



OSIsoft®

INDUSTRY SEMINAR

E M E A

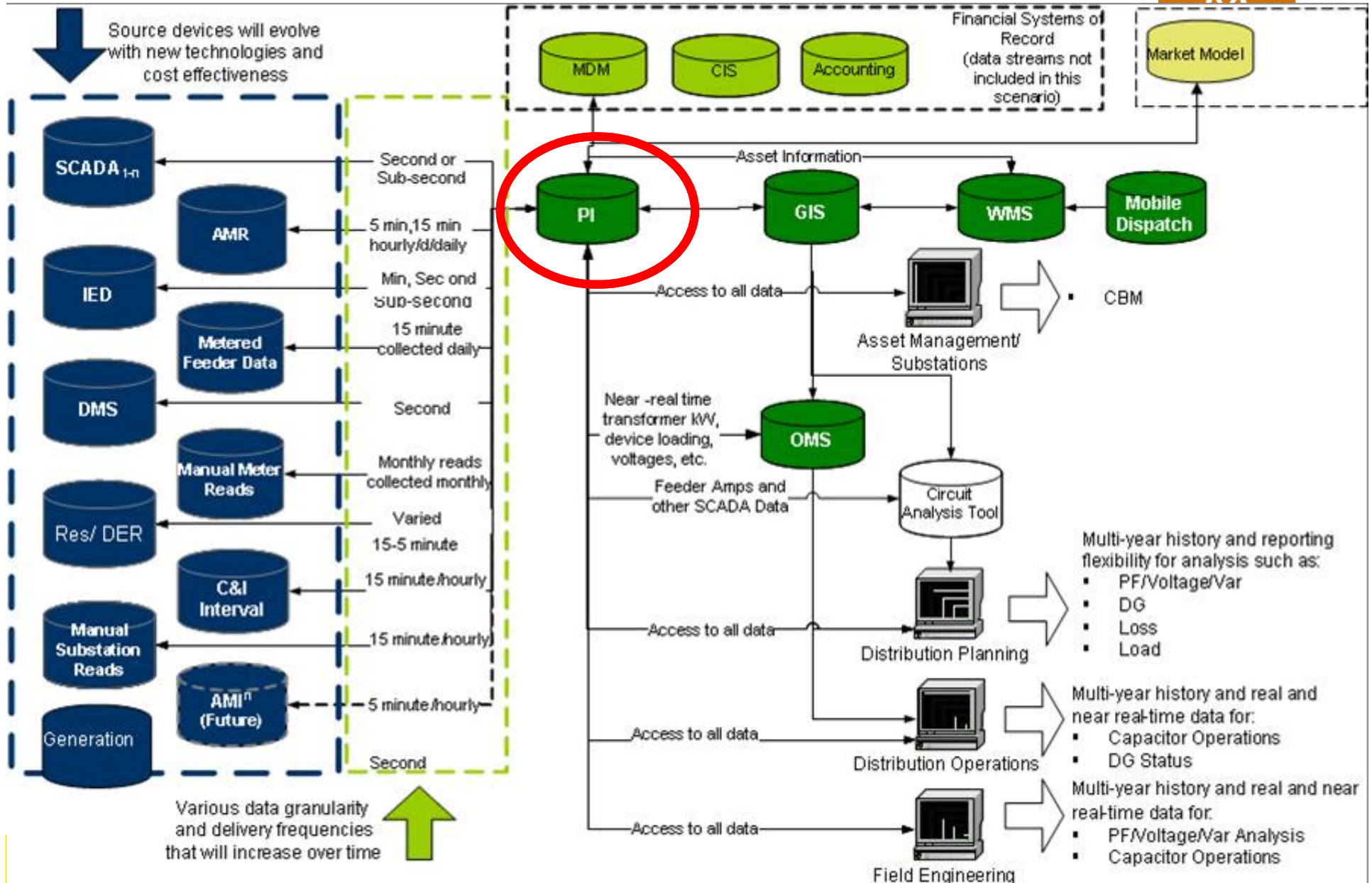
The **Power** of **Data**



PI as a real-time Infrastructure covering the entire T&D spectrum: from grid operations support to asset management

Presented by **Ann Moore and Martin Levionnois - OSIsoft**

PI as the Enterprise Data Infrastructure



PI T&D Utility Trends



- EMS/DMS/SCADA Data for T&D Operations and Reliability
- Synchrophasor and WAMS-Wide Area Measurement System
- Power Quality/Transient/Disturbance
- Substation Automation
- Asset Management and Condition Based Maintenance
- Distribution Automation
- AMI/AMR Metering
- Smart City, Smart Grid and Microgrids

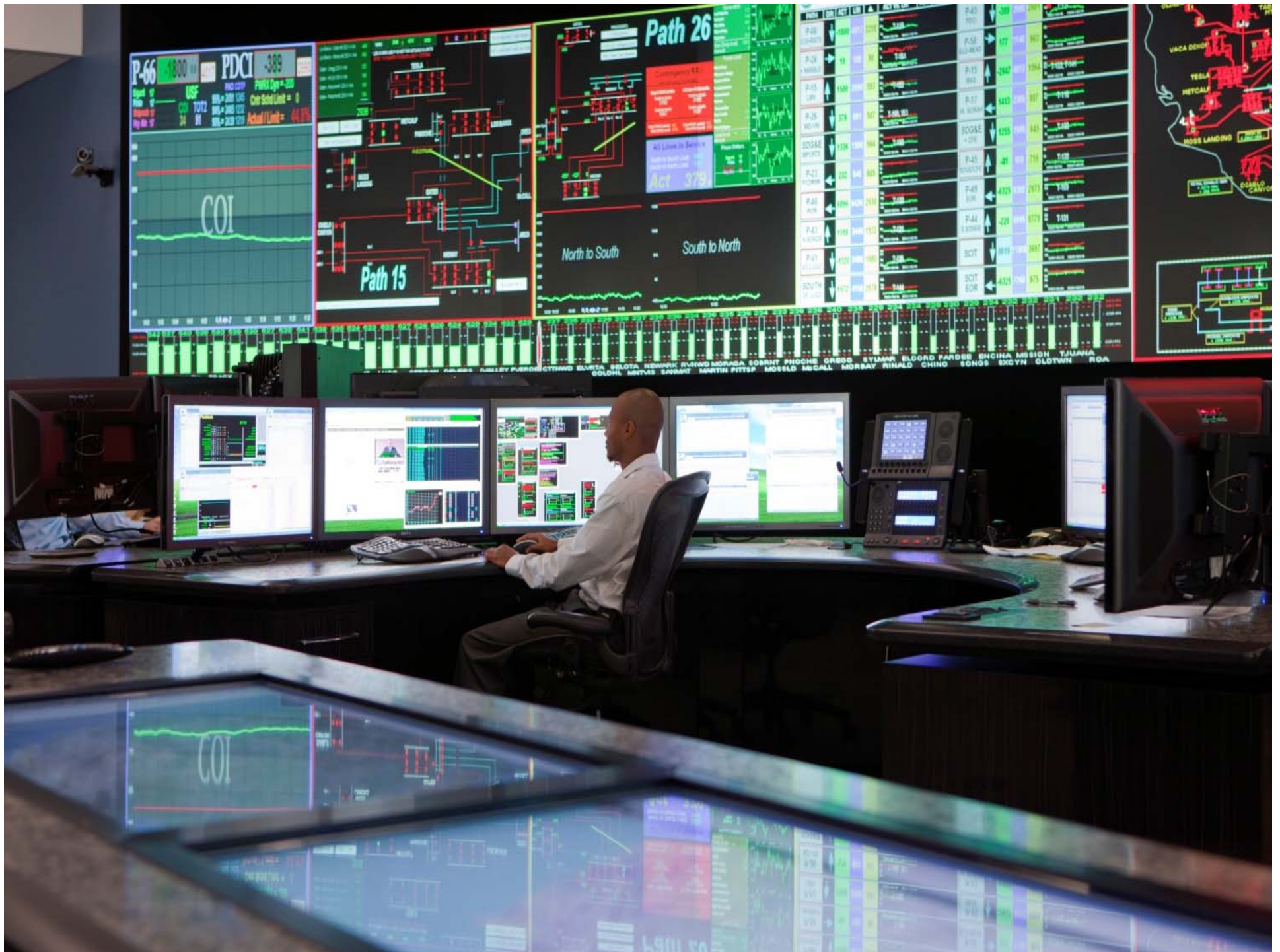


1. PI for Grid Operations



CAISO-Where we are now...





Solutions helped if you think this way



- EMS provides reality and a way to operate reality
- The market is the forecast of the reality to come
- We need to provide operators visualization to tie the past, current, and the future
- Operators' confidence is increased as you provide the visualizations and accuracy of the forecast

PI is the continuum for operators to see and analyze the past, operate the current, and proactively make decisions to prevent a negative future

Courtesy: Hani Alarian, Director, Power Systems Technology Operations

Dr. Khaled Abdul-Rahman, Director, Power Systems Technology Development

Example in Numbers only 6 hours of 24

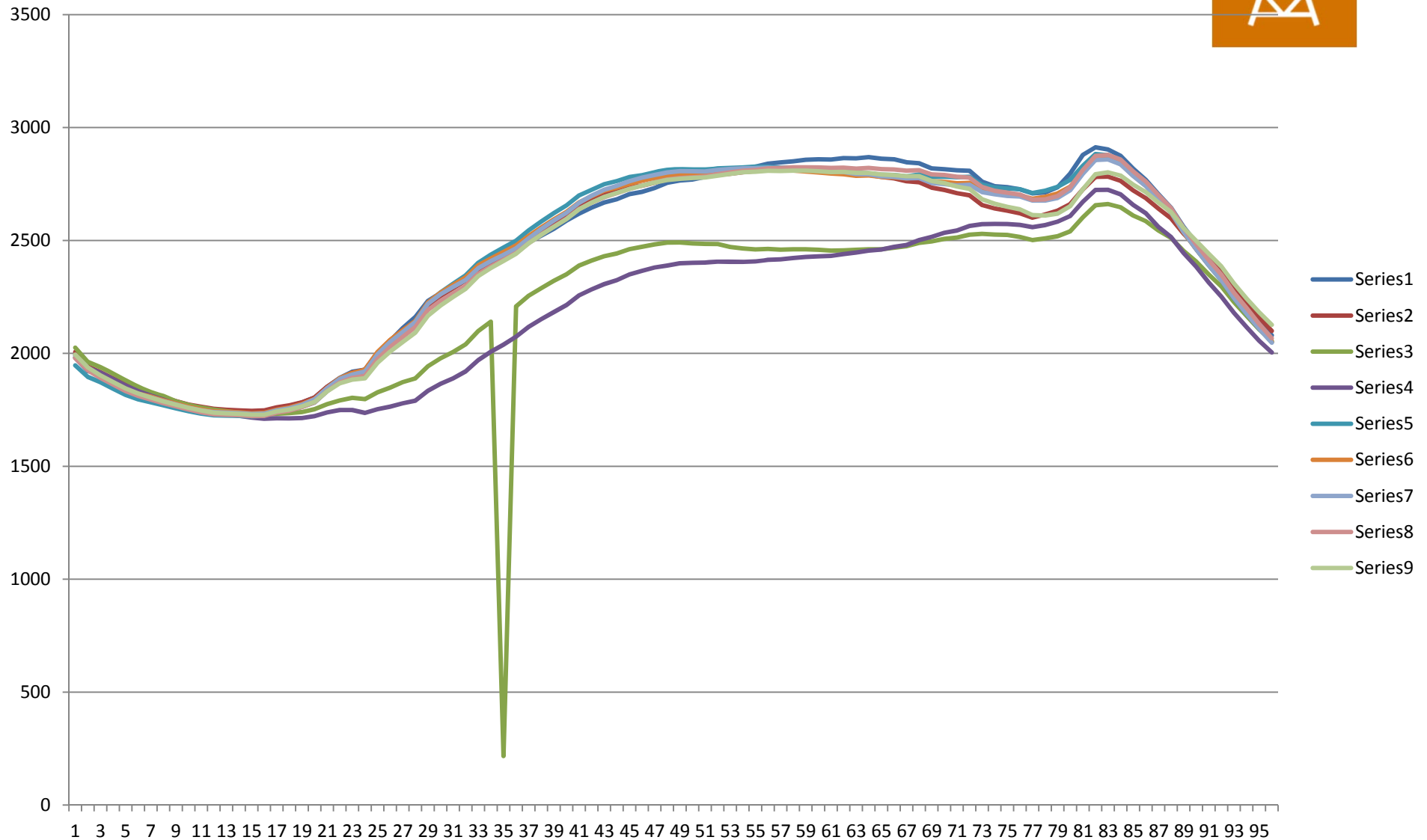
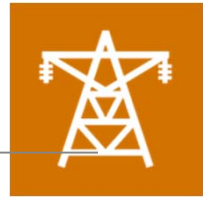
Can you find the mistake?



| | | | | | | | | | |
|-------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 4:30 | 1766.807 | 1770.041 | 1735.584 | 1712.094 | 1748.954 | 1760.249 | 1756.513 | 1746.813 | 1751.224 |
| 4:45 | 1782.593 | 1783.582 | 1740.005 | 1713.625 | 1763.2 | 1776.202 | 1772.523 | 1762.432 | 1765.907 |
| 5:00 | 1804.619 | 1804.311 | 1753.202 | 1722.105 | 1782.787 | 1798.3 | 1796.214 | 1783.199 | 1785.155 |
| 5:15 | 1851.697 | 1851.983 | 1775.265 | 1738.878 | 1833.121 | 1848.069 | 1846.02 | 1832.959 | 1832.181 |
| 5:30 | 1891.173 | 1889.403 | 1791.779 | 1749.428 | 1874.77 | 1890.169 | 1887.194 | 1871.383 | 1867.261 |
| 5:45 | 1918.68 | 1914.849 | 1803.538 | 1749.229 | 1901.105 | 1913.318 | 1905.974 | 1891.461 | 1883.946 |
| 6:00 | 1927.751 | 1928.128 | 1797.334 | 1736.343 | 1917.293 | 1927.759 | 1919.787 | 1900.453 | 1889.87 |
| 6:15 | 2001.637 | 2003.804 | 1827.463 | 1753.16 | 1994.741 | 2006.415 | 1996.289 | 1975.221 | 1958.406 |
| 6:30 | 2054.95 | 2058.036 | 1848.321 | 1764.349 | 2050.196 | 2060.041 | 2051.025 | 2028.24 | 2008.001 |
| 6:45 | 2112.258 | 2103.88 | 1872.549 | 1778.843 | 2095.131 | 2102.328 | 2094.292 | 2072.529 | 2050.109 |
| 7:00 | 2160.629 | 2137.386 | 1888.932 | 1790.602 | 2135.888 | 2143.732 | 2138.594 | 2116.436 | 2091.379 |
| 7:15 | 2232.516 | 2211.839 | 1943.359 | 1834.518 | 2220.943 | 2225.654 | 2219.614 | 2192.266 | 2166.789 |
| 7:30 | 2267.812 | 2254.537 | 1978.218 | 1865.147 | 2270.142 | 2268.746 | 2261.528 | 2233.358 | 2211.937 |
| 7:45 | 2294.774 | 2288.251 | 2006.233 | 1889.359 | 2308.142 | 2303.487 | 2294.172 | 2266.28 | 2249.907 |
| 8:00 | 2325.94 | 2322.89 | 2040.28 | 1920.23 | 2345.282 | 2336.993 | 2324.838 | 2299.474 | 2286.259 |
| 8:15 | 2370.621 | 2371.534 | 2099.076 | 1970.189 | 2400.857 | 2389.888 | 2377.086 | 2352.518 | 2342.512 |
| 8:30 | 2398.012 | 2401.169 | 2140.396 | 2007.306 | 2437.142 | 2420.344 | 2408.794 | 2385.162 | 2377.984 |
| 8:45 | 2427.269 | 2429.596 | 217.261 | 2038.443 | 2468.24 | 2449.527 | 2436.273 | 2415.056 | 2409.495 |
| 9:00 | 2452.356 | 2457.249 | 2208.352 | 2074.063 | 2499.239 | 2478.301 | 2465.481 | 2444.879 | 2441.46 |
| 9:15 | 2490.627 | 2502.216 | 2255.25 | 2117.835 | 2544.785 | 2520.463 | 2509.126 | 2488.076 | 2487.573 |
| 9:30 | 2521.597 | 2540.463 | 2288.521 | 2151.365 | 2584.2 | 2557.204 | 2550.518 | 2526.244 | 2525.164 |
| 9:45 | 2551.844 | 2575.42 | 2321.138 | 2182.995 | 2621.057 | 2593.661 | 2588.434 | 2561.901 | 2560.209 |
| 10:00 | 2588.298 | 2611.475 | 2350.499 | 2213.857 | 2655.357 | 2626.772 | 2622.822 | 2596.66 | 2594.748 |
| 10:15 | 2619.03 | 2650.911 | 2388.768 | 2256.956 | 2699.702 | 2668.777 | 2666.828 | 2638.944 | 2637.933 |
| 10:30 | 2645.652 | 2678.506 | 2411.097 | 2283.247 | 2724.45 | 2695.779 | 2698.503 | 2667.695 | 2667.878 |
| 10:45 | 2668.184 | 2703.642 | 2430.173 | 2307.043 | 2749.066 | 2720.254 | 2725.196 | 2691.454 | 2693.37 |
| 11:00 | 2682.564 | 2718.079 | 2442.608 | 2324.405 | 2763.242 | 2733.837 | 2741.958 | 2709.303 | 2710.661 |
| 11:15 | 2705.387 | 2736.648 | 2461.428 | 2349.543 | 2780.964 | 2750.594 | 2762.598 | 2728.487 | 2728.311 |
| 11:30 | 2715.591 | 2742.262 | 2472.007 | 2365.656 | 2788.949 | 2764.653 | 2778.697 | 2743.69 | 2742.778 |

Same Example in visual

Can you find the mistake?



Example in Numbers only 6 hours of 24

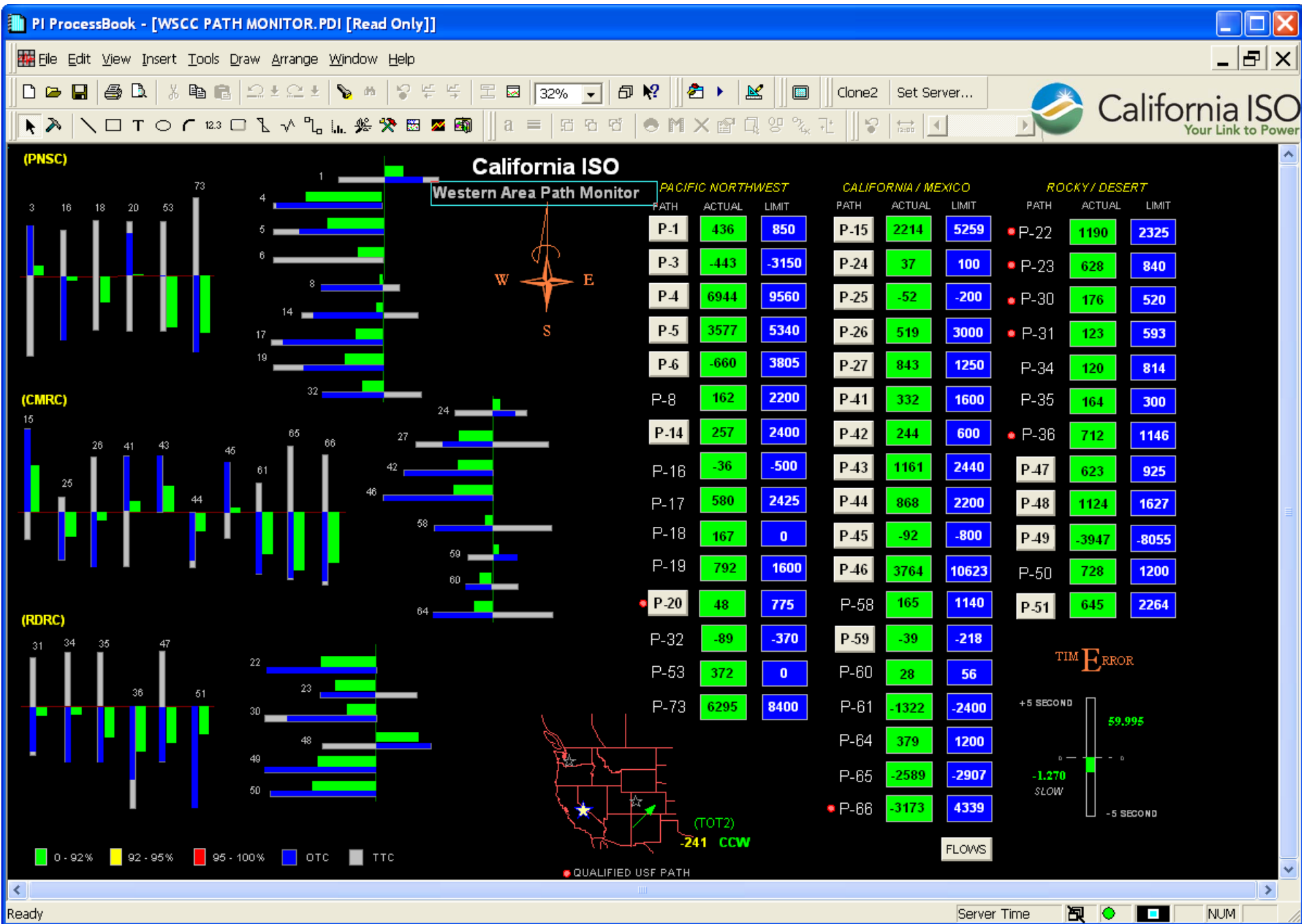
Can you find the mistake?

