

The Modern PI System for AMI Meter Data

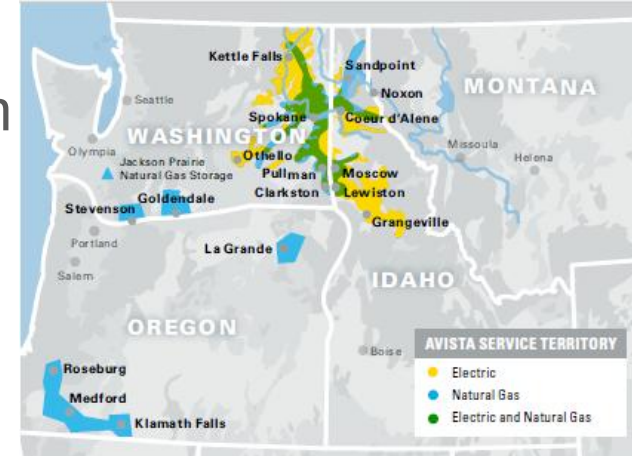
Greg Paulson
System Operations Engineer

Conference Theme & Keywords



Avista

- Investor Owned Utility founded in 1889
- Annual Revenues of more than \$1.4 billion
- 710,000 electric and gas customers
- 30,000 square mile service territory
- 2,250 miles of transmission line
- 19,000 miles of distribution line
- 7,700 miles of natural gas distribution mains
- Headquartered in Spokane, Washington
- Over 1,700 employees work in four western states



The Modern PI System for AMI Meter Data

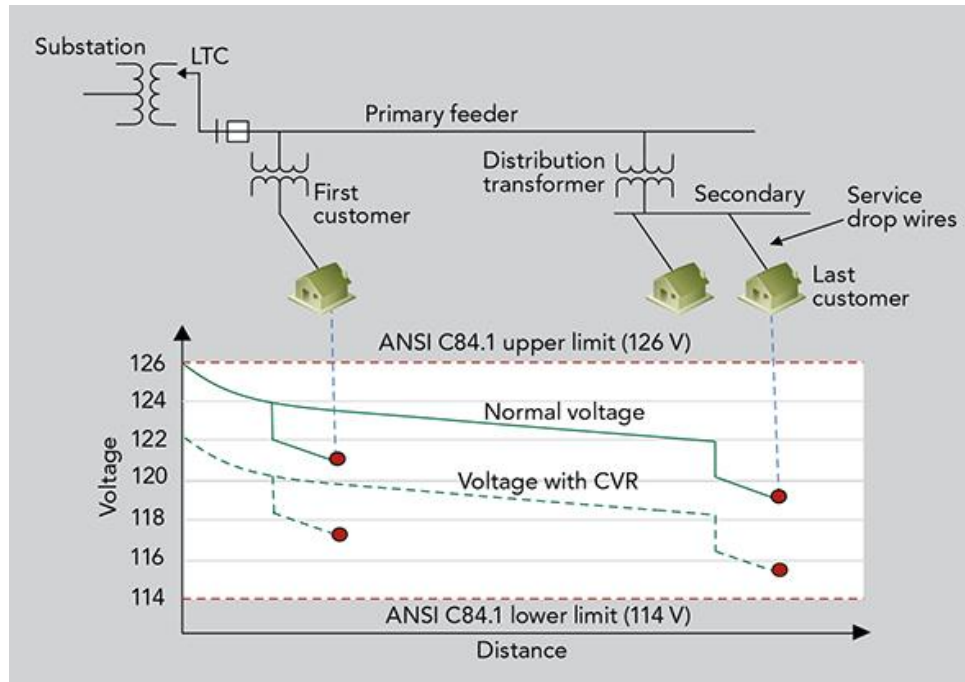
- Washington AMI Project
 - Conservation Voltage Reduction (CVR)
 - Pullman, WA SDGP AMI Project
- The Modern PI System
- Finding Problems
- Fixing Problems
- Future Plans

Washington AMI

- Interval Data for 400,000 meters
- MDM – Billing and Customer presentment
 - Not typically focused on traditional operational needs
- Benefits for Conservation Voltage Reduction (CVR)
 - Interval Data and Events for Operations

