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The Power of Data

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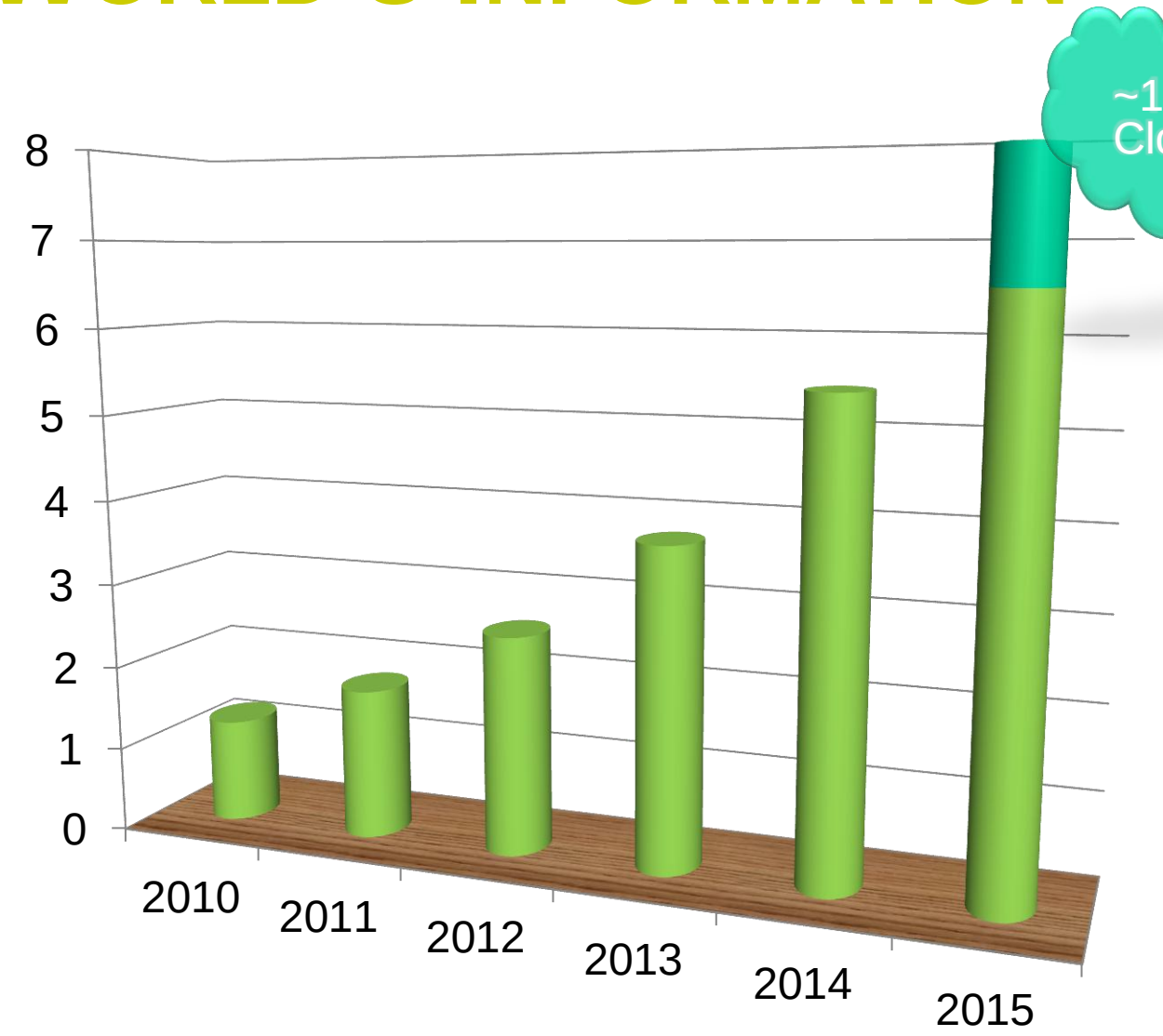
The Power of Data

PI System Infrastructure Overview

Presented by **Yves Gauthier**

ygauthier@osisoft.com

World's Information



10^{21} bytes
(1 billion TB)

Zettabytes

Source: http://www.emc.com/leadership/programs/digital-universe.htm

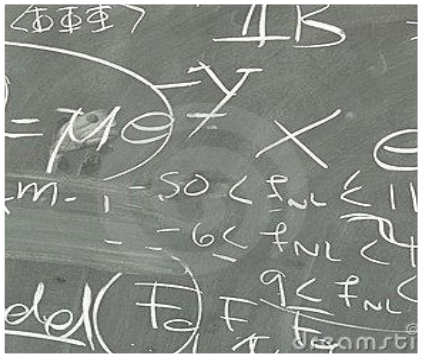
Characteristics of Big Data

Volume

Velocity

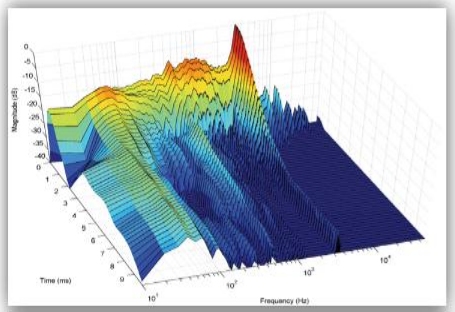
Diversity

Analytics



Structure

PI SERVER 2012



Syncro Phasors

430TB

4.8K data streams, 120Hz

3 years online

Unique Events: 55 Trillion

Estimated Data: 430TB

Data Center

840TB

100K cells, 2M breakers

10 years online

Unique Events: 105 Trillion

Estimated Data: 840TB

Automated Metering

1,410 TB

20M meters, 5-min reads

7 years online

Unique Events: 177 Trillion

Estimated Data: 1,410TB

Fleet Monitoring

50,460 TB

1K assets, 1M points

10 years online

Unique Events: 6,307 Tr

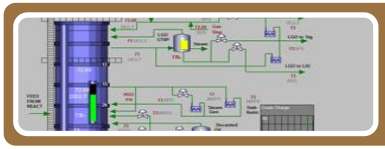
Estimated Data: 50,460TB

PI System as Infrastructure

Capabilities of the PI System

Acquire – Collect streaming data and events

Historize – Store at resolution of acquisition and trend on demand



Present – Visualize pre-built and ad hoc displays or reports

Analyze – Process data including simple to complex calculations

Organize – Structure data and events based on assets

Monitor – Trigger and notify on events

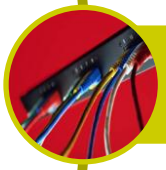
Integrate – Exchange data with external systems