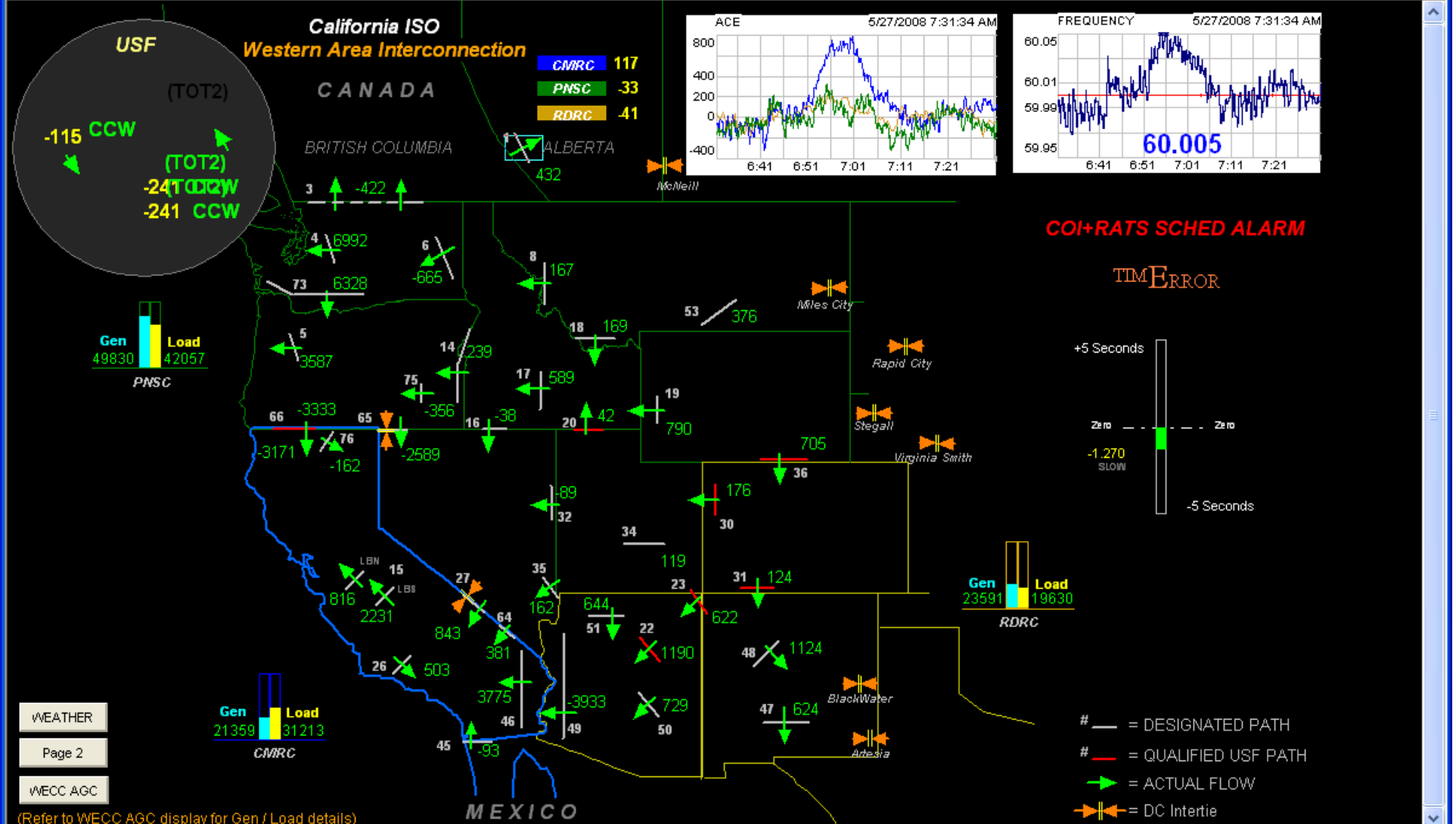


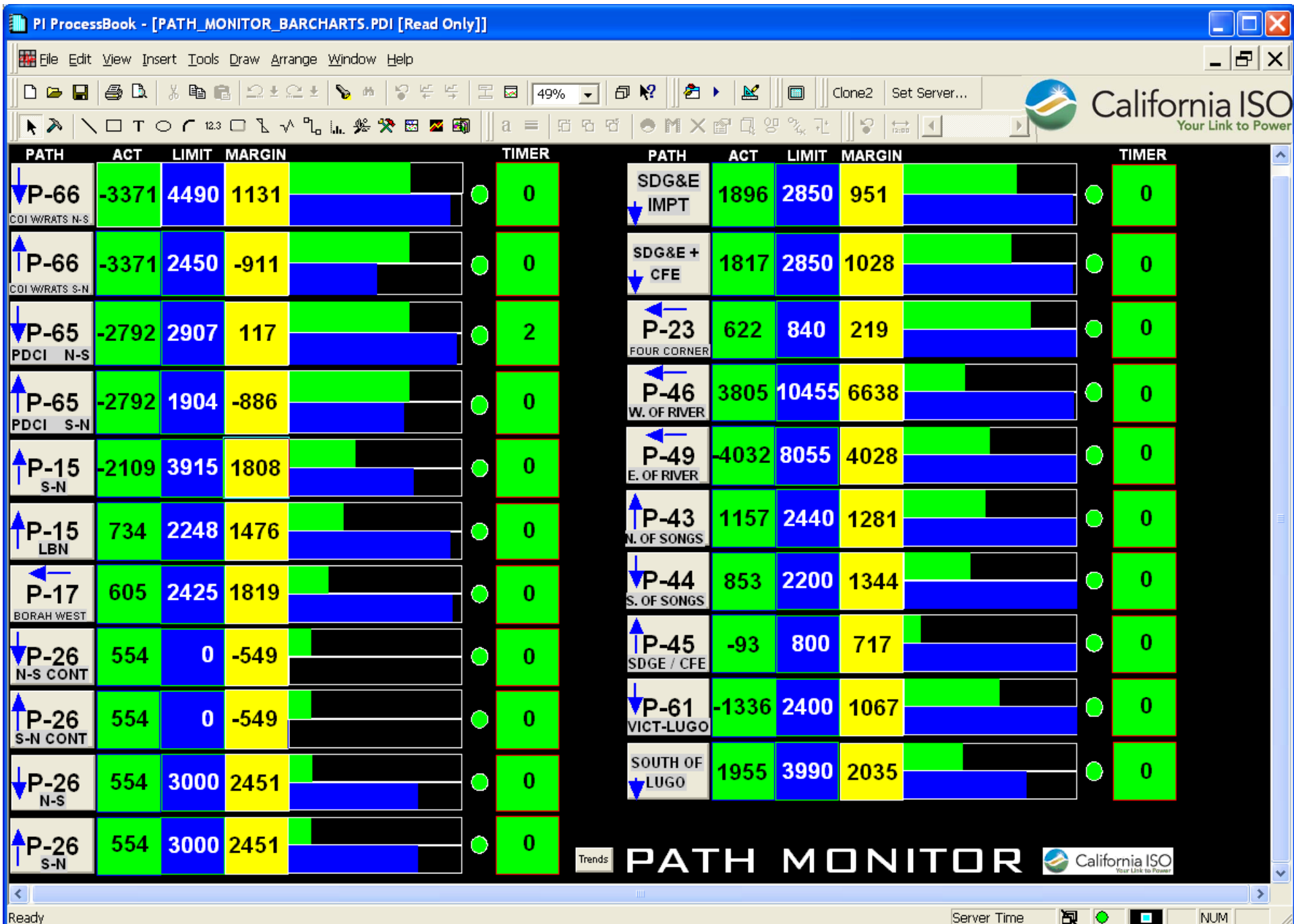
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| 11:30 | 2715.591 | 2742.262 | 2472.007 | 2365.656 | 2788.949 | 2764.653 | 2778.697 | 2743.69 | 2742.778 |

CAISO Typical Transmission Operator Views









PG&E (Pacific Gas & Electric) Grid Operations



- Clearance Tool
 - allows System Dispatchers to manage the impact of maintenance activity on the transmission grid
 - includes alarms to notify System Dispatchers of maintenance activity that requires action
- Operational Procedures
 - set screens verified by CAISO
 - make weather data available for use in PI ProcessBook (PB)
 - add data validity indicator to identify stale data
 - create a tool to synchronize PG&E (PB) screens with CAISO PB screens

The situation:

- Transmission facilities change constantly
 - 40 to 60 maintenance operations per day
- Each change removes grid resources and increases power flows in remaining resources
- Grid operators need:
 - A grid design that re-routes power
 - Assurance that re-routed power is safe and reliable

In other words, every day is a new grid



Today – a spreadsheet



From

A Spreadsheet

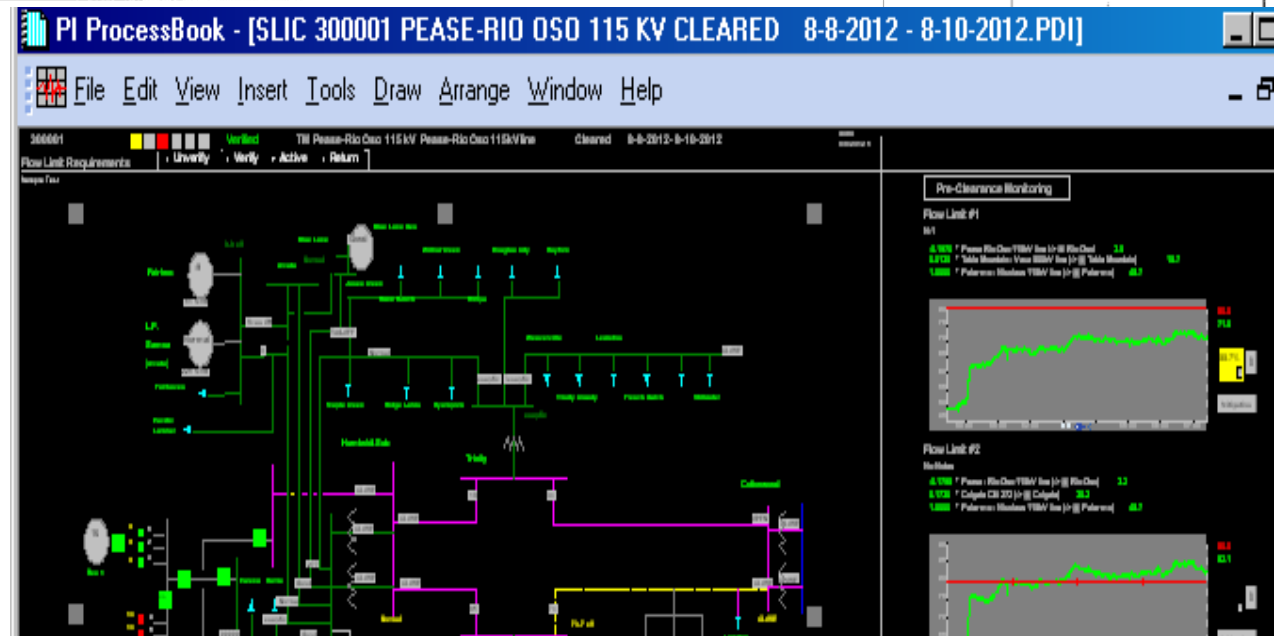
Manually generated
30-60 times per day

| | | | |
|---|--------------------------------|------------|---------------|
| Moraga #1-230/115kV Bank (->) | 77 | | |
| 0.29*Moraga #3-230/115kV Bank (->) | 64 | | Limit |
| | Total | 141 | MW 180 |
| | | | |
| San Mateo #7-230/115kV Bank Cleared | SLIC | 188188 | 4/22-6/30 |
| Pre-Clearance Requirement - Flow Limit #1 | | | |
| Ravenswood-San Mateo 115kV Line (-> @ Ravenswood) | 44 | | |
| 0.11 * San Mateo 230/115kV Bank #5 | 21 | | |
| 0.11 * San Mateo 230/115kV Bank #7 | 0 | | Limit |
| | 4 fps 1000 - 1900 Total | 64 | MW 115 |
| | 1900 - 1000 Total | 64 | MW 100 |
| Real Time Requirements - Flow Limit #1 | | | |
| Ravenswood-San Mateo 115kV Line (-> @ Ravenswood) | 44 | | |
| 0.11 * San Mateo 230/115kV Bank #5 | 21 | | |
| | 4 fps 1000 - 1900 Total | 64 | MW 115 |
| | 1900 - 1000 Total | 64 | MW 100 |

To

A Graphic

Click and search data into PI AF
Automatically produce graphic
one-lines
flow trends
alarms



Title, alarm, one-line and flow limit at a glance



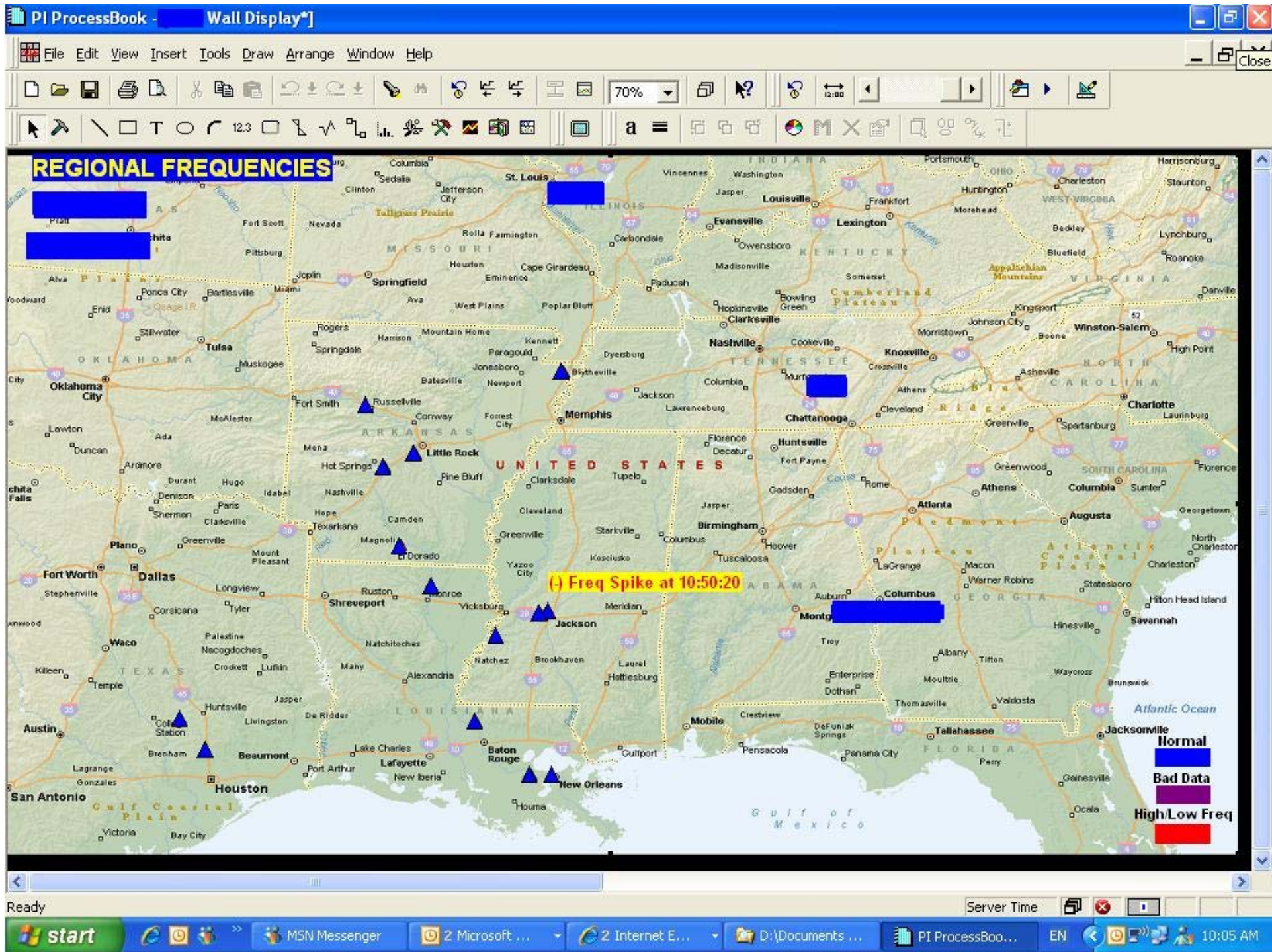
2. PI for WAMS

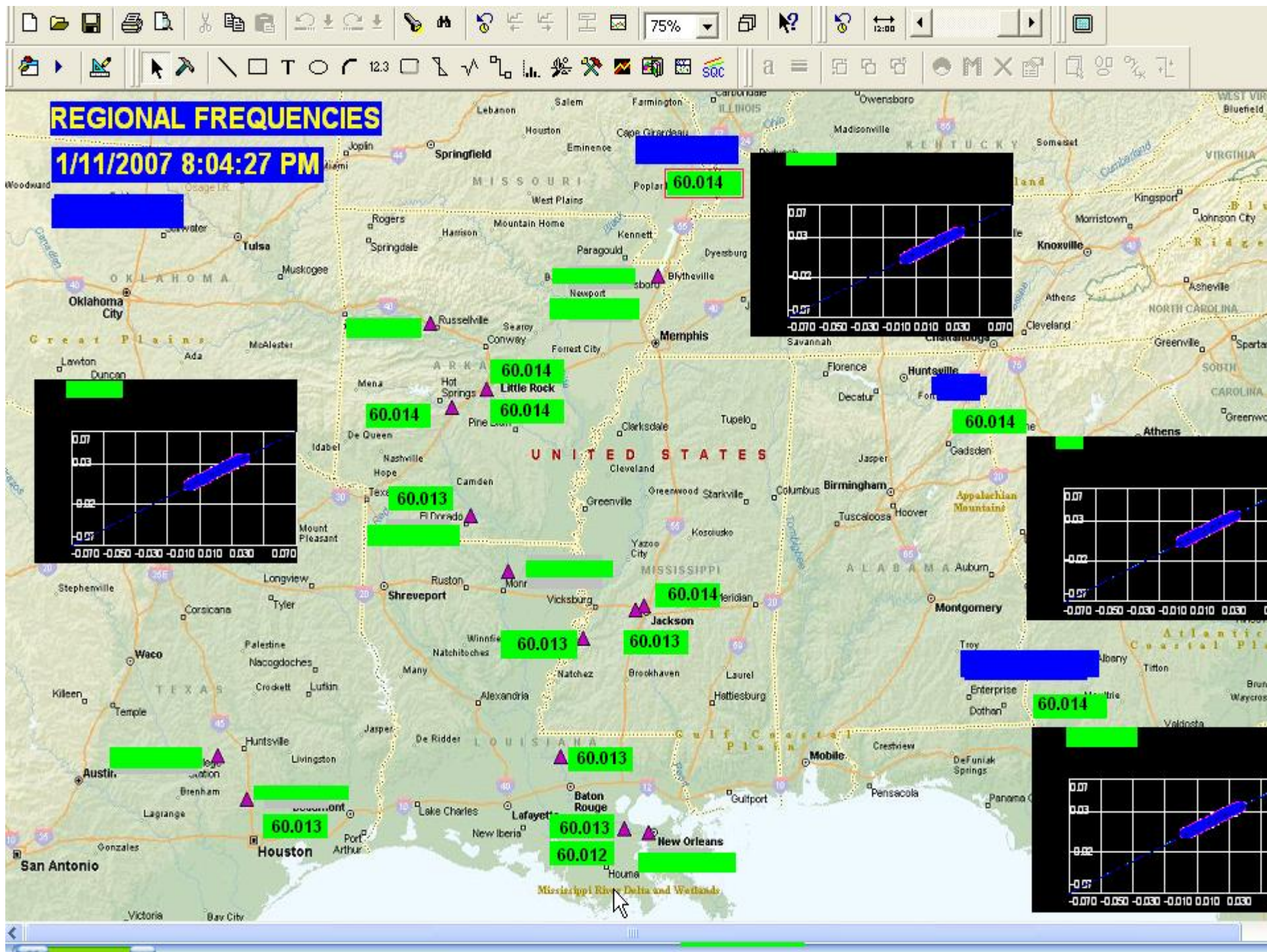
Wide Area Measurement System Synchrophasor Data

