

OSIsoft®

USERS²⁰¹¹ CONFERENCE



Turning **insight** into **action**.



Turning Insight Into Action

Presented by **Jon Peterson**, Vice President – Marketing, OSIsoft
Rick Smith, Manufacturing IT, International Paper
Dave Olsheski, Engineering Manager, Wood Group Gas Turbine Services
Bryan Sower, Senior System Analyst, Dow Corning

- **Data**

- Connectivity
- Servers
- Data Access

- **Information**

- Analytics
- Trending
- Graphics
- Reports

- **Insight**

- Humans
- Models
- Systems

- **Action**

- Autonomous
- Workflows
- Schedule
- Hard work

Turning insight
into action.

Entergy's "big catch"

Entergy christened its Performance Monitoring and Diagnostic Center several years ago to leverage the expertise of its most senior operators and technicians across the company's entire fleet of plants. The center also makes use of advanced software tools that increase plant availability and reliability by identifying equipment issues before they become major problems. The center last year.

By Dr. Robert Peltier, PE

Entergy has a long history in performance monitoring, beginning with the first implementation of its Operations Information System (OIS) over a decade ago. The introduction of market competition for reliable, low-priced power drove the investment in new data collection and evaluation tools at the plant level.

About the same time as the OIS was introduced, Entergy embarked on a best-evaluation of its entire fleet. One of the findings of that study was an adjustment of appropriate plant staffing levels that was based on routine plant operations and maintenance. The industry's long-term reaction to a market-driven power supply system bottom line: Plant staffing was reduced to minimum levels during those early market competition.

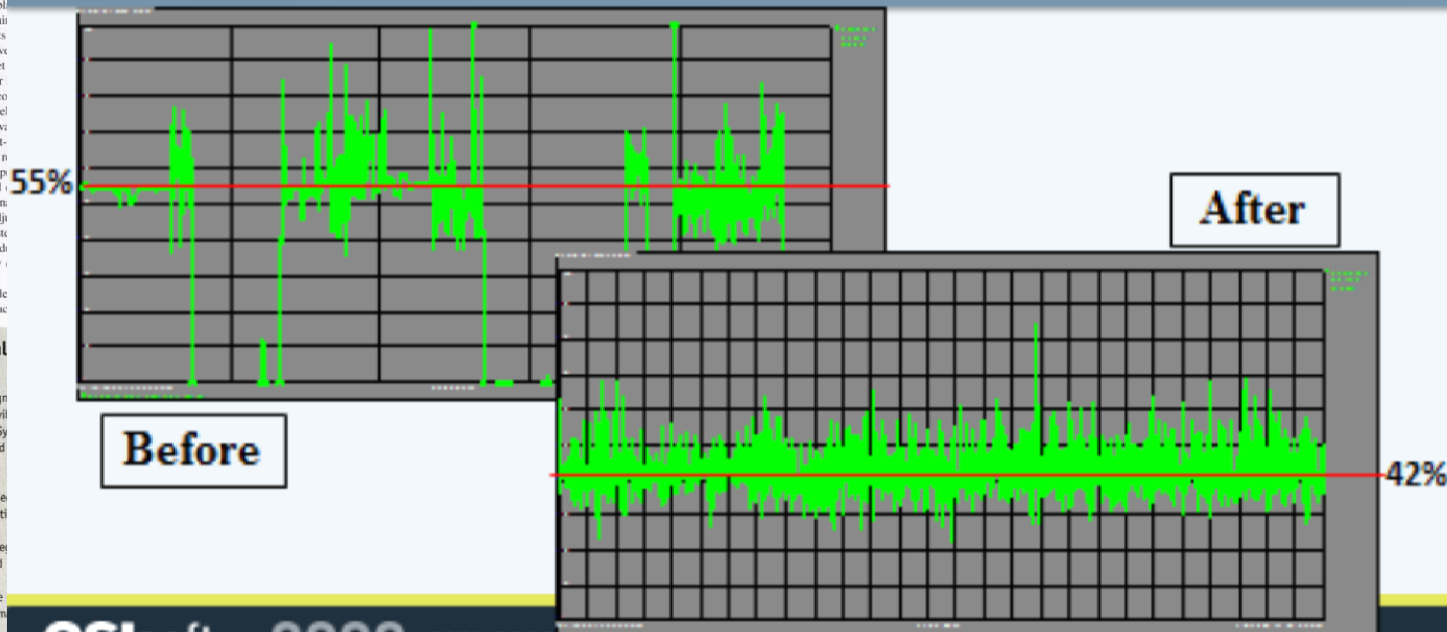
The OIS at the time was a simple, driven program used to facilitate ac-

Entergy's PM&DC goal and objects

Establish monitoring and diagnostic standards and processes that will leverage Operations Information System information and achieve increased efficiency through:

- Early identification of changes in equipment physical, thermal, operational and environmental performance.
- Improved ability to mitigate declining equipment condition and performance.
- Improved ability to maximize value, considering current market opportunities.
- Leveraging expertise and technology.
- Enhanced teamwork.

...Lowers Boiler Gas Consumption



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Wood Group GTS
Keep on turning

Dave Olsheski – Engineering Manager
Monitoring, Diagnostics & Performance
Wood Group GTS Loveland, CO USA

Wood Group GTS is a leading independent service provider for gas turbines in the global oil & gas and power generation industries



Long-Term Contractual Asset Portfolio



Wood Group GTS
Keep on turning

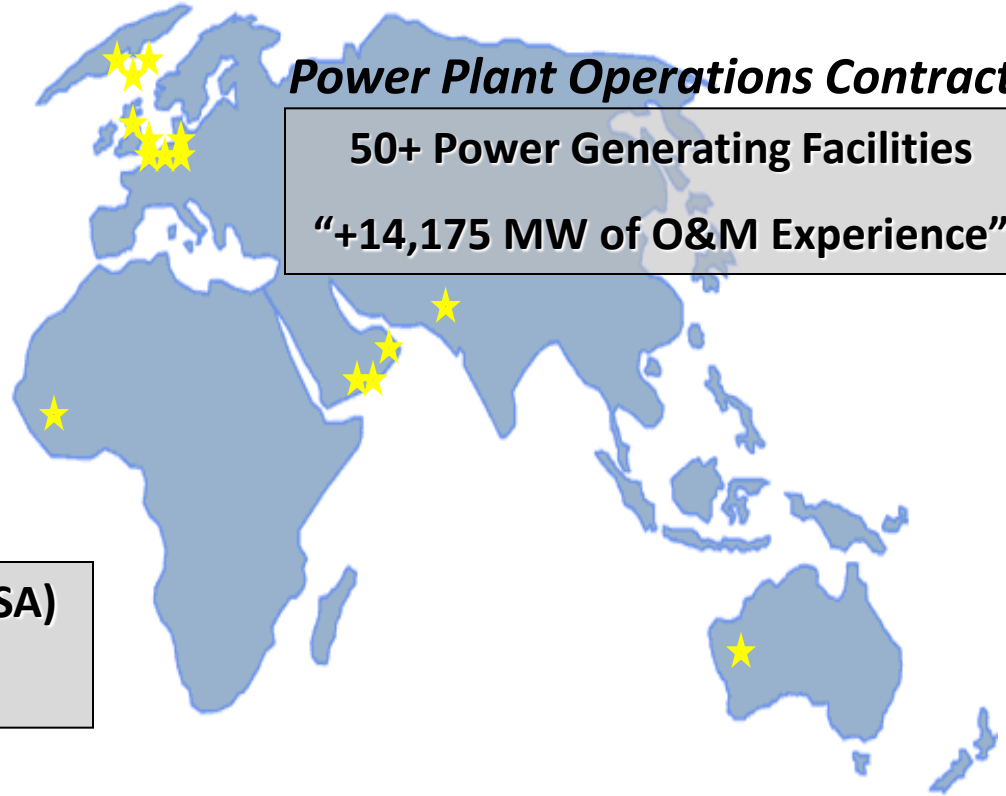
“Diverse Gas Turbine Technology and Geographical Locations”



Turbine Maintenance Contracts

40+ Long Term Service Agreements (LTSA)

“+7,542 MW Under Contract”



Power Plant Operations Contracts

50+ Power Generating Facilities

“+14,175 MW of O&M Experience”

