OSIsoft.

REGIONAL SEMINAR 2012
E M E A
The **Power** of **Data**

Examples for Leveraging Real-time Infrastructure Value

Presented by

Zsolt A. Oros
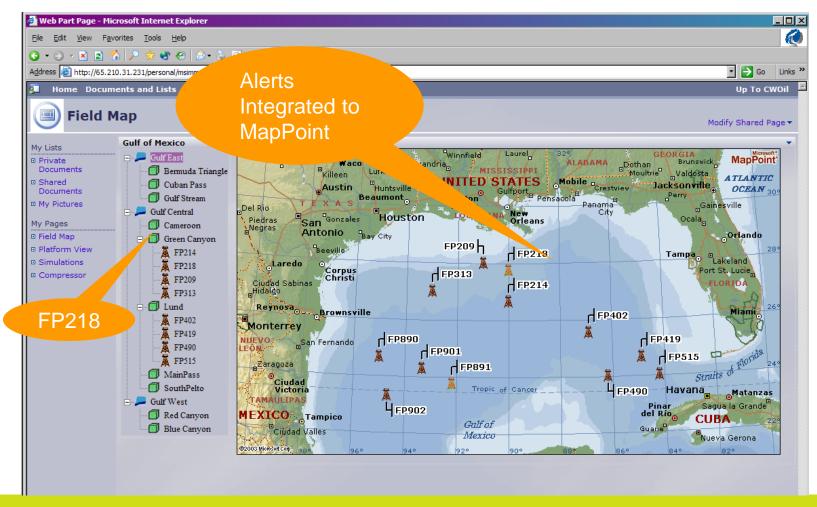
Zsolt.oros@osisoft.com
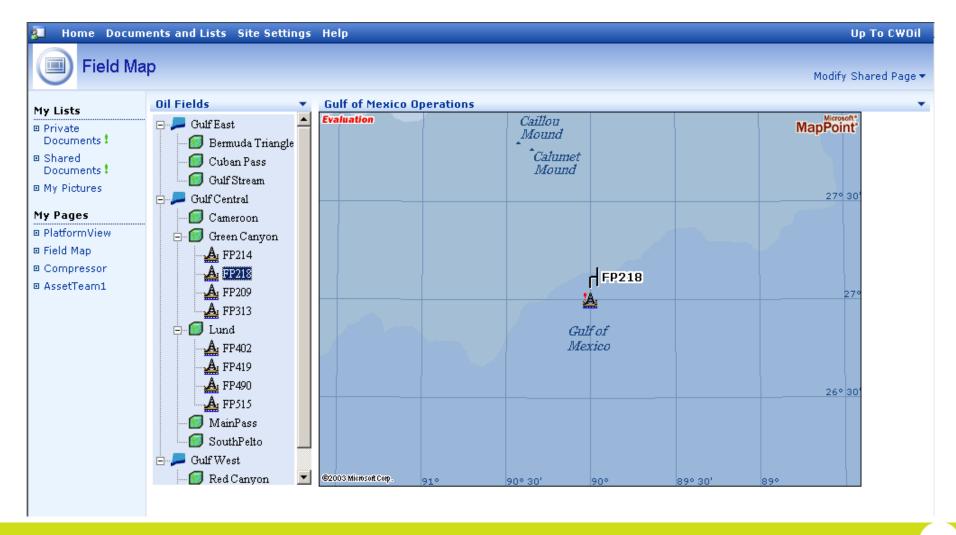
Regional Account Executive, CEE

OSIsoft UK Ltd.

PI Use Cases in the Oil&Gas Industry

PI at Enterprise/Divisional Level
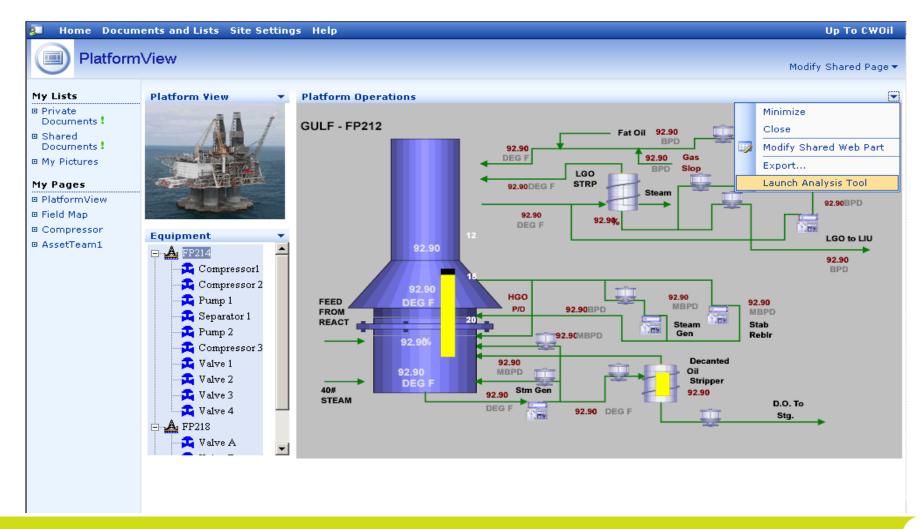
- OSIsoft's Asset Hierarchy linked (SharePoint Connections) to Microsoft MapPoint Web Services Web Part

PI at Enterprise/Divisional Level
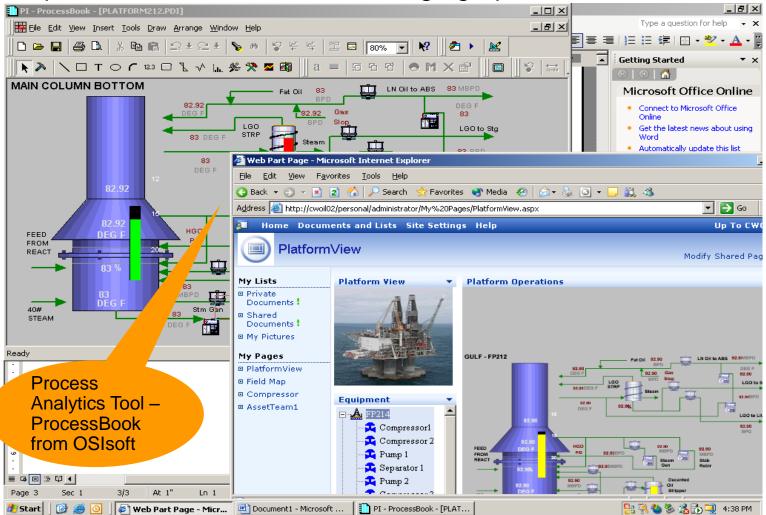
- Drill Down and Update from MapPoint Web Services

PI at Enterprise/Divisional Level

- Navigating Data dictionary based Treeview down to the Platform View

PI at Enterprise/Divisional Level
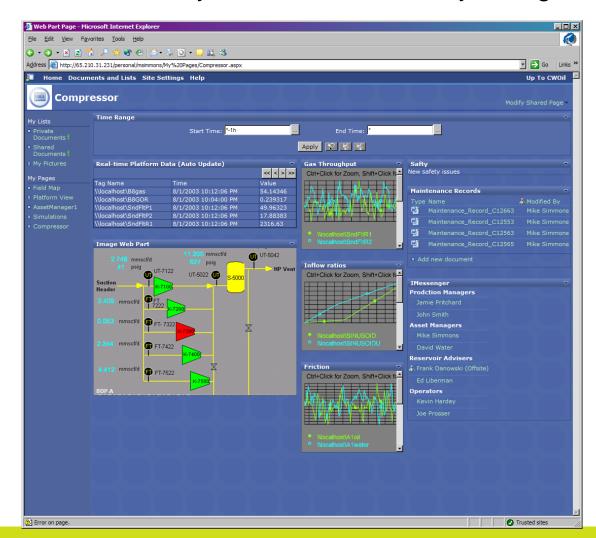
- Experts can use rich client to change graphics structure

Process Analytics Tool – ProcessBook from OSIsoft

PI at Enterprise/Divisional Level

- Sharepoint technology allows combination of real-time and non real-time webparts

PI at Enterprise/Divisional Level
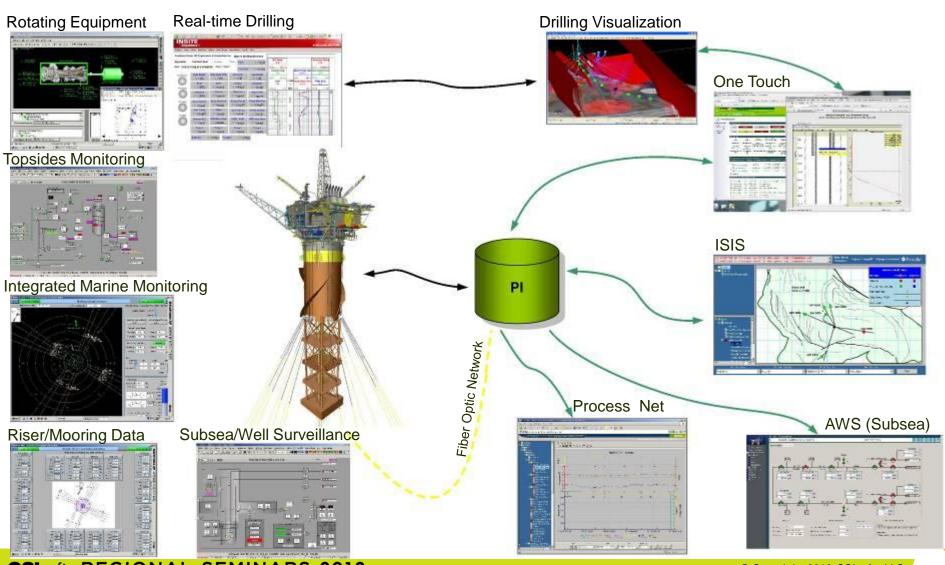
- Data Directory allows to track history changes on asset level
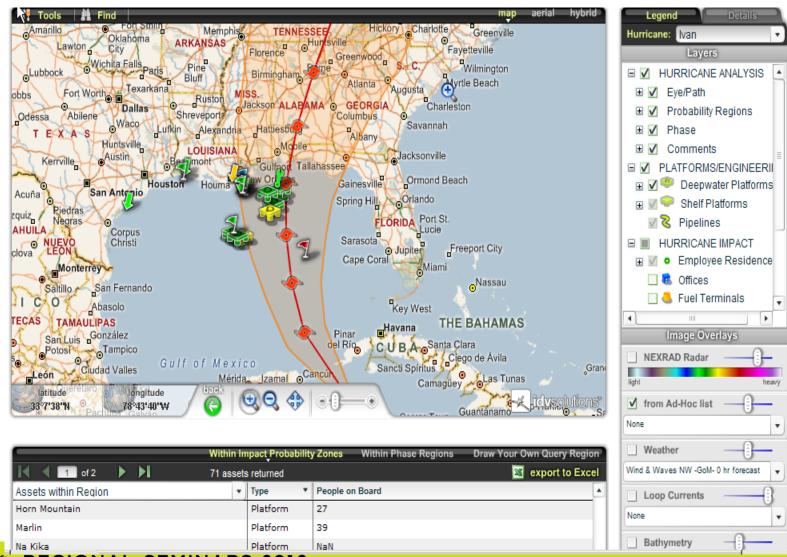
Example - BP Exploration & Production

