

Concentrated Photovoltaic Market – Global Industry Size, Share, Trends, Opportunity, and ForecastSegmented By Product (Reflector and Refractor), By Concentration (Low and High), By Application (Utility and Commercial), By Region, By Competition Forecast & Opportunities, 2018-2028F

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### **Abstracts**

Global Concentrated Photovoltaic Market was valued at USD 982.46 million in 2022 and is anticipated to project robust growth in the forecast period with a CAGR of 9.61% through 2028. The increasing demand for centralized photovoltaic (CPV) applications is projected to drive growth in energy purchase agreements between private companies and electricity boards. The global CPV industry is expected to experience market competition, improved reliability, and enhanced efficiency in the coming years. Moreover, incentives and government subsidies aimed at achieving renewable energy objectives are likely to contribute to the growth of the global photovoltaic concentrator market. Cost efficiency and the utilization of renewable energy resources are anticipated to be the primary drivers of demand in the forecast period.

Key Market Drivers

High Energy Conversion Efficiency

One of the key drivers of the global concentrated photovoltaic (CPV) market is the technology's exceptional capability to achieve high energy conversion efficiency. CPV systems utilize optical components, such as lenses or mirrors, to concentrate sunlight onto small, high-efficiency solar cells called multi-junction solar cells. These specialized cells can convert a larger portion of incoming sunlight into electricity, resulting in



significantly higher conversion efficiencies compared to traditional photovoltaic (PV) systems.

The pursuit of greater energy conversion efficiency is a central focus in the renewable energy sector, and CPV stands out as a technology that can deliver outstanding results. With CPV systems achieving conversion efficiencies exceeding 40%, they offer the potential to generate more electricity from a given amount of sunlight, making CPV an attractive choice for regions with limited available land or a need for high electricity output.

The drive to maximize energy production while minimizing land use and environmental impact positions CPV as a leading technology for utility-scale solar installations and grid integration. The quest for even higher conversion efficiencies continues to drive research and innovation in CPV, propelling its growth in the global renewable energy market.

Increasing Demand for Clean and Sustainable Energy

The global shift towards clean and sustainable energy sources is a significant catalyst for the CPV market. Governments, businesses, and consumers increasingly acknowledge the imperative of reducing greenhouse gas emissions and transitioning away from fossil fuels to combat climate change. Solar energy, including CPV, plays a pivotal role in this transition.

CPV systems offer several sustainability advantages. Their high energy conversion efficiency enables them to generate more electricity with fewer solar cells, thereby reducing the environmental footprint associated with manufacturing and materials. Moreover, CPV's emission-free and air pollution-free electricity production aligns seamlessly with sustainability objectives.

Countries worldwide are establishing renewable energy targets and implementing policies and incentives to support the adoption of solar technologies, including CPV. These initiatives create a favorable environment for CPV market growth by encouraging investments in clean energy projects and contributing to the expansion of CPV installations.

As the demand for clean and sustainable energy sources continues to surge, CPV's position in the global energy landscape is expected to expand, reinforcing its role as a driving force in the renewable energy market.



Grid Integration and Energy Security

The demand for reliable and secure energy sources, alongside the objective of enhancing grid resilience, serves as a significant catalyst for the CPV market. CPV systems are well-suited for seamless grid integration, thanks to their remarkable ability to generate electricity efficiently during peak demand periods. This characteristic significantly contributes to energy security by mitigating the risk of power shortages during high-demand hours.

Moreover, CPV technology plays a vital role in bolstering grid stability. The exceptional energy conversion efficiency and rapid response capabilities of CPV systems make them invaluable assets in ensuring grid reliability, particularly when combined with energy storage systems. CPV technology enables a fine balance between supply and demand, granting grid operators greater control over electricity generation.

Furthermore, CPV excels in cross-border electricity interconnectors, which facilitate the exchange of electricity between nations, thereby improving energy security and market efficiency. Given its efficient electricity generation capabilities, CPV emerges as an attractive option for interconnector projects, especially in regions with abundant solar irradiance.

As governments and utilities worldwide prioritize the integration of grids and energy security, CPV technology emerges as a key driver of innovation and growth in the global renewable energy market. Its potential to enhance grid reliability and contribute to energy security aligns seamlessly with the evolving requirements of modern energy systems.

Key Market Challenges

Land and Space Requirements

Concentrated Photovoltaic (CPV) systems necessitate a significant amount of land or space to accommodate the concentrating optics and tracking systems that trace the sun's trajectory throughout the day. This requirement for land or space can present a challenge, especially in densely populated areas where available land is limited or costly.

