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## **ABB solutions for rural electric cooperatives**

Supporting the utilities that power their communities





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# **Rural electric co-ops and ABB**

## **Together, creating a stronger, smarter and greener grid**



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## A responsibility beyond reliable power

Every utility has a responsibility to provide reliable power to its customers. As a rural electric co-op, you work to even higher standards.

You don't just provide electricity to your customers. You are much more closely integrated and engaged with your communities and your members. They look to you as their partner, and rely on you as their source for safe, reliable, and affordable electric power.

Through your active engagement with, and support of, the communities where you operate, you drive improvements in quality of life and elevate the prospects for economic growth. Providing reliable and efficient electric power is essential to meet their needs today. Your continued investment in grid modernization and service enhancements strengthens your ability to sustain and build community vitality in the years to come.

With 125 years of experience in the power industry, ABB has the applications, products, and expertise to help you meet your customers' expectations. While we are a global organization, we connect locally with our customers through plants, offices, and over 10,000 employees located in communities across the U.S. We work with local power providers to help them develop new electric power resources and enhance existing operations.

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850 electric co-ops across the U.S. provide electricity to 42 million people in 47 states.



# Essential solutions for rural electric co-ops

With over 132,000 employees and operations in more than 100 countries, it's not surprising ABB offers customers an impressive product portfolio. ABB offers a range of applications that extend from source to socket. At every point in the flow of electric power, from generation to transmission and distribution, you will find ABB technology.

Through our ABB Ability™ platform, we provide a unified, digital capability extending from device to edge to cloud. ABB Ability connects devices, systems, solutions, and services to enable customers to know more, do more, do better, together.



**Integration of distributed generation** Successfully integrate new energy sources into your distribution network



**Transformer maintenance** Improve reliability and extend critical asset life



**Physical | Cyber security** Build a better-protected and more resilient distribution network



**Fault detection, isolation and restoration (FDIR)** Reduce customer outage instances and duration



**Storm recovery & planning** Withstand storms better and restore power more quickly



**Volt-VAR optimization** Increase distribution efficiency and power quality



**Substation digitalization** Enhance control, optimize operation, and increase reliability



**Communications** Share data and connect critical assets throughout your system



**Asset management** Prevent asset failures and extend equipment life



**Microgrids / Energy storage** Ensure availability of power when you need it



**Service & consulting** Guide intelligent design and prolong asset life





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## Integration of distributed generation

Successfully integrate new energy sources into your distribution network



Even if you do not generate any renewable energy, you will almost certainly be expected to add it to your network. Driven by consumer demand, requirements from regulators, or the desire to shift to a greener power portfolio, every utility is wrestling with how best to integrate distributed energy resources with their traditional generation. Whether carried great distances from remote resources or from local rooftop solar panels, renewable energy is part of your future. For most co-ops, it's not a matter of if, but of how, they will add renewables.

Driven by this growing pressure, the required technology has become both more advanced and affordable. New approaches like energy storage make it possible to better manage the uneven and unpredictable availability of solar and wind power. Advanced analytics enable better projections of both the need for, and availability of, distributed energy sources. Wide variations of power quality can more effectively be eliminated.

ABB has been a leader in bringing more renewables online and making that power available to utility customers. You will find our technology at work in massive offshore wind farms, as well as in small, remote communities that are turning to renewables to reduce the cost and environmental damage of their diesel-fired generators.

ABB helps overcome the unpredictability of renewable resources with technology that includes our PowerStore™, a flywheel-based technology that provides grid stabilization, as well as other energy storage and microgrid options. Voltage and power quality issues can be resolved with compensating technologies such as smart inverters, STATCOMs, battery energy storage and advanced communication, and controls. These solutions yield additional benefits across the system. We lead in the technology used to manage, store, and distribute renewable energy.

# Transformer maintenance

## Improve reliability & extend critical asset life



The keystone assets in every power distribution network are the transformers. Their reliability is legendary. Many transformers now in service continue to operate long after their predicted design life. Still, their criticality makes it essential to monitor transformer health and respond to potential issues, preferably while they are still minor and readily corrected.

The size and complexity of transformers, coupled with the relatively infrequent need to service them, make it unlikely that most co-ops have the on-staff expertise needed.

Transformer owners can collect a wealth of asset health data that will enable them to identify potential issues long before performance is affected.

