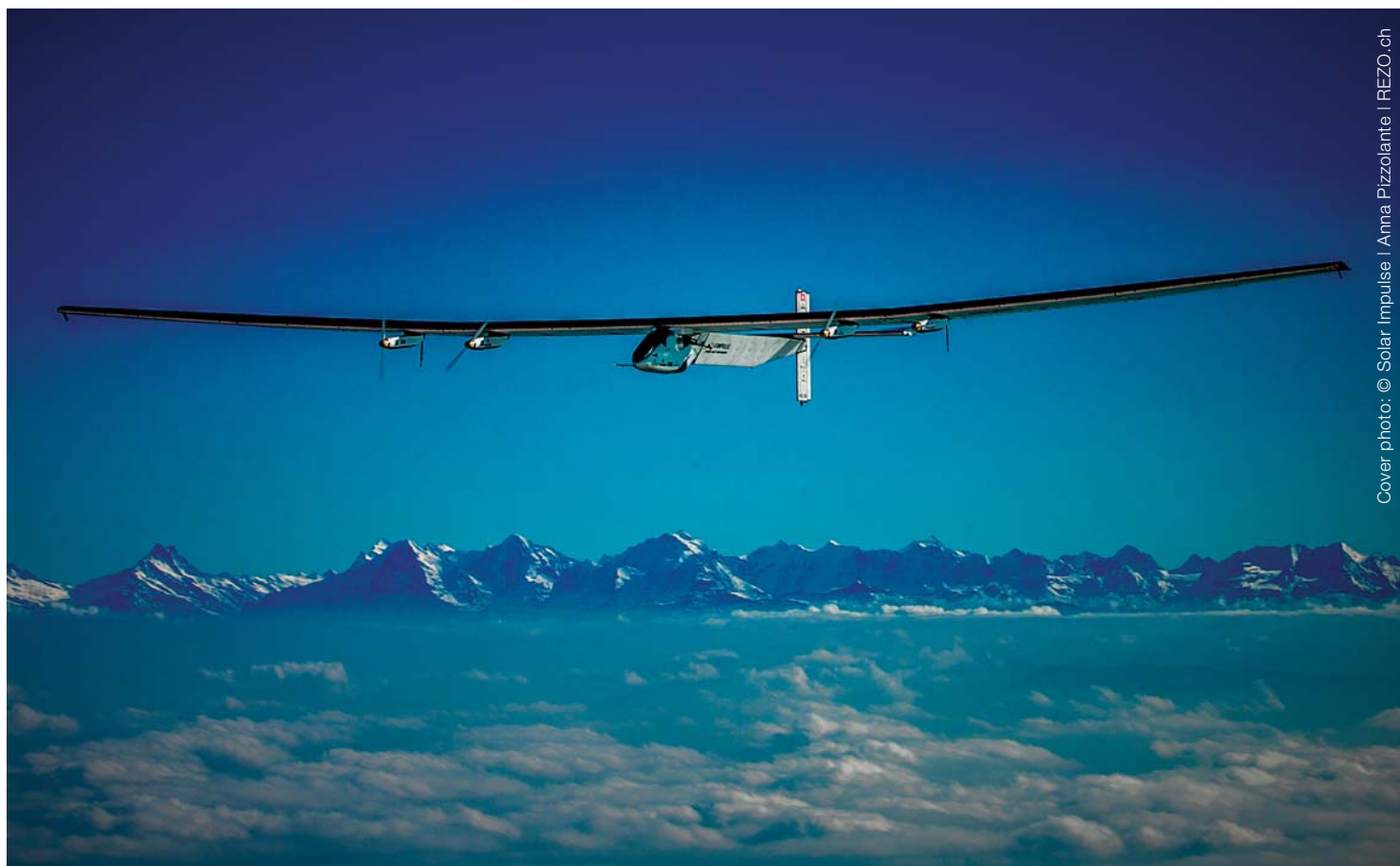


The customer newsletter of
ABB Power Generation

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in control



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for a better world™



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Massimo Danieli

Managing Director, ABB Power Generation

Dear Reader,

The renewable energy industry continues to grow at a rapid pace.

The latest figures from the International Energy Agency show that in 2013 renewable energy generated almost 22 percent of the world's electricity. By 2040 it is expected to account for one-third of total power generation.

At ABB, we have long been a pioneer in the development of renewable power generation. As a world leader in power and automation products and systems, we offer a proven portfolio of integrated electrical and control solutions for all types of renewable power generation. These solutions are standardized, modular and based on state-of-the-art ABB products and ABB process know-how. They are designed to meet the needs of engineering, procurement and construction contractors for speedy and cost-effective deployment, and to maximize plant performance for end users.

Many of these solutions are making a big difference to the way renewable energy is generated. For instance, in India our products and expertise have helped create a new plant application for utility-scale solar photovoltaic power plants. Built on an irrigation canal, the plant protects the water from evaporation and does not require the use of land for construction (see page 17). In Switzerland, we are providing an advanced control system for a new pumped storage plant that will rapidly release energy into the European transmission network to stabilize the effects of wind and solar intermittency (pages 14-15). And, we have recently formed a partnership with Vestas, the world's leading supplier of wind turbines, to provide microgrid solutions for energy-poor communities with untapped wind generation resources.

In technology and innovation we continue to expand our portfolio of products in our Symphony Plus total plant automation platform. In March this year we will officially release our new SD Series. SD Series is a suite of DIN rail-mounted control and I/O products

that provides total plant automation for the entire control spectrum, regardless of application type, size or location.

This green automation solution delivers significant energy savings, withstands extreme operating conditions and reduces hardware requirements.

Accompanying the SD Series are two dedicated solutions for wind and solar automation: Symphony Plus for Wind and Symphony Plus for Solar (page 27). Both solutions reduce the cost of operations for wind farms and solar PV plants through a comprehensive range of functionalities and efficiency-enhancing technologies. These include real-time monitoring, powerful plant diagnostics and remote operations and control. For wind we have added two wind-sensing technologies to our Symphony Plus for Wind portfolio (pages 20-21), and in solar PV we have developed an automation and service solution for PV plants based on Symphony Plus for Solar (pages 22-23).

I would like to thank John Theunissen of AusNet Services, Australia, for taking part in this issue's customer interview (pages 6-7). Working in collaboration with Samsung SDI, we have recently developed an energy storage and grid stabilization solution for AusNet's power distribution network in Victoria state. The 1 MW solution automatically provides additional power for the distribution network during peak demand, thereby enabling AusNet to dynamically manage the peaks and troughs in consumer demand.

At ABB we continue to innovate and develop solutions that improve the way renewable energy and conventional power generation are integrated with daily life. We hope you enjoy reading this new issue of In Control.

With kind regards,

A handwritten signature in blue ink that reads "Massimo Danieli". The signature is fluid and cursive.

Massimo Danieli
Managing Director
ABB Power Generation



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Renewable energy for remote areas



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Solutions for renewable energy plants

ABB has long been a leading player and trusted partner in the global renewable energy market. Our portfolio of integrated electrical and automation solutions for utility-scale renewable energy plants benefit EPCs and end users alike.

The renewable energy market continues to expand at a rapid pace. According to the International Energy Agency (IEA), in 2013 the growth in new renewable power capacity was the biggest ever recorded. Renewables now account for 22 percent of total power generation, about the same as gas.

The IEA expects this pattern to continue. By 2020 global renewable electricity generation is forecast to increase by another 45 percent. Two global trends are driving this growth: better scalability for larger plants, and cost competitiveness with alternative types of power generation.

Trusted partner

ABB has long been a leading player and trusted partner in the global renewable energy market.

We are a market leader in power products and power systems, and the world's leading supplier of distributed control systems. This combination of market and technology leadership has enabled us to develop standardized and optimized electrical balance of plant and control solutions for renewable energy plants. The solutions are complete, fully integrated and based on our own products. They enable speedy and cost-effective project execution for EPCs and better plant performance for end users.

Our expertise in electrical and automation engineering serves the customer from the very start of the project.

Through comprehensive consulting capabilities we guide the customer through the crucial initial stages of project development. We then design a plant that best serves their requirements for levelized cost of electricity (LCOE), grid stabilization and power security. As a one-shop stop, we perform feasibility studies; analyze the project's profitability, facilitating financing if required; design, engineer and optimize the plant; provide project management; and install, optimize and commission the electrical and automation systems.

