OSIsoft®

SEMINÁRIO REGIONAL 2014

The Power of Data

L A T A M

DECISION READY IN REAL-TIME

BIO / Experience

David Thomason has 29 years experience in applying information technology to the requirements of the electrical utility & power generation industry.

An active advocate in the use of advanced analytics and technologies to enhance value. David's experience at a fuel diverse 30K MW competitive power company includes multi-market EMS, Plant Analytics systems, SAP Work and Material Management, custom SW development & Support teams.

He joined OSIsoft in February 2011 in Business Development focusing on global power generation.

One foot in the business and one in IT! ☺

The Power of Data in Power Generation

Presented by
David Thomason – Industry Principal Global Power Generation


Data is the currency of the Future…
Data is currency NOW!

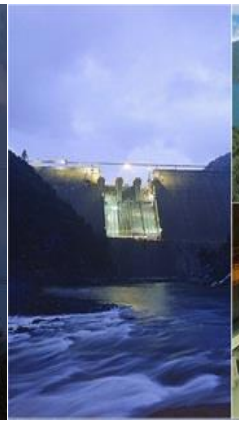

NRG
City of San Antonio
Portland General Electric
FirstEnergy
SDGE
A Sempra Energy utility
Росэнергоатом
Мосэнерго
Energy
THE NEXT GENERATION OF ENERGY
Sierra Pacific
POWER COMPANY
HEI
Miso
TVA
Corgi
ENERGY
Nevada Power.
Ontario Hydro
PNM
CLECO
We're Ameren!
Our roots are American energy, our vision is growth...
PSEG
We make things work for you.
Pacific Gas and Electric Company
PG&E
Westar Energy.
NMC
DYNEGY
IPL
AN IPALCO ENERGY COMPANY
AUSTIN ENERGY
Xcel Energy
DTE Energy
Minnkota Power
COOPERATIVE, INC.
A Touchstone Energy® Partner
conectiv
Cogentrix
CINERGY
ERCOT
THE TEXAS CONNECTION
VIRGINIA POWER
Exelon
ISO new england
Wisconsin Energy Corporation
TMPA
elpaso
КЭС ХОЛДИНГ
ДИВИЗИОН «ГЕНЕРАЦИЯ ЦЕНТРА»
ОАО «Территориальная генерирующая компания №6»
bp
Saudi Aramco
ExxonMobil
GAZPROM
ROSNEFT
TNK-BP
Eni
PETROBRAS
MARATHON
BG GROUP
Chevron
NiSource
Alyeska pipeline
TIGF
ENBRIDGE
KOGAS
Sempra Pipelines & Storage
PETRONAS
IBERDROLA
saggas
RasGas
Gaz de France
NuStar
Sempra LNG
KOGAS
RasGas
CHENIERE
REPSOL YPF
angola LNG
Nigeria LNG Limited
Chevron
SUNOCO
MOL
PEMEX
TOTAL
CITGO
PETROBRAS
TESORO
SUNOCO
VALERO
REG
POET
Cargill
ABENGOA BIOENERGY
ADM
ICM
the energy of innovation
Delta-T


System z9


Power of Data!

Sustainable Generation Mix of Tomorrow Today



Gas Coal Nuclear Hydro

OSIsoft in Power Generation





Wind Solar PV & CSP Geo / Bio / Marine…

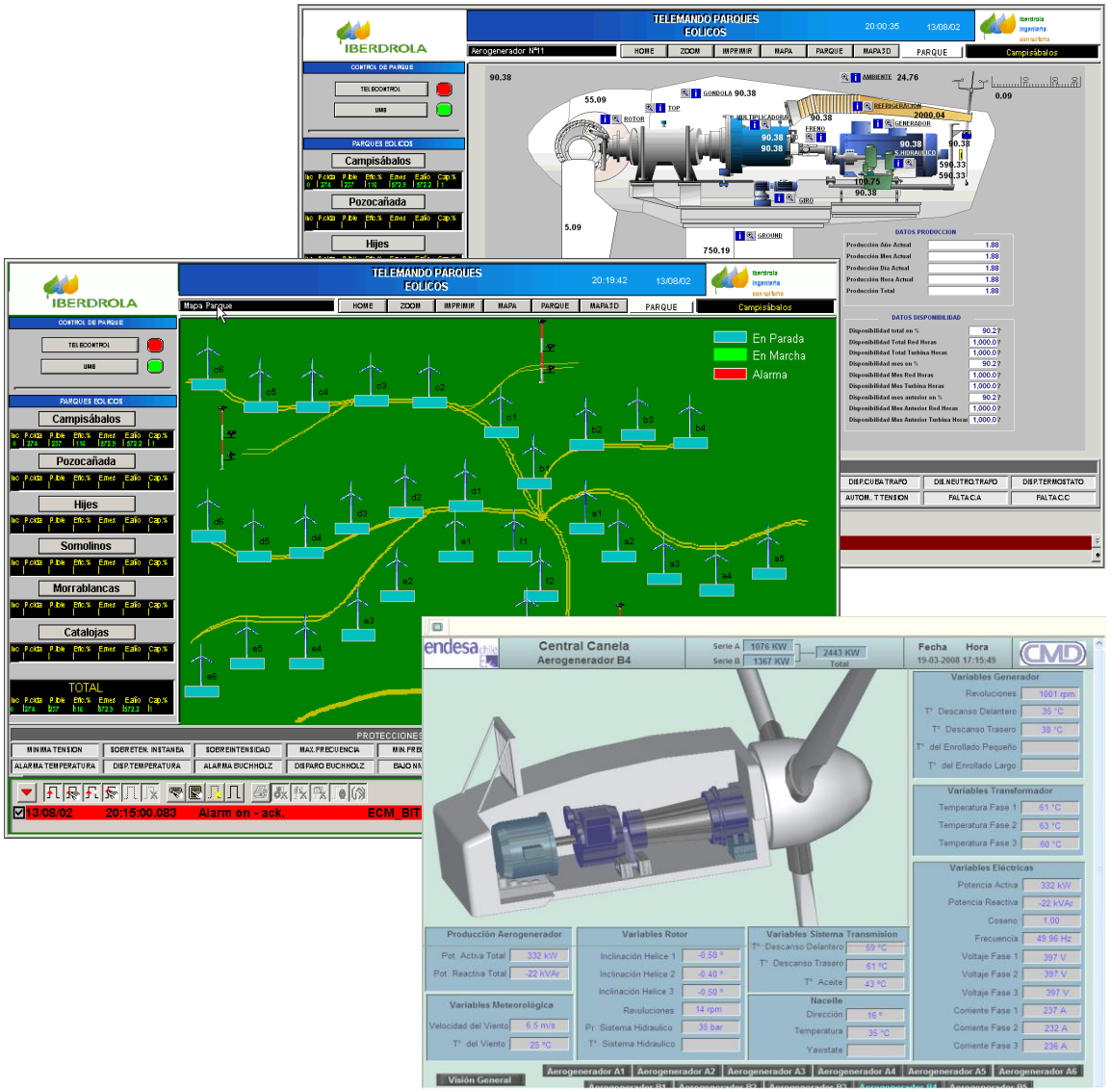
OSIsoft in Power Generation

Spanning the Power Generation Spectrum

Defacto Standard in Power and Utilities

Renewable Power - Wind

- 13 of the top 15 wind generating producers in the world
- 19.5GW of total 23 GW USA wind generation
- Renewable Integration by ISOs

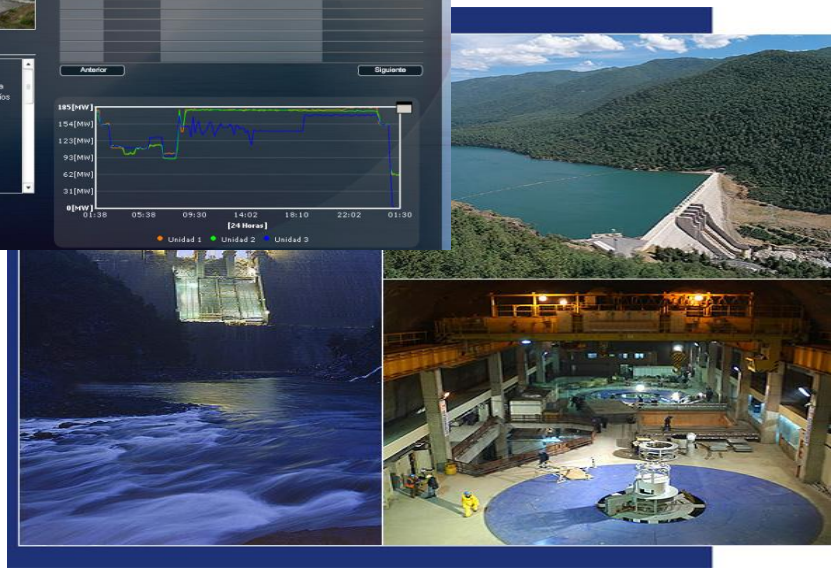


Renewable Power - Solar

- PI System in over 50% of the Concentrated Solar Plants (CSPs)
- Many large PV / CPV solar sites utilize the PI System (SunPower, EDF-EN, E.ON, Iberdrola, EGP, Abengoa Solar, Sempra)
- NRG's Ivanpah 377MW CSP
- Central M&D
  - SunPower
  - OCISolar
  - Power Factors, INC

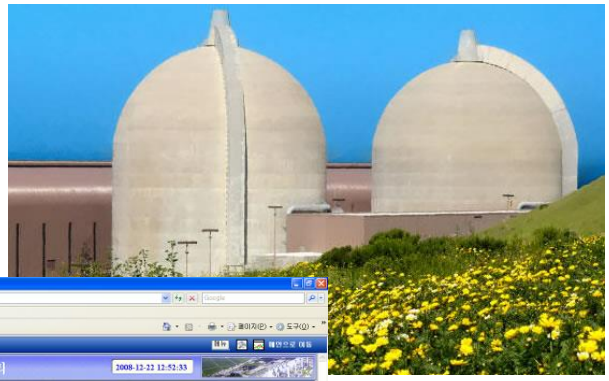
Hydro Electric Power

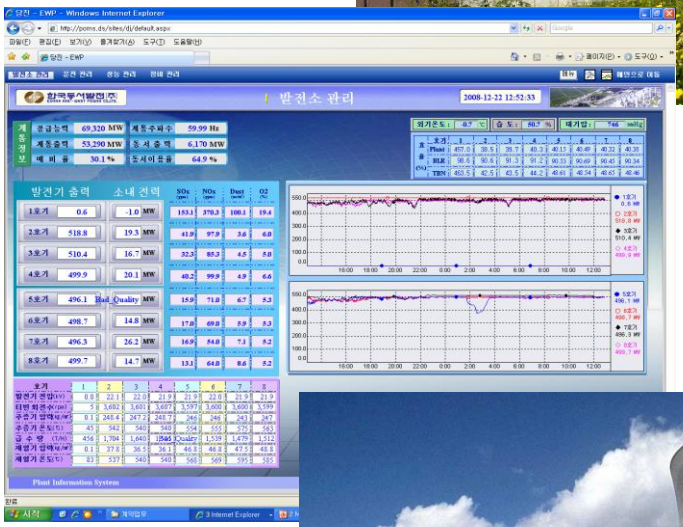
- Hydro Generation success with PI
- Hydro Quebec
- PGE Hydro
- Endesa
- Itaipu (14K MWs)
- BC Hydro
- KenGen
- EDF Hydro



Nuclear Power

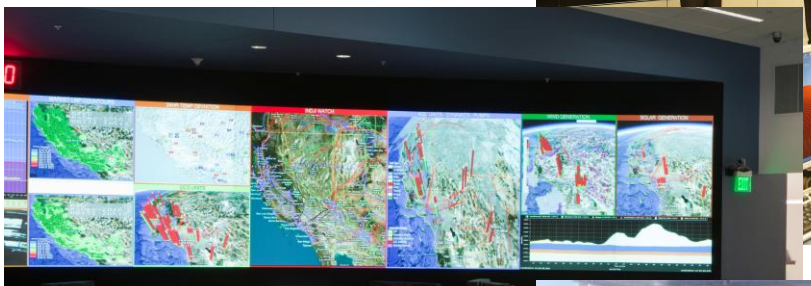
- 76% of USA nuclear plants and growing
- Nearly 100% of nuclear in Canada, UK and Korea
- Emergency preparedness and response, including the US Nuclear Regulatory Commission
- In nuclear mining, fuel conversion, fuel enrichment, fuel fabrication and waste processing
- Securely providing access to critical data and information

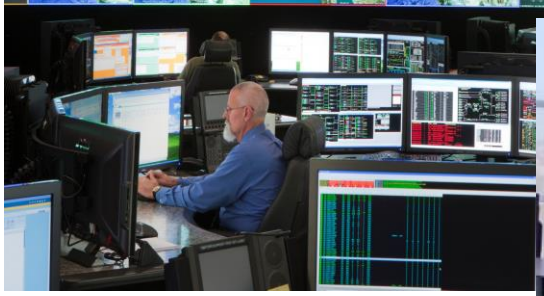




Fleet Monitoring and ISO

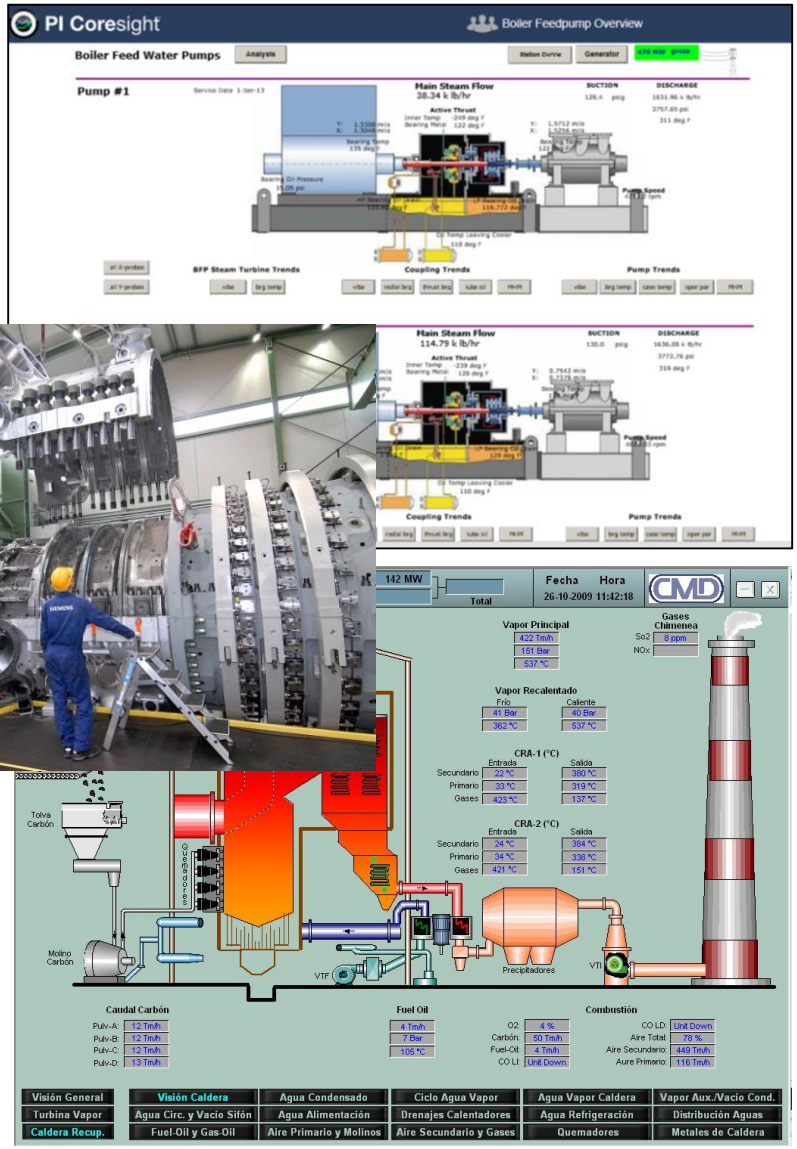
- 100% of the ISOs/RTOs in the North America
- PI System for Fleet Management
  - PJM
  - CAISO
  - Entergy
  - DTE
  - NRG
  - Endesa
  - Iberdrola