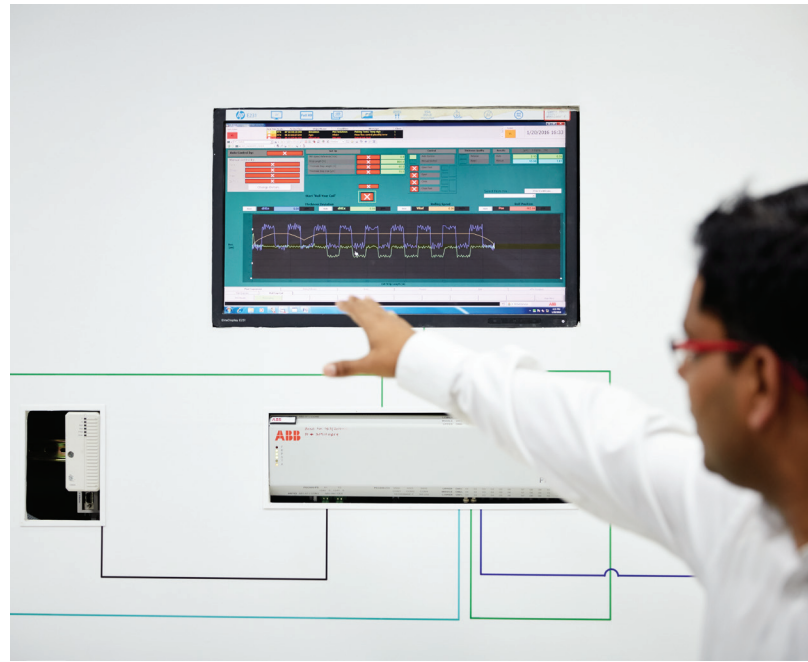
The ABB CoreSense sensor monitors moisture and specific gasses in transformer coolant oil, two highly reliable indications of transformer health. Data from CoreSense and other sources can be passed to the ABB Asset Health Center, which can predict and prevent failures with proactive health and performance insights.

When service or upgrades are required, utility managers can rely on ABB to dispatch experienced technicians to the site. With more transformers installed around the world than any other supplier, ABB offers unmatched transformer service capabilities. ABB provides services throughout the transformer life cycle for all brands and kinds of transformers. We have technical information for more than 30 legacy brands.

In the face of financial constraints and reduced maintenance budgets, ABB helps maximize your ROI by ensuring high reliability, reduced life cycle costs, and optimized performance.







## Physical & cyber security

Build a better-protected & more resilient distribution network



The essential role electric power plays in the lives of your community members makes you a prime target for sabotage and attacks. In addition to physical assaults, you also face several increasingly dangerous new threats, including cyber attacks.

ABB advises – and helps co-ops implement – a layered, five-step approach to enhancing physical security:

- **Assessment** – Assess substation and asset vulnerability to attacks
- **Hardening** – Strengthen transformers and power equipment with technology like AssetShield ballistic protection and dry bushings
- **Monitoring** – Detect power disruptions in real time
- **Rapid repair** – Quickly restore transformers and critical substation equipment
- **Rapid replacement** – Minimize delay in replacing damaged assets with shared transformer stockpiles and smaller, modular designs that are easier to transport

In our increasingly connected world, cyber attacks offer the more sophisticated assailant an even greater opportunity to disrupt power and the lives of your customers. The digitalization of utility assets promises levels of automation, ease of operation and speed of response unattainable in an analog environment. But the networks that connect these assets must be protected.

ABB provides that protection, in part, through our Enterprise Software, which includes cyber security services designed to prevent, detect, deter, and respond to sophisticated cyber security attackers.

Utilities don't have to forfeit safety, value or control in order to realize the benefits of digitalization. ABB Ability™ closes the loop between these needs with an innovative, multi-layered approach to data security.

# Fault detection, isolation & restoration (FDIR)

## Reduce customer outage frequency & duration



Utilities constantly strive for, and are achieving, ever-higher levels of reliability. Still, no asset or network is immune to faults. Whether due to aging equipment, natural disaster, simply an animal on the line, or terrorist attack, faults will always occur. A key metric related to quality of utility service is the speed at which those faults are identified and cleared. The metric is especially important to co-ops, since 90% of all outages occur at the distribution level where they operate.

Until recently, utilities relied on customer phone calls and repair crew reports to identify the location and scope of outages. Isolating the outage and restoring power was largely a manual operation. Today, smarter devices – from meters at the customers' premises, to the switches and reclosers on poles, and to breakers and

transformers in the substations – are supporting dramatically shorter restoration times.

These devices can report the precise location of the outage and take independent action to correct the fault or route power around it. At the substation level, they work together following programmed responses to minimize the outage. At the highest levels of integration, all that data rolls up to the control room for a coordinated, optimal response that will improve your CAIDI/SAIDI metrics and save money from costly fines.