Real-time Data – Usage in Different Contexts

Rotating Equipment

Real-time Drilling

Drilling Visualization

One Touch

Topsides Monitoring

ISIS

Integrated Marine Monitoring

PI

Fiber Optic Network

Process Net

Riser/Mooring Data

Subsea/Well Surveillance

AWS (Subsea)

Example - BP Exploration & Production

Crisis Management – Weather, Geo and Production Data

BP Example

Advanced Collaborative Environment

- Onshore Remote Ops Support

- Replicated Offshore Data (Read-Only)

- 24/7 Video Conferencing

- Real-time Monitoring:
  - Topsides
  - Marine
  - Subsea
  - Drilling

Offshore Line of Sight

Virtual Team Meetings
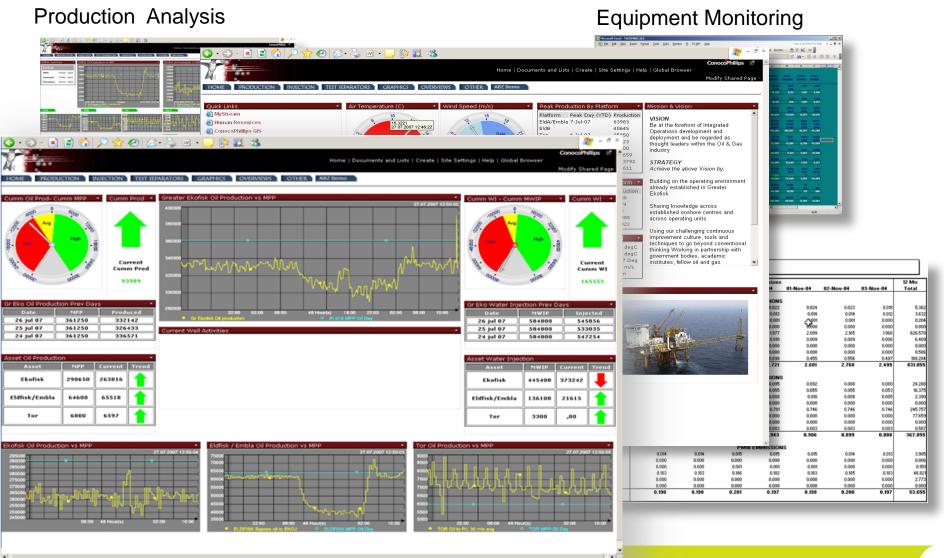
Dedicated Onshore Team
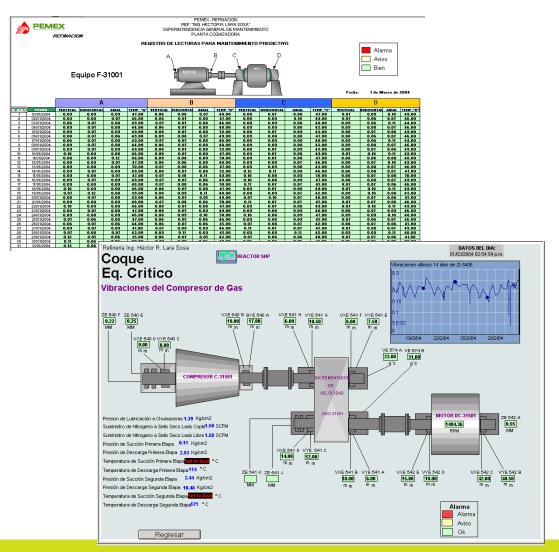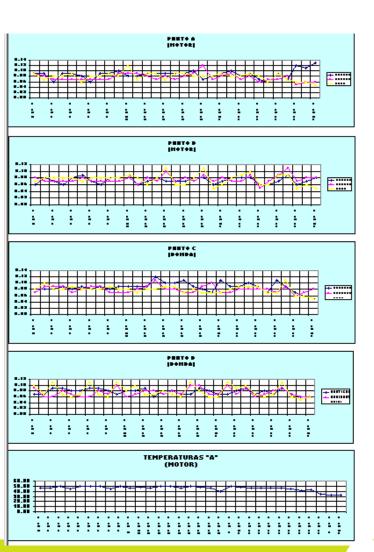
Conoco-Phillips E&P – North Sea
Analysis Tools to Support Asset and Cross-Asset Collaboration

Production Analysis

Equipment Monitoring
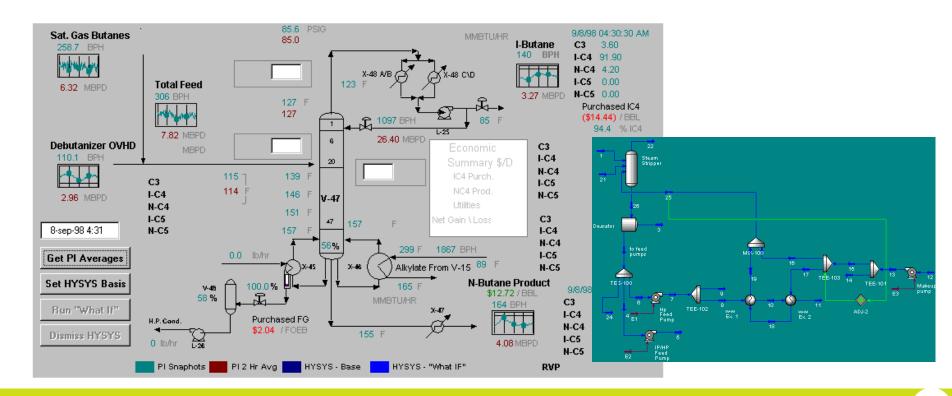
Example – Site Level (Local)
Equipment Health Monitoring – Compressor (3.)

Example – Site Level (Local)
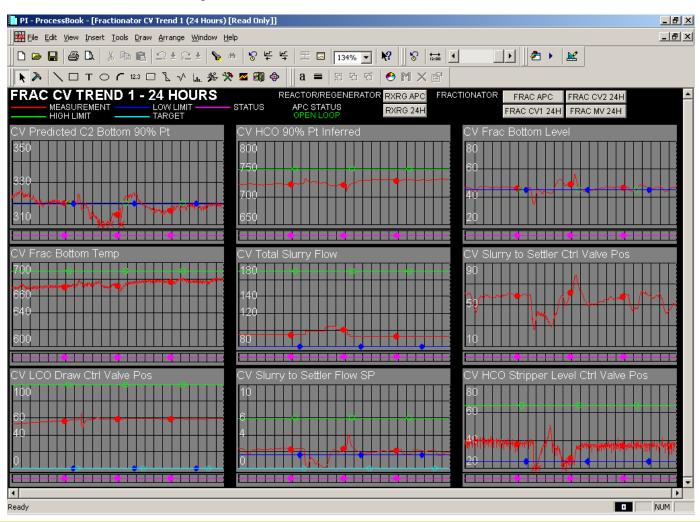
Process Simulator Integration

To smooth out raw operational data for use in the model, two-hour averages are used. The "Get PI Averages" button retrieves these averages from the PI database for the two-hour period around the specified time. In this example, the lab data timestamp is used. Averaged values are show in brown on the display. Trends shown for feed and product flows reflect the same two-hour period. Of course, the timestamp specified could be for any time in the PI database history. If this was the case, historical values for laboratory data and process economic would also be displayed.

Examples – Site Level (Local)

APC Performance Monitoring
MPC - Constraint Analysis

Examples – Site Level (Local)
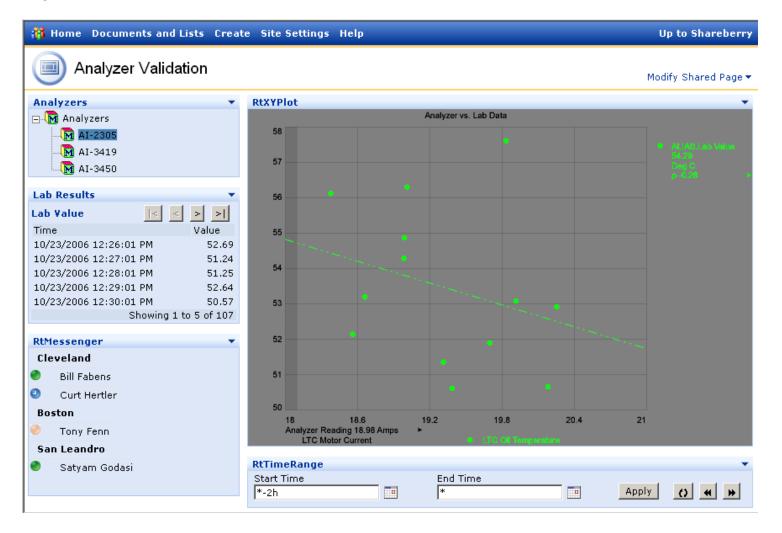
Product Quality Management

- Statistical Quality Control
- Process Stability
- Applied to any PI Value
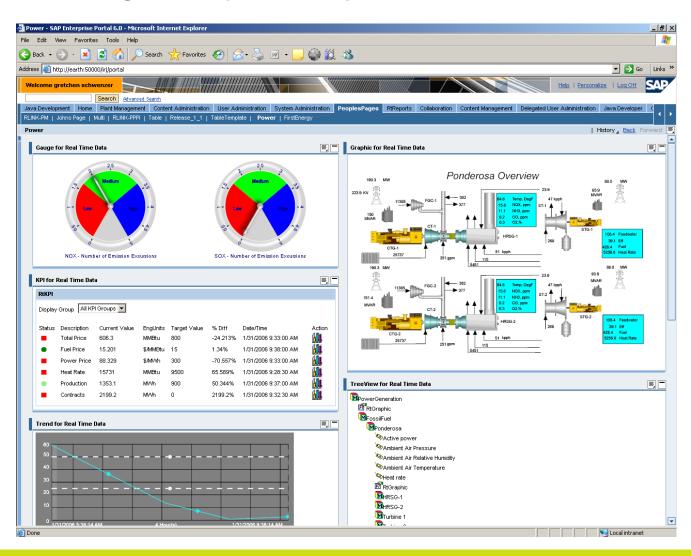
Examples – Site Level (Local)