Standardized solutions

Our standardized modular solutions for renewable power plants are designed for fast-track deployment. These pre-assembled, factory-tested modules enable short lead times and easy installation. For EPCs this reduces site work, cuts vendor interfaces, and minimizes project risk. For end users the products in the solutions are the best on the market, designed and manufactured by ABB to the highest standards. Seamlessly integrated into a complete and optimized solution they deliver the highest levels of reliability and efficiency and the lowest levels of plant energy consumption.

As a leading supplier of power transmission and distribution solutions, we have a close working relationship with all electric utilities worldwide. We know the grid codes of each transmission and distribution system operator, and can

deliver a solution that meets the exact requirements of each operator.

When the plant is up and running we have a range of service solutions to help owners get the most from their investment. These range from repairs and spare parts to remote management and service of single plants or entire fleets from our dedicated remote monitoring center for renewable energy plants.

Total plant automation

The brain of any renewable energy plant is the automation system. Our Symphony® Plus total plant automation platform is designed specifically for the power generation and water industries. As the latest generation of our Symphony family of distributed control systems, it builds on a 30-year heritage and more than 6,500 installations. Over 4,500 of these installations are in power and water applications – more than any other automation platform on the market today.

Symphony Plus is widely used in all types of conventional and renewable power plant. Our new Symphony Plus for Solar and Symphony Plus for Wind (see page 27 for more details) automation systems integrate monitoring and diagnostics with control and forecasting of renewable power production into a single system. They are designed to simplify fleet management and enable energy trading. Operators can remotely monitor and control an entire fleet



of power generation facilities – solar, wind, hydro and conventional plants – from the same operator stations. The solutions also provide dynamic optimization in response to changing production forecasts, grid requirements and energy prices.

Microgrids

Microgrids are a key element of our expertise and portfolio. At the heart of our offering is our widely proven Microgrid Plus System™ control and PowerStore™ stabilization solutions, which enable up to 100 percent renewable penetration while ensuring utility-grade levels of stability and reliability of the power supply.

We offer turnkey solutions, and have references for, all types of microgrid requirement: greenfield hybrid power plants consisting of renewable and diesel power generation; the integration of renewable energy generation with an existing fuel-based microgrid; optimizing the performance of an unstable microgrid that combines renewable energy and fossil fuel generation; stabilizing the connection of an existing renewable

energy plant to a weak power grid; and power grid stabilization.

ABB has 25 years of experience developing microgrid technologies and has delivered more than 80 microgrid solutions worldwide - more than any other supplier.

Why choose ABB?

- Consulting capabilities
- Cutting-edge technologies and a long history of innovation
- Product portfolio covering the entire plant
- Strong local presence to support customer needs
- Global manufacturing and engineering footprint
- Global installed base and proven track record
- Significant service presence to support installed base
- Skilled, experienced workforce

Energy storage and grid stabilization

A new ABB energy storage and grid stabilization solution is helping Australian transmission and distribution utility, AusNet Services, provide additional power during peak demand. John Theunissen of AusNet explains the whys and wherefores of the solution.

AusNet Services is the largest energy delivery service in Victoria, the second most populous state in Australia. The company supplies electricity and gas to more than 1.3 million homes and businesses, and employs around 2,200 people.

In 2014 AusNet Services selected ABB to supply a hybrid grid energy storage and diesel generation system for its electricity distribution network in the eastern part of the state. The 1 MW trial solution automatically provides additional power for the 22 kV network during peak demand. It can operate at full power for one hour and provide electricity for about 300 homes.

The turnkey solution comprises ABB's Microgrid Plus distributed control system and PowerStore™ grid stabilization system. It includes a 3 MVA mobile substation and a backup diesel generator. The solution is portable and housed in outdoor containers for easy deployment. The battery is supplied by ABB's partner in the project, Samsung SDI.

ABB was also responsible for power system modelling and grid connection

compliance, design and testing, manufacture and assembly, installation and commissioning. ABB will also provide AusNet Services with support for the two-year duration of the trial.

The solution has been in operation since 1 December, 2014 – the start of the Australian summer.

Interview with John Theunissen, manager of network modernization at AusNet Services.

Why did you decide to initiate this project?

Energy storage is one of those technologies that is very much on the radar in our business. One of our objectives as a company is to embrace new technologies like this and to try to get as much value out of them as possible. We therefore applied for – and were awarded – incentive-related funding for the project from the regulator. Our purpose was to test the technology's ability to enhance demand management during peak periods, as well as to deliver benefits in other

applications like power factor correction, voltage imbalance and island operation.

Why is demand management so important?

An energy network is a real-time system in which supply and demand has to be managed on a moment-by-moment basis. You have to operate within the capacity tolerances of the assets in the network. If you don't it might lead to asset failure and power supply problems for customers. But asset and network utilization is not uniform during the day or during the year. There might only be a few occasions a year when you exceed the capacity of your assets. So the question is: How can you efficiently manage demand during those periods when demand exceeds capacity? One answer is to ask your customers to reduce their load, which is not always practical or achievable. Another is to augment the network with equipment upgrades, but that is expensive and time consuming. A third is to use innovative non-network technologies like this one.



John Theunissen, manager of network modernization at AusNet Services

“The real beauty of the solution is that it is energy-dynamic – we use it to match the peaks and troughs in demand. We use the power stored in the battery during the peaks when demand is high, and recharge the battery during the troughs when demand is low”

What are the advantages of the technology?

One advantage is that the solution doesn't affect our customers at all. We don't have to ask them to reduce their load during the peak demand season. But the real beauty of the solution is that it is energy-dynamic – we use it to match the peaks and troughs in demand. We use the power stored in the battery during the peaks when demand is high, and recharge the battery during the troughs when demand is low.

Why did you select ABB for this project?

We wanted to partner with an organization with experience and a track record in this technology - a company with an international footprint but also with local presence and a local engineering capability. Before we initiated the selection process we looked at some of the reference sites and ABB was one of the companies that stood out in this technology. Secondly, we wanted a partner with the ability to do this project on a turnkey basis. This is a new technology so minimizing our exposure to risk is an important issue for us.

What uses do you expect from this solution?

We see a great future for energy storage. One of the key benefits is that it offers multiple value streams. If you

want to get the most out of a solution like this then you have to be able to get as much value out of it as possible. For example, the main application for us is peak load management. But we also want to test how the solution can help improve power quality in environments where voltage stability is an issue, such as residential areas with many roof-top PV installations. Another use we want to test is islanding – creating a mini-grid in a section of the network where we have maintenance work to do. Normally, we would have to cut the power off for customers in that section, but by creating a mini-grid we can keep them supplied with power while we are doing maintenance.

ABB and Vestas initiative to supply remote areas with wind power

ABB is partnering with Vestas in an innovative, commercially-based business venture that will bring affordable electricity to communities that are energy-poor but rich in untapped wind generation resources.

Many such communities rely on diesel generators to supply what power they have, which is an expensive, polluting and potentially uncertain power source. The Wind for Prosperity initiative is based on a hybrid wind-diesel electricity generating system made up of ABB microgrid power stabilization solutions and factory-refurbished Vestas wind turbines with advanced diesel power generation capability.

The system combines ABB's unique grid modeling, integration engineering and electrical system specification with Vestas' leading hybrid wind-diesel turbine technology to create a stable, reliable power source and electrical infrastructure for remote, energy-poor areas not linked to a power grid.

Powering remote places

Designed to increase capacity and reduce the cost and environmental impact of electrical generation in remote places, the Wind for Prosperity initiative is an opportunity for business, government and financial institutions to join forces and improve lives while generating risk-adjusted returns for private investors.

"A typical microgrid power system is made up of many parts, which must be integrated to work together" says Massimo Danieli, managing director of ABB's Power Generation business, a part of the company's Power Systems division. "ABB's distributed control and grid-stabilizing PowerStore™ technology combined with Vestas' wind turbines will create strong, sta-

ble self-contained power systems where regular grid infrastructure cannot easily reach. ABB microgrids are a proven method of power generation, able to reduce emissions and dependence on diesel power."