There's nothing more important to your customers than uninterrupted service and quick recovery from outages. FDIR systems can help you create a more resilient, self-healing network that minimizes outage frequency and duration.

Three levels of FDIR			
Peer-to-Peer FDIR	Description	Benefits	Required equipment
	A group of reclosers, load break switches, and high voltage circuit breakers operate together to restore power in the most optimal manner.	<ul style="list-style-type: none"> <li>- Focus investments on feeders that experience the most outages</li> <li>- Fast implementation</li> <li>- Initial low capital investment</li> <li>- Popular for a pilot project</li> <li>- Improves SAIDI and CAIDI scores</li> </ul>	<ul style="list-style-type: none"> <li>- Reclosers</li> <li>- Load break switches</li> <li>- Two-way communications</li> <li>- Circuit breakers</li> </ul>
Substation FDIR			
	Coordinated control between groups of reclosers, load break switches, and high voltage circuit breakers within a substation and with adjacent substations.	<ul style="list-style-type: none"> <li>- Avoids overloading adjacent substations</li> <li>- Reduces engineering support and recurring costs</li> <li>- Popular for pilot programs</li> <li>- Target solution appropriate for problem feeders</li> <li>- Supports future communications investments for applications such as Asset Health and Volt-VAR Control</li> <li>- Realize benefits on groups of substations and the feeders you control</li> <li>- Increases improvement in SAIDI and CAIDI scores</li> </ul>	<ul style="list-style-type: none"> <li>- Reclosers</li> <li>- Load break switches</li> <li>- Gateway/RTU</li> <li>- Motor automated switches</li> <li>- Circuit breakers</li> <li>- Fault current indicators</li> <li>- Two-way communications</li> </ul>
Centralized FDIR			
	Coordinated control between groups of reclosers, load break switches, and high voltage circuit breakers across the distribution grid.	<ul style="list-style-type: none"> <li>- Takes advantage of load profile forecasting</li> <li>- A proactive approach to power management</li> <li>- Highest level of worker safety</li> <li>- Supports smart grid initiatives</li> <li>- Realize benefits across the grid</li> <li>- Maximum improvement in SAIDI and CAIDI scores</li> </ul>	<ul style="list-style-type: none"> <li>- Reclosers</li> <li>- Load break switches</li> <li>- Gateway/RTU</li> <li>- Motor automated switches</li> <li>- Circuit breakers</li> <li>- Fault current indicators</li> <li>- Two-way communications</li> <li>- DMS</li> </ul>





## Storm recovery & planning

Withstand storms better & restore power more quickly



Severe weather is the leading cause of outages in the U.S. and costs the economy billions of dollars a year. By one estimate, the number of severe weather events is five times greater than in 1970, a trend that is expected to continue.

