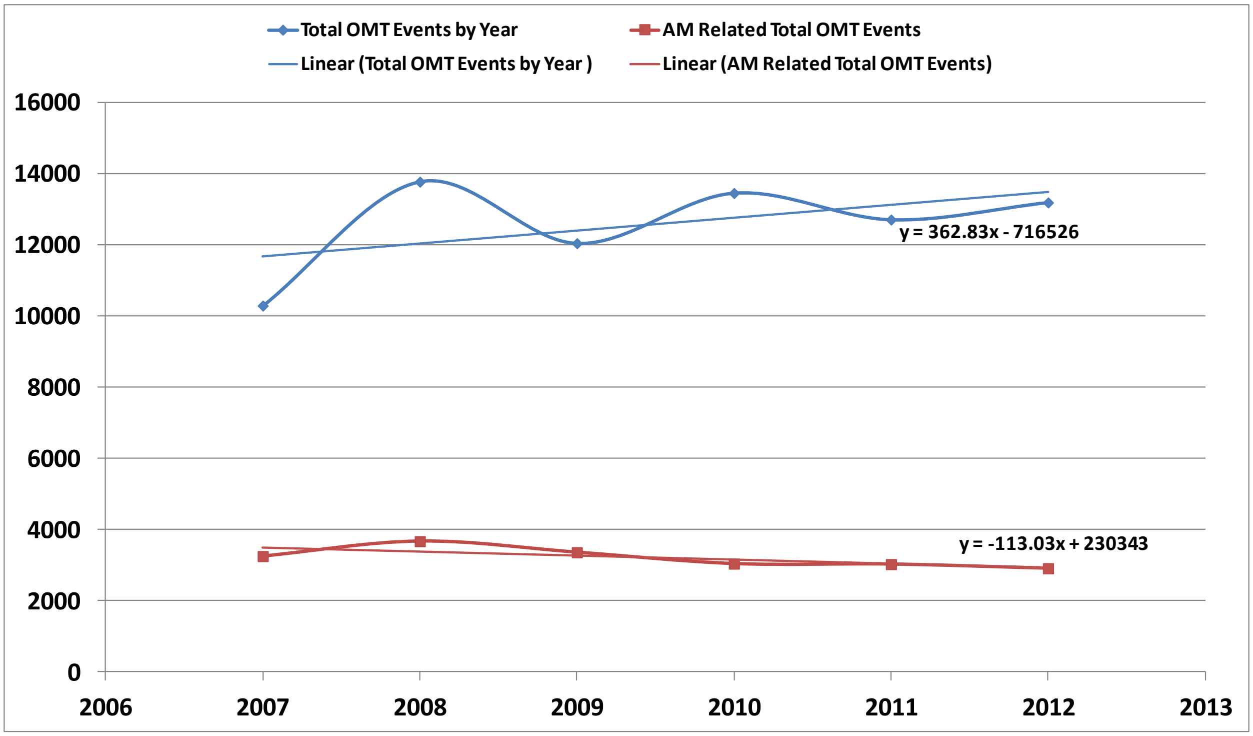

Figure 1, OMT Annual Number of Events and AM Related Event Trends and Trend Lines

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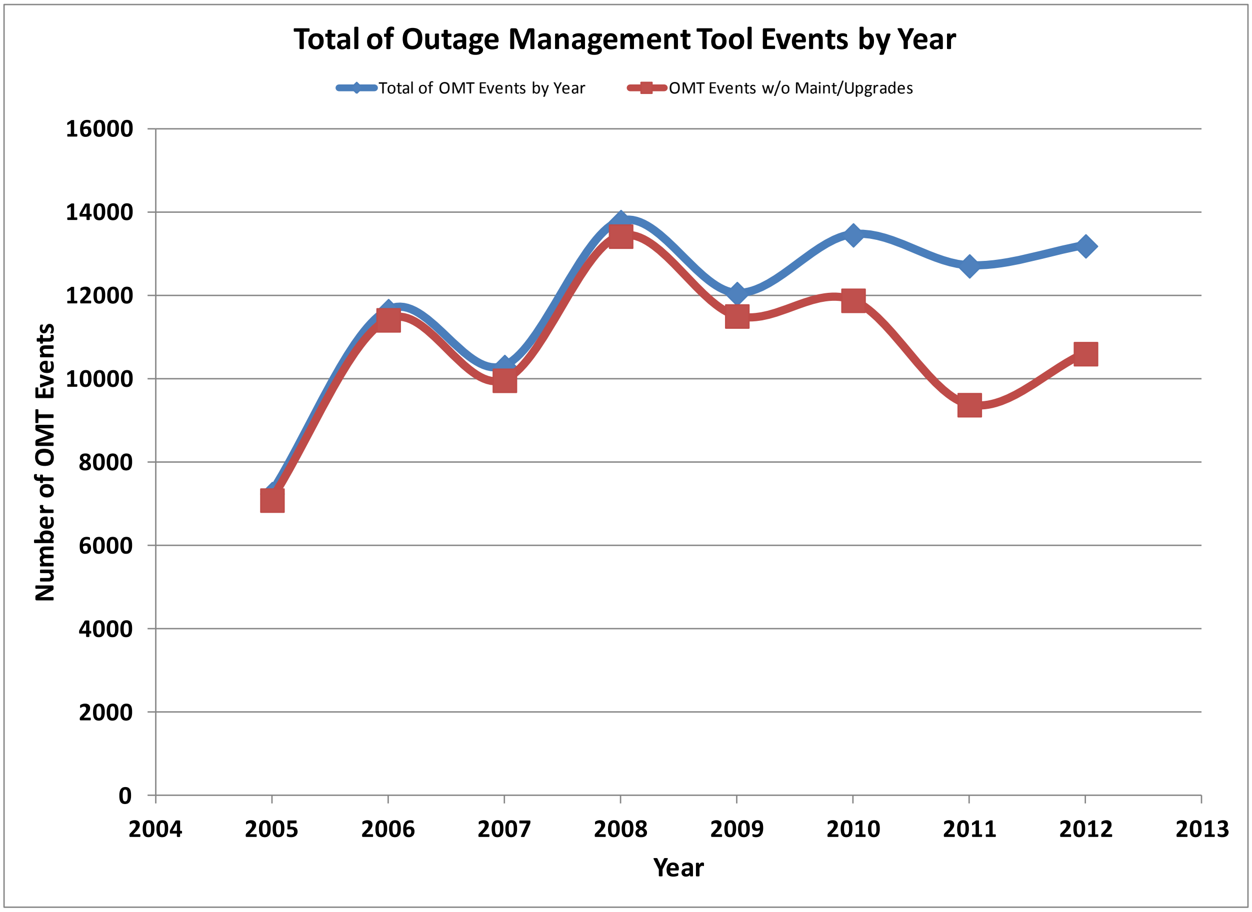

Figure 2, OMT Events with and without Planned Maintenance or Upgrades

SAIFI Trends by OMT Sub-Reasons

Examining how SAIFI changes each year is shown in Table 5. SAIFI values in Table 5 represent the annual value each event contributes to the overall SAIFI number. For example, in 2005, the average Arrester event in OMT added 0.000203395 to the overall SAIFI number for the year. While the number of electrical customers does grow each year, the main driver for changes in the average SAIFI number per event comes from the average numbers of customers affected by the event. Continuing our example with Arresters, in 2005 Avista had 338,437 electrical customers and the average Arrester outage event affected 271 customers, so the average SAIFI impact per event was 0.000203. In 2006, our electrical customer count increased to 345,517 and the average number of customers affected by an Arrester related outage jumped to 527, almost double the previous year and the average SAIFI impact due to Arrester events rose to 0.000388. The result for SAIFI was an increase in the average impact to SAIFI in 2006 compared to 2005.

While most Sub-Reasons in OMT have fluctuating value around an average value over the past five years, some Sub-Reasons have demonstrated a definite trend upward as shown in Figure 4~~Figure 4Figure 4~~. Figure 4~~Figure 4Figure 4~~ shows the top 10 Sub-Reasons based on the percentage change in 2012. Some of the items in Figure 4~~Figure 4Figure 4~~ had small numerical changes but the percentage change was significant. The Elbow Sub-Reason is an example of this, because the number of OMT events was <10 in all years and the SAIFI value in 2005 was in the 10^{-6} range but moved steadily into the 10^{-4} range showing a dramatic percentage change over five years.

Figure 5, Figure 6~~Figure 6Figure 6~~, and Figure 7 illustrate the makeup of the overall SAIFI value, overall OMT Sustained Outages, and OMT Events by Sub-Reasons. Figure 6~~Figure 6Figure 6~~ and Figure 7 generally show the same results but Figure 5 shows a different result because the number of customers impacted by each Sub-Reason is different. For example, we have very few Transformer caused outages, but they affect a large number of customers. So, Transformers show a significant impact to SAIFI in Figure 5 but are insignificant on Figure 6~~Figure 6Figure 6~~ and Figure 7.

Table 5, SAIFI Trends by OMT Sub-Reason Average per Outage

Average SAIFI by Sub-Reason Event							
OMT Sub-Reason	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Arrester	0.010961955	0.01336324	0.011896617	0.008745915	0.009230266	0.003380523	0.015245676
Bird	0.024434391	0.015658058	0.016111406	0.051184585	0.026835343	0.050143556	0.015659978
Bus Insulator	0.010865142	0	0	0	0	0.009016775	0.000463618
Capacitor	0	0.000954613	0.002953837	0.002533353	0.002842798	0	0.006147101
Car Hit Pad	0.004008913	0.004577603	0.003859152	0.003022983	0.001972404	0.00315424	0.004171572
Car Hit Pole	0.072635457	0.082729511	0.056285174	0.05623644	0.055741604	0.034563763	0.078829605
Conductor - Pri	0.018499731	0.021600264	0.011489151	0.025289327	0.013459389	0.025213018	0.024181701
Conductor - Sec	0.001247081	0.001383003	0.001479731	0.001086872	0.001923463	0.001952154	0.003857768
Connector - Pri	0.012843943	0.019175112	0.044761723	0.036707546	0.029390854	0.022841718	0.023941651
Connector - Sec	0.001489753	0.002766032	0.002171923	0.00158371	0.001764569	0.001927718	0.002095065
Crossarm-rotten	0.004762366	0.050334458	0.0252873	0.001820303	0.010791352	0.017452881	0.004106797
Customer Equipment	0.00010476	7.49088E-05	0.000124802	8.77548E-05	8.43629E-05	4.18879E-05	0
Cutout/Fuse	0.037662682	0.015844599	0.024630616	0.020002232	0.029472485	0.014918168	0.027484801
Dig In	0.013822657	0.011935045	0.017879617	0.017426241	0.002911047	0.007751271	0.001543001
Elbow	7.04241E-05	0.000175223	0.001148975	0.001834192	9.54113E-05	0.000737521	2.50685E-05
Fire	0.003434279	0.017648049	0.001552322	0.000963714	0.000916016	0.001765849	0.004579849
Forced	0.026498934	0.022935126	0.037704074	0.041119919	0.026724006	0.011341762	0.01007956
Foreign Utility	0	4.62462E-05	0.000104966	9.67203E-06	0.06415389	1.9551E-05	1.10385E-05
Highside Breaker	0.005137229	0.005624164	0	0	0.001809346	0	0
Highside Fuse	0	5.79715E-06	0.003370373	0	0	0	0
Highside Swt/Disconnect	0	0	0	0	0	0	0
Insulator	0.008319149	0.006320321	0.005329816	0.032674813	0.00947135	0.00767475	0.001619894
Insulator Pin	0.007745791	0.015949133	0.002512396	0.00073663	0.00609977	0.012718209	0.002646432
Junctions	0.000359708	0.000127537	0	0	5.63488E-06	0	0.002791077
Lightning	0.125091807	0.128468634	0.083469701	0.093833897	0.05153771	0.029986357	0.107700751
Lowside OCB/Recloser	0.003589236	0.002156231	0.00501564	0.032172584	0.02327413	0.013159376	0

Average SAIFI by Sub-Reason Event							
OMT Sub-Reason	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Lowside Swt/Disconnect	0.004042156	0	0	0.001932028	0	0	0
Maint/Upgrade	0.067346483	0.056121124	0.073959603	0.146879337	0.115272977	0.131045664	0.093958391
Other	0.150591892	0.139200478	0.087814989	0.158240122	0.177318475	0.156583826	0.114257941
Pole Fire	0.124284188	0.071639978	0.085131634	0.056866386	0.108242728	0.087722138	0.058825288
Pole-rotten	0.002994252	0.000430513	0.000936218	0.001111959	0.002027401	0.002475849	0.001111378
Primary Splice	0	8.94841E-05	2.81903E-06	0	1.40872E-05	0.000227493	0
Protected	0.00227485	0.009257534	0.013300204	0.006434116	0.005438117	0.000105902	0.000523814
Recloser	3.83302E-05	0.001297214	0.001916203	0.003492427	0.002520587	0.000212125	8.36386E-06
Regulator	0.003510922	0.005390496	0.024938242	0.011105746	0.019517299	0.003012273	0.020486437
Relay Misoperation	1.7681E-05	0.008228451	0.005720398	0.01961408	0.026993562	0	0
SEE REMARKS	0.019351895	0.015994757	0.032649991	0.017553605	0.0263254	0.022946333	0.024001629
Service	0.00113598	0.000501324	0.00054765	0.000382684	0.001512913	0.001254413	0.001425234
Snow/Ice	0.120736899	0.081725352	0.264038325	0.133791974	0.091003627	0.039682871	0.109703932
Squirrel	0.016993837	0.023857822	0.08015205	0.056647666	0.021425719	0.039013725	0.050207568
Switch/Disconnect	0.013598186	5.79715E-06	0.002055625	0.0165265	0.004582077	0	4.14971E-05
Termination	0.000203253	0.000467243	0.000867328	0.000227232	0.000152009	0.000173439	0.000637191
Transformer	0	0.009703026	0.023561073	0	0.002368376	0	0.026729531
Transformer - OH	0.004014128	0.007052431	0.01118744	0.00773242	0.002407314	0.017106495	0.004874802
Transformer UG	0.001399379	0.002360207	0.002263655	0.001051355	0.001704189	0.001165537	0.001438726
Tree	0.016868605	0.013180035	0.004975592	0.005575766	0.013288743	0.000938339	0.011356792
Tree Fell	0.098678253	0.076230149	0.057889379	0.048048112	0.092136448	0.062998204	0.067319172
Tree Growth	0.0038179	0.012134005	0.010881641	0.004394705	0.007012046	0.003838547	0.005569335
Underground	0	8.34231E-05	3.4203E-05	0	2.81744E-06	2.80426E-06	3.87453E-05
Undetermined	0.133189972	0.168118512	0.29086705	0.286489483	0.110134471	0.234672203	0.177748096
URD Cable - Pri	0.011201018	0.017483349	0.022121806	0.009632032	0.005903606	0.008770789	0.002422167
URD Cable - Sec	0.000792905	0.000815417	0.001058763	0.000945651	0.000953008	0.001467391	0.001544569
Weather	0.100863902	0.078263003	0.115917398	0.097935383	0.195547002	0.051231256	0.053674679
Wildlife Guard	0	0	0	8.47553E-06	0	0	8.35232E-06
Wind	0.555124223	0.232776552	0.220754073	0.115850205	0.291134088	0.089836161	0.195492335

OMT Sub-Reason Events High Limit

The second metric used to determine if we must examine a problem is the deviation from the established mean discussed above for each OMT Sub-Reason. If the number of OMT events for a specific Sub-Reason exceeds the OMT Sub-Reason Events High Limit (High Limit) AM will conduct an investigation and try to explain why the annual values are exceeding the limit (see Appendix D of the "2013 Asset Management Electrical Distribution Program Review and Metrics"). The High Limit is based on the average of annual values for each Sub-Reason plus two standard deviations. This method is also used to calculate the quarterly High Limit as well. The data for the average is the OMT Data for 2006 through 2010. For 2012, the following OMT Sub-Reasons exceeded their High Limit are shown in Table 6. We anticipated that Avista would exceed these limits due to natural deviations for events outside our control and due the some cyclical nature we observe in our data. Our goal here is to help identify trends in time to potentially address them if possible.

Table 6, OMT Sub-Reasons Exceeding Annual High Limit

OMT Sub-Reasons Exceeding their associated OMT High Limit	Number of Years High Limit Exceeded
Car Hit Pole	3
Conductor - Pri	2
Fire	2
Maint/Upgrade	3
Other	1
Service	3
Transformer	1

Based on Table 6, we currently don't see any issues requiring changes to our current plans. Most of the issues identified above are outside our control. However, we currently monitor Car Hit Pole events more closely and anticipate that some kind of action may be called for in the future.

Figure 3 shows the quarterly trends that feed into the annual trends for the OMT High Limit. For all OMT Sub-Reasons, only three Sub-Reasons have had more than three quarters where they exceeded the High Limit, Car Hit Pole with 9 quarters above the limit, Maint/Upgrades, and Service with 6 quarters above the limit. This information is consistent with Table 6 above. We will continue to monitor Service for potential future action, but it currently does not warrant a maintenance or replacement strategy.

