

Solar PV Inverter Market – Global Industry Size, Share, Trends, Opportunity, and Forecast, 2018-2028 Segmented By Inverter Type (Central Inverters, String Inverters, and Micro Inverters), By Application (Residential, Commercial and Industrial (C&I), and Utility-scale), By Region, Competition

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Abstracts

Global Solar PV Inverter Market was valued at USD 14.08 Billion in 2022 and is anticipated to project robust growth in the forecast period with a CAGR of 12.06% through 2028. The Global Solar PV Inverter Market refers to the worldwide industry involved in the production, distribution, and sale of photovoltaic (PV) inverters. Photovoltaic inverters, commonly known as solar inverters, are essential components of solar power systems. They play a crucial role in converting the direct current (DC) electricity generated by solar panels into alternating current (AC) electricity, which is suitable for use in homes, businesses, and the electricity grid.

In essence, solar PV inverters act as intermediaries between solar panels and the electrical grid or the end-use applications. They ensure that the electricity generated by solar panels is compatible with standard electrical systems and can be used to power various devices and appliances. Solar inverters also perform functions such as tracking the maximum power point of the solar panels to optimize energy generation and ensuring safety by monitoring grid connection conditions. The Global Solar PV Inverter Market encompasses a wide range of products, including string inverters, central inverters, microinverters, and power optimizers. These products vary in terms of capacity, design, efficiency, and applications. The market is influenced by factors such as government policies and incentives supporting solar energy adoption, technological advancements in inverter technology, cost reductions, and increasing awareness of

renewable energy's environmental benefits. The market is dynamic and has witnessed significant growth over the years due to the increasing adoption of solar energy as a clean and sustainable power source. Solar PV inverters are a critical component in this transition toward renewable energy sources and the reduction of carbon emissions. Market players in the Global Solar PV Inverter Market include manufacturers, suppliers, distributors, and service providers. Key players often engage in research and development efforts to improve inverter efficiency, reliability, and functionality, as well as to develop new features such as smart monitoring and integration capabilities. It's important to note that the information provided here is based on knowledge available up until September 2021, and developments in the solar PV inverter market may have occurred since then.

Key Market Drivers

The growing demand for solar power is expected to stimulate the growth of the solar PV inverters market during the forecast period. Increasing investments and ambitious solar energy targets are expected to drive the growth of the market studied. However, technical drawbacks of string inverters are expected to hamper the growth of the solar PV inverters market during the forecast period.

The value chain of solar inverters is considerably complex and comprises component manufacturers, inverter manufacturers, distributors, sellers, and End-Uses. Different components of the solar value chain account for different revenue generation as a significant portion constitutes panels followed by inverters and batteries. The value chain complexity offers little room for technical differentiation of solar devices as the efficiency of these devices is relatively high. Solar PV inverters are an integral part of the larger solar system. These inverters convert the DC electricity to the alternate current and hence determine the efficiency of the whole solar system. Solar PV inverters are available with distinct characteristics and features and take into account different factors affecting solar system production. Some of the critical factors include shading, roof orientation, roof inclination, summer vs winter production, tilting panels, and many other factors that result in the required output. Renewable power generation cost has witnessed a very steep decline and in the current scenario is very competitive to meet the need for new capacity. For instance, solar photovoltaics have resulted in a decrease of approximately ~72% for the leveled cost of electricity (LCOE) which is one of the highest cost reductions compared to other renewable energy technologies such as wind. This fall in the prices of solar power generation came with the reduction of installation costs for solar modules, cells, inverters, and related equipment. The COVID-19 pandemic hindered the market growth of PV inverters globally owing to

factors such as disruption in the supply chain. Furthermore, the demand has been reduced for the PV inverter from residential and commercial End-Uses due to restricted new construction activities and due to the diversion of available funds by residential and commercial End-Uses to sustain during the COVID-19 pandemic.

Key Market Challenges

In traditional PV systems, PV panels, wires, and other equipment are energized with high DC voltages. These high DC voltages pose risks to installers, maintenance personnel, and firefighters. Solar inverters with PV arrays involve high DC voltages, making it difficult to isolate DC electric devices from PV arrays using DC isolation switches. When PV modules are connected in series, they create a high voltage, which can be dangerous for installers during the system installation. Under the condition of short-circuit current, there is a possibility of electric arcs, which can result in fire and a resulting threat to people in the vicinity of a PV system. These DC arcs are difficult to extinguish, posing a risk to firefighters. The fire can damage DC cables in PV arrays, thereby leading inverters to shut down automatically while manually isolating DC cables and other components. Safety mechanisms mandated by the National Electric Code (NEC) and the Electrical Safety Authority (ESA) of the US do not eliminate all risks, which hamper the growth of the inverter market.

Key Market Trends

Battery Advancements in the Market

The global energy landscape has been rapidly evolving in recent years, driven by the increasing need for sustainable and clean sources of power to mitigate climate change and address energy security concerns. In this context, solar photovoltaic (PV) systems have emerged as a key player, providing a viable and scalable solution to harness solar energy and convert it into electricity. Central to the efficient functioning of solar PV systems are solar PV inverters. These devices, which convert the direct current (DC) generated by solar panels into usable alternating current (AC) electricity, have become pivotal in shaping the Global Solar PV Inverter Market.

