The power of solar

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ABB’s comprehensive offering

Green turbine technology for Aluminium Bahrain 11
Reducing NOx emissions drastically

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A plant-wide unified control system

ABB extends lifecycle commitment 21
Evolution without obsolescence
Capturing the power of the sun?
Naturally.

With more than 125 years of technology innovation and experience in power generation, ABB is a partner you can rely on. Our portfolio includes integrated electrical, automation, instrumentation and control solutions that help optimize performance, improve reliability, enhance efficiency and minimize environmental impact. A worldwide service capability supports the plant throughout its lifecycle. Whether it is thermal, nuclear or renewables such as hydro, wind, solar or biomass, ABB has the know-how and track record to serve all types of power generation needs. [www.abb.com/powergeneration](http://www.abb.com/powergeneration)
ABB Power Generation

ABB is a leading provider of integrated power and automation solutions for all types of power generation and water plants. With an extensive offering that includes electrical balance of plant, automation, instrumentation and control systems, and service – along with more than 125 years of expertise and innovation and a presence in over 100 countries – ABB helps optimize performance, improve reliability, enhance efficiency and minimize environmental impact throughout the plant lifecycle.

Dear Reader,

Welcome to the new look In Control, which is appearing for the first time under ABB’s new and highly distinctive visual identity. Many of you will already have noticed our global advertising campaigns bearing the new visual identity and promoting the ABB themes of power and automation solutions that improve energy efficiency, increase productivity and secure grid reliability. These themes permeate the entire issue of In Control.

We begin with a new series on power generation applications, in which we present ABB’s uniquely broad offering of turnkey electrical, control and instrumentation solutions for the power generation and water industries. First out is solar power, for which we have developed highly efficient and productive solutions for photovoltaic and concentrated solar power plants in Europe and North America, as well as the new generation of hybrid solar thermal and combined cycle plants nearing completion in North Africa and the United States.

Integration of the plant control and electrical systems is a key differentiator of ABB’s power generation capability. ABB was one of the initiators of the IEC 61850 global standard for interoperability in substation automation systems, and has delivered more IEC 61850 solutions than any other company. In ‘Integrated process and power automation’ on pages 18–20 we present an overview of how ABB distributed control systems and substation automation systems have made integration of power plant electrical and control systems possible and the benefits these solutions are bringing to our customers.

At this year’s Power-Gen Asia exhibition and conference in Singapore, we announced the extension the lifecycle commitment for Symphony Harmony and Symphony Melody range of control systems. The Symphony platform has one of the largest installed bases of distributed control systems with more than 6,000 systems installed worldwide, a large part of which is in the power generation and water

Franz-Josef Mengede
Head of ABB Power Generation
sectors. ABB’s investment program for Symphony includes the continued development of products that provide greater capacity, higher performance and new functionality. Key application areas will include electrical integration, operator effectiveness, plant life extension and optimization as well as integration of renewables and enabling of smarter grids.

As usual, In Control contains a selection of the many orders we have been awarded and projects we have completed during the past few months in a diverse range of applications: hydropower and pumped storage, clean coal, waste-to-energy, combined cycle, and conventional coal-fired, to name but a few.

Kindest regards,

Franz-Josef Mengede
Head of ABB Power Generation

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Solar power plants

ABB’s portfolio of products, systems and solutions for power plants is unmatched in the power generation industry. We begin a new series highlighting the breadth and benefits of this portfolio by focusing on our offering for photovoltaic and solar thermal power plants – applications for which ABB has developed some uniquely efficient solutions.

ABB has been active in the solar power industry since the 1980s when we developed an automation platform for the world’s first test facility for concentrating solar power technologies at the Plataforma Solar de Almería (PSA) in Spain.

Since then ABB has been involved at a pioneering stage in many of the photovoltaic (PV) and concentrating solar power (CSP) technologies that have been developed and deployed worldwide. As a result ABB has built up a unique expertise in how best to harness, control and store solar energy and efficiently convert it into reliable electricity, ready for transfer into the local power grid.

ABB’s portfolio of products, systems and solutions ranges from turnkey photovoltaic power plants to complete power and automation solutions for CSP plants and for commercial, industrial and residential rooftop PV installations.

ABB supports its customers with a complete portfolio of lifecycle services – including remote monitoring and diagnostics – to ensure the efficient and cost-effective operation of their solar power plants and photovoltaic assets.

Photovoltaic power plants

ABB offers a fast-track modular concept for turnkey photovoltaic power plants, a ‘one partner, one solution’ answer to the needs of customers operating in the global PV market.

The approach combines a high level of customization, rapid delivery, and system optimization technologies that enable the plants to generate around 15 percent more energy than alternative designs. Rapid delivery is facilitated by ABB’s well-proven concept of pre-assembled, factory-tested electrical balance of plant modules, and by expertise in project
Execution. This enables ABB to cut weeks off conventional delivery times and complete installation and commissioning within a few months of signing the contract.