Interest in decentralized or off-grid electricity generation is growing as developing countries grapple with the challenges of delivering electricity to rural and remote locations. However, extending the existing grid is often challenging in terms of cost, power quality and limited demand in isolated areas and sparsely populated zones. Fuel-powered microgrids play a key role in bringing electricity to these areas, but are also vulnerable to fuel price increases and the logistical challenge of delivering fuel to remote places.



This has given rise to the development of renewable energies as an additional or main source of generation in fuel-powered microgrids.

Kenya focus

The Wind for Prosperity initiative is focusing on rural Kenya to start, where 13 communities - home to more than 200,000 people - have been identified as potential project areas, in coordination with Kenyan government agencies. The scheme is expected to supply electricity at significant lower cost than diesel-only power production.

In addition to Africa, Wind for Prosperity partners are also exploring potential projects in other geographical areas with similar needs. The initiative plans to install hybrid power generation systems reaching at least one million people in the coming years.

For these projects, ABB is providing its unique PowerStore technology, microgrid controller and other equipment on a site-to-site basis to keep the hybrid wind systems stable and provide grid-quality electrical power, in addition to related electrical infrastructure and localized service solutions.

Vestas is supplying factory refurbished Vestas wind turbines, wind simulation studies for site selection and site designs, and EPC services for wind turbines, including foundations, power cables and transformers, as well as localized wind turbine service solutions.

ABB's microgrid technology is designed to manage renewable energy generation in isolated grids and ensure utility-grade power quality and grid stability, as well as very high levels of wind and solar power penetration, helping to reduce both emissions and dependency on fossil fuel. ABB has more than 80 microgrid project references worldwide, including consulting, key products in microgrid systems, and expert project execution.

ABB's distributed control and grid-stabilizing PowerStore technology combined with Vestas' wind turbines will create strong, stable self-contained power systems where regular grid infrastructure cannot easily reach.

New microgrid research laboratory chooses ABB

ABB is providing a control system and expertise for a new microgrid research laboratory in Italy.

ABB is supplying technical support and a real-time monitoring and control system for a smart microgrid pilot project at the Politecnico di Bari technical university in Bari, Italy. The control architecture provided by ABB will help the university conduct research into how power generation resources can feed electrical and thermal loads at minimum cost in islanded or grid-connected microgrids.

The experimental microgrid comprises a microturbine-based combined heat and power system, an internal combustion engine based cogenerator, a photovoltaic generator, two flywheels, a wind turbine simulator, a battery storage system, and a vehicle-to-grid (V2G) system equipped with two electric vehicles and two charging stations.

The microgrid will be monitored and controlled in real time from a control room where an ABB Symphony Plus monitoring and control system is installed. This is the core of the microgrid. The laboratory will simulate the future energy system of residential buildings, shopping centers and industrial areas.

"ABB's Symphony Plus provides us with a great opportunity to develop microgrid technology as we research new software and algorithms to optimize short-term and real-time operation of the experimental microgrid," said Professor Michele Trovato, head of the project. "ABB is a trusted supplier of state-of-the-art solutions and a first-class technical and scientific partner with whom we can explore new areas of collaboration."

The Symphony Plus solution will provide efficient and optimized control and enable research teams to rapidly and easily test microgrid technologies. The solution will optimally manage a number of key parameters including generation



and storage resources, generation resources when the microgrid is in island mode, energy storage and the exchange of energy with the grid, and component monitoring and control.

The heart of ABB's portfolio for microgrids is its proven control and grid stabilization technologies, which can integrate up to 100 percent of a microgrid's renewable energy resources, while maintaining the highest levels of grid stability and reliability. Our portfolio encompasses a comprehensive range of enabling technologies including inverters, converters for wind turbines, energy storage systems, control systems and grid connections – all supported by ABB's broad experience in microgrid engineering and project execution.

ABB has delivered more than 80 microgrid solutions worldwide, more than any other supplier. These include solutions for hybrid microgrids, the integra-

tion of renewable energy generation into fuel-based microgrids, and stabilization and flow optimization solutions for existing microgrids.

Helping Zambia generate more power efficiently

ABB is supplying a new Symphony Plus total plant automation system to maximize production and reliability at the Kafue Gorge hydropower plant in Zambia.

The Zambian economy has been growing vigorously over the past decade, achieving an average annual growth rate of 6.4 percent. Electricity demand at peak times is estimated at 1,950 megawatts (MW), while the available capacity is 2,120 MW of which 85 MW is spinning reserve.

As part of its efforts to improve Zambia's electric power infrastructure and reliability of supply, ZESCO, the state-owned power utility company, has embarked on an ambitious investment program throughout its generation, transmission, distribution and supply operations.

One of the key projects in this program is to maximize production and reliability at one of the country's biggest power plants - the 990 MW Kafue Gorge hydropower station - by modernizing the aging plant automation system.

ZESCO chooses ABB

ZESCO selected ABB to supply a new distributed control system for the Kafue Gorge plant. Once installed, the system will automate the entire power generation process at the plant. It will control the six 165 MW units, provide an interface with the turbine governor system, and control the plant auxiliaries, start and stop sequences, electrical components and plant substation. It will also facilitate the remote control of the Kafue Gorge hydro facility, which is located ten kilometers upstream from the plant.

The solution is based on powerful Symphony® Plus HPC800 controllers, and includes the intensive use of the PROFIBUS fieldbus. Control and supervision of the entire plant will be performed from operator friendly S+ Operations workplaces.



ABB is also supplying and integrating protection relays from its market-leading Relion® product family, and will provide a new ergonomically designed control room with large screens to facilitate effective operator performance. Design, engineering, installation, commissioning and training are also included.

ABB has extensive experience of supplying and evolving plant automation systems for hydropower stations in Africa. Recent ABB projects include solutions for the Aswan hydropower complex in Egypt and an instrumentation, control and electrical solution for a new 360 km water network in Botswana.

Recent ABB hydropower projects in Africa include solutions for the Aswan complex in Egypt and a new 360 km water network in Botswana.



Maintaining control system functionality in Denmark

ABB and Amager Resource Center (ARC), a Danish waste management company, have developed a service agreement that keeps control system functionality at the highest levels of performance and uptime.

ABB and ARC have recently implemented a control system functionality agreement with the purpose of maintaining functionality and uptime in ARC's control system and plant production process.

This means that both companies are focused on ARC's strategic target of 100 percent uptime at its waste-to-energy plant in Copenhagen, Denmark. The new concept allows ABB to propose and implement measures towards the customer's overriding target, not just activities related to specific points of service. When the strategic target is met, both companies share the savings.

Dynamic agreement

With the service agreement in place, both parties take responsibility for staying ahead of potential problems and, in the event that problems occur, solving them in the right order. Since both parties inform each other of important matters that arise during plant operations, the service agreement is naturally dy-

namic and progressive. With this, ARC and ABB can anticipate potential control problems and find solutions for control systems and control system hardware.

If the targeted uptime is achieved, the savings are shared. Targeted uptime is measured on a monthly and quarterly basis in order to ensure continuous focus.

As part of the cooperation ABB logs on weekly to ARC's control management system and power generation information (PGIM) system, collecting historical operations data for environmental reporting, overall equipment effectiveness (OEE) reporting and other technical reports. In this way ABB is able to monitor the actual state of the facility's systems. This allows early identification of potential issues, and a regular check and review cycle.

Additionally, ABB project managers visit the ARC facility each month for meetings with ARC personnel to exchange operational information. To ensure the best possible levels of trust,

confidence and continuous collaboration between the two partners, a nominated and specialized ABB service engineer is connected to the agreement.

Comprehensive coverage

As ABB is involved in identifying requirements and selecting future solutions at the plant, the service agreement is wide-ranging. It covers software updates as provided by Automation Sentinel (ABB's control system life cycle management program) as well as the replacement of components. The service agreement also includes third-party equipment and software. ABB ensures regular checks, corrections and updates, and can make requests with regard to equipment and the training of employees. The long-standing relationship of trust between the two companies was a vital prerequisite for the agreement and such close cooperation. It is a win-win arrangement, in which both ABB and ARC can share best practices and knowledge.

Utility-scale solar power solution in Japan

ABB is supplying its industry-renowned plug-and-play transformation centers for one of Japan's largest foreign-owned solar power plants.