In regions with competing land-use interests, like agriculture or urban development,



acquiring suitable sites for CPV installations can be demanding. Striking a balance between the imperative for renewable energy generation and other land-use priorities and environmental considerations demands meticulous planning and, in some instances, land-use policies that endorse renewable energy projects.

Moreover, the need for extensive land or space can curtail the scalability of CPV projects in certain locations. Tackling this challenge may involve the development of innovative CPV designs that are more compact or exploring the integration of CPV with other land-use practices, such as agrivoltaics (the combination of agriculture and solar energy generation).

#### Variability in Solar Irradiance

CPV systems rely heavily on direct sunlight for optimal performance. While they excel in regions with high solar irradiance and clear skies, their efficiency can be significantly influenced by weather conditions, cloud cover, and shading. The variability in solar irradiance presents a challenge to the reliable and consistent operation of CPV systems.

In areas where weather patterns are unpredictable or cloud cover is frequent, CPV systems may experience fluctuations in electricity generation, leading to challenges in grid integration. Utilities and grid operators must consider this variability and develop strategies to manage the intermittent nature of CPV-generated power.

Mitigating the impact of variable solar irradiance may involve integrating energy storage systems to store excess electricity during sunny periods and dispatch it during cloudy or low-light conditions. Additionally, enhanced weather forecasting and advanced tracking technologies can optimize CPV system performance and grid integration.

#### Key Market Trends

Technological Advancements and Efficiency Improvements

A notable trend observed in the global concentrated photovoltaic (CPV) market is the continuous technological advancements and efficiency improvements in CPV systems. With the solar industry's ongoing pursuit of enhancing energy conversion efficiency, CPV has emerged as a focal point due to its potential to deliver higher efficiency compared to traditional photovoltaic (PV) systems.



CPV systems employ optical components, such as lenses or mirrors, to concentrate sunlight onto high-efficiency solar cells. This concentration of sunlight significantly enhances the electricity generation capability of CPV systems. Recent advancements in optical design, materials, and solar cell technology have resulted in significant improvements in CPV efficiency.

An area of key innovation lies in the design of advanced concentrator optics. Companies are actively developing more efficient and precise optical elements capable of concentrating sunlight onto small, high-efficiency multi-junction solar cells. These advancements have led to CPV systems achieving conversion efficiencies of 40% or higher, surpassing those of traditional PV systems.

Furthermore, improvements in tracking systems, which ensure accurate alignment of CPV modules with the sun's path throughout the day, contribute to enhanced energy yields. Advanced tracking technologies are becoming increasingly reliable, accurate, and cost-effective, enabling CPV systems to maintain optimal alignment with the sun.

Hybrid Systems and Energy Storage Integration

Hybrid systems that integrate CPV with other renewable energy technologies, such as energy storage or traditional PV, are a significant trend in the CPV market. These hybrid configurations offer several advantages, including enhanced grid integration, improved energy generation reliability, and the ability to provide electricity during periods of low sunlight.

One commonly adopted hybrid approach involves integrating CPV with energy storage systems, typically incorporating advanced batteries. Energy storage enables the storage and dispatch of excess electricity generated during sunny periods, effectively addressing the intermittency of solar power. This is particularly crucial for ensuring consistent power supply in off-grid and remote areas.

Moreover, CPV-photovoltaic hybrid systems that combine CPV and traditional PV technologies are gaining momentum. These systems leverage CPV's concentrating optics to optimize efficiency in sunny conditions, while relying on PV modules for stable and consistent power output under diffused or low-light conditions.

Segmental Insights

#### **Product Insights**

Concentrated Photovoltaic Market - Global Industry Size, Share, Trends, Opportunity, and ForecastSegmented By...



Based on the category of product, the Utility segment emerged as the dominant player in the global market for concentrated photovoltaic in 2022.

The utility sector within the global concentrated photovoltaic (CPV) market is a crucial and rapidly expanding segment for the deployment of CPV technology. Utility-scale CPV installations are typically large-scale solar power plants that generate electricity for the grid. Utility-scale CPV installations are specifically designed to generate a significant amount of electricity, with capacities ranging from several megawatts to hundreds of megawatts. These installations play a substantial role in contributing to the electricity grid.

To maximize energy production in sunny regions, utility-scale CPV systems utilize highefficiency multi-junction solar cells that can achieve conversion efficiencies exceeding 40%. Ongoing innovations in materials, manufacturing processes, and system design have contributed to cost reductions within the CPV market.