INTRINSIC VALUES OF THE PI SYSTEM INFRASTRUCTURE

Reliability

Availability

Scalability



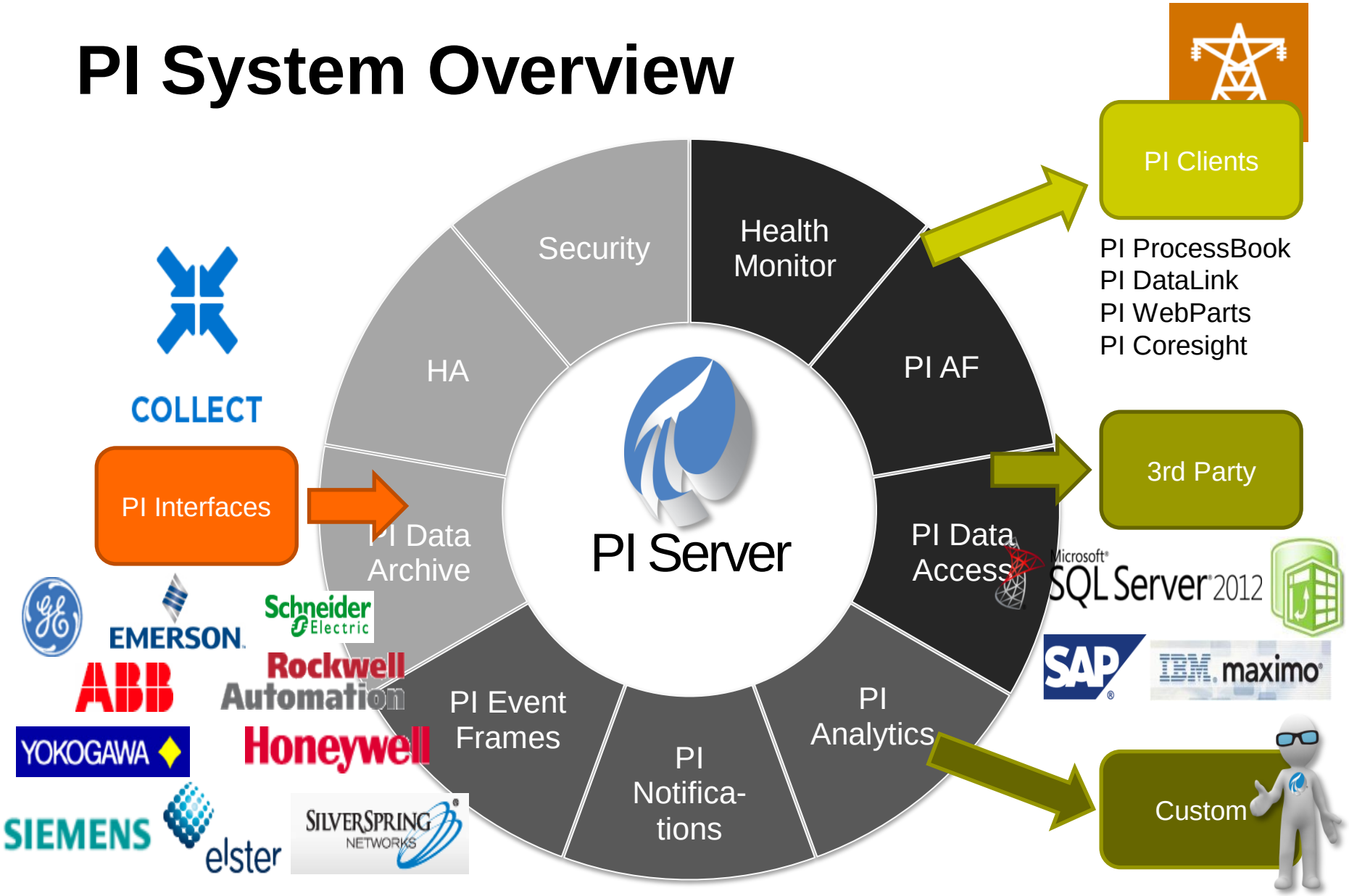
Extensibility

Searchability

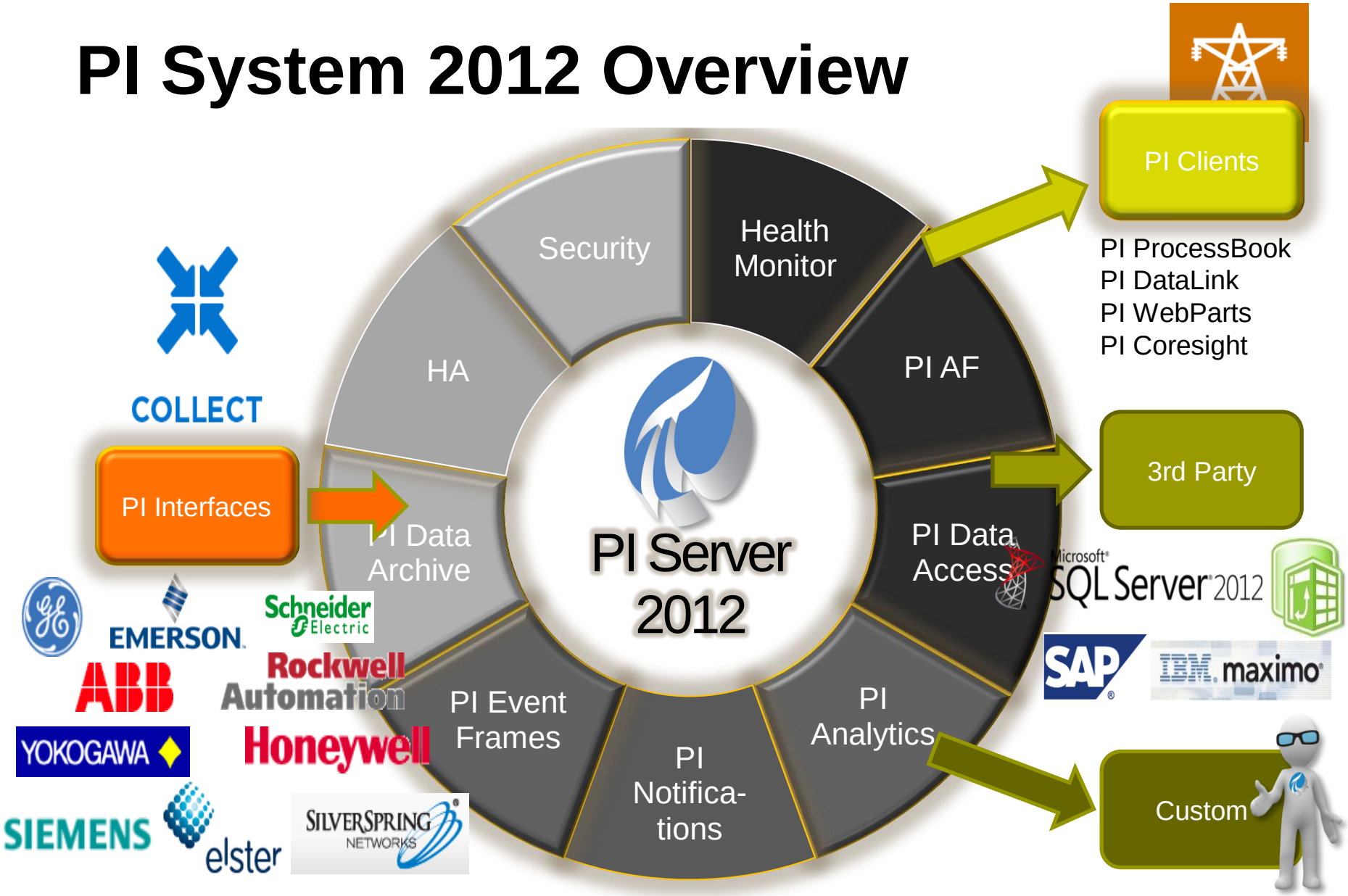
Interoperability

Security

PI System Overview



PI System 2012 Overview



PI Interfaces

Connectivity

- Real-time data acquisition from multiples sources
  - Aggregates a broad range of data types
  - Handles both time-series data and events
  - Secures data access and transmission
  - Redundancy
- Sub-second to day frequencies
- Data available online forever.
- The PI System can connect to more than 450 different protocols.

