PI System at CAISO Since Year 2000

Presented by **Tim Willenberg – California ISO**

Jim Hiebert – California ISO

Where we started…

- PI System was brought into CAISO around 2000 as an engineering planning tool

- 10-15 users

- Developed a way to connect CAISO EMS SCADA data to the PI System

- PI System replaced the Historian for ABB Spider EMS "archived" data.

Where we started…

PI is used at CAISO…

- Real Time Operations and Engineering

- Planning

- Compliance/Market

- Forecasting

- Training/Simulation

- Web Services

Where we started…

- A new EMS brings new opportunities
  - Multiple real-time data streams to multiple PI Servers
  - PI System becomes useful for real-time visualization
  - Engineering groups become more engaged
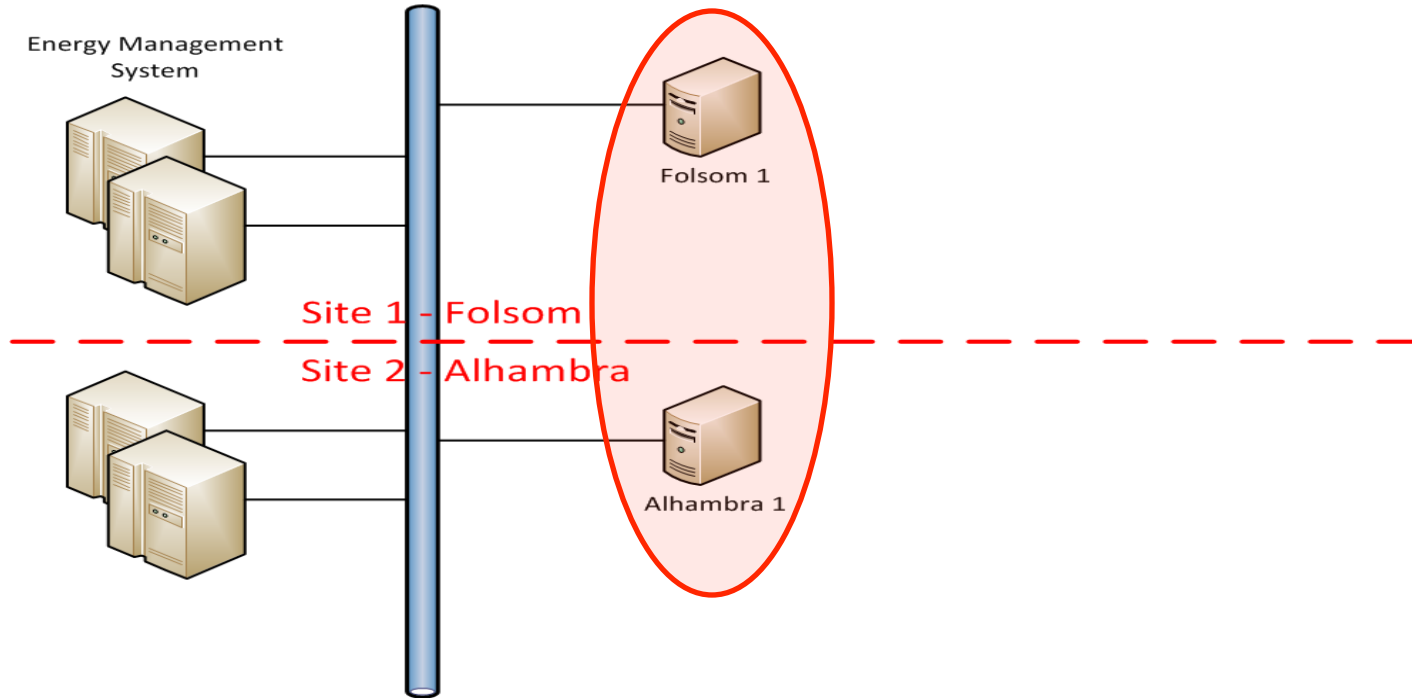 - CAISO Real-time Operations sees the benefits

