In Pursuit of Operational Excellence for PG&E Power Generation with SAP MII

May 2013
Agenda

1. Who is PG&E
2. PG&E Business Strategy and Initiatives
3. In Pursuit of Operational Excellence
4. Pilot Projects
   • Condition-based Maintenance Pilot
   • Incident Reporting
5. Lesson Learned
6. Next Steps
7. Q&A
Who is Pacific Gas & Electric Company

Headquarter: San Francisco, CA
Employees: 19,424 (2012)

5.2 million electricity customers and 4.3 million natural gas customers

Power Generation operates Hydro, Fossil and Solar generation providing 5300 MW, DCPP operates Nuclear generation providing 2200 MW.
# Business Strategy of Energy Supply

<table>
<thead>
<tr>
<th>Cornerstones</th>
<th>Strategies</th>
<th>Sponsors</th>
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</thead>
<tbody>
<tr>
<td>Reliability</td>
<td>Operational Excellence</td>
<td>DCPP, Chief Nuclear Officer; Vice President, Power Generation</td>
</tr>
<tr>
<td>Safety</td>
<td>Facility Material Condition and Asset Management</td>
<td>DCPP, Chief Nuclear Officer; Vice President, Power Generation</td>
</tr>
<tr>
<td>People Organizational Effectiveness</td>
<td>Training and Qualifications Employee Engagement</td>
<td>DCPP, Chief Nuclear Officer; Vice President, Power Generation</td>
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<td>Environmental Stewardship</td>
<td>Greenhouse Gas Renewables</td>
<td>Senior Vice President, Energy Procurement</td>
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<tr>
<td>Cost</td>
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</table>

**Modernization**

**Common Toolsets**

**Centralization**

**Process Improvement**

**Cost Reduction**
IT Initiatives to support business

• Five-Year IT Roadmap
  • Modernize IT infrastructure
  • Business Systems
    • Leverage common toolsets to maximize business value
    • Integrate systems to improve reporting and decision making
    • Introduce mobility to reduce double entry and improve user adoption

• Strategy Role within Energy Supply IT
  • Introduce business architect
  • Introduce technology architect

• Monthly interaction between business and IT leadership
  • Shift emphasis from “order taker” to “equal partner”

• Energy Supply Governance Team
  • Ensure business and IT are supportive and ready to develop / adopt new and/or improved toolsets

• New IT and Energy Supply Intake Process
  • Standardize around a single toolset for requesting IT support
SAP MII was chosen to integrate SAP and PI

SAP Manufacturing Integration and Intelligence (MII) is an SAP bolt-on application designed to integrate external databases with SAP.

MII has a user friendly front end that can be harnessed to manage data in external databases and SAP.

MII can analyze multiple sets of data, provide condition assessment and equipment health indexing.
Operations Information Backbone

- Fossil
- Nuclear
- PV
- Hydro
- Wind

Plant Dashboard
Asset Monitoring
Performance Mgt
Unit Health Indexing
Operations Performance Management
Beyond MII...

**Operations Performance Management**
Powerful and innovative analytics to drive operational performance.

**Analytics & Visualization**
Comprehensive performance management dashboards and analytics providing insights that drive proactive and preventative actions to avoid incidents.

**Integration & Visibility**
Functional integration of data from disparate sources across the enterprise and plant operations to provide basic visibility.

**Enterprise Solutions (IT)**

**Plant Solutions (OT)**

**DATA SILOS – ENTERPRISE & PLANT OPERATIONS**
Business Suite & Manufacturing Execution Systems provide integration between application sets. Provides context for activities and deviations. Remains a key challenge area for most organisations with focus on cost reductions.
<table>
<thead>
<tr>
<th>Yesterday</th>
<th>Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>Once a day, an operator manually collects engine hour readings and</td>
<td>Every three seconds, SAP MII automatically updates the HBGS dashboard</td>
</tr>
<tr>
<td>updates a MS Excel spreadsheet.</td>
<td>with engine hour meter readings from OSI PI.</td>
</tr>
<tr>
<td>Once a week, an operator manually creates an engine hour measurement</td>
<td>Once a day, SAP MII automatically collects the latest engine hour</td>
</tr>
<tr>
<td>document for each engine and generator in SAP.</td>
<td>reading from OSI PI and creates SAP engine and generator hour</td>
</tr>
<tr>
<td>SAP maintenance plans for each engine and generator analyzes the</td>
<td>measurement documents. Generator hours are affected by number of</td>
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<td>reading and determines if maintenance is required. If yes, then a pm</td>
<td>engine starts.</td>
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Pilot Project: Condition-based Maintenance
Oct of 2012 to Jan of 2013

OSI PI System
Humboldt Bay Generating Station
PG.HBGS
Individual Units
PG.HBGS.01.XXX

SAP Enterprise System
SAP Maintenance Plan
SAP Counter Reading
SAP Scheduled Call Task List

PGE
Northern California

PG.EH
PG.EH.BGS
PG.EH.BGS.01.XXX

SAP Maintenance Plan
SAP Counter Reading
SAP Scheduled Call Task List
Pilot Project: Condition-based Maintenance
Oct of 2012 to Jan of 2013

Plant Operational Health
Pilot Project: Condition-based Maintenance
Oct of 2012 to Jan of 2013

Individual Operation Unit Health

[Image of a computer screen displaying data on condition-based maintenance, with graphs and tables showing power usage, cumulative figures, and maintenance notifications.]
Pilot Project: Condition-based Maintenance
Oct of 2012 to Jan of 2013

Enterprise SAP System
Pilot Project: Condition-based Maintenance
Oct of 2012 to Jan of 2013

“…This is a powerful tool that allows us to have a friendly navigation in SAP work management while having a real time visualization of operating conditions at the plant…”

Plant Manager

“…what is cost of this tool, trying to understand potential uses for condition based maintenance elsewhere in whole business unit..”

