

The Value of Software and Data Analytics in Delivering the Nuclear Promise

What is the Nuclear Promise?

“Delivering the Nuclear Promise: Advancing Safety, Reliability and Economic Performance” is a multi-year initiative the nuclear energy industry has launched to continue safe generation of electricity more efficiently and economically. The initiative is coordinated by the Nuclear Energy Institute (NEI) and comes in light of nuclear energy facilities experiencing a steady increase in electric generating costs. Even with U.S. nuclear power plants operating at sustained high levels of safety, capability and reliability; total electric generating costs have increased 28 percent in the last 12 years.

12-Year Trend of Nuclear Plant Costs				
2014 \$ per Megawatt-hour				
YEAR	FUEL	CAPITAL	OPERATING	TOTAL
2002	5.72	3.92	18.59	28.23
2003	5.59	4.93	18.84	29.37
2004	5.28	5.65	18.54	29.47
2005	5.02	5.80	18.95	29.77
2006	5.04	5.56	19.21	29.81
2007	5.13	6.12	19.07	30.31
2008	5.35	6.76	19.51	31.62
2009	5.93	8.91	20.49	35.33
2010	6.76	9.16	20.63	36.55
2011	7.10	10.06	21.88	39.04
2012	7.46	10.76	21.47	39.70
2013	7.73	8.20	20.93	36.86
2014	7.17	8.18	20.92	36.27
2002-14 INCREASE	25%	109%	13%	28%

From “Delivering the Nuclear Promise” Nuclear Energy Institute

How is the industry responding?

“The Industry’s goal is...to identify opportunities to rethink operating practices, improve efficiency and reduce costs to help keep nuclear power competitive in a changing electricity market—all while advancing safety at the facilities.”

-Nuclear Energy Institute

Resulting Outcomes

“This initiative will help ensure that nuclear energy remains a vital, innovative and cost-effective part of America’s increasingly clean electricity portfolio by achieving...a 30 percent reduction in electric generating costs by January 2018.”

-Nuclear Energy Institute

How the goals are achieved?

Establishment of industry-wide teams led by chief nuclear officers who are tasked with analyzing and identifying improvement opportunities in ten areas of operations such as work management preparation and execution, preventive maintenance strategies and training.

GE Hitachi Nuclear Energy is committed to assist the nuclear industry in delivering the nuclear promise, through our technology expertise as a nuclear provider, digital solutions capabilities leveraging the power of the industrial internet and employing an innovative framework to drive better outcomes for our customers. Nearly half of the 53 opportunities identified by the industry working group align to our digital solutions.

“Identify technology options that have the potential to reduce costs, ensure [widespread] industry awareness of those options, and drive broad industry adoption of innovative tools and techniques that not only reduce cost, but enhance safety and provide greater efficiency.”

-Nuclear Energy Institute

GE Digital

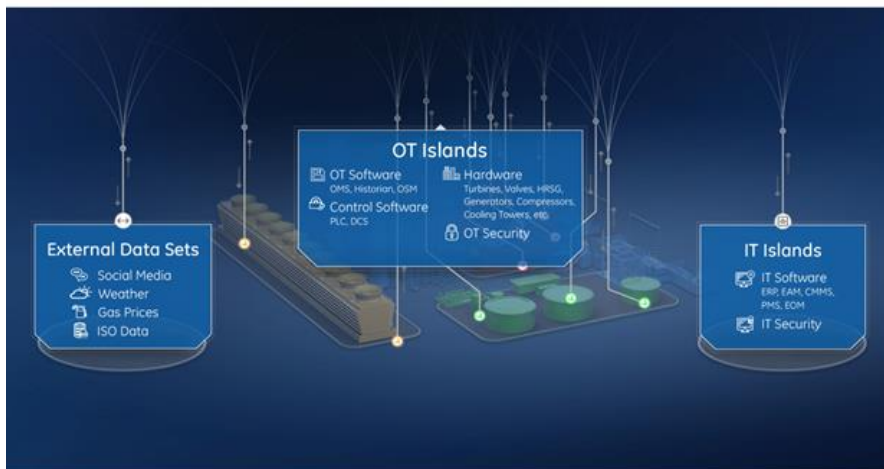
GE is leading the way in an age of industrial innovation that can harness massive quantities of data to deliver transformative progress for people and businesses around the world. The Industrial Internet has the ability to drive unprecedented gains in productivity and efficiency, and could add \$10–\$15 trillion to global GDP.

At the heart of this revolution is an invaluable resource: data that can be converted rapidly into insights, leading to smarter business decisions and increased automation.

At GE Hitachi Nuclear Energy, we are developing a better way to leverage data to trigger insights. We are in the early stages of a long journey of discovery and invention, taking a longer-term view to strategic data management and its technologies that translate to business advantage.