New Control Room

PI grows quickly at the CAISO…

- PI System becomes a Critical Cyber Asset at the CAISO
  - 6 identical Production servers in 3 HA Collectives
  - Staging Systems (tied to EMS Staging System)
  - Test Systems (tied to EMS Development System)
  - 5 Training Simulation and Market Test Systems
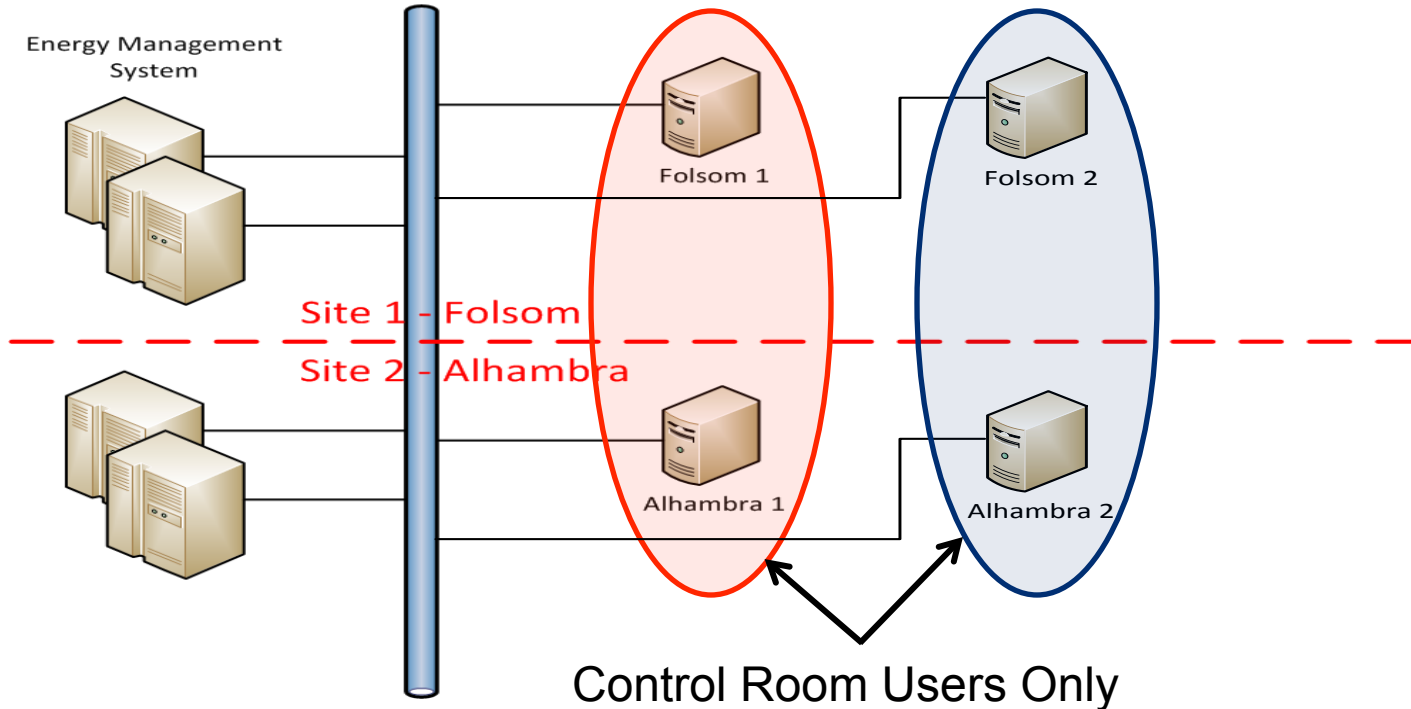
CAISO HA Architecture