Thermal Power

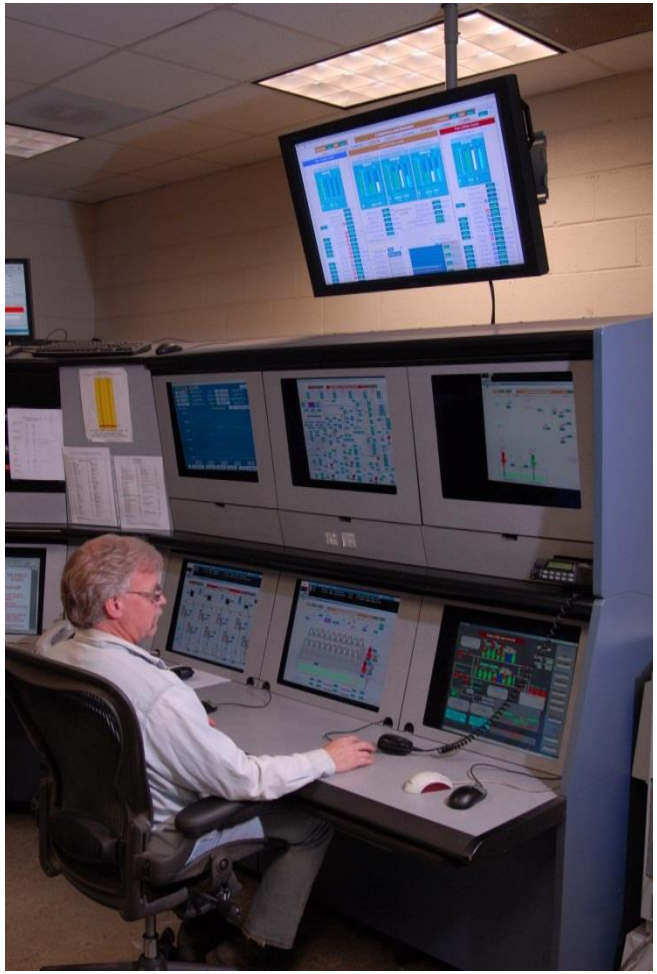
- Leader in thermal Generation (Gas, Coal, Oil…)
- Approximate market share
  - 60% of USA
  - 30% EMEA
  - 24% APAC
- CCGT, GTs, Steam,…
- Critical Equipment and Systems Condition
- Efficiencies
- Operations Excellence
- Condition Based Maintenance



Power & Utility Industry Challenges

- Competitive Market Pricing
- Limited Power Reserves
- Lower capital ROI
- Plant and T&D life extensions / modernization
- Dynamic Environmental requirements
- Optimize use of renewable and distributed energy sources
- Need for higher availability, reliability, and flexibility
- Plants operating outside of design
- High Demand for Real-Time Situational Awareness
  - Market / Grid conditions (Power, Fuel, Ancillary Services…)
  - Current and Forecasted Capability
  - Weather
  - Environmental Compliance
  - Security
- Need to respond and make decisions in real-time

Driving Factors for PI Infrastructure



- Problem: Many disparate systems
  - DCS, PLC, CEMS, Analyzers…
  - Various timestamps
  - Data accessibility & integrity
- Solution: OSIsoft Data Infrastructure
  - Common real-time data and events
  - Common visualization and analytic toolset
  - Common platform for notifications, development and advanced analytics
  - Leverage SMEs (Central, Plant, Vendors)
  - Remote Monitoring & Diagnostics

Increase availability, lower lost margin

Supports Key Power & Utility Processes

Proactive / Condition Based Maintenance (CBM)

T&D / Grid Optimization

Asset Management

Environmental Monitoring & Regulatory Compliance

Root Cause Analysis (RCA)

OSIsoft.

Infrastructure

Controllable Losses, startup / shutdown

Vendor Performance

Outage Planning

Commercial Trading and Dispatch

Security: Passive real-time copy of critical systems

Integration of renewable energy

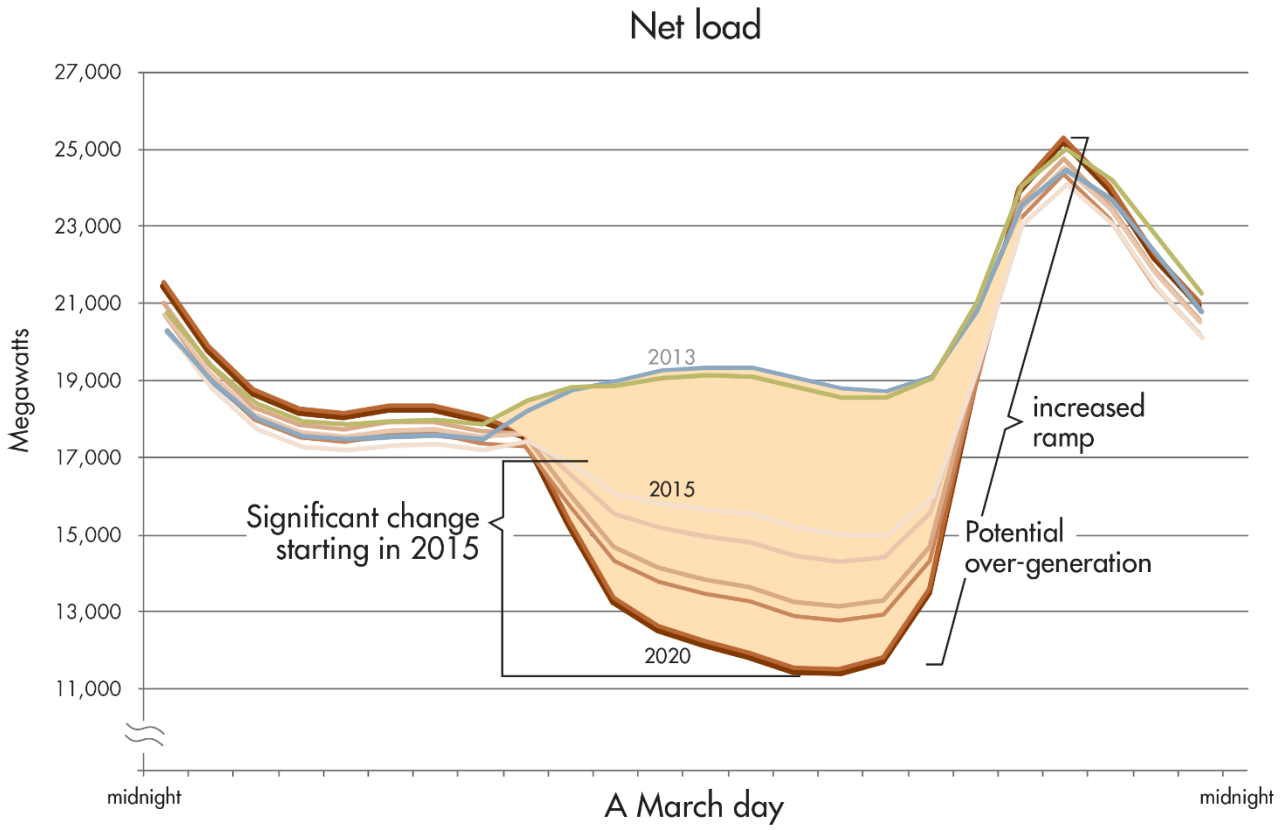
Operations Excellence

Plant and System Performance / Efficiency

Power Industry Trends

- Renewables to Account for More than 20% of Brazil's Generation Capacity by 2030
- High efficiency Combined Cycle Power Plants
  - Availability of LNG / Natural Gas
  - Flexibility, units designed for market response
- Plant modernization / modification
  - Implementing Environmental BACT (Scrubbers / SCRs)
  - Carbon Capture (Still a work in progress)
  - Modifications to Base load plants
    - Intermediate / load following / spinning reserve
    - Multiple startups = additional stress / wear on equipment
- Renewables
  - Many Renewables coming to end of warranty period
  - Companies taking on maintenance of wind turbines – need data
  - Growth in solar
  - Investment in storage capabilities

Effects of Distributed Solar Generation:
Operational needs are significantly changing between 2013 and 2020 the "Duck" Curve - Brian Cummins – Manager, CAISO



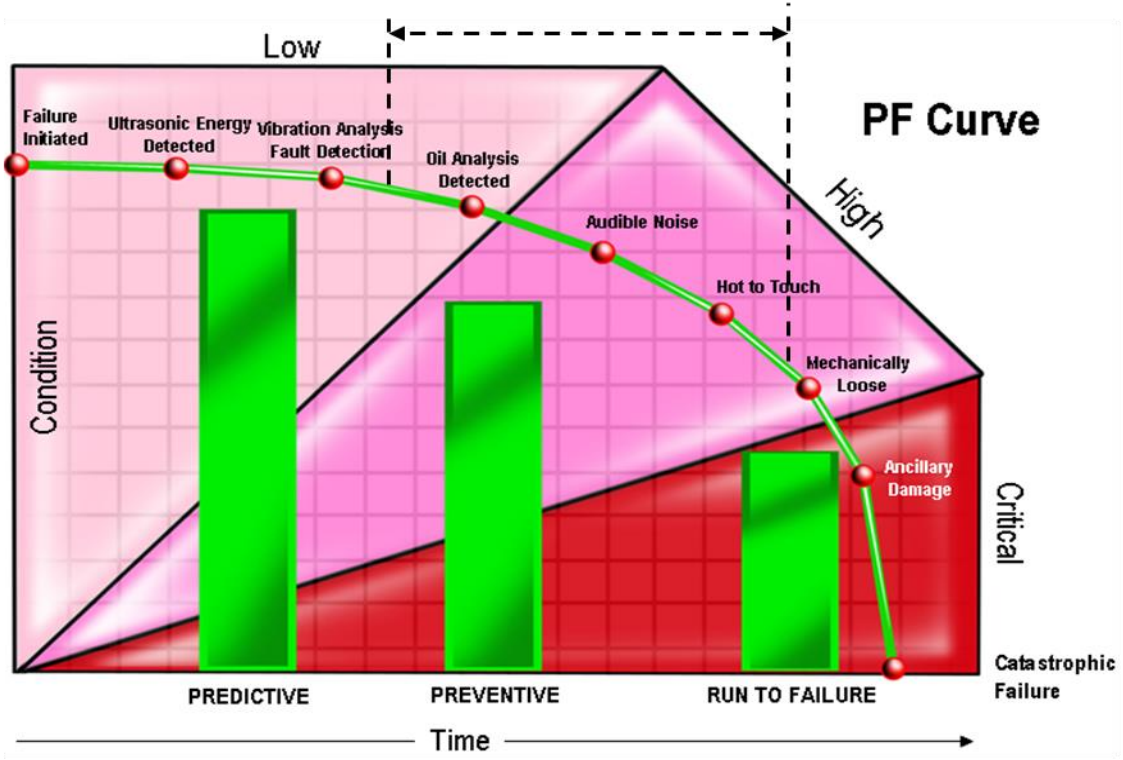
Power Industry Technology Trends

From:		*To:*
• Static / periodic equipment condition assessments	→	• Dynamic real-time online condition information
• Many disparate data systems	→	• Single source of all plant and enterprise information
• Limited employee use beyond assigned facility	→	• Leverage all experts throughout the company for all assets
• Multiple projects to address singular issues	→	• Information infrastructure that can provide many solutions
• Reactive & Preventive Maintenance	→	• Proactive & Predictive Maintenance
• Aggregating and assessing post situation	→	• Real-time situational awareness and enable market predictability

CBM / Proactive Maintenance P-F Curve

The P-F curve is to show the behavior of equipment as it approaches failure.

- The P on the curve is the first possible point when equipment degrades or changes can be detected.
- The F is the point of equipment or system failure.
- The time between is your "opportunity" to avoid unplanned events



P-F Interval

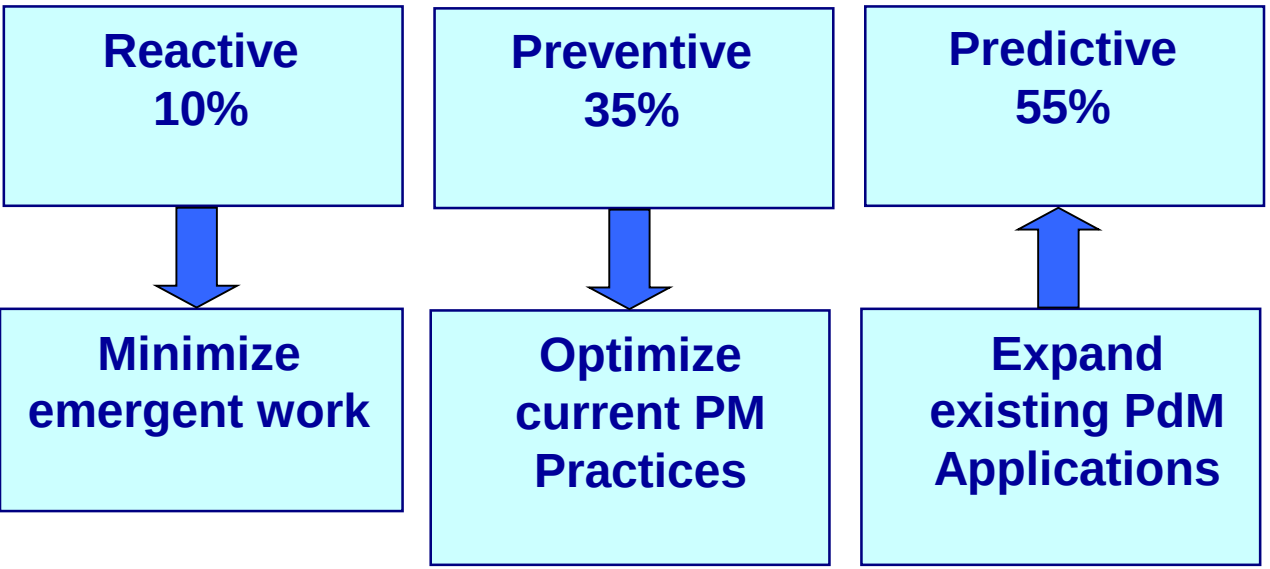
Time frame to rectify impending equipment failure (Planning / Scheduling / Execution Window)

Earliest detection provides the greatest opportunity time

Source: Allied Reliability

CBM / Proactive Maintenance

- Proactive Maintenance is a strategy in which Corrective, Preventive, and Predictive processes complement one another.
- The average industrial plant performs more than 55% Reactive maintenance work. Reactive is the highest cost!
- The top industrial plants perform less than 10% Reactive maintenance work. An industry “best practice” target goal maintenance mix



- Strategy: enhance & expand the use of real time, historical data and analytics systems

CBM / Proactive Maintenance

- Screens and information with Maintenance in mind
- Focus on critical equipment, parameters for condition
  - Vibrations (rotating equipment, motors, pumps, turbine…)
  - Temperatures (bearings, oil, metal, motors…)
  - Amps
- Transform data and use in a new, valuable way
- Use out of the box, PI System functionality
  - Totalizers for run time counters, compare / balance usage, schedule maintenance, measure accumulative damage
  - Multi-state graphics
  - Notifications
- Increase speed and accuracy of decisions

AF Structures & Templates

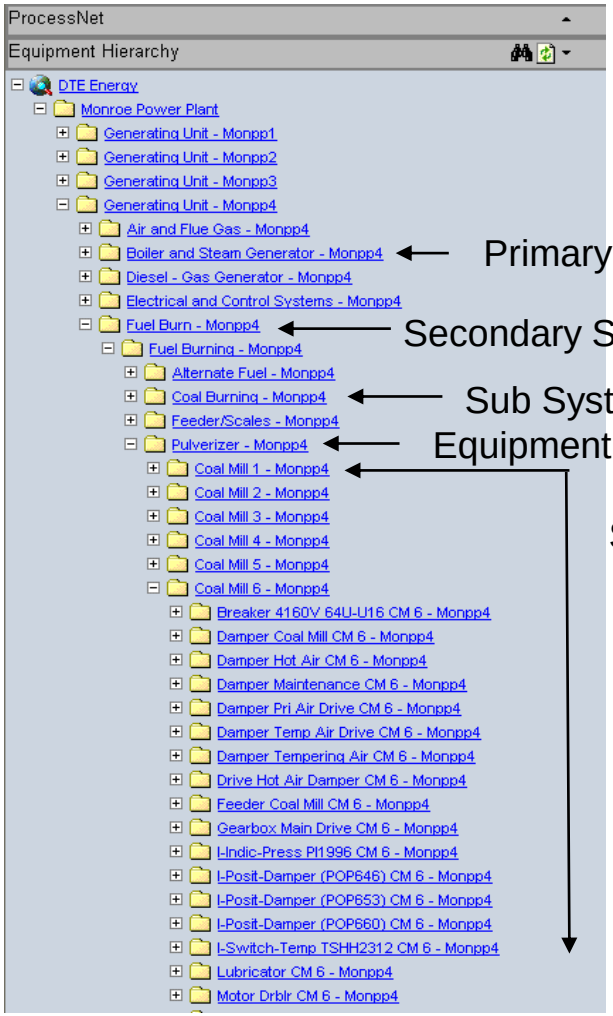
Example AF for Power & Utilities:

