

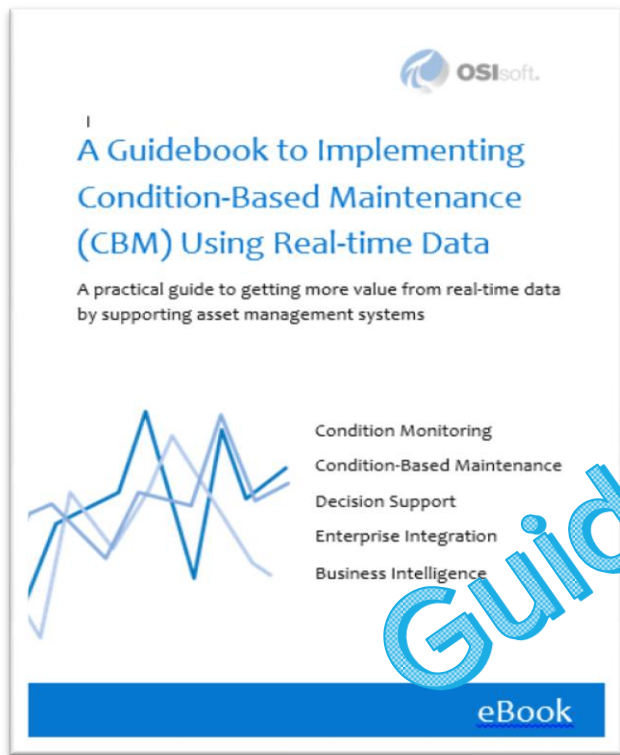


Keeping Assets Healthy – PI System's Role in Asset Maintenance

Presented by Gopal GopalKrishnan, P.E.
Keith Pierce



CBM Prescriptive Guidance



Terms & Definitions

Implementation Guidance

PI System Overview for CBM

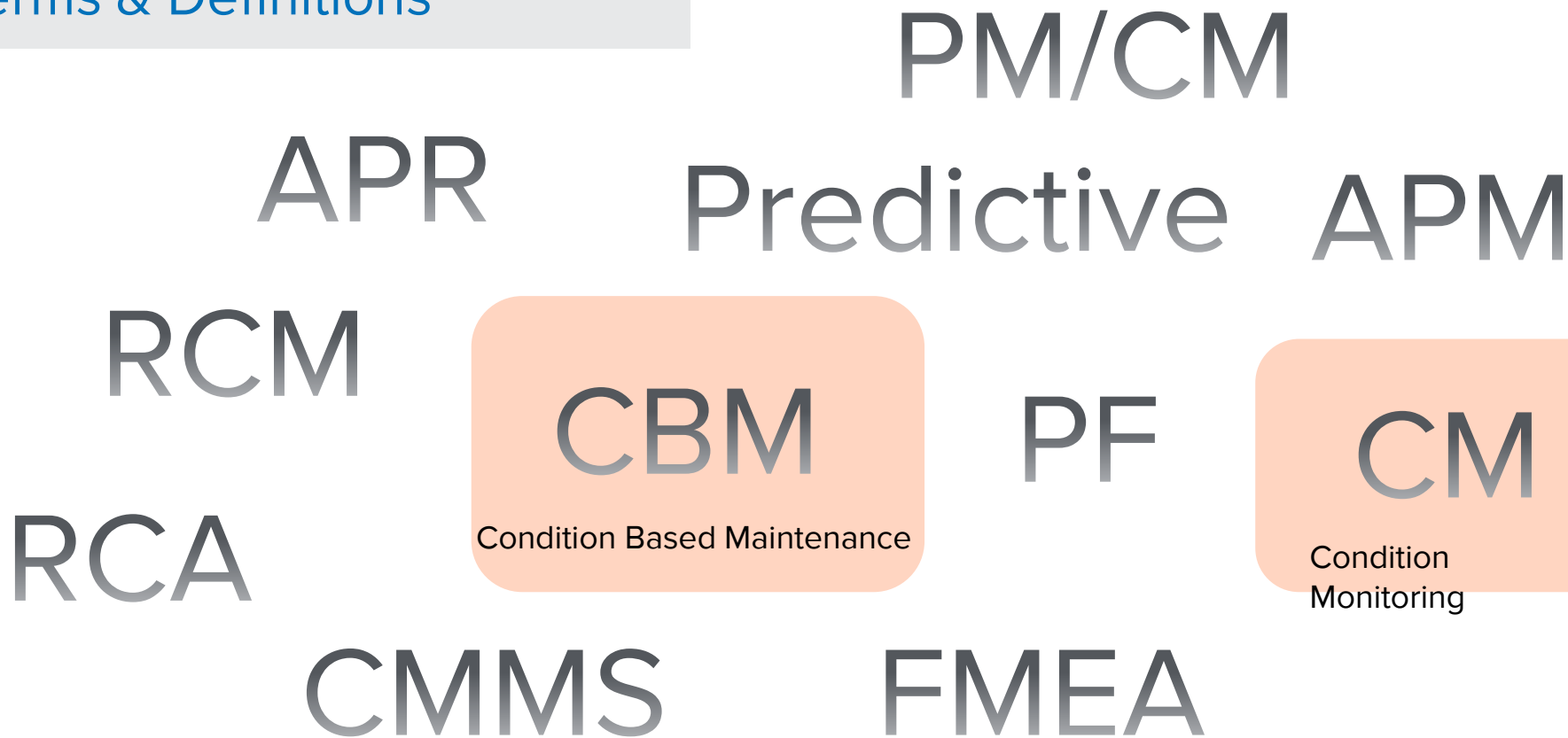
PI System Integration w/ CMMS

Enabling Opportunities

Solution Examples

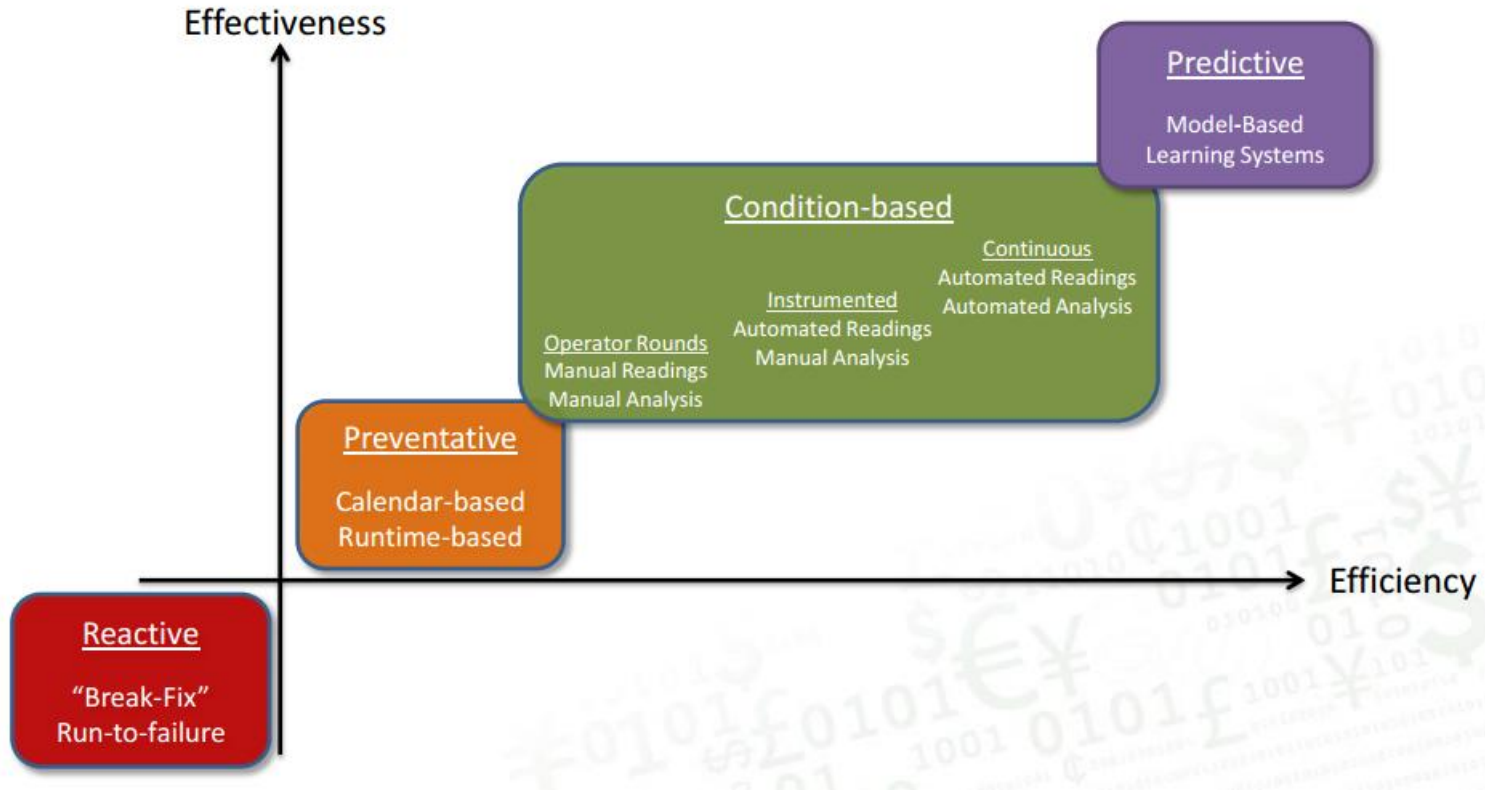
Industry References

<http://pages.osisoft.com/CBMWebinarOnDemand.html>



<http://pages.osisoft.com/CBMWebinarOnDemand.html>

Condition Monitoring is an Effective Maintenance Strategy

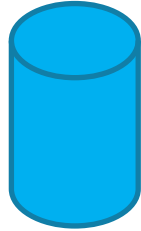


CBM means different things to different people

- Incipient Failure Detection
- Condition Monitoring
- Condition Assessment
- CBM Preventive Maintenance

Operations

Data + Events
History

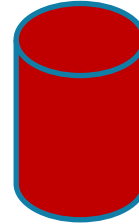


PI System

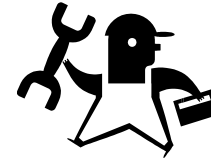


Maintenance

Data + Events
History



Maximo



ORACLE

INFOR



ABB

Mincom
Asset Suite
Passport

Operations vs. Maintenance Data

- Pressure
- Flow
- Temperature
- Level
- ...
- ...