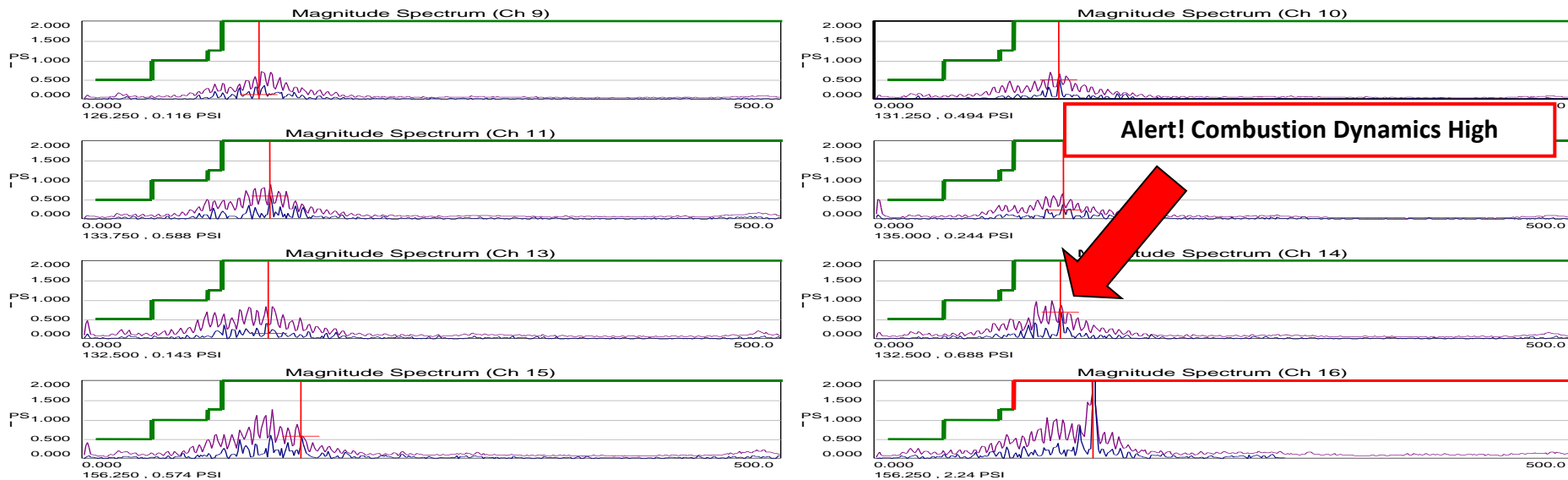
Wood Group GTS Remote Monitoring & Diagnostics

Avoid This....



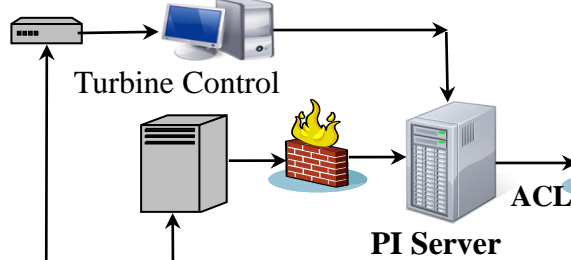
Wood Group GTS Remote Monitoring & Diagnostics

By Using This!

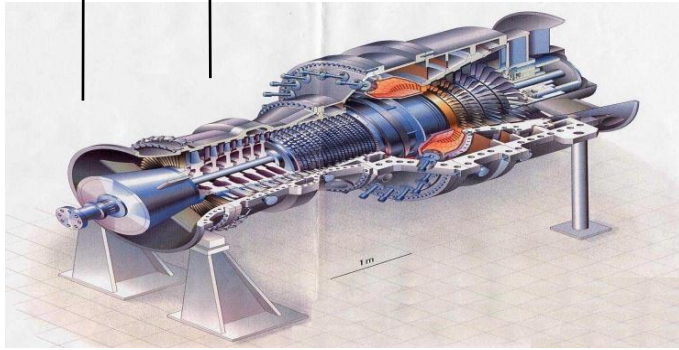


Power Plant - ACTION

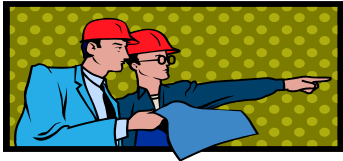
Vibration / Combustion / Performance



PI Server



On-Site O&M



Process Data

IPsec VPN

Solutions

SERVICES

Remote Monitoring
Web Graphics/Trends
Periodic Reports
Engineering Analysis
Technical Support
Recommendations
Pager / E-mail Alerts

Wood Group RM&D Center - INSIGHT

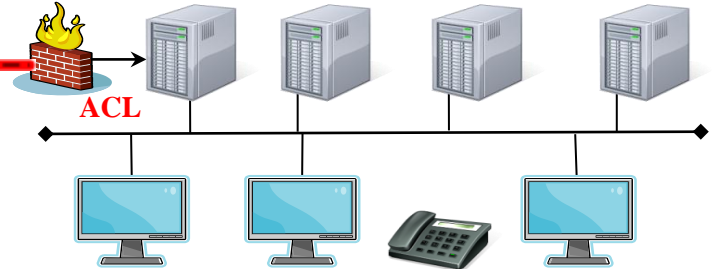


PI to PI
Interface

PI Server

PI ACE

PI
WebParts



Customer Contract
Managers

Global Engineering



Cost

MISSION: Asset Financial Optimization

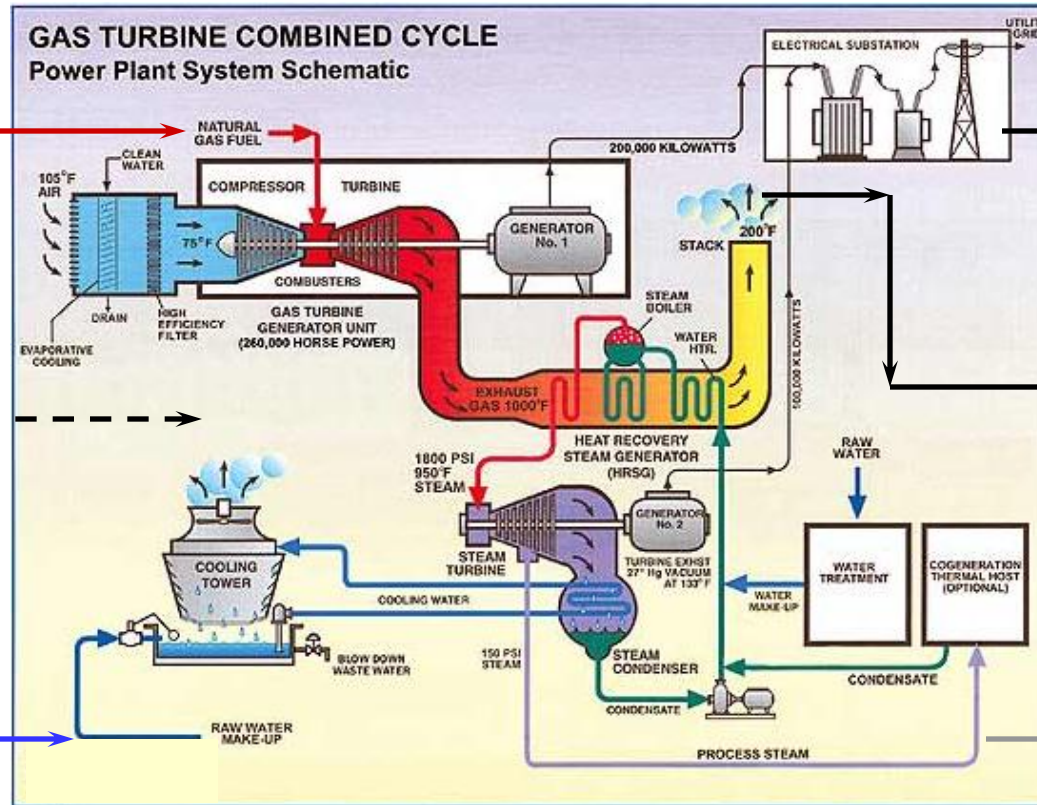
Revenues

Fuel – Natural Gas
\$3 - \$6 / MMBtu (USA)

\$

Power Plant O&M

Make-Up Water
Variable



Power Purchase Agreement (PPA)
\$30 - \$50 / Mwh (USA)