Analyzer Validation

Examples – Site Level (Local)
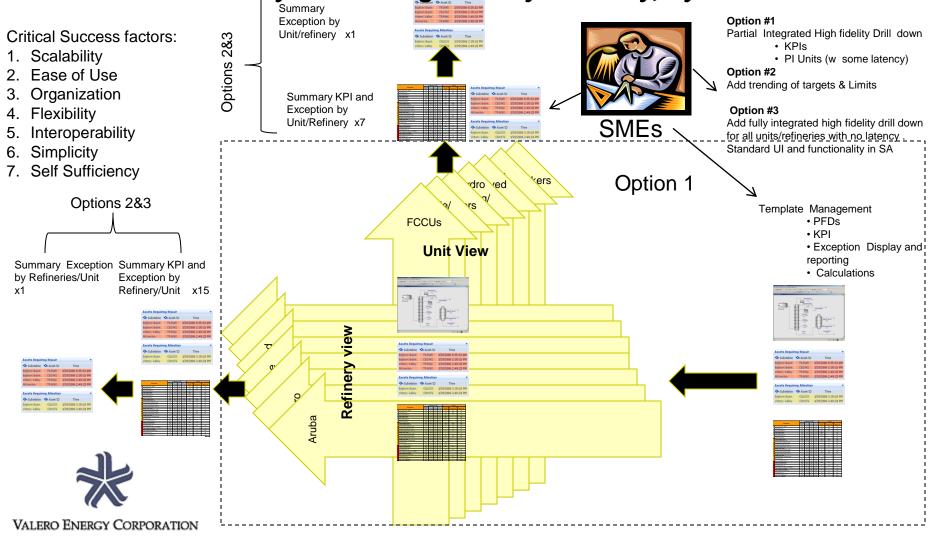
Performance Management (Site KPIs)

Example – Enterprise Level
SMEs Continuously Monitoring KPIs by Refinery, by Processes

Critical Success factors:
1. Scalability
2. Ease of Use
3. Organization
4. Flexibility
5. Interoperability
6. Simplicity
7. Self Sufficiency

Options 2&3

Summary Exception by Unit/refinery x1

Summary KPI and Exception by Unit/Refinery x7

Option #1
Partial Integrated High fidelity Drill down
- KPIs
- PI Units (w some latency)

Option #2
Add trending of targets & Limits

Option #3
Add fully integrated high fidelity drill down for all units/refineries with no latency . Standard UI and functionality in SA

SMEs

Option 1

Option 1

Template Management
- PFDs
- KPI
- Exception Display and reporting
- Calculations

Options 2&3

Summary Exception by Refineries/Unit x1

Summary KPI and Exception by Refinery/Unit x15

FCCUs

Unit View

Refinery view

Aruba

VALERO ENERGY CORPORATION

PI Use Cases in the Power Generation Industry
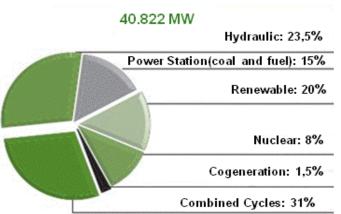
Iberdrola Case Study – CMDS
Overview

- *Background Information on Iberdrola:*
  - Power Generation, Transmission&Distribution
  - Global Operations, one of the biggest in the world
  - World Leader in Renewables
- *Drivers:*
  - One Combined Cycle 2GTx1ST
    - ≈ 350 M€ Investment
    - Gas Prices / Equipment Prices Increasing
    - Environmental concerns increasing
    - ⇨ **Optimization IS A MUST**

- *History:*
  - CMDS: Monitoring, Diagnostics and Simulation
    - Technology Center for the CC Fleet (O&M)
- *Current Status:*
  - Renewables Integrated (WINDCore)
  - Coal-fired plants underway

IBERDROLA

SANTURCE
400 MW, 109FA

CASTEJÓN
400 MW, 109FA

TARRAGONA POWER
400 MW , 1FA

CASTELLÓN A
800 MW, 209FA

CASTELLÓN B
800 MW, 209FB

ARCOS I y II
800 MW, 2X109 FA

ARCOS III
800 MW, 209FB

ESCOMBRERAS
800 MW, 209FB

ACECA
400 MW, 109FA

40.822 MW

- Hydraulic: 23,5%
- Power Station(coal and fuel): 15%
- Renewable: 20%
- Nuclear: 8%
- Cogeneration: 1,5%
- Combined Cycles: 31%

Iberdrola Case Study – CMDS
Goals & Objectives

MAIN GOALS

- Maximize efficiency, availability and reliability
- Support power plants to:
  - ➢ OPERATE &MAINTAIN in an optimum way
  - ➢ Minimize costs
  - ➢ Unify technology management

POWER PLANTS O&M OPTIMISATION

ADDITIONAL BENEFITS

- Common O&M model for all stations : Fleet approach
- O&M on-site and on-line support
- Share operational experiences and best practices
- Center of Excellence
- Reduce OEM dependency
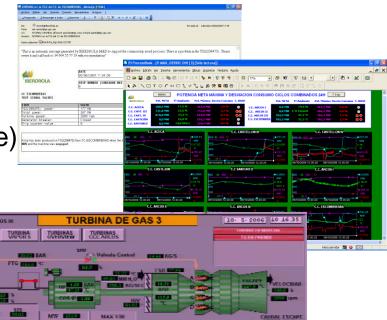
Iberdrola Case Study – CMDS

PI is the foundation for CMDS

- Applications Developed Over Time
  - Performance Tracking
  - Contract Tracking
  - System Advisor
  - AEM (Advanced Equipment Monitoring)
  - IT Doctor
  - GE M&D Connection
  - SAP Connection (PM & BW Module)
  - EMS Connection (Dispatching Center)
  - Daily Inspections
  - Others…….

Iberdrola Case Study – CMDS

Benefits / Lessons Learned

- 6 years PI System experience over Combined Cycle Technology:
  - Quick ROI ≈ 1-2 years
  - Increasing efficiency →1%-2%
  - Increasing availability → 0,1%-0,5%
- Easily exportable to another business
- Opening the platform for all users = A lot of value
- Focus on business drivers – Business Agility
- Event based monitoring
- Success requires collaboration between operations, maintenance and engineering

IBERDROLA

BChydro Case Study – OI System
Overview

- *Bacground Information on BChydro:*
  - BChydro is third largest utility in Canada
  - Predominantly a hydro electric utility with 10,000 MW of installed hydro generation capacity
  - 7 largest generating stations with 38 turbines make up 8,850 MW

- *Drivers:*
  - Water use and generation optimization
  - Keep the plants running (O&M)

- *History:*
  - PI has been used since 1996. PI used first as a firewall to the Energy Management SCADA system.
  - In 1999 PI used to support Generation Operations
    - Generating Stations (the power generated in MW)
    - Resource Management (water availability and generation optimization)
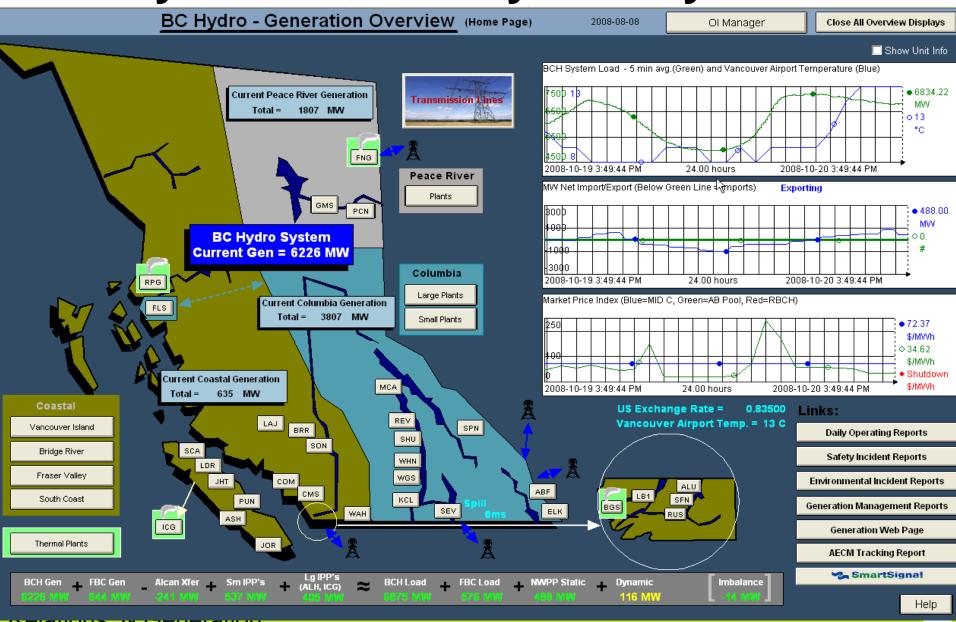
- *Current Situation:*
  - PI is the foundation for B.C.Hydro's Operational Information (OI) System
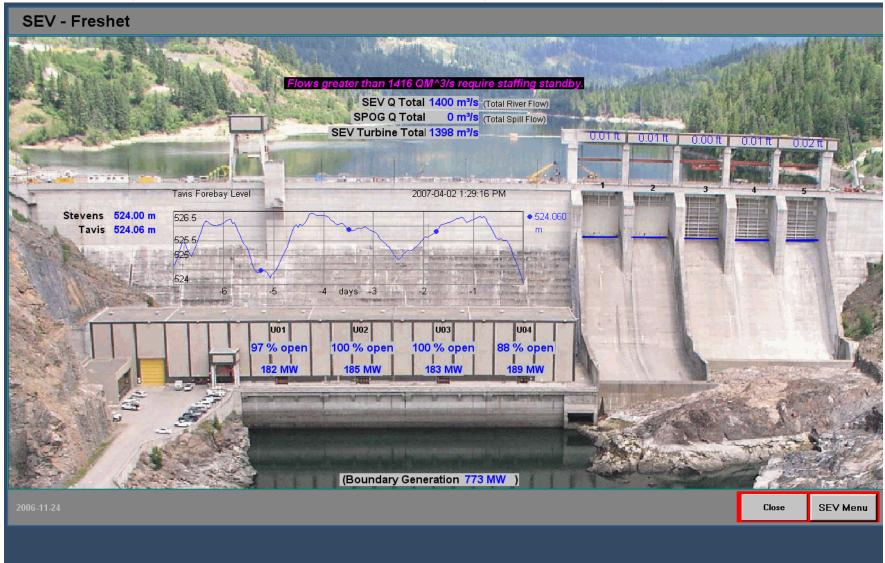
BChydro Case Study – OI System