The ABB concept includes powerful tools that calculate the best type of solar panel and solution for a given site and the nuances of its altitude and climate. All the power and automation equipment is optimized to increase productivity and reduce power losses; it includes high-efficiency inverters, reliable dry type transformers and specially designed technologies for the accurate control and remote monitoring of the plant.

The ABB turnkey solution comprises design, engineering, supply (including solar modules), erection, civil works, commissioning and, once the plant is up and running, service and maintenance, including remote monitoring and diagnostics.

Concentrating solar power

ABB provides complete power and automation solutions for all the main CSP technologies – parabolic trough, power towers, integrated solar combined cycle, heliostat solar concentrators, Stirling solar dish systems, combined solar-biomass and others.

Our scope of supply ranges from patented high-precision programmable logic controllers for the thousands of parabolic troughs, dishes or collectors in the solar field to control systems for thermal storage tanks, electrical balance of plant for the power block, and electrical equipment that feeds the power reliably into the local power grid.

ABB’s capability in CSP encompasses the entire project chain and includes design, engineering, installation, commissioning, service and maintenance.

As a pioneer in the commercial application of CSP technologies, ABB has accumulated vast expertise in the complex processes of solar thermal power generation. This expertise includes such critical process stages as controlling the temperature and viscosity of the heat transfer fluid in the solar field, keeping the molten salt in the giant thermal storage tanks at the correct temperature, accurately positioning the collectors to capture maximum energy from the sun, and synchronizing hundreds of devices and integrating the data into the plant automation systems.

Europe’s largest CSP plants

ABB has supplied extensive power and automation solutions for the Andasol 1 & 2, Extresol 1 & 2 and Manchasol 1 & 2 CSP power plants in Spain, the largest solar thermal plants in Europe. Each of the six units has a generating capacity of 50 MW. ABB’s solution for Extresol, for instance, includes control systems for the power plant and parabolic trough collectors, instrumentation, motors, drives and low voltage products, as well as substation power equipment for delivering the energy safely and reliably to the power grid.

World’s first hybrid solar power plants

ABB has provided wide-ranging power and automation solutions for three of the world’s first integrated solar and combined cycle (ISCC) power plants: the 150 MW Hassi R’Mel ISCC plant in Algeria, the 150 MW Kuraymat ISCC plant in Egypt, and the 75 MW Martin solar thermal plant in Florida. All three plants are fired by a combination of natural gas and solar energy harnessed by parabolic troughs or collectors, and are scheduled for commissioning in late 2010.

20 turnkey PV orders for the Mediterranean

ABB has won orders for around 20 turnkey photovoltaic power plants in Spain, France and Italy this past year. The plants are of varying capacities of between 1 and 24 MW, and demonstrate the benefits of ABB’s fast-delivery modular turnkey solution for investors in PV power plants. Patented technologies enable the plants to generate around 15 percent more energy than alternative solutions.

First commercially operated CSP tower in the U.S.

ABB was selected by eSolar to develop an advanced distributed control system (DCS) for eSolar’s inaugural 5 MW Sierra SunTower solar park in California. SunTower is the first commercially operated CSP tower in the United States. The ABB solution is interfaced with a vibration monitoring system and eSolar’s proprietary heliostat field control system. It includes a remote diagnostic service capability that enables ABB to diagnose and correct DCS-related issues by remote.
Why Gestamp Solar chooses ABB

In January 2010 Gestamp Solar selected ABB to provide a turnkey 13 MW photovoltaic power plant at La Robla in Spain. The project was completed within 20 weeks, six of which were lost to bad weather when heavy rainfall prevented work on the site. Building on the successful outcome of La Robla, Gestamp Solar has selected ABB to deliver an additional four PV power plants of varying capacities in Italy and France. We asked Mr Alfredo Gonzalez, operations manager for Gestamp Solar, why they choose to work with ABB.
Gestamp Solar develops and builds large-scale solar energy projects, offering a complete concept for the entire process, from site searching and project finance to engineering and procurement, construction and assembly, and plant operation and maintenance.

Gestamp Solar has completed some 30 photovoltaic power plant projects with a total generating capacity of around 300 MW. The company is currently building its first project in the United States (a 300 MW PV plant in New Mexico) and is expanding its operations into Asia.

Gestamp Solar is part of the Gestamp Corporation, a leading multinational company in the steel, automotive components, storage, logistics and renewable energy sectors.

How would you describe Gestamp Solar’s current operations in the solar power industry?

Gestamp Solar is growing rapidly. By 2008 we had completed about 20 projects with a total capacity of about 100 MW. All of these plants are located in Spain. This year we have switched our focus to Italy, where we now have several large-scale projects in progress. We are also building a huge 300 MW plant in the United States and are actively looking for suitable projects in several countries in Asia.

Why did Gestamp Solar select ABB as a partner?

We chose ABB for several reasons. ABB has a large global footprint and can provide us with global support and local expertise in all regions of the world. This will be a valuable benefit to us as we expand into new European markets and into the Americas and Asia. On a group level, Gestamp and ABB have worked together for many years. ABB is an important supplier of robotics and automotive solutions to Gestamp’s automotive components business. The two companies know each other well.