- Corp (ie…AGL, DEWA) ← Corp Level – KPIs, Production rollups, …
  - Generation (ie.. GU, Power Gen…) ← Biz Unit Level – KPIs, Total Production,…
    - Plant ← Plant Level – KPIs, Production, Performance, Info, …

      (May org by type fossil, renewable, nuke, hydro)
      - Unit # (1, A,) ← Unit Level – Production, Performance, Info, …
        - » Primary System ← Primary System - Performance Calcs
          - » Sub-System ← Sub-System - Performance Calcs
            - » Equipment ← Equipment Specific Templates
              - RT Condition Monitoring
              - Calculations (Runtime, Start Count…)
              - CBM Scoring
              - MFG Name plate
              - Work Mgmt ($spent, $planned,…)
  - T&D
    - Substation(s)
      - Feeders
        - » Equipment

Each level templates w/ Calcs, notifications, element relative displays…

Common Thread Equipment Hierarchy



Equipment Hierarchy

- Hierarchical System Index (HSI)
- Work Breakdown Structure (WBS)

DTE Energy – Business Unit
Monroe Power Plant – Plant
Generating Unit - Monpp4 – Unit
Fuel Burn - Monpp4 – Primary System
Fuel Burn - Monpp4 – Secondary System
Pulverizer - Monpp4 – Sub System
Coal Mill 1 - Monpp4 – Equipment / Sub Equip
Breaker 4160V 64U-U16 CM 1 - Monpp4
Damper Coal Mill CM 1 - Monpp4
Damper Hot Air CM 1 - Monpp4
Damper Maintenance CM 1 - Monpp4
Damper Pri Air Drive CM 1 - Monpp4

Equipment Template Details

- Electric Motor
- PI Condition data
- ERP Nameplate information
- Calculations
  - In PI Server
  - In AF
- Table reference
  - Docs
  - Test results
  - WM &MM
- CBM Score

Meas. Point	Parameters	Parameter Units
Operational Data	MOTOR CURRENT	Amps
	VOLTAGE	Volts
	Run-Time Hours (since Overhaul)	*Hours*
	Starts Count	*Count*
Stator Temperature Data	MTR WINDING TEMP 1	deg. C
	MTR WINDING TEMP 2	deg. C
	MTR WINDING TEMP 3	deg. C
	MTR WINDING TEMP 4	deg. C
Bearing Temperature Data	FAN MTR IB BRG TEMP	deg. F
	FAN MTR OB BRG TEMP	deg. F
Vibration Data	FAN MTR OB BRG VIB	
	Inboard X	mils
	Inboard Y	mils
	Inboard X	Vdc
	Inboard Y	Vdc
	FAN MTR IB BRG VIB	
	Outboard X	mils
	Outboard Y	mils
	Outboard X	Vdc
	Outboard Y	Vdc
Oil Analysis Data	*VISCOSITY*	*centistokes ssu*
	WATER CONTENT	*ppm water*
	PARTICLE COUNT	*iso count*
...ta	*INFRARED IMAGE*	*(Document)*
	SPOT TEMPERATURE	*Deg. F or C*

Calculated Values

Real-time Data

Reference Data from other systems

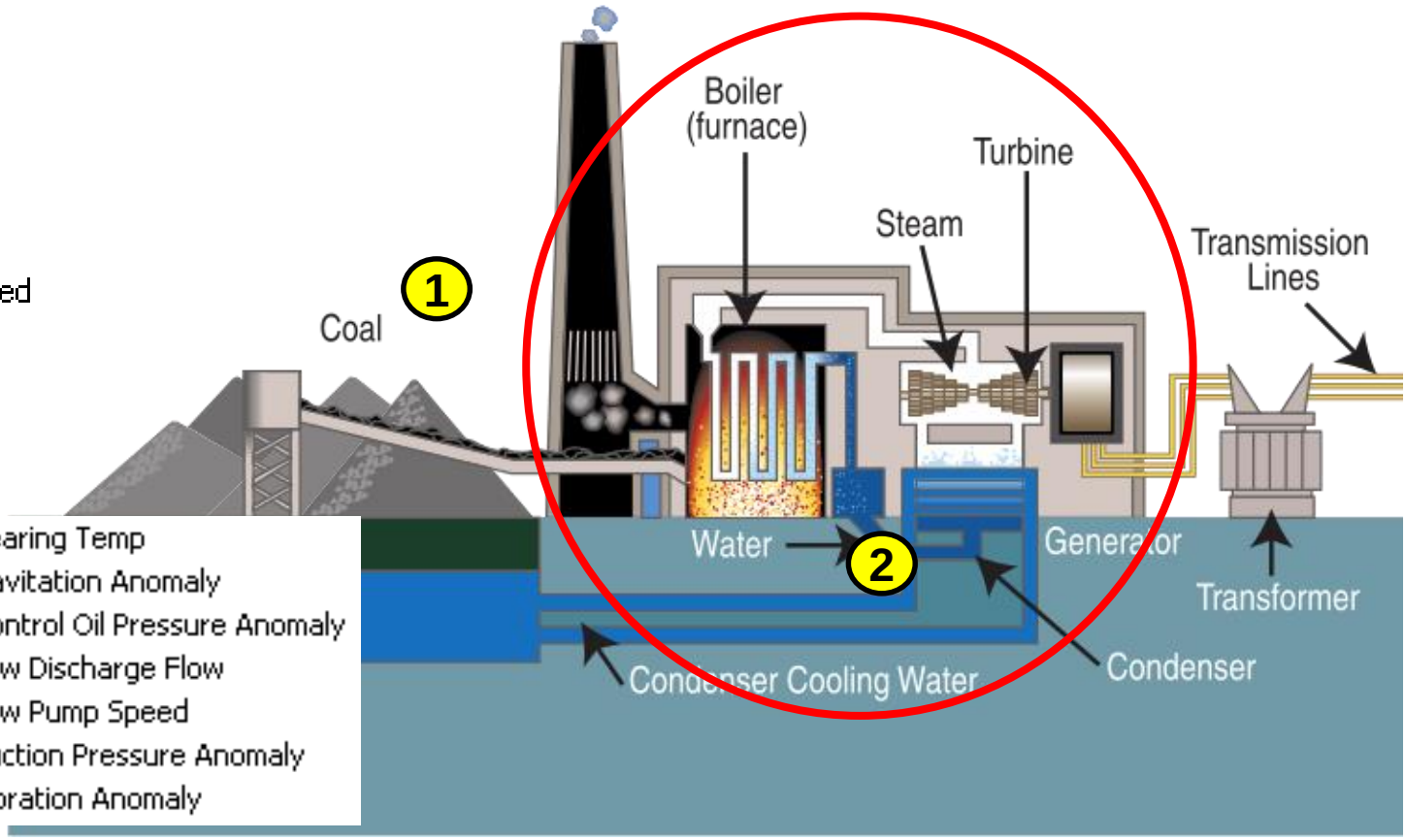
Event Frames

Event Types

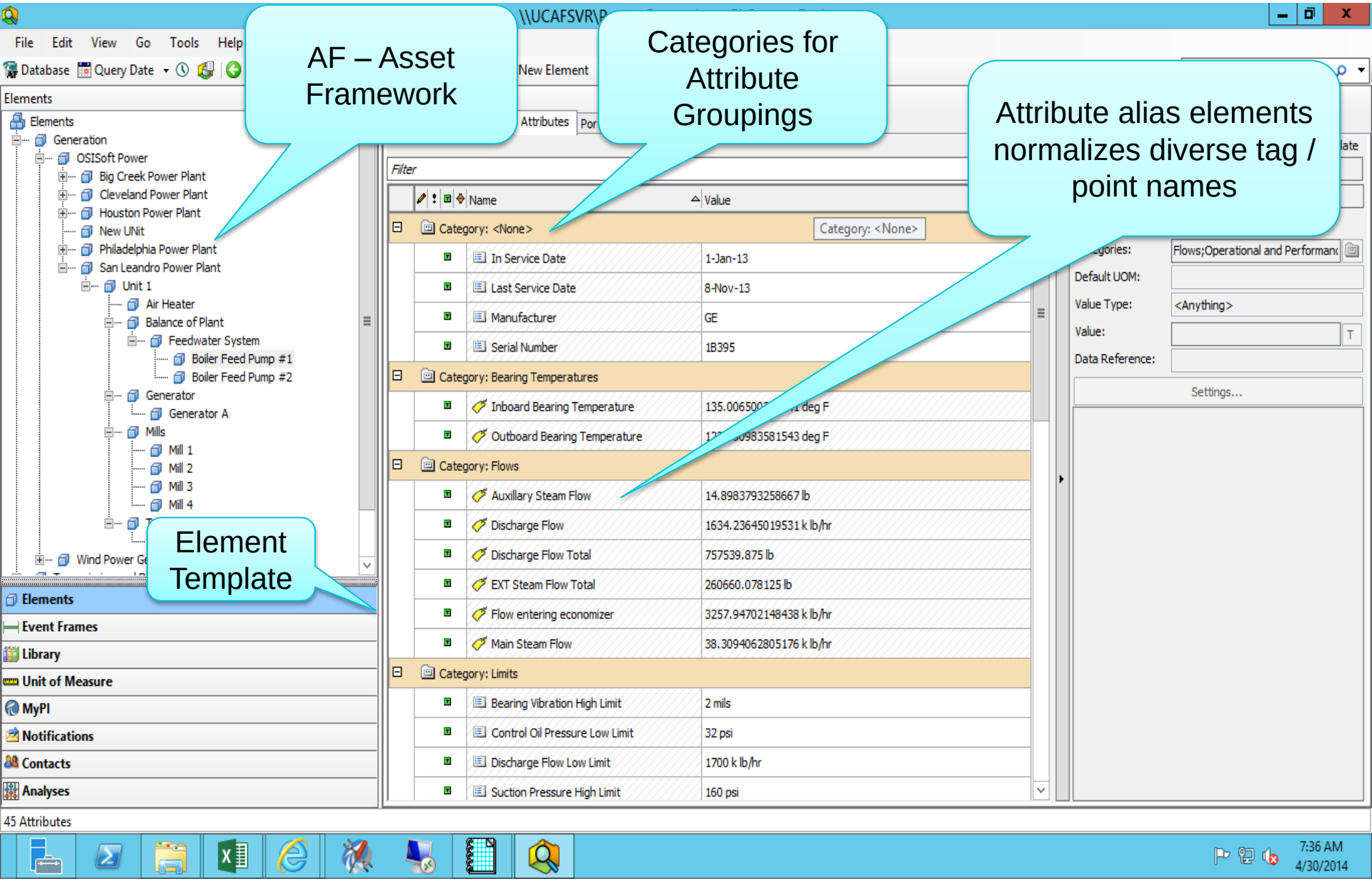
0
- Unit Shutdown
- Unit TIME.Day
- Unit TIME.Hour
- Unit Trip

1
- Mill Low Feeder Speed

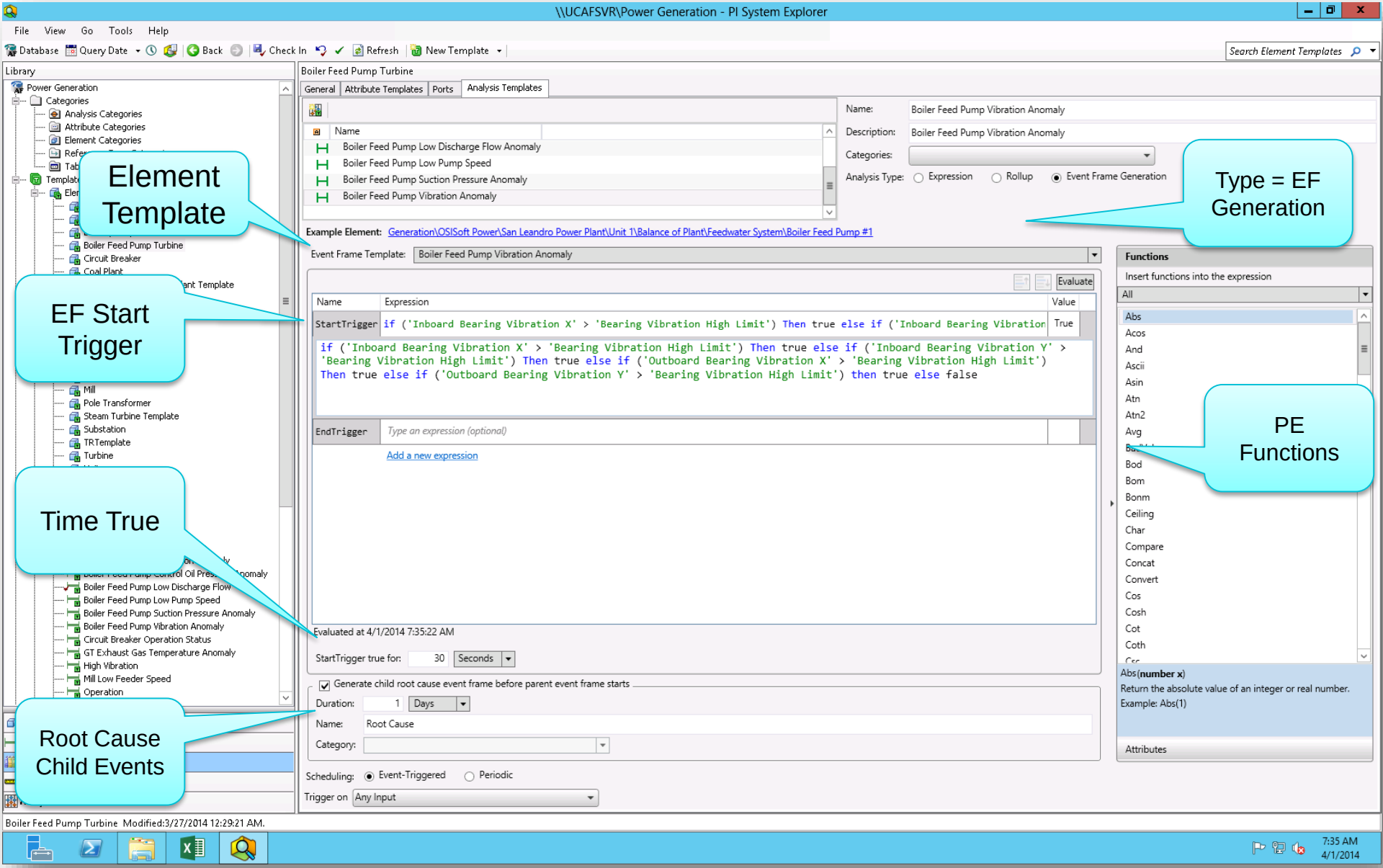
2
- Boiler Feed Pump Bearing Temp
- Boiler Feed Pump Cavitation Anomaly
- Boiler Feed Pump Control Oil Pressure Anomaly
- Boiler Feed Pump Low Discharge Flow
- Boiler Feed Pump Low Pump Speed
- Boiler Feed Pump Suction Pressure Anomaly
- Boiler Feed Pump Vibration Anomaly