BChydro Case Study – OI System

BChydro Case Study – OI System
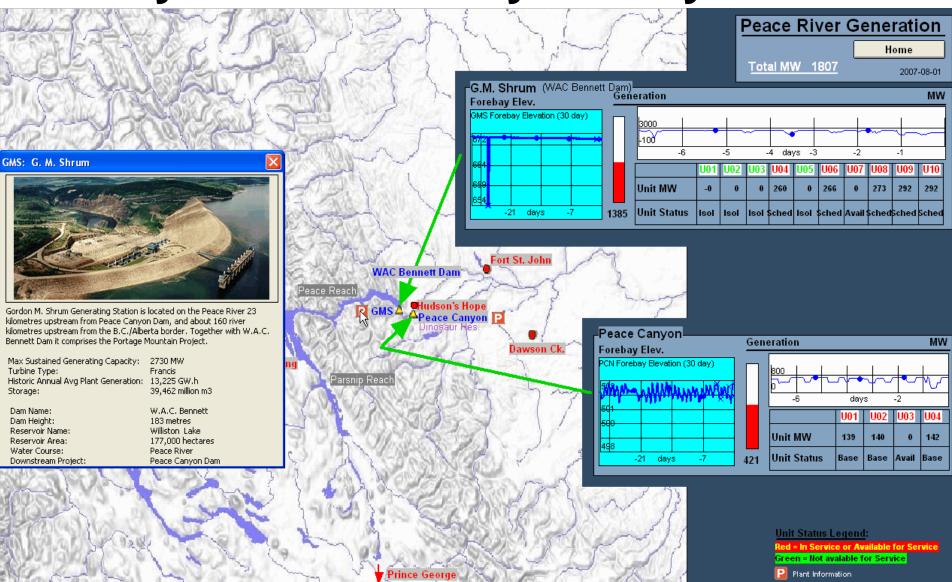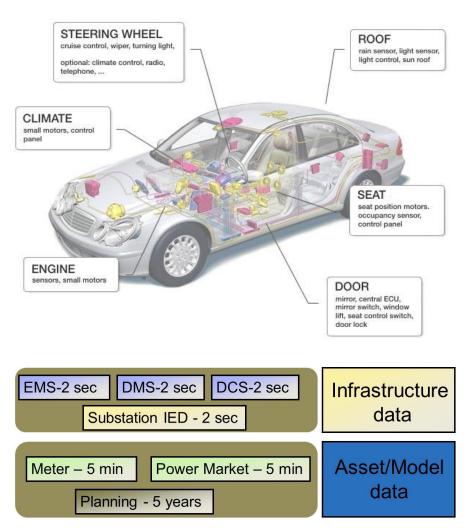
PI Use Cases in the Power Transmission Industry
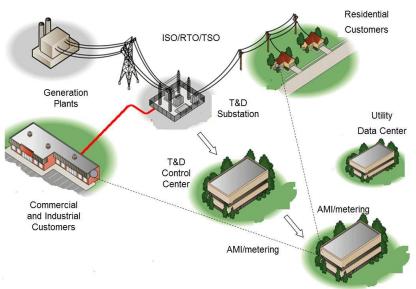
Industry Characteristic

- Very complex and complicated
  - Lots of small systems and devices
- Required to manage many different generation sources
- Geographically dispersed networks
- Data, data, data...
  - SCADA, DMS, OMS, IED, GIS etc.
- Various data granularity and delivery frequencies, that increase over time
  - from sub-second to years range
- Infrastructure / Asset Model

EMS-2 sec	DMS-2 sec	DCS-2 sec	Infrastructure data
Substation IED - 2 sec			

Meter – 5 min	Power Market – 5 min	Asset/Model data
Planning - 5 years		

Industry Challenges / Initiatives

- Grid Operations and Reliability

- Power Quality/Transient/Dist. Data

- Condition Based Maintenance

- Asset Management

- Substation Automation

- Distribution Automation

- AMI-Advanced Metering Infrastructure

- Distributed Generation

- Smart Grid/Intelligent Grid

ISO/RTO/TSO

Residential Customers

Generation Plants

T&D Substation

Utility Data Center

T&D Control Center

Commercial and Industrial Customers

AMI/metering

AMI/metering
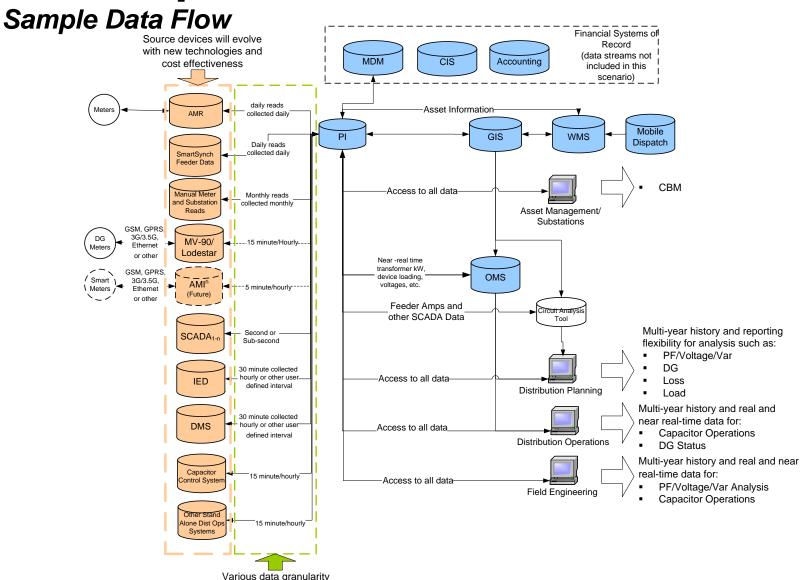
Utility Corporate and Regional Offices

The Common Thing in All:
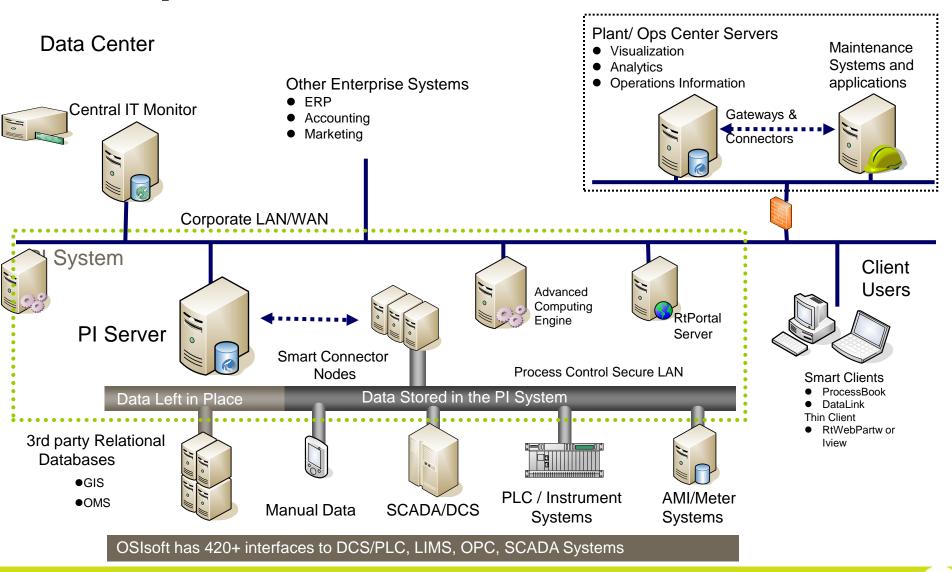
Requires
- *Accessible, precise, real-time data*
- *long-term persistent data store*
- *Notifications and analysis*

PI for Operation & Maintenance

Sample Data Flow

Sample Architecture

Data Center

Central IT Monitor

Other Enterprise Systems
- ERP
- Accounting
- Marketing

Plant/ Ops Center Servers
- Visualization
- Analytics
- Operations Information

Maintenance Systems and applications

Gateways & Connectors

Corporate LAN/WAN

PI System

PI Server

Smart Connector Nodes

Advanced Computing Engine

RtPortal Server

Process Control Secure LAN

Client Users

Smart Clients
- ProcessBook
- DataLink

Thin Client
- RtWebPartw or Iview

Data Left in Place

Data Stored in the PI System

3rd party Relational Databases
- GIS
- OMS

Manual Data

SCADA/DCS

PLC / Instrument Systems

AMI/Meter Systems

OSIsoft has 420+ interfaces to DCS/PLC, LIMS, OPC, SCADA Systems

Proven Use Cases

- **Operational:**
  - EMS/DMS/SCADA data monitoring and archiving, event reporting and analysis

- **Non-operational:**
  - substation field device IED, SOE, Power Quality and DFR data monitoring and archiving

- **Asset/Model:**
  - asset model management and analytics
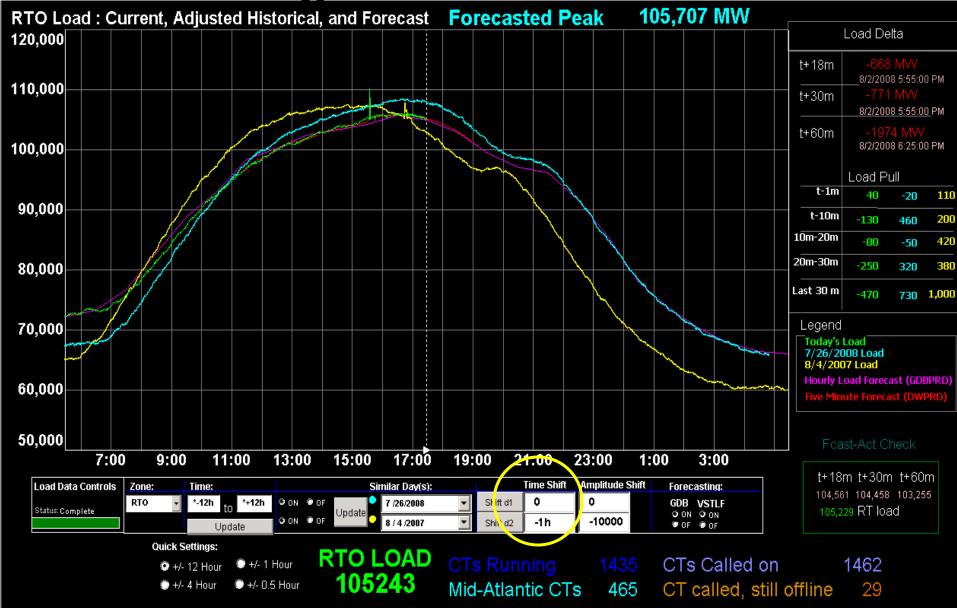
- **Cyber Security / IT:**
  - Critical Infrastructure Protection and Control System IT Infrastructure Monitoring