Avista CVR

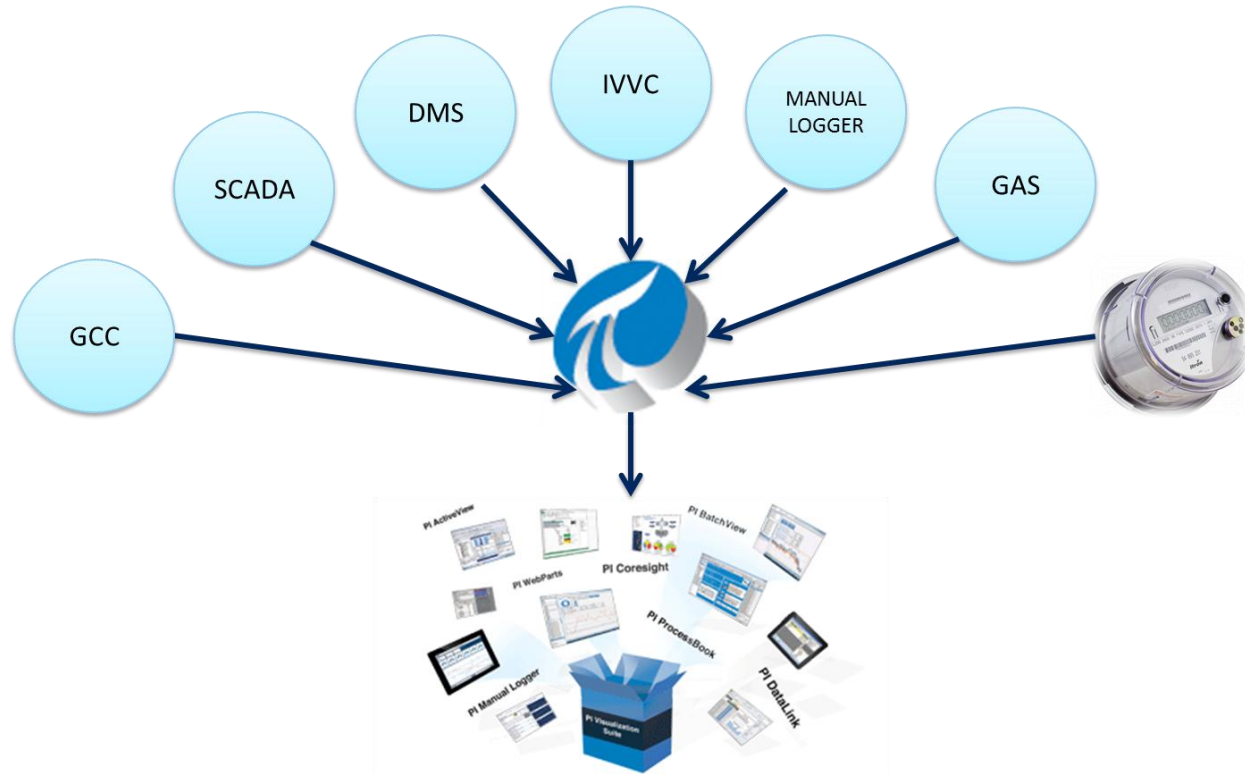
- CVR – Reduce Energy and Peak Demand



CVR Control

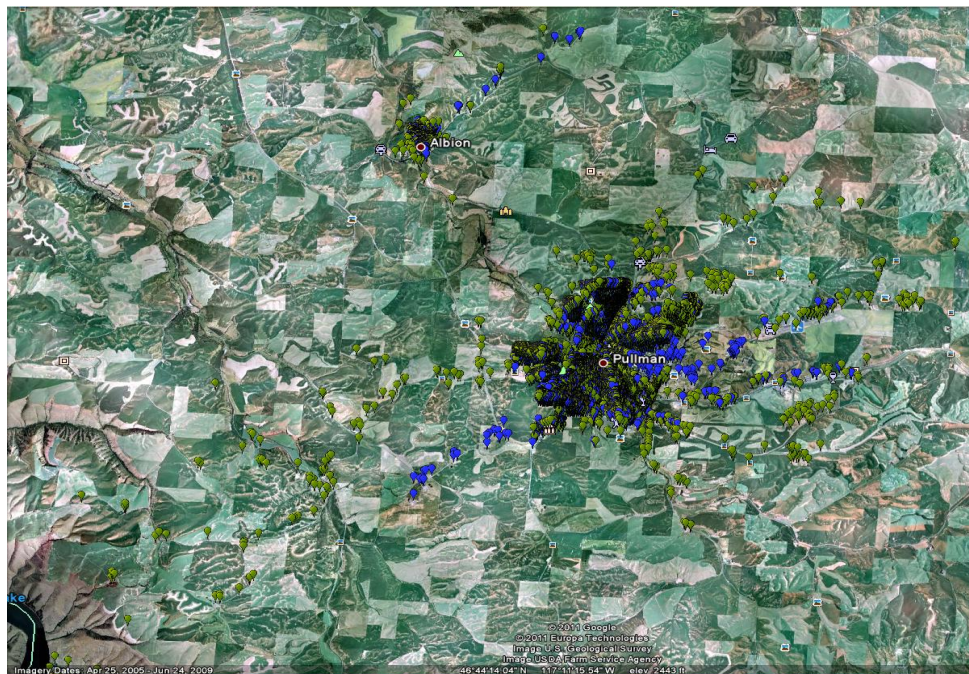
- Distribution Management System (DMS)
 - Integrated Volt and VAR Control (IVVC)
- Energy Management System (EMS or “SCADA”)
 - Remotely change Voltage Regulator settings
- Manual
 - Field personnel will be dispatched to change Voltage Regulator settings

