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FAST FORWARD WITH ABB

POWER GENERATION SPECIAL ISSUE 2010

Power with responsibility

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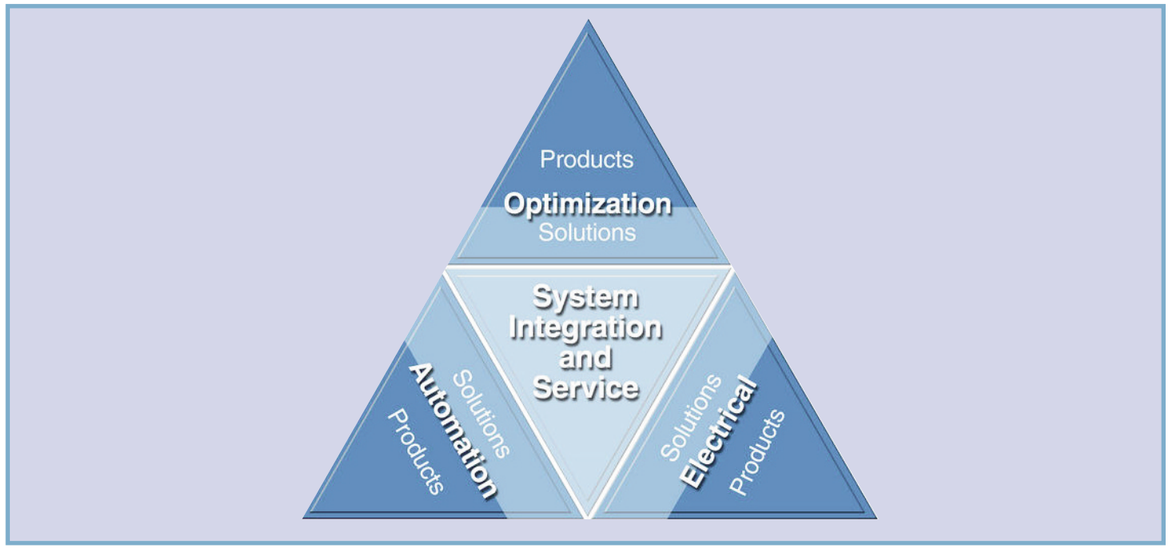
ABB

Serving the power generation industry worldwide



A single-source provider with worldwide presence

ABB offers an unrivalled portfolio of products and services for the power generation industry. It has a network of hundreds of sales offices, service centres and manufacturing facilities that provide power plants with world-class automation solutions. ABB is recognized as the largest independent system integrator for instrumentation, control and electrical systems in power generation – all from a single source. These solutions have been applied to over 4,000 power plants around the globe, ranging from small hydro-electric facilities to large fossil-fired power stations.

Experience, innovation and dedication

Modern power plants rely on sophisticated instrumentation, control and electrical systems, all working in harmony. ABB scientists and engineers are dedicated to delivering innovative solutions that ensure power generation systems operate flawlessly, to produce reliable power. They can also draw on a profound knowledge of power plant processes that provides the basis for a wide variety of optimization solutions.

Life-cycle partner

ABB supports its customers throughout all the stages of a plant's life-cycle, from initial project development, through operation, to refurbishment and upgrading, helping to maximize their return on investment. ABB's advanced life-cycle services help customers extract the maximum possible value from their installed assets by maintaining optimum levels of availability and performance.

Ideal business partner

ABB's core strength is its ability to consistently translate process and operational requirements into a harmonized and economical automation configuration and single-line electrical diagram. This both minimizes and optimizes the interfaces between instrumentation, control and electrical systems. In this environment, ABB is an ideal partner for utilities, general contractors, plant suppliers and process equipment suppliers.

Solutions for all power plant types

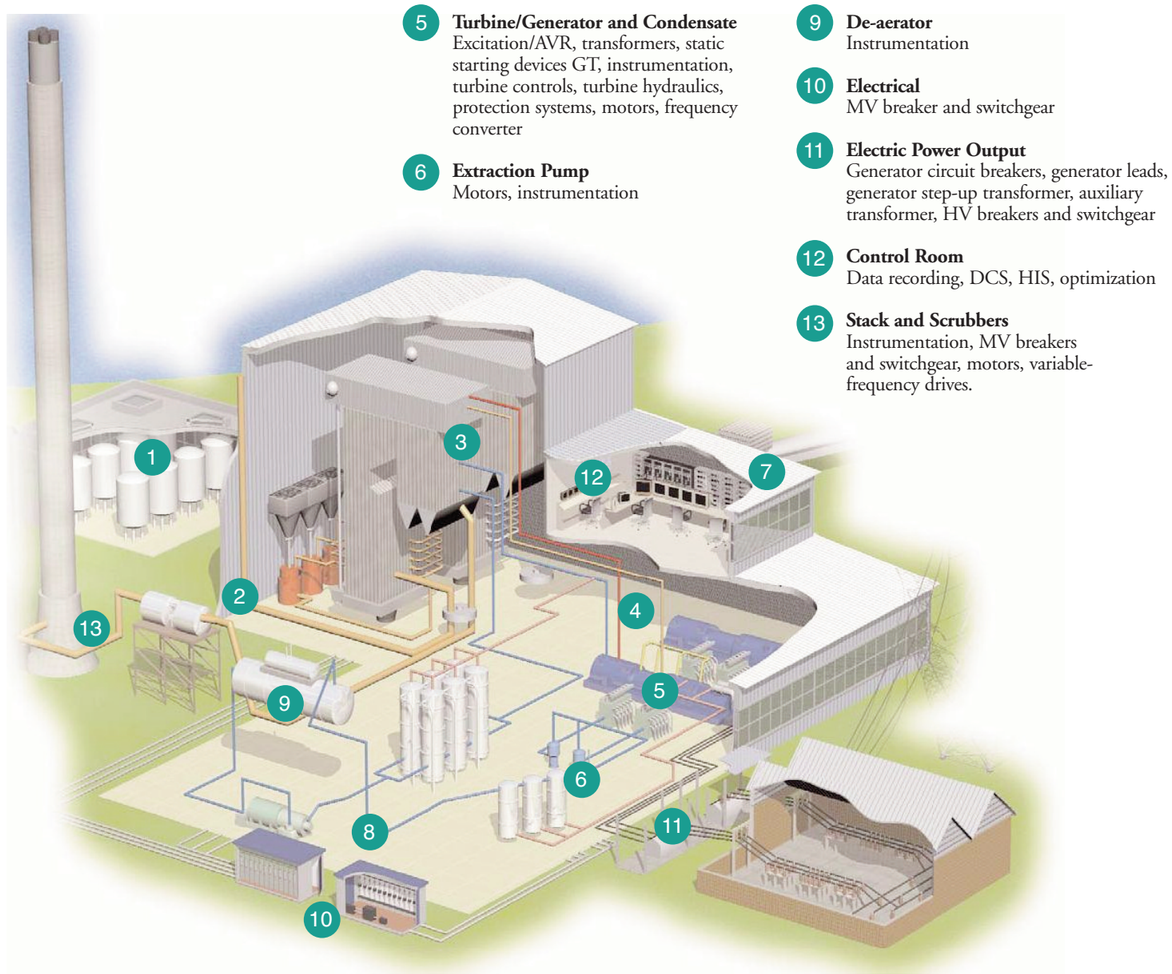
ABB offers solutions for all types of power plant, from thermal to solar, including:

- Fossil-fired power plant
- Combined-cycle power plant
- Waste-to-energy plant
- Industrial power plant
- Hydro power plant
- Alternative energy plant.

