Innovation
Investing in the future

Innovation is at the heart of ABB's success and crucial to our long-term competitiveness. Through continuous development of our product and solution portfolio, ABB helps customers improve their operating performance, grid reliability and productivity while saving energy and resources and lowering environmental impact.

ABB's approach to innovation consists of three pillars: Corporate research and development (R&D), alliances with academic and research institutes, and our corporate venture capital unit, ABB Technology Ventures (ATV).

To support our R&D effort, ABB employs some 7,500 highly skilled people in different businesses and at seven corporate research centers worldwide. Spending on research and development in 2011 was $1.37 billion, representing 3.6 percent of revenue during the year.

ABB's research engineers and scientists launch R&D projects in close cooperation with our businesses or directly with pilot customers, to ensure a clear understanding of present and future business needs and opportunities.

When developing new products and technologies, ABB designers follow sustainability guidelines in each phase of the process. These include, for example, standardized Life Cycle Assessment procedures, a handbook for environmentally aware design, a health and safety checklist to identify potential risks, and a list of prohibited and restricted substances to ensure our sustainability objectives are also embedded into product development.

Power electronics helping to shape the grid of the future

The power sector is facing rapid changes due to ever-increasing levels of electricity consumption, increased use of alternative, often remote, energy sources, and a greater focus on energy efficiency, grid reliability and the need to reduce greenhouse gas emissions.

ABB has pioneered the development of a variety of technologies to help the power industry address these challenges. Many of these technologies rely on power semiconductors, the key building blocks of power-electronics-based switching devices that control the flow of electricity and convert it to the form required for different applications.

The development of power semiconductors has brought many subsequent innovations, including the efficient bulk transmission of electrical energy in the form of high-voltage direct current (HVDC), the introduction of energy-saving variable speed drives, the development of frequency converters used by electric trains and metros, and the introduction of FACTS (Flexible AC Transmission Systems) to enhance control and increase the power transfer capability of the network.

Having developed the technology in the 1950s, ABB continues to advance HVDC applications, helping to deliver large amounts of electricity over thousands of kilometers from remote sources of generation to busy population centers and installing submarine HVDC cable interconnections between Western European countries, such as the NorNed project connecting Norway with the Netherlands. HVDC technology has also allowed the connection of offshore wind farms to the mainland, including the BorWin 1 project, the most remote offshore wind farm in the world, located 128 kilometers from the German mainland.

A further recent development in HVDC, the Caprivi Link Interconnector project in Namibia allowed the world's first application of HVDC in overhead transmission lines, fulfilling the customer's economic and technical needs while providing a more stable power supply for poor and remote communities.

About the same time that ABB was revolutionizing long-distance high-voltage DC power transmission in the 1950s with HVDC, we were also revolutionizing the transportation of AC power over long distances with flexible AC transmission systems (FACTS). FACTS is a generic term for a group of technologies that dramatically increase the security, capacity and flexibility of power transmission systems.

FACTS technologies, which rely on the switching capabilities of specialized semiconductors, have a small footprint and minimal impact on the environment. Project implementation times are considerably shorter and investment costs substantially lower than the alternative of building more transmission lines or new power generation facilities. A recent addition to the FACTS family now includes an energy storage system that not only helps to ensure grid stability, but can also deliver active power to the network, providing an alternative to the need for extra capacity for peak-load support.

Semiconductors are also applied in variable-speed drives to efficiently control industrial motors. First launched in 1969, ABB variable-speed drives can reduce energy consumption by 30 to 50 percent by precisely matching the speed and torque of the motor to the needs of the application. Motors are used to power fans, pumps and compressors in a wide range of industries, such as cement, chemical, pulp and paper, metal, and oil and gas, and account for an estimated 65 percent of all industrial energy use. ABB's continued development of drives technology has reduced their size and cost, improved reliability and broadened their applications, to improve energy efficiency, productivity and process control across industrial sectors.

Further developments in semiconductor technology have also provided solutions for frequency converters, used to alter the power frequency of the domestic grid to suit the power frequency used in electric rail transport. In various countries, railway power grids are operated at a different frequency from the public power grid. In the past, dedicated power plants were built to supply single-phase railway grids. Progressively the public three-phase AC network is being interconnected to the railway grid via frequency converters. ABB is a pioneer and world market leader in providing these railway interconnections.

