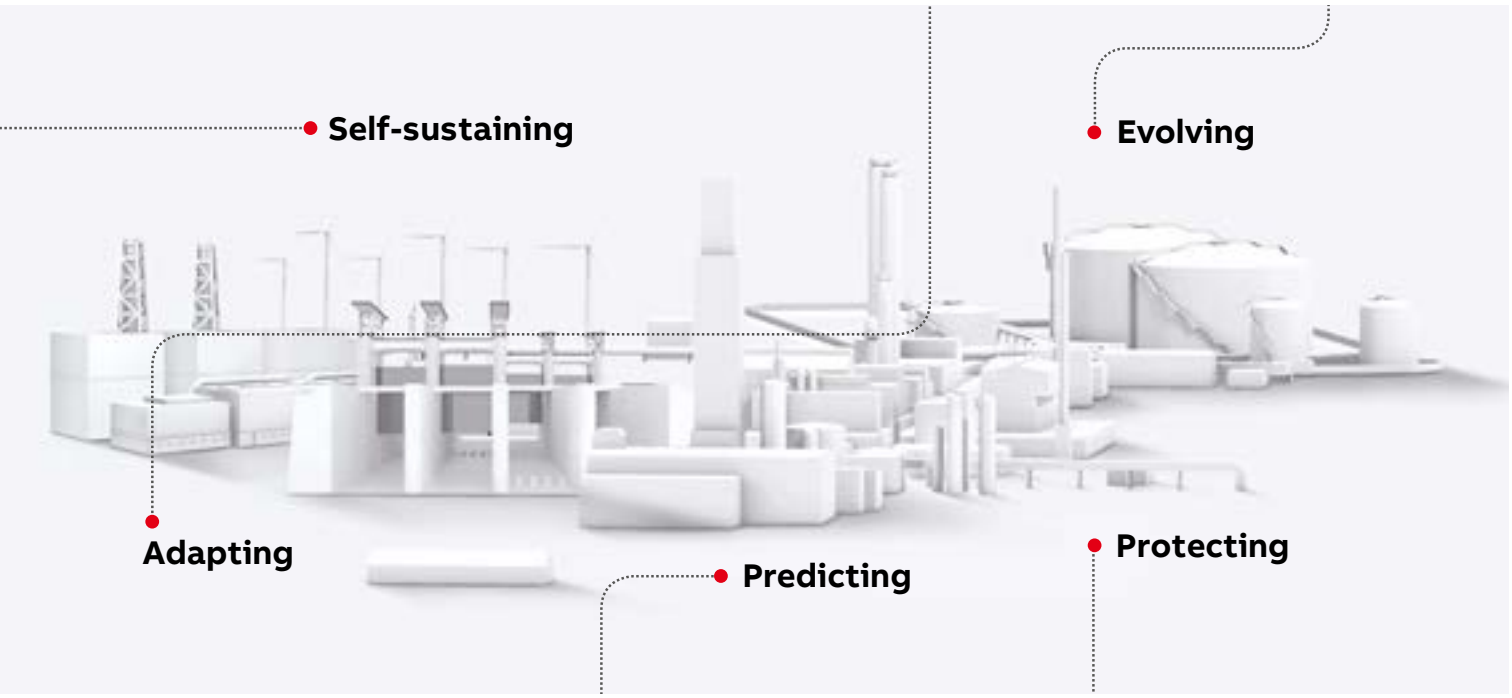
WHITE PAPER

Power generation control technology and the vision of the digital era

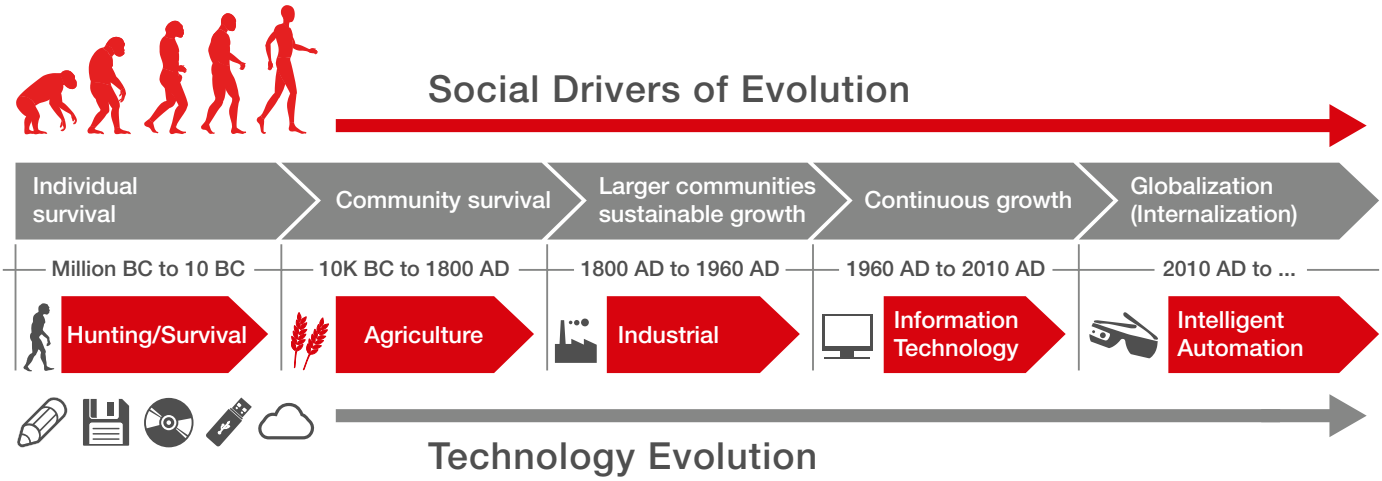


The Fourth Industrial Revolution, a changing world

There has never been a time of greater promise, or one of greater potential peril, according to Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, in his discussion of the Fourth Industrial Revolution. He asserts that this revolution is unprecedented in its pace, in its scope – it is disrupting almost every industry in every country – and its impact on transforming entire systems of production, management, and governance. It is set to affect such diverse areas as social equality, career planning, privacy, human interaction, security, policy-making, business models and customer expectations; and yet we do not know what kind of future we face: is it a bleaker, 'soulless' version where humans are replaced by robots or living in social media-fuelled isolation, or an optimistic one in which our social interactions, work-life balance and even life expectancies are changed for the better?

The Fourth Industrial Revolution goes beyond the Third – broadly summed up as the development of digital systems, communication, computing power and automated production – in that the Fourth heralds a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres; and it includes not only the way humans are connected but the way in which technology can even be embedded in human bodies.

A note on terminology: alongside the Fourth Industrial Revolution, the terms Industrie 4.0 (used mostly in Germany to describe intelligent manufacturing) and the (Industrial) Internet of Things (the term used most often in the US) are also found.



The Internet of Things and the impact on business models

Schwab describes as "unlimited" the possibilities associated with connecting billions of people by mobile devices. And indeed the concept of the Internet of Things – in which almost any "thing" that can be connected to another "thing" will be connected – is both redefining business models and customer expectations, as well as opening up huge potential for those companies which can harness this technological progress.

