Thermophotovoltaics Market Set to Reach $400.2 Million by 2032, Driven by Clean Energy Demand

Rising Energy Efficiency Goals Propel Growth of Thermophotovoltaics Industry Globally

WILMINGTON, DE, UNITED STATES, August 26, 2025 /EINPresswire.com/ --

According to a new report by Allied Market Research, the thermophotovoltaics market size was valued at $120.3 million in 2022 and is projected to reach $400.2 million by 2032, growing at a CAGR of 12.8% from 2023 to 2032.

Thermophotovoltaics (TPV) is an advanced technology that converts thermal radiation into electricity using photovoltaic cells. These systems are composed of emitters, filters, photovoltaic cells, and heat sources, offering high energy conversion efficiency and compatibility with various thermal inputs. As the global energy sector shifts toward sustainability, TPV has emerged as a promising solution for clean power generation.

> Thermophotovoltaics market to hit $400.2M by 2032, growing at 12.8% CAGR, fueled by clean energy demand & industrial waste heat recovery.”
>
> *Allied Market Research*

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Key Findings

Crystalline photovoltaic cells expected to continue leading the market.

Solar applications account for more than two-thirds of market share.

Asia-Pacific remains the fastest-growing consumer region.

R&D and strategic collaborations are essential for overcoming efficiency and cost challenges.

 Drivers of Thermophotovoltaics Market Growth

Rising Climate Concerns Increasing global pressure to cut carbon emissions has accelerated investments in renewable energy. TPV's ability to convert waste heat into usable power makes it a key contributor to sustainable energy solutions.

Industrial Waste Heat Recovery Industries such as power plants, manufacturing, and residential heating systems generate significant waste heat. TPV systems capture this energy, improving efficiency and reducing dependency on fossil fuels.

Energy Security & Decentralization TPV enables distributed power generation, reducing reliance on centralized grids. This is especially valuable for industries and regions seeking energy independence and cost savings.

Military Applications TPV systems are gaining traction in defense due to their ability to power unmanned vehicles, surveillance systems, and remote sensing devices. By utilizing waste heat from military equipment, TPV enhances mission endurance and operational capability.

 Market Challenges

Despite opportunities, TPV adoption faces hurdles such as:

Complex system design and need for advanced materials.

High manufacturing costs compared to traditional systems.

Efficiency limitations and challenges in thermal management.

Ongoing R&D efforts, government incentives, and industry-academic collaborations are expected to address these barriers, paving the way for wider commercialization.

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 Thermophotovoltaics Market Segmentation

By Type:

Silicon Photovoltaic Cells – Dominated the market with nearly 50% share, due to cost-

effectiveness and large-scale commercialization.

Crystalline Photovoltaic Cells – Emerging as a global leader with strong efficiency performance.

Thin Film Photovoltaic Cells & Others – Used in specialized applications requiring flexibility.

By Application:

Solar Energy – Largest application segment, holding three-fifths of global revenue, driven by integration with existing renewable facilities.

Nuclear & Thermal Power Plants – Harness TPV to improve efficiency and recover waste heat.

Military & Defense – Compact, portable energy solutions for tactical operations.

Off-Grid Generators & Portable Electronics – Expanding applications in remote energy supply.

By Region:

Asia-Pacific – Dominates the global market, with more than 50% share in 2022. Rapid urbanization, population growth, and renewable energy policies in China and India fuel demand.

North America & Europe – Growing adoption in industrial and defense sectors.

LAMEA – Emerging markets showing increasing interest in sustainable power solutions.

 Geopolitical & Economic Impacts

Russia-Ukraine Conflict

Disruptions in supply chains may affect TPV production.

Shifts in global energy markets could influence competitiveness.

Geopolitical uncertainty may delay investments in emerging technologies.

Global Recession

Economic slowdowns may reduce funding for R&D in TPV.

Companies may delay or cancel projects due to financial instability.

However, governments' long-term clean energy targets remain a positive driver.

 Competitive Landscape

Key players shaping the thermophotovoltaics industry include:

MicroLink Devices

Azur Space Solar Power

Spectrolab

Schott AG

Alta Devices

Tesla Energy

Acciona SA

Abengoa Solar GmbH

BrightSource

ACWA Power

These companies focus on new product development, partnerships, acquisitions, and capacity expansion to strengthen their global presence.

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 Conclusion

The thermophotovoltaics market presents a transformative solution in the global clean energy landscape. With its ability to convert waste heat into electricity, TPV technology offers immense potential for industrial, military, and renewable applications. Despite cost and design challenges, rapid technological advancements, geopolitical energy shifts, and rising demand for sustainable power solutions are set to propel TPV adoption worldwide. By 2032, the market is projected to more than triple in value, solidifying its role as a critical enabler of energy efficiency and carbon reduction goals.

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David Correa
Allied Market Research
+ +1 800-792-5285
email us here
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X