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Global Photovoltaics Market Assessment, By Type [Monocrystalline Silicon, Polycrystalline Silicon, Thin Film Cells, and Organic PV], By Grid Type (On grid, Off grid, and Hybrid), By Installation [Ground Mounted, Roof Mounted, Building-integrated Photovoltaics, & Floating Photovoltaics], By Application [Solar Farms, Electronic Devices, Healthcare Facilities, Public Infrastructure, Aerospace, Construction, Military and Defence, Transportation, and Others], By End-User [Residential, Commercial & Industrial, and Utility], and By Region, Opportunities, and Forecast, 2018-2032F

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Abstracts

Global Photovoltaics Market has experienced burgeoning growth in recent years and is expected to grow significantly in the coming years as well. The global photovoltaics market size was valued at USD 100.17 billion in 2024 which is expected to reach USD 234.04 billion in 2032 growing at 11.19% CAGR for the forecast period between 2025 and 2032. This growth could be attributed to growing environmental concern regarding energy production as nations across the globe strive to decarbonize the energy, industrial and commercial sectors. More than 70 countries including China, the US, and nations of the European Union have set a net-zero target which aims to cut down greenhouse gas emissions to as close as zero by 2050. Hence, countries across the globe are promoting sustainable and clean energy production to meet clean energy demand for different end-users like the residential sector, manufacturing, government

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operations, etc. For instance, in 2022, the U.S. launched a Net-zero government initiative which aims to cut down emissions resulting from government operations and public infrastructure. This initiative is further joined by 18 countries like Australia, France, Germany, etc. Therefore such initiatives would help governments meet its energy demand through clean energy like solar energy. Hence surging demand for solar energy is amplifying the need for photovoltaics globally to increase solar energy production. For example – In January 2023, China's National Energy Administration revealed that China installed 87 gigawatts (GW) of Solar PV capacity in 2022 indicating 59% increase on year-over-year (y/y) basis. Therefore, the increasing demand from nations across the globe is accelerating the remarkable growth of the Global Photovoltaic Market to all new heights.

Strategic Investments in Emerging Markets Fueling PV Growth

A notable trend in the PV industry is the strategic investment in emerging markets to establish manufacturing facilities. Companies are increasingly recognizing the benefits of setting up operations in countries with favorable investment climates, abundant renewable energy resources, and advantageous trade policies. This approach not only diversifies supply chains but also mitigates risks associated with geopolitical tensions and trade restrictions.

In October 2024, TOYO Co., Ltd announced plans to establish a 2-gigawatt solar cell manufacturing plant in Hawassa, Ethiopia. The $60 million investment aims to leverage Ethiopia's favorable investment policies and renewable energy resources to produce solar cells primarily for the U.S. market. The facility is expected to begin production by the end of the first quarter of 2025, creating approximately 880 jobs in the region.

Technological Advancements Paving Way for Global Photovoltaics Market

Technological advancements are a major driver of the global photovoltaics market. Innovations such as bifacial solar panels, which capture sunlight from both sides, and perovskite tandem solar cells, which combine traditional silicon with cutting-edge materials, have significantly increased energy efficiency and reduced production costs. These advancements make solar power more competitive with other energy sources, driving higher adoption rates. Enhanced manufacturing techniques and improved panel designs also contribute to longer-lasting and more efficient solar systems. These technological breakthroughs attract substantial investments and facilitate the development of large-scale solar projects, ultimately accelerating the growth of the global photovoltaics market.

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For example, in January 2024, MIT published an article regarding the development of perovskite tandem solar cells. Combining traditional silicon with cutting-edge perovskites, these cells have achieved over 33% efficiency in the lab, far surpassing that of silicon-only cells. Perovskites absorb different wavelengths of light, allowing for more electricity generation per cell. Companies like Oxford PV are rapidly improving this technology, aiming to commercialize high-efficiency perovskite tandem panels. Such advancements make solar power more efficient and affordable, accelerating the growth of the global photovoltaics market.