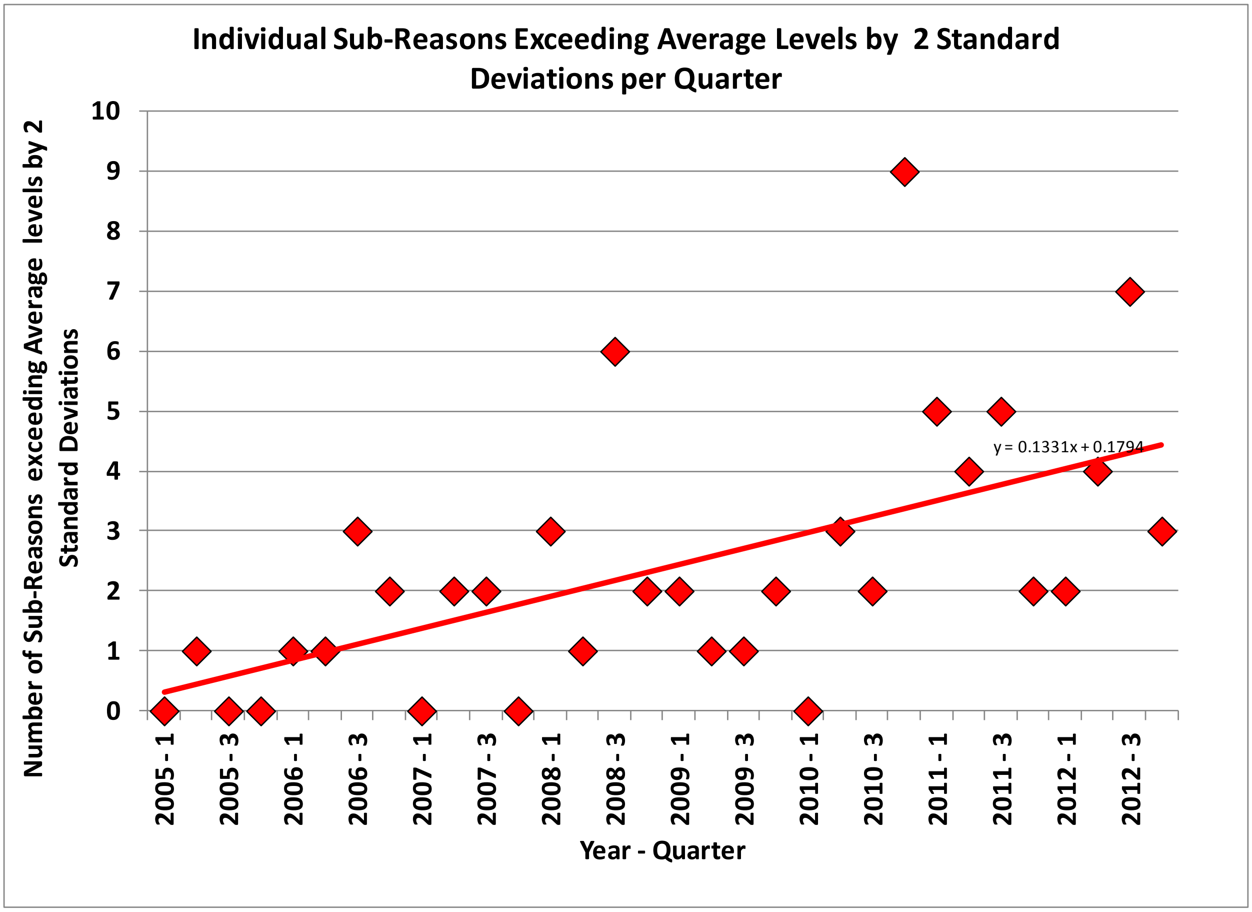

Figure 3, Individual Sub-Reasons exceeding Quarterly High Limits

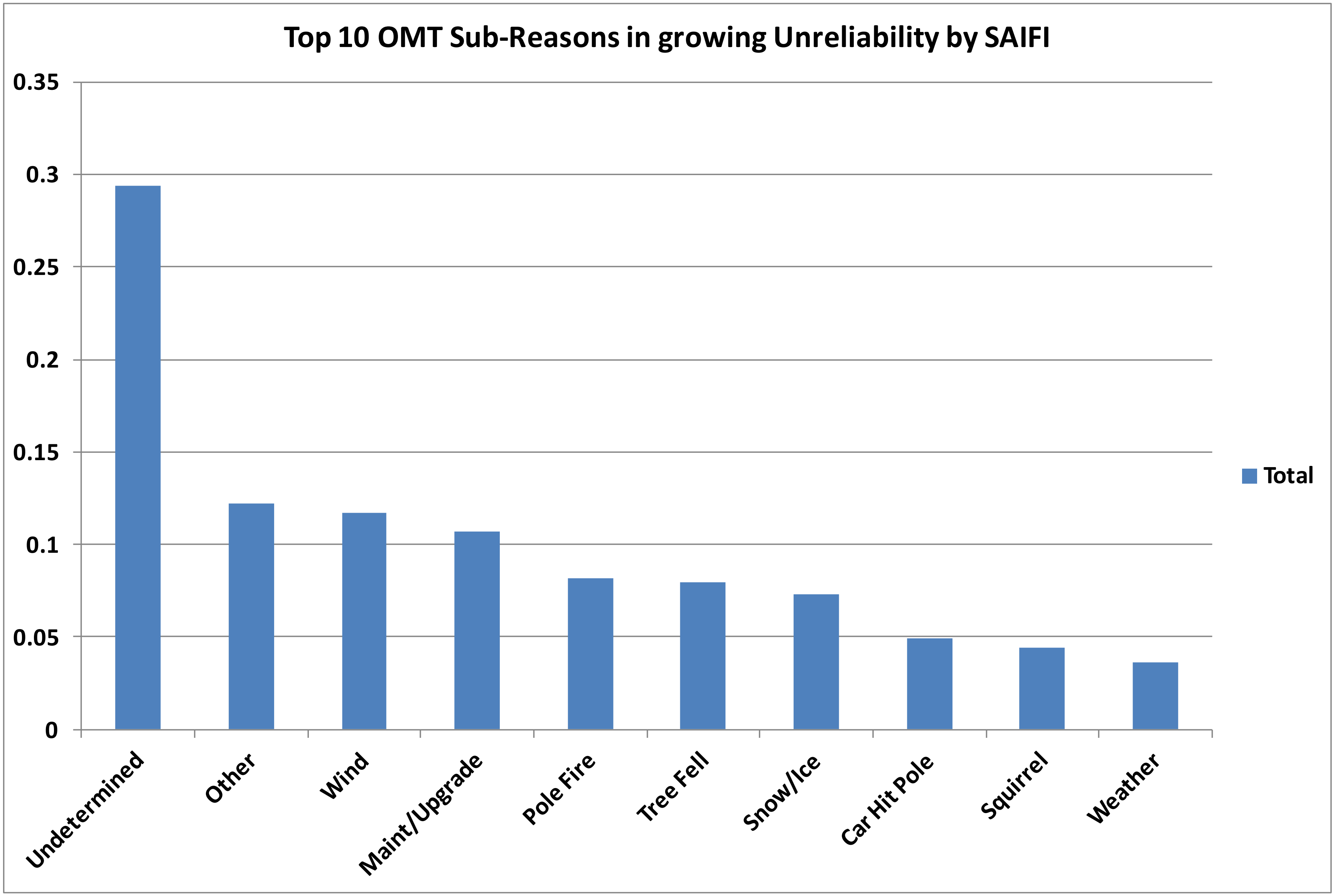

Figure 4, Top 10 Sub-Reasons with the Value of SAIFI Rising over Time

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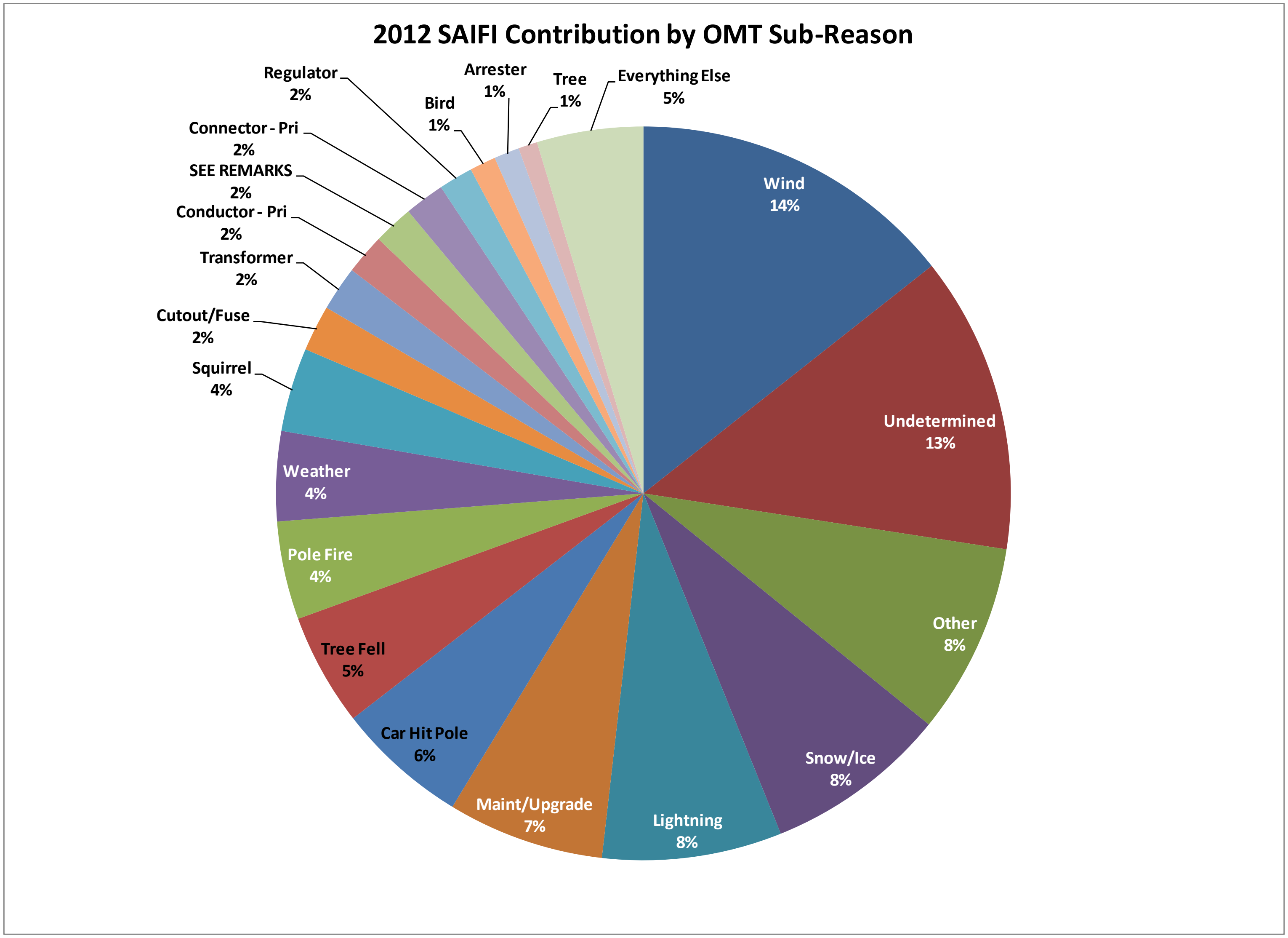

Figure 5, 2012 OMT SAIFI Contribution by Sub-Reason

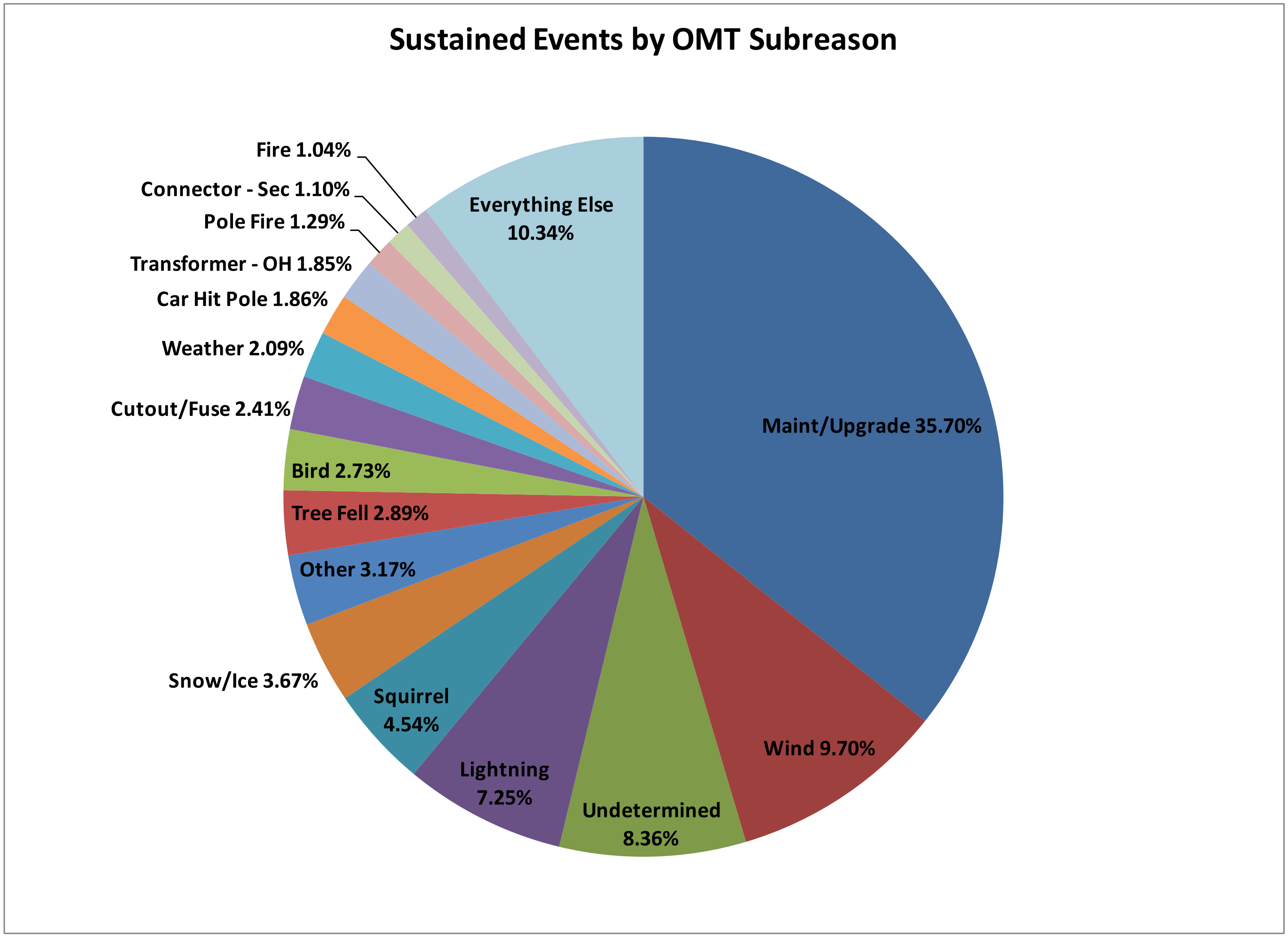

Figure 6, 2012 OMT Sustained Outage Comparisons

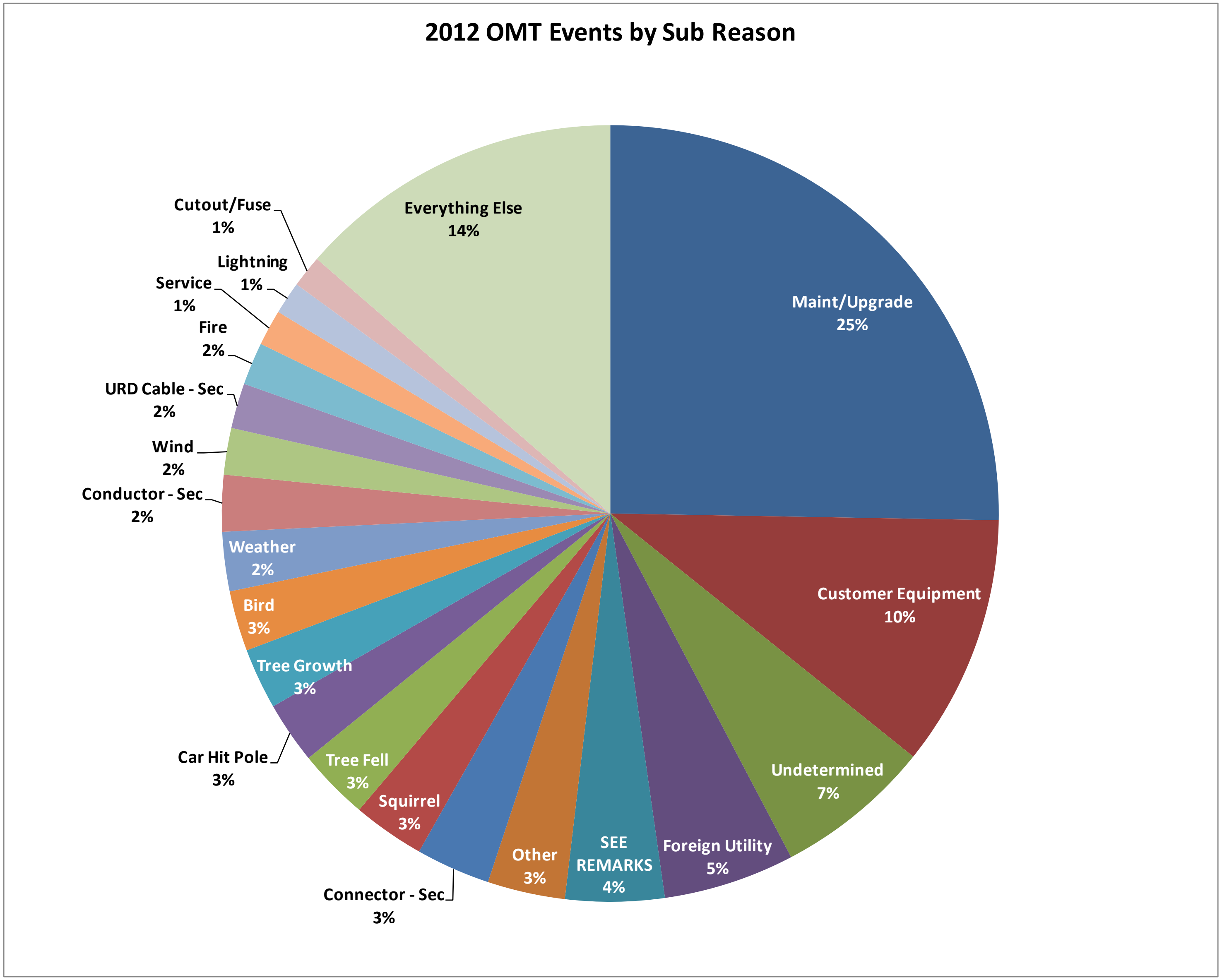

Figure 7, 2012 OMT Events by Sub-Reason

AM Related Material Used by Electric Distribution Minor Blanket, ER 2055

The Electric Distribution Minor Blanket, ER 2055, provides an opportunity to examine capital work that replaces equipment for various reasons not associated with a specific job. This ER includes replacing components known to be in bad order. By plotting the number of AM related material used in ER 2055 along with the number of OMT events each year, we see some interesting trends as shown in Figure 8~~Figure 8~~Figure 8. 2011 and 2012 saw some large swings compared to previous years. It is too early to tell where the trends are headed, but a lot more work similar to Wood Pole Management was accomplished in 2012 on aged and failing equipment and components than previously seen.

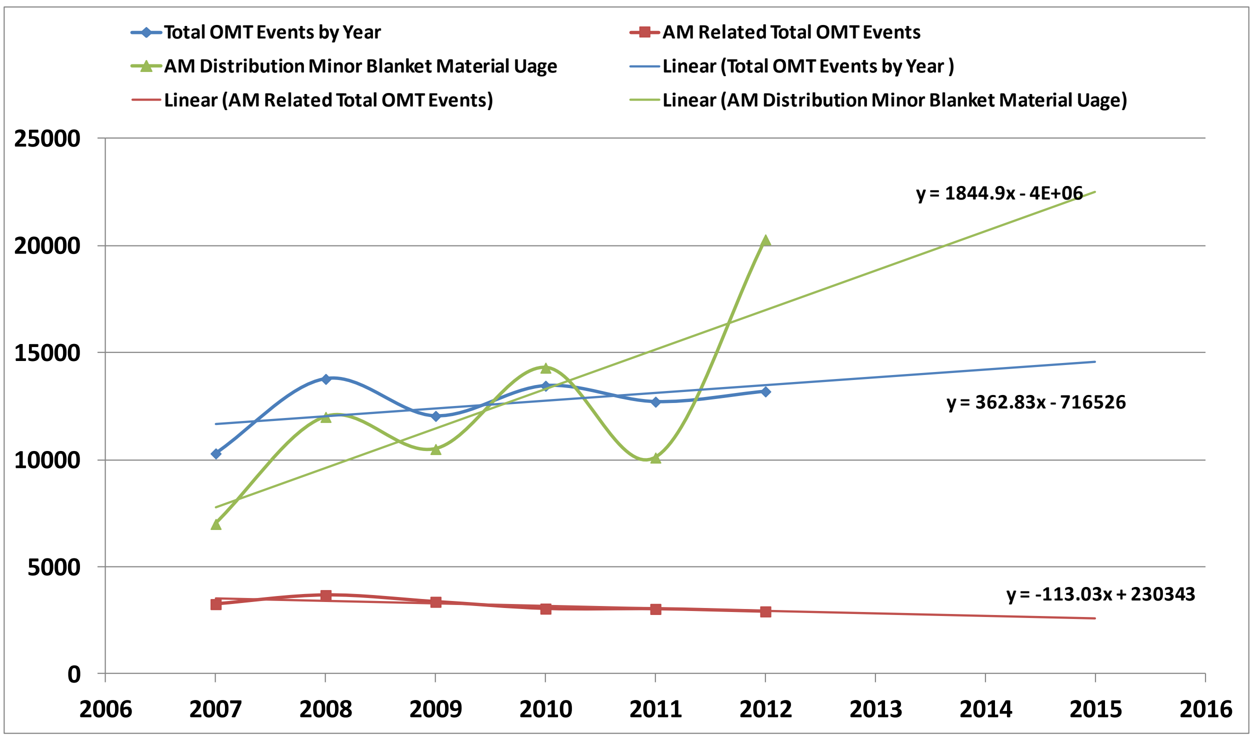

Figure 8, OMT Events and AM Related Material Used by ER 2055 by Year and their associated Trend Lines

Risk Action Curve Evaluation

For the year 2012, three different OMT Sub-Reasons exceeded the Risk Action Curve annual threshold than we have seen the past two years, Car Hit Pole, Snow/Ice, and Transformer. Figure 9 shows the Customer/Event values for 2007 -2012 as a bar chart and the Risk Action Curve thresholds for each year as a line for all of the Sub-Reasons that have exceeded the Risk Action Curve at least two times. When the bar chart value is above the limit line for a particular Sub-Reason, the Sub-Reason has exceeded the threshold value. Examining 2012 on Figure 9, shows that all three Sub-Reasons exceeded the threshold values by a small margin. For 2012, many of the past issues performed much better and those that exceeded the Risk Action Curve seem to be an anomaly.