A large variety of data sources

Real-time

SCADA
ICCP - TASE 2
IEC 60870-5-104
COMTRADE
DNP3
FFT
Phasors C37.118
OPC

Web Services

Enterprise
Gateway
SOA

IT

SNMP
Windows Performance
MCN Health Monitor

AMI

Elect Meters
Gas Meters
Water Meters

Others

Text files
Manual
HTML

Relational

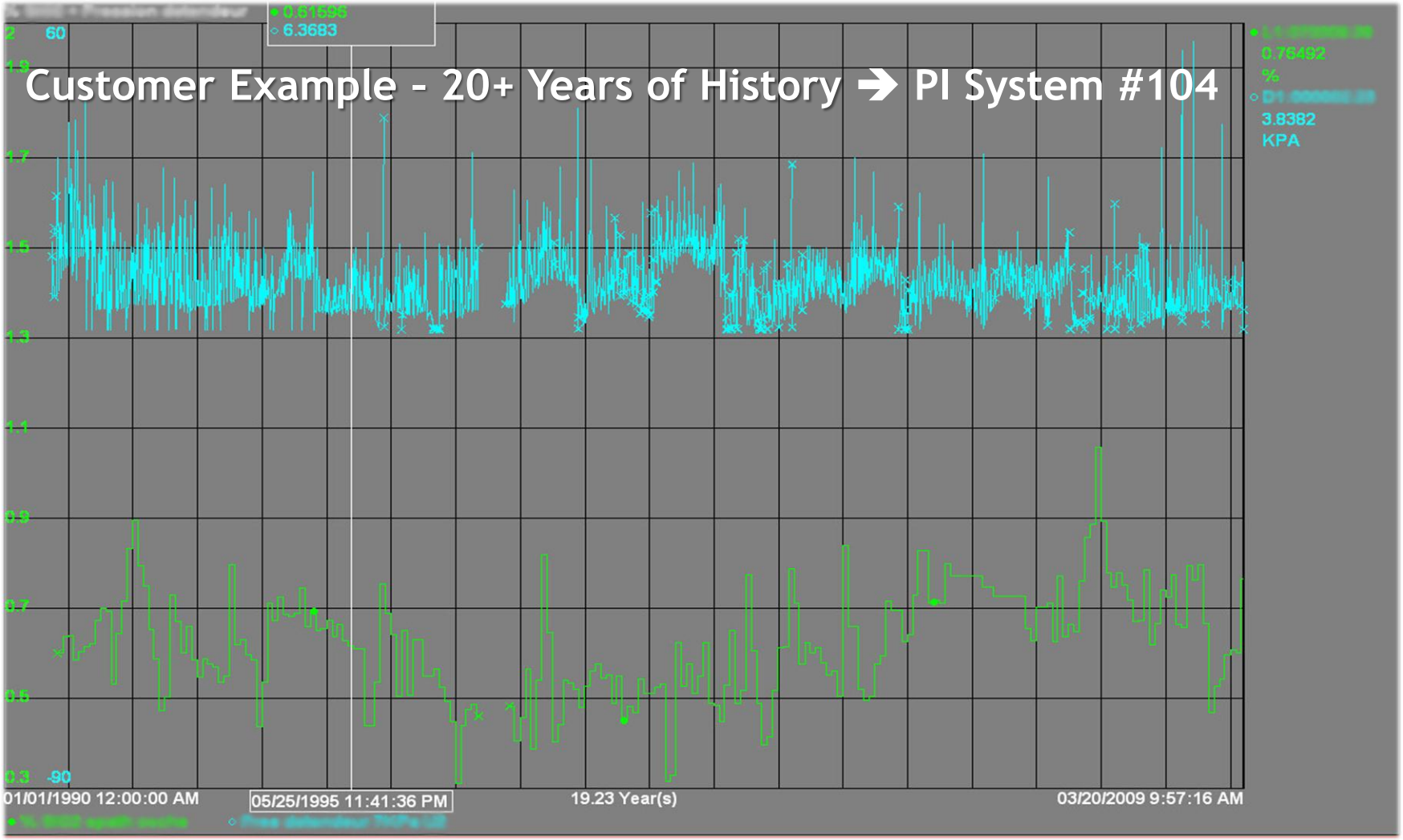
OLEDB
ODBC/JDBC
ORACLE
SQL

Custom

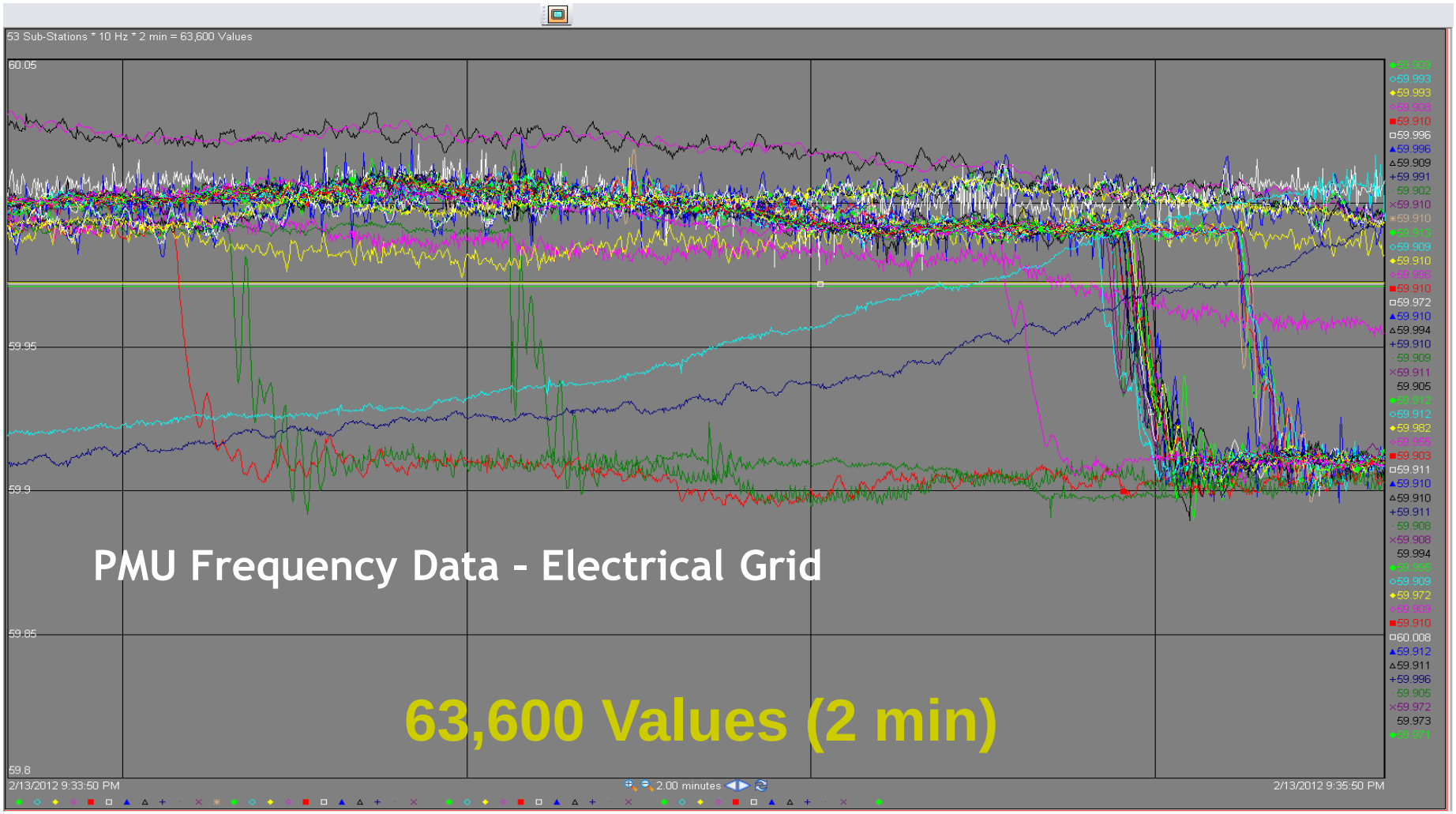
SDK (Software Development Kits)

PI Data Archive

Complete history online



Data stored with high precision



PI Server performances

2010 R3

Max Point Count	2M+ tags
Max Data In Rate	<100K ev/sec
Max Data Out Rate	<1M ev/sec
Online Archives	<10K files
Real-time Updates	200K signups
Point Changes	<10 pt/sec
Startup Time	>20 minutes

2012

Max Point Count	20M+ tags
Max Data In Rate	1M ev/sec
Max Data Out Rate	>10M ev/sec
Online Archives	>50K files
Real-time Updates	10M+ signups
Point Changes	2,000 pt/sec
Startup Time	<10 minutes

Windows Integrated Security

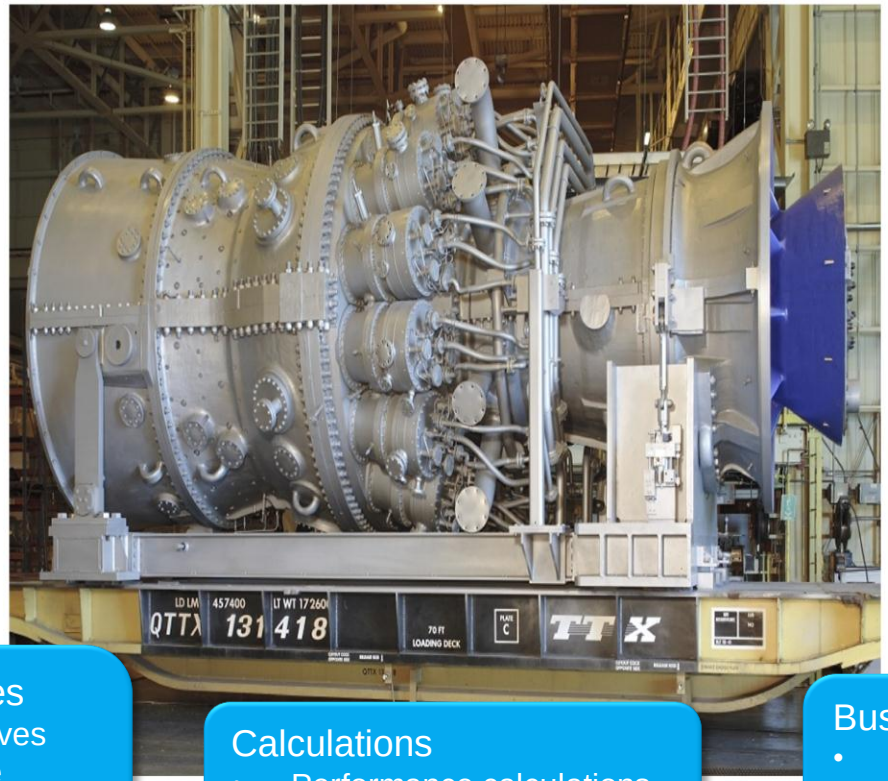
- True Single Sign-On (SSO)
- Easier to Manage
  - User Accounts in Windows/AD Only
  - Leverage AD Tools and Security Policies
- More Secure
  - Server-Side Authentication Control
- More Flexible
  - Unlimited Access Control Lists (ACLs)

PI Asset Framework

A Complete Picture of Your Assets

Real-time Values
- Inlet pressure
- Inlet flow
- Ambient temperature

Real-time Values
- Exhaust temperature
- Exhaust flow
- Measured MW output



Asset Details
- Name
- Make
- Model

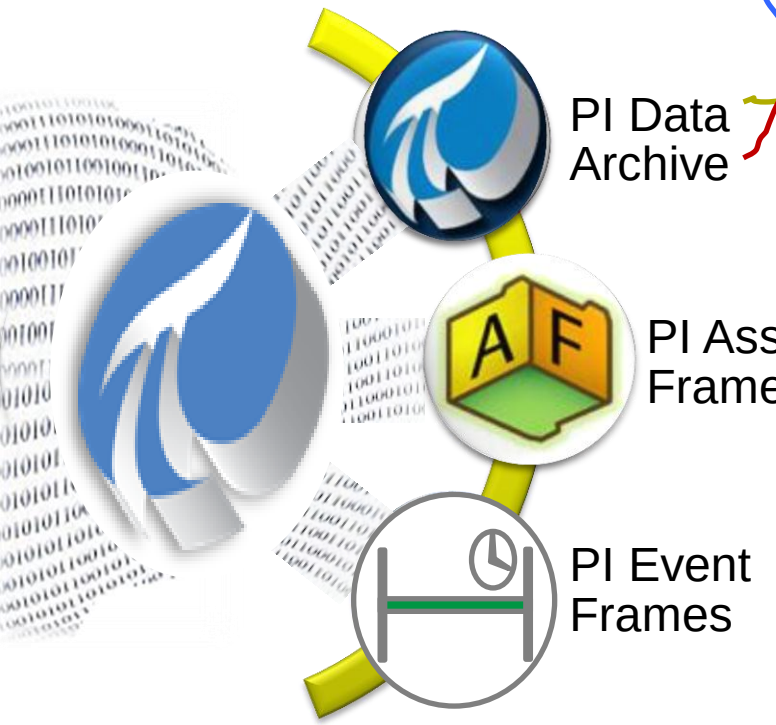
Notifications
- Performance excursions
- Temperature difference
- High temperature

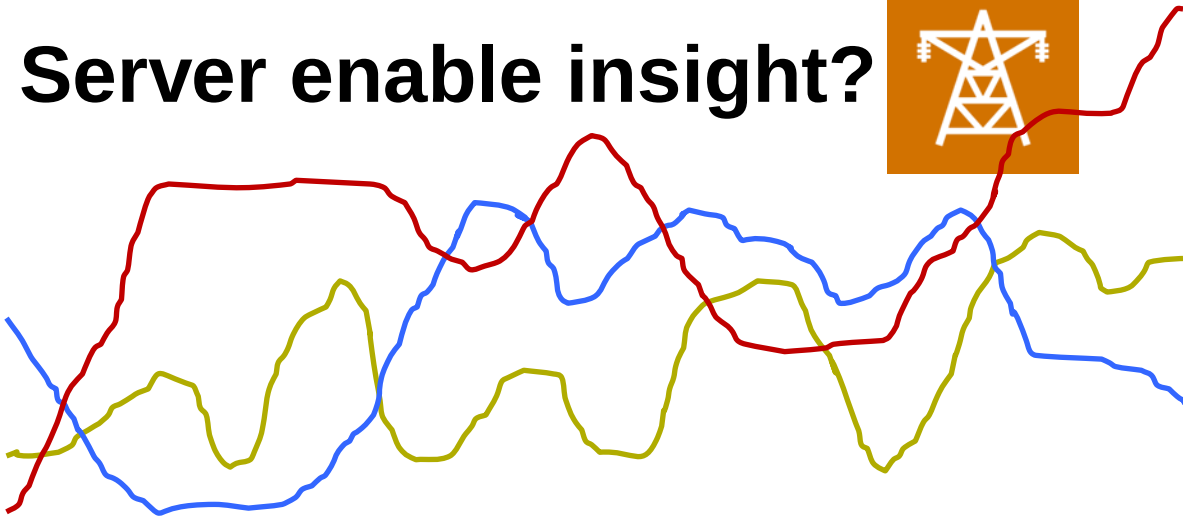
External Databases
- Performance curves
- Last service date
- Design documents
- Inspection best practice