Rising Demand for Renewable Energy

One of the most prominent trends driving the solar PV inverter market is the global shift towards renewable energy sources. As concerns about the environmental impacts of fossil fuels grow, countries around the world are setting ambitious renewable energy

targets. Solar energy, due to its abundance and inherent sustainability, has gained substantial traction. Solar PV inverters, being integral to solar energy systems, have experienced increased demand in tandem with the rising adoption of solar power. Governments, businesses, and consumers alike are recognizing the economic and environmental benefits of solar energy, which is further propelling the solar PV inverter market's growth.

Technological Advancements

Technological innovation has played a pivotal role in shaping the solar PV inverter market. Manufacturers have been actively investing in research and development to enhance the efficiency, reliability, and functionality of solar inverters. One notable advancement is the development of smart inverters, which offer advanced monitoring and control features. These inverters enable real-time communication with the grid, facilitating grid stability through capabilities such as voltage regulation and reactive power control. Additionally, smart inverters provide improved insights into system performance, enabling more efficient maintenance and troubleshooting. As the energy landscape becomes increasingly digital, smart inverters are expected to become a standard feature, driving the market forward.

String vs. Central vs. Microinverters

Another significant trend in the solar PV inverter market is the diversification of inverter types to cater to various system sizes and applications. String inverters, central inverters, microinverters, and power optimizers are some of the options available. String inverters, which connect multiple solar panels in a series, have been widely used due to their cost-effectiveness. Central inverters, on the other hand, are employed in utility-scale projects, offering high efficiency and power conversion capabilities. Microinverters, installed at the panel level, optimize energy harvest by mitigating the impact of shading or panel-level variations. The choice of inverter type depends on factors such as system size, shading, and desired performance, driving innovation and competition in the market.

Efficiency Improvements

Efficiency is a key metric in the solar PV inverter market. Higher efficiency ensures that more of the solar energy collected is converted into usable electricity, reducing waste and increasing overall system performance. Manufacturers are consistently working to improve the efficiency of inverters, resulting in higher energy yields and faster return on

investment for solar installations. Advanced semiconductor technologies improved thermal management, and better designs have collectively contributed to these efficiency gains. As solar power becomes more cost-competitive with conventional sources, efficient inverters play a crucial role in making solar energy economically viable.

Global Market Dynamics:

The solar PV inverter market is inherently tied to global market dynamics, including policy developments, economic conditions, and industry collaborations. Government policies, such as feed-in tariffs, tax incentives, and renewable energy targets, greatly influence the adoption of solar energy and subsequently impact the demand for solar inverters. Economic factors, such as the decreasing cost of solar panels and advancements in manufacturing processes, contribute to cost reductions in the overall solar PV system, driving market growth. Additionally, collaborations between inverter manufacturers, solar panel manufacturers, and energy utilities are fostering innovative solutions and driving market expansion.

Segmental Insights

Technology Type Insights

A central inverter is a large grid feeder. It is often used in solar photovoltaic systems with rated outputs over 100 kWp. Floor or ground-mounted inverters convert DC power collected from a solar array into AC power for grid connection. These devices range in capacity from around 50kW to 1MW and can be used indoors or outdoors. A central inverter consists of one DC-AC conversion stage. Some inverters also have a DC-DC boost stage to increase their MPP (maximum power point) voltage range. Low-frequency transformers are sometimes used to boost the AC voltage and provide isolation at the output. However, this reduces efficiency and increases the inverter's size, weight, and cost. A central inverter typically has a maximum input voltage of 1,000V. However, some newer central inverters already come with 1,500V input voltage. These inverters allow PV arrays based on a maximum voltage of 1,500V, requiring fewer BOS (balance of system) components. Therefore, the growing demand for electricity, the government's efforts to decarbonize the power sector, and the declining costs of central inverters are expected to drive the segment's growth during the forecast period.

Regional Insights

The Asia Pacific region has established itself as the leader in the Global Solar PV Inverter Market with a significant revenue share in 2022. Asia-Pacific dominated the solar PV inverter market in 2022, and it is expected to continue its dominance over the coming years. Most of the demand is expected to come from China, which is also the largest producer of solar energy in the world. There has been an increased emphasis on solar inverters in China, providing a zero-voltage ride through (ZVRT) scheme. To meet the scheme norms, the solar PV power plants must continue to operate without breaking. This is even more significant as the country hosts the largest amount of solar power generation in the world.

Key Market Players

Siemens Energy

Fimer Group

SMA Solar Technology AG

Delta Electronics, Inc

SunPower Corporation

Omron Corporation

Eaton Corporation plc

Emerson Electric Co.

Power Electronics S.L.

Hitachi Hi-Rel Power Electronics Private Limited.

Report Scope:

In this report, the Global Solar PV Inverter Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

Global Solar PV Inverter Market, By Inverter Type:

Central Inverters

String Inverters

Micro Inverters

Global Solar PV Inverter Market, By Power:

Residential

Commercial and Industrial (C&I)

Utility-scale

Global Solar PV Inverter Market, By Region:

North America

United States

Canada

Mexico

Asia-Pacific

China

India

Japan

South Korea

Indonesia

Europe

Germany

United Kingdom

France

Russia

Spain

South America

Brazil

Argentina

Middle East & Africa

Saudi Arabia

South Africa

Egypt

UAE

Israel

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Solar PV Inverter Market.

Available Customizations:

Global Solar PV Inverter Market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following

Solar PV Inverter Market – Global Industry Size, Share, Trends, Opportunity, and Forecast, 2018-2028 Segmented...

customization options are available for the report:

Company Information

Detailed analysis and profiling of additional market players (up to five).

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