



The 3.15/4.4 MW Modular Inverter: Leading the Next Generation in PV Plant Development

1. Overview

As the solar industry evolves rapidly and the demand for large PV plants surges, many new situations and requirements emerge. These new situational requirements include but are not limited to different optimal block sizes in different countries, varied requests for ESS capacity, pressing needs for easier O&M, the pressure to lower LCOE, as well as more stringent grid-supporting requests. Such requirements set a higher threshold for the inverter.

Sungrow has launched its newest generation modular inverter to significantly innovate traditional inverters;

thus, combining the advantages of both central and string inverters. It can be designed from 3.15MW to 4.4MW block size with a modularized design to provide extraordinary flexibility when designing PV power plants.



Fig- 1: SG4400UD-MV-US Modular Inverter

2. Modular Design at Different Levels, Easier O&M, and Extraordinary Flexibility

The SG3150/4400UD-MV-US inverter is modularly designed at the component, inverter, and system levels. This modularity makes the PV plant design more flexible and the O&M more convenient. The main components in the SG3150/4400UD-MV-US; including, IGBTs, fans, capacitors, etc., are modularized and designed to provide plug & play functionality, improving O&M time and efficiency by up to 70%. In addition, even a technical or engineering novice is able to complete the component replacement procedure.

The SG3150/4400UD-MV-US inverter can be configured

with 1.05MW/1.1MW modular capacity as the minimum unit and one MPPT for each unit, making the PV plant design unprecedentedly flexible and doubles the number of MPPT in the inverter when compared to mainstream central inverters. Moreover, since every single unit of the SG3150/4400UD-MV-US works independently, any malfunctioning will not affect other units; thus maximizing the energy yield during O&M significantly.

Both Sungrow's SG3150/4400UD-MV-US modular inverter and newly launched Power Conversion System (PCS) share the same platform and have approximately 90% common components. As a result, when using Sungrow's SG3150/4400UD-MV-US and PCS units, customers can benefit from a 50% reduced spare parts catalog – saving considerable spare parts costs.

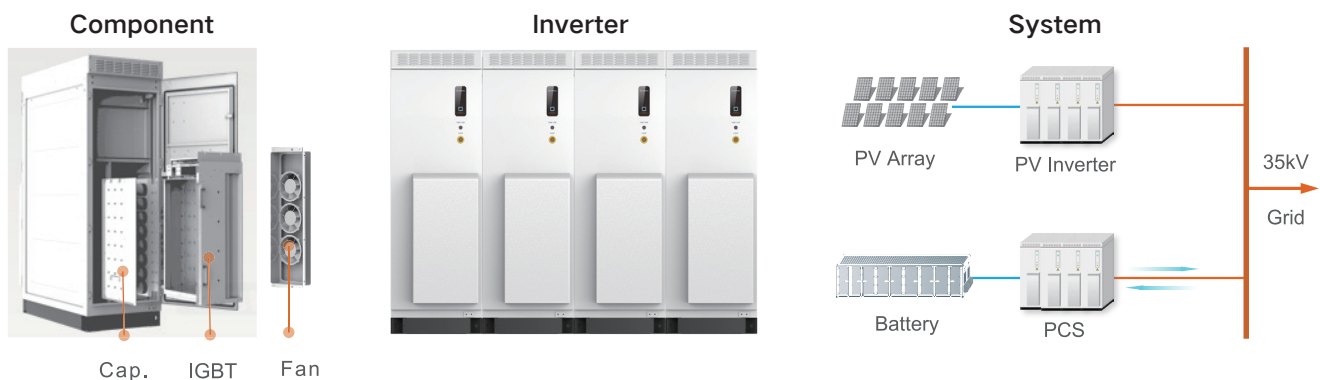


Fig-2: SG4400UD-MV-US Modular design

3. High Protection Degree, Better Adaption to Various Harsh Environments

To better adapt to various harsh environments, such as high levels of dust and sand, the SG3150/4400UD-MV-US modular inverter characterizes a high ingress protection level of NEMA 3R. The inverter's cabinet comprises two compartmental cavities, a heat dissipation cavity, and an electronic cavity.

Independent Cavity Heat dissipation cavity Electronic cavity

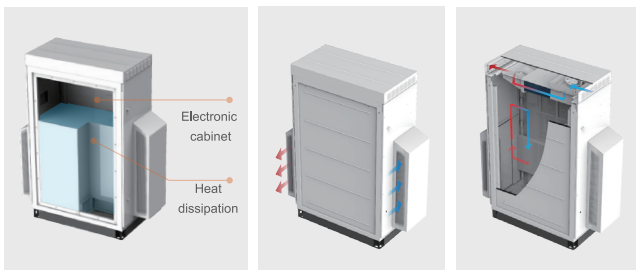


Fig-3: Independent cabinet design for heat dissipation

The heat dissipation cavity of the power module and reactor is cooled by the integrated smart forced air-cooled system while the electronic cavity transfers internal heat generated by the components, copper bars, and PCB boards to the outside through a heat exchanger located on top of the unit. The schematic diagram of the heat dissipation is illustrated in Fig-3.