- Vibration
- Oil analysis
- Motor current
- Thermography
- ...
- ...

PI System's role in Maintenance

The 6 Steps of CBM with the PI System

1. Connect to relevant sources

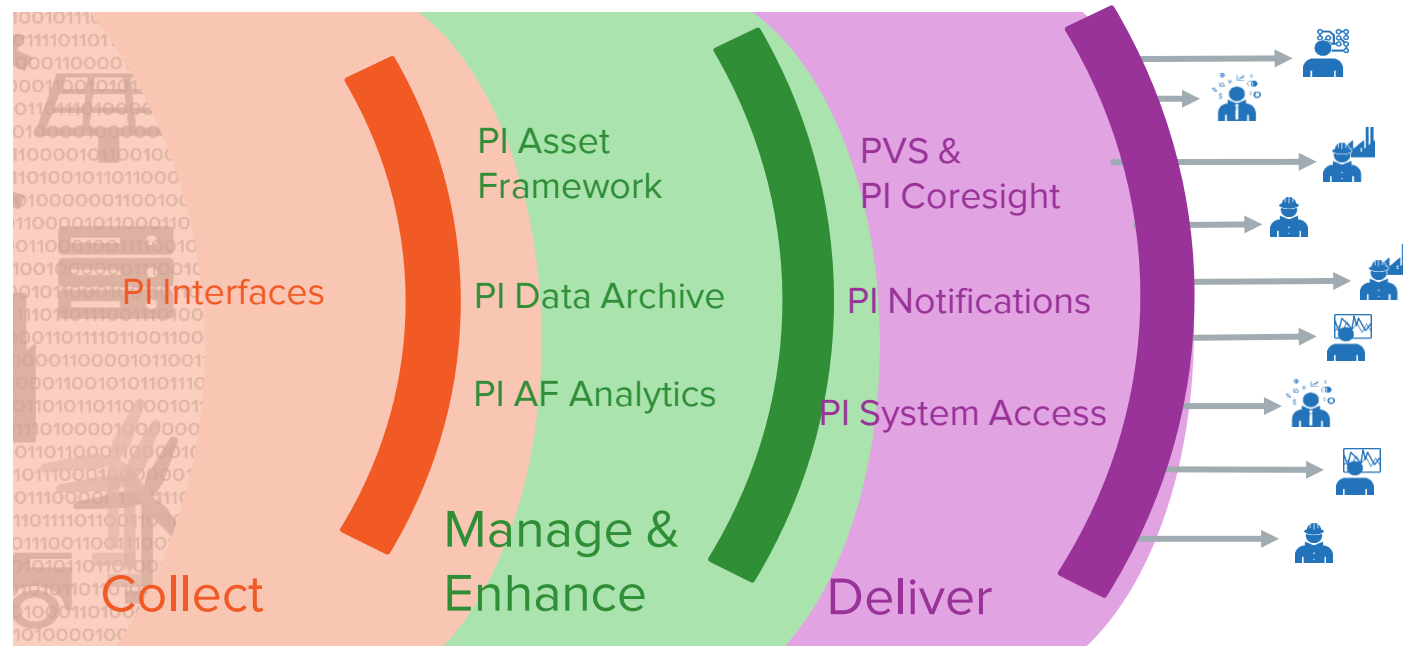
2. Collect and archive data

3. Assign context (asset based)

4. Execute condition monitoring logic

5. Visualize real-time conditions

6. Alert & notify



To Do List - Basic

- Create a watch list – early warning system
 - Equipment usage – run hours, tons processed, start/stop cycles...
 - Equipment condition alerts – filter clogged, heat-exchanger fouled, motor vibration high...
- Notify the asset owner – with links to details
- Create a report – across asset and production events

To Do List - Advanced

- Asset health score
- Work management integration – it is not hard – SAP PM, Maximo, Oracle...
- Make it easy for Maintenance to see Operations (PI System) data

To Do List - Basic

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Search in Boiler Feed Pump #1

EXT Steam Pressure

Suction Pressure

RunHours

RunHours_MonthTD

RunHours_WeekTD

RunHours_YearTD

Temperature

BFP#1_RunHrs_MTC

199 h

BFP#1_RunHrs_YTD

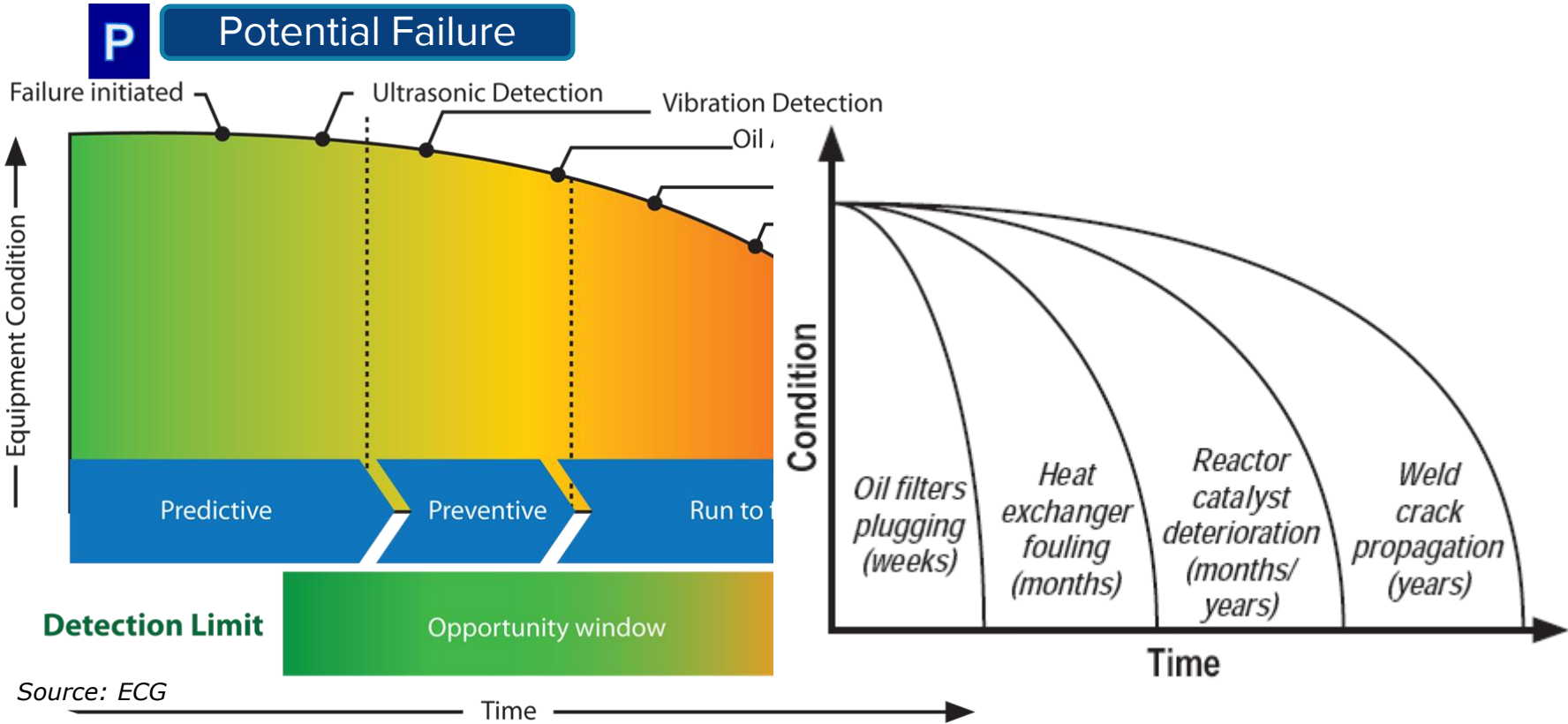
2 h

Description ▲	Value	Units
01 BFP#1 WeekTD Runhours	86	h
02 BFP#1 MTD Runhours	199	h
03 BFP#1 YTD Runhours	2	h

To Do List - Basic

- Create a watch list – early warning system
 - Equipment usage – run hours, tons processed, start/stop cycles...
 - Equipment condition alerts – filter clogged, heat-exchanger fouled, motor vibration high...
- Notify the asset owner – with links to details
- Create a report – across asset and production events

Incipient Failure Detection



Filter clogging, Heat exchanger fouling...

