PI Asset Framework (PI AF) and PI Notifications in Electric Distribution Operations

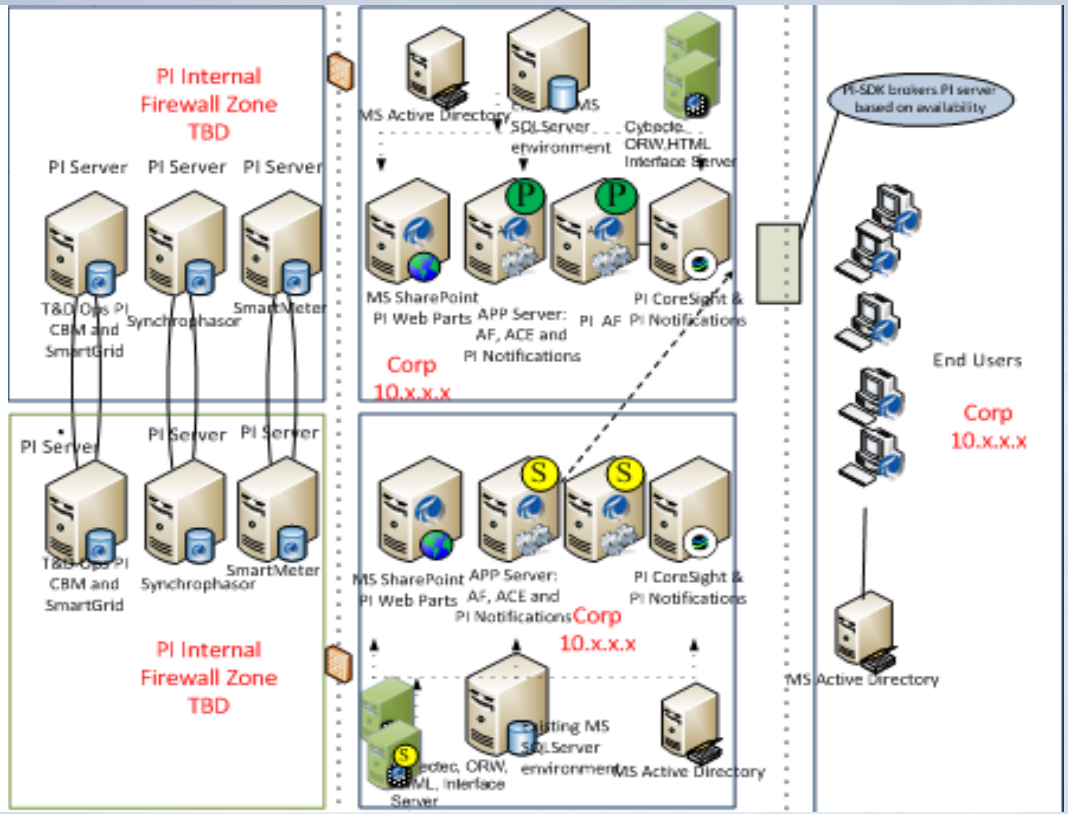
Presented by **Khoa V. Vo,** San Diego Gas & Electric Company

Agenda

- About our PI System
- About SDG&E's Electric Distribution System & Data
- About our Weather Network Data
- PI AF, PI Notifications, PI Coresight & PI ProcessBook Examples
- Future plans
- Summary and Benefits

About Our PI System

- We signed Enterprise Agreement (EA) with OSIsoft in 2012.
- Unlimited PI Tags, PI Clients and PI Interfaces
- 24/7 PI System monitoring and technical support
- Enterprise Project Manager (EPM) and Center of Excellence (CoE) support
- With PI AF, we currently have about 10,000 elements and 5,000 PI Notifications in the Distribution Operations side.



About SDG&E's Electric Distribution System

- Total of 175 Substations
- 1113 Distribution Circuits
- 9,954 Miles of UG Dist. Circuits
- 6,702 miles of OH Dist. Circuits
- 1,562 Field Sites on SCADA
- 81 Dist. Substations on SCADA

Weather Station Network

- Installing weather instrumentation to support SDG&E Smart Grid vision.
- To date, we are the largest utility-owned weather station network in the US and one of the densest weather station networks in the world.
- Real-time weather data every 10 minutes (wind direction, wind speed, wind gust, temperature, relative humidity, etc.) provides SDG&E with another tool to maintain and operate the system safely.
- Measuring wind in areas that have never been monitored to help to “harden” overhead electric system with larger conductors and steel poles to better withstand high winds.
- Sharing data with the public, local universities and posting on the National Weather Service site.
- Using wind gust and relative humidity data from weather stations to automatically turn on or turn off reclosing of SCADA field devices in the high risk fire area if needed.