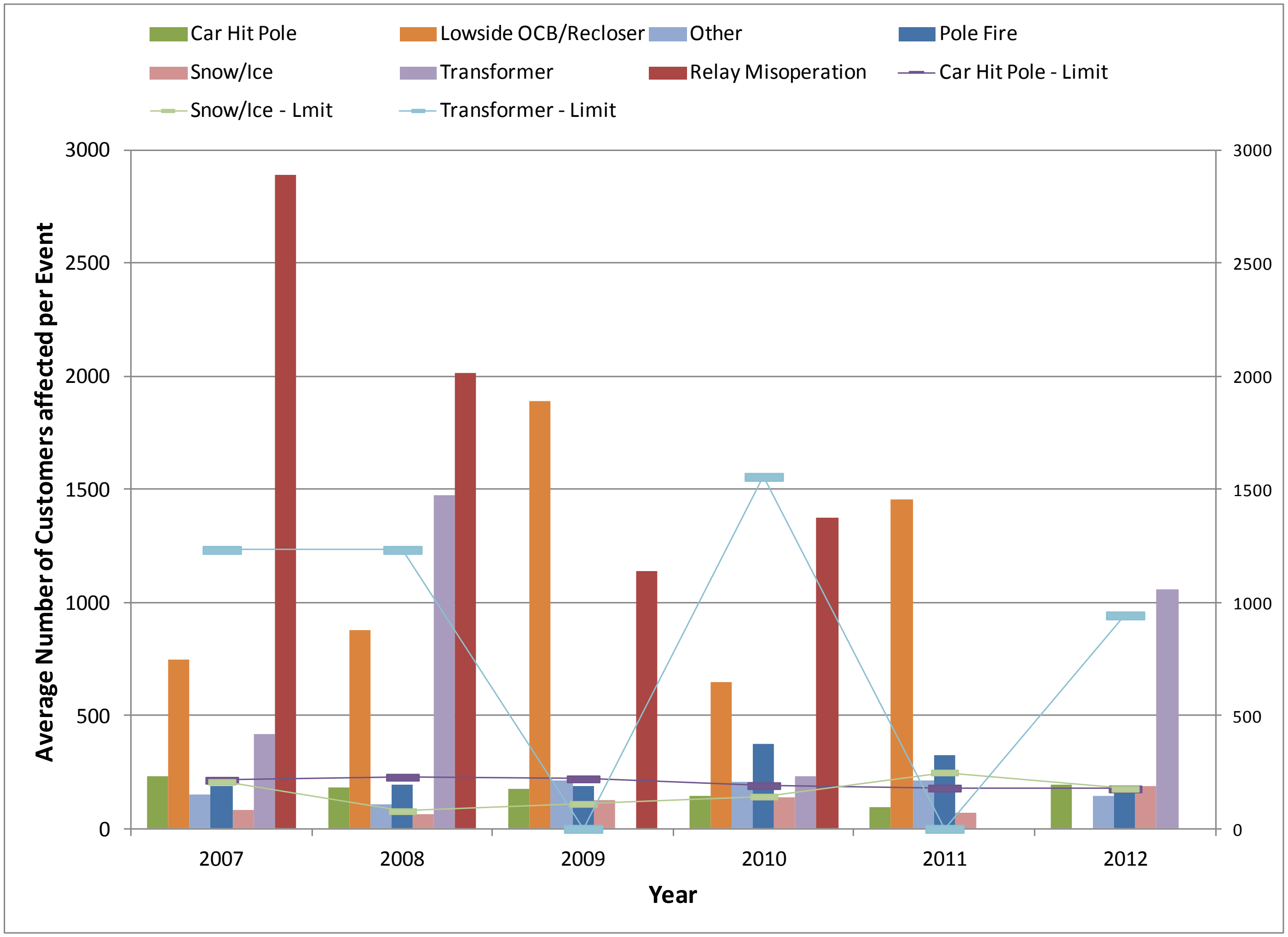

Figure 9, Customers Affected Per Event Exceeding Risk Action Levels

Specific Distribution Programs and Assets

In the following sections, AM reviews the different programs and work done to determine an AM action plan for particular assets. Some plans indicated the current case or no action was the best approach and others indicated there was an appropriate action for managing an asset. If a plan was implemented, then the available information will be reviewed to determine how the plan has impacted the system.

Distribution Wood Pole Management (WPM)

The current WPM program inspects and maintains the existing distribution wood poles on a 20 year cycle. Avista has 7,793 circuit miles of Distribution lines that is predominately overhead. The average age of a wood pole is 28 years with a standard deviation of 21 years. Nearly 20% of all poles are over 50 years old and we have an estimated 240,000 distribution poles in the system. This means that about 48,000 poles are currently over 50 years old. Our inspection cycle allows us to reach approximately 12,000 poles each year. Along with inspecting the poles, we inspect distribution transformers, cutouts, insulators, wildlife guards, lightning arresters, crossarms, pole guying, and pole grounds. The inspection of these other components on a pole drives additional action to replace bad or failed equipment along with replacing known problematic components. These additional inspection items have expanded the current program beyond the original scope but have proven a cost effective way to address more than just the wood pole issues.

Selected KPIs and Metrics

AM selected the number of OMT Events by Year related to WPM work and feeder miles of follow-up work completed verses miles of feeders inspected as KPIs to monitor WPM. These KPI relate to reliability performance, cost performance, and customer impacts. Our goal is to maintain or reduce the number of OMT events related to WPM. The current plan optimized the inspection cycle based on cost, so the impacts to reliability were addressed only as it related to costs. The goal for these KPI is to stay below the number of events averaged over 2006 – 2010 for WPM Related OMT Events. See Table 7 for the goal and for the actual value for 2012. The Goal for the KPI is the 5 year average value using 2006-2010. The OMT Events KPI is a lagging KPI and an indication of how well past work has impacted outages. The feeder miles of follow-up work completed verses miles of feeders inspected KPI is a leading indicator and reflects how outages in the future will be impacted by the work. The number of miles inspected is shown in Table 7 for the goals and actual values.

The feeder miles of follow-up work completed verses miles of feeders inspected KPI comes from the annual Distribution WPM inspection plan and is the sum of all miles of the feeders completed in that year. The completed number of miles for follow-up work on feeders comes from Asset Maintenance based on their tracking of the work as it is completed. However, many poles are addressed by the Distribution Grid Modernization Program which has not been included into the count. The purpose of this metric is to evaluate how much backlog work is created each year in order to adjust future year's budgets. Based on analysis of the current backlog, a revised budget of ~$11 million was recommended in 2014 to help catch up on the backlog of work.

Table 7, WPM KPI Goals by Year

KPI Description	WPM Goal Related number of OMT Events	Actual WPM Related number of OMT Events	Projected Miles Follow-up Work	Actual Miles Follow-up Work Completed
2009	1460	1320	500	372
2010	1460	1004	450	435
2011	1460	1004	459	333
2012	1460	1013	416	435
2013	1460		445	
2014	1460		412	
2015	1460		446	

*Note: Beginning with 2012, the Actual Miles Follow-up Work Completed will include WPM and Distribution Grid Modernization miles.

Metrics provide a more detailed review of WPM. WPM metrics involve more information and calculations than the KPIs and include: WPM contribution to the annual SAIFI number; number of distribution wood poles inspected; material usage for WPM by Electric Distribution Minor Blanket and Storms; number of Pole-Rotten OMT Events; Crossarms-Rotten OMT Events; and actual material use verses model predicted material use for WPM follow-up work (see Table 8).   The WPM contribution to the annual SAIFI number metric comes from data pulled out of OMT by Cognos and calculated the average impact to SAIFI per event by Sub-Reason.

The average impact to SAIFI per WPM event is the sum of the average impact to SAIFI for Arresters, Cutouts/Fuses, Crossarms, Insulators, Insulator Pins, Pole Fires, Poles – Rotten, Squirrels, Transformers-OH, and Wildlife Guards. The average impact to SAIFI for WPM events is then multiplied by the number of event causing an outage or partial outage (this is the sum of OMT events causing an outage or partial outage for Arresters, Cutouts/Fuses, Crossarms, Insulators, Insulator Pins, Pole Fires, Poles – Rotten, Squirrels, Transformers-OH, and Wildlife Guards). The goal for this metric is the five year average for 2005-2009. The purpose of this metric is to ensure WPM maintains the current reliability.

The number of Distribution System poles inspected metric measures the annual plan for inspecting wood poles against how much work was actually completed. The AM plan calls for a 20 year inspection cycle which was originally estimated to be ~12,000 poles per year. The AM plan also represents inspecting 17.5 feeders a year. This metric ensures the WPM program meets the AM plan for Distribution Wood Poles.

Material Usage for WPM By Electric Distribution Minor Blanket and Storms metric monitors other areas outside of AM that may reflect trends for WPM. Key stock numbers (see Appendix B of the "2013 Asset Management Electrical Distribution Program Review and Metrics") are monitored in the Electric Distribution Minor Blanket (ER 2055) and Electric Failed Plant – Storms (ER 2059). The number of stock items used is tracked and compared to the average used in 2006-2010 as a baseline. The purpose is to monitor for asset failures not indicated by OMT data, since not all failure information is captured by OMT.

The final metric, material use verses model predicted material use, tracks the actual number of key stock numbers (see Figure 14 for assets monitored) against what the AM model predicted. Discoverer is used to pull stock number usage out for the applicable stock numbers and then they are compared to the AM model predictions. The purpose of this metric is to measure the performance of the model to predict the future outcomes. If the difference between the model predictions and actual values becomes more than 30%, the model should be revised.

Table 8, WPM Metric Goals by Year

Metric Description	Projected WPM Contribution To The Annual SAIFI Number	Actual WPM Contribution To The Annual SAIFI Number	Projected Number of Dist Poles Inspected	Actual Number of Dist Poles Inspected	Projected Material Usage For WPM By Elec Dist Minor Blanket and Storms	Actual Material Usage For WPM By Elec Dist Minor Blanket and Storms
2009	0.214024996	0.1863468	12600	13,161	14,391	**18524**
2010	0.208489356	0.19916836	12600	15,553	14,391	10266
2011	0.211022023	0.202462739	12600	13,324	14,391	12176
2012	0.211022023	0.16613099	12600	17,318	14,391	22202
2013	0.211022023		12600		14,391	
2014	0.211022023		12600		14,391	
2015	0.211022023		12600		14,391	
Metric Description	**Model Predicted Material Use for WPM Follow-up Work**	**Actual Material Use for WPM Follow-up Work**	**Projected Number of Pole Rotten OMT Events**	**Actual Number of Pole Rotten OMT Events**	**Projected Number of Crossarm OMT Events**	**Actual Number of Crossarm OMT Events**
2009	4792	**7538**	137	44	32	25
2010	4932	**7904**	137	37	32	23
2011	5010	**28011**	137	35	32	28
2012	6770	**28120**	137	52	32	19
2013	8592		137		32	
2014	10566		137		32	
2015	12606		137		32	

Figure 10 shows the trends in OMT events for the Sub-Reasons associated with WPM and generally the trend in OMT events is downward. The major contributors (Cutouts/Fuses, Pole Fire, Squirrel, and Transformer – OH) all showed a general trend downward over the past 5 years. Three of the four major contributors showed improvements from 2009 (Pole Fire, Squirrel, and Cutouts) with the Squirrel sub-reason dropping drastically in the last year. Overall, WPM is controlling the number of OMT events. The leading indicator, Miles Follow-up Work Completed, shows we are falling behind in addressing issues identified during the inspection. If this backlog continues to grow, it will begin to impact the number of OMT events into the future. We plan to address the backlog by completing more Distribution Grid Modernization work and increasing funding for the follow-up work in 2015.

The KPI “Actual Miles Follow-up Work Completed” provides an indication of what could happen to the other metrics (see Table 7). Simply inspecting the poles does not improve the systems performance. The follow-up work to the inspection needs to get completed. This metric shows follow-up work carrying over into 2013. The driver for WPM is a 20 year inspection cycle and if allowed to fall behind, the WPM follow-up work could become a major financial issue and reliability risk for future years. While Cutouts/Fuses, Pole-Fire, Transformer – OH, and Squirrel Sub-Reasons have other programs to address these issues, only the WPM program addresses Arrester, Crossarms, Insulator, Insulator Pin, Poles, and Wildlife guard issues. The issues only addressed by WPM do not show the same improvement as the issues addressed concurrently by other programs.

Grid Modernization work discussed later in this document also impacts the same metrics as WPM. For 2012, we revised the metrics and now include the miles of completed Grid Modernization work in the Table 9~~Table 9Table 9~~ since the work is coordinated with WPM and intended to help address the backlog in WPM.

WPM Metric Performance

The annual contribution to SAIFI trend improved in 2012 even further and remains below the five year average value as shown in Table 8 and Figure 11. Overall, WPM has been effective at maintaining the current level of reliability to our customers.

The number of Distribution poles inspected measures how well the program is performing against a 20 year inspection cycle. The goal is to inspect every feeder once every 20 years. The work to perform the wood pole inspections is tracked based on the number of poles inspected. Using miles can work, but different feeders have different pole densities per mile and the way the contractor bills for the inspection work makes using the number of poles inspected easier. The results of the work exceeded the planned number of inspections shown in Table 9~~Table 9Table 9~~. The completed inspections are following the AM plan for WPM very nicely. Other work besides WPM has contributed significantly to the number of poles inspected annually over the past two years. The Smart Grid project worked on a lot of poles not part of WPM along with the Transformer Change Out Program and increased the numbers of poles inspected in 2012.

Figure 12~~Figure 12Figure 12~~ shows how Avista’s use of Distribution Wood Poles changed with time. This graph supports a growing number of pole and WPM related issues. Based on poles lasting 74 years before they will be replaced on a planned basis, Avista would need to replace 3,200 poles per year at equilibrium. We finally reached and exceeded 3,200 poles per year in 2012. Figure 13 shows how an increasing number of poles are reaching 74 years so we anticipate replacing more than 3,200 poles each year for many years. As shown in Table 8, we are using more material in WPM and the Electric Distribution Minor Blankets to address our aging and failing equipment. We expect this trend to continue for another 10 years before it stabilizes based on a model developed in 2012.

WPM Model Performance

The AM model for WPM provided a baseline for estimating the future costs of the follow-up work, but it under predicted the number of components for Lightning Arresters and Wildlife Guards (see Figure 14 and Table 10). For our WPM, Lightning Arresters and Wildlife Guards are minor components compared to poles, Crossarms, and Transformers, so when you ignore these two items, the model performed within the 30% margin. Currently, we don't plan on updating the model until we have a few more years of data since this model was completed in 2012.

WPM Summary

The main message from the KPI and metrics for WPM is that we are moving in the right direction, but we are falling behind and will need to complete work on more feeder miles to control the impact on future reliability.

