OSIsoft®

USERS CONFERENCE 2011

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

Proactive Maintenance at GenOn Energy

GenOn Proactive Maintenance Data Gateway (PMDG)
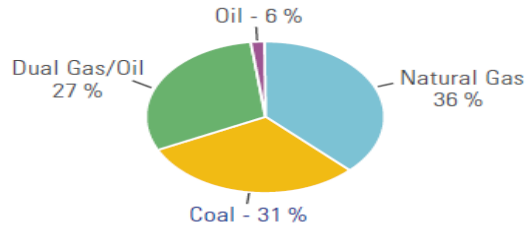and Accenture Plant Performance Solutions (APPS)

Presented by   **Raul Gonzalez, GenOn**
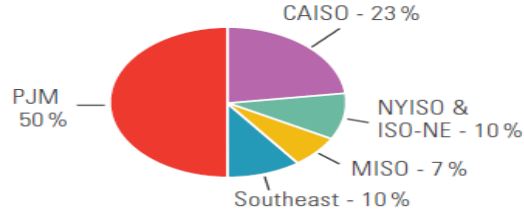
Thomas Marshall, GenOn

Mickey Peters, Accenture

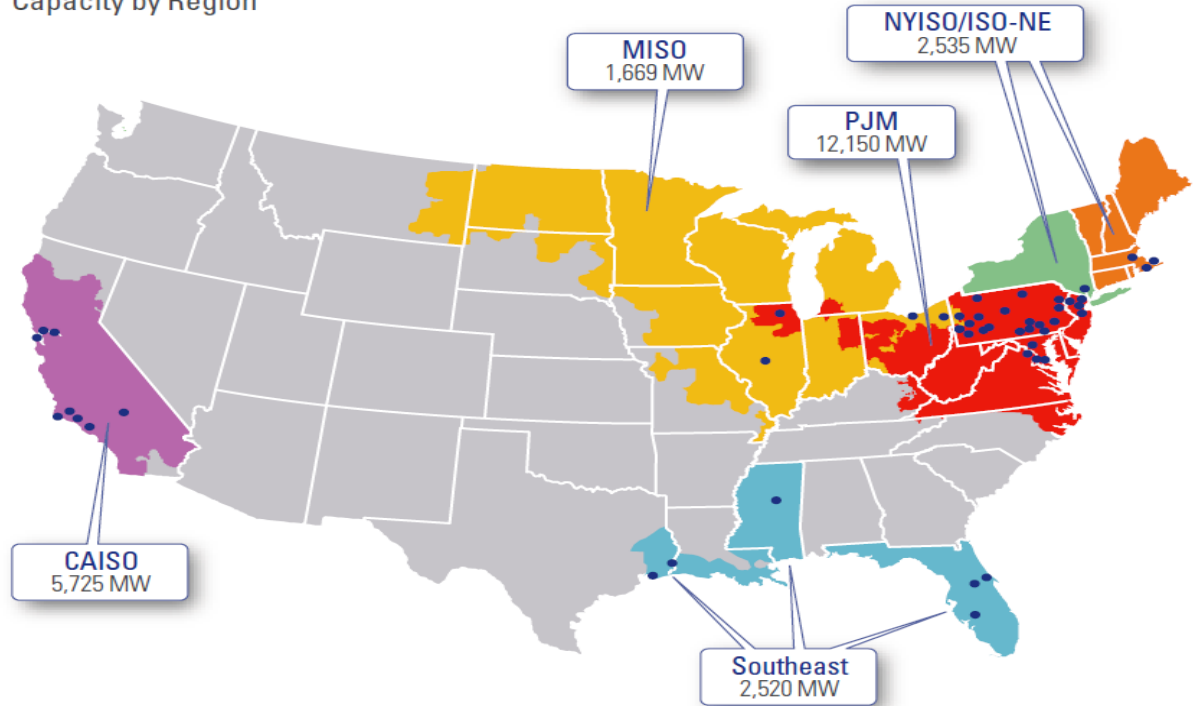## Electric Generating Capacity
24,599 megawatts (owned and contracted)