PI for Operational Data

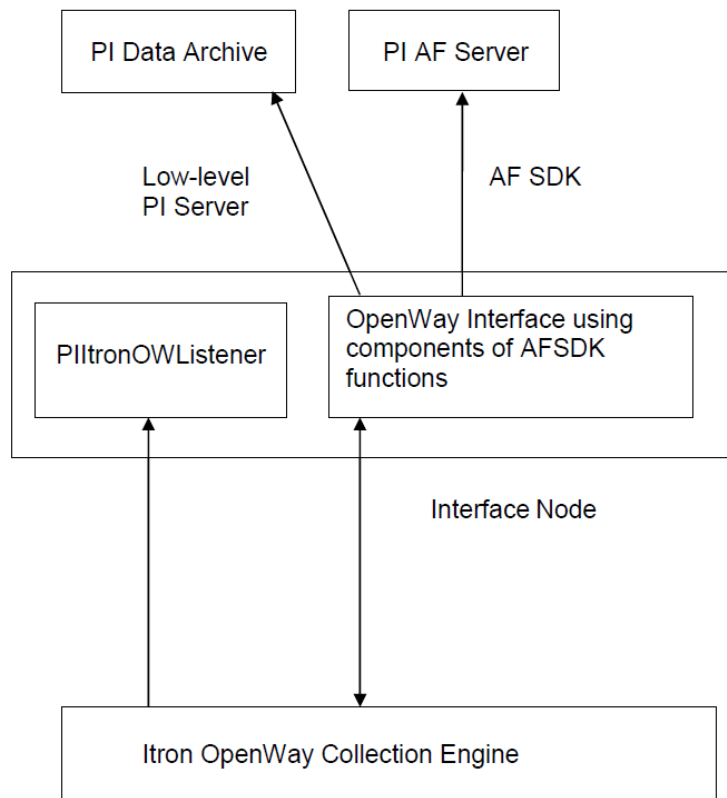


AMI Testbed in Pullman, WA

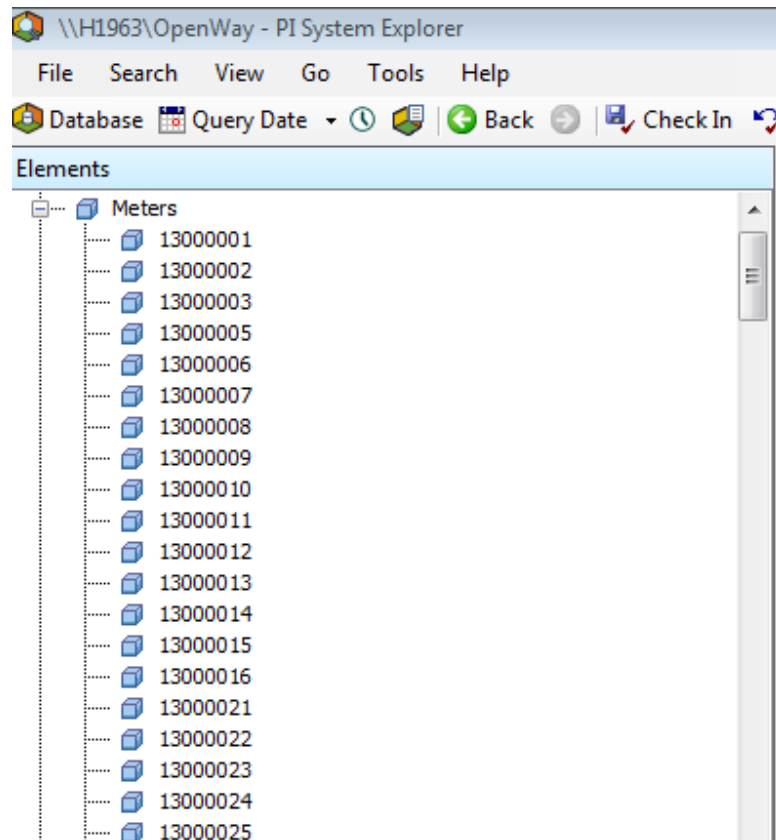
- SGDP Project in 2011
 - 15,000 Electric Meters



AMI Interface for Itron OpenWay



PI Magic!!! 15,000 meters



15,000 meters – With Context and Data

Category: Connectivity					
☒		Feeder	TUR117	1/1/1970 12:00:00 AM	
☒		Meter Number	13001020	1/1/1970 12:00:00 AM	
☒		Service Length	35.5546882553731	1/1/1970 12:00:00 AM	
☒		SPID	9820639264	1/1/1970 12:00:00 AM	
☒		Transformer	AV00530 _ _	1/1/1970 12:00:00 AM	
Category: Voltage					
 ☒ 		V	238.200004577637 V	2/26/2018 7:55:00 AM	
☒		V - Inst	238.3	2/26/2018 8:40:25 AM	
☒		V - Max	238.6	2/26/2018 7:55:00 AM	
☒		V - Min	237.5	2/26/2018 7:55:00 AM	
  ☒ 		Voltage Status	Shutdown	2/21/2018 7:24:03 PM	

What If Analysis

13001031

General Child Elements Attributes Ports Analyses Notification Rules Version

Name	Backfilling
1V - Voltage Low	✓
2V - Voltage Low	✓
Meter Exception	✓
Power and Voltage	✓
Power Outage	✓
Voltage Low	✓

