OSIsoft®
USERS CONFERENCE
2009
SAN FRANCISCO

Improving Decision Making Through Advanced Analytics

Presented by
Kenny Luebbert – KCP&L
Dave Thomason – Reliant
Gary Barnes – Entergy

Empowering Business in Real Time
PI Infrastructure for the Enterprise

Maintenance Decision Support with OSI PI & SmartSignal

Presented by
David Thomason
Manager Wholesale IT
Reliant Energy

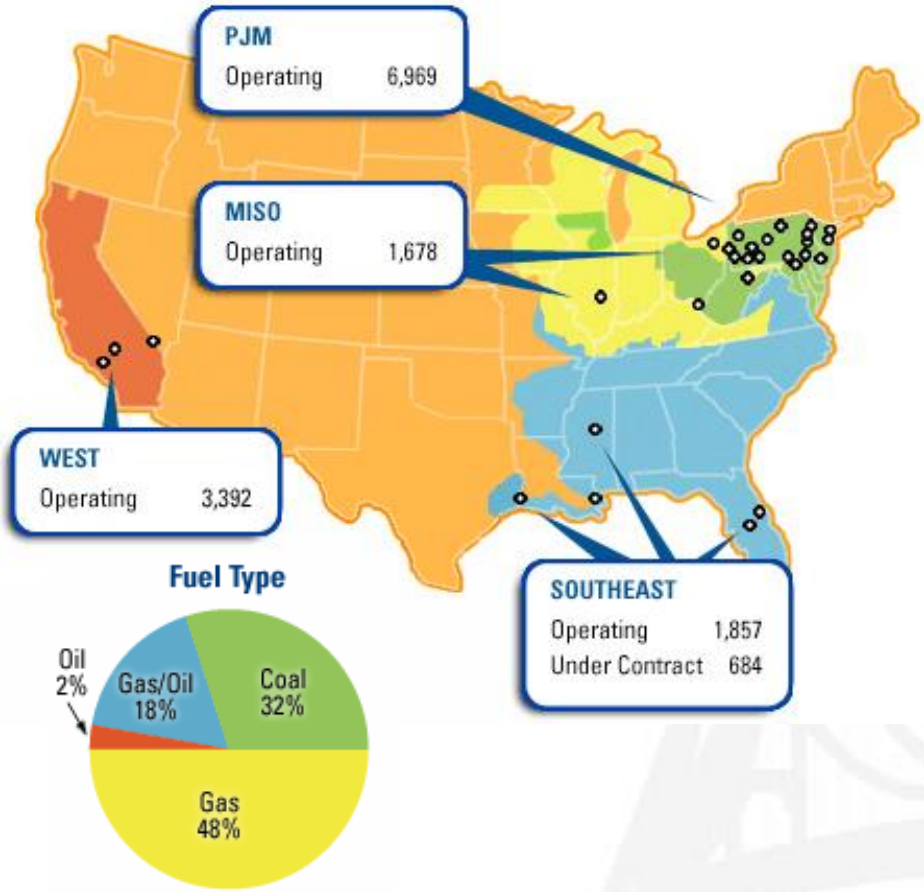
Empowering Business in Real Time
PI Infrastructure for the Enterprise

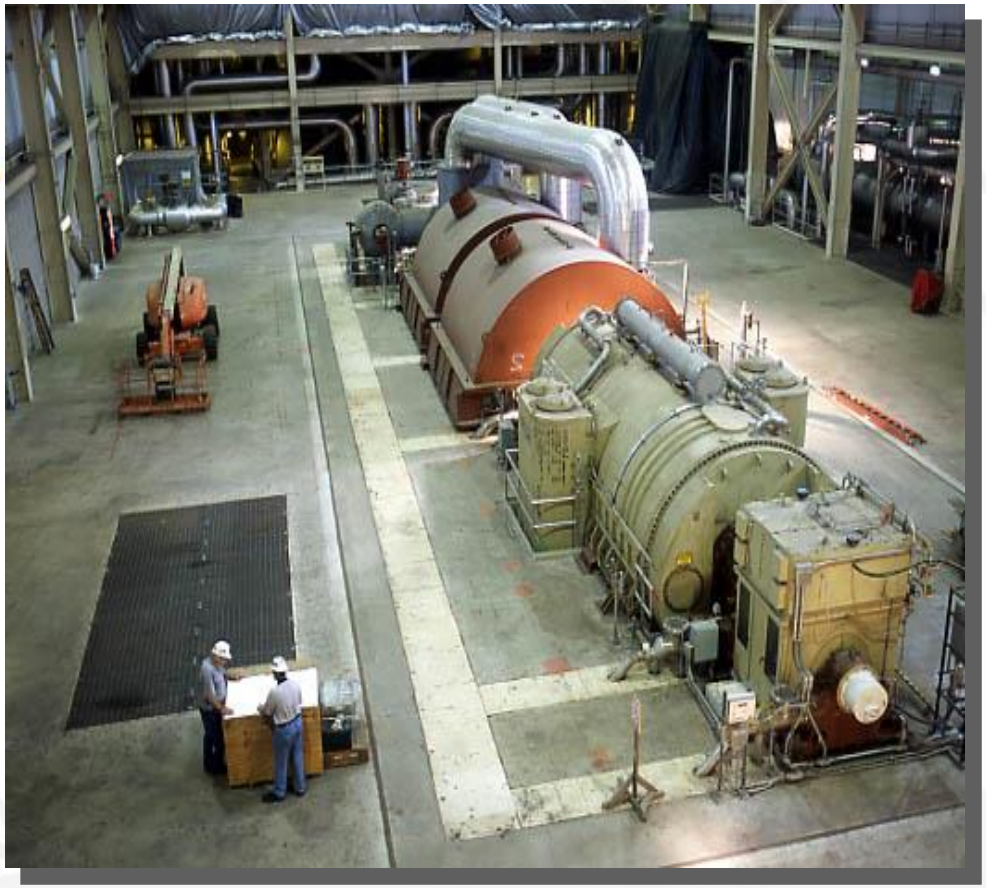
Reliant Energy Company Information

Reliant Energy, Inc. (NYSE: RRI), based in Houston, Texas, provides electricity and energy-related products to more than 1.7 million retail and wholesale customers, primarily in Texas. We are one of the largest independent power producers in the nation with more than 14,000 megawatts of power generation capacity in operation or under contract across the United States.