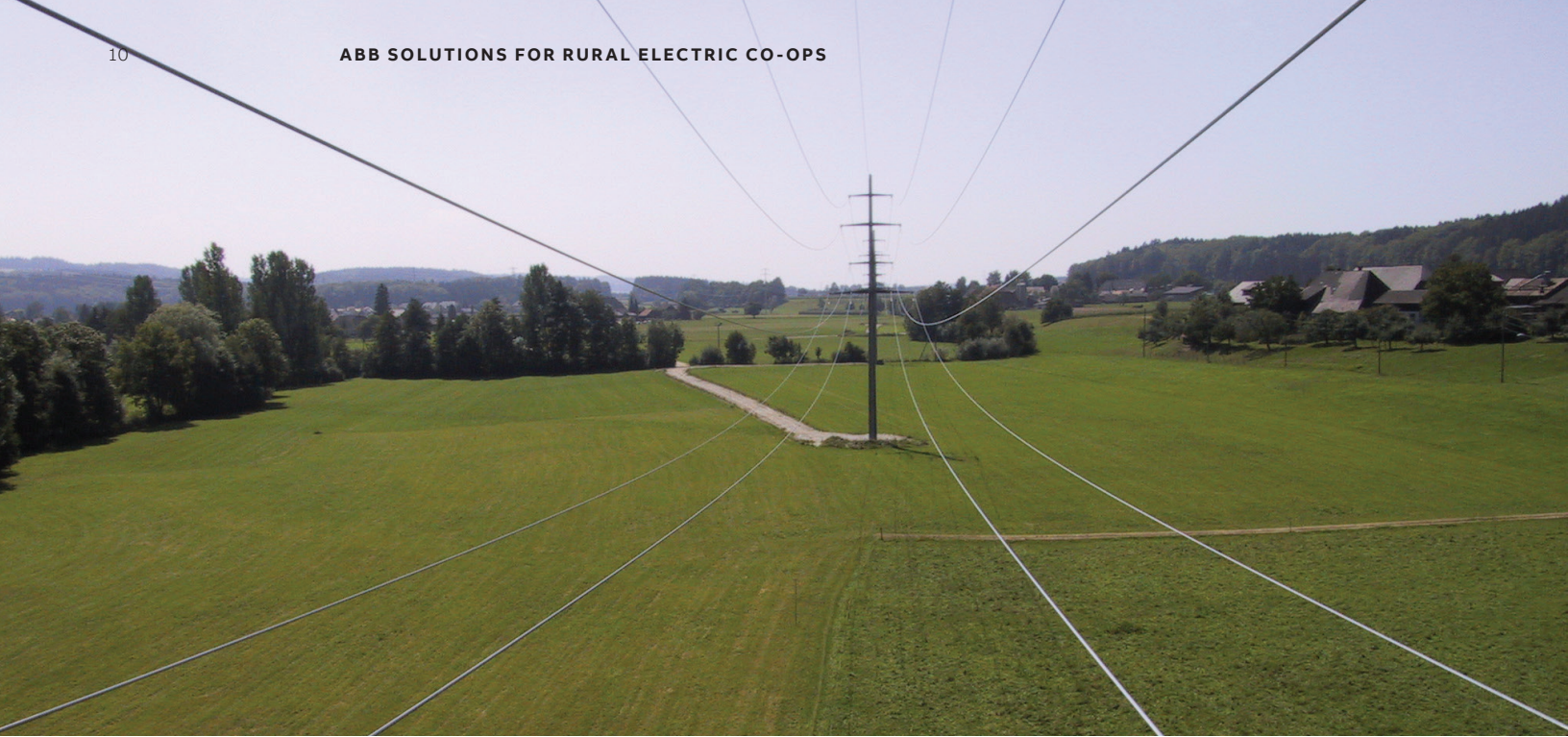
ABB helps utilities build more resiliency into their assets and networks, strengthen their ability to resist storm damage, and deploy technology and systems to restore power more quickly.

ABB advises a multi-step strategy utilities can use to anticipate, mitigate, and recover from major storm events faster. From grid hardening to mobile and outage management solutions, ABB's technology, automation, and strategic rapid repair and recovery strategies can lead to more reliable systems and improved customer satisfaction.

More-efficient storm response and restoration management can be achieved through ABB's highly capable outage-management systems. They collect and analyze accurate outage data that enables more effective dispatch and management of repair crews, and keeps your customers informed of their restoration status.

ABB also provides restoration support through our storm response teams of experienced engineers, technicians, and factory personnel. As the OEM for ABB, ITE, ASEA, Westinghouse, BBC and other brands, we have the required drawings, parts and replacements to quickly return damaged assets to full operating condition.





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## Volt-VAr optimization

### Increase distribution efficiency & power quality



Many people are under the incorrect impression that Volt-VAr optimization (VVO) is a concern related only to utilities involved in generation and transmission. In fact, it's a vital issue to co-ops that are engaged exclusively or primarily in distribution.

VVO is essential to maintain grid stability, but it also offers an opportunity for utilities to measurably increase distribution efficiency, and therefore reduce power costs, through better power management and line-loss reduction. Also important is improved power quality. Deployment of VVO systems also enhances operational effectiveness by providing visibility into system performance regarding asset health, power quality and efficiency.

ABB offers utilities options to deploy VVO at three layers of control, with solutions for power providers of all sizes. At the device level, it's

possible to manually or remotely control capacitors using settings based on historic metrics of customer power usage. With the addition of communications between devices and the substation, it's possible to coordinate and control local capacitors, voltage regulators, and load tap changers in real time. By overlaying network management software and an impedance model of the distribution system, you can optimize energy loss reduction at the network level.

VVO helps reduce wholesale power cost through better management of usage peaks, keeping customers' power costs lower. By optimizing power distribution and usage, VVO helps you delay capacity expansion of substations and feeders. And all of these solutions integrate with your other systems – SCADA, AMI, GIS, DMS – creating an integrated, network-wide monitoring and control architecture.



# Substation digitalization

## Enhance control, optimize operation & increase reliability



The vital organs of your power distribution network are the substations. Enhancements made to substation functionality and capability ripple throughout the network in the form of increased efficiency and reliability. ABB helps utilities take a dramatic leap forward in substation technology.

The digitalization of substations centers on replacing copper-based analog process control with digital data carried via fiber-optic cables, achieving interoperability from the process bus to the station level. Eliminating most of the copper wire and relying on digital data reduces both safety risks to your technicians and most service issues related to troublesome physical connections.