Base Tag: %PT_0295 VARIABLE(0.VALUE)

Filter difference
over 3 months

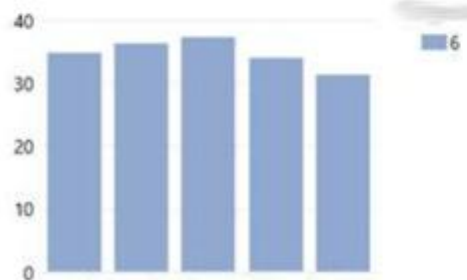
11/22/2010 09:28:28 AM

Cartridge Filter DP

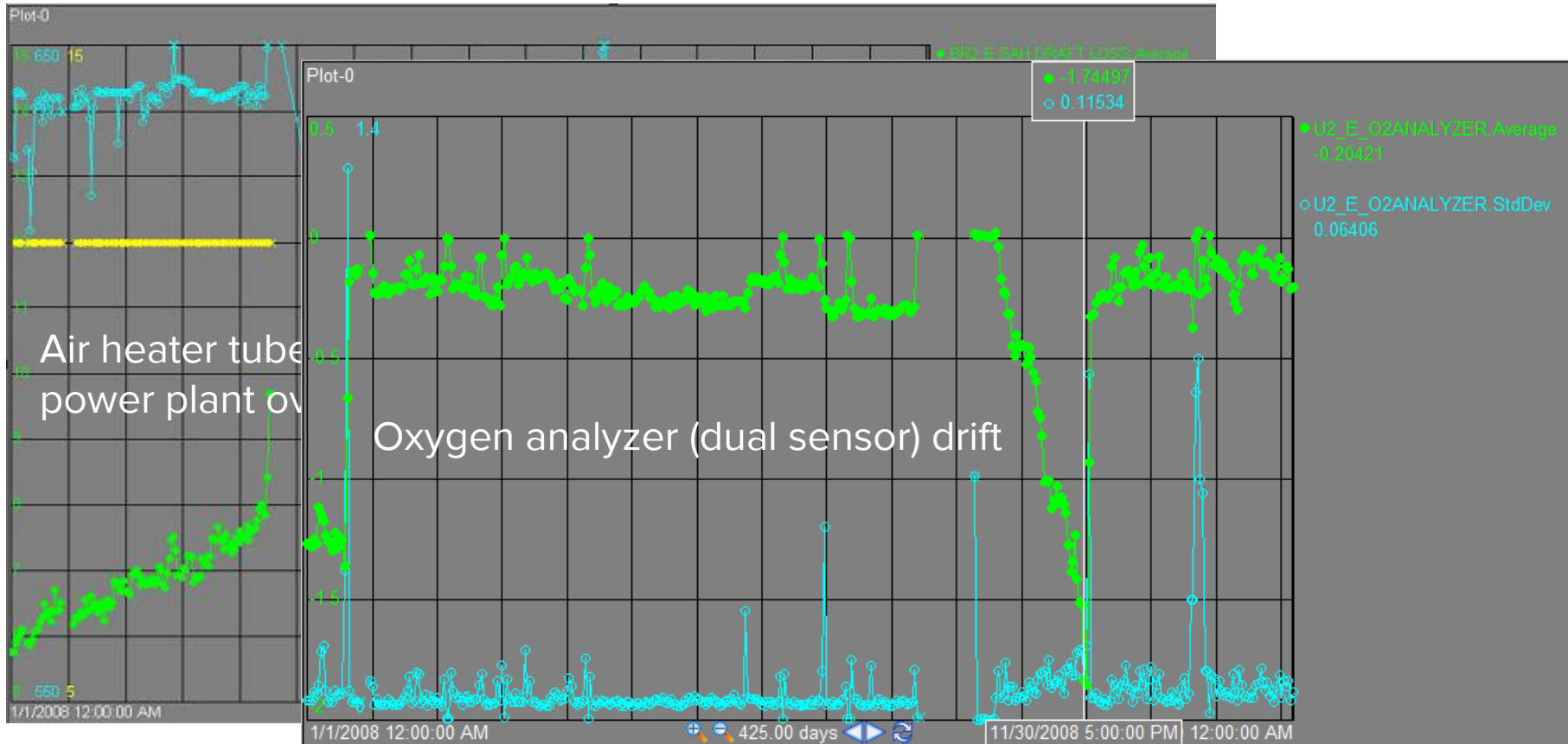
Average of IndirectSteam1000 by StartTime, and



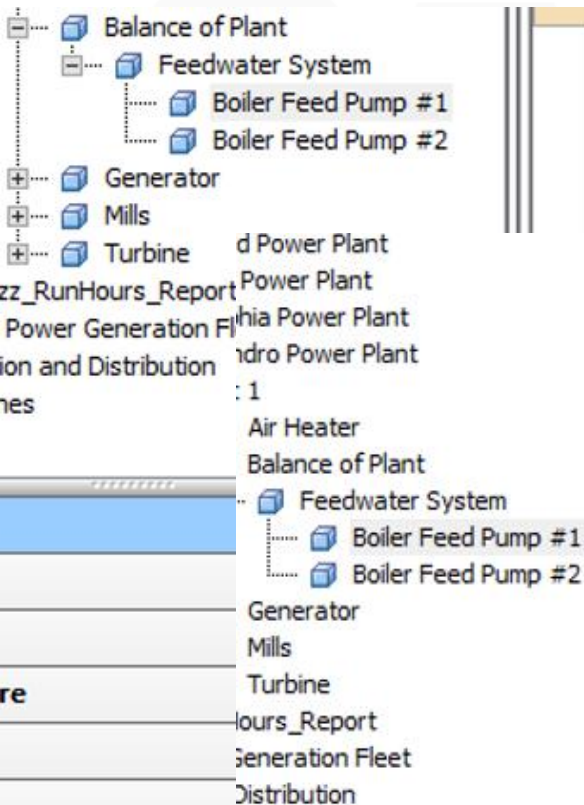
Average of IndirectSteam1000 by



Air heater tubes plugging, Oxygen analyzer drift...



Motor vibration alert calculations



☒	Bearing Vibration High Limit	2 mils
☒	Control Oil Pressure Low Limit	32 psi
☒	Discharge Flow Low Limit	1700 k lb/hr

☒	☒	☒	Boiler Feed Pump High Bearing Temperature	☒
☒	☒	☒	Boiler Feed Pump Low Discharge Flow Anomaly	☒
☒	☒	☒	Boiler Feed Pump Low Pump Speed	☒
☒	☒	☒	Boiler Feed Pump Suction Pressure Anomaly	☒
☒	☒	☒	Boiler Feed Pump Vibration Anomaly	☒

Event Frame Template: Boiler Feed Pump Vibration Anomaly

Name	Expression
OutboardYFault	'Outboard Bearing Vibration Y' > Limit
StartTrigger	if InboardXFault or InboardYFault or OutboardXFa

Evaluated at 3/29/2015 7:10:46 PM

To Do List - Basic

- Create a watch list – early warning system
 - Equipment usage – run hours, tons processed, start/stop cycles...
 - Equipment condition alerts – filter clogged, heat-exchanger fouled, motor vibration high...
- Notify the asset owner – **with links to details**
- Create a report – across asset and production events

Notify asset owner – include links to displays

From: DoNotReply@OSIssoft_PINotif.com [mailto:DoNotReply@OSIssoft_PINotif.com]
Sent: Thursday, September 25, 2014 7:00 AM
To: [REDACTED]
Subject: [REDACTED] Production KPIs] generated a new notification event.

Name: Daily [REDACTED] Production KPIs

Trigger Time: 9/25/2014 6:00:00 AM Central Daylight Time (GMT-05:00:00)

Unit: Batch Operation

In the Last 24 hours:

[REDACTED] Cycles = 259 count

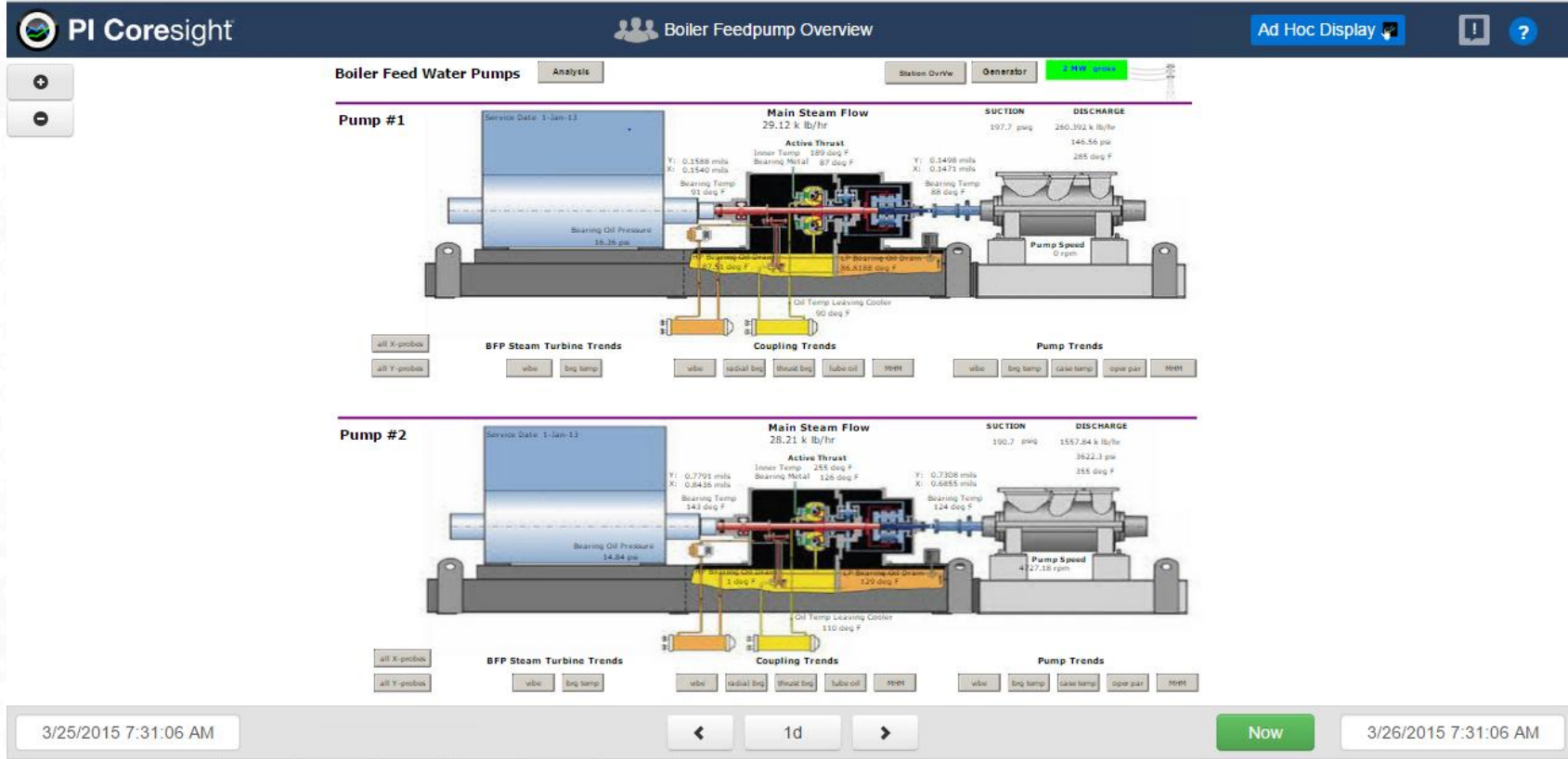
[REDACTED] Downtime = 2.583333 h

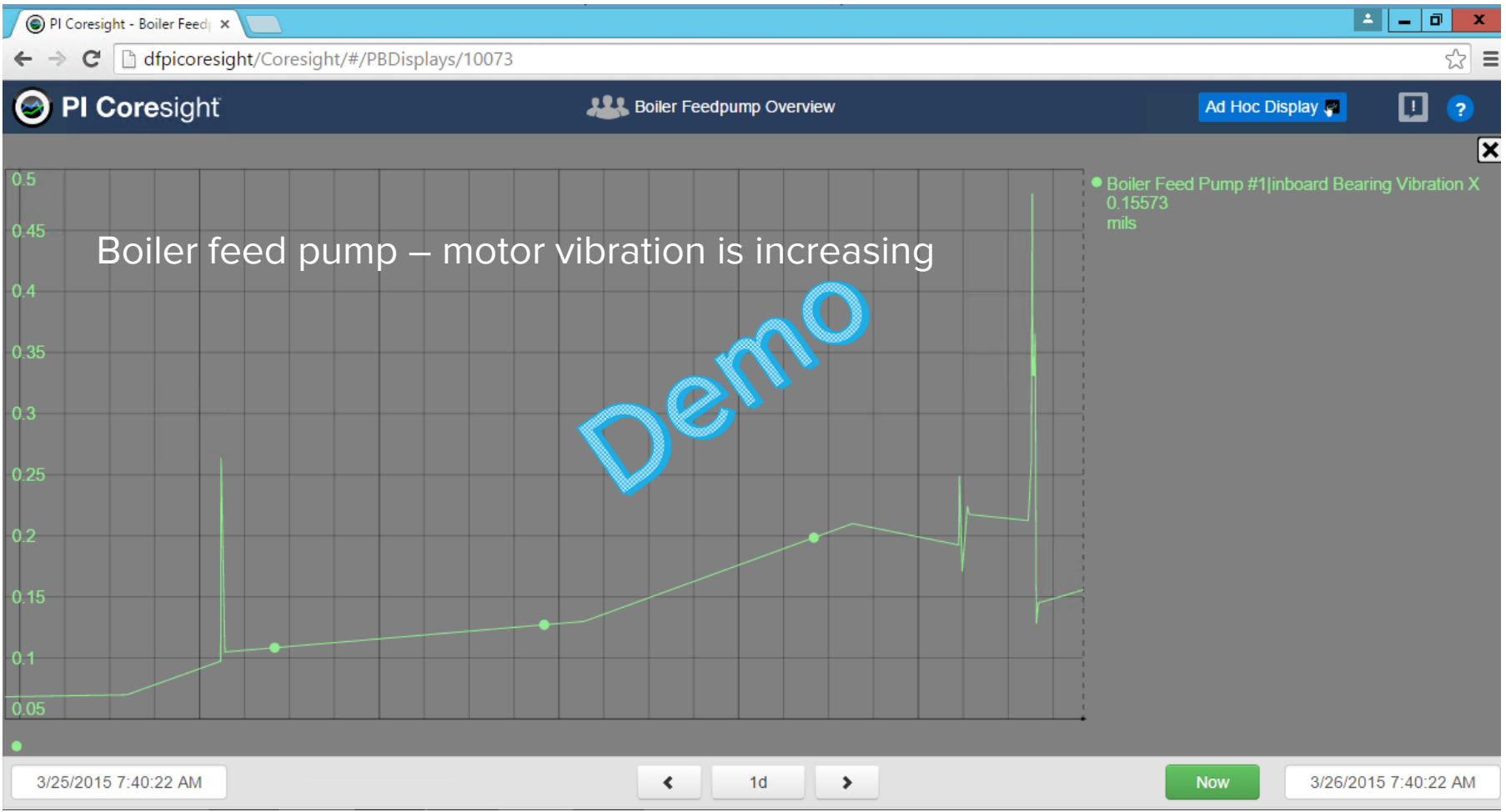
[REDACTED] Feed 1 = 43062.45 US gal

[REDACTED] Feed 2 = 20236.69 US gal

<http://dfpicoresight/Coresight/#/PBDisplays/10073>

Linked PI System display from Notifications





To Do List - Basic

- Create a watch list – early warning system
 - Equipment usage – run hours, tons processed, start/stop cycles...
 - Equipment condition alerts – filter clogged, heat-exchanger fouled, motor vibration high...
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- Create a report – across asset and production events

Report across asset events

Select a DAY

2015_01_13

Search Start 1/10/2015 10-Jan-

Search End * 24-Mar-

GENERAL INFORMATION

DAY NAME	2015_01_13
Site	San Leandro Power Plant
Unit	Unit 1
Start Time	13-Jan-15 00:00:00
End Time	14-Jan-15 00:00:00
Duration	1 0:00:00
Duration (min)	1440.0
Day of Week	TUESDAY
Day Type	WEEKDAY
Element Path	\\DFPIA\FI\Power Generation\Generation\OSI Soft Power\San Leandro Power Plant\Unit 1

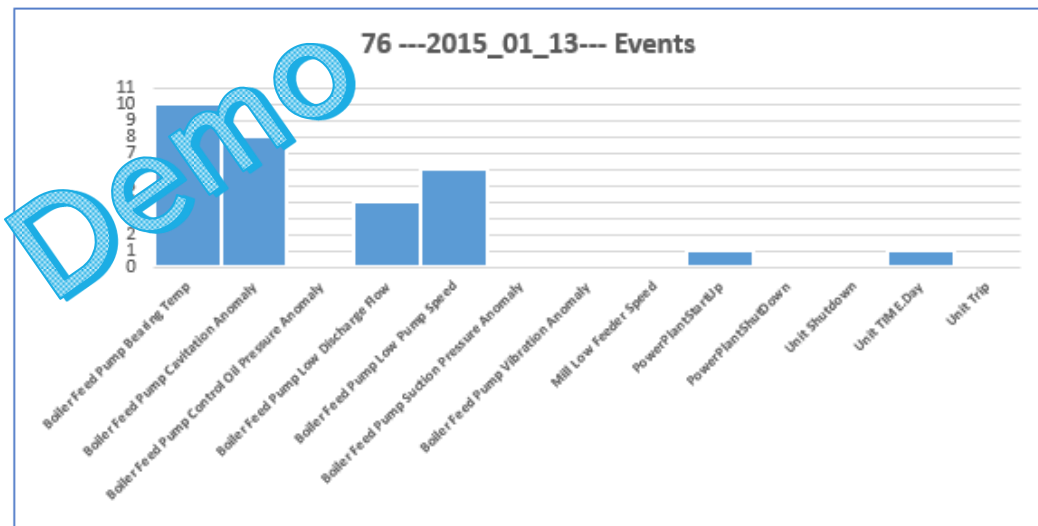
AMBIENT TEMPERATURE

Ambient Temperature.Min	36.23
Ambient Temperature.Avg	38.02
Ambient Temperature.Max	40.44