CAISO HA Architecture

PI Production Environment

Collective 1

Collective 2

Energy Management System

Folsom 1

Folsom 2

Site 1 - Folsom

Site 2 - Alhambra

Alhambra 1

Alhambra 2

Control Room Users Only

CAISO HA Architecture

PI Production Environment

Collective 1

Collective 2

Collective 3

Energy Management System

Folsom 1

Folsom 2

Folsom 3

Site 1 - Folsom

Site 2 - Alhambra

Alhambra 1

Alhambra 2

Alhambra 3

Control Room Users Only

Non – Control Room Users
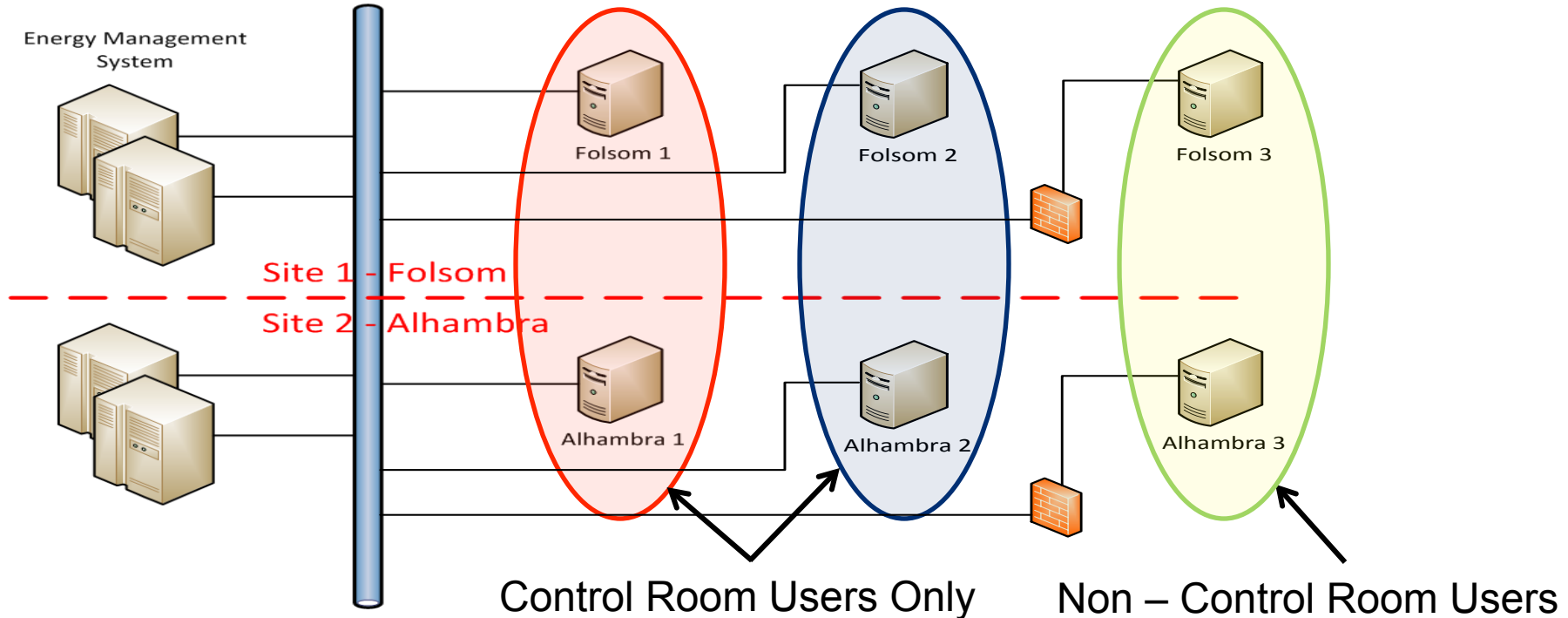
PI Content Management

- New PI opportunities = **lots** more users
  - Currently we have over 400

- The "Wild Wild West"
  - CAISO leverages the flexibility of PI
  - Balance flexibility with "loss of control"
  - PI becomes a critical system – we need reliability
  - Managing operator and engineering displays is crucial

PI Content Management

- E2T Tracking Tool
  - What is E2T?
  - New or Modified display? Check it in!!
  - What does E2T do?
    - Looks for common errors
    - Updates to current tag names
    - Distributes across all systems
    - Puts display in the right place

Request and Tracking Management Tool – E²T

PI Display "Water Marks"

- "Water Mark" indications at the bottom of every display show:
  - Display Owner
  - Quality Validation Date
  - Display Expiration Date
  - Content Location
  - Warnings

Quality Validation Passed on 7/13/2011 9:25:06 PM by Display Owner 'AGILFOY'.

