

ABB POWER GRIDS SOLUTIONS

The evolving world of power

Enabling a stronger, smarter
and greener grid



Driving the energy revolution takes ability. ABB Ability™.

With a heritage of technology and innovation since 1883 and a presence in over 100 countries, ABB shapes the grid of the future, enabling a stronger, smarter and greener grid.

Our industry-leading digital capabilities are combined with decades of experience with utilities. This includes over 120 years of experience across the electricity value chain, more than 50,000 experts currently on our team, 7,000 distributed control systems and 5,000 power and water installations worldwide.

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A leader in power and automation

Background in power

ABB is a global leader in power and automation technologies. Based in Zurich, Switzerland, the company operates in approximately 100 countries. The company in its current form was created in 1988, but its history spans over 130 years. The company's North America operations are headquartered in Cary, North Carolina and include engineering, manufacturing and service locations throughout the region.

Power Grids is one of ABB's four divisions, organized in relation to the customers and industries served. Power Grids' offering includes circuit breakers, switchgear, capacitors, instrument transformers, power distribution, traction transformers as well as turnkey solutions for traditional and renewable energy based power generation plants, transmission grids and distribution networks. These solutions play a key role in the optimization of electricity generation, transmission and distribution and the evolution of stronger, smarter and greener grid.

ABB's success in the power industry has been driven by three cornerstones: research and development, safety and sustainability.

Research & development (R&D)

ABB has continued to invest in R&D through all market conditions. ABB has eight corporate research centers (including one in Raleigh, North Carolina), along with 6,000 scientists and 70 university collaborations across the world – all working to develop unique technologies that make our customers more competitive, while minimizing environmental impact. ABB's fundamental R&D priorities never change – products, systems and services for increased productivity, reliable energy, and sustained customer partnerships.

Safety

As a leader in the power industry, ABB carefully considers health, safety and the environment in all aspects of product design, manufacturing, installation/construction and life cycle services – helping customers minimize risks, lower project costs and shorten project schedules.

ABB's North American Power Grids Division has a safety track record that is better than industry average. ABB extensively uses engineering controls and personal protective equipment throughout our manufacturing sites and in our field service activities. OSHA's 18001 (health and safety) and ISO 14001 (environmental) registrations are required for all of our facilities. At least one of our facilities has achieved OSHA's Voluntary Protection Program Star status.

Sustainability

ABB is a world leader in sustainability reducing carbon emissions, while contributing to global development and GDP growth. ABB is among the few to adopt Environmental Product Declarations (EPDs). An EPD is a safety and sustainability report for a product that is performed by a third-party. It details the product's environmental impact throughout its entire life. Over 80 percent of ABB's products now display EPDs.

Responsible behavior towards different stakeholders includes the health, safety and security of our employees and contractors, how we work in communities, how we work with our supply chain in different countries, and how we embed human rights considerations into business practices.

01 ABB carefully considers health, safety and the environment in all aspects of product design, manufacturing, installation and service.

ABB's commitment to research and development, safety and sustainability underlies our ability to help customers adapt to current issues.

Today's realities offer substantial challenges. Electricity use is forecasted to increase, yet coal-fired power plants, the largest source of electricity generation, are slated to decline. Generation from renewable energy sources is increasing, however for all its positive attributes, it adds more stress to the grid due to its inherent variability. And finally, an aging infrastructure, coupled with a retiring workforce, is not a short-term challenge — it is a core business driver in this asset intensive industry.

Luckily, ABB has the technology and expertise in three key areas - **resiliency, renewable energy and grid modernization** - to offer solutions to these challenges. These evolutions will bring flexibility, reliability, intelligence and the ability to manage power networks effectively and efficiently.

Resiliency

There were roughly 679 outages caused by weather events between 2003 and 2012, each of which affected at least 50,000 consumers. The aging infrastructure makes the networks more susceptible to weather outages. In order to mitigate these effects, the electric grid must be upgraded to be more flexible, more robust and allow a quicker response to outages through applications such as

fault detection, isolation and restoration. Additionally, monitoring systems that perform complex functions, such as asset management, can greatly reduce capital costs and provide optimal grid efficiency.

Solutions include the use of software, sensors, asset management programs and a shift in the way industry professionals approach resiliency from traditional crisis planning to resiliency planning - preparing the grid ahead of time to mitigate ever having to spring into crisis mode. Renewable energy

Power generation is moving from a centralized and mainly carbon-based infrastructure to more distributed, less predictable and less controllable clean generation. This transition brings challenges in terms of reliability, efficiency, security, renewable integration and power quality. New systems and solutions are needed to help overcome these challenges that range from harnessing and integrating renewables, to energy forecasting, to minimizing the effect on the environment and to preparing the grid for electric vehicles.