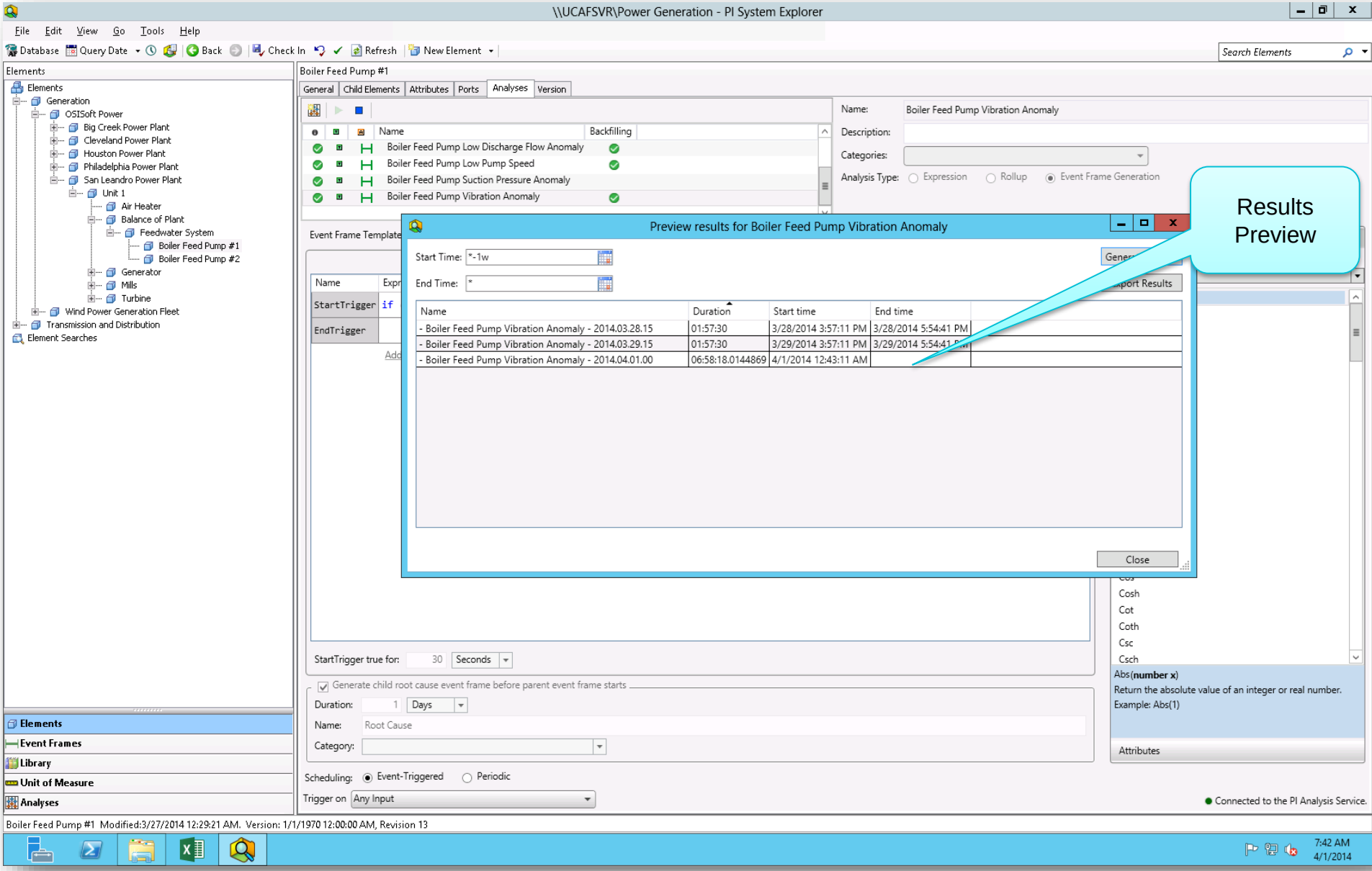
PI AF – Structure and Attributes



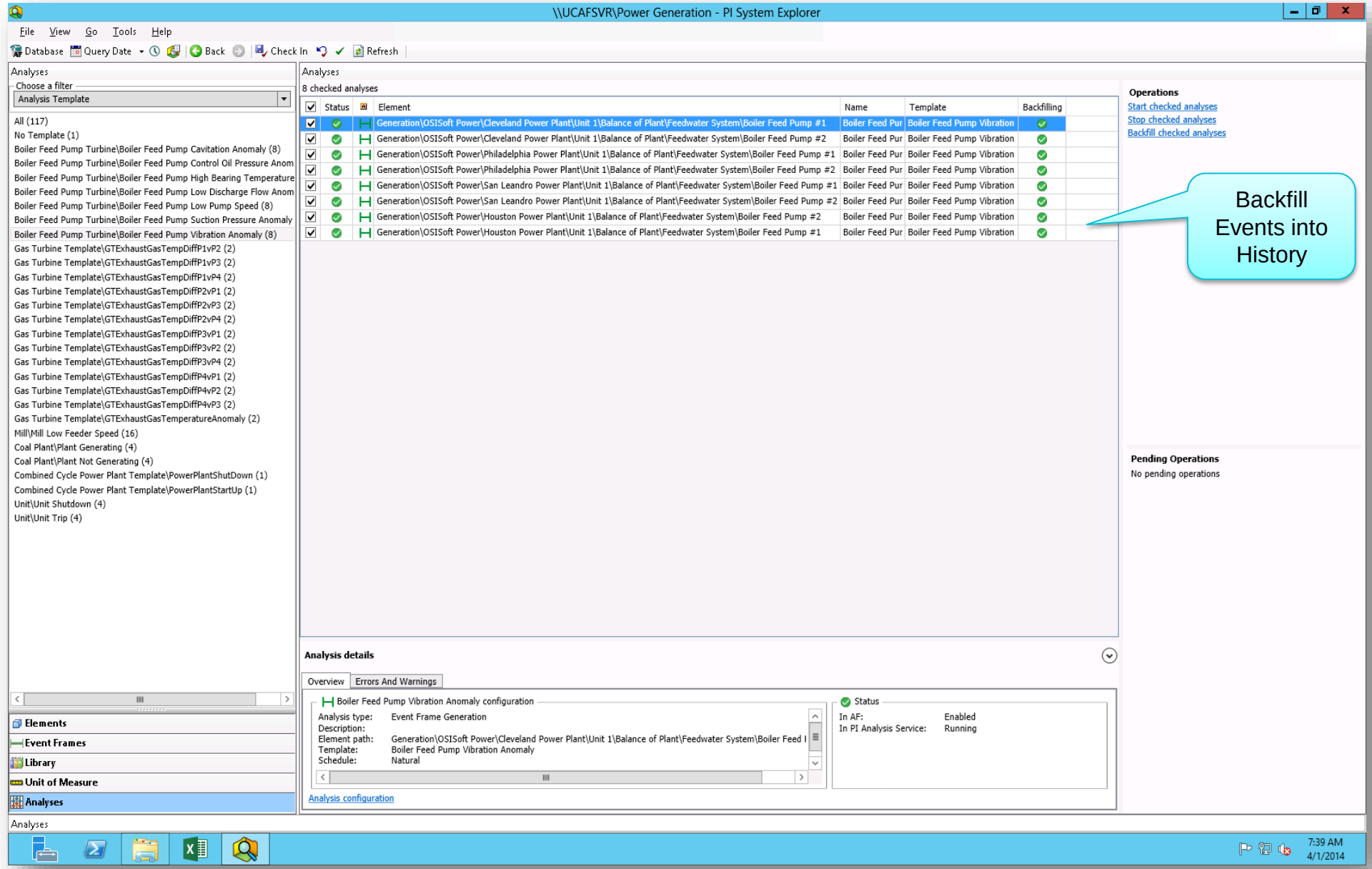
PI AF Asset Based Analytics – Event Detection



PI AF Asset Based Analytics – Event Preview



PI AF Asset Based Analytics – Backfilling Events



PI DataLink 2014 – Pump Relative Report

Site Name	San Leandro Power Plant
Search Start	1/10/2014 0:00 (10-Jan-14 00:00:00)
Unit Name	Unit 1
Search End	* (29-Apr-14 06:40:12)
Pump Name	Boiler Feed Pump #2

Now looking at BFP2

Pump Information [PI AF]

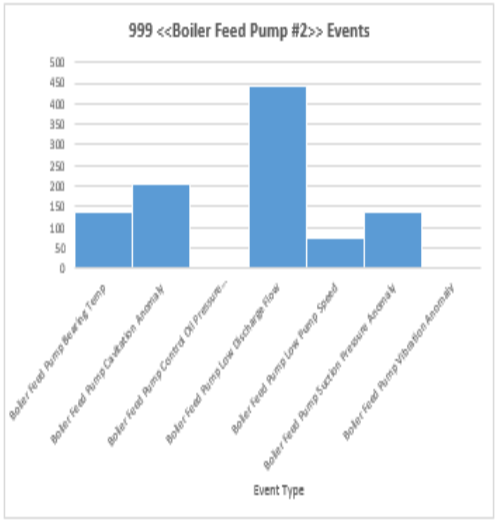
	VIBRATION DATA				PRESS				BEARING TEMPERATURE		
	Inboard Bearing Vibration X	Inboard Bearing Vibration Y	Outboard Bearing Vibration X	Outboard Bearing Vibration Y	Bearing Oil Pressure	Control Oil Pressure	Discharge Pressure	Suction Pressure	Inboard Bearing Temperature	Outboard Bearing Temperature	
UOM	mils	mils	mils	mils	psi	psi	psi	psi	deg F	deg F	UOM
Value at Start: 10-Jan-14 00:00:00	1.02	0.95	0.74	0.68	14.80	35.76	3689.14	115.66	147.31	125.44	Value at Start: 10-Jan-14 00:00:00
Value at End: 29-Apr-14 06:40:12	0.97	0.87	0.75	0.74	14.78	35.75	3776.16	129.87	147.96	125.25	Value at End: 29-Apr-14 06:40:12
Minimum	0.05	0.04	0.03	0.03	14.71	35.46	-38.58	6.60	71.83	73.63	Minimum
Average	0.85	0.89	0.62	0.61	15.61	37.00	2628.75	111.23	128.93	116.20	Average
Maximum	2.72	1.86	3.68	3.70	19.98	46.90	4099.07	207.40	155.31	135.38	Maximum
StDev	0.53	0.54	0.30	0.31	0.78	1.47	1698.24	50.97	29.67	19.54	StDev

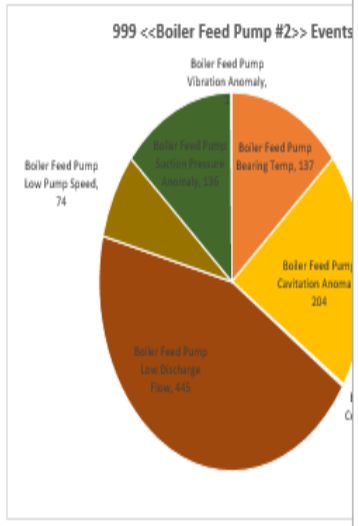
Pump Events [PI EF] (999)

EF NAME: * EVENT CATEGORY: * EVENT TEMPLATE: *

	Duration	Duration Minutes
Minimum	0 0:01:26	1.4
Average	0 16:42:43	1003.3
StDev	2 12:06:59	3607.8
Maximum	31 13:03:01	45423.0

Event name	Start time	End time	Duration	Event template	uration Minutes
Boiler Feed Pump #2 - Boiler Feed Pump L	10-Jan-14 00:00:00	11-Jan-14 06:40:00	16:40:00	Boiler Feed Pump Low Discharge Flow	1840.0
Boiler Feed Pump #2 - Boiler Feed Pump L	10-Jan-14 00:00:00	11-Jan-14 06:40:00	16:40:00	Boiler Feed Pump Low Discharge Flow	1840.0
Boiler Feed Pump #2 - Boiler Feed Pump E	10-Jan-14 00:00:00	12-Jan-14 21:05:00	2 21:05:00	Boiler Feed Pump Bearing Temp	4145.0
Boiler Feed Pump #2 - Boiler Feed Pump E	10-Jan-14 00:00:00	10-Jan-14 05:20:00	0 5:20:00	Boiler Feed Pump Bearing Temp	320.0
Boiler Feed Pump #2 - Boiler Feed Pump E	10-Jan-14 00:00:00	12-Jan-14 21:05:00	2 21:05:00	Boiler Feed Pump Bearing Temp	4145.0
Boiler Feed Pump #2 - Boiler Feed Pump E	10-Jan-14 00:00:00	10-Jan-14 05:20:00	0 5:20:00	Boiler Feed Pump Bearing Temp	320.0
Boiler Feed Pump #2 - Boiler Feed Pump C	10-Jan-14 00:00:00	12-Jan-14 18:40:00	2 18:40:00	Boiler Feed Pump Cavitation Anomaly	4000.0
Boiler Feed Pump #2 - Boiler Feed Pump C	10-Jan-14 00:00:00	12-Jan-14 18:40:00	2 18:40:00	Boiler Feed Pump Cavitation Anomaly	4000.0
Boiler Feed Pump #2 - Boiler Feed Pump E	11-Jan-14 00:30:00	24-Jan-14 21:05:00	13 20:35:00	Boiler Feed Pump Bearing Temp	19955.0
Boiler Feed Pump #2 - Boiler Feed Pump E	11-Jan-14 00:30:00	24-Jan-14 21:05:00	13 20:35:00	Boiler Feed Pump Bearing Temp	19955.0
Boiler Feed Pump #2 - Boiler Feed Pump C	11-Jan-14 07:10:00	11-Jan-14 16:00:00	0 8:50:00	Boiler Feed Pump Cavitation Anomaly	530.0
Boiler Feed Pump #2 - Boiler Feed Pump C	11-Jan-14 07:10:00	11-Jan-14 16:00:00	0 8:50:00	Boiler Feed Pump Cavitation Anomaly	530.0
Boiler Feed Pump #2 - Boiler Feed Pump C	12-Jan-14 16:00:00	13-Jan-14 10:45:00	0 18:45:00	Boiler Feed Pump Cavitation Anomaly	1125.0
Boiler Feed Pump #2 - Boiler Feed Pump C	12-Jan-14 16:00:00	13-Jan-14 10:45:00	0 18:45:00	Boiler Feed Pump Cavitation Anomaly	1125.0
Boiler Feed Pump #2 - Boiler Feed Pump L	12-Jan-14 18:55:00	12-Jan-14 19:55:00	0 1:00:00	Boiler Feed Pump Low Discharge Flow	60.0
Boiler Feed Pump #2 - Boiler Feed Pump L	12-Jan-14 18:55:00	12-Jan-14 19:55:00	0 1:00:00	Boiler Feed Pump Low Discharge Flow	60.0
Boiler Feed Pump #2 - Boiler Feed Pump C	12-Jan-14 19:55:00	12-Jan-14 20:15:00	0 0:20:00	Boiler Feed Pump Cavitation Anomaly	20.0
Boiler Feed Pump #2 - Boiler Feed Pump C	12-Jan-14 19:55:00	12-Jan-14 20:15:00	0 0:20:00	Boiler Feed Pump Cavitation Anomaly	20.0
Boiler Feed Pump #2 - Boiler Feed Pump L	12-Jan-14 20:55:00	14-Jan-14 08:50:00	1 11:55:00	Boiler Feed Pump Low Discharge Flow	2155.0
Boiler Feed Pump #2 - Boiler Feed Pump L	12-Jan-14 20:55:00	14-Jan-14 08:50:00	1 11:55:00	Boiler Feed Pump Low Discharge Flow	2155.0





LIVE | LIVE Root Cause Compare | **Boiler Feed Pump Relative** | Production Summary Report | Hourly Report | Daily Anomaly Investigation | ...