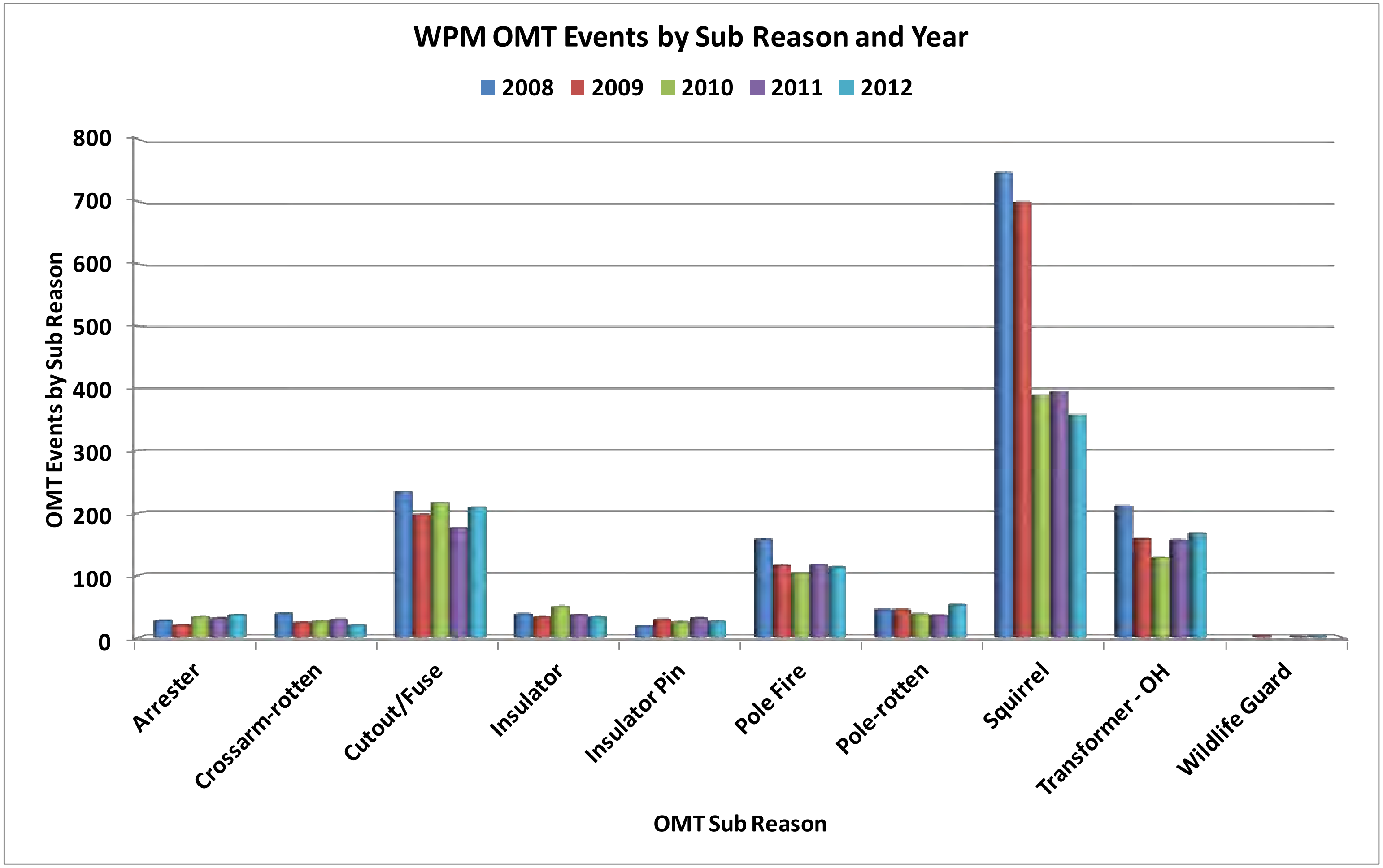

Figure 10, WPM OMT Event Trends

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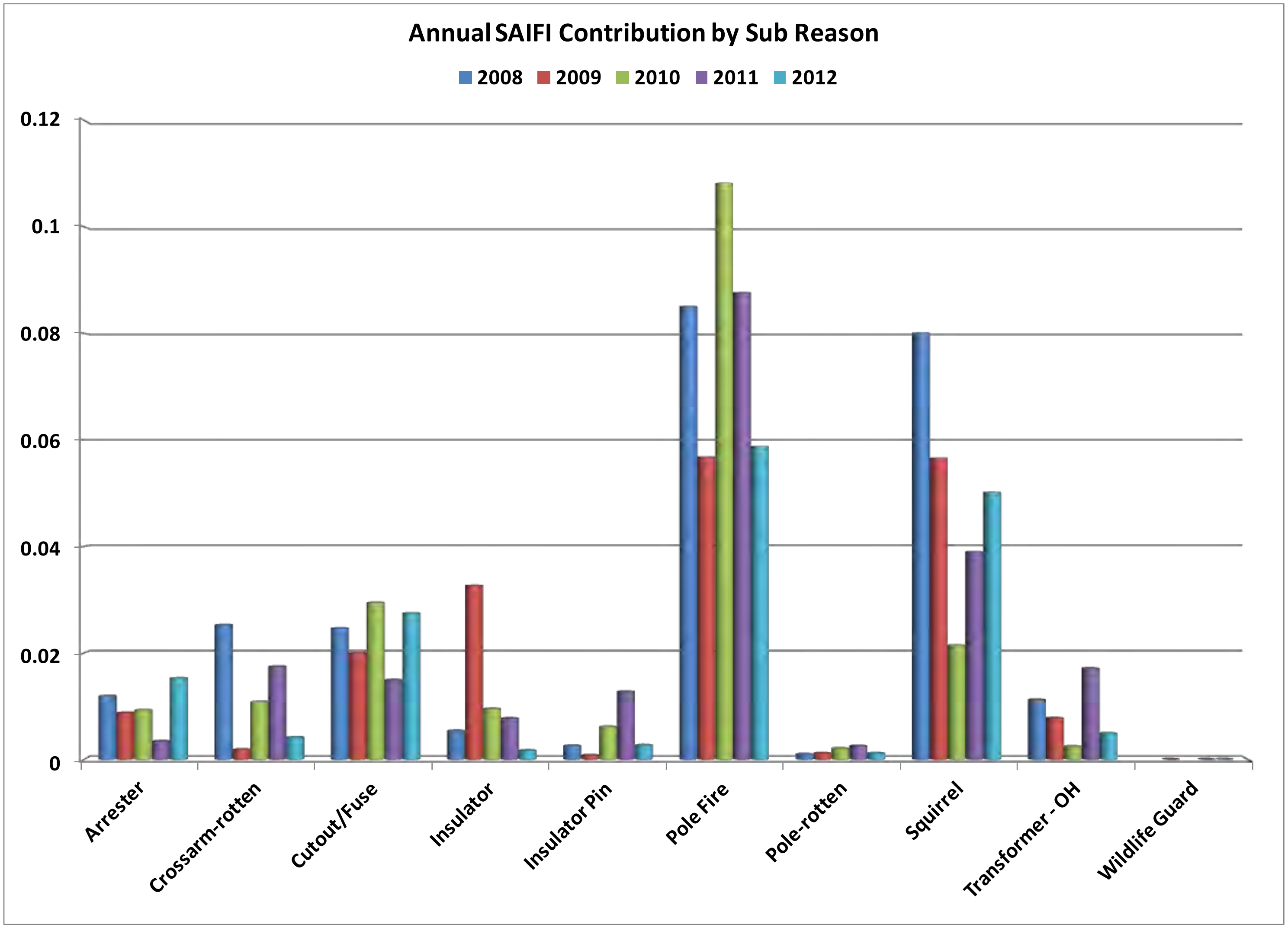

Figure 11, WPM Contribution to Annual SAIFI value by Sub-Reason and Year

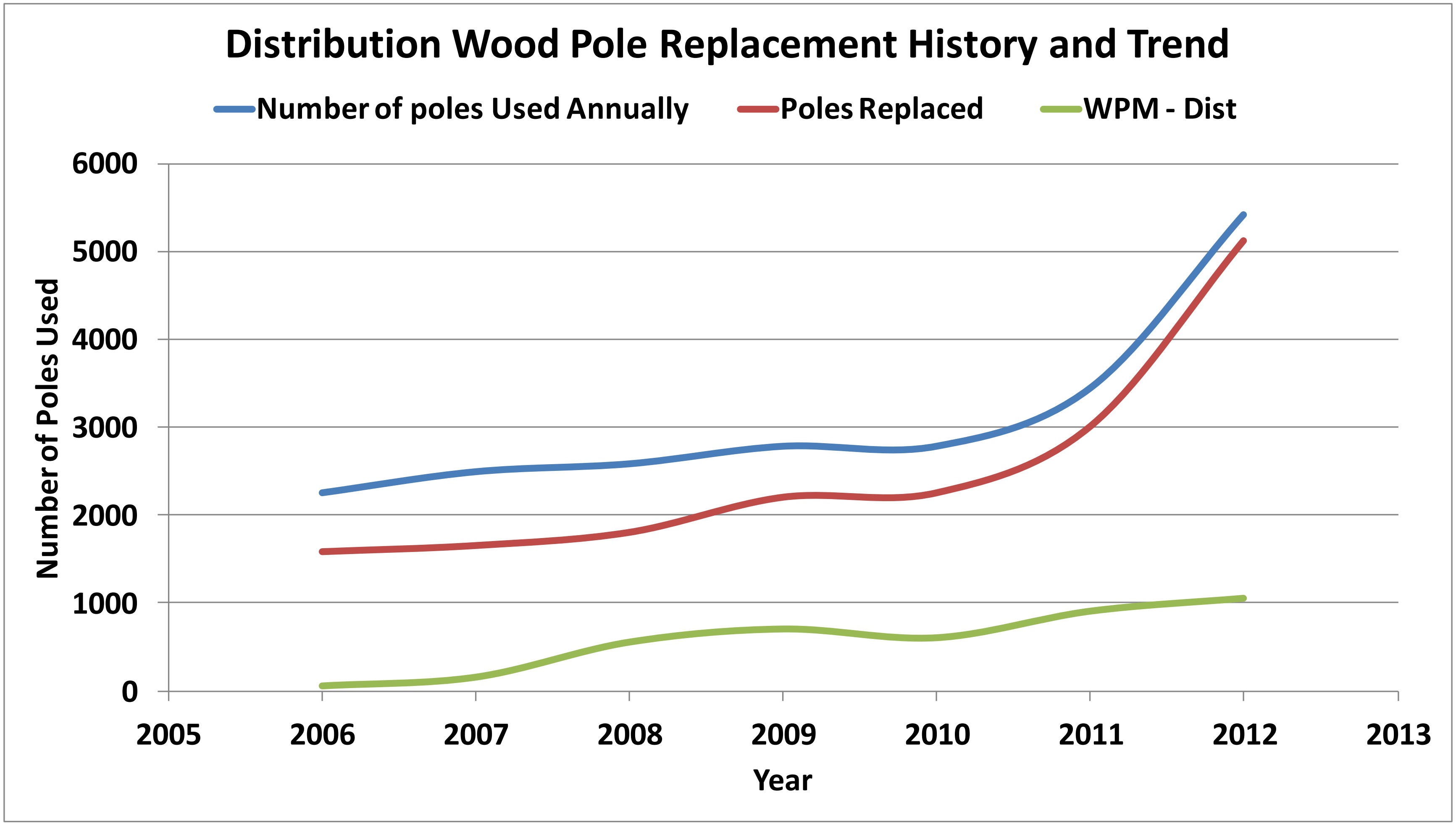

Figure 12, Wood Pole Used by Summarized Activity

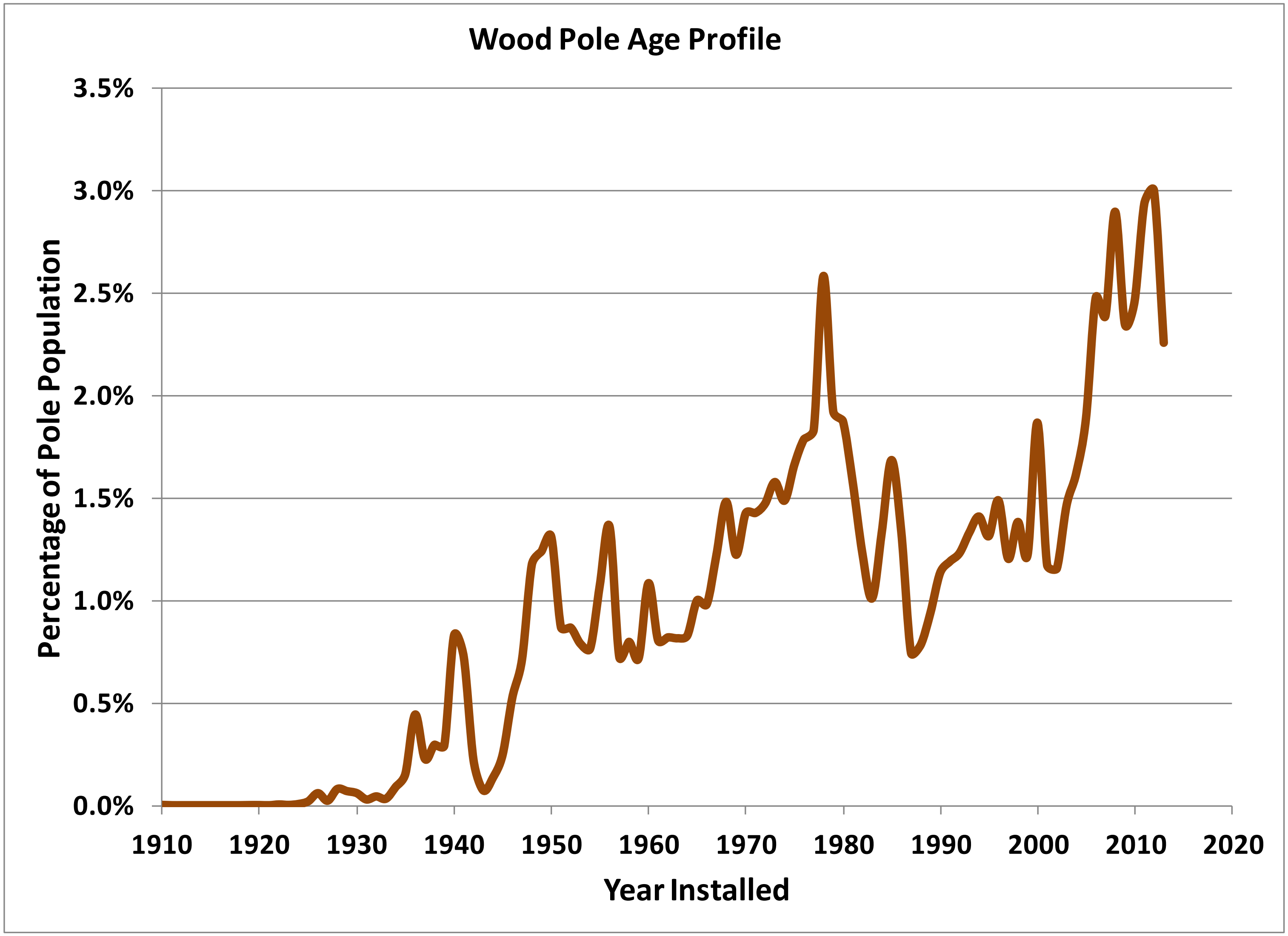

Figure 13, Distribution Wood Pole Age Profile

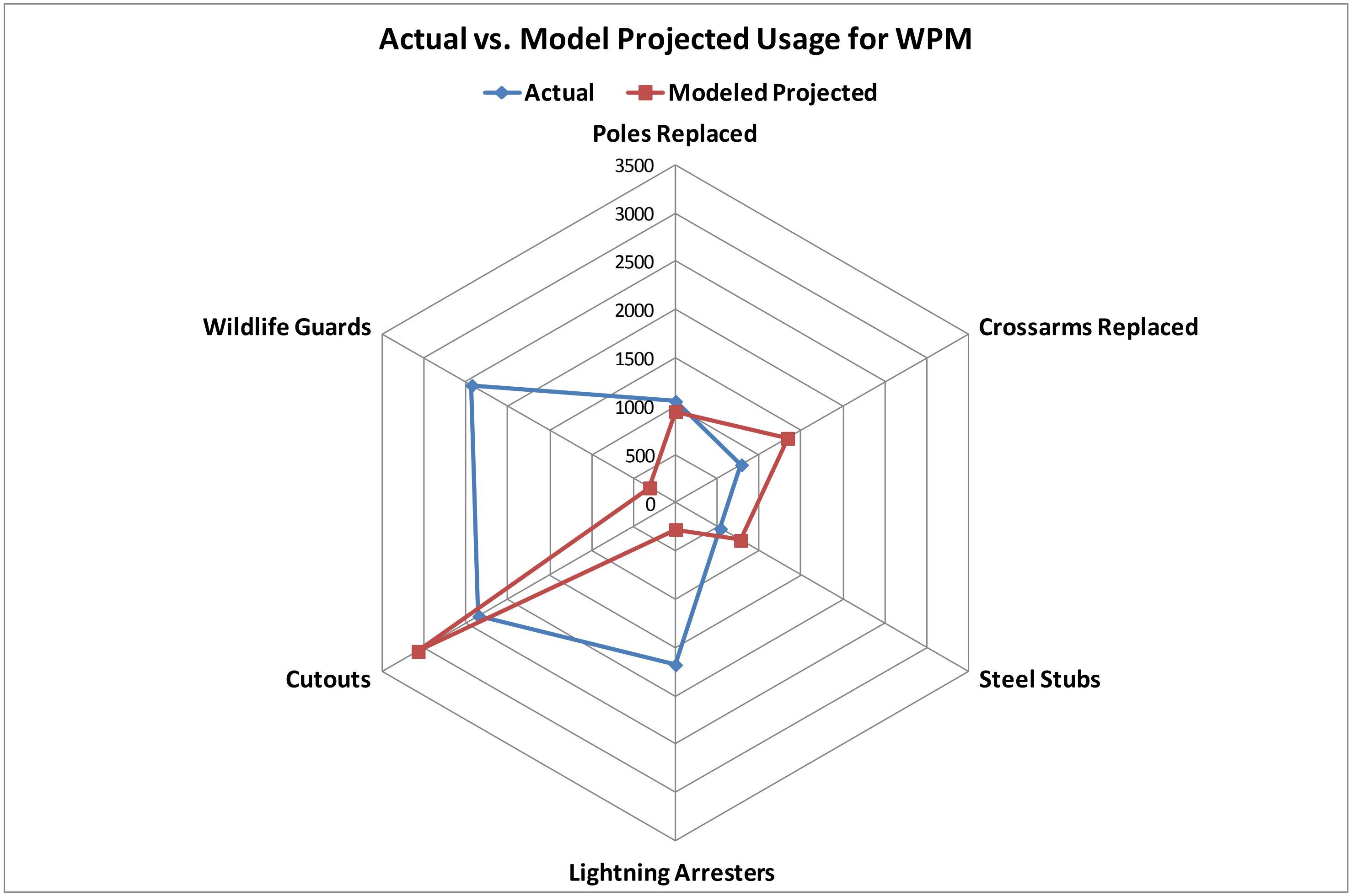

Figure 14, WPM Model Projections vs Actual Usage for 2012

Wildlife Guards

Wildlife caused outages have a significant impact on electric service reliability to customers. The improved outage tracking implemented in 2001 has consistently shown, within a percent or two either way, that animal's cause 19% of outages experienced by electric customers. While generally short in duration, labor impacts to respond are significant. In 2010, Squirrels accounted for only 6% of all sustained outages (see Table 9~~Table 9Table 9~~) which is a significant drop from 2009 value of 12%. This trend downward has continued so in 2012 only 3% of sustained outages were caused by Squirrels. When complete, it is estimated that O&M savings will be $220,000 per year in labor costs, assuming guards are 80% effective. There will also be a capital benefit, because a small percentage of transformers are damaged and must be replaced due to wildlife outages.

Selected KPIs and Metrics

The goal of the Wildlife Guards program is to reduce the number of Animal caused outages on the distribution system. More specifically, the program targets reducing the number of squirrel caused outages. Since the plan estimates that installing guards on the worst 60 feeders will reduce the number of Squirrel caused outages by 50%. 2006 was selected as the starting point, because the work performed that year was not influenced by the current AM plan as seen in Figure 15. The final goal was a 50% reduction from the 2006 value of 902; however, this year's value of 358 already exceeds the final goal and has for the past three years.

The second KPI is the number of Distribution Feeders completed for the Wildlife Guard Installation program. This KPI measures how effective we were at following the plan. The annual goal for the five year program was 12 feeders a year but was modified each of the previous years based on available budget. WPM is also installing wildlife guards as well and is on top of the number included here. The WPM program does address some of these worst 60 feeders, but is not driven by this program. WPM's role in Wildlife Guards is to install them on the remainder of the Distribution system over the next 15 years on transformers or poles they work on for other reasons. Since the number of feeders completed has nearly reached 60 feeders, Avista will drop this KPI in the near future.

The third KPI used is the percentage of sustained outages caused by Squirrels. This KPI provides a relative impact squirrel related outages are having on the system and represents the future value of installing Wildlife Guards on Distribution Transformers.

The only metric for Wildlife Guards is the annual avoided outage benefit from Squirrel related outages. We estimate $82 in benefit for every outage avoided starting in 2011. Using this benefit per event, the projected avoided outage benefit by year is the difference between 902 events in 2006 and projected number of events for that year multiplied by $82. The goals by year for the next four years and for 2010 are shown in Table 10.

Table 9, Wildlife KPI Goals for 2010 - 2015

KPI Description	Projected Number of Squirrel OMT Events	Actual Number of Squirrel OMT Events	Projected Number of Feeders Completed via Program	Actual Number of Feeders Completed via Program	Percentage of sustained outages caused by Squirrels
2009	810	700	12	17	12.2%
2010	720	390	4	23	5.62%
2011	630	395	12	7	3.11%
2012	540	358	8	8	2.71%
2013	450		0		
2014	450		0		
2015	450		0		

Table 10, Wildlife Metric Goals for 2010 - 2015

Metric Description	Projected Avoided Outage Benefit due to Squirrel Caused Outages	Actual Avoided Outage Benefit due to Squirrel Caused Outages
2009	$36,000	$47,190
2010	$71,000	$157,466
2011	$22,000	$34,696
2012	$30,000	$37,935
2013	$37,000	
2014	$37,000	
2015	$37,000	

*Note: Avoided costs were revised from $390 per event to $82 for 2011 and 2012 values. This change was based on a review of costs.

WILDLIFE GUARDS KPI Performance

Installing Wildlife Guards has exceeded expectations so far and have cut into the number of OMT events for Squirrels. The original model estimated costs were higher than actual costs because the model assumed more guards would be needed. So, the saved money has been used to work on more feeders than originally planned in the model. Based on Figure 15 and Figure 16, Wildlife Guard installations made a big jump driven largely by work in Moscow to install the guards on the worst feeders in Avista's system for squirrel related outages in 2007. This work had an immediate impact on the number of events in 2008 and 2009 (see Figure 8). In 2010, the program was funded along with WPM work to install 1017 wildlife guards.

WILDLIFE GUARDS Metric Performance

The main purpose of the Avoided costs metric shown in Table 10 is to demonstrate the savings associated with the work from the original model. In 2010, Avista saw savings nearly triple the projected amount. Other work such as Electric Distribution Minor Blanket and WPM continue to install Wildlife Guards on Distribution Transformers. However, the large increase in savings is most likely due to the increase in the number of feeders completed in 2010.

WILDLIFE GUARDS Model Performance

The Wildlife Guard model over estimated the impact of the work performed (see Table 9~~Table 9Table 9~~), so our performance has exceeded our expectations. This exceeds the goal of being within +/- 30% of the actual value. However, since the program has accomplished its purpose, no further work is planned.

WILDLIFE GUARDS Summary

The Wildlife Guard program shows real cost savings over time. The work in WPM and other efforts to install wildlife guards on Distribution Transformers will create even more savings into the future. However, continuing a Wildlife Guard installation program is no longer justified. Examining Table 11 shows the current top 10 worst feeders represent 159 outages but only provides an opportunity to save $3,500 annually (159 outages * 80% effectiveness * $82/3 years = $3,500 annually). At a cost of ~$360,000 to install Wildlife Guards on ten feeders, we estimate the time to payback the cost of installation at 100 years. Continuing the program as a separate program no longer justifies future costs.

