



HITACHI

SOLAR INVERTERS FOR

MULTI-MEGAWATT AND UTILITY-SCALE PV POWER PLANTS

ABOUT MULTI-MEGAWATT AND UTILITY-SCALE PV POWER PLANTS

Multi-megawatt and utility-scale photovoltaic (PV) power plants represent a significant leap forward in the renewable energy sector, addressing the increasing global demand for sustainable and clean power solutions. These expansive solar installations, often spanning several megawatts to hundreds of megawatts in capacity, are designed to feed large amounts of electricity directly into the grid.

At the core of these installations are solar string inverters, which are crucial for converting the direct current (DC) generated by solar panels into alternating current (AC) that can be utilized by the electrical grid. Unlike central inverters, solar string inverters manage smaller clusters of panels, offering increased flexibility and redundancy in power plant design.

Solar string inverters excel in optimizing energy production and enhancing system reliability. Their modular design allows for easier maintenance and scalability, making them an ideal choice for multi-megawatt and utility-scale applications. Additionally, these inverters can efficiently handle shading issues and improve overall system performance by operating each string of panels independently.

The implementation of solar string inverters in large-scale PV power plants not only boosts energy efficiency but also contributes to reducing carbon emissions and promoting a sustainable energy future. As the push for renewable energy intensifies, the role of advanced solar string inverters in large-scale projects will continue to be a cornerstone of the global energy transition.

This application note will explore the technical specifications, benefits, and deployment considerations of solar string inverters in multi-megawatt and utility-scale PV power plants, highlighting their importance in advancing large-scale solar energy initiatives.

CHALLENGE/ISSUES

In multi-megawatt and utility-scale PV power plants, solar inverters face several challenges and issues, including:

- **Reliability and Maintenance:** High-power solar inverters are critical components, and their failure can significantly impact plant performance. Ensuring reliability and ease of maintenance is crucial, especially in remote locations.
- **Efficiency:** Achieving high conversion efficiency is essential to maximize energy output. Solar Inverters must handle large power flows and minimize losses to ensure optimal performance.

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- **Grid Integration:** Integrating large amounts of solar power into the grid requires advanced grid management solutions. Solar Inverters must provide grid support functions, such as voltage regulation and frequency control, to maintain grid stability.
- **Thermal Management:** High-power inverters generate significant heat, requiring effective cooling systems to prevent overheating and ensure continuous operation.
- **Compatibility and Scalability:** Ensuring compatibility with various PV modules and system configurations is essential. Solar Inverters must be scalable to accommodate future expansions or upgrades.
- **Cost:** Balancing cost and performance is a challenge. High-power Solar inverters are expensive, and selecting the right inverter that offers the best value for money is crucial.
- **Environmental Conditions:** Solar Inverters must withstand harsh environmental conditions, including extreme temperatures, humidity, and dust, which can affect their performance and lifespan.

Addressing these challenges requires advanced technology, robust design, and effective project management to ensure the successful deployment and operation of multi-megawatt and utility-scale PV power plants.

NEED FOR THE SOLUTION

The need for advanced solar inverters in multi-megawatt and utility-scale PV power plants is paramount to maximize energy efficiency, ensure grid stability, and enhance reliability. These inverters optimize energy conversion, handle high power demands, and integrate seamlessly with the grid, supporting the transition to sustainable and reliable renewable energy. The advanced solutions in solar inverters for multi-megawatt and utility-scale PV power plants arises from several critical factors:

1. Maximizing Energy Efficiency

- **Optimal Energy Conversion:** High-quality inverters ensure maximum conversion of DC electricity from solar panels to AC electricity, which is essential for grid integration. This efficiency directly impacts the overall energy output and financial viability of the plant.
- **Minimizing Losses:** Advanced inverters are designed to minimize energy losses during conversion and transmission, enhancing the overall performance of the power plant.

2. Ensuring Grid Stability and Compliance

- **Grid Support Functions:** Inverters equipped with grid support capabilities can help maintain voltage and frequency stability, which is crucial for integrating large amounts of solar power into the existing grid infrastructure.
- **Regulatory Compliance:** Modern inverters comply with stringent grid codes and regulations, ensuring the power plant operates within required standards and avoids penalties.

3. Enhancing Reliability and Longevity

- **Robust Design:** Inverters designed to withstand harsh environmental conditions, such as extreme temperatures, dust, and humidity, ensure reliable operation over the long term.
- **Reduced Downtime:** High-reliability inverters reduce the risk of failures and maintenance needs, leading to fewer interruptions and higher uptime for the power plant.

4. Flexibility and Scalability

- **Modular Approach:** String inverters, in particular, offer modularity, allowing for easier scaling of the power plant. This flexibility is vital for accommodating future expansions and technology upgrades.

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- **System Integration:** Advanced inverters can seamlessly integrate with various PV modules and system configurations, enhancing the adaptability of the power plant to different site conditions and design requirements.

5. Cost Efficiency

- **Operational Cost Savings:** Efficient inverters reduce the operational costs by lowering energy losses and maintenance needs, contributing to the overall cost-effectiveness of the solar power plant.
- **Investment Protection:** Investing in high-quality inverters protects the significant capital invested in the power plant, ensuring a better return on investment through reliable performance and longevity.

HITACHI'S OFFERED PRODUCT / SOLUTION

To address the challenges faced in multi-megawatt and utility-scale PV power plants, Hitachi offers its state-of-the-art Grid-Tied Solar String Inverters. These inverters are designed to ensure maximum efficiency, reliability, and long-term performance, making them an ideal solution for large-scale solar power installations.

