03 Leading technology

LEADING TECHNOLOGY

Making the world's cities and industries smarter and more efficient

ABB provides products, solutions and services that are enabling the cities and industries of the future to be cleaner, safer, more resilient and less resource intensive

For more than 130 years, ABB has created technologies that stimulate economic growth and improve people's lives. Today, we remain focused on delivering leading-edge solutions for our customers and are working to further enhance the eco-efficiency of these offerings to support the fight against climate change. Our extensive portfolio of products, solutions and services contributes to the economy and raises people's standard of living, while contributing to delivering the energy efficiency and resource conservation the world needs to achieve the goals of the 2015 Paris Agreement.

In 2014, we set a target to increase our revenues from energy efficiency and eco-efficiency related products, services and solutions by 20 percent. In 2017, we made this target more ambitious, aiming for our eco-efficiency portfolio to account for 60 percent of ABB's total revenue by 2020. This portfolio delivers positive use-phase impacts in three areas: energy efficiency, renewable energy and resource efficiency. Our eco-efficiency portfolio accounted for 57 percent of ABB's revenue in 2019, remaining on track to achieve our target by the end of 2020.

We continue to tailor our portfolio in line with the changes that are rapidly reshaping the world, while making progress toward our target.

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Urbanization, population growth and economic expansion are surging even as the public, private and civil sectors are nearing consensus on the need to significantly reduce our reliance on the outdated technologies that contribute to climate change. For utilities and the construction, mobility and industrial sectors, among others, climate change and the responsible use of resources have moved to the top of the global agenda.
In addressing these new priorities, sustainable operations and products increasingly represent a competitive advantage in and of themselves.

The global consensus on climate change is driving demand for products, solutions and services that increase energy efficiency and reduce consumption of non-renewable resources. Technological innovation will play a critical role in meeting these needs – improving people's living standards while simultaneously reducing their impact on the environment. With this in mind, we believe ABB's mission is fully aligned with global efforts to bring the Sustainable Development Goals (SDGs) within reach by 2030.

Energizing SDGs 11 and 9

The ABB Sustainability Report this year largely focuses on how ABB's technologies contribute to SDG 11, which calls for sustainable and resilient cities and communities, and SDG 9, which calls for resilient infrastructure and inclusive and sustainable industrialization.

SDG 11 encourages the transition to smart cities, which leverage innovations in transport, renewable energy, waste management and digital technologies to manage resources more efficiently. The smart cities of tomorrow should be more livable, attractive and affordable, as well as sustainable.

Today, half the world's population lives in towns and cities. According to the International Energy Agency, urban areas, which are at the center of most economic activity, account for 64 percent of global energy consumption and are responsible for 70 percent of global carbon dioxide emissions. The smart, energy-efficient and low-carbon technologies required to significantly reduce the environmental impact of cities already exist, and they must be rapidly deployed on a wider scale to achieve the underlying targets associated with SDG 11 by 2030.

SDG 9 emphasizes the urgent need for industry and infrastructure to become cleaner and more efficient, even while contributing to economic growth and inclusivity. According to the Intergovernmental Panel on Climate Change, industry generates about 21 percent of global greenhouse gas emissions – not just from burning fossil fuels, but also from chemical processes, waste management and other production related activities. The advanced solutions required to make industry smarter and cleaner have also already been developed.

Cleaner industries can be located closer to urban areas, which can in turn provide manufacturers with access to the deep talent pools that will be needed to operate and maintain the digital factories of the future. Moving production sites closer to cities would also enhance employment opportunities for rural-to-urban migrants.

With respect to cleaner and more efficient infrastructure, existing technologies can be used to optimize water and waste treatment, energy services and other resources of critical importance to cities. New solutions can reduce the amount of electricity and water that is lost, either in transmission or due to extreme differences between peak and off-peak demand.

