



RELIABLE SG200HX-US 600VAC/1500VDC STRING INVERTER

*THE OPTIMAL SOLUTION FOR COMMUNITY SOLAR AND
C&I PV MARKETS*

WHITE PAPER

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EXECUTIVE SUMMARY

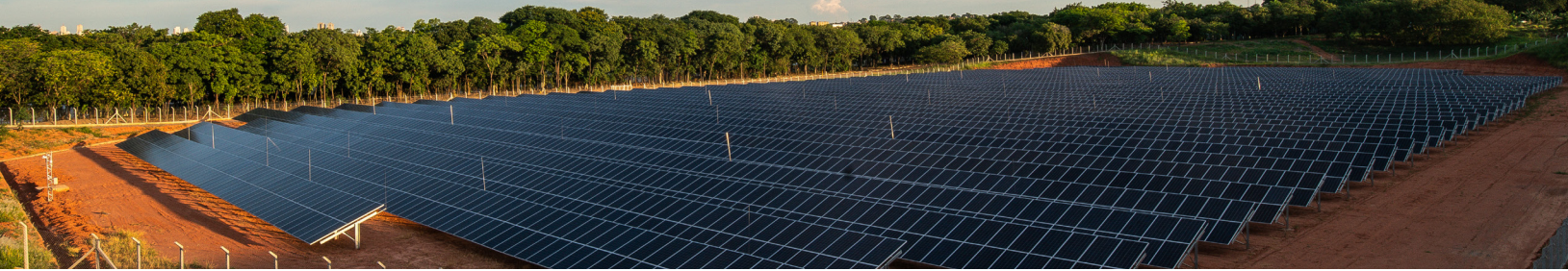
The solar energy landscape is rapidly evolving, demanding smarter and more reliable inverter solutions. The transition from conventional single direct current (DC) input inverters to advanced multiple-input string inverters is revolutionizing the market, driven by the desire for more granular control, enhanced optimization, improved serviceability, and cost-effective solutions to maximize revenue.

Sungrow's [**SG200HX-US 600VAC / 1500VDC string inverter**](#) sets a new standard in inverter technology, effectively addressing prevalent challenges within the solar market. With its intelligent string architecture and high-power capacity, the SG200HX-US is tailored to meet the needs of commercial and industrial (C&I) solar projects across North America, especially in challenging environments.

KEY FEATURES OF THE SG200HX-US

- **High efficiency:** Reaches up to 98.8% efficiency with advanced maximum power point tracking (MPPT).
- **Cost-effective:** Delivers a lower levelized cost of energy (LCOE) by reducing installation and maintenance costs and minimizing the number of units needed, with each large inverter capable of handling up to 24 strings.
- **Flexible and scalable:** Suitable for 200 kW to 5 MW solar projects; adaptable to various terrains – such as hills, valleys, and waterways – and module types.
- **Superior reliability:** Features easy serviceability for minimal downtime and fewer components for enhanced reliability and simplified operation.
- **Optimal energy production:** Equipped with 12 MPPTs for precise power tracking at the string level and high energy yield.
- **Smart grid support:** Includes many smart grid functionalities, such as reactive power support at night, Volt-VAr, Frequency-Watt, VAr-Watt, Power Factor mode, and reactive power injection capability during over-voltage or under-voltage events.

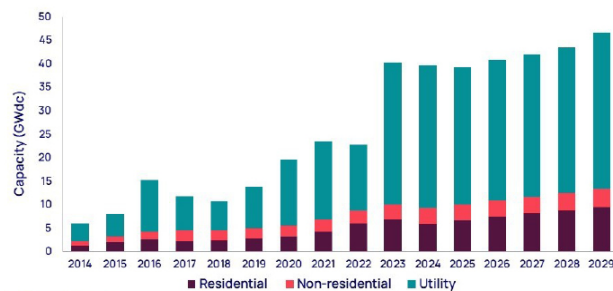
This white paper explores the growing adoption of larger, more powerful string inverters and highlights the benefits of Sungrow's SG200HX-US 600VAC / 1500VDC string inverter in enhancing efficiency, performance, and project economics within C&I solar markets for projects ranging from 200 kW to 5 MW.