TURBINE OVERVIEW

HP Overall Efficiency.Avg	0.00
IP Overall Efficiency.Avg	0.00

(76) Events during DAY ---2015_01_13--- on <<Unit 1>>



Boiler Feed Pump Relative | Production Summary Report | Hourly Report

Daily Anomaly Investigation

GLOBAL

EF Name

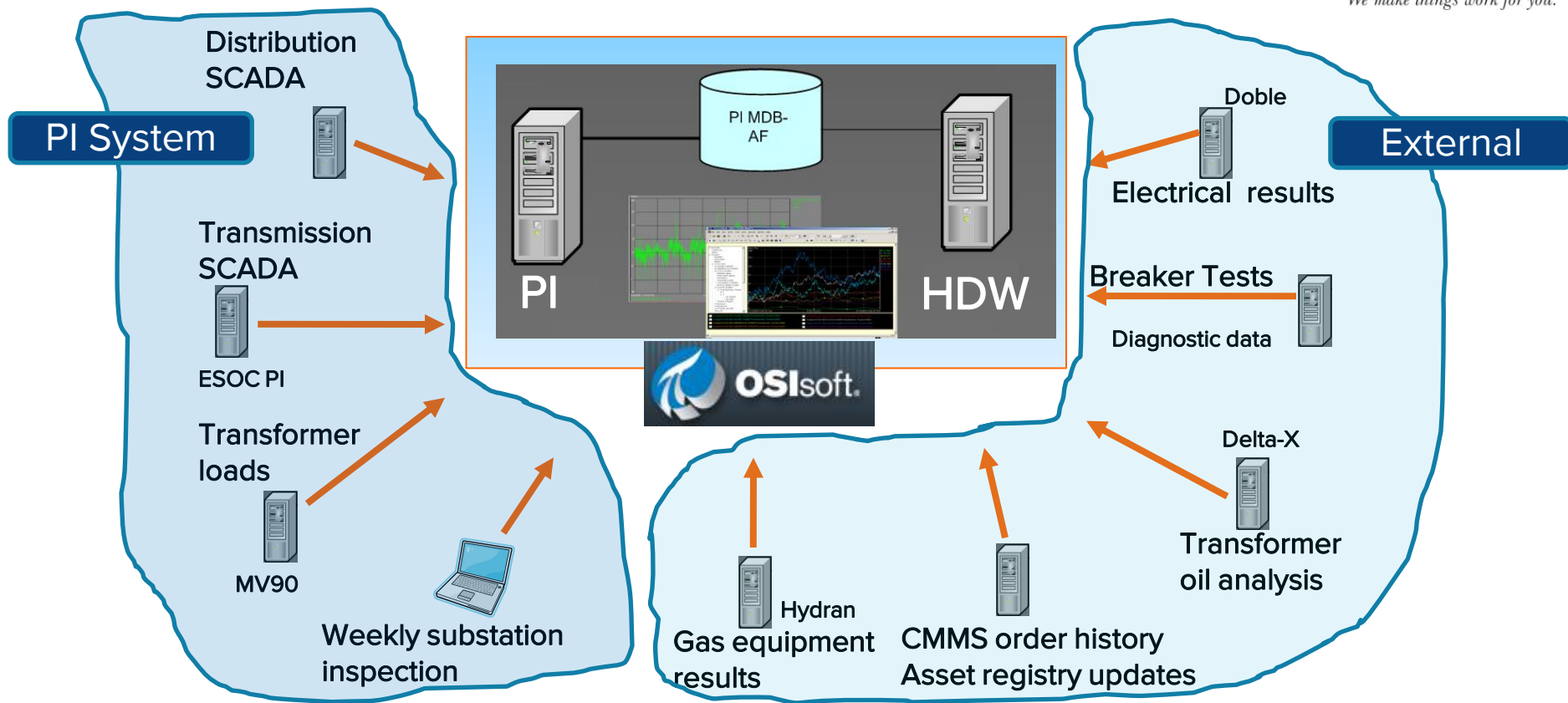
DAY Data



To Do List - Advanced

- Asset health score
- Work management integration – it is not hard – SAP PM, Maximo, Oracle...
- Make it easy for Maintenance to see Operations (PI System) data

CBM data sources (T&D example)



Asset health score



PSEG

We make things work for you.

Address <http://njnwdev29/Asset%20Management2/WebPages/LtcsCA-ActionSummaryNew.aspx>

Home Documents and Lists Create Site Settings Help

PSEG LTC CA-Action New Summary Report

CA Records

Details	Division	Floc	Equipment	Equip Descr	Score	Person
	CE	IPE-CE-PC	000000000010504694	Load Tap Changer (UVT)	6.25	
	CE	IPE-CE-SI	000000000010505424	Load Tap Changer A (LRS700)	4.9	George
	CE	IPE-CE-SI	000000000010526193	Load Tap Changer SEL 220-1	4.4	Mark
	PA	IPE-PA-HC	000000000010507132	Load Tap Changer	3.1	Paul
	CE	IPE-CE-SE	000000000010505426	Load Tap Changer C (LRS700)	3	George
	CE	IPE-CE-GI	000000000010505430	Load Tap Changer C (LRS700)	3	Mark
	SO	IPE-SO-MI	000000000010505427	Load Tap Changer A (LRS700)	3	Mark
	SO	IPE-SO-SNF-4TRX	500-4 Transformer	000000000010523970 Load Tap Changer 500-4A	2.5	
	SO	IPE-SO-MRO-T1	# 1 Transformer	000000000010525854 Load Tap Changer	2.5	Mark Pending Action
	PA	IPE-PA-HOM-T3	# 3 Transformer	000000000010515806 Load Tap Changer	2.4	
	CE	IPE-CE-SDN-3TRX	500-3 Transformer	000000000010505433 Load Tap Changer C (LRS700)	2.4	Paul Pending Action

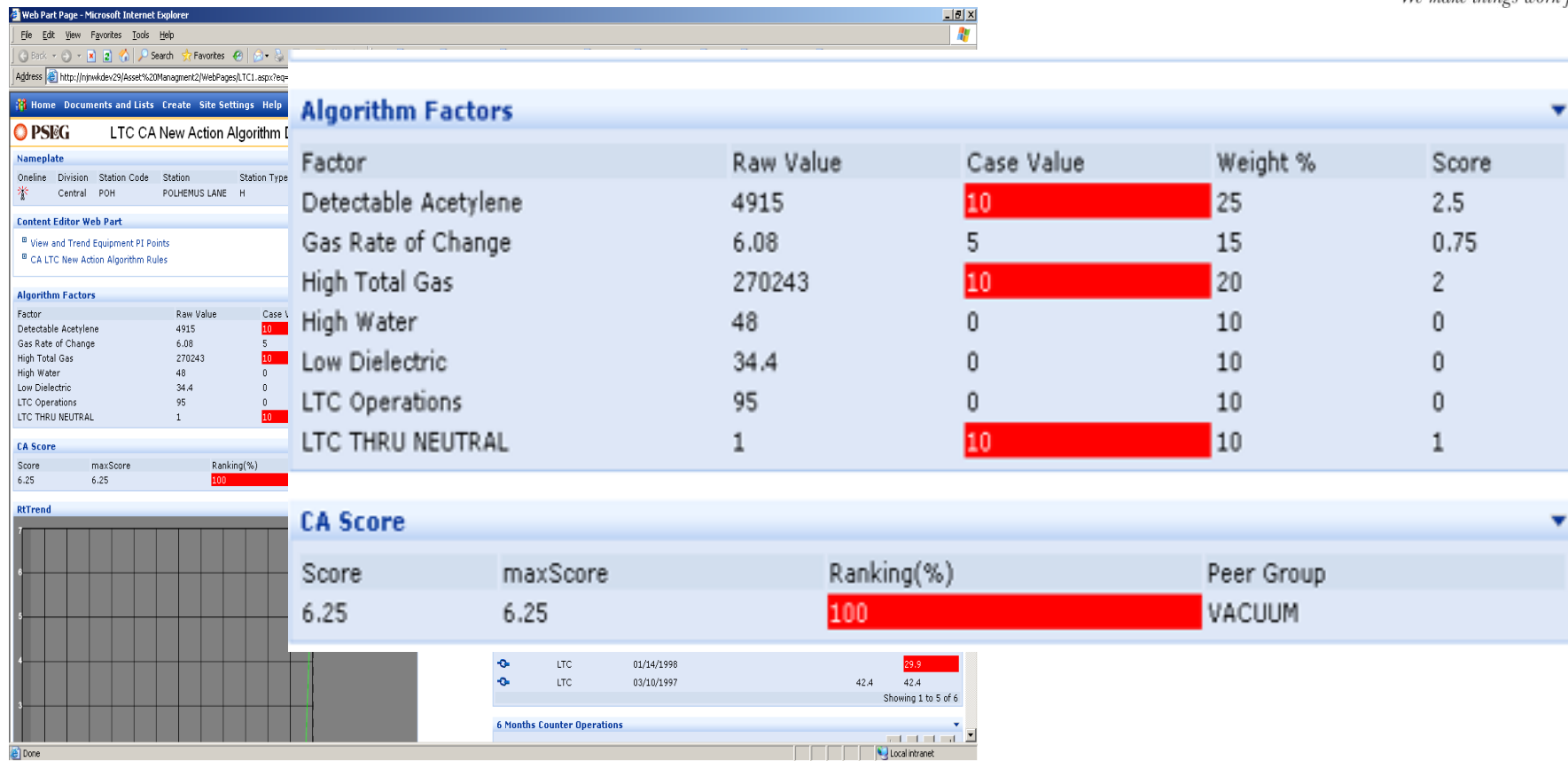
http://videostar.osisoft.com/Regional_Seminars/2009/Boston/Video/RS2009_Boston_CBM_PSEG_Gopal_Rothweiler.wmv

Asset health score - details



PSEG

We make things work for you.