A 2015 report by McKinsey quantifies the potential economic impact of the IoT as $4 trillion to $11 trillion a year in 2025 – with the level of value (including the consumer surplus) at the highest end of this scale being equivalent to about 11 percent of the world economy. What we can say now is that those companies who have already displayed the agility, innovation and entrepreneurialism needed to grasp this potential are redefining traditional business models. For example, we see the demand and supply sides merging (Airbnb and Uber) or the traditional boundaries between industries blurring (Amazon Prime Air, SpaceX and Google X).

According to Schwab, customers are increasingly at the epicenter of the economy, which is about improving how they are served, adding that data can now be used to enhance physical products and services as well as the way assets are maintained. For customers in the markets ABB serves, the benefits of connecting the physical and digital include increased efficiency, improvements in uptime, speed, and yield, and growth through new business models and the ability to expand into new markets.

The changing power sector

Increased complexity and flexibility, and new business models, are also the hallmark of the power sector, which – as with other industries – is seeing changes on an unprecedented scale and pace. Complexity is increasing due to a number of factors, including in the areas of generation, infrastructure, regulations and security.

For example, electrification is increasing due to greater demand from emerging countries, industry and mobility; there is a rapid growth in renewables; generation is now distributed over multiple locations; and the traditional model of one-way electricity flows is giving way to multi-directional flows. Furthermore, we are seeing the emergence of microgrids, hybrid models of conventional and renewable plants, stricter environmental regulations and the growing importance of cyber security. And while rising populations will guarantee the long-term upward demand for energy, patterns of consumption are also changing, for example through the increased use of smarter cars, homes and appliances.

This is not only bringing about changes in the transmission infrastructure itself but also the way it is operated, necessitating more intelligent management of supply and demand. This calls for a power system that makes greater use of digital technologies and requires condition and performance monitoring, diagnostics, maintenance, protection and optimization of assets. Indeed, such changes bring their own challenges, but for those companies which surmount these challenges, and grasp the potential of digital, an optimistic future awaits.