At ABB, we understand that SDGs 9 and 11 are interlocking and mutually supporting goals. Sustainable and resilient cities not only need buildings, transportation options and infrastructure that minimize emissions and conserve energy and non-renewable resources, but also need local industries that can provide residents with economic opportunities and an accessible supply of essential goods. Cities that are cleaner, safer and less polluted improve the quality of inhabitants' lives, and are thus in everyone's interest.

ABB supplies many of the products, solutions, services and systems that serve these needs. In fact, a large part of ABB's technologies relate directly to matters of sustainability, so it would not be practical to provide a comprehensive listing of them in this report. Nonetheless, in this chapter we highlight some of the key technologies that contributed in 2019 to achieving the targets associated with SDGs 9 and 11. These include smart and sustainable technologies for buildings, electric vehicles, water, power, and waste infrastructure, data centers and factories.

Underpinning nearly all of these solutions is our comprehensive digital offering, ABB Ability™, which drives substantial gains in efficiency. Solutions under the ABB Ability™ brand collect and analyze data from across the industrial internet and provide our customers with automated insights into their processes and equipment in order to increase the uptime, speed and yield of their operations. ABB Ability™ connects one of the world's largest installed bases of industrial devices – around 70 million of them – to industry-leading digital solutions in a wide range of sectors, including utilities, transportation, energy, construction and industry.

But while ABB Ability™ ties together many of our company's innovations through connectivity and the digital cloud, it represents just one aspect of what can be done to make the future a brighter place for us all. We recognize that policy is just as important as technology in paving the way for successful smart cities, infrastructure and industries.

Accordingly, ABB collaborates with policymakers around the world to realize a collective vision for modern smart cities that can combine data, people and technology. ABB is also working towards inclusive and sustainable solutions as an Associate Partner of the Smart Cities Council, a collaboration among technology companies that is developing a policy framework for the future, including the Smart Cities Readiness Guide.

To help further develop smart infrastructure and industry, ABB is closely cooperating with other leading, global companies. ABB has entered into strategic partnerships with digital market leaders Dassault Systèmes, Ericsson, Hewlett Packard Enterprise, Huawei, IBM and Microsoft to drive the digital transformation and enable customers to unlock unprecedented improvements in performance and productivity. Each strategic partnership brings ABB together with a world-class organization to create an unmatchable combination of technological expertise and domain knowledge focused on developing enhanced digital solutions.

Smart buildings

ABB remains firmly committed to SDG 11 – making cities and human settlements inclusive, safe, resilient and sustainable. We recognize that cities are facing unprecedented challenges that threaten their ability to achieve SDG 11. According to the United Nations, one in eight of the world's 7.6 billion inhabitants lives in a megacity today – 33 sprawling urban areas with populations of more

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Upgrade of landmark buildings for smart city project in Zaragoza, Spain

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than 10 million. By 2030, it is predicted that there will be 43 megacities, and the global population will surge to 8.6 billion.

As they expand, cities are in need of smarter, more eco-efficient technologies. In providing them with digital sensors, devices, solutions and services that enable them to run in cleaner and more sustainable ways, ABB has become a partner of choice for cities around the world.

One of the ways that we are helping cities to become more sustainable is through our ABB Ability™-branded digital offering, which supports smart buildings with integrated solutions that achieve energy efficiency and cut electric consumption and costs in industrial, commercial and residential environments. When fully implemented, these solutions typically deliver a 30 percent reduction in energy costs for heating, lighting and appliances. For example, ABB's energy-efficient motors and drives can radically enhance the performance of the heating, ventilation and air conditioning systems used for heating and cooling, reducing energy consumption by up to 50 percent.

For smart homes, our offering is centered on the ABB-free@home® platform. This complete automation platform enables occupants to centrally manage power consumption and cut costs. With up to 60 functions, ABB-free@home® can integrate up to 150 devices per system. Via a touch control panel, smartphone or wall-mounted switch and motion sensors, one can control everything from blinds, heating and air conditioning, to door communication and lighting.