Capacity by Fuel Type

- Oil - 6 %
- Dual Gas/Oil 27 %
- Natural Gas 36 %
- Coal - 31 %

Capacity by Region

- CAISO - 23 %
- PJM 50 %
- NYISO & ISO-NE - 10 %
- MISO - 7 %
- Southeast - 10 %

Capacity by Region

- MISO 1,669 MW
- NYISO/ISO-NE 2,535 MW
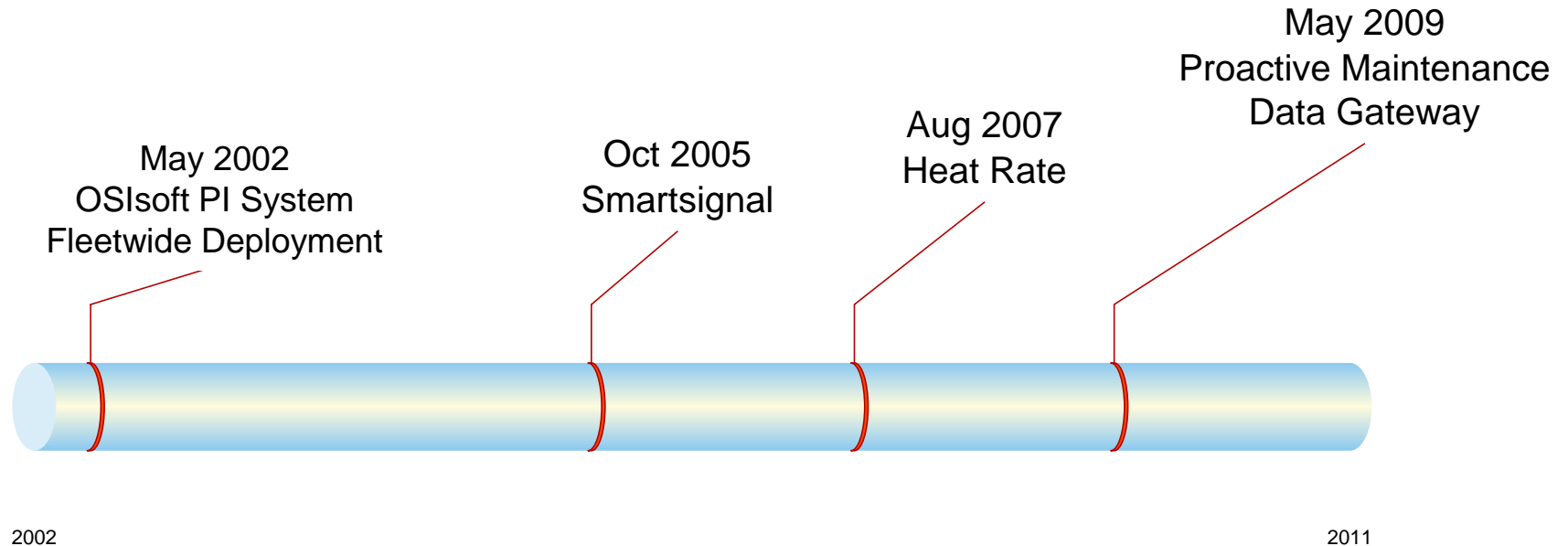- PJM 12,150 MW
- CAISO 5,725 MW
- Southeast 2,520 MW

GenOn Energy, Inc (NYSE:GEN)
- One of the largest competitive generators of wholesale electricity in the United States
- Portfolio includes baseload, intermediate, and peaking units

Business Drivers for PI System/ Generation Analytics Platform

- Provide "Fleet wide" Plant Monitoring Capabilities
- Leverage Staff Expertise, by Providing Remote Monitoring & Diagnostics for Subject Matter Experts (SMEs)
- Support the Proactive Maintenance Initiative
- Provide Station with Data and Analytical Tools to Support Operations
- Provide Standard Database for Fleet Metrics:
  - Generation Data
  - Fuel Usage - Gas Meter and Fuel Burn Data
  - Emissions Data
  - Unit Status and Control System States
- Align with Power Generation's Goal to be the Low Cost Power Producer