ABB has won an order from Maetel, an engineering, construction and procurement (EPC) contractor, to supply 26 transformation centers for the Fukuroda photovoltaic power plant in Japan.

The plant will have a generating capacity of 26 megawatts (MW) and will produce enough emission-free energy to power 10,000 Japanese homes. The plant is currently under construction on a former golf course, and is scheduled to start production in spring 2015. It is owned by Spain-based Gestamp Solar, a leading developer and operator of solar power plants.

ABB transformation centers convert the direct current generated by the photovoltaic modules into utility-standard alternating current that can be fed safely and reliably into the power grid. The transformation centers are specifically designed by ABB to meet customer needs and the harsh operating conditions of solar plant environments. Each center is a highly standardized, pre-assembled and fac-

tory-tested container comprising inverters, transformers, medium voltage switchgear and low voltage switchboards, all of which are manufactured and optimized by ABB for high-output solar power production.

Highest power density

The transformation centers will connect the Fukuroda PV plant to the transmission network in compliance with local grid codes.

ABB and the plant's owner-operator, Gestamp Solar, have a long and successful partnership in the photovoltaic industry. Over the past five years ABB has supplied Gestamp Solar with consultancy and turnkey power and automation solutions for photovoltaic power plants all over the world. For Fukuroda, which is Gestamp Solar's first project in Japan, ABB has provided support and expertise throughout the development of the project.

ABB and the PV market in Japan

Japan has the third largest photovoltaic generating capacity in the world, after Germany and China. Its installed capacity is currently growing by 4-5 gigawatts of new photovoltaic production annually, thanks to attractive government incentives and feed-in tariffs. ABB has played a significant role in the growth of this market by providing power and automation solutions for projects throughout the country. The benefits of ABB and our PV solutions are:

- Established in Japan in 1907
- Local support from network of ABB offices throughout the country
- Strong expertise in renewables
- Turnkey power and automation solutions for PV plants, including grid connection
 - Standardized and containerized for rapid deployment
 - Compact footprint reduces installation costs
- Consultancy and advice throughout the project
- Knowledge of government and utility requirements
- Operations and maintenance, including remote monitoring
- Large installed base of solar power solutions in Japan
- Operates own ABB-equipped PV plant at an ABB factory near Tokyo



Pumping power in the

ABB is providing a plant automation solution for one of the biggest and most innovative power projects ever to be built in the Alps.

Building a power plant in the middle of a mountain, 2,000 meters above sea level, is a huge undertaking. It also takes a long time.

Construction of the Nant de Drance pumped storage power plant in Switzerland began in 2008, and is not scheduled to finish until 2018, ten years later. It is one of the biggest and most challenging power projects ever to be built in the Swiss Alps.

The project involves raising the level of an existing reservoir dam by 20 meters, drilling 17 kilometers of tunnels and excavating a vast underground cavern for the turbines and machinery.

Nant de Drance will have a generating capacity of 900 megawatts, which is enough to power 625,000 European homes. The plant's primary purpose is to help stabilize the European transmission network by rapidly releasing energy into the network to counter fluctuations in supply from wind and solar power plants.

At night and during periods of low demand the plant will pump water uphill from the reservoir to a second reservoir where it will be stored until needed. The water is released - usually at peak demand - and runs downhill to the turbines to generate power, which is then transferred into the grid.

Distributed control

ABB was selected by the plant's owners, also known as Nant de Drance, to supply a plant automation system to control the entire production process at the plant, which is spread out over several sites, most of which are underground.

Nant de Drance chose ABB for its long track record in supplying automation systems for hydropower plants and particularly for pumped storage power plants all over the world.

The ABB solution will integrate the numerous plant subsystems with interna-

tional standard interfaces like IEC 61850 and IEC 60870, and enable remote monitoring from a control center in Lausanne, 70 km away. High integrity ABB controllers will prevent damage caused by hardware defects or software errors from impacting plant operation. The solution will also meet the customer's requirement for an automation system that will evolve over the lifetime of the plant.

System evolution is a key feature and differentiator of all ABB automation systems. ABB continually evolves its automation platforms by developing new products and functionalities and by ensuring that they are compatible with previous generations of the platforms. This protects the customer's investments in the system and in their intellectual capital such as engineering and staff expertise.



Image: Alpic/Marcel Studer

Hydropower plant automation in Ecuador

ABB is supplying the plant automation system for the 480 MW Sopladora hydropower plant in Ecuador.

The customer is China Machinery Engineering Corporation (CMEC), the Beijing-based electrical and mechanical equipment contractor.

Sopladora is currently under construction in Azuay province in Ecuador's south-central highlands, about 100 kilometers from Cuenca, the country's third largest city. When completed in late 2015 the plant will provide a much-needed boost in electricity supply for regional communities and the national power grid.

ABB will provide an integrated control and protection solution for Sopladora's three 160 MW units. The solution is based on Symphony® Plus, ABB's flagship automation system for the power generation and water industries. It includes plant and unit control, electrical protection, generator frequency and voltage control (AVR), energy metering and supervisory control and data acquisition (SCADA).

requirements for operational reliability and cost-effective evolution over the lifetime of the plant.

ABB is also supplying a comprehensive electrical and control solution for the 1,500 MW Coco Codo Sinclair hydropower plant in the Amazon Basin. The plant is the biggest energy project in Ecuador's history. When completed it will generate enough power to meet 45 percent of the country's electricity needs. ABB was awarded the contract by the Chinese hydropower contractor, Sinohydro.

“ABB has vast experience of working with EPCs in the power generation sector. ABB's global reputation and Symphony Plus solution strengthen our competitiveness and provide end users with a stable and reliable automation system.”

Peng Xin
CMEC's project manager for Sopladora

Minimizes risk

The ABB solution delivers benefits for both CMEC the contractor and CELEC the end user. CMEC gains from ABB's long experience of working with engineering, procurement and construction contractors on power generation projects worldwide. This expertise minimizes CMEC's exposure to risk during project execution. For the plant owners, ABB provides a plant automation system that meets CELEC's stringent

Alps

ABB wins hydropower orders in Latvia

ABB is partnering power plant engineering company Power Machines in two hydropower plant projects in Latvia, providing complete electrical and control solutions for Power Machine turbines and generators.



“ABB is one of the few global power and automation companies that can partner an independent manufacturer of turbines and generators like Power Machines.”

ABB and power plant engineering company Power Machines have joined forces to win two hydropower plant contracts in Latvia.

Most of Latvia's electricity is generated at four hydropower plants – Plavinas (the second largest hydropower plant in the European Union), Riga and Kegums 1 and 2. With three of these plants in need of modernization, Power Machines and ABB combined their offerings and expertise to win two turnkey orders for these two important projects.

The most extensive of the two projects is a \$65 million refurbishment of the two plants at Kegums, one of which (Kegums 2) was built 75 years ago. Within the project framework Power Machines is to supply three 78 megawatt (MW) hydropower turbines as well as equipment to renovate three hydro generators at Kegums 2, while ABB is supplying a complete inte-

grated electrical and automation solution for the entire Kegums 2 plant. ABB is also supplying instrumentation and a distributed control system for Kegums 1, which was built in the 1970s.

Power Machines and ABB have also been appointed to modernize two of the 10 units at the Plavinas hydropower plant. Power Machines is overhauling two hydropower units and supplying a turbine and generator for each unit, while ABB is supplying a complete integrated electrical and automation solution and will upgrade the two existing ABB distributed control systems.

“ABB is one of the few global power and automation companies that can partner an independent manufacturer of turbines and generators like Power Machines,” says Massimo Danieli, managing director of ABB's power generation business, a part of the company's Power

Systems division. “Our brand reputation, global footprint and ability to supply complete and fully integrated electrical and control solutions provide Power Machines with a unique competitive advantage.”

Power Machines is the largest power plant engineering company in Russia, providing design, manufacture and delivery of equipment for thermal, nuclear, hydraulic and gas-turbine power plants. The equipment manufactured and supplied by the company generates more than 300,000 MW of power in 57 countries worldwide.

ABB's power generation business provides complete, integrated and optimized electrical and control solutions for all types of conventional and renewable power plants. ABB has been active in the hydropower industry for more than 125 years and has one of the largest installed bases of power and automation solutions in the hydropower sector.