Name: 1V - Voltage Low

Description:

Categories:

Analysis Type: ☐ Expression ☐ Rollup ☒ Event

[Create a new notification rule for 1V - Voltage Low](#)

Event Frame Template: Voltage Low

Name	Expression	True for	Severity	Value at Evaluation	Value at Last Trigger
Start triggers					
StartTrigger1	('Meter Form' = "FM2" and ('V' <= 230 and 'V' >= 115)) or ('Meter Form' = "FM1" and ('V' <= 115 and 'V' >= 60))	Not Set	None		
End trigger					
EndTrigger					

Event Frames

Event Frames		Event Frame Search 1																																																																																																																																																															
Event Frame Searches		Filter																																																																																																																																																															
Event Frame Search 1		Name 2.. [13:35:14] ... Duration Start Time End Time																																																																																																																																																															
- Voltage Low 2018-02-26 14:35:11.000 - Voltage Low 2018-02-26 14:35:03.000 - Voltage Low 2018-02-26 14:29:57.000 - Voltage Low 2018-02-26 14:20:01.000 - Voltage Low 2018-02-26 12:40:03.000 - Voltage Low 2018-02-26 11:35:10.000 - Voltage Low 2018-02-26 11:15:09.000 - Voltage Low 2018-02-26 11:15:09.000 - Voltage Low 2018-02-26 11:15:03.000 - Voltage Low 2018-02-26 11:14:59.000 - Voltage Low 2018-02-26 09:30:53.000 - Voltage Low 2018-02-26 09:30:13.000 - Voltage Low 2018-02-26 09:30:09.000 - Voltage Low 2018-02-26 09:25:58.000 - Voltage Low 2018-02-26 09:00:04.000 - Voltage Low 2018-02-26 08:59:58.000 - Voltage Low 2018-02-26 08:15:16.000 - Voltage Low 2018-02-26 08:05:12.000 - Voltage Low 2018-02-26 07:55:12.000 - Voltage Low 2018-02-26 07:55:07.000 1V - Voltage Low 2018-02-26 07:50:00.000 1V - Voltage Low 2018-02-26 07:50:00.000 1V - Voltage Low 2018-02-26 07:50:00.000 2V - Voltage Low 2018-02-26 07:50:00.000 2V - Voltage Low 2018-02-26 07:50:00.000 2V - Voltage Low 2018-02-26 07:50:00.000 2V - Voltage Low 2018-02-26 07:50:00.000 1V - Voltage Low 2018-02-26 07:50:00.000 2V - Voltage Low 2018-02-26 07:50:00.000 2V - Voltage Low 2018-02-26 07:50:00.000 2V - Voltage Low 2018-02-26 07:50:00.000 1V - Voltage Low 2018-02-26 07:50:00.000 2V - Voltage Low 2018-02-26 07:50:00.000 2V - Voltage Low 2018-02-26 07:50:00.000 1V - Voltage Low 2018-02-26 07:50:00.000 - Voltage Low 2018-02-26 07:45:07.000 - Voltage Low 2018-02-26 07:45:05.000 - Voltage Low 2018-02-26 07:45:01.000 2V - Voltage Low 2018-02-26 07:45:00.000 2V - Voltage Low 2018-02-26 07:40:00.000 2V - Voltage Low 2018-02-26 07:40:00.000 2V - Voltage Low 2018-02-26 07:40:00.000 - Voltage Low 2018-02-26 07:35:21.000 - Voltage Low 2018-02-26 07:35:17.000		OpenWay Event Frames 1 ... Next <table> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 