GENERIC CASE STUDY

Predictive analytics enables Duke Energy to cut costs and better operate and maintain assets

**Client**
Duke Energy

**Industry**
Energy

**Business need addressed**
- Cost over-runs related to wind turbines and other equipment, maintenance fees, component replacements, and aging units no longer under warranty
- Limited visibility into asset health and dependency on suppliers for action

**Genpact solution**
- Based on Genpact’s Lean Digital™ approach, an integrated framework to monitor and optimize assets utilization of the wind farm equipment
- A specialized Big Data system, Intelligent Process Insights Engine (IPIE) with custom master data management and data governance capabilities, to manage data from geographically distributed assets and a wide range of sources

**Business impact**
- Lower operating expenses, minimized regulatory risks and clear visibility into operations due to improved predictive maintenance
- Accurate picture of equipment health enables a clear understanding of capital and operating investments, and minimize sub-optimal expenditure
Duke Energy, the largest electric power holding company in the United States, struggled with cost levels and predictability, as well as control and optimization of assets. The company used a practical Lean DigitalSM approach to reimagine its maintenance and repair processes, implementing a Data-to-Insight-to-Action analytics process that transformed operations and successfully addressed business challenges.

**Business challenge**

Duke Energy is the largest electric power holding company in the United States, supplying and delivering energy to approximately 7.3 million US customers, and its subsidiary, Duke Energy Renewables, is a leader in developing innovative wind and solar energy solutions. To maintain its strong position in the market, Duke Energy Renewables developed a three-pronged strategy: improve customer service, establish long-term purchase agreements with those customers in support of a more predictable revenue model, and maximize utilization of expensive investments—more than $3 billion, since 2007—in wind and solar power projects.

Seven original equipment manufacturers (OEM), each having their own custom monitoring software systems supply the vast rows of turbines that turn wind into energy for Duke Energy. The volume of data produced by the OEMs’ systems was growing exponentially, and they were struggling to derive insights from it. The OEMs’ cost projections were often inconsistent with the actual data. Maintenance fees, component replacement, and aging units no longer under warranty were degrading the operation’s financial performance.

Duke Energy **needed a new framework to optimize their industrial assets utilization** in order to better monitor the operational and financial health of the powerful equipment so vital to its wind farms.

**Genpact solution**

Duke Energy realized that standalone advanced technology and analytics initiatives could quickly sap management’s energy and bandwidth without a clear line of sight on promised outcomes. A Lean DigitalSM approach — combining digital technologies, and Lean principles — proved instrumental in helping the company achieve a new level of excellence. First, Duke Energy identified its key business outcomes, and then determined how to source and transform relevant data from appropriate sources and supporting processes. Next, it used analytics to make critical information visible to all relevant stakeholders — from field to management — to enhance the quality of decision-making and prioritize interventions at scale. Focused use of digital technology complemented legacy technology and helped reimagine processes to make the interventions practical and generate impact faster.

Duke Energy started with an inventory of the company’s data-capture and data-cleanup procedures to establish a context for the data...
already available. Rather than consider each OEM – and the information it contributed — discretely, Duke Energy decided on a more holistic approach, taking the entire operation into account. Specifically, they introduced a system for evaluating each wind farm as a whole, rather than assessing every turbine in a piecemeal manner.

A specialized Big Data system, the Intelligent Process Insights Engine (IPIE), was applied to manage data derived from geographically distributed assets.

The platform’s robust master data management and data governance helped analysts look beyond information maintenance toward using it for predictive analytics as an enhanced decision-making tool. To minimize equipment failures and limit maintenance costs, the utility provider designed a consolidated approach that integrated data from a wide range of sources beyond the OEMs, including meteorologists and technicians in the field.

Importantly, and in departure from many typical analytics exercises, advanced organizational structures such as an analytics Center of Excellence (CoE) helped embed and sustain the improvement. Continuous tuning and improvements were guided by the institutionalization of the learning gleaned from outcomes of prior iterations. The result: a design of operations that makes them “intelligent” (see Figure 1) – able to sense, act appropriately, and learn from their actions.

**Business impact**

Duke Energy is now more predictive about the condition of its equipment. The technicians and site managers responsible for operations are now equipped with proactive suggestions on repairs and scheduling preventive maintenance. Additionally, Duke Energy is able to share actionable insights across functions, embedding

---

**Run Data-to-Insight**

- Specialized big data system: Intelligent Process Insight Engine (IPIE) process data from multiple systems and integrated new sources like meteorological and field technician data
- Reliability analytics - by turbine and component
- Performance analytics

**Continuous learning**

- Data mining and simulation to enable optimized maintenance planning at a farm level
- Proactive identification and prevention of causes of downtime

---

**The platform’s robust master data management and data governance helped analysts look beyond information maintenance**

---

**Improve execution practices**

- Improved scheduling of preemptive maintenance based on accurate failure/remaining useful life prediction
- Accurate projections for operating cost, and related charges (depreciation, insurance)

---

**Identify target outcome**: revenue, margins

**Identify metrics**: power demand fulfillment, asset downtime, capacity factor, availability, operating costs (including maintenance, repair and servicing)

---

*Figure 1*
them further into the fabric of the enterprise. Predictive maintenance has reduced operating expenses, lowered the regulatory risk, and provided the CEO with a clear picture of the company's available power inventory. Duke Energy's engineers are providing more precise information on asset wear to OEMs, who in turn use the information to develop new manufacturing methods. The technology teams can now gauge equipment wear more precisely and evaluate new methods of manufacturability and design of components going forward. For the CFO, an accurate picture of equipment health enables a clear understanding of how to manage equipment depreciation in terms of capital and operating investments – and ultimately, the bottom line. This holistic approach raises the prospect that it can beat the performance it achieved with its initial investment.

Company leaders say they intend to further industrialize their processes – and they find themselves on what they describe as an “institutional learning curve.” In the process, according to Duke Energy executives, the company has reassessed its core competencies and reimagined its entire enterprise, creating in the process a foundation for future innovation.