- **Enterprise:**
  - integration, correlation and repository
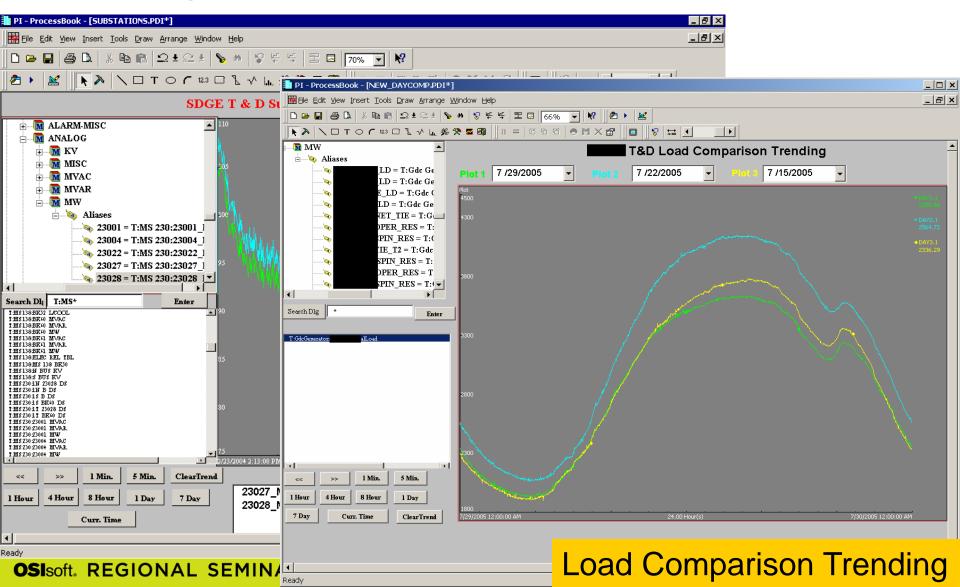
Forecasting Load Peaks
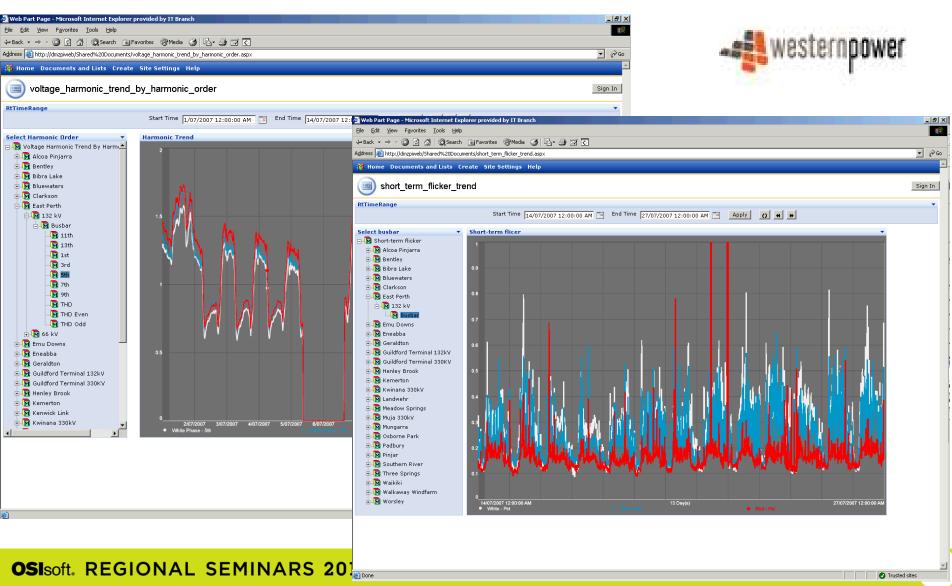
Substation Load Analysis
Load Comparison

Load Comparison Trending
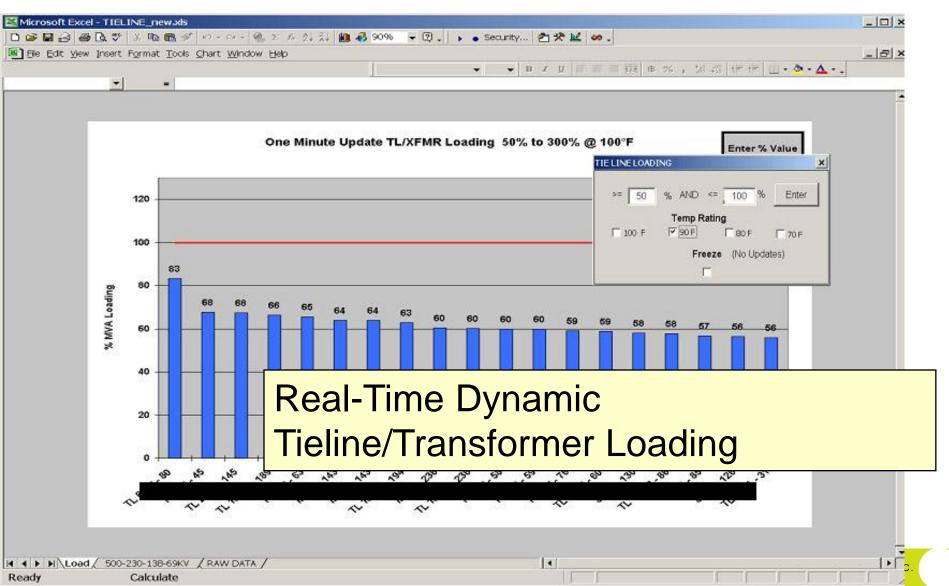
Power Quality Monitoring
Voltage Harmonics / Flickering
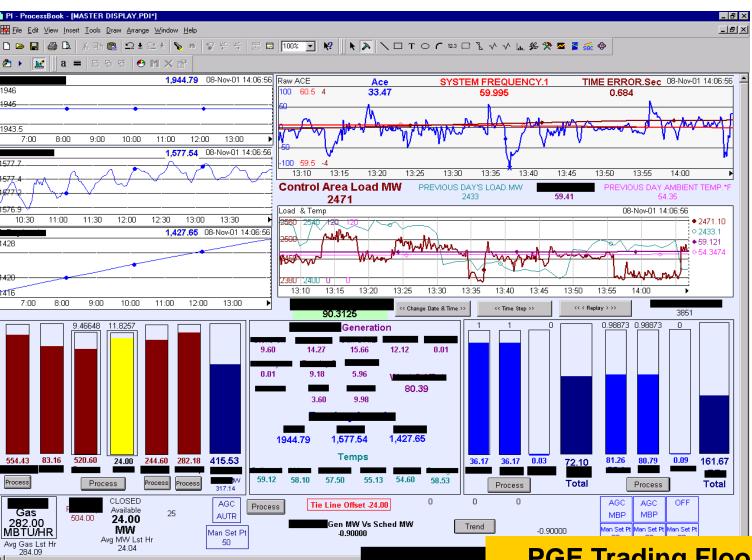
Operations Planning / Tieline Control
Transformer Loading

Real-Time Dynamic Tieline/Transformer Loading

Trading

PGE Trading Floor Wall Screen
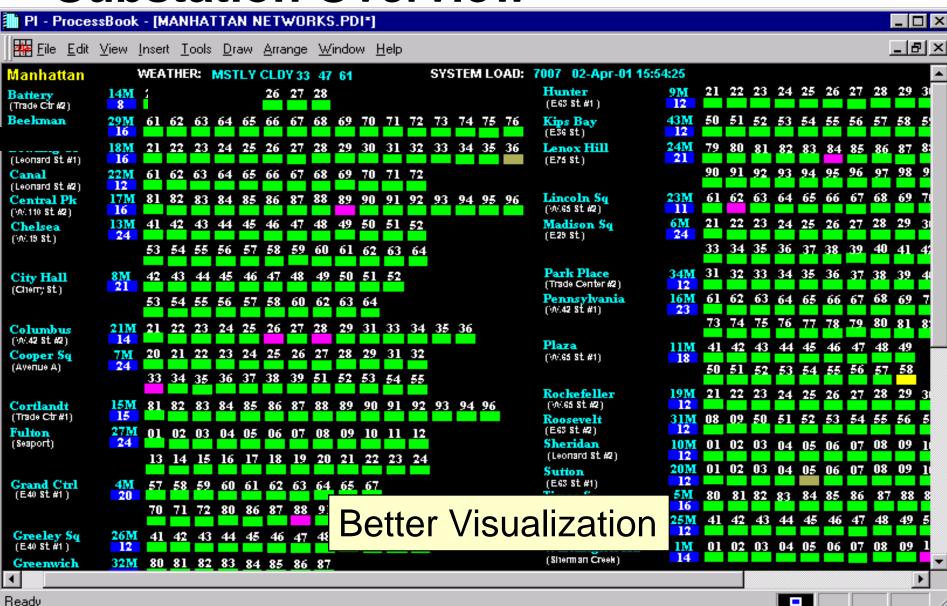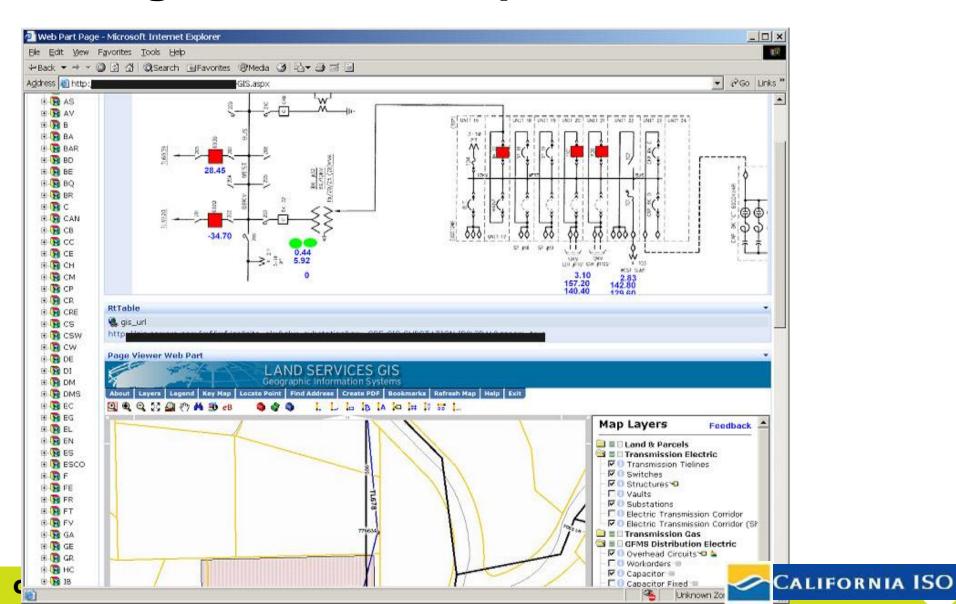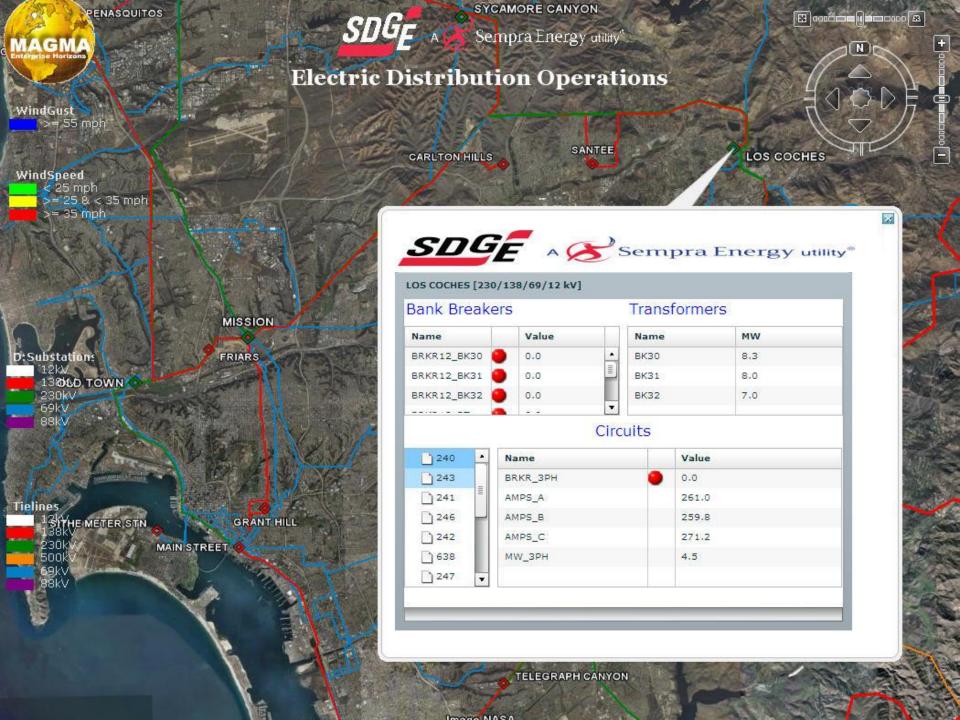
Substation Overview