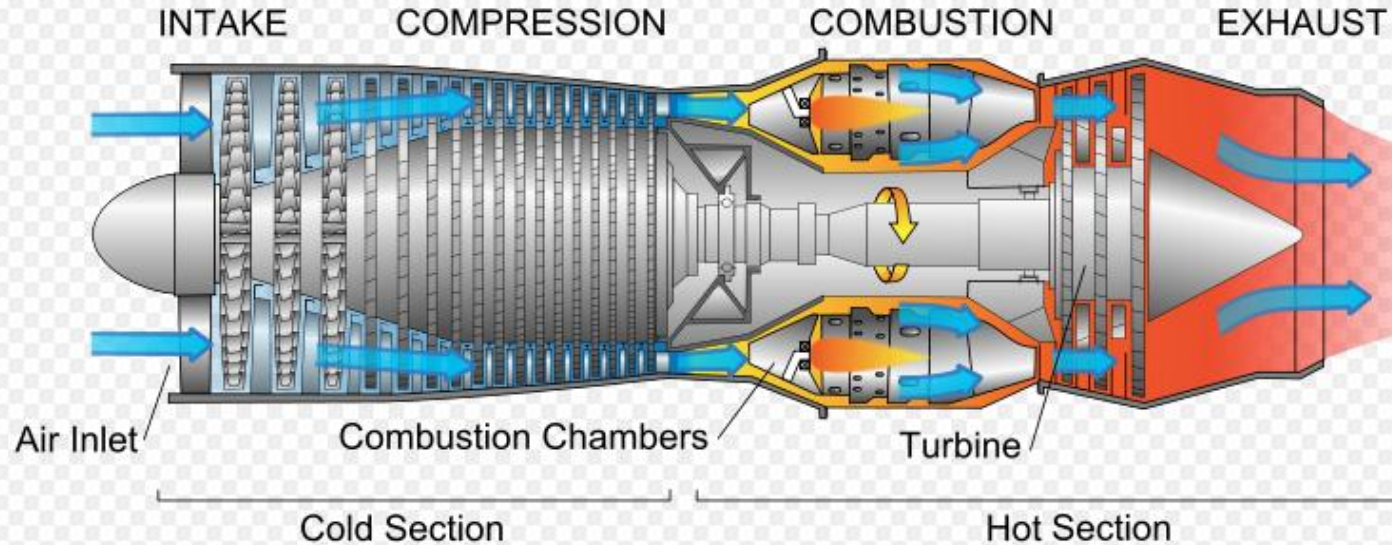
Regulated Emissions
Permit, Cap & Trade

\$

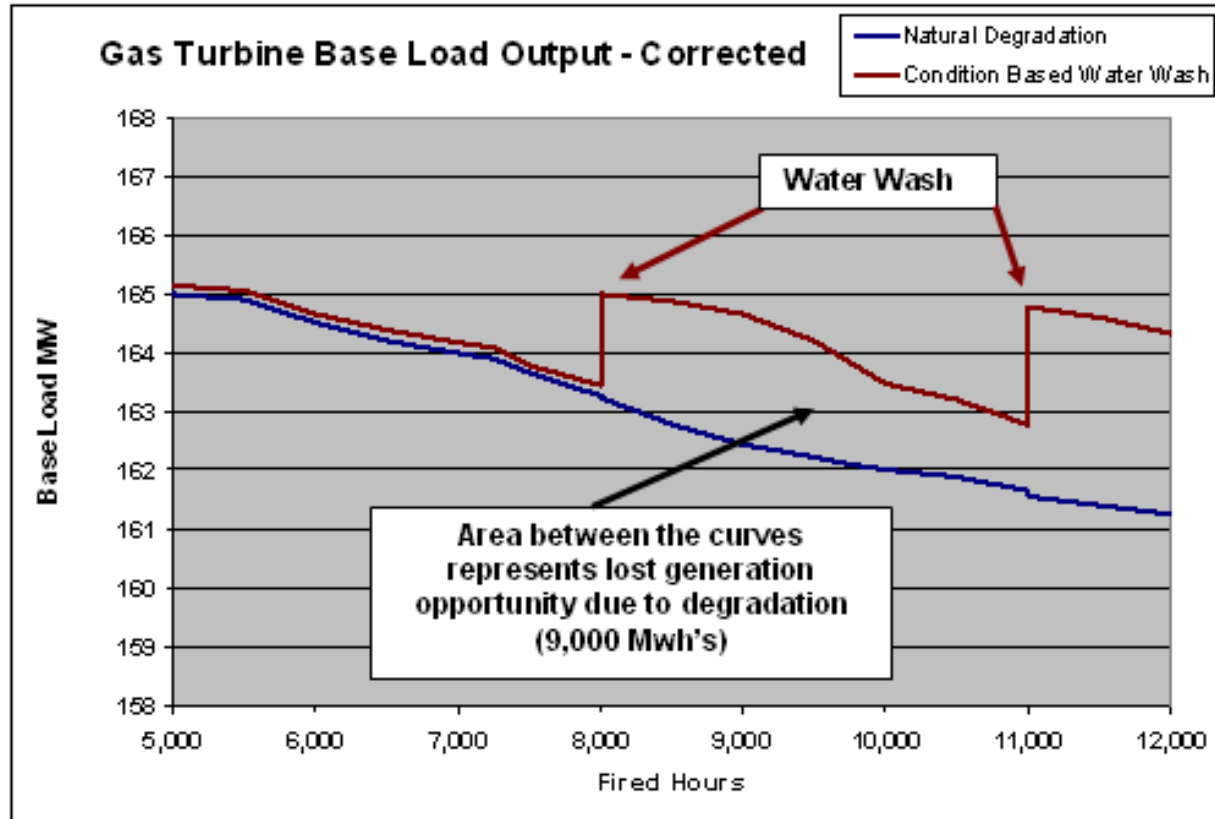
Process Steam (Cogen)
Variable, Availability

Gas Turbine Technology

- Thermodynamically Described by the Brayton Cycle
- Air is Compressed, Fuel is Added, Combustion Occurs, Hot Gas Expansion Over Turbine Drives Shaft
- 30% - 40% of Fuel Energy is converted to Electrical Energy, the Rest is Lost in Exhaust Heat
- Gas Turbine Efficiency is Defined by **Heat Rate** = 8,500 – 11,500 Btu / kwh



Gas Turbine Thermal Performance Optimization



Gas Turbine Corrected Output (Blue) provides a beneficial performance metric that can be used to track turbine degradation.

Blue trend shows that turbine corrected output has degraded 2.4% over 7,000 fired hours. This is typical if unit maintenance is neglected or not performed.

Red trend shows the results of proactive condition based water washing. Effective thermal performance management allows water washes to be conducted on actual turbine condition.

M&D allowed increased generation opportunity of 9,000 Mwh's = \$43,000

PI Thermal Performance Metrics Utilized for Degradation Management



Gas Turbine Degradation Management

How Did My Scheduled Maintenance Effect Gas Turbine Performance? What's the Economic Bottom Line?