EBoP - electrical balance of plant

ABB's integration experts create added customer value by combining these solutions into comprehensive power plant systems for instrumentation, control and EBoP – including Medium Voltage breakers and switchgear, motor control centres, auxiliary transformers and Low Voltage equipment. Here we provide an overview of ABB's scope of solutions for power plant.

1. **Fuel Supply**
(Conveyor or compressor)
Motors, variable frequency drives
2. **Fuel Supply**
Motors, variable frequency drives, instrumentation
3. **Boiler and Steam Line**
Motors, instrumentation, boiler controls, boiler management systems
4. **Cooling Water System**
Motors, instrumentation
5. **Turbine/Generator and Condensate**
Excitation/AVR, transformers, static starting devices GT, instrumentation, turbine controls, turbine hydraulics, protection systems, motors, frequency converter
6. **Extraction Pump**
Motors, instrumentation
7. **Cooling water system**
MV switchgear, motor, instrumentation
8. **Boiler Feedwater**
Motors, variable-frequency drives, softstart, instrumentation
9. **De-aerator**
Instrumentation
10. **Electrical**
MV breaker and switchgear
11. **Electric Power Output**
Generator circuit breakers, generator leads, generator step-up transformer, auxiliary transformer, HV breakers and switchgear
12. **Control Room**
Data recording, DCS, HIS, optimization
13. **Stack and Scrubbers**
Instrumentation, MV breakers and switchgear, motors, variable-frequency drives.



Ensuring balance of power with EBoP

ABB has the capability, experience and in-house technologies to deliver turnkey electrical systems and plant packages (EBoP) tailored to a wide variety of plant, such as oil- and gas-fired combined-cycle power plants, coal-fired boiler power plants and hydro-electric plants, as well as industrial-sized turbine and boiler power applications.

ABB's electrical balance of plant (EBoP) service covers every electrical control and instrumentation system and component in the power plant, apart from the generator and turbine. This includes a broad portfolio of products and solutions that provide a single source of supply for both new build and refurbishments projects, from high voltage (HV) down to the low voltage (LV) level.

ABB takes responsibility for the complete engineering, supply, manufacture, delivery to site, installation, commissioning, testing and quality of the EBoP package. Direct control over all engineering and project management functions enables ABB to ensure the best performance and quality of engineering workmanship and deliveries.

Through innovative electrical power applications, ABB helps utilities to build and maintain reliable power systems installations safely and efficiently, providing cost-effective solutions that guarantee results.

ABB has supplied turnkey EBoP solutions to a wide variety of projects worldwide, resulting in these benefits:

- Integrated solution
- Reduced project risk
- Optimization of the complete system
- Improved plant efficiency
- Pre-tested plant configurations
- Reduced overall project cost
- Reduced number of interfaces
- Consistent technology approach and spares strategy
- Improved project delivery
- Reduced commissioning time and cost
- Complete system approach to meet compliance and local regulations
- Common platform that minimizes the required investment in hardware spares, reduced training needs and eliminates the need for serial interfaces.

Boosting performance at Ratcliffe-on-Soar

E.ON has selected ABB to help boost the performance of each of the four 500 MW units at Ratcliffe-on-Soar power station in the UK 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 Grid.

ABB's new range of HECS generator circuit breakers feature 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 unit protection systems are based on ABB's groundbreaking REC670 intelligent electronic devices, which provide a comprehensive package of benefits that improve grid reliability, safety (a key issue in the UK), 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 due to 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.

Power systems and grid connections for Nuon Magnum multi-fuel power plant

ABB is providing the power systems and grid connections for a multi-fuel power plant to be built in The Netherlands.

The new 1,200 MW Magnum power plant for the Dutch utility Nuon is located in Eemshaven, on the North Sea coast. It will feed electricity into the existing Dutch high-voltage grid and could supply power to around two million households.

The power plant is based on gasification technology and can generate electricity from gas, coal and biomass, combining sustainability with production capacity. Nuon is developing the plant in two phases. Phase 1 is the natural gas-fired plant. Phase 2 entails investments in coal and biomass gasification technology.

The new plant, scheduled to go on line in 2011, will consist of three units, each producing about 430 MW. ABB's scope of supply includes the auxiliary power supply systems, a 380 kV substation and the switchgear building. ABB is also supplying 380 kV cables, transformers, generator breakers, medium- and low-voltage switchgear, emergency-power diesel sets, batteries and communication systems, as well as engineering, installation, commissioning and training.

HV substations make the connection for West Burton CCGT power station

The broad scope and flexibility of ABB's HV substation technology came to the fore in a project to connect EDF Energy's new 1,300 MW CCGT (Combined Cycle Gas Turbine) power station at West Burton, Nottinghamshire to the National Grid. Not only has ABB constructed a complete new turnkey 400 kV AIS (Air Insulated Switchgear) outdoor substation and upgraded an existing indoor 400 kV substation with the latest GIS (Gas Insulated Switchgear) technology, it has also implemented a comprehensive, tailor-made, centralized protection and control system that interfaces with both substations and the power station.

The new CCGT power station features six generator circuits in groups of two – steam and gas combined-cycle – providing three units. ABB's task was to design, build and commission a new AIS substation, based on its well proven HPL 400 kV circuit breakers, to bank the six incoming transformer bays together in a busbar arrangement that connects into two outgoing 400 kV underground cable circuits. This project is progressing well and is currently being prepared for handover in early 2010.

The two underground cable circuits feed into a substation located 1 km away, where ABB has constructed two new 400 kV GIS bays within an existing indoor AIS building to provide the connection to National Grid's transmission system. ABB's ELK3 switchgear proved the ideal choice here, since its compact, state-of-the-art design enabled it to meet EDF Energy's requirements for performance, reliability, safety, minimal maintenance and low environmental impact within a very small installation footprint.

Protection & control systems

ABB has implemented a comprehensive custom engineered protection and control system, based on its NICAP (National scheme for Integrated Control and Protection) philosophy and incorporating the very latest Relion 670 IEDs (Intelligent Electronic Devices). This system facilitates fully independent control of the West Burton AIS and GIS substations from three points – at each substation and the power station. Even if two control points should fail, the system can still be operated, ensuring a high level of availability.