Better Visualization
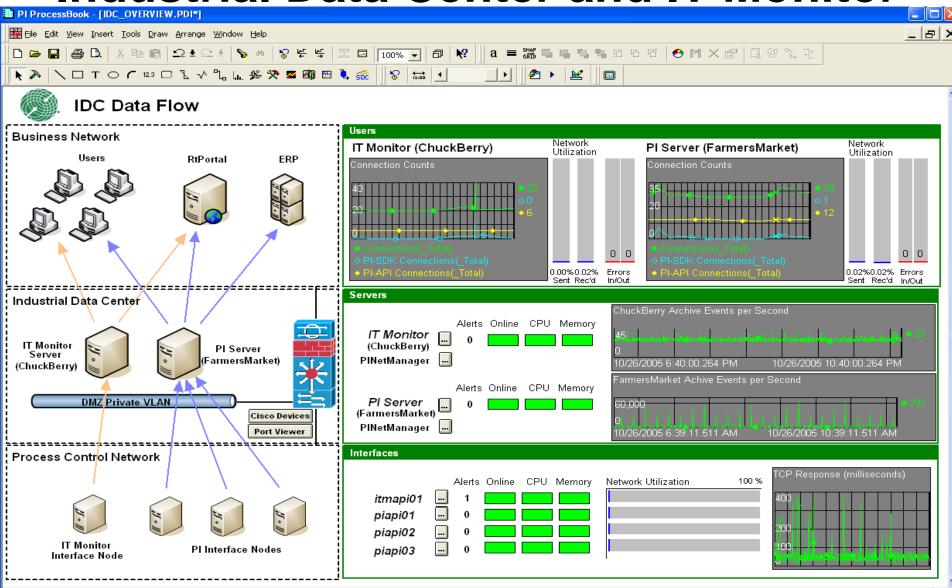
Integration of Geospatial Information

MAGMA
Enterprise Horizons

SDGE A Sempra Energy utility

Electric Distribution Operations

WindGust
>= 55 mph

WindSpeed
< 25 mph
>= 25 & < 35 mph
>= 35 mph

D:Substations
12kV
138kV
230kV
69kV
88kV

Tielines
12kV
138kV
230kV
500kV
69kV
88kV

PENASQUITOS
SYCAMORE CANYON
CARLTON HILLS
SANTEE
LOS COCHES
MISSION
FRIARS
OLD TOWN
SITHE METER STN
GRANT HILL
MAIN STREET
TELEGRAPH CANYON

N

SDGE A Sempra Energy utility®

LOS COCHES [230/138/69/12 kV]

Bank Breakers

Name	Value
BRKR12_BK30	0.0
BRKR12_BK31	0.0
BRKR12_BK32	0.0

Transformers

Name	MW
BK30	8.3
BK31	8.0
BK32	7.0

Circuits

240
243
241
246
242
638
247

Name		Value
BRKR_3PH		0.0
AMPS_A		261.0
AMPS_B		259.8
AMPS_C		271.2
MW_3PH		4.5

Image NASA

Industrial Data Center and IT Monitor
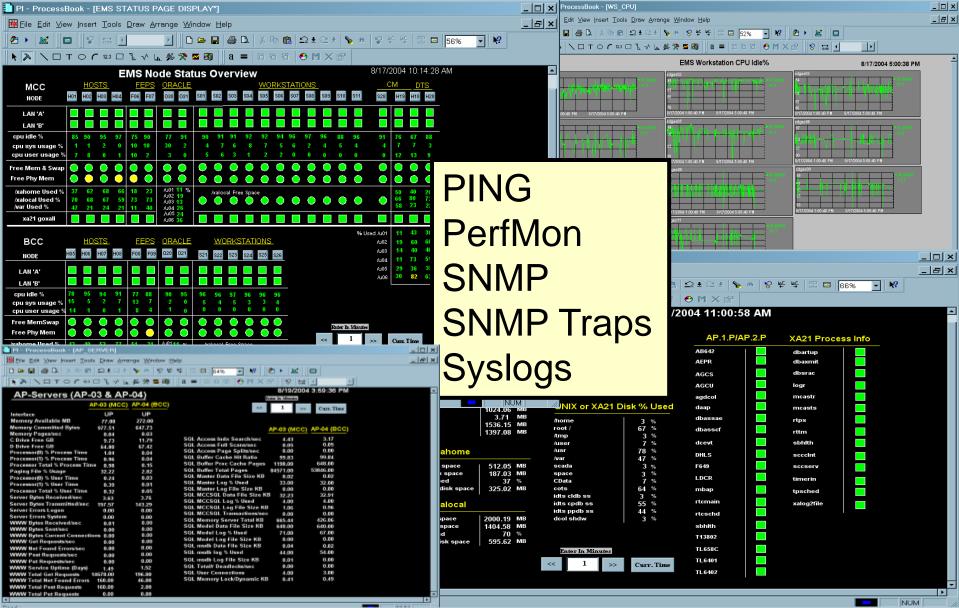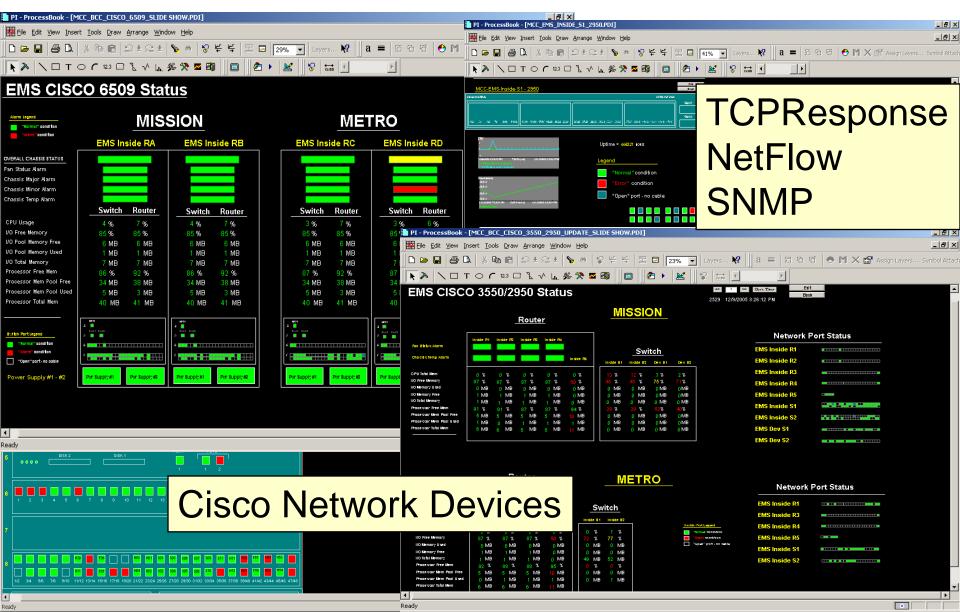
Monitor and Protect Critical Systems

PING
PerfMon
SNMP
SNMP Traps
Syslogs
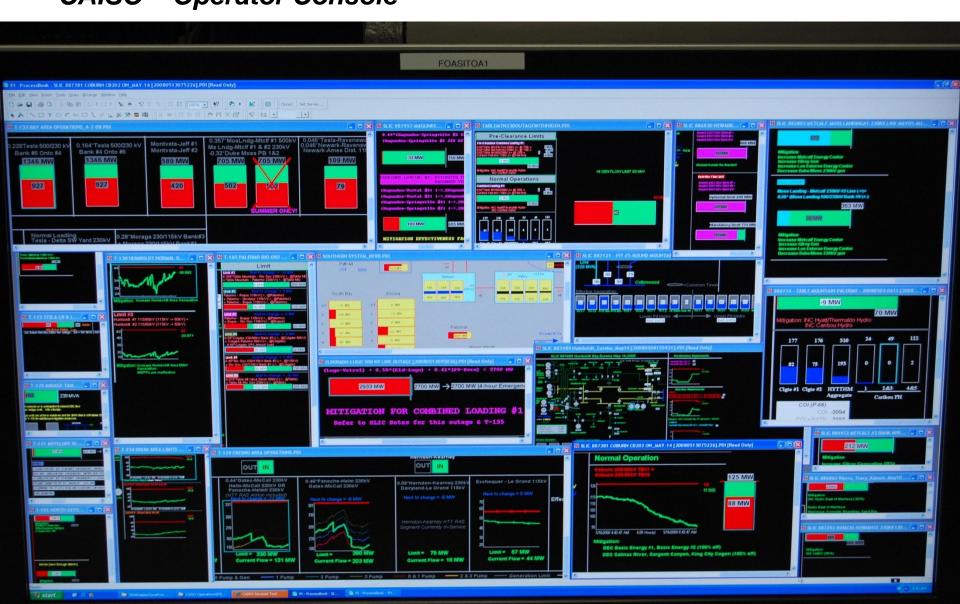
Monitor and Protect Networks