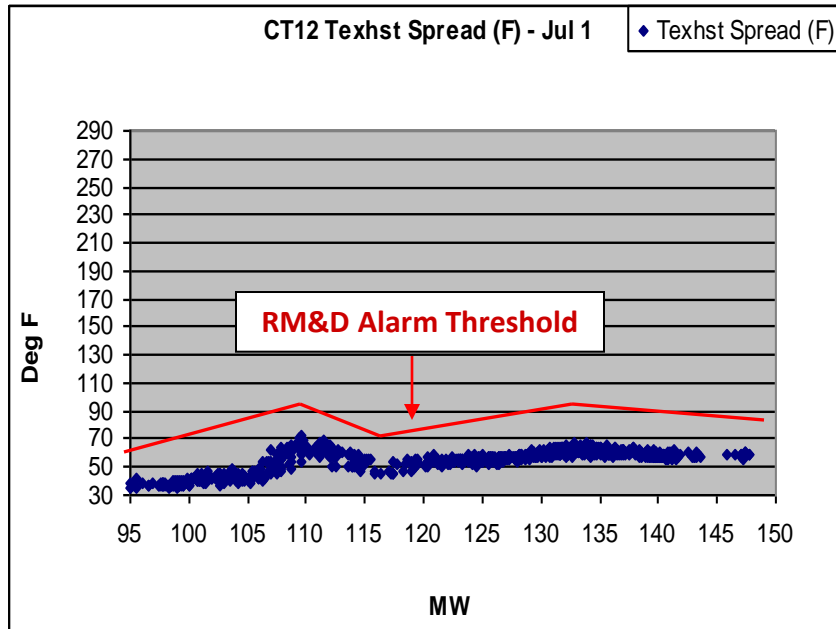
Asset Configuration CT Technology	E-Tech CTG Pre-Outage	E-Tech CTG Post-Outage	
Assumptions	Base Cogen	Base Cogen	Units
Nominal Capacity	82.2	85.7	MW
Nominal Heat Rate (HHV)	10,879	10,692	Btu / kwh
Service Factor	95%	95%	%
Base Load Run Time %	90%	90%	%
Part Load Run Time %	10%	10%	%
Nominal Fuel Cost	\$3.25	\$3.25	\$ / MMBtu
Nominal Power Price	\$38.00	\$38.00	\$ / Mwh
Nominal Spark Spread	\$2.64	\$3.25	\$ / Mwh
Avg Daily Mwh's	1,827	1,905	Mwh / Day
Avg Hourly Revenue	\$201	\$258	\$ / Hour
Avg Daily Revenue	\$4,830	\$6,194	\$ / Day

- Output Increased 4.3%
- Heat Rate Decreased 1.7%
- \$0.60 Increase in Spark Spread
- \$1,364 / Day Increase in Revenue
- \$42,000 / Month = \$252,000 over 6 months

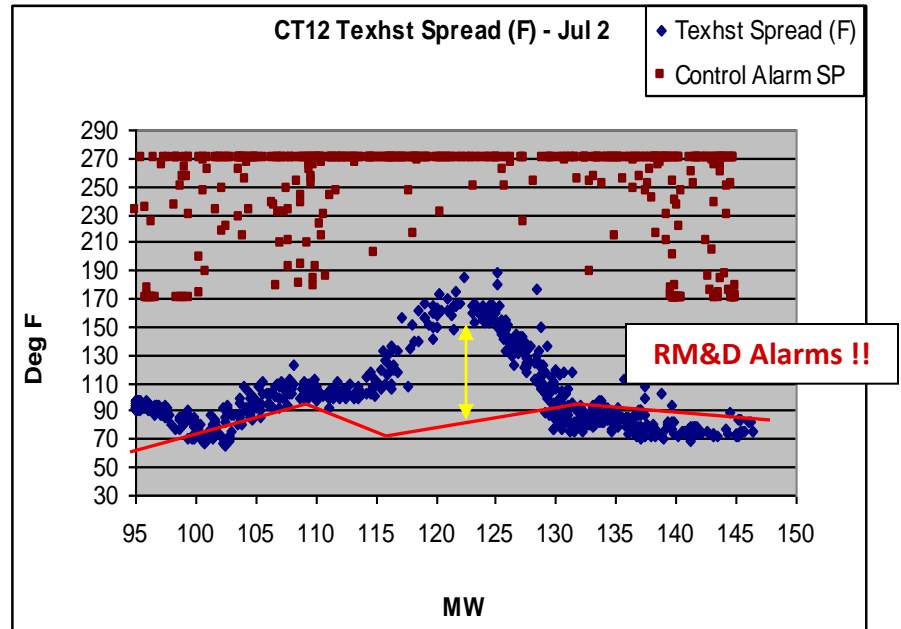
PI ACE Utilized for Early Identification of Component Failure

Unit Cycled July 1 - July 2. Noted Step Change in Texhst Spread +100F

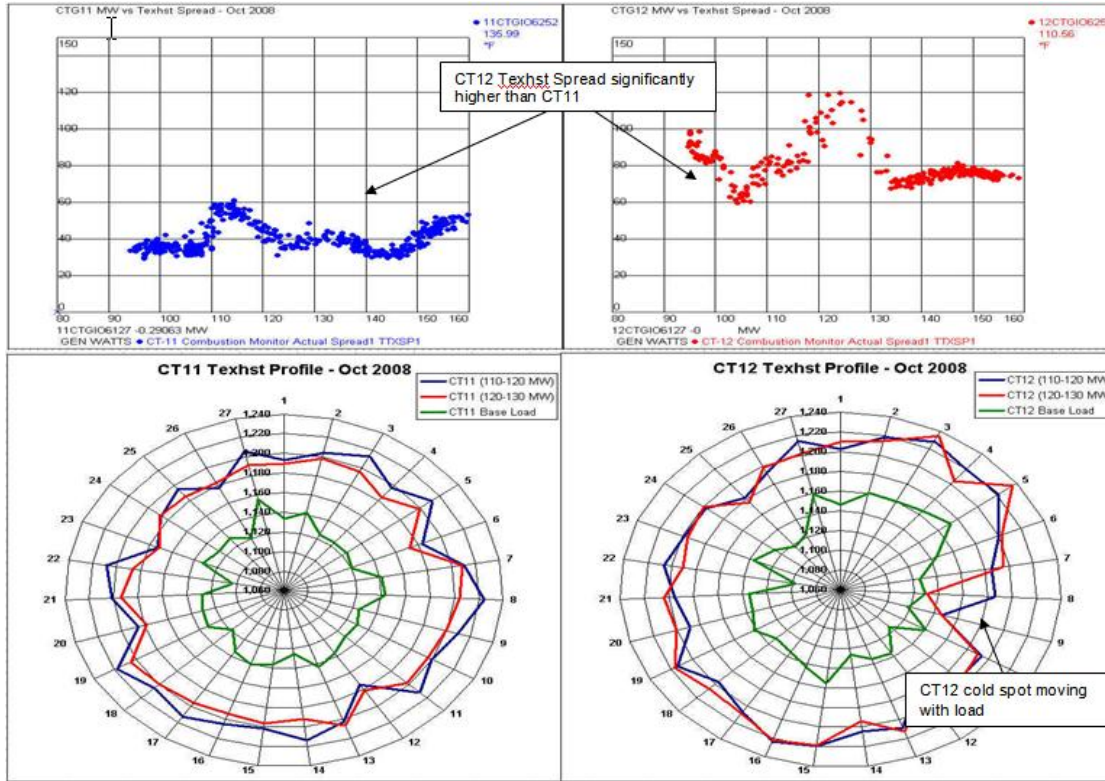
July 1 - Load vs. Texhst Spread



July 2 - Load vs. Texhst Spread



\$10k / Month of Additional NH3 Injection – Avoided Forced Outage



Damaged Cross-Fire Tube



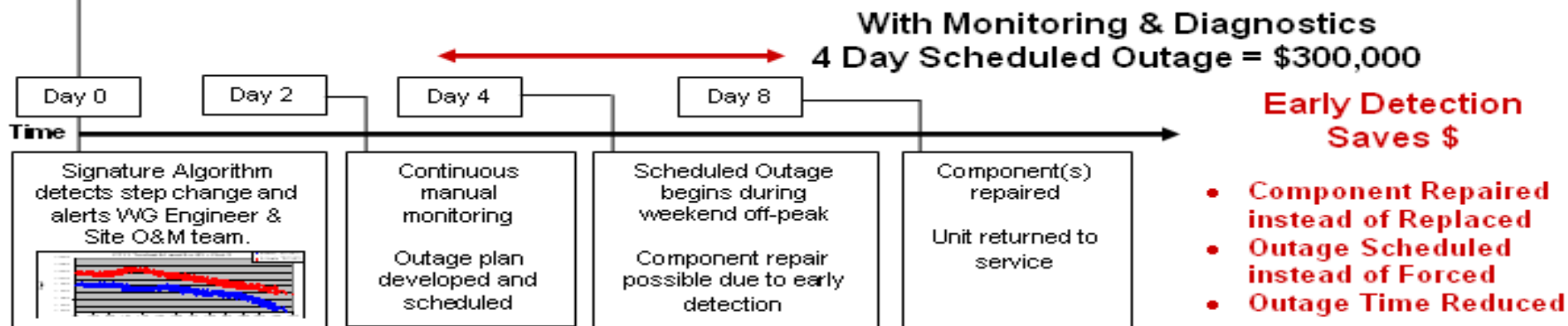
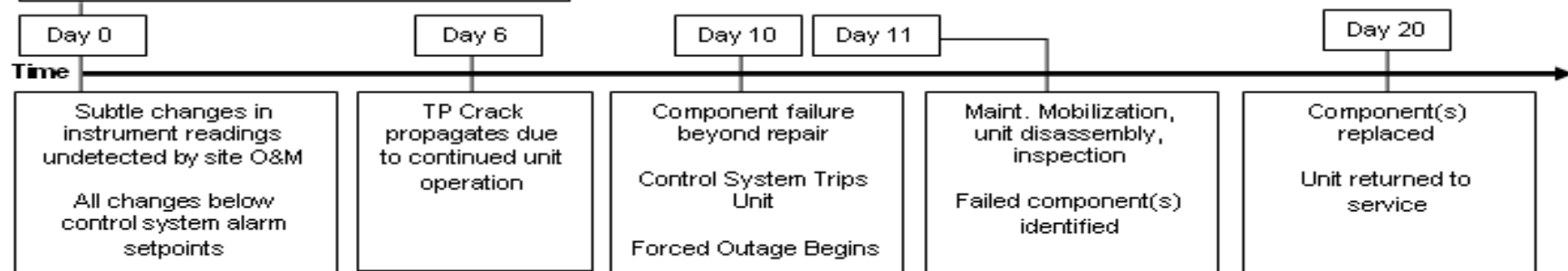
Unseated Transition Piece Floating Seal



