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Thin Film Photovoltaics Market Assessment, By Type [Cadmium Telluride, Amorphous Silicon, Copper Indium Gallium Selenide, Perovskite, Organic PV, Copper Zinc Tin Sulfide, Others], By Installation [On-grid, Off-grid], By End-user [Residential, Commercial, Industrial], By Region, Opportunities and Forecast, 2016-2030F

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Abstracts

Global thin film photovoltaics market has experienced significant growth with the revenue of approximately USD 7.34 billion in 2022, forecasted to reach a projected value of USD 19.1 billion by 2030, displaying a robust CAGR of 12.7% from 2023 to 2030.

Thin film photovoltaics possess numerous advantages such as flexibility, lightweight construction, minimal material consumption, cost-effectiveness, adaptability to different surfaces, and reliable performance under low-light conditions. These attributes render them suitable for a wide range of applications, including building-integrated solar panels, portable devices, and remote power generation.

The thin film photovoltaics market experiences growth driven by several factors. Technological enhancements, including increased energy conversion efficiency, boost market appeal. Growing demand for sustainable energy sources and continuous cost reductions and scalability enhance competitiveness, further driving thin film photovoltaics market expansion.

Through groundbreaking research at MIT, thin film photovoltaics have emerged as a cost-effective and versatile solar energy solution. These ultrathin solar cells, one-

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hundredth the weight of conventional photovoltaics, offer exceptional lightweight characteristics. Their adaptability extends to diverse surfaces, including roofs, boat sails, drone wings, and tents. Innovative solar cell structures and materials enable enhanced performance, particularly in low-light conditions, mitigating traditional solar panel limitations of weight and fragility. This technological advancement significantly advances the thin film photovoltaics market, enhancing accessibility, scalability, and efficiency in solar power generation, thereby addressing critical industry challenges.

For instance, in September 2023, Ascent Solar Technologies, Inc. increased its CIGS solar technology efficiency from 10.8% to 15.2% through enhanced manufacturing processes and eliminating hazardous materials, showing potential for broader thin-film photovoltaics adoption.

Reduced Carbon Footprint Contribute to the Market

The thin film photovoltaics market is experiencing significant growth due to its vital role in reducing carbon emissions. As the global focus shifts toward sustainable energy sources, there's a heightened emphasis on environmental accountability and diminished greenhouse gas output. Thin film technology inherently has a lower carbon footprint, making it a sustainable choice. It aligns with eco-conscious consumers and government initiatives promoting renewable energy. With the escalating demand for cleaner energy alternatives, manufacturers and investors are increasingly attracted to thin film photovoltaics. It propels thin film photovoltaics market expansion and stimulates investments in research and development to enhance the technology's efficiency and sustainability.

For example, in December 2022, MIT engineers developed ultra-thin, lightweight fabric solar cells that can be attached to various surfaces. These flexible, durable solar cells are one-hundredth the weight of traditional panels, generating 18 times more power-per-kilogram, and can be used in wearables, emergency deployments, and more.

Energy Storage Integration Fuels the Growth of Thin Film Photovoltaics Market

The integration of energy storage plays a pivotal role in bolstering the growth of the thin film photovoltaics market, elevating its adaptability and dependability. The seamless pairing of thin film solar panels with energy storage systems, such as batteries, renders them an enticing choice for off-grid and remote areas where a steady power source is imperative. It broadens the scope of potential applications for thin film photovoltaics, extending their market presence beyond grid-tied installations. Furthermore, it

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effectively addresses the intermittent issues associated with solar power generation, assuring continuous energy supply throughout day and night. Consequently, this integrated approach garners broader consumer and industry appeal, fostering increased adoption and thin film photovoltaics market expansion.

For example, in May 2023, Oxford PV, a leader in next-gen solar cells, achieved a new world record for commercial-sized solar cell efficiency at 28.6%, using perovskite atop silicon. This 'perovskite-on-silicon' tandem cell surpasses mainstream silicon-only cells, signifying a significant step toward a low-carbon global economy.

Dominance of Cadmium Telluride in Thin Film Photovoltaics Market

Cadmium telluride is a leading technology in the thin film photovoltaics market. Cadmium telluride thin film solar panels excel in cost-efficiency, demanding fewer materials and presenting a relatively straightforward manufacturing process. They deliver impressive energy conversion efficiency, comparable to traditional silicon-based panels. Additionally, these Cadmium telluride panels exhibit exceptional performance in low-light conditions, making them adaptable to diverse geographic locations. Their robustness, scalability, and potential for large-scale production have firmly established cadmium telluride as a prominent choice, effectively meeting the demand for economical, dependable, and high-efficiency solar power solutions.