Generating Fleet Location and Fuel Type

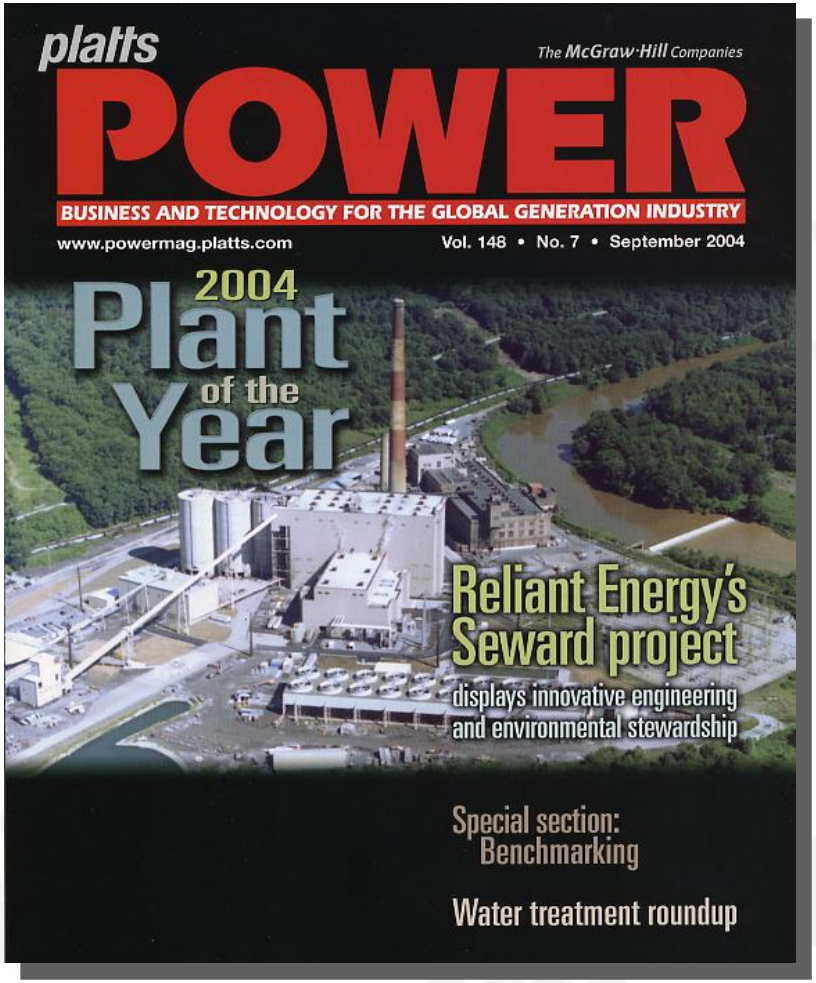
Reliant Energy™



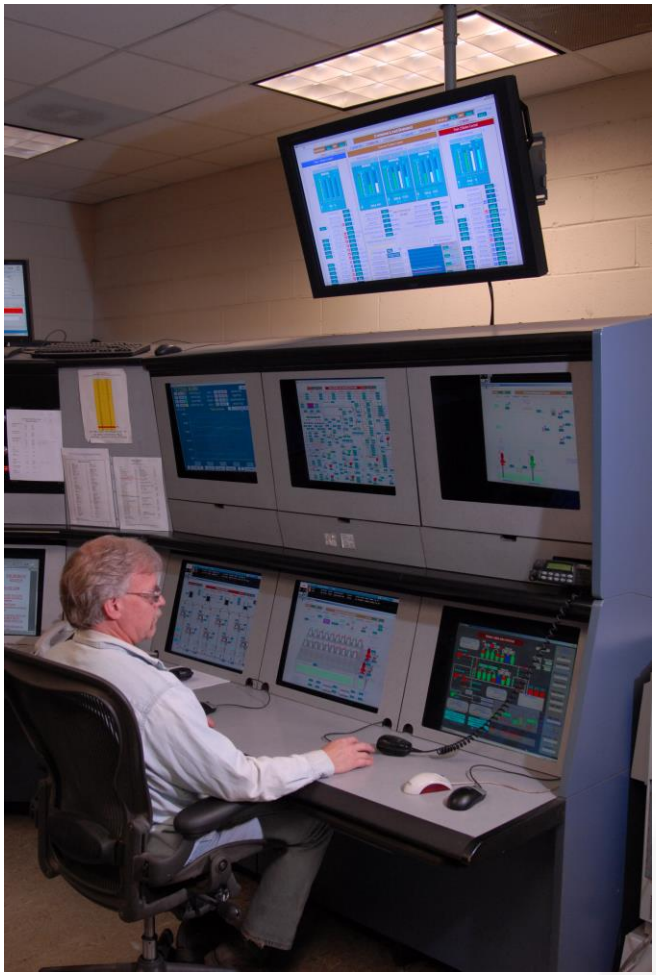


Outline

- Driving Factors
- OSI PI & SmartSignal Footprint
- Proactive Maintenance
- Cool Catch
- Possibilities with OSI PI, SmartSignal & SmartConnector



Driving Factors



- ***Problem:*** Many Disparate Plant Systems and the need to turn data into ***actionable*** information
  - DCS, PLC, CEMS, Analyzers…
  - Various timestamps
  - Data accessibility & integrity
- ***Solution:*** OSI PI & SmartSignal
  - Common Database (PI)
  - Common Toolset (ProcessBook & DataLink)
  - Common architecture platform for development and advanced analytics
  - Leverage SMEs (Central & Plant)

OSI PI & SmartSignal Footprint

OSI PI Infrastructure

- 29 PI Servers, 203 Interfaces
- 1000+ real-time process displays & reports
- 350K tags (real-time data points)
- ProcessBook, Datalink, ActiveView, RTPortal, ACE,…

SmartSignal Scope

- 67 coal & natural gas power units across U.S.
- Total 13,450 MW power
- Rotating & non-rotating balance of plant assets monitored
- 411 assets, 1174 models, using 30K+ sensors for advance analytics

Proactive Maintenance

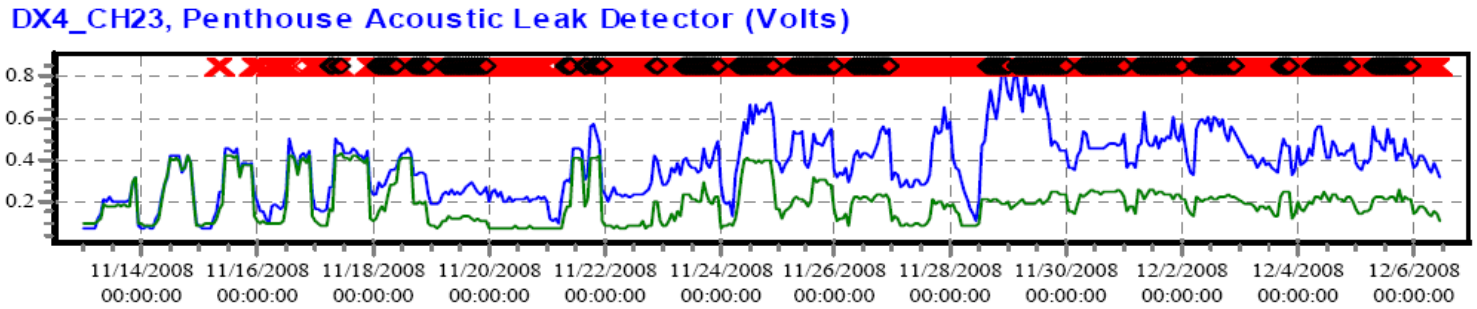
- **Proactive Maintenance** is a strategy in which Corrective, Preventive, and Predictive processes complement one another. We are targeting a **"best practice"** maintenance mix.

