WHITEPAPER

Rethinking asset performance management for the digital age

Your asset performance management strategy determines whether your assets help drive your business forward or hold your business back. In this white paper, we help asset and maintenance managers understand how a digital asset management strategy can enable the predictive maintenance needed to increase overall asset effectiveness while lowering costs.

Reading time: 20 minutes

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The journey to maximum value from assets

No matter what business you're in, you're in the asset management business. Without physical machinery, devices and electrical systems, asset-intensive businesses like manufacturers, utilities, refineries and more, simply don't work. That makes asset management one of the most critical strategic functions of your entire organization.

However, the world of asset management is rapidly evolving, with the emergence of the Industrial Internet of Things (IIoT) leading to the digitalization of physical infrastructure. Smart sensors embedded into assets provide massive quantities of data that can be used to fine-tune performance, measure utilization, determine return on investment and help plan maintenance actions.

This asset data couldn't have come at a better time, particularly when it comes to your electrification assets. Today's baby-boomer dominant energy workforce is rapidly aging; as experienced asset and maintenance managers and engineers retire, much of their institutional knowledge will walk out the door with them, with no simple way of replicating or sharing that knowledge. A competitive market for talent may mean you have to rely on fewer people to do more work.

Not only that, but an aging legacy infrastructure can mean that you're spending more time and money conducting costly preventative maintenance, which may or may not be necessary based on the equipment's actual condition.

Because many of these systems are siloed from each other and require manual monitoring and operation, your limited staff time is spent collecting and analyzing data, with little time left over to take data-driven action.

While unnecessary preventative maintenance is expensive, the cost of unplanned downtime can be even more so. According to the International Society of Automation, the annual production loss from unplanned downtime can cost your organization as much as 5-20% of your total yearly production capacity[1], resulting in millions in lost revenue. Unplanned downtime isn't just inconvenient. It's dangerous. The wrong asset failing at the wrong moment can lead to workplace injuries or fatalities to operators and service personnel. You have a moral and legal responsibility to keep workers safe. You also have a financial responsibility: the economic impact of work-related injuries and death costs global businesses almost $3 trillion[2] per year. Both the direct and indirect costs of failure are something your business cannot afford.

Your asset management strategy determines whether your assets amplify or create a drag on your business results. By placing data at the foundation of your strategy, you can improve the way you approach maintenance to increase its overall effectiveness while reducing costs.

[1] https://ww2.isa.org/standards-and-publications/isa-publications/intech-magazine/2006/January/channel-chat-when-true-cost-of-downtime-is-unknown-bad-decisions-ensue

[2] https://www.safetyandhealthmagazine.com/articles/16112-ilo-global-cost-of-work-related-injuries-and-deaths-totals-almost-3-trillion


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Choosing the right maintenance strategy

The maintenance conundrum is this: Conduct maintenance too early and you may spend money and time fixing something that isn't broken, but if you wait until it's too late you may end up damaging equipment and suffering unplanned downtime. Just like Goldilocks, the goal is to get it "just right."

Throughout the years, several strategies have been developed to determine the optimal moment to conduct maintenance in a way that provides the greatest overall availability over the long term for the lowest cost.

There are two main approaches to maintenance: corrective and preventive[3]. Corrective maintenance is simple to understand; run the asset until it breaks, and then fix or replace it.

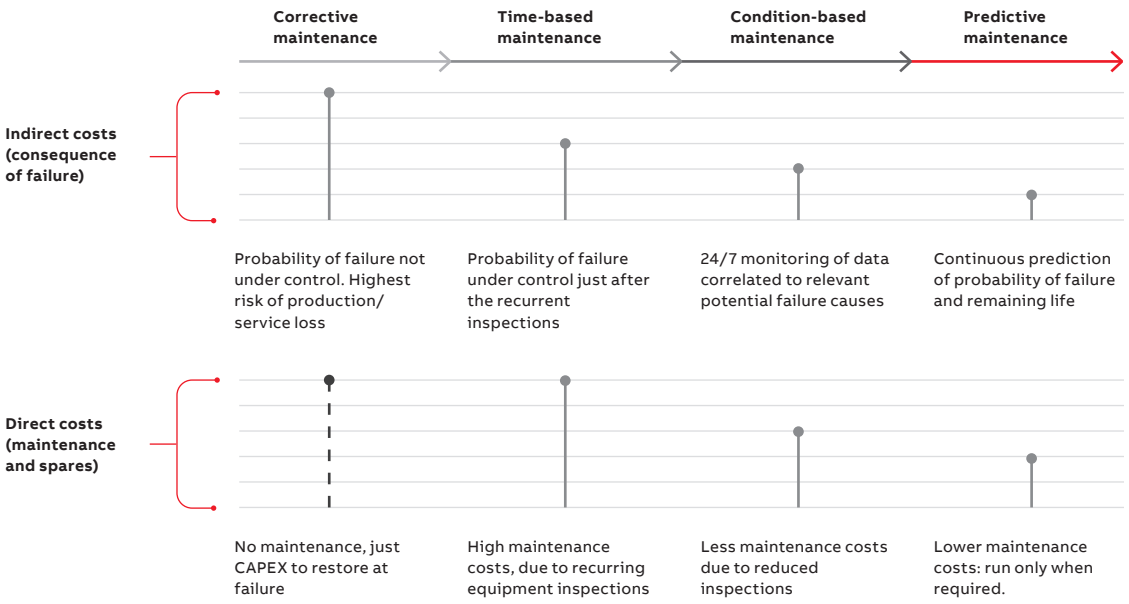
While this has the benefit of saving money on unnecessary maintenance, the risk of unplanned downtime, equipment damage and employee safety make corrective maintenance unpalatable for all but the most inessential or redundant assets.

