

Products and services

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Our stakeholders have confirmed to us that resource efficiency, products and systems which strengthen renewable sources of power, and our efforts to limit both customers' and our own environmental footprint, are important issues for them. These issues are also material to ABB's business success. More than 50 percent of ABB's revenues stem from energy efficient products, systems and solutions that we provide to our customers to increase their productivity while lowering environmental impact. Driving innovation in these areas is key to our future success.

Products and services

Innovating for a better world

Technology is one of ABB's key differentiators and is crucial to our long-term competitiveness. Through continuous development of our portfolio of products, systems and services, ABB helps our customers improve their operating performance, grid reliability and productivity while saving energy and resources, and lowering environmental impact.

Innovation is at the heart of ABB's growth strategy, and research and development (R&D) is a critical strategic resource for the Group. To support our R&D effort, we maintain seven corporate research centers, employ some 8,000 researchers and developers and collaborate with more than 70 universities across the world. ABB's R&D investments in 2013 totaled \$1.5 billion, representing 3.5 percent of revenues.

These investments bring results. In 2013, ABB filed more patent applications in Europe than any other Swiss-based company, a confirmation of our efforts to serve the market with innovative products and solutions. This was further underlined in 2013 when Thomson Reuters and the MIT Technology Review recognized ABB as one of the world's top innovators.

ABB is also committed to the localization of technology research and we have been increasing our capacity for local research and innovation in growing markets such as China and India, as well as in the United States. In China, for example, we now employ over 2,000 researchers and engineers in 20 cities across the country.

Helping to shape a better world

ABB has identified mitigation of climate change, renewable energy, energy and resource efficiency and increasing urbanization as key drivers and growth opportunities for our business. About 51 percent of our revenues are already related to products and services in our energy efficiency portfolio that help customers save energy and reduce greenhouse gas emissions.

Our technologies are used along the entire energy value chain from the extraction of primary resources, the liquefaction of natural gas or refinement of petroleum products, to their transformation into electricity and their efficient use in industry, transportation and infrastructure.

Utilities: Power plants consume five percent of the electricity they generate. This can be cut by 10 to 30 percent by optimizing operations and auxiliary systems through the use of sophisticated control systems and energy efficient equipment. In transmission and distribution, ABB technologies enable more power to travel over existing networks and reduce power losses.

In the 1950s, ABB pioneered high-voltage direct current (HVDC) technology, enabling the efficient transmission of electricity over large distances. We have now developed the world's first direct current (DC) circuit breaker for HVDC systems, solving a longstanding engineering puzzle and paving the way for a new generation of highly efficient, interconnected and reliable power transmission grids.

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400 TWh of electric power saved by our installed base of variable-speed drives
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In addition to efficiency efforts, governments around the world are focusing on reducing CO₂ emissions by increasing the use of renewable energy in the power chain. However, integration of renewable energy into existing grids presents significant challenges: generating sites are often located in remote areas and can depend on intermittent primary energy sources such as wind and sun. ABB's HVDC technology facilitates the efficient, long distance transfer of power from hydro, solar and wind power projects and is a key enabler in a future energy system based on renewables.

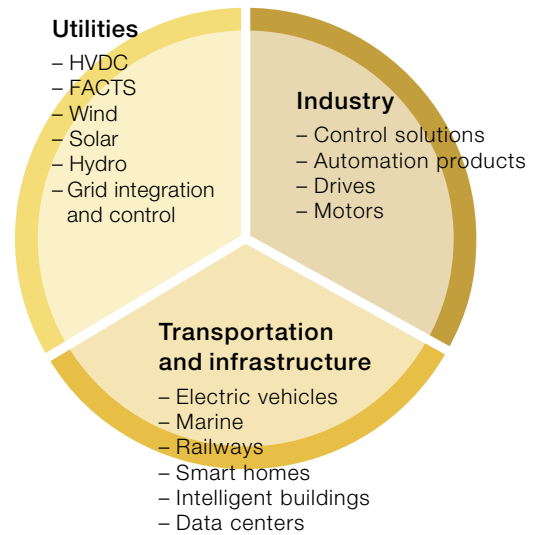
We are also a leading supplier of technology solutions to solar, wind and hydropower customers. ABB has been developing solutions for the hydropower industry for more than 125 years and provides the market's most comprehensive range of power and automation products and systems. With our expertise in power electronics, ABB is also a key player in the solar industry, providing solar inverters, low-voltage and grid connection products as well as PV power plants. We are a leading supplier of electrical products and solutions to the wind power industry.