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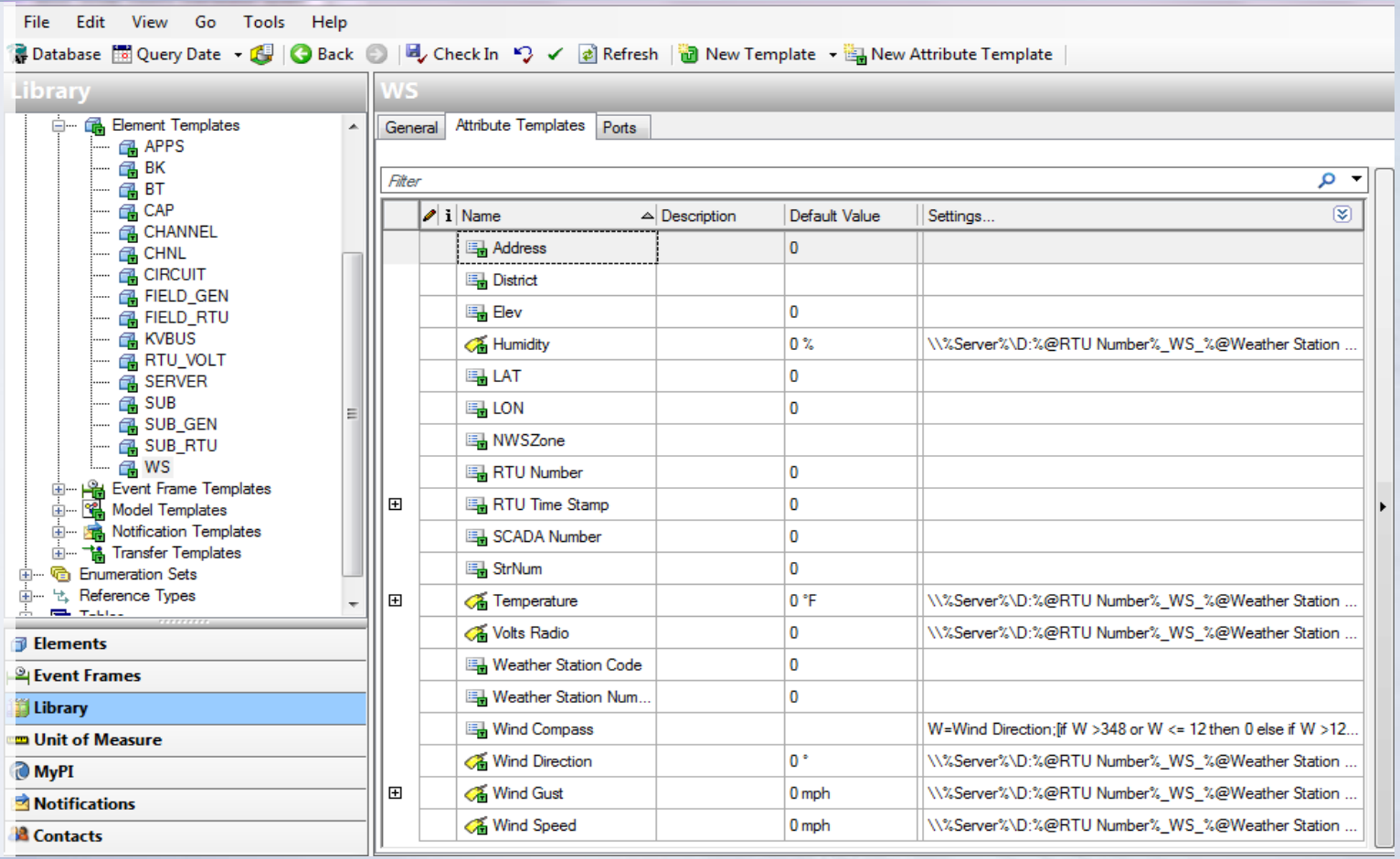
PI AF and PI Notifications Examples

