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Power and productivity
for a better world™

Capturing the power of the sun
Power and automation solutions for solar plants

Power and productivity
for a better world™

Customer benefits

Photovoltaic plants

- Complete solution from a single supplier
- Optimized modules for each stage of the process
- Produces more power, more efficiently
- Unique ABB process experience and know-how
- All power and automation products and systems made by ABB.

Thermosolar plants

- Complete power and automation solution from one supplier
- Unrivalled process expertise from CSP pioneer
- Large installed base of successfully completed projects
- Rapid project completion in compliance with international and local standards
- All power and automation products and systems manufactured by ABB.

Local expertise and global presence

ABB serves its power generation customers with a global network of dedicated power generation centers and strong local expertise in all major markets of the world.

Power and automation solutions for solar plants

Clean, inexhaustible, emissions-free energy

The earth absorbs more solar energy in one hour than the whole world uses in a year.

Solar energy is clean, inexhaustible, safe and even when converted into electricity in solar power plants, completely emissions-free. For every kilowatt-hour of solar power generated, as much as 600 grams less carbon dioxide (CO_2) will pollute the planet. Translated into a 50 megawatt (MW) solar power plant, the savings in CO_2 emissions are considerable.

The world wants more solar power

The world needs more solar power and the world wants more solar power. Governments are encouraging it and some, like Spain, Germany, France and Italy are providing incentives with preferred feed-in tariffs. The demand is there, the market is growing and the technologies are in place and evolving.

The question facing utilities, developers and EPCs alike is: How best to capture that endless stream of emissions-free heat and light, and which solutions provider should they chose to help turn that energy into profitable, reliable electric power?

Rapid delivery and exceptional performance

Totana PV plant, Spain

Capacity: 1 MW
Location: Murcia, Spain
Completion: September 2008
Solar technology: Photovoltaic
Customer: Global Capital Finance
ABB's scope of supply: Complete solar plant solution from design to commissioning

ABB designed, delivered and commissioned the entire solution in just four months.
The plant has an exceptionally high performance ratio of 80 percent, five percent higher than the accepted industry standard.

High-performance solution for prototype utility-scale CSP plant

eSolar, United States

Capacity: 5 MW
Location: California, USA
Completion: Early 2009
Solar technology: Power tower
Customer: eSolar
ABB's scope of supply: Design, engineering and implementation of plant control system including supervisory control of steam turbine and interface to patented eSolar heliostat farm control system.

ABB also supplied a facet control solution that monitors and evenly distributes the solar light reflected by each of the farm's 24,000 dual-axis heliostats to maximize the performance and operating life of the two thermal receivers.

1 Totana PV plant, Spain | 2 eSolar, United States

Helping our customers achieve success

Europe's largest solar energy plants

Andasol 1&2, Spain

Capacity: 2 x 50 MW
Location: Andalusia, Spain
Completion: Andasol 1 in November 2008, Andasol 2 in 2009
Solar technology: Parabolic trough
Customer: ACS Cobra and SENER
ABB's scope of supply: Complete power block automation solution, extensive power solution
Five more plants are planned for the site to give a total generating capacity of 350 MW.

Extresol 1&2, Spain

Capacity: 2 x 50 MW
Location: Extremadura, Spain
Completion: Extresol 1 in 2009, Extresol 2 in 2010
Solar technology: Parabolic trough
Customer: ACS Cobra and SENER
ABB's scope of supply: Complete power automation solution for the solar field and power block. One additional plant is planned for the site to give a total generating capacity of 150 MW.

ACS Cobra and SENER are also planning to build two 50 MW plants in La Mancha using the same technology.

This picture belongs to ACS Extresol power plant builded by Cobra and Sener.

1 On-site inspection | 2 Extresol, Spain

Complete solar power solutions from ABB

Pioneering market and technology leader

ABB has been a leading force in the solar power industry since the early 1990s 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 we have been involved at a pioneering stage in just about every type of photovoltaic (PV) and concentrating solar power (CSP) technology developed, be it in Europe, North America, Australia, North Africa or the Middle East. This has given us a unique expertise in how best to capture, control and store solar energy and efficiently convert it into reliable electricity, ready for transfer into the local grid.

ABB is also at the forefront in developing smart grid solutions that integrate centralized and distributed power generation into a single optimized network with multi-directional power flows and real-time grid monitoring and market mechanisms.

Photovoltaic power plants

ABB's solutions for PV power plants are designed to maximize plant performance and provide owners with a rapid return on investment and long plant operating life.

