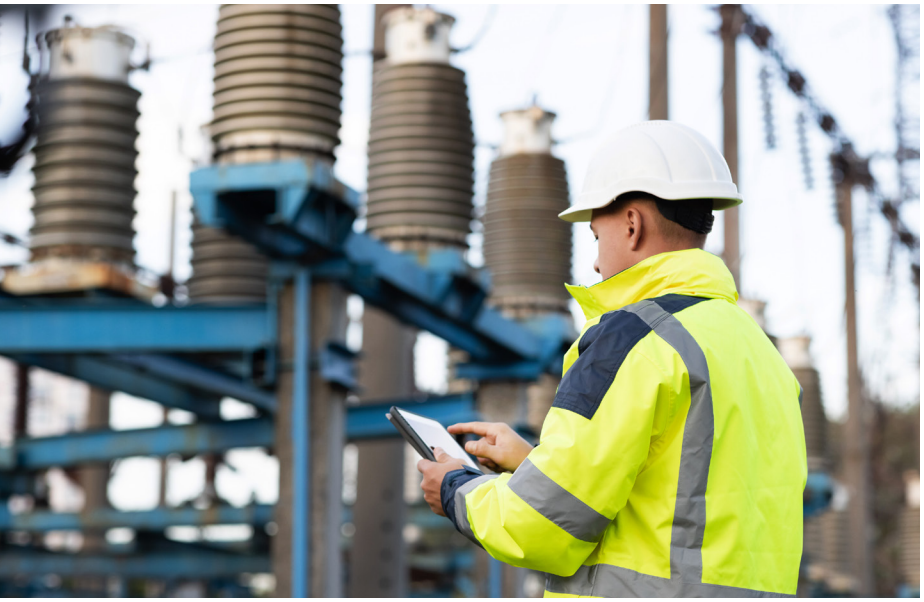
WHITEPAPER

Utilities digital transformation for smarter safety and workforce management



The need to dispatch crews to assess and correct problems is on the decline. Digitalization of grid assets provides operators and maintenance staff with a rich stream of data that's helping utilities operate far more efficiently and safely.

Utilities face many challenges today, including the ability to safely operate their power grids while managing changing workforce needs. Digital solutions provide the means to accomplish both of these critical objectives. It's no exaggeration that grid digitalization is changing the way utilities manage and maintain their distribution networks.

This paper will explore these three aspects of how digital technologies are enabling utilities to enhance safety for power consumers and utility employees while maximizing utility operational efficiency:

- Monitoring, to provide utility operators with valuable, actionable data regarding their grids
- Controlling, by enabling cloud-based technologies for remotely controlling assets
- Facilitating a more informed and proactive asset-management strategy

A final, overarching benefit of digitalization is that implementing any of the monitoring and control measures described in this paper lays the foundation for the inevitable transition to digital grids, future proofing your network.

Monitoring

What's happening across your grid at any given point in time? You have some systems in place to help answer that question, such as systems showing loads at various locations. Your network may also provide outage data, indicating which customers are without power. But you could know far more about what's happening across your grid by relying on a solid remote-monitoring system to obtain more detailed insights.

Today you can select digital components including breakers and reclosers that can provide you with status information of not just the overall grid, but of individual assets down to the pole level. Most current-generation power-distribution grid components include, or offer as an option, sensors

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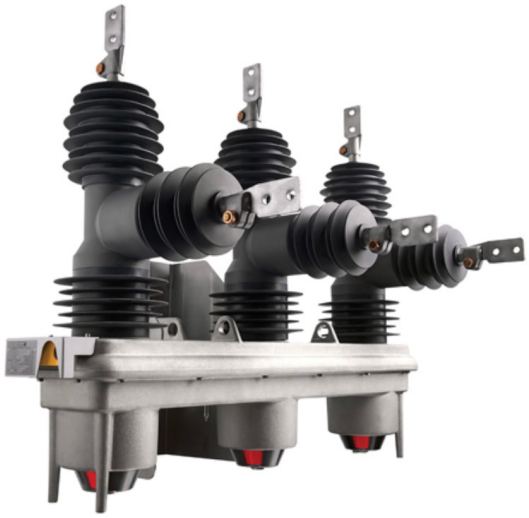
Digital components like the Elastimold™ Recloser from ABB are smart grid ready. When paired with microprocessor-based recloser control it can accurately detect a wide range of line disturbances and provides reliable, high-speed isolation for adverse conditions.

that can detect and report key operating parameters and network status, giving you a deeper reach into the status of your grid.