Refurbished substation for Pembroke power station

ABB has carried out a grid connection project for RWE npower at Pembroke 400 kV grid substation, in south west Wales, for a new 2.1 GW CCGT power station. The power station, due to come on line in 2011, is a five-unit plant, each comprising a gas turbine and steam turbine on a single shaft.

The original 400 kV indoor substation was constructed in the 1960s to support an oil-fired power plant, now demolished. Four of the old bays plus one spare were made available for the new works. The primary connection element at Pembroke utilizes a hybrid version of the well proven ELK 400 kV PASS (Plug & Switch System) switchgear but with the AIS coupling built in. This enabled the replacement bays to be constructed within a much smaller footprint.

The protection systems utilizes the newly National Grid-approved standardized IEDs, namely the REC670 bay control unit and REB670 low-impedance connection protection. The SCS control system features a combined panel mounted computer/monitor that uses the latest touch screen technology.

Did you know?

ABB holds the world record in switching high current at 200,000A with its generator circuit breaker using a new type of self-blast technology.

System 800xA takes control of power generation

When selecting an automation system, power plant operators focus primarily on high availability, low life cycle costs and the need to steadily increase productivity and profitability. Previously, power plants had a large number of controller sub-systems, each covering specific tasks. However, to meet the changing needs of the modern power generation industry, there is a demand for a scaleable, multifunctional controller platform that is highly adaptable, with open architecture and maximum availability.

ABB has responded to this demand with its System 800xA, which provides a consistent and intuitive workplace for the management and automation of power generation plant – either within a single site or multiple plants across different locations – using both ABB controllers or third-party systems. It covers both the automation and electrical areas of the plant, so that operators have every device or subsystem under control in a consistent and intuitive environment.

Engineering

System 800xA takes an integrated engineering approach to provide efficient support for a project throughout its entire life-cycle – from planning, configuration and generating the library to commissioning, operating and servicing the installation.

Safety

A complete, scalable IEC 61508- and IEC 61511- compliant SIS (Safety Instrumented System) spans the entire safety loop, including SIL-rated field devices, I/O modules, controllers and field actuators. Powerful system functions combined with operator and engineering tools reduce plant risk by managing the human factor.

Control

Scalable System 800xA controllers can be adapted to any customer need and plant size, while remote and rack-based I/Os for compact, space-saving installations are available. Common industry protocols such as HART, PROFIBIS and FOUNDATION Fieldbus are supported, as well as most protocols for switchgear and substation automation – including the emerging standard for electrical integration, IEC 61850.

Adaptable building blocks

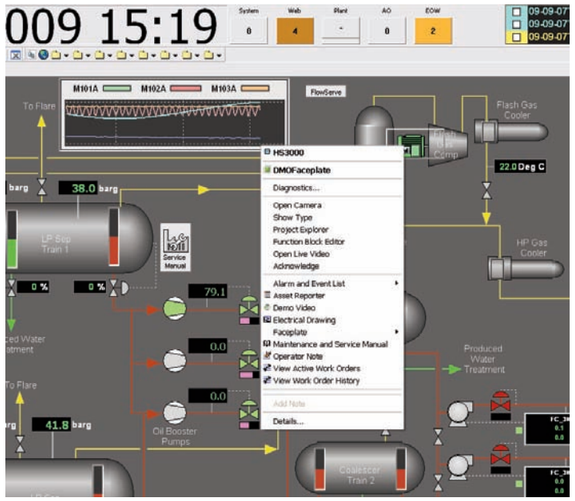
System 800xA modular controllers provide the building blocks for systems that are readily adaptable to suit a very broad range of plant sizes. They provide the efficient engineering environment that makes a substantial contribution to improving asset profitability. They also enhance process control and availability and reduce maintenance requirements.

Open architecture

ABB's open architecture has been designed from the ground up to leverage the power of industry-standard fieldbuses and open communication protocols. This allows the easy integration of a wide variety of devices and systems. So System 800xA facilitates total plant data integration while reducing overall system support costs.

Visual environment

ABB has designed System 800xA to provide a visual environment for easy design and deployment of automation strategies, process visualization displays, information management, asset optimization and field device integration. Project data can be accessed, created and modified simultaneously by different users.



Reusable solutions

Adoption of 'best practice' solutions helps operators ensure maximum consistency, reliability and availability of their power plant assets. System 800xA aids this process by allowing standard solutions to be quickly reproduced and deployed. In contrast to most automation systems, which focus on reusability only at the process control strategy and implementation levels, with System 800 xA the standard solutions also incorporate extended automation entities such as faceplates, graphic elements, trends, document links and so on.

Product planning process

ABB's fundamental belief is that any new features and capabilities must be able to be adapted seamlessly with minimal impact on existing applications. So each new step is regarded as a natural progression and never behaves like a plug-in or raw adaptation of another supplier's product. As an example, new controllers can coexist happily in the same control network with previous generations and operate together seamlessly.

Customer evolution

A successful evolution programme starts with a solid plan, driven by the power plant operator's business goals. Good planning helps to minimize any potentially negative impact from an upgrade and is critical for incremental, step-wise evolution. It also helps to simplify and improve annual budgeting and facilitates planning for system upgrades and plant shutdowns.

ABB doesn't offer a 'one size fits all' approach. It recognizes that customers have different strategies and business goals, and adopts a collaborative approach to map out the optimum evolution plan to avoid hitting the brick wall of obsolescence. This philosophy enables plant operators to improve productivity continuously through step-wise extensions of their automation systems, taking advantage of new technologies and products as they become available and applying them to one functional area at a time.

Delivery of solutions

Another vital aspect of the evolution value chain is the delivery of sound system solutions. So System 800xA comes with the support of ABB's team of highly trained and skilled system engineers who have the knowledge and expertise to design and implement a project solution that delivers results, protects investments and presents the lowest possible risk.

Plant automation for power generation

IEC 61850 – The new standard for power plant automation

The latest developments in automation standards and technology enable the previously separate automation of a power station's process and electrical systems to be combined into a single integrated system. For power plant operators, this results in a wide range of benefits in engineering, operation and maintenance.

Plant operators and electricians can work with the same control system and use the same graphic displays. The uniformity of the presentation of information and operating procedures improves the quality of the operational processes. The electrical systems can also be operated from any power plant control system workplace. This means that electrical system information is also available without limitation at any time and from any workplace.

A key step towards this integration has been the inclusion of the station control standard IEC 61850, based on Ethernet technology. IEC 61850 does not replace the process automation field buses, but can however eliminate the many different serial interfaces in the area of the electrical systems. In the future, with IEC 61850, power station control systems will be based on two pillars: the field bus standard for process automation and IEC 61850 for the electrical part.

System 800xA for RWE npower's Staythorpe CCPP

ABB is supplying four System 800xA control systems for each of the four KA26-1 Alstom power plants at RWE npower's 1,650 MW Staythorpe CCPP power station in the south of England. The order also includes four EGATROL and four TURBOTROL control systems for the gas and steam turbines as well as the equipment for the control room, which is equipped with large displays.

