

Almost Real-Time Reliability Improvements

Taking reliability analysis to the next level!

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Pacific Power | Rocky Mountain Power

The Challenge...

- With the advent of outage management systems and reporting systems, how can solutions be delivered in a more proactive way?
 - ▶ With that in mind, how can we get ahead of customer's concerns when their reliability is slipping?
- Pacific Power and Rocky Mountain Power have used process and technology to balance the answers for these two questions.

Real-Time Improvement vs. Program Improvement

- Program Improvement
 - System metrics are used to measure the effectiveness of the system *as a whole*.
 - Long range budgeting!
 - Historical analysis and trending.
 - Changes to the system *should not* be reactive.
 - Generally requires a longer time to deliver reliability benefits.
- Real-Time Improvement
 - Mainly customer oriented programs
 - Fuse melt outs
 - Reliability work plans
 - Breaker operations
 - Response metrics
 - Managed well, the programs will result in very quick impact to system reliability metrics.

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Fuse Melt Out Process

Fuse Melt Out Occurs

Operations re-fuses the location to get amp readings and calls engineering to get fuse size if available.

Outage is recorded with pertinent information in OMS.

Fuse melt outs are extracted from the OMS system and tracked.

Engineering has 24 hours to get a solution to Operations.

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Fuse Melt Out Form Example

Fuse Melt-out Report Form - Return to the operations manager by the next business day.

CADOPS Number: _____	Responder Name: _____	Date: _____
Time: _____	Weather/Temperature: _____	Circuit: _____

Fuse melt out
 Circle the phase(s) that had the fuse melt-out
 N C S or E C W or T C B _____ Amps _____ Amps _____ Amps FPN: _____

Fuse size that melted: _____ Replacement fuse size: _____ Wait 5 minutes after replacing fuse for the load to settle and then check and record amps per phase. If the amp reading on fuse is greater than the fuse size please contact the engineer on call.

Field engineer _____ agrees disagrees with fuse melt out solution. Date: _____ Notify Operations of required changes.
 Required Changes: _____

General Instructions:

The Fuse Melt-out Report Form should be used whenever a fuse appears to have melted out on the primary system. Complete one form per event. All completed forms should be returned to the local operations manager by the next business day.

Enter CADOPS outage number, your name, date, time, weather conditions, and circuit name.

Fuse Melt Out - The fuse melt out section should be completed when a fuse appears melted.

Circle the phases that had the fuse melt out. On multi-phase taps use:

North Center South when the line is running east - west
 East Center West when the line is running north - south
 Top Center Bottom for vertical construction.

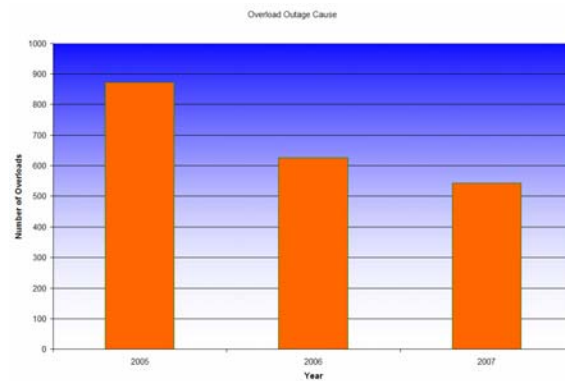
On single phase taps use N or S or E or W for flat construction and T for vertical construction.

Once a fuse is re-installed measure and record the amps on each phase of the impacted tap. Ensure the fuse label matches the fuse size on the pole.

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Fuse Melt Out Results

— 38% reduction from 2005 in overload related outages!