Maintenance Optimization

Subtle step change in process

- CT Exhst Temp Spread Step Changes +20 F
- CT Exhst T/C 7,8,9 Step -20 F
- CT Exhst NOx +2 ppmvd

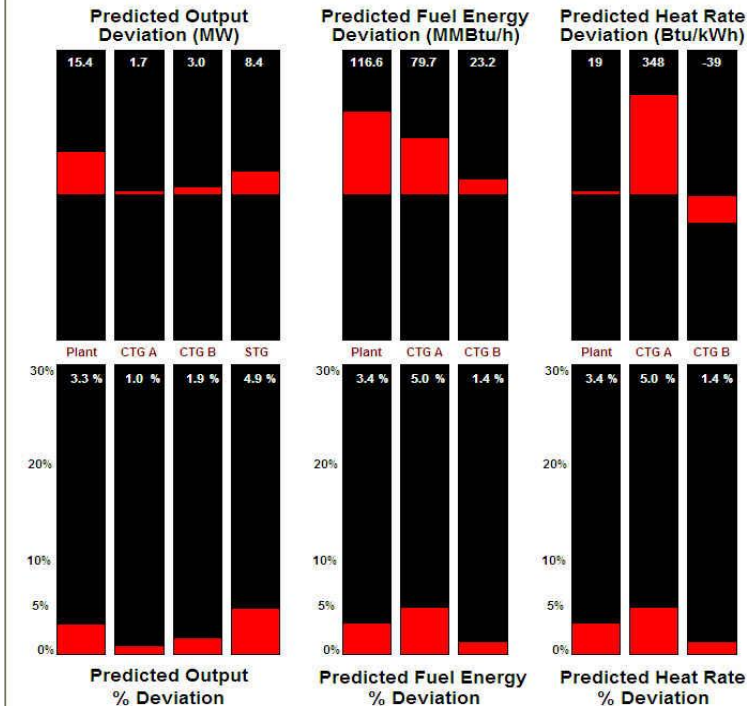


M&D Allowed Avoidance of \$450,000 of additional Maintenance Expense

Plant Dispatch Models Derived from PI System Data - Recognized Savings of \$50,000 / Month

	Apex - Las Vegas, NV 474.2 MW 7,200 Btu/kWh 5/21/2009 3:36:51 PM	Unit CTG A CTG B STG	Gross Output 157.9 MW 157.5 MW 173.8 MW	Heat Rate (HHV) 9,960 Btu / kWh 10,395 Btu / kWh	Load Indication Base Load Base Load Steady State	Configuration Status Evap On, Pag Off, DB On Evap On, Pag Off, DB On	Duct Burner Fuel Flow 96 MMBtu / h 96 MMBtu / h	Dry Bulb 92 Deg F Wet Bulb 61 Deg F Dew Point 53 Deg F Rel Hum 16 % Bar Press 27.13 inHGA

Plant CTG HRSG STG ACC Power Fuel .xls **APEX - Predictive Model Performance**



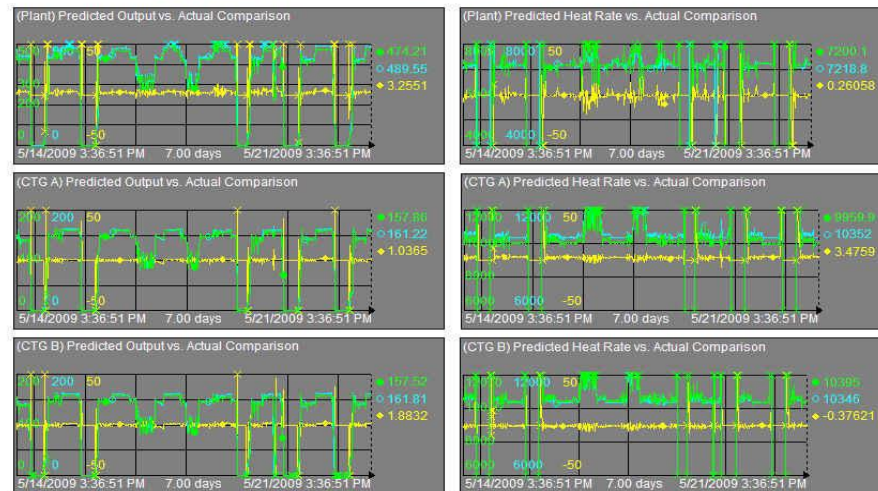
MDS Model Comparisons

Predicted Fuel Gas Flow - energy
 Fuel Gas Flow Deviation
 Fuel Gas Flow % Deviation

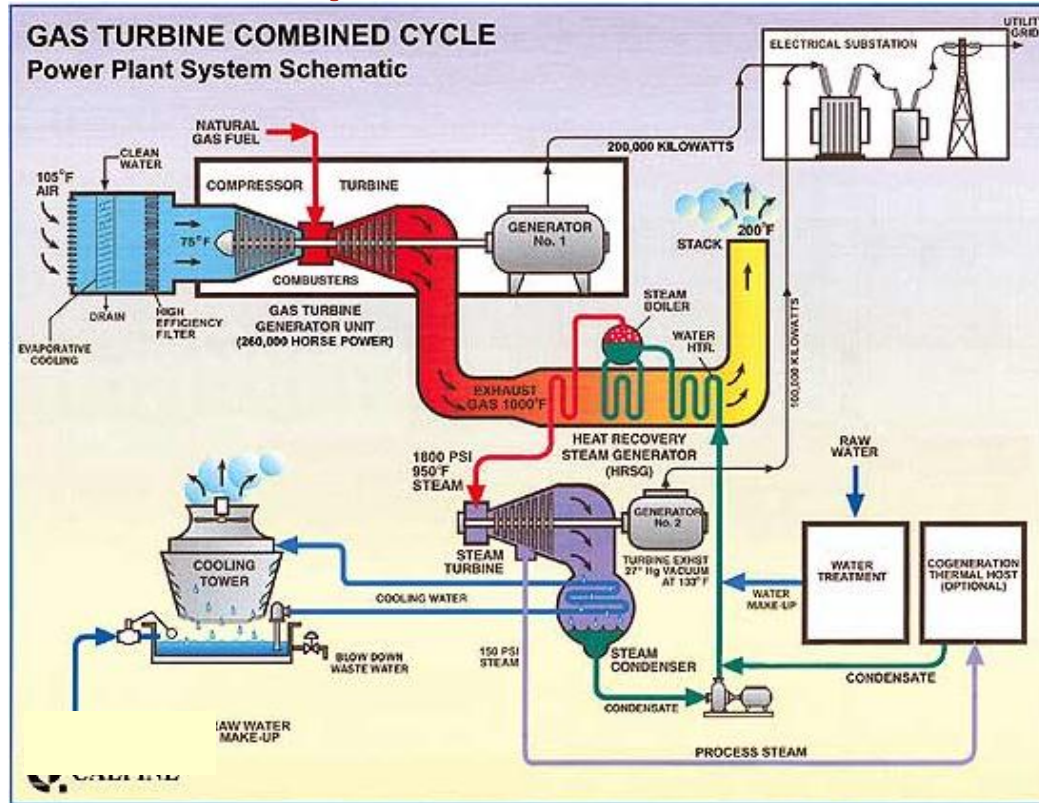
Predicted Output
 Output Deviation
 Output % Deviation