Following on from the Staythorpe project, ABB has won an order to supply five system 800xA control systems for RWE npower's new 2,160 MW Pembroke power station in Wales. This includes five EGATROL and five TURBOTROL control systems for the gas and steam turbines as well as the plant control system, a Power Generation Information Manager (PGIM) system and equipment for the control room.

System 800xA for Grain power plant

ABB is equipping E.ON UK's new Grain power plant with the integrated System 800xA for gas and steam turbines, exhaust gas boilers and steam cycle plus electrical and mechanical auxiliary systems.

The new 1,275 MW gas-fired combined heat and power (CHP) station is situated on the Isle of Grain in Kent. It consists of three natural gas-fired units using the very latest in combined-cycle technology to produce enough electricity to supply around one million homes. As well as generating electricity, the power station will feature an innovative CHP scheme that will supply 'waste' heat in the form of hot water to the nearby liquefied natural gas (LNG) terminal, making Grain one of the world's largest and most efficient CHP plants.

ABB's scope of supply comprises the control system, including the workstations in the control room, process stations, connections to field devices, information management system, and the gas and steam turbine control systems EGATROL and TURBOTROL. The adjacent gas liquefaction station is also being equipped with System 800xA and field bus technology. The System 800xA operating stations quickly generate complete information across the entire process, so that the operator can safely control the plant under a variety of generating and process conditions.

Hameln WTE plant extended with System 800xA

At Enertec's Hameln waste-to-energy (WTE) plant in Germany, ABB has automated a new waste-fired boiler and replaced the operating and monitoring systems of the existing process components. The new number 4 boiler was automated using System 800xA based on AC 870P-controllers. Boilers 2 and 3 had been automated some years previously with Contronic E. Despite the different controller families, the System 800xA enables the complete plant to be operated and monitored consistently from the new central control room. This has opened up fast, flexible and secure access to all the relevant information so that the plant operators can execute monitoring and operational activities efficiently and precisely.

Control for bio-fuel power plant in Sweden

The city of Mölndal in Sweden is investing in a new bio-fuel power plant for electricity and district heating. The Riskulla power plant is being equipped with a System 800xA solution consisting of 3 AC 800M controllers with 2,200 S800 I/O channels and Profibus DP for interaction with the process. The solution also has 4 Operator Workplaces and one combined workplace and engineering station. There are two system servers and one application server which also will include an information management solution.

The 800xA solution is being provided by ABB Sweden's channel partner FB Engineering who will do the application programming. ABB is also delivering drive systems for this project.

Automating clean coal power plant

The Italian utility Enel has transformed its Torrevaldaliga Nord thermal power plant near Rome from heavy fuel to 'clean coal' with the help of an ABB DCS (Distributed Control System), increasing the electricity generated from each ton of fuel by 15 percent. ABB's DCS connects 3,500 instruments across the plant, gathering and analyzing data that enables Enel to operate the plant at maximum efficiency – and to reduce the plant's emissions of nitrogen oxide, sulphur dioxide and dust by more than half.

The project scope included design, supply, assembly and commissioning of components and instruments for automation, supervision, control and protection of the entire power station, including critical boiler and filter systems based on System 800xA technology. ABB also supplied Medium Voltage switchgear, SCADA and a protection system.

Upgrading one of Europe's largest waste-to-energy plants

With three incineration lines and a processing capacity of 190,000 tons of waste a year, the Kommunekemi waste-to-energy plant in Denmark is one of the largest of its kind in Europe. The plant produces around 162,000 MWh of heat and about 60,000 MWh of electric power annually, which is sold on the open electricity market.

Previously, the plant was equipped with an ABB Advant OCS control system, which was based on the Unix platform and processed some 30,000 signals. Having worked with ABB for many years Kommunekemi naturally turned to ABB when they decided to upgrade the ageing control room and install a new process automation system.

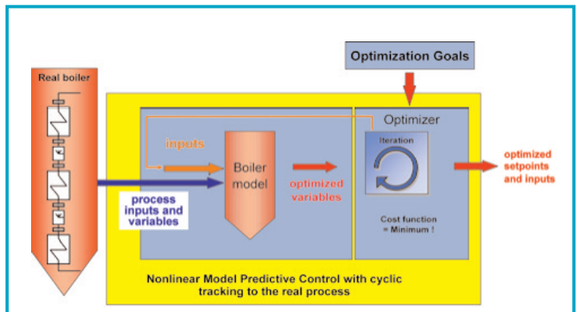
"Our primary demands for the new system were ease of use, reliability and 100 percent availability – both during the replacement process and normal operation," says Jørgen Pedersen, electrical engineer at Kommunekemi. "We also wanted a state-of-the-art user interface and the advantages of a Windows-based platform that the Unix-based system (although extremely reliable), didn't provide."

During the upgrade it was possible to run the old and new automation systems in parallel in order to prevent interruptions to production – a key customer requirement when selecting ABB.

Boiler optimization systems

In their search for improved power plant efficiency, engineers are focusing on the effects of start-up procedures and load cycles. ABB has responded by developing the BoilerMax control software packages that automatically calculate the optimal start-up strategy for steam generators. This approach can achieve savings of 10 to 20 per cent of the costs for fuel and auxiliary power per start-up. This control concept employs the principle of feed-forward control as a way of 'acting rather than reacting' to the process. BoilerMax uses a non-linear model of the process, where the most important dynamic behaviour of the boiler components relevant to cold, warm and hot start-ups are simulated while also taking into account basic conditions such as the maximum permissible loads of critical thick-walled components or the respective minimum flow rates.

BoilerMax installations



BoilerMax has been successfully operating for over two years at four E.ON power plants in Germany – Staudinger, Ingolstadt, Zolling and Heyden – where it has achieved some remarkable reductions in fuel consumption.

Savings of between 10 and 20 percent in the cost of each start-up have been consistently recorded since installation. This equates to annual savings of between $125,000 – 250,000 for the approximately 100 start-ups a year that a typical average-capacity power plant performs.

The installations cover coal-, gas-, and oil-fired plants of varying generating capacities:

- Staudinger 4 – 622 MW gas-fired unit
- Ingolstadt 4 – 420 MW oil-fired unit
- Zolling – 450 MW coal-fired unit
- Heyden – 950 MW coal-fired unit.

BoilerMax is integrated with ABB's System 800xA control system at Ingolstadt and Zolling, and with ABB's earlier Procontrol P unit control system at Staudinger and Heyden.

UNITROL 6000 – the new generation of SES and AVR

UNITROL 6000 is ABB's latest and most powerful generation of Static Excitation Systems (SES) and Automatic Voltage Regulators (AVR) designed to deliver high performance control for all kinds of synchronous generators and motors. Available for output currents up to 10,000 A (DC) and ceiling voltages up to 2,000 V (DC), the new range makes a highly efficient contribution to network stability.