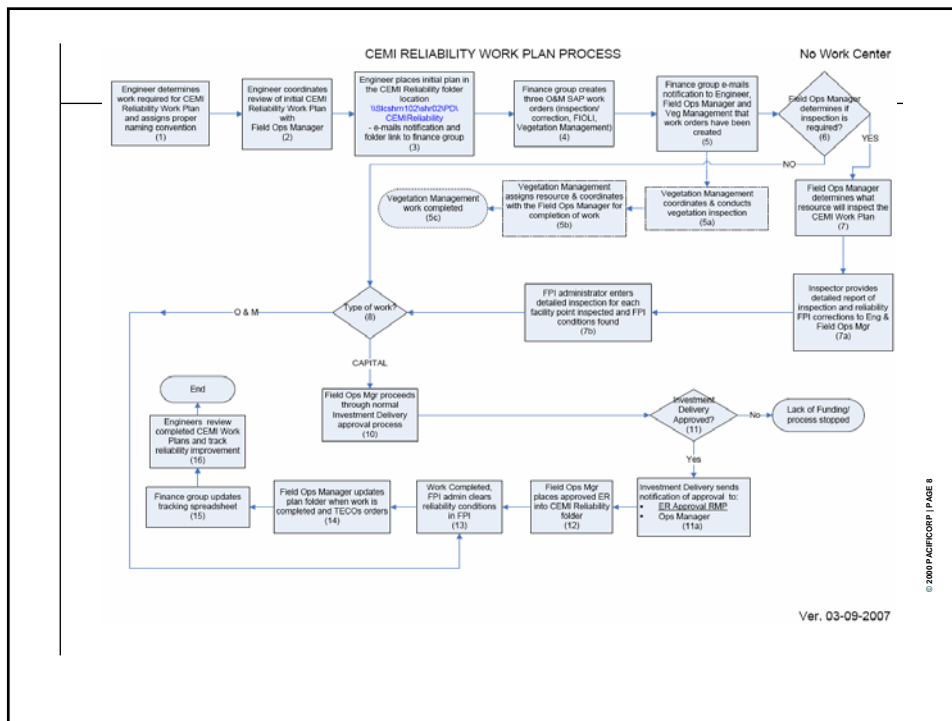
— Resulted in visible improvement in annual SAIDI/SAIFI metrics

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Reliability Work Plans

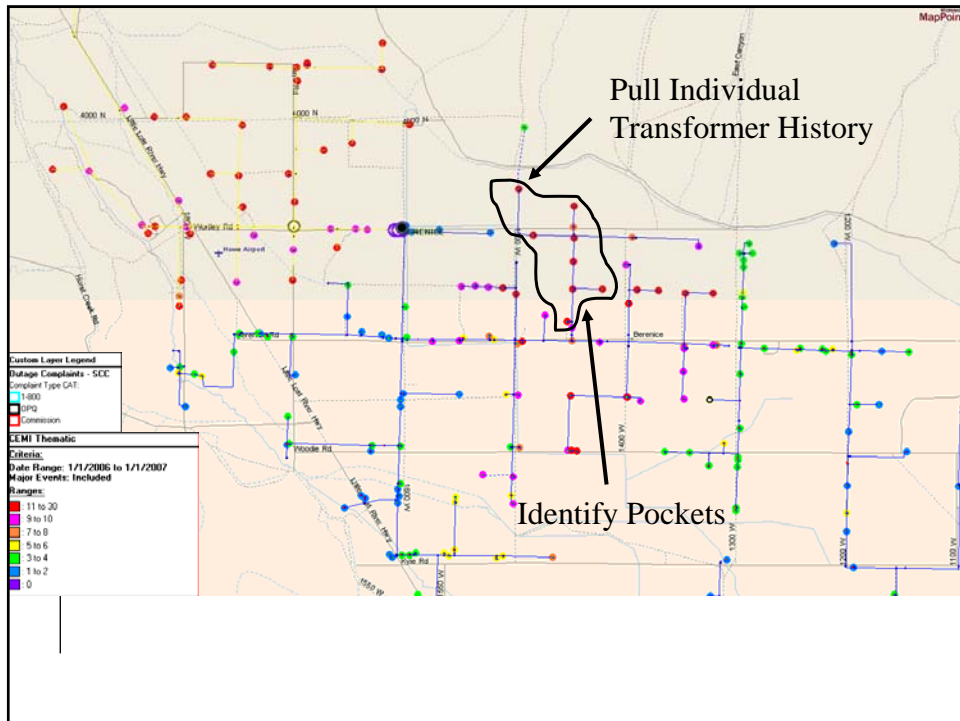
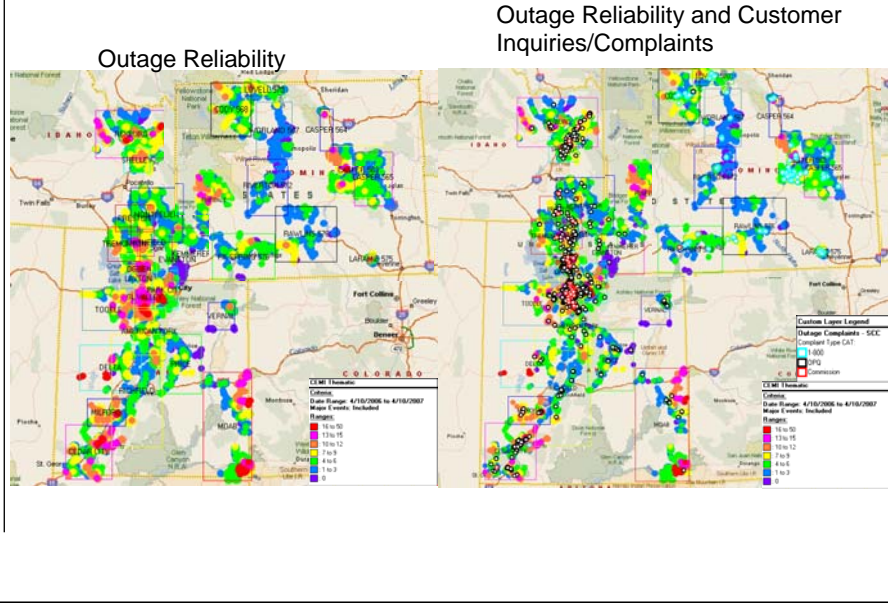
- Reliability Work Plans are oriented around what the customer experiences.
 - ▶ The customer does not care what is interrupting their power they just want it to STOP!
- Areas and circuits have different characteristics in which they operate
- New technology has allowed us to view and identify characteristics isolated to a distinct location on a circuit.
- Build a plan targeted to meeting that location's needs.
- Do the work.
- Review the improvements and make changes if needed.

