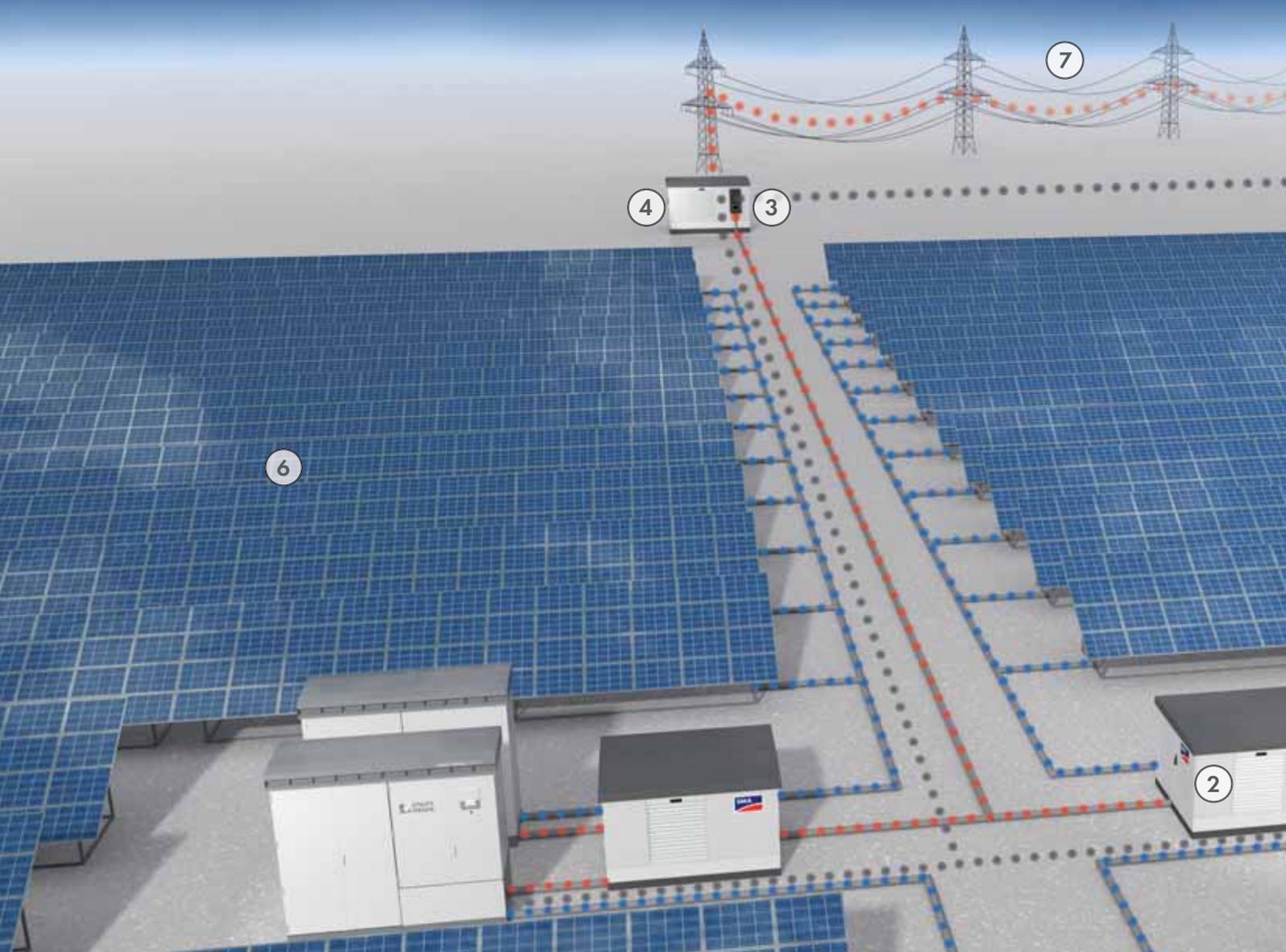




SMA Power Plant Solutions





FLEXIBLE SYSTEM TECHNOLOGY.