Going digital, decades of innovation for ABB's power generation control technology

ABB is behind technology developments in the power generation control technology sector dating back to the mid-1910s. As such, it has evolved its products and solutions from the earliest days of providing boiler meters to offering the current state-of-the-art digital control system ABB Ability™ Symphony® Plus.

In line with the Third Industrial Revolution, ABB developed the first digital system for power plants to monitor processes, provide data logging, performance computing and burner and pulverizer start-up and supervision. Then in 1980, the Network 90 system made it possible, for the first time, for a single operator to control processes from other areas of the plant. This advancement marked the end of so-called islands of automation and, with the addition of smart field instrumentation, led to the distributed control systems of today. For decades, ABB's Network 90 has been the industry benchmark, the DCS system that other suppliers compare theirs against or take inspiration from. It planted the roots to the future of this technology.

Further into the digital age, advances in data gathering, networking and processing enabled information to be easily shared throughout the plant. With the development of the INFI 90 system and later INFI 90 Open, process control evolved to become strategic enterprise management, enhancing collaboration and enabling integration of multiple business functions. However, it was not enough to simply collect data, or even to analyze it; the customer – to use Schwab's term – had to become the epicenter.

ABB Ability™, 'closing the loop' and customer collaboration

ABB Ability™ is the range of digital solutions which connects ABB customers to the power of the Industrial Internet of Things. ABB recognizes that sensing data and then analyzing it to create insights are two necessary steps; however realizing these insights in the physical world of a company's operations – making them actionable, delivering solutions and 'closing the loop' – is the crucial third step where customer value creation occurs.

Closing the loop is how ABB unlocks new opportunities for its customers to reduce downtime, lower energy or fuel consumption, lower maintenance effort, increase resource efficiency, elevate performance, and improve productivity. Today, many benefits of Symphony® Plus are driven by this approach, including functions such as predictive control and maintenance, operator efficiency, and collaboration. Around a third of the 70 million ABB-connected devices are connected to power generation control systems from ABB i.e. Symphony® Plus or its predecessors.

People are at the core of this strategy as it is their expertise and knowledge that transform the control systems' data-generating capability into actionable insights for the customer. The collaborative approach is key here. ABB works with its customers to help them use their data. One power generation example is remote support for on-site personnel that can detect hidden turbine issues and prevent problems before they happen.

Humanity meets digitalization – the 'human' digital plant

The concept of the Digital Power Plant builds on the activity of 'closing the loop' and the reliance on human collaboration and expertise. It encap-

sulates the customer benefits of ABB's power generation control technology in a new, intelligent customer experience.

The plant of the future is seen as evolving, self-sustaining, predicting, protecting and adapting – human characteristics which encapsulate the solutions offered by Symphony® Plus and which contribute to higher operational performance for the customer.

An evolving plant, for example, has a longer and healthier lifetime because its technology keeps evolving over time. A self-sustaining plant is aware of its status, limits and capabilities, and requests maintenance when needed. A predicting plant knows how much power it will be able to generate and optimally manages resources in relation to status, meteorological condition and market constraints. A protecting plant is safe for personnel and the environment, and is cyber secure. An adapting plant is flexible in relation to market requests, responsive to stakeholder's needs and, if necessary, a renewable and conventional hybrid.

Being a new intelligent experience, the digital power plant goes beyond the generation of data to apply this to real company operations, allowing power plant operators to visualize the effect on their plant. This new experience can be compared to Google Street View in the world of car navigation systems. While navigation systems analyze data to provide the optimum route, Google Street View adds a visual experience for drivers, offering them an extra level of recognition and therefore comfort for their route. Google is using the data it stores – images – to create a new user experience.

Another way in which the human and digital worlds meet can be seen in the 'evolution without obsolescence' approach of Symphony® Plus and its predecessors. Here, the product may evolve to the next technological level but seamlessly integrates into the environment and remains familiar to customers. ABB views its control systems as generations in an evolving family, the same 'soul' inside a changing outer shell, which customers will recognize and know – just as it views its legacy of innovation as the roots to its future.

In this sense, Symphony® Plus blurs the lines between the physical, digital and biological as defining characteristics of the Fourth Industrial Revolution. But in retaining the same soul through its generations, it is the more optimistic, rather than bleaker, version of the future which it aims to attain.

Roots to the future

Digital

ABB is a leading provider of integrated power and automation solutions, with unrivaled experience partnering with the energy and water sectors to deliver improved, sustainable operations. Integrated and secure ABB digital systems, services and solutions help power customers automate and optimize the performance of both conventional and renewable power plants and water facilities.

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