Predicted Heat Rate
 Heat Rate Deviation
 Heat Rate % Deviation

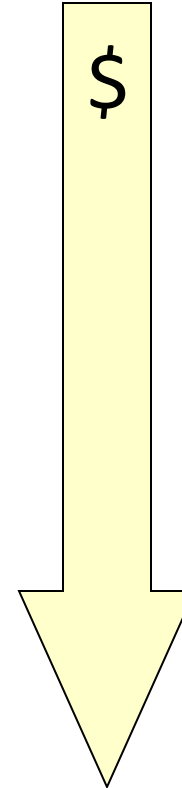
Plant	CTG A	CTG B	STG	Units
3,535	1,668	1,675		MMBtu / h
117	80	23		MMBtu / h
3.4	5.0	1.4		%
489.5	161.2	161.8	181.0	MW
15.4	1.7	3.0	8.4	MW
3.3	1.0	1.9	4.9	%
7,219	10,352	10,346		Btu / kWh
19	348	-39		Btu / kWh
0.3	3.5	-0.4		%



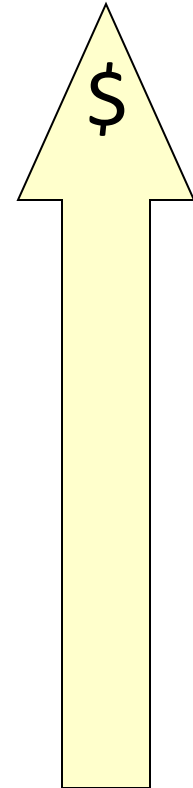
Gas Fired Power Plant – Financial Optimization



Costs



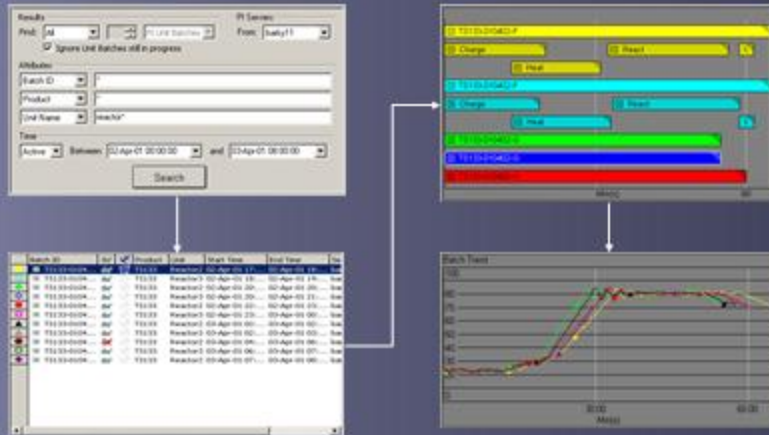
Revenues





Improvements in OEE

Batch Data Flow



Context

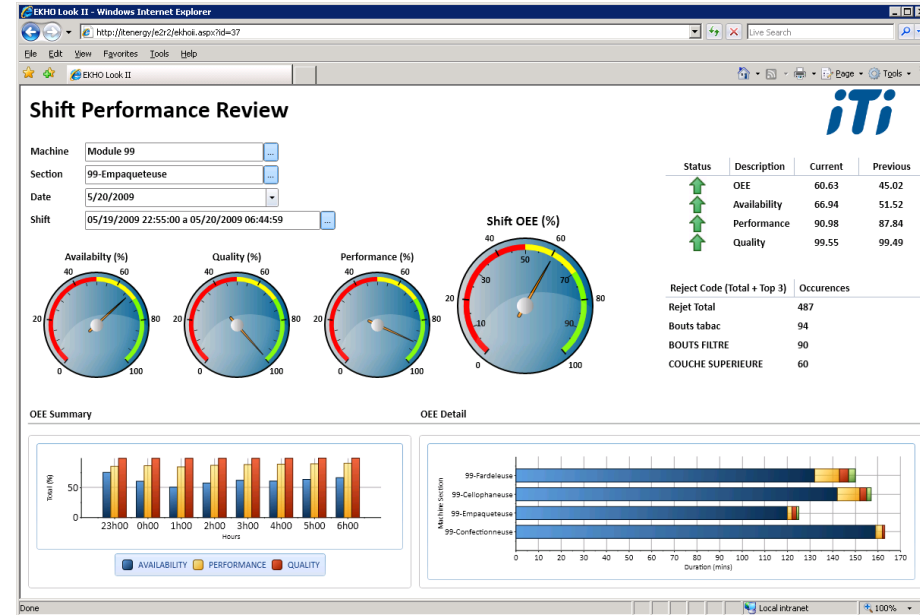
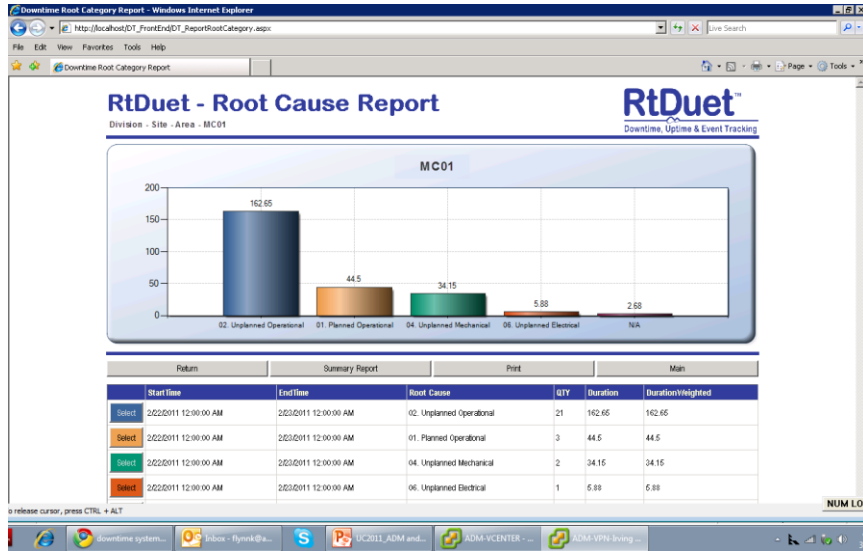
- Tags, Time
- Displays, reports
- PI Batch
- PI AF
- Event Frames