Canal topping

A new space-efficient 10 MW photovoltaic power plant in India generates emission-free energy while preventing water loss in an irrigation canal.

One of the world's most innovative solar power projects was inaugurated in January 2015 by UN Secretary General Ban Ki-moon.

Located on the outskirts of Vadodara city in Gujarat state, India, the 10 MW photovoltaic (PV) power plant is built on a 3.6 km stretch of irrigation canal. The plant not only generates a significant amount of emission-free energy, it also prevents evaporation and eliminates the need to use valuable agricultural land for construction of the plant.

The plant has saved an estimated 16 hectares of land and will prevent 90 million liters of water from evaporating each year. The cooling effect of the water beneath the PV panels boosts panel efficiency by an estimated 7 percent.

On the strength of its successful track record in India's solar power industry, ABB was selected by the plant's engineering, procurement and construction (EPC) contractor, Megha Engineering & Infrastructures Limited (MEIL), to provide a fully integrated electrical balance of plant and automation solution for the PV power plant.

ABB's integrated high-performance solution includes a broad range of ABB power and automation products, which are designed and optimized for PV power plants. These include central inverters, transformers, indoor and outdoor switchyards, and connection to the local distribution network in compliance with utility grid codes. ABB was responsible for design, engineering, installation, testing and commissioning of the EBoP solution.



Canal irrigation network

The plant has generated huge interest in India and other parts of the world for its ability to produce clean renewable energy and save water and land – this in an area where water and land are a scarce resource. Hence the participation of Ban Ki-moon in the opening ceremony. The success of this pioneering concept is now being evaluated for implementation in other Indian states as well.

Gujarat state has one of the world's largest irrigation networks. Some 19,000 km of canals distribute water to vast tracts of farmland throughout the state. It is estimated that if 10 percent of the network was used for canal-top

power generation, it would generate 2,400 MW of clean energy. It would also save more than 21 billion liters of water annually and eliminate the need to use 11,000 acres of land for plant construction.

ABB has long been at the forefront of India's growing PV power industry – providing complete and fully integrated power and automation solutions for more than 10 utility-scale PV power plants with a generating capacity of between 1 MW and 50 MW. These include the 50 MW Sakri PV plant in Maharashtra state, which uses advanced thin-film technology.

Introducing the new Symphony Plus SD Series

Green automation solution reduces energy consumption, lowers hardware requirements and withstands extreme operating conditions.

The SD Series is the latest addition to the Symphony® Plus S+ Control and I/O family. This family, which also includes the HR Series (Harmony Rack) and MR Series (Melody Rack), provides Symphony Plus with a comprehensive offering to meet the needs of new and existing customers from all segments and all regions.

Originally introduced in March 2012, with subsequent portfolio enhancements in 2014 and 2015, the SD Series is designed for distributed applications in conventional and renewable power plants and water networks. It features modular DIN rail packaging; a flexible, Fast Ethernet-based plant network; intelligent electrical and field device integration; PROFIBUS, HART, IEC 61850 and Modbus TCP communication protocols; and an integrated turbine control solution. The SD Series also protects investments made in previous controllers, while delivering higher performance, reliability and capacity.

SD Series products have a modular, high-density design and streamlined architecture that reduce control and I/O hardware requirements and cabinet footprint, thus lowering design, installation and operating costs.

The SD Series is a green automation solution that provides significant energy savings with low 24 VDC power consumption and lead-free RoHS-certified modules.

SD Series products are designed to withstand extreme environmental conditions, which makes them ideal for remote I/O applications. Their G3 coating and

70 °C temperature rating eliminate the need for fans, louvers, air filters, purging systems, or other environment controlling techniques.

Significantly higher efficiency means lower power consumption, less heat dissipation requirements, and less need for cooling systems. This eliminates the use of parts that can affect reliability and productivity, thereby reducing footprint and lowering installation costs. This can make a huge difference in installation expenditure by reducing the need for climate-controlled buildings or cabinets. Once in operation, the reduced volume of parts and equipment improves reliability and cuts maintenance costs.

The SD Series maximizes uptime and production with a scalable family of high-performance and highly reliable controllers and control loop integration of secondary smart field device information.

They protect intellectual investment in existing INFI 90 / Harmony systems - one of the most widely used control systems in power generation worldwide - by enabling the easy reuse of existing INFI 90 control strategies.

Backwards and forwards compatibility ensures smooth integration with existing and future systems, enabling customers to protect previous investments by reusing field-proven solutions and avoiding rip and replace alternatives.

SD Series products

SD Series is a suite of flexible control and I/O products that work across the entire control landscape, providing to-

tal plant automation regardless of application type, size or location.

The suite includes a set of high-performance, scalable process controllers that support the plant's total control requirements, from discrete and continuous to batch and advanced control applications. Supported by a comprehensive range of I/O options, SD Series delivers powerful, versatile and scalable automation solutions for plant applications of all sizes and requirements.

The SD Series portfolio comprises:

Controllers

HPC800: Large controller for large and/or complex installations

SPC700: Mid-range controller for medium-sized and small installations

Communication interface modules

PDP800: PROFIBUS DPV2 interface

CI850: IEC 61850 electrical integration interface

I/O modules

Analog I/O: AI0x and AO0x

HART I/O: HAI805 and HAO805

Digital I/O: DI0x, DO0x and PI0x

Control network communication

PN800: Fast Ethernet-based plant network



SD Series SPC700 controller and I/O for mid-sized and small control applications

Main product features

- Green, energy-efficient design
- Withstands extreme operating conditions
- Compact modular design
- Smart device integration
- Based on field-proven technology

Key solution benefits

- Less power used / Environmentally friendly
- Eliminates cooling / Enables flexible remote I/O
- Smaller footprint
- Greater visibility / Less HW / Less cabling
- Protects previous investments / Easy to expand

Symphony Plus

Symphony Plus is ABB's total plant automation platform for the power generation and water industries. It is designed to meet the requirements of engineering, procurement and construction contractors in the power and water sectors, and of plant owners in all geographic markets and in all types of power generation and water treatment.

Today, there are more than 6,500 Symphony Plus related DCS installations in operation all over the world, with more than 4,500 in power and water applications. Since the launch in 2011, ABB has delivered or is delivering Symphony Plus solutions that control more than 40,000 MW of new power generation. In addition many customers have upgraded their existing systems with new Symphony Plus technology

to meet their evolving needs. These solutions – both new and upgrades – range in complexity from the simplest to the most challenging or automation requirements.

Discover more on the SD Series:
new.abb.com/symphony-plus-sd-series
new.abb.com/power-generation/symphony-plus

How to improve the LCOE of wind power

The levelized cost of electricity (LCOE) of wind power depends on many factors, among them the performance of the wind turbines. As subsidies and incentives in the wind power sector decline, the performance of assets like wind turbines is key to maximizing owners' return on investment.

ABB has invested in two companies whose products improve wind turbine performance and operations by accurately measuring wind conditions.



ABB has made a strategic investment in Pentalum Technologies, a company that has developed advanced wind sensing technology for the control and optimization of wind turbines and wind farms.

Pentalum's innovative LIDAR (light detection and ranging) technology remotely senses the wind vector in front of wind turbines in order to optimally align them to incoming wind flow. Known as SpiDAR®, the technology is also used for wind forecasting and site assessment, and is designed to significantly increase wind farm efficiency at a lower cost per site than existing measurement technologies.

Using an eye-safe laser beam, SpiDAR accurately measures wind speed and direction at heights of up to 300 meters. This portable, easy-to-use measuring unit can be placed on the ground or mounted on the turbine. Designed primarily for site assessment, it



iSpin sensor by ROMO Wind

ERG Renew tests ROMO Wind technology

ABB has been awarded an order by ERG Renew, the renewable energy arm of the ERG Group and one of Europe's largest wind power companies, to provide a pilot wind optimization solution based on ROMO Wind technology.