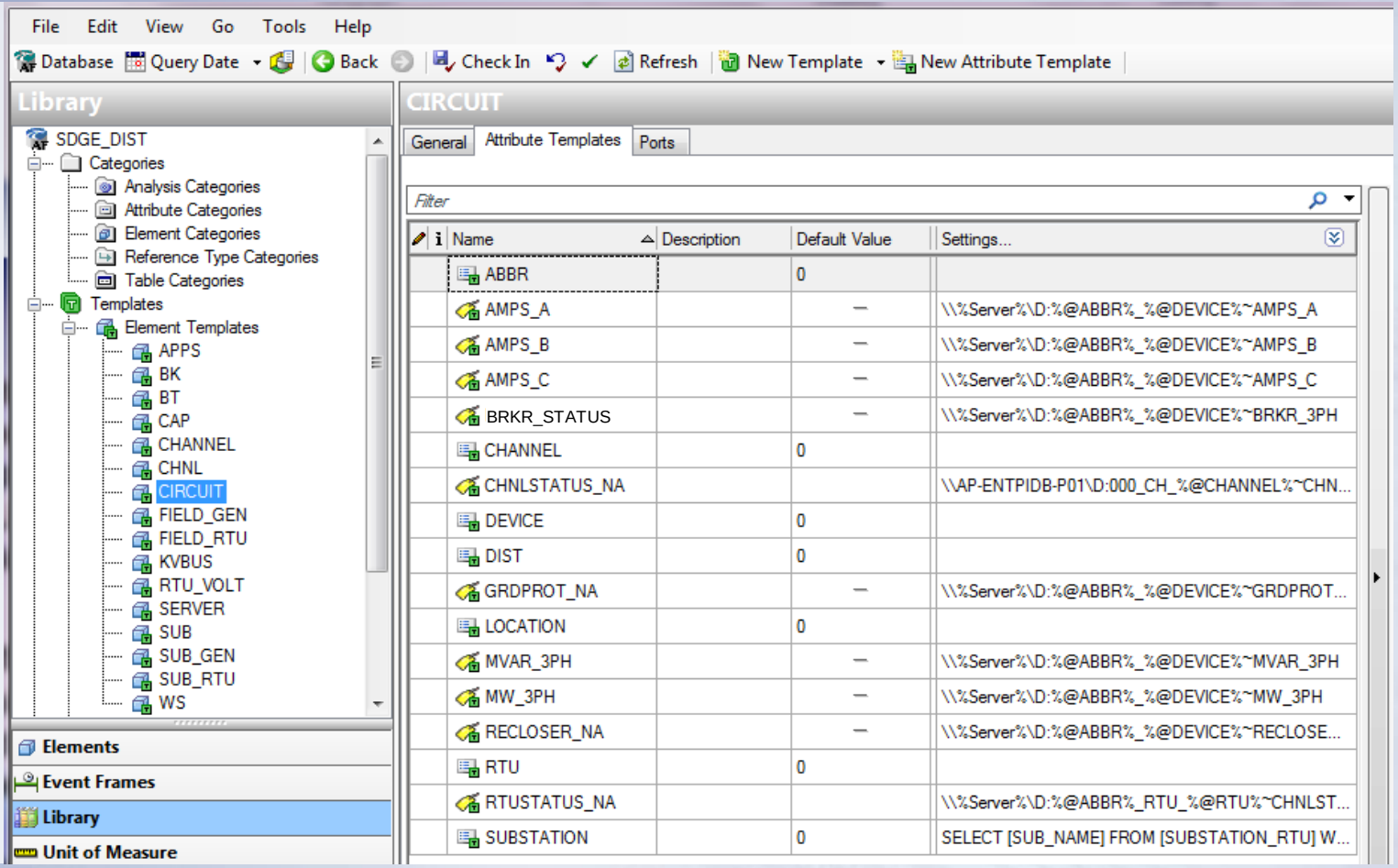
Why PI AF and Element Templates?

- We have data in PI System, Oracle, SQL, etc. databases
- Use PI AF as a single point of contact for getting data
- Template is the key element in PI AF.
- We use templates to create elements for PI Clients and PI Notifications.



PI AF and Circuit Breaker Element Template Example

- **Create Element Templates in the Library of PI AF**
- **Use these templates to build elements for PI Coresight PI ProcessBook displays and PI Notifications**
- **PI AF Database gets updated weekly or as needed.**