PI System / Generation Analytics Milestones

May 2009
Proactive Maintenance
Data Gateway

Aug 2007
Heat Rate

Oct 2005
Smartsignal

May 2002
OSIsoft PI System
Fleetwide Deployment

2002

2011

GenOn PI System Intrastructure Summary

- Half Million PI Tags/Points
- 40 + Control Systems
- Over 200 interfaces into 40 PI Servers
- 100 + recorders
- 32 vibration systems
- 40 + PLC's
- Other various I/O telemetry and meters...

PI System User Environment Overview

- 1,000 + Trained Users Fleetwide
  - Training Levels -> [Power User, General, ActiveView]
- PI ActiveView 2500+ Screens, PI DataLink, PI ProcessBook,
  - PI Manual Logger
- GenOn PI System / SmartSignal Users Group Annual Meeting
  - (Sharing of Best Practices)
- Performance Calculation Platforms

PI System / SmartSignal User Group Objectives

GenOn Plant Champions and Power Users meet
on an annual basis

- Spread the Operational Knowledge of PI System, SmartSignal, Performance Systems, etc…
- Leverage Expertise and Work Done by Others
- Implement and Share Best Practice
- Minimize Redundant Efforts
- Focus on Priorities Established by Peer Groups & Operations Management
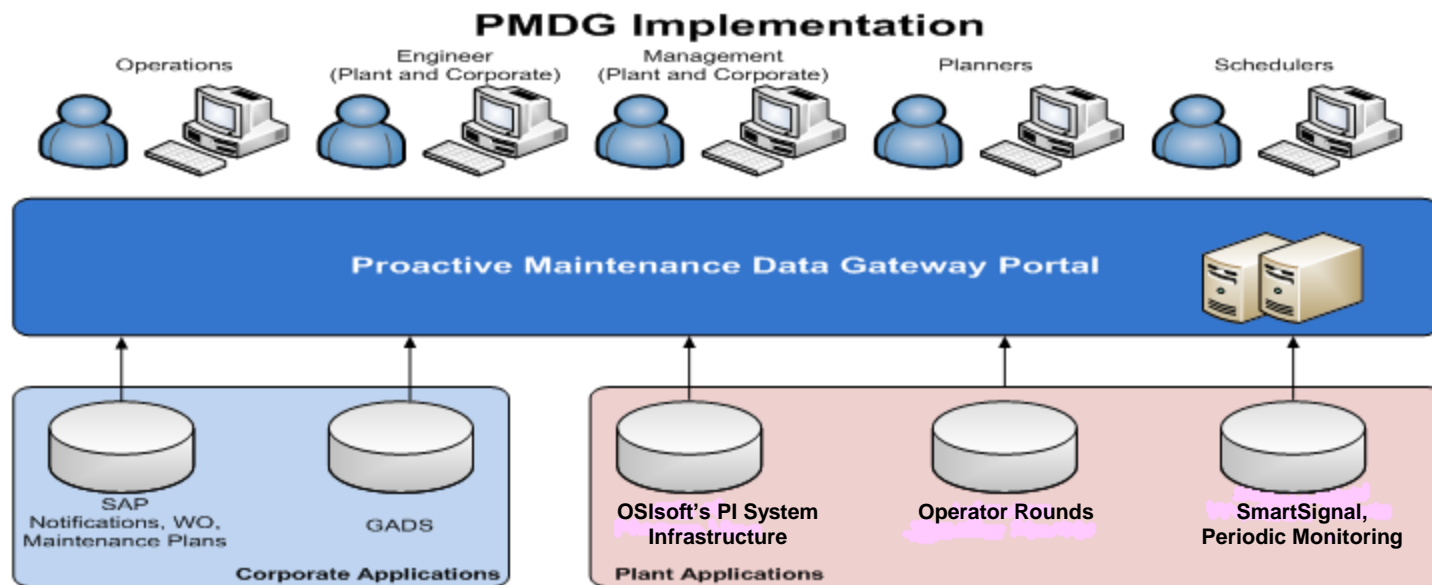
Key Related Systems / Data / Information:

- SAP - Work Management
  - Past, Planned, Notifications, & $$$
- Files / Documents
  - Oil analysis results
  - Thermography images
  - Engineering studies, Tests (motor…)
- NERC GAD Outages / De-rates events
- Financial impact / Lost Margin Opportunities…

PMDG Project:

- Fast track. What? Do it by EOY!
- 2009 Deployment at Seward Station (500MW Coal CFB)
  - Test & validate the technology and the business value
- Partnered with Accenture Consulting
  - Experience w/ AFPS technology deployment
  - Business Process Improvement
- Vendor Involvement
  - SmartSignal
 - OSIsoft
  - Microsoft (MOSS)

PMDG Vision

- Built on Microsoft SharePoint platform
- Integrates asset information into portal
- Single sign on and hierarchy
- Search and drill-down capabilities

- Role – based dashboards and reports
- Enables collaboration between employees
- Facilitates knowledge transfer
- Flexible and scalable for future integrations

PMDG Implementation

Operations | Engineer (Plant and Corporate) | Management (Plant and Corporate) | Planners | Schedulers

Proactive Maintenance Data Gateway Portal

SAP Notifications, WO, Maintenance Plans | GADS

Corporate Applications

OSIsoft's PI System Infrastructure | Operator Rounds | SmartSignal, Periodic Monitoring

Plant Applications

Industry studies of Proactive Maintenance strategies consistently show two characteristics:

- The average industrial plant performs **more than 55% Reactive** maintenance work.