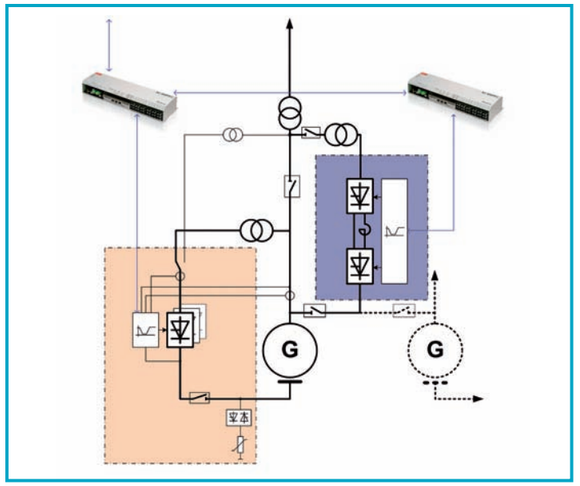
The UNITROL 6000 product range uses the AC 800PEC controller, which has been developed as an extension of the 800xA control platform to meet the particular high-speed control requirements of power electronics applications such as MV Drives, Frequency Converters, High Current Rectifiers, etc. The compatibility of the 800Ax application software tool with the AC 800PEC platform is an additional important advantage.

For maximum flexibility, UNITROL 6000 is based on reuseable thyristor bridge modules. Depending on output current and requested availability, the modules can be connected in parallel. In the case of three or more parallel modules, the current sharing among the modules is actively optimized.

The architecture of the main controller depends on availability requirements. While two identical control channels are state-of-the-art for larger generators, high-end applications may require an additional independent back-up controller, which can be implemented in the UNITROL 6000 system. The connection between the various controllers is by fibre-optic serial communication. This ensures electrical isolation and highest possible EMC immunity.

MEGATROL combined solution

MEGATROL is a smart and compact solution that combines the UNITROL 6800 SES and MEGADRIVE-LCI Static Frequency Converter (SFC) in one container. The use of ABB's powerful AC 800PEC controller for both systems results in lower costs for the customer, both in terms of spare parts and training of maintenance staff. MEGATROL is an attractive solution for gas turbine, combined-cycle and pumped storage power plant applications.



Challenging upgrade for Tilbury power station

RWE npower's coal-fired power station at Tilbury, on the Thames Estuary to the East of London, has been in operation since 1968, and is currently capable of generating a total of 1,059 MW. Although the plant is scheduled to be taken out of service by 2015, RWE npower decided to retrofit its three power-generating units. This decision was driven by the condition of the existing equipment, as well as RWE npower's commitment to ensure safe and reliable operation of the station.

ABB's technical expertise and extensive experience in retrofitting solutions helped it secure the upgrade order. Three new UNITROL 5000 Static Excitation Systems with dual auto channels, excitation transformers and high-voltage cable connections, have replaced the existing rotating AC exciters, static diode rectifiers, permanent magnet generators and field breakers.

The ABB team designed an optimized system layout that had the added benefit of reducing the installation effort required. In view of the limited lifetime of the station, ABB suggested that the most cost-effective approach was to have a non-redundant configuration of the UNL14300 power converter with the withdrawable option, and a spare converter bridge to enable a quick repair solution. The Excitation Control Terminal and the Ethernet connection with OPC protocol were further options that enabled simplified operation, monitoring and maintenance of the new excitation systems.

The new equipment successfully met the current Grid Code requirements, which had been revised on several occasions since the beginning of the plant's operation. The dual-channel configuration of UNITROL 5000 significantly improves the availability of the plant, while the integrated PSS function contributes to the stability of the network, as demonstrated during the grid acceptance test. The first unit was commissioned in 2006 and the last in October 2007. All 3 units have been in successful operation ever since.

Power Generation Service

Power Generation Service

Protecting customer investment by step- wise evolution and updating of instrumentation, control & electrical sy stems

ABB Power Generation Service is a single seamless organization that offers total service support for power generation assets, covering instrumentation, control and electrical systems, as well as project delivery and consultancy. The key to its success is a team of highly skilled and experienced professionals that provide a whole-life approach to the service support of power generation assets, with the focus on keeping critical plant in optimum condition.

The main elements in ABB's Power Generation Service portfolio are:

- continuous access to innovations
- operational improvements
- life-time extension
- evolution and integration of existing installations
- remote support and diagnostics
- structured maintenance planning.

DCS console system upgrade for Connah's Quay power station

In 2009 ABB completed a major contract from E.ON UK to replace the existing VAX-based operator stations at its 1,420 MW Connah's Quay Combined Cycle Gas Turbine Power Station at Deeside, North Wales with new MS Windows-based power generation portal consoles

The existing SODG graphics used on the current OIS-40 series consoles were converted to PGP (power generation portal) graphics. The upgrade project replaced existing OIS-40 series consoles with state-of-the-art technology suitable for meeting the power station's needs for the foreseeable future.

Key considerations in the new system were to achieve backward compatibility for existing graphics and retaining the existing 'look and feel' of this part of the system.

The contract included the supply and installation of a wide range of necessary network interfaces, switches and peripherals as well as cabling, desk and alarms. In addition, ABB provided installation & commissioning, inspection & testing, training and spares.

Perfect harmony

In a previous project at Connah's Quay, ABB carried out the design, manufacture, supply and commissioning of the replacement steam turbine supervisory system for the power station, using ABB's advanced Harmony platform for process control and automation.

E.ON UK had become concerned that, after 10 years of operation, the steam turbine supervisory systems were outdated and becoming increasingly difficult to maintain. So a tender was issued for the complete replacement of the control systems for all four modules over a period of two years. In addition to demonstrating the sophisticated level of control and programmability provided by the Harmony platform, and the improved interface to the existing plant-level control system, the key factor in ABB's success was its capability to provide a complete service from design to delivery. This included manufacture and installation of all panels, wiring and equipment, and commissioning of the system from field devices through to the DCS (distributed control system).

Organic power plant gets efficiency boost from System 800xA

An ABB System 800xA installation in Europe's largest organically-fuelled electricity generator has helped improve energy-efficiency at the 38.5 MW plant. The contract, for Energy Power Resources Limited in Thetford, UK called for ABB to provide an overview of the entire plant operation by transferring hard-wired data from existing panels into the new 800xA control system, and installing a central control desk along with new operator work places.

ABB integrated separate displays into a single large display, while its power generation information management system now enables a company-wide reporting system for processes and production that can be easily expanded to serve all EPR's power plants in future.

The upgrade was part of ABB's 'Evolution' lifecycle support strategy, which allows owners and operators to upgrade existing equipment over time. It is designed to enable continuous operation while upgrades are achieved through a series of small, cost-effective steps, to meet the needs of changing business environments.

Did you know?

ABB control systems are installed in over 60% of the UK's CCGT plants, controlling over 12GW of power generation. That's enough electricity for over 10 million homes!