Industry: The industry sector accounts for around one third of the world's energy demand. ABB can improve industrial energy efficiency at facilities ranging from the most energy-intensive process plants to factories engaged in discrete manufacturing. We provide modern control solutions, automation products and electrical equipment.

Motors, used to power fans, pumps and compressors in a wide range of industries, account for an estimated 65 percent of all industrial energy use. ABB's variable-speed drives control the speed of electric motors to match the task in hand, reducing energy consumption by 30 to 50 percent and improving performance.

Our continued development of drives technology has reduced their size and cost, improved reliability and broadened their

Solutions for a better world



applications. In 2013, ABB's installed base of low-voltage drives saved an estimated 400 terawatt-hours of electric power, the equivalent of more than 100 million households' annual usage in the European Union, and reduced global carbon dioxide emissions by some 340 million tons.

Transportation and infrastructure: Urbanization – especially in developing economies – will result in about 1.5 billion more people living in cities over the next 20 years. The challenge will be to support such growth with minimal environmental impact.

An effective way to support these city goals is to use technology to monitor, optimize and control key systems and infrastructure in a more intelligent way. ABB products and solutions are at the heart of a city's critical infrastructure, relied upon for everything from the supply of power, water and heat, to the automation of the buildings we live and work in. We offer smart solutions in the areas of city communication platforms, electricity and water networks, transport, buildings, and district heating and cooling.

The transport sector represents 23 percent of overall global carbon emissions generated by fossil fuel combustion and is expected to grow by approximately 40 percent between 2007 and 2030. ABB technology can help lower energy losses and reduce carbon emissions in transportation on both land and sea.

In electric mobility, ABB is a world leader in DC fast-charging technology, providing a unique multi-standard design that supports all fast-charging standards and protocols. This is critical to maintain compatibility between rapidly evolving cars and chargers in the years to come. In 2013, we won a landmark contract to supply a nationwide fast-charging network for electric vehicles in the Netherlands, having already constructed a similar network in Estonia.

In rail transport, ABB offers solutions for transferring power efficiently from grids to trains and, on board, supplies a range of traction solutions to help public transport operators provide efficient, less carbon-intensive transport.

ABB is a leading solutions provider for electric power and propulsion systems for ships at sea and has introduced DC – instead of alternating current – electrical infrastructure to run propulsion rotors. This enables more efficient variable-speed operation of the main engine generator sets, cutting up to 20 percent in energy and fuel consumption, and reducing emissions. ABB commissioned the world's first application of this high-efficiency innovation in 2013.

Increasing impact through collaboration

As well as conducting research in our own laboratories, ABB collaborates with over 70 universities and research institutions across the world. Our investments in research initiatives, fellowships and strategic partnerships continue to enhance the ABB portfolio and lead to international and cross-industrial cooperation in almost every ABB business.

We also continue to invest in the ABB Research Grant Program, initiated in 2012 and intended to support promising graduate students and senior researchers working on projects with industrial applications in power and automation. Grants typically range from \$50,000 to \$80,000 per year, initially for one year, but with the goal to continue over multiple years.

Investing in technology leadership

Additional key components of ABB's innovation strategy are investments around inorganic growth (mergers and acquisitions) and venture capital investment. ABB has executed more than \$10 billion of strategic acquisitions since 2010, and in 2013 we continued to expand our portfolio. The most significant acquisition was solar inverter maker, Power-One, which makes ABB the number two global player in the most intelligent part of the solar photovoltaic value chain.

Our corporate venture capital unit, ABB Technology Ventures, makes early- and growth-stage investments in novel companies introducing new technologies or improvements to existing technologies. The goal is to build technology leadership and drive growth, to both complement and add to the activities of our existing R&D programs. In 2013, we made key investments in renewable energy technologies, including Romo Wind, which improves the performance and energy generation of wind farms, and Scotrenewables, a Scottish tidal turbine company.

ABB's investments, along with recognition by MIT Technology Review and other innovation awards, reaffirm our commitment to innovation and the future success of ABB and our customers. Examples of achievements and innovations announced in 2013 are shown on the following pages.