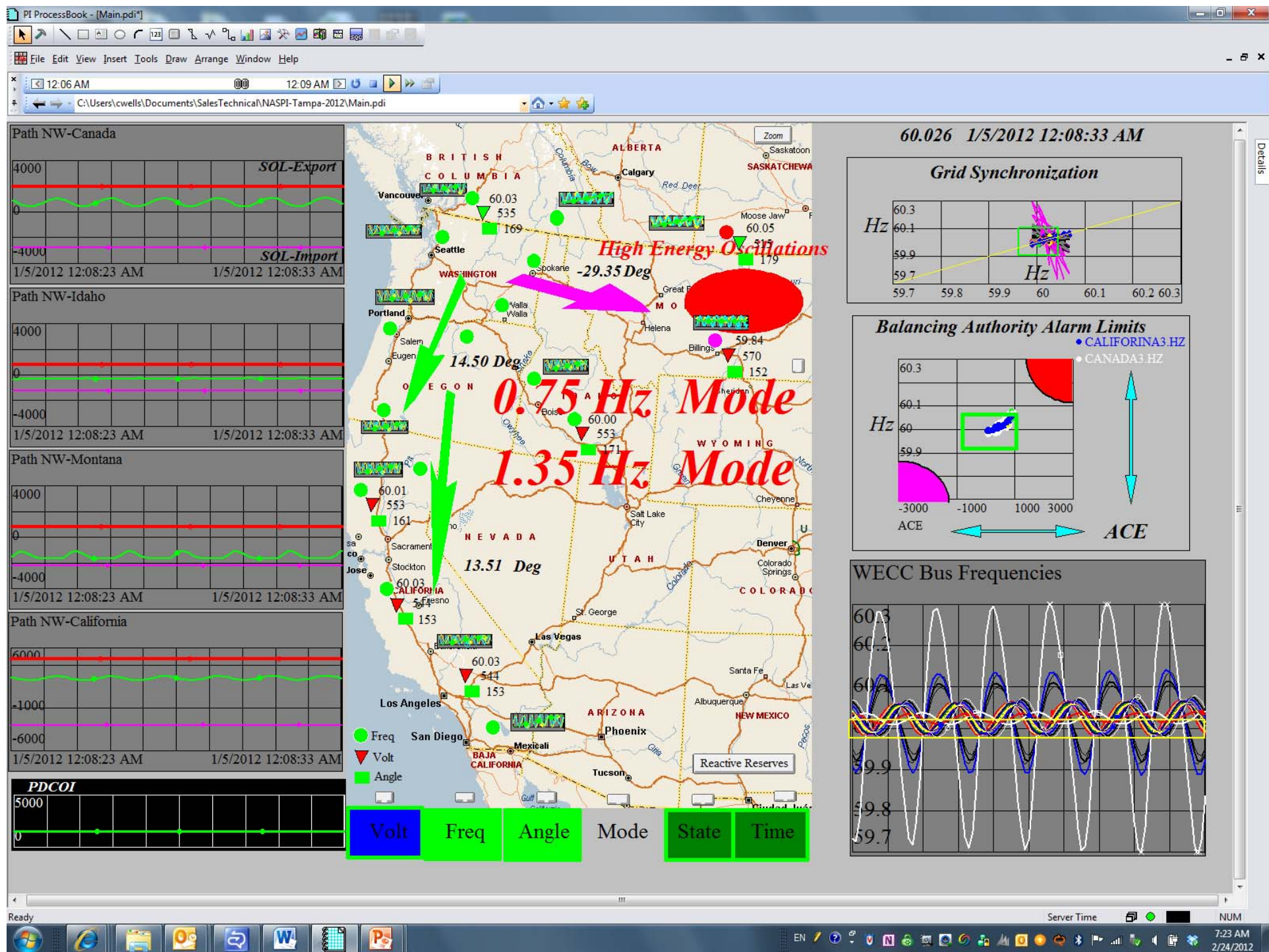
PI for PMU Synchrophasor Data



- **Streaming Server:** Very Fast Sampling (up to 120 samples/sec) and Synchronized Sampling with PI Standard IEEE C37.118 Interface
- **Real-time Analytics:** Fast and Synchronized Real-Time Calculations (phase angle difference and FFT-Fast Fourier Transform, etc.)
- **Visualization/Alerts:** Enhance Operations and Early Warning to Prevent Grid Instability and Cascade Collapse



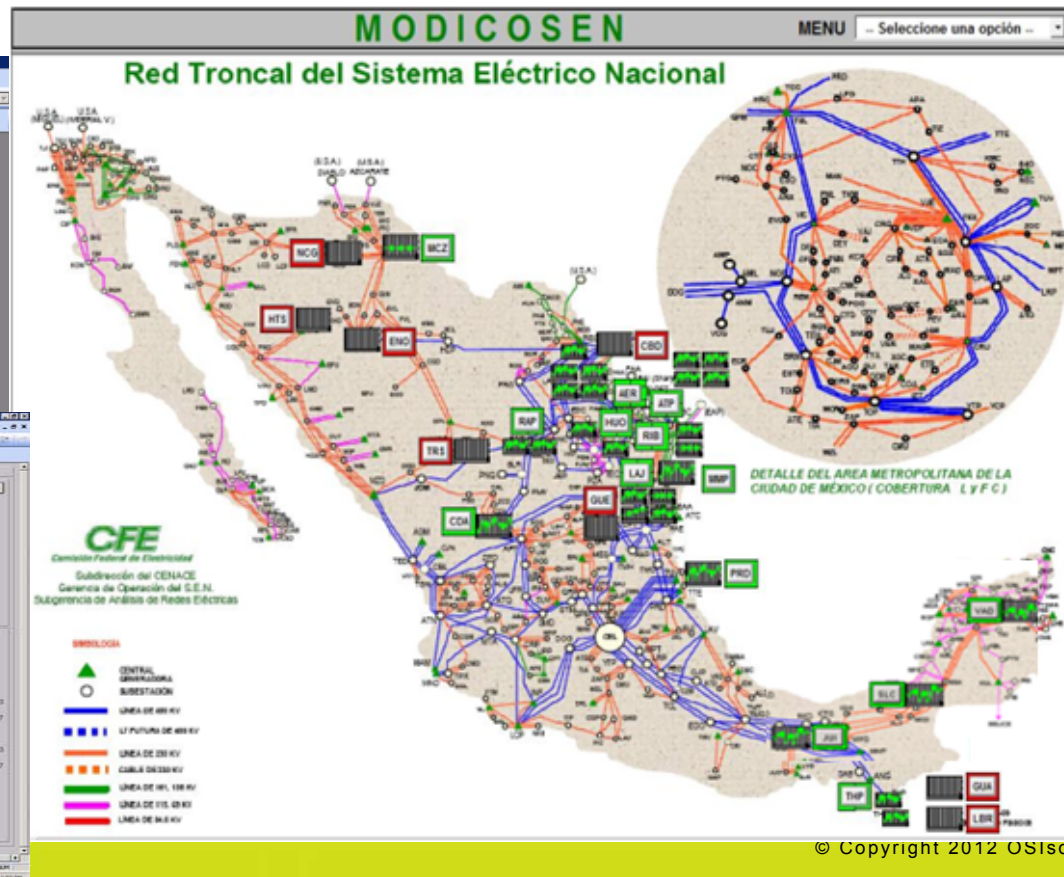
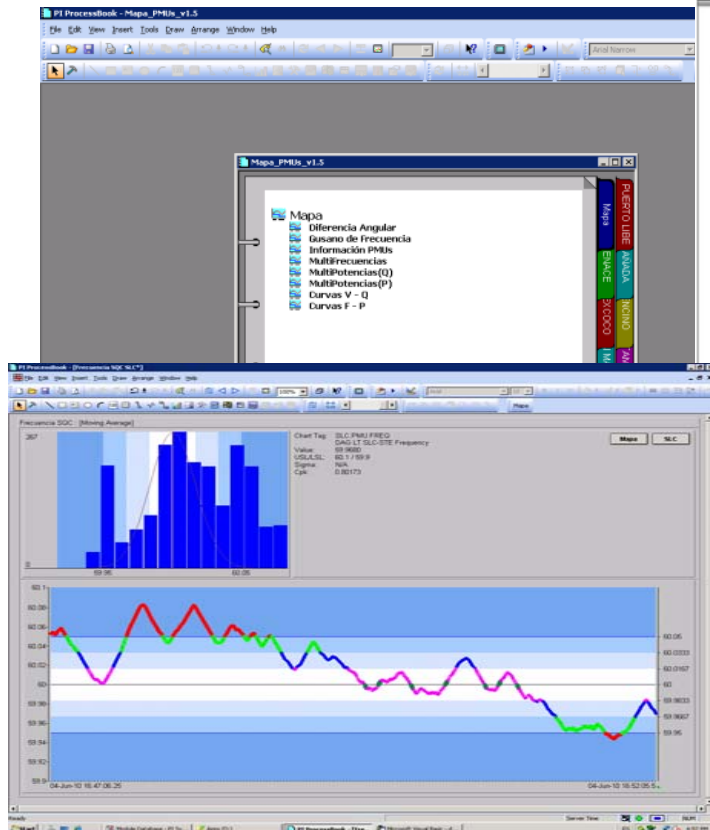
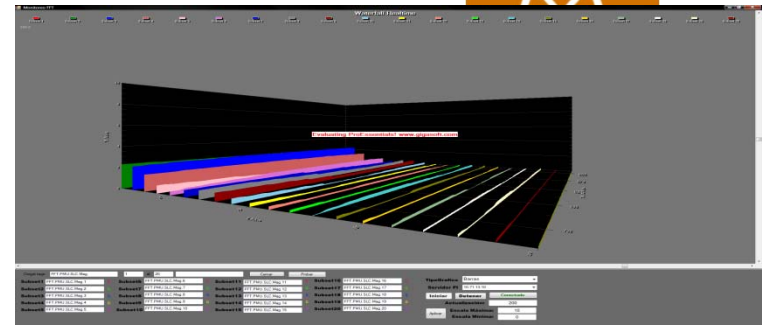




Mexico Comision Federal de Electricidad (CFE) Centro Nacional de Control de la Energía



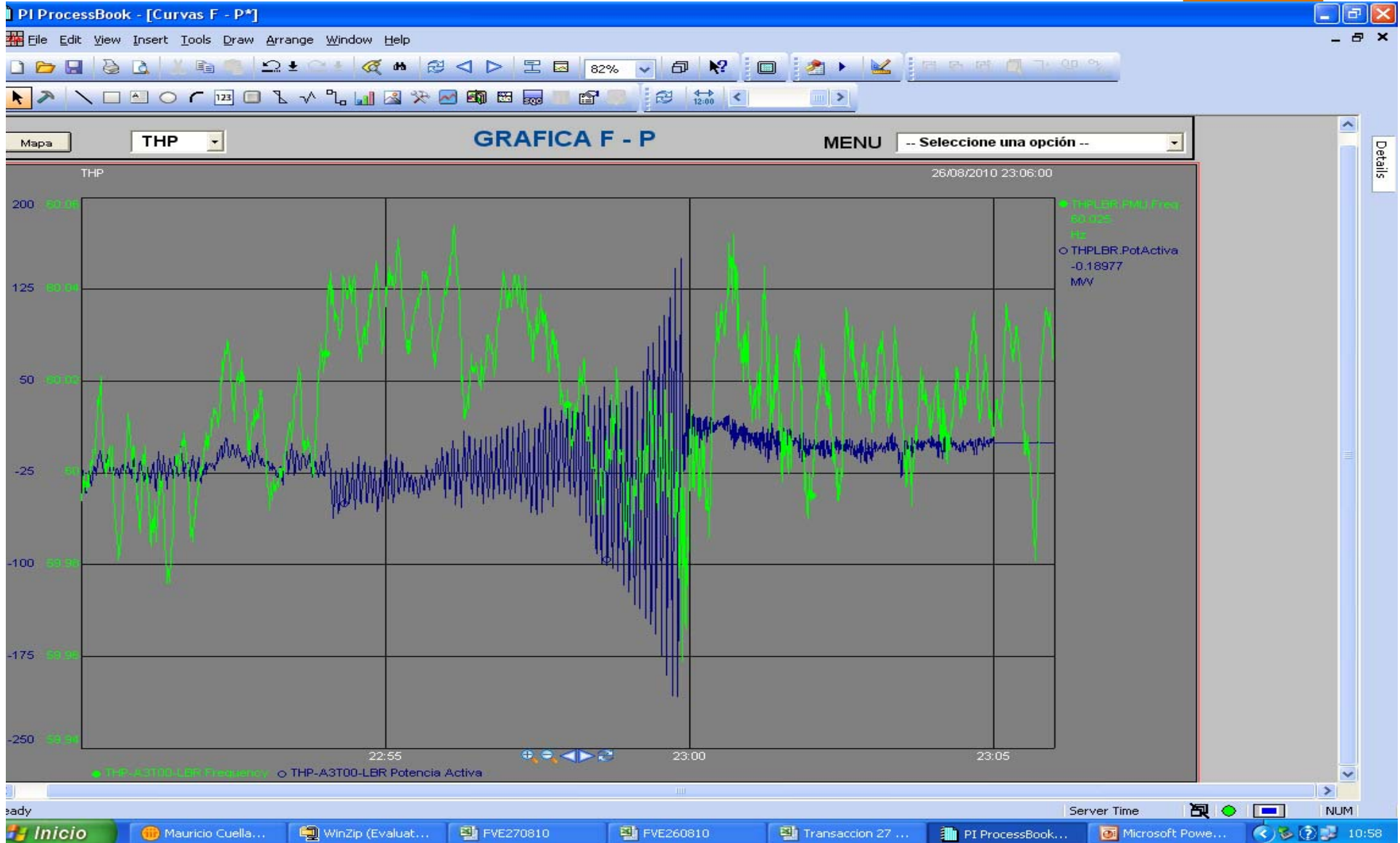
MODICOSEN (Dynamic Monitoring & Control of the National Power System):



MODICOSEN Analytics

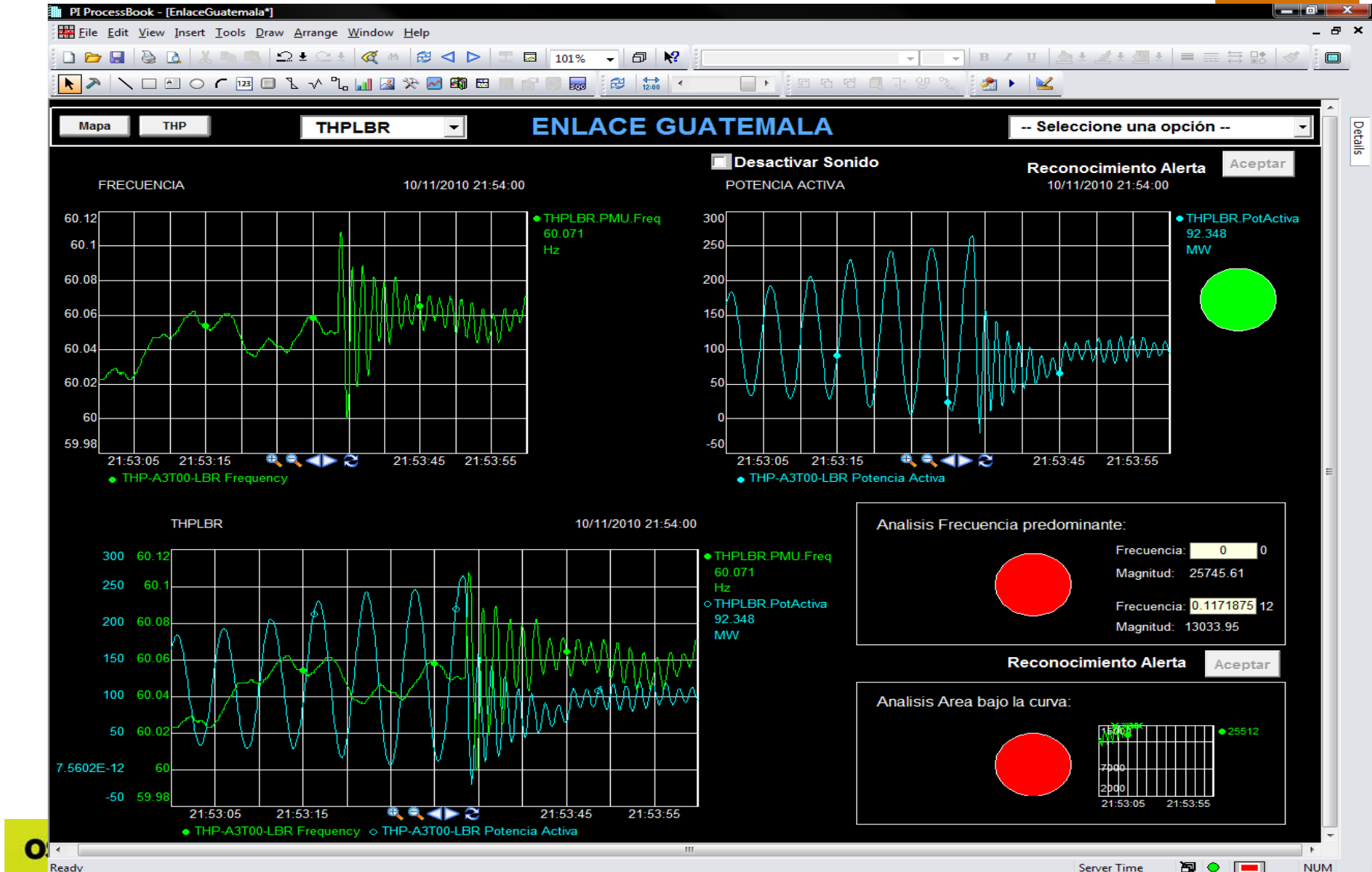


- Mexico – Guatemala Tie Line Event



MODICOSEN Analytics

PI FFT Interface - Low Frequency Oscillations Detection and Alarming



WECC

Western Electricity Coordinating Council



Promoting Bulk Electric System Reliability



WECC Reliability Coordinator Website

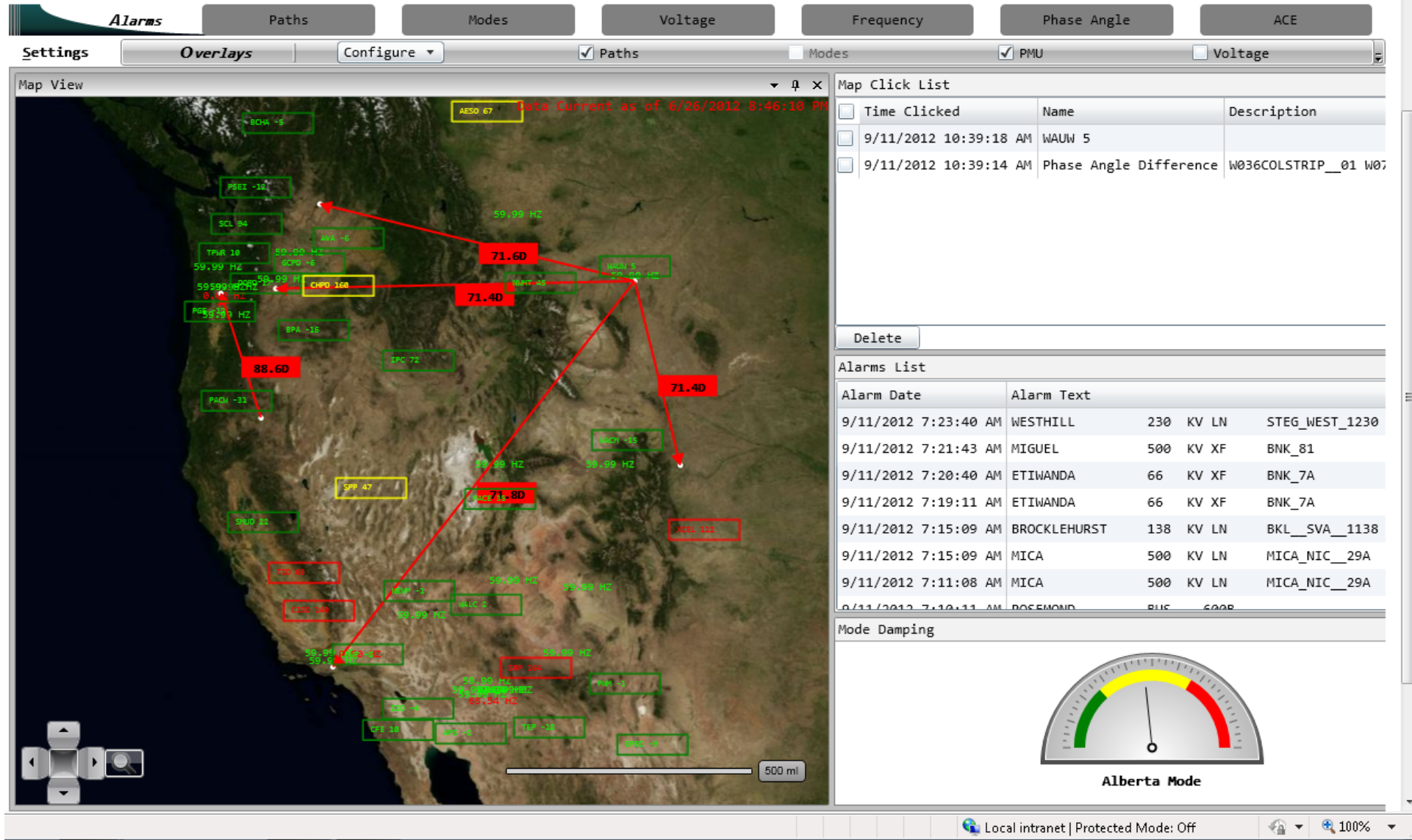
Courtesy: Kirk Stewart – Manager Applications



Wide-Area View (WAV)



- Content (note all driven from PI):
 - Path display (shows WECC paths loading)
 - Mode display (shows damping for WECC major modes of oscillations)
 - Voltage display (major voltages)
 - Frequency display (frequency within different BAs)
 - PMUs display (shows PMUs and their status)
 - Angle display (indicates angle differences among preselected voltages)



Home - Windows Internet Explorer

http://vnd-ws01-an/Reliability/WAV/Pages/default.aspx

Home

Site Actions

Home Model Reliability Study Administration Historian Jeff's Playground Reporting Outages

Status: Published and visible to all readers Note: You are viewing a published version of this page, but this page is also being edited and is checked out exclusively to Vidyadhar Ramanujapuram. Publication Start Date: 5/9/2012 6:50 PM

Home > Reliability > WAV

Alarms Paths Modes Voltage Frequency Phase Angle ACE

Settings Overlays ACE Paths Modes PMU Voltage

Map View

Data Current as of 6/26/2012 8:46:20 PM

Map Click List

| <input type="checkbox"/> | Time Clicked | Name | Description |
|--------------------------|----------------------|------|-------------|
| <input type="checkbox"/> | 9/12/2012 9:56:59 AM | P03 | Northwest-B |
| <input type="checkbox"/> | 9/12/2012 9:56:49 AM | P71 | South of Al |
| <input type="checkbox"/> | 9/12/2012 9:56:45 AM | P04 | West of Cas |
| <input type="checkbox"/> | 9/12/2012 9:56:35 AM | P05 | West of Cas |

Delete

Alarms List

| Alarm Date | Alarm Text | |
|----------------------|----------------|-----|
| 9/12/2012 9:52:30 AM | GREAT FALLS | 230 |
| 9/12/2012 9:51:42 AM | WECC LINK UP | |
| 9/12/2012 9:51:34 AM | WECC LINK DOWN | |
| 9/12/2012 9:48:37 AM | WECC LINK UP | |
| 9/12/2012 9:48:30 AM | WECC LINK DOWN | |
| 9/12/2012 9:13:08 AM | CAMPBELL RIVER | 132 |
| 9/12/2012 9:12:34 AM | ELDORADO | 230 |
| 9/12/2012 9:05:30 AM | ROCKLEHURST | 132 |

