



EXTREME CONDITIONS REQUIRE EXPERIENCE

SUNBELT REGIONS AS THE MARKET OF THE FUTURE: NEW PERSPECTIVES FOR SOLAR POWER

The earth's sunbelt offers unparalleled chances for the development of photovoltaic technologies.

Gigantic land masses, extremely high solar irradiation, large areas without reliable energy sources – desert-like regions in the earth's sunbelt offer interesting opportunities for solar power plants. But desert locations also come with huge challenges. Extreme climate conditions make for extreme demands on solar technologies.

Entirely new concepts are needed for advanced technology to help reduce the risks of extreme climate conditions. The following examples will help illustrate this.

All components, especially the interior of the inverters, need to be securely sealed to protect them against the damaging effects of sand and dust.

Temperature extremes are coupled here with significantly higher inverter loads. The output can quickly increase to a factor of two. Components of the very highest quality are thus the most important factor for extending the useful life of the entire installation.

SMA is thinking, researching and developing in all directions in order to find solutions for these problems. With a broad-based research project that aims to optimize large power stations in sunbelt regions. With innovations such as the SMA OptiCool system for high temperatures. And with increasingly demanding quality tests that simulate the most extreme stress factors.

Energy from desert-based solar power plants – a market with considerable potential. As a technology and innovation leader, SMA is doing anything to meet the challenges these regions inherent. Our goal is to become the primary leader in the development of photovoltaic power for this new market – in all corners of the globe.



10 MW PV Plant at Masdar City (Inverters: Sunny Central 560 HE)

SMA QUALITY TESTS

All devices subjected to regular stress tests for extreme environmental conditions

Dust, maritime air, sandstorms, heat – these are the kinds of extreme environmental conditions that central inverters can be exposed to, depending on location. Particularly open-air equipment like the Sunny Central CP series have to withstand the worst kinds of climate conditions, from desert storms to enormous temperature swings.

SMA regularly conducts demanding stress tests to make sure that the quality of our equipment lives up to their promise. The tests simulate potential climatic scenarios – sometimes making them even more extreme

than in real life. The results are then used to provide definitive statements about inverter performance in a wide variety of environmental conditions, recommendations for optimized installation, or directions for the development of new products to be used in chemically aggressive environments.



DESERT-PROOF

Sunny Central tested against sand and dust

In addition to extreme fluctuations in temperature, desert locations have another characteristic that directly impacts all the components of a central inverter. Very fine sand can penetrate the smallest openings and slits to settle on everything, which puts the operation and life expectancy of the entire PV installation at risk.

The Sunny Central CP integrated OptiCool system eliminates this problem – a direct result of SMA's sand and dust tests that simulate desert conditions. A Sunny Central unit

was sent to an independent testing facility and subjected over an extended length of time to fine dust particles. The facility used pulverized roof tiles whose composition was found to be similar to the sand found in the Arizona desert.

With wind velocities of between 1.5 and 20 m/s, dust and sand were blown horizontally directly onto the unit. During the experiment, the ventilators took in and circulated air, as is normal with the OptiCool system.

The test showed that although the exterior of the unit and its seals were covered in dust, none had found its way to the interior. The same was true for the ventilators: when they were taken out, they proved to be completely free of dust. OptiCool's encapsulated design securely protects the units and their electronic components from all dust. A huge plus when it comes to functional security, life expectancy, and robustness.





FROM ONE EXTREME TO ANOTHER

SMA inverters in the climate chamber test

In locations like Africa, Asia or North America, inverters are often subjected to extreme temperatures, sometimes combined with high humidity. The result: components under great stress, performance variations, and a high risk of failure. This is why SMA requires all its inverter types passing a climate stress test before going into serial production.

SMA has its own test center for solar technology where inverters are tested to the limits of their operational capabilities in temperatures ranging from -40 °C to +90 °C.

The chamber can also create relative humidity of between 10 percent and 95 percent. The inverters are subjected to these kinds of conditions in tests lasting up to 1 000 hours. Under unchanging conditions.

The climate chamber test is not only a reliable predictor of the components durability. It provides extremely precise values regarding the performance and energy conversion of each Sunny Central. A plus for efficiency. A plus for reliability.

EXPERIENCE MEETS EXPERTISE: SMA'S DESIGN FOR HIGH ALTITUDES

Special high-altitude design for Sunny Central CP sets new standards for durability and security.

Some geographic locations – such as altitudes above 2 000 m – are characterized by challenging atmospheric parameters. Guaranteeing the functionality of PV inverters at these heights requires an especially high level of experience and expertise in solar technology. This is because the added stress on components is highly complex. So is the solution: SMA has developed a number of special design features for the Sunny Central CP series that make these units extremely durable and robust at altitudes above 2 000 m above sea level – features that guarantee full functional security.

For open-air installations at high altitudes in locations such as India or South America, low air pressure has a negative effect on cooling. This is counteracted by the lower temperatures found at higher altitudes. On the other hand, the dielectric strength of air decreases with altitude. The dimensioning and peak voltage of the Sunny Central CP units are designed to compensate for this. Maximal current and initial output have to

be reduced at altitudes above 2 000 m above sea level. Here all control voltage circuits are hardened for altitudes up to 4 000 m. Inverters would then be designed with a modified DC window.

The higher the location, the more robust the design. This is the principle that guides

the complex design for the Sunny Central CP series at extreme altitudes. This is how SMA can provide PV inverters for all climate conditions. Without exception. Another pioneering achievement in the further development of solar technology.



Highest PV power plant in Europe at 2 200 m altitude (Inverters: SUNNY MINI CENTRAL 11000TL)
1 MW, Wildkogel, Austria:

WHEN NOMINAL POWER EXCEEDS ALL EXPECTATIONS

Sunny Central CP at its best in ambient temperatures of up to 50 °C.

The demands on solar technology today are enormous, and they keep growing. Operators of utility-scale PV power plants expect significantly reduced and competitive costs of energy. This is possible only if they can offer high availability, minimal system costs, peak efficiency, and maximum power. This means that the quality of each individual component has to be well above the norm. And as the heart of every PV system, inverters are expected to provide outstanding performance. And outstanding energy yields.

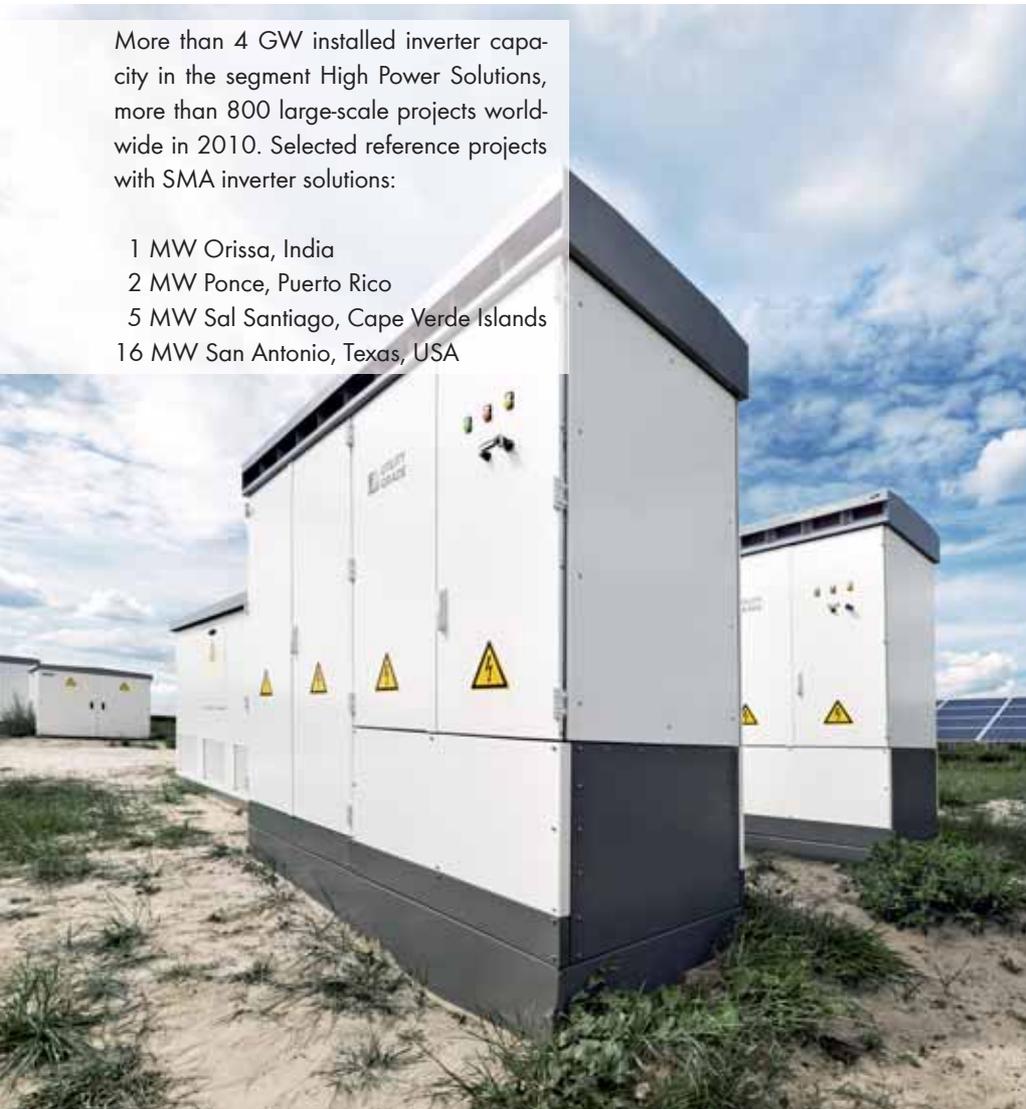
100 percent nominal power up to 50 °C – the SMA Sunny Central inverters have always been known for providing high power outputs. This record is now being broken by the Sunny Central CP series. It can deliver 10 percent more power in continuous oper-

ation at ambient temperatures of up to 25 °C.

The Sunny Central CP series outdoor devices offer peak performance at low system costs. High-tech functionalities such as comprehensive grid management or intelligent power management are enormous advantages for plant operators. The greatest advantage is the enormous output: 10 percent overload capability at low temperatures means that considerably more modules can be connected. And with an efficiency of 98.5 percent, combined with an optimized specific price, the Sunny Central CP series are at the very top of their class.

More than 4 GW installed inverter capacity in the segment High Power Solutions, more than 800 large-scale projects worldwide in 2010. Selected reference projects with SMA inverter solutions:

- 1 MW Orissa, India
- 2 MW Ponce, Puerto Rico
- 5 MW Sal Santiago, Cape Verde Islands
- 16 MW San Antonio, Texas, USA



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