Reactive 10%	Preventive 35%	Predictive 55%
Minimize and Control emergent work	Optimize current PM Practices	Expand existing PdM Applications

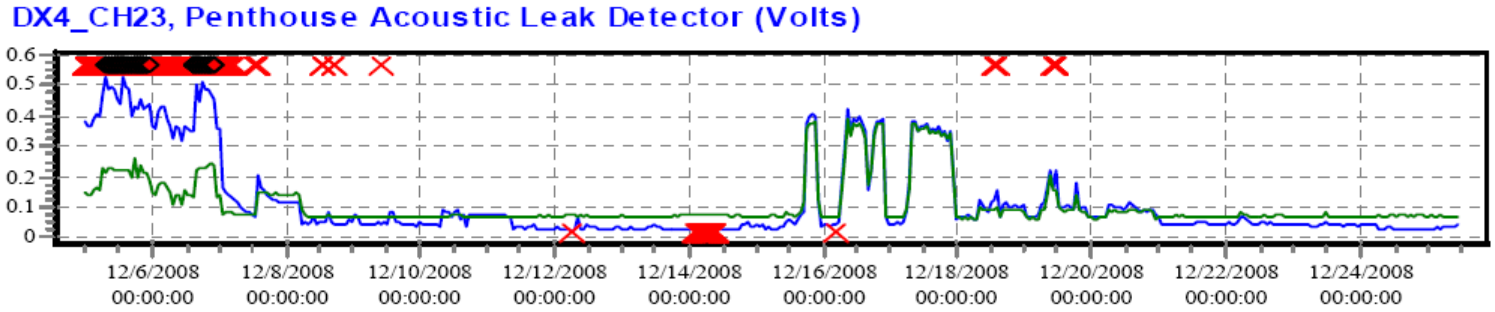
- In support of this strategy we will enhance & expand the effective use of our data and analytical systems.

Cool Catch

Background: A boiler acoustic detector system was installed and the data was integrated into OSI PI. A SmartSignal model was created from the statistical data. The Plant engineer noticed an increase in the Unit Penthouse Acoustic Leak Detector.



Resolution: The problem was looked into while the unit was offline and a small tube leak was discovered in the penthouse. The leak was repaired and the penthouse acoustic leak detector has returned to historically normal levels, avoiding a potential forced outage.



Possibilities with OSI & SmartSignal

- SmartSignal modeling & SmartConnector capabilities to push statistical expected values back into PI can provide real-time operational feedback to your ProcessBook displays and the control room.
  - Expected values for critical equipment
    - Temps, Pressures, Vibrations, …
  - Controllable Losses
  - Heat Rate
  - Expected values during start up & shut down for optimization

Q&A

The Next Plateau

Integrating Best-in-Class Technologies to Achieve World-Class Performance

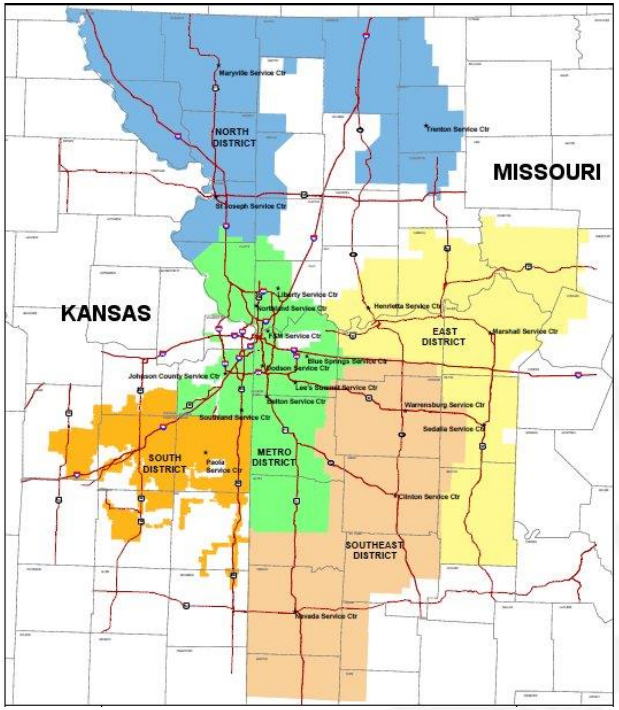
Presented by Kenny Luebbert

Empowering Business in Real Time

PI Infrastructure for the Enterprise

Kansas City Power & Light Overview

- Acquired Aquila in 2008
- Regulated energy provider to more than 800,000 customers
- Operates a generation fleet exceeding 6,000 MW