Asset health score - template

\\myAF\myAFDB_vc13 - PI System Explorer (Administrator)

File View Go Tools Help

Database Query Date Back Check In Refresh New Template New Attribute Template

Library

Elements

- BR430_RUNHOURS
- Motor
- TR0404
 - HealthScore_LTCNeutral_1
 - HealthScore_LTCOps_1
- Element Searches

General Child Elements Attributes Ports Analyses

Filter

	Name	Value
Category: <None>		
	Case Value	5
	Raw Value	42
	Threshold	100
	Weight %	20
Category: CBM Score		

Elem
Event
Library
Unit of Measure
Analysis

Asset health score – roll up calculations

TRTemplate

General Attribute Templates Ports Analysis Templates

Name: Analysis1

Description:

Analysis1

BR430_RUNHOURS

Motor

TR0404

HealthScore_LTCNeutral_1

HealthScore_LTCOps_1

Searches

TR0404

General Child Elements Attributes Ports Analyses Ver

Filter

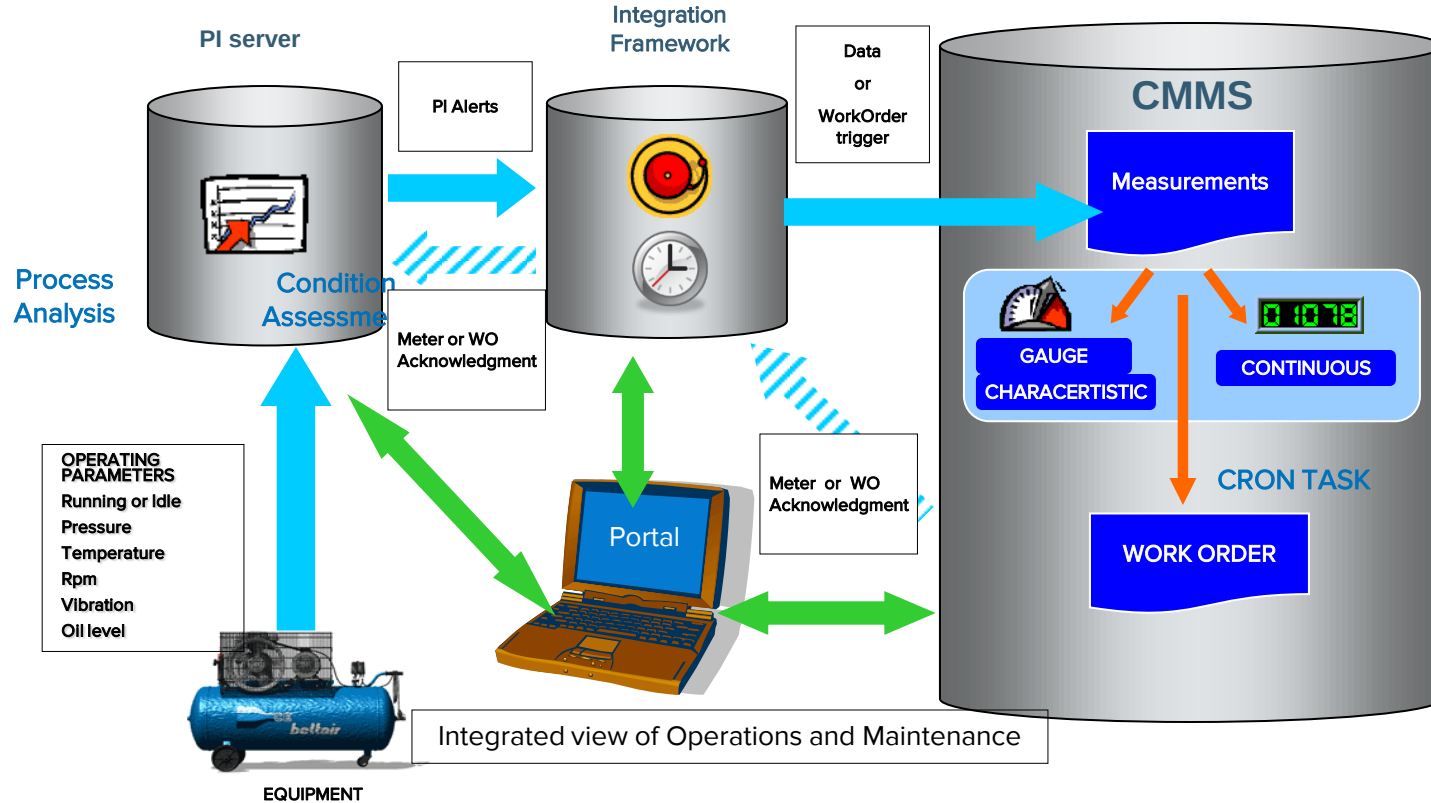
Name	Value
Category: <None>	
Health Score	5.8

Demo

To Do List - Advanced

- Asset health score
- Work management integration – it is not hard – SAP PM, Maximo, Oracle...
- Make it easy for Maintenance to see Operations (PI System) data

PI System to CMMS data flow



ORACLE™

INFOR™



ABB

Mincom
Asset Suite
Passport

Send runhours from PI to SAP counter

0 1078



Measurement Document Edit Goto Extras Environment System Help

Display Measurement Document: General Data

MeasDocuments Previous Measurement Document... Last Measurement Document...

MeasDocument 1006582

Measuring point 10117 Cat. ☒ MeasPoint (general)

MeasPosition Betriebsstunden

Equipment P-1000-M002

Description Electric pump 002

Document data

MeasurementTime 11/19/2013 / 10:36:15

Characteristic BETRIEBSSTUNDEN

CharactUnit h Hour

Counter reading 104504

Difference 16.0 ☒ Difference entered

TotalCtrReading 104504.4

Valuation code

Text John Doe ☒ Long text

Additional information

Read by GGOPAL

ProcessStatus

Template for SAP integration

The screenshot displays the SAP integration software interface. On the left, a 'Library' pane shows a tree structure of templates, with 'SAPCounterTemplate' selected. A blue arrow points from this selection to the main configuration area. The main area is titled '10117_SAPCounter' and contains two tabs: 'General' and 'Child Elements'. The 'General' tab is active, showing a table of attributes for the 'SAPCounter' category. The table has columns for 'Name' and 'Value'.

Name	Value
Category: <None>	
IsEnabled	1
LastMeasurementDoc	00000000000001006582
LastUpload_Error	
LastUpload_Reading	15.98509 / 2013-11-19 10:36:21
Category: SAPCounter	
DIFFERENCE_READING	X
FLOC	
MEASUREMENT_POINT	10117
RECORDED_VALUE	15.98509
SHORT_TEXT	John Doe

To Do List - Advanced

- Asset health score
- Work management integration – it is not hard – SAP PM, Maximo, Oracle...
- Make it easy for Maintenance to see Operations (PI System) data

Linked PI System display from Maximo

Work Order Tracking x PI Coresight - AdHoc

File Edit View Favorites Tools Help

Work Order Tracking Bulletins: (0) Go To Reports

Bedford Work Orders Find: Select Action

List Work Order Plans Assignments Related Records Actuals Safety Plan Log Failure Reporting Specifications