14:35:11.000</td><td>0:05:03</td><td>2/26/2018 2:35:11 PM</td><td>2/26/2018 2:40:14 PM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 14:35:03.000</td><td>0:05:01</td><td>2/26/2018 2:35:03 PM</td><td>2/26/2018 2:40:04 PM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 14:29:57.000</td><td>0:10:02</td><td>2/26/2018 2:29:57 PM</td><td>2/26/2018 2:39:59 PM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 14:20:01.000</td><td>0:05:05</td><td>2/26/2018 2:20:01 PM</td><td>2/26/2018 2:25:06 PM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 12:40:03.000</td><td>0:05:02</td><td>2/26/2018 12:40:03 PM</td><td>2/26/2018 12:45:05 PM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 11:35:10.000</td><td>0:13:12</td><td>2/26/2018 11:35:10 AM</td><td>2/26/2018 11:48:22 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 11:15:09.000</td><td>0:06:01</td><td>2/26/2018 11:15:09 AM</td><td>2/26/2018 11:21:10 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 11:15:09.000</td><td>0:05:01</td><td>2/26/2018 11:15:09 AM</td><td>2/26/2018 11:20:10 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 11:15:03.000</td><td>0:05:02</td><td>2/26/2018 11:15:03 AM</td><td>2/26/2018 11:20:05 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 11:14:59.000</td><td>0:04:58</td><td>2/26/2018 11:14:59 AM</td><td>2/26/2018 11:19:57 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 09:30:53.000</td><td>0:05:24</td><td>2/26/2018 9:30:53 AM</td><td>2/26/2018 9:36:17 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 09:30:13.000</td><td>0:05:00</td><td>2/26/2018 9:30:13 AM</td><td>2/26/2018 9:35:13 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 09:30:09.000</td><td>0:05:00</td><td>2/26/2018 9:30:09 AM</td><td>2/26/2018 9:35:09 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 09:25:58.000</td><td>5:38:22.749</td><td>2/26/2018 9:25:58 AM</td><td></td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 09:00:04.000</td><td>0:04:58</td><td>2/26/2018 9:00:04 AM</td><td>2/26/2018 9:05:02 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 08:59:58.000</td><td>0:10:00</td><td>2/26/2018 8:59:58 AM</td><td>2/26/2018 9:09:58 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 08:15:16.000</td><td>0:04:54</td><td>2/26/2018 8:15:16 AM</td><td>2/26/2018 8:20:10 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 08:05:12.000</td><td>0:05:15</td><td>2/26/2018 8:05:12 AM</td><td>2/26/2018 8:10:27 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 07:55:12.000</td><td>0:15:01</td><td>2/26/2018 7:55:12 AM</td><td>2/26/2018 8:10:13 AM</td></tr> <tr> <td></td><td></td><td>Voltage Low 2018-02-26 07:55:07.000</td><td>0:15:00</td><td>2/26/2018 7:55:07 AM</td><td>2/26/2018 8:10:07 AM</td></tr> <tr> <td></td><td></td><td>1V - 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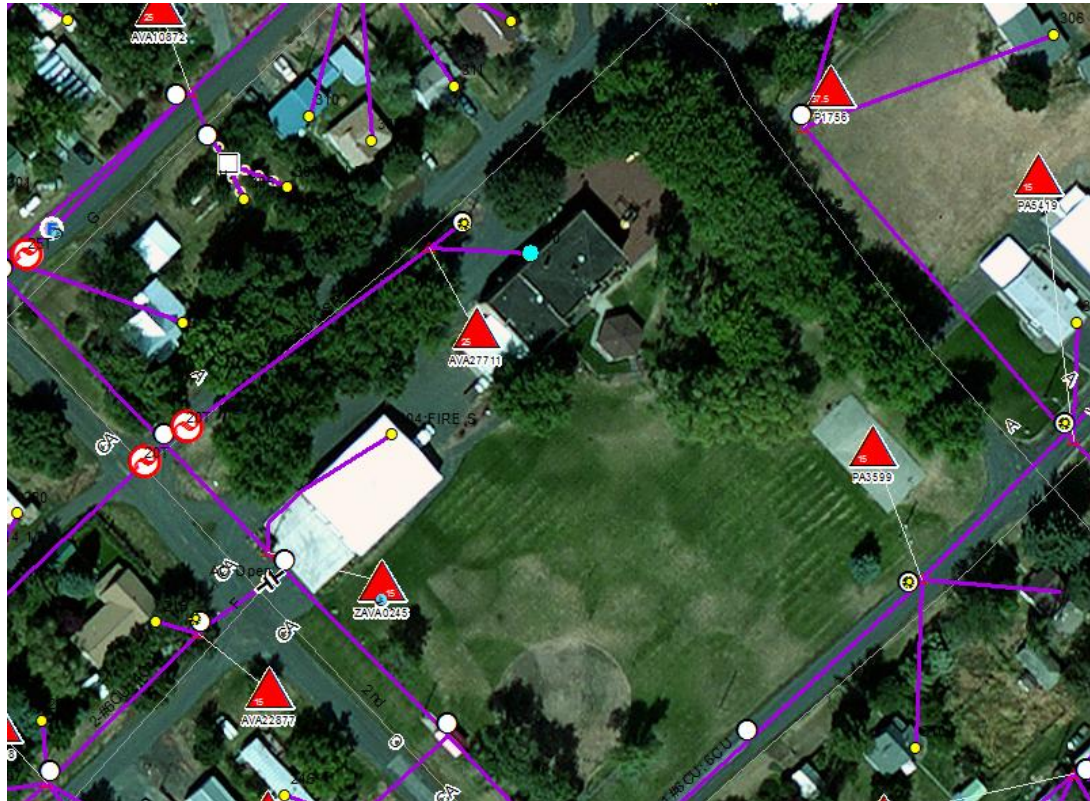
Back Office Analysis of Event Frames