Table 11, Worst Feeders for Squirrel related Events for 2010 - 2012

Feeder	Sustained Outages	Momentary Outages	Combined Outages	Percentage of all Squirrel related Outages	Running Percentage
WAK12F2	19	0	19	1.79%	1.79%
SLW1358	18	0	18	1.70%	3.49%
WAK12F1	17	1	18	1.70%	5.18%
PDL1203	17	0	17	1.60%	6.79%
CFD1210	15	1	16	1.51%	8.29%
CLV34F1	16	0	16	1.51%	9.80%
VAL12F1	14	1	15	1.41%	11.22%
OGA611	14	0	14	1.32%	12.54%
CHE12F1	13	0	13	1.23%	13.76%
CHW12F2	13	0	13	1.23%	14.99%

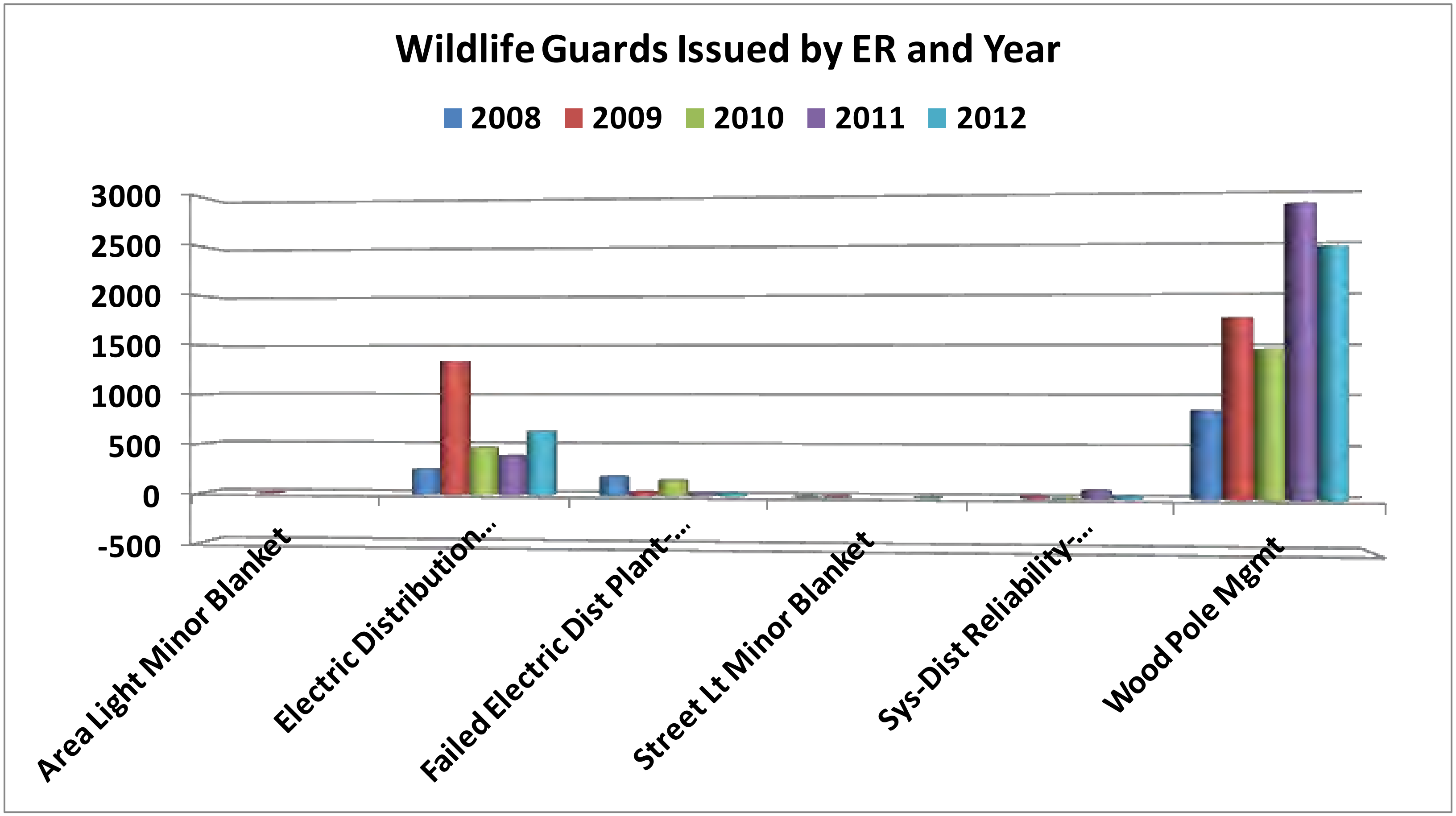

Figure 15, Wildlife Guards Installed by Year and Expenditure Request

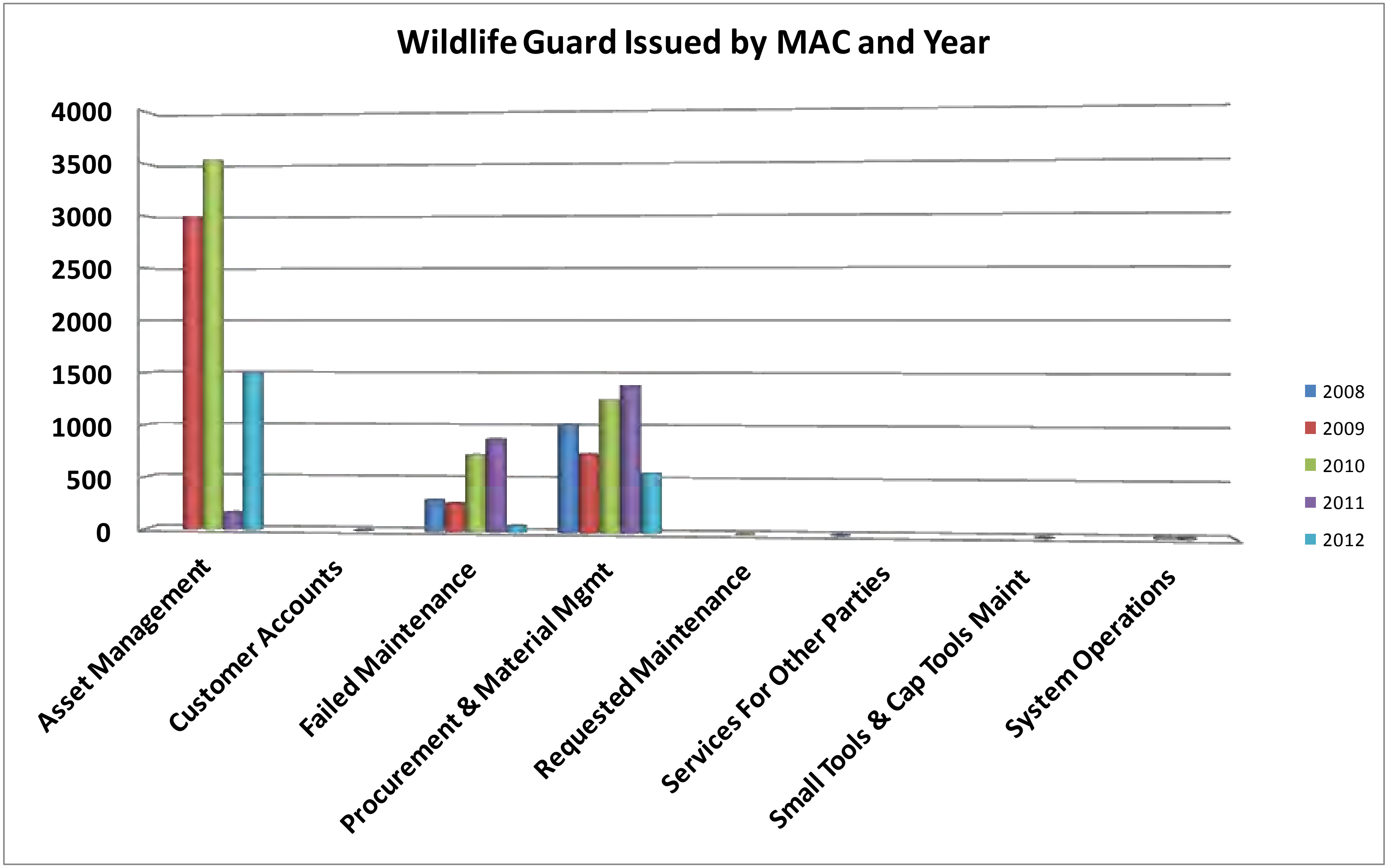

Figure 16, Wildlife Guards Usage by MAC for 2005-2010

URD Primary Cable

URD Primary Cable replacement addresses aging underground primary distribution cable, commonly referred to as URD (Underground Residential District). URD installation began in 1971. Over 6,000,000 feet of URD was installed before 1982. Outage problems exist on cable installed before 1982, cable installed after 1982 has not shown the high failure rate of the pre-1982 cable. Programmed replacement of the problem cable has been on-going at varying levels of funding since 1984. Emphasis is on the original vintage of URD. That cable was not jacketed with a protective layer of insulating material, neutral conductor was bare tinned copper concentric type construction on the outside of the cable. Insulating material was vulnerable to water intrusion. Based on the historical data, we estimated that approximately 72,000 feet of the pre-1982 cable remains in service as of January, 2013.

Historically, over 200 faults of primary cable happen annually. There have been as many as 264 primary cable faults in 2003. During 2007 there were 168 primary faults. From 1992 faults increased from 2 per 10 miles of cable to 8 per 10 miles in 2005. The number of faults per mile has stabilized between 2005 – 2007 after steadily climbing between 1992 and 2005.

Funding for URD Primary Cable replacement was significantly increased in 2007 and began the current program. The program had an original estimate of 5 years to complete but the funding has not matched the original plan, but almost all of the work was accomplished over six years. The year 2012 represents the last year of major funding for the program since the number of outages has significantly dropped and the worst feeder for URD Cable – Pri failures only had two outages. We anticipate some low level of funding to remain for the last of the cable as it fails to get the last remaining segments and will continue to monitor the results.

Selected KPIs and Metrics

We selected two KPIs to track for URD Primary Cable replacement, URD Primary OMT Events and number of feet replaced each year. The goals for each of these KPIs came from the trends observed over the past few years and set a goal to complete the replacement of URD Primary cable in 2012. Table 12 shows the goals for each KPI by year. The OMT events reflect the impact to our system of past work. The number of feet of URD Primary Cable replaced acts as a precursor to future OMT performance. After the first generation of URD Primary Cable has been replaced, the second generation will need to be monitored and plan established for addressing this vintage of cable.

Table 12, URD Cable - Pri KPI Goals

KPI Description	Projected URD Cable - Primary OMT Events	Actual URD Cable - Primary OMT Events	Projected Number of Feet Replaced	Actual Number of Feet Replaced
2009	143	136	178000	213,000
2010	119	93	178000	217,883
2011	94	95	178000	225,823
2012	70	72	178000	117,247
2013	45		0	
2014	45		0	
2015	45		0	

The selected metric for URD Primary Cable is the avoided costs due to cable faults. The savings is based on a projected number of failures without the program of around 600 events per year. Each event on average costs ~$2,680 due to the duration of the outage and the number of people involved in correcting the fault. While this indicator is based on a projection, it provides a reasonable estimate of the return on investment for the money spent to replace this vintage of cable. Table 13 projects the anticipated avoided outage benefit by year for the estimated number of avoided outages.

Table 13, URD Cable - Pri Metric Goals

Metric Description	Projected Avoided Outage Benefit due to URD Cable - Pri Caused Outages	Actual Avoided Outage Benefit due to URD Cable - Pri Outages
2009	$1,038,613	$1,056,113
2010	$1,228,275	$1,295,225
2011	$1,368,561	$1,352,648
2012	$1,516,159	$1,481,504
2013	$1,744,539	
2014	$1,898,311	
2015	$1,997,052	

URD PRIMARY CABLE KPI Performance

For 2012, the performance for URD Primary Cable met expectations and performed well. Table 12 shows that for both URD Cable – Pri events exceeded expectations. Figure 17 shows a steadily declining trend in the number of events. If the trend continues, Avista should reduce the number of events to less than 50 events in 2013. However, if the second generation of URD Primary Cable begins failing at an increasing rate, it would signal the next round of cable replacements. We do have some faults in newer cables and anticipate that this will be true for several years to come. Iif these faults begin to significantly increase over time, we will have to begin replacement of this cable since the earliest of the second generation cable is now approaching 30 years old.

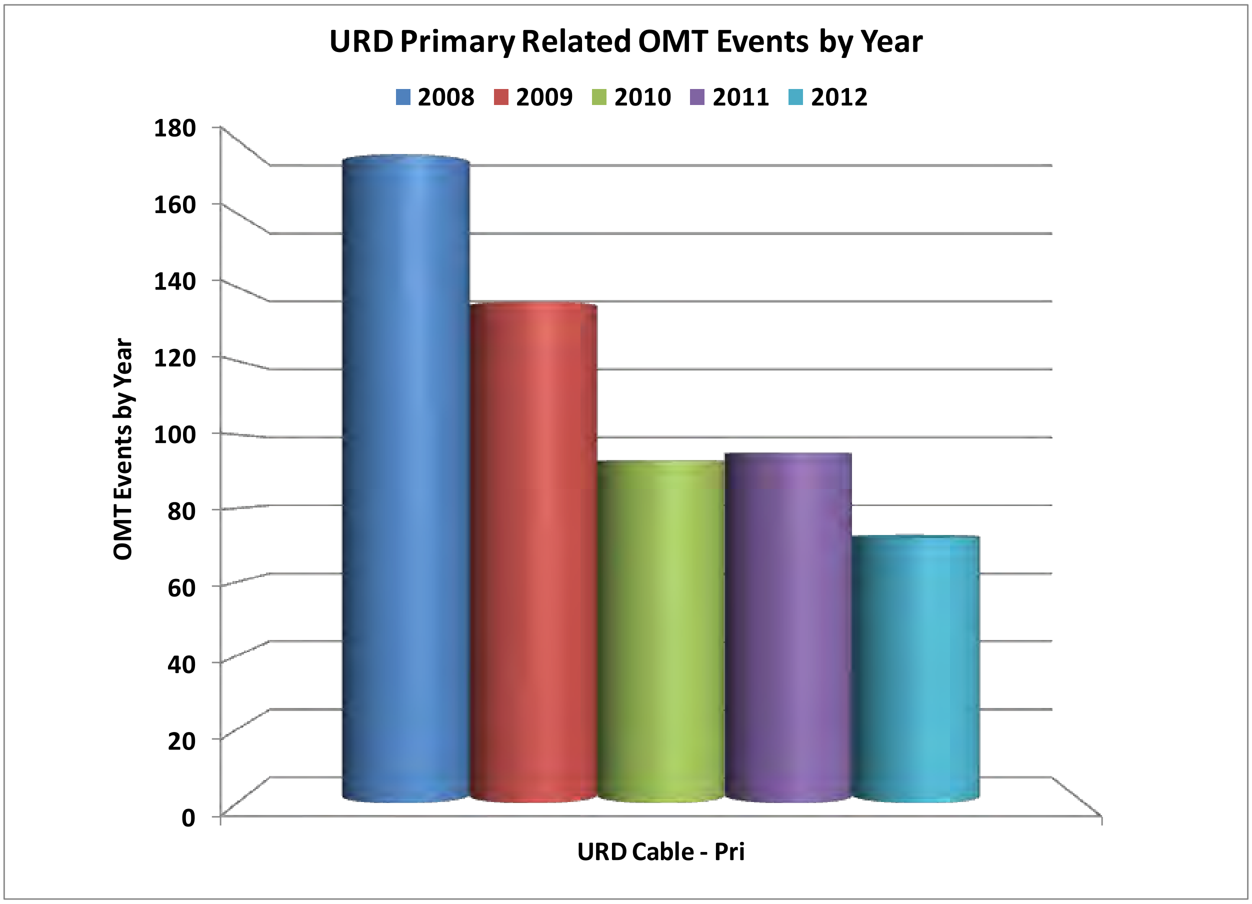

Figure 17, URD Primary Cable OMT Events by Year

URD PRIMARY CABLE Metric Performance

The projected savings and estimated savings due to avoided outage costs for Avista came in very close as seen in Table 13. The current program is performing as expected.

URD PRIMARY CABLE Model Performance

This AM model is an early vintage model and given the cash flow, did not match the model, it has generally predicted performance reasonably well. The model performed sufficiently well. Because of the good performance and limited remaining time for the program, the model will be retained as is and the program allowed to expire once all of the first generation URD Primary Cable has been replaced.

URD PRIMARY CABLE Summary

Several people have worked hard on this program and it is now nearing completion. We anticipate another round of URD Cable replacements in the future, but we don't have any evidence that we have reached the end of life on the second generation of URD Cable. The program has succeeded in reducing O&M costs by avoiding long and costly outages. Since all of the work to replace the cable comes from capital spending, the program is a great example of how capital spending can reduce O&M. However, operations continue to find more cable than estimated remaining, so future funding is recommended to only cover planned work on known cable.

URD Secondary Cable

URD Secondary Cable does not have a planned AM program, so no specific metrics or KPIs have been identified. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Open Wire Secondary

Open Wire Secondary does not have a planned AM program, so no specific metrics or KPIs have been identified. While this area covers secondary conductors and connections, OMT does not provide any direct link to Open Wire Secondary. Previous analysis indicated that this program was not financially justified. However, future indication may drive us to re-evaluate the situation. We do anticipate that the Distribution Grid Modernization Program will address many of these issues. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Distribution Cutouts

Distribution Cutouts are addressed by the WPM program discussed above.

Distribution Air Switches

Distribution Air Switches do not have a planned AM program, so no specific metrics or KPIs have been identified. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Distribution Mid-Line Reclosers

For the Mid-Line Reclosers, no maintenance or planned replacement is recommended over the next 10 years. Feeder Reclosers are not easily accessible as in a substation, so any maintenance on them is equivalent to a planned replacement. Our analysis indicates that any planned replacement program is not cost effective for our customers. Further analysis will be performed to ensure this is the correct approach, but until information is available, no change in our current approach is recommended.

The Smart Grid work has replaced and installed new Mid-Line Reclosers and switches that now provide monitoring and remote operations. We have plans to analyze these new devices to determine a maintenance and replacement strategy specifically for Smart Grid devices.

The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Distribution Mid-Line Voltage Regulators

Avista's distribution system includes 1,171 Voltage Regulators located in substations and out on the distribution feeders. The age profile has a large portion of regulators around 30 years old with ~38% of all voltage regulators being over 30 years old but only 1% greater than 40 years old. When regulators fail, they will cause an outage 81% of the time and add 0.005 to the overall SAIFI value per event. The average outage duration for regulator failures is 2.7 hours. On average, 30 to 40 regulators per year come to the shops for repair, refurbishment, or replacement for a variety of reasons. Some come in because of failures but many are brought in because of changes and other work to be refurbished and re-used. On older voltage regulators, we have also seen that they have higher losses, and by replacing them, Avista could save an estimated $138,000 in energy savings on regulators over 20 years old.

AM analyzed four cases in detail in 2010 to find the best program for managing the voltage regulators. We examined the current case, replacing all the regulators with new regulators at a specific interval, refurbishing/rebuilding all regulators, and finally replacing the older regulators and refurbishing the newer regulators. The analysis identified a program that replaces the oldest regulators and refurbishing the new ones as the best approach to manage the regulators. The replace/rebuild program provides an 8.37% IRR compared to a 5.00% IRR for the base case. The plan will replace an average of 50 Voltage Regulators per year in the near term. Then the newer Voltage Regulators will be refurbished when they reach 35 years old or come in from the field for other reasons.

Due to a lack of craft resources, this program has not been implemented and remains in a monitoring mode. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine if and when the plan will be implemented or modified.