One advanced ABB technology supporting substation digitalization is the ABB fiber-optic current sensor or FOCS. It replaces traditional current transformers with safer and significantly more accurate sensors.

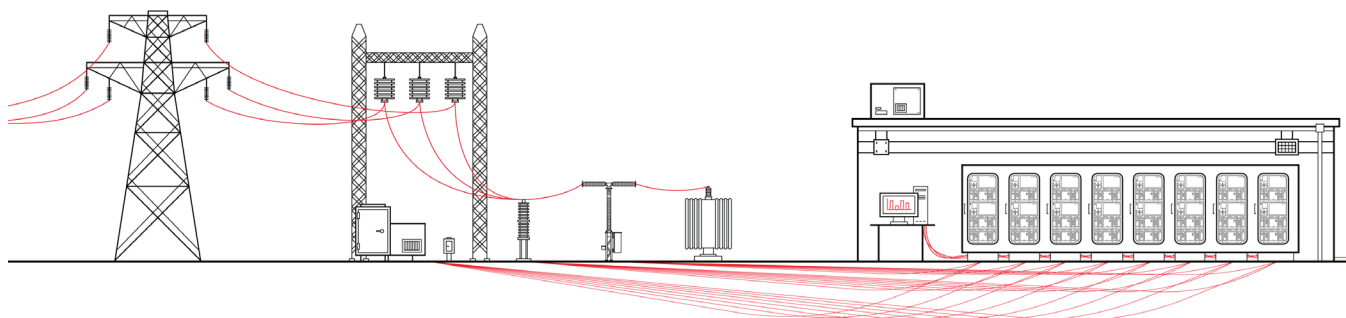
Key benefits of substation digitalization include:

- Reduce maintenance
- Identify issues earlier
- Extend asset life
- Reduce environmental footprint
- Reduce downtime
- Improve worker safety
- Shrink physical footprint

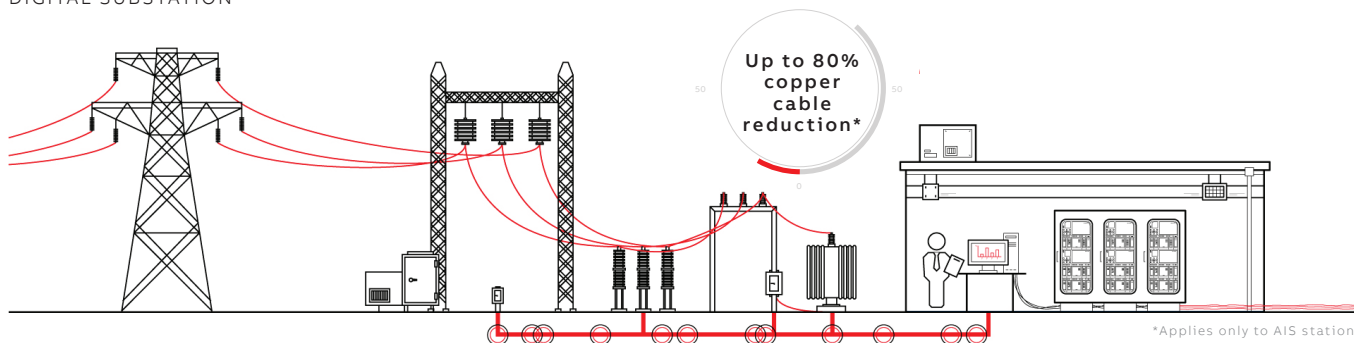
The digital substation perfectly illustrates ABB Ability™, our capability to connect devices, systems, solutions, and services.

### Digital substations reduce cabling, require less space and increase safety

#### CONVENTIONAL SUBSTATION



#### DIGITAL SUBSTATION



\*Applies only to AIS stations

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# Communications

## Share data & connect critical assets



Much has been written about The Internet of Things (IoT), interconnecting smart devices to collect data and respond in ways that automate and enhance activities, both in residential and commercial settings.

While individual smart devices create incremental improvements, it's only through the interconnection of the individual devices via robust communication networks that the enormous potential of IoT can be realized. Many of those networks rely on ABB's broad range of wireless communication technology.

ABB communication technology provides the foundation for operational optimization and a smarter grid. Remote sensing gives operators a real-time view of network function and status, with the ability to remotely control assets.

At the network level, a capable communication network enables deployment of asset health

monitoring, outage management, and other performance-enhancing systems.

Reliable wireless communication networks from ABB enable valuable new applications such as automated metering infrastructure, feeder automation, outage management, automatic load shedding and the ability to manage alternative energy sources.