PI DataLink 2014 – Pump Relative Report

AF & Datalink

Events

Excel Charting

Copy of Copy of UC2014 Power Gen Reports - Excel

	1/10/2014 0:00	10-Jan-14 00:00:00	Site Name: San Leandro Power Plant
	*	24-Mar-14 14:17:41	Unit Name: Unit 1
			Pump Name: Boiler Feed Pump #1

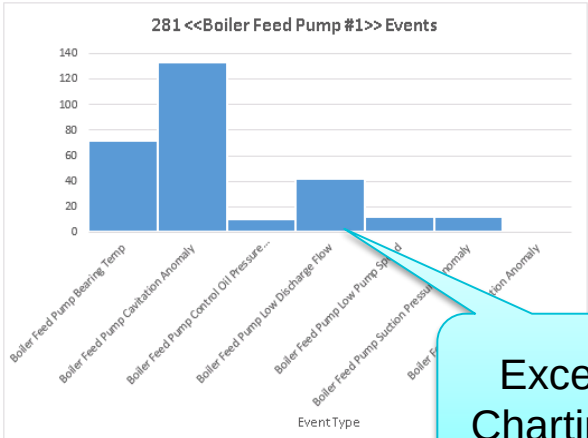
	VIBRATION DATA				PRESSURES				BEARING TEMPERATURES		
	Inboard Bearing Vibration X	Inboard Bearing Vibration Y	Outboard Bearing Vibration X	Outboard Bearing Vibration Y	Bearing Oil Pressure	Control Oil Pressure	Discharge Pressure	Suction Pressure	Inboard Bearing Temperature	Outboard Bearing Temperature	
UOM	mils	mils	mils	mils	psi	psi	psi	psi	deg F	deg F	UOM
Value at Start: 10-Jan-14 00:00:00	1.56	1.39	1.50	1.55	15.04	32.33	3675.56	116.17	135.82	122.56	Value at Start: 1
Value at End: 24-Mar-14 14:17:41	0.09	0.13	0.09	0.05	8.40	34.19	28.38	62.59	80.64	81.67	Value at End: 24
Minimum	0.05	0.05	0.04	0.04	2.11	29.82	-76.94	-4.00	71.84	73.44	Minimum
Average	1.05	1.45	1.21	1.26	14.14	32.87	2796.92	123.04	121.42	110.60	Average
Maximum	2.36	21.00	2.11	1.88	19.12	39.91	4081.23	207.12	142.32	127.20	Maximum
StDev	0.59	2.22	0.68	0.62	3.69	0.96	1687.24	46.10	23.46	16.71	StDev

Pump Events [PI EF] (281)

EF NAME	EVENT CATEGORY	EVENT TEMPLATE
*	*	*

	Duration	Duration Minutes
Minimum	0 0:05:00	#VALUE!
Average	0 12:15:22	#VALUE!
StDev	1 6:01:40	#VALUE!
Maximum	8 7:40:00	#VALUE!

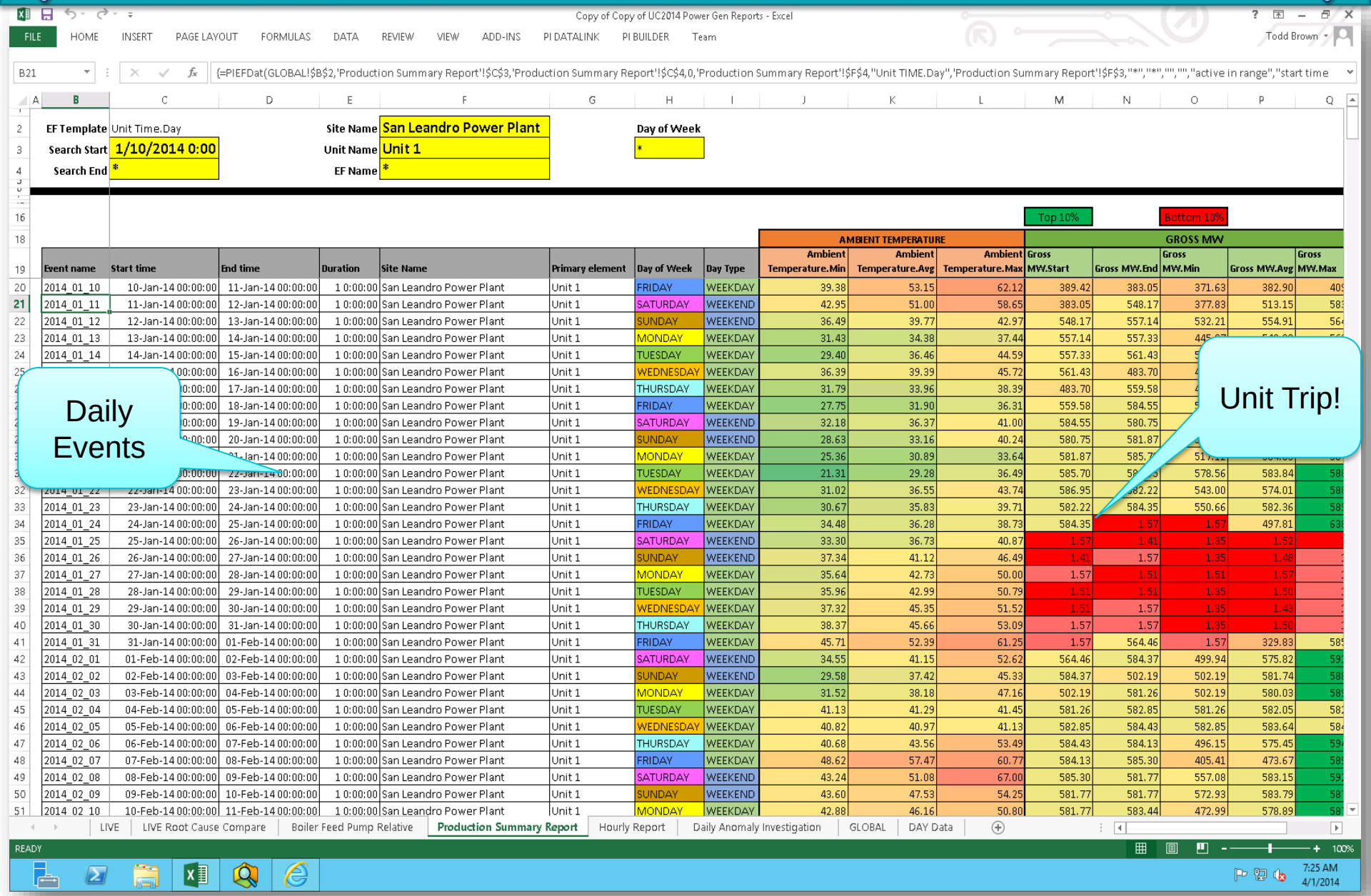
Event name	Start time	End time	Duration	Event template	Duration Minutes
Boiler Feed Pump #1 - Boiler Feed Pum	10-Jan-14 00:00:00	11-Jan-14 06:40:00	1 6:40:00	Boiler Feed Pump Low Discharge Flow	1840.0
Boiler Feed Pump #1 - Boiler Feed Pum	10-Jan-14 00:00:00	11-Jan-14 06:40:00	1 6:40:00	Boiler Feed Pump Low Discharge Flow	1840.0
	10-Jan-14 00:00:00	10-Jan-14 00:55:00	0 0:55:00	Boiler Feed Pump Cavitation Anomaly	55.0
	10-Jan-14 00:00:00	10-Jan-14 00:55:00	0 0:55:00	Boiler Feed Pump Cavitation Anomaly	55.0
	10-Jan-14 06:35:00	10-Jan-14 07:00:00	0 0:25:00	Boiler Feed Pump Bearing Temp	25.0
	10-Jan-14 06:35:00	10-Jan-14 07:00:00	0 0:25:00	Boiler Feed Pump Bearing Temp	25.0
	10-Jan-14 09:35:00	11-Jan-14 11:30:00	1 1:55:00	Boiler Feed Pump Cavitation Anomaly	1555.0
	10-Jan-14 09:35:00	11-Jan-14 11:30:00	1 1:55:00	Boiler Feed Pump Cavitation Anomaly	1555.0
	10-Jan-14 11:45:00	10-Jan-14 12:05:00	0 0:20:00	Boiler Feed Pump Bearing Temp	20.0
	10-Jan-14 11:45:00	10-Jan-14 12:05:00	0 0:20:00	Boiler Feed Pump Bearing Temp	20.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 01:30:00	11-Jan-14 01:50:00	0 0:20:00	Boiler Feed Pump Bearing Temp	20.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 01:30:00	11-Jan-14 01:50:00	0 0:20:00	Boiler Feed Pump Bearing Temp	20.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 07:35:00	11-Jan-14 07:50:00	0 0:15:00	Boiler Feed Pump Cavitation Anomaly	15.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 07:35:00	11-Jan-14 07:50:00	0 0:15:00	Boiler Feed Pump Cavitation Anomaly	15.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 08:20:00	11-Jan-14 08:30:00	0 0:10:00	Boiler Feed Pump Cavitation Anomaly	10.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 08:20:00	11-Jan-14 08:30:00	0 0:10:00	Boiler Feed Pump Cavitation Anomaly	10.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 08:25:00	11-Jan-14 08:50:00	0 0:25:00	Boiler Feed Pump Bearing Temp	25.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 08:25:00	11-Jan-14 08:50:00	0 0:25:00	Boiler Feed Pump Bearing Temp	25.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 12:35:00	12-Jan-14 18:35:00	1 6:00:00	Boiler Feed Pump Cavitation Anomaly	1800.0
Boiler Feed Pump #1 - Boiler Feed Pum	11-Jan-14 12:35:00	12-Jan-14 18:35:00	1 6:00:00	Boiler Feed Pump Cavitation Anomaly	1800.0



LIVE | LIVE Root Cause Compare | Boiler Feed Pump Relative | Production Summary Report | Hourly Report | Daily Anomaly Investigation | GLOBAL | DAY Data

READY

PI DataLink 2014 – Daily Events Production Report



PI DataLink 2014 – Daily Anomaly Report

Daily Data

Excursion Events

Excel Charting

Copy of Copy of UC2014 Power Gen Reports - Excel

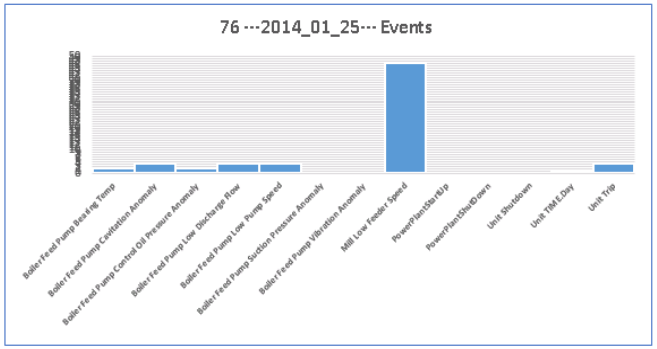
FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW ADD-INS PI DATALINK PI BUILDER Team Todd Brown

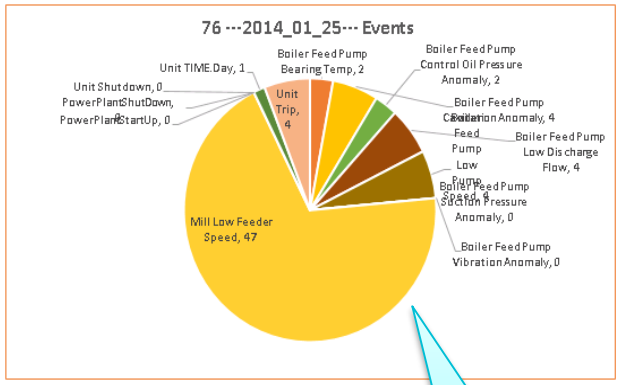
Search Start 1/10/2014 10-Jan-14 00:00:00 Unit Name Unit 1

Search End * 24-Mar-14 14:20:12

DAY NAME	2014_01_25
Site	San Leandro Power Pla
Unit	Unit 1
Start Time	25-Jan-14 00:00:00
End Time	26-Jan-14 00:00:00
Duration	1 0:00:00
Duration (min)	1440.0
Day of Week	SATURDAY
Day Type	WEEKEND
Element Path	\\UCAFSVR\Power Generation\Generation\OSISoft Power\San Leandro Power Plant\Unit 1
AMBIENT TEMPERATURE	
Ambient Temperature.Min	33.30
Ambient Temperature.Avg	36.73
Ambient Temperature.Max	40.87
TURBINE OVERVIEW	
HP Overall Efficiency.Avg	0.00
IP Overall Efficiency.Avg	0.00
GENERATOR OVERVIEW	
Gross MW.Start	1.57
Gross MW.End	1.41
Gross MW.Min	1.35
Gross MW.Avg	1.52

(76) Events during DAY ---2014_01_25--- on <<Unit 1>>





EF Name *

Event Category * Event Template *

Events Active In Range

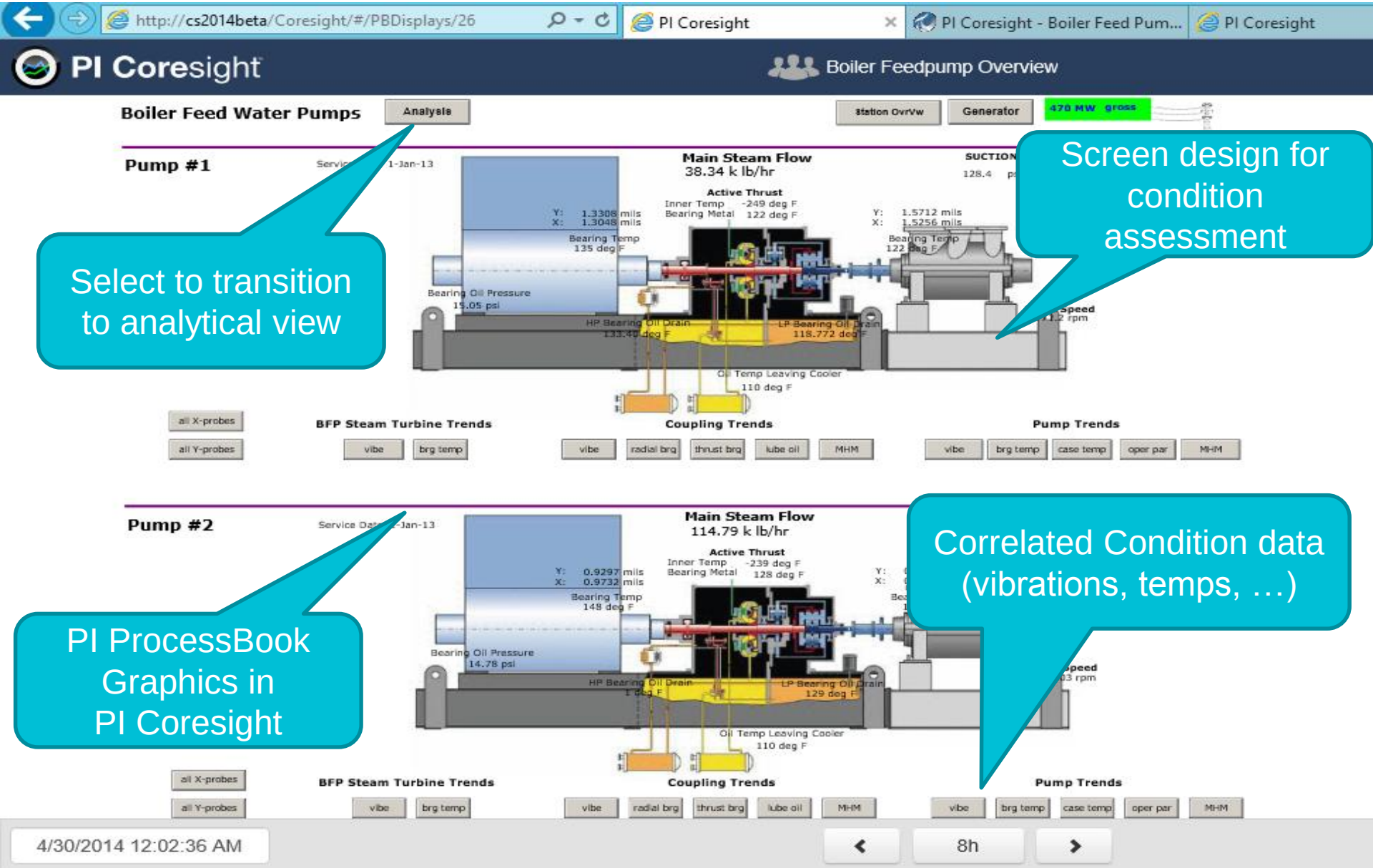
Relative Time	Event name	Start tir	End tir	Durati	Event template		Site
00 -- 05:05:00	Boiler Feed Pump #1 - Boiler Feed Pump Low Discharge Flo	24-Jan-14 18:55:00	29-Jan-14 21:55:00	5 3:00:00	Boiler Feed Pump Low Dischar		San
00 -- 04:05:00	Boiler Feed Pump #1 - Boiler Feed Pump Low Pump Speed -	24-Jan-14 19:55:00	29-Jan-14 21:55:00	5 2:00:00	Boiler Feed Pump Low Pump S		San
00 -- 03:05:00	Boiler Feed Pump #2 - Boiler Feed Pump Low Discharge Flo	24-Jan-14 20:55:00	26-Jan-14 08:50:00	1 11:55:00	Boiler Feed Pump Low Dischar		San
00 -- 02:45:00	Boiler Feed Pump #1 - Boiler Feed Pump Control Oil Pressu	24-Jan-14 21:15:00	25-Jan-14 01:55:00	0 4:40:00	Boiler Feed Pump Control Oil P		San
00 -- 02:30:00	Unit 1 - Unit Trip - 2014.01.24.21	24-Jan-14 21:30:00	31-Jan-14 05:15:00	6 7:45:00	Unit Trip	Unit 1	San
00 -- 01:15:00	Boiler Feed Pump #2 - Boiler Feed Pump Low Pump Speed -	24-Jan-14 22:45:00	26-Jan-14 09:15:00	1 10:30:00	Boiler Feed Pump Low Pump Speed	Boiler Feed Pump #2	San
00 -- 00:06:40	Mill 2 - Mill Low Feeder Speed - 2014.01.24.23	24-Jan-14 23:53:20	25-Jan-14 00:01:00	0 0:07:40	Mill Low Feeder Speed	Mill 2	San
00 -- 00:00:00	2014_01_25	25-Jan-14 00:00:00	26-Jan-14 00:00:00	1 0:00:00	Unit TIME.Day	Unit 1	San
00 -- 00:32:30	Mill 4 - Mill Low Feeder Speed - 2014.01.25.00	25-Jan-14 00:32:30	25-Jan-14 00:42:00	0 0:09:30	Mill Low Feeder Speed	Mill 4	San
00 -- 00:32:50	Mill 1 - Mill Low Feeder Speed - 2014.01.25.00	25-Jan-14 00:32:50	25-Jan-14 01:36:30	0 1:03:40	Mill Low Feeder Speed	Mill 1	San
00 -- 00:34:00	Mill 2 - Mill Low Feeder Speed - 2014.01.25.00	25-Jan-14 00:34:00	25-Jan-14 01:41:20	0 1:07:20	Mill Low Feeder Speed	Mill 2	San
00 -- 01:40:20	Mill 1 - Mill Low Feeder Speed - 2014.01.25.01	25-Jan-14 01:40:20	25-Jan-14 02:22:00	0 0:41:40	Mill Low Feeder Speed	Mill 1	San
00 -- 04:20:20	Mill 1 - Mill Low Feeder Speed - 2014.01.25.04	25-Jan-14 04:20:20	25-Jan-14 04:32:30	0 0:12:10	Mill Low Feeder Speed	Mill 1	San
00 -- 04:34:00	Mill 1 - Mill Low Feeder Speed - 2014.01.25.04	25-Jan-14 04:34:00	25-Jan-14 04:38:30	0 0:04:30	Mill Low Feeder Speed	Mill 1	San
00 -- 04:40:50	Mill 1 - Mill Low Feeder Speed - 2014.01.25.04	25-Jan-14 04:40:50	25-Jan-14 08:03:30	0 3:22:40	Mill Low Feeder Speed	Mill 1	San
00 -- 08:14:00	Mill 1 - Mill Low Feeder Speed - 2014.01.25.08	25-Jan-14 08:14:00	25-Jan-14 08:40:00	0 0:26:00	Mill Low Feeder Speed	Mill 1	San
00 -- 08:46:40	Mill 1 - Mill Low Feeder Speed - 2014.01.25.08	25-Jan-14 08:46:40	25-Jan-14 08:53:50	0 0:07:10	Mill Low Feeder Speed	Mill 1	San
00 -- 09:09:00	Mill 1 - Mill Low Feeder Speed - 2014.01.25.09	25-Jan-14 09:09:00	25-Jan-14 09:14:20	0 0:05:20	Mill Low Feeder Speed	Mill 1	San