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GREAT

(Geographical Reliability Enhancement Analysis Tool)



Individual Transformer Incident History

Incident History													
JOB ID	INCIDENT DATE TIME	DIRECT CAUSE CATEGORY	DIRECT CAUSE	LINE/CUT/POLE ID	LINE/CUT/POLE X	LINE/CUT/POLE Y	DESCRIPTION	PHASE	COMPONENT	MAJOR EVENT NUMBER	CUSTOMERS OUT/DURATION	CUSTOMERS OUT/MOMENTARY	DISPATCH HOURS
CSL080497	7/12/2006 11:00	Equipment Failure	Deterioration or Rotting	LINE/CUT/25433	1114473	15627349	replaced burned off jumper and junction fuse.	A	Jumper Wire/Strap Oh	0	33	0	1.58
CSL080125	7/25/2006 18:23	Weather	Lightning	Oh_211000_495450381	1109645	15627374	patrolled and replaced blown junction fuse	A		0	35	0	2.162
CSL082245	3/27/2006 1:14	Loss of Supply	Loss of Transmission Line	BRN_C821	1109695	15622963	Lost the CB 77 at Scoville Sub tree 8 and 8 feed	A		0	172	0	0.128
CSL080362	1/20/2006 2:06	Weather	Snow, Sleet and Blizzard	Oh_211000_495450381	1109645	15627374	Junction fuses open	A		0	47	0	2.287
CSL080190	7/5/2006 11:42	Other	Unknown	LINE/CUT/25439	1109168	15627387	patrol the line and replaced junction fuse.	A	Fuse (No Cause Found) Oh	0	50	0	1.026
CSL080323	8/8/2006 21:36	Loss of Supply	Loss of Transmission Line	LINE/CUT/26641	1109164	15626642	CB 77 at Scoville locked open closed by waka holding	A		0	0	0	0.076
CSL080980	10/7/2006 17:11	Other	Unknown	Oh_211000_495450381	1109645	15627374	patrolled the line and refueled the junction fuse ok	A	Fuse (No Cause Found) Oh	0	42	0	1.987
CSL080891	10/11/2006 11:52	Planned	Emergency Damage Repair	Oh_220302_495450378	1117063	15627602	to replace bad outlet	A	Call-Out B/O Oh	0	12	0	0.35
CSL080287	10/19/2006 9:04	Other	Unknown	Oh_211000_495450381	1109645	15627374	blown line fuse	B	Fuse (No Cause Found) Oh	0	40	0	1.97
CSL080868	11/23/2006 8:17	Weather	Minor Sleet and Blizzard	Oh_211000_495450381	1109645	15627374	average 6 009652	B	No Distribution Damage	0	40	0	0.70
CSL0721791	12/15/2006 9:20	Weather	Wind	Oh_211000_495450381	1109645	15627374	high winds got fuse blown troubleman replaced fuse	A	No Distribution Damage	0	35	0	0.609

- Viewing what impacts a customer is experiencing both tabular and geographical.
- Identify the problems and recurring causes.
- Build a plan to meet the individual needs of that section of circuit or customer.