These communication networks also provide the needed foundation to deploy mobile workforce applications for your employees in the field.

As of last year, the IoT included about 6.4 billion connected "things," a number that is expected to grow to more than 20 billion by 2020. In an increasingly connected environment, with a growing number of smart devices in your substations and at your customer sites, capable communication systems are an essential element.







# Asset management

## Prevent asset failures & extend asset life



Your distribution network is only as strong as its weakest link. 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.

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. ABB's Enterprise Software options include several tools to help utilities better manage assets.

Ellipse is an enterprise work and asset management tool that enhances work, supply chain, and people management, with mobile capabilities to support your team regardless of

where they are. It documents all work performed on each asset, providing valuable historical data.

ABB's Asset Health Center is a predictive analytics solution that helps identify when service, repair, or replacement of an asset is appropriate, and prioritizes asset-maintenance requirements based on severity of the issue and criticality of the asset.

The ABB Ability Connected Asset Lifecycle Management platform integrates your various management systems to provide one true view of your network. Utilities can implement a complete management system, but the modular, interoperable design of our tools allows you to select only the applications you need today, and later expand them to larger, more capable systems.

With deeper knowledge and insights into your operations, utility managers can extend asset life, and maximize efficiency of both power distribution and maintenance services.





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## Microgrids & energy storage

Ensure availability of power when you need it



Microgrids are being put to good use in a variety of applications. Many of them are in the most remote parts of our country where connections to the grid can be unreliable or unavailable. The term “microgrid” is perhaps most apt in these locations where the consumers rely on a self-contained, but much smaller, version of the larger grid.

But microgrids are also applicable in regions and communities that rely on the traditional grid. Rather than acting as the primary or sole source of power, these rural microgrids primarily ensure uninterrupted power in the event of a network-level disruption.

Redundant distribution, automated switches, distributed generation, energy storage, and grid stabilization technologies enable the microgrid to isolate itself when necessary, with little or no disruption to customers. In addition to the reliability and independence benefits, microgrids can also increase efficiency by locating generation close to consumption, and reducing electric line losses and costs associated with transmission.

Energy storage is a key element of many microgrids or can be used as a stand-alone solution. ABB offers turnkey energy-storage systems that help maintain grid stability and ensure a reliable and high-quality energy supply.



## Service & consulting

# Guide intelligent design & prolong asset life



Much of your network's performance is determined before the assets are even commissioned. It's essential to understand the condition and capability of your current network, the needs and expectations of your customers, and relevant regulatory considerations. Only with that information can you pursue additions or enhancements with confidence of realizing a strong ROI.

We partner with utilities at every stage of their projects, but provide the greatest benefit when given the opportunity to participate in the early planning stages. Utilities rely on ABB's diverse knowledge, with expertise that extends beyond engineering, to ensure that their power projects are considered from all relevant perspectives. Our simulation expertise, using both commonly used and specialized software, lets us fine tune power-system designs and model both economic and financial aspects of the project.

Most distribution equipment is highly reliable, but every piece of equipment requires service throughout its operational life. Utilities are challenged to provide that service due to the lack of new, skilled technicians combined with the continuing drain of veteran talent through retirements. Compounding this shortage is the increased sophistication of new distribution equipment.

For service needs beyond what your in-house team can meet, utilities rely on ABB. Whether it's simple on-call technical expertise, full-time onsite maintenance teams, or always available remote asset health monitoring and service support, ABB has the skilled technicians and technology needed to support our customers.

ABB helps our rural electric co-op customers increase system reliability, improve safety, reduce risks and extend equipment life by using technology, data, asset health care, and enabling predictive and condition based maintenance.



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# Helping rural electric co-ops succeed

## **Alaska utility reduces renewable energy variability**

Chugach Electric Association (CEA), a co-op serving nearly 70,000 customers in Alaska, relied on relatively clean natural gas for over 80% of its generation. But, as part of its commitment to be a leader in long-term, sustainable energy production for Alaskans, the co-op set out to achieve the goal of 100% reliance on renewables.

While 11% of their current generation is hydro, most new renewable resources would consist of less-predictable wind and solar generation. With those forms of power comes considerable variability, a problem that CEA turned to ABB for help in overcoming.

One piece of the solution was a pair of ABB PowerStore™ units. These grid-stabilizing generators combine the inertial properties of a flywheel, power management functions of advanced inverters, and control software. The success of the first two units in stabilizing power variability encouraged CEA to order additional units.

## **Major co-op protects transformers from gunfire**

One of the largest power co-ops in the country, wanted to reduce the vulnerability of their new transformers to damage from firearms. Because of their rural setting, the transformers were at an especially high risk of being damaged by gunfire.