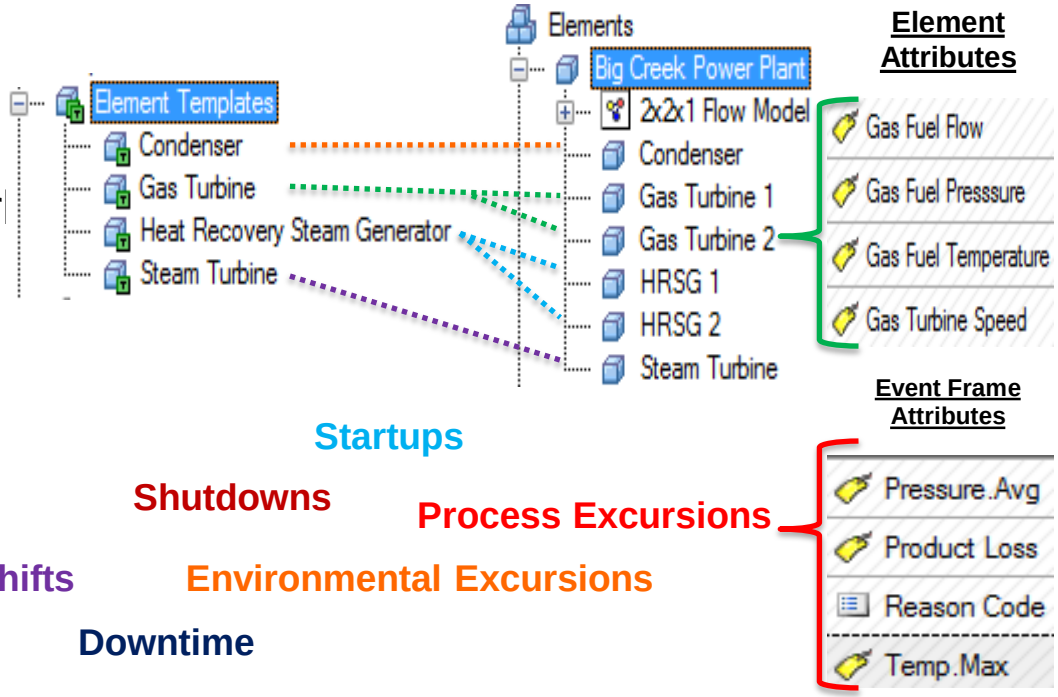
Calculations
- Performance calculations
- KPI's

Business Events
- Downtime
- Startup
- Excursions

How does the PI Server enable insight?

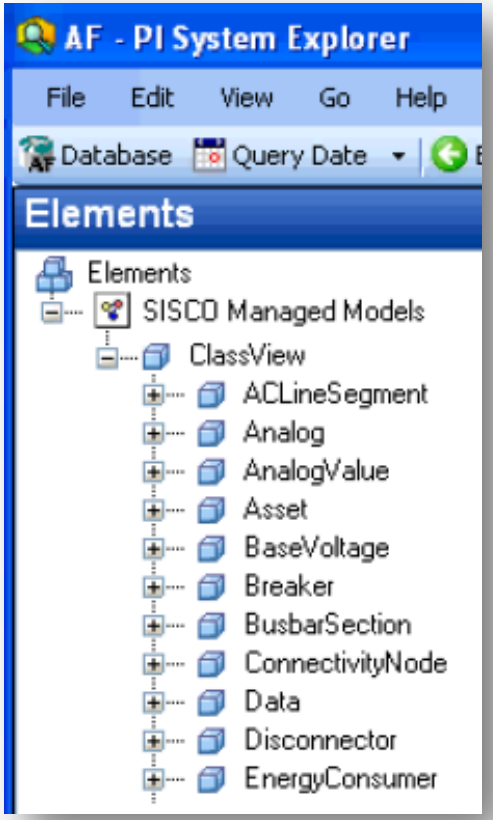






PI Asset Framework

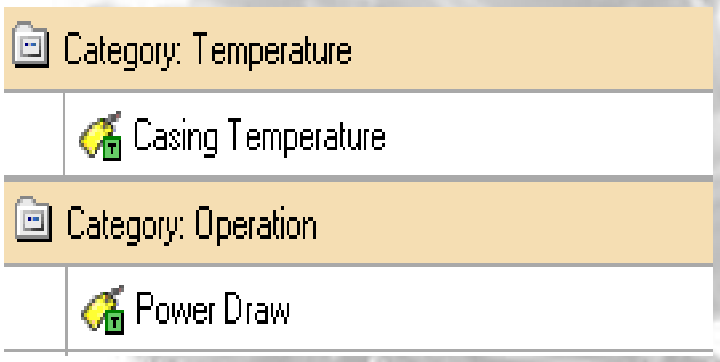
- PI Asset Framework allows to
  - Manage assets in a scalable and extensible infrastructure.
  - Use a CIM compliant infrastructure.
  - Search data from different PI Servers
  - Access non time series data sources
  - Integrate with analysis tools



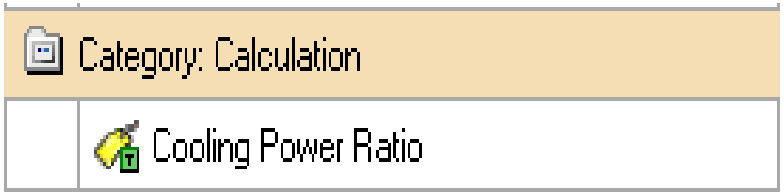
PI Analytics

PI Analytics – Streaming calculations

Have



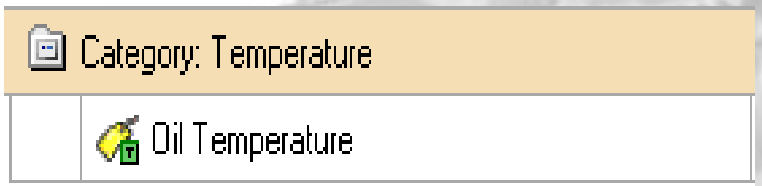
Need



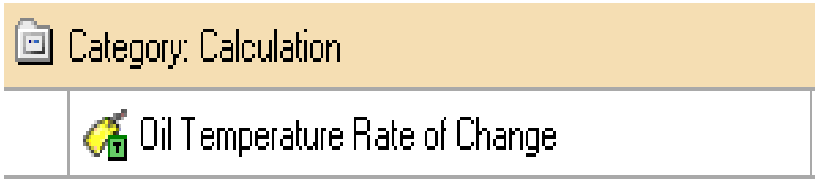
"What is the hourly temperature average per total power draw that hour?"

PI Analytics – Compare asset performance

Have



Need



"How fast is this thing heating up?"

PI Analytics – Choose the best for you

Configure

Programmatic

- PI AF Formula Data Reference
- PI AF Point Data Reference summary
- PI Client calculations

- PI Performance Equations
- PI Totalizers
- PI Statistical Quality Control (SQC)

- PI Advanced Computing Engine (PI ACE)