ABB will install ROMO Wind's iSpin technology in two Vestas V90 turbines in two wind farms in Italy. The pilot project will last for four months, after which ABB will provide an efficiency improvement report and recommendations to ERG.

iSpin significantly improves insight into local wind conditions and turbine performance by providing highly accurate readings of wind speed, yaw misalignments (static and dynamic), flow inclinations, turbulence intensity, air pressure, nacelle direction, temperature and other crucial variables.

considerably reduces analysis time and improves decision-making on whether a site has sufficiently good wind conditions to merit funding. SpiDAR's ability to generate data on wind conditions at various altitudes – along with its portability and ease of use - makes it an attractive alternative to traditional meteorological masts. SpiDAR has successfully completed more than 2.2 million hours of measurements at hundreds of sites worldwide.

In addition to site assessment, SpiDAR also identifies wakes and turbulence. When integrated with Symphony Plus for Wind, ABB's dedicated automation system for wind power plants, the solution provides operators with the relevant information and necessary lead time to react correctly to changing weather conditions that could impact wind power plant operations.

Increases turbine efficiency

ABB recently made a second strategic investment in the wind power industry, this time in ROMO Wind, a Swiss-Danish company. ROMO Wind's

iSpin technology monitors and corrects yaw misalignments in wind turbines. It also monitors turbine power curves and potentially damaging wind conditions such as turbulence.

iSpin consists of three specially designed sonic sensors that are strategically located on the turbine spinner. From this position it is possible to accurately measure the free wind speed, all wind flow inclination angles - including yaw misalignment - as well as quantify turbulence intensity. Due to its unique position on the spinner, iSpin measures free wind as accurately as a meteorological measurement mast, but without the huge infrastructure and cost that a mast entails. This enables it to record highly accurate absolute power curves for every single wind turbine.

In an analysis of more than 150 wind turbines, ROMO found that more than half of them showed significant yaw misalignments. These typically cause the turbines to lose 2 percent of their annual energy production. Yaw misalignment has a direct impact on output as it affects the rotor area perpendicular to the

wind direction. With just a few weeks of iSpin monitoring, yaw misalignment can be detected and corrected to improve turbine performance. Using a few months of iSpin data, an absolute power curve of the wind turbine can also be determined. Measures can then be taken to correct yaw misalignment and other inefficiencies identified by the data.

The combination of iSpin and Symphony Plus for Wind enables online and historical performance analysis of each wind turbine in a wind park or fleet of parks, thereby enabling owners to draw up efficiency-improvement programs and increase profitability.

To learn more about Symphony Plus for Wind, see page 27.

Getting the most out of your PV plant

ABB automation and services optimize PV power production and minimize cost.

Solar is becoming an increasingly important form of power generation, and is already reaching grid parity in some markets. Additional performance optimization and cost reduction are, however, needed, as declining subsidies pressurize solar power generators to reduce costs in order to be competitive with other power generation technologies such as wind, thermal and hydro.

One key to cost reduction and optimized production is a plant automation and monitoring system and an operations and maintenance strategy that keep the plant operating optimally at all times.

ABB offers a versatile and scalable automation and service solution for solar PV power plants. Symphony® Plus for Solar is based on our Symphony Plus platform, the world's leading automation system for the power generation and water industries. Using a scalable SCADA system, high performance controllers and a range of dedicated software applications, Symphony Plus for Solar offers:

- Plant automation and control
- Remote operations
- Remote monitoring and services

Plant automation and control

Symphony Plus for Solar monitors all critical plant components: from PV panels (with or without tracking systems) to inverters, transformers, the grid connection and meteorological station. It supports a broad range of communication protocols, which enable it to connect and exchange data with virtually all plant components. In addition to the generation part, Symphony Plus for

Solar also monitors and controls substation equipment using the IEC 61850 protocol. This enables integration of generation and electrical components into a single information system.

Equipped with a real-time database and historian, Symphony Plus for Solar acquires and stores all relevant data, either on site or in a remote operations center. It also provides plant management and control in accordance with local grid codes by managing active and reactive power, power factor, and by providing voltage and frequency control. A high-performance ABB controller is connected to all relevant power plant equipment (inverters, tracking systems and – if applicable – capacitor banks, STATCOMs and energy storage). Real-time measurements and calculations are used to regulate the plant's power production in accordance with the specifications.

With access to the databases, the controller monitors all relevant plant information and dispatches setpoints to the inverters to meet grid code requirements. It monitors the condition of the inverters, ensures power production is in accordance with the setpoints, controls the production ramp rate according to grid code specifications and provides power factor and voltage control at the point of connection to the grid.

Remote operations

Symphony Plus for Solar has the versatility to remotely monitor plants of all sizes in the customer's fleet. Its flexible SCADA system is built on a hierarchical architecture, which enables it to monitor and manage solar, wind,

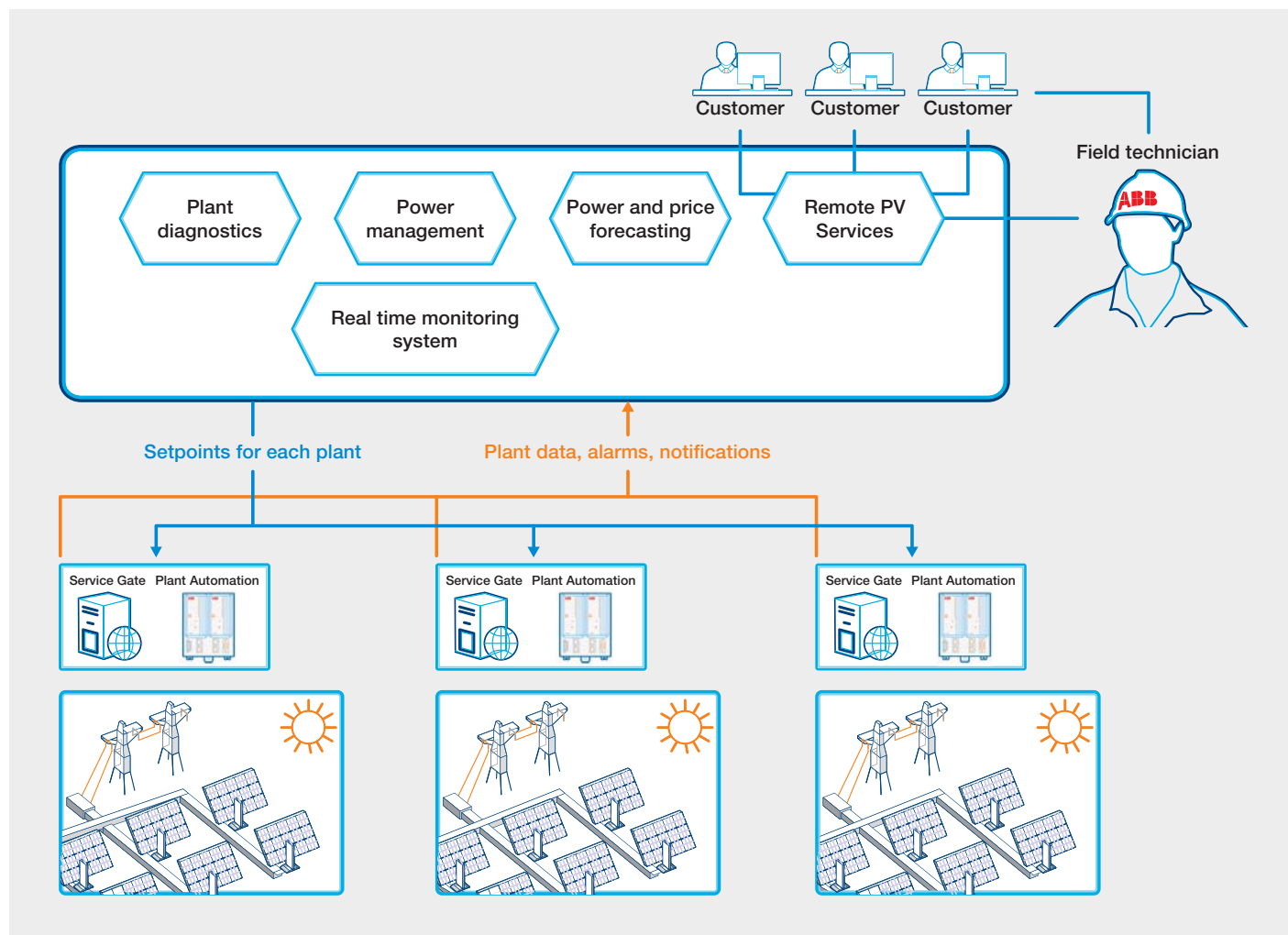
hydro and other types of power plant, as well as electrical equipment. The solution can be installed at the customer's premises or accessed via the cloud. Plant data and key performance indicator reports are provided to operators and service personnel through regular, comprehensive reporting, tailored to meet customer needs. Power management and production forecasting functions turn the entire generation fleet into a flexible virtual power plant. The main benefits of remote operations include:

- Efficient operations

Data from the various monitoring points is brought into the system in real time and stored by the SCADA system's data historian. A unified internal information model together with an ergonomic and plant-specific human machine interface improves transparency and operator efficiency. System or plant-specific applications analyze the collected data to determine plant and component performance and the condition of assets in each plant. This enables plant owners to develop efficient maintenance strategies.