3	Row Labels	Count of Primary element		Feeder		Transformer
4	13000015	1476	13000015	Feeder TUR116	13000015	Transformer AVA27711 __
5	13001097	1341	13001097	Feeder TUR116	13001097	Transformer AVA27711 __
6	13013811	405	13013811	Feeder SPU123	13013811	Transformer __ AVA13122
7	13003922	362	13003922	Feeder TUR113	13003922	Transformer _ AVE06954 _
8	13002150	362	13002150	Feeder TUR113	13002150	Transformer _ AVE06954 _
9	13003923	359	13003923	Feeder TUR113	13003923	Transformer _ AVE06954 _
10	13003947	339	13003947	Feeder TUR113	13003947	Transformer _ AVE06954 _
11	13003349	332	13003349	Feeder TUR113	13003349	Transformer _ AVE06954 _
12	13013382	236	13013382	Feeder TUR112	13013382	Transformer SC3783 __
13	13001628	195	13001628	Feeder TUR113	13001628	Transformer __ PA1366
14	13011198	117	13011198	Feeder TUR113	13011198	Transformer _ AVE08895 _
15	13011200	108	13011200	Feeder TUR113	13011200	Transformer _ AVE08895 _
16	13011199	104	13011199	Feeder TUR113	13011199	Transformer _ AVE08895 _
17	13010234	98	13010234	Feeder SPU121	13010234	Transformer PA1939 PA1934 PA4992
18	13006023	92	13006023	Feeder SPU121	13006023	Transformer PA1939 PA1934 PA4992
19	13011980	74	13011980	Feeder TUR113	13011980	Transformer __ PA1366
20	13011978	68	13011978	Feeder TUR113	13011978	Transformer __ PA1366
21	13011979	66	13011979	Feeder TUR113	13011979	Transformer __ PA1366
22	13000893	64	13000893	Feeder TUR116	13000893	Transformer PA459 __
23	13014062	64	13014062	Feeder TUR113	13014062	Transformer __ PA1366
24	13003556	54	13003556	Feeder TUR113	13003556	Transformer PAS322 __
25	13005772	50	13005772	Feeder SPU121	13005772	Transformer __ ZAVA0465
26	13010462	49	13010462	Feeder TUR113	13010462	Transformer PA4508 AVA04212 _
27	13001627	46	13001627	Feeder TUR113	13001627	Transformer __ PA1366
28	13005381	45	13005381	Feeder TUR116	13005381	Transformer __ P9229
29	13011173	43	13011173	Feeder TUR113	13011173	Transformer __ PA1366
30	13011174	39	13011174	Feeder TUR113	13011174	Transformer __ PA1366
31	13003343	37	13003343	Feeder TUR116	13003343	Transformer __ P9229