ABB helped them by providing a trio of power transformers equipped with ABB's AssetShield ballistic protection system. AssetShield is an impact- and fragmentation-protective system for substation equipment such as transformers, switchgear, circuit breakers, and capacitors. It reduces the kinetic energy of the bullets and reduces spalling after impact.

Regulatory bodies are developing new standards to ensure a more-durable and resilient grid. The North American Electric Reliability Corporation (NERC) recently issued a first draft of a standard for physical security measures (CIP-014-1) that requires electric utilities to identify and protect critical substations within their system, directly addressing critical equipment security such as these large power transformers. AssetShield provides an important part of this protection.

## **Muni remotely monitors transformer health**

A municipal power provider was looking for solutions to improve its transformer fleet's reliability and predictability. It also wanted to implement condition based maintenance, including the ability to perform automated transformer fleet condition assessments. The utility operators had no experience with transformer sensors or monitoring devices, and were keen to learn more about ABB's hydrogen and moisture sensors, and the full support of ABB experts.





ABB Transformer Repair and Engineering Services (TRES) prepared a pilot project where two critical substation transformers were equipped with CoreSense monitors to collect real-time data for Asset Health Transformers (AHT) performance models. ABB also provided one-year of engineering support.

Utility operators are now able to monitor the health of the transformers remotely. The AHT system provides alerts for any emerging health issues, and generates notifications to dispatch technicians to investigate the causes. For more complex or serious issues, they turn to the on-call engineering support from ABB experts for help. The combination of ABB asset health technology with remote support will increase uptime, provide more reliable power distribution, and reduced overall maintenance costs.

#### **Chattanooga recovers more quickly from storms**

Chattanooga, Tennessee's Electric Power Board (EPB) serves 170,000 homes and businesses in its 600 square mile area. According to EPB, power outages cost the community \$100 million per year. They wanted to reduce those costs and enhance service to their members.

To speed restoration and reduce costs, EPB created a smarter grid by installing automated fault isolation and services-restoration technology. Rather than relying on phone calls from members to identify the location and scale of issues, EPB added smart meters at customer locations as well as automated feeder switching.

EPB's new system was tested in a July 2012 wind storm. While 30,000 customers lost power, EPB estimated that their network automation kept the lights on for another 50,000 customers who would otherwise have lost power. Network data enabled a smarter response to the outages that occurred, easily identifying the fault location by looking at which switches had been closed. They avoided approximately 500 truck rolls and reduced total restoration time by 1.5 days.

#### **Enhanced communication network enables smart meters in Memphis**

Memphis Light, Gas and Water's (MLGW) roots may reach back to just after the Civil War, but today MLGW, the country's largest three-service municipal utility with nearly 421,000 customers,

has its eyes on the future. The utility launched an initiative to begin replacing its analog meters with smart meters. As part of the rollout, MLGW needed a communications network to transmit usage data to their offices.




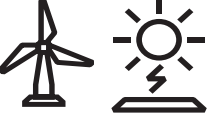

ABB was selected to provide wireless network products and services to support their deployment of smart meters across the city. The network ultimately will support advanced metering infrastructure (AMI) communications, covering an area of around 2030 square kilometers and collecting data from nearly one million smart meters. It will enable real-time monitoring of the power distribution system and support the development of a smarter grid.

The smart meter deployment, and expansion of the supporting communication network are ongoing efforts. As more meters come online, MLGW expects to see improved efficiency of electricity, water and gas supplies, while mitigating loss and theft. One consumer benefit is availability of instant-on, pre-paid service transfer, and service restoration after an outage. The project is a solid example of how ABB facilitates increased automation of power networks to enable a smarter grid.