UC2001

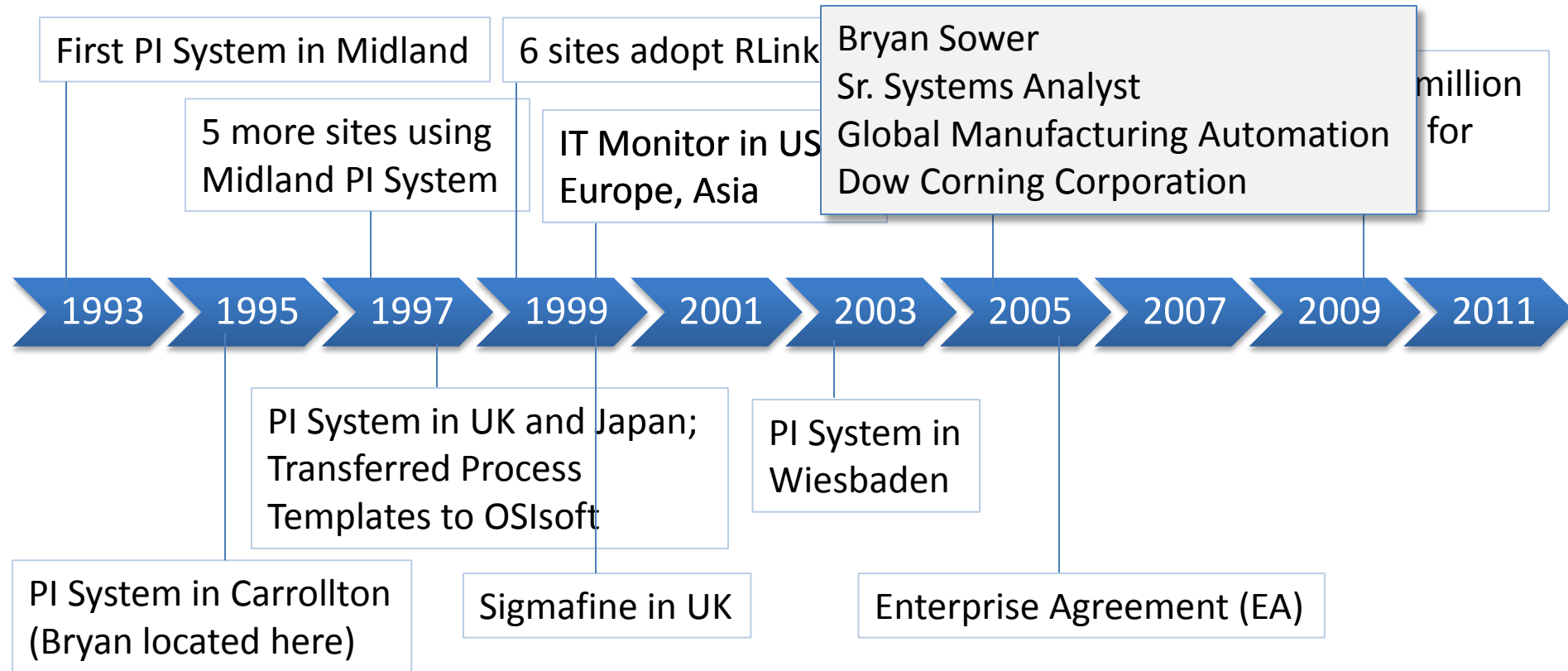
PI Batch Products – Chris Coen and Jack Aude