LIVE | LIVE Root Cause Compare | Boiler Feed Pump Relative | Production Summary Report | Hourly Report | Daily Anomaly Investigation | GLOBAL | DAY Data

READY 20 OF 77 RECORDS FOUND 90%

7:28 AM 4/1/2014

CBM / Proactive Maintenance Monitoring



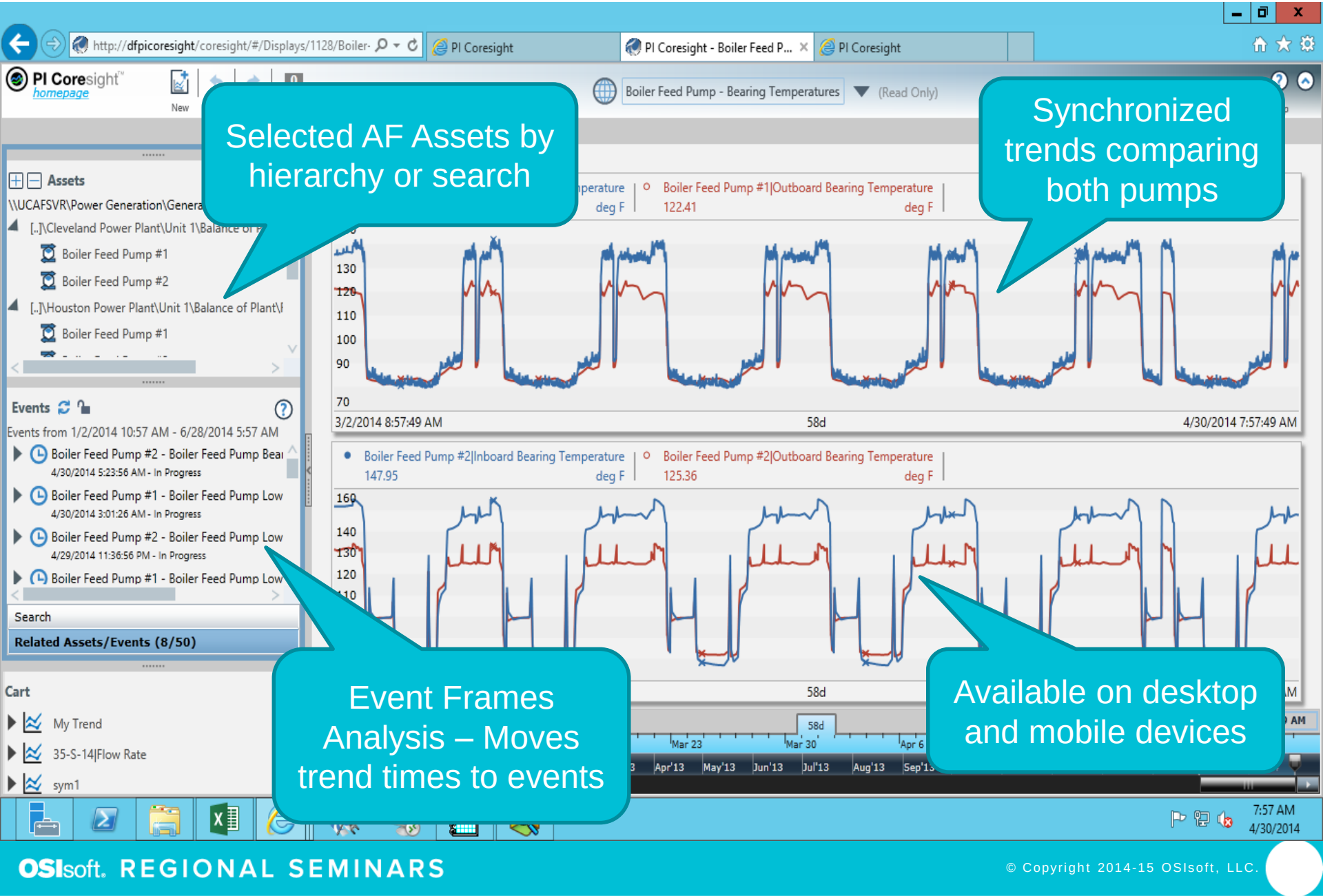
Select to transition to analytical view

Screen design for condition assessment

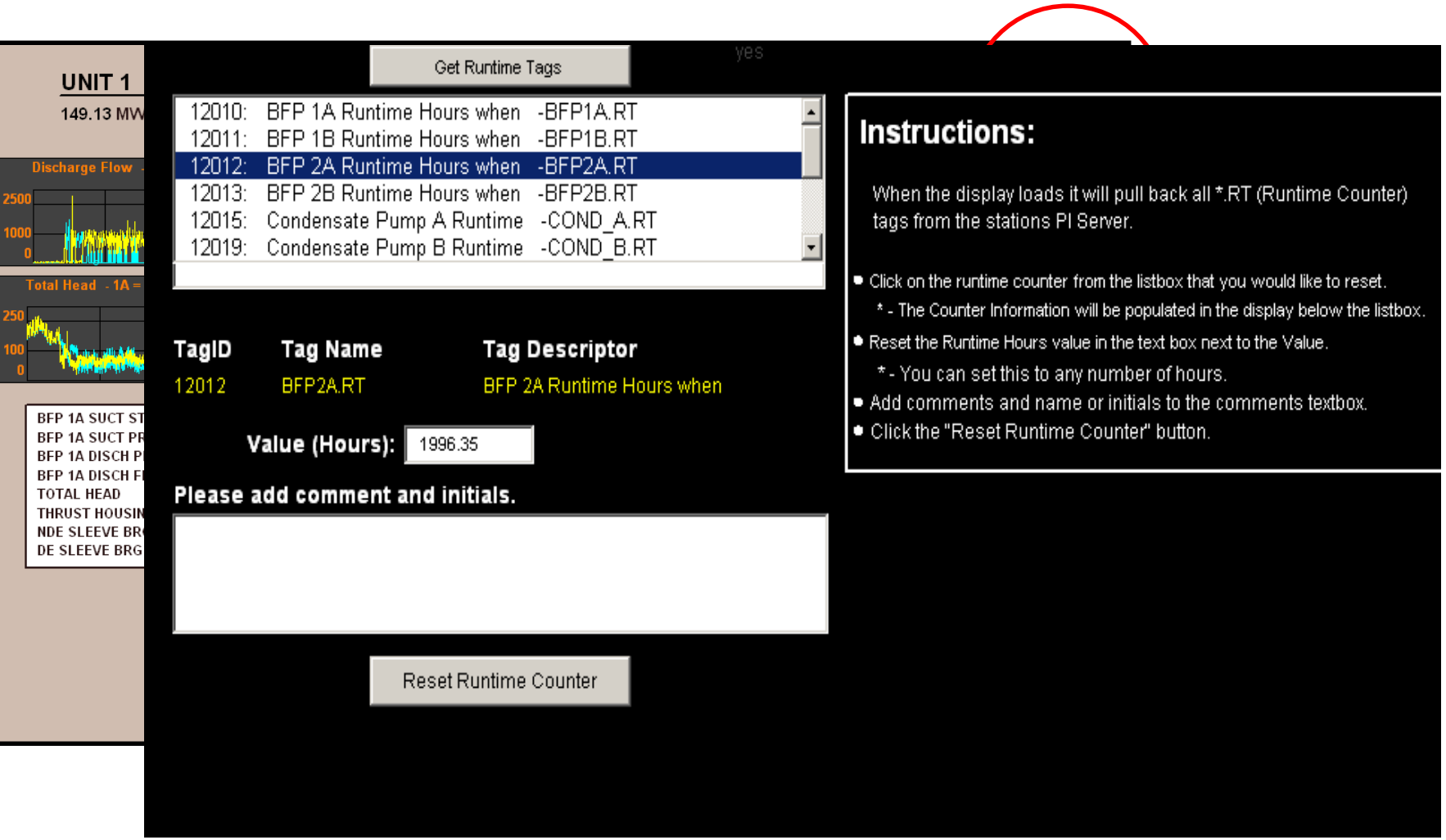
PI ProcessBook Graphics in PI Coresight

Correlated Condition data (vibrations, temps, …)