On-demand

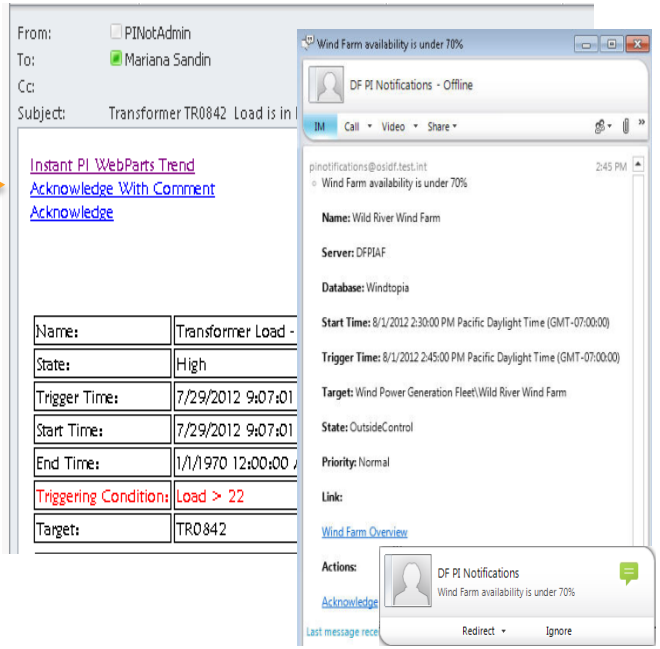
Schedule & Store

PI Notifications
&
PI Data Access

PI Notifications – keeps you informed of your assets

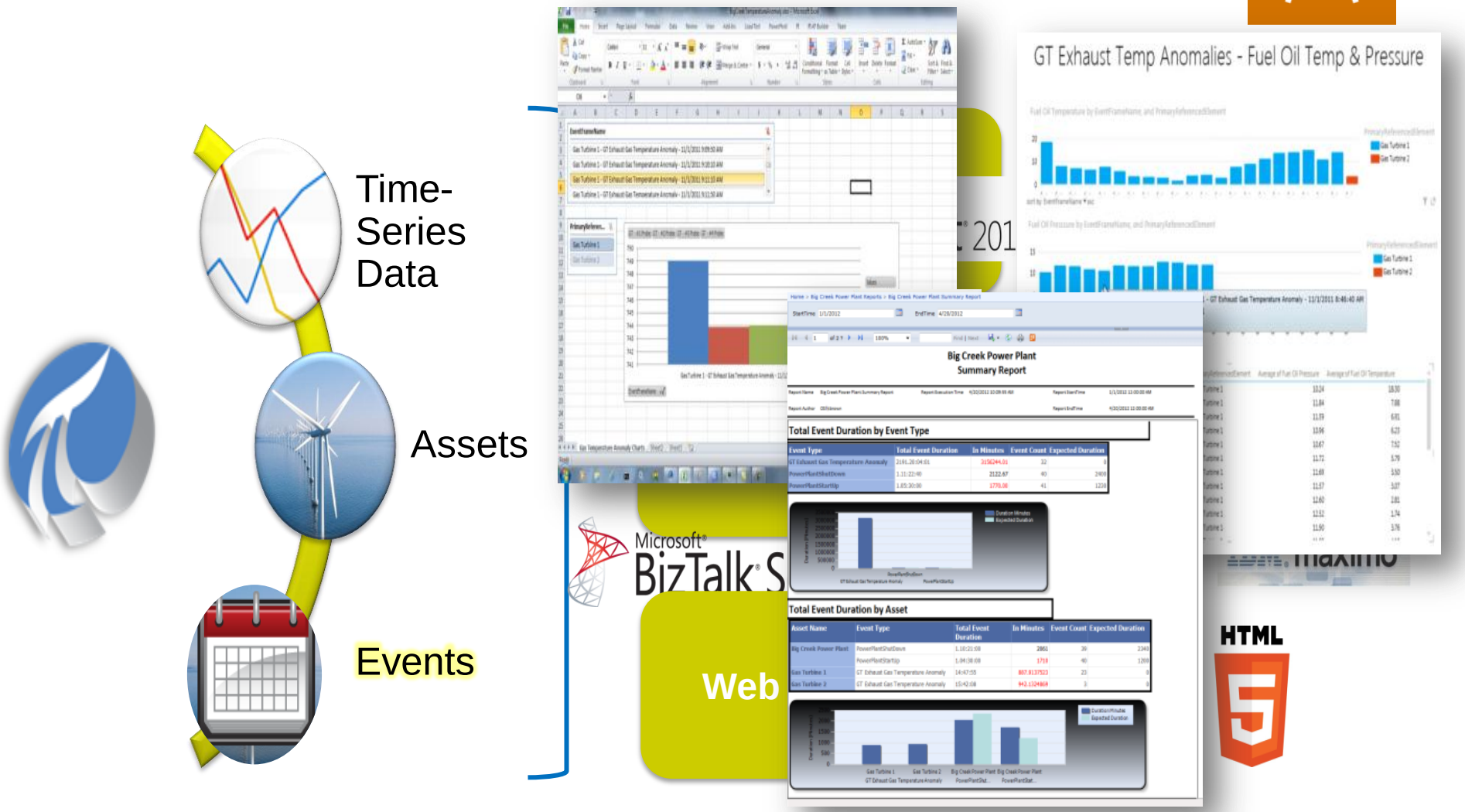
"One of the transformators has been acting up…
Let's keep an eye on the temperature and create a work order for maintenance if it fluctuates more than 5% in 5 seconds.
Make sure Bob is notified of this also."

DELIVER



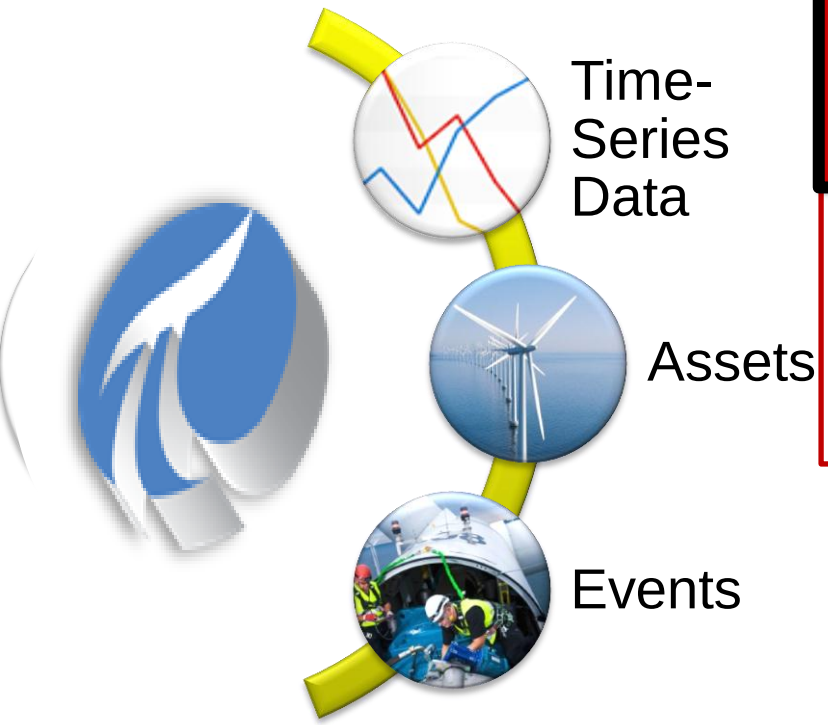
Web Service

PI Data Access – Integrate your events

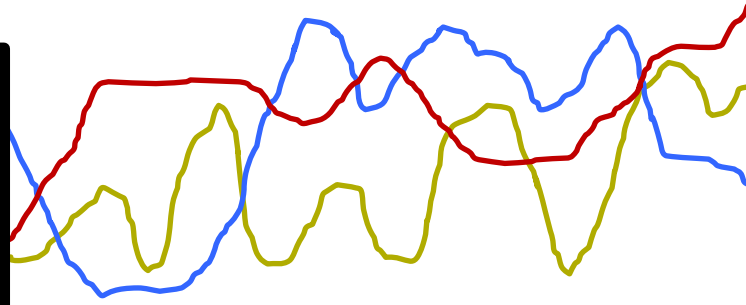


PI Clients

How does the PI Server enable insight?

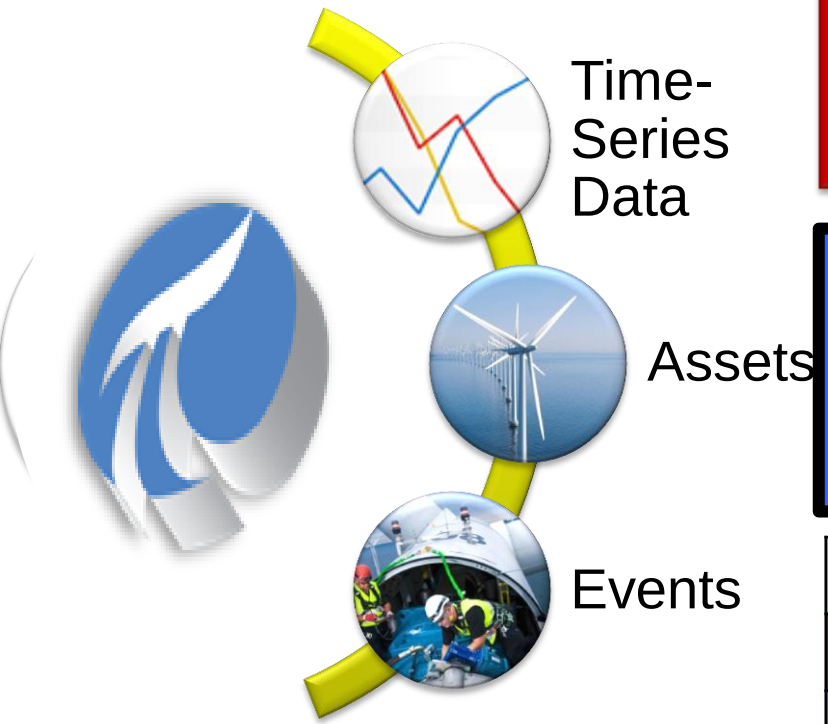


Store Full Data Fidelity



- Stores the raw data (not summaries)
- Enables ALL the possible analyses
- Don’t miss critical information needed for analysis / reporting

How does the PI Server enable insight?