Director of Fossil O&M
Event Reporting System

Event Reporting business process required a scalable system that will enable plant personal to log, analyze, monitor, and report on Power Generation events impacting day to day energy supply and will sustain PGE’s commitment to external auditing compliance and improve alignment with PGE’s existing business process and systems along with future association to Individual equipment and their operational data reads.

**Phase 1 Basic System:** in process of deployment. It is to replace current incident reporting solution, to support incident investigation and documenting equipment and human factors involved in the incident. It provides better visibility into assignment and managing work activities, as well as ad hoc searches.

**Phase 2 Integrated System:** The goal is to leverage an integrate Incident Reporting platform to facilitate end-to-end tracking of incidents, by integrating OSI PI, Outage Management System, SAP WM, Field Work notification and GUSS.

**Why MII:** Application is plant operation focused, User friendly; Standalone application; Fast to value; Integration capabilities for operational data integration
Event Reporting System

Event Report Form

Reason(s) for Reporting *
- Forced Outage / U1-U2-U3
- Unit Rerating / De-rating greater than 2% GWY
- All regulatory, environmental, license or permit deviations
- Failure to report the following to the CA Independent System Operator (CAISO) within the required timeframe. Applies to the loss and/or diminished capability of:
- Other Regulatory Reporting
- Generation Facility Equipment / Material Problems
- Work Process / Guidance Document Problem
- Project, Engineering or Construction Problems
- Change Management Problems
- Close Call - Near Hit
- Heat Equipment, Truck, Car or Special Vehicle Problem
- Cause Analysis as requested by Leadership Team

Event ID: 206
Report Status: Closed
Report Type (Check all that apply) *
- System / Equipment Factors
- Human Factors
- Procedures Process Factors

Event Date: 8 May 2013
Event Time (24-hour): AM PM

Related NERC Events:

Generation Type: Hydro
Area: Shasta - Powerhouse
Facility / Location: Coleman
Unit: U1

Impact:
Power outage to North East Bakers region for 10 min

Preliminary Description:
Failure to start the Engine due to Circuit breaker fault

Detailed Description:
Failure to start the Engine due to Circuit breaker fault
Event Reporting System

- Log Plant Event
- Analyze Plant Event
- Monitor Event
Event Reporting System

**Raw Data Report**

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<tr>
<th>Type</th>
<th>Month</th>
<th>Event No.</th>
<th>Area</th>
<th>Unit</th>
<th>Date of Event</th>
<th>Short...</th>
<th>Action...</th>
<th>Owner</th>
<th>Action...</th>
<th>Notes</th>
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<tr>
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<td>April</td>
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<td>Coleman</td>
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**Aging Report**

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Lesson Learned

- **Pilot** a solid use case, show the fast value then expand the project
- Involve **business** as early as possible and show business deliverables every few weeks
- Learn the best practice from other **industry** like Oil and Gas
- **Plan** and coordinate resources needed as early as possible, it is integration project
- Chose **partners** who can be flexible resource provider, high quality developer and trusted advisor
Next Steps: Automated Reports and Dashboard

**Today**

- **HUMELOCH Day Generating Station**
- **PERFORMANCE REPORT**

**Tomorrow**

- **Pacific Gas & Electric Energy Supply Group**
- **Overall Performance**
  - Performance
  - Cost
  - Environment, Safety and Health

**Biodiesel**

- **4:** 200459, 200599, 200699, 200799
  - **Overall Performance**
  - **Special Events**
    - **Overview:**
      - Unit 01 MED Flare, Unit 02 Cylinder D5 gas leak replacement (backing troubleshooting)
      - Unit 03 MED Flare, Unit 05 Cylinder D5 gas leak replacement (backing troubleshooting)

- **MII Presentation**
  - **PRESENTATION**
Next Steps: Simplify Work Management

“Data Entry into SAP is Eating us up alive”
Next Steps: Mobilizing Work Mgmt

- **What it is**: Deploy the Mobile Work Management and make innovation with 3D Maintenance Procedures and Real-time information to field engineers, which will further improve the productivity a lot.
Next Steps: Asset Health Indexing
SAP MII Future

Enterprise SAP System
- Asset Registry
- Corrective Action Program
- Hydro Licensing
- Work Management

SAP MII
Manufacturing Integration and Intelligence

Plant System
- OSI PI System
- ODMS System
- GUSS System
- GE Smart Signal
- SKF Vibration System
- LOTO

PGE MII Application Landscape
- HBGS Dashboard and Integration
- Integrated Event Reporting System
- Asset Health Indexing*
- Condition Based Maintenance(CBM)
- O&M Performance Mgmt*
- Simplify Work Management* (SAP VE )
- Corporate Dashboards*

* Future Plans
Thank You!