For several assets, the more logical approach to maintenance is preventive. By taking action before an asset fails, you can extend the life of the asset, reduce overall total cost of ownership and avoid catastrophic unplanned outages. But the challenge, if not the art, of asset management is determining the exact best moment to conduct preventive maintenance.

There are a number of preventive approaches:

- **Time-based maintenance:** This approach involves conducting maintenance based on a schedule (such as every 12 weeks) or a run-time basis (such as every 10,000 hours). While this helps ensure your assets get regularly inspected and serviced, you can end up wasting time taking a perfectly working asset offline, not to mention the cost of replacing parts that may still have life left in them.
- **Condition-based maintenance:** A more sophisticated approach to maintenance uses condition-based monitoring equipment to monitor the asset's actual condition. This allows you to conduct preventive maintenance when an abnormal condition is detected, allowing you to get the most use out of every component. The downside of condition-based maintenance is that it can make your maintenance demands naturally more reactive and harder to predict.
- **Predictive maintenance:** With this approach, you can use data collected by your condition-based monitoring equipment and other external sources to not only track the condition of equipment but anticipate the future performance of each asset. With this sophisticated analysis, you'll be able to optimize your maintenance scheduling, minimize the time spent maintaining equipment and reduce costs.

[3] BS EN 13306:2017 Maintenance. Maintenance terminology



Overcoming unpredictability with predictive maintenance

The majority of asset failures are uncorrelated to the age of equipment or the time between maintenance inspections; a study by NASA and the US Navy found that 82% of asset failures were completely random, with only 18% being the result of age[4]. Two identical assets can have wildly different maintenance requirements throughout their life, with no way of knowing how, why or when each will fail.

However, many organizations still perform preventive maintenance as if maintenance frequency or the age of equipment are still the primary factors. That means a time-based maintenance strategy only provides a benefit for those 18% of assets that happen to fail "on time," leaving the vast majority of maintenance needs unserved.

While these schedules are determined using best practices, an asset will almost always fail unpredictably in between scheduled maintenance.

Many asset managers find that scheduled maintenance is too frequent for a relatively new asset and too infrequent for an asset's needs near the end of its lifecycle.

With a predictive asset management strategy, you can continuously predict the probability of failure and remaining life for every asset you monitor. This helps you achieve the lowest maintenance costs of any strategy by allowing you to conduct maintenance only when required.

According to ABB data, a predictive asset management strategy can decrease maintenance time and frequency by 30%, helping you achieve a 40% OpEx cost reduction compared to a time-based maintenance strategy. In addition, it can help you avoid costly and disruptive emergency services since activities can be planned before failure occurs.

[4] https://reliabilityweb.com/articles/entry/reliability_centered_maintenance_report_by_f_stanley_nowlan_and_howard/

Maintenance savings in terms of lower duration and frequency thanks to predictive analysis.

Equipment	Maintenance	Time-based	Predictive
MV circuit breaker	Visual/Basic	2h every 3 years	1.4h every 4 years
	Advanced	2h every 5 years	1.4h every 6 years
MV switchgear	Visual	0.5h every 2 years	0.35h every 3 years
	Basic	0.75h every 5 years	0.5h every 6 years
	Advanced	2.5h every 10 years	1.75h every 13 years

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Source: based on ABB experience.