Surging adoption of BIPV Systems

Globally, there is increasing demand for BIPV cells owing to the growing global real estate market coupled with increased demand for sustainable solutions to meet solar energy demand in buildings. Hence real estate developers are seeking BIPV solutions due to their numerous benefits that aid in integration of solar energy solutions on buildings. Furthermore, according to 2022 report by International energy agency, in 2021 the operation of buildings accounted for almost 30% of global energy consumption and 27% of total energy sector emissions which signifies the extent to which energy consumption takes place in buildings. Hence, in order to meet the energy demands of buildings, harnessing solar energy through photovoltaics is increasingly recognized as a practical solution, either in full or partial capacity. A notable emerging trend is the adoption of building-integrated photovoltaic (BIPV) systems, which not only enhance the visual appeal of buildings but also fulfill their energy requirements.

In addition to their aesthetic and electricity-generating benefits, BIPV systems function as integral components of buildings, effectively reducing solar heat gain while allowing ample daylight to penetrate into the interior spaces. Hence the demand for BIPV cells has witnessed a significant rise in recent years which in turn contributed to increased sales of Thin Film PV cells. Therefore, rising demand for BIPV cells is expected to drive the demand for the Thin Film cells segment in the coming years as well.

Crystalline Silicon Solar PV Panels Dominate

The dominance of crystalline silicon photovoltaic (PV) technology in the global PV market has been attributed to its superior qualities, which include high efficiency, reliability, and comparatively low manufacturing costs. Crystalline silicon solar panels, specifically monocrystalline and polycrystalline types, have been widely favored by consumers over an extended period. Polycrystalline silicon panels are composed of

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numerous crystals, while monocrystalline silicon panels are formed from a single crystal structure. However, both variants employ silicon as the semiconductor material to convert sunlight into electrical energy. The continuous advancements in crystalline silicon technology have been the primary driving force behind the robust growth of the solar PV market worldwide. These advancements have yielded notable improvements in panel efficiency, manufacturing cost reduction, and overall performance enhancement. Consequently, solar PV systems utilizing crystalline silicon panels have become increasingly cost-effective and accessible to a broader customer base, encompassing residential, commercial, and utility-scale installations.

Asia-Pacific Accounted for the Major Market Demand

Asia-Pacific is driving the demand for solar PV panels. This is due to a combination of factors, including government policies, rising electricity demand, and falling costs. Government policies in many Asian countries promote the use of solar energy by providing subsidies and tax breaks to businesses and consumers who install solar panels. The demand for electricity is also rising rapidly in Asia-Pacific, and solar PV panels are a clean and renewable source of energy that can help to meet this rising demand.

Finally, the cost of solar PV panels has fallen significantly in recent years, making them more affordable and accessible to businesses and consumers in Asia-Pacific. According to the Office of energy efficiency & renewable energy 2023 report, In the first 9 months of 2022, solar photovoltaic (PV) installations increased significantly in China (106%) and India (51%) on year-on-year basis. Hence, the Asia-Pacific is expected to provide lucrative opportunity for market expansion in the coming years as well owing to the rising demand for photovoltaics market.

Government Initiatives

Governments worldwide are taking major initiatives for enhancing the market growth of photovoltaics. From providing financial incentives to consumers adopting solar PV panels to manufacturers for scaling up production, governments across globe have ramped up efforts to support market growth. Furthermore, apart from promoting awareness and educating the public regarding the benefits of harnessing solar energy, governments are investing in research and development to improve the efficiency and cost-effectiveness of photovoltaics as well. This investment is helping to drive down the cost of solar power, making it more competitive with traditional forms of energy. It’s estimated by the experts that these initiatives will in turn yield a massive benefit as far

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as the market expedition is concerned.