- **High Efficiency:** Hitachi's solar string inverters boast high conversion efficiency, ensuring that the maximum amount of solar energy is converted into usable electrical power. This leads to higher energy yields and improved overall performance of the solar power plant.
- **Robust Design:** Built to withstand harsh environmental conditions, Hitachi's solar string inverters are designed for durability and longevity. This robust design minimizes the risk of failures and reduces maintenance requirements, ensuring continuous operation.
- **Advanced Monitoring and Control:** Equipped with advanced monitoring and control systems, Hitachi's solar string inverters provide real-time data on performance and operational status. This allows for proactive maintenance and quick resolution of any issues, further enhancing reliability.
- **Scalability:** Hitachi's solar string inverters are highly scalable, making them suitable for both small and large solar power installations. This flexibility allows for easy expansion of the solar power plant as needed.
- **Long-Term Support:** Hitachi is committed to providing long-term support for its products. The customer can rely on Hitachi for consistent service and availability of spare parts throughout the lifespan of the inverters.
- **Grid Compatibility:** Designed to seamlessly integrate with the grid, Hitachi's solar string inverters ensure stable and efficient power delivery. This compatibility helps in maintaining grid stability and meeting regulatory requirements.

BENEFITS OF USING HITACHI SOLAR STRING INVERTERS

Using Hitachi Grid Tied Solar String Inverters in multi-megawatt and utility-scale PV power plants offers several benefits:

- **High Efficiency:** These inverters provide high conversion efficiency, ensuring maximum energy harvest from solar panels.
- **Advanced MPPT:** Equipped with Maximum Power Point Tracking (MPPT) technology, they optimize energy production even under varying sunlight conditions.
- **Scalability:** Suitable for a wide range of system sizes, from small to large installations, offering flexibility in design and expansion.
- **Robust Design:** Built to withstand harsh environmental conditions, ensuring reliable performance and longevity.

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- **Grid Support:** Features such as reactive power control and anti-islanding protection enhance grid stability and compliance with grid codes.
- **Ease of Installation:** User-friendly design and installation process reduce setup time and costs.
- **Low Maintenance:** Designed for minimal maintenance requirements, reducing operational costs over the system's lifespan.

These benefits make Hitachi Grid Tied Solar String Inverters an excellent choice for large-scale solar projects, ensuring efficient, reliable, and cost-effective energy production.

HITACHI SOLAR STRING INVERTERS PORTFOLIO FOR MULTI-MEGAWATT AND UTILITY-SCALE PV POWER PLANTS

Grid Tied Solar String Inverters

HIVERTER-Si Series - 350 kW & 255 kW (Three Phase)

- Wide DC input range
- True three phase bridge, transformer-less topology
- >8 independent MPPT to ensure optimal energy harvest
- Wide operating temperature range from -30°C to 60°C
- Type II SPD (Surge Protection Device)
- String current monitoring
- Low Voltage Ride Through (LVRT) compliance
- IP 66 protection for Indoor & outdoor application
- Reactive power controller



ABOUT HITACHI SOLAR INVERTERS URL:

<https://www.hitachi-hirel.com/products/grid-tied-solar-inverters/>

ABOUT HITACHI HI-REL POWER ELECTRONICS PRIVATE LIMITED

Founded & established in 1983 as Hi-Rel Electronics Pvt. Ltd., which later on in year 2015 had become the 100% subsidiary company of Hitachi, Japan which is one of the Global fortune 500 companies with a new name as Hitachi Hi-Rel Power Electronics Private Limited, which is being recognized as one of the pioneers in power electronics domain. Hitachi Hi-Rel, today, is a leading manufacturer of Industrial UPS, IT & Infra UPS, Medium & Low Voltage Variable Frequency Drives, Grid Tied Solar Inverters, Air Compressors and Railway Inverters.

Hitachi Hi-Rel has state-of-the art manufacturing facility at Sanand near Ahmedabad in Gujarat-India. Hitachi Hi-Rel is helping a wide array of industries and organizations to meet the mission critical demands through technologically superior, low polluting and innovative products Solutions and continue to offer world class power electronics products, value added services & customized solutions.

With a vision of "To be recognized as the most trusted Power Electronics Company by supplying superior products and services", Hitachi Hi-Rel has garnered a significant level of trust in Indian power electronics market segment wherein it serves the entire gamut of Industries, particularly in mission critical applications for Refineries, Petro-Chemicals, Power Generation, Steel & Metals, and Process Industries as well as Critical

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Data Processing Applications. Besides offering greater energy efficiency & lower carbon footprint, each of the company product streams bears the hallmark of excellence with company accreditations. Hitachi Hi-Rel is an ISO 9001:2015, ISO 14001:2015, ISO 45001:2018 & ISO/IEC 27001:2022 certified company having export house status. Hitachi Hi-Rel sales network & service infrastructure expands out to the world & with this network, we have made strong inroad in Global markets like South East Asia, Middle East, Africa and Brazil. Also, with a presence of strategically located skilled service engineers in India helps us to score high in terms of customer expectations on service deliverables & uptime of the product.

With expertise, experience and an efficient product line, Hitachi Hi-Rel will always try to be your power electronics partner. When you choose to do business with Hitachi Hi-Rel, you are partnering with a company who cares.

FOR MORE INFORMATION

To know more about Hitachi Hi-Rel Power Electronics Private Limited and its offered products and solutions, please visit www.hitachi-hirel.com

You may also share your requirements at <https://www.hitachi-hirel.com/inquiry> to receive the phone call or Hitachi product information email from our authorized sales representative of your region.

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