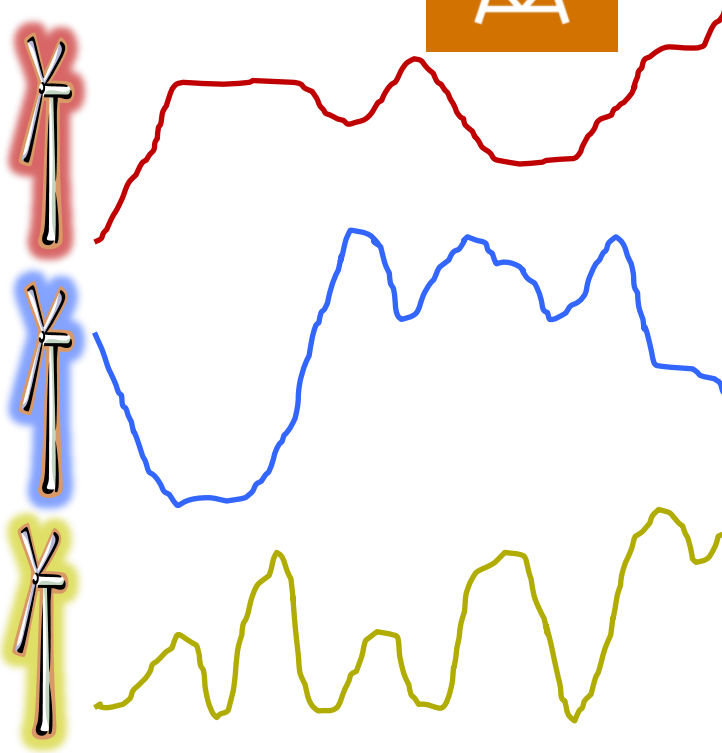
Time-Series Data

Assets

Events

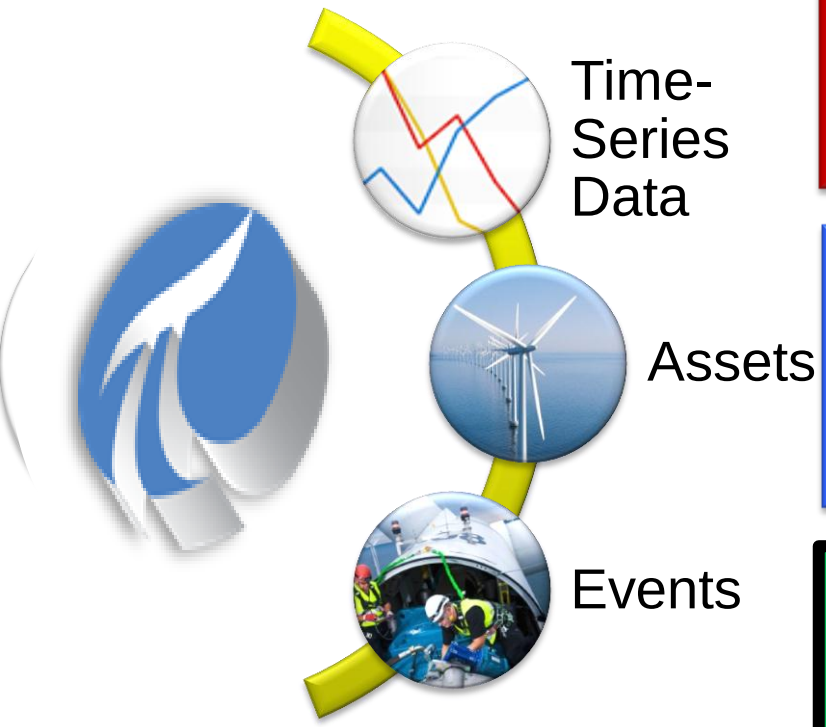
Store Full Data Fidelity

Perform Asset Comparisons



Asset	Current	Day.Peak	Week.Total	Month.Avg
WT101	1.22 MW	1.97 MW	13.32 MW	1.93 MW
WT102	0.56 MW	1.53 MW	15.56 MW	2.21 MW
WT103	0.72 MW	1.78 MW	9.34 MW	1.59 MW

How does the PI Server enable insight?



Time-Series Data

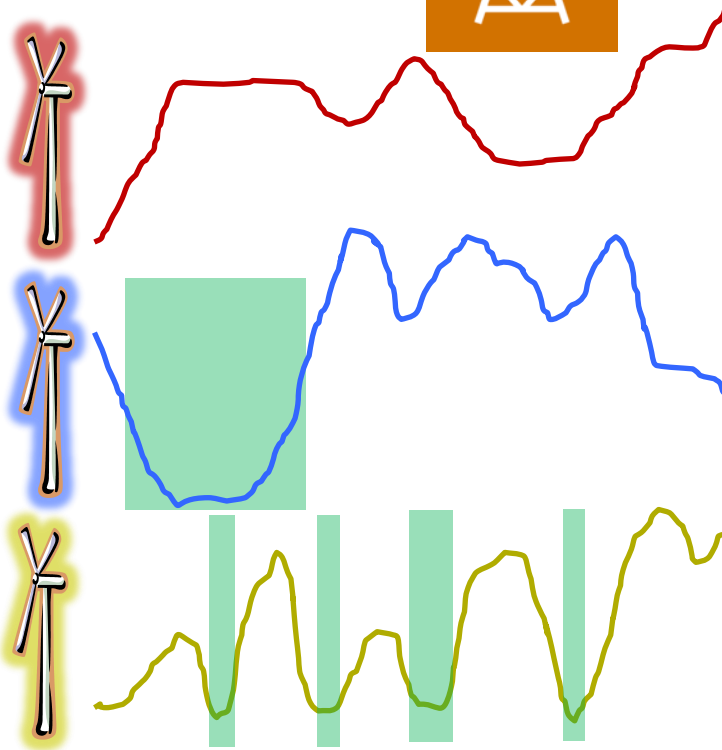
Assets

Events

Store Full Data Fidelity

Perform Asset Comparisons

Perform Asset & Event Comparisons



Asset	# Downtime	Total Downtime
WT101	0	00:00:00
WT102	1	08:21:23
WT103	4	06:47:35

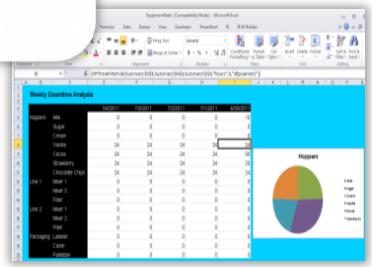
Visualization Landscape

PI Coresight:
Ad Hoc Analysis & Collaboration

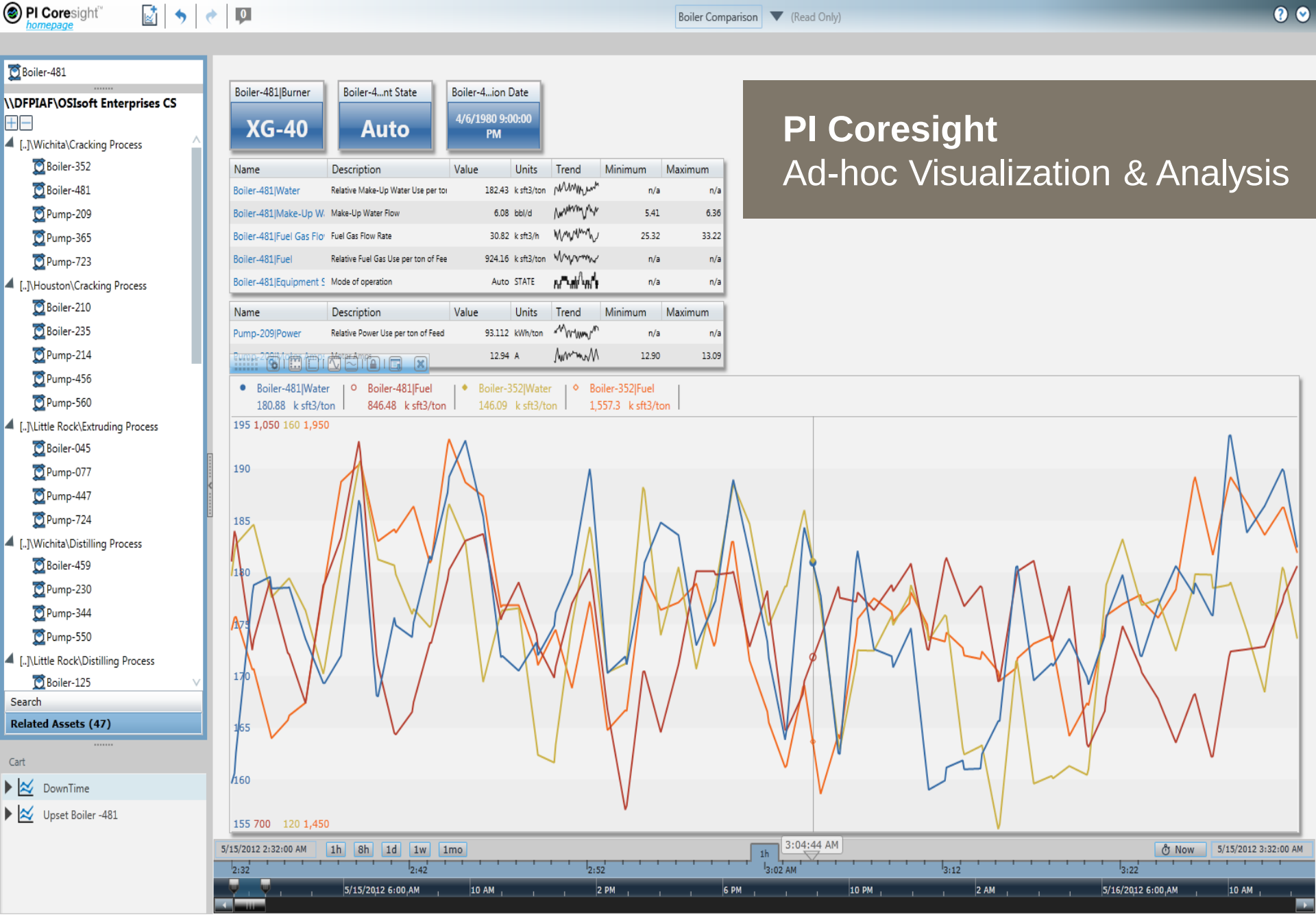
PI WebParts:
Composite Apps, Shared broadly