Electrical infastructure service

An integral feature of ABB's Power Generation Service is its support for power plant electrical infrastructure. This service covers everything from routine inspection and maintenance of an 11kV network, through major transformer repair and upgrade projects, to the construction management, installation and commissioning of a new 400kV GIS substation.

Repairing Scottish Power's failed GSU transformer

ABB's fast-track transformer re-manufacturing service is currently working on its greatest ever challenge, to repair a failed GSU (generator step-up) transformer at Scottish Power's Longannet power station in Fife, Scotland. At a dry shipping weight of 270 tonnes, the transformer is the largest single unit ever repaired by ABB.

A major challenge in this project was in devising a method of safely transporting the failed transformer to ABB's specialized facility in Drammen, Norway. After considering a number of options and carrying out risk assessments, the GSU unit was lifted out of the power station and on to a barge using a special land-based crane. The barge was then towed to the nearest port and transshipped for the voyage to Drammen.

The rebuilding project is now well under way and the GSU transformer, restored to 'better than new' condition, will soon be on its way back to Longannet power station.

GCB overhaul for Torness power station

Two compressed-air operated generator circuit breakers (GCBs), located between the generator units and the step-up transformers, provide vital protection for the electrical systems at British Energy's Torness AGR nuclear power station. ABB provides regular service and maintenance support to keep the GCBs in optimum condition and the Unit 2 GCB recently became due for its major overhaul, scheduled at six-year intervals. The challenge was that the work had to be completed within the short space of time available during the power station's statutory outage.

ABB's service team rose to the challenge of stripping down the GCB completely and inspecting and testing every moveable component, and replacing them as necessary. Thanks to detailed logistical planning and the coordinated support of the ABB switchgear factory in Switzerland for spare parts, the project was completed in just three weeks.

On-site transformer repair

When the GSU (generator step-up unit) transformer at the Edenderry Power Station in Ireland began to fail, ABB recommended a different approach to the traditional one of returning the unit to the factory for repair. In this case, the service team took the factory to the customer, so avoiding the major disruption and costly loss of production that would have resulted from sending the unit away.

The project was completed in just three weeks. Furthermore, the total cost of the exercise was around one-tenth of the cost of a brand new transformer which, based on current lead times, would have probably taken two years to manufacture and deliver.

ABB's service team was called in when Edenderry Power noticed a problem with gassing of the transformer, indicating that it could be about to fail. After analysing daily gas samples and carrying out diagnostics, an internal fault was located on the low-voltage connections.

With each day of lost generation likely to cost the customer over £100k, sending it away for factory repair was out of the question. ABB's on-site repair team swung into action. First it decommissioned the transformer, and then moved it to a spare building at the power station which was converted into a temporary, fully-equipped, workshop, complete with clean room. Working around the clock, the ABB team de-tanked the transformer, repaired it, reassembled it and tested it on the spot. The work was carried out to exactly the same high standards that would be expected of a factory repair, with every phase conducted strictly to ISO 9001 and ISO 14001 procedures.

Did you know?

ABB has a 24/7 helpline service for emergencies.
For transformers call 0800 083 3211
For Transmission & Distribution call 0800 085 0698

Frequency converters save energy

The efficiency levels of existing coal-fired power plants can be enhanced in many ways. For example, the consumption of auxiliary power significantly affects the efficiency of the power generation. So reducing the demand for auxiliary power by utilizing intelligent frequency converters for the speed control of pumps and fans is therefore economically attractive as well as being technically feasible.

Variable-speed drives, based on hydraulic turbine-control couplings, fans with line-side swirl controls or throttling systems in media cycles are characterized by high power losses. Speed controls using frequency converters offer low loss rates, high dynamics, output frequency bands greater than 50 Hz, and good overload behaviour. Consequently, they are suited to controlling electric motors within their speed range, that is not just for load ranges of a few kW but also for motors in the MWs range. Energy savings through implementing frequency converters can be up to 30 percent.

Did you know?

ABB's installed base of low-voltage drives, which control the power consumed by electric motors, save an equivalent of 140 million tonnes of CO_2 each year.

ACS 1000 saves energy at GKM

The Grosskraftwerk Mannheim Aktiengesellschaft's (GKM) coal-fired power plant in Mannheim, Germany is one of the largest and most modern of its kind in Europe. When the boiler plant in Block 6 was recently restructured, GKM took the opportunity to fit two of the three boiler feed pumps with ABB's high-efficiency ACS 1000 drives. The result is a 25% energy saving and a short return on investment.

Previously, the three boiler feed pumps were directly connected to the 6 kV grid and regulated by hydraulic clutches. This inefficient set-up was wasting over 1 MW of heat energy per pump. In contrast, the ACS 1000 drives provide the electrical output actually required, directly to the pump drive motor. This not only saves energy, it reduces CO_2 emissions by some 850 kg per hour.

ABB modernized two of the three boiler feed pumps – the third pump serves as a stand-by. For each pump a complete package was provided, including a robust RESIBLOC feed transformer, an ACS 1000 medium-voltage AC drive, a star-delta reconnection of the existing 6 kV machine and its complete overhaul.

Water Stream Cycle Sampling Systems

Water Steam Cycle Sampling Systems, sometimes known as SWAS – Steam Water Analytical System, are self-contained systems that monitor the quality of the water and steam produced via the power plant HRSG (Heat Recovery Steam Generator) and turbine.

Process parameters such as pH, conductivity, dissolved oxygen, sodium and silica are monitored to ensure that the values in the steam and water do not exceed the limits indicated by the turbine manufacturers. This avoids potentially damaging build up of solids/corrosion on the turbine blades that would result in very expensive re-blading of the turbine.

The samples from the plant are continuously monitored via the ABB analysers and any changes in the process can be checked and the associated dosing of the water/steam can be made to ensure its specification is kept within the plant operating limits.

ABB has vast experience of supplying SWAS packages to steam-raising plants globally, including combined-cycle power plants. In the most recent contract, five WSC cabins, complete with five separate Hotwell Condenser Monitoring racks, have been ordered for a 2,165 MW gas-fired Combined Cycle Gas Turbine plant in the UK.

Also currently on order is a WSCS for a new 240 MW unit in Asia which will have both primary and secondary cooling contained within a 7 metre long cabin.

Intelligent Motor Control Centres for Drax Biomass facility

Drax Power Limited owns and operates the largest, cleanest and most efficient coal-fired power plant in the UK, currently meeting 7% of the UK's electricity needs. The output capacity of Drax's six generators is 4,000 MW, making Drax nearly twice the size of the next-largest coal-fired power station in the UK.

Drax Power Station is currently undertaking the largest biomass co-firing project in the world, in which renewable biomass is burnt alongside coal to produce electricity. The multi-million pound 400 MW facility, alongside its existing 100 MW co-firing facility, will provide Drax with the capability to meet its target to produce 12.5% of its power generation from renewable sources, and is a key element in its goal to reduce carbon dioxide (CO_2) emissions.