4. Self-constructed Grid Function, Earlier COD & Lower Investment

In the early stage of the plant's construction, most equipment has no access to power supply and hence, cannot be debugged. Even more, most debugging tools need a power supply before the high voltage side is electrified. The SG3150/4400UD-MV-US has a self-constructed grid function to construct AC power within a certain frequency and voltage by controlling the inverter to work in voltage frequency mode, thereby supplying AC power to debug the equipment. The self-constructed grid function is shown in Fig-4.

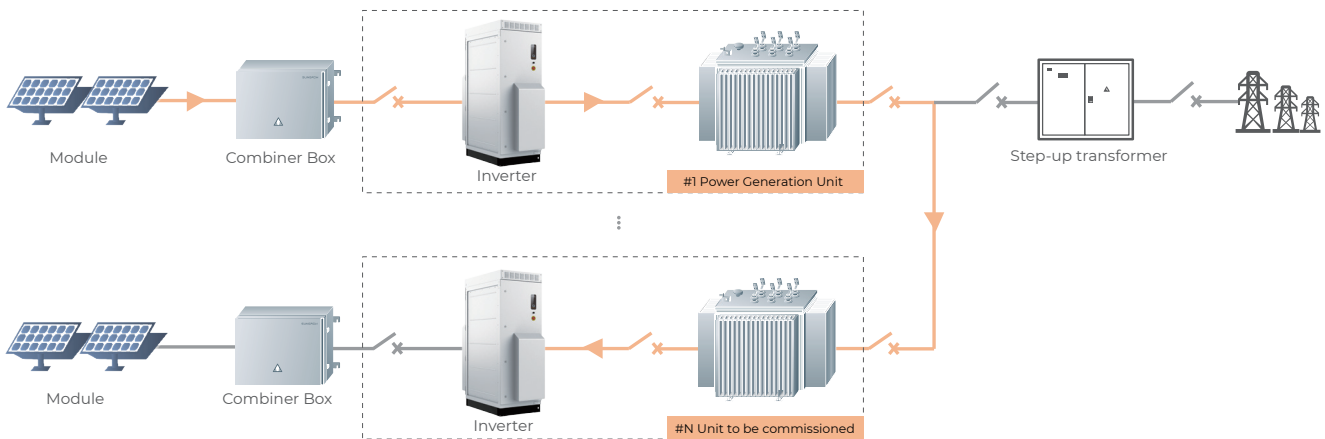


Fig-4: Self-constructed grid diagram

5. Strongly Enhanced Grid Features Support System's Reliability

Renewable energy is expected to account for over 20% to 40% of the global energy mix. However, renewable sources such as solar and wind energy, feature intermittence and volatility, which weaken the grid

and lower the short circuit ratio (SCR). Normally, a lower SCR translates to a weaker grid. The SG3150/4400UD-MV-US modular inverter can operate stably even if the SCR is as low as 1.018. It also supports fast active and reactive power control, with < 20ms Q (reactive power) response time and <140ms P (active power) response time, aiding in utility grid stabilization.