Mode Damping

Done

Local intranet | Protected Mode: Off

100%

Home - Windows Internet Explorer

http://vnd-ws01-an/Reliability/WAV/Pages/default.aspx

Site Actions Browse Page Publish

Home Model Reliability Study Administration Historian Jeff's Playground Reporting Outages

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Delete

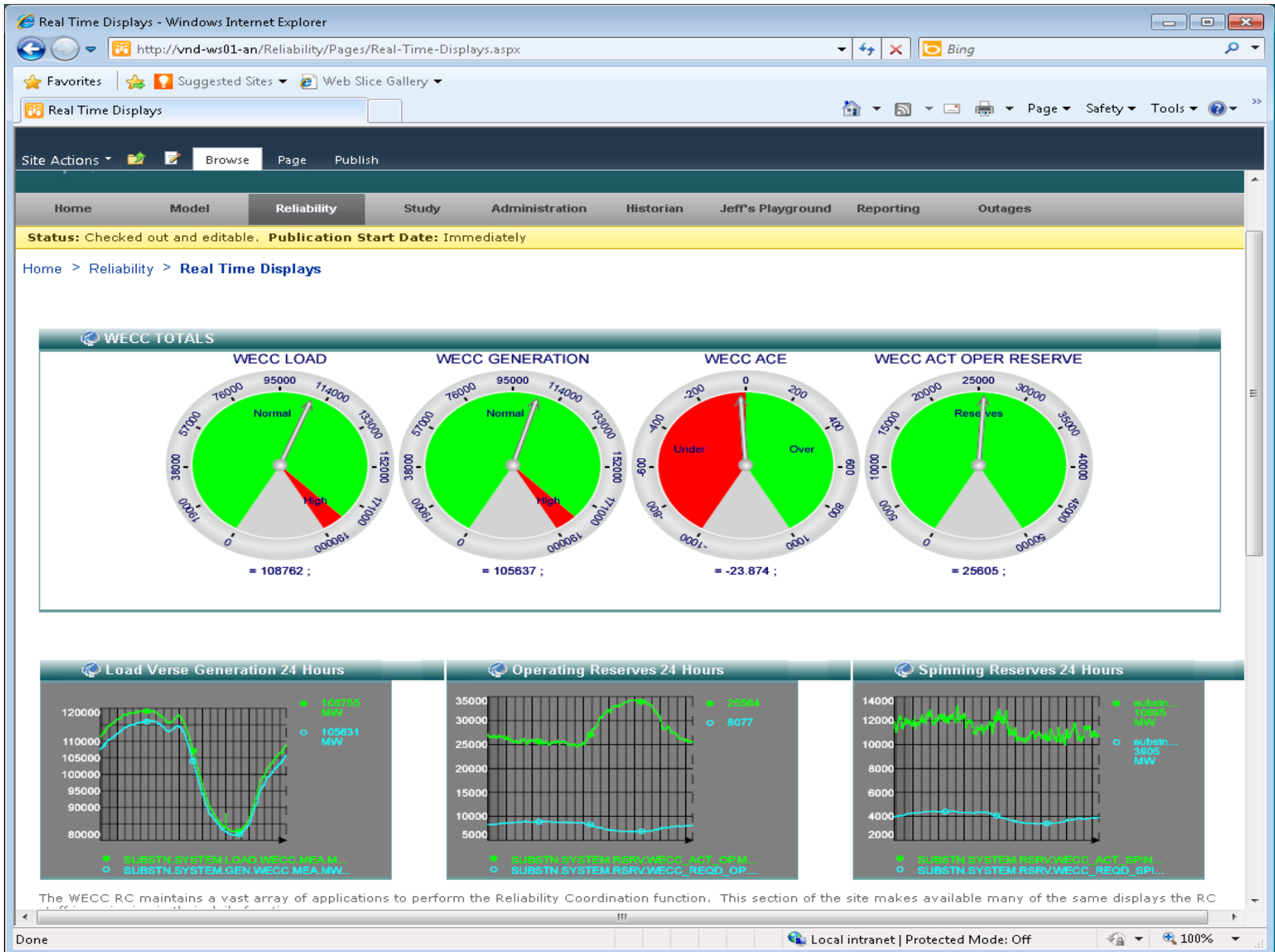
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| 9/12/2012 9:12:34 AM | ELDORADO | 230 |
| 9/12/2012 9:05:30 AM | BROCKLEBURST | 132 |

Mode Damping

Local intranet | Protected Mode: Off

100%



WECC Reliability Coordination

Home Model Reliability Study Administration Historian Jeff's Playground Reporting Outages

Status: Checked in and viewable by authorized users. Publication Start Date: Immediately

Home > Reliability > WECC AGC Totals

WECC AGC Totals

- WECC TOTALS -

| SCHED INTG | ACTUAL INTG | GENERATION | ACE | LOAD | ACT OPER RSRV | ACT SPIN RSRV |
|------------|-------------|------------|-----|--------|---------------|---------------|
| 881 | 602 | 110566 | 565 | 114775 | 26571 | 1175 |

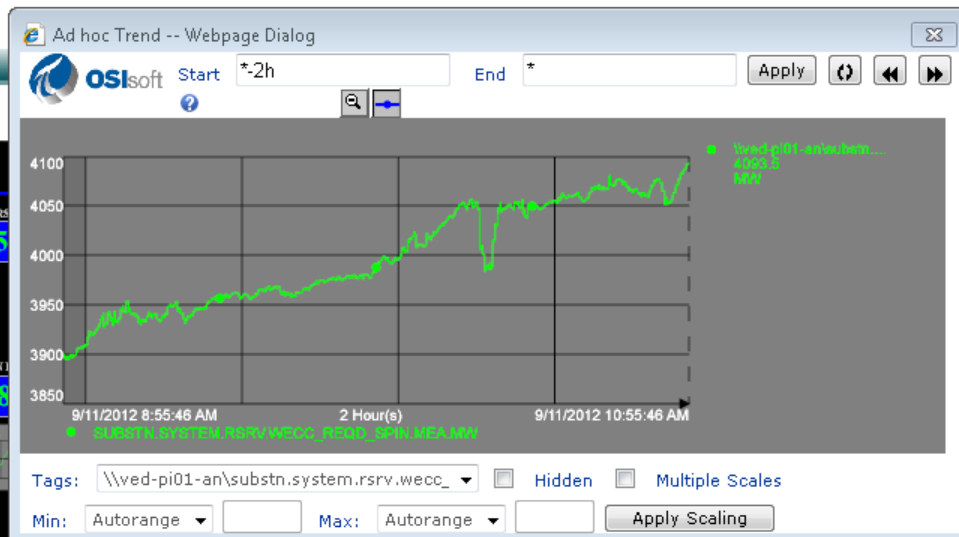
Loveland, CO

| SCHED INTG | ACTUAL INTG | GENERATION | ACE | LOAD | ACT OPER RSRV | ACT SPIN RSRV |
|------------|-------------|------------|-----|-------|---------------|---------------|
| 5723 | 5506 | 35908 | 206 | 35100 | 7636 | 428 |



Vancouver, WA

| SCHED INTG | ACTUAL INTG | GENERATION | ACE | LOAD | ACT OPER RSRV | ACT SPIN RSRV | REQD OPER RSRV | REQD SPIN RSRV |
|------------|-------------|------------|-----|-------|---------------|---------------|----------------|----------------|
| -4841 | -4904 | 74657 | 360 | 79675 | 18935 | 7469 | 5821 | 2848 |



Pages - WECC Path Map - Windows Internet Explorer

http://

Pages - WECC Path Map


Site Actions

Browse

Page

Publish

Kirk Stewart

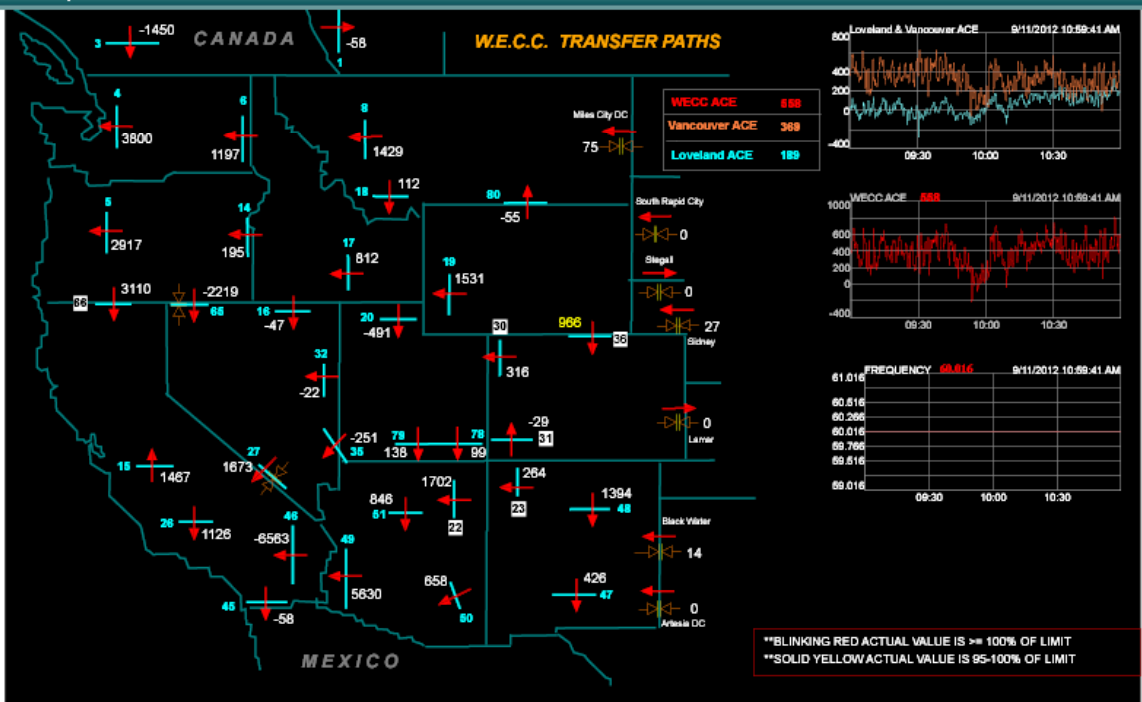
 **WECC** Reliability Coordination

HomeModelReliabilityStudyAdministrationHistorianJeff's PlaygroundReportingOutages

Status: Checked in and viewable by authorized users. Publication Start Date: Immediately

Home > Reliability > WECC Path Map

WECC Path Map



| | |
|---------------|-----|
| WECC ACE | 888 |
| Vancouver ACE | 368 |
| Loveland ACE | 189 |

9/11/2012 10:59:41 AM

WECC ACE 888

9/11/2012 10:59:41 AM

FREQUENCY 60.016

9/11/2012 10:59:41 AM

**BLINKING RED ACTUAL VALUE IS >= 100% OF LIMIT
**SOLID YELLOW ACTUAL VALUE IS 95-100% OF LIMIT

Adobe SVG Viewer Help

SVG Display Controls

Local intranet | Protected Mode: Off

100%

My Reporting



- Enables users to subscribe to events and be notified via e-mail when they have occurred
- Generates automatic reports from pre-defined events
- Provides download links to event-related data for post-mortem analysis using offline tools

Subscribe Events Screen



This screen enables users to subscribe to pre-defined events and have email notifications delivered to their email address when the event occurs.

| Event Type Name | Event Type Description | Subscribe | Email Alert |
|----------------------|--|-------------------------------------|-------------------------------------|
| Loss of generation | Loss of generation or load(1000MW or more) | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Frequency deviation | Greater than +/- 0.15 Hz frequency deviation | <input type="checkbox"/> | <input type="checkbox"/> |
| Bus voltage change | Large change, or rate of change, in bus voltage. | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Separation/Islanding | System Separation/Islanding events | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| Noise Level | Large increase in system noise level | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| Oscillation | Unusual Oscillations in the system | <input type="checkbox"/> | <input type="checkbox"/> |

The event type such as Breaker Trip or Frequency Deviation

Submit

Cancel

Check to subscribe. Event will show up using My Events Filter on View Events Screen.

Click the check box to have email notifications sent to your inbox.

View Events Screen



Select a start and end date to restrict the event list to a specific time period.

WISPVviewer

By default, it displays only events that have occurred that you have subscribed to. Clicking and Selecting View will display all events.

Click to view data files.

Click to view reports.

Start-Date/Time

End-Date/Time

Select Events

<M/d/yyyy>



<M/d/yyyy>



View My Events ▼

Submit

| Event Type | Event Details | Date Time | Reports | DataFiles |
|----------------------|---|-------------------|---------|-----------|
| Loss of generation | Loss of generation or load(1000MW or more) | 9/27/2011 4:00:00 | | |
| Frequency Deviation | Greater than +/- 0.15 Hz frequency deviation | 9/27/2011 4:00:00 | | |
| Bus voltage change | Large change, or rate of change, in bus voltage | 10/3/2011 4:00:00 | | |
| Separation/Islanding | System Separation/Islanding events | 10/3/2011 4:00:00 | | |
| Noise Level | Large increase in system noise level | 10/3/2011 4:00:00 | | |
| Oscillations | Unusual Oscillations in the system | 10/3/2011 4:00:00 | | |

What is a Signal Registry at its Core?



- WECC's Registry Approach:
 1. A listing of Devices with an associated set of META data that defines each device.
 2. A listing of Measurements with an associated set of META data defining the measurement.
 3. A hierarchy that defines how the Devices and Measurements relate to each other.

PMU META Data



RegistryEditor

PMU MALIN.PMU.500.1

PMU: MALIN - MALIN PMU 500.1

Common

RCO: Owner: BPA

RCO Abbr: Operator: BPA

EMS:

SCADA:

Owner:

RCO Station:

Contacts

Location

Longitude: 42.00686 Latitude: -121.3165

GISSource: Platts GISSourceId: 3337417425

Time Zone: PST

Device

Virtual: ☒

Manufacturer: Not Defined Model:

Serial Number: Revision:

Net IP Address:

Protocol: C37.118-2005 Protocol Id: 34001

Clock Time Zone: PST

Install Date: 1/1/0001 12:00:00 A

In Service Date: 1/1/0001 12:00:00 A

Retired Date: 1/1/0001 12:00:00 A

Status

CIP Compliant: ☒

GetLOV Returned Data...

ALPHA/scrcplay Admin SHAREPOINTS

[Home](#)[Model](#)[Reliability](#)[Study](#)[Administration](#)[Historian](#)[Jeff's Playground](#)[Reporting](#)[Outages](#)[Home](#) > [Model](#) > [Registry](#)

Registry

Save  Add  Refresh  Work Queue 

Registry

Areas

▶ AESO

▶ APS

▶ AVA

▶ BC-HYD

BPA

Assets

▶ Lines

Substations

19TH_ST

2ND_ST

7_AVENUE

72ND_CC

99TH_ST

ABERDEEN

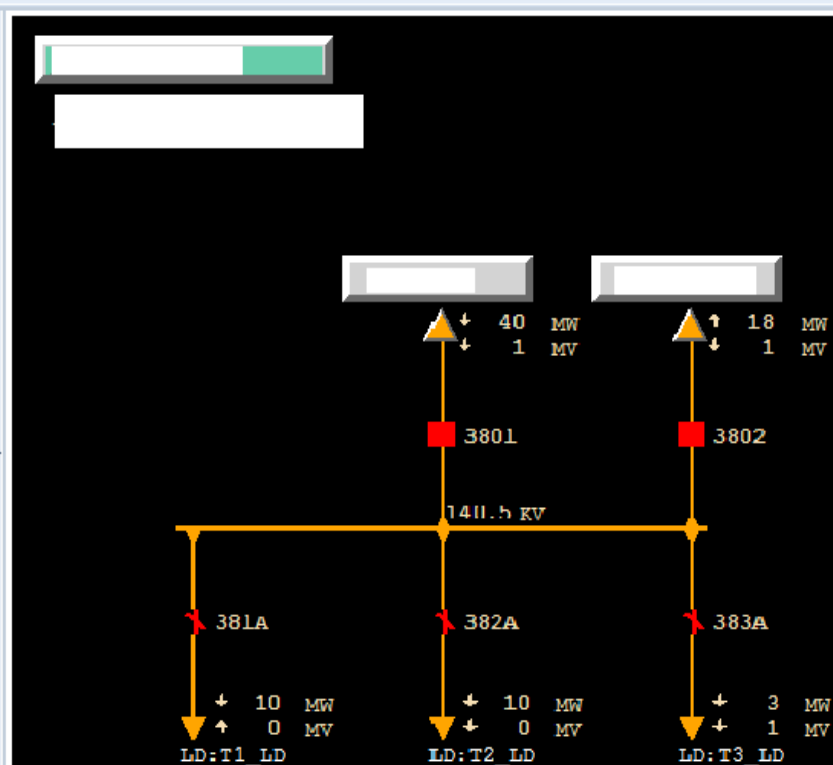
ABERDTP

ACTON

ADAM

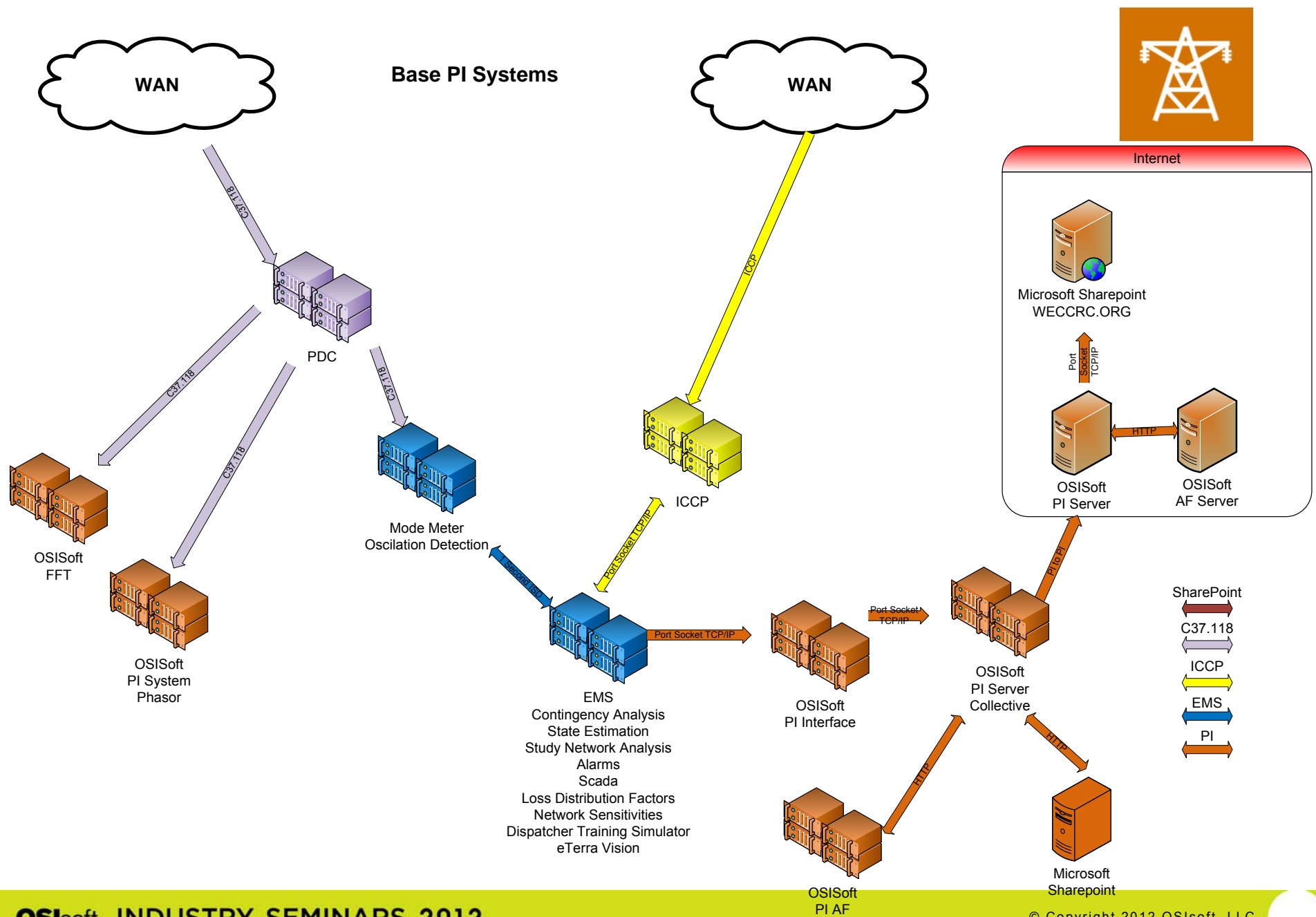
ADAMS 3

ADAMS



Ready

User Account: DEMS\kstewart





3. PI for Asset Management and Proactive Maintenance



Sempra Energy Utilities OpEx 20/20



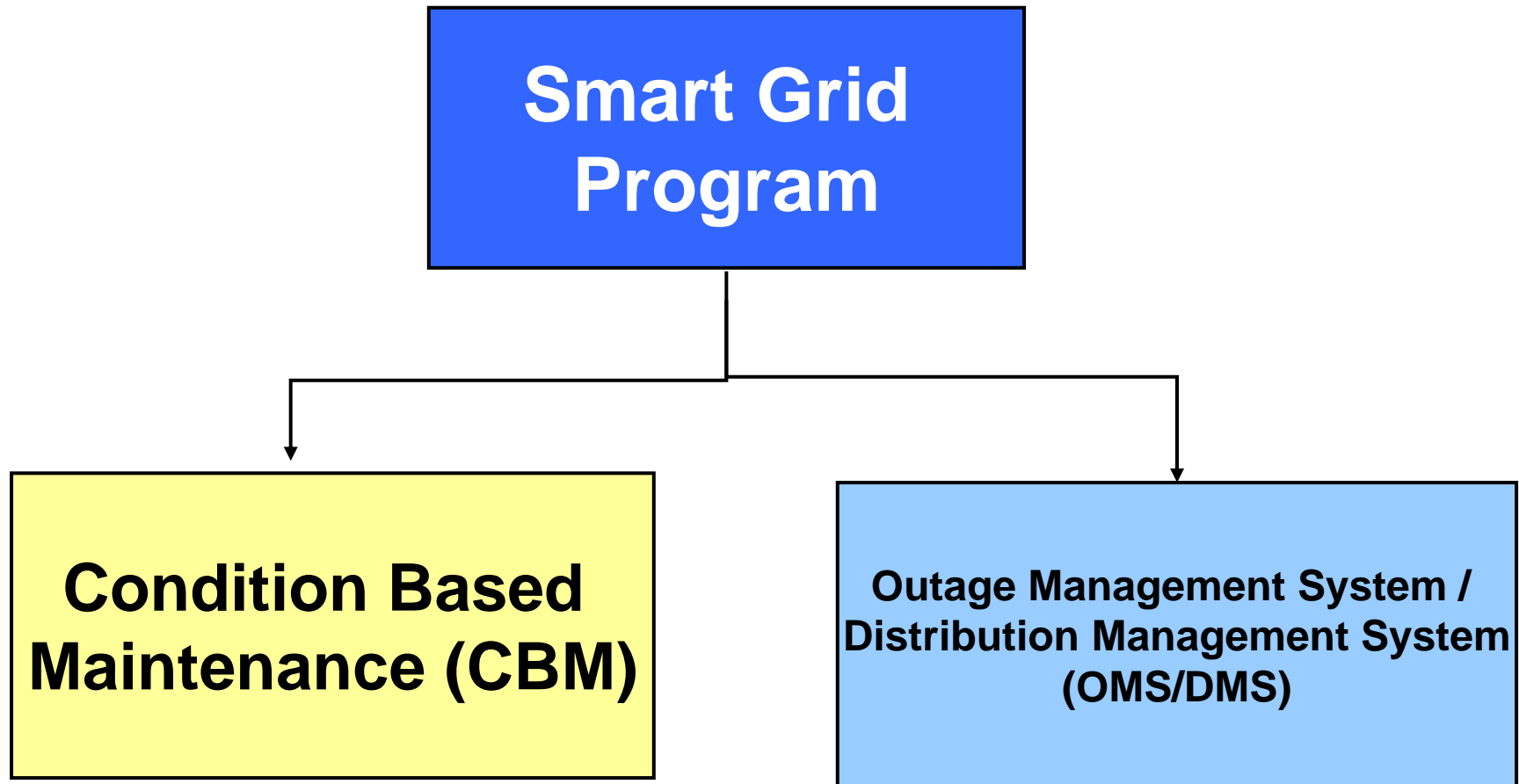
- In 2006, a team of employees developed a roadmap to prepare company for future success. The plan includes a renovation of the systems that support our operations. These initiative were named:



- The program's technology and process improvements will enable our utilities to *continue* to deliver our commitment of Operational Excellence.
- 20/20 symbolizes a clear, sharp vision guiding our efforts.