- Power management

A power management module provides automatic control of the power production of the whole fleet, enabling virtual power plant functionality. Based on a powerful optimization engine, this application considers the capabilities, constraints, running costs and production forecasts of every plant connected to the system, and ensures the best economical running point of the entire fleet.



Symphony Plus for Solar PV

- Production forecasting

The ability to forecast power production is becoming increasingly important as solar power plants grow larger. To maximize power production, ABB offers a flexible power production solution suitable for single power plants and multi-plant fleets.

For a single plant, relevant data from assets such as panels, strings, inverters, etc, as well as historical production and meteorological information, is used to predict plant output. The forecasting horizon spans from hours ahead (typically 6 hours, with a time resolution of 15 minutes) to days ahead (typically one week, with hourly resolution).

To further improve production forecasting ABB has developed algorithms to track the movement of clouds in the vicinity of the PV plant. The algorithms predict the time of arrival and the duration of cloud cover over the solar panels. This information is used to calculate the

expected drop in output. This prediction is also used to optimize power balancing with the grid and, if applicable, the energy storage system.

Remote monitoring and services

ABB offers a broad range of services for solar PV plants. These services are supported by cloud-based remote monitoring, which provides a comprehensive array of tools and services such as performance ratio calculations, power forecasting, shading estimations, soiling detection, aging, and so on. Underperforming equipment can be analyzed and detected by comparing base line and current data. We can then either take action remotely or dispatch appropriate resources to the site to address the problem.

Customers and service personnel can easily monitor and track plant data via our dedicated Web portal. The data is reported with predefined or customer-specific key performance indicators. This is delivered as software as a ser-

vice on a subscription basis, and consists of four tailored service levels in our ServiceGrid life cycle management program for the power generation and water industries.

Our remote monitoring center currently manages around 50 PV power plants all over the world. They range in capacity from about 1 MW to more than 100 MW.



The first round-the-world solar-powered flight

Solar Impulse will begin its historic 40,000 kilometer flight around the world in early March, fuelled only by solar energy. ABB is supporting Solar Impulse on its momentous journey.



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Bertrand Piccard and André Borschberg,
pilots of Solar Impulse

Solar Impulse will begin its epic voyage in Abu Dhabi in the United Arab Emirates.

Along the way, it will stop in Muscat, Oman; Varanasi and Ahmedabad in India; Chongqing and Nanjing in China; and Hawaii, Phoenix and New York City in the United States. The plane's last stop will be either in southern Europe or North Africa before completing the round-the-world tour in Abu Dhabi.

Among challenges facing the mission, due to last several weeks, is a non-stop flight of five days and nights from China to Hawaii. The plane, powered by 17,248 solar cells, will soar higher than Mount Everest each day while fully charging its lithium batteries to stay airborne during the night.

The carbon-fiber airplane has the wingspan of a Boeing 747 Jumbo jet and the weight of a small car.

ABB and Solar Impulse formed an innovation and technology alliance in 2014. Three ABB engineers have joined the Solar Impulse team to provide expertise in control systems for ground operations, charging electronics for the plane's battery systems and resolving obstacles that emerge along the route.

www.solarimpulse.com/en/our-story/pilots/#.VOck8E10xol

“It was my dream to have ABB as technology partner of Solar Impulse,” said Bertrand Piccard, initiator and chairman of Solar Impulse. “We have the same goal of improving the world by using energy more efficiently and conserving natural resources.”

Symphony Plus SD Series



Advantages

- Green, energy-efficient design consumes less power and delivers significant energy savings
- Withstands extreme operating conditions and eliminates the need for costly cooling systems
- Compact modular design with more than 50 percent higher density than typical DCS solutions
- Smart device integration provides greater process visibility from fewer components and less cabling
- Based on field-proven technology for easy expansion and investment protection

The SD Series SPC700 mid-sized controller, DI03 and DI04 Digital Input modules, and the CI850 IEC 61850 (GOOSE and MMS) electrical integration interface module are the latest additions to the SD Series portfolio. Together with the controller, I/O and communication interfaces introduced in 2012 and 2014, the SD Series now consists of a suite of flexible and scalable control and I/O products that work across the entire control landscape and deliver total plant automation regardless of application type, size or physical location.

SD Series features modular DIN rail packaging; a flexible, Fast Ethernet-based plant network; intelligent electrical and field device integration; PROFIBUS, HART, IEC 61850 and Modbus TCP communication protocols; and an integrated turbine control solution. SD Series products have a modular, high-density design and streamlined architecture that reduce control and I/O hardware requirements and cabinet footprint, thus lowering design, installation and operating costs.

Symphony Plus for Wind



Symphony Plus for Wind offers integrated monitoring and control of single and multiple wind farms. It is designed to reduce the cost of operations for wind farms through real-time monitoring combined with plant diagnostics and remote operations and control.



Advantages

- Tight integration of a flexible and scalable real-time monitoring system with powerful plant diagnostics and a power forecasting and management module
- Dedicated and ergonomic HMI, designed by our scientists together with operators of renewable plants, improves operation effectiveness
- The diagnostic and data analytics tools offer decision support to make operators more comfortable with the actions they take
- The power management module helps improve plant uptime, ensuring the most economic operating point at all times using optimization techniques
- Objective evaluation of wind farm efficiency with the integration of advanced wind sensing technologies

Symphony Plus for Solar



Advantages

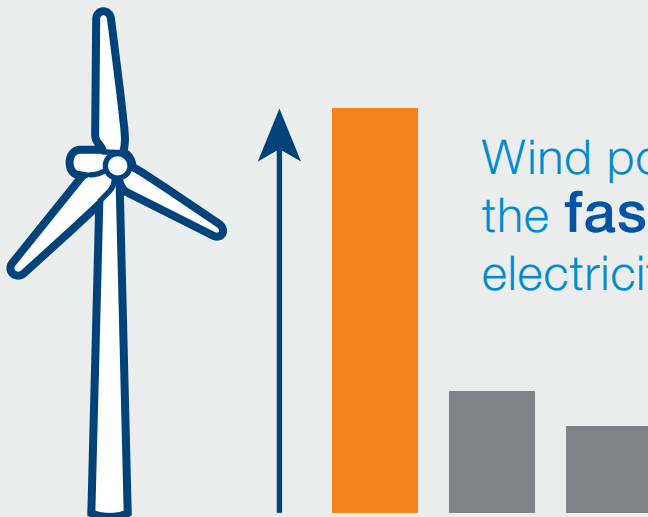
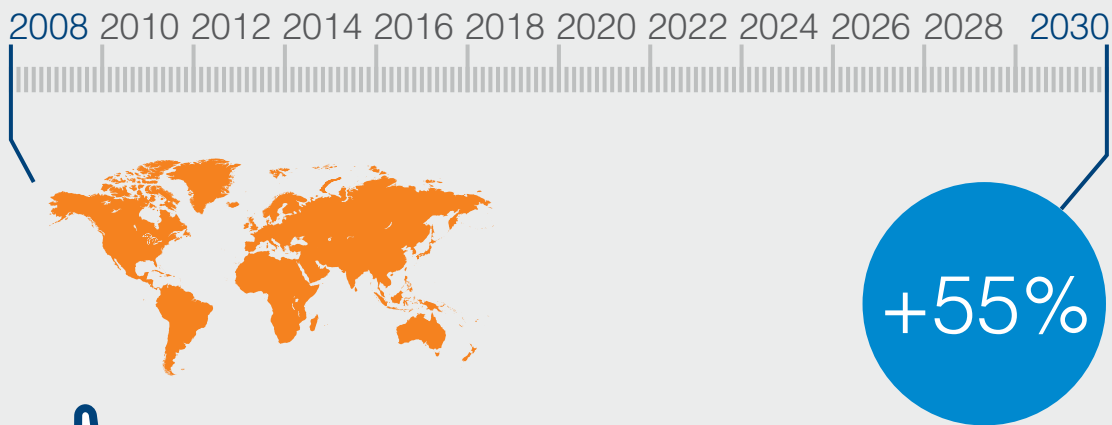
- Complete plant automation solutions, including combiner boxes, tracking systems and plant monitoring and control
- Grid code compliant control libraries for utility-scale plants
- Remote monitoring and operations, including plant diagnostics and decision support mechanisms
- Operations and maintenance services, ranging from monitoring and expert support to corrective, preventive and predictive maintenance
- Integrated automation solutions and services from a market-leading player