OSIsoft

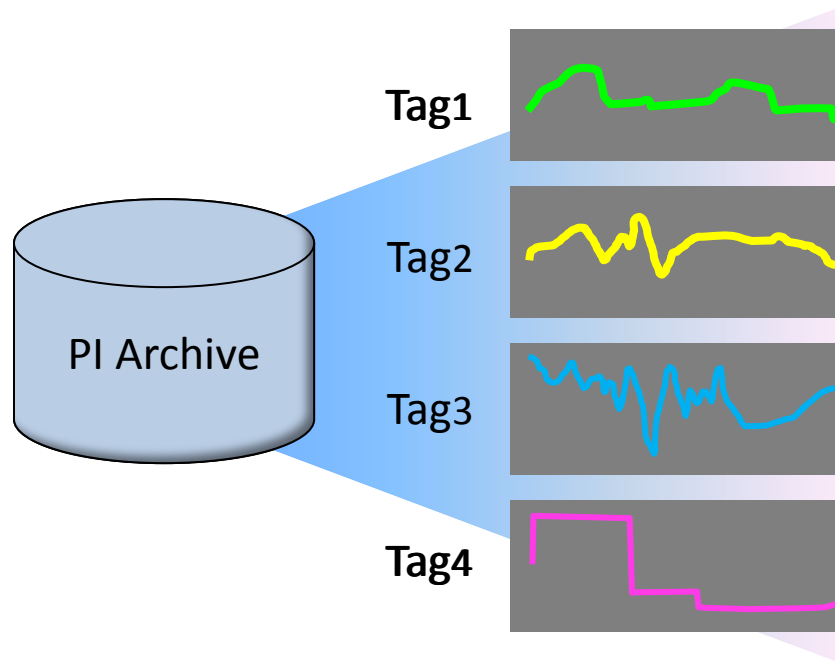
EF Partner Early Adoption



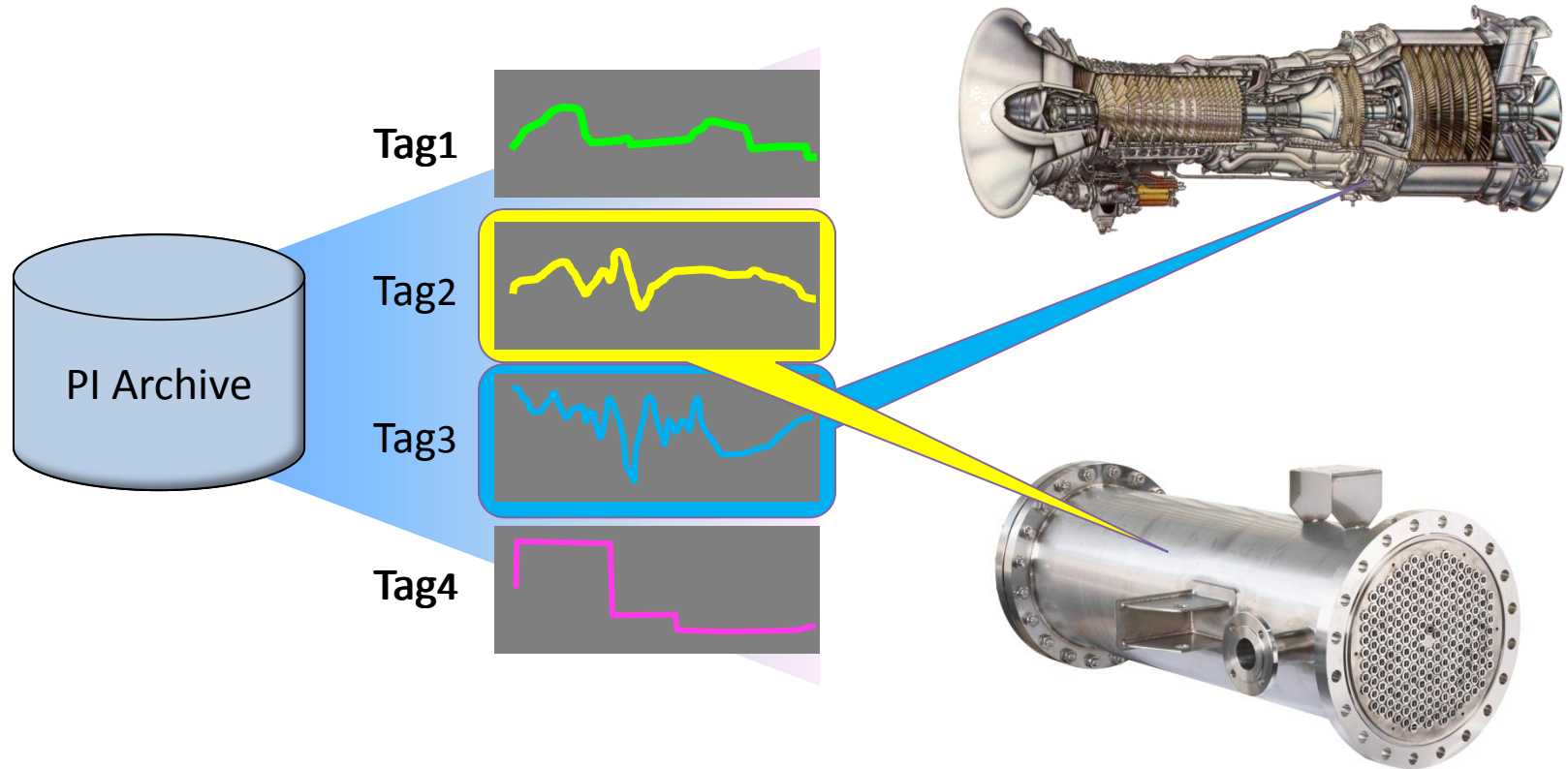
Dow Corning and OSIsoft



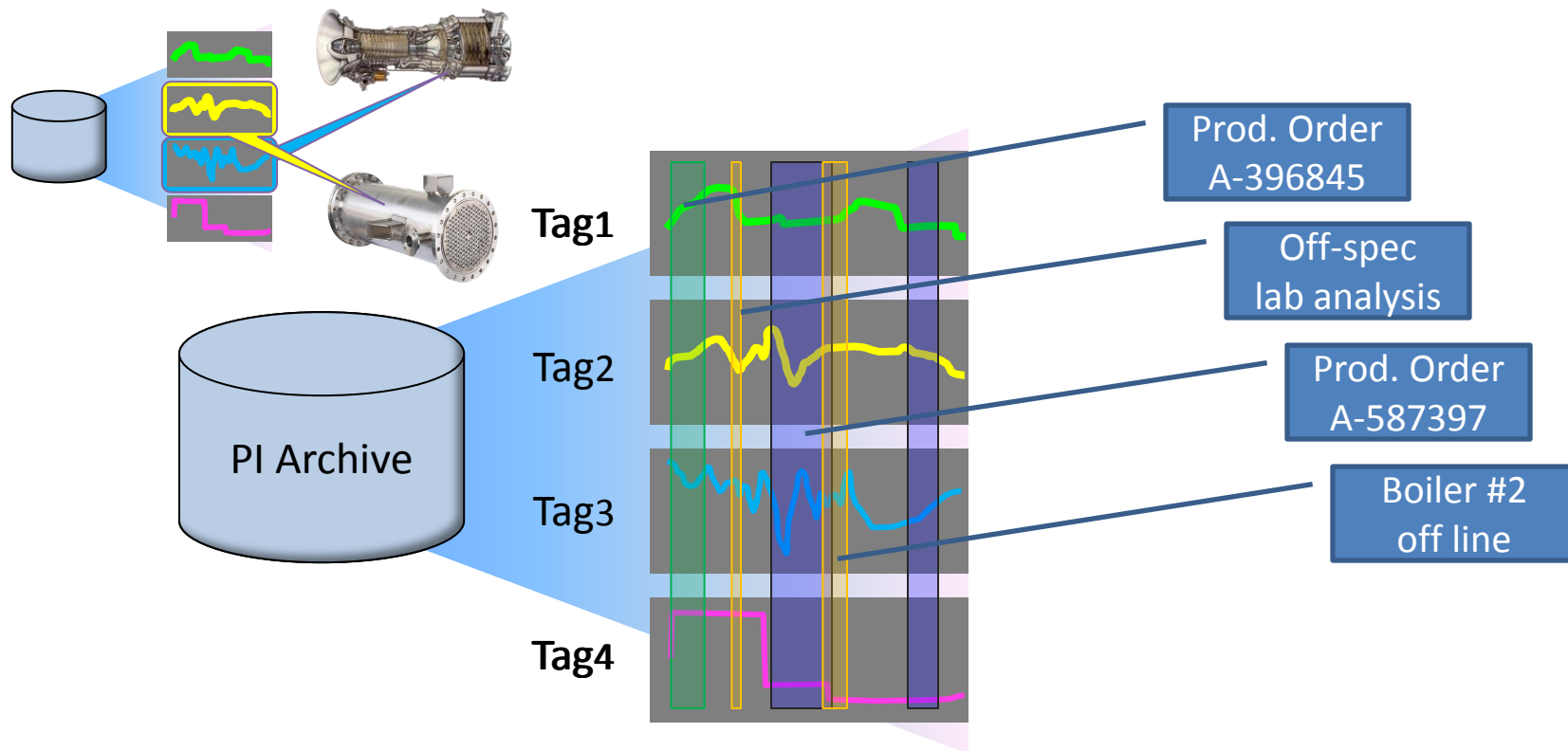
PI Server – Time series data and tags



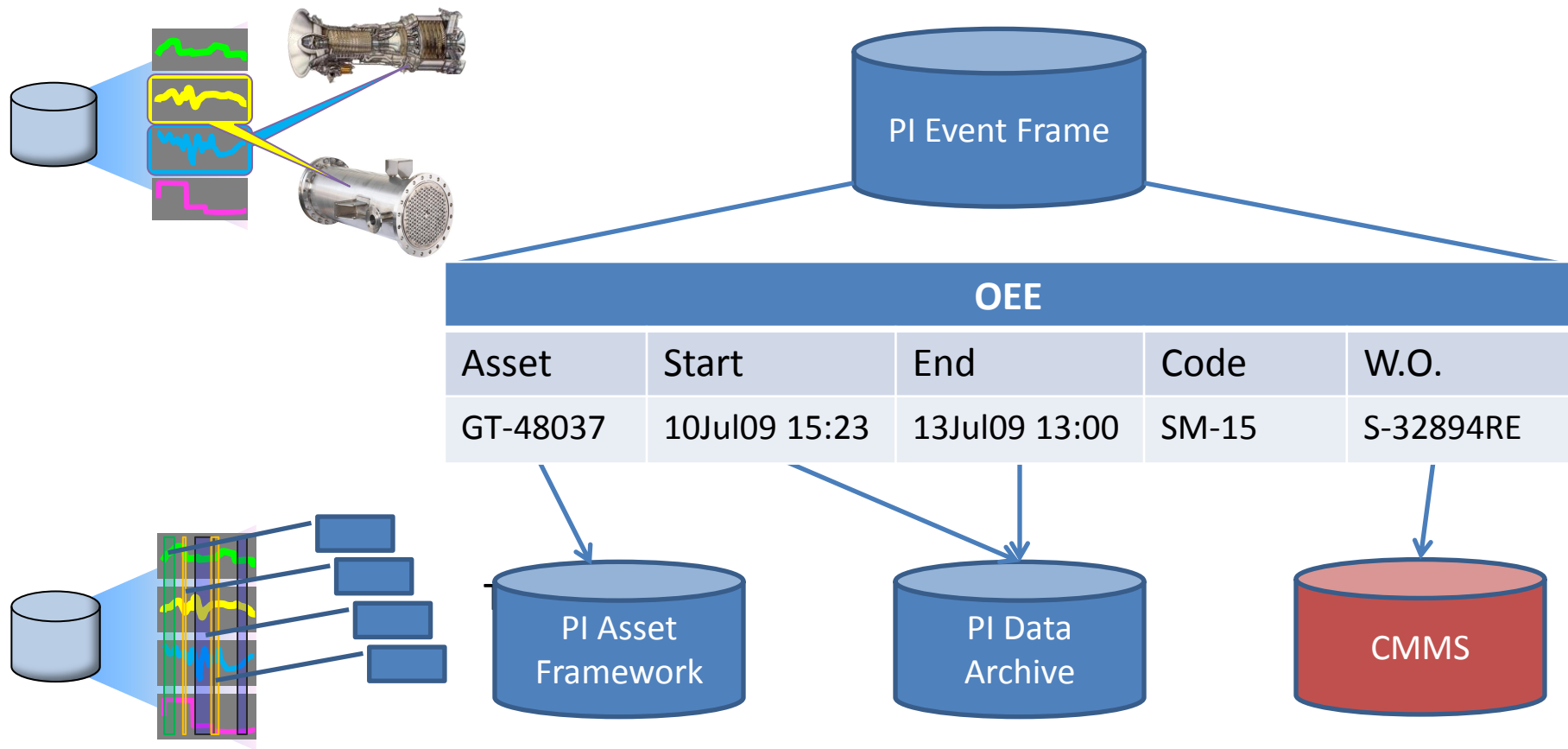
Assets help you find the right Tags



Event Frames helps you find the right time periods



Event Frames also supplies links to other systems



Product Requirements

1. Easy and fast way to view data

Introducing:



PI Coresight

International Paper and OSIsoft

Corporate Agreement
for 19 N.A. mills

PI System expanded to
Brazil, Russia & Europe

Acquires 6 Weyerhaeuser
Mills. Corporate agreement
extended to all 6 mills

1998

2000

2002

2004

2006

2008

2010

2011

Acquires Champion Paper
mills. Corporate agreement
extended to all 6 mills

Acquires Union Camp. Corporate
agreement extended to all 4 mills

PI Systems deployed
at all 19 mills

Becomes first installation of
PI Coresight

Schedules

Talk	Time	Location
Leveraging the PI System for Gas Turbine Remote Monitoring and Diagnostics <i>- Wood Group Gas Turbine Services</i>	Tuesday 2:10 PM	Continental 1-2
PI Coresight: Introducing the Fastest Easiest way to view your PI System Data <i>- OSIsoft and Microsoft</i>	Tuesday 3:30 PM Wednesday 8:00 AM	Continental 4-9 Continental 4-9
PI Event Frames - Infrastructure to Find Data Relevant to Your Events <i>- OSIsoft</i>	Tuesday 3:40 PM Wednesday 8:00 AM	Plaza Plaza



Thank you

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into **action.**