Service Territory

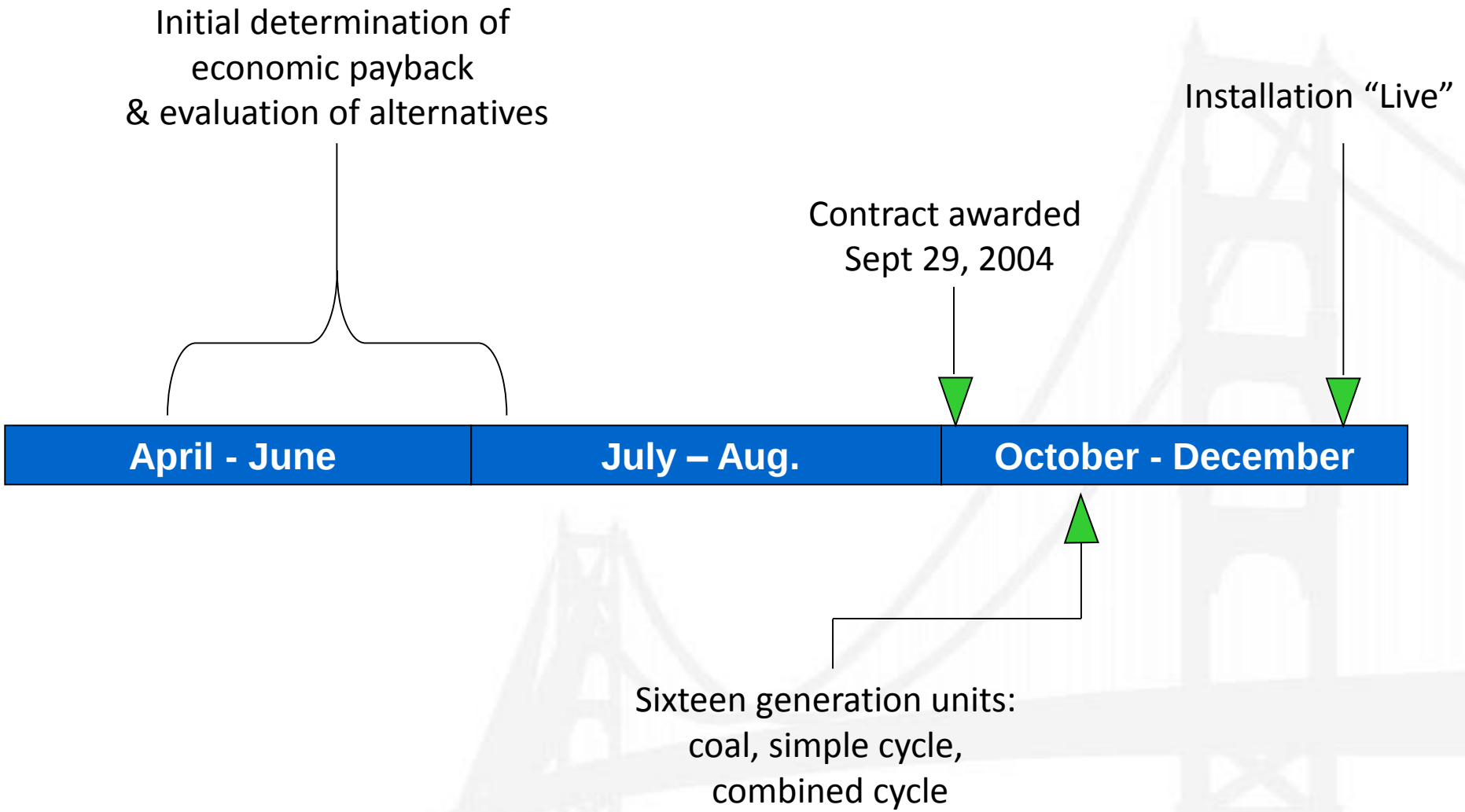
Discussion Overview

- Past
  - Why we chose Predictive technology - SmartSignal
  - Catches
- Present
  - Distributed Monitoring Approach
  - Reporting
- Future
  - Fleetwide Performance Monitoring and CO_2 Program
  - Further integration of Historical Database, Performance Monitoring, Equipment Condition-Monitoring applications

Why did we need Predictive Technology?

- Despite the following systems, equipment was still failing unexpectedly
  - Distributed Control System
    - Considerable alarm management
    - Alarm response database
  - PI Historian
  - Extensive preventative-maintenance program
- Executives tasked engineering to look at various technologies to improve plant operation
  - Statistical based monitoring software
  - Neuro-network optimization software
  - Advanced alarm management software

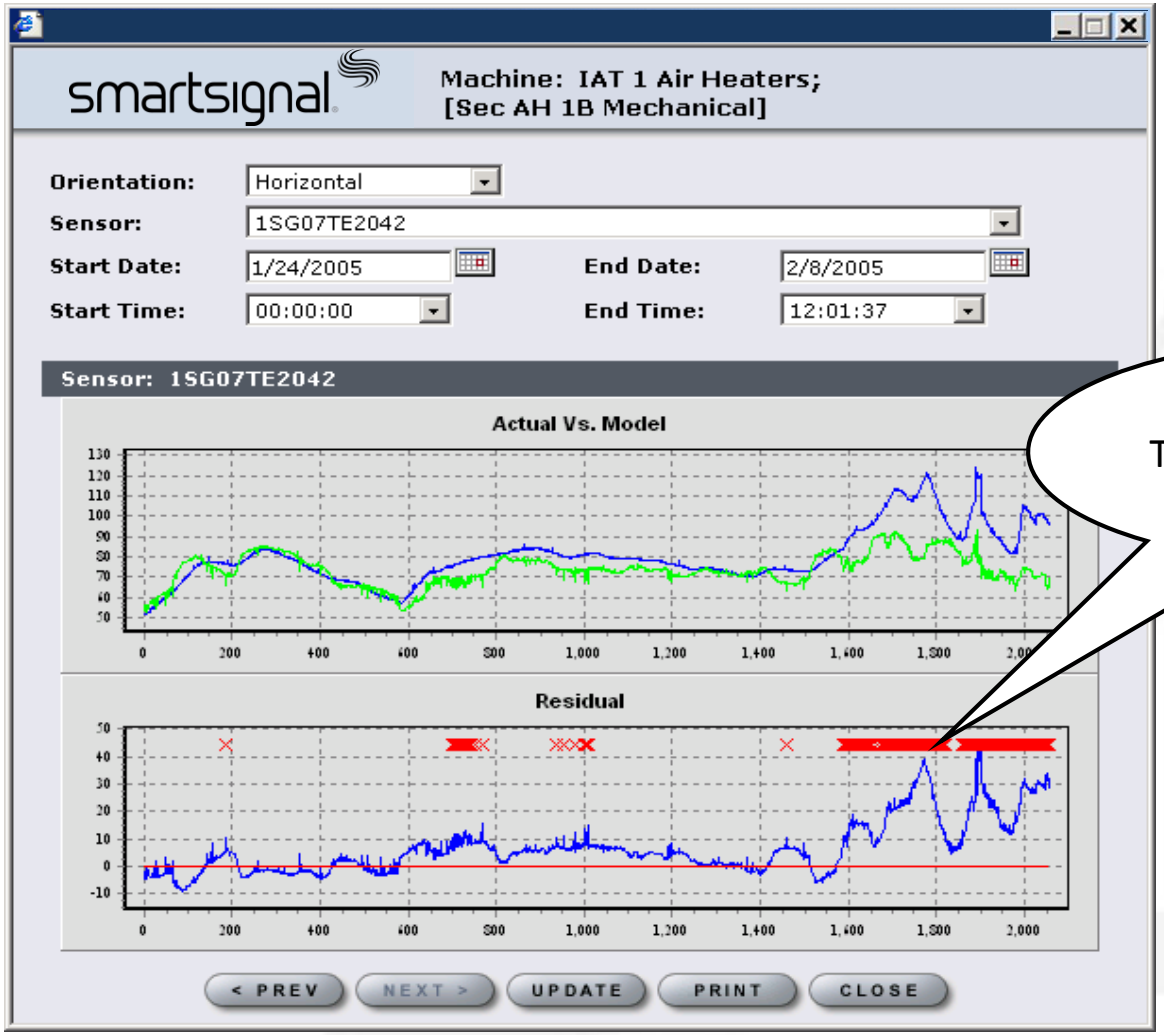
Installation Timeline



Air Heater Support Bearing Catch

- Iatan Power Plant, 700 MW coal-fired base load unit
- **Symptom:**
  - Bearing temperature increased 40 deg F above what would be considered normal for respective ambient temp.
- **Diagnosis:**
  - These bearings have a very tight Oil Max/Min range and have been troublesome for the plant in the past.
- **Findings/Fix:**
  - Operators added 3 ½ gallons of oil to this bearing (25-30 gallon capacity) and temperature came back down and has been running normal ever since.
- **Value:**
  - Plant had previously had an Air Heater Support Bearing Failure on July 24, 1998.
  - The bearing failure took nine days to repair and according to NERC data resulted in 138,804 MWH's lost generation.
  - For this unit, the current cost of lost generation is between $10 and $30 / MWH. Therefore, a similar support bearing failure would cost KCP&L between $1.5 million and $4 million in lost generation alone.