The new co-firing facility will enable the power station to receive, handle, store and process a variety of biomass materials before they are directly injected into Drax's coal-fired boilers where they are burnt alongside coal. ABB is playing a vital role in the project by supplying its MNS iS Intelligent Motor Control Centres – the first time they have been used in a UK power generation installation.

The MNS iS is a platform that defines the next benchmark in Low Voltage Switchgear and Motor Control. It incorporates a number of distinct elements:

- Increased personnel safety
- Standard power modules
- Integrated control schematics
- Asset monitoring
- User interfaces.

ABB is supplying a total of nine 415V MNS iS units, together with close-coupled 11 kV/433 V cast resin transformers and ACS 800 Variable Speed Drives. ABB is also contributing to the Drax EBoP by supplying the 11 kV infrastructure including a 22-panel UniGear ZS1 switchboard and REF542 plus protection relays.

Did you know?

Over its life a motor can cost 100 times more to run than it did to buy? A high-efficiency motor can pay for itself many times over in lower energy costs, saving money as well as helping to protect the environment.

Continuous Emissions Monitoring Solutions (CEMS)

Stringent European and UK legislation imposes statutory limits on gaseous and dust emissions to the atmosphere from industrial plant. Power generators must comply with the Large Combustion Plant Directive – LCPD (Directive 2001/80/EC), and incinerators of waste materials must comply with the Waste Incineration Directive – WID (Directive 2000/76/EC). ABB Process Analytics manufactures emissions monitoring solutions to help plant owners meet these compliance needs.

Operators of power plant of greater than 50 MW capacity are required to measure SO_x and NO_x emissions continuously. Operators of waste incinerators – which can range from small scale biomass plants of greater than 5MW to large-scale municipal waste incinerators greater than 200MW – are required to measure the same gases and also typically CO, HCl, NH_3, TOC and sometimes HF.

The LCPD and WID directives place obligations on plant owners to ensure that CEMS are available for not less than 97%. Furthermore, owners of plant operating under WID are obliged to stop their processes – and therefore suffer a loss of revenue – if their CEMS fail for more than 4 hours.

ISO and EN standards define the performance, reliability and maintenance requirements of the gas analysers in CEMS. These requirements are regulated in the UK by the Environment Agency.

Plant owners are obliged to report to the EA their annual emissions statistics, and also to report occasions when emissions limits are exceeded. Buyers of CEMS, therefore, attribute the greatest importance to meeting these legislative demands, and selecting gas analysers that provide the reliability and performance demanded. ABB Process Analytics gas analysers are approved under the EA's type testing scheme called MCERTS, and they comply with the demands for ongoing Quality Assurance of CEMS defined by EN14181, so that buyers are assured that ABB provides instruments fit for purpose.

ABB Process Analytics gas analysers used for CEMS have been designed and manufactured for almost 100 years. Only proven analytical methods are used. For LCPD power generators, the AO2000 series of infra-red and ultra-violet photometric analysers are used, packaged into the ACX system.

For WID incineration processes, the ACF-NT Fourier Transform Infra-Red (FTIR) spectrometers are used. Both methods extract a sample of representative gas from the process – usually the final chimney – to a floor-mounted, accessible and weather-proofed analyser cabinet.

In either case, ABB Process Analytics custom-engineers each CEMS for each application at its UK engineering and build centre. ABB Process Analytics typically integrates into the emissions monitoring system dust measurements using MCERTS-approved particulate analysers, and flow measurements, so that mass flow emissions calculations can be offered to the EA. Furthermore, sophisticated data capture and reporting software is provided to make all the calculations required.

In order to meet the requirements for 97% availability, many plant owners duplicate their gas and dust analysers to provide duty and standby pairs. ABB Process Analytics often engineers duplicated systems, and takes care to duplicate power supplies, communication highways to plant control systems, and data capture systems.

Such systems, and even simple single analysers, are supplied by ABB Process Analytics in a self-contained analyser house, designed specifically to meet each site's requirements. On-site installation and hook-up time is minimised.

All CEMS require maintenance, at least semi-annually as is the case for ABB analysers. Therefore, buyers also pay attention to the service capabilities of their selected CEMS vendor. ABB Process Analytics assures post-sales support for its customers by retaining a team of 13 service engineers and back-up staff, dedicated to the commissioning, maintenance and service of CEMS.

More than 40 ABB CEMS are installed at most of the major power generation companies in the UK. Recent contracts for new CEMS have been awarded for new power stations under construction on the Isle of Grain, and in Devon.

More than 70 ACF-NT CEMS are installed at waste incineration plants in the UK, and more than 1,000 have been installed worldwide. Recent contracts for new CEMS have been awarded for new municipal waste incinerators under construction in East Sussex and on the south bank of the Thames Estuary.

Uvisor SF810i flame scanner with SIL-2 certification

ABB has combined its two highly successful flame scanner product ines, Uvisor™ and Safe Flame DFS, into a new advanced Flame Scanner, the Uvisor™ SF810i. This is a multi-fuel, SIL-2 certified scanner designed to provide stable and reliable information on both the flame consistency and the flame quality in utility and industrial boiler burners.

In a single robust housing, the Uvisor™ SF810i embeds state-of-the-art technology including:

- Solid-state sensor module, covering the whole flame-radiant spectrum (UV-Vis-IR and dual sensor UVIR).
- Signal Processor Unit – an extremely powerful module to run the ABB proprietary flame analysis process. Live measurement of the dynamic flame parameters are constantly subjected to an extensive fail-to-safe validation routine, prior to indicating the flame status.
- Communication drivers. Two redundant Profibus DP-V1 links (or alternatively Modbus standard), are available to provide high-speed data transfer to an external monitoring and supervisory system.
- Termination and configuration board. With local display and push-buttons to allow the preliminary set-up and on-line aiming assistance. All I/Os terminations are available on screw-type removable connectors.
- The Uvisor™ SF810i flame scanner is available with accessories for the following installations:
  - Line of sight (LOS) for wall-fired burners boilers.
  - Fiber optic cable (FOC) with outer guide pipe, cooling hose and fitting flanges for corner-fired tilting burner boilers.

The PC-based Flame Explorer package provides extended set-up, parameter file archiving, groups view and advanced diagnostics, including flame raw data, real-time and historical trends of up to 254 networked scanner heads.

Power station risk assessment

Scottish & Southern Energy (SSE) recognized the need to carry out detailed process safety risk assessments at its Peterhead power station. The company wanted to identify potential hazardous events and assess the adequacy and robustness of its risk-reduction measures.

This information and the associated action plan has provided a platform for improvement across the power station and helps with development of key risk control procedures within the Process Safety Management (PSM) system. A major concern was the time required using a familiar technique such as HAZOP and the fact that busy operations staff would need to be heavily involved.

SSE talked to ABB Engineering Services about its unique Process Hazard Review (PHR) technique that was developed for the rapid assessment of process safety hazards on existing plants. PHR has been used extensively in plants throughout the process industries and particularly in recent years for sites coming under the COMAH regulations. It provides a detailed yet high-level assessment of the whole process, focusing on areas of concern and helping to demonstrate continuous improvement in process safety.

