EC&M®

EXECUTIVE SUMMARY

Is Your Electrical Distribution System Smarter Than You?

Tommy Northcott, PE, CRL, CMRP, Senior Power Engineer and Branch Manager, Jacobs Technology Inc.
Mike Dutoit, Product Marketing Manager, Low Voltage Power & Insulated Case Circuit Breakers, ABB

SEPTEMBER 28, 2022

KEY TAKEAWAYS

- The electrical industry is moving away from centralized systems toward distributed distribution.
- Integrating smart technology into electrical distribution facilities yields significant benefits.
- Smart technology contains built-in knowledge gathering to support ROI business cases.
- ABB's smart technology reduces cost and improves the efficiency and safety of electrical distribution.

in partnership with

ABB

Is Your Electrical Distribution System Smarter Than You?

OVERVIEW

Traditional electrical distribution systems often rely on manual, on-site operation and local response in the event of abnormal conditions. As systems have advanced to include remote operation capabilities and safety improvements, these ever-evolving "smart" technologies have been integrated into distribution equipment such as lighting panels, power panels, motor control centers (MCCs), breakers, switches, and switchgear.

ABB designed and developed the SACE® Emax 2 and Tmax® XT low voltage power and molded case smart breakers to enable smart facility design and implementation. The circuit breaker lines are part of the ABB ReliaGear™ Smart Power Distribution platform for improved safety, efficiency, maintainability, reliability, and sustainability of distribution systems.

CONTEXT

Tommy Northcott explained electrical distribution trends and how smart technology in distribution facilities can lower cost, increase efficiency, and improve safety. Mike Dutoit shared information about ABB's smart breakers and how the "All-in-One" design supports smart facilities.

KEY TAKEAWAYS

The electrical industry is moving away from centralized systems toward distributed distribution.

While energy sources and the reach of electricity distribution have evolved over the years, major components of the distribution system have not experienced much radical design change. Traditionally, power transmission and distribution systems consist of large generation plants that use some form of fuel, coal, gas, nuclear, or hydro to generate electricity.

In a traditional system, a centralized point of generation is repeatedly split out into multiple circuits as the electricity moves closer to end users. However, since these systems are mostly passive, with limited means of communication between devices and little internal regulation, they are frequently labeled "dumb"—which is increasingly a disadvantage in an ever-advancing industry.

Figure 1: Traditional distribution system equipment

Although the traditional system is the primary standard of electrical generation and distribution around the world, distributed generation (or distributed distribution) leverages renewable resources, is smaller in scale, and is located on-site with the end user. These "micro grids" or "nano grids" are becoming increasingly popular due to the desire to be less dependent on a utility provider while minimizing carbon footprint.

Is Your Electrical Distribution System Smarter Than You?

Figure 2: Solar power is the most common source of distributed generation

Most distributed distribution facilities are also connected to the grid to ensure reliable access to electricity around the clock. However, distributed distribution systems can also be isolated and standalone or can work in tandem with the utility grid. Some are even integrated with other local systems in a collaborative manner, where the distributed distribution systems produce and consume collectively to make an overall group of interconnected micro grids more reliable.

Integrating smart technology into electrical distribution facilities yields significant benefits.

As traditional systems require more automation to maintain service and as distributed distribution systems continue to evolve into larger capacity and increased complexity, all systems need to become "smarter" to maintain high levels of reliability, sustainability, and safety.

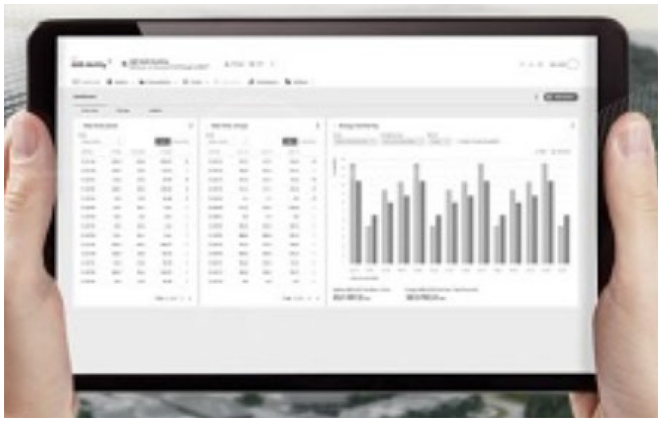
A foundational characteristic of a smart facility is the capability to monitor power usage and status or health of the system, at virtually any location on the electrical system, within the facility. Smart monitoring tools further enable the use of data in real time to find and even automatically correct inefficiencies in the system.

Smartphone technology, combined with the industrial Internet of Things (IoT), is fomenting evolutionary leaps in electrical distribution system capabilities. Smartphones are already capable of monitoring and controlling multiple systems and house a vast range of capabilities in a small package. Applying smart industrial IoT technology to distribution equipment means that a wide variety of data can be precisely collected, displayed, and analyzed, allowing facility managers to make proactive decisions or even program automated actions based on system variables.