The sensors can also report on the condition or health of the component, calling attention to potential future problems. All grid components have an expected life, often determined by the number of ON/OFF or OPEN/CLOSE cycles they've experienced. Digital assets can report that information, providing advanced warning that a device is nearing the end of its expected life.

These assets can also report on their current status, which helps you understand what's happening in each section of the grid. Geographic patterns of tripped devices provide you with the ability to scope the severity and location of grid problems. You can also better determine whether it's a transitory event like a surge or an ongoing issue. Having this information will help you respond more quickly and correctly.

Some digital components include the ability to sense environmental variables like temperature and humidity. This data gives you a useful snapshot of conditions at locations across your grid. Some utilities take the data



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streams from these smart, digital assets and combine it using risk-assessment analytics with other relevant data like wind speeds and vegetation density. This enables grid operators to determine appropriate times and locations to implement public-safety power shutoffs, a capability that's been particularly useful in a number of western states.

The sensors needed to provide this data have been widely available for some time. Most current-generation assets offer this data-collection capability built in, whether as standard equipment or an optional feature. For older equipment, sensors can typically be added as bolt-on upgrades. Utilities can easily add these sensors even to their older assets to gain insight into grid status.

What was once missing, though, and is now widely available are the analytics needed to make sense of what is happening with your grid and provide you with smart guidance on how to respond. These analytics continue to advance, and the application of artificial intelligence will further elevate the utility of this grid data.

There are many approaches to getting sensor data to the operators who need it. For years, that communication was provided via physical networks over communication lines, and in some cases that remains the best approach. Cellular is increasingly being used by utilities, but it can be an expensive option and unavailable in some areas. Secure WiFi and Bluetooth can also be used, typically transmitting to a local hub that then relays the data to the operations center.

There is a communication solution that will make it possible for every utility to implement some level of data gathering from your sensor network. However, when exploring your digital assets and communication options, interconnectability is critical. To provide the greatest flexibility, both today and in the future, open-architecture devices that can be integrated with other

components regardless of the brand are the smart choice.

Whether due to aging equipment, natural disaster, an animal on the line, or a physical attack, problems will always occur. The ability to monitor your devices and grid will alert you to those problems in a literal instant.

Control and maintenance

Having asset- and grid-status data available to your operations and maintenance teams gives them a tremendously valuable tool that will help them perform their roles faster and more efficiently.

An asset-management system with predictive analytics can tell you when an issue is likely to occur and what will happen. Operators can rely on these analytics to identify anomalies in key grid or asset-operating parameters to call your attention to any worrisome conditions or trends. These alerts can be customized to provide a heads-up before the condition escalates to the point where an outage actually occurs. Instead of telling you, “This device just failed,” it can tell you, “There’s something going on here and you should probably look at it.”

Sensors can also give you insights to loads at various points of your grid, allowing you to respond appropriately. That may mean rebalancing power or, in more serious situations, selectively shutting down sections of the grid. Sensor data can help you decide how much and/or which part of the grid needs to be shut down. You can island the problem areas while maintaining service to more of your customers.

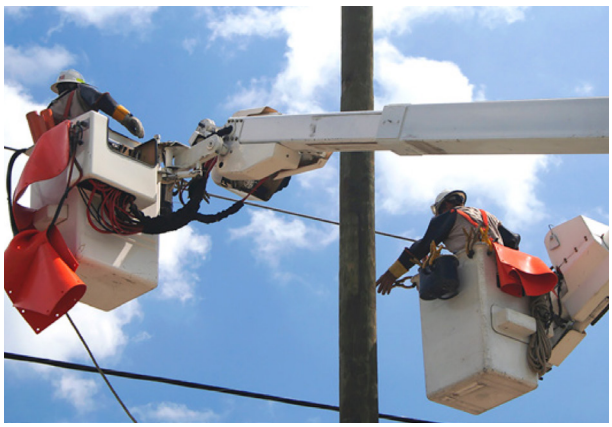
Alarms and alerts are transmitted the instant issues occur, a far more desirable situation than relying on customer phone calls or waiting for a crew to arrive at the scene and assess the situation. This enables a much faster response on your part, which can avoid having the situation escalate to an even larger issue.