Go to PI

Location: BR300 >> Boiler Room Reciprocating Compressor

Work Order: 1000 Relocate Guard Rails Around Compressor

Asset: 11300 >> Reciprocating Compressor- Air Cooled/100 M

Configuration Item: >>

Parent WO: >>

Classification: >>

Class Description: >>

Launch Entry Name: >>

Site: BEDFORD

Class: WORKORDER

Work Type: CM

GL Account: 6210-300-??? Ir

Failure Class: >>

Problem Code: >>

Storeroom Material Status: >>

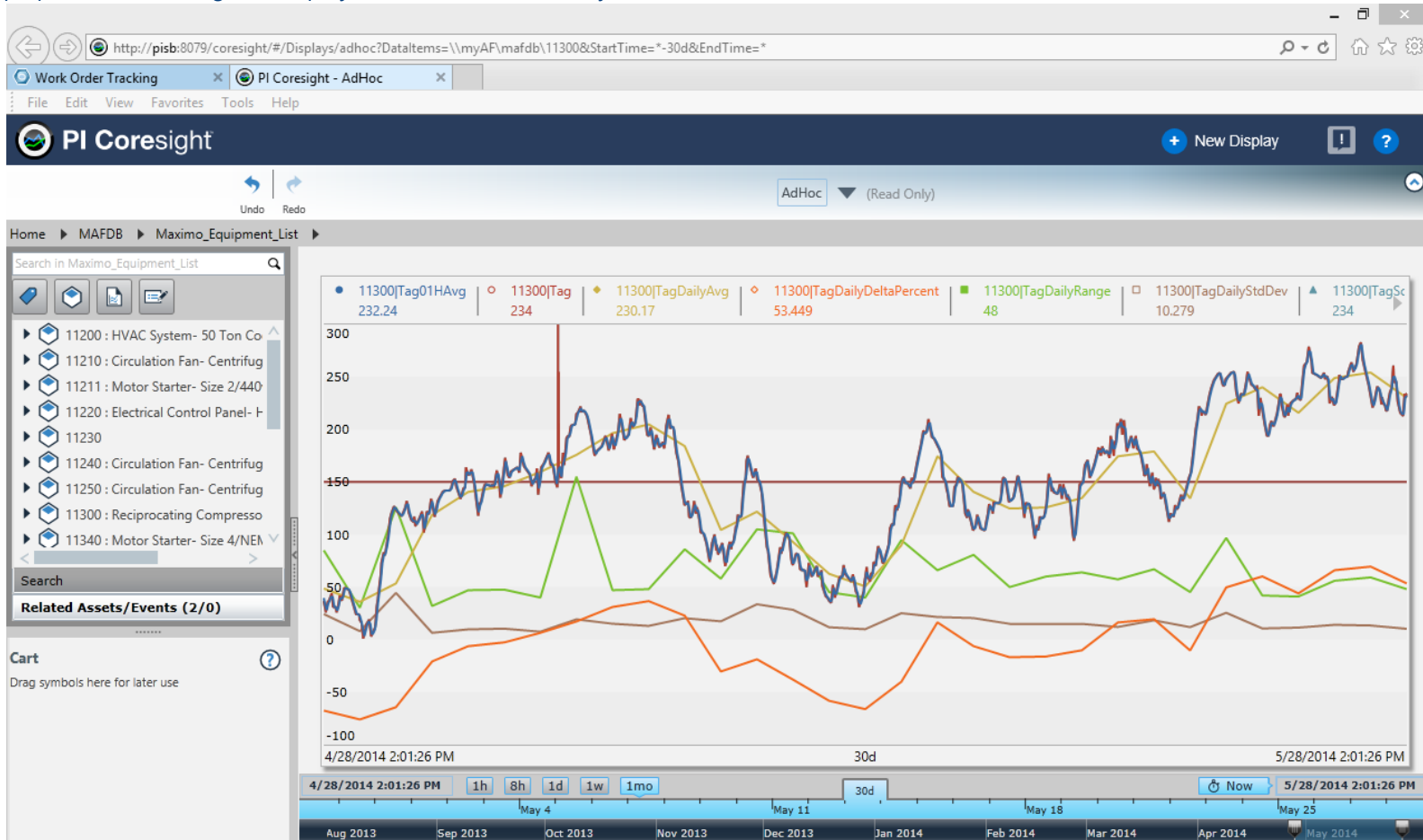
Direct Issue Material Status: >>

Work Package Material Status: >>

Material Status Last Updated: >>

<http://pisb:8079/coresight/#/Displays/adhoc?DataItems=\\myAF\\mafdb\\11300&StartTime=-30d&EndTime=>

http://pisb:8079/coresight/#/Displays/adhoc?DataItems=\\myAF\\mafdb\\11300&StartTime=*-30d&EndTime=*



Shared Asset Names

The screenshot displays the IBM Maximo interface, specifically the 'Assets' section. The main window is titled 'AF - PI System Explorer' and shows a list of assets under the 'Maximo_Eqpt_List' database. The asset '11210 : Circulation Fan- Centrifugal/ 20/000 CFM' is highlighted in the list. The right-hand pane shows the details for this asset, including its name, description, template, and categories. The 'Find' section at the bottom of the details pane lists various links: Parents, Models, Layers, Connections, Analyses, and Notifications.

Assets | Bulletins: (0) | Go To | Reports | Start Center | Profile | Sign Out | Help | IBM.

Find: []

List | Asset | Spare Parts | Safety

Advanced Search | Save Query

Assets | Filter | []

Asset	Description
11200	HVAC System- 50 Ton Cool Cap/ 450 Heat Cap
11210	Circulation Fan- Centrifugal/ 20/000 CFM
11211	Motor Starter- Size 2/440v/3ph/60cy
11220	Electrical Control Panel- HVAC System
11230	Emergency Generator
11240	Circulation Fan- Centrifugal/ 20/000 CFM
11250	Circulation Fan- Centrifugal/ 20/000 CFM
11300	Reciprocating Compressor- Air Cooled/ 12/440v/3ph/60hz
11340	Motor Starter- Size 4/NEMA 12/440v/3ph/60hz
11400	Boiler- 50,000 Lb/Hr/ Gas Fired/ Water Tube
11430	Centrifugal Pump 100GPM/60FT HD
11450	Centrifugal Pump 100GPM/60FT HD

AF - PI System Explorer

File | Edit | View | Go | Tools | Help

Database | Query Date | Back | Check In | New Element | Search

Elements

Maximo_Eqpt_List

- 11200 : HVAC System- 50 Ton Cool Cap/ 450 Heat Cap
- 11210 : Circulation Fan- Centrifugal/ 20/000 CFM**
- 11211 : Motor Starter- Size 2/440v/3ph/60cy
- 11220 : Electrical Control Panel- HVAC System
- 11230 : Emergency Generator
- 11240 : Circulation Fan- Centrifugal/ 20/000 CFM
- 11250 : Circulation Fan- Centrifugal/ 20/000 CFM
- 11300 : Reciprocating Compressor- Air Cooled/ 12/440v/3ph/60hz
- 11340 : Motor Starter- Size 4/NEMA 12/440v/3ph/60hz
- 11400 : Boiler- 50,000 Lb/Hr/ Gas Fired/ Water Tube
- 11430 : Centrifugal Pump 100GPM/60FT HD
- 11450 : Centrifugal Pump 100GPM/60FT HD
- 11470 : Centrifugal Pump 100 GPM, 60 FT-H

11210 : Circulation Fan- Centrifugal/ 20/000 CFM

General | Child Elements | Attributes | Ports | Version

Name: 11210 : Circulation Fan- Centrifugal/ 20/000 CFM

Description:

Template: Maximo_Asset | Type: None

Categories:

Default Attribute: assetnum

[Extended Properties](#)

Find: [Parents](#) | [Models](#) | [Layers](#) | [Connections](#) | [Analyses](#) | [Notifications](#)

Maximo asset hierarchy in Asset Framework

The screenshot displays the Maximo Asset Framework interface. The left pane shows a tree view of the Maximo equipment list and locations. The right pane shows a table of asset details for a selected asset.

Maximo equipment list

- Maximo_Equipment_List
 - 11200 : HVAC System- 50 Ton Cool Cap/ 450000 Btu Heat Cap
 - 11210 : Circulation Fan- Centrifugal/ 20/000 CFM
 - 11211 : Motor Starter- Size 2/440v/3ph/60cy
 - 11220 : Electrical Control Panel- HVAC System
 - 11230
 - 11240 : Circulation Fan- Centrifugal/ 20/000 CFM
 - 11250 : Circulation Fan- Centrifugal/ 20/000 CFM
 - 11300 : Reciprocating Compressor- Air Cooled/100 CFM
 - 11340 : Motor Starter- Size 4/NEMA 12/440v/3ph/60hz
 - 11400 : Boiler- 50,000 Lb/Hr/ Gas Fired/ Water Tube
 - 11430
 - 23972
 - 11450 : Centrifugal Pump 100GPM/60FT HD1
 - 11470 : Centrifugal Pump 100 GPM, 60 FT-HD
 - 11480 : Centrifugal Pump 100 GPM, 60 FT-HD1
 - 23972
- MaximoLocations
 - 7900WESTPARK
 - BASIN-w1
 - BOSTON
 - BR200
 - CSPOLE30
 - FACTORY
 - FLMGMT
 - MAINLINE
 - NEEDHAM
 - BOILER
 - BR200
 - BR230
 - BR300
 - BR400
 - BR430