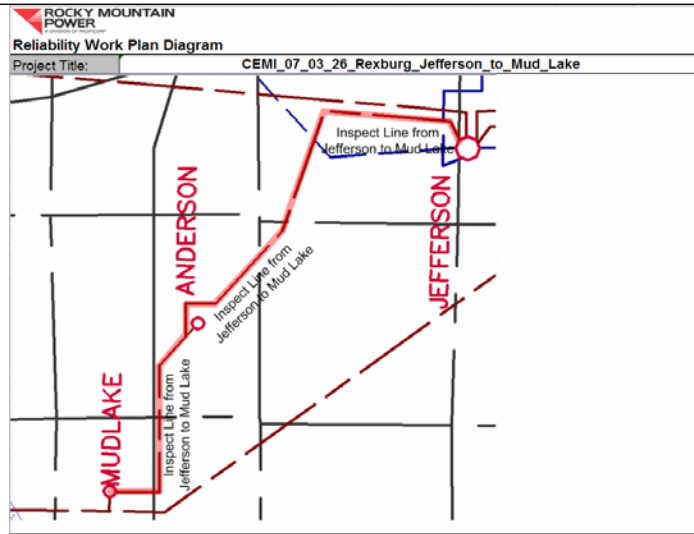
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Reliability Work Plan (Page 1)

ROCKY MOUNTAIN POWER A DIVISION OF PACIFICORP		Create Name	Reliability Work Plan	
CEMI_07_03_26_Rexburg_Jefferson_to_Mud_Lake		Charge Numbers	Prioritization Criteria	
Operations Manager	District	O&M Charge Number	Number of Incidents: 8	
Tony Nielsen	Rexburg	15447760	Plan Effects: 7	
Prepared By	Substation	FIOLI Charge Number	36 Month Transformer CHI: 6.46	
Joshua Jones	Jefferson	15447761	Average Incident Duration: 0.81	
Date Created	Feeder/Transmission Line	Tree Trimming Number	Customer Count: 870	
3/26/2007	Jefferson_to_Mud_Lake	15447762	OPQ's/1-800/Commission: 6	
Estimated By	Capital Cost	Capital Charge Number	Overhead/Underground: Overhead	
Date Work Completed	Vegetation Inspection Requested		Estimate Type	
	No			
Summary:				
This year two transmission lines were picked for incremental improvements as part of the 2006 Underperforming Circuit.				
Incremental Improvements Justification:				
The transmission line was picked by Joshua Jones, Tony Perkins, Vance Wittbeck, and Heide Caswell. The transmission line has had poor performance in the last three years with a TCPI of 503 and is ranked the 24th worst performing transmission line in Rocky Mountain Power's 2008 selection. The transmission line has a large number of reliability conditions conditions, poor ground clearance, rotten poles(200+), and a problem with raptor guarding. The geographical location of the line also causes for long restoration time due to a three hour travel time.				
Initial Recommendations				
Detailed inspection from Jefferson to Mud Lake on each structure and wire section.				

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Reliability Work Plan (Page 2)



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Reliability Work Plan (Page 3)