OpEx 20/20: Smart Grid Program



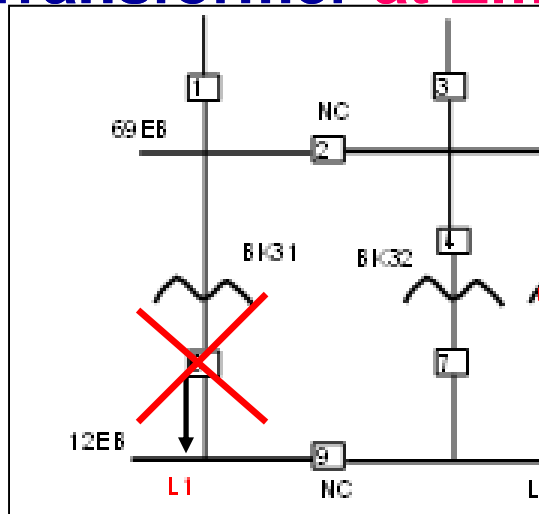
CBM – Data Integration



- Weekly general inspections
 - ***LTC operations***
 - ***Alarms, temperature, visual***
- Monthly equipment inspections
 - ***Operation counters***
 - ***Temperature, Pressure***
 - ***Voltage***
 - ***Functional check***
- General asset
 - ***Rating***
 - ***Age, Type, Design***
 - ***Operating limits***
- Operational
 - ***Relays & Digital fault recorders***
 - ***PQ Monitors***
- Specific equipment
 - ***Operating conditions***
 - ***Stress factors***
 - ***Trouble history***
 - ***Maintenance data***
 - ***Oil test data***
 - ***Electrical test data***
 - ***Operating speed***
- Real-time
 - ***Voltage & Current***
 - ***Temperature***
 - ***Bushing On-line Power Factor***
 - ***Hydrogen in Oil***
- Simulated
- System & Engineering

Operations Decision Support

Transformer at Emergency Rating ?



Paper Insulation Health

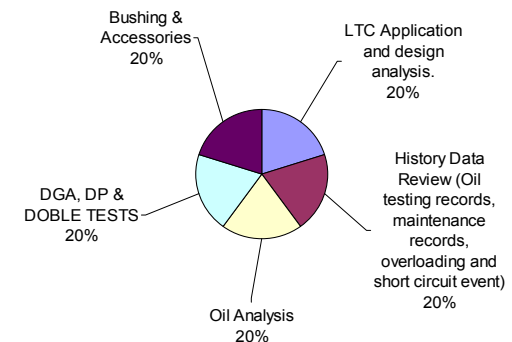
| Location of Paper Sample | Degree of Polymerization (DP) |
|--------------------------|-------------------------------|
| NLTC - Phase A | 586 |
| NLTC - Phase B | 737 |
| 69kV Bushing C | 688 |

New Insulation Paper: $1000 < DP_v < 1300$
Middle Aged Insulation Paper: $DP_v = 500$
Old Age Insulation Paper: $DP_v < 251$
Severely Degraded Insulation Paper: $DP_v < 151$

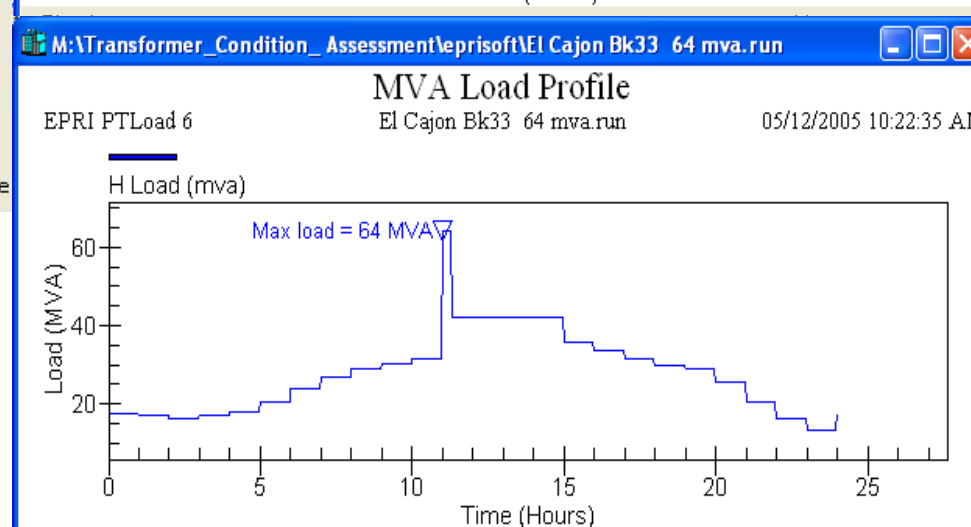
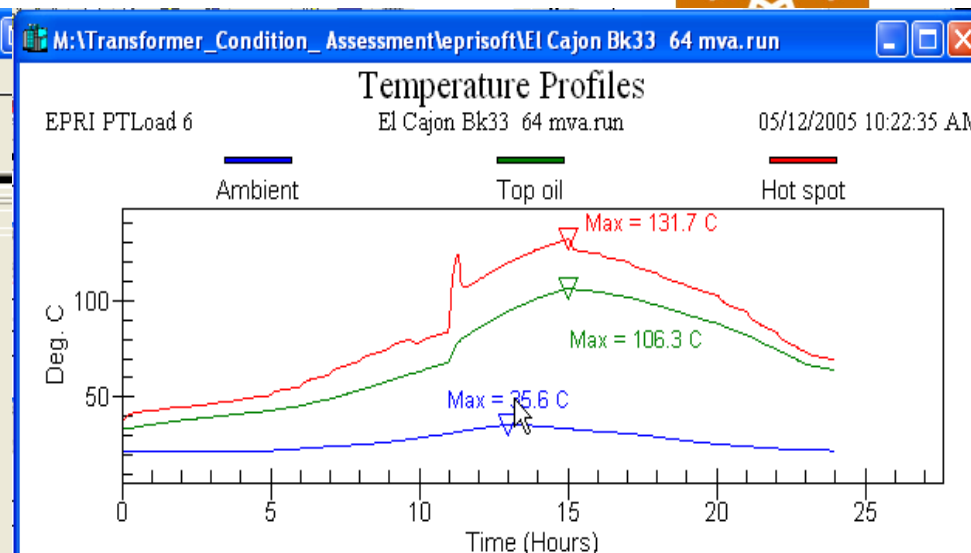
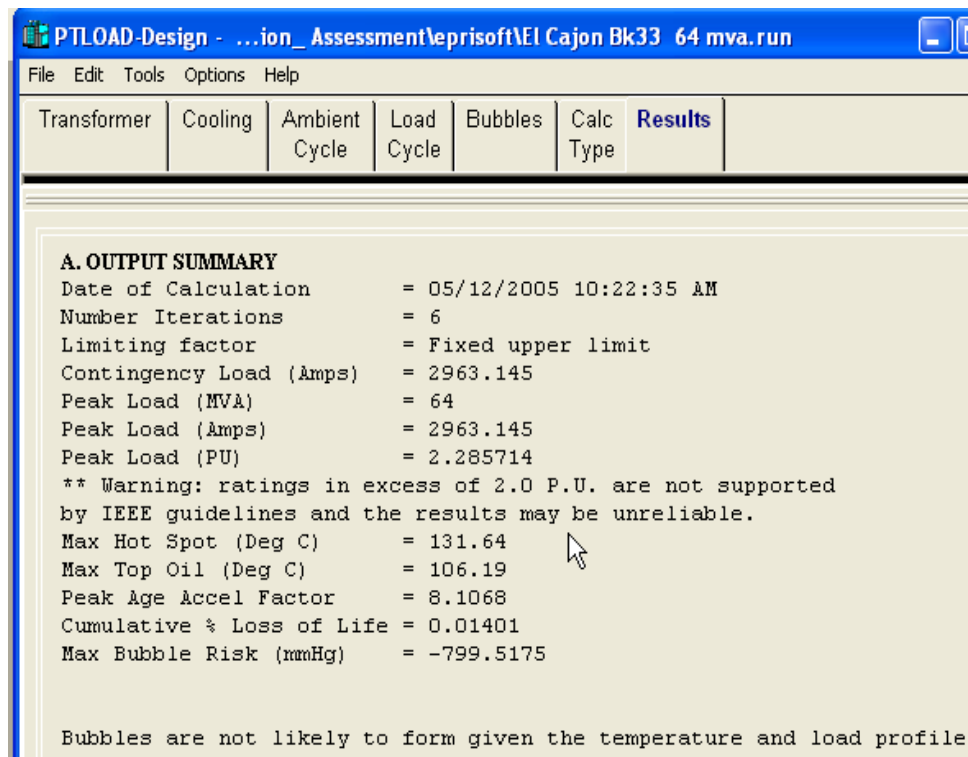


TRANSFORMER Health Indices

- Insulation Power Factor
- LTC Application & Design
- Oil Conditions
- Bushing & Accessories
- Operating History & Conditions



Transformer Operating Limits



Comparison of hot spot rise over top oil simulated versus actual

| | <u>Top Oil</u> | <u>Hot Spot</u> | <u>LOL</u> |
|----------------|----------------|-----------------|------------|
| IEEE | 105 | 176 | .149 |
| Ptload | 105 | 145 | .039 |
| Actual HS rise | 106 | 131 | .014 |

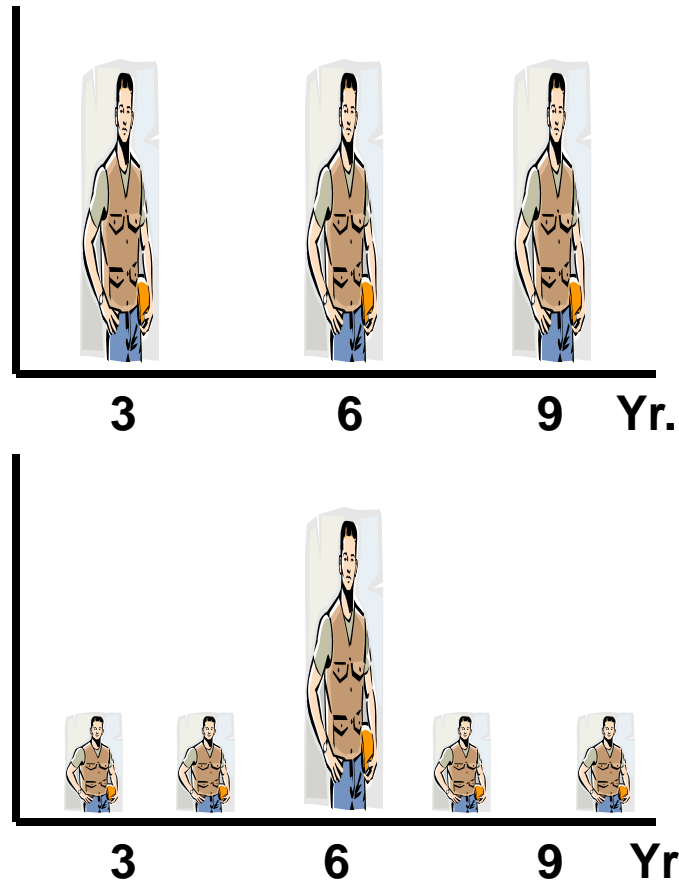
Decision: Based on Transformer Unit Health and Real Time Conditions

Time-based to CBM – Circuit Breakers

Data Available

- **Weekly safety inspections**
- **Monthly equipment insp.**
- **Asset Data**
- **Historical Data**
 - Operating conditions
 - Stress factors
 - Trouble
 - Maintenance data
 - Test data (insul & elec)
- **Operational data**
 - Relays & Digital fault recorders
 - PQ Monitors
- **Real-time data**
 - Voltage & Current
 - I²T and Contact Wear
 - Operations Counter

Maintenance Intervals



Planned
Approach



Circuit Breaker Operations

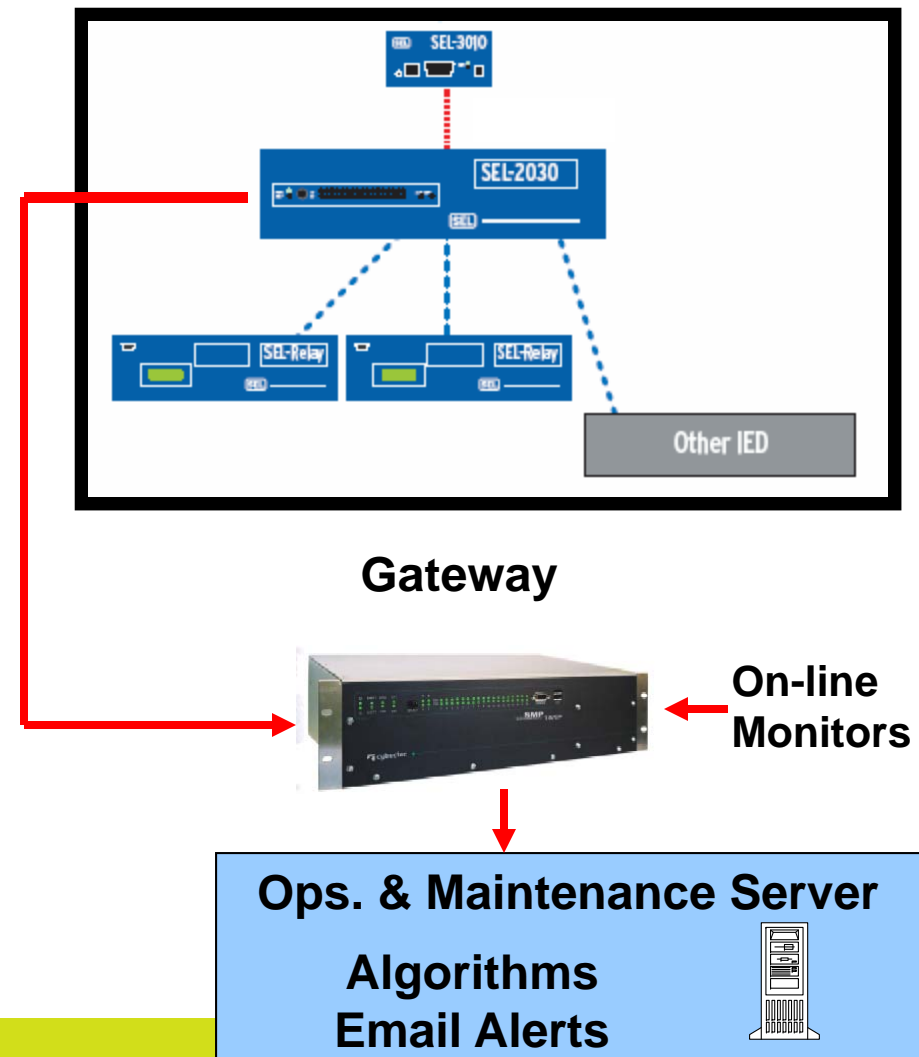
Concerns

- Proper fault clearing
- Fault testing with a circuit breaker

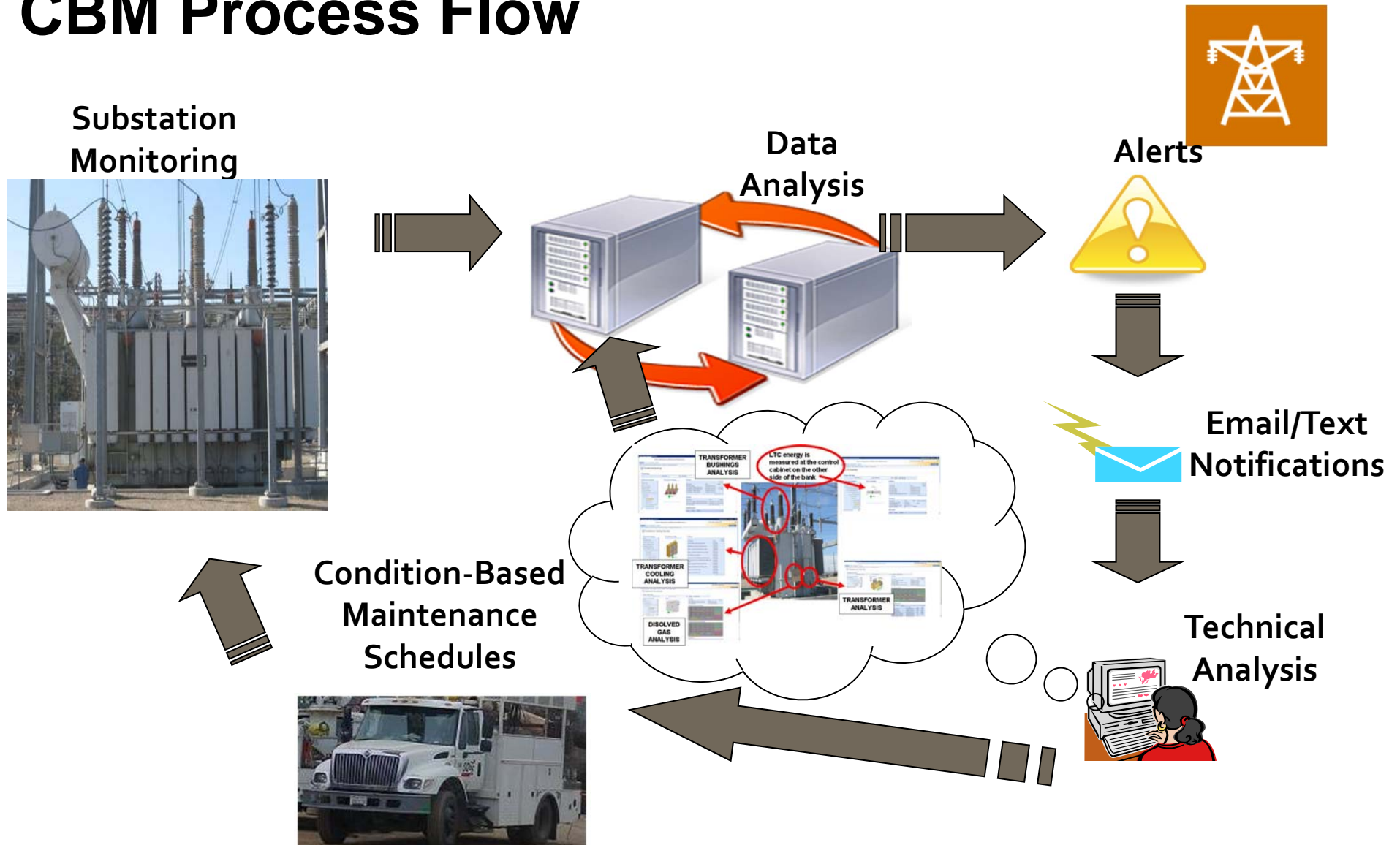
Solution

- Verify the health of CB
 - Contact wear
 - Insulation medium integrity
 - Bushings and accessories
 - Operating history
- Use historical and real-time contact wear data (I^2T) to make a decision