CBM / Proactive Maintenance Monitoring



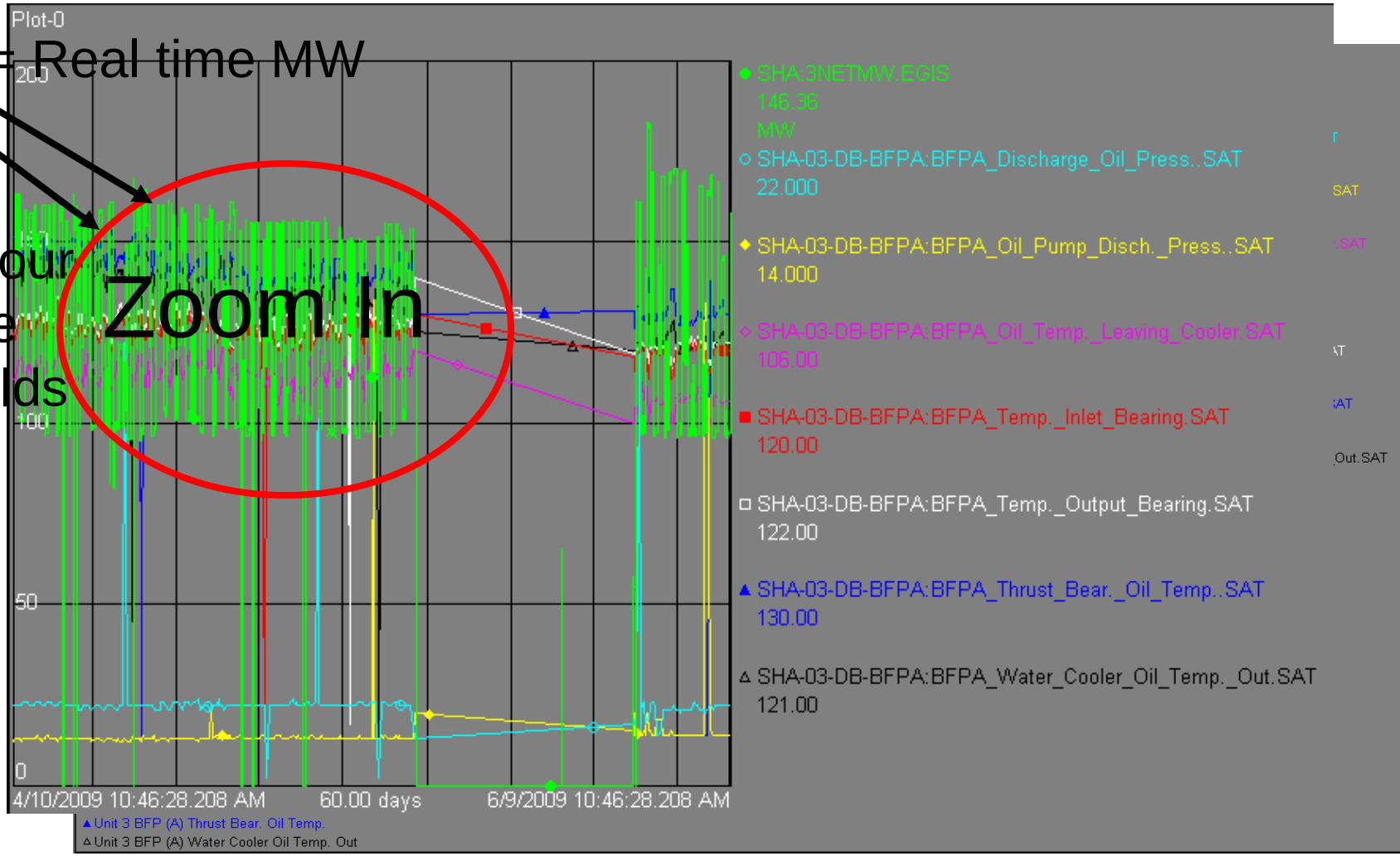
Condition Based Maintenance Screens



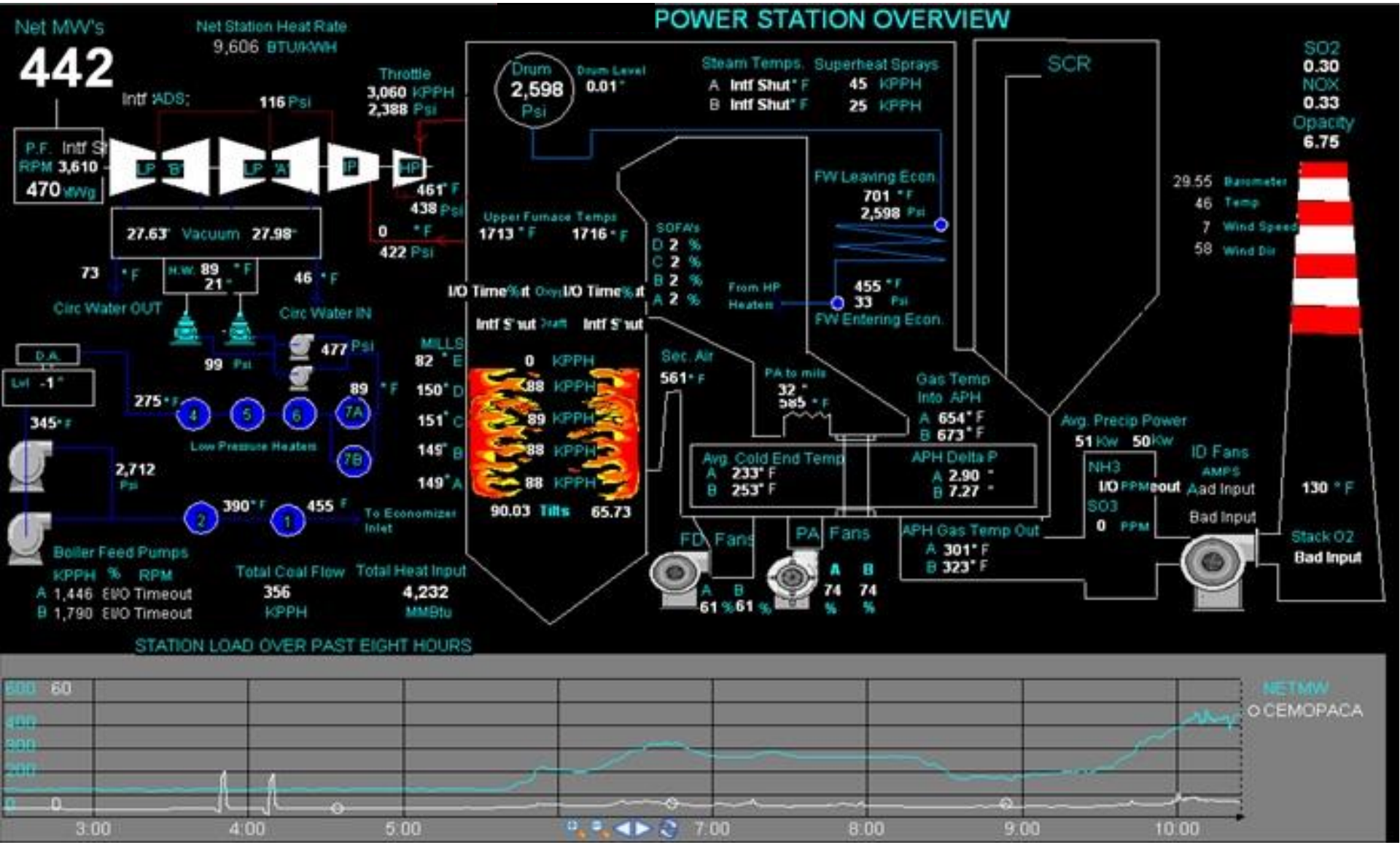
Manual Round Data Correlation

Green = Real time MW

Data Taken every hour from the handhelds

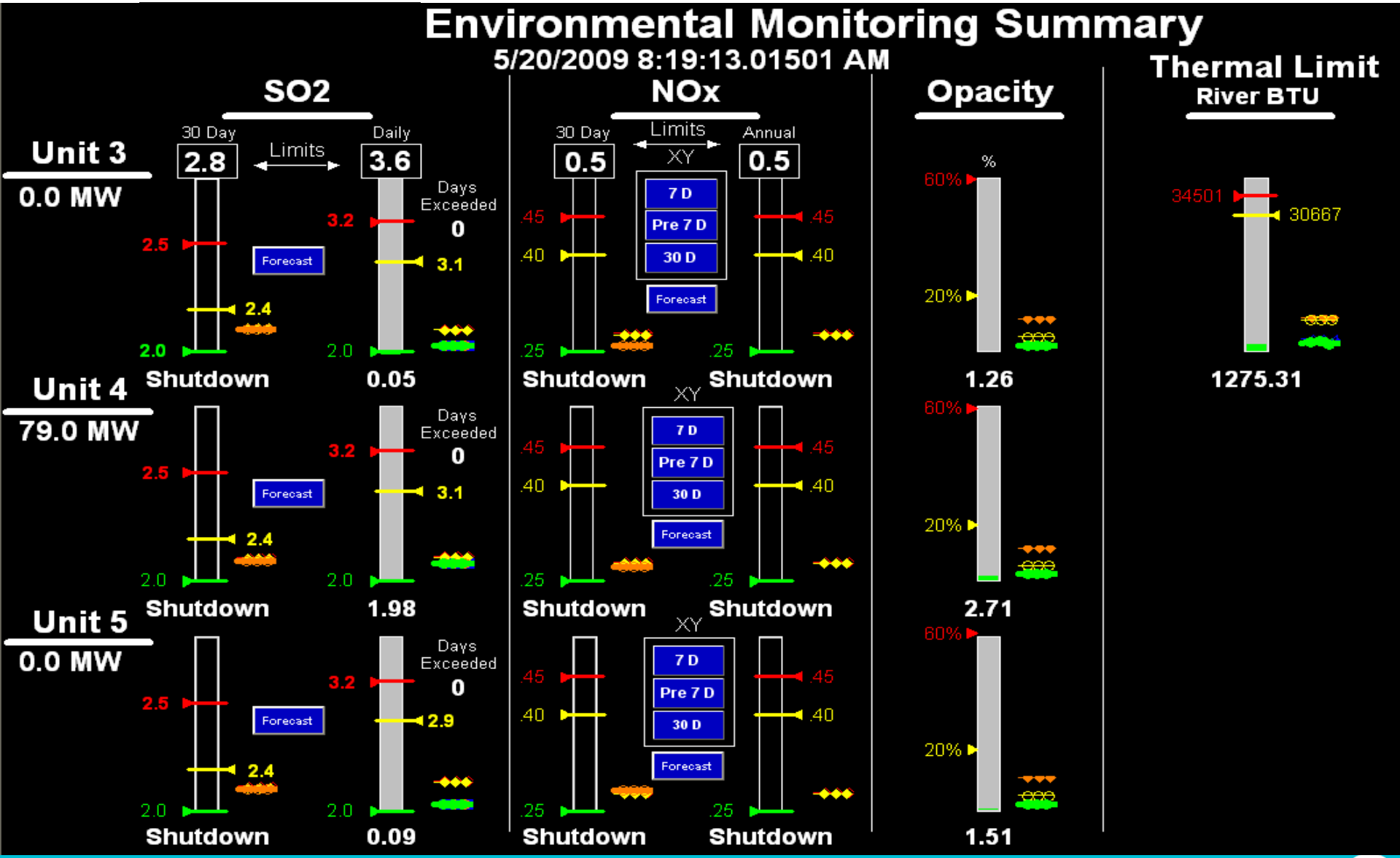


Operations – Plant Overview



Operations – Controllable Loss

Environmental Monitoring



IBERDROLA

TELEMANDO PARQUES EOLICOS

20:00:35 13/08/02

Iberdrola Ingeniería y Consultoría

Aerogenerador Nº11 | HOME | ZOOM | IMPRIMIR | MAPA | PARQUE | MAPA 3D | PARQUE | Campisábalos

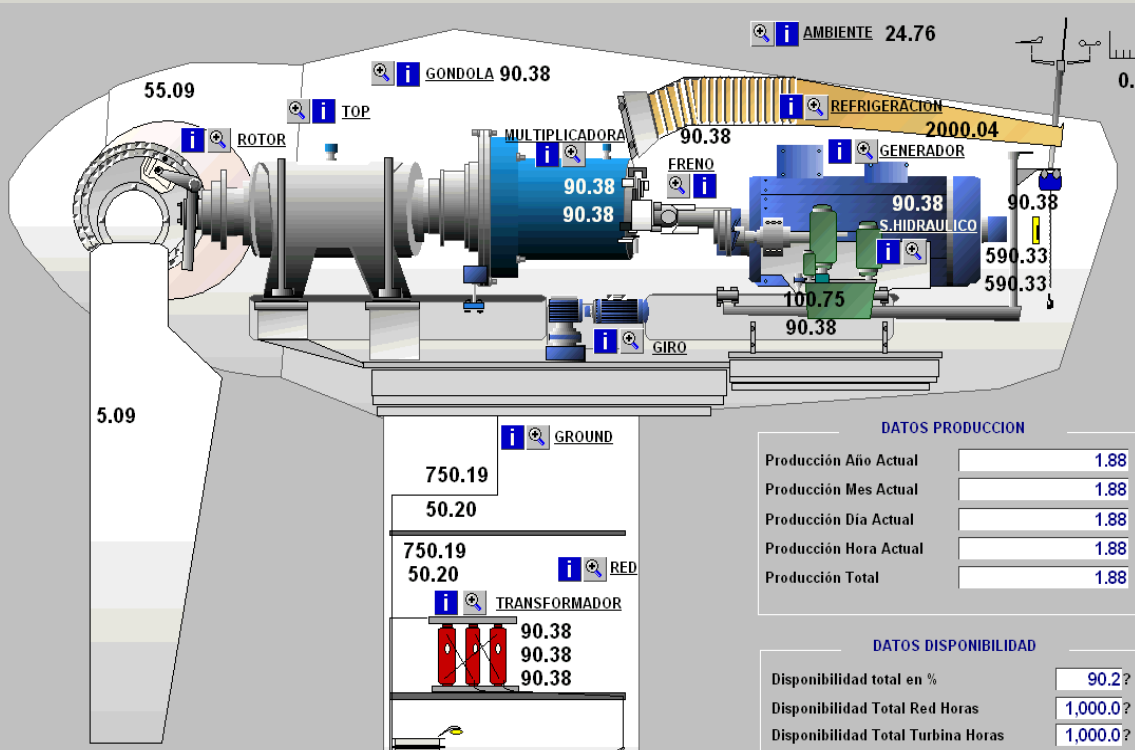
CONTROL DE PARQUE

TELECONTROL

UMB

PARQUES EOLICOS

	Inc	P.cida	P.ble	Enc.%	Emes	Eaño	Cap.%
Campisábalos	0	274	237	116	572.9	572.2	1
Pozocañada							
Hijes							
Somolinos							
Morrablancas							
Catalojas							
TOTAL	0	274	237	116	572.9	572.2	1



DATOS PRODUCCION

Producción Año Actual	1.88
Producción Mes Actual	1.88
Producción Día Actual	1.88
Producción Hora Actual	1.88
Producción Total	1.88

DATOS DISPONIBILIDAD

Disponibilidad total en %	90.2
Disponibilidad Total Red Horas	1,000.0
Disponibilidad Total Turbina Horas	1,000.0
Disponibilidad mes en %	90.2
Disponibilidad Mes Red Horas	1,000.0
Disponibilidad Mes Turbina Horas	1,000.0
Disponibilidad mes anterior en %	90.2
Disponibilidad Mes Anterior Red Horas	1,000.0
Disponibilidad Mes Anterior Turbina Horas	1,000.0

VERSIONES AEROGENERADOR

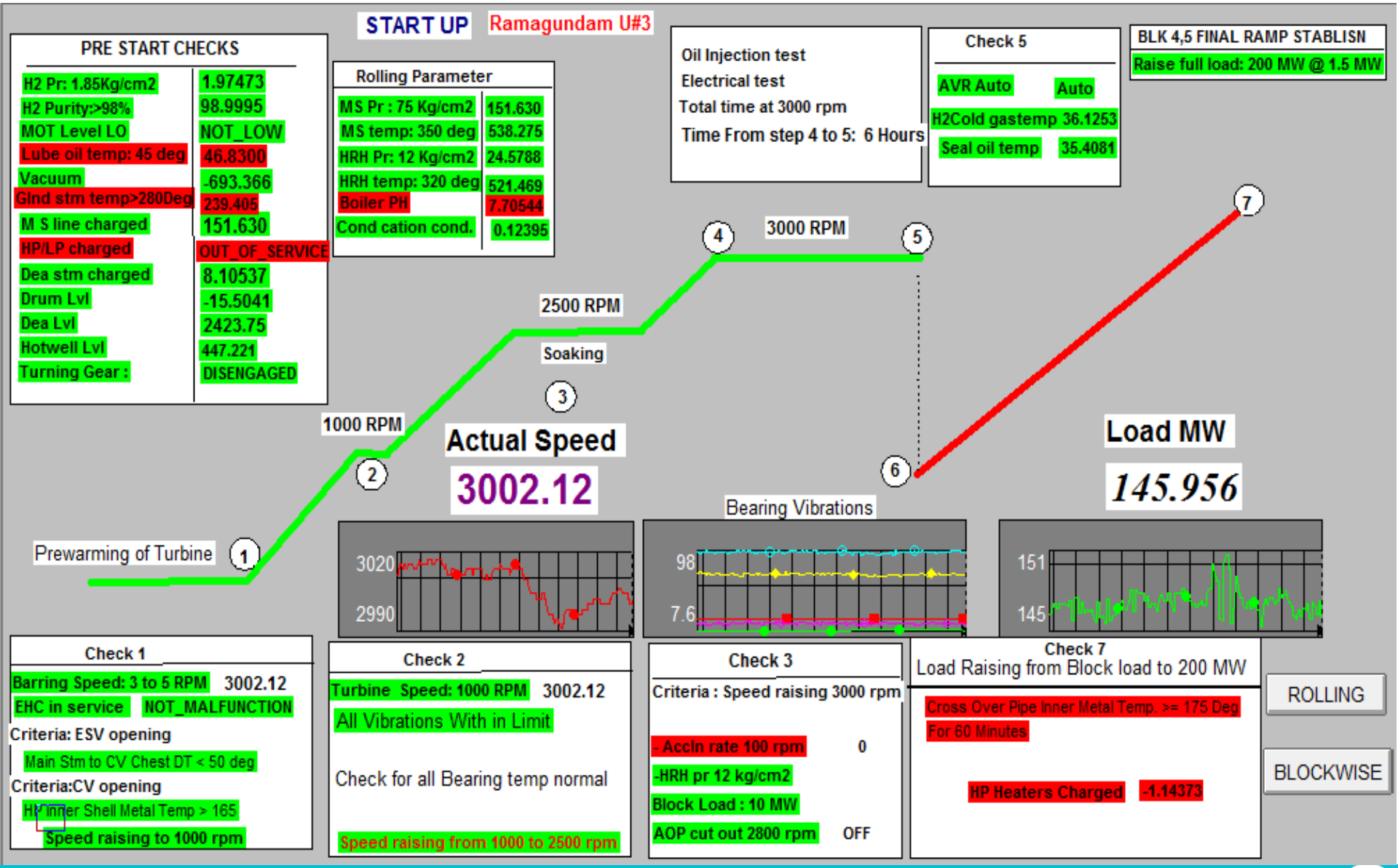
Versión Armario Control Top	?
Versión Armario de Control Ground	?