INTRODUCTION

The U.S. solar market is projected to [triple by 2030](#), according to a recent report by Wood Mackenzie and the Solar Energy Industries Association (SEIA). This upsurge is accompanied by a rising demand for inverters, particularly three-phase inverters, driven by the growth of C&I solar markets.

US solar PV installations and forecasts by segment



Source: Wood Mackenzie

[Click to view chart](#)

[Inverters](#) are pivotal to solar projects' performance, reliability, and LCOE. Increasingly, more medium and large-scale solar photovoltaic (PV) projects worldwide are opting for three-phase string inverters due to declining costs and a heightened awareness of string inverter's benefits—such as lower operations and maintenance (O&M) costs, easier installation, and smart grid support functionality.

Additionally, new technological developments and innovations have amplified the power output of string inverters, with some models now capable of delivering up to [350 kW](#) to accommodate high-capacity solar projects.

This white paper examines the solar industry's transition to high-power string inverters and introduces Sungrow's SG200HX-US 600VAC / 1500VDC string inverter as an ideal solution for the North American C&I market and community solar PV.

BRIEF HISTORY OF STRING INVERTERS

String inverters emerged in the mid-1990s to bridge the gap between small and large projects, focusing on single-string input. Unlike central inverters, which handle large volumes of DC power (up to about 5 MW each), string inverters are smaller and manage individual arrays or strings of modules—allowing for greater control, flexibility, and efficiency.

Today, string inverters are designed for all sizes of PV systems and are commonly employed in residential and commercial solar projects, such as rooftop, ground mount, carport, and tracker installations.

Often referred to as the heart or brain of the system, string inverters are increasingly incorporating more advanced features such as anti-islanding, grid-forming, grid communication, grid support, and enhanced security and safety.

KEY TRENDS IN THE INVERTER MARKET

HEIGHTENED FOCUS ON BALANCE OF SYSTEM (BOS)

The cost of panels has plummeted over [90%](#) in the last decade and no longer represents the majority of the solar PV investment cost.

As a result, the solar industry has increasingly focused on balance of system (BOS), which includes all components and installation expenses except the solar panels themselves.

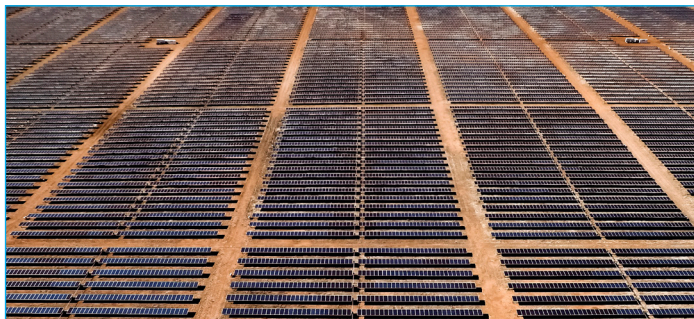
Inverters play a sizable role in BOS, typically comprising [10%](#) of the total solar PV cost. Consequently, there has been an increased focus on efficient inverter design to improve the bottom line.

EMPHASIS ON LONG-TERM RELIABILITY

Beyond initial startup costs, developers are placing increasing importance on long-term reliability, lifetime costs, and overall quality to ensure that solar plants meet their projected performance and returns. Especially with the large influx of new competitors in the space, brand reputation and production quality of essential components are paramount for achieving successful solar projects.

LARGER AND MORE POWERFUL SOLAR MODULES

The trend towards larger solar modules, now exceeding 500 Wp, has prompted advancements in inverter technology to be compatible with these more powerful solar panels. The introduction of bifacial technology, which captures sunlight on both sides of the panel, has increased the maximum operating current of PV panels to more than 15 amperes, necessitating higher-capacity inverters to support these enhancements.



