INSIGHTS

UTILITY GRADE

PV POWER PLANTS: THE FUTURE OF POWER GRIDS

INVERTERS AS GRID MANAGERS

For highest flexibility in all PV power plant classes

Of all the sources of energy in the world, the sun has clearly taken center stage. PV power plants play a rapidly expanding role in global electricity production.

The optimal integration of solar electricity into the power grid helps ensure a stable supply of solar power while increasing the use of renewable energy.

Unlike conventional power plants, PV systems, even large-scale arrays with capacities of up to 500 MW or more, have customizable control features that allow them to provide grid management functions. They can therefore help stabilize power grids in a manner that would otherwise incur additional costs.
Advanced power electronics and communication components ensure compliance with all grid operator requirements for PV power plants. The ability to reduce the feed-in rate within seconds of a frequency increase and to provide reactive power and short-circuit current when an error occurs allows PV power plants to accurately control the amount of power they supply to the grid.

To ensure that solar power generation continues to expand in the future, SMA is actively shaping the discussion on global requirements for power distribution and transmission grids. Inverters that function as grid stability managers help secure the future of the solar industry.

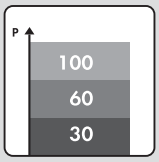
16 MW PV-Power Plant Blue Wing, Texas, US
realized by juwi solar, operator Duke Energy Corp. (Inverters: Sunny Central 630HE-US)

WHAT SMA CENTRAL INVERTERS OFFER FOR GRID INTEGRATION

Implement target values, control line voltage, ride-through voltage dips

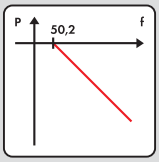
SMA PV inverters offer both an intelligent interface to the power distribution grid and decentralized grid management services. These inverters will be able to receive and implement the target values specified by grid operators using all standard data transfer protocols (Modbus, OPC, Ethernet and TCP/IP).

Remote-controlled power reduction



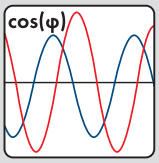
To avoid temporary overloads in the power distribution grid, grid operators prescribe specific active power values that inverters are required to achieve with minimal delay. In conjunction with the SMA Power Reducer Box, these target values are transmitted via a ripple control receiver.

Active power control



If there is a frequency spike in the transmission line, the inverters respond by automatically reducing their active power output according to a characteristic curve. The inverters can therefore play a decisive role in stabilizing the power frequency.

Voltage stability with reactive power

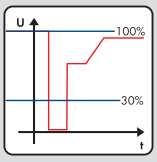


To control the line voltage, SMA inverters supply lagging or leading reactive power to the grid. The grid operator specifies whether the reactive power value is fixed or dynamic. The SMA Power Plant Controller is used to analyze and manage the process. The reactive power, or displacement factor, can also be controlled along a characteristic curve in relation to the supplied active power, the line voltage or an absolute value.

Reactive power at night

The provision of reactive power at night avoids future costs and offers an additional source of income. Reactive power compensation reduces the load on power grids while ensuring decentralized voltage stability.