ABB innovations such as energy storage, static compensators, microgrids, flexible AC transmission, including the world's first circuit breaker for high voltage direct current, help customers efficiently transform renewable energy into reliable power and connect it to the grid.



These solutions lie in smart grid investments that maximize ROI by improving the performance of current assets, while laying a path to a more sustainable and profitable future. Smart grid investments provide quantifiable cost savings and performance benefits through improved asset utilization; while preparing utilities for inevitable (and beneficial) changes in how electricity is generated, transmitted, distributed and consumed.

With a smart grid, problems are addressed pro-actively instead of reactively. Grids can “heal” themselves when sensors send signals based on a pre-determined condition and system status. And real-time information quickly moves throughout the system to maximize resources and reduce the high cost of unexpected interruptions. This heightened operational effectiveness is cumulative. As utilities make more smart grid investments, they not only address immediate pain points, but also elevate overall system performance. This is happening now because of the convergence of operations technology (OT) and information technology (IT), which integrates enterprise-level IT applications with grid systems and equipment.

At every step in the process ... generation, transmission, distribution and consumption ... the smart grid will deliver benefits. It’s possible to begin with affordable, incremental steps that provide immediate benefits and lay the foundation for future investments. With relatively modest investments, utilities can make strides toward a scalable smart grid implementation.

No other smart grid solution partner in the world offers the breadth of systems expertise, equipment, software and communications technologies provided by ABB.

ABB Ability™ digital solutions
Aging infrastructure, new regulations, distributed energy resources and the convergence of Information Technology and Operations Technology (IT/OT) are just a few of the issues that are dramatically changing the utility landscape today.

ABB Ability™ provides tailored digital solutions and products for the differing needs of utility providers across power generation, transmission and distribution. From advanced diagnostics that prevent unplanned downtime to the control of individual coal-fired boilers, ABB Ability enables utility providers to know more, do more, do better, together.

ABB technologies address the challenge of balancing rising demand for power with increasing concern for the environment. ABB products, systems and service solutions cover the entire value chain from generation, transmission and distribution through to end use, helping customers deliver reliable power efficiently, safely and with lower environmental impact.

Generating power
More power generation is needed as we add load. Although power generation will continue to depend heavily on coal and other fossil fuels for the foreseeable future, the natural gas and renewable sectors are growing. ABB provides products and solutions for all generation types: coal, oil and gas, natural gas, hydro, solar and wind power.

ABB is a leading provider of integrated power and automation solutions for conventional and renewable based power generation plants and water applications. The company’s extensive offering includes turnkey electrical, automation, instrumentation and control systems supported by a comprehensive service portfolio to optimize performance, reliability, and efficiency while minimizing environmental impact.

Transmitting power
ABB offers products at ratings up to 1,100 kV, which include air, gas and hybrid insulated switchgear solutions, live and dead tank circuit breakers, instrument transformers, power capacitors and surge arresters. ABB maximizes efficiency and improves grid reliability by offering alternating and direct current transmission systems, which help customers reduce transmission losses and stabilize the grid through Flexible Alternating Current Transmission Systems (FACTS). Furthermore, ABB has the capability and expertise to offer a full scope of high voltage cable solutions as one of the world’s most experienced cable suppliers.

Over 60 years ago, ABB pioneered high voltage direct current (HVDC) technology, which is ideal for grid interconnections and long-distance transmission projects. Additionally, ABB offers HVDC Light™, specifically intended for underground, submarine and long distance applications. These technologies are designed for high-efficiency power transmission and have lower losses and a smaller footprint. They are also able to stabilize intermittent power supplies that might otherwise disrupt the grid.



— 01 ABB is the world's leading manufacturer of transformers and was one of the first companies to develop one, pictured above.

Distributing power
ABB solutions help control costs and meet consumer demand with fewer resources. One way of achieving this is through distribution grid management, which increases reliability and efficiency, while reducing operating costs through better communications and control.

Substations are at the core of electrical power distribution. More than 100 years of experience building and upgrading air and gas insulated substations around the world, has provided ABB with the expertise necessary to deal with challenges in the construction of indoor and outdoor substations, irrespective of site conditions.