Collaboration to grow smart grid knowledge

As well as conducting research in our own laboratories, ABB collaborates with over 70 universities and research institutions across the world. We have long recognized the value of teaming up with other pioneers. Investments in research initiatives, fellowships and strategic partnerships have enhanced the ABB portfolio and led to international and cross-industrial cooperation in almost every ABB business.

Such collaborations are proving particularly important in the area of smart grids, where the increasing impact of renewable energies and distributed generation is changing the management of electricity distribution networks from "passive" to "active." The structures of the power systems, as well as their operational schemes, have to be re-invented to a significant extent to meet the challenge of balancing load and generation. Close cooperation between suppliers of technology, users and policy makers is needed to align the different sectors of electricity supply and consumption and to develop solutions for the future.

To this end, ABB is working on a joint development project with the Nordic utility Fortum to design and install a large-scale smart grid in a new district of Stockholm. The R&D project will test the concept of a flexible, low-emission power network in the Stockholm Royal Seaport area as part of a larger initiative to cut emissions in the Swedish capital by two-thirds by 2020.

ABB and Fortum are developing a variety of solutions to ensure that excess power generated from renewable energy sources in the district (from sources such as rooftop solar panels) can be fed into the power grid and to enable electric vehicles to draw electricity from the grid or feed it back in. The project will also investigate energy storage options and how to provide more flexibility and transparency in the distribution grid, helping to lower consumption and emissions.

The project with Fortum is one of our many smart grid collaborations with industrial partners and learning institutions around the world, including projects in the US, Denmark, Germany and Italy. In the US, for example, ABB is a corporate partner of the FREEDM Systems Center, a National Science Foundation Engineering Research Center headquartered at North Carolina State University that is developing key technologies to revolutionize the US energy grid.

ABB Technology Ventures grow ABB's business

The third pillar of ABB's technology edge is the corporate venture capital unit, ABB Technology Ventures (ATV). ATV investments are used to build technology leadership strategically and drive growth. In 2011, investments strengthened ABB's focus on renewables and expanded our portfolio of energy solutions for data centers.

ABB's investment in California-based GreenVolts provides access to their proprietary technology and enables us to offer turnkey solutions for concentrating photovoltaic power plants in addition to our current capabilities in solar thermal and conventional photovoltaic power plants. The technology complements our recent acquisition of a stake in Novatec Solar, a leading provider of Linear Fresnel concentrating solar power technology.

ABB also purchased a controlling interest in Validus DC Systems, a leading provider of direct current (DC) power infrastructure equipment for data centers. The Validus investment boosted ABB's presence in the data center power market, following our investment in Power Assure, which provides data center energy management solutions. These investments ensure that ABB is well positioned as these markets develop.

Recognition, such as Cleantech Corporation of the Year, awarded at the San Francisco Cleantech Forum in March 2011 and nomination as one of the Thomson Reuters' 2011 Top 100 Global Innovators, confirms our commitment to innovation and the future success of ABB and our customers.

GRI indicators

PR1 Health and safety impacts of our products

ABB products generally help improve users' health and safety. They do this, for example, by improving industrial environments (automation control products), reducing exposure to aggressive, repetitive or hazardous operations (robotics), and reducing potential explosions, fire risks and oil pollution (oil-free capacitors and cables). Products with a potentially negative impact are those that could contribute to global warming (leak of SF_6 gas from substations), require deforestation and present a visual impact (transmission lines), cause losses of energy (most electrical products), or cause electrocution if misused.

PR2 Number of non-compliance incidents relating to product health and safety

All countries in ABB's sustainability management program are asked to give details of any non-compliance incidents, including those concerning health and safety impacts of products and services. No such incidents were reported for 2011.

PR3 Product and service information

ABB's goal is to produce Environmental Product Declarations (EPDs) for our core products. They describe and quantify the environmental impact and performance of ABB products through every phase of their life cycles, covering raw material extraction, component manufacture, transportation and use over their full operating lifetime. They also contain recovery, recycling and disposal instructions for when the product has completed its useful life. The EPDs are published on ABB's website and help customers to select products that will improve their own environmental performance. We have developed associated Life Cycle Assessment (LCA) tools, such as the "LCA Light" tool that helps sales representatives to include environmental aspects in their discussions on the relative costs and benefits of different ABB solutions. ABB also engages with customers with particular reporting needs to ensure clarity and completeness of environmental data.

PR6 Adherence to marketing communication regulations
PR7 Non-compliance concerning marketing communications

This is not an issue for ABB, which works in the field of advanced technologies and does not supply to the consumer product market.