- The top industrial plants perform **less than 10% Reactive** maintenance work. Top plant performers are typically identified as those whose financial, operational, and safety metrics out perform others in their peer groups.
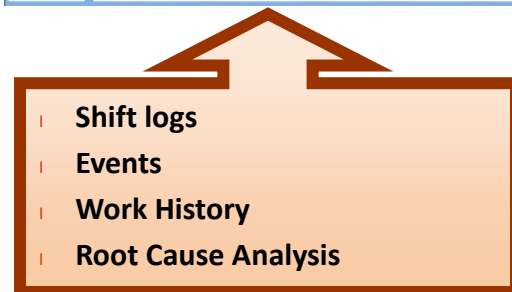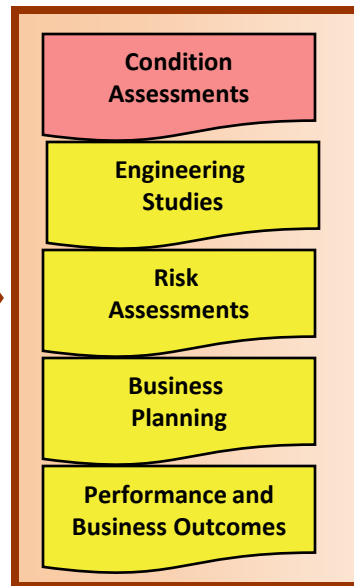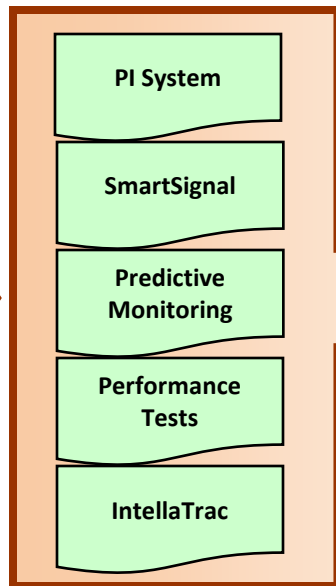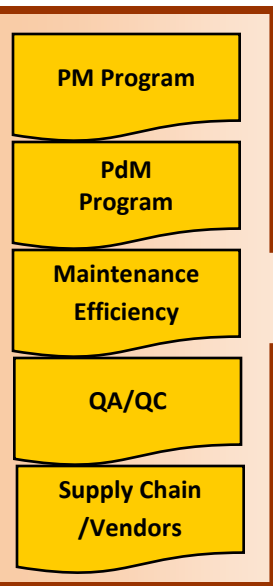
Source: DOE Best Practices on Ops Excellence PNNL-13890
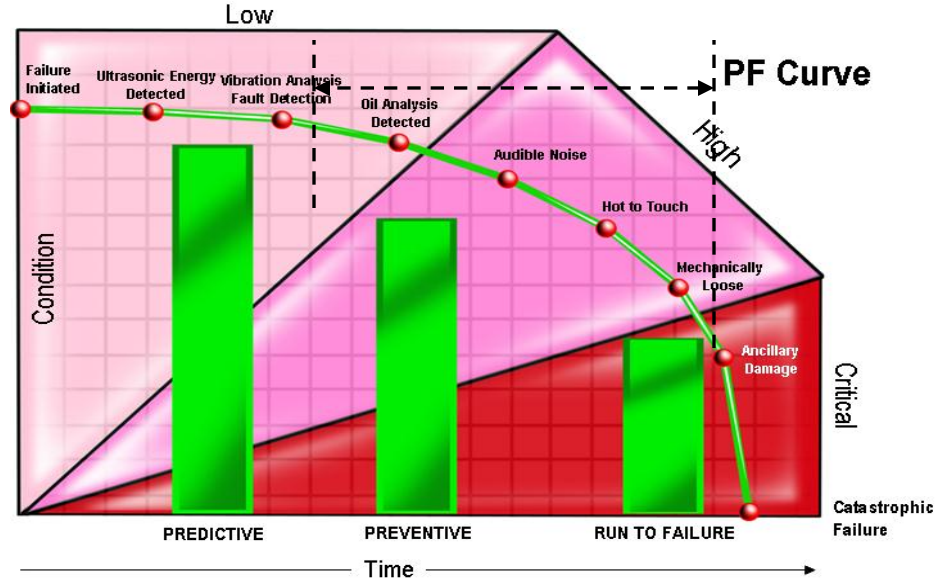
Source: Allied Reliability

Integration and Visualization

GenOn

Maintenance Programs	Real-time / Periodic Monitoring	Diagnostics, Reporting, & Risk Mitigation	
PM Program	PI System	Condition Assessments	
PdM Program	SmartSignal	Engineering Studies	
Maintenance Efficiency	Predictive Monitoring	Risk Assessments	Shift logs
QA/QC	Performance Tests	Business Planning	Events
Supply Chain /Vendors	IntellaTrac	Performance and Business Outcomes	Work History
			Root Cause Analysis

Right Maintenance Basis - Monitoring - Integrated Assessment - Risk Mitigation/Business Planning/Learning

PROACTIVE MAINTENANCE DATA GATEWAY

Ability to display at critical system and equipment levels:

Key Functional Requirements

- ✓ PI System trends
- ✓ Active View displays
- ✓ Smart Signal alerts
- ✓ Route vibration data
- ✓ Lubrication test results
- ✓ IntellaTrac data