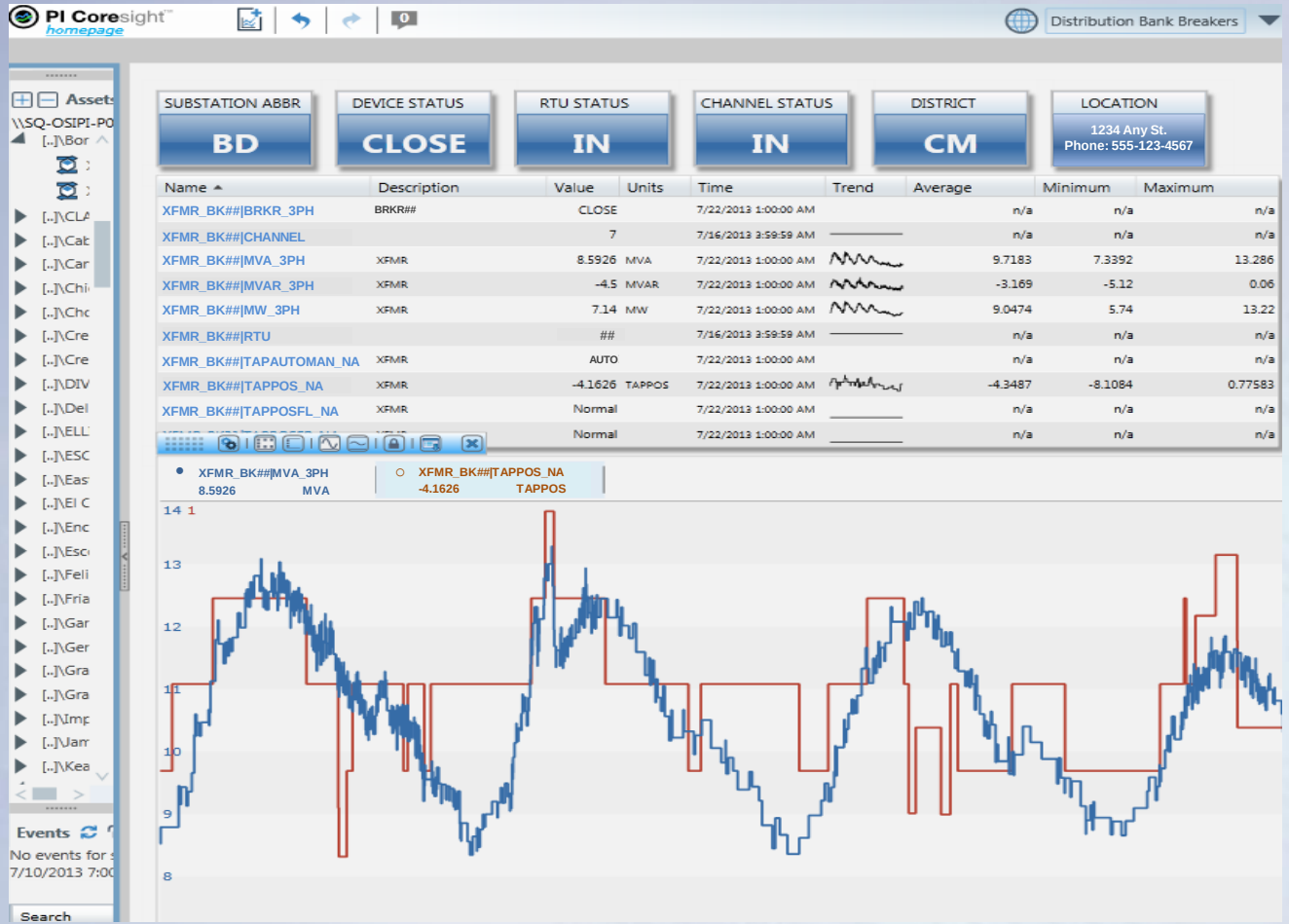
Distribution Circuit Breaker Monitoring

- Using PI ProcessBook to create a display similar to SCADA system
- PI AF and PI ProcessBook allow operators to select and monitor any circuit from the list, without remembering display number.

PI AF and PI Coresight for Substation Bank Breakers

PI AF and PI Coresight also allow us to monitor bank breakers from web browser or smart phones.

Users just click the substation name on the left, then information will be displayed on the main window.



Monitoring Weather Stations Without PI AF

SITE INFORMATION

ID: CMNC1
NAME: CAMERON FIRE STATION
LATITUDE: 32.7211
LONGITUDE: -116.4639
ELEVATION: 3443 ft
MNET: RAWS

(Click for topo/terrain map)
(Click for satellite)

SITE LINKS
Help
ROMAN

SITE LINKS
Help
ROMAN
Metric Units
Greenwich Mean Time
2 Week Summary
Past Data
Data Quality
Station Information
Station Status
Restrictions
Data in Spreadsheet Format