ABB provided a PHR leader and a consultant to work with a team of SSE staff over four weeks, covering all process systems on the Peterhead site. The SSE team consisted of knowledgeable operations and technical staff with day-to-day experience of the systems under review and a wider understanding of standards at Peterhead. Following an initial site tour, to gain an understanding of the scale of operations, a scoping meeting explored the nature of process safety hazards on the site and identified shortfalls in the overall management arrangements.

The main part of the PHR involved a structured review of each process system on the power station, starting with the high pressure gas supply. A set of guide words was used to help the team identify credible ways in which hazardous events could occur, mostly related to loss of containment or sudden release of energy. For each event, the severity of the possible consequences was assessed, considering harm to people, the environment, or damage to SSE assets or reputation. The full range of measures to prevent, control and mitigate each event were then assessed to ensure that they were robust and fit for purpose.

This stage gave the opportunity to identify any key concerns with the existing layers of protection and make recommendations for improvement. Each scenario identified on the PHR was rated for severity and likelihood using the SSE standard word models and risk matrix calibrated to SSE corporate tolerability of risk criteria.

SSE is now working through a prioritized action plan for the Peterhead site that will provide an assurance that process safety risks are under control.

Rotating machinery

ABB specializes in the seamless system integration of mechanical and electronic equipment. The optimization of hydraulic turbine components, actuators, turbine control and unit control concepts can enhance the capability of plant for frequency stabilization, peak-load management and spot-marketing. ABB's rotating machinery solutions are based on universal products that can be integrated into nearly any type of mechanical system in current use.

Turbine control retrofit for US power plant

ABB recently completed the turbine control retrofit at unit 4 of the Four Corners power plant in New Mexico, one of the largest coal-fired generating stations in the USA.

The retrofit is the second that ABB has delivered to Arizona Public Service for the 2,040 MW power plant in New Mexico. It follows the successful completion of a similar turbine control retrofit for unit 5 in 2008. Both units have a generating capacity of 750 MW.

ABB's scope of supply was comprehensive. For the main turbine it included a controls retrofit that encompassed replacing the steam turbine mechanical-hydraulic controls. The project required removing the original mechanical governors and retrofitting the 'wet box' actuator and interface to the steam valves, as well as providing a new overspeed trip system.

In addition to the traditional base speed and load control, the solution included an automatic turbine start-up program and rotor stress monitoring system.

Auxiliary turbines

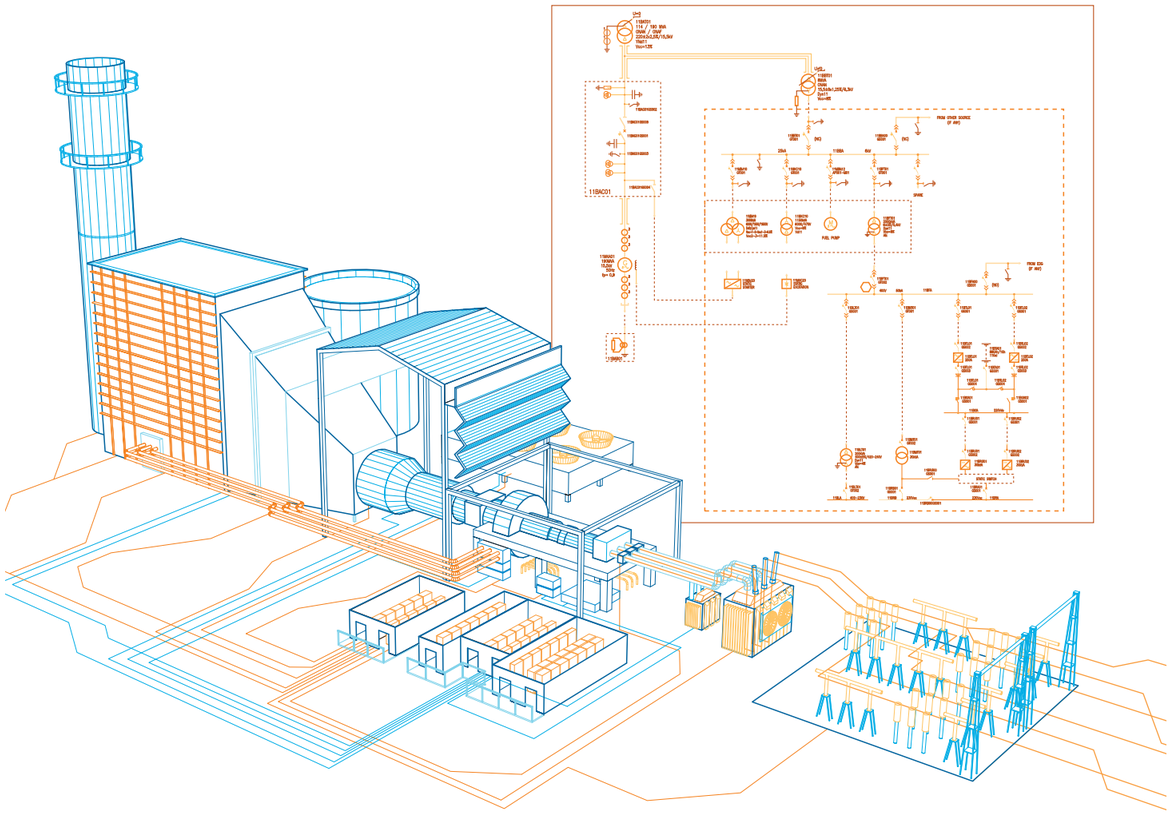
The auxiliary turbine scope included a retrofit for the low-pressure pilot valve actuators. This type of retrofit requires replacing the low-pressure pilot valves and actuators with high-pressure final element actuators. ABB also provided a new over-speed trip system for the auxiliary turbines.

In addition to the main and auxiliary turbine control system retrofits, ABB delivered a turbine vibration monitoring system for unit 4. The solution provides alarm, tripping, and historical vibration data for the main and auxiliary turbines, as well as for fans and motors.

Arizona Public Service, a long-standing customer of ABB, has benefited hugely from the precision control, reduced maintenance and ease of maintenance that the retrofits have made possible. Capabilities such as turbine roll on the main stop or control valves have also been immensely beneficial.

EBoP

ABB offers a truly integrated electrical balance of plant (EBoP) design, engineering, supply, installation and whole-of-life service approach for power generation assets operated by utilities, EPCs, power generation companies and industrial customers.



CONTACTS

You can find more information on the products and services in this issue at:
www.abb.com/powergeneration
or call us on:
01785 825050 or fax 01785 819019

For emergencies please call ABB's special hotline numbers:

Transformers	–	0800 833211
Transmission & distribution	–	0800 0850698
Power generation service	–	01785 285925

Power and productivity for a better world™