With regard to the PV solution, ABB’s ability to provide a high-performance turnkey package and meet a very challenging deadline was vital. ABB is a comprehensive supplier who manufactures the equipment, installs and commissions the plant and connects it to the grid, while giving us valuable support throughout the project.

Did your first project with ABB – La Robla – progress satisfactorily?

Yes, it was a complete success. The entire project took five months to complete, from signing the contract to producing power. This includes a six-week period when the winter rainfall was so heavy that it stopped work at the site. In effect the delivery time was only about three-and-a-half months, which is very fast.

Does Gestamp Solar retain the PV plants or sell them on as investments?

Generally speaking our policy is to sell them on as investments. The high quality of the design and equipment means that we can offer warranties guaranteeing a high level of plant performance and yield. This makes them extremely attractive to investors.

What are Gestamp Solar’s growth plans for the future?

Our objective is to make Gestamp Solar a leading player in the solar energy market worldwide. In the immediate future we will continue to focus on Italy in Europe and to continue to implement our expansion plans in Asia and the Americas. This is an area in which ABB’s global reach and support is an asset.

ABB would like to thank Mr Gonzalez for his participation in this interview.

Gestamp Solar photovoltaic power plant projects for which ABB is supplying a turnkey solution:

<table>
<thead>
<tr>
<th>Location</th>
<th>Capacity</th>
<th>Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>La Robla, Spain</td>
<td>13.3 MW</td>
<td>Completed August 2010</td>
</tr>
<tr>
<td>Sapeu, Italy</td>
<td>3.9 MW</td>
<td>Completion 2010</td>
</tr>
<tr>
<td>Monreale, Italy</td>
<td>3.3 MW</td>
<td>Completion 2010</td>
</tr>
<tr>
<td>Francofonte, Italy</td>
<td>2.5 MW</td>
<td>Completion 2010</td>
</tr>
<tr>
<td>Duccotto, Italy</td>
<td>7.0 MW</td>
<td>Completion 2010</td>
</tr>
</tbody>
</table>

ABB’s scope of supply typically includes inverters, DC and AC cabinets, transformers, switchgear, cabling, equipment housing, system optimization, control, SCADA, substation, fencing, security system and PV modules. ABB is also responsible for installation, ground and civil works, commissioning, and remote monitoring once the plant is operating.
Projects

Control upgrade at the Philippines’ largest power plant

ABB has upgraded the distributed control system of the largest power generation facility in the Philippines, providing this groundbreaking node in the country’s huge gas-to-power project with a broad sweep of benefits and savings.

The gas-to-power project provides natural gas for Ilijan and two other combined cycle power plants in Luzon, the largest and most economically important of the Philippines’ island groups.

Owned by independent power producer KEILCO, the 1,200 megawatt Ilijan combined-cycle power plant in Batangas City, Philippines, went into operation in 2002 and was quickly named one of the world’s top 12 power plants by a leading U.S. power industry magazine in 2003.

Ilijan power plant is the largest power generation facility in the Philippines and part of the country’s gas-to-power project, which uses natural gas from the offshore Malampaya field to generate electricity at Ilijan and two other combined cycle power plants.

Ilijan has the distinction of housing the Philippines’ biggest reverse osmosis desalination plant and first 500 kV switchyard (the desalination plant provides water for the power plant, and the power generated is transferred to the 500 kV transmission grid). The entire infrastructure of the gas-to-power project – offshore platform, pipelines, power plants, desalination plant, high-voltage transmission – was built from scratch.

ABB was recently selected by KEILCO to upgrade the distributed control system (DCS) at what is generally considered the node of the gas-to-power project – the 2 x 600 MW Ilijan power plant. ABB supplied the original DCS solution in the early 2000s, and is enhancing the system to provide the plant with cutting-edge capability while simultaneously protecting the customer’s original investment. Among its many new features, the enhancement will upgrade the operator stations and servers and significantly increase the speed of the network, as well as provide loop segmentation to enable partial shutdown of the plant in planned or emergency situations.

System evolution is fundamental to ABB’s control system philosophy. It enables customers to evolve their control systems as needs grow or change, while protecting major system investments like process graphics, control applications and history data.

ABB is implementing the installation online to minimize the plant shutdown to just final testing and a short planned outage, thereby enabling the plant to maintain its target availability of 90 percent.
Complete ICE solution for waste-to-energy plant in Switzerland

ABB in control

Electrical and process control solution to improve operating efficiency of Bern facility.

ABB is supplying equipment for a new waste-to-energy facility currently being constructed by Energie Wasser Bern. The facility will be the first of its kind in Europe, integrating a clean biomass-fired power station and combined cycle gas turbine plant. It will replace an existing waste incinerator, which is around 35 years old and has reached the end of its technical service life.

ABB will supply integrated electrical and process control systems for the entire plant and will also be responsible for the high-voltage power grid connection to the capital city of Bern. The new plant is scheduled for commissioning in 2012.

With an annual incineration capacity of 110,000 metric tons of waste and 112,000 metric tons of wood, the facility will generate about 250,000 megawatt hours (MWh) of thermal energy and 338,000 MWh of electricity per year, significantly reducing Bern’s dependence on external power supplies.