Primary Conductors

Primary Conductors do not have a planned AM program, so no specific metrics or KPIs have been identified. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Primary Connections

Primary Connections do not have a planned AM program, so no specific metrics or KPIs have been identified. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Secondary Conductors

Secondary Conductors do not have a planned AM program, so no specific metrics or KPIs have been identified. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Secondary Connectors

Secondary Connectors do not have a planned AM program, so no specific metrics or KPIs have been identified. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Distribution Transformers

In 2011, Avista implemented the Transformer Change Out Program (TCOP) to replace all Distribution Transformers containing PCB's followed by replacing all pre-1981 transformers. The driver for the program is to reduce the risks associated with PCB's in transformers and improve the overall electric distribution system by eliminating higher loss transformers.

The program has two strategies associated with it. The first strategy is to eliminate all transformers containing or potentially containing PCB's. The initial focus was on areas near water sources and now has moved to all transformers containing PCB's as the water regions are done. These transformers have specific work plans to remove them from the system. The second strategy uses the Wood Pole Management program to remove all pre-1981 transformers as part of their follow-up work on a feeder. The first strategy work should be completed in 2016 and the Wood Pole Management work should have all the pre-1981 transformers replaced by 2036.

Selected Metrics

Table 14 shows the metrics selected for TCOP. The number of transformers changed out represents the reduction of future risk from PCB's. It also provides a leading indicator of how many future transformer failures we may experience. The energy savings represents the value of changing out the less efficient transformers and quantifies the approximate amount of energy saved each year by replacing less efficient transformers with more efficient ones.

Table 14, TCOP Metrics

Year	Planned Number of Transformers Changed Out	Actual Number of Transformers Changed Out	Planned Energy Savings from Transformers (MWh)	Actual Energy Savings from Transformers (MWh)
2012	2,687	2,529	2,304	2,430
2013	2555		2,304	
2014	2930		2,304	
2015	305			
2015 – Pad/Subm	2,030		1,447	
2016 – Pad/Subm	2,335			

- Note: values in red have negatively missed the goal.

Metric Performance

While we removed fewer transformers than anticipated, the ones removed were significantly older and provided more energy savings than anticipated. Both metrics were within 5% of the target and TCOP is providing the anticipated benefit.

Summary

The TCOP is accomplishing it objectives and reducing Avista's and customer's risks associated with Distribution transformers containing PCB's and providing energy savings.

Area and Street Lights

Asset Management converted the existing area and street light data into our Geographical Information System (GIS) in 2012 and will continue the work through 2014. This work will update and correct the existing information and provide a platform to convert our High Pressure Sodium (HPS) lights to Light Emitting Diode (LED) fixtures in the future. The recent cost and reliability improvements in LED lights have made converting lights to LED fixtures cost effective. We anticipate replacing the 100 watt HPS street lights to LED fixtures in 2015, once a rate schedule for LED lights has been approved for use.

Until a conversion program is implemented, no KPI's or metrics have been established to monitor area or street lights.

Riser Terminations

Riser Terminations do not have a planned AM program, so no specific metrics or KPIs have been identified. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Dead End Insulators

Dead end Insulators do not have a planned AM program outside of work identified as part of Wood Pole Management, so no specific metrics or KPIs have been identified. The general metrics discussed above for number of OMT Events (Table 1) and the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plan will be developed or if action is needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

Distribution Capacitors

Distribution Capacitors do not have a planned AM program, so no specific metrics or KPIs have been identified. Smart Grid work has added switch capacitors to our system but our initial analysis did not indicate any maintenance or replacement strategy was justified. The general metrics discussed above for number of OMT Events (Table 1) along with the associated action level; Risk Action Curve limits; and requests by responsible parties will determine in the future if a plans are needed. In summary, this asset will be monitored to determine if and when planned actions are needed.

9CE12F4 Partial Feeder Rebuild

This program was created to integrate several AM programs into a comprehensive program to address feeder's issues at one time and then not have to return to the feeder for several years. This program combined WPM, re-conductoring, transformer replacement and reconfiguration, Wildlife Guards, Vegetation Management, and other work that fit. While the project created a list of feeders along with a priority ranking, the only work funded was on Ninth and Central Substation feeder 12F4 in Spokane. The main drivers for the project were energy savings efficiency for the redesign portion of the work and integrated AM work to gain labor efficiency.

In 2011, Avista implemented a Feeder Upgrade Program based on this work that will be discussed below. We retained this program here to provide a place to document the results of the work competed in 2009.

Selected KPIs and Metrics

Since the program was a one year project, the only metric selected is the number of OMT events associated with the feeder. No KPI was selected since there are no further actions planned or anticipated on this feeder. We did not develop an OMT performance metric when the model was created, but we will monitor the OMT results to see how the work impacted the feeder's reliability. Avista's crews completed the work on the feeder at the end of 2009 along with the WPM inspection and Vegetation Management work.

Partial Feeder Rebuild KPI Performance

No KPI's were selected nor tracked for this program.

Partial Feeder Rebuild Metric Performance

Since the work on Feeder 9CE12F4 was completed in 2009, we monitor the OMT data for the feeder to see how reliability is impacted. Figure 18 shows the trends and shows that the work has made a significant impact on the feeder's performance driving the number of OMT events to their lowest levels in recent records. Along with Figure 18, Figure 19 provides a baseline and trends on specific measures we anticipated the work would impact. Based on the available OMT data for 2012, the work did impact performance but the real benefit took three years to realize. While weather does impact these numbers, the impact on equipment failures is clearly improved.

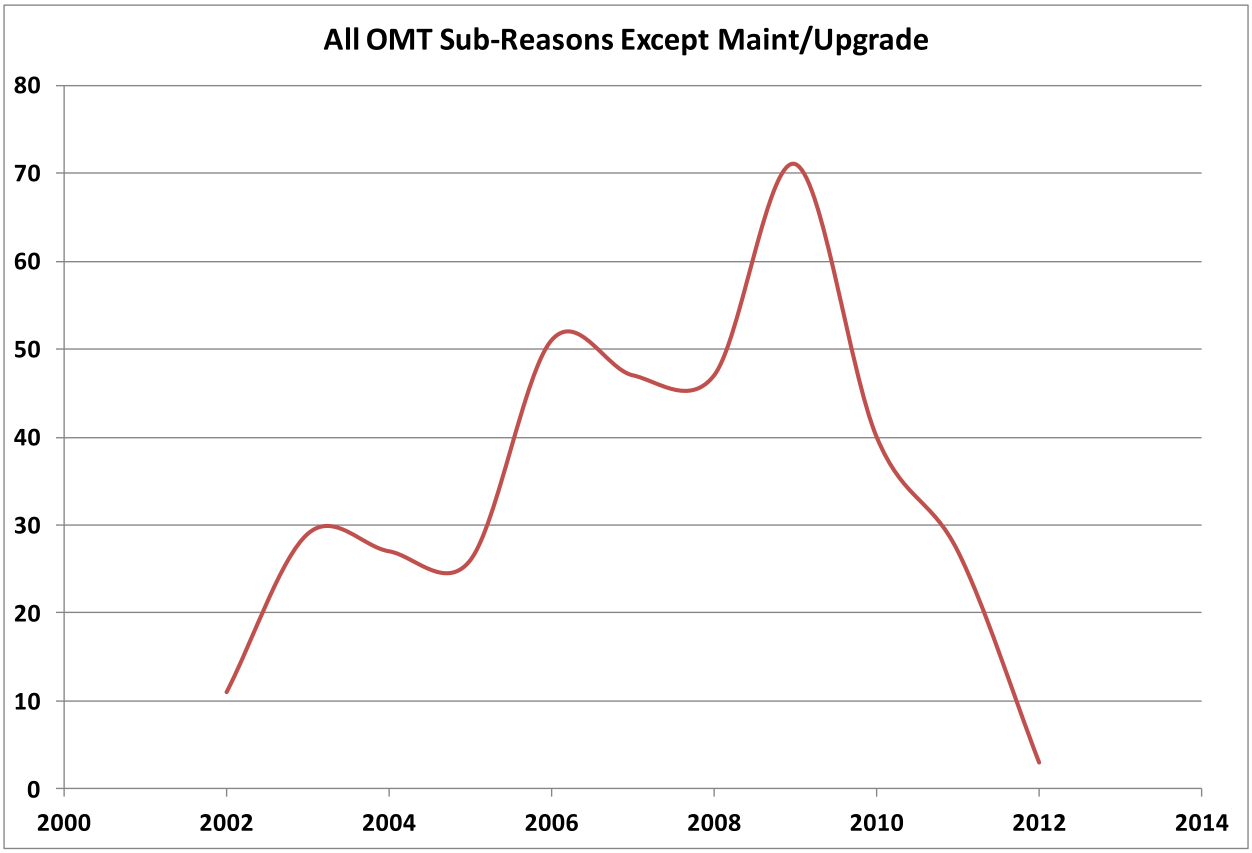

Figure 18, All OMT Sub-Reasons except Maint/Upgrade for Feeder 9CE12F4 2002-2010

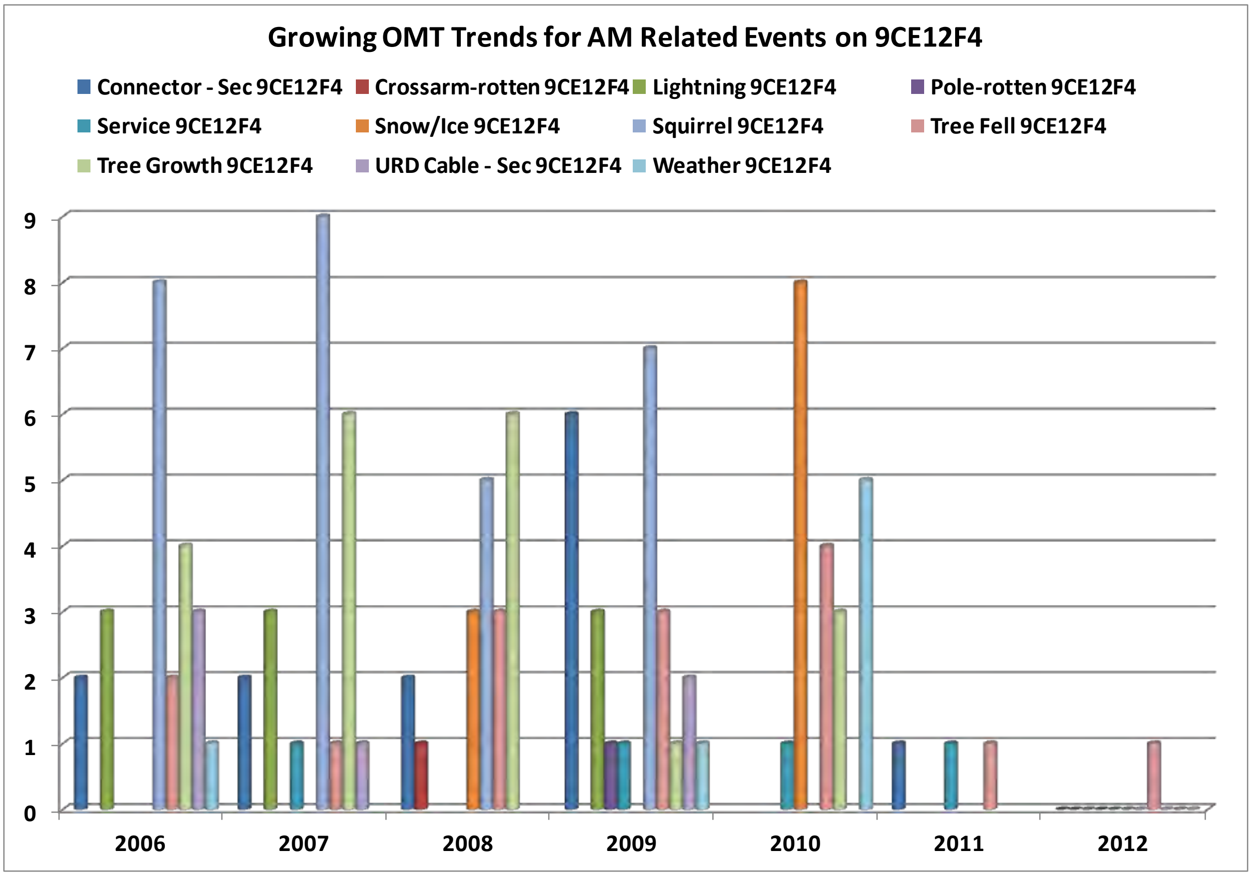

Figure 19, Selected OMT Trends for AM Related Events with Upward Trends for Feeder 9CE12F4

Partial Feeder Rebuild Model Performance

The model did include some projections for future performance, but we have selected not to evaluate this model. The actual work performed exceeded the scope of the model, since it included Open Wire Secondary work. The AM model had predicted a work cost of $1.1 million excluding the following: WPM inspection costs, Vegetation Management, and Open Wire Secondary work. The total cost of modeled portion of the project came in at $1.1 million and an additional $1 million work of work was added on top of this. In future models, all of the work will need to factor the lessons learned into the model to improve costs projections.

Partial Feeder Rebuild Summary

The 9CE12F4 feeder performed very well in 2012, but we anticipate 2013 and 2014 will see more Vegetation Management issues as the feeder approaches its five year cycle for Vegetation Management work. Based on previous work on Vegetation Management models, the first year after clearing a feeder results in some infant mortality type vegetation issues. When a line is cleared, some of the remaining vegetation is weaker because it no longer has the other branches or vegetation that provided additional support. This results in some vegetation issues that first year after clearing when the weaker structures fail under windy or other loading situations. Usually years 2-3 between clearings have the lowest number of vegetation issues and then years 4-5 see a buildup of issues as the next clearing approaches.

Chance Cutouts

This program focused on replacing a particular brand of cutout showing signs of premature failure. The bulk of the work was completed in 2007 and 2008. However some outlying areas did not participate as planned and had some remaining into 2012. The program and associated funding was spent on replacing several cutouts in the system and did replace the anticipated number of cutouts. However, an initial assumption of how many cutouts remain was too low, so the actual number in the field was higher. The work of WPM and other types of work has effectively eliminated the remaining Chance cutouts. The future cutout failures will come from all the non-Chance cutouts and should levelize around 150 events per year.

Selected KPIs and Metrics

The goal of the Chance Cutouts was to save money. The KPI selected is the annual projected avoided outage benefit shown in Table 15~~Table 15Table 15~~. The estimated benefits are quite substantial and anticipated making a large impact on cutting the number of failures. The only action that can be taken in the future is through the WPM program, so the KPI and Metrics will be lagging indicators.

The selected metric is the number of OMT events. While normally OMT events are the KPI, it was selected as the metric since the project was funded with Productivity money and is reported quarterly as an estimate of the cost savings. Table 15~~Table 15Table 15~~ shows the goals for the number of OMT events under the "Projected OMT Events w/ Action" column.

Table 15, Chance Cutout Replacement KPI and Metric Goals

Year	Projected OMT Events w/o Action	Projected OMT Events w/ Action	Projected Annual Avoided Outage Benefit
2009	380	91	$654,000
2010	430	78	$671,000
2011	480	106	$665,000
2012	510	80	$640,000
2013	550	152	$579,000
2014	560	152	$524,000
2015	560	152	$524,000

Chance Cutouts KPI and Metric Performance

Both the KPI's and Metrics shown in Table 16~~Table 16Table 16~~, failed to meet their goal. Two factors appear to be contributing to the lower than expected results. While the Chance cutouts did remain in the system, a larger portion of the failures came from all the other cutouts than anticipated. The model appears not to have accurately predicted the number of failures due to other types of cutouts in the early phases of the work. However, we appear on track to achieve 150 failures a year based on WPM work and Feeder Upgrade work addressing other issues with cutouts.

Table 16, Chance Cutout KPI and Metric Performance

Year	Projected OMT Events w/o Action	Projected OMT Events w/ Action	Actual Number of OMT Events	Projected Annual Avoided Outage Benefit	Measured Annual Avoided Outage Benefit	Percent Model Error
2009	380	91	197	$654,000	$ 366,000	216%
2010	430	78	217	$671,000	$ 438,780	278%
2011	480	106	176	$665,000	$577,600	166%
2012	510	80	209	$640,000	$583,338	261%
2013	550	152		$579,000		
2014	560	152		$524,000		
2015	570	152		$524,000		

- Note: values in red have negatively exceeded the goal.

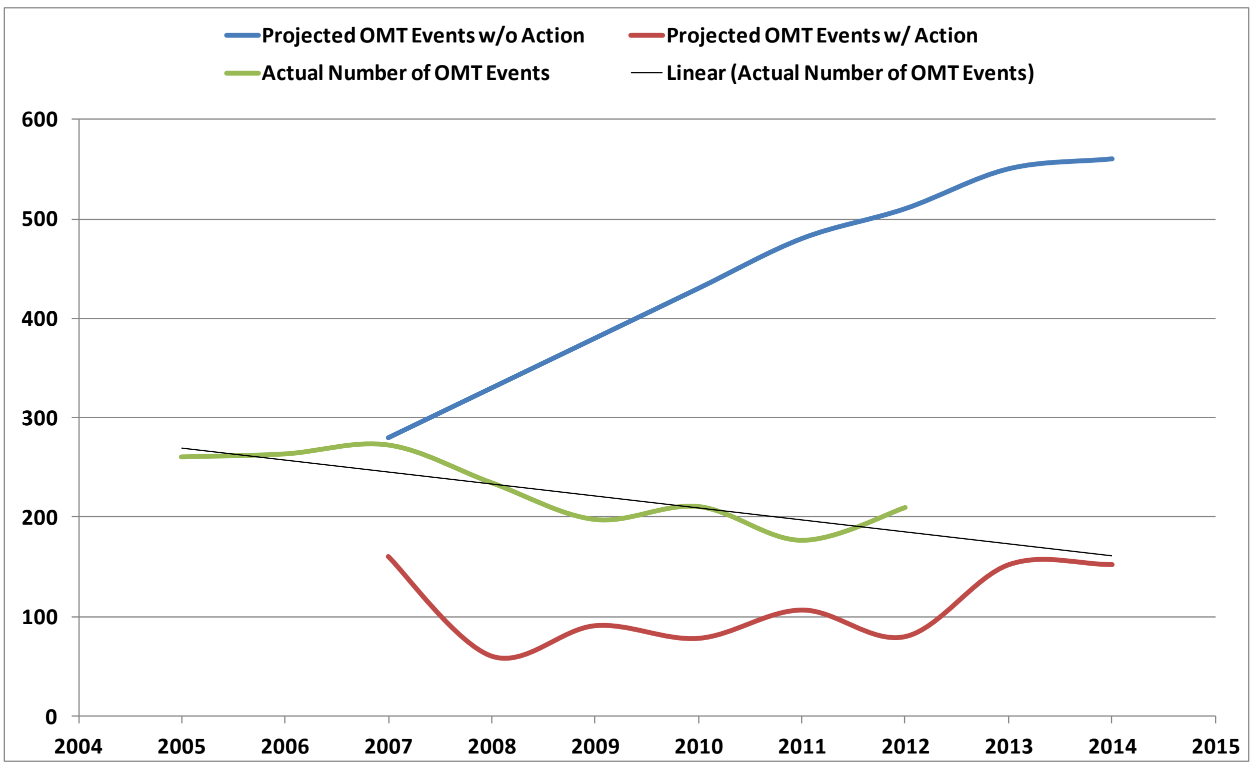

Figure 20, Cutout/Fuse OMT Event Comparison between Actual, Projected without Action, and Projected with Action

Chance Cutouts Model Performance

The model performance for Chance Cutouts provided a good indication of the trends but failed to accurately predict the trends. The model for future cutout analysis will need to be updated and improved to better predict future trends. The method of completing the work also caused the actual values to deviate from the model. The differences in actual work compared to projected mainly comes from the number of Chance Cutouts remaining in the system was more than anticipated as an assumption. Another contributing factor comes from the worse than expected performance of other cutouts. The model, however, for Chance Cutouts will not be changed since the bulk of the work has already been completed and any remaining work is to be picked up by WPM.