RIISING INVERTER CAPACITIES

Inverter capacities have significantly increased, leveraging the latest technological and efficiency advancements in the semiconductor space. Over the past decade, the maximum capacity of central inverters has exploded from [100 kW](#) to about 5 MW. Similarly, the capacity of string inverters has scaled from 10-15 kW to over 200 kW in the C&I sectors.

SMARTER AND SAFER INVERTERS

Inverters are becoming more intelligent and efficient, leading to reduced O&M costs. As these devices evolve into critical information hubs for solar projects, there is a growing emphasis on their safety to maintain operations. Consequently, the solar industry is focusing more on robust enclosures to ensure that inverters can perform reliably, even in challenging environmental conditions.

GROWING ADOPTION OF LARGER STRING INVERTERS FOR C&I

Initially, string inverters were mainly used in residential and commercial building applications up to [1 MW](#), operating within the conventional AC voltages of 120 VAC single phase and 480 VAC three-phase. However, technological advancements have made string inverters increasingly capable, with the [world's largest single-site solar plant](#) in 2020—with a capacity of 2.2 GW—using only string inverters.

String inverters offer a distributed architecture for solar plants, providing enhanced design flexibility, granular control, and monitoring at the PV array level.

High-power string inverters are equipped with multiple MPPTs for precise tracking and feature a conversion efficiency of up to [99%](#) for high system performance.

Despite higher CAPEX due to the need for multiple units, string inverters also present lower O&M costs, easy serviceability, and minimal downtime. This reduced OPEX makes string inverters cost-effective for C&I and small utility-scale solar projects under about 5 MW—offering a more favorable LCOE over the plant's lifetime. String inverters are also compatible with nearly all DC generation and storage technologies and can be scaled infinitely with versatile configurations to meet diverse system layouts and terrain requirements.

Additionally, string inverters are often used in [battery storage](#) systems for their distributed design, allowing for granular monitoring and control of charge-discharge cycles.

BENEFITS OF HIGH-POWER STRING INVERTERS FOR C&I

EASY SERVICEABILITY AND MAINTENANCE

String inverters are small and portable and can be serviced by any trained electrician. Site owners often keep spare string inverters and components on hand to quickly swap parts or entire inverters within minutes. These simple repairs ensure minimal downtime and revenue loss in case of failure, thus reducing the lifetime OPEX costs. Moreover, string inverters have widely available components, making them ideal for remote or overseas installations, including microgrids.

GRANULAR ENERGY OPTIMIZATION

String inverters excel in balancing volts and amps, enhancing power conversion efficiency through the granular management of individual strings. Multiple MPPTs per array ensure precise power conversion and better overall power optimization.

ADAPTABLE TO TOUGH TERRAIN

Ideal for uneven and rugged landscapes, string inverters have multiple MPPTs per array to maximize energy production in conditions with partial shading, multiple orientations, or hilly terrain.



SIMPLE INSTALLATION

String inverters are compact and light, eliminating the need for heavy equipment for installation. They can be easily transported using standard utility trucks, making them ideal for locations inaccessible to tractor-trailers and cranes. Typically, string inverter installations only require two technicians and can be mounted directly to the PV array.

DISTRIBUTED ARCHITECTURE

String inverters boost energy optimization, provide more granular control, and reduce power loss with string-level intelligence. This distributed, modular architecture can reduce excess costs and improve project economics.

LOW O&M COSTS

String inverters have low O&M costs with multiple MPPTs providing [precise fault detection](#) at the string level, enabling efficient maintenance and early diagnostics to prevent critical system failures through remote system health monitoring.

HIGH YIELD

String inverters feature dual power point trackers, enabling these devices to treat each string as a separate solar PV system. This allows panels to be oriented in two different directions (i.e., north and east) while also optimizing DC output during varying peak hours. This capability is especially beneficial for sites with uneven terrain, diverse array orientations, and environments prone to dust or shade.