Incident History

JOB_ID	INCIDENT_DATE_TIME	DIRECT_CAUSE_CATEGORY	DIRECT_CAUSE	AUTO_ISOL_POINT_ID	AUTO_ISOL_POINT_K	AUTO_ISOL_POINT_Y	DESCRIPTION	PHASE	COMPONENT	MANPLACEMENT	CUSTOMERS_OUT_SUPPLIED	CUSTOMERS_OUT_MOMENTARY	DURATION_HOUR
CSL047853	7/26/2004 1:37	Loss of Supply	Loss of Transmission Line	LINECUT-13686	1251400	15920242	Line CB at Amps opened up opened CB 66 closed CB 69 by SCADA	ABC	ABC	0	186	0	0.646
CSL0507956	11/14/2004 14:50	Loss of Supply	Loss of Transmission Line	LINECUT-15207	1251407	15920320	amps sub opened up closed in at mud lake cb 69	ABC	ABC	0	186	0	0.236
CSL000159	12/3/2005 3:10	Loss of Supply	Loss of Transmission Line	LINECUT-21437	1251420	15920242	amps 230 line tripped out. Going to have to close in at Anderson.	ABC	ABC	0	205	0	0.603
CSL0812589	3/2/2006 12:40	Loss of Supply	Loss of Transmission Line	MDL_CB11	1251437	15920320	test cb at amps closed in at mud lake	ABC	ABC	0	204	0	0.143
CSL0652639	1/20/2005 5:53	Loss of Supply	Loss of Transmission Line	LINECUT-21569	1251407	15920320	Lost transmission line feed from jefferson closed at mudlake	ABC	ABC	0	205	0	0.211
CSL011011	12/6/2004 10:14	Loss of Supply	Loss of Transmission Line	LINECUT-15546	1251372	15920242	lost transmission line previous call rolled into outage	ABC	ABC	0	186	0	2.286
CSL0517847	7/12/2005 12:47	Loss of Supply	Loss of Transmission Line	LINECUT-16060	1251456	15920320	Los of transmission line feeding the area. Troublemaker on the way.	ABC	ABC	0	189	0	2.071
CSL0001279	12/29/2005 1:22	Loss of Supply	Loss of Transmission Line	MDL_CB11	1251437	15920320	Amps C52211 opened by acadia close in Mudlake CB 68	ABC	ABC	0	205	0	0.193

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Reliability Work Plan (Page 4)

ROCKY MOUNTAIN POWER

Reliability Work Plan Review Sheet

Project Title: **CEMI_07_03_26_Rexburg_Jefferson_to_Mud_Lake**

Initial History

Prioritization Criteria	
Number of Incidents:	8
Peak Effects:	7
12 Month Transformer Out:	6
Average Incident Duration:	1
OPQ's/1-800/Commission:	6

90 Day Review

Prioritization Criteria	
Number of Incidents:	0
12 Month Transformer Out:	0.00
Average Incident Duration:	0.00
OPQ's/1-800/Commission:	0

Wait till 1 year review.

1 Year Review

Prioritization Criteria	
Number of Incidents:	0
12 Month Transformer Out:	0.00
Average Incident Duration:	0.00
OPQ's/1-800/Commission:	0

Done! Archive

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Reliability Work Plan Results

- The Reliability Work Plans have addressed a lot of low hanging fruit by putting outage visualization tools and processes in the hands of local engineering staff.
 - Rocky Mountain Power has moderated the impact of summer related heat and weather during the summer months.
 - Customers with specific needs can be explained or monitored with respect to the rest of the customers to find a balance between customer expectations and reliability concerns.
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Breaker Operations

- Many companies have different philosophies.
 - Save the Fuse (Fuse Saving Scheme)
 - Operate the Fuse (Sensitive Customer Scheme)
- Regardless of the philosophy breaker operations should be tracked. (This is what the customers see)
 - High breaker activity should be reviewed and addressed regardless of type (momentary count or sustained count).
 - Sensitive customer circuits should be monitored closely to evaluate effective target ranges.
 - System serving industrial customers or high tech customers.

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Historical Practices and Recent Feedback has helped Tailor the Approach Taken:

- Pacific Power has been more concerned by long duration interruptions caused by breaker lock outs.
 - Breaker Lock Outs are recorded.
 - Engineering reviews the lock outs daily, reviews relay settings and issues relay changes if necessary within 2 days.
- Rocky Mountain Power has been more concerned about number of interruptions.
 - Breaker lock outs and momentary operations are combined for a total operation count.
 - The list is dynamic and re-prioritizes with each operation.
 - Breakers on the top of the list require a review of the relay settings and cause of outages. If the outage cause can not be determined the engineer issues relay setting orders to disable the low set instantaneous trip, allowing the fuse to operate.
 - Operations is made aware of the relay change and investigates activity on the circuit.