Critically, this system is flexible. It can be easily integrated not only with ABB's video door entry system, but also with third-party products and services, such as smart home appliances, smart lighting systems, door entry systems, home entertainment devices and cloud-based voice services, not to mention a variety of solar-thermal and photovoltaic energy systems. This smart home solution leverages the Microsoft Azure cloud computing platform.

For smart buildings, ABB's offering is based on the widely used KNX open standard. Our ABB i-bus® KNX system gives occupants and building managers the ability to control lights, window shades and heating/cooling systems for improved temperature management and to program strategies that will optimize a building's energy demand and deliver maximum levels of comfort and safety.

ABB research and development paves the way for cities and industries of the future to become more sustainable, efficient, productive, cleaner, safer, resilient and less resource intensive.

Bazmi Husain – Chief Technology Officer

ABB technology is also being deployed in support of the Netherlands 2019 National Climate Agreement, in which the Dutch government committed to sustainably transforming the Netherlands' existing built environment and adapting the country's 7 million homes and 1 million buildings so that they are all well insulated and use or even generate clean energy. ABB is working together with Factory Zero, a company that builds homes that incur zero energy bills, to help the country create some of the 1.5 million zero-emission homes the Netherlands aims to construct by 2030.

Each of the new structures will use one of our smart energy management modules (SEMs) to coordinate and balance their energy demand and use, controlling a heat pump, ventilation and an ABB solar panel converter and reading energy meters. Energy generated by a home's solar panels and heat pump is monitored, kept within the home and optimally adjusted to consumption. This innovative solution uses data generation and visualization to provide residents with insights into their energy consumption. By continuously measuring and adjusting the amount of energy consumed by a home, SEMs reduce energy costs.

Smart mobility

In an effort to be more sustainable, cities today are looking for ways to get polluting internal combustion engines off the streets without disrupting the daily flow of people and goods. Going forward, e-mobility is the clear, clean choice. That is why ABB is active across the entire e-mobility value chain, offering a complete range of solutions for the electrification of buses, commercial vehicles, trucks, autonomous vehicles, automobiles, ships and railways. We have rapidly become a world leader in fast charging solutions, which are increasingly in demand as urban areas shift away from fossil fuels.

According to the International Energy Agency, the number of electric and plug-in hybrid electric cars on the road reached 5.6 million at the beginning of 2019 and is expected to rise to 125 million by 2030. ABB is supporting this trend in sustainable mobility by providing not only electric vehicle (EV) charging stations, but also critical EV charging network components, such as substations, energy storage systems and eco-friendly switchgear. These technologies are designed so that EV charging stations, once erected, will be both future-proof and scalable.

Case study
Electric fast chargers in Gothenburg, Sweden

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One of the EV solutions developed by ABB is the DC 50 kW Terra 54 fast-charging station, which provides charging on the go for the most common battery sizes within 30 to 45 minutes. The ABB Terra uses open standards to enable connectivity, remote monitoring and remote assistance functions via an ABB Ability™ solution, reliably connecting public EV charging stations to the power grid. Around 13,000 ABB fast chargers have now been sold in more than 80 countries, making ABB a global leader in DC fast-charging technologies.

ABB's Terra HP 350 kW next-generation fast chargers provide a more powerful solution, capable of adding 200 kilometers of range to an electric car in just eight minutes. ABB has already installed 200 of these units for Electrify America, the largest EV infrastructure project to date in the United States. In many other countries, including Germany, Switzerland and Iceland, ABB is the key technology supplier for sustainable mobility infrastructure.

ABB has also been selected as the main technology partner and supplier of fast-charging systems by IONITY, a consortium of major automakers that has opened 202 fast-charging stations across 18 European countries since 2018. Fastned, a Dutch startup that aims to create a European network of 1,000 fast-charging stations, also uses the Terra series of fast chargers, which run on the ABB Ability™ Connected Services Platform. This platform employs Microsoft Azure's cloud services to enhance uptime, scalability and speed of development, as well as to provide real-time remote support services.