PROTECCIONES SUBESTACION

MINIMA TENSION	SOBRETEN. INSTANEA	SOBREINTENSIDAD	MAX.FRECUENCIA	MIN.FRECUENCIA	SOBRETENS. HOMOL.	DISP.CUBA TRAFO	DIS.NEUTRO.TRAFO	DISP.TERMOSTATO
ALARMA TEMPERATURA	DISP.TEMPERATURA	ALARMA BUCHHOLZ	DISPARO BUCHHOLZ	BAJO NIV. ACEITE	SOBREPRES. TRAFO	AUTOM.. T TENSION	FALTA C.A	FALTA C.C

13/08/02 19:57:20.279 Alarm on - not ack. ECM_HIGH

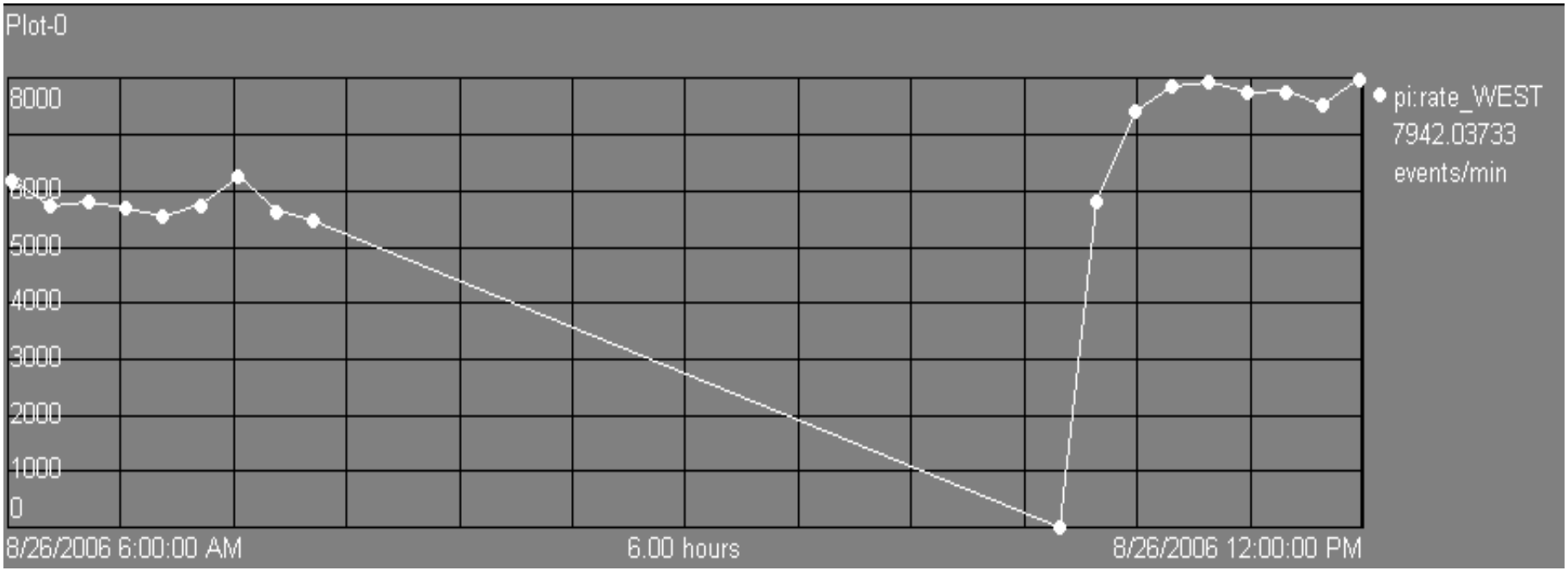
Non-routine Operations : Start-Up



The Challenge

So much data, So little time…

- Larger systems
- Data Overload
- How can we mine the data for information?



Advanced Pattern Recognition (APR) Modeling (Partner products using the PI System)

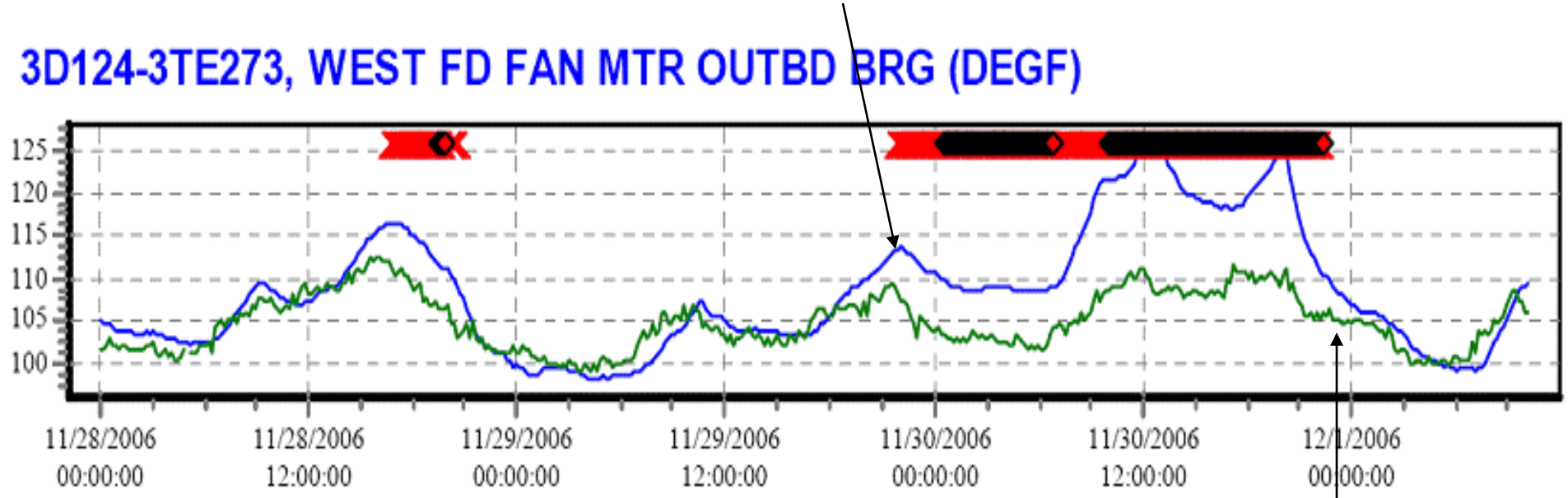
Predictive Analytics leverages the PI system

- *Computers working for you!*
- Reduces Manual Monitoring
- Detects anomalies on critical equipment and systems
- Early detection of slow developing failure
- Multiple sensor models, not just a single signal
  - Avoiding failures
  - Supporting Operations
  - Optimizing Maintenance

Rules based monitoring of critical systems.
Computer models watching the data all the time

Fan Motor Bearing

Temperature movement on FD Fan Motor outboard bearing (about 17 degrees above expected currently).



After detection, the filters were found dirty, replaced, and the real time oil level and temps are dropping back to the model expected value.

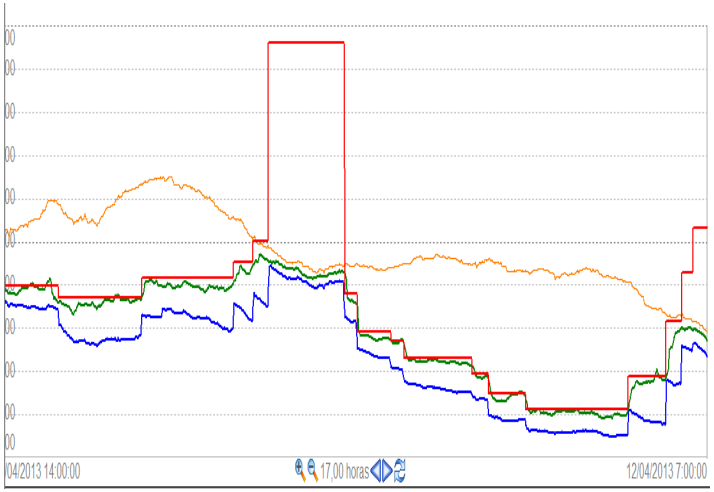
PI System usage to improve Curtailment Strategies

"… Along this month generation has been increased in more than 50 GWh, which would not have been generated if we had followed the former curtailment strategies."

"This means an important benefit to our company. And also a few other facts such as less mechanical wear of our turbines, less urgent works on site, … which are more difficult to quantify"

Gustavo Moreno

CORE Manager



Business Challenge

- Reduce inefficiencies
- To use aggregate real time data for real time decision making during curtailment issued by TSO

Solution

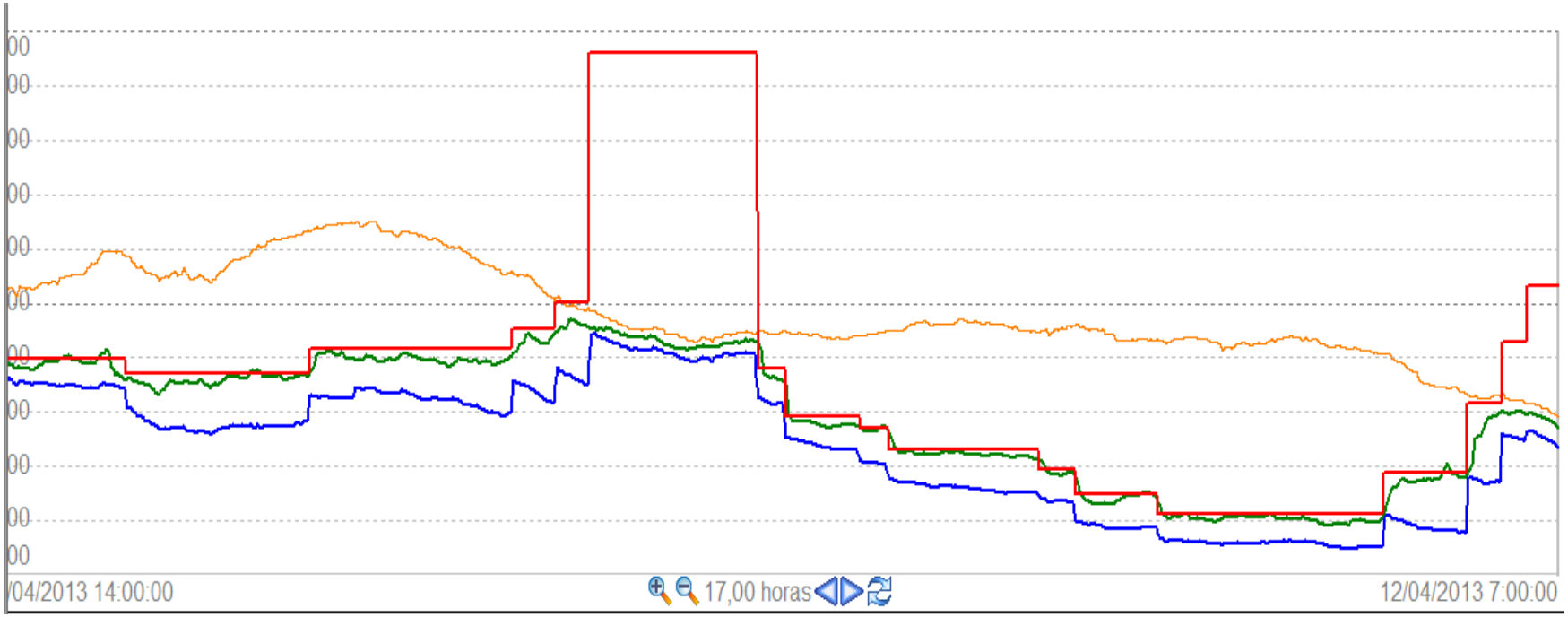
- PI AF training, design, planning and deployment
- CoE help with PI ACE deployment
- Calculated data inserted in PI Servers

Results and Benefits

- Average increase in energy generation: 30% with peaks above 60%
- Other benefits not quantified yet

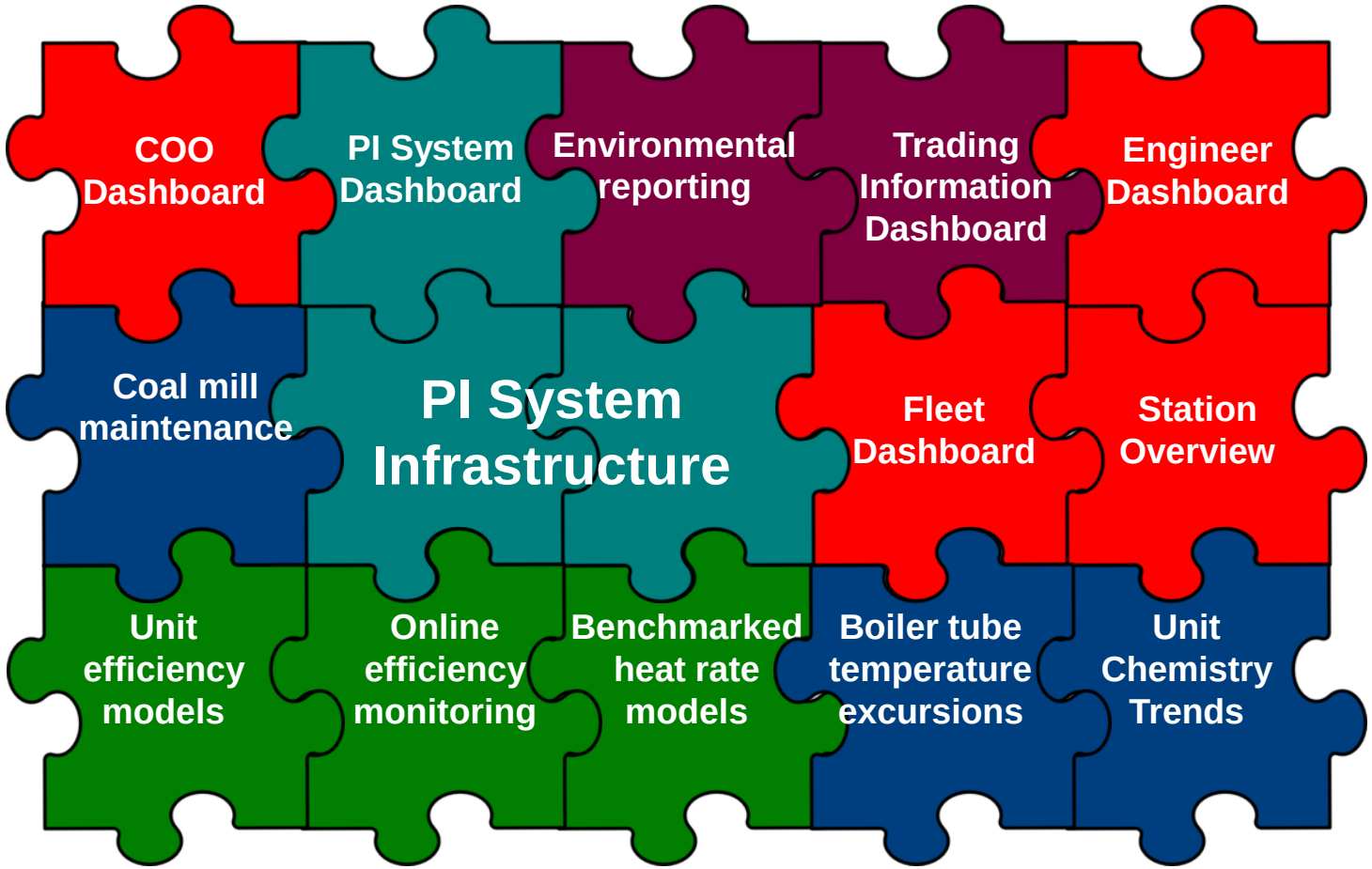
IBERDROLA

CURRENTLY: Global Setpoint Curtailment



Average increase in energy generation: 30% with peaks above 60%

Business Transformation - Benefits



Capability Development

PI System Infrastructure & data feeds

Integration with Intranet, create awareness

Explore expert systems:

- Performance Optimisation
- Asset use optimisation, predictive monitoring

Relate other data sources:

- Advanced analysis & process tuning

verve ENERGY

Business Case – 12 months later

- Bu
  -
  -

OSIsoft “Power Of Data”

- All data in real-time with context and history
- Decision Making is:
  - Faster
  - More Accurate and Complete
  - More Effective
- Preserve and expand knowledge
- Enable situational awareness and predictability
- Increase speed of execution
- Cultivate and leverage the collective “mind” power of the organization

Please contact us for more information

Thank you for your attention

Mr. David A. Thomason
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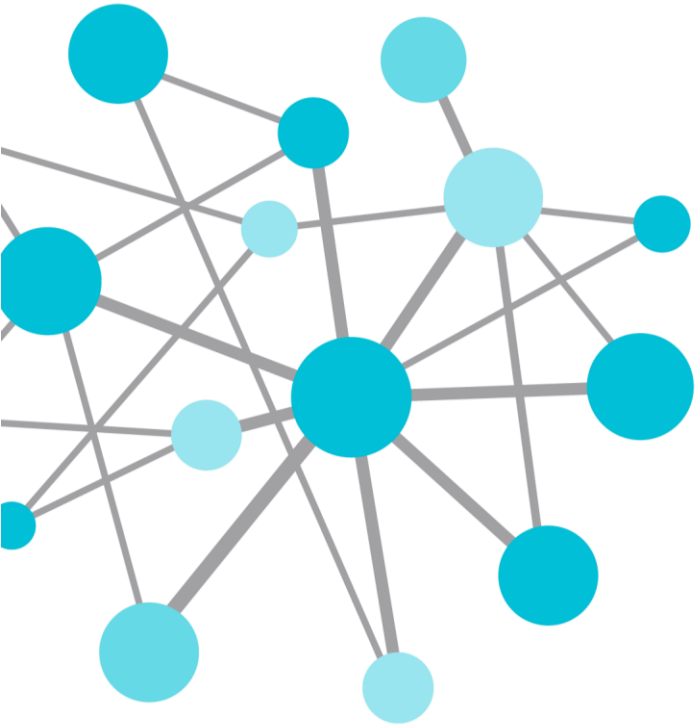
Email: dthomason@osisoft.com
Corporate Website www.osisoft.com



THANK YOU

Brought to you by OSIsoft.