Display Expire: 7/13/2012

\\csifiapp612\netapps\pi\fcl1\pi\content\Operations\Reliability Authority\Displays\CASC AGC II.p
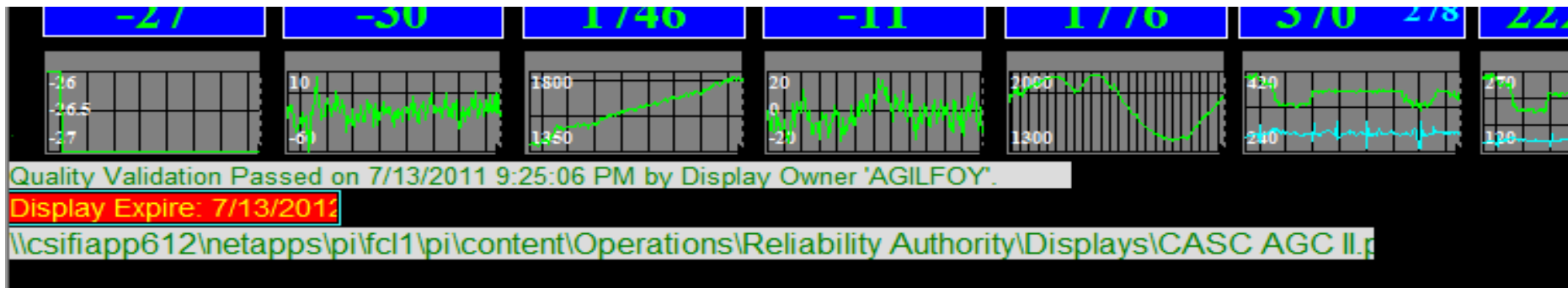
Two types of CAISO PI Displays

- Persistent Displays
    - Stable Displays – infrequent changes
    - Validated/Tested by both the PI Admin and Operations Engineers before moving to production
    - Highly optimized

- Outage Displays
    - Submitted through E2T tracking tool but processed automatically to production for validation
    - Accessed by automatically generated Table of Contents
    - Temporary displays correspond to the Planned Outage
    - Expire (disappear) when Grid maintenance is complete

Planned Grid Outage Maintenance

✚ **Auto Pushed Displays – Date Sort**

   ✚ **Today, 9/19/2012**

- SLIC 1987349 KESWICK-CASCADE LINE   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1961221 SOBRANTE-MORAGA   [7/3   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1965281 & 1965380 - Palermo-Nicolaus & Palermo-Bogue 115kV lines
- SLIC 1965263 & 1965379 - Palermo-Nicolaus & Palern   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1961713 & 1965373 - Palermo-Nicolaus & Palern   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1986852 Vierra_Kasson_Tracy_0705   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1986135_Vierra_Kasson_Tracy_0703   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- Cottonwood-Olinda overload   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1961711 & 1965372 - Palermo-Nicolaus   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1983401 BC3-Springville_230 Line   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep
- SLIC 1987242 Lugo-Vincent_2_out   [9/19/2012 4:29:04 PM - 9/19/2012 4:29:04 PM] Sep