Air Heater Support Bearing Catch

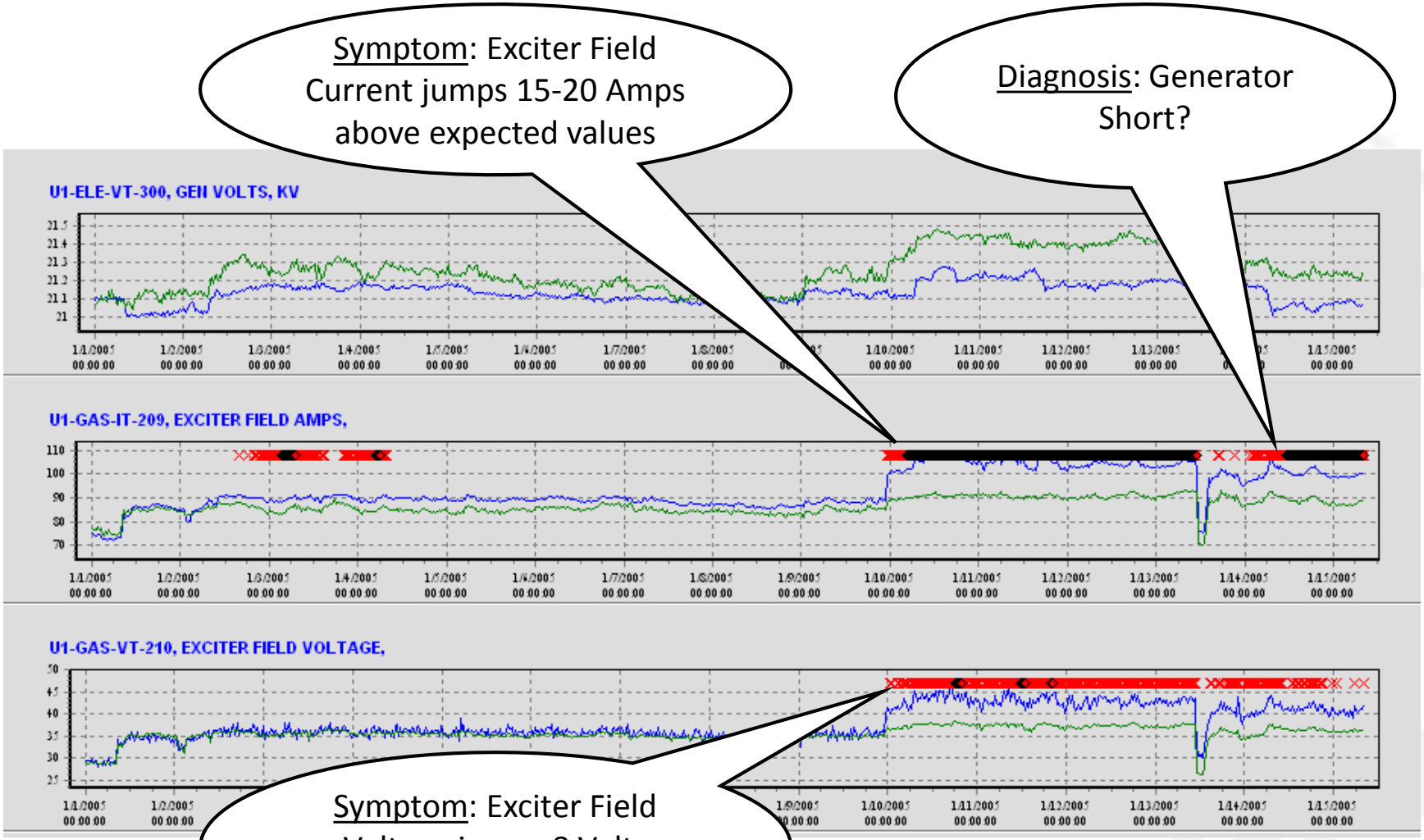


Symptom: Bearing Temp 40 deg F above normal

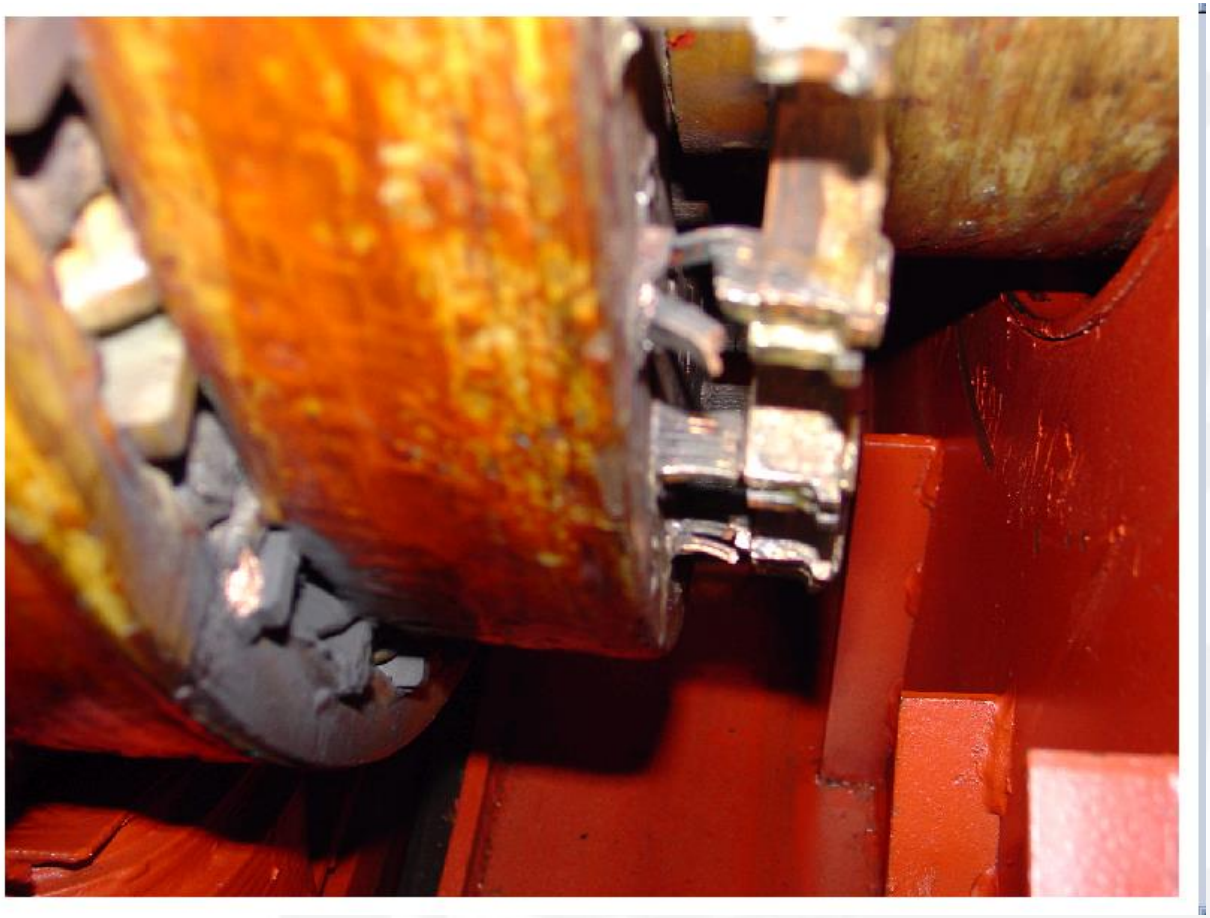
Generator Exciter Catch

- La Cygne Power Plant, 800 MW coal-fired base load unit
- **Symptoms:**
  - Exciter Field Current jumped to 15-20 Amps above normal
  - Exciter Field Voltage jumped to 6-8 Volts above normal
  - No corresponding change in relative MW or MVAR
- **Diagnosis:**
  - Current, Voltage jumps attributed to potential short in unit generator
  - Plant was approximately two weeks from an 80+ day outage to replace large sections of the turbine and rewind the generator so no immediate action taken.
- **Findings/Fix:**
  - On second week of outage, exciter inspected and shorted turns found in the exciter. Exciter repair required; this repair turned out to be critical path and extended unit outage by one week.
- **Value:**
  - Estimated cost for lost week of generation exceeds $1 million