Substation Relays with Circuit Breaker Monitor



CBM Process Flow

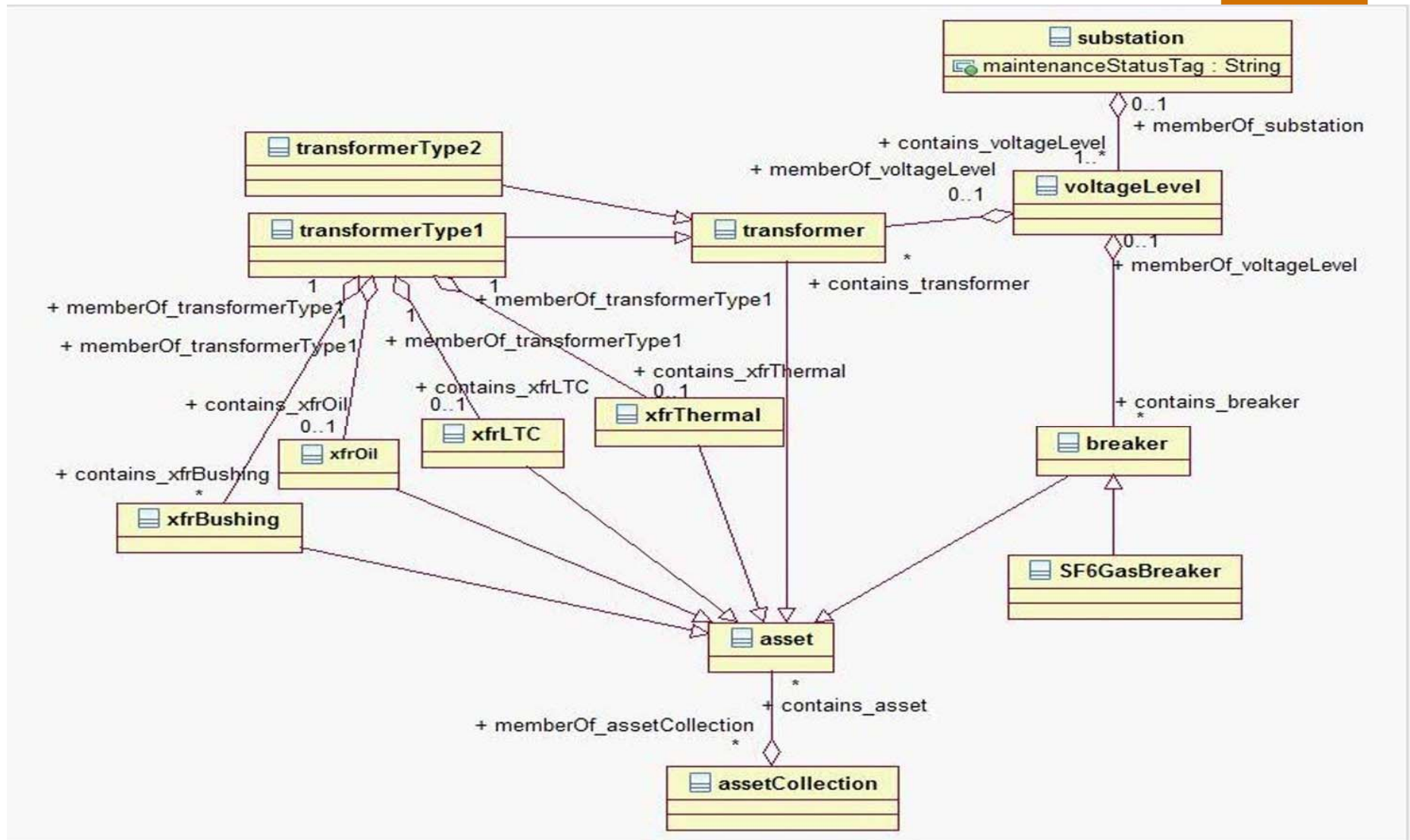


PI as the CBM Server & Analytics



- Controls communication from Enterprise Gateway to PI
- Maps new data points automatically from Enterprise Gateway
- Collects and stores all time-series data
- Provides Analytics (PI ACE) and Visualizations (PI WebParts)
- Visualizes graphing, trending and analytics
- Integrates with other internal PI Systems
- Integrates with Legacy applications
- Sends PI Notifications and Acknowledgement
- Serves as a CBM Model server

CBM CIM (Common Information Model) Asset Model



PI Asset Framework Modeling



CBM - PI System Explorer

File Edit View Go Help

Database Query Date Back Check In New Element Search

Elements

- Elements
 - SISCO Managed Models
 - Layers
 - SDGE_CBM
 - Layers
 - ClassView
 - breakerAssets
 - breakerType
 - bushing
 - CBMSystem
 - DGA
 - distributionTransmission
 - LTC
 - LTCTransformer
 - predictiveAnalysis
 - report
 - SF6GasBreaker
 - Substation
 - systemReports
 - systemStatus
 - thermal
 - transformerAssets
 - transformerType
 - voltageLevel
 - InstanceView

Elements

CBM Group by: ☐ Category ☐ Template

Search

| Name | Description | Category | Type | Template |
|---------------------|-------------------|----------------|------|-----------------------------------|
| SISCO Managed Mo... | | | None | SISCO Model Template |
| SDGE_CBM | Created from R... | | None | SDGE_CBM |
| ClassView | | | None | |
| breakerAssets | | SDGE_CBM; S... | None | SDGE_CBM:breakerAssets |
| breakerType | | SDGE_CBM; S... | None | SDGE_CBM:breakerType |
| bushing | | SDGE_CBM; S... | None | SDGE_CBM:bushing |
| CBMSystem | | SDGE_CBM; S... | None | SDGE_CBM:CBMSystem |
| DGA | | SDGE_CBM; S... | None | SDGE_CBM:DGA |
| distributionTran... | | SDGE_CBM; S... | None | SDGE_CBM:distributionTransmission |
| LTC | | SDGE_CBM; S... | None | SDGE_CBM:LTC |
| LTCTransformer | | SDGE_CBM; S... | None | SDGE_CBM:LTCTransformer |
| predictiveAnalysis | | SDGE_CBM; S... | None | SDGE_CBM:predictiveAnalysis |
| report | | SDGE_CBM; S... | None | SDGE_CBM:report |
| SF6GasBreaker | | SDGE_CBM; S... | None | SDGE_CBM:SF6GasBreaker |
| Substation | | SDGE_CBM; S... | None | SDGE_CBM:Substation |
| systemReports | | SDGE_CBM; S... | None | SDGE_CBM:systemReports |
| systemStatus | | SDGE_CBM; S... | None | SDGE_CBM:systemStatus |
| thermal | | SDGE_CBM; S... | None | SDGE_CBM:thermal |
| transformerAssets | | SDGE_CBM; S... | None | SDGE_CBM:transformerAssets |
| transformerType | | SDGE_CBM; S... | None | SDGE_CBM:transformerType |
| voltageLevel | | SDGE_CBM; S... | None | SDGE_CBM:voltageLevel |
| InstanceView | | | None | |

Elements

Transfers

Library

Unit of Measure

MyPI

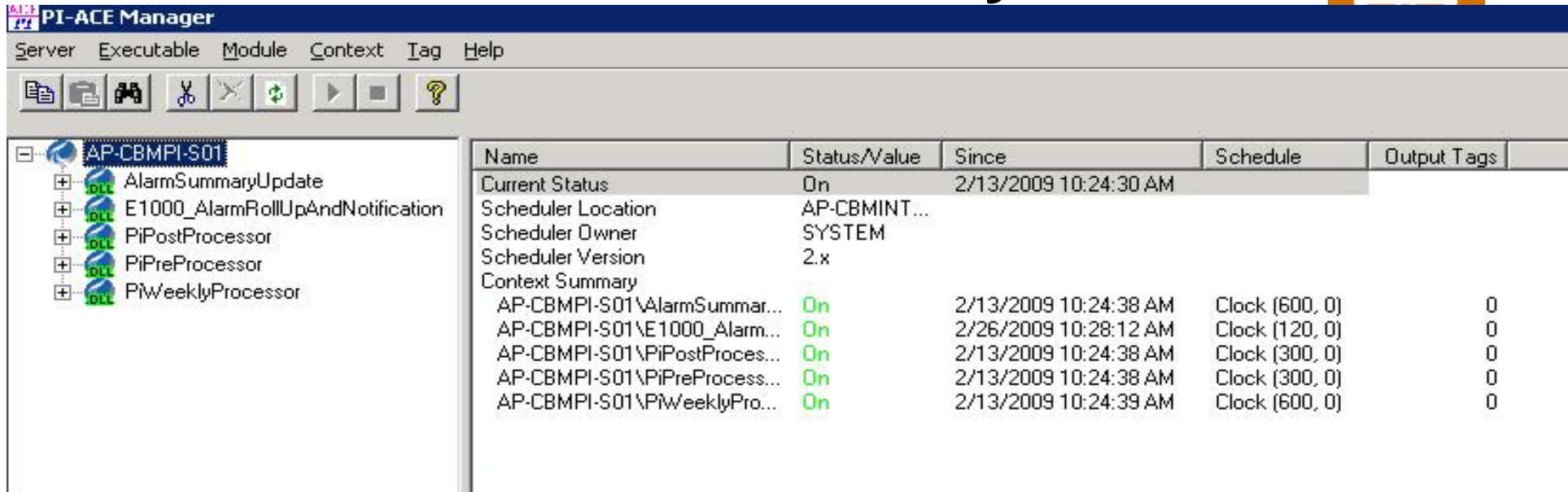
Notifications

Contacts

ClassView Modified: 10/28/2008 3:09:05 PM. Version: 1/1/1970 12:00:00 AM, Revision 1

Start CBM - PI System Expl... 8:06 AM

PI ACE Calculation and Analytics



| Name | Status/Value | Since | Schedule | Output Tags |
|-------------------------------|--------------|-----------------------|----------------|-------------|
| Current Status | On | 2/13/2009 10:24:30 AM | | |
| Scheduler Location | AP-CBMINT... | | | |
| Scheduler Owner | SYSTEM | | | |
| Scheduler Version | 2.x | | | |
| Context Summary | | | | |
| AP-CBMPI-S01\AlarmSummar... | On | 2/13/2009 10:24:38 AM | Clock (600, 0) | 0 |
| AP-CBMPI-S01\E1000_Alarm... | On | 2/26/2009 10:28:12 AM | Clock (120, 0) | 0 |
| AP-CBMPI-S01\ PiPostProces... | On | 2/13/2009 10:24:38 AM | Clock (300, 0) | 0 |
| AP-CBMPI-S01\ PiPreProcess... | On | 2/13/2009 10:24:38 AM | Clock (300, 0) | 0 |
| AP-CBMPI-S01\ PiWeeklyPro... | On | 2/13/2009 10:24:39 AM | Clock (600, 0) | 0 |

- Background Calculation Jobs
 - Alarm Tags Generation
 - Transformer Oil Analysis
 - Alarm Summary
 - Alarm Increase Reports
 - Alarm Decrease Reports

PI Notifications Management

The screenshot displays the 'CBM - PI System Explorer' application. The main window is titled 'Notifications' and shows a list of alarm levels on the left pane, including 'SX_BK60_LTC_AlarmLevel3', 'SX_BK60_LTC_AlarmLevel4', and others. The right pane is titled 'SX_BK60_LTC_AlarmLevel4' and shows the 'Trigger' tab. The 'Target' field is set to '\\AP-CBMINT-S01\CBM\SSICO Managed Models\SDGE_CBM\ClassView\LTC\SX 60 L'. The 'Conditions' section shows a table with one rule: 'Comparison' with configuration 'LTC.LTC_GROUP_ALM = 4', 'Time True' set to 0, 'Result' set to 'Alarm 4', and 'Priority' set to 'Normal'. The 'Time Rule' is set to 'Natural'. The 'Options' section includes a checked box for 'Notify only on change in status', 'Resend Interval' set to 0 seconds, and 'Non Repetition Interval' set to 0 seconds. The bottom status bar shows the time as 8:08 AM.

Notifications

New

- SX_BK60_LTC_AlarmLevel3
- SX_BK60_LTC_AlarmLevel4
- SX_BK60_Main Tank Buchholz Relay_AlarmLevel4
- SX_BK60_Main Tank COPS Membrane Failure_AlarmLe
- SX_BK60_Pressure Relief Device Main Tank_AlarmLev
- SX_BK60_THER_AlarmLevel3
- SX_BK60_THER_AlarmLevel4
- SX_BK60_Top Oil Gauge High Temp 1_AlarmLevel3
- SX_BK60_Top_Oil_Temp_AlarmLevel3
- SX_BK60_Top_Oil_Temp_AlarmLevel4
- SX_BK60_Winding Gauge High Temp 1_AlarmLevel3
- SX_BK70_BUSH_AlarmLevel3
- SX_BK70_BUSH_AlarmLevel4
- SX_BK70_Calculated Winding Hot Spot_AlarmLevel3
- SX_BK70_Calculated Winding Hot Spot_AlarmLevel4
- SX_BK70_DGA_AlarmLevel3
- SX_BK70_DGA_AlarmLevel4
- SX_BK70_DGA_CommFail_AlarmLevel2
- SX_BK70_DR_CommFail_AlarmLevel2
- SX_BK70_Low Oil Main Tank_AlarmLevel3
- SX_BK70_LTC_AlarmLevel3
- SX_BK70_LTC_AlarmLevel4
- SX_BK70_Main Tank Buchholz Relay_AlarmLevel4
- SX_BK70_Main Tank COPS Membrane Failure_AlarmLe
- SX_BK70_Pressure Relief Device Main Tank_AlarmLev

Elements

Transfers

Library

Unit of Measure

MyPI

Notifications

Contacts

SX_BK60_LTC_AlarmLevel4

Overview Trigger Content Subscriptions History

Target: \\AP-CBMINT-S01\CBM\SSICO Managed Models\SDGE_CBM\ClassView\LTC\SX 60 L Select A Target...

Conditions

New Condition

| Rule | Configuration | Time True | Result ... | Priority |
|------------|-----------------------|-----------|------------|----------|
| Comparison | LTC.LTC_GROUP_ALM = 4 | 0 | Alarm 4 | Normal |

Time Rule: Natural

Options


☒ Notify only on change in status

Resend Interval: 0 Seconds

Non Repetition Interval: 0 Seconds

Start CBM - PI System Expl... 8:08 AM

PI Notifications Email Alert

From:  opex2020cbm@semprautilities.com
To: CBM-XfmrLv4 Ack
Cc:
Subject: SX_BK71_THER_AlarmLevel4

Sent: Wed 1/21/2009 11:57 AM

Name: SX_BK71_THER_AlarmLevel4

Description:  Bank 71 Thermal Alarm Level 4

Server: AP-CBMINT-P01

Database: CBM2

Start Time: 1/21/2009 11:56:24 AM Pacific Standard Time (GMT-08:00:00)

Trigger Time: 1/21/2009 11:56:24 AM Pacific Standard Time (GMT-08:00:00)

Target: AP-CBMINT-P01\CBM2\SISCO Managed Models\SDGE_CBM\ClassView\thermal\SX 71 Thermal

Value: Alarm 4

Priority: Normal

Link:

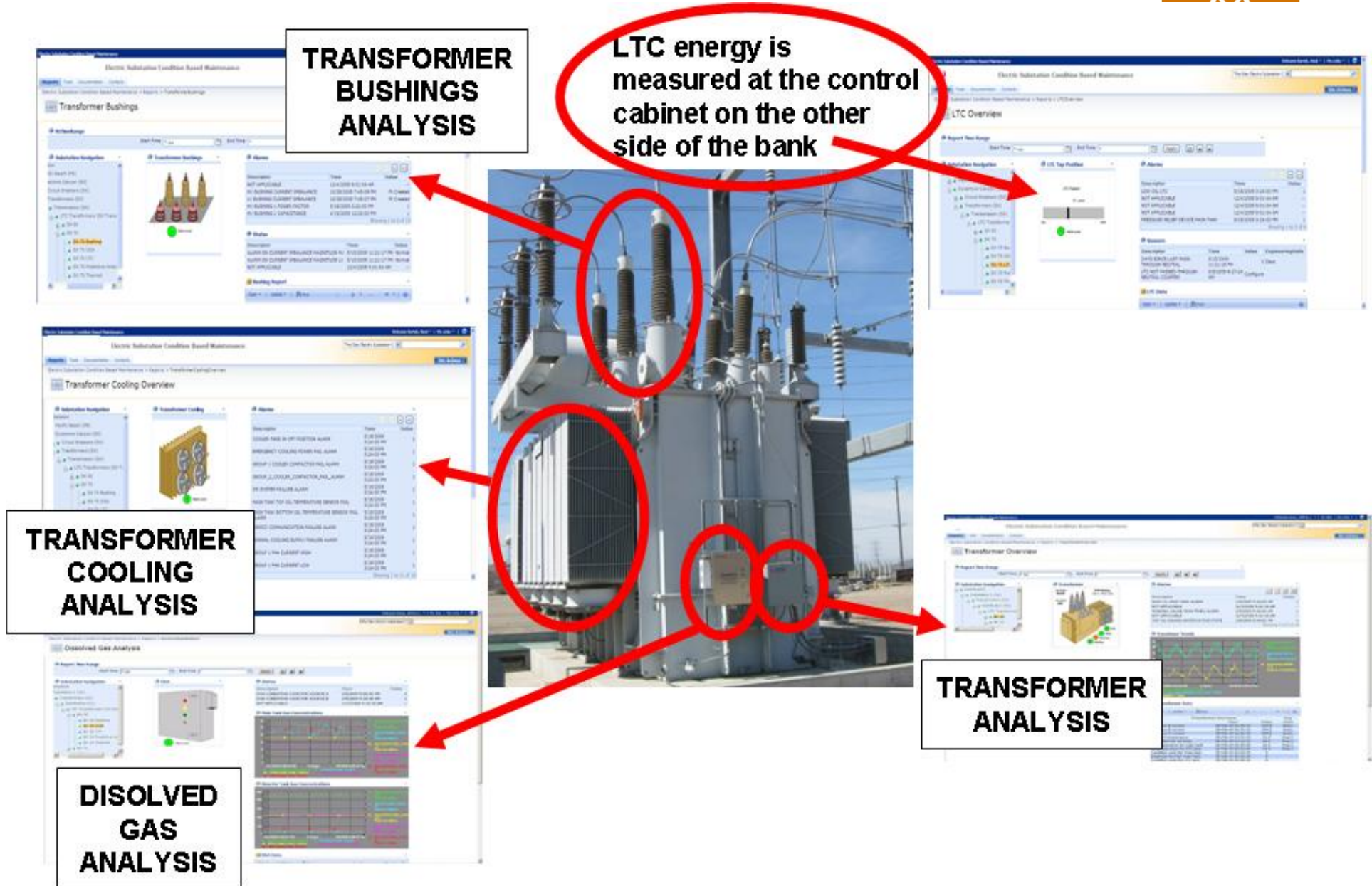
[SX - BK71 - Thermal](#)

Actions:

[Acknowledge](#)

[Acknowledge with comment](#)