   ✚ **Tomorrow, 9/20/2012**

- Cottonwood-Olinda overload
- SLIC 1961711 & 1965372 - Palermo-Nicolaus & Palermo-Bogue 115kV lines
- SLIC 1983401 BC3-Springville_230 Line
- SLIC 1987242 Lugo-Vincent_2_out
- P26vsTehachapi
- 1986127-GEYSERS#3-CLOVERDALE
- SLIC 1983889 MIDWAY BANK 1
- SLIC-1925824-MENDOCINO-REDBUD
- SLIC 1979766 VACA DIXON BNK 2-2A
- SLIC 1794561 ANTELOPE-VINCENT #2
- IID Actual vs Scheduled flow
- SLIC-1940075-CORTINA-MENDOCINO-
- SLIC 1900622 Lugo 1AA Bank outage
- SLIC 1839622 LLAGAS
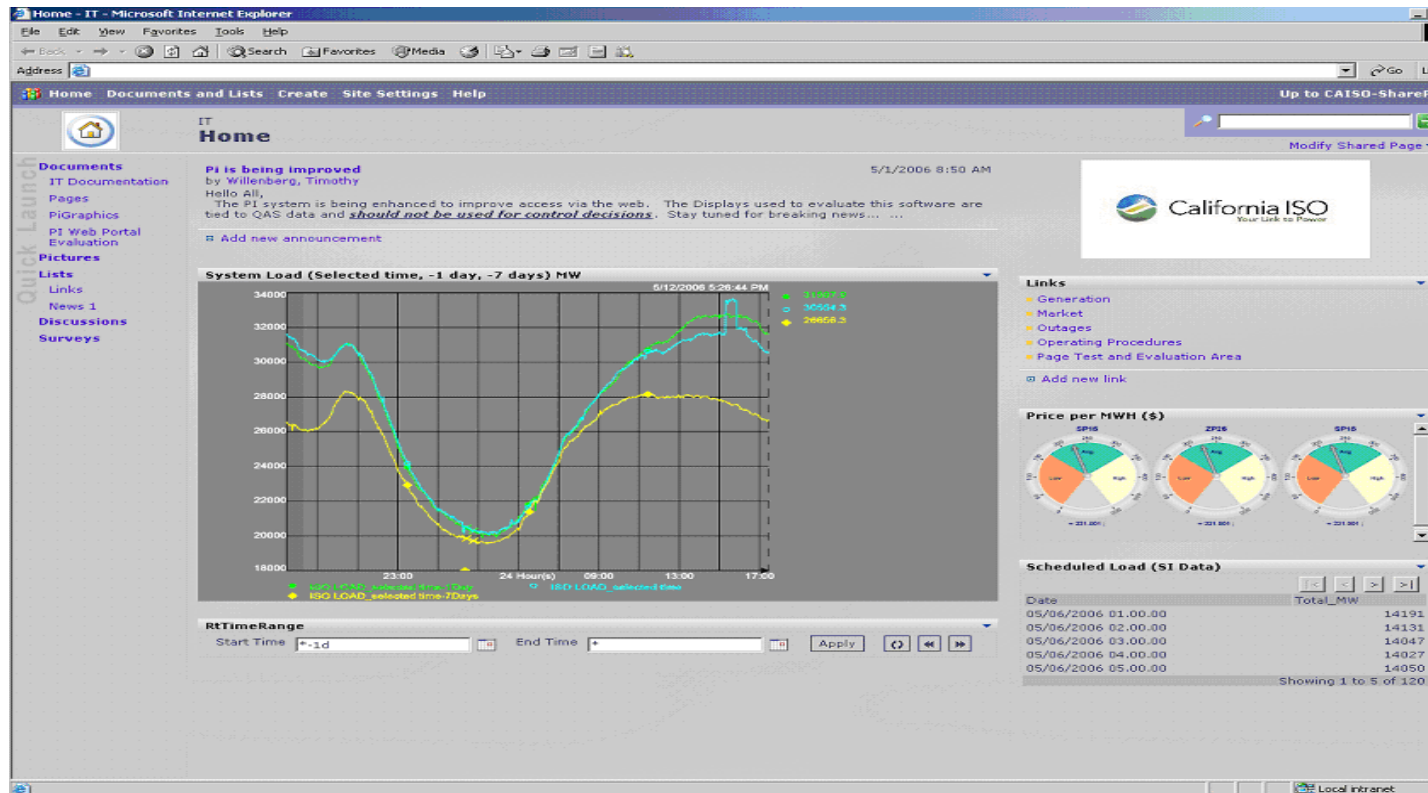
Real Time Contingencies

Save-Set Tool

- Dispatchers have the ability to organize PI displays on the screen and "save" them in the tool

- Each dispatcher can access PI content from any of the three collectives using the Save-set Tool
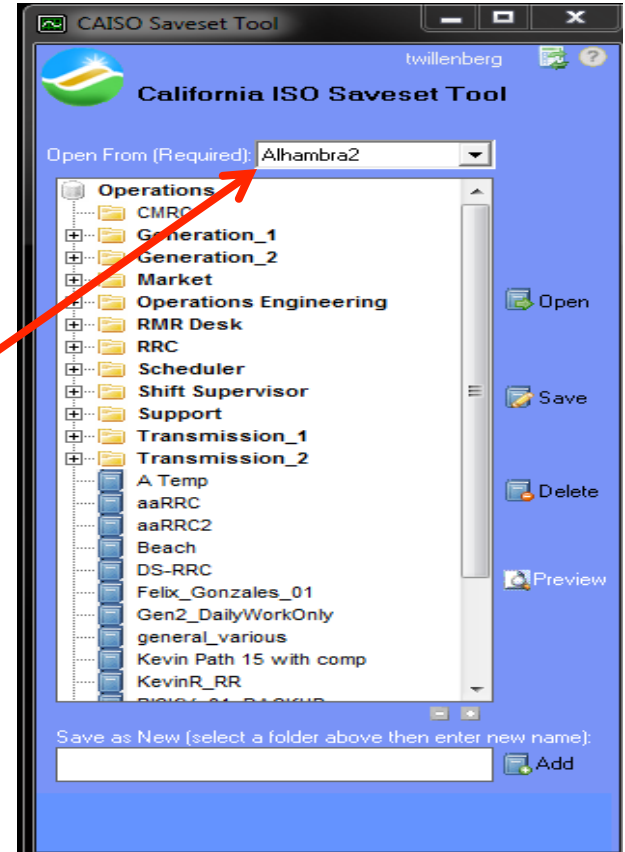
WebParts