- ✓ Lost Margin data
- ✓ Work orders
- ✓ Notifications
- ✓ Preventive Maintenance plans
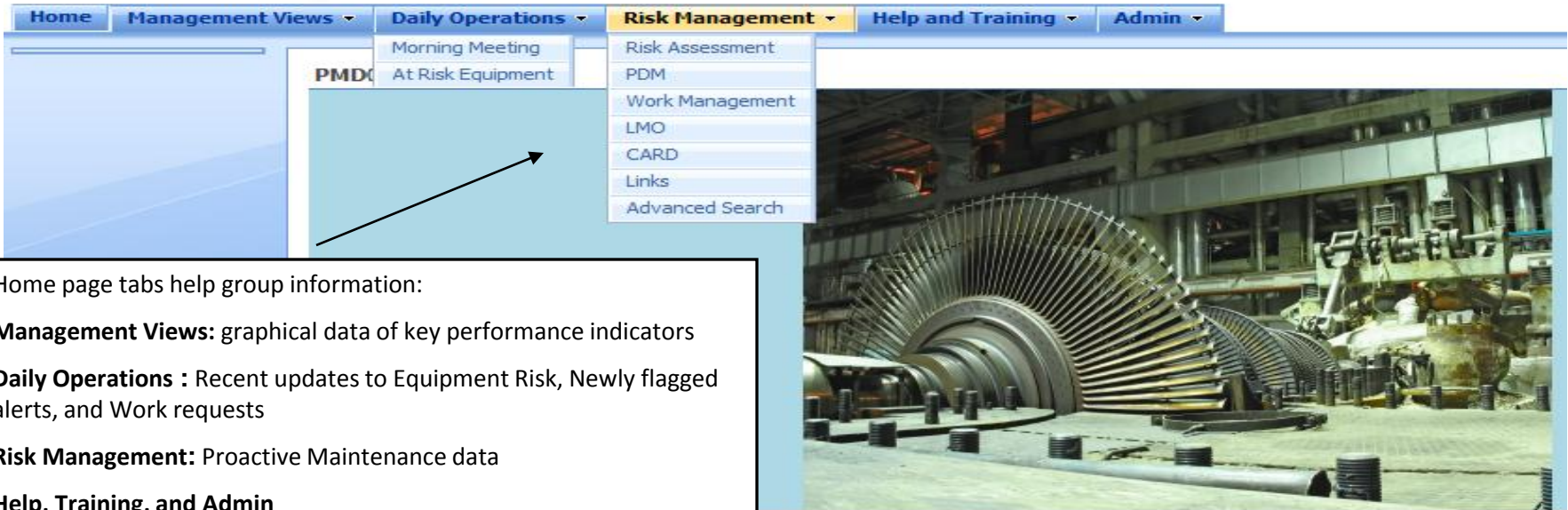- ✓ Planned vs. actual costs

Work Practice Improvement

- ✓ Linking equipment condition assessment results to budget forecast
- ✓ Linking financial performance drivers to equipment condition indicators
- ✓ Creating transparency to equipment / system condition and action items
- ✓ Presenting equipment condition data for personnel who are not versed in all of the technologies
- ✓ Creating transparency to Predictive Maintenance related notifications and tasks
- ✓ Providing a dynamic equipment condition assessment summary

Impact on Station Leadership Roles

- ✓ Creates relation of business outcomes to equipment reliability
- ✓ Aids in collaboration between operations and maintenance
- ✓ Summarizes critical equipment condition without needing to have expertise in all proactive maintenance databases
- ✓ Provides equipment condition information for morning meetings, reliability meetings, shop floor discussions
- ✓ Provide a clearer path for maintenance best practices and Maintenance Performance Index goal attainment

PMDG Home Page

Organized like a collaboration site – data grouped for reliability engineers, station leadership, corporate leaders

GenOn
Home
Management Views
Daily Operations
Risk Management
Help and Training
Admin
Morning Meeting
At Risk Equipment
Risk Assessment
PDM
Work Management
LMO
CARD
Links
Advanced Search
PMD

Home page tabs help group information:

Management Views: graphical data of key performance indicators

Daily Operations : Recent updates to Equipment Risk, Newly flagged alerts, and Work requests

Risk Management: Proactive Maintenance data

Help, Training, and Admin

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PMDG Risk Management

Portal information tables for the risk assessment page

Navigation and date range selections drive what is seen in the portal tables

PMDG Risk Management

Risk Management | **Risk Assessment** | PDM | Work Management | LMO | CARD | Links | Advanced Search | Back

