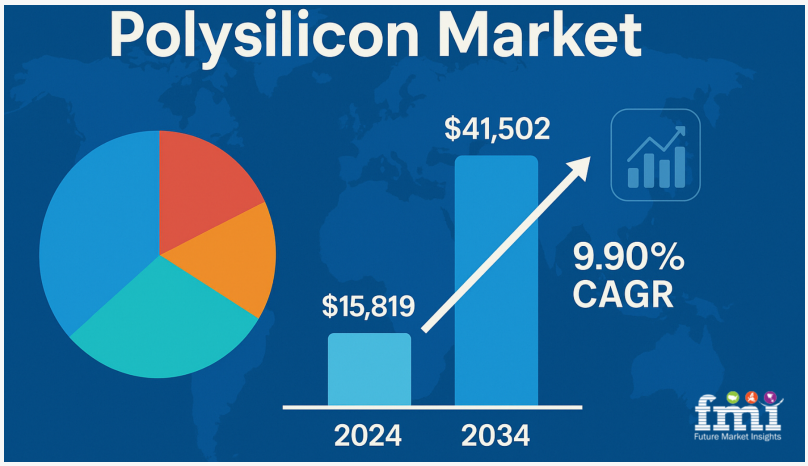
Metallurgical Grade Polysilicon: The Underrated Driver of Low-Cost Solar and Emerging Semiconductor Applications

Metallurgical grade polysilicon is gaining ground as a cost-effective, strategic material in solar and semiconductor markets, especially in emerging economies.



Polysilicon Market

NEWARK, DE, UNITED STATES, May 2, 2025 /EINPresswire.com/ -- With an initial forecast of USD 15,819.00 million in 2024, the sales revenue of polysilicon is vouching a considerable rise to USD 41,502.20 million by 2034. After a thorough survey, the polysilicon market sales reflect an upward trajectory from 2024 to 2034, inferring a healthy growth rate of 9.90%.

The augmentation in polysilicon adoption from the solar power segment escalates the poly-Si market growth. The surging demand for polysilicon for myriad commercial uses, comprising manufacturing of multi-crystalline solar panels and others, and the innovation and expansion of diverse end-use industries in emerging economies directly influence the polycrystalline silicon market's growth rate.

> While often overlooked, MG-Si is becoming vital in decentralizing solar manufacturing and supporting non-critical semiconductor needs, particularly where cost and supply risks dominate."
>
> *Nikhil Kaitwade, Associate Vice President at Future Market Insights*

Understanding Metallurgical Grade Polysilicon and Its Technical Composition

Metallurgical grade polysilicon typically contains around 98-99% silicon, compared to the ultra-high purity required in solar (99.9999%) and semiconductor (99.9999999%) grades. Produced through carbothermic reduction in electric arc furnaces, MG-Si retains higher levels of impurities such as iron, aluminum, and carbon, making it

historically unsuitable for high-efficiency applications. However, ongoing innovations in material blending and process optimization are beginning to blur these lines. In certain contexts, especially where tolerance thresholds are more flexible, MG-Si is now being evaluated for its utility and economic feasibility.

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Its coarse particle structure, lower processing cost, and high thermal stability make it ideal for applications that can tolerate slight variations in purity without compromising performance. While not a replacement for high-purity silicon in core electronics, MG-Si is increasingly being used as a feedstock in processes that further purify or adapt it for specialized roles.

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One of the most intriguing developments is the use of MG-Si in affordable solar panel production. In regions like Southeast Asia and sub-Saharan Africa, where electrification efforts are often constrained by budgetary limitations, manufacturers have started incorporating MG-Si as a component in multicrystalline solar wafer fabrication. While the resulting panels may not achieve the efficiency of their monocrystalline counterparts, they meet the functional requirements for basic residential and agricultural electricity needs.

For instance, a study conducted by a renewable energy initiative in Kenya revealed that solar modules made with MG-Si blends, while achieving only 14-15% efficiency, had cost savings of up to 40% compared to conventional panels. The lower capital cost and reduced dependency on imported materials make these modules viable for mass deployment in rural areas. Furthermore, the ease of local production using MG-Si aligns with efforts to build indigenous renewable energy industries.

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The semiconductor industry, long reliant on hyper-pure silicon, is now witnessing a nuanced shift. As the demand for semiconductors expands beyond high-performance computing and mobile devices into more ubiquitous, cost-sensitive markets, the need for ultra-pure silicon is not universal. Applications such as automotive sensors, HVAC control chips, smart meters, and basic display drivers often operate within broader performance tolerances.

Manufacturers in countries like India and Brazil have begun experimenting with lower-grade silicon—including refined forms of MG-Si—as a substrate material for such non-critical applications. These adaptations are not only technically viable but also economically strategic, particularly in emerging economies looking to reduce dependency on imports of ultra-high-purity silicon wafers from China, Japan, and the USA.

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The post-pandemic period exposed significant vulnerabilities in global silicon supply chains. Prices for solar-grade polysilicon surged nearly 300% between 2020 and 2022 due to factory shutdowns and raw material shortages. In response, manufacturers began exploring alternative feedstocks and process technologies to insulate themselves from future shocks.

MG-Si emerged as a feasible solution in this context. Its production is less energy-intensive and capital-heavy than the Siemens process used for solar-grade silicon. Moreover, localized MG-Si production helps mitigate risks associated with shipping delays and geopolitical tensions. In India, for example, state-backed programs are supporting local MG-Si production as part of broader Make-in-India solar initiatives, recognizing its potential role in securing domestic PV module manufacturing.

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The market is somewhat fragmented and presents favorable circumstances to major polysilicon manufacturers and startups, but high investment expenditures curb entry to small or novel poly-Si vendors. Polysilicon producers emphasize strengthening their production ability across diverse regions to satisfy spurring demand from developing countries with significant production.

Noteworthy Developments

- Daqo New Energy Corp., a polysilicon producer based in China, commenced its pilot production at a novel factory in December 2021. The production plant was anticipated to produce 35,000 tonnes of polysilicon per year initially and then slowly rise to 105,000 tonnes yearly.
- In May 2021, REC Silicon ASA, a polysilicon and silicon gas supplier headquartered in Norway, announced the restart of its Lake Moses Plant in Washington - in 2023. Earlier the plant was shut down in May 2019 over the imposition of tariffs by China on polysilicon manufactured by the United States.

Essential Polycrystalline Silicon Manufacturers

- Wacker Chemie AG
- OCI Company Ltd.
- GCL-Poly Energy Holdings Limited
- TBEA Co. Ltd
- REC Silicon ASA.
- CSG Holdings Co. Ltd.

- Tokuyama Corporation
- Daqo New Energy Co. Ltd.
- Mitsubishi Materials Corporation
- Hanwha Chemical Co. Ltd
- Asia Silicon
- Osaka Titanium Technologies Co. Ltd.
- Qatar Solar Technologies
- Hemlock Semiconductor Corporation

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By Grade Type:

- Solar Grade
- Electronics Grade

By Region:

- North America
- Latin America
- Europe
- East Asia
- South Asia and Pacific
- Middle East and Africa (MEA)

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Future Market Insights Inc.
Christiana Corporate, 200 Continental Drive,
Suite 401, Newark, Delaware - 19713, USA
T: +1-347-918-3531
For Sales Enquiries: sales@futuremarketinsights.com
Website: https://www.futuremarketinsights.com
LinkedIn| Twitter| Blogs | YouTube

Ankush Nikam
Future Market Insights Global & Consulting Pvt. Ltd.
+ +91 90966 84197
email us here
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