PI AF Implementation

- CAISO PI AF Implementation
  - Compliance focused on Generator modeling
  - Brings together equipment "nameplate" information along with active telemetry and performance trends
  - Programmed PI AF to display information for over 1000 Generators
  - Replaced 898 "conventional" displays with a single PI AF enabled display

PI AF Display
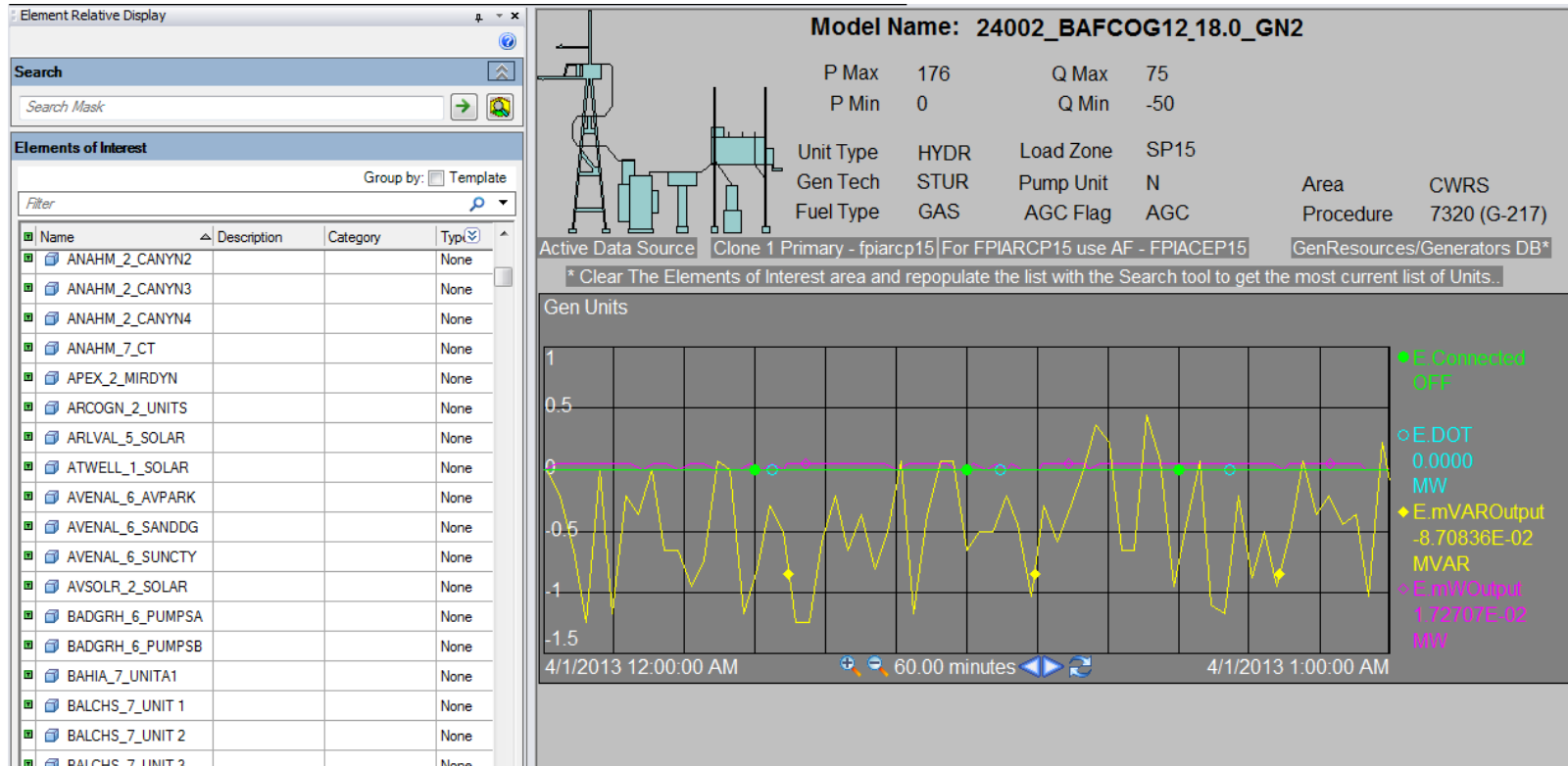
Synchrophasor Project
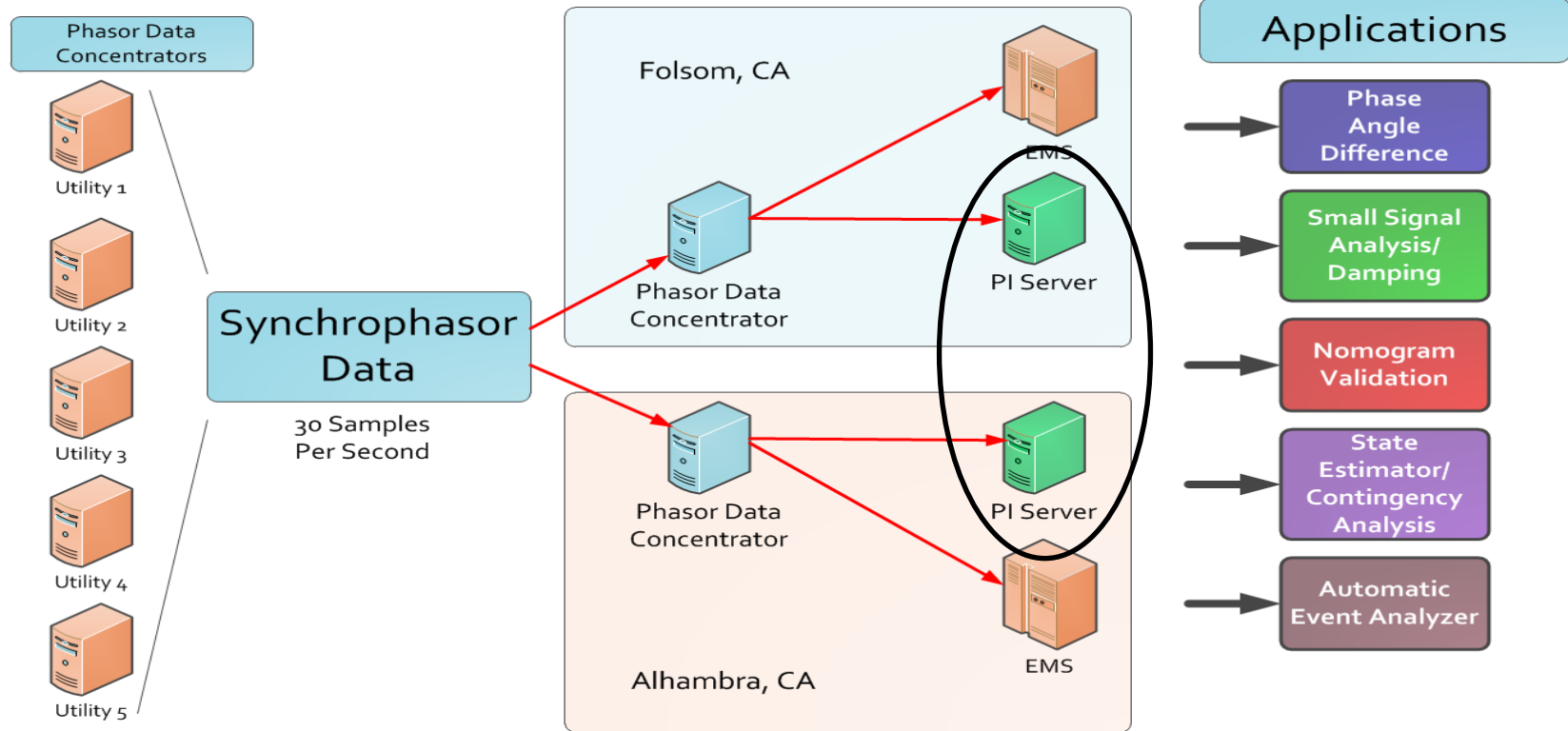
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THANK YOU

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