Generator Exciter Catch



Generator Exciter Catch

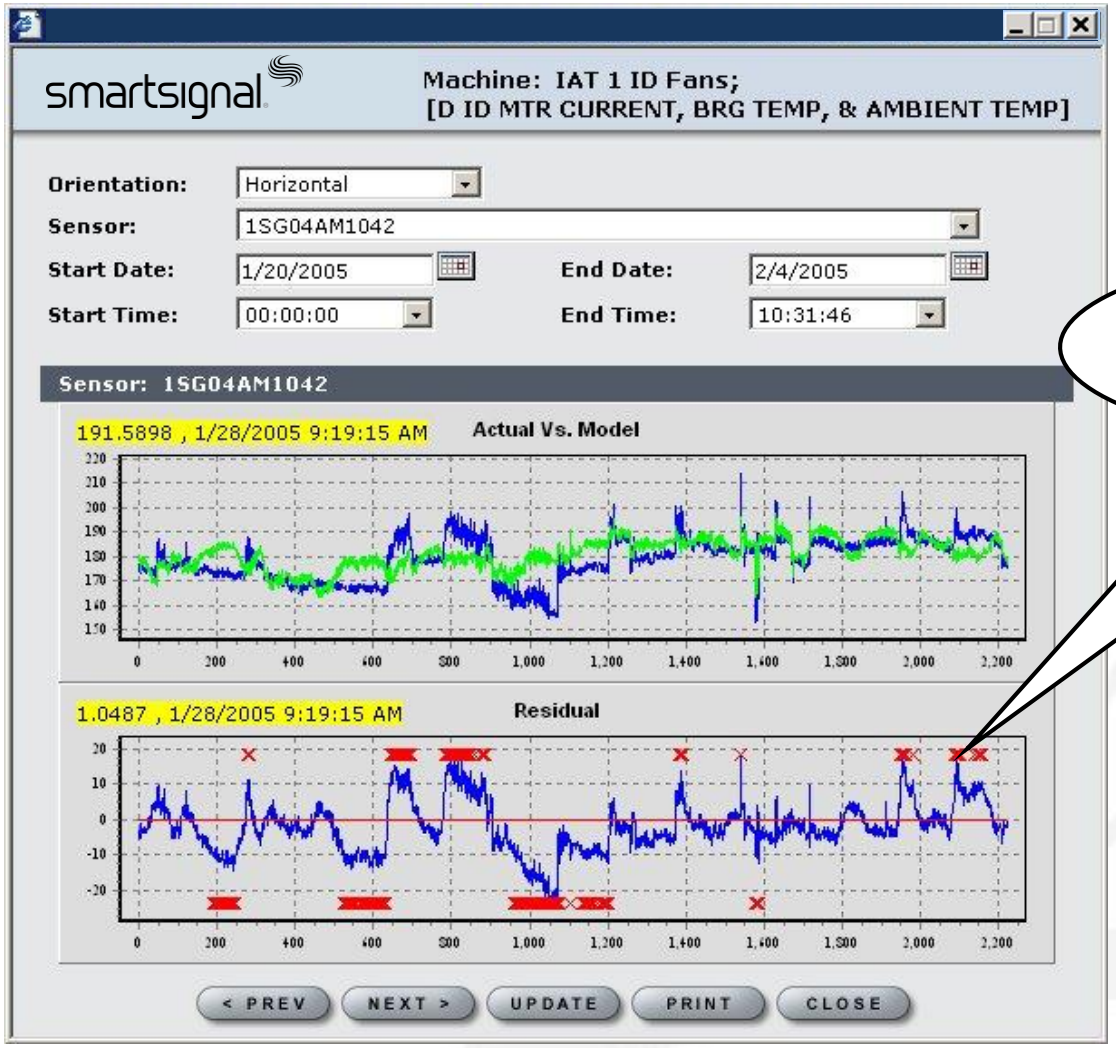


Damage Found in Exciter When Disassembled

ID Fan Coupling Catch

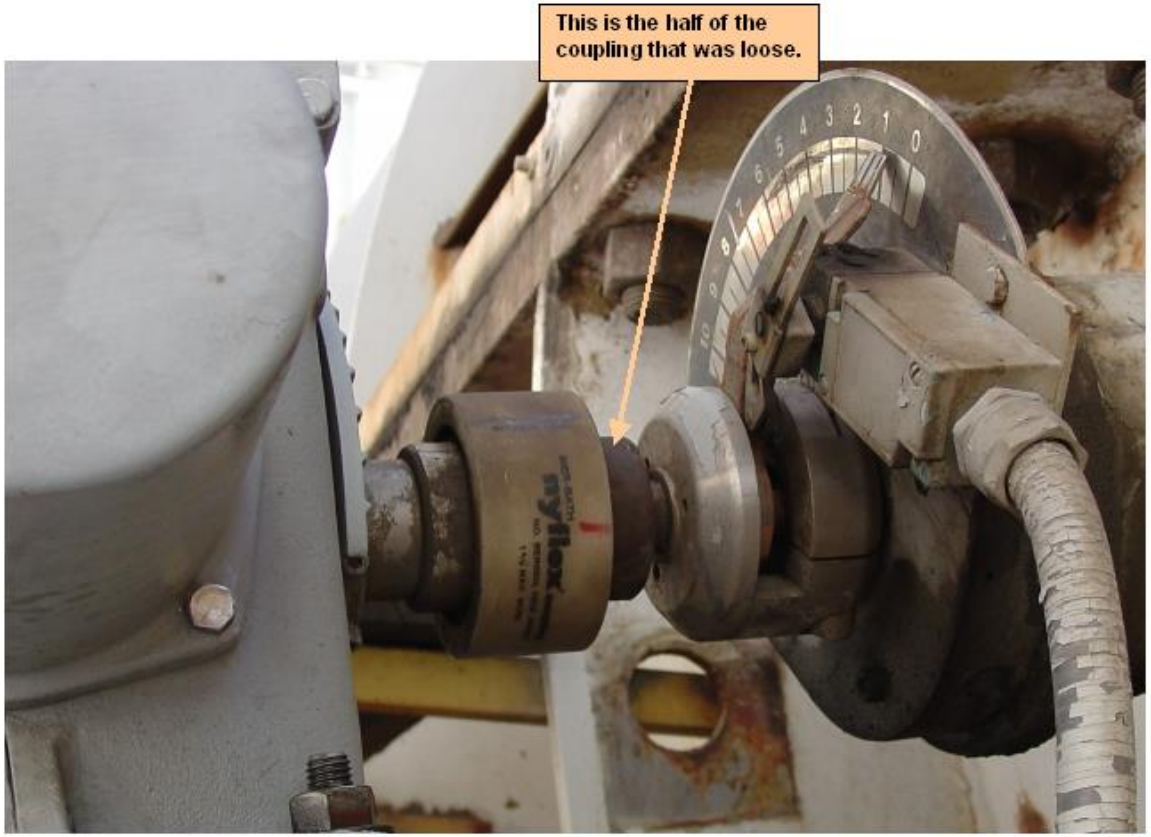
- Iatan Power Plant, 700 MW coal-fired base load unit
- **Symptoms:**
  - Current High-Low Alerts on ID Fan D
- **Diagnosis:**
  - Following last work on this fan, fan loading found to no longer correspond with blade pitch. The plant suspects one or more of the following may be the problem:
    - Beck Drive
    - Linkage
    - Servo
    - Blading
    - Coupling
- **Findings/Fix:**
  - The shaft coupling set screw on the fan side of the shaft was found to be loose. Tightening resolved the control problem.
- **Value:**
  - Improved unit air flow control

ID Fan Coupling Catch



Symptom: ID Fan D Amp High-Low Alerts

ID Fan Coupling Catch



Present – Decentralized Monitoring Approach

- Primary monitoring performed by Operations & Maintenance program personnel – two per coal plant
- Individual logons developed for each individual in generation
  - Shift Foreman
  - Maintenance Foreman
  - Superintendents
  - Engineers
  - Control Operators
- Incident emails sent to Shift Foreman and Operations & Maintenance personnel
- Central Engineering responsibilities:
  - Model Maintenance (retraining)
  - Future Model Expansion

Weekly Report to Generation Management

Montrose 1,2 & 3 Smartsignal Watchlist Summary Report (2/17/2009 to 2/23/2009)

Asset	Alert	Description in Smartsignal	Username	Notes
		Plant Instrument or Equipment Issues		
MON 1 Pulverizers	VT-1400D - 1D PULVERIZER VIBRATION HIGH	work request to PDM # 09-000348 to check vibration	Bill Jolley	