FLEXIBLE SYSTEM DESIGN

[Transformerless](#) string inverters offer remarkable flexibility as they are not sensitive to connection type or vector group. This adaptability and heightened compatibility enhance value-stacking opportunities, boosting potential revenue streams and improving project economics. This flexible system design with unlimited scaling also allows for precise inverter sizing, avoiding the need to oversize equipment to meet energy targets.

ENHANCED GRID SERVICES AND ENERGY MANAGEMENT

Modern string inverters are equipped with advanced grid capabilities and are evolving into sophisticated [energy management hubs](#). They utilize [big data analytics](#) and cloud-based services (provided by external domestic asset management/cloud service providers) to enhance grid management, making them increasingly integral to the future of smart grid technology. As a result, inverters are now expected to offer [greater reliability](#) and a broader spectrum of grid services—especially for distributed commercial, industrial installations, and microgrid applications.





INTRODUCING SUNGROW'S SG200HX-US 600VAC / 1500VDC STRING INVERTER

After pioneering the world's first 1500VDC string inverter in 2016, Sungrow, the world's leading PV inverter manufacturer, has launched the [SG200HX-US 600VAC / 1500VDC string inverter](#) for the North American C&I market. The string inverter is designed for community solar and ground-mount tracker installations ranging from 200 kW to approximately 5 MW projects, particularly well-suited for projects in challenging environments.

This large 24 string input/12 MPPT string inverter had an impressively quick time to market of less than a year as it was built on the proven reliability and success of Sungrow's utility-scale [SG350HX](#), which has converted 57 GW of clean power worldwide as of June 2024. One notable project, a 364 MW solar power plant in [Atrisco, New Mexico](#), has incorporated over a thousand SG350HX string inverters and is expected to be one of the largest solar-plus-storage projects in the U.S.

The behind-the-meter SG200HX-US uses the same components and hardware as the SG350HX, just scaled down to the user-friendly 600V class. For instance, the SG200HX-US features the same robust grid support functions as its larger counterpart, including reactive power support at night, Volt-VAr, Frequency-Watt, VAr-Watt, Power Factor mode, as well as the ability to inject reactive power during overvoltage or undervoltage events.

The SG200HX-US is based on the proven larger SG350HX string inverter, optimized for utility-scale applications, and shares most components with this inverter. This ensures that a high level of reliability of the new SG200HX-US is inherently built into the product already from the beginning,

commented Daniel Friberg, Director of Product and Engineering, North America at Sungrow.

Large compared to competitors in the space, the SG200HX-US collects up to 24 strings per inverter while maintaining power flexibility with its 12 MPPTs, which track a dozen independent inputs for precise control and up to 98.8% efficiency. This granular power tracking is ideal for C&I applications with geographical challenges, such as hills, valleys, waterways, and shading, which can otherwise cause power losses.

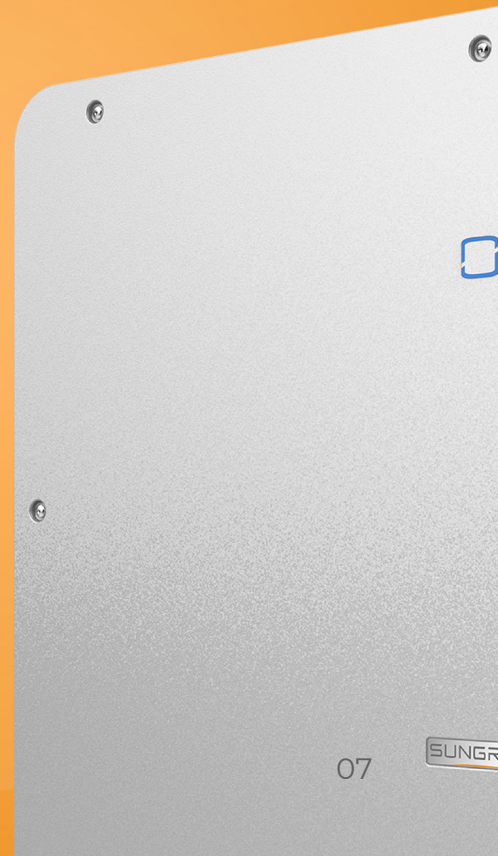
As a large string inverter, the SG200HX-US requires fewer components than multiple smaller inverters, increasing reliability and simplifying operation with less communication interfaces.