Few of the notable initiatives by government across globe are The European Union Solar PV Industry Alliance in which the Commission embraced the establishment of a fresh European Solar PV Industry Alliance to bolster the goals outlined in the EU's Solar Energy Strategy. This strategy aims to deploy over 320 GW of solar photovoltaic capacity by 2025 and nearly 600 GW by 2030. On December 9, 2022, the Commission, in collaboration with industrial players, research institutes, associations, and other pertinent entities, officially launched the European Solar PV Industry Alliance.

Apart from this alliance, even US government have ramped up efforts in terms of providing financial incentives for example, federal incentives which encompass various tax credits such as the Renewable Electricity Production Tax Credit (PTC), the Investment Tax Credit (ITC), the Residential Energy Credit, and the Modified Accelerated Cost-Recovery System (MACRS) for eligible renewable energy projects and equipment. Additionally, grant and loan programs may be accessible through government agencies like the U.S. Department of Agriculture, the U.S. Department of Energy (DOE), and the U.S. Department of the Interior. It is worth noting that numerous states also offer their own financial incentives to incentivize the production and adoption of renewable energy.

Impact of COVID-19

During the COVID-19 pandemic, lockdown measures and restrictions on international trade led to disruptions in the supply chain, causing delays in the delivery of PV modules, inverters, and other components. This affected the installation timelines of PV projects worldwide, thereby slightly reducing the demand and overall shipment of PV cells, globally. Nevertheless, while overall global demand may have declined, there were specific regions where PV demand increased or remained resilient. For instance, in 2020, China's newly installed grid-connected photovoltaic capacity reached 48.2GW, a year-on-year increase of 60.1%, of which the installed capacity of centralized photovoltaic power plants was 32.7GW, a year-on-year increase of 82.68%. Similarly, in countries like Poland and other nations of Europe witnessed surging demand for PV modules. This could be primarily due to increased interest in decentralized energy systems, including PV installations, to reduce reliance on centralized power generation and grid infrastructure. In regions where energy security was a concern, such as remote areas or island communities, PV installations gained popularity and supported the market growth. Therefore, due to the COVID-19 pandemic supply chain disruption might have impacted the overall market development, however also fueled the market growth

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in some geographies like North Europe, Central Asia, etc.

Key Players Landscape and Outlook

The photovoltaics industry is composed of various players who contribute to the development, manufacturing, distribution, and installation of photovoltaic systems. Most of the companies operating in this industry are focusing on the development of rooftop solar panels owing to the declining costs of solar PV technology and the growing adoption of rooftop solar PV made up of crystalline silicon by end users. Moreover, Rooftop solar PV installations have experienced remarkable demand globally, numerous countries have witnessed a surge in residential, commercial, and industrial rooftop solar installations. Hence, most companies operating in this market are focused on working economies of scale and innovative rooftop solar PV modules. For instance,

> In March 2022, Canadian Solar Inc. commenced large-scale production of a new module in a 54-cell format, featuring 182 mm cells, intended for residential, commercial, and industrial rooftop solar systems. The shipment of these modules has already commenced this month. This new module, known as CS6R-MS, belongs to the HiKu6 series and boasts a power output of up to 420 W and module efficiency of up to 21.5%. It is specifically designed for rooftop solar applications, offering a compact module size (1.95 m? x 30 mm), light weight (21.3 kg), and an aesthetically pleasing design for a consistent appearance. Canadian Solar offers a wide range of solar modules, both bifacial and mono-facial, with power outputs ranging from 400W to 670W for customers worldwide.

> In March 2022, Residential solar company SunPower Corp. planned to jointly develop a panel aimed specifically at home rooftops with First Solar Inc., the largest manufacturer of solar panels. First Solar would produce the panels, and SunPower would be the exclusive provider. The panels would incorporate thin-film solar technology along with the more widely used crystalline silicon in an effort to capture more of the sun’s energy.

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Contents

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6. GLOBAL PHOTOVOLTAICS MARKET OUTLOOK, BY REGION, 2018-2032F

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