TCPResponse
NetFlow
SNMP

Cisco Network Devices
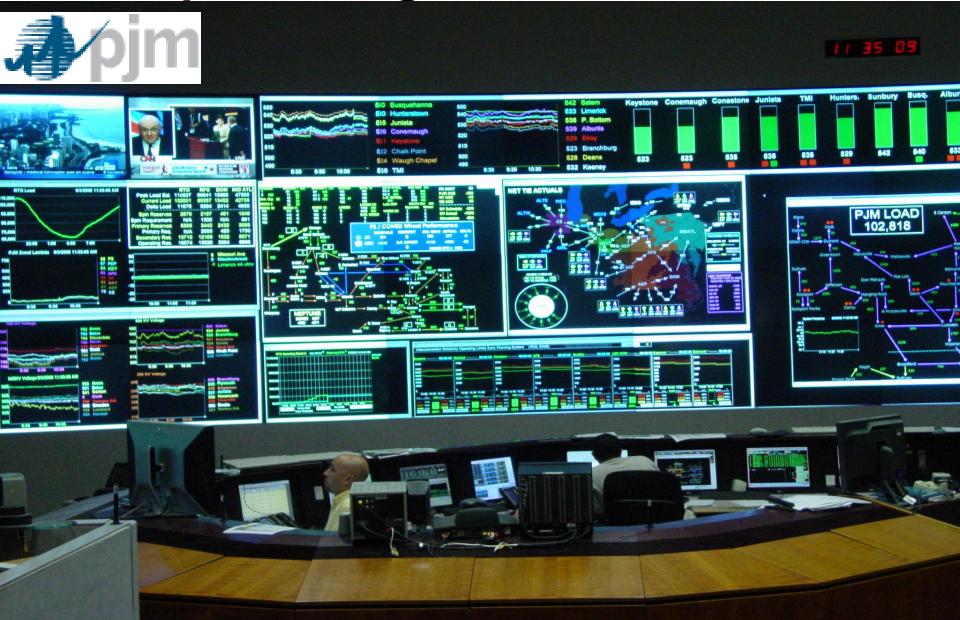
Enterprise Integration
CAISO – Operator Console

Enterprise Integration

California ISO: Governor's visit

Summary

- What?
  - Infrastructure that
    - Creates an integration platform to all islands
    - Connects your plant floor data into the business management system
    - Supports Integrated Operations (Fleet Mentality)
- Why?
  - Foundation for Business and Operational Improvement Initiatives
    - Improved Business Agility – real-time decision making
    - Standardization - One version of truth
    - Collaboration – Everyone works with the same data, rules & tools
    - Protection of existing and future investment
    - Low Risk & Quick option
- How?
  - Build the Foundation first
    - Infrastructure first, followed by applications supporting Performance Improvement Initiatives

THANK YOU

Brought to you by **OSI**soft.

Example: Transformer Condition Monitoring

Transformer Failure Modes

- *Failure Modes* Transformer Condition Monitoring

  - OLTC Monitoring

  - Dissolved Gas Analysis (DGA)

  - Transofrmer Temperature

  - Cooling System Monitoring

- The two most probable failure modes on a Transformer are

  - Load Tap Changer

  - Windings (including insulation)

- These are 60% of total

MIN. AVGERAGE LOAD CURRENT

APPARENT POWER, MVA

HOTTEST-SPOT ON WINDING

INSULATION AGING RATE

WATER CONTENT

STEADY LOAD

DYNAMIC OVERLOAD

COOLING EFFICIENCY

ETC WEIGHTED TEMP. DIFFERENCE
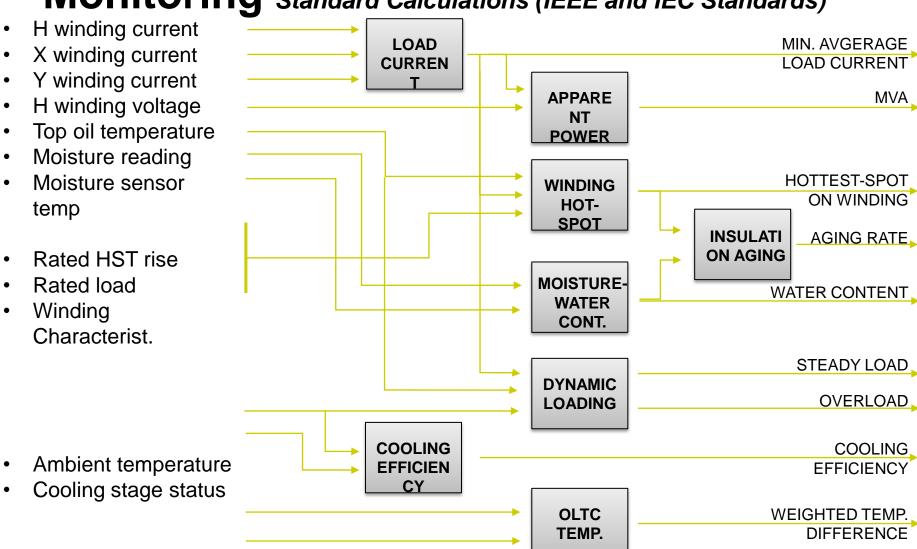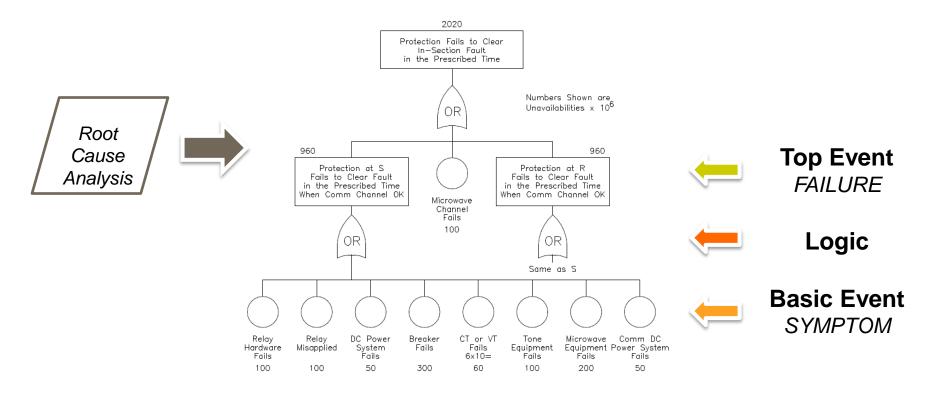
Example: Transformer Condition Monitoring *Standard Calculations (IEEE and IEC Standards)*

- H winding current
- X winding current
- Y winding current
- H winding voltage
- Top oil temperature
- Moisture reading
- Moisture sensor temp

- Rated HST rise
- Rated load
- Winding Characterist.

- Ambient temperature
- Cooling stage status

- Tap Changer temp.
- Main tank temp.

LOAD CURRENT → MIN. AVGERAGE LOAD CURRENT

APPARENT POWER → MVA

WINDING HOT-SPOT → HOTTEST-SPOT ON WINDING

INSULATION AGING → AGING RATE

MOISTURE-WATER CONT. → WATER CONTENT

DYNAMIC LOADING → STEADY LOAD / OVERLOAD

COOLING EFFICIENCY → COOLING EFFICIENCY

OLTC TEMP. → WEIGHTED TEMP. DIFFERENCE

Example: Transformer Condition Monitoring

Root Cause Analysiy (RCA) and FMEA / FMECA

Fault Tree

(FMEA, RCA)

Root Cause Analysis

2020 — Protection Fails to Clear In−Section Fault in the Prescribed Time

Numbers Shown are Unavailabilities x 10^6

960 — Protection at S Fails to Clear Fault in the Prescribed Time When Comm Channel OK

Microwave Channel Fails — 100

960 — Protection at R Fails to Clear Fault in the Prescribed Time When Comm Channel OK

Same as S

Relay Hardware Fails — 100
Relay Misapplied — 100
DC Power System Fails — 50
Breaker Fails — 300
CT or VT Fails 6x10= — 60
Tone Equipment Fails — 100
Microwave Equipment Fails — 200
Comm DC Power System Fails — 50

Top Event *FAILURE*

Logic

Basic Event *SYMPTOM*

Example: Transformer Condition Monitoring

CONNECT *Data Sources*	COLLECT & ARCHIVE	CALCULATE *Performance*	VISUALIZE & NOTIFY	CORRECTIVE ACTION

Control System
- PLC
- SCADA

On-line Monitors
- WINDING
- LTC POSITION
- BUSHING
- WATER IN OIL

DGA
- DISSOLVED GAS ANALYSIS

Databases
- FMEA
- RCA

H winding current

X winding current

Y winding current

H winding voltage

Top oil temperature

Moisture reading

Moisture sensor temp

Ambient temperature

Cooling stage status

Tap Changer temp.
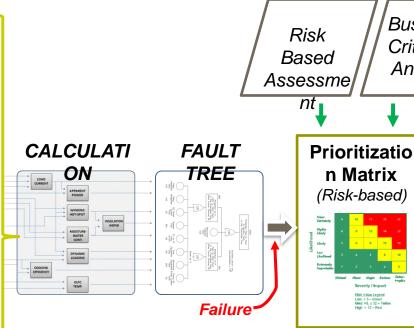
Main tank temp.

Rated HST rise

Rated load

Winding Characterist.

etc.