The streamlined design makes data monitoring and control more efficient, with detailed information available down to the string level.

As the solar market transitions towards larger 500+ W solar modules, the SG200HX-US is already compatible, offering 20A inputs per string. It also accommodates panels with different ratings (provided each string uses the same type of panel and the differing panels are connected to separate MPPTs) while ensuring optimal output.

OUR NEWEST C&I STRING INVERTER

The SG200HX-US offers a reliable and efficient solution for commercial and industrial solar installations, meeting the highest standards of grid performance and safety.



ESSENTIAL FEATURES OF THE SG200HX-US

SMALL FORCED AIR-COOLING SYSTEM

The SG200HX-US is designed with a fully enclosed housing to prevent dust and other external contaminants from getting inside. It uses heat sinks for bi-directional air cooling, eliminating the need for filters and reducing annual maintenance requirements.

PROVEN SAFETY AND RELIABILITY

The system incorporates various protective safety features and complies with strict standards:

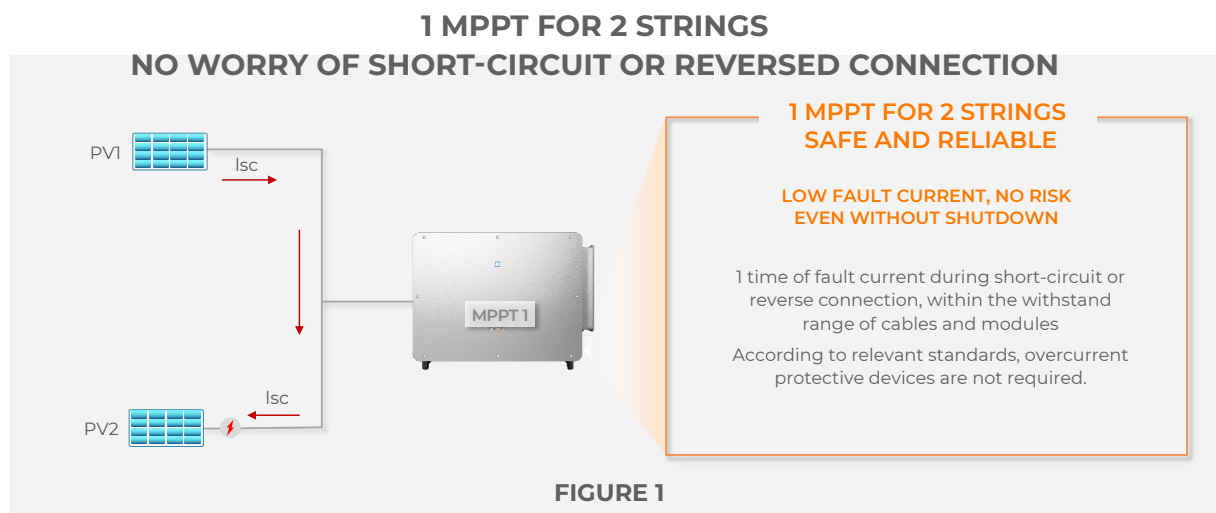
- Two strings per MPPT design: Eliminates the possibility of string reverse connection issues, with no external fuse required for cost savings.
- 24/7 real-time monitoring: Includes AC and DC insulation monitoring with string-level voltage and current monitoring the IV Curve health.
- C5 anti-corrosive protection: Protected against salty and corrosive environments.
- IP66 (NEMA 4X) protection: Features a sealed electronic cavity, IP68 high protection fan, and weather-resistant sealing strip.