Achievements and innovations in 2013



A world first in low voltage

Low-voltage circuit breakers are ubiquitous, but the new Emax 2 is the only device that can both protect electrical circuits and adapt energy consumption within user specified limits on peak power use. Replacing existing traditional breakers with the Emax 2 breaker has the potential to achieve annual savings of 5.8 million MWh, energy savings that would reduce CO₂ emissions by 4 million tons. Breakers like Emax 2 are deployed where protection and control of large amounts of energy are used in a low-voltage environment such as industrial and commercial buildings, data centers or ships.



Irish and Welsh grids connected

ABB has connected the power grids of Ireland and Wales with an undersea HVDC transmission link. Currently the highest-rated HVDC Light® connection at 500 MW, the link enables cross-border power flow, enhancing grid reliability and facilitating power trading between the two countries. The link also facilitates the integration of renewable energy; as Ireland expands its wind power capacity, it can export surplus electricity to the United Kingdom and can import power when required. Additionally, HVDC Light's "black start" capability can help restore power quickly in the event of an outage, without the aid of external energy sources.



Wind of change

ABB has designed and tested a new approach to selecting the electrical drivetrains for wind turbines, providing a solution that is compact, lightweight and of the highest efficiency, compared to all other concepts. The drivetrain is the main electrical production system of the turbine and influences the weight, size and maintenance needs of the turbine. Selection of the appropriate drivetrain requires care and must take into account all of the requirements and lifetime costs, including turbine power, grid requirements, availability, material and maintenance costs.



Switchgear for smarter grids

A new disconnecting circuit breaker with a fiber-optic current sensor (FOCS) simplifies substation design while adding to the intelligence of the device. For many decades, current measurement in high-voltage equipment has relied on often bulky transformers that could weigh up to several tons. These measurement transformers can now be replaced by ABB's FOCS, whose small size allows it to be integrated into primary equipment such as circuit breakers, saving on space and installation costs. The FOCS also saves on material – e.g. aluminum, copper, insulation materials and transformer oil – that are contained in a functionally-equivalent conventional current transformer.

New electric bus tested in Geneva

With no overhead lines and ultrafast charging times, the bus enables new opportunities for silent, flexible, zero-emission urban mass transportation. The system delivers a 15-second charge at bus stops, providing enough power for the bus to reach the next charging stop, allowing for traffic and detours. The fast-charging technology and the onboard traction equipment used in this project were developed by ABB and optimized for high-frequency bus routes in key urban areas. Thanks to an innovative electrical drive system, energy from the roof-mounted charging equipment can be stored in compact batteries, along with recuperated energy due to vehicle braking, powering both the bus and its auxiliary services, such as interior lighting.



Greening the microgrid

Faial, one of the Azores islands in the mid-Atlantic ocean, has deployed ABB software that will allow it to meet its goal of generating 75 percent of its electricity from renewable sources by 2018 without destabilizing the network. The microgrid control solution – based on ABB’s Microgrid Plus – controls and monitors all the wind turbines and oil-fired generators on the island, calculates the most economical configuration, ensures balance between supply and demand, maximizes the system’s use of wind power and, crucially, optimizes the generators so that the entire system performs at the peak of its potential.



An intelligent solution for universities and colleges

ABB has launched a data center infrastructure management (DCIM) solution specifically for academic institutions, to help them reduce data center energy costs while increasing reliability of online services. With the proliferation of online courses and services in higher education, institutions depend increasingly on reliable and affordable management systems for energy-hungry data centers. The DCIM “Education Edition” provides special pricing on deployment for accredited academic institutions, real-time power monitoring for both power and cooling systems and specific reporting to increase visibility of energy savings and forecasting.



Meeting demand for energy efficiency

New technology for the capture and reuse of regenerative braking energy in trains boosts the energy efficiency of traction systems. Rail vehicles regenerate braking energy through their traction motors. Most of the time, a small portion of this kinetic energy powers onboard loads, while the remaining energy is sent back to the network and reused if a nearby vehicle is accelerating. If this is not possible, the surplus is usually dissipated. With ABB’s Enviline™ Energy Recovery System, this waste can now be minimized and overall energy consumption reduced by 10 to 30 percent – without the need to invest in new rolling stock or network control systems.