In large facilities, remote capabilities enabled by smart devices provide both operational efficiencies and personnel safety benefits. In a traditional system, an operator has to be physically present at each device to operate or connect to it in order to monitor its status and health. However, in a smart facility equipped with sensors, smart relays, and other smart devices connected to the Internet of Things or the cloud, the system and associated data can be accessed and controlled remotely, at any time and from anywhere.

Is Your Electrical Distribution System Smarter Than You?

Figure 3: Smart devices allow access to monitoring and control operations from anywhere, anytime



Smart facilities are designed to integrate the electrical distribution system into the smart system to enable seemingly endless configurations that reduce cost, improve safety, minimize carbon footprint, and more. Examples of the multitude of possible applications include:

- **Remote access and control:** In a complex R&D test facility project, smart technology was incorporated into the facility design so the lead facility engineer was able to remotely configure and start up the test facility from a smartphone app before commuting to the facility. Upon arrival, the facility had already ramped up to the desired test conditions, maximizing test time during that shift. Smart facilities such as this also support lights-out operations to reduce staffing requirements or avoid personnel exposure to hazards.
- **Self-healing facilities:** With smart capability for automation and control built into the equipment, smart facilities can be programmed to be self-healing. Sensors can pinpoint the precise location of faults on a smart system, allowing the system to quickly determine which breakers to automatically open or close to isolate the fault while minimizing the outage impact. Systems can also determine whether there are alternate power sources that can be switched over, improving impact on uptime and facility efficiency, and reducing personnel exposure to potential hazards.
- **Using logic:** the ability to add logic functions to switchgear plays an important role in energy savings and sustainability. Equipment can be programmed to sense when renewable energy is available and switch appropriate loads to renewable sources, thus minimizing the use of traditional utility power.
- **Automating actions:** automatically de-energizing detected unused loads and/or areas of a facility reduces energy losses and reduces overall environmental impact. The same functionality can detect when loads are needed again and automatically restore power. Smart lighting and hazard minimization, both based on movement or RFID-enabled employee badges, help reduce cost and improve safety.
- **Taking advantage of connectivity:** next-generation breakers and switch gear offer Bluetooth connectivity, which allows electrical workers to stay outside of the arc flash boundary of electrical equipment while connecting to it with a smartphone to safely monitor real-time status, set parameters, and check measurements.

Figure 4: ABB arc-resistant switchgear

Is Your Electrical Distribution System Smarter Than You?

Smart technology can also be expanded for use with micro grids. Improved electrical energy storage technologies can allow end users to switch to stored energy from the micro grid during a utility's higher-cost peak hours, with additional savings from the option to charge the energy storage device with renewable resources. In a smart micro grid, the smart control system can learn power usage patterns, compare patterns against peak pricing schedules, and then control usage to minimize the cost of utility power and determine times when it is beneficial to use stored energy to power other needs.

> As renewable energy generation technologies continue to improve . . . smart technologies will need to be used to monitor in real time the available renewable energy capacity compared to the facility demands. . . . With the use of algorithms and machine learning technology, the smart grid can make power usage decisions based on peak hours, usage trends, and load shedding of inefficient loads to improve overall efficiencies and reduce utility bill overhead costs.
>
> *Tommy Northcott, Jacobs Technology Inc.*

Smart technology contains built-in knowledge gathering to support ROI business cases.

By design, smart technology tracks gained efficiencies and renewable energy use to assess ROI progress and aid in predictive maintenance improvements, which can drastically reduce the overall cost of electrical maintenance programs.

With the built-in data tracking capability of smart technology, facility managers can streamline their facility power system operations to minimize their overall operating costs, as the asset health monitoring feature in many smart devices aids in planning maintenance tasks based on actual equipment health needs, rather than time-based frequency. Smart systems also contribute to improved personnel safety by allowing for more remote monitoring and operations, which drastically reduces personnel exposure to electrical hazards.

Every facility will have unique priorities that drive which smart capabilities are most beneficial, but the flexibility and possibilities enabled by smart technology is reshaping the electrical industry. Further, the addition of smart technologies is not limited to new projects or facilities. Many options can be retrofitted into existing systems and equipment to incrementally make improvements, and are modular to accommodate future changes.

ABB's smart technology reduces cost and improves the efficiency and safety of electrical distribution.

ABB ReliaGear Smart Power Distribution is an innovative cloud computing platform designed to monitor, optimize, and control the electrical distribution system. As part of the ReliaGear family, the SACE Emax 2 and Tmax XT low voltage power and molded case circuit breaker lines were designed and engineered around the "All-in-One" innovation concept, embedding protection, measurement, logics, and connectivity within the design of the breaker, rather than relying on additional external components.

ABB's smart breakers reduce the need for complex PLC programming by adding the ability to embed logic and perform custom logic by combining information obtained from the circuit breaker with programmable inputs and outputs. This capability also ensures continuous power and system operation.

Is Your Electrical Distribution System Smarter Than You?