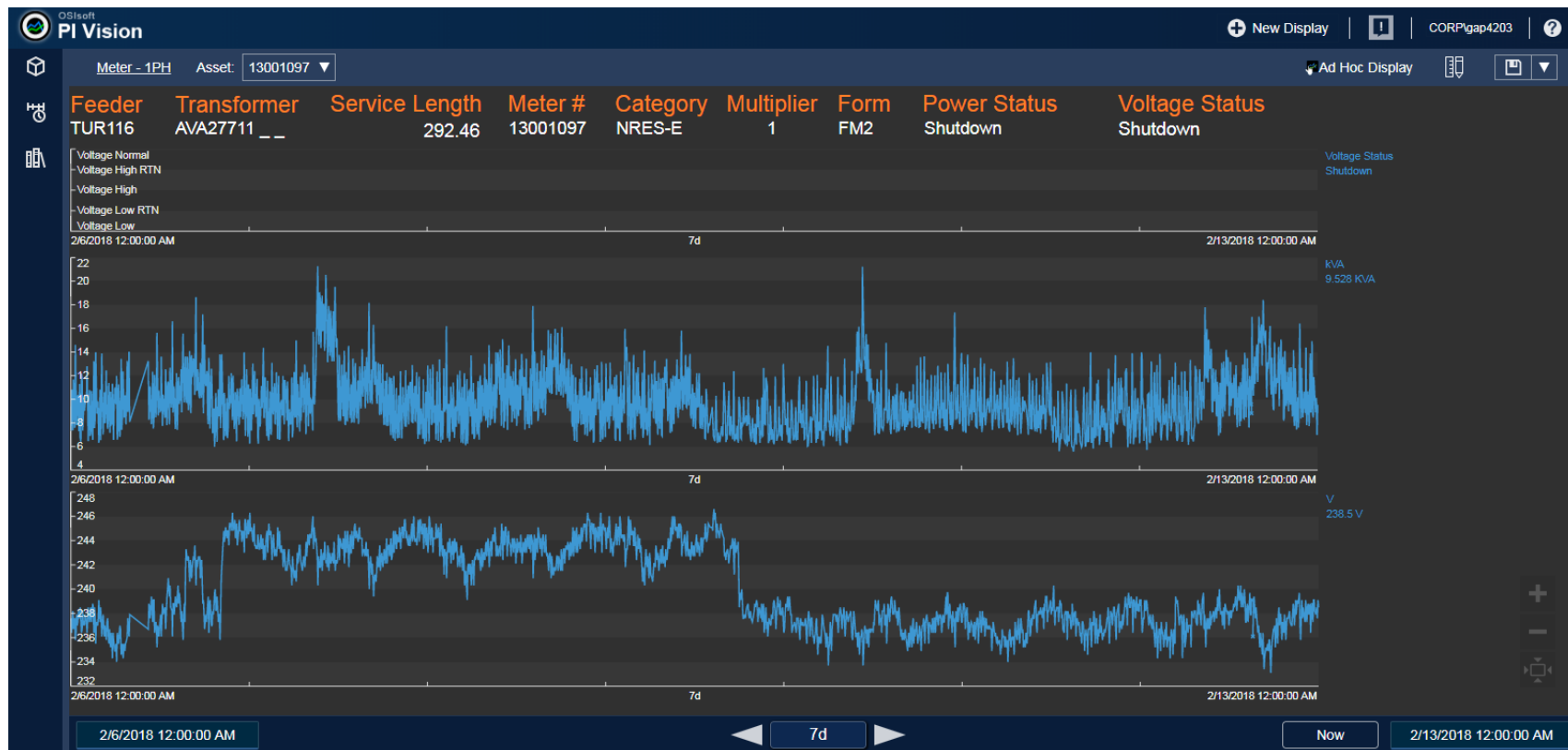
Visualize the Problem



Correct the Problem



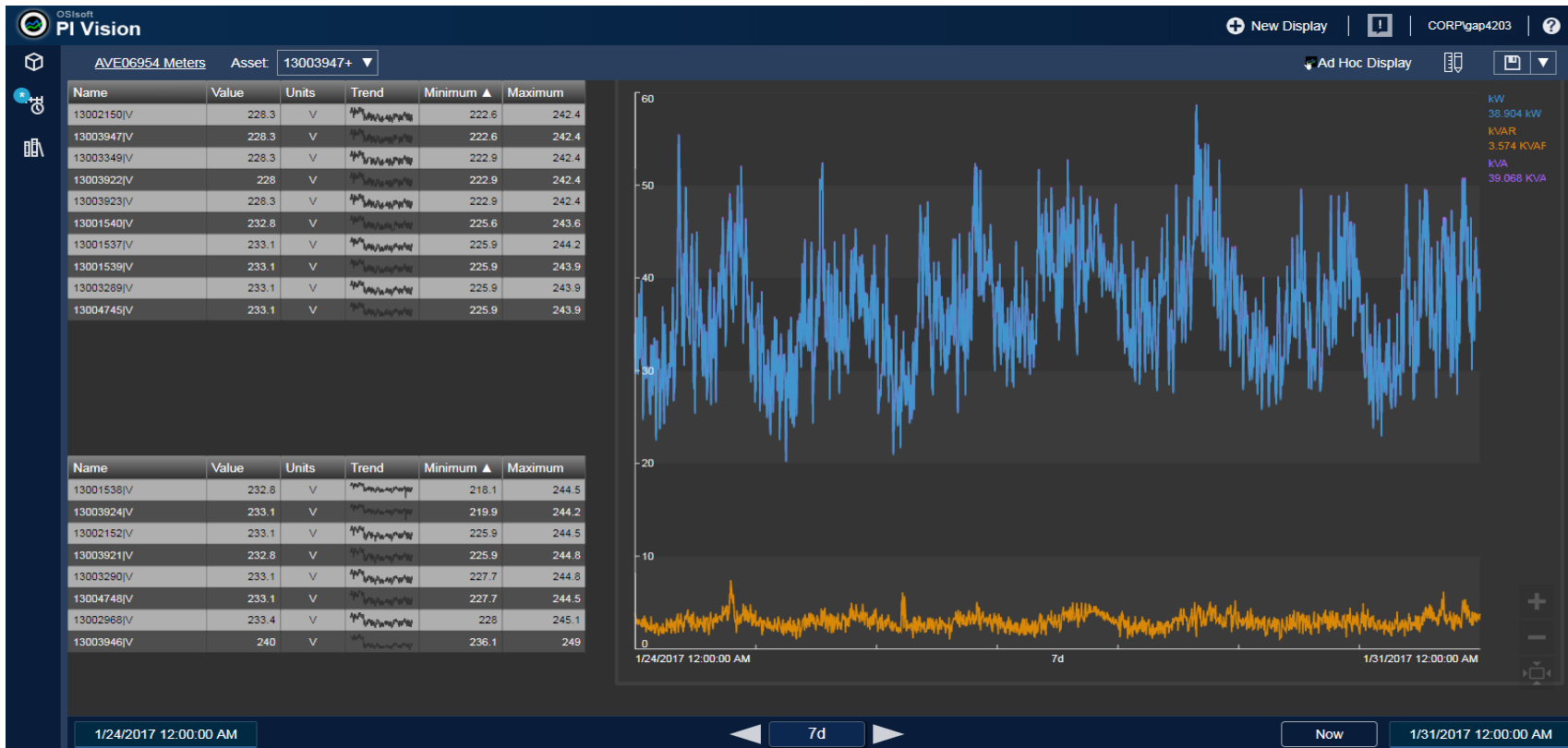
Visualize the Solution



Correlate Data Across Assets



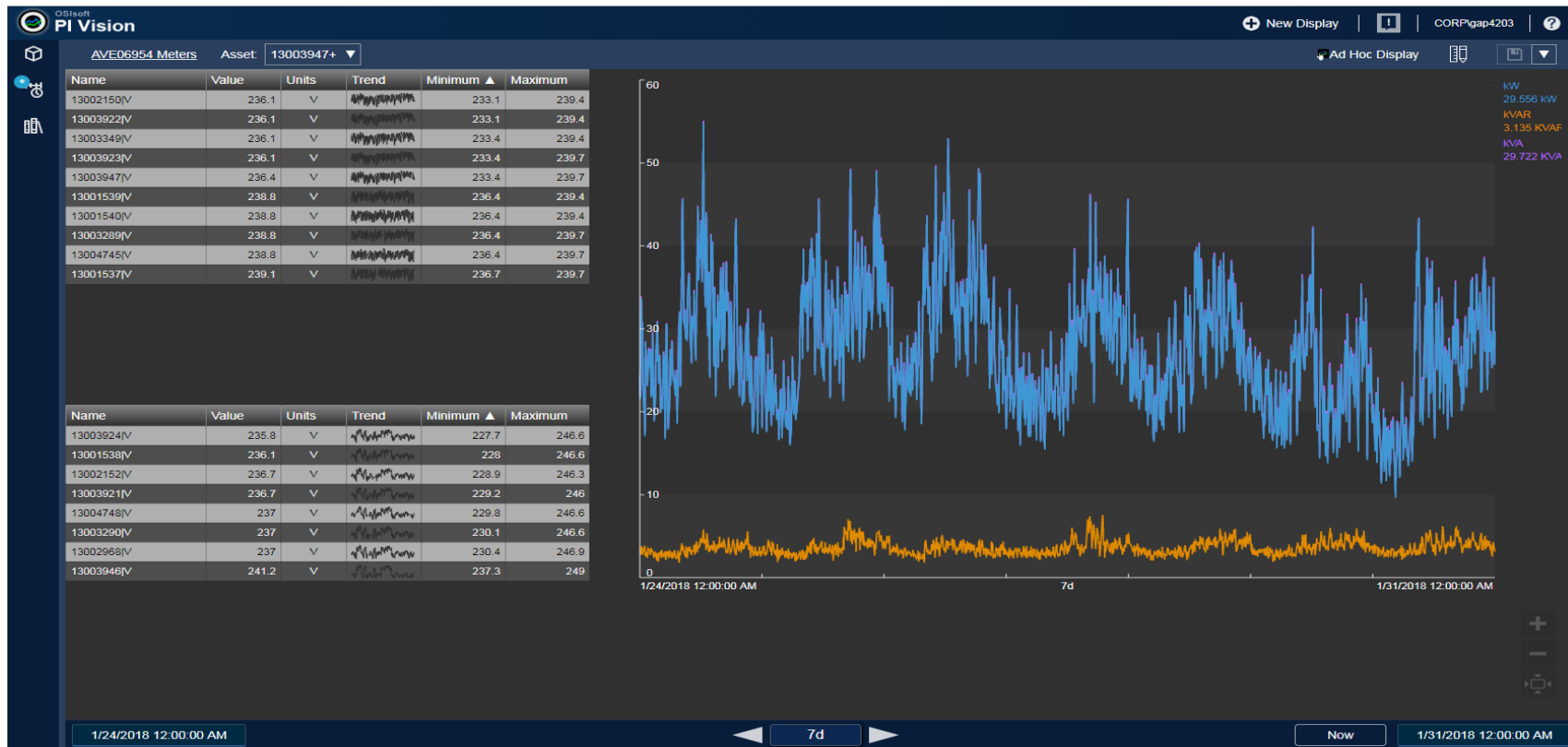
Visualize the Problem



Correct the Problem



Visualize the Solution



Users

- Distribution Operations Engineers
- Area Engineers
- Field Personnel

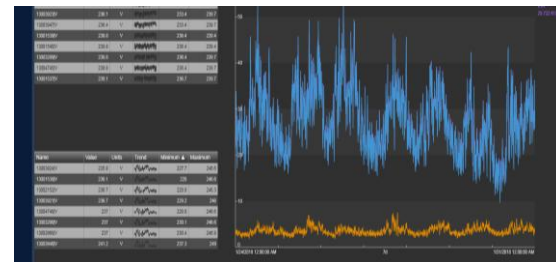
Future Plans

- Field Tools
- Integration to Maps
- Transformer Loading
- Reliability Metrics

The Modern PI System for AMI Meter Data



Leverage interval meter data to achieve operational benefits associated with the AMI business case.



CHALLENGE

Utilize AMI meter data to optimize system voltage for CVR benefits

- MDM systems are not typically focused on operational needs
- A solution to handle large volumes of data with analytics capabilities

SOLUTION

Utilize the Modern PI System to perform analysis and visualize problems and solutions

- AF Analyses provided the features needed to evaluate interval data
- Vision provided the means to visualize the interval data
- Context can be supplied to the data

RESULTS

The Modern PI System provided the means to analyze the system to achieve CVR benefits

- Analyses will help to pinpoint areas that need to be corrected
- Meter data has context with the rest of the system

Contact Information



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- System Operation Engineer
- Avista

Questions

Please wait for the **microphone** before asking your questions

State your **name & company**



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Merci

谢谢

Спасибо

Danke

Gracias

Thank You

감사합니다

ありがとう

Grazie

Obrigado

Optional: Click to add a takeaway you wish the audience to leave with.