In addition to full substation commissioning and retrofitting, ABB also supports the distribution grid with a broad product portfolio of switchgear, modular systems, distribution automation products, current limiters, instrument transformers, sensors, circuit breakers, reclosers, cutouts, capacitor banks, switches, arresters and transformers.

Transforming power
ABB was one of the first companies to develop a transformer, integrating it with the world’s first commercial AC power transmission link, a solution innovated by ABB in 1893 to connect a hydropower plant with a large iron ore mine in Sweden. Since then, ABB has continually extended the limits of transformer performance by developing new technologies and materials that raise efficiency, reliability and durability to new levels.

As the world’s leading manufacturer of transformers, ABB produces over 2,000 power transformers and 500,000 distribution transformers every year. ABB is also the original equipment manufacturer for over 70 percent of the current North American installed base.

The continuous focus on research and development brings new substation technologies into the market such as combined disconnecter circuit breakers, hybrid switchgear and future-proof automation solutions based on IEC 61850. Our transmission substation teams help customers to reduce footprint, environmental impact, and operational and lifecycle management costs, while increasing availability and reliability of high-quality power supply.

Managing power
Under the ABB Ability™ umbrella, ABB’s network management and utility communications solutions monitor, control, operate and protect power systems. They ensure the reliability of electricity supplies and enable real-time management of power plants, transmission grids, distribution networks, and energy trading markets.

ABB’s Wireless Communication Systems offers outdoor wireless broadband IP mesh networks trusted by customers to enable mission critical applications. Customers use their broadband mesh networks to monitor and control thousands of automation devices in the field and large outdoor facilities and to communicate with mobile workers.

ABB's offering also includes control and protection systems, cyber security and software solutions. ABB provides SCADA-based network management and central market software systems. Their full-range solutions enable utilities to collect, store and analyze data from hundreds of thousands of data points in national and regional networks and play a very central role in the on-going development of smart grids. ABB solutions help meet growing demand for electricity by raising the efficiency of electricity systems and helping to incorporate renewable energy into the grid.

Power service and consulting

ABB's service portfolio includes design, installation and commissioning, performance optimization and routine maintenance, repairs, extensions, upgrades, retrofits, replacements, spare parts, training, asset management and consulting. ABB aims to increase system reliability, improve safety, reduce risks and extend equipment life with minimal spending through preventative maintenances.

In addition to typical product maintenance, ABB's Asset Health Center (AHC) is a comprehensive intelligence platform that embeds ABB's unique T&D engineering, equipment monitoring and systems expertise in order to establish an asset management business processes for reducing costs, minimizing risks, improving reliability and optimizing operations across the enterprise. ABB allows customers to address the issue of asset health management systemically – with an end-to-end solution offering the right combination of integration, embedded intelligence and automation – to offset the demands of aging resources, stringent regulatory environments and increasing financial pressure.

ABB power consulting also provides unique approaches and solutions to developers, EPCs, electric utilities, system operators, independent power producers and industrial electric users worldwide. A wide range of consulting services are available in the areas of transmission systems, system controls, energy efficiency, power market analysis, asset evaluation, arc flash studies, industrial systems and equipment selection. Combined with years of experience and state-of-the art technology, ABB's internationally recognized team of consultants will help you to develop and optimize your electric system to reach your desired level of performance.

Optimizing the grid with ABB

The evolving world of power requires the most advanced and reliable technology. ABB's vast experience and expertise ensure systems are at their maximum operability and efficiency. ABB's dedicated focus on R&D, sustainability and safety has resulted in a long track record of successful innovation. Many of the technologies that underlie our modern society, from high-voltage DC power transmission to a revolutionary approach to ship propulsion, were developed or commercialized by ABB. Today, ABB stands as the largest supplier of industrial motors and drives, the largest provider of generators to the wind industry, and the largest supplier of power grids worldwide.

From source to socket

Providing solutions for a more reliable and intelligent network

Industries ABB serves:

- | | | | | |
|---------------------------------------|---|--------------------------------------|------------------------------------|--|
| - Automotive and electric charging | - Data centers | - Government and defense | - Minerals and mining | - Railways |
| - Cement | - Electric, gas and water utilities | - Independent power producers (IPPs) | - Oil and gas | - Refining |
| - Chemical and pharmaceutical | - Engineering, procurement & construction firms | - Marine and turbocharging | - Original equipment manufacturers | - Telecommunications and data communications |
| - Commercial and industrial buildings | - Food and beverage | - Metals | - Petrochemicals | - Wholesalers and distributors |
| | | | - Pulp and paper | |





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