Digital assets often incorporate remote-control capabilities that enable you to respond to the issue without rolling a truck, resolving it instead with a button push. The next-level automation that’s now increasingly available can even eliminate the need to push a button. Responses to routine faults can be automated, with no human intervention required.

Being able to take corrective action remotely improves safety for your maintenance team by eliminating instances where a crew must be dispatched to resolve the issue.

Digital-grid devices also provide the foundation for the shift to a far more efficient and safer approach to maintenance. Remote sensing and responsing to grid problems mean a significant reduction in crew dispatches, with an accompanying reduction in the number of potential injuries to crew members.

Data gathered from the various assets can be collected and analyzed to help identify troublesome devices or sections of the grid. This lets you focus your maintenance activities on the most critical issues, avoiding the often wasteful practice of routine maintenance. Instead of sending crews to maintain trouble-free assets, you can use a predictive maintenance approach to focus the crew’s attention on the most likely points of failure.



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A predictive-maintenance approach can reduce the amount of crews dispatched to maintain trouble-free assets during routine maintenance. Instead, focus their attention on the most critical issues.

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Modern asset hea;th systems like the ABB Ability™ Energy and Asset Manager provide utilities with detailed real time condition monitoring and support for predictive maintenance programs.

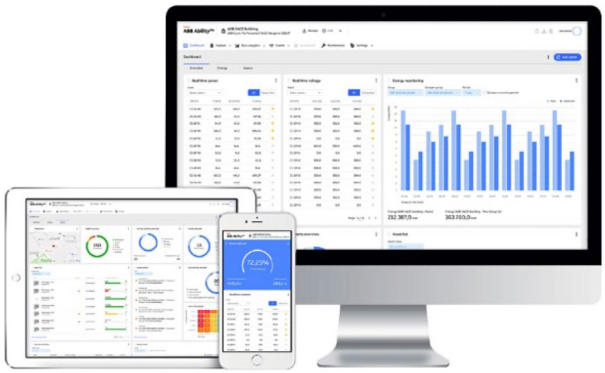
Asset management

As mentioned earlier, asset-health data make it possible for you to do a much better job of managing the lifecycle of your assets. Your network has hundreds, perhaps thousands, of breakers and other devices. Each device has an expected life, typically between 25 and 40 years. That means a 15-year time span when it might be appropriate to pull each of those devices from service.

Your distribution network is only as strong as its weakest link. But how do you know what those links are? Unfortunately, it can be difficult to assess the health of key assets throughout your network. Knowing the equipment age and service history is helpful, but that data doesn't always indicate an accurate picture of the asset's health, when it's likely to fail, and how and when to service it.

In most cases, devices are replaced when they fail or repeatedly create problems. That break/fix approach means that you respond to problems rather than prevent them. And those responses often require urgent attention.

A better approach is to collect asset operational and maintenance data, analyze the data to identify trends and potential issues, and then apply that knowledge to enable a more informed and proactive asset management strategy. You can know exactly how many cycles or events each device has experienced. Analytics can assess the condition of each breaker and let you know which ones truly need attention at this instant in time. Those replacements can be done on a routine, scheduled basis, rather than as an urgent repair. This represents a giant step beyond traditional preventive maintenance.



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Clear benefits for utilities

Utilities are, by nature, conservative in their adoption of new technology. Still, there is a clear and growing migration toward grid digitalization. The ability to remotely monitor device and grid status and remotely control devices enables enhanced grid operation, reduces issues and outages, and accelerates response time when problems arise.

And when grid issues are reduced, safety is improved for customers, for your crews, and for your assets. The ability to monitor and measure the performance of assets and systems, and take action in real time, opens up new possibilities to optimize safety, utilization, and resource efficiency.

Additionally, digitalization enables vastly improved asset lifecycle management, helping utilities maximize the uptime and longevity of the components that comprise their grids.

Sensors are relatively inexpensive options or add-ons, far less costly than the devices they protect. The ROI on digitalization is quick and impressive when you consider the cost and aggravation avoidance they provide. Still, considering all the potential points of failure in your grid that could benefit from sensors, it requires careful analysis to select where they can best be put to use.

The advantages of digital technology are compelling and increasing. Each utility needs to assess their operations to determine where digitalization can best be put to work to enhance your grid.

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