Panel Discussion: PHM for Electric Grids

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WORLD POWER ... THE NEXT 10 YEARS
New Equipment, 2015-2024

- Centralized power
  Still ~75% of orders
- Emerging markets drive growth
  ~75% of orders
- Renewables becoming mainstream
  Solar up ~200% vs. last 10 years

2,500 GW

- Nuclear: 6%
- Solar: 15%
- Wind: 20%
- Gas Turbines: 30%
- Steam: ~3%
- Hydro: 5%
- Renew.ST: ~3%

Excludes 700 GW of non-grid connected capacity additions

Source: GE Power estimates, McCoy, UDI, Platts

Making power more reliable, affordable, and sustainable

#PoweringEveryone
“... The future of the power sector is a **new value chain augmented and interconnected by digital technologies** — one where both power and information flow in multiple directions; all actors add value; and the overall efficiency, cost-effectiveness, resilience, and sustainability of the system are enhanced through information sharing, openness, collaboration, and coordination between stakeholders through the right set of incentives.

It will encompass **three key elements**: 

(1) **a digital centralized generation pillar**, relying on a mix of fossil fuel and renewable sources;  
(2) **a digital grid**, connecting generation and consumption, and enabling the multidirectional flows of energy and information  
(3) **a digital consumption pillar**, improving consumption patterns along with distributed generation and storage capacity.”

### Figure 3: Value at stake for digital initiatives

<table>
<thead>
<tr>
<th>Category</th>
<th>Industry</th>
<th>Societal</th>
<th>Total Value at Stake (USD Bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Performance Management</td>
<td>387</td>
<td>172</td>
<td>559</td>
</tr>
<tr>
<td>Digital Field Worker (26)</td>
<td>-60</td>
<td></td>
<td>34</td>
</tr>
<tr>
<td>Smart Asset Planning</td>
<td>30</td>
<td>360</td>
<td>390</td>
</tr>
<tr>
<td>Energy Aggregation Platform</td>
<td>68</td>
<td>70</td>
<td>137</td>
</tr>
<tr>
<td>Real Time Supply &amp; Demand Platform</td>
<td>191</td>
<td>823</td>
<td>814</td>
</tr>
<tr>
<td>Real Time Network Controls</td>
<td>113</td>
<td>143</td>
<td>256</td>
</tr>
<tr>
<td>Connected &amp; inter-operable devices</td>
<td>73</td>
<td>360</td>
<td>432</td>
</tr>
<tr>
<td>Energy Storage Integration</td>
<td>130</td>
<td>59</td>
<td>189</td>
</tr>
<tr>
<td>Digital Customer Model</td>
<td>97</td>
<td>151</td>
<td>248</td>
</tr>
<tr>
<td>Energy Solution Integration</td>
<td>142</td>
<td>31</td>
<td>173</td>
</tr>
<tr>
<td>Energy Management</td>
<td>69</td>
<td>70</td>
<td>139</td>
</tr>
</tbody>
</table>

Source: Accenture research for the Digital Transformation of Industries project

APM – Typical Business Benefits

- **5-10%**
  - Inventory Cost Reduction

- **2-6%**
  - Increased Availability

- **10-40%**
  - Reduction in Reactive Maintenance

- **3-40%**
  - EH&S Incident Reduction

- **5-25%**
  - Gain in Employee Productivity

- **5-25%**
  - Reduction in IT Total Cost of Ownership

PHM = Prognostics & Health Management
APM = Asset Performance Management, that includes PHM as part of a larger enterprise IT solution

Source: Meridium Conference Data + Industry Benchmarks
## Suite Overview | APM Offerings

**APM Solution Map**

GE Digital's APM is a full end-to-end suite that is comprised of four modules designed to increase asset reliability and availability, while simultaneously reducing cost and risk.

### Reliability Management

Achieve less unplanned downtime by predicting equipment issues before they occur.

- Predictive analytics
- Case and collaboration management
- Knowledge management
- Root cause analysis
- Reliability analysis

### Compliance and Integrity Management

Ensure asset integrity and compliance by monitoring changing risk conditions.

- Hazard analysis
- Safety lifecycle management
- Risk based inspection
- Inspection management
- Thickness monitoring

### Asset Strategy Optimization

Optimize across availability, reliability, risk, and costs through intelligent asset strategies.

- Reliability centered maintenance
- Failure mode and effects analysis
- Strategy management
- Strategy library
- Lifecycle cost analysis
- Financial and risk simulation

### Machine and Equipment Health

Anytime, anywhere, unified view of your assets' current state and health.

- Connectivity
- Data management
- EAM integration
- Condition monitoring
- Data analysis and visualization
- Criticality analysis
- Event management
- Recommendation management
- Benchmarking
## Typical APM Time to Value

<table>
<thead>
<tr>
<th>4-6 Weeks</th>
<th>3 Months</th>
<th>6 Months</th>
<th>9 Months</th>
<th>1 Year</th>
</tr>
</thead>
</table>

### Machine and Equipment Health: Get Connected
- Begin use
  - Operator Rounds
  - E-Logs
  - GAA & KPI’s

### Reliability Management: Get Insights
- Begin use Predictive Analytics
- Consolidated Asset Data:
  - Contextualized anomalies

### Asset Strategy Optimization: Get Optimized
- ASO Solution Design
  - Align APM program to business objectives
  - Benchmarking for selection of asset strategy optimization
- Begin Intelligent Asset Strategy (IAS) Process
- Accelerated IAS deployment with pre-built content
- Deploy IAS on 1st group Assets ... repeat

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**Technology Improvements**

**Business Process Change**

**Digital Transformation**