UTILITY GRADE

SMA Utility Grade is an integrated concept for the worldwide development of PV power plants. It combines SMA system technology and services to provide customers with advanced power conversion solutions. All products and services carrying this label fulfill the intensive, complex requirements placed on state-of-the-art energy solutions.

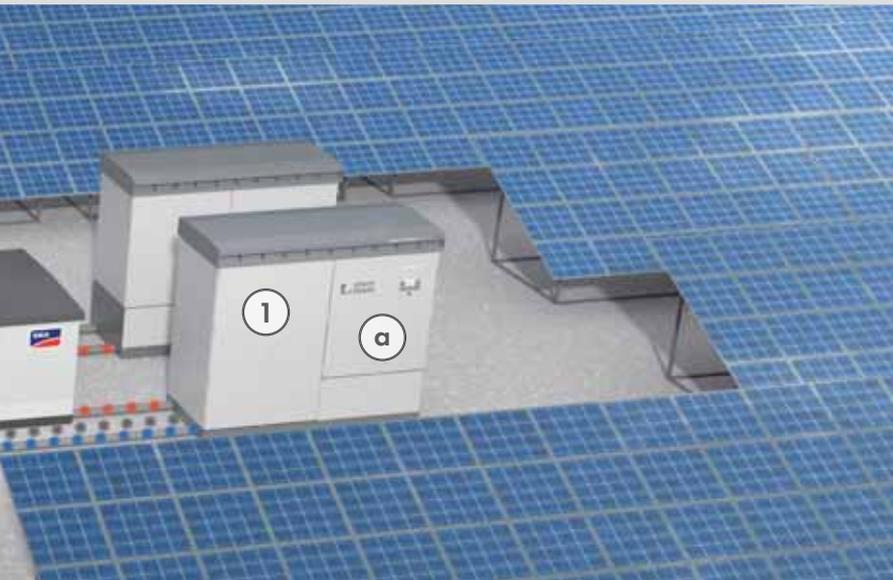
choose from individual components or pre-configured and pre-engineered packages, either for centralized or decentralized plant configurations. What's more, with the MV Power Station and the MV Power Platform, we offer two fully integrated, turn-key power solutions, which are delivered fully assembled and ready for connection.

Our flexible product portfolio meets the requirements of our customers, regardless of complexity. We offer all system components, from central and string inverters to PV plant monitoring, for medium voltage applications as a modular building set. Customers may



Typical large-scale PV power plant with SMA system technology

1. SMA central inverters (Sunny Central CP series, outdoor concept) with
 - a. Optiprotect (integrated string monitoring)
 2. SMA Transformer Compact Station
 3. SMA Power Plant Controller
 4. Substation
 5. Control Center (operator or utility)
 6. Generator (module array)
 7. Medium-voltage or high-voltage grid
- Dual current (from module array to inverter)
 - Alternating current (from inverter to the grid)
 - SMA Power Plant Control System (plant monitoring and remote control)



“As the technology and global PV inverter market leader, SMA is working together with numerous stakeholders on the further development of photovoltaics and the acceleration of a widespread change in our global energy portfolio. We provide the most advanced system technology, further increasing the productivity of PV power plants and protecting the investments of our customers. As the pioneer in grid management, we deliver tailor-made solutions for increasingly demanding power plant configurations to our customers worldwide while ensuring the stability of the public utility grid. These factors are essential for the recognition of photovoltaics as a primary energy source and for the continued integration of PV electricity on the grid.”

Marko Werner
SMA Chief Sales and
Marketing Officer



WE THINK BIG.

The rapid development of solar energy is leading to an increasing number of ever-larger PV power plants. SMA has realized a worldwide, total installed inverter base of more than 4 GW in High Power Solutions. The experience of more than 800 projects in over 30 countries in 2010 alone underlines our leading position in the global market.

Leading technology

PV power plants utilizing SMA system technology lead the market. Our performance is a result of a series of factors. The world-class efficiency, durability and reliability of an SMA PV inverter directly protects the balance sheet of the

operator. Our reduced installation and service costs as well as cutting-edge technologies for grid stabilization, plant control and monitoring are also advantages we offer.

Worldwide experience

Around the world, our customers profit from 30 years of experience. From consultation and project management to installation, service and maintenance of PV inverters and stations, we prove ourselves daily as a reliable partner. And, our proven expertise as the technology and global market leader also helps to safeguard investments over the entire life-cycle of a power solution.



Centralized configuration with
SUNNY CENTRAL CP and Trans-
former Compact Station.

“Worldwide, our customers’ projects are increasing in size and are now entering into the three-figure megawatt range. SMA not only provides the ‘Sunny Central’ central inverter for these projects but more often total solutions as well. To this end we are pulling out all the stops to refine our pre-engineered solutions by making advances in important areas such as lowering system costs and grid management. We are also supporting our customers during project execution. We have created a separate system development and project planning department to better support our partners. Another key element of this customer-centric concept is the close collaboration between development and sales.”

Jürgen Reinert

Executive Vice President (Technology)
SMA Power Plant Solutions



WE INCREASE PERFORMANCE.

Since 1990, the specific price per watt of an SMA inverter has been reduced by a massive 75 percent. Over the same period, the efficiency has increased from 90 percent to in excess of 98 percent. More than 600 development engineers worldwide are already working on the next goal: 99 percent, whereby losses will again be halved. Favorably, increased efficiency also means lower thermal losses, allowing inverters to be more compactly built and providing the opportunity for further savings potential.

High efficiency

We increase performance through innovative approaches in technology

development with parallel reductions in material usage, as well as applied system technology in the field.

We reduce installation and operating costs through the maintenance-friendly design of our inverters, the integration of external plant components and functions such as string monitoring, as well as the configuration and administration via *Bluetooth*[®].

However, PV plants are investment projects with a lifespan of more than 20 years, which is reason enough to focus not just on the inverters, but also on the overall system costs.

Reduced system costs

This includes system efficiency as well as the life cycle costs, from planning and installation to maintenance and repair. These are all aspects that we consider during the early stages of new product development.

One example of this holistic approach is the SMA Sunny Central 800CP, which was recognized with the 2010 Intersolar Award for concentrating the most advanced technology into the smallest space, demonstrating our focus on optimizing performance while reducing costs.

A flexible production enables reliable supply of SMA inverters.



Intelligent power management, our OptiCool cooling concept and integrated monitoring functions reduced system costs by an impressive 35 percent compared to its predecessor. At the same time, the Sunny Central 800CP distinguished itself through its unique overload capability. Even at ambient temperatures of 50 degrees Celsius it achieves 100 percent power. At 25 degrees Celsius, it can operate at up to 110 percent higher than nominal power, resulting in increased yields for the operator.

Intelligent system design

The outdoor-rating provides additional

design flexibility and potential costs savings by reducing material and transport fees. Cost reduction is also achieved through our extraordinary Optiprotect technology, which provides integrated string monitoring and automatic error correction.

Fast Ethernet and optical fiber connections connected directly to the SMA Power Plant Control System via standard, public interfaces, such as Modbus or OPC, form the basis of a real-time communication and control platform within large PV power stations equipped with SMA inverters. A high-capacity communications capability within SMA invert-

ers ensures quick access for customers to monitor a multitude of critical data.

And of course we also provide outstanding system technology for large-scale decentralized plant concepts. For example, the three-phase Sunny Tripower inverter was awarded the Innovation Prize by the Symposium for Photovoltaic Solar Energy in Bad Staffelstein Germany in 2010.



WE SEE THE BIG PICTURE.

The performance of a PV power plant is not just measured by conversion efficiency. The continued development of photovoltaics control functions and grid services are becoming increasingly critical. Numerous regulatory policies define comprehensive grid management tasks that PV power plants must fulfill. As the PV inverter technology leader, SMA is breaking new ground by addressing grid management issues.

In close cooperation with regional utility operators, we provide solutions that meet these new specifications, most times before they are required.

Inverters are the power electronic control components of a PV plant. As a result, they take on the grid stabilization stipulations that policy makers are increasingly requesting all around the world. With the help of the SMA Power Plant Control System, PV power plants play an active role in keeping public utility grids in energetic balance and as a result meet all prerequisites for continued photovoltaic development.

Plant monitoring and control

The SMA Power Plant Control System provides station operators with comprehensive performance. In addition, it reacts dynamically, just like a neural

network, to all changes in the public utility grid. In the event of increasing frequency in the grid, within seconds the fed-in power is reduced and the externally set specifications of the utility operator are recorded. A shut-down of the plant is delayed, preserving system availability.

Grid management

The same applies to grid voltage. Thanks to SMA system technology, our PV power solutions are capable of supplying controlled, reactive power in the event of grid voltage spikes and are thus able to maintain stable grid voltage within a defined range.

Everything under control with SMA Power Plant Control System.



Grid management included

Until now, in the event of voltage drops, PV plants had to immediately disconnect from the grid, even during non-critical situations. However, SMA system technology ensures that plants may remain on the grid for up to 1.5 seconds during grid disturbances and supports the triggering of the grid protection provisions through the feeding-in of reactive power. This prevents downtime, improves predictability and results in a more reliable overall system.



Remote-controlled power reduction in case of grid overload



Frequency-dependent active power control



Grid support through reactive power



a) Fixed presetting of the reactive power by the grid operator



b) Dynamic control based on remote grid operator setting



c) Control of the reactive power via a characteristic curve



Complete dynamic grid support (Low Voltage Ride Through)

Technical consultation

Based on more than 20 years of project experience

Advice on planning, design and dimensioning



Service and Maintenance

Global Service infrastructure with 85 Service locations

Modular Service concept for individual packages



WE GUIDE AND SUPPORT.

SMA supports customers globally from consultation through project management and installation, as well as in the service and maintenance of a PV power plant. Alongside complete system technology solutions, we also provide service packages encompassing the entire life cycle of a PV inverter or power station. Every customer has a dedicated team of specialists available who personally support the projects from the initial inquiry through commissioning and operation.

Consulting

The initial customer inquiry for the planning of a PV plant starts the support

process within SMA. What requirements must be strictly followed? How will the optimal design of the inverters or PV modules be organized? Which inverters are appropriate and what communications solutions are required? Which regional grid access conditions should be considered? Which static and dynamic grid requirements must the plant meet? These questions and many more are clarified through intensive consultation meetings in order to optimally design each PV plant. Upon request, a static load flow calculation can be created and supplied to the utility operators as well. Certified simulation environments provide verifiable

information on dynamic grid support functions of a PV project before installation.

Delivery and installation

From the initial order right through commissioning of a PV plant, qualified project managers ensure seamless purchase, execution and delivery. They serve as the contact person for technical and logistical questions, including project alterations; they simplify coordination and guarantee compliance with the agreed-upon delivery terms. They can be on-site on short notice to advise customers on system technology or logistics. In addition, they coordinate the



Order to delivery

Seamless order execution and delivery by qualified project managers

Coordinated commissioning by our service team



Grid connection

Pioneer in grid integration

Worldwide compliance with the requirements of the local grid operators

commissioning of the PV system with the service team and complete project documentation. Official correspondence is taken on by the Order Processing Managers.

Commissioning and Operation

Upon commissioning, service employees take on responsibility for maintenance and servicing of the customer's plant. Furthermore the account manager is also available to the customer with the overall plant-specific know-how. From components through platform solutions, support is available during and after commissioning through a wide range of operation and maintenance

contracts designed to fit the individual needs of the site operator.



WE PROVIDE EXCELLENT SERVICE.

Our inverters, control and monitoring capabilities, and grid management technologies are the foundation for achieving the highest possible availability. SMA Service guarantees the maintenance of this availability over the entire life cycle of more than 20 years.

A modular service concept, developed specially for requirements of large power plants, makes it possible for our customers to define individual service packages. Currently, 85 service locations worldwide guarantee outstanding customer support through SMA Service packages.

Every PV power plant is different. Requirements change. The modular SMA Service concept is designed to be flexible in order to develop with evolving requirements.

Maintenance

We carry out controls, cleaning and the replacement of parts at regular intervals.

Spare parts warranty

Whether electronic or mechanical – we guarantee the availability of all component parts over the duration of the complete system life cycle.

Diagnostics and repair

Call and we are there. Beginning with remote service, which speeds response time and can eliminate on-site assistance to First Level, (diagnostics and small repairs), or Second Level Support, (comprehensive repairs), SMA offers the proper service plan for our customers' needs. Customers can optionally administer First Level Support themselves. Additionally, the remote service enables even faster response times.

Inverter Availability

SMA increases investment security through an optional 98 or 99 percent inverter availability guarantee.



SMA is represented globally on four continents in 19 countries and 85 service stations. We continue to develop this presence each year. Our strong sales and service network, are close to our customers. The on-site service takes place quickly, and undesired downtimes are reduced to a minimum.

"From India to Italy, from California to Korea, in 2010 alone, SMA has undertaken more than 800 power plant projects in over 30 countries. Globally customers trust not only our products but also our know-how, from planning through installation to the service and maintenance of PV power stations. Fixed support teams in the respective countries are available to customers over the complete life cycle of a plant. That means that we know every PV power station as though it was our own. Additionally, we work intensively with utility operators on-site in order to develop individual solutions which meet our customers' needs while also meeting all of the power stations' requirements."

Jeanette Klockgether

Executive Vice President (Sales & Marketing)
SMA Power Plant Solutions



WE SAFEGUARD INVESTMENTS.

Whether it's investors, banks or power plant operators, as the technology and global market leader, SMA provides the greatest possible transparency in investment risk assessment through highly efficient and first-class products, warranty contracts up to 25 years in length, comprehensive and individually tailored service packages, and a strong balance sheet structure with an equity ratio of 58.2 percent (As of 2010).

As a TecDAX-listed company, SMA is one of the most financially sound technology companies in an exceptionally dynamic market. Active on a global scale, we prove ourselves daily as a

strong partner and provide the safety that expands customers' prospects and protects investments. Through our financial stability, investors, integrators and operators know they are working with a partner with proven technology but also one that will play a critical support role in the near term and distant future.

Many of the well-known components of risk are directly linked to the inverter: energy production (off-take), delivery schedule, operations, management and grid integrity. Inverters, therefore, play a central role in project risk mitigation. By partnering with SMA, risk is minimized.

We provide system technology that lasts. Thousands of our SUNNY CENTRAL inverters have proven their reliability and performance in the field.



Signs of success. Figures that speak for themselves.

- > Global player and market leader with more than 40 percent market share
- > More than 20 years' experience in PV system technology
- > More than 800 projects in over 30 countries in 2010
- > Strong financial structure with an equity ratio of 58 percent (As of 2010)
- > Over 11 GW flexible production in Germany and North America
- > Up to 99 percent inverter availability
- > Warranty periods of up to 25 years



You will find further information on our solutions for PV power plants at www.SMA.de/power-plants



Are you interested to learn more? Contact our sales department. Powerplants@SMA.de

SMA Solar Technology

www.SMA-Solar.com

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