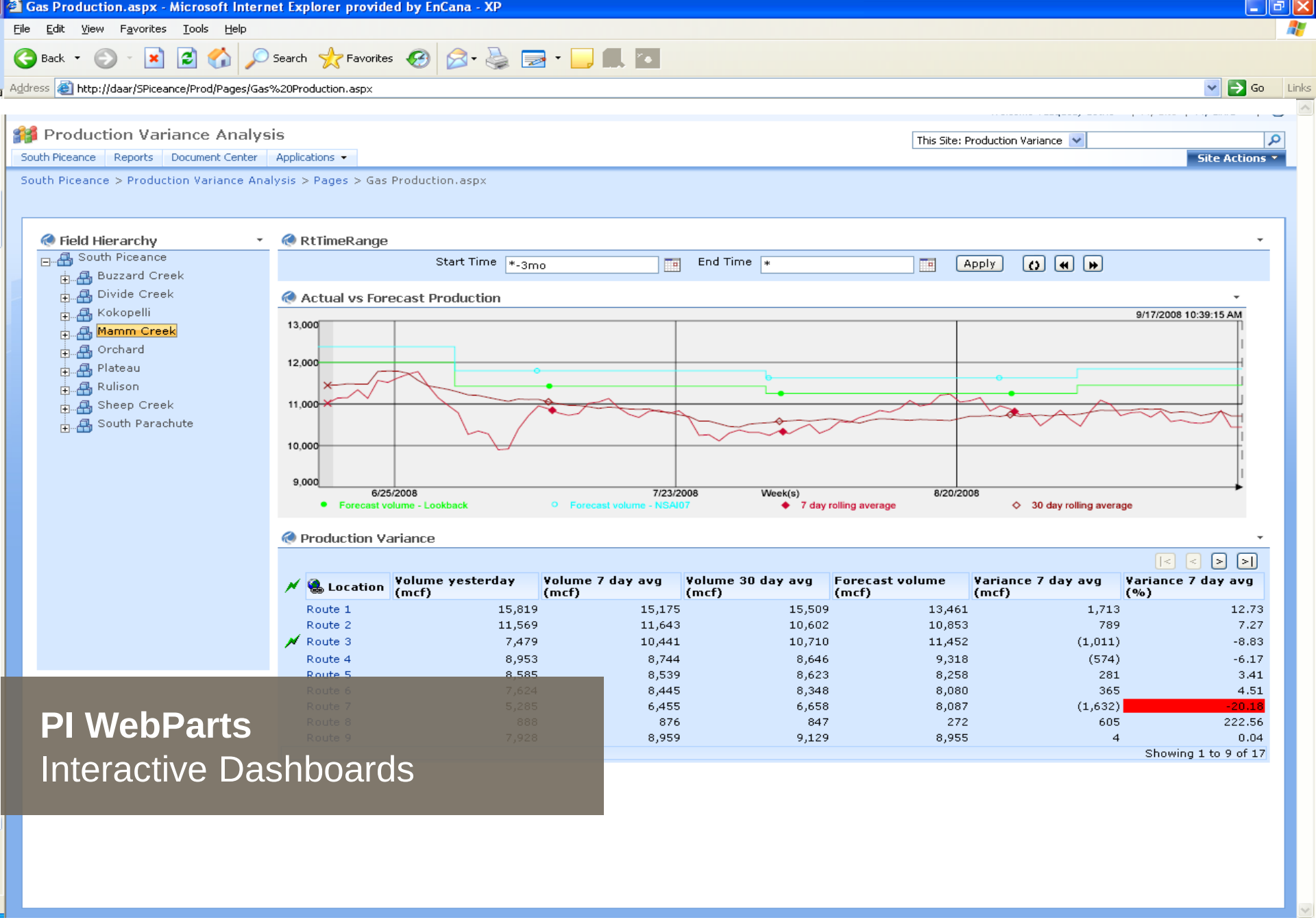
PI ProcessBook:
Display authoring and Process monitoring

PI DataLink:
Reporting and table based analytics in Microsoft Excel

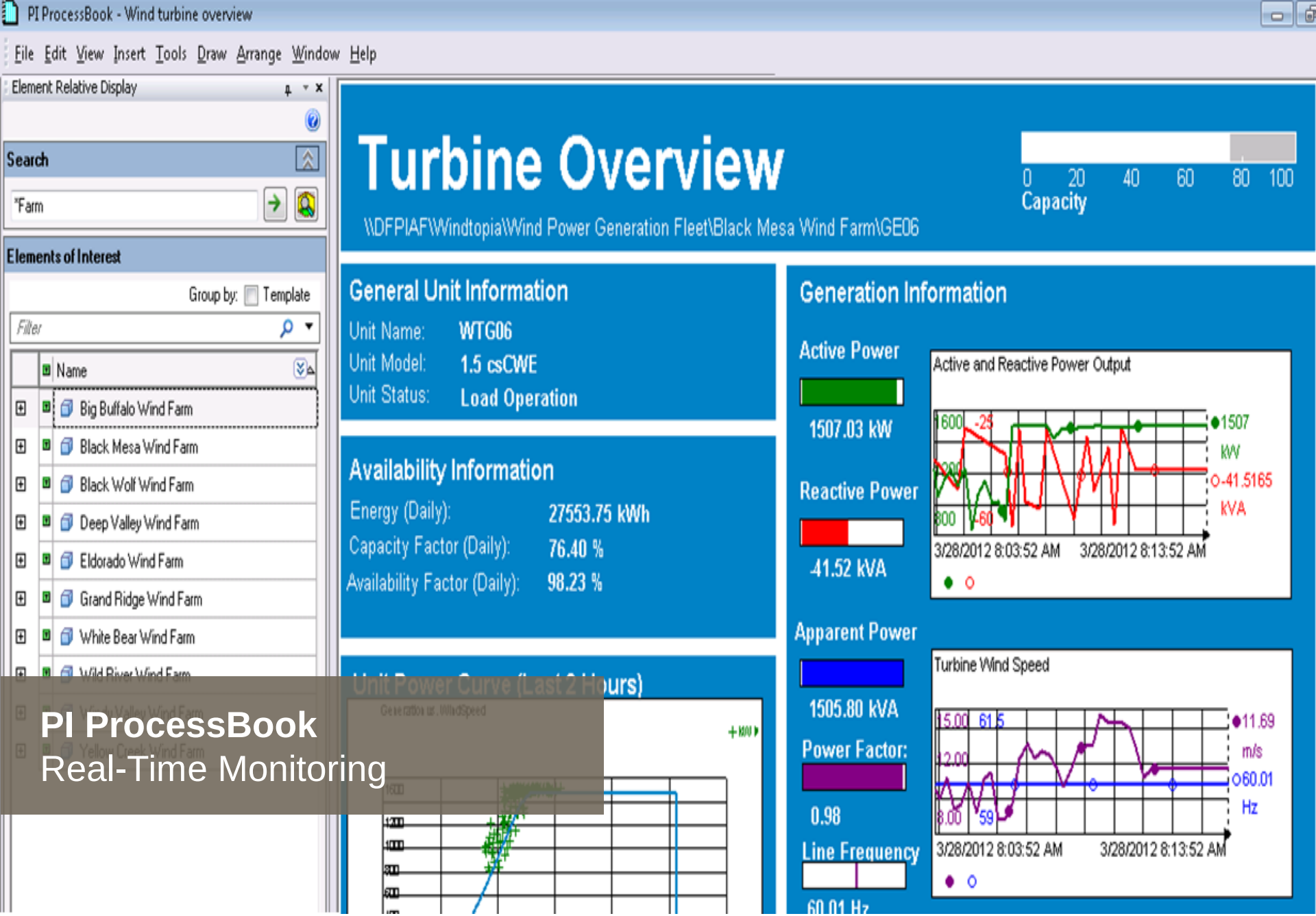


PI Coresight
Ad-hoc Visualization & Analysis





PI WebParts
Interactive Dashboards



PI ProcessBook
Real-Time Monitoring

	A	B	C	D	E	F
1	**2008 CO2 Emissions (lbs)**					
2	AQMD Unit ID:	Facility ID:	Type:	January	February	March
15	D-15	K-26	Major	0	98,684	3,375,547
16	D-16	K-27	Major	0	69,113	2,639,550
17	D-83	H-6	Process	96,274	56,349	13,120
18	D-84	H-20	Process	37,588	13,418	2,701
19	D-175	H416	Process	244,634	151,862	5,328
20	D-176	H417	Process	19,283	2	0
21	D-177	H418	Process	225,835	95,620	0
22	E-173 (M24)	AC	R219	64,400	46,711	13,942
23	E-15	Air Compressor	R219	1,302	22	897
24	E-16	Generator	R219	143	0	18
25	E-18	Air Compressor	R219	1,109	292	11,618
26	E-18B	Air Compressor	R219	16,188	320	13,096
27	E-22	Trash Pump	R219	0	0	0
28	E-23	Trash Pump	R219	0	0	0
29	E-24	Trash Pump	R219	3,129	3,054	1,046
30	E-25	Steam Cleaner	R219	649	0	0
31	E-27	Welder	R219	5,869	123	4,269
32	E-28	Light Plant	R219	-1	4	113
33	E-29	Generator	R219	0	0	0
34	E-30	Welder	R219	11,904	125	3,404
35	E-31	Air Compressor	R219	1	2	0
36	E-32	Generator	R219	0	0	0
37	E-33	Pressure Washer	R219	0	0	0
38						
39		*Major*		10,320	997,616	10,645,707
40		*Large*		276,570	278,036	452,744
41		*Process*		964,375	565,436	85,566
42	*R219*	*Gasoline*		5,685	3,369	13,578
43		*Diesel*		34,610	572	20,881
44		*Nat. Gas*		64,400	46,711	13,942
45	Major, Large, Process, Natural Gas all in MMSCF					
46	Gasoline, Diesel in gallons					

DAILY PRODUCTION REPORT - Papermachine

Daily Report For :	23-Jul-07					
SHIFT FOREMAN	John Smith	Mike Jones	Peter Richards			
FIBRE INPUT	Shift 1	Shift 2	Shift 3	Total	Spec	Unit
Base NSSC - Grubbens	15	50	50	115		BDT
Total fibre input				115.00		BDT
FIBRE TO FAN PUMPS	Shift 1	Shift 2	Shift 3	Total	Spec	Unit
Liner pulp	10	40	50	100		BDT
Base K4	15	55	80	150		BDT
Base NSSC	25	70	60	155		BDT
Base broke	1	5	15	21		BDT
Total fibre to fan pumps	51	170	205	426		BDT
PAPER PRODUCTION				End of day		
Grade (Shift start)	ML140	ML140	ML225	ML225	Spec	Unit
Standard speed	500	500	490			m/min
Actual Average speed	390	520	505			m/min
Gross Pope Production	40	180	220	440		t/day
Bone Dry Production	35	160	200	395		BDt/day
Fibre Loss on Machine	16.0	10.0	5.0	31		BDt/day
PM Production Over Scale	38	180	220	438		t/day
Saleable PM Production	10	160	220	390	400	t/day
Rewinder Production	0	0	10	10		t/day
Total Saleable	10	160	230	400		t/day
Broke	20	5	0	25		t/day
Hold Reels	8	15	0	23		t/day
Second Cut	0	0	0	0		t/day
Jumbo's on Kitchen Rail				12		tons
DOWNTIME	240	15	0	255	minutes	