100% PREDICTION AVOID HIGH COSTLY UNPLANNED LABOR +

30% DECREASE MAINTENANCE TIME +

30% REDUCE MAINTENANCE FREQUENCY


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The benefits of predictive maintenance for electrical distribution assets

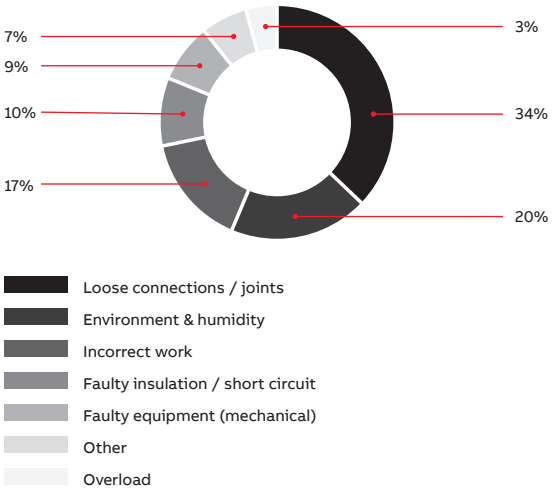
While most of electrical distribution assets have no moving parts, these devices are some of the most important and hardest-working assets in your facility. Extreme temperatures, rapidly fluctuating cycles of demand and exposure to humidity, salt, vibrations, corrosive elements and dirt can cause connections to loosen, creating a high resistance path that is responsible for more than 30% of electrical failures. If the wrong electrical asset goes down at the wrong time, it can bring your entire facility to a halt.

For example, inspections often require equipment shutdown, which can be difficult to schedule for a facility that runs 24 hours a day. Manual inspection of equipment can also be dangerous for workers who are exposed to accidental electrocution. And because many manual inspections involve writing down data on a chart, this paper-based process makes it time-consuming to digitize data, while also introducing the risk of errors due to illegible handwriting or faulty manual data entry into a spreadsheet, resulting in decisions being made on incorrect data.

Condition monitoring software, sensorization and IoT can help automate data collection by providing 24/7 continuous monitoring of equipment. Accurate digital data from every asset can be easily collected, stored, combined and analyzed without human intervention to give you a clear and complete understanding of your asset health, helping you accurately predict your maintenance requirements. Benefits include:

- **Achieve maintenance savings:** Avoid unnecessary inspections and replacement of still-useful components, which can reduce time spent per asset, unplanned emergency maintenance and operating expenses.
- **Avoid unexpected downtime:** Condition monitoring devices and sensors can track up to 70% of the most common failure causes, such as loose connections or joints, environmental conditions, faulty insulations and faulty mechanisms.
- **Improve safety:** Remote condition monitoring allows field service staff to evaluate electrical systems from a safe distance, helping avoid arc flash incidents that can cause injury or loss of production and equipment.
- **Extend the life of assets:** Most electrical equipment has a failure rate curve shaped like a bathtub, with the probability for failure increasing as it nears its average end of life. Condition monitoring and predictive analytics help detect possible wear out and abnormal conditions in advance so that mitigation can occur before a failure occurs, prolonging the asset's life.

Failure rate statistics of Industrial MV and LV electrical distribution. Source: based on ABB experience.



Manual (corrective or time based)	Automatic (condition monitoring)
Temperature power parts inpection (requires shutdown)	Continuous joints temperature monitoring (detect loose connections)
Environment assessment (might require shutdown)	Continuous environmental monitoring (temperature, humidity, etc)
Insulation inspection and tests (might require shutdown)	Continuous partial discharge monitoring (detect insulation degradation)
Circuit Breaker Periodical tests (requires shutdown)	Continuous electro-mechanical operations monitoring with protection relays

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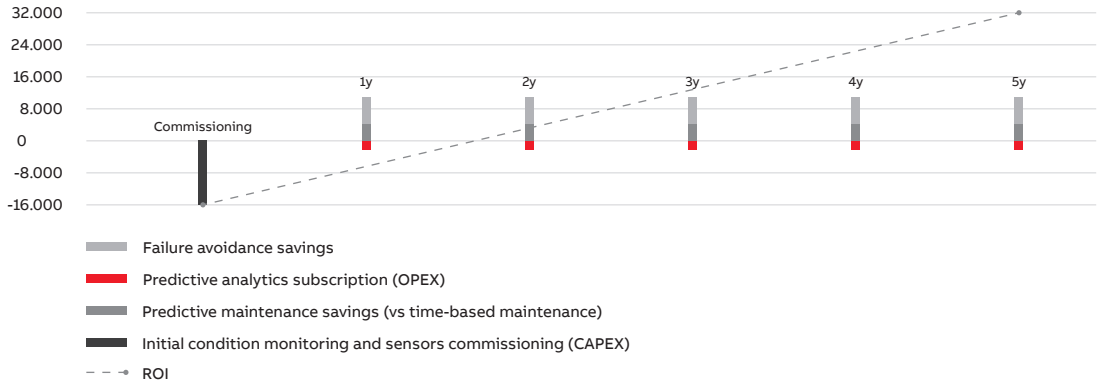
Source: based on ABB experience on industrial MV and LV electrical distribution

Making predictive maintenance pay

Of course, digitalization of existing equipment, like adding sensors and condition monitoring software, can come with its own costs. The correct selection of digital upgrading kits for legacy systems is key to making predictive-based maintenance sustainable.