DATA COURTESY OF
Bureau of Land Management
and
USDA Forest Service

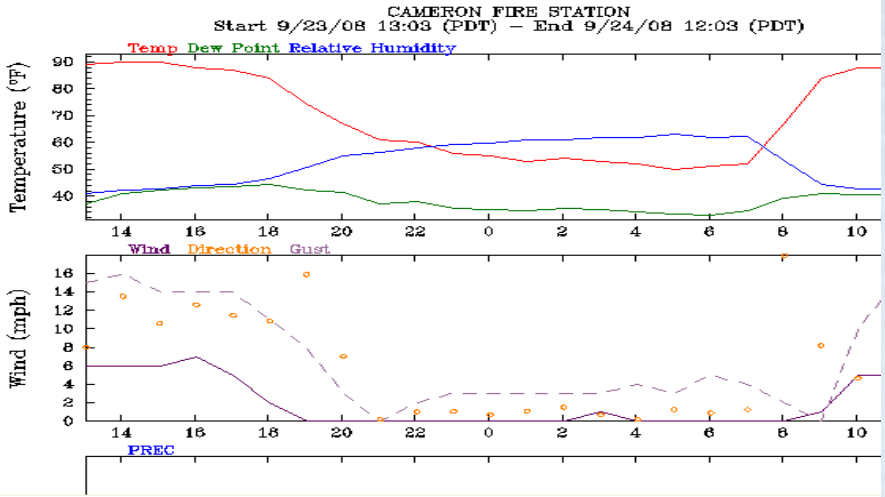
Weather Conditions for CMNC1

Current time: September 24, 2008 - 12:06 PDT

Most Recent Observations at September 24, 2008 - 12:03 PDT

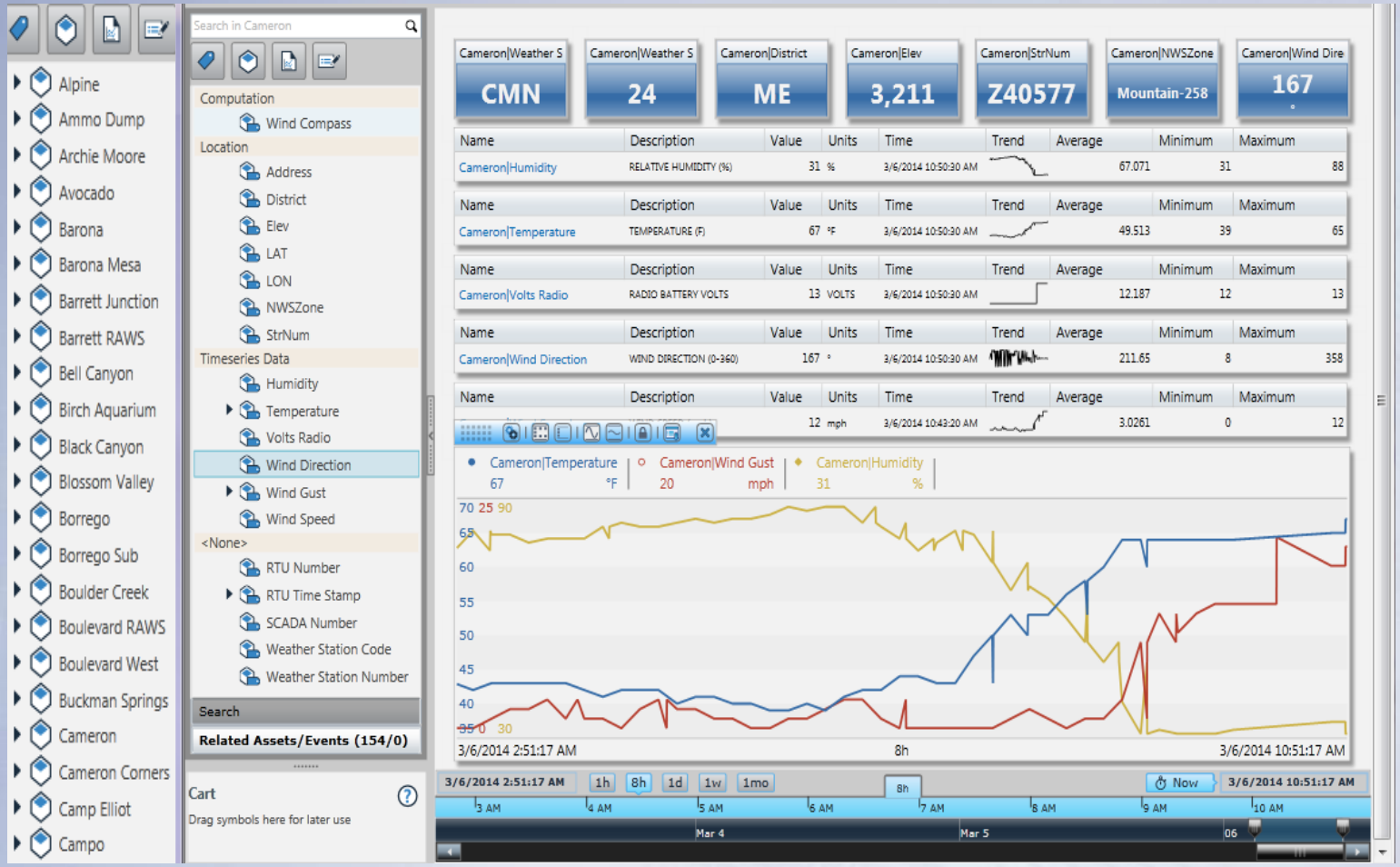
	12:03	Max since Midnight	Min since Midnight	24 Hour Max	24 Hour M
Temperature	91.0° F	91.0 at 12:03	50.0 at 5:03	91.0 at 12:03	50.0 at 5:
Dew Point	43.0° F	43.0 at 12:03	33.0 at 6:03	44.4 at 18:03	33.0 at 6:
Relative Humidity	19%	52 at 5:03	19 at 10:03	52 at 5:03	16 at 13:(
Wind Speed	3 mph from SSE	5 at 10:03	0 at 0:03	7 at 16:03	0 at 19:0
Wind Gust	15 mph	15 at 11:03	0 at 9:03	16 at 14:03	0 at 21:0
Solar Radiation	0.0 W/m*m	0.0 at 0:03	0.0 at 0:03	0.0 at 13:03	0.0 at 13:
Fuel Temperature	106.0° F	106.0 at 12:03	46.0 at 5:03	106.0 at 12:03	46.0 at 5:
10 hr Fuel Moisture	0 gm	0 at 0:03	0 at 0:03	0 at 13:03	0 at 13:0
Battery voltage	13.30 volt	13.40 at 9:03	12.30 at 5:03	13.40 at 9:03	12.30 at 5