The new installation is an integral part of the city’s long-term district heating and electricity plan, and at the same time will deploy a futuristic recycling concept that can dispose of waste in an environmentally friendly and sustainable manner.

EBoP solution for new pumped storage plant in South Africa

ABB has won an order worth $23 million from Eskom to supply an electrical balance of plant (EBoP) solution for the Ingula Pumped Storage Scheme (PSS), currently under construction in South Africa.

The Ingula plant will have the capacity to generate 1,333 MW of hydropower, which will be integrated into the South African grid when fully operational in 2014. It is estimated that South Africa will require an additional 40,000 MW of power by 2025.

As part of the turnkey EBoP solution for the power plant, ABB will be responsible for the design, engineering, supply, installation and commissioning of the project. Key products to be supplied include the service and auxiliary transformers, dry-type distribution transformers and medium- and low-voltage switchgear.

The Ingula PSS will comprise an upper and a lower reservoir. The upper reservoir will have a total capacity of 22.6 million cubic meters (MCM) and an active storage of 19.3 MCM. The lower reservoir will have a 26.3 MCM capacity and active storage of 21.9 MCM. The reservoirs, 4.5 kilometers apart, will be connected by underground waterways to a subterranean generating plant with four 333 MW pump turbines.

During times of peak energy consumption, water will be released from the upper reservoir through the pump turbines to the lower reservoir to generate electricity. When energy consumption is low, the process will be reversed, and water will be pumped from the lower to the upper reservoir.

ABB was awarded the contract by Eskom, South Africa’s leading electric utility.
ABB has provided a complete instrumentation, control and electrical (ICE) solution for AmerenUE’s recently reopened Taum Sauk pumped storage plant in Missouri.

The new upper reservoir of the Taum Sauk pumped storage plant, Missouri

ABB has provided a complete instrumentation, control and electrical (ICE) solution for AmerenUE’s recently reopened Taum Sauk pumped storage plant in Missouri.

Taum Sauk powerhouse

“ABB’s replacement of the plant controls – including installation in the new upper reservoir of the most advanced-level monitoring, control and protection system in the country – significantly improves the safety and reliability of the Taum Sauk Power Plant,” said Mark Birk, vice president of power operation for AmerenUE.

ABB began the project with a full audit of the existing equipment at the 40-year-old plant. The audit drew on ABB’s vast experience in pumped storage and hydropower, and included comparing and evaluating the plant against modern designs and making recommendations to improve plant reliability, operations, maintainability and personnel safety.
Maximizing the potential of green turbine technology

An ABB distributed control system is helping Aluminium Bahrain improve the energy efficiency and reduce the nitrogen oxide (NOx) emissions of six new gas turbines.

Aluminium Bahrain (ALBA) is one of the world’s largest producers of aluminium. The single-site complex produces more than 500,000 metric tons of aluminium a year and is powered by four power plants producing 2,265 MW of electric power.

ALBA recently upgraded two of the power plants in line with the country’s initiatives to promote green technology. The upgrade involved shifting to environmentally friendly gas turbine technology at power station 3 and the Rifaa phase 2 power plant. ALBA upgraded six of the single-silo combustor gas turbines to low-NOx gas turbines.

Low-NOx gas turbines are able to run at high engine efficiency while minimizing emissions of nitrogen oxides and carbon monoxide from the engine. However, in order to reach their full potential the turbines require an efficient control system, coupled with the necessary electrical modifications. To this end, ALBA selected ABB to design, install and commission a control system that would maximize the gains from its new green initiative.

Finding a future-proof solution

After carefully assessing the company’s needs, ABB delivered a modular scalable distributed control system with easy expansion capabilities for large power plants. The system was installed in six of the new gas turbines during planned outages.

“The control system designed by ABB is exactly what we were looking for. With the new solution in place we are now able to effectively increase the energy efficiency of the turbines and therefore drastically reduce NOx emissions, which means lower environmental impact. This is a high priority for our company and the industry as a whole.”

Amin Sultan
Power utilities maintenance and projects manager
Aluminium Bahrain

Simplifying maintenance and usability

Key advantages of the ABB system include very low maintenance and inventory costs made possible by the minimal number of modules; all modules are intelligent with self-diagnostics. The system is also very user friendly and offers uniform hardware for both the power plant DCS and the plant protection system, ensuring smooth interoperability and optimizing maintenance spares.

On the protection front, the system has a proven track record in reliability. For this particular upgrade, ABB used a 2-channel protection system with reliable self-monitoring functionalities. In the event of a protection or load trip shedding, the system will go into safe mode by reducing the load at a pre-determined rate, thereby preventing hazardous situations for plant personnel and equipment.
ABB hydro solution brings power and revenues to Laos

ABB has supplied an extensive instrumentation, control and electrical solution for the Nam Theun 2 hydropower project in Laos – helping to triple the country’s generating capacity and earn vital revenues from the export of sustainable energy.

Commissioned in May this year, the Nam Theun 2 hydroelectric power project is bringing much-needed electricity to Laos and Thailand, and is set to generate more than $2 billion in government revenues during the first 25 years of operation.