Symphony Plus for Solar comprises best-in-class automation solutions for solar power plants. Based on Symphony Plus, the most widely used automation system in the power industry, it provides dedicated functionality for monitoring and controlling solar power plants, maximizing uptime and ensuring grid code compliance at all times.

Did you know?

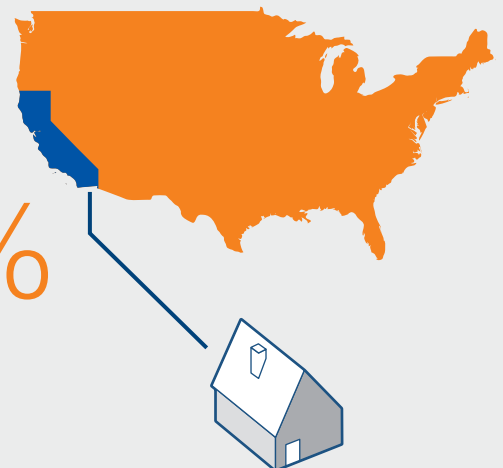
From 2008 to 2030,
world energy consumption is
expected to increase by **more than 55%**

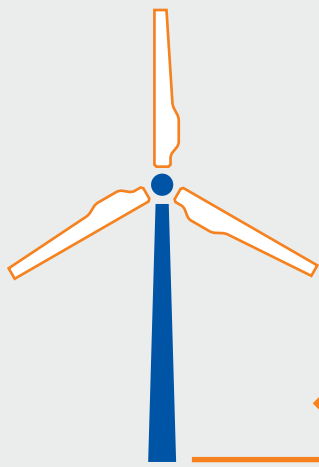


Wind power is currently
the **fastest-growing** source of
electricity production in the world

On average, **one pool pump**
consumes electricity equal to
of the annual electricity
consumption of a typical
California household

44%





A single wind turbine can power

500 homes



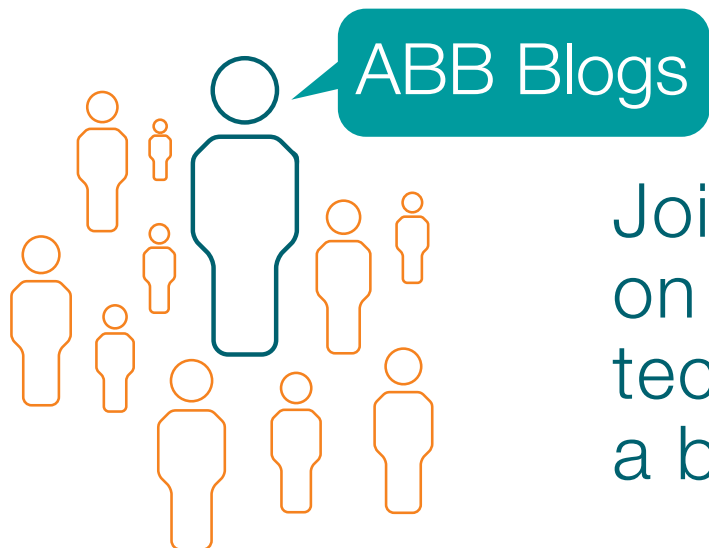
80%

of all renewable energy
generated comes from hydropower



In 1921, **Albert Einstein**
won the Nobel Prize for
his experiments with
solar energy and photovoltaics



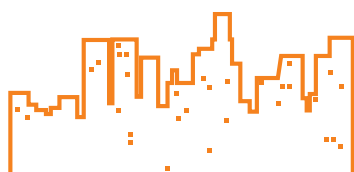


Join the conversation on the trends and technologies shaping a better world



How the "end of the known world" became a model for a sustainable world

A wind-hydro project turns El Hierro into a model for renewable energy



The "Smart City" vision starts with "Smart" Generation

Tuning the energy engine



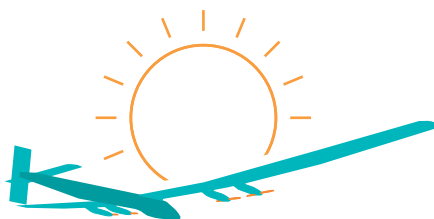
Solar is approaching parity in several key markets

Data from renewables consultancy, Eclareon, shows that solar is becoming price competitive in many countries, but the target is a moving one



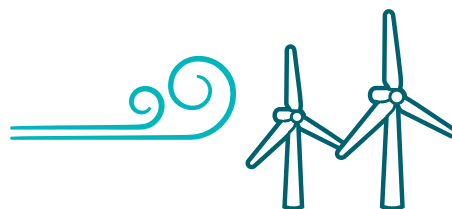
The art of recycled systems

Automatic automation based on reusable engineering



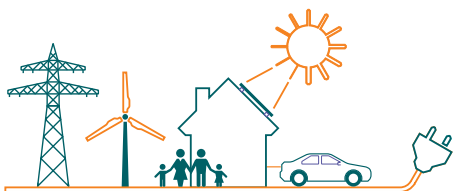
Solar Impulse crew gears up to transport plane to Abu Dhabi launch site

Before Solar Impulse flies around the world, it's got to get to Abu Dhabi. As its ground crew chief and developer will tell you, that's no mean feat, either



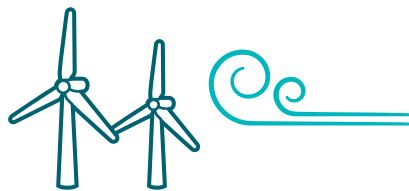
How to make the most of rising wind-energy production

Supporting electricity grids as wind power reaches new highs



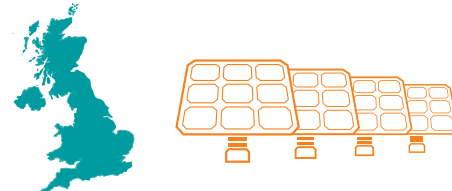
The future of smart distributed energy resources integration

Smart grids will mitigate the variable nature of solar and wind DERs, as well as support overall grid stability and reliability



It's all about integration and optimization

Wind power has reached the stage where squeezing out every cent of cost matters as much as providing the relevant functionality for power system support



Are these cloud-covered islands Europe's biggest solar power market?

Surprisingly for some, the UK's solar power market has grown exponentially in recent years. A look at why

You will find the blogs while browsing the conversations page
www.abb-conversations.com
under the power and renewable energy categories

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.

We would like to learn your opinion about our newsletter. Please take a minute to fill in a short survey. Your opinion will help us to improve our newsletter to better suit your needs. Find the online survey at <http://goo.gl/6H1OQg>



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Integrating renewables into fuel-based microgrids?

Naturally.

ABB microgrid solutions deliver up to 100% wind and solar power penetration in isolated diesel-powered grids, reducing CO₂ emissions as well as dependency on costly fossil fuel. These widely proven technologies continuously maintain a proper balance between supply and demand that maximizes the use of renewable energy. Our turnkey solutions include consultancy, grid stabilization, intelligent automation, remote monitoring and maintenance. And, as the world's leading supplier of microgrid solutions, we have more than 80 references for a broad range of applications and customer requirements worldwide. new.abb.com/power-generation/microgrids-solutions



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