Select Previous Periods: 12 Hours 24 Hours 2 Days 5 Days 7 Days 10 Days 30 D
Hodograph



Monitoring Weather Stations With PI AF

- We had a workshop with the OSIsoft CoE engineers last year for our weather network data.
- They guided us to create a Weather Station Template in PI AF.
- Now, we can use PI AF and PI Coresight to view weather data on web browser and smart phones.
- Users can select any data from any weather station with just a click.

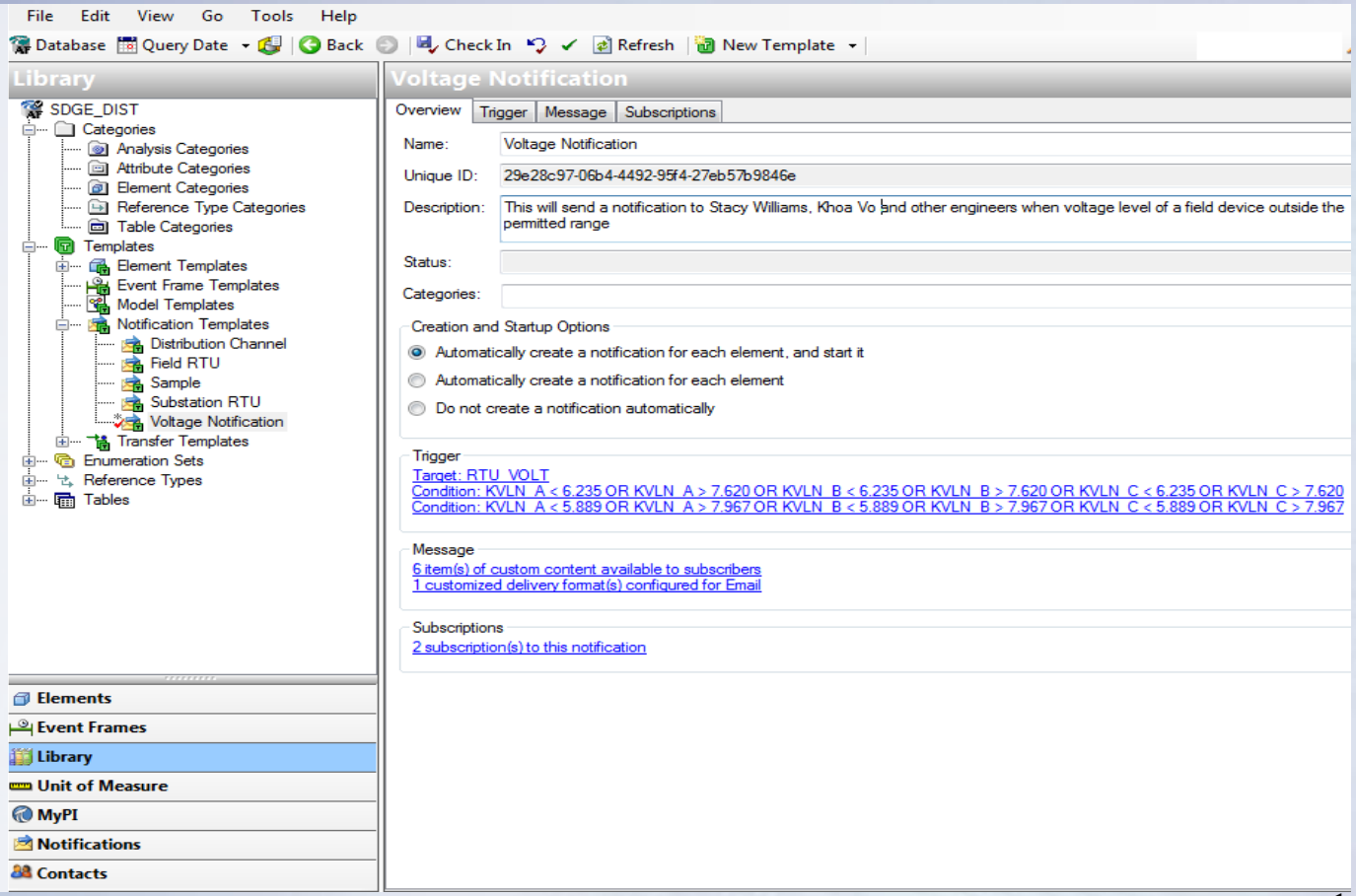


Distribution Field Recloser Monitoring

- We currently have over 1,500 SCADA field devices, with many more to be installed in the near future.
- Using templates and PI AF database, we don't have to create 1,500+ displays for operators to use.
- PI Client trending allows us to view any events happening in the field that we may not be able to see in our SCADA historical trending.