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Breaker Operation Benefits

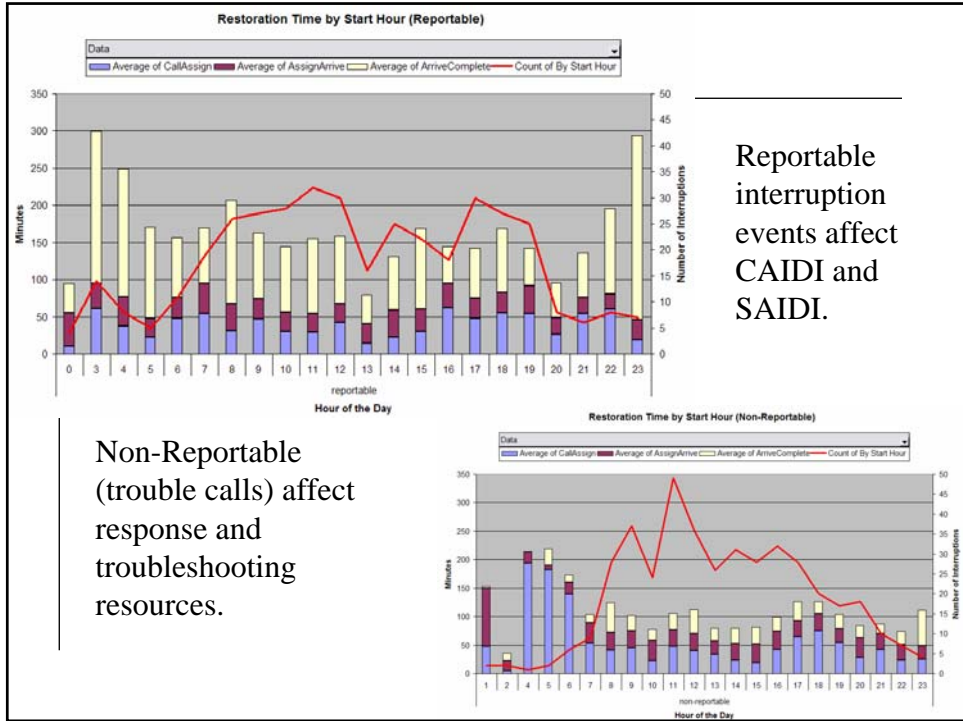
- Pacific Power has made substantial inroads with certain circuits' performance, by catching improperly set equipment as well as by more promptly patrolling for root causes of repeated devices.
- Rocky Mountain Power customers have been very pleased with the change.
 - ▶ The company has received positive feedback from customers.
 - ▶ The down side can be the change in turning a momentary outage into a sustained outage, which can only be mitigated by finding where the problem is and fixing it.

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Response Metrics

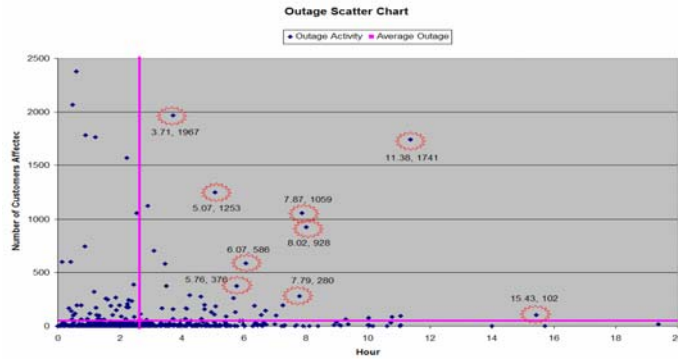
- Outage Activity is a key real-time outage management opportunity.
- Outage management system technologies have delivered some improvements.
- Key areas for Pacific Power & Rocky Mountain Power are managing:
 - ▶ Resource hours,
 - ▶ Type of calls responded to,
 - ▶ Cause trends, and
 - ▶ Heavy-hitters that dominate day-to-day comparisons.

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CAIDI Outliers

- All outages are plotted to identify outliers!
- Root cause analysis is done on the outliers and modifications are made to restoration methods.



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Summary

- Plans can be developed that put you in the driver's seat by acting more rapidly on reliability information.
- Several questions need to be considered:
 - What top issues are you facing?
 - What data do you take action on?
 - How do you use the data?
 - Who uses the data?
 - Do they know what differences in the data drive differing actions?
- If you've attacked the problem in this sort of way you too can be developing almost real-time solutions for managing reliability.

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Questions



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