Our scope of supply covers the entire project from site and project assessment to plant design, engineering, installation, commissioning, service and maintenance. It includes all plant equipment and systems. With the exception of the trackers, each solution component is designed, engineered and manufactured by ABB specifically for PV solar power applications.

ABB's concept is unique – standard, pre-tested and containerized modules of optimized plant components, ready for installation anywhere in the world.

Thermosolar plants

ABB is the world's leading supplier of power and automation solutions for the new generation of large-scale concentrating solar power plants.

Our scope of supply embraces the whole plant and includes instrumentation, control systems and electrical equipment for each stage of the process, including electrical balance of plant for the power block and connection to the high voltage grid. Most importantly, ABB brings unrivalled process expertise in the demands and requirements of the solar field (arrays, heat transfer, thermal storage tanks) and of converting the energy into grid-quality electric power.

100 years in power generation

ABB has one of the largest installed bases of power plant equipment in the world. Our system and process expertise in automation and electrical balance of plant is unmatched and covers all types of power generation – fossil-fired, nuclear, waste-to-energy, combined cycle, hydro, wind, biomass and solar.

ABB supports its power generation customers – who include all the leading EPCs and OEMs – with strong local expertise and extensive global presence. Our hallmarks of excellence are rapid project delivery times and better plant performance.

Photovoltaic plants

One partner, one solution

ABB has developed a standard modular concept for all PV technologies and for all markets. It is our “one partner, one solution” answer to the needs of customers operating in the global PV market.

Each part of the solution – trackers, inverters, transformers, control system, etc – is delivered in pre-tested, containerized 1 MW modules for scalability, cost efficiency and rapid installation. Whether the plant has a capacity of 1 MW or 100 MW, the modules are easy to integrate and the solution is repeatable at any site and in any country.

ABB, in partnership with contracted manufacturers, offers a complete range of solar trackers – of all types and all materials. All other products and systems are made by ABB and are designed for the special requirements of PV plants and the demands of a high-performance modular solution.

Optimization – the key to productivity

Optimization is a prime differentiator in the ABB solution. It enables the plant to achieve the highest levels of power delivery and energy efficiency.

Each ABB module is engineered for the latest generation of solar applications and includes innovations like a uniquely efficient automatic switching system and highly accurate and robust controllers that enable the trackers to harness more energy from the sun. The result is a standard modular solution that is more productive, more efficient and more reliable than any other on the market.

Getting it right from the start

ABB offers its customers a number of unique tools to determine the optimal solution for any given site and any given project.

Based on powerful ABB algorithms, these tools include an automatic PV power calculation assistant that calculates the optimal layout and generating capacity for a site, an automatic budget calculation tool that computes the cost and revenues of the project by taking into account all conceivable variables, and an automatic return on investment tool that calculates the payback time of the proposed investment.

Together, these tools enable the customer to get the project right from the start and to know what lies ahead in the way of costs, revenues and returns.

Thermal storage doubles productivity

Andasol 1&2 use an innovative method for storing thermal energy. Surplus energy captured during the day is stored overnight in two large tanks, each of which contains 28,000 tons of molten salt. Together they almost double the operating time and productivity of the plant by some 3,500 hours a year, enabling the turbines to generate power during the night or on days when the sun is not shining. An ABB control system controls the tanks and ensures that the molten salt is kept precisely at the correct temperature and within critical process parameters. If not, the salt will crystallize and the contents, tanks and process equipment be destroyed.

Controlling and energizing the power plant

As one of the world's leading suppliers of electrical balance of plant, ABB provides complete solutions in instrumentation, control systems and electrical equipment to automate and energize the power plant. An ABB System 800xA extended automation system integrates the entire facility – solar field, thermal storage tanks, power plant and grid connection – into a single automation and information management system.

Grid connection and IEC 61850 substations

The power produced by the thermosolar plant is transferred to the power grid at the required voltage via ABB substations – transformers, switchgear, circuit breakers, protection and control equipment – to ensure maximum reliability. For customers who require IEC 61850 substations, ABB was an initiator of both the international standard and the enabling technologies, and has conducted more than 400 installations to date.

Modular standardized solutions for rapid delivery

ABB provides modular standardized electrical and control solutions for fast-track projects. These compact, containerized solutions are designed and pre-tested for rapid delivery and fast installation.

Service and maintenance

ABB offers a broad range of service and life-cycle support options from preventive maintenance to 24/7 support, remote monitoring and plant optimization.