PI Notifications and Template Example

- We have thousands of field devices, and their data is now in the PI System, but how can we monitor all of them?
- PI Notifications is one of answers for the above question.
- With PI Notifications, not only operators in Control Center can see alarms, but also other engineers in Relay/Protection, Planning, RTU, Telecom, etc. departments can get alarms in the real-time; therefore, we can correct problems quickly.



Voltage Alarm PI Notifications

We use PI Notifications to monitor the voltage level of Distribution field devices.
If the voltage level is too high or too low, engineers will be notified by email.

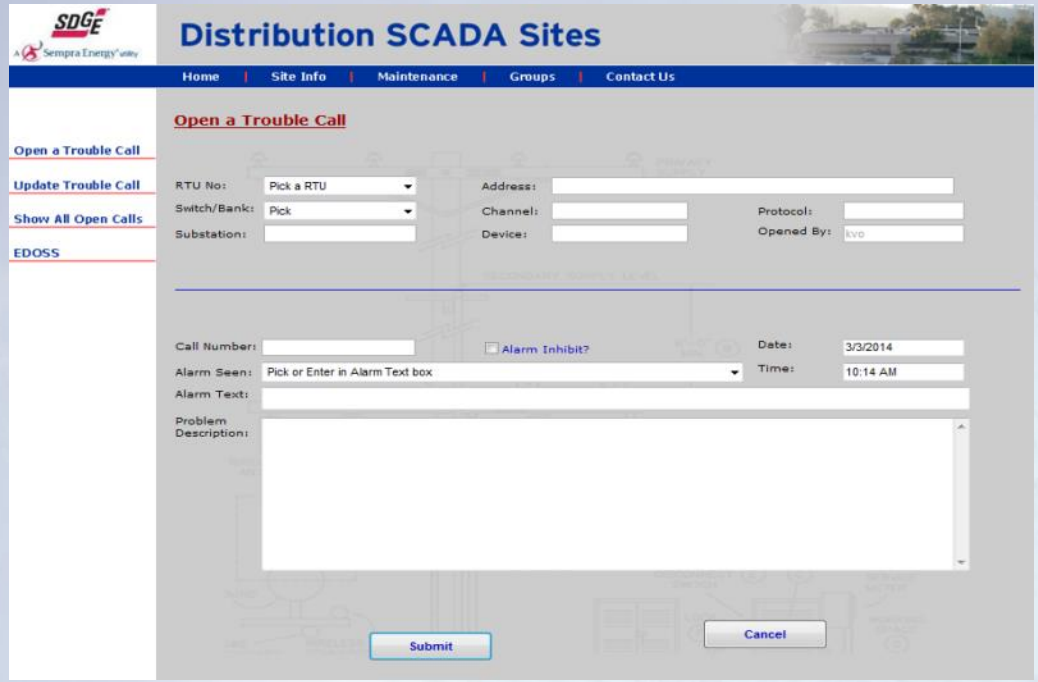
From: DistSystemAdmin@semprautilities.com [mailto:DistSystemAdmin@semprautilities.com]
Sent: Friday, January 10, 2014 10:44 AM
To: Vo, Khoa
Subject: Voltage Alert CIRCUIT# X###, RTU# ###, STRUCT_ID# X######

Tag Name	KVLN_A	KVLN_B	KVLN_C
Voltage Value	8.849712	6.99727201461792	7.01977157592773
Time Triggered	10:43:40 01/10/2014	10:40:10 01/10/2014	10:39:10 01/10/2014