CALCULATION

FAULT TREE

Risk Based Assessment

Business Criticality Analysis

Prioritization Matrix *(Risk-based)*

Failure Notification

Failure

CMMS
SAP PM
Maximo

REQUIREMENT: Calculate condition parameters and implement failure logic$

RULE: What is the PRIORITY of the Failure?
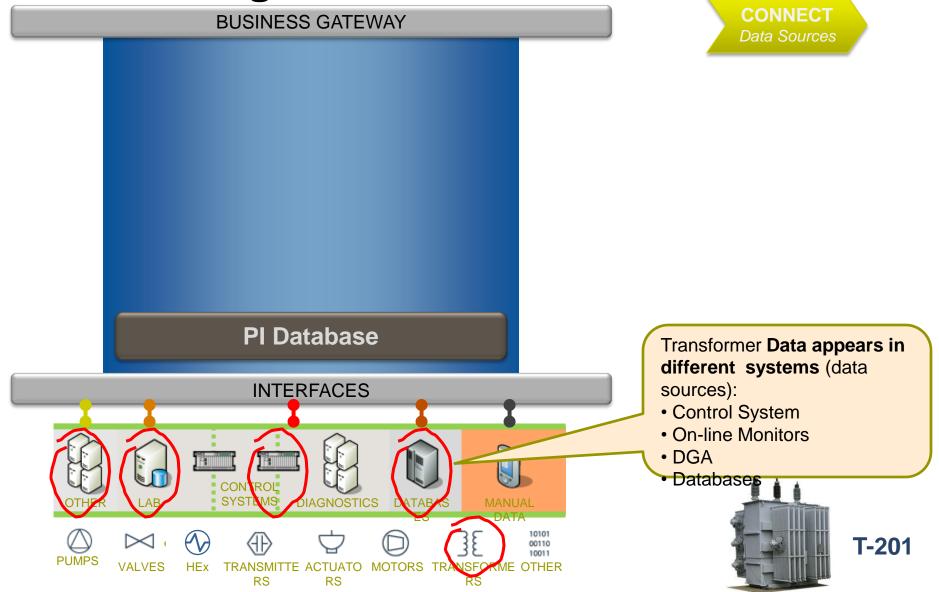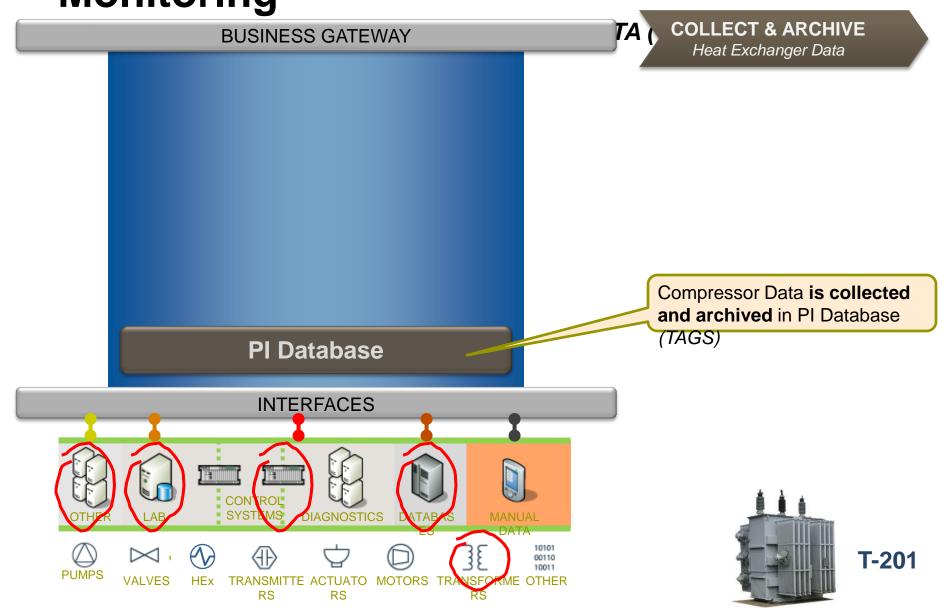
ACTION: Work Order Generation

Example: Transformer Condition Based Monitoring

BUSINESS GATEWAY

CONNECT
Data Sources

PI Database

INTERFACES

OTHER   LAB   CONTROL SYSTEMS   DIAGNOSTICS   DATABASES   MANUAL DATA

PUMPS   VALVES   HEx   TRANSMITTERS   ACTUATORS   MOTORS   TRANSFORMERS   OTHER

10101
00110
10011

Transformer **Data appears in different systems** (data sources):
- Control System
- On-line Monitors
- DGA
- Databases

T-201

Example: Transformer Condition Monitoring

BUSINESS GATEWAY

COLLECT & ARCHIVE
Heat Exchanger Data

PI Database

Compressor Data **is collected and archived** in PI Database
(TAGS)

INTERFACES

OTHER   LAB   CONTROL SYSTEMS   DIAGNOSTICS   DATABASES   MANUAL DATA

PUMPS   VALVES   HEx   TRANSMITTERS   ACTUATORS   MOTORS   TRANSFORMERS   OTHER

10101
00110
10011

T-201

Example: Transformer Condition Monitoring

BUSINESS GATEWAY

COLLECT & ARCHIVE
Heat Exchanger Data

PI Asset Framework

PI Database

INTERFACES

OTHER   LAB   CONTROL SYSTEMS   DIAGNOSTICS   DATABASES   MANUAL DATA

PUMPS   VALVES   HEx   TRANSMITTERS   ACTUATORS   MOTORS   TRANSFORMERS   OTHER

Data is assigned to an individual equipment (Transformer 201):
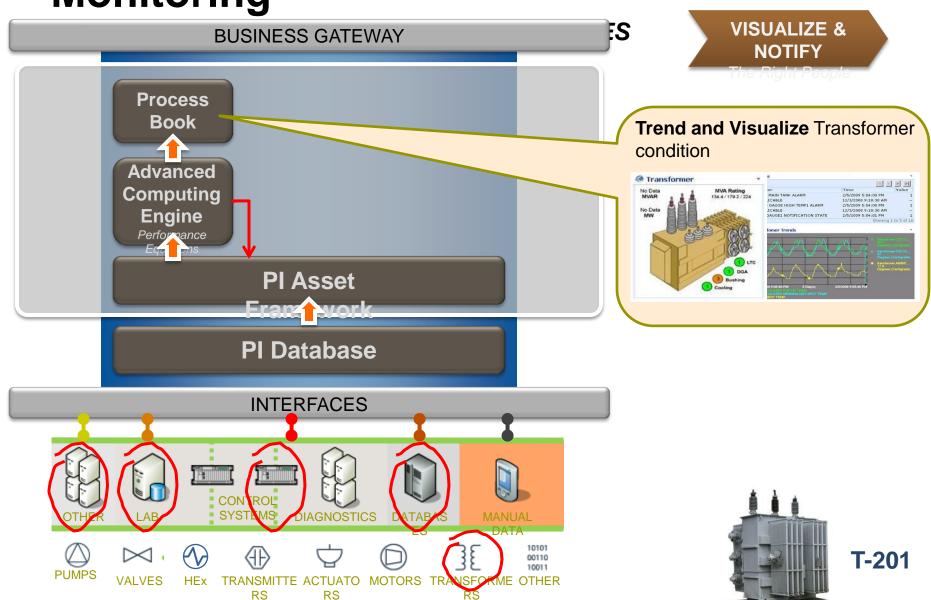
• **Asset-centric** representation of data. **Model driven** measurements

• Asset model complies with **IEC61970/68 CIM**

• Integration & synchronisation with SAP PM infrastructure

T-201

T-201

Example: Transformer Condition Monitoring

BUSINESS GATEWAY

CALCULATE
Performance

Advanced Computing Engine

Performance Equations

PI Asset Framework

PI Database

INTERFACES

Calculation and Fault tree is implemented in Performance Equations

Fault Tree

V_B

T_B F_B

Q_{LO}

Failure is recorded in PI Database as Event (Abnormal Situation)

OTHER   LAB   CONTROL SYSTEMS   DIAGNOSTICS   DATABASES   MANUAL DATA

PUMPS   VALVES   HEx   TRANSMITTERS   ACTUATORS   MOTORS   TRANSFORMERS   OTHER

10101
00110
10011

T-201

Example: Tramsformer Condition Monitoring

BUSINESS GATEWAY

ES

Process Book

Advanced Computing Engine

Performance Equations

PI Asset Framework

PI Database

Trend and Visualize Transformer condition

INTERFACES

OTHER LAB CONTROL SYSTEMS DIAGNOSTICS DATABASES MANUAL DATA

PUMPS VALVES HEx TRANSMITTERS ACTUATORS MOTORS TRANSFORMERS OTHER

T-201

Example: Transformer Condition Monitoring

BUSINESS GATEWAY

AL-TIME

VISUALIZE & NOTIFY
The Right People

Process Book

Advanced Computing Engine
Performance Equations

Notification

PI Asset Framework

PI Database

INTERFACES

OTHER LAB CONTROL SYSTEMS DIAGNOSTICS DATABASES MANUAL DATA

PUMPS   VALVES   HEx   TRANSMITTERS   ACTUATORS   MOTORS   TRANSFORMERS   OTHER

10101
00110
10011

Notification is sent to shift operators and maintenance personnel, about:
TRANSFORMER LTCFAILURE

Maintenance Notification is sent to CMMS (SAP PM)

T-201

Example: Transformer Condition Monitoring

BUSINESS GATEWAY

RISK

VISUALIZE & NOTIFY
The Right People

Process Book

Advanced Computing Engine
Performance Equations

Web Parts

Notification

PI Asset Framework

PI Database

INTERFACES

Visualize maintenance priority matrix

OTHER   LAB   CONTROL SYSTEMS   DIAGNOSTICS   DATABASES   MANUAL DATA

PUMPS   VALVES   HEx   TRANSMITTERS   ACTUATORS   MOTORS   TRANSFORMERS   OTHER

10101
00110
10011

T-201

Customer Use Case – PSE&G

Microsoft SharePoint Server

RtWebParts

PSEG

Non-Operations PI Algorithms Email Alerts

User Interface and Analysis Tools

Operations PI Server

Relational Databases

SCADA

Maintenance System	Dissolved Gas Analysis	Others

WiMax/ Wired LAN Connection

Non Operations/Non-Scada Data

On-line Equipment Monitors

RTU

Real-time Equipment Data

Temperature -Winding, Top Oil, -LTC

Bushing Monitors Phase A, B & C

Hydrogen/ Water in Oil Monitor

LTC Tap Position Indicator

Substation Gateway

Customer Use Case – PSE&G

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss Research Messenger

Address http://njnwkdev29/Asset%20Managment2/default.aspx

Customize Links   Free Hotmail   Google Search   Information Central   PSEG - Home   PSEG Applications Online   PSEG Dining Services Website   Windows

PSEG
We make things wo

Title	Body	Created By	Modified	
Coming Soon New CMMS Engineering Desktop!!!		Rothweiler, Angela	2/29/2008 7:41 AM	

□ Add new announcement

Earnings Releases

Price $44.03
06/05/08 10:03 a.m. ET
   Web Capture last updated

weather newark nj - Google Search

Weather for Newark, NJ - Add to iGoogle

65°F
Cloudy
Wind: NW at 6 mph
Humidity: 71%

Thu	Fri	Sat	Sun
76°F | 61°F	79°F | 65°F	95°F | 72°F	94°F | 72°F

Weather Information

Asset Management Web S

□ Information Central
□ Consolidated Manager
□ PSEG Online Applications
□ CMMS Web Reports
□ NYSE:PEG
□ ...ines

CMMS Asset Information

□ IPE Equipment Search
□ Mechanical Work Priorization
□ Temperature Sensitive Ratings
□ DeltaX Gas and Fluid Tests
□ Relay Work Priorization
□ ESOC System Load

CMMS Asset Information

Equipment Condition Assessment

Division

□ Station Ground Tests By
□ SAP Station List By Divisi
□ Central Mechanical
□ Metro Mechanical
□ Palisades Mechanical
□ Southern Mechanical

Condition Assessment Summary Reports with Drill Downs

□ Transformer Action Summary
□ LTC Action Summary
□ Breaker Action Summary
□ Circuit Switcher Action Summary

□ Transformer Replacement Summary
□ LTC Replacement Summary
□ Breaker Replacement Summary
□ CA Equipment Ranking

□ LTC NEW Action Summary
□ LTC New Action Summary By PG

Equipment Reports

□ Worst Transformers
□ Transformer High Hydrogen

□ Worst LTCs

Equipment Reports

Docs

□ CMMS Notification Rules

Customer Use Case – PSE&G