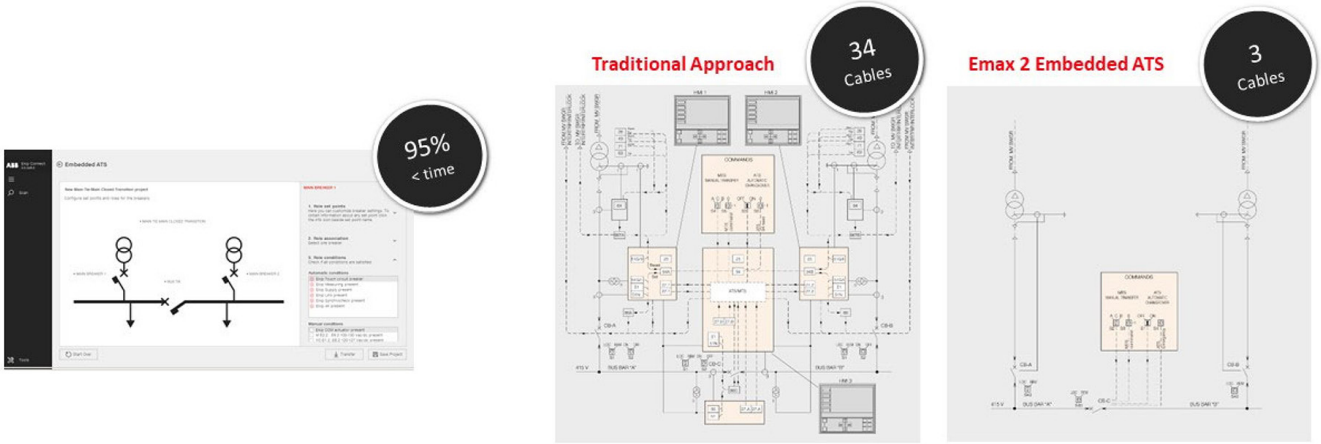
The ABB Ekip Touch Trip Units are the brains of the circuit breakers. The Ekip units utilize an industrial-grade touchscreen HMI for easy navigation and are offered in different versions to meet the needs of various applications. The platform is designed to evolve over its lifecycle, facilitating upgrades through downloadable digital packages without replacing trip units or purchasing additional hardware.

ABB breakers are easy to integrate into automation and energy management systems by providing high-accuracy measurements and three levels of connectivity to share critical data from ABB breakers to the facility system, including:

- **Bluetooth local connection.** When securely paired with the ABB Epic app, users have a smart and intuitive way to install, commission, and access independent data from the circuit breaker while being safely away from the front of the equipment using their mobile device.
- **Native communication protocols** for remote supervision and control, utilizing dedicated plug-and-play modules without the need for additional converters. ABB supports using two different protocols simultaneously, or redundancy of a single protocol. The Emax 2 and Tmax XT families share a single register mapping for each protocol to simplify integration into a supervisory system.
- **Cloud connectivity.** ABB Ability™ Energy and Asset manager is a cloud-based platform for monitoring and managing facilities' electrical distribution systems from anywhere and provides key data to analyze and optimize energy usage.

ABB's embedded ATS solution simplifies the design of a traditional ATS system from approximately 34 cables to only three cables, reducing engineering time and points of failure that come with complex ATS schemes, without compromising service continuity for critical power applications.

Figure 5: SACE Emax 2 and Tmax XT embedded ATS solution improves efficiency and reduce cost



Is Your Electrical Distribution System Smarter Than You?

ADDITIONAL INFORMATION

To learn more, visit https://electrification.us.abb.com

BIOGRAPHIES

Tommy Northcott, PE, CRL, CMRP

Senior Power Engineer and Branch Manager, Jacobs Technology Inc.

Tommy serves as a senior power engineer and branch manager for Jacobs Technology Inc. With almost 20 years in the electrical industry as an electrical engineer, project manager, arc flash program manager, electrical safety trainer, and utility manager, he brings a broad range of experience into his passion toward electrical safety. As a Certified Reliability Leader and Certified Maintenance and Reliability Professional, he also has a clear vision on how maintenance of electrical equipment has a direct impact on personnel safety.

Tommy has a B.S. in electrical engineering and is a licensed professional engineer in two states. He is also a principal committee member on the NFPA 70B Committee for Recommended Practice for Electrical Equipment Maintenance. He currently lives in Tennessee with his wife of 20 years and four children.

Mike Dutoit

Product Marketing Manager, Low Voltage Power & Insulated Case Circuit Breakers, ABB

Mike is the U.S. product marketing manager for low voltage power & insulated case circuit breakers at ABB Electrification - Smart Power Division, a global leader in electrical products and solutions operating in over 100 countries. With over 15 years of experience in the electrical industry and 10 years with ABB, and passion for advanced circuit breaker technology, Mike is responsible for the overall product strategy, positioning, and commercialization for the United States. Mike resides in Memphis, Tennessee with his wife and two dogs.