Maximo locations

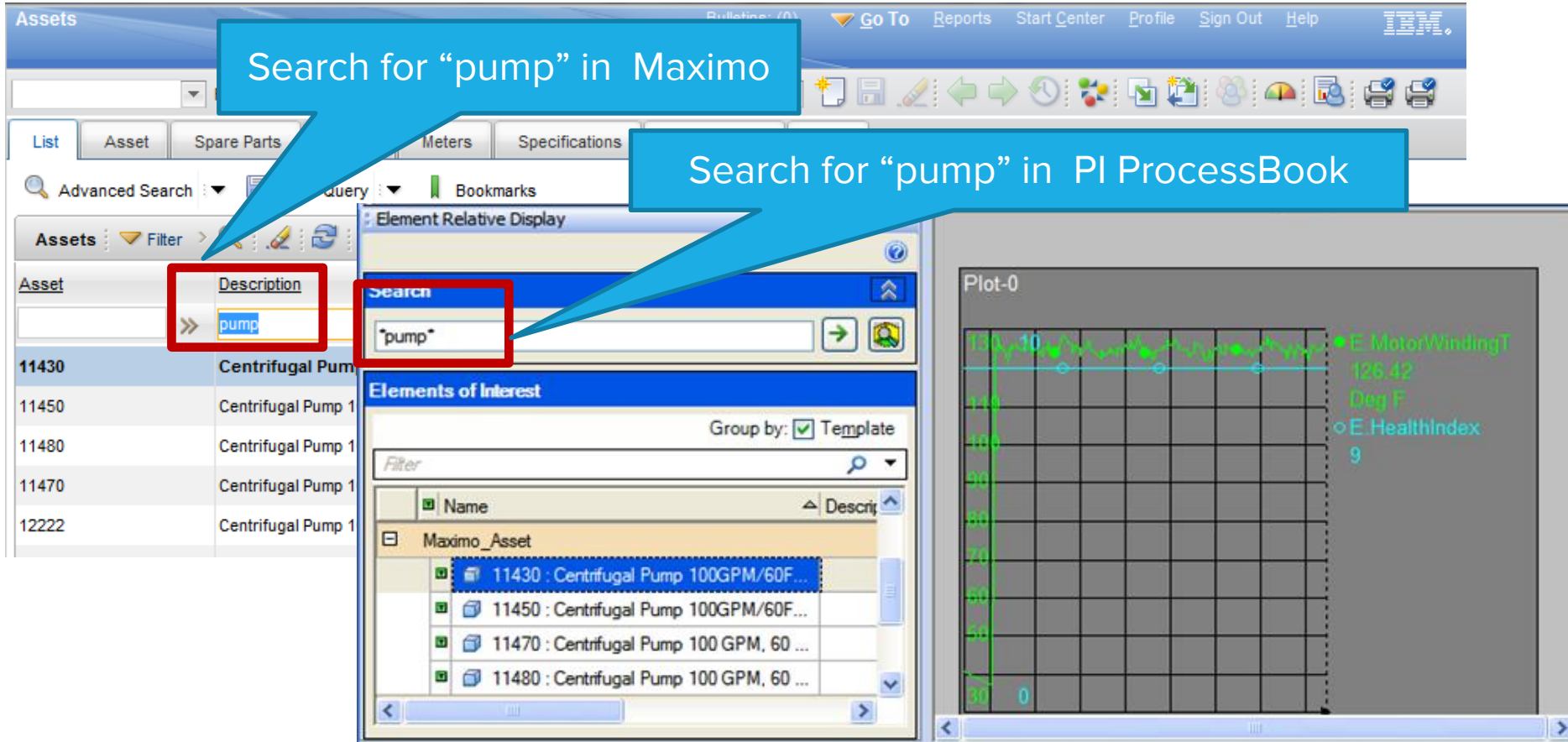
Filter

Name	Value
Category: Calculated	
HealthIndex	9
Category: Events	
Downtime	Need to refer to the last Downtime event for t...
Category: MaximoAsset	
assetnum	11430
changeby	WILSON
changedate	2/9/2005 8:01:37 AM
description	Centrifugal Pump 100GPM/60FT HD
failurecode	PUMPS
manufacturer	IR
serialnum	377-9A
siteid	BEDFORD
Vibration	0.07

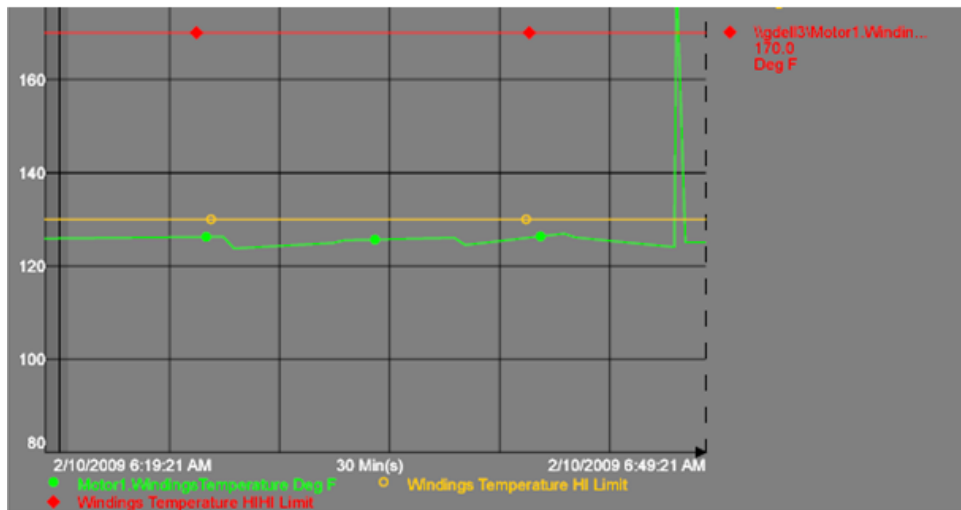
Shared Asset Names

Search for “pump” in Maximo

Search for “pump” in PI ProcessBook



Shared Asset Names



Maximo Work Orders

Equipment	WoNum	PM	Description	Status	StatusDate	Location	ReportedBy	Re
11430	1668		HiTempAlert	COMP	12/8/2008 10:22:18 AM	BR430	WILSON	12/10/2008 10:21:53 AM
11430	1666		HiTempAlert	COMP	11/21/2008 10:21:53 AM	BR430	WILSON	11/21/2008 10:21:53 AM
11430	T1573		Check pump operation.	WSCH	5/2/2008 1:33:34 PM	BR430	MAXADMIN	5/2/2008 1:33:22 PM
11430	T1574		Check pump float switch.	WSCH	5/2/2008 1:33:34 PM	BR430	MAXADMIN	5/2/2008 1:33:23 PM
11430	T1575		Check seal and housing for leaks.	WSCH	5/2/2008 1:33:33 PM	BR430	MAXADMIN	5/2/2008 1:33:23 PM

The screenshot shows the PI Coresight homepage with a search bar and a list of equipment. The search bar contains the text "Search in Maximo_Eqpt_List". The list of equipment includes:

- 11220 : Electrical Control Panel- HVAC System
- 11230 : Emergency Generator
- 11240 : Circulation Fan- Centrifugal/ 20/000 CFM
- 11250 : Circulation Fan- Centrifugal/ 20/000 CFM
- 11300 : Reciprocating Compressor- Air Cooled/1
- 11340 : Motor Starter- Size 4/NEMA 12/440v/3p
- 11400 : Boiler- 50,000 Lb/Hr/ Gas Fired/ Water T
- 11430 : Centrifugal Pump 100GPM/60FT HD
- 11450 : Centrifugal Pump 100GPM/60FT HD1

Maximo Work Orders for
“pump” 11430 in PI Web Parts

Maximo assets via PI Builder

Book1.xlsx - Microsoft Excel

AF - PI System Explorer

Elements

11210 : Circulation Fan- Centrifugal/ 20/000 CFM

General Child Elements Attributes Ports Version

Name: 11210 : Circulation Fan- Centrifugal/ 20/000 CFM

Description:

Template: Maximo_Asset Type: None

Categories:

Default Attribute: assetnum

Extended Properties

Find: Parents Models Layers Connections Analyses Notifications

11210 : Circulation Fan- Centrifugal/ 20/000 CFM Modified: 1/7/2010 5:56:54 PM. Version: 1/1/1970 12:00:00 AM, Revision 4

assetnum	description
11200	HVAC System- 50 Ton Cool Cap/ 450000 Btu Heat Cap
11210	Circulation Fan- Centrifugal/ 20/000 CFM
11211	Motor Starter- Size 2/440v/3ph/60cy
11220	Electrical Control Panel- HVAC System
11230	Emergency Generator
11240	Circulation Fan- Centrifugal/ 20/000 CFM
11250	Circulation Fan- Centrifugal/ 20/000 CFM
11300	Reciprocating Compressor- Air Cooled/100 CFM
11340	Motor Starter- Size 4/NEMA 12/440v/3ph/60hz
11400	Boiler- 50,000 Lb/Hr/ Gas Fired/ Water Tube
11430	Centrifugal Pump 100GPM/60FT HD
11450	Centrifugal Pump 100GPM/60FTHD
11460	Burner, Gas Fired- For Boiler
11470	Centrifugal Pump 100 GPM, 60 FT-HD
11480	Centrifugal Pump 100 GPM, 60 FT-HD

To Do List - Basic

- Create a watch list – early warning system
 - Equipment usage – run hours, tons processed, start/stop cycles...
- Equipment conc heat-exchanger
- Notify the asset owner
- Create a report – events
 - – filter clogged, motor vibration high...
 - links to details
 - at and production



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Solution Architect

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Solution Architect

OSIsoft, LLC

Questions

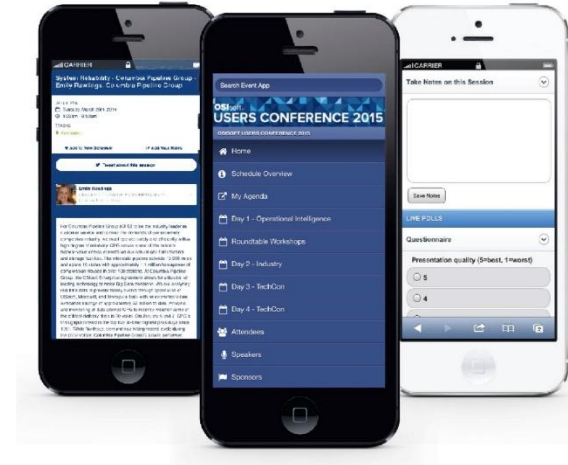
Please wait for the **microphone** before asking your questions



State your
name & company

Please don't forget to...

Complete the Online Survey
for this session



<http://eventmobi.com/emeauc15>



감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado