



Kickstarting Your Predictive Maintenance Journey with Existing Data and Resources Insights for the Power Industry

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Introduction

Most utility executives and upper level management cannot go one day without hearing how machine learning and artificial intelligence (AI) will revolutionize the utility industry. The truth is these technologies are already revolutionizing operations and services at many power utilities. Utility personnel at all levels are eager to get access to the right data and tools to optimize their work and transform their businesses. The goals they hope to achieve through digital transformation include reduced unplanned outages, optimized renewables, storage to manage intermittency challenges, a higher return on capital investments and improved capacity planning.

This paper considers the challenges power generation operators face today and the forces that are driving demand for more proactive maintenance strategies. Next, it offers insight into predictive maintenance, being used to create a more comprehensive, correlated, efficient and effective environment for the collection, management, analysis and presentation of data.

Also discussed are the critical differences that make predictive

maintenance a much more efficient and effective alternative to planned and condition based maintenance methodologies.

Finally, the paper takes a look at how electric utility operators are using their existing operational data infrastructure to leverage predictive maintenance on both fixed and mobile assets. All the while, organizations are still under pressure to maintain and improve availability and capacity factors.

To provide proper context, the following areas fall within the “power” or “power generation” industries:

- Heat (thermal) energy generated from fossil fuels (e.g., coal, petroleum, natural gas), solar thermal energy, geothermal energy, and nuclear energy
- Potential energy from falling water in a hydroelectric facility
- Wind energy
- Solar electric from solar (photovoltaic) cells



While many power generation companies are charging ahead and accelerating their digitalization journey across the enterprise, many more are lagging. Perhaps it's because they are letting the numerous challenges facing the industry hold them hostage, keeping them from embracing digital technologies that are an imperative for today's businesses to build the agility, resiliency and staying power they'll need to remain competitive.

Challenge: Leveraging Renewables and All That Data

Like most industries today, the power generation industry is undergoing a period of accelerated digital transformation. A number of challenges, such as deregulation, the rapid adoption of renewable energy sources and a new emphasis on extending facility lifecycles, are forcing electric utility operators to take a closer look at the way they expend resources and optimize operations.

A large percentage of utility companies continue to struggle with data management, even though they want to use data to improve the business. Managing huge amounts of data at an enterprise level is a huge obstacle, often holding back even the most advanced companies. At the same time, many of these organizations remain under pressure to maintain and improve availability as well as capacity.

Additionally, what's being generated must also account for the growing demand for sustainable, carbon-free energy production. According to [Deloitte's 2021 Industry Outlooks](#), there'll likely be "an acceleration in the energy industry's transition and convergence, with increased calls for net-zero greenhouse gas emissions by 2050 and a \$2 trillion US investment in clean energy. The power and utilities industry is expected to lead this transition, with a goal to fully decarbonize the power sector by 2035."

With the pressure to transition to sustainable sources as well as impressive growth, many utilities are adding alternative energy sources such as solar, wind and geothermal to fleets. However, these assets come with challenges such as the variation in maintenance needs, as well as dependency on things like weather conditions. The combination of these variables makes for more complex planning in order to avoid financial losses due to unplanned downtime or reduction in availability at critical peak times.



Amidst the explosion of data and a heightened focus on digital transformation, utilities are at an inflection point where ideas are materializing into tangible business value. Data is the underlying force driving this transformation, as is the ability to turn it into action through analytics. But to do that effectively data must be managed, cultivated, and continually updated.

Solution: Embracing a Predictive Maintenance Strategy

Digitalization in the power industry is not new, especially with more recent sources such as wind and solar energy continuing to shrink the gap for both price and performance with conventional energy sources. Still, technologies like industrial AI, machine learning and predictive maintenance are starting to greatly impact the industry.

Through the use of predictive maintenance solutions, companies can not only reduce the risks to human life, but they can also reduce the risks to the environment. And by taking those early-intervention actions, they reduce the risks for shareholders and stakeholders as well.