Triggered by KVLN_A < 5.889 OR KVLN_A > 7.967 OR KVLN_B < 5.889
OR KVLN_B > 7.967 OR KVLN_C < 5.889 OR KVLN_C > 7.967

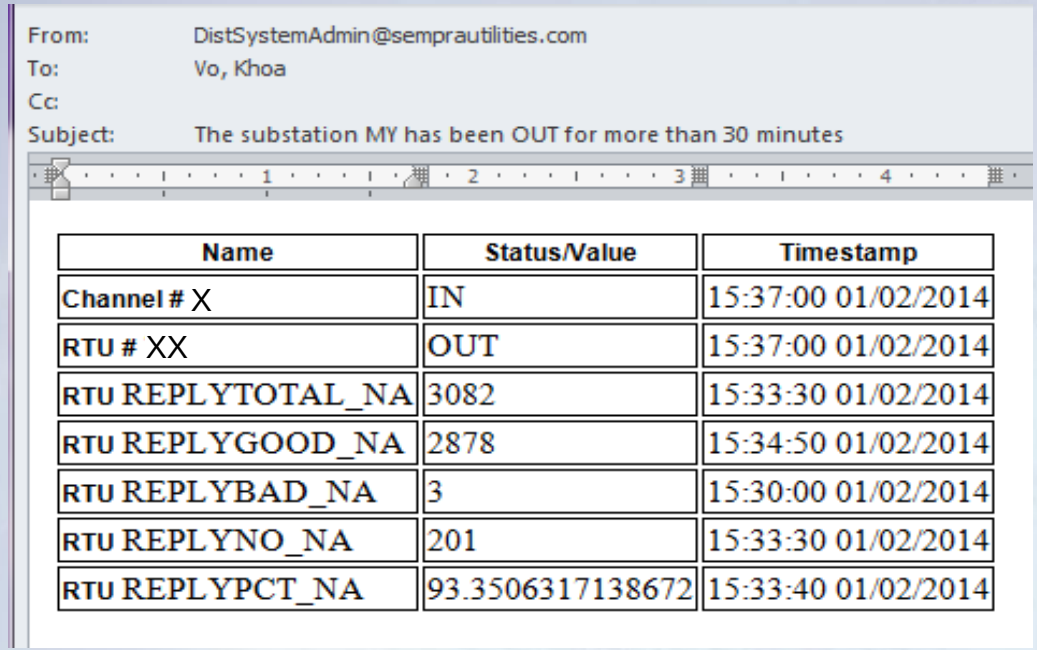
RTU Communication Without PI Notifications

If any Distribution RTU is out of communication, we have to call RTU/Telecom technicians to notify them of the issue and/or login to the ticket system to open a ticket, in order for the technicians to start the troubleshooting process.



RTU Communication With PI Notifications

With PI Notifications, when a Distribution RTU is out of communication, PI Notifications will send emails to RTU and Telecom technicians right away. Therefore, they don't have to wait for someone to notify them of the problem.



From: DistSystemAdmin@semprautilities.com
To: Vo, Khoa
Cc:
Subject: The substation MY has been OUT for more than 30 minutes

Name	Status/Value	Timestamp
Channel # X	IN	15:37:00 01/02/2014
RTU # XX	OUT	15:37:00 01/02/2014
RTU REPLYTOTAL_NA	3082	15:33:30 01/02/2014
RTU REPLYGOOD_NA	2878	15:34:50 01/02/2014
RTU REPLYBAD_NA	3	15:30:00 01/02/2014
RTU REPLYNO_NA	201	15:33:30 01/02/2014
RTU REPLYPCT_NA	93.3506317138672	15:33:40 01/02/2014

Next Steps/Future Plans

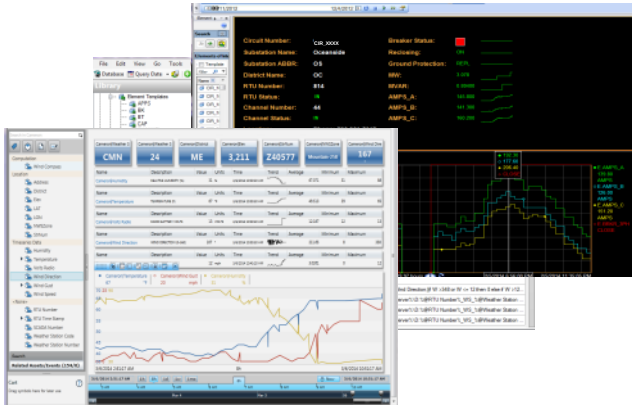
- Installing dynamic line rating sensors on distribution circuits to calculate conductor tension, sag, and real-time conductor capacity (maximizing conductor capacity during high temperatures).
- Installing thousands field capacitors and regulators in the next few years to monitor and control the voltage level.
- Maximizing transformer capacity by monitoring the current consumption, and scheduling electric vehicle charging and smart appliances during low loading periods.
  - i.e. a customer's thermostat could be programmed to activate a home furnace when certain ambient weather conditions and transformer loading conditions are met.
- All of the above plans indicate more data coming; therefore, we need to find ways to view/consume the data. The PI System, PI AF and PI Notifications will continue to be useful tools for us.

PI AF and PI Notifications in Electric Distribution Operations

“PI AF and PI Notifications have provided us with great tools for monitoring and analysis our electrical system.”

Khoa V. Vo

SDG&E



Business Challenge

- Processing and Monitoring increasing amounts of incoming data from thousands of field devices and from different sources.
- Sending alarms to engineers in different departments, not just operators in the Control Center

Solution

- Use PI AF as a single point contact for getting data
- Build templates in the PI AF database
- Use them to create elements for PI Coresight, PI ProcessBook displays and PI Notifications

Results and Benefits

- SDG&E can more effectively plan, prepare and respond to major events
- Therefore delivering the highest level of customer satisfaction

Questions ???

Contact :

kvo@semprautilities.com

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