For instance, in August 2023, The U.S. Department of Energy introduced the Cadmium Telluride Accelerator Consortium (CTAC) with the goal of progressing cadmium telluride thin-film solar cell technology to attain increased efficiency and reduced manufacturing expenses, thereby supporting the growth of the U.S. cadmium telluride PV market.

Asia-Pacific Dominates Thin Film Photovoltaics Market

Asia-Pacific has a prominent position in the thin film photovoltaics market, primarily due to its substantial manufacturing infrastructure, notably in countries such as China and Japan, renowned for their leadership in thin film technology production. These nations leverage cost-effective production capabilities, thereby contributing to the affordability of thin film panels. Additionally, several areas within the Asia-Pacific enjoy high solar irradiance levels, rendering them optimally for solar installations. Government incentives, burgeoning energy demand, and heightened emphasis on sustainability serve to incentivize the adoption of thin film photovoltaics further, thus solidifying the region's dominance in this market.

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For instance, in March 2023, Sharp Energy Solutions Corporation (SESJ) and Sustech Inc. are collaborating to develop a non-FIT power generation business, focusing on Power Purchase Agreements (PPA) in Asia and Japan, addressing the need for non-FIT power sources.

Government Initiatives Acting as Catalyst

The funding initiative by the U.S. Department of Energy's (DOE) Solar Energy Technologies Office (SETO) is pivotal in advancing the thin film photovoltaics market. With an allocated budget of up to USD 36 million in June 2023, this initiative is specifically tailored to stimulate research, development, and demonstration projects in two significant thin-film PV technologies: industrial perovskite PV and cadmium telluride PV. By extending financial support to for-profit lead applicants, the government actively encourages innovation and investment in these technologies. It expedites the commercialization of thin film PV and propels enhancements in efficiency, reliability, manufacturability, and economic viability, heightening the competitiveness in thin film photovoltaics market and contributing to the expansion of the renewable energy market.

Impact of COVID-19

The onset of COVID-19 pandemic initially disrupted the global energy landscape, causing economic difficulties and diminished investments in renewable energy, including the thin film photovoltaics market. Nevertheless, due to lockdowns and reduced industrial activities, an unforeseen positive consequence emerged in a substantial reduction in air pollution, particularly in countries like Italy, France, and India. This cleaner air environment subsequently bolstered the efficacy of solar energy generation, thereby accelerating the adoption of thin film photovoltaics. Consequently, these technologies have assumed a critical role in the worldwide shift towards sustainable energy sources, underscoring their resilience and significance in addressing environmental pollution and reducing dependence on fossil fuels in a post-pandemic era.

Future Market Scenario (2024 – 2030F)

Progress in manufacturing processes and materials is expected to reduce the production costs of thin film solar panels, rendering them a cost-efficient choice for a broader spectrum of applications.

As developing nations contend with increasing energy demands, the adoption of thin

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film photovoltaics is expected to rise as an affordable and sustainable solution for power generation.

Advancements in wireless power transfer using photovoltaic cells could open the door to fresh applications in energy distribution and galvanically isolated power supplies.

Thin film photovoltaics could become a standard feature in a variety of products, ranging from smart clothing to consumer electronics, further propelling the market growth.

Key Players Landscape and Outlook

The global thin film photovoltaics market is characterized by vigorous activity and fierce competition, spearheaded primarily by industry giants such as Panasonic Corporation, First Solar, Inc., SunPower Corporation, Ascent Solar Technologies, Inc., and JA Solar Technology Co., Ltd. These prominent players lead the way in continuous technological innovation, propelling the market expansion. An unwavering pursuit of heightened efficiency, cost-efficiency, and sustainability defines the landscape. With the global shift towards renewable energy gathering momentum, the market's prospects appear optimistic, with a strong focus on broadening applications, reducing costs, and integrating thin film photovoltaics across diverse sectors, including construction, transportation, and consumer electronics.

In May 2023, First Solar bolstered its position in thin film photovoltaics by acquiring Evolar AB, a European perovskite technology leader, in a deal valued at up to USD 80 million. This purchase is set to expedite next-gen PV technology, including high-efficiency tandem devices, by integrating Evolar's expertise with First Solar's research and development efforts, IP portfolio, and thin film PV experience, furthering their commitment to eco-friendly solar energy.

In April 2023, Ascent Solar Technologies, Inc. acquired the manufacturing assets of Flisom AG, thereby expanding its production capacity by 300%, establishing a global presence. The move is aligned with increasing emphasis on solar energy in Europe and Asia, which contributed to the company's revenue stream and international footprint.

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