Thermosolar plants
Controlling complex CSP processes

ABB provides complete power and automation packages (consisting entirely of ABB products and systems) for all the main concentrating solar power technologies – parabolic trough, power towers, integrated solar combined cycle, heliostat solar concentrators, Stirling solar dish systems, combined solar biomass and others.

These technologies are highly complex. They produce large amounts of power from solar fields covering hundreds or even thousands of dishes, troughs or collectors spread out over hundreds of hectares in challenging conditions of heat, cold, dust and mechanical stress.

Controlling the process and capturing maximum volumes of energy from the sun requires knowledge, experience and expertise. None more so than the latest generation of parabolic trough thermosolar plants in Spain.

50 MW parabolic trough thermosolar plant

A typical parabolic trough thermosolar unit produces 50 MW of power. The generating capacity of each unit is sometimes determined by local legislation, not by technical feasibility; the number of units at any one site is theoretically unlimited (seven 50 MW units are projected for the Andasol site in Spain).

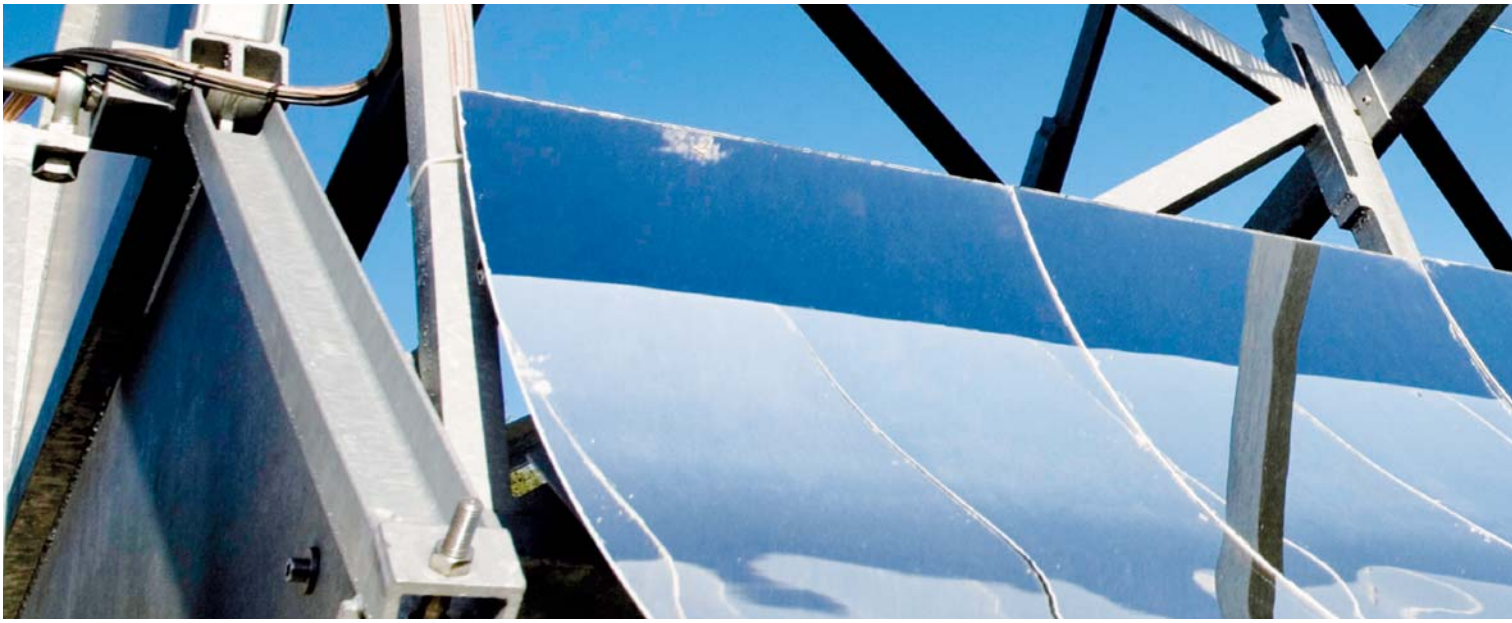
Maximum energy from the sun

A parabolic trough solar field for a 50 MW plant is enormous. It consists of 624 troughs with more than 510,000 square meters of collector surface, dispersed over 190 hectares in 156 loops of four troughs per loop.