PLUG-AND-PLAY DESIGN

Installation is straightforward, without the need for ground pilings or heavy equipment. Mount the rack on the pole, connect the inverter, plug in the quick-connect DC MC4 connector, and bolt in the AC side.

FLEXIBLE SYSTEM DESIGN

The transformerless inverter is compatible with any 3-phase, 600V connection for added convenience. The SG200HX-US offers extreme flexibility in module layout and adapts to various tough terrains.



EASY SERVICEABILITY

Parts can be quickly and easily replaced without specialized training, minimizing downtime and potential revenue loss.

BUDGET-FRIENDLY

Lightweight and compact with a more modern design, the SG200HX-US is cost-effective with minimal installation and maintenance costs.

INFINITELY SCALABLE

Each inverter supports up to 200 kVA, with unlimited additional connections to scale to any project size.

COMPATIBLE WITH MAINSTREAM PV MODULES

The system supports 20A inputs per single string, making it compatible with more powerful 500 Wp+ modules, bifacial modules, and TOPCon cells.

HIGH-ACCURACY SOLAR TRACKING

Equipped with 12 MPPTs and two MPPTs per string, the inverter enables precise solar tracking and optimal performance, especially in uneven and difficult terrain.

ADAPTABILITY TO HARSH CONDITIONS

The technology performs well in extreme environments such as deserts and coastal regions with severe wind, sand, high temperatures, and humidity.

MAX. CURRENT OF 20A FOR A SINGLE STRING MATCH MAINSTREAM MODULES, NO GENERATION LIMIT

EFFECTIVELY MATCH 210 MODULE

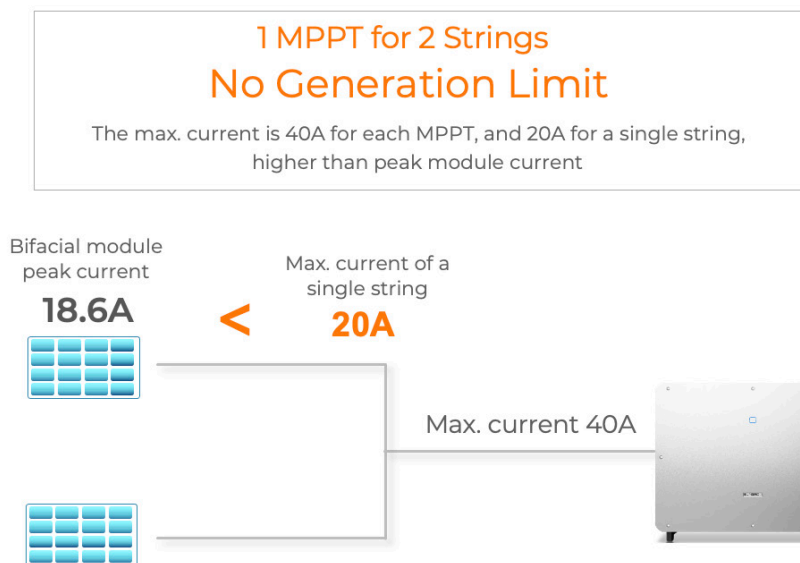


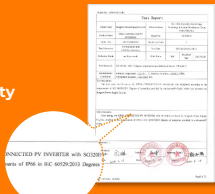
FIGURE 2

**The comparison is based on 550W and 660W series modules, the peak current value of bifacial modules is calculated as 1.1 times of that of monofacial modules.*

IP66 PROTECTION, C5 ANTI-CORROSION, ADAPTABLE TO ALL HARSH CONDITIONS

IP66 Protection

- Completely sealed electronic cavity
- IP68 high protection degree fan
- Sealing strip with high resilience and weather resistance



C5 Anti-Corrosion



- Hot dip galvanized sheet and carbon steel
- Electrostatic spraying and galvanizing
- Integrated bending and welding



Adaptable to regions of severe wind and sand, like desert and high land, as well as coastal regions of severe corrosion, high temperature and humidity.