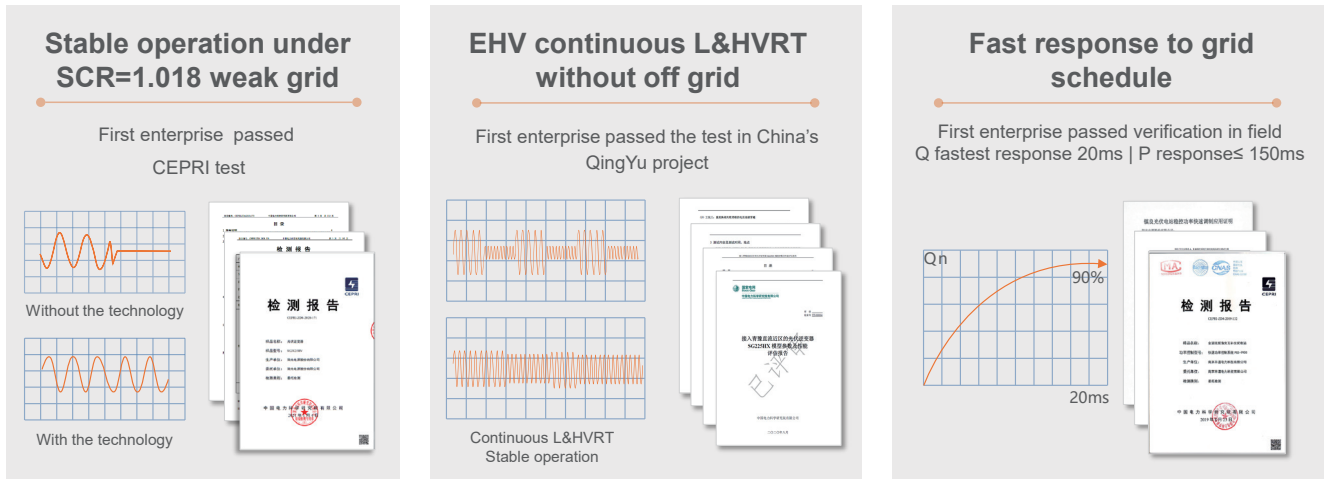


Fig-5: Strongly enhanced grid supports

6. DC Energy Storage System (ESS) Interfaces, Modifications Are No Longer Required

Considering that Energy Storage Systems will see more applications in the future with its significant functions such as peak shaving, power smoothing, renewable energy curtailment, frequency and voltage regulation, etc., the SG3150/4400UD-MV-US modular inverter can be equipped with DC ESS interfaces. Hence, systems using the SG3150/4400UD-MV-US inverter with DC ESS interfaces no longer need further modifications if an ESS is required in later stages.

The SG3150/4400UD-MV-US modular inverter can realize the DC-coupled energy storage system by connecting the

DC/DC converter and the battery to the reserved ESS interface directly. In addition, the SG3150/4400UD-MV-US modular inverter supports PCS mode so that the battery can be charged by the grid. The energy regulation will be more flexible also, as shown in Fig-6.

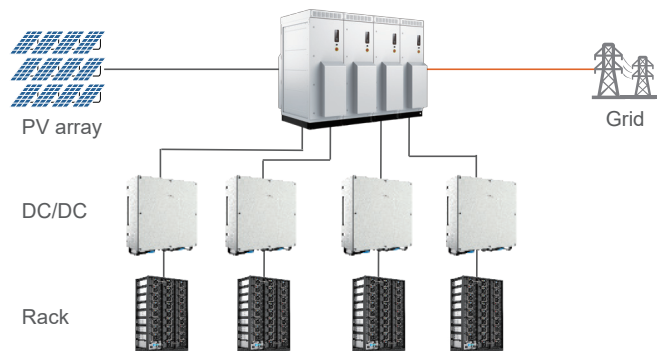


Fig-6: DC ESS interface and PCS mode

7. Higher Power Density + Increased Block Size + SVG Replacement, Lower LCOE

The SG3150/4400UD-MV-US 3.15/4.4MVA Turkey MV Station solution includes the inverters, the MV transformer, the auxiliary panel, and the monitoring system, in a sin-

gle 20ft container. This inverter has a higher power density and increased block sizes; thus, providing customers with a significant cost reduction in transportation, construction, equipment, and O&M. With < 20ms Q (reactive power) response time, the SG3150/4400UD-MV-US inverter can also replace the SVG equipment to save on the initial investment. The combination of these features lowers the total LCOE.

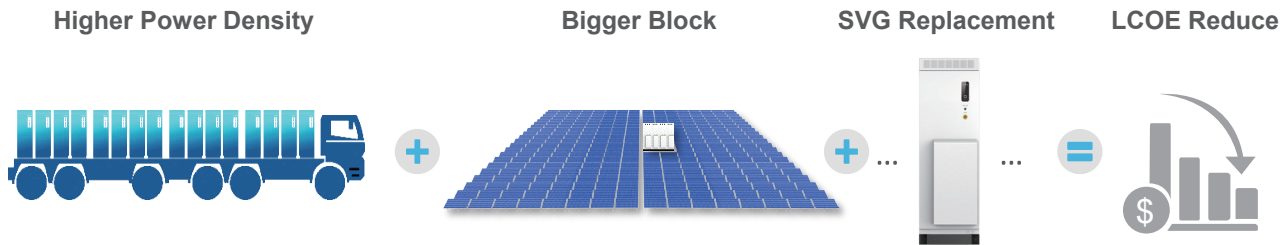


Fig-7: Higher Power Density + Bigger Block Size + SVG Replacement

8. Summary

The SG3150/4400UD-MV-US modular inverter combines the advantages of both central and string inverters, which presents a more flexible design for different block sizes and allows for more streamlined on-site O&M. When the self-structured grid function is applied, the on-site commissioning is accomplished more efficiently. Further, the application of the SG3150/4400UD-MV-US modular solution adapts better to various harsh environments as a result of its NEMA 3R protection

degree. In conclusion, Sungrow's SG3150/4400UD-MV-US modular inverter satisfies various requirements and new obstacles in utility-scale PV plants in the North America and provides customers a lower LCOE and an increased ROI. The innovative SG3150/4400UD-MV-US modular inverter is expected to lead the next generation of PV plant development and reshape the future of energy.



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