That's why it's important to have a clear ROI target to determine if the costs are worth the benefits for your specific use cases and facility. It is here where a manufacturer's expertise, combined with your maintenance engineers' internal knowledge, can help you best determine your strategic approach to maintenance.

Example of predictive maintenance return on investment (1.6 years) for a medium voltage switchgear



For example, a clean and dry environment might not require environmental monitoring, but may require continuous thermal monitoring of the main joints using thermal cameras on live equipment to avoid expensive inspection. However, assets in another part of your facility may require partial discharge to monitor insulator reliability, as well as thermal and environmental monitoring. Rather than one-size-fits-all, you should seek to find an approach that is "one-size-fits-you."

The benefits of predictive maintenance for electrification distribution assets

In the past, conventional asset management solutions have faced a series of challenges:

- Large upfront investments, especially when digitizing existing brownfield assets
- Slow, complicated implementation processes
- Time-consuming training due to solution complexity
- Difficulty implementing and customizing predictive models
- A “run-to-failure” maintenance culture unused to the work process of predictive maintenance

These challenges can jeopardize or postpone the ROI of predictive maintenance, or even create a barrier to implementation. But with an Asset Performance Management as a Service (APMaaS) solution augmented by digital technologies such as sensorization, cloud connectivity and advanced analytics, you can immediately achieve valuable returns through reduced inspections, fewer emergency services and asset performance traceability.

Benefits of an APMaaS solution include:

- **Simplicity:** APMaaS solutions enable a pure IoT architecture that makes it simple to collect data from new and existing equipment, helping you eliminate time-consuming and error-prone manual data collection, or a complex and expensive revamping.
- **Flexibility:** These solutions can be implemented anywhere there is an internet connection, allowing asset managers to stay connected to their real-time asset performance no matter where they are.
- **Scalability:** Solutions can be implemented on a small-scale to cover your most pressing needs or greatest opportunities, and then scaled throughout the facility when additional features or coverage is required. For instance, maintenance management, energy management, and other powerful functions can be easily enabled and used.
- **Ease of implementation:** Edge/cloud solutions don’t require a server computer to install or run applications, making it simple to add new sensors as needed.
- **Cost savings:** Cloud-based solutions are charged as a subscription service, helping you avoid large upfront investments while ensuring you pay only for the solutions you actually use.

Asset performance management is easy to implement at just one site or across a multi-site environment. Your software will create a digital twin of physical assets that allow you to remotely dive into the details, while powerful analytics will provide easy-to-understand asset health information and actionable recommendations for recommended maintenance – no complex tools, software, or mathematical calculations required. In addition, the solution will provide a single source of truth for your assets, giving your entire staff equal access to asset conditions from the highest level down to the most minute detail.

Optimize your asset management with ABB

ABB's asset management solutions can help provide the insights you need to prevent critical asset failures while maximizing asset lifecycle costs for greenfield and brownfield applications.

Learn more about ABB Asset Performance Management.

As the most proven and efficient asset performance management solution available on the market, its speed of implementation and extensibility allow you to start lean, experiment and learn, and accelerate your organization's digital transition while savings are materialized.

ABB customer success story: Commercial Building

Thanks to cost-efficient and plug-and-play upgrade of installed low voltage circuit breakers through Ekip UP digital units, with embedded ABB Ability™ connectivity, customer is able to implement predictive maintenance and reduce routine maintenance costs using ABB Ability solutions for asset management.

ABB customer success story: Cement

The motor control center, heart of a complex process electrical system, has been equipped with state-of-the ABB Ability™ asset management solution condition monitoring solution. This is enabling customer to quicker troubleshooting, optimized operations while safeguarding process uptime.

ABB customer success story: Semiconductor manufacturer

With high requests of power availability, the customer equipped the new medium voltage switchgear with ABB smart breakers iVD4 12kV, which include temperature sensors, and a plug-and-play connectivity to Ability™. The ABB Ability™ solutions for asset management are increasing operation efficiency and prevent unexpected outage time.

ABB customer success story: Utility

A smart grid, for a utility, is not just efficient power flow monitoring, control and protection, but also an accurate and continuous evaluation of the assets condition to avoid unwanted power interruptions and expensive emergency and restoration services. Customer therefore adopted during a modernization journey ABB Ability™ solutions for asset management for their distribution substations, bringing truly digitalization at the grid.

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