A patented ABB programmable logic controller cabinet with relays and low voltage switchgear - one cabinet for each trough - enables the collectors to capture maximum energy from the sun with minimum error. At Extresol, there are 1,248 cabinets. Exceptionally robust, the cabinets are designed to withstand extreme environments of intense heat and cold, as well as dust, erosion and the mechanical stress caused by the collector moving every few seconds as it accurately tracks the progress of the sun.

Delivering the energy from the field to the turbines

The concentrated energy captured by the collectors is absorbed by heat transfer fluid (usually oil) flowing through tubes in the solar field. ABB instrumentation and control systems ensure that the fluid is kept within the required temperature parameters, which can be as high as 400 degrees Celsius. The fluid is pumped to the power block, passed through a heat exchanger, where water is heated and steam produced to power the turbines and generate electricity. The fluid is then returned to the solar field where the process begins again.



Thermosolar plants

Solutions at the cutting edge

ABB has played a leading and pioneering role in the development of large-scale concentrating solar power technologies since the industry's birth in the early 1990s.

Most recently, ABB has provided comprehensive power and automation solutions for the two largest thermosolar power plants in Europe – Andasol 1&2 and Extresol 1&2, each unit of which has a generating capacity of 50 MW. ABB is also involved in other large-scale CSP projects in Australia, the United States, North Africa and the Middle East.

From the solar field to grid connection

ABB supplies complete power and automation solutions for the entire CSP plant – 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 stably and reliably into the local power grid.

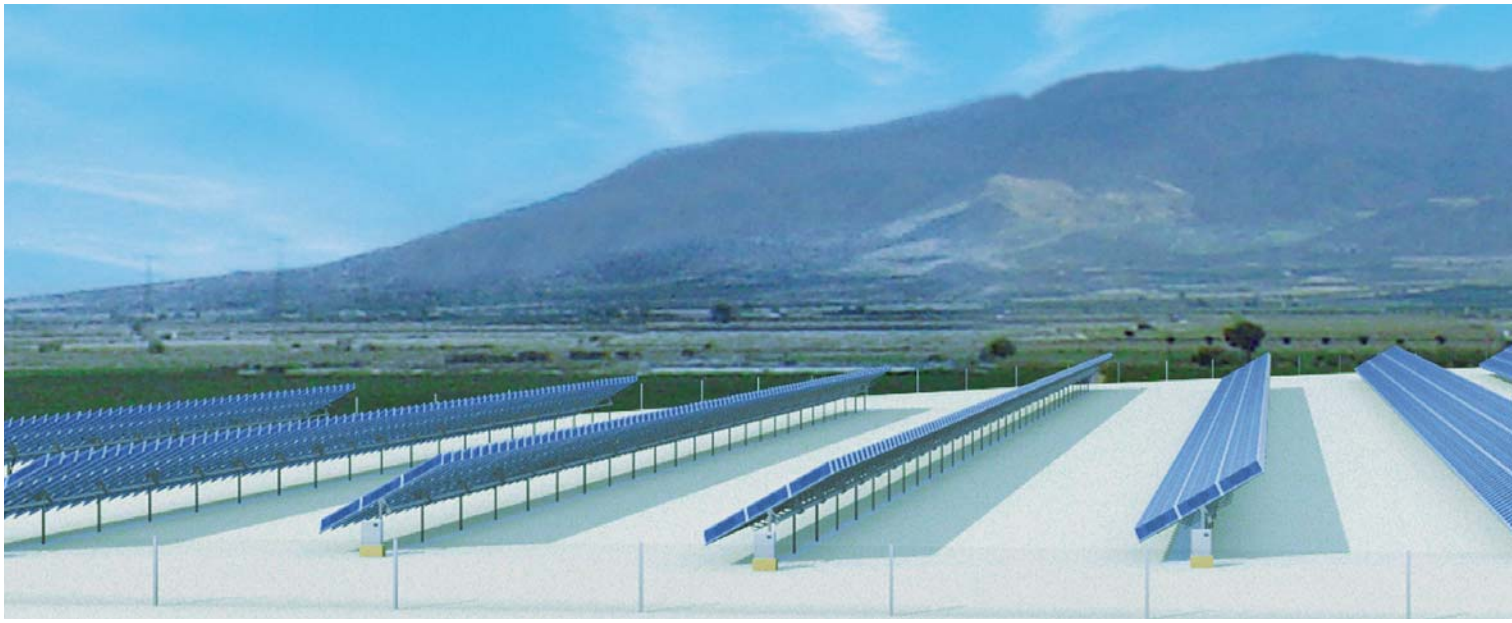
Our capability extends through the entire project chain and includes design, engineering, erection, installation, commissioning, service and maintenance.