Predix as a Platform

When everything is on its own island it's hard to be intelligent



Unplanned Downtime
HITACHI

Wasted Analytics

Lost Productivity

Missed Opportunities



HITACHI

Predix

Predix is a system-agnostic platform that can be used to help connect systems, devices, databases, external and internal information to provide insight in a simplistic and impactful manner.

Investment in the Industrial Internet of Things (IIoT) is expected to top \$60 trillion during the next 15 years. By 2020, over 50 billion assets will connect to the Internet.

GE Power customers leveraging Predix include: AES Corporation, Exelon, GMR Group, PSEG, RasGas, Salt River Project, and TEPCO.

However, despite the promise of big data, companies struggle to exploit its value. Why? Abundant data by itself solves nothing. Its sheer volume and variety exceeds human capacity to configure it efficiently. Inherent challenges, tied to evolution and integration of information and operation technology, make it **difficult to glean intelligence from unorganized data, compromising digital literacy.**

Asset Performance Management (APM)

APM is designed to increase asset reliability and availability while reducing maintenance cost. APM connects disparate data sources and uses advanced analytics to translate data into actionable insights while fostering collaboration and knowledge management across the organization. The early warnings and push notifications of degrading conditions minimizes the reliance on resources that were needed to support maintenance activities.

Sites use APM to:

- Reduce unplanned downtime and prevent lost power production
- Improve reliability and equipment availability to minimize total cost of ownership
- Reduce operational risks, non-performance penalties, and plant maintenance costs

Preventative Maintenance

- Optimize tasks & frequency
- Value-based reliability
- Minimize downtime

Asset Key Capabilities



Monitoring & Diagnostics

- Connect assets and visualize their performance for condition-based maintenance
- Act on priority issues



Asset Lifecycle Management

- Maximize asset utility to capitalize on market opportunities
- Plan critical asset usage



Predictive Maintenance

- Predict failures using machine data and analytics
- Take proactive action toward eliminating unplanned downtime



Operations Intelligence

- Transform big data into actionable insights, accessible anywhere with mobility
- Reduce operator variability



ANALYTIC INSIGHTS



Operational Performance

OP leverages internal plant data, historical operational data, and business drivers to model and predict a site's key performance indicators (KPIs) in order to reduce plant costs and identify opportunities to improve efficiency. The predictive model evaluates the hundreds of potential influencing factors, paring down to the KPI primary influencers, and then provides a 3-6 month advance pointer to a negative event with actionable accuracy. By predicting KPI's such as capacity factor, forced loss rate, reactivity management, scrams, safety system performance and event-free clock resets, the prediction provides organizational and site management insight into operations and align site performance to business objectives.

Oversight & Metrics

- Reduce contract review boards
- Remove monitoring teams
- Targeted oversight
- INPO Evaluations → performance-based



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Every level of operations benefit from consistent visibility across systems, to allow for faster decision-making built on credible data and advanced analytics. By identifying negative events early, sites can:

- Reduce oversight costs and maintain better organizational effectiveness and productivity
- Avoid event recovery costs and lost revenue due to forced outages
- Avoid non-performance penalties

Outage Management

Resource Planning and In-Processing

Optimized staffing management collects all personnel information to provide a centralized view of staffing requirements and personnel availability. By aligning training requirements and work experience to assigned work roles, staffing managers can quickly identify and remediate unnecessary training, compare staffing plans to available resources, and assign work based on expected or actual qualifications. Across the industry, leveraging common resource profiles supports standardization of training and experience requirements for resource roles.

Aligned with staffing optimization, digitizing In-Processing yields personnel and supplier metrics to reduce overhead costs and augment contractual requirements. Resource onboarding is easily combined with work assignment requirements because of the clear view of the supplemental resource's training requirements and completion status, and the tracking of site-specific access requirements. This capability results in:

- Providing resource-readiness visibility and in-processing metrics
- Eliminating duplicate or recent training and reducing requalification for work performed
- Reducing the site's obligation to provide costly resources

Work Scope and Scenario Modeling

Designed to optimize the planning and scheduling of maintenance events, the model would use historical performance data and planned events to provide site managers insight into maintenance-event schedule reliability and identify risks before the event occurs.

Work scope planning and scenario modeling considers the variability of the equipment, the facility, and human resources, to identify collision points and run simulation models. This provides guidance for outage planners to balance business drivers with outage scope. Further, during outage execution it provides outage managers the mechanism to evaluate event recovery scenarios and minimize the impact of discoveries and unplanned events.

Outage Planners will:

- Reduce operation and maintenance costs
- Leverage best practices across a region or fleet
- Optimize work scope scheduling to accomplish the work with fewer resources
- Balance business levers (for example, cost, duration, preventative maintenance, maintenance reliability, and so on) to influence the outage scope

Training & Resource Management

- Standardize & Streamline
- Reduce Admin costs
- Systematic vs. arbitrary time-based

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Ways to engage:

Collaborative innovation is the way to develop software
Schedule a design thinking meeting, hackathon, 2.5 day workout

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