Laos is a mountainous, land-locked country with a population of 6.3 million, the majority of whom live in remote rural areas.

According to the World Bank, which along with the Asian Development Bank and other financial institutions is supporting the project, the generation and export of hydroelectric power is one of Laos’ most viable options for economic growth and poverty eradication.

Nam Theun 2 can generate 1,070 megawatts (MW) of renewable energy, 95 percent of which is for export to neighboring Thailand. The revenues will play a key role in helping the Laotian government implement its National Growth and Poverty Eradication Strategy.

Advanced ABB control solution
ABB and consortium partners Andritz Hydro and Clemessy were awarded the electromechanical contract for Nam Theun 2 by head contractor Électricité de France.

ABB’s scope of supply is extensive and includes static generator excitation systems, 13 single-phase transformers, a plant SCADA system, electrical protection systems and telecommunication systems, a 500 kV substation, 115 kV substation and two 50 MVA 3-phase transformers.

The SCADA system is based on ABB’s 800M controllers with an ABB Power Generation Portal human machine interface. Controls are included for gates on the dam, water intake and regulating pond. Communication between the various remote sites is by fiber optics or microwave transmission.

The ABB control system includes advanced functions for forecasting the power station flow from the power generation load schedules. The load schedules allow for smooth transition between the present megawatt set point and future scheduled set points. The load schedule can be on a unit by unit basis or load balancing can also be used.

ABB also provided advanced controls for a regulating dam and a 27 kilometer downstream channel located between the power station and the Nam Kathang river. The main purpose of the regulating dam is to dampen the flow variations from the power station to the river. The solution includes the regulating dam constraint control, the downstream channel rate of change control, and the gate movement minimization algorithm.

To ensure that water flows and water levels are always optimal, ABB developed advanced tools that take into account the elevation levels of the input water tributaries, channel widths and depths, and known losses. Operator level alarms are generated if the water flow calculations are outside the acceptable limits.
Control solution improves WtE reliability

ABB is upgrading the turbine process control system and grate controller for Limeco’s Limmattal waste-to-energy (WtE) plant in Switzerland.

Limeco (previously KVA Limmattal), situated outside Zurich, uses waste and sludge from communities and sewage treatment plants in the Dietikon area as its main source of energy. This is then converted by a cogeneration plant into electricity for 8,000 households and some 28,000 MWh of district heating and industrial process steam a year.

The new turbine control system will replace an old electromechanical governor with two set-point adjustment possibilities (rpm and rating), and thus improve Limeco’s control and regulation quality. The old control gear has already been replaced with two ABB touchscreen operator panels.

An additional benefit for Limeco is fault detection. Measurements and the set-point/actual value control loop error signal are monitored and can be viewed at any time. This permits more efficient operation and maintenance. In addition to the process control system, the turbine controller is equipped with generator protection, synchronization and regulation systems.

Clean combustion

The grate controller ensures that the waste and sludge are burned cleanly, which is a complicated task due to the inconsistency of these materials. The existing grate controller, supplied by waste-to-energy company Martin, had been in service for more than 20 years. It was controlled by a Westinghouse PLC, which was difficult to service and maintain. The advantages of the new ABB controller are an improved overview of the combustion process and the ability to tune the system at any time. This results in better combustion at lower emission levels.

The new turbine controller and the grate controller for Line 1 were started up in May 2010. The grate controller for Line 2 will be replaced during the next scheduled plant maintenance shutdown.

“After several weeks of operation, we can clearly see that the new grate controller provides better control than the old solution. After completing this project on the first incineration line, I am totally convinced we have chosen the right solution.”

Heinz Siegenthaler
Manager of thermal recycling, Limeco
Upgrading Austria’s most important hydropower plant

The Kaprun Main Power Station and Kaprun Upper Stage pumped storage plant belong to a group of hydroelectric power plants located in Austria’s Hohe Tauern mountains in the Alps. The construction of the Glockner-Kaprun power plant group was finished in the late 1940s; it remains an important source of regulating and peaking power for the Austrian power grid.

The power station group currently has an installed capacity of 330 MW in turbine mode and 130 MW in pumping mode. The annual capacity is 742 million kWh (including pumped storage operation). The water used by the power stations to generate electricity is largely meltwater from the Grossglockner’s Pasterze glacier. The Grossglockner is Austria’s highest mountain at 3,796 m. This water is collected in the Margaritze reservoir and connected to the Mooserboden storage basin via the 11.6 km Möll tunnel. The elevation of Mooserboden’s full reservoir level is over 2,000 m above sea level. The reservoir is formed with the 107-meter Mooser and 112-meter Drossen dams.

The Kaprun Upper Stage (or Limberg) Power Station is located directly at the lower end of the Limberg dam and uses the water from the Mooserboden reservoir to generate electricity. During pumped storage operation, the water from the Wasserfallboden reservoir is pumped back to the Mooserboden reservoir. The total concept for upgrading the process control system had to be aligned with the Kaprun Main Stage Power Station. The automation system has to optimize the refurbished power plant and has to be completely integrated with the existing process computer network and LAN architecture. The pumped storage station will be completely automated and operated from a remote location. The generating sets will be operated by Verbund’s grid control center.