Unique process expertise

As a pioneer in the new generation of CSP technologies, ABB has acquired unrivalled expertise in the complex processes of thermosolar power generation.

In parabolic trough solutions, 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 (a patented and uniquely precise ABB technology), and synchronizing hundreds of devices and integrating the data into the plant automation systems.

Photovoltaic plants
Optimized modules for each step of the process



Optimized standard modules for each stage of the PV power plant process and a complete capability in design, engineering, erection, installation and commissioning – this is what differentiates ABB's solution from the alternatives.

The benefits are proven – maximum power produced at each moment of the day (regardless of light or weather conditions), fewer power losses at each stage of the process, and higher revenues. Field comparisons show that ABB optimized solutions produce more power and have a higher performance ratio than those of competing suppliers.

Each ABB module and the ABB products it contains are engineered for the requirements of PV solar applications. These compact, pre-tested 1 MW units are easy to install, easy to integrate and highly scalable. As a result, delivery and project completion times are faster and investment costs are as much as 15 percent lower. Below are some of the highlights and unique benefits of the ABB products, modules and tools that make up the ABB solution.

Advanced quotation tools

ABB has developed advanced automatic quotation tools to compare the cost and payback time of installing the various PV alternatives at a specific site. The tools take into account every conceivable technical and cost variable – as well as historical meteorological data for the site – to calculate production revenues and return on investment.
This enables ABB to help the customer select the right PV technology and the right solution at the very start.

Solar trackers

ABB supplies all types of solar trackers, from conventional fixed-structure to 1- or 2-axis panels. Trackers are supplied by various manufacturers under contract to ABB and are available in all types of PV material. Consortium arrangements with manufacturers of heliostats – technologies well-known to ABB – are also possible.

Finding the right panel or tracker

ABB's automatic PV power calculation tool compares the performance data of different types of panels and trackers and calculates the correct number of parallel and serial connections required to achieve the optimal solution for the required generating capacity. Factors like land and civil works requirements, tracker footprint and wind resistance, motor energy consumption, maintenance requirements and speed of module heat evacuation are calculated for each possible solution.

Patented controller increases tracker accuracy

ABB's patented PLC, specially developed for solar trackers and collectors, increases the accuracy of the trackers to within 0.2 degrees of error, thereby enabling the trackers to capture maximum energy from the sun. The PLCs are designed to withstand the challenging conditions of excessive heat during the day and freezing temperatures at night, as well as high levels of mechanical stress and dust.

High-efficiency inverters

Inverters are supplied by various manufacturers cooperating with ABB. Available in the 100-500 kW power range, they achieves an exceptional Euro efficiency of at least 97.3 percent and a standby power consumption of less than 0.1 percent of the nominal power.

Unique switching system boosts efficiency

A unique and patented automatic switching system, developed by ABB for PV applications, increases efficiency by an additional 2-4 percent – regardless of weather conditions – by automatically connecting or disconnecting the number of inverters in operation according to changes in the amount of light at different times of day and during different types of weather.

Reliable and redundant transformers

Whereas competitors use a single, standard oil-filled transformer, ABB uses two low-loss dry transformers to ensure reliability and productivity. ABB dry transformers are more efficient at lower loads. If one dry transformer should ever fail the reserve will take over, thereby preventing a complete plant shutdown. ABB oil-filled transformers are available as an option.

UniMix medium voltage switchgear

As the world's leading supplier of air insulated and gas insulated switchgear, ABB has selected its UniMix series of medium voltage switchgear for its modular PV solution. Itself of compact modular design, UniMix is available in an extensive range of ratings and is especially suitable for scalable modular solutions.

DC protection cabinets

ABB's standard DC protection cabinets are the most optimal solution for DC protection.

Control system

ABB's extended automation platform, System 800xA, is one of the world's most widely used process control systems. With more than 4,000 installations worldwide and numerous unique performance-enhancing capabilities, System 800xA is ranked number-1 in many of the most demanding process industries.

Service and maintenance

ABB offers a comprehensive selection of service and maintenance alternatives including round-the-clock remote supervision and performance-based Full Service® maintenance agreements.

Other key ABB deliverables

Low voltage products, process instrumentation, IEC 61850 substations, communication systems, civil works, safety and security systems.