MON 3 Steam Turbine	PT-3215 - TURBINE 3 GLAND EXHAUST VACUUM LOW	Mechanical problems with blowers	Marv Zeiler	
MON 3 Steam Turbine	TE-3126 - GENERATOR 3 BEARING #6 TEMP LOW	Sensor problem - reading ranging from 152 to 162 degrees on DCS	Bill Jolley	Work order # 08-481731 (outage)
		Smartsignal Modeling and/or Load Related Minor Issues		
MON 1 Condenser	AI-1202 - CONDENSER 1A CONDUCTIVITY HIGH	Returned to normal	Kenny Luebbert	Trend returned to normal with no modeling
MON 1 Steam Turbine	PT-1215 - TURBINE 1 GLAND EXHAUST VA LOW	Retrained with additional 2009 data.	Kenny Luebbert	Remodeled
MON 1 Unit Performance	PERF DEV:FI-1060R-BLR 1 RIGHT RH SPRAY FLOW HIGH	Reheat sprays not usually in serice. Only use when needed, for example when on upper load and blowing backpass sootblowers. System wasn't modeled with Reheat sprays in service.	Bill Jolley	Trend returned to normal with no modeling
MON 1 Unit Performance	PERF DEV:FI-1500TTL-BLR 1 TOTAL CORRECTD A HIGH	Returned to normal	Bill Jolley	Trend returned to normal with no modeling
MON 2 BFP	FI-2350 - #2 BLR FEEDWATER FLOW LOW ,PT-2320 - #2 BLR FEED PUMP DISCH PRE HIGH ,PT-2330 - #2 BLR FEEDWATER PRESSURE LOW	Unit Trip	Bill Jolley	Trend returned to normal with no modeling
MON 2 ID Fans	IT-2650A - 2A ID FAN MOTOR AMPS LOW	Unit Trip	Bill Jolley	Trend returned to normal with no modeling

Circ Water Pump Bearing Catch

- Email alert on evening on November 3rd.

-----Original Message-----
From: Clay Jerry
Sent: Tuesday, November 04, 2008 9:33 AM
To: Luebbert Kenneth; Richardson Jeff; Sheffield Ron; Russaw Tony; Radford Bill
Subject: RE: Smartsignal Alert

Had Operator check cooling water flow, line was plugged. Operator back flushed line with air cooling water flow back to normal motor cooling off.