With the trifecta of benefits—reduced lost production opportunity, decreased compliance risk and improved safety—this is technology that represents a true investment in the future.

According to [a recent article](#), BNEF, Bloomberg's primary research service, found that wind and solar were the cheapest power sources in most places, near the end of October 2020. The article also predicted a tipping point in five years when it will be more expensive to operate an existing coal or natural gas power plant than to build new solar or wind farms.

For industry executives, unable to go one day without these huge pressures weighing them down, there's a good chance they're also hearing about digital transformation solutions nearly as often. For every success story touted, there are just as many or more horror stories of long-drawn-out projects that did not yield results or live up to initial promises. Those companies that have succeeded are very likely to encounter scalability issues as they move to whole site or enterprise deployment, potentially minimizing any long-term benefit.

With increased calls for net-zero carbon emissions, the power and utilities industry is expected to lead the energy industry's transition and convergence.

-Deloitte 2021 Industry Outlooks



Utility executives understand the potential benefits of enterprise-wide digitalization initiatives and have begun searching for the right tools to transform their business.

Despite these significant challenges, and others, utility executives are continuing the search for the right data and tools to transform their business. Why? Because of the numerous benefits they're likely to enjoy by doing so. These benefits include:

- **Reduced unplanned downtime** by predicting failures with enough time to plan maintenance
- **Quantified analysis** of exactly how much an event impacts revenue, providing a clear target for the technology
- **Significant safety and sustainability improvements** resulting from avoiding unsafe conditions related to unplanned downtime
- **Optimized margins** via improved reliability that significantly reduces unplanned downtime
- **Continuous improvement opportunities** around operational risks from unplanned downtime

With these great opportunities before them, why do many organizations struggle to succeed in digitalization efforts? Often, there is the feeling that the foundation for growth and scalability of digitalization needs to be laid before you can ramp up your efforts. Other times, you're having trouble identifying the ROI you need to get financial buy in. Are the right people in place? Do you have the data and sensors necessary to make good headway? Important questions, but you're probably more ready to take off than you think.

Leveraging In-House Experience and Expertise

It is often surmised that data science expertise is required to make headway in digitalization efforts. While this skill set is a powerful force within any organization, true digitalization efforts also make use of the domain expertise of existing engineers and other resources within your organization. This not only puts the inherent, muscle memory, knowledge of the front lines to work for customers, but frees up what data science resources might be in place to tackle what is likely a backlog of projects. This divide and conquer strategy make the most of all resources on hand and makes digitalization part of how business is done and not a tertiary function.



The Right Digital Solutions Are Available Today

While all companies differ in terms of culture and approach to business challenges, this does not mean that all digitalization efforts have to start from ground zero. Solutions like those provided by AspenTech are designed to:

- **Capitalize on** and be used by those with process expertise you have in house
- **Leverage existing data**
- **Scale to enterprise level quickly**, to ensure that small issues can be found before they become big rather than hunting for only the large interruptions

Using Existing Data to Get Results

It might not be pretty, but your existing data are all you need to begin a fruitful digitalization journey that will realize benefits in a relatively short time frame. A frequent assumption is that more sensors are needed before analysis can begin. Another is that the current data that has been collected in the past is too 'messy' so a new data collection effort is required. While it is true that up to 50 percent of time spent solving a problem centers on data cleansing and refinement, powerful new solutions make quick work of these tasks.

There is a good chance that you have already spent much time and expense on data historians. This investment should not be wasted because your existing data has a story to tell. You can enable your time-series data and combine other sources such as CMMS data to drive predictive applications and analytics. Digital technologies like asset monitoring tools can deliver the earliest, most accurate warning of equipment failures while prescribing detailed actions to mitigate or solve problems. Using machine learning, products such as Aspen Mtell® can recognize precise patterns in operating data that indicate degradation and impending failure—well before it happens.