Furthermore, utility-scale CPV installations contribute to grid stabilization by providing consistent and predictable electricity generation during daylight hours. This is particularly significant in regions with a high share of intermittent renewable energy sources, such as wind and solar, in order to ensure grid reliability.

Moreover, utility-scale CPV installations offer emission-free electricity generation, contributing to the reduction of greenhouse gas emissions and air pollution. This aligns with global efforts to combat climate change and improve overall air quality.

#### **Product Insights**

The Refractor segment is projected to experience rapid growth during the forecast period. Refractors are optical elements, typically composed of transparent materials such as glass or acrylic, that refract or bend sunlight to achieve the desired concentration. They play a fundamental role in Concentrated Photovoltaic (CPV) systems by focusing sunlight onto solar cells. Refractors effectively refract incoming sunlight, altering its path to increase the intensity of light reaching the solar cells. This concentration of sunlight significantly enhances the energy conversion efficiency of CPV systems.

One common type of refractor utilized in CPV systems is the Fresnel lens. These lenses consist of concentric grooves or ridges on a flat surface, enabling them to effectively



concentrate sunlight. Renowned for their compact design, Fresnel lenses are frequently employed in CPV applications. Continual research and development efforts within the CPV industry aim to enhance refractor efficiency. Innovations in refractor design, materials, and manufacturing techniques contribute to achieving higher concentration ratios and overall system performance improvements.

While refractors are crucial for CPV efficiency, cost-effectiveness remains a significant consideration. Manufacturers are continuously striving to develop refractor solutions that meet optical performance requirements without significantly increasing the overall system cost.

The environmental impact of refractors is garnering increased attention. Manufacturers are exploring the use of recyclable materials and sustainable production processes to reduce the environmental footprint of refractors employed in CPV systems.

#### **Regional Insights**

Asia Pacific emerged as the dominant player in the global concentrated photovoltaic market in 2022, holding the largest market share.

The Asia-Pacific region plays a significant role in the global concentrated photovoltaic (CPV) market owing to its increasing energy demands, growing emphasis on renewable energy, and rapid expansion of the solar industry. The Asia-Pacific region is home to populous countries, including China and India, which are experiencing rapid urbanization and industrialization. Consequently, there is a substantial and rising demand for electricity in the region. This demand, coupled with a growing interest in clean energy solutions, presents significant growth potential for the CPV market.

Numerous countries in the Asia-Pacific region possess abundant solar resources, including high levels of direct sunlight. These favorable conditions make CPV an attractive option for electricity generation. CPV systems are renowned for their efficiency in converting sunlight into electricity, making them a suitable choice for harnessing solar energy in this region.

Several countries in the Asia-Pacific region have implemented supportive policies and incentives to promote the adoption of renewable energy technologies, including CPV. These policies often include feed-in tariffs, tax incentives, and renewable energy targets, which encourage investments in CPV projects.



The Asia-Pacific region is witnessing an increasing interest in high-efficiency solar technologies. CPV's ability to achieve higher conversion efficiencies compared to traditional photovoltaic systems aligns with the region's pursuit of more efficient and cost-effective renewable energy solutions.

Some projects in the Asia-Pacific region are exploring hybrid solar solutions that combine CPV with other solar technologies or energy storage systems. These combinations can enhance energy generation reliability and grid integration.

Key Market Players

Radical Sun Systems, Inc.

SolAero Technologies Corp.

Arzon Solar LLC.

Cool Earth Solar

Morgan Solar Inc.

ARIMA Group

Suncore Photovoltaic Technology Company Limited

Sumitomo Electric Industries, Ltd.

Saint-Augustin Canada Electric Inc. (STACE)

Sanan Optoelectronics Technology Co., Ltd

Report Scope:

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

Concentrated Photovoltaic Market, By Product:



#### Reflector

Refractor

Concentrated Photovoltaic Market, By Concentration:

Low

High

Concentrated Photovoltaic Market, By Application:

Utility

Commercial

Concentrated Photovoltaic Market, By Region:

North America

United States

Canada

Mexico

Europe

France

United Kingdom

Italy

Germany

Spain

Asia-Pacific



China

India

Japan

Australia

South Korea

South America

Brazil

Argentina

Colombia

Middle East & Africa

South Africa

Saudi Arabia

UAE

Competitive Landscape

Company Profiles: Detailed analysis of the major companies present in the Global Concentrated Photovoltaic Market.

Available Customizations:

Global Concentrated Photovoltaic market report with the given market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:



**Company Information** 

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



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