Chance Cutouts Summary

In summary, the Chance Cutout replacement program has succeeded in reducing the number of failures due to this type of cutout. While it has not created the savings originally hoped for, the program continues to save Avista a significant amount of money each year.

Distribution Vegetation Management (VM)

Our Vegetation Management program maintains the distribution system clear of trees and other vegetation. This reduces outages caused by trees and to a lesser extent squirrel caused outages. Our Distribution System runs for 7,793 circuit miles in Washington, Idaho, and a little in Montana. While the Vegetation Management program does cover work on the Transmission System and the High Pressure Gas Pipeline system, the purpose here is to only look at the Distribution System.

For the Distribution System, our analysis has shown that a pro-active maintenance program provides the best value to our customers. While our past practices were a four and seven year cycle based on location and had a reduced clearing diameter, our analysis has indicated a five year clearing cycle at a normal clearing distance has some advantages.

The purpose of Vegetation Management is to meet regulatory compliance, provide the best value to our customers, and maintain current reliability. The current Vegetation Management program added herbicide spraying and enlarged the risk tree programs to further improve vegetation management. Both of these additions strive to improve the performance of the system by reducing vegetation related events.

Selected KPIs and Metrics

For Vegetation Management (VM), we selected one leading KPI and a lagging KPI. The leading KPI is the number of Distribution Feeders miles managed each year. This indicates how well the actual work matches the planned work and the model. The results of the work in VM should directly impact the number of Tree Growth and Tree Fell events in OMT which is the lagging KPI. The number of Tree Growth events and Tree Fell events are summed for each year and compared to the AM models predictions if the plan is followed. The goals for each KPI by year are shown in Table 17~~Table 17Table 17~~. The AM model for Tree Growth events and Tree Fell events shows varying KPI's for each year due the strict following of the 5 year cycle based on when the feeder was last done.

For a VM metric, we selected the number of Tree-Weather OMT events by year and SAIFI impacts. As seen in Figure 21, there is a definite relationship between weather events and VM. We assume that improvements in VM results should impact the number of Tree-Weather OMT events and set a goal shown in Table 18~~Table 18Table 18~~. The goal for Tree-Weather events is based on the AM models average value over a 10 year period. This metric was not included as a KPI, because weather events are very unpredictable and random in nature. Once the relationship has been better established, it may become a KPI.

Another metric selected for monitoring is the cost per mile for VM on the distribution feeders. While no goals have been established, this will measure how effective our AM spending gets the work done and how much work is required to clear the lines. The costs per mile should drop in future years, because the amount of work required to clear them should drop after reaching a 5 year cycle. Inflation and other escalators will drive costs up in the future to counter the reduced workload, but the net effect remains an open question. The total number of miles of all planned work was modified in 2011. Beginning in 2011, the costs per mile calculation includes all planned work and not just the miles cleared. So, the total number of miles for all planned work was included in the metrics.

Table 17, Vegetation Management KPI Goals

KPI Description	Miles of Vegetation Management Completed	OMT Events due to Tree Fell + Tree Grow
2009	1,560	556
2010	1,560	540
2011	1,560	500
2012	1,560	520
2013	1,560	630
2014	1,560	780
2015	1,560	845

Table 18, Vegetation Management Metric Goals

Metric Description	OMT Events due to Tree-Weather	SAIFI - Tree Fall	SAIFI - Tree Grow	SAIFI - Tree Weather
2009	166	1.40E-07	8.84E-08	1.34E-05
2010	166	1.40E-07	8.84E-08	1.34E-05
2011	166	1.40E-07	8.84E-08	1.34E-05
2012	166	1.40E-07	8.84E-08	1.34E-05
2013	166	1.40E-07	8.84E-08	1.34E-05
2014	166	1.40E-07	8.84E-08	1.34E-05
2015	166	1.40E-07	8.84E-08	1.34E-05

VM KPI Performance

Both Figure 21 and Figure 22 shows the same trends for Tree Growth, Tree Fell, and Tree Weather. The number of OMT events due to Tree Growth and Tree Fell were below the 10 year average and above the five year cycle projections. The number of miles completed in VM will cause the number of events in the future to continue and exceed projected five year cycle values. Table 19~~Table 19Table 19~~ shows the results. The number of OMT events remains above the values for 5 year cycle plan but less than the 2009 plan. We did clear enough miles in 2011 to exceed a five year cycle but slipped back to less than a five year cycle in 2012. Until we have a well entrenched five year cycle, we will continue to realize more vegetation related events than projected by the five year cycle plan. However, we do see the number of events improving and still anticipate clearing enough miles in 2013 to align with a five year cycle.

Table 19, VM KPI Performance

Year	Projected Tree Growth + Tree Fell OMT Events – 2009 Plan (Current)	Projected Tree Growth + Tree Fell OMT Events – 5 Year Cycle	Actual Number of OMT Events	Projected Annual Miles Managed	Actual Annual Miles Managed w/o Risk Tree or Spraying	Percent Model Error
2009	1120	556	765	1,220	790	65.6%
2010	620	540	836	1,560	1,304	83.6%
2011	790	500	727	1,560	1,747	92%
2012	1210	520	712	1,560	1,296	59%
2013	1390	630		1,560		
2014	1400	780		1,560		

- Note: values in red have negatively exceeded the goal
- * This model error is for the current plan model and not the 5 year cycle model

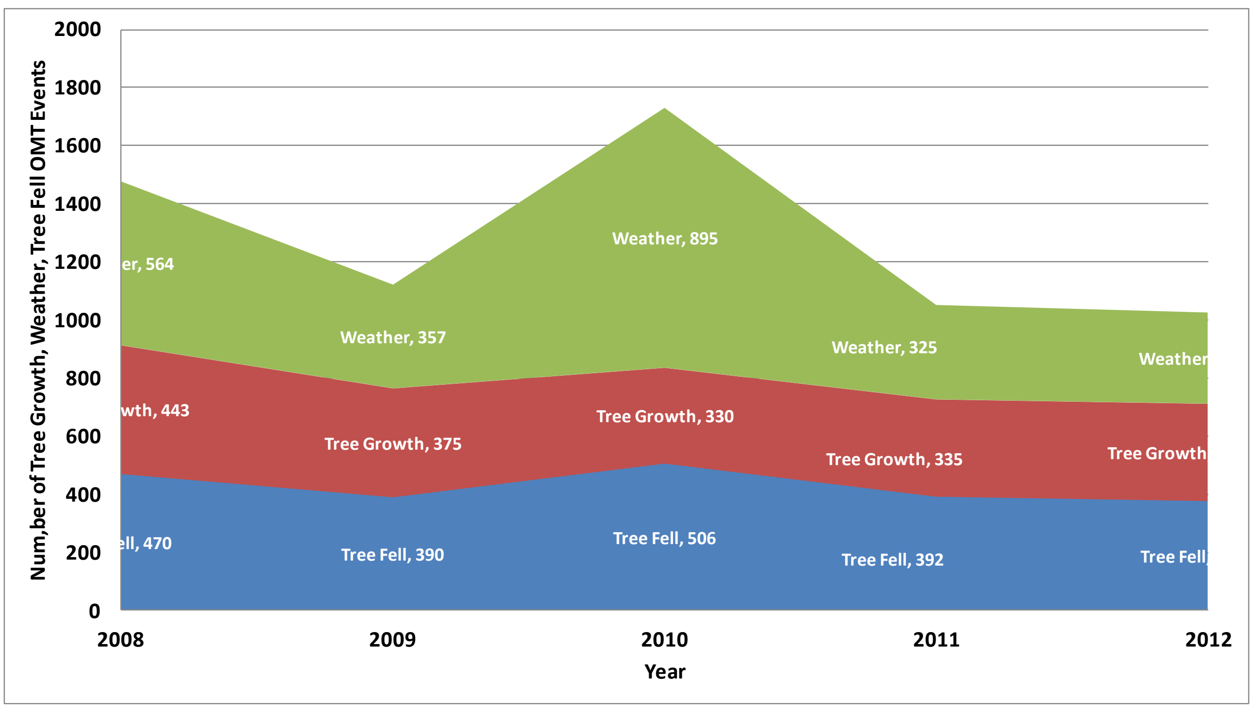

Figure 21, OMT Events Data Trends for Tree-Weather, Tree Growth, and Tree Fell Sub-Reasons

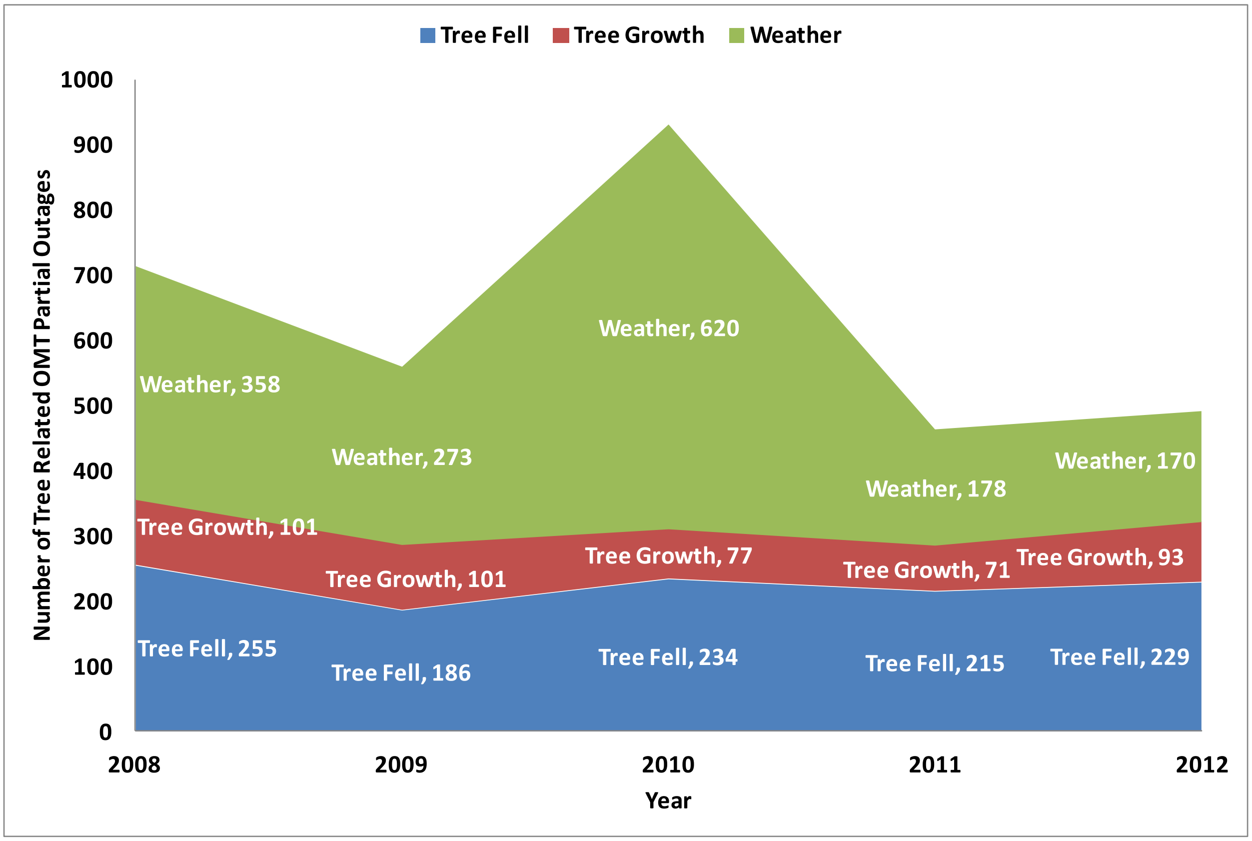

Figure 22, OMT Outage and Partial Outage Data Trends for Tree-Weather, Tree Growth, and Tree Fell Sub-Reasons

VM Metric Performance

The Tree-Weather OMT Events for 2012 continued to show improvement and were below the AM model projects (see Table 20~~Table 20Table 20~~). With the addition of herbicide spraying and enhanced risk tree work, we must update the Vegetation Management models before we have better projections.

The SAIFI contribution for 2012 was higher than anticipated by the model as seen in Table 21~~Table 21Table 21~~. However, the trend for SAIFI for Tree Growth, Tree Fell, and Weather continue to improve (Table 5). The biggest reason for the difference between the projected SAIFI and actual SAIFI comes from the model. The next revision to the model will need to improve the projection of SAIFI to more accurately reflect the actual values.

The cost per mile for VM in 2012 was $3,272. We need to update the Vegetation Management model to address changes in the program and help understand the impact to our system. Table 22~~Table 22Table 22~~ shows the current information.

Table 20, Tree-Weather OMT Events Metric for Vegetation Management

Year	Projected Tree-Weather OMT Events – 2009 Plan (Current)	Projected Tree-Weather OMT Events – 5 Year Cycle	Actual Number of Tree-Weather OMT Events	Percent Model Error
2009	420	166	357	85%
2010	80	50	620	775%
2011	220	70	325	148%
2012	580	70	314	54%
2013	800	170		
2014	1120	430		

- Note: values in red have negatively exceeded the goal.

Table 21, VM SAIFI Metrics

Year	SAIFI – Tree Fall Projected (Current)	SAIFI – Tree Grow Projected (Current)	SAIFI – Tree Weather Projected (Current)	SAIFI – Tree Fall Actual	SAIFI – Tree Grow Actual	SAIFI – Tree Weather Actual
2009	1.40E-07	8.84E-08	1.34E-05	0.000251196	4.65439E-05	0.000374485
2010	1.40E-07	8.84E-08	1.34E-05	0.000376171	7.26157E-05	0.000337983
2011	1.40E-07	8.84E-08	1.34E-05	0.000299004	6.08985E-05	0.000281085
2012	1.40E-07	8.84E-08	1.34E-05	0.000284774	6.55877E-05	0.000239443
2013	1.40E-07	8.84E-08	1.34E-05			
2014	1.40E-07	8.84E-08	1.34E-05			

- Note: values in red have negatively exceeded the goal.

Table 22, VM Cost per Mile and All Vegetation Management Work Metric

Year	Actual Annual Miles Managed all work	Cost per Mile of VM
2009	N/A	$6,575
2010	N/A	$2,990
2011	3,455	$2,612
2012	3,364	$3,272
2013		
2014		

VM Model Performance

The AM model for Distribution VM was revised in 2010, but the recent changes to the work performed and errors experienced justify updating the model. We anticipate completing the update in 2014.

VM Summary

Depending on how you evaluate the program, VM is currently not getting enough miles completed each year to achieve the goal of a 5 year cycle. The costs per mile may be too high and/or the current funding levels are too low and the impacts of herbicide spraying and enhanced risk tree work modify the meaning of work per mile. Vegetation Management's performance does show continued improvement but further analysis will provide an opportunity to re-evaluate our current performance and update future expectations.

Distribution Grid Modernization Program

Avista initiated a Grid Modernization Program designed to reduce energy losses, improve operation, and increase the long-term reliability of its overhead and underground electric distribution system. The program includes replacing poles, transformers (Pad Mount, OH & Submersible), cross arms, arresters, air switches with steel arms, grounds, cutouts, riser wire, insulators, conduit and conductors in order to address concerns related to age, capacity, high electrical resistance, strength, and mechanical ability. The program also includes the addition of wildlife guards, smart grid devices, switched capacitor banks, balancing feeders, removing unauthorized attachments, replacing open wire secondary, and reconfigurations.

When funded to a level that allows 5-6 feeders to be upgraded per year, the continuous program represents a 60 year interval to upgrade all the feeders in Avista's system and coordinates all of its activities with Avista's Wood Pole Management. The objectives of the Grid Modernization Program are listed in Table 23.

Table 23, Grid Modernization Program Objectives

Objective	Objective Description
Safety	Focus on safe practices for crew work by designing work plans to avoid safety risks
Reliability	Replacing aging and failed infrastructure that has a high likelihood of creating an unplanned crew call-out
Energy Savings	Replace equipment that has high energy losses with new equipment that is more energy efficient and improve the overall feeder energy performance
Operational Ability	Replace conductor and equipment that hinders outage detection and install smart grid devices that enable isolation of outages

Selected Metrics

Since Feeder Upgrade impacts the same KPI's as WPM, we include them in WPM KPI's above. The metrics selected for Feeder Upgrades represent the program's performance. The metrics selected include miles of work completed, OMT sustained outages on feeders with Grid Modernization work completed, and energy savings provided by completed work.

Based on Avista's 2013 Integrated Resource Plan dated August 31st, 2013, Table 5.3 and Table 5.4, the realized and anticipated energy savings by identified feeders is shown in Table 24. From Table 24, we calculated that the power saved per mile of work is 1.38 kW.

Table 24, Energy Savings based on 2013 Integrated Resource Plan

Feeder	Energy Savings (MWH)	OH Circuit Miles
NE12F3	115	13.09062
RAT231	91	52.25448
OTH502	21	0.783542
M23621	151	28.388
DVP12F2	35	39.1079
HAR4F1	69	12.0028
BEA12F3	167	9.854272
FWT12F3	121	10.5042
TEN1255	249	12.27521
ROS12F1	267	18.93558
SPI12F1	162	91.80389
TUR112	101	24.33467
9CE12F4	601	17.04767
WIL12F2	1403	105.5954
BEA12F1	972	24.80689
F&C12F2	570	20.6956
BEA12F5	885	15.66515
TUR113	76	5.098
Total	6056	502.2438
KW per Mile		1.376471

The miles of work planned is ultimately driven by the approved budget and generally can only be projected for 5 years. In order to maintain a 60 year cycle, Avista would need to address an average of 137 miles per year of overhead circuit miles. This would result in an average of 188 kW of power savings each year.

For tracking the impacts of the work on outages, we will monitor the following OMT sub-reasons shown in Table 25~~Table 25Table 25~~. While the Grid Modernization will affect all of the sub-reasons listed in Table 25~~Table 25Table 25~~, the sub-reasons identified as potentially avoidable represent the most direct impact of the work. So we assume that the number of OMT sustained outages will be reduced by 0.1 outages per mile of overhead work completed. Based on the data shown in Figure 23, the average number of OMT events that could potentially been avoided over the last 5 years is 773. Dividing 773 outages by the number of circuit miles yields 0.1 outages avoided per mile of work. So, the annual anticipated number of OMT sustained outages will be the average value of outages minus the number of OMT outages avoided by performing the work.