PI DataLink
Personalized Reports

- Factory 1 Batch Cycle Time
- Factory 1 Batch Trend Comparison DLES
- Factory 1 Batch Trend Calcs

Add new link

Alarm Query Time Range

Start Time
2/3/2010 12:00:00 AM

End Time
2/4/2010 12:00:00 AM

Apply

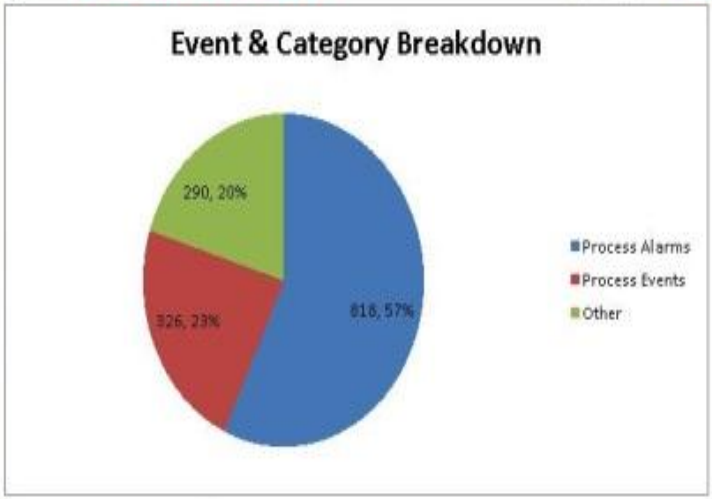
Select a Unit

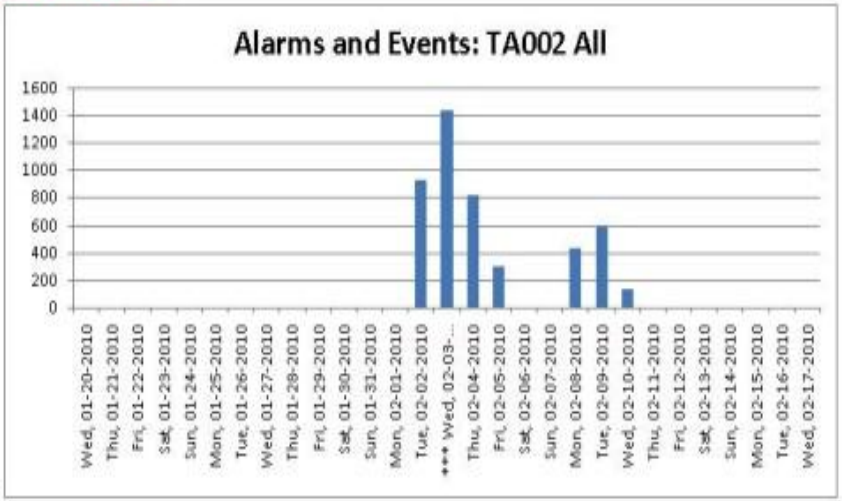
- All Factory 1 Units
  - All Units
  - BF008
  - BF009
  - CIP005
  - CIP006
  - TA001
  - TA002

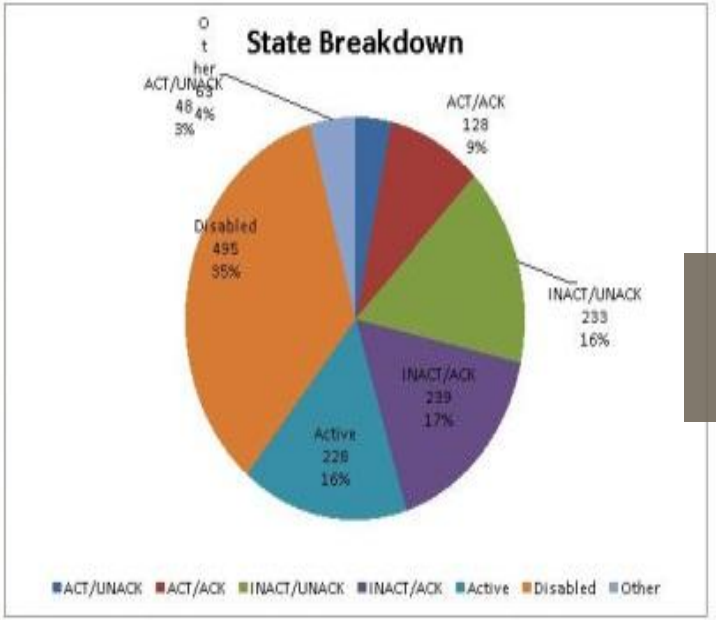
Excel Web Access - BioPharma Factory 1 Alarm Events

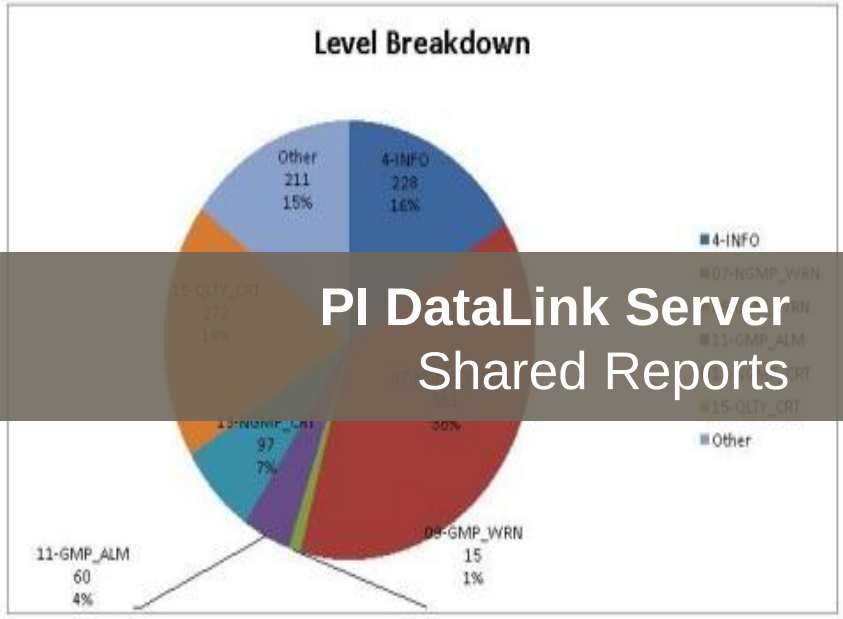
Open | Update | Find

Unit: BioPharma\Factory 1\All Factory 1 Units\TA002
Tag: BioPharma:TA002.AE.All
Start Time: 2010-02-03T00:00:00
End Time: 2010-02-04T00:00:00
Values: 1434



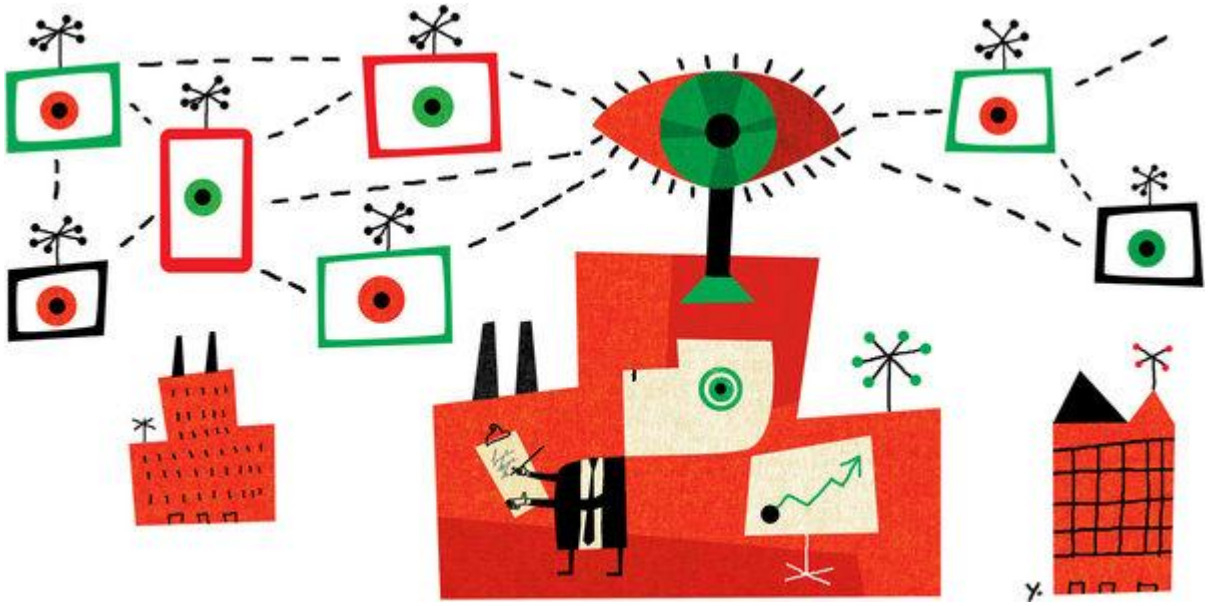






PI DataLink Server
Shared Reports

When There's No Such Thing as Too Much Information



Net Gain – Output and Productivity 5 % to 6 % higher in DDD (Data Driven Decision Making)

Reference: Brynjolfsson, et al., MIT, How does Data-Driven Decision making Affect Firm Performance, 2011.
http://www.nytimes.com/2011/04/24/business/24unboxed.html

Yves Gauthier

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Customer Service Engineer

OSIsoft France

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