For ABB, the next step is to optimize one of the most important power generation units in the Austrian grid. In the next years the new power plant Limberg 2 and the Möllpumpe pumping station will be also equipped with ABB’s control system for power generation.

### Technical data – Kaprun upper level:

- **Power station type:** pumped storage plant
- **Annual capacity:** 166.1 million kWh
- **Max. rating:** 112.80 MW
- **Generator sets:** 2 with horizontal shaft
- **Turbines:** Francis turbines
- **Average gross head:** 365 m
- **Design flood discharge:** 36 m³/s
- **Storage pumps:** 2 radial flow pumps
- **Commissioned:** 1954 / 1955; upgraded 2010
ABB wins order to improve power plant efficiency

Control system modernization to optimize plant operation and upgrade energy efficiency

ABB has won an order worth $16 million from RWE Power AG to modernize the control systems for Units G and H at the Weisweiler power plant in Germany. The Weisweiler power plant, with a present-day overall gross rating of 2,293 MW, is located near the town of Eschweiler in the Rhineland’s lignite field, and first went into operation 55 years ago. Units G and H, each with a generating capacity of 600 MW, went on line in 1975, and are at present being used essentially for handling the base load.

The modernization is designed to optimize plant operation and control systems, with the aim of upgrading its energy efficiency and overall flexibility, particularly in off-peak periods. ABB is supplying the System 800xA for Power Generation process control system, including boiler protection and turbine control. Modules from ABB’s OPTIMAX® family will be used to handle the optimization tasks involved. All the measures being taken are geared to optimize plant operation and extend its lifetime. The order includes the associated engineering, erection and commissioning.

“This project is a good example of how ABB’s scalable solutions contribute toward extending a power plant’s useful lifetime and improving its energy efficiency”, said Franz-Josef Mengede, who heads ABB’s power generation business unit. “This is achieved with minimal impact on plant operation, and prepares the facility to cope with future developments in the power grid.”

RWE Power AG is one of Germany’s leading energy utilities, supplying 16 million customers with electricity and approximately eight million customers with gas.
ABB has won two contracts to power the huge $2 billion Tembusu Multi-Utilities Complex, which is currently under construction at Jurong Island, Singapore.

The facility is owned by Tuas Power, one of the country’s largest power generation companies, and consists of a 160 MW biomass and clean coal (BMCC) cogeneration plant, a seawater desalination plant and a wastewater treatment plant. The plants will provide steam, chilled water and electricity, and treat industrial waste for the petrochemical companies at the complex.

The project aims to be environmentally sustainable using the most efficient clean coal technology available. Because each unit of electricity will be produced at lower cost compared to a gas-fired plant, the savings in utility costs for each factory are expected to be around 10 percent.

**Extensive electrical solutions**

The first contract is from Marubeni Corporation, for the turnkey electrical balance of plant for the main BMCC plant. Marubeni is the main engineering, procurement and construction contractor for the cogeneration plant.

ABB’s scope of supply includes power and distribution transformers, low- and medium-voltage intelligent switchgear, a fully automated power management and load shedding system, and protection and communication systems. ABB is also responsible for the design, engineering, supply, installation, integration and commissioning of the solution.

The second contract comes from Hyflux for the seawater intake plant, where ABB will design, engineer, supply, install and commission an electrical solution comprising distribution transformers, low- and medium-voltage switchgear and drives. This off-site plant will supply the cooling water for the main power island of the cogeneration plant.

The projects are scheduled for completion in 2011.
Boosting performance at a major U.K. power plant

E.ON has selected ABB to help boost the performance of each of the four 500 MW units at the Ratcliffe-on-Soar power station in the U.K. by providing a high-performance grid connection.

The ABB solution includes the latest HECS generator circuit breakers (GCBs) and IEC 61850 devices to ensure the reliable transfer of power to the national high-voltage grid. The 2,000 MW Ratcliffe-on-Soar coal-fired power plant is one of the most efficient coal-fired generating facilities in the country, and has broken several U.K. records for plant availability and the volume of power produced.

To conform with new government legislation and enhance the transfer of power to the U.K. national grid, E.ON selected ABB to provide a high-performance grid connection for each of the four 500 MW generating units.

The solution includes ABB’s new range of HECS generator circuit breakers featuring innovative technology that has improved GCB performance by more than 25 percent, while simultaneously reducing the footprint, weight, noise levels and maintenance requirements of these critical power plant components.

The solution also includes unit protection systems based on ABB’s ground-breaking REC670 intelligent electronic devices, which provide a comprehensive package of benefits that improve grid reliability, safety (a key issue in the U.K.), productivity and system integration. The solution is fully compliant with the IEC 61850 standard.