MLGW



# Our portfolio of products & services for rural electric cooperatives

	Category	Offering	Description
	ABB Ability™ digital offerings	Connected asset lifecycle management	Increase asset life by 3 years, save up to 15% in operation & maintenance and reduce overtime costs by 2%.
		Distributed energy resource management	Improve power reliability and ensure safe, secure and efficient operation of the electric distribution network.
		Digital substations	Digitalization and ABB's deep knowledge of power transmission are coming together to improve the integrity of the electrical grid.
	Grid automation	Communication networks	ABB broadband wireless network solutions enable a wide range of smart grid applications for electric grids, as well as significant cost savings.
		Enterprise Software	Across solutions for asset optimization and management, workforce and plant operations management, real-time operations and control and energy portfolio planning and management, ABB helps utilities increase reliability, ensure safety, security and sustainability, and improve operational performance and efficiency.
		Microgrids & distributed generation	Our portfolio encompasses the full range of enabling technologies including conventional and renewable power generation, automation, grid stabilization, grid connection, energy storage and intelligent control technology, as well as consulting and services to enable microgrids globally.
		Substation automation products & systems	ABB's world-class protection and control solutions ensure reliable power transmission and distribution. To ensure interoperable and future-proof solutions, our products have been designed to implement the core values of the IEC 61850 standard.
	Grid integration	Energy storage	EssPro PCS and EssPro Grid solutions provide customers with the ability to solve power quality, stability and availability issues.
		FACTS	FACTS (Flexible Alternating Current Transmission Systems) offering includes Static Var Compensators (SVC), static compensators, series compensators, and a combined SVC energy storage device.
		HVDC	ABB offers High Voltage Direct Current (HVDC) products, systems and solutions as well as engineering and consulting services.
		Substations	ABB's substation offering includes electrical systems consulting, conceptual design, detailed electrical, civil and protection and control engineering, civil and electrical construction management, commissioning and start-up, project management, post-installation service and asset management.
	Renewable energy	Wind & solar power	ABB offers inverters, low voltage products, grid connections, power plant solutions, power products and expertise for both the solar and wind industries. Additionally for the solar industry, ABB offers tracking products and solutions, photovoltaic solar power plants and Power-One's portfolio of products.
			High voltage products (HV)
Components	HV components include surge arrestors, optical sensors and systems, instrument transformers, coupling capacitors, harmonic filters, capacitor units and capacitor banks.		
GIS & GCBs	Gas Insulated Switchgear (GIS) ranges from 72.5 to 1,100 kV. Generator Circuit Breakers (GCBs) range from 80 to 1800 MW and are capable of interrupting up to 825 kA.		



	Category	Offering	Description
	Transformers	Distribution	Offer includes single and three phase pole-top (up to 315 kVA) and padmounted transformers (25 kVA – 3 MVA; up to 38 kV).
		Dry type	ABB offers vacuum pressure encapsulated or impregnated (VPE and VPI), vacuum cast and RESIBLOC (500 kVA – 10 MVA; up to 38 kV) dry transformers.
		Insulation & components	Insulation and components include bushings, load tap changers, de-energized tap changers, switching, voltage control termination, replacement components, replacement bushings and bushing refurbishment programs.
		Large, medium and small power	ABB manufactures small (3 – 70 MVA; up to 170 kV), medium (63 – 200 MVA; up to 345 kV) and large (200 – 1200 MVA; up to 800 kV) transformers and can be indoor or outdoor and with or without tap.
	Medium voltage products (MV)	Apparatus	ABB offers cutouts, overhead switches, instrument transformers, sensors, indoor breakers, outdoor distribution breakers, reclosers and padmounted switches.
		Distribution automation	ABB's offering includes Relion distribution protection and control relays, electromechanical relays, solid state relays and FT test switches.
		Modular systems	ABB modular systems are prefabricated, walk-in or nonwalk-in, outdoor enclosures or buildings designed to house MV switchgear, distribution transformers, LV switchboards, connections and ancillaries, such as battery banks.
	Cable apparatus & accessories	Switchgear	The switchgear offering includes standard and arc resistant switchgear 5 kV - 40 kV.
		Capacitors, switches & reclosers	Joslyn Hi-Voltage® overhead products improve the efficiency and reliability of electrical power systems and reduce the frequency and duration of outages.
		Indicators, sensors & controls	Fisher Pierce® Faulted Circuit Indicators (FCIs) for both overhead and underground applications are cost-effective tools to more quickly locate faults, thereby reducing outage duration and customer complaints.
		Connectivity & grounding	Homac® is a complete line of underground and substation connectors and is recognized as an industry leader for its Flood-Seal™ technologies and custom solutions.
	Service & consulting	Underground cable accessories	Elastimold® is the most complete package for managing underground cable connections in the industry and is available from 5 kV to 138 kV to connect, ground, splice, terminate and protect underground cable.
		Consulting	Power Consulting offers a wide range of consulting services in the areas of transmission systems, system controls, energy efficiency, power market analysis, asset evaluation, industrial systems and more.
		Service	Our service spectrum covers the entire energy supply path from the power plant through the substation up to the meter including: design, installation and commissioning, performance, optimization and routine maintenance, repairs, extensions, upgrades, retrofits, replacements, spare parts, training, asset management and consulting.
		Training	ABB offers an extensive training program for our power products, services, solutions and systems in a variety of formats, including classroom trainings, webinars, seminars and hands-on opportunities.



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