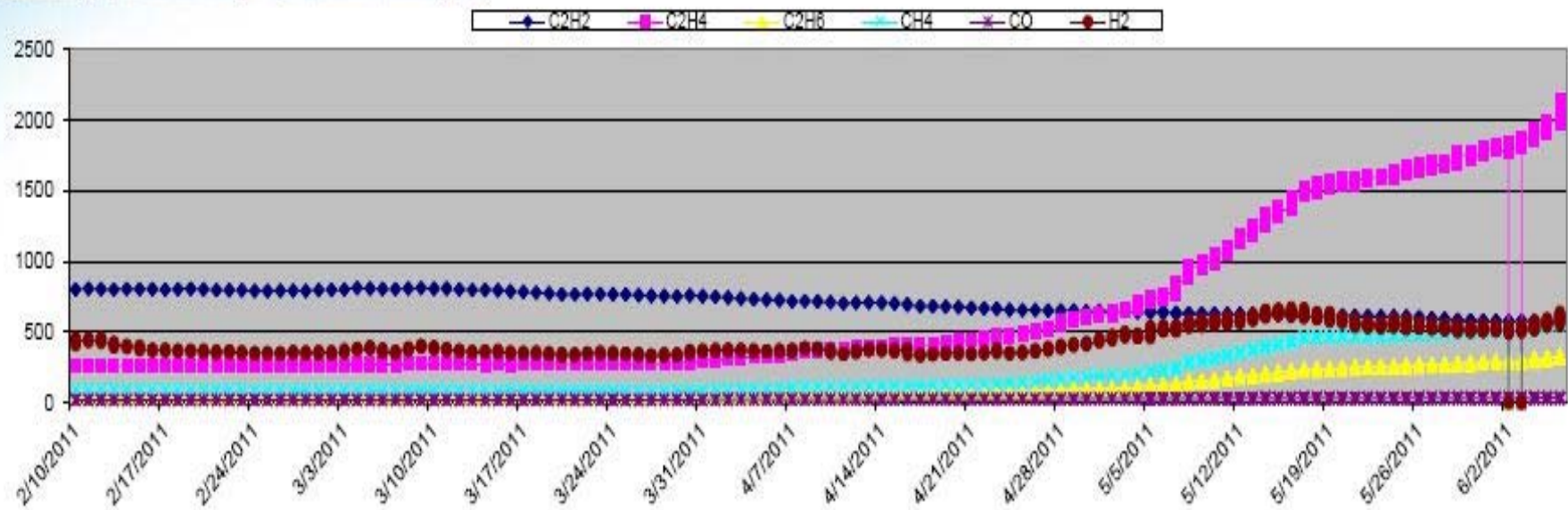
CBM Visualization and Reporting



Condition-Based Maintenance

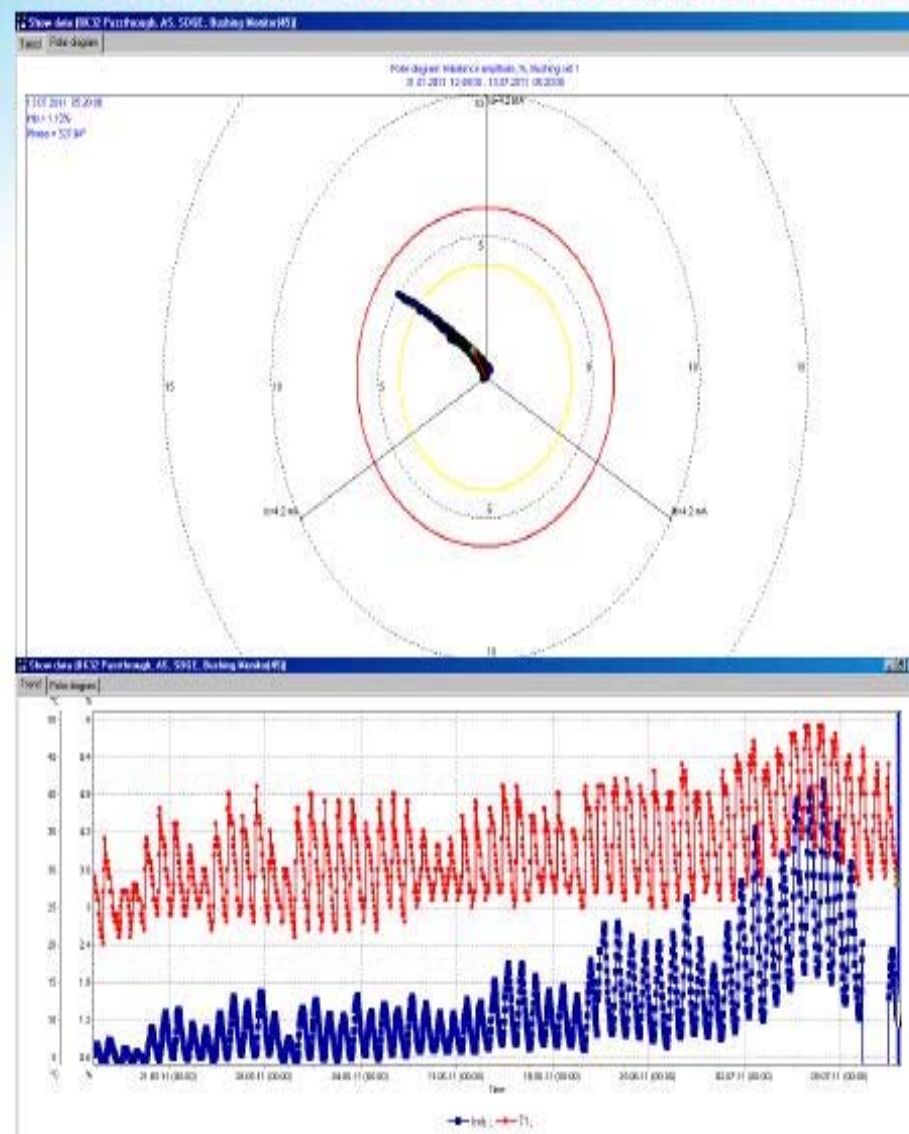


- June 2, 2011, DGA alert level 3 on LTC tank
- June 6, 2011, inspection resulted in replacement of LTC contacts from heating and coking



Condition-Based Maintenance

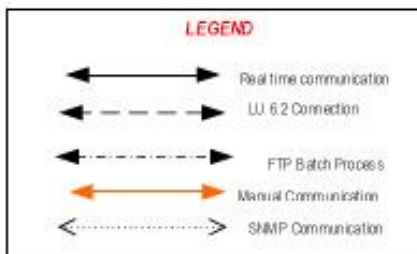
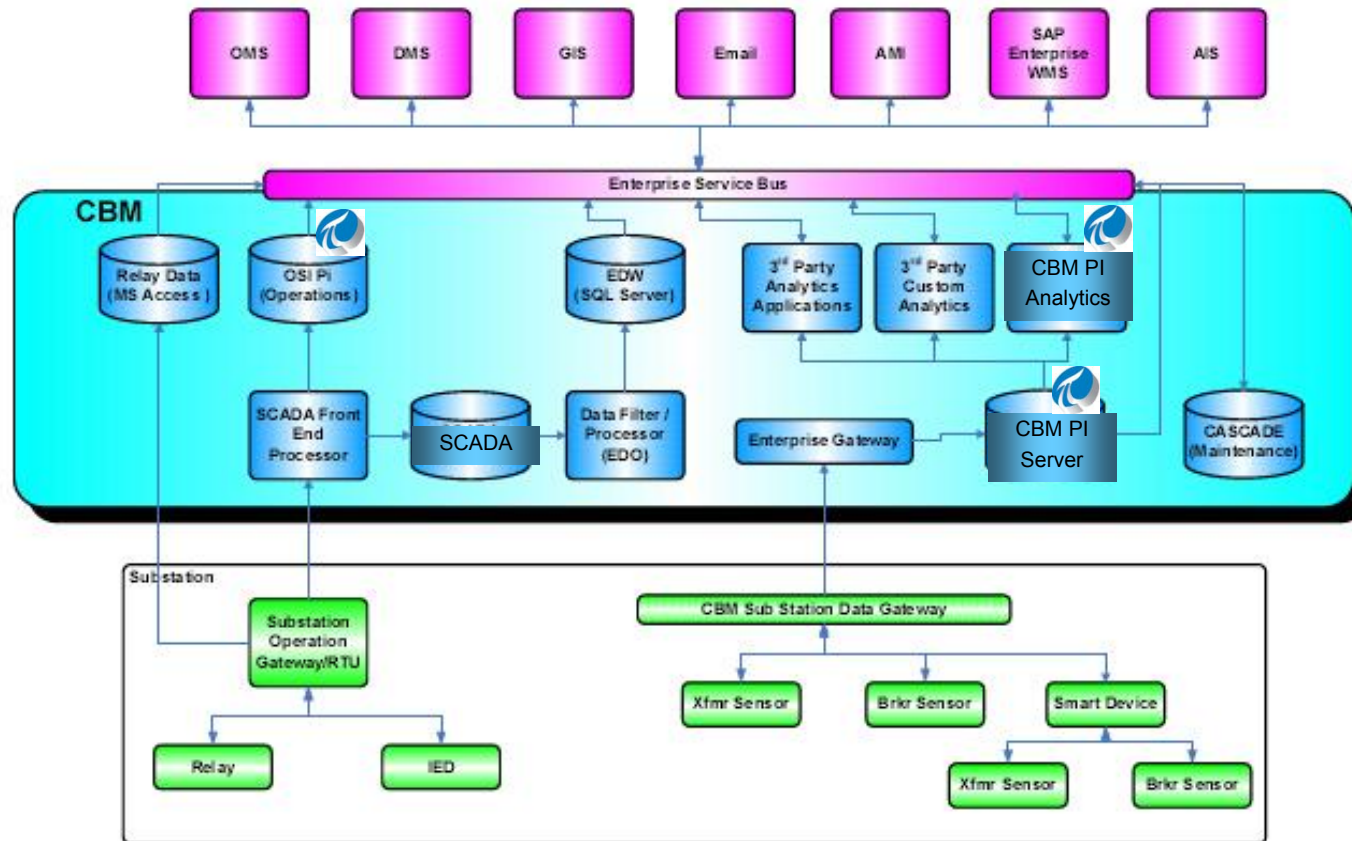
- July 19, 2011, Bushing Health Monitor alert on C-phase
- 2008 test = 0.3 power factor
- 2011 test = 2.25 power factor
- Transformer was removed from service and all three bushings were replaced



CBM Enterprise Integration



CBM TO-BE SYSTEM CONTEXT & DATA FLOW



Glossary

| | |
|-----|----------------------------------|
| EDW | Engineering Data Warehouse |
| AIS | Asset Information System |
| RTU | Remote Terminal Unit |
| IED | Intelligent Electronic Device |
| OMS | Outage Management System |
| CBM | Condition Based Maintenance |
| EDO | Electric Distribution Operations |

SDG&E-San Diego Gas & Electric Distribution Control Center



SDG&E Distribution Plans



- Interfacing weather data into CBM (Condition Based Maintenance) PI to make better operational decisions
- Installing dynamic line rating sensors to calculate conductor tension, sag, and real-time conductor
- Modifying existing distribution transformers, to allow for control of both customer load and distributed generation
- Maximizing transformer capacity by monitoring the current consumption, and scheduling electric vehicle charging and smart appliances during low loading periods
- Helping demand response and energy efficiency programs for customer and residential programs

SDG&E Load Curtailment Screen



- Enter total MW's required to be dropped
- Show circuit breakers status and MW load
- Automatically calculate how many breakers need to be opened and total customers are out
- Automatically publish to SDG&E public website and report to CPUC and Regulator

Microsoft Excel

Home Insert Page Layout Formulas Data Review View Developer Add-Ins

Dist LC 2010_Master_Final.xls [Compatibility Mode]

Ready

Daily Totals:

| | |
|------------------|------|
| ISO Requested MW | 0.00 |
| SDG&E MW Total | 0.00 |
| PGP MW Total | 0.00 |
| MW Dropped: | 0.00 |
| Cust Affected: | 0 |

Recalc every (min):

Include non-SCADA

Project

Test Mode

Send

Don't Send to Web

ISO Requested MW: 25.00

SDG&E Contribution: 35.72

PGP: 0

Run Start Time: 0

Run End Time: 0

Firm MW Dropped: 25.72

Customers Affected: 21,049

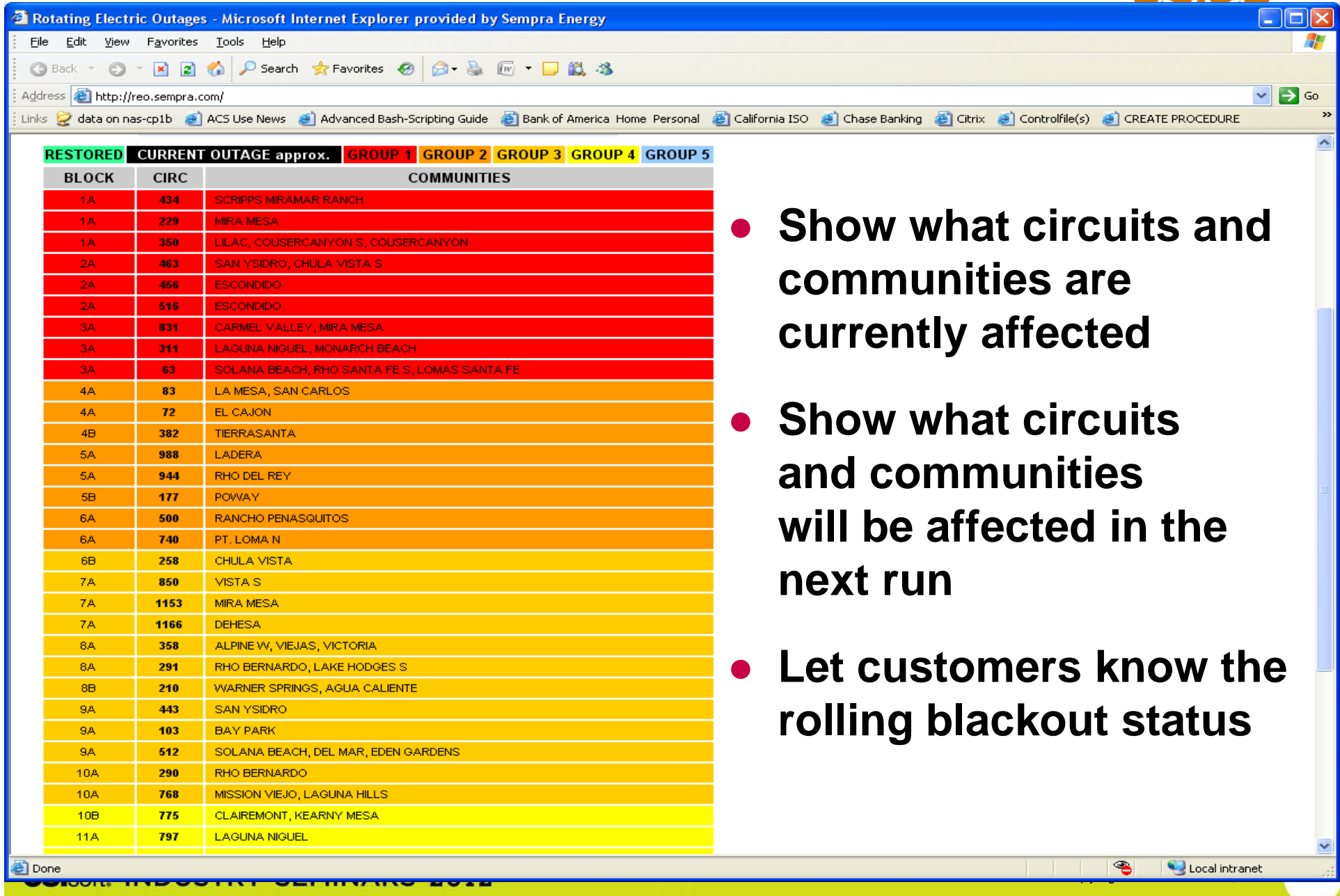
| Run #1 | Run #2 | Run #3 |
|--------|--------|--------|
| 25.00 | 25.00 | 25.00 |
| 30.62 | 30.62 | 27.30 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 25.72 | 30.62 | 27.30 |
| 21,049 | 15,636 | 12,776 |

| Order | Block | Circuit | Station | Total Customers | PI Breaker Status Tag | MW Tag | Real Time MW | Breaker Status | MW Dropped | Customers Affected |
|-------|-------|---------|---------|-----------------|-------------------------|-----------------------|--------------|----------------|------------|--------------------|
| 1 | 1A | 434 | SS | 2470 | D-SS_CIR_434*BRKR_3PH | D-SS_CIR_434*MV_3PH | 4.60 | CLOSE | 4.60 | |
| 2 | 1A | 229 | MR | 1808 | D-MR_CIR_229*BRKR_3PH | D-MR_CIR_229*MV_3PH | 2.87 | CLOSE | 2.87 | |
| 3 | 1A | 350 | LI | 1517 | D-LI_CIR_350*BRKR_3PH | D-LI_CIR_350*MV_3PH | 3.50 | CLOSE | 3.50 | |
| 4 | 2A | 463 | SYO | 1760 | D-SYO_CIR_463*BRKR_3PH | D-SYO_CIR_463*MV_3PH | 5.76 | CLOSE | 5.76 | |
| 5 | 2A | 456 | AS | 2407 | D-AS_CIR_456*BRKR_3PH | D-AS_CIR_456*MV_3PH | 3.05 | CLOSE | 3.05 | |
| 6 | 2A | 516 | ESCO | 934 | D-ESCO_CIR_516*BRKR_3PH | D-ESCO_CIR_516*MV_3PH | 4.13 | CLOSE | 4.13 | |
| 7 | 3A | 831 | NCV | 4465 | D-NCV_CIR_831*BRKR_3PH | D-NCV_CIR_831*MV_3PH | 5.46 | CLOSE | 5.46 | |
| 8 | 3A | 311 | LNL | 3163 | D-LNL_CIR_311*BRKR_3PH | D-LNL_CIR_311*MV_3PH | 2.63 | CLOSE | 2.63 | |
| 9 | 3A | 63 | DM | 2524 | D-DM_CIR_63*BRKR_3PH | D-DM_CIR_63*MV_3PH | 3.73 | CLOSE | 3.73 | |
| 10 | 4A | 83 | MY | 2354 | D-MY_CIR_83*BRKR_3PH | D-MY_CIR_83*MV_3PH | 1.79 | CLOSE | | 1.79 |
| 11 | 4A | 72 | EC | 2587 | D-EC_CIR_72*BRKR_3PH | D-EC_CIR_72*MV_3PH | 1.99 | CLOSE | | 1.99 |
| 12 | 4B | 382 | EL | 1169 | D-EL_CIR_382*BRKR_3PH | D-EL_CIR_382*MV_3PH | 7.68 | CLOSE | | 7.68 |
| 13 | 5A | 988 | MAR | 1243 | D-MAR_CIR_988*BRKR_3PH | D-MAR_CIR_988*MV_3PH | 1.92 | CLOSE | | 1.92 |
| 14 | 5A | 944 | TC | 1735 | D-TC_CIR_944*BRKR_3PH | D-TC_CIR_944*MV_3PH | 1.57 | CLOSE | | 1.57 |
| 15 | 5B | 177 | PO | 1335 | D-PO_CIR_177*BRKR_3PH | D-PO_CIR_177*MV_3PH | 7.00 | CLOSE | | 7.00 |
| 16 | 6A | 500 | CC | 2761 | D-CC_CIR_500*BRKR_3PH | D-CC_CIR_500*MV_3PH | 3.47 | CLOSE | | 3.47 |
| 17 | 6A | 740 | PL | 2452 | D-PL_CIR_740*BRKR_3PH | D-PL_CIR_740*MV_3PH | 5.20 | CLOSE | | 5.20 |
| 18 | 6B | 258 | MG | 2 | D-MG_CIR_258*BRKR_3PH | D-MG_CIR_258*MV_3PH | 1.02 | CLOSE | | 1.02 |
| 19 | 7A | 850 | SH | 410 | D-SH_CIR_850*BRKR_3PH | D-SH_CIR_850*MV_3PH | 4.60 | CLOSE | | 4.60 |
| 20 | 7A | 1153 | EG | 2 | D-EG_CIR_1153*BRKR_3PH | D-EG_CIR_1153*MV_3PH | 0.00 | CLOSE | | 0.00 |
| 21 | 7A | 1166 | LL | 314 | D-LL_CIR_1166*BRKR_3PH | D-LL_CIR_1166*MV_3PH | 0.26 | CLOSE | | 0.26 |
| 22 | 8A | 358 | AL | 1184 | D-AL_CIR_358*BRKR_3PH | D-AL_CIR_358*MV_3PH | 4.42 | CLOSE | | 4.42 |
| 23 | 8A | 291 | BE | 2051 | D-BE_CIR_291*BRKR_3PH | D-BE_CIR_291*MV_3PH | 3.82 | CLOSE | | 3.82 |
| 24 | 8B | 210 | VR | 192 | D-VR_CIR_210*BRKR_3PH | D-VR_CIR_210*MV_3PH | 0.88 | CLOSE | | 0.88 |
| 25 | 9A | 443 | SYO | 5 | D-SYO_CIR_443*BRKR_3PH | D-SYO_CIR_443*MV_3PH | 0.95 | CLOSE | | 0.95 |
| 26 | 9A | 103 | OT | 1518 | D-OT_CIR_103*BRKR_3PH | D-OT_CIR_103*MV_3PH | 3.02 | CLOSE | | 3.02 |
| 27 | 9A | 512 | DM | 2578 | D-DM_CIR_512*BRKR_3PH | D-DM_CIR_512*MV_3PH | 3.42 | CLOSE | | 3.42 |
| 28 | 10A | 290 | BE | 3127 | D-BE_CIR_290*BRKR_3PH | D-BE_CIR_290*MV_3PH | 2.33 | CLOSE | | 2.33 |
| 29 | 10A | 768 | TB | 1393 | D-TB_CIR_768*BRKR_3PH | D-TB_CIR_768*MV_3PH | 2.58 | CLOSE | | 2.58 |
| 30 | 10B | 775 | MSH | 779 | D-MSH_CIR_775*BRKR_3PH | D-MSH_CIR_775*MV_3PH | 6.72 | CLOSE | | 6.72 |
| 31 | 11A | 797 | LNL | 2767 | D-LNL_CIR_797*BRKR_3PH | D-LNL_CIR_797*MV_3PH | 2.18 | CLOSE | | 2.18 |
| 32 | 11A | 588 | PAR | 101 | D-PAR_CIR_588*BRKR_3PH | D-PAR_CIR_588*MV_3PH | 3.44 | CLOSE | | 3.44 |
| 33 | 11B | 774 | MSH | 478 | D-MSH_CIR_774*BRKR_3PH | D-MSH_CIR_774*MV_3PH | 6.84 | CLOSE | | 6.84 |
| 34 | 12A | 452 | AS | 3102 | D-AS_CIR_452*BRKR_3PH | D-AS_CIR_452*MV_3PH | 2.35 | CLOSE | | 2.35 |
| 35 | 12A | 517 | ESCO | 459 | D-ESCO_CIR_517*BRKR_3PH | D-ESCO_CIR_517*MV_3PH | 2.15 | CLOSE | | 2.15 |
| 36 | 12B | 487 | MH | 1667 | D-MH_CIR_487*BRKR_3PH | D-MH_CIR_487*MV_3PH | 2.24 | CLOSE | | 2.24 |
| 37 | 13A | 745 | GE | 17 | D-GE_CIR_745*BRKR_3PH | D-GE_CIR_745*MV_3PH | 4.50 | CLOSE | | 4.50 |
| 38 | 13A | 986 | MAR | 2843 | D-MAR_CIR_986*BRKR_3PH | D-MAR_CIR_986*MV_3PH | 2.20 | CLOSE | | 2.20 |
| 39 | 13A | 975 | CRE | 1341 | D-CRE_CIR_975*BRKR_3PH | D-CRE_CIR_975*MV_3PH | 1.43 | CLOSE | | 1.43 |
| 40 | 14A | 590 | PV | 2637 | D-PV_CIR_590*BRKR_3PH | D-PV_CIR_590*MV_3PH | 2.94 | CLOSE | | 2.94 |
| 41 | 14A | 468 | UB | 112 | D-UB_CIR_468*BRKR_3PH | D-UB_CIR_468*MV_3PH | 2.21 | CLOSE | | 2.21 |
| 42 | 14A | 1117 | BQ | 3865 | D-BQ_CIR_1117*BRKR_3PH | D-BQ_CIR_1117*MV_3PH | 4.30 | CLOSE | | 4.30 |
| 43 | 15A | 296 | SM | 3175 | D-SM_CIR_296*BRKR_3PH | D-SM_CIR_296*MV_3PH | 2.77 | CLOSE | | 2.77 |
| 44 | 15A | 438 | SS | 4058 | D-SS_CIR_438*BRKR_3PH | D-SS_CIR_438*MV_3PH | 4.54 | CLOSE | | 4.54 |
| 45 | 15A | 68 | DM | 1479 | D-DM_CIR_68*BRKR_3PH | D-DM_CIR_68*MV_3PH | 3.77 | CLOSE | | 3.77 |
| 46 | 16A | 112 | B | 2 | D-B_CIR_112*BRKR_3PH | D-B_CIR_112*MV_3PH | | | | |
| 47 | 16A | 947 | GA | 0 | D-GA_CIR_947*BRKR_3PH | D-GA_CIR_947*MV_3PH | | | | |
| 48 | 16A | 510 | DM | 1806 | D-DM_CIR_510*BRKR_3PH | D-DM_CIR_510*MV_3PH | | | | |