For mass transit, ABB offers solutions for the electrification of buses. And for the electrification of railways, ABB supports sustainable mobility with power and automation technologies for customers ranging from train manufacturers to rail operators. We design, engineer and commission solutions to deliver safe, reliable and cost-effective rail freight and passenger transportation solutions. Our product offering includes traction transformers, motors and converters to move vehicles quickly and reliably. This includes leading integrated and collaborative digital solutions with ABB Ability™.

To further enhance our portfolio of EV charging solutions, ABB has invested some $10 million in a new e-mobility research and development facility in Delft, Netherlands, which opened mid-2019. The center focuses on EV charger interoperability and also incorporates large testing areas to accelerate the development of charging solutions for the rapidly growing electric bus segment.

Sustainable infrastructure

ABB contributes directly to the achievement of SDG 9 by developing advanced products, solutions and services that are changing the way facilities and systems deliver essential services to towns, cities and industries.

Since infrastructure comprises the foundation of any properly functioning city, we believe our SDG 9-related products, solutions and services are vital to the success of smart city initiatives. Indeed, ABB technology and leadership are behind many of the major projects that keep our cities and nations running. In cities around the world, ABB's sensors and systems provide real-time information and control for utilities and transport systems, enabling them to save energy, reduce losses of water and power and enhance management processes. And ABB's measuring and detection technology enables city managers to closely monitor and react to dangerous spikes in emissions.

The efficient and reliable distribution of renewable power is critical to any sustainable city and will be a prerequisite for industrial facilities in the future. ABB technology is perfectly suited to this application, as evidenced by our latest installation in Brazil. There, Enel Green Power chose our ABB Ability™-powered digital substation to deliver emission-free solar power from the São Gonçalo solar photovoltaic plant to Brazil's 500 kV transmission network. This solution will eliminate 600,000 tons of carbon emissions a year and make Brazil's grid stronger, greener and smarter.

In the city of Västerås, Sweden, ABB Ability™ digital solutions and expertise are being applied to good purpose in close cooperation with Microsoft. There, ABB is working in partnership with Swedish energy company Mälarenergi. Mälarenergi operates a broad range of essential services for the city of 150,000, including hydropower plants, the local power grid, a waste-to-energy plant, heating and cooling networks, water and wastewater treatment plants, a water distribution network and a fiber-optic network. For the management of all of these core functions, they rely on ABB Ability™ Collaborative Operations to make more information about these services available faster.

In Vietnam, Ho Chi Minh City's local utility, SAWACO, uses the ABB Ability™ Symphony® Plus supervisory control and data acquisition system (SCADA), reducing water leakage from 30 percent to 10 percent while supporting long-term growth. The smart collection of digital data offers real-time insights into the water network's status, enabling quality improvement of its drinking water and better living conditions for millions of people in the Vietnamese city.

Hospitals are also categorized as fundamental infrastructure assets, and ABB is at the forefront of efforts to empower them with smart technologies. The healthcare sector is now being challenged to keep pace with advances in the diagnosis and treatment of disease while coping with an aging population, increasing costs and a growing worldwide shortage of medical staff. In response, in 2019 we opened the first ABB global healthcare research hub, on the Texas Medical Center campus in Houston, Texas. The goal is to develop robots for repetitive, delicate and mundane processes, leaving highly skilled medical and laboratory staff free to take on more valuable roles, and ultimately treat more patients.

At the research hub, we will use our experience in industrial and collaborative robotics to create flexible automation solutions for healthcare. Cutting-edge robotics have the potential to reduce the number of manual procedures performed by medical staff, improve the accuracy of laboratory work and enhance patient satisfaction and safety. The hub will feature a number of concept technologies, including a mobile YuMi® robot, which will be designed to assist with laboratory and hospital logistical tasks. Additional YuMi® robots could be used for centrifuge tending and test tube handling systems, while an IRB 1200 robot may be used to execute liquid transfers in a pipetting application.