Table 25, OMT Sub-Reasons impacted by Grid Modernization

OMT Sub-Reason	Potentially Avoidable
Arrester	Yes
Capacitor	Yes
Conductor - Pri	Yes
Conductor - Sec	Yes
Connector - Pri	Yes
Connector - Sec	Yes
Cross arm - rotten	Yes
Cutout/Fuse	Yes
Elbow	Yes
Insulator	Yes
Insulator Pin	Yes
Lightning	No
Pole Fire	No
Pole - rotten	Yes
Recloser	Yes
Regulator	Yes
Snow/Ice	No
Switch/Disconnect	Yes
Transformer - OH	Yes
Transformer UG	Yes
Undetermined	No
Weather	No
Wildlife Guard	Yes

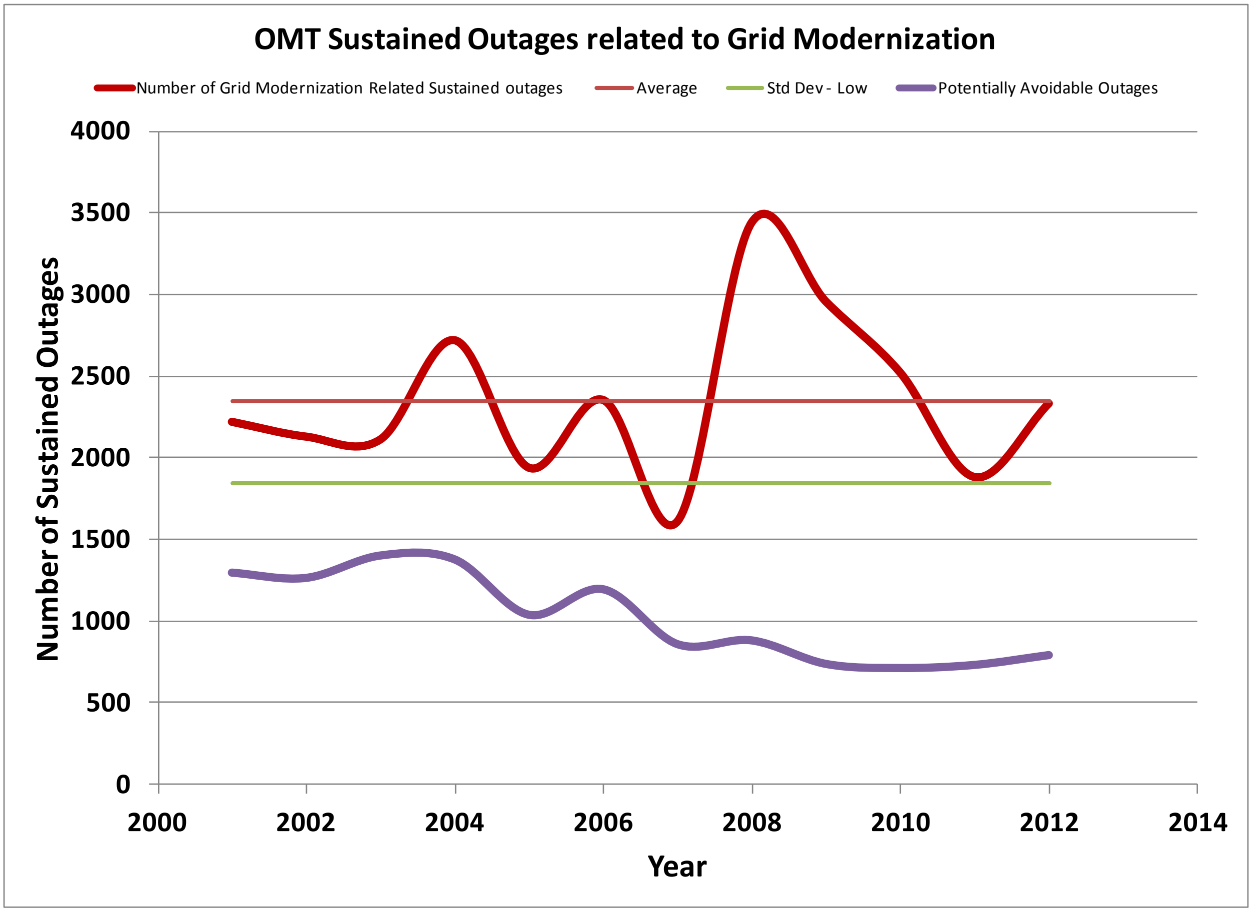

Figure 23, OMT Sustained Outages related to Grid Modernization

Metric Performance

The results of the first years work are shown in Table 26~~Table 26Table 26~~. The year 2012 marks the beginning of the program, so the results will only partially reflect the actual results. The number of miles actually completed missed the goal of 95 and the energy savings fell short of its goal as well. We will continue with the program as allowed by the budgets and continue to monitor the results for a few more years before considering any significant changes to the plan.

Table 26, Metric Performance for Grid Modernization Program

Year	Planned Miles for Modernization (Miles)*	Actual Miles Completed (Miles)	Anticipated Power Savings (kW)*	Realized Power Savings (kW)	Anticipated Number of Sustained Outages	Realized Number of Sustained Outages
2012	95	82	127	39.4	2340	2331
2013	137		188		2327	
2014	137		188		2313	
2015	137		188		2300	
2016	137		188		2286	
2017	137		188		2272	

*Note: The planned or anticipated values may be modified to match approved work plans for each year that more accurately align with the actual work planned.

Summary

The Grid Modernization Program began in earnest in 2012 and represents feeder replacement work and upgrades founded on smart grid work. We need to examine a few more years' worth of data before drawing any conclusions.

Asset Management Area Work plans for Electric Distribution

Spokane Area Work Plans

The feeders listed here represent the current plans and are subject to change based on several factors. These are provided for planning purposes only.

Grid Modernization

- **2013**
  - BEA12F5
  - NE12F3
- **2014**
  - -
- **2015**
  - ROS12F1
  - WAK12F2
- **2016**
  - BEA12F3
  - FWT12F3
- **2017**
  - F&C12F6
- **2018**
  - BEA12F2
  -
- **2019**
  - -

Vegetation Management

- **2013**
  - 3HT12F1
  - 3HT12F2
  - 3HT12F3
  - 3HT12F4
  - 3HT12F5
  - 3HT12F6
  - 3HT12F7
  - 3HT12F8
  - 9CE12F1
  - 9CE12F2
  - 9CE12F3
  - 9CE12F4
  - BKR12F1
  - BKR12F3
  - C&W12F1
  - C&W12F2
  - C&W12F3
  - C&W12F4
  - C&W12F5
  - C&W12F6
  - MIL12F1
  - MIL12F2
  - MIL12F3
  - MIL12F4
  - NW12F1
  - NW12F2
  - NW12F3
  - NW12F4
  - NW13T23
  - RDN12F1
  - RDN12F2
  - WAK12F1
  - WAK12F2
  - WAK12F3
  - WAK12F4
- **2014**
  - BKR12F2
  - DEP12F1
  - DEP12F2
  - EFM12F1
  - EFM12F2
  - H&W12F1
  - H&W12F2
  - SUN12F1
  - SUN12F2
  - SUN12F3
  - SUN12F4
  - SUN12F5
  - SUN12F6
- **2015**
  - BEA12F1
  - BEA12F2
  - BEA12F3
  - BEA12F4
  - BEA12F5
  - BEA12F6
  - BEA13T09
  - F&C12F1
  - F&C12F2
  - F&C12F3
  - F&C12F4
  - F&C12F5
  - F&C12F6
  - NE12F1
  - NE12F2
  - NE12F3
  - NE12F4
  - NE12F5
  - OPT12F1
  - OPT12F2
  - PST12F1
  - SIP12F1
  - SIP12F2
  - SIP12F3
  - SIP12F4
  - SIP12F5
  - SLK12F1
  - SLK12F2
  - SLK12F3
  - VAL12F2
- **2016**
  - AIR12F1
  - AIR12F2
  - CHE12F1
  - CHE12F2
  - CHE12F3
  - CHE12F4
  - CLA56
  - INT12F1

- INT12F2
- L&S12F1
- L&S12F2
- L&S12F3
- L&S12F4
- L&S12F5
- LOO12F
- LOO12F2
- MLN12F2
- SE12F1
- SE12F2
- SE12F3
- SE12F4
- SE12F5

- **2017**
  - COB12F1
  - COB12F2
  - FWT12F1
  - FWT12F2
  - FWT12F3
  - FWT12F4
  - GLN12F1
  - GLN12F2
  - LIB12F1
  - LIB12F2
  - LIB12F3
  - LIB12F4
  - MEA12F1
  - MEA12F2
  - MLN12F1
  - PVW241
  - ROS12F1
  - ROS12F2
  - ROS12F3
  - ROS12F4
  - ROS12F5
  - ROS12F6
- **2018**
  - -
- **2019**

Wood Pole Management Inspection

- **2013**
  - 3HT12F1
  - 3HT12F3
  - 3HT12F5
  - 3HT12F6
  - 3HT12F7
  - 3HT12F8
  - C&W12F2
  - C&W12F3
  - C&W12F4
  - C&W12F5
  - C&W12F6
  - NW12F 1
  - NW12F2
  - NW12F3
  - NW12F4
  - NW13T23
- **2014**
  - AIR12F3
  - BEA12F3
  - FWT12F3
  - L&S12F1
  - L&S12F2
  - L&S12F3
  - L&S12F4
  - L&S12F5
  - ROS12F1
- **2015**
  - CHE12F1
  - CHE12F2
  - CHE12F4
  - CLA56
  - H&W12F1
  - H&W12F2
  - MLN12F1
  - MLN12F2
  - NE12F1
  - NE12F2
  - NE12F4
- **2016**
  - BEA12F2
  - F&C12F1
  - F&C12F2
  - F&C12F3
  - F&C12F4
  - F&C12F5
  - F&C12F6
  - LIB12F2
  - LIB12F4
  - SE12F3
  - WAK12F2
- **2017**
  - 9CE12F1
  - 9CE12F2
  - 9CE12F3
  - BEA12F4
  - BEA12F6
  - BEA13T19
  - GLN12F1
  - OPT12F1
  - OPT12F2
  - ROS12F2
  - ROS12F4
  - ROS12F5
  - ROS12F6
- **2018**
  - FWT12F2
  - FWT12F4
  - INT12F1
  - INT12F2
  - WAK12F1
  - WAK12F3
  - WAK12F4
- **2019**
  - -

Wood Pole Management Follow-Up

- **2013**
  - **-**
- **2014**
  - 3HT12F1
  - 3HT12F3
  - 3HT12F5
  - 3HT12F6
  - 3HT12F7
  - 3HT12F8
  - C&W12F2
  - C&W12F3
  - C&W12F4
  - C&W12F5
  - C&W12F6
  - NW12F 1
  - NW12F2
  - NW12F3
  - NW12F4
  - NW13T23
- **2015**
  - AIR12F3
  - BEA12F3
  - FWT12F3
  - L&S12F1
  - L&S12F2
  - L&S12F3
  - L&S12F4
  - L&S12F5
  - ROS12F1
- **2016**
  - CHE12F1
  - CHE12F2
  - CHE12F4
  - CLA56
  - H&W12F1
  - H&W12F2
  - MLN12F1
  - MLN12F2
  - NE12F1
  - NE12F2
  - NE12F4
- **2017**
  - BEA12F2
  - F&C12F1
  - F&C12F2
  - F&C12F3
  - F&C12F4
  - F&C12F5
  - F&C12F6
  - LIB12F2
  - LIB12F4
  - SE12F3
  - WAK12F2
- **2018**
  - 9CE12F1
  - 9CE12F2
  - 9CE12F3
  - BEA12F4
  - BEA12F6
  - BEA13T19
  - GLN12F1
  - OPT12F1
  - OPT12F2
  - ROS12F2
  - ROS12F4
  - ROS12F5
  - ROS12F6
- **2019**
  - FWT12F2
  - FWT12F4
  - INT12F1
  - INT12F2
  - WAK12F1
  - WAK12F3
  - WAK12F4

Palouse Area

The feeders listed here represent the current plans and are subject to change based on several factors. These are provided for planning purposes only.

Grid Modernization

- **2013**
  - TUR113
- **2014**
  - M23621
- **2015**
  - M23621
- **2016**
  - TUR112
- **2017**
  - TUR112
- **2018**
  - TUR112
- **2019**
  - -

Vegetation Management

- **2013**
  - GAR461
  - M15511
  - M15512
  - M15513
  - M15514
  - M15515
  - M23621
  - NMO521
  - NMO522
  - PAL311
  - PAL312
  - SPA442
  - SPU121
  - SPU122
  - SPU123
  - SPU124
  - SPU125
- **2014**
  - DIA231
  - DIA232
  - JUL661
  - LAT421
  - LAT422
- **2015**
  - DER651
  - DER652
  - JUL662
  - RSA431
  - TKO411
  - TKO412
- **2016**
  - EWN241
  - ROK451
  - TUR111
  - TUR112
  - TUR113
  - TUR114
  - TUR115
  - TUR116
  - TUR117
  - TVW131
  - TVW132
- **2017**
  - ECL221
  - ECL222
  - LEO611
  - LEO612
  - POT321
  - POT322
  - WOR471
- **2018**
  - -
- **2019**
  - -

Wood Pole Management Inspection

- **2013**
  - -
- **2014**
  - GAR461
  - TUR112
- **2015**
  - -
- **2016**
  - JUL661
  - JUL662
  - LEO612
  - M23621
  - ROK451
- **2017**
  - POT321
  - POT322
  - TUR116
- **2018**
  - -
- **2019**
  - -

Coeur D'Alene Area

The feeders listed here represent the current plans and are subject to change based on several factors. These are provided for planning purposes only.

Grid Modernization

- **2013**
  - CDA121
  - RAT231
- **2014**
  - CDA121
- **2015**
  - RAT231
- **2016**
  - -
- **2017**
  - APW114
- **2018**
  - -
- **2019**
  - -

Vegetation Management

- **2013**
  - BIG411
  - BIG412
  - BIG413
  - BLU321
  - HUE141
  - HUE142
  - LKV341
  - LKV342
  - LKV343
  - LKY551
  - OSB522
  - STM631
  - STM632
  - STM633
- **2014**
  - BLA311
  - CDA121
  - CDA122
  - CDA123
  - CDA124
  - CDA125
  - OGA611
  - OLD721
  - OLD722
  - OSB521
  - PF211
  - PF212
  - PRV4S40
  - SPL361
- **2015**
  - APW111
  - APW112
  - APW113
  - APW114
  - APW115
  - APW116
  - AVD151
  - AVD152
  - CKF712
  - IDR251
  - IDR252
  - IDR253

- PF213
- SAG742
- WAL542
- WAL543
- WAL544
- WAL545

- **2016**
  - CGC331
  - CKF711
  - DAL131
  - DAL132
  - DAL133
  - DAL134
  - NRC352
  - RAT231
  - RAT233
  - SAG741
  - SPT4S21
  - SPT4S22
  - SPT4S23
  - SPT4S30
- **2017**
  - BUN422
  - BUN423
  - BUN424
  - BUN426
  - MIS431
  - ODN731
  - ODN732
  - PIN441
  - PIN442
  - PIN443
  - PRA221
  - PRA222
  - PVW243
- **2018**
  - -

Wood Pole Management Inspection

- **2013**
  - APW112
  - APW113
  - LKV341
  - LKV342
  - LKV343
  - SAG741
- **2014**
  - APW111
  - APW115
  - APW116
  - IDR252
  - SAG742
- **2015**
  - IDR251
  - IDR253
  - SPT4S22
  - SPT4S23
  - SPT4S30
- **2016**
  - APW114
  - PVW243
- **2017**
  - BIG411
  - BIG412
  - PIN441
  - RAT233
- **2018**
  - PRV4S40
- **2019**
  - -

Wood Pole Management Follow-Up

- **2013**
  - **-**
- **2014**
  - APW112
  - APW113
  - LKV341
  - LKV342
  - LKV343
  - SAG741
- **2015**
  - APW111
  - APW115
  - APW116
  - IDR252
  - SAG742
- **2016**
  - IDR251
  - IDR253
  - SPT4S22
  - SPT4S23
  - SPT4S30
- **2017**
  - APW114
  - PVW243
- **2018**
  - BIG411
  - BIG412
  - PIN441
  - RAT233
- **2019**
  - PRV4S40

Lewis-Clark Area

The feeders listed here represent the current plans and are subject to change based on several factors. These are provided for planning purposes only.

Grid Modernization

- **2013**
  - -
- **2014**
  - -
- **2015**
  - -
- **2016**
  - TEN1255
- **2017**
  - -
- **2018**
  - HOL1205
  - ORO1280
- **2019**
  - -

Vegetation Management

- **2013**
  - COT2401
  - COT2402
  - DRY1208
  - DRY1209
- **2014**
  - LOL1359
  - SLW1316
  - SLW1348
  - SLW1358
  - SLW1368
  - TEN1253
  - TEN1254
  - TEN1255
  - TEN1256
  - TEN1257
- **2015**
  - HOL1205
  - HOL1206
  - HOL1207
  - JPE1287
  - LOL1266
  - N131222
  - N131321
  - PDL1201
  - PDL1202
  - PDL1203
  - PDL1204
  - WEI1289
- **2016**
  - CFD1210
  - CFD1211
  - GRV1271
  - GRV1272
  - GRV1273
  - GRV1274
  - KAM1291
  - KAM1292
  - KAM1293
  - KOO1298
  - KOO1299
- **2017**
  - CRG1260
  - CRG1261
  - CRG1263
  - NEZ1267
  - ORO1280
  - ORO1281
  - OROR1282
  - SWT2403
  - WIK1278
  - WIK1279
- **2018**
  - -
- **2019**
  - -

Wood Pole Management Inspection

- **2013**
  - -
- **2014**
  - LOL1266
  - LOL1359
- **2015**
  - JPE1287
- **2016**
  - COT2402
  - HOL1205
  - N131222
  - ORO1280
  - SWT2403
- **2017**
  - -
- **2018**
  - KAM1291
  - KAM1292
  - KAM1293
- **2019**
  - -

Wood Pole Management Follow-Up

- **2013**
  - -
- **2014**
  - -
- **2015**
  - LOL1266
  - LOL1359
- **2016**
  - JPE1287
- **2017**
  - COT2402
  - HOL1205
  - N131222
  - ORO1280
  - SWT2403
- **2018**
  - -
- **2019**
  - KAM1291
  - KAM1292
  - KAM1293

Big Bend Area

The feeders listed here represent the current plans and are subject to change based on several factors. These are provided for planning purposes only.

Grid Modernization

- **2013**
  - WIL12F2
  - SPI12F1
  - DVP23F2
- **2014**
  - SPI12F1
  - WIL12F2
- **2015**
  - SPI12F1
  - OTH502
- **2016**
  - SPI12F1
  - SPR761
- **2017**
  - DAV12F2
  - HAR4F1
  - SPR761
- **2018**
  - DAV12F2
  - HAR4F1

Vegetation Management

- **2013**
  - ARD12F1
  - CLV34F1
  - CLV12F2
  - CLV12F3
  - CLV12F4
  - HAR4F1
  - HAR4F2
  - KET12F1
  - RIT731
  - RIT732
- **2014**
  - ARD12F2
  - KET12F2
  - LIN711
  - ORI12F1
  - ORI12F2
  - ORI12F3
  - WAS781
  - WIL12F1
  - WIL12F2
- **2015**
  - FOR12F1
  - GIF34F1
  - LL12F1
  - ODS12F1
  - SOT521
  - SPI12F2
  - SPR761
  - VAL12F3
- **2016**
  - FOR2.3
  - GIV34F2
  - L&R511
  - ROX751
  - SOT522
  - SOT523
  - SPI12F1
  - VAL12F1
- **2017**

- CHW12F1
- CHW12F2
- CHW12F3
- CHW12F4
- DVP12F1
- DVP12F2
- GRN12F1
- GRN12F2
- GRN12F3
- L7R512
- LF34F1
- OTH501
- OTH502
- OTH503
- OTH505

- **2018**
  - -
- **2019**
  - -

Wood Pole Management Inspection

- **2013**
  - DVP12F2
  - GIF34F1
  - WAS781
- **2014**
  - GIF34F1
- **2015**
  - SOT522
- **2016**
  - -
- **2017**
  - OTH501
  - OTH503
  - OTH505
  - SPR761
- **2018**
  - CHW12F1
  - CHW12F4
  - FOR12F1
  - FOR2.3
- **2019**
  - -

Wood Pole Management Follow-Up

- **2013**
  - -
- **2014**
  - DVP12F2
  - GIF34F1
  - WAS781
- **2015**
  - GIF34F1
- **2016**
  - SOT522
- **2017**
  - -
- **2018**
  - OTH501
  - OTH503
  - OTH505
  - SPR761
- **2019**
  - CHW12F1
  - CHW12F4
  - FOR12F1
  - FOR2.3

Conclusion

In this report, we documented and examined the KPIs and metrics AM selected for the Distribution system and provided the results for 2010. Some of the metrics compared how an asset performed with a program and how it would have performed without a program. The difference in performance provide an estimate of the cost saving and value of an AM program. While the exact savings are impossible to calculate in most cases, it provides a relative comparison and supporting justification or motivation for change in AM decisions made in the past. Other KPIs and metrics provided indications of how well an asset performed and help determined if further work is required. Some AM models clearly need more work to better predict future conditions and will be scheduled in the future if it makes sense.