Ready Calculate

55%

Load Curtailment for SDG&E Public Website



The screenshot shows a Microsoft Internet Explorer window displaying the "Rotating Electric Outages" page from Semptra Energy. The page features a table with columns for status, circuit, and communities, categorized into five groups. The status column uses color-coding: green for "RESTORED", red for "CURRENT OUTAGE approx.", and yellow for "GROUP 1" through "GROUP 5".

| RESTORED | CURRENT OUTAGE approx. | GROUP 1 | GROUP 2 | GROUP 3 | GROUP 4 | GROUP 5 |
|----------|------------------------|--|---------|---------|---------|---------|
| BLOCK | CIRC | COMMUNITIES | | | | |
| | 434 | SCRIPPS MIRAMAR RANCH | | | | |
| | 229 | MIRA MESA | | | | |
| | 350 | LILAC, COUSERCANYON S, COUSERCANYON | | | | |
| | 463 | SAN YSIDRO, CHULA VISTA S | | | | |
| | 456 | ESCONDIDO | | | | |
| | 516 | ESCONDIDO | | | | |
| | 831 | CARMEL VALLEY, MIRA MESA | | | | |
| | 311 | LAGUNA NIGUEL, MONARCH BEACH | | | | |
| | 63 | SOLANA BEACH, RHO SANTA FE S, LOMAS SANTA FE | | | | |
| | 83 | LA MESA, SAN CARLOS | | | | |
| | 72 | EL CAJON | | | | |
| | 382 | TIERRASANTA | | | | |
| | 988 | LADERA | | | | |
| | 944 | RHO DEL REY | | | | |
| | 177 | POWAY | | | | |
| | 500 | RANCHO PENASQUITOS | | | | |
| | 740 | PT. LOMA N | | | | |
| | 258 | CHULA VISTA | | | | |
| | 850 | VISTA S | | | | |
| | 1153 | MIRA MESA | | | | |
| | 1166 | DEHESA | | | | |
| | 358 | ALPINE W, VIEJAS, VICTORIA | | | | |
| | 291 | RHO BERNARDO, LAKE HODGES S | | | | |
| | 210 | WARNER SPRINGS, AGUA CALIENTE | | | | |
| | 443 | SAN YSIDRO | | | | |
| | 103 | BAY PARK | | | | |
| | 512 | SOLANA BEACH, DEL MAR, EDEN GARDENS | | | | |
| | 290 | RHO BERNARDO | | | | |
| | 768 | MISSION VIEJO, LAGUNA HILLS | | | | |
| | 775 | CLAIREMONT, KEARNY MESA | | | | |
| | 797 | LAGUNA NIGUEL | | | | |

- Show what circuits and communities are currently affected
- Show what circuits and communities will be affected in the next run
- Let customers know the rolling blackout status



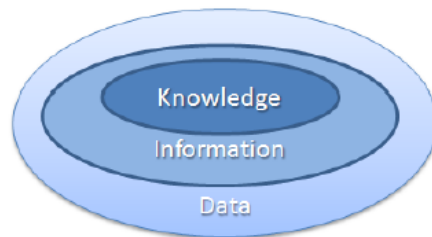
4. PI as the platform for reporting and BI across and beyond the Enterprise

Business Intelligence by leveraging real-time data from OSIsoft PI



What is Business Intelligence?

Business Intelligence is the ability to transform data into information and information into knowledge, so as to optimize the process of making business decisions



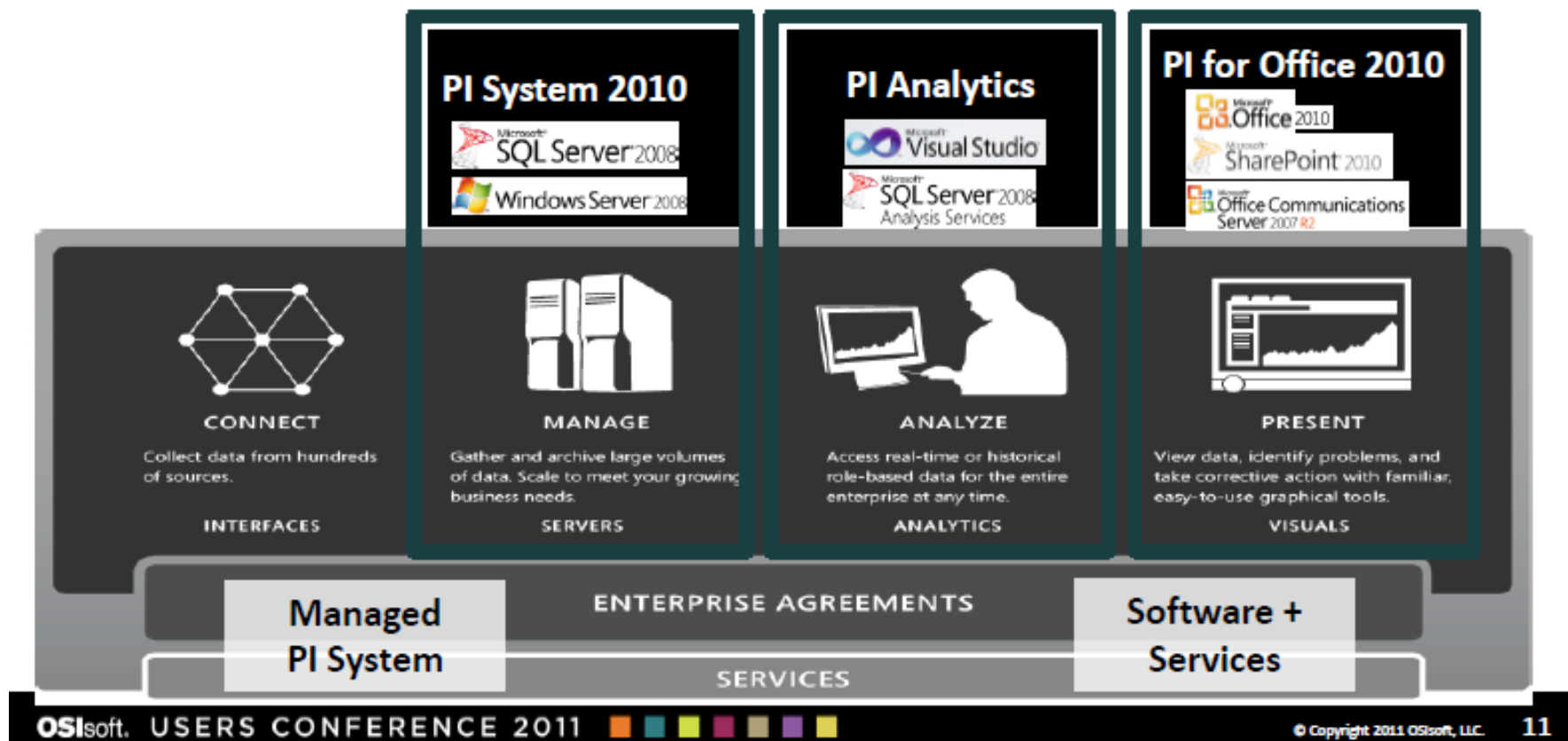
CFE BI Project Vision

- CFE had no Business Intelligence (BI) applications in the information system infrastructure that is currently supported by OSIsoft Technology
- As BI applications are required to achieve rapid and sustained growth of CFE Energy Market
- Utilizing the real-time infrastructure provided by the OSIsoft PI System and Microsoft latest technology offerings

Leveraging OSIsoft & Microsoft alliance to deliver best-of-breed BI



OSIsoft/Microsoft Integration



Using PI-AF to create an contextual model for an easier access to data



PI AF Hierarchy

GAO01

| Name | Value |
|---------------|----------------------|
| Capacidad... | 31500 |
| Clave | GAO01 |
| Descripcion | |
| EnergiaBruta | 27.6940002441 406 kW |
| EnergiaNeta | 26.4950008392334 kW |
| Fecha de ... | 1/1/2002 12:00:00 AM |
| Fecha de ... | 1/1/2020 12:00:00 AM |
| Nodo | GAO01 |
| Tipo de pa... | CPE |

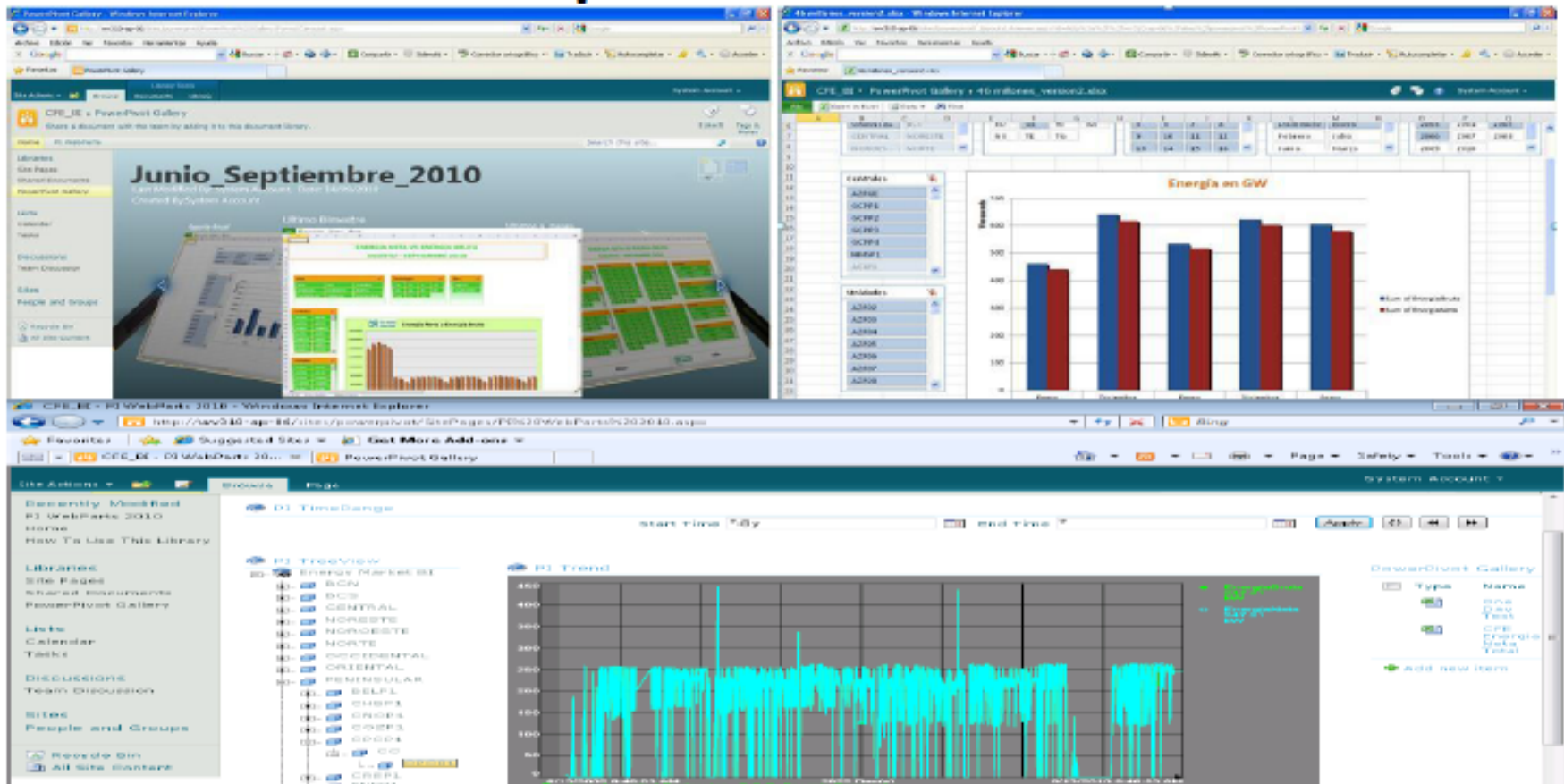
Built Complete Hierarchy

For Area, Central, Type of Generation Unit

Web Portal strategy to make data readily available in a contextual manner



SharePoint Site Implementation



Easy access to data for end users



End Users PowerPivot Reports

- Internet Explorer 8
- Silverlight
- Office 2010
- PowerPivot for Office 2010
- PI SQL Commander
- PI System Explorer 2010
- PI DataLink 2010



Intangible benefits...



Intangible Benefits

- To provide the users with a single channel to operate comprehensive information brought from different data sources
- Users can generate their own reports and analyze data
- Users can publish their own reports
- Users can download reports to the local machines for their own further analysis
- Have a common repository for all reports
- Provide analysis in time
- Provide the mass data storage but with excellent response time (in seconds)



5. PI as the backbone for SmartGrid

SDG&E Enterprise Initiatives

| SDG&E EA Initiatives | | 2012 | | | | | | | | | | | | 2013 | | | | | | | | | | | |
|-------------------------------|----------------------------|------|---|---|---|---|---|---|---|---|---|---|---|------|---|---|---|---|---|---|---|---|---|---|---|
| | | J | F | M | A | M | J | J | A | S | O | N | D | J | F | M | A | M | J | J | A | S | O | N | D |
| Consolidate PI Systems | | | | | | | | | | | | | | | | | | | | | | | | | |
| | EMS | | | | | | | | | | | | | | | | | | | | | | | | |
| | CBM | | | | | | | | | | | | | | | | | | | | | | | | |
| | Power Generation | | | | | | | | | | | | | | | | | | | | | | | | |
| | AF Modeling | | | | | | | | | | | | | | | | | | | | | | | | |
| New Data Collection | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Sustainable Community PV | | | | | | | | | | | | | | | | | | | | | | | | |
| | Substation PV | | | | | | | | | | | | | | | | | | | | | | | | |
| | Weather | | | | | | | | | | | | | | | | | | | | | | | | |
| | AES | | | | | | | | | | | | | | | | | | | | | | | | |
| | On Ramp Wireless | | | | | | | | | | | | | | | | | | | | | | | | |
| | Synchrophasors | | | | | | | | | | | | | | | | | | | | | | | | |
| | Smart Meters (Cell Relays) | | | | | | | | | | | | | | | | | | | | | | | | |
| Use Cases | | | | | | | | | | | | | | | | | | | | | | | | | |
| | Borrego Springs Microgrid | | | | | | | | | | | | | | | | | | | | | | | | |
| | Dynamic Voltage Support | | | | | | | | | | | | | | | | | | | | | | | | |
| | EV Detection | | | | | | | | | | | | | | | | | | | | | | | | |
| | Dynamic Line Rating | | | | | | | | | | | | | | | | | | | | | | | | |

Draft of recent activity for illustration purposes

SDG&E Borrego Springs Microgrid Project

Utilize advanced technologies to integrate and manage distributed resources within the Smart Grid

| | |
|-----------|--|
| Budget: | \$7.5M DOE and \$2.8M CEC plus matching funds from SDG&E and partners |
| Benefits: | <ul style="list-style-type: none">▪ Integrate and leverage various generation and storage configurations▪ Reduce the peak load of feeders and enhance system reliability▪ Enable customers to become more active participants in managing their energy use |



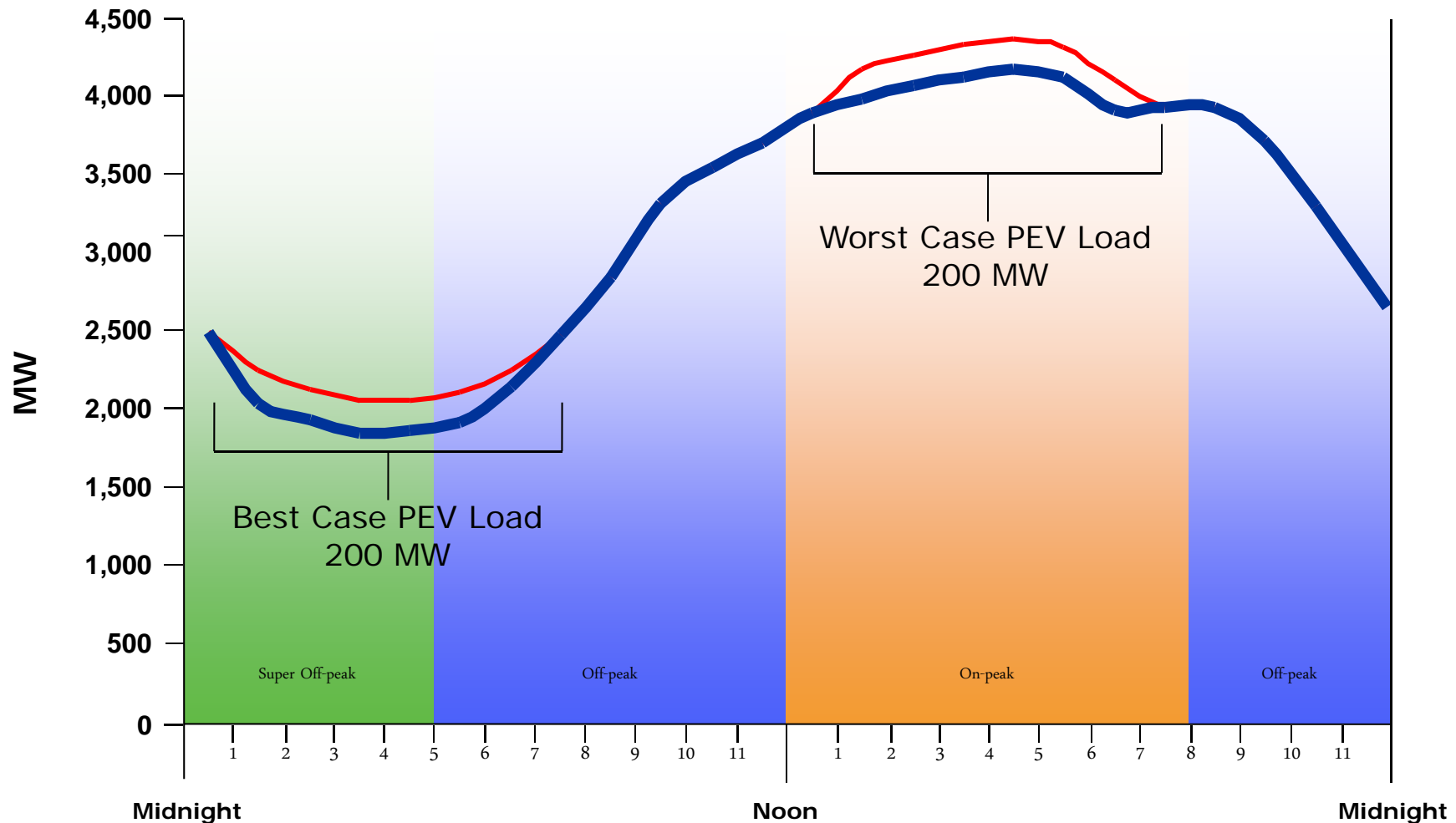
Other Microgrid Types and Variations

- Loads and/or generation with special needs
- Residential (e.g. HAN)
- Commercial or industrial facilities
- Commercial or industrial campuses (multiple facilities/loads)
- Larger campuses (e.g. Universities)
- Clearly delineated distribution systems and/or generation (e.g. portions of cities, military bases)
- Utility/Grid integrated
- Primary distribution system for developing or remote areas

Electric Vehicles: Smart Grid Will Encourage Off-Peak Charging

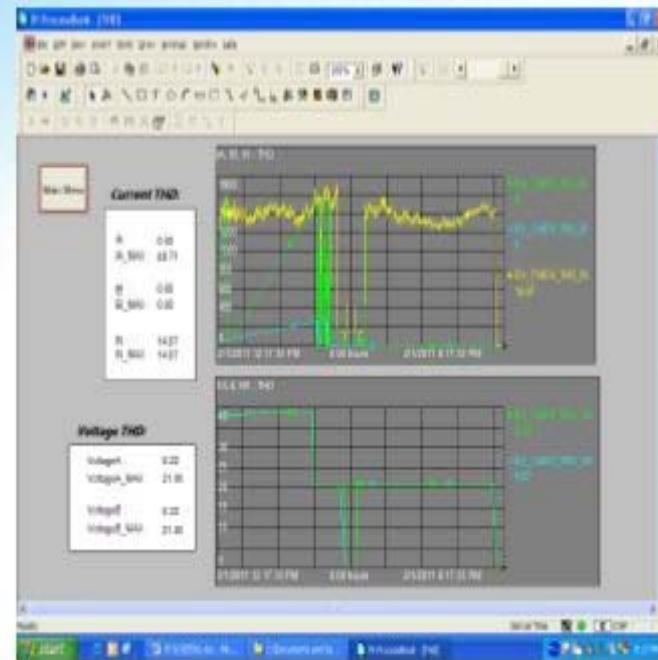


Example Summer Daily Load Profile



Innovation does not wait...

EV Analytics





THANK YOU

Brought to you by  **OSIsoft.**