Search

SEWARD | Go

- ▲ SEWARD
  - ▶ SWD-00
  - ▶ SWD-10
  - ▶ SWD-11
  - ▲ SWD-12
    - ▶ SWD-12-AH
    - ▶ SWD-12-BF
    - ▶ SWD-12-BG
    - ▶ SWD-12-BS
    - ▶ SWD-12-EX
    - ▶ SWD-12-FC
    - ▶ SWD-12-FW
    - ▶ SWD-12-LS

Equipment Risk

FullScreen | Export

Drag a column header and drop it here to group by that column

	Action	Equipment	Description	Conseq.	ProbOfFailur	Risk Fact	OCR	Opr.Risk
▶	Edit	13093104	#2 FA AIR COMPRESSOR (550)	2	2	4	56.1	2.6

Action Items

Create New | FullScreen | Export

Drag a column header and drop it here to group by that column

	Action	Type	Location	Equipment	Title
▶	Edit	PDM Watch List	FBAC - 2A BED ASH AIR COMPRESSOR EQPT	2A BA X-PORT COMPRESSOR (500A)	T2 500A Blower high particle
	Edit	PDM Watch List	GRAVEL SCREW COMPRESSOR A	502A BA AIR COMPRESSOR	T2 502A Screw Conv high p

Hierarchical Navigation

- Navigate by plant/unit/system/ equipment
- Navigation within the hierarchy drives content on portal pages
- Navigation is able to be updated and modified as equipment details change

At GenOn, reliability issues that impact equipment risk are assigned a severity and probability.

The rating table to the right was developed to standardize the various condition assessment, predictive maintenance, consultant reports, etc. that may assign a severity to a discovered problem.

The PMDG is the place where a station reliability engineer identifies risk from the numerous data sources at their disposal.

SEVERITY AND PROBABILITY OF CONSEQUENCE	1 NEGLIGEBLE 1 or less outage days*	2 MARGINAL 2-5 outage days*	3 CRITICAL 6-14 outage days*	4 CATASTROPHIC 14+ outage days*
4 Certain 75-100% Event will occur before next outage cycle or within 1 yr.	4	8	12	16
3 Likely 25-75% Event will occur before next outage cycle or 1-2 yrs.	3	6	9	12
2 Possible 5-25% Event will occur before next outage cycle or 3-5 yrs.	2	4	6	8
1 Remote 0-5% Event will occur before next outage cycle or 5+ yrs.	1	2	3	4

* Forced and/or maintenance outage or 'equivalent days' outage factor for derates

12-16	Very High Action required to lower risk level. Sr.Management Sign Off	8-11	High Counter measures employed. Risk mitigation strategy developed and endorsed by	4-7	Medium Discussion on mitigation strategy required	1-3	Low Operation Permissible

PMDG Predictive Maintenance

The Predictive Maintenance section was designed to enable the user to display all PdM data for a Critical System or a specific Critical Asset.

PMDG Predictive Maintenance – PI

OSIsoft PI System screens were created and linked to the hierarchy. These screens are interactive and typically drill down to trend plots for key parameters and drill upward for system overviews.