Dynamic grid support

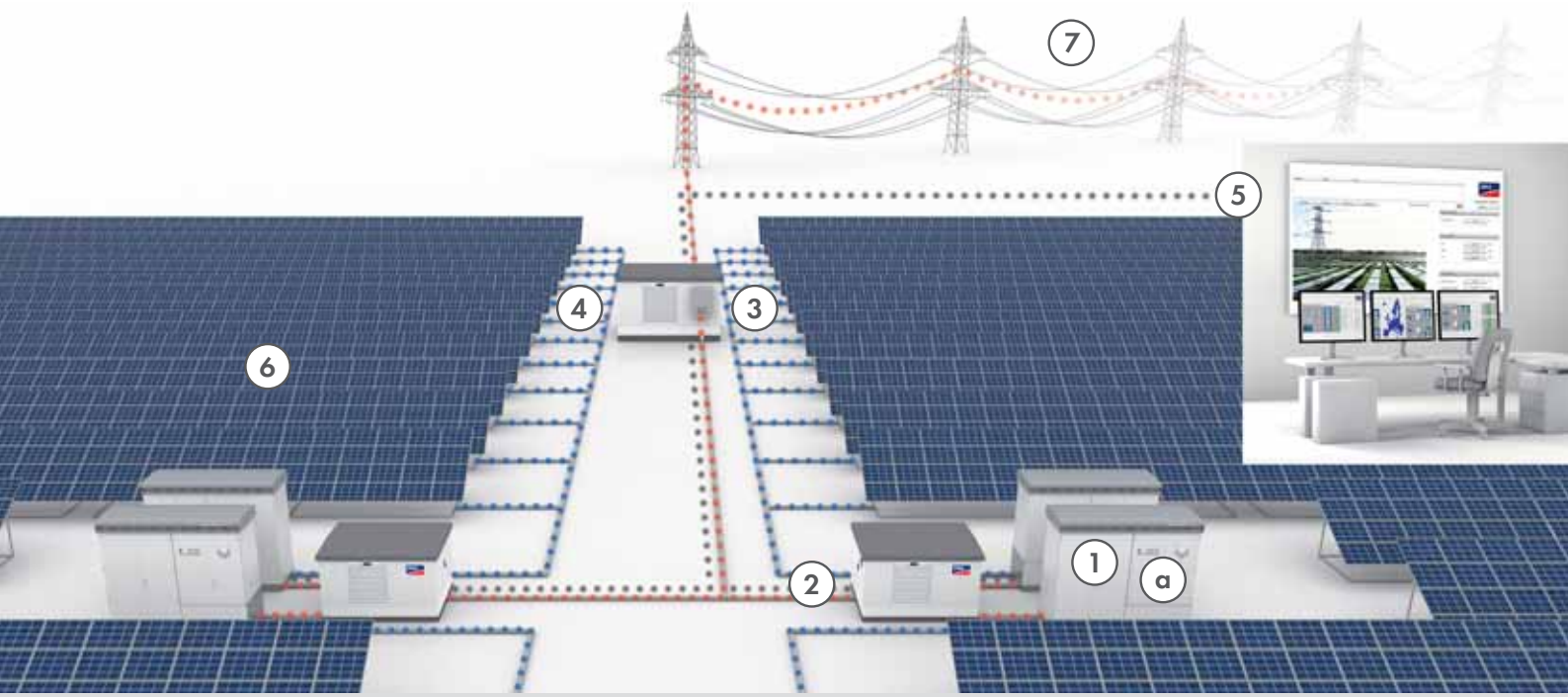


The inverters remain connected to the grid during voltage dips that last no longer than a few seconds and support the grid by feeding in reactive power. They immediately resume normal feed-in operation once the voltage exceeds a defined minimum threshold.

Inverters are the ideal grid managers

FLEXIBLE REGULATIONS FOR PV PARKS TO PROMOTE THE ACCEPTANCE AND GROWTH OF PV POWER

PV power plants with SMA system technology for optimal grid management



(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

•• Direct current (from module array to inverter)

•• Alternating current (from inverter to the grid)

•• SMA Power Plant Control System (plant monitoring and remote control)

WHAT CHALLENGES DO NEW PV MARKETS FACE?

Three questions for Gerd Hackenberg, Director of Global Technical Support and Projects at SMA.

What impact can renewable energy sources have on the quality of supply?

Without grid services the power input at the feed-in points is typically low. By using PV power plants and their integrated grid management functions, the power input can be significantly increased to further stabilize the power distribution grid.

What services can SMA experts provide on-site?

In addition to supporting our customers in the realization of their PV projects, we also play a role in shaping the future of transmission lines. In cooperation with local grid operators, we help create new guidelines and standards for the grid integration of renewable energy. Germany is a pioneer in this area, and we are working on leveraging more mature European standards throughout the world.

What is the experience like in countries that are just taking their first step in the direction of PV power?

In countries with an emerging PV industry, there is often a large degree of uncertainty when it comes to renewable energy integration, but also a great deal of openness and enthusiasm regarding the use and future prospects of PV power.

Gerd Hackenberg

Stable grids: The requirements for PV power plants are growing

FLEXIBILITY AND MAXIMUM YIELDS

PV power plants can offer even more

The stability of transmission lines can be maintained and expanded through the active contributions of SMA inverters, flexible concepts for PV park regulation and power plant configurations with SMA systems technology.

Grid operators across the globe benefit from new technologies such as the provision of reactive power both night and day, intelligent and flexible PV park regulation with the Power Plant Controller, and communication interfaces integrated into the inverter.

SMA inverters offer the ideal solution for managing reactive power. The requirements for supplying reactive power to electric utility companies already pose serious challenges. Large-scale PV power plants that offer grid management services and flexible functions for reactive power provision have proven to be the perfect partner in this regard.

Since reactive power cannot be transported over large distances, the fact that it can be supplied in a distributed manner via PV power plants is especially beneficial. PV power plants can offer this form of decentralized power for grid stabilization.

To ensure the stability of transmission lines in the future and guarantee the highest degree of flexibility and yield reliability for investors, the PV park regulation systems of SMA, which include Sunny Central Compact Power (CP) and Sunny Central High Efficiency (HE) series of inverters, will be able to cope with even more fundamental requirements.

Unlike conventional power plants, large-scale PV systems are already capable of offering grid services. The PV industry continues to plan and research for the future. Existing features of conventional power plants will soon be implemented in large-scale PV plants. This includes the use of storage technologies, which expands the functionality of PV power plants even further.

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