Innovative industry

ABB is developing advanced products, solutions and services that are radically reshaping the production landscape by making smart and sustainable factories of the future possible. Our portfolio enables manufacturers to respond to the increasing pressure for shorter product design cycles, the rise of mass customization, and increased environmental, safety and compliance regulations.

Case study
Energy savings enabled by intelligent motion solutions

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As a technology leader in the fields of industrial automation, electrification, robotics, discrete automation and motion, ABB's work contributes directly to the achievement of SDG 9. Our suite of ABB Ability™ digital solutions and services uses sensors, network connectivity and data analytics to provide a real-time view into operations, enabling predictive maintenance, improved safety and reduced operating costs. And because ABB Ability™ uses the Microsoft Azure cloud as its integrated connectivity platform, our customers benefit from access to enterprise-grade cloud infrastructure.

Moreover, ABB is a world leading provider of automated control solutions that can increase output while reducing energy usage and waste of raw materials. We recently launched our first cloud application for original equipment manufacturers (OEMs). The new ABB Ability™ Asset Performance Monitor collects data on production rates, energy consumption and temperature and provides a continuous overview of an OEM's entire installed base, enabling more informed business decisions. The ABB Ability™ Asset Performance Monitor displays data on a digital dashboard, giving OEMs the necessary insights to initiate machine upgrades and advanced services. State-of-the-art security standards and transfer protocols ensure data integrity.

This is just one of the flexible, scalable and secure solutions that ABB offers to facilitate the shift to smart factories. Digitalizing production processes increases system reliability and throughput, reduces raw material and energy use and improves product quality. For instance, the virtual commissioning of drives and programmable logic controllers (PLCs) can cut project costs significantly while making more efficient use of engineering personnel.

To power the smart factories of the future, ABB offers a wide range of solutions for secure and efficient energy distribution. For example, our cloud platform can connect all of the electrical devices in a facility to the industrial internet, enabling precise information and control functions. Our compact, intelligent circuit breakers deploy integrated connectivity to link smartphones, tablets and PCs with data analysis tools in the ABB Ability™ suite in real time.

ABB believes the digital transformation of global industry – with AI at the center – will rise to the challenge of providing the clean and plentiful food, water, energy and mobility the future demands.

Guido Jouret – Chief Digital Officer

The ABB Ability™ Digital Powertrain solution also leverages digitalization to improve factory operations. This solution consolidates sensor and drive data with cloud-based analysis of all components in an industrial system within a single unit – covering everything from frequency converters and motors to pumps and bearings. The deep data insights it can provide enables customers to make better decisions to ensure safe, reliable and efficient operations.

Robotics and other factory automation solutions increase efficiency and reduce waste and energy consumption. This is particularly true in the fast-evolving field of collaborative robots, or cobots. ABB has been introducing new robotics breakthroughs that enable human-machine collaboration, allowing robots to share working spaces with people to achieve optimal efficiency.

The new robotics manufacturing and research facility we are building in Kangqiao, near Shanghai, China will be a perfect example of what the digital factories of the future will be like. Production in this complete digital manufacturing ecosystem will be based on cells of automation rather than on a fixed assembly line, which will allow robots to move from station to station for greater customization and flexibility than in traditional, linear production systems. Automated guided vehicles (AGVs) will deliver parts to the production robots just in time, while the latest collaborative technologies will ensure that humans and robots can work safely side by side, bringing greater flexibility and agility to production processes and combining the advantages of robots with the unique capabilities of people.

ABB's solutions for industry, just like its solutions for cities and infrastructure, leverage the latest digital technologies to deliver unprecedented levels of resource efficiency. Our world is a fragile one, with limited resources. These resources must be used sustainably and in a manner that minimizes the impact of their use on the environment itself. Intelligent technologies offer the key to protecting the earth while enabling continued economic growth. ABB is committed to developing the products, solutions and services required to make a brighter future possible for future generations.