Reverse navigation capability allows a user to start at a OSIsoft PI System screen and find where the equipment is located in the hierarchy.
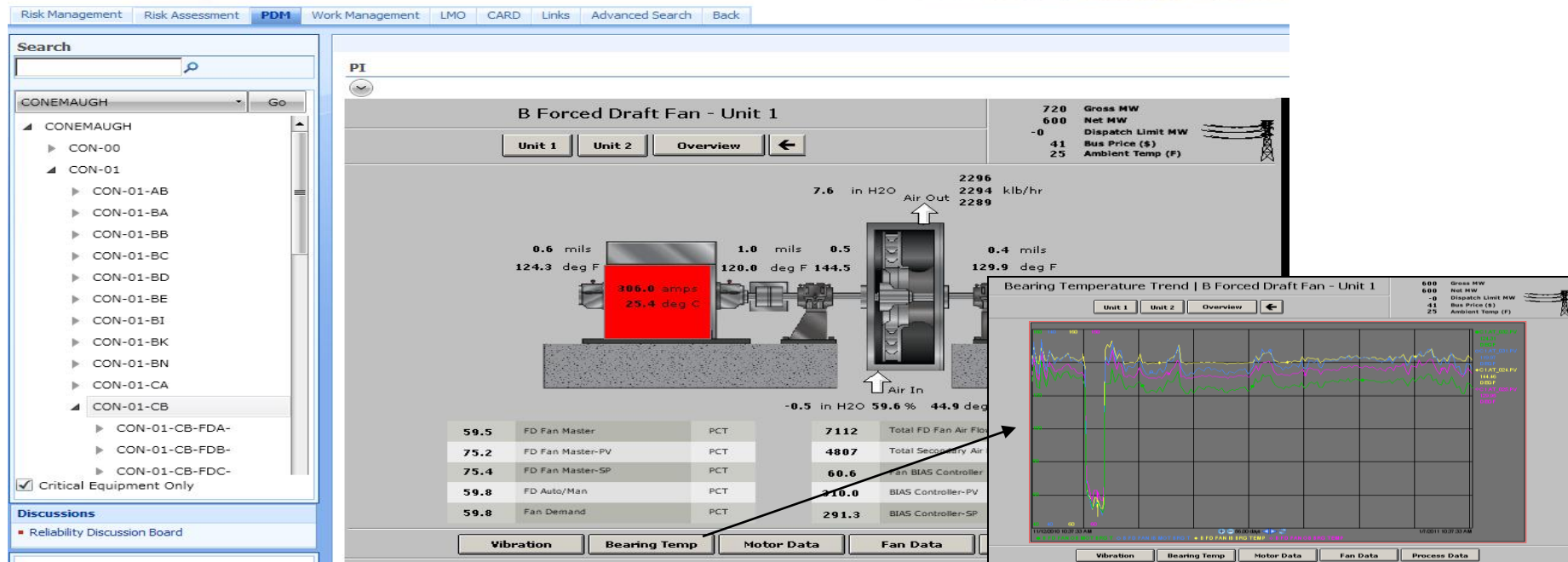
Intellatrack

Grouped by:	Group Title	▶	Criticality				Full Screen	Export

			Functional Location ▼	Equipment number ▼	Equipment Desc. ▼	Item Title
∧ Unit # 2 2nd Floor						
∨ Rotating Equ. Alert						
∧ Unit # 2 3rd Floor						
∧ Process Alert						
			POR-02-FW-FWHT	13072561	10TH STG HP HTR A SHELL SIDE RV-139	Check "A" & "B" Coal Pipe ElbowC
			POR-02-FW-FWHT	13072562	10TH STG HP HTR B SHELL SIDE RV-140	Check "A" & "B" Coal Pipe ElbowC
			POR-02-FW-FWHT	13072671	10TH STG HEATER A	Check "A" & "B" Coal Pipe ElbowC
			POR-02-FW-FWHT	13072672	10TH STG HEATER B	Check "A" & "B" Coal Pipe ElbowC
∨ Unit 2 Battery Room						

Operator rounds are facilitated by hand held electronic data collectors. Output from the data collectors is stored in PI System and linked to PMDG through the equipment hierarchy.

If an alarm is triggered in an operator round, it is displayed in a table on the PMDG Predictive Maintenance page as well as the Morning Meeting page.

PMDG Morning Meeting

The morning meeting view displays data from the risk management section of the portal that has changed in the last 48-hours.

It is designed to facilitate a traditional "morning meeting" that is held at the station. Instead of personnel preparing the data from the night before to bring to the meeting – this view provides the information for them.

PMDG Statistics to Date

- 20 stations in PMDG to date
- \> 5000 pieces of critical equipment
- \> 50 users
- ~ 20,000 site hits per week
- PMDG User Group Quarterly Meetings

PMDG Future Plans

- Add additional 10 stations in PMDG due to merger activity
- Incorporate additional PdM Data
- Greater Management View flexibility
- Standardized reporting tools
- Tools for Reliability Engineers such as Mean Time Between Failure tables

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Thank you