



Johannes Bernreuter

The Polysilicon Market Outlook **2024**

Technologies · Capacities · Supply · Demand · Prices

Your Polysilicon Market Guide

A major shakeout and the rapidly rising demand for mono-grade material have thoroughly reshaped the polysilicon industry in recent years. Do you want to be up to date on the latest technological developments, the decisive market trends and future price points? *The Polysilicon Market Outlook 2024* provides you with all of that. The 76-page report analyzes hundreds of data and details, presents them in a clear and compact form and draws insightful conclusions to help you navigate in a volatile market.

- ▶ The **introduction** explains how monocrystalline solar cells and modules could grab so much market share from the once dominant multicrystalline technology within just three years.
- ▶ The **technology** chapter analyzes why the prevalent Siemens process has remained unchallenged, how much progress fluidized bed reactor (FBR) technology for producing polysilicon granules has made to come out of its market niche, and what the fate of upgraded metallurgical-grade (UMG) silicon looks like.
- ▶ The **capacity** chapter provides a concise overview of plant shutdowns, capacity expansions and green-field projects. A comprehensive table lists all capacity additions and changes between 2016 and 2023.
- ▶ The **supply** chapter presents four different scenarios of production volumes and end-of-year capacities for 42 polysilicon plants from 2016 through 2024. It highlights the market shares of the top ten manufacturers, points out China's strongly growing influence among the world's polysilicon production regions, and reveals the increasing extent of industry concentration. In view of a U.S. draft bill against forced labor in Xinjiang, the chapter also quantifies the share of Xinjiang-based