Advantages of Predictive Maintenance Solutions

Predictive Maintenance technologies can provide a number of benefits including:

- Prescriptive guidance
- Potential failure avoidance
- Low-touch machine learning
- Equipment-and process-agnostic
- Earlier detection of equipment wear
- More accurate failure detection with fewer false alarms

Putting Predictive Maintenance into Practice: Real-World Use Cases

Here are some examples of how companies in the power generation industry are using predictive maintenance solutions to drive measurable results.

Reducing Costs with Advanced Planning

A complex in the Mediterranean was looking for ways to drive greater reliability in capital-and asset-intensive operations. Aspen Mtell was used to mine historical and real-time operational and maintenance data.



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This led to the discovery of the precise failure signatures that precede asset degradation and breakdowns, prediction of future failures and prescription of detailed actions to mitigate or solve problems.

The data used for the Aspen Mtell Agents consisted of 52 million sensor values, including condition data and process data. Initially, the team cross-referenced the work order history for four assets, including 340 prior work orders. The maintenance history spanned 17 problem classification codes.

The analysis, which was done in a matter of weeks provided failure prediction lead times of up to 45 days... and did so without false positives. These capabilities are expected to reduce unplanned shutdowns by up to 10 days, increase revenue by 1 to 3 percent, reduce maintenance costs and cut operating expenses by 1 to 5 percent. Ultimately increasing asset availability by 2 percent on average.

Optimizing Efficiency and Profit

A 600MW integrated gasification combined cycle power generation plant wanted to improve uptime and decrease maintenance costs. Within a few weeks, the Asset Performance Management (APM) solution analyzed 52 million sensor values, including condition data and process data, and cross-referenced the work order history for the plant assets, including 340 prior work orders. Monitoring agents created from this data accurately identified specific failure modes, without false positives, with significant lead time on seal and valve repairs including:

- High valve temperature: 36 days
- Oil seal replacement: 45 days
- Pump seal replacement: 33 days
- Gas seal replacement: 24 days





Organizing Business Critical Data

An essential component to operational success is real-time and historical process data from operations and other sources. By organizing streams of business-critical data into a single comprehensive format enables plant managers and executives to maximize plant productivity and efficiency, and more accurately plan future business operations. A data historian is an excellent tool to aggregate data (regardless of OEM) into a “single version of the truth” for any power generator.

Conclusion: Seize the Power of Digital Technologies

Today’s power generation industry demands electric utilities deliver high reliability, assured availability, and high efficiency at low cost. Yet, many facilities are using multiple, disparate data systems with limited employee participation beyond the assigned function, static equipment condition assessments, and have a high reactive maintenance impact. The key to utilities reducing maintenance costs will be rapid adoption of predictive maintenance technology that is rapidly scaled to enterprise wide use, ensuring protection of critical assets and prediction of the ‘small’ issues before they become big problems.

As the industry moves more fully into the digital transformation age, asset monitoring is paramount. Among the APM technologies in the marketplace today, Aspen Mtell stands out for its distinct ability to provide earlier prediction of asset failures while reducing or eliminating false positives. Aspen Mtell was also recognized by the hydrocarbon processing industry in 2019 for its ability to recognize leading indicators of asset failure and alert plant staff weeks prior to breakdown, allowing time to plan maintenance and reschedule production to minimize financial impact.

About Aspen Technology

Aspen Technology (AspenTech) is a leading software supplier for optimizing asset performance. Our products thrive in complex, industrial environments where it is critical to optimize the asset design, operation and maintenance lifecycle. AspenTech uniquely combines decades of process modeling expertise with machine learning. Our purpose-built software platform automates knowledge work and builds sustainable competitive advantage by delivering high returns over the entire asset lifecycle. As a result, companies in capital-intensive industries can maximize uptime and push the limits of performance, running their assets safer, greener, longer and faster.

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