NO ANNUAL MAINTENANCE

The filterless smart air-cooled design only requires periodic visual checks or remote diagnostics for optimal performance and is designed to last the life of the system.

HIGH YIELD AND EFFICIENCY

The system delivers up to 98.8% efficiency with 12 MPPTs, maximizing power output and overall energy yield.

LOW LCOE

The technology reduces costs and losses by using fewer cables compared to a central inverter and minimizes O&M costs, leading to a lower lifetime cost.

FREE OF SVG (STATIC VAR GENERATOR)

The technology offers up to 60% dynamic reactive power (VAR support) for grid support capabilities, operating during daytime or exclusively at night to supply reactive power (Q) without active power generated, minimizing the need for additional capacitors or generators and keeping system costs down.

12 MPPTS FOR ONE INVERTER, HIGHER YIELD

1 MPPT for 2 strings, higher accuracy
Independent optimization without mutual influence
Flexible module layout according to the terrain



FIGURE 3



Reactive power response time $\leq 30\text{ms}$



SVG Capable

EXCELLENT POWER QUALITY

The system includes a high-speed, self-adaptive Genlock processor for stable operation and SCR (short circuit ratio) ≥ 1.15 for operation in weak grids. The inverter measures high sample rates with fast active and reactive power response times to grid dispatch within 30ms to manage high-frequency disturbances for additional grid support. The SG200HX-US also features transient overvoltage suppression, fast waveform tracking, and dynamic impedance shaping for strong grid adaptability.

HIGH DC/AC RATIO

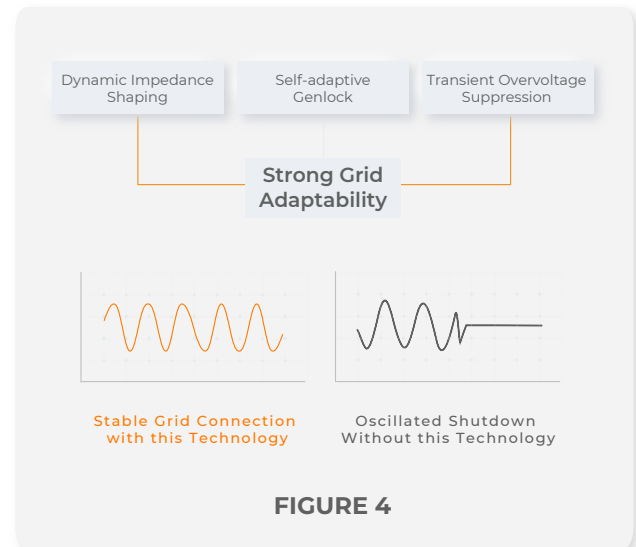
The system achieves a high DC/AC ratio to maximize energy yield.

Q AT NIGHT FUNCTION

This function allows for reactive power support and power factor correction, even during nighttime.

FUSE-FREE DESIGN

The technology eliminates the need for fuses with only two strings per MPPT (as there is no risk of short-circuit or reversed connection) and features smart string current monitoring.



ADDITIONAL PROTECTIONS FOR SAFETY AND RELIABILITY

- DC Reverse Connection Protection
- AC Short Circuit Protection
- Leakage Current Protection
- Grid Monitoring
- Ground Fault Monitoring
- DC Switch
- PV String Current Monitoring
- Type II Surge Protection Device (SPD) for both DC and AC
- Intelligent shutdown