Jerry Clay
Operations Programs Coordinator
LaCygne
x5048

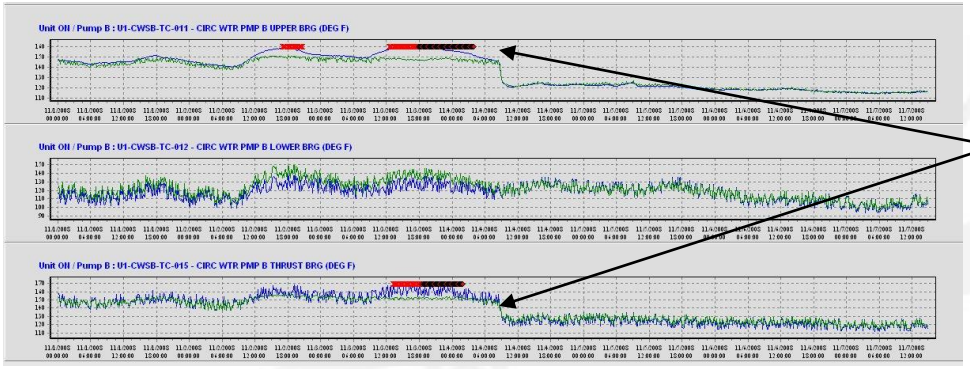
Response from Operations Program Coordinator to plant personnel

-----Original Message-----
From: Luebbert Kenneth
Sent: Monday, November 03, 2008 5:50 PM
To: Clay Jerry
Subject: Smartsignal Alert

KCPL\Base Load Units\La Cygne 1\LAC 1 Circ Water Pumps
U1-CWSB-TC-011 - CIRC WTR PMP B UPPER BRG HIGH
11/03/2008 5:50:18 PM

Please visit the Smartsignal site
http://ntsp28/ecm
for more information
Username - same as network username (i.e. kf10477) Password - your initials

Original automated email alert



Distinct drop in CW Pump B Upper Bearing and Thrust Bearing Temps

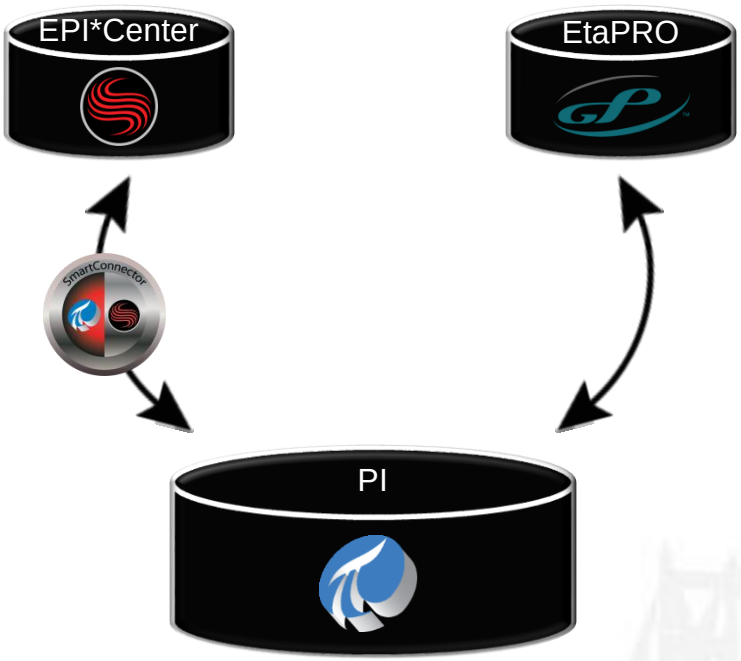
The Next Plateau

- Improved monitoring of Air Quality Control Equipment
  - Scrubbers
  - SCRs
  - Baghouses
- Monitoring of Renewable Assets
  - Wind
  - Solar

The Next Plateau

- Greenhouse Gas Reduction – CO_2
  - Increased emphasis on Plant Efficiency Performance
  - Early Warning of Key Performance Indicator Degradation
    - Condenser Pressure
      - Air In-leakage
      - Fouling
    - Air Heater Performance
      - Seal Leakage
    - Cycle Isolation
      - Valve Leakage
- Requires tight integration of Historical Database, Performance Monitoring, and Equipment Condition-Monitoring Software

Integration Delivers Incremental Value



- Detect and address developing efficiency losses & equipment failures sooner
- Quantify the impact on capacity & heat rate from the developing problem
- More accurately diagnose and prioritize impending problems
- Predict a wider range of equipment failures across more types of equipment and components
- Detect and replace faulty sensor readings

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The Big Catch – How Did We Do It?

Presented by Gary Barnes
Entergy Fossil Operations

Empowering Business in Real Time
PI Infrastructure for the Enterprise

The Big Catch

- In December, 2007, Entergy Fossil's Performance Monitoring & Diagnostic Center (PMDC), working with the Waterford 1&2 plant staff, averted a catastrophic failure of their Unit 2 generator.
- The unit was repaired for a fraction of the $10's of millions the failure would have cost and in a few weeks versus 18-24 months or longer.

How Did We Do it?

- A sound process for detecting, evaluating, and communicating issues with plant equipment
- A great team in the PMDC and teamwork with the plant following that process
- A strong foundation for the process:
  - OSIsoft data infrastructure provides the data foundation and presentation.
  - SmartSignal's EPI*Center provides advanced analytics required to detect-diagnose-prioritize developing equipment and process problems.
- All leading to accurate and timely decisions

Process Details

- PI is a great tool and mainly what we used the first year.
- EPI*Center greatly reduces the time and effort to identify anomalies among the thousands of PI data points, generally well below the alarm or otherwise noticeable level.
- PMD Specialist analyzes the anomalies and contacts control room to alert them to developing issue(s).
- May recommend collection of additional data at plant or items to check
- May escalate to plant management if equipment or unit needs to be removed from service immediately
- If not urgent, plant works out mutually convenient time to schedule repair outage.

No Whales? – No Worries

- The Big Catch may be a once-in-a-lifetime event (We hope so, hate for problems to get that big).
- The ~30/month normal catches from sardines (failed critical instruments) to groupers (pumps or fans) are what keep us in business and well-fed on an ongoing basis.

Grouper Examples

- EPI*Center using PI data alerted to:
- BFP - high vibration
  - Analysis indicated a suspected coupling problem.
  - Plant found spool piece cracked and replaced spool piece and coupling.
- Coal Mill - elevated temperature on lower mill bearing
  - Operator thought it was a bad instrument.
  - Specialist believed it real, so elevated alert to plant supervisor who found black oil with metal shavings.
  - Bearings had to be replaced and oil flushed, but more extensive collateral damage avoided.
- BFP vibration high and rising (6+ when shut down), pump taken off line and repaired

Operational Catches

- BFP low flow (below minimum), recirc valve had not opened, plant corrected.
- BFP bearing drain temperature high due to no cooling water lined up (first-time pump rolled since outage).
- Deaerator extraction partially closed, resulting in low DA pressure and low BFP suction – could have tripped pump and unit or damaged pump.
- FD Fan bearing/lube oil step change – hard to see in PI alone due to load variation but unmistakable in EPI*Center

Hold for SmartConnector Demo

Questions?

?