ABB’s market-leading UniGear medium-voltage switchgear was also instrumental in winning the order and for its ability to provide protection against fault currents of up to 53 kA. E.ON also chose ABB’s fifth generation of automatic synchronizing equipment, SYNCHROTACT 5, to synchronize the generators with the power lines, further improving grid reliability and availability. ABB is performing the modernization at the rate of one unit a year, with completion scheduled for 2013.
Integrated process and power automation

A unified plant environment that increases productivity, improves safety and reduces cost.

Power plant automation is traditionally based on two control platforms: one for process control and the other for switchgear control and protection. Integration of the two platforms is the next frontier in the drive towards a unified plant environment that will increase productivity, improve safety and reduce costs. With the number of complex plant system interfaces growing and fewer employees to maintain them, plant operators also require total plant visualization and the ability to view the entire plant with a single interface.

Traditionally, the two control platforms are divided into three areas: process control, process electrification, and power distribution and management. In the past, each area was handled by a separate computer system with a unique communication protocol. In older plants it is still common for the electrical equipment to be connected to the plant automation system through hardwired connections via a marshalling rack and the plant I/O (input/output) system. The amount of wiring required is significant and the risk of connecting a device to the wrong I/O card is high. Even if integration is successful, the benefits are limited because hardwired devices do not offer the same information and communication capabilities as smart devices.

In newer power plants, the low-voltage (LV) equipment is often linked via a fieldbus with the distributed control system (DCS). This increases the amount of intelligence, information and communication between the DCS and the LV equipment. The medium-voltage (MV) and high-voltage (HV) components have their own SCADA (supervisory control and data acquisition) system, which is hardwired to the marshalling rack. However, the amount of functionality for the high- and medium-voltage systems remains limited and the effort, cost and risk of integrating them with the DCS is just as high as in older plants.

What characterizes both types of older and newer solution is the ‘wall’ that separates the distributed control system from the electrical control system. Typically, the two systems are operated from separate control rooms by different sets of staff. One system might be UNIX-based, the other Windows-based, and they are often supplied by different vendors. All of this costs money, in terms of installation and lifecycle costs, and it involves a doubling of everything – staff, control systems, hardware and software. ABB has eliminated the inefficiencies and disadvantages of this model – hard-wired electrical components with limited functionality, high cost and risk of integration, and separate control systems – with a solution that integrates the plant DCS with the IEC 61850 standard for substation automation.

IEC 61850

IEC 61850 is the global standard for substation automation systems. Issued by the International Electrotechnical Commission (IEC) in 2004, it is an Ethernet-based standard for communications and system architecture in substation automation and power distribution systems. IEC 61850 provides a flexible and open architecture for interoperability between intelligent electronic devices (IEDs). It also provides virtualized modeling of logical devices and a common IED configuration language. Integration with
IEC 61850 makes it possible to connect the electrical world with the process control world. It replaces the scores of different protocols of the past with a single IEC 61850 protocol that enables the IEDs of different vendors to interoperate.

The key enabler of the IEC 61850 standard is the IEDs. A single and uniquely powerful IED like the REG670, which is part of ABB’s new Relion® family, can protect the entire generator and grid connection unit of a power plant. It provides, for instance, differential protection for the generator, step-up transformer and auxiliary power transformer, as well as all the usual functionality normally required to protect and control those components. Similar degrees of protection and control are provided by other products in the Relion family for the various MV and HV components in the power plant.
The diagram above shows how the plant automation and electrical systems are typically integrated by the ABB solution via the IEC 61850 interface. Field instrumentation and LV and MV process electrification (drives, motors, LV switchgear, etc) are usually integrated with fieldbus technologies.

Integration of the power generation and power distribution MV and HV equipment is via the IEC 61850 interface, which communicates both horizontally with the other fieldbuses and vertically with the IEDs and ABB’s power management system. The result is the integration of the process control, process electrification and power management systems. The benefits of integrating the electrical and process automation systems are many. Among the most significant are the following:

**Unified operations**
Dismantling the wall between the process control and process electrical systems eliminates the unnecessary duplication of equipment, staff and control rooms. A single view of both systems is provided without additional process I/Os, complex software interfaces, or marshalling racks. Unified operations give plant personnel greater efficiency and flexibility in controlling the entire facility. This alone significantly reduces investment and lifecycle costs; it makes the staff more efficient, reduces the need for training and gives them greater flexibility in operating the plant. The fact that only one database rather than two is required improves plant safety and data security.

**Extending asset management benefits**
The ABB solution makes it possible to extend the benefits of asset management to the plant electrical systems. Condition-based monitoring of the process and electrical systems can now be performed with one system. It enables consistent and real-time monitoring of all plant assets and the identification of poorly performing equipment through an asset condition reporting system. A single, standardized interface for ERP (enterprise resource planning) integration provides the basis for a plant-wide computerized maintenance management system.

**Cost avoidance**
The solution achieves plant integration cost effectively and without increasing the footprint of the plant. This ‘more from less’ capability does not require additional marshalling racks, remote panels or dispatch equipment; nor does it need a load bank system, annunciator panels or fault recorders. It replaces hardwired I/O signals with high-performance, communication-based connections, which means less wiring and less commissioning.