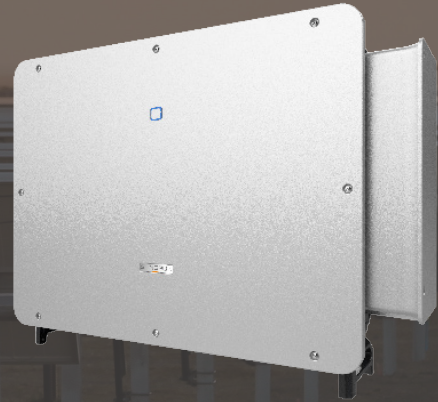
TECHNICAL SPECIFICATIONS AND CERTIFICATIONS

- Country of origin: Manufactured and fully assembled in Thailand
- Degree of protection: IP66 (NEMA 4X)
- Isolation method: Transformerless
- Rated power: 200 kVA
- Rated input voltage: 600V
- Efficiency: Up to 98.8% efficiency with 12 MPPTs
- Design life: 15+ years
- Weight: ≤120 kg (≤265lbs)
- Dimensions: W * H * D: 1166 mm * 870 mm * 361 mm (45.9" * 34.3" * 14.2")
- Max. number of input connectors per MPPT: 2
- Grid support: Q at night function, LVRT, HVRT, active and reactive power control and power ramp rate control, Q-U control, and P-f control
- Safety features: IP66 protection, DC reverse connection protection, and AC short circuit protection
- Reactive power response time: ≤ 30ms
- Power consumption at night: < 6 W
- Operating ambient temperature range: -22 F to 140 F
- Allowable relative humidity: 0-100 %
- Cooling method: Smart forced air cooling
- Max operating altitude: 4000 m / 13123 ft
- Communication interface: RS485, SunSpec, ModBus
- Max PV input voltage: 1500V
- MPP voltage range: 500-1500V*
 - * Full power MPP range is temperature dependent; check the characteristic curve of the inverter for more information.
- Certifications: Compliance with UL 1741, UL 62109-1, CSA C22.2 No.107.1-16, IEEE 1547-2018, IEEE 1547.1-2020, UL 1741 SA/SB, CEC, California Rule21, and FCC Part 15 Class A Limit.
- Patents: Numerous innovations in the new string inverter have led to the filing of 23 new patents.

For more details, please view the SG200HX-US datasheet [here](#).

CONCLUSION

SG200HX-US



Sungrow's latest innovation, the [SG200HX-US 600VAC / 1500VDC string inverter](#), exemplifies the company's dedication to advancing solar technology for the North American community solar and C&I market. Designed for applications ranging from 200 kW to 5 MW, this high-performance inverter stands out for its exceptional reliability, performance, and flexibility.

Featuring 12 MPPTs, the SG200HX-US offers precise control and power management, accommodating up to 24 strings per unit to meet the demands C&I projects with geographical challenges, like hills, valleys, and shading, to minimize power losses. Additionally, the powerful inverter is compatible with 500+ W panels and can even optimize output with panels of different ratings.

Built upon the proven reliability of Sungrow's utility-scale SG350HX, the SG200HX-US also incorporates advanced smart grid support functionalities, including reactive power support at night, Volt-VAr, Frequency-Watt, VAr-Watt, Power Factor mode, and reactive power injection capability during an over/under-voltage event. Compared to competitors, the SG200HX-US's larger size and streamlined design reduces the number of components, enhancing reliability and simplifying operation with less communication interfaces while maintaining detailed monitoring at the string level.

For more information about how the SG200HX-US 600VAC / 1500VDC string inverter can elevate your next community solar or C&I solar project, [contact](#) Sungrow's dedicated customer service team today.



**UNLOCK
THE POWER
OF SOLAR.**

ABOUT SUNGROW

Sungrow Power Supply Co., Ltd. ("Sungrow") is a global leading PV inverter and ESS supplier with over 740 GW of power electronics equipment installed worldwide as of December 2024. Founded in 1997 by University Professor Cao Renxian, Sungrow is a leader in the research and development of solar inverters with the largest dedicated R&D team in the industry and a broad product portfolio offering PV inverter solutions and ESS for utility-scale, commercial & industrial, and residential applications, as well as internationally recognized floating PV plant solutions, NEV driving solutions, EV charging solutions and renewable hydrogen production systems. With a strong 28-year track record in the PV space, Sungrow products power over 180 countries worldwide. For more information about Sungrow, visit: [w.](https://www.us.sungrowpower.com)

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