**Unified system engineering**
Prior to the ABB solution, a plant automation system required two engineering tools: one for the IEC 61131 standard and one for the IEDs. This is another example of duplication: two different tools, two different sets of documentation, two types of configuration. IEC 61850, on the other hand, contains all the required engineering tools and makes it possible to create a unified system engineering environment.

**Flawless project execution**
The solution brings an entire raft of benefits to project execution, including simplified design, standardized and well-documented interfaces for all subsystems, a unified engineering database, type-tested interfaces with reduced risk of error, faster commissioning with fewer changes in the field, and an optimized project execution schedule. The common engineering database supports easier and more efficient data exchange between domains and partners via formats like SCD, CAEX, and DTM / GSD / EDD.

**Cost savings and efficiency improvements**
ABB installations to date show that a typical solution with IEC 61850 compatibility delivers significant cost reductions compared to the conventional approach. These savings are significant in all phases of the project, making all the processes leaner and minimizing throughput time in engineering, installation, commissioning, startup, training and service.
ABB extends lifecycle commitment for Symphony control system

Lifecycle management strategy addresses current and future needs

At Power-Gen Asia conference in Singapore, the premier conference and exhibition for the power generation and transmission and distribution industries, ABB announced it is extending the lifecycle commitment for its Symphony Harmony and Symphony Melody range of control systems.

"This initiative is part of our ‘evolution without obsolescence’ strategy and is aimed at supporting customers in finding a balance between the introduction of new technology and maximizing the return on asset investments already made.”

Franz-Josef Mengede
Head of ABB’s power generation business

ABB originally announced a minimum 10-year commitment to active investment in Symphony products in 2006. As the midpoint of this undertaking nears, ABB is making it clear that it will continue to actively invest in the Symphony system well beyond the previously stated date.

Introduction of new technology and functions follow ABB’s lifecycle policy of ‘evolution without obsolescence.’ This policy follows that no product will be removed from active sale until a compatible, equivalent or superior product is available. ABB’s lifecycle strategy of functional backward compatibility has resulted in the Symphony DCS having the largest contiguous installed base of any process automation system in the world with more than 6,000 systems installed worldwide, a large part of which is in the power generation and water sectors.

Specifically to future development, ABB’s ongoing investment program for its Symphony line focuses on developing products that will improve its customers’ overall productivity. This includes active development at all levels the system including control, I/O (input/output), communications, engineering, operations, safety and security. These efforts will also aim to address power and water industry specific challenges. Key application focus areas will include electrical integration, operator effectiveness, plant life extension and optimization as well as integration of renewables and enabling of smarter grids.

### ABB control product lifecycle phases

- **Active** actively sold
- **Classic** maintained and manufactured
- **Limited** reduced support – repair/refurbish
- **Obsolete** normal support not available

![ABB control product lifecycle phases diagram](image)
ABB at Power-Gen International
Orlando, Florida

ABB is showcasing an extensive range of leading-edge technologies at this year’s Power-Gen International conference and exhibition in Orlando, Florida on December 14–16.

Among the many products and solutions on display are examples of ABB’s industry-leading integrated instrumentation, electrical and control system solutions. In addition to its full scope of supply capability, plant electrical system integration and control system features and differentiators, ABB will showcase its technologies and solutions for energy efficiency, asset optimization and renewable energy. During each of the three days, ABB representatives will be available to discuss and demonstrate capabilities and expertise on a broad array of topics of importance to the power generation industry.

Conference papers to be presented include

Power Up Your Plant: An introduction to integrated process and power automation
Jeff Vasel (ABB)

Optimized hydro plant chain controls using real time models and economic dispatch solver
Indra Kusuma and Reid Boutot (ABB)

Achieving a balanced mix for future power generation – a view from Europe
Stefan Hatt (ABB), Rolf Kehlhofer (The Energy Consulting Group)

Energy efficiency – the other alternative fuel
Werner Janik (ABB)

Pump storage power plants – a flexible solution for variable loads
Kazmer Borovszky and Gary Shaw (ABB)

We look forward to welcoming you to booth 2221, at Power-Gen International 2010 in Orlando.
Events

Upcoming events

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<td>VGB Conference</td>
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<td>“Power plants in competition 2011”</td>
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<td>Annual meeting on nuclear technology</td>
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Product news

RIO02

New solution for remote Harmony I/O applications

Increase performance, robustness and reliability vs RIO02

Symphony Harmony’s latest rack remote I/O module, RIO22, operates with ABB Bridge Controllers (BRC300/400) to provide powerful control capabilities on a plant wide scale. The RIO22 module is designed for communication between a BRC controller and remotely located Harmony Rack I/O modules. As a replacement for the RIO02 module, the RIO22 follows ABB’s ‘Evolution without obsolescence’ commitment and is fully compatible with the INFI90® OPEN system in functionality, communication, and packaging. The RIO22 is also designed for redundancy (two RIO22 modules are required).

Advantages

- Functional superior replacement for RIO02 installations
- Reuse of existing RIO02 software configuration
- RIO22 modules located up to 3,000 m from controller
- Support for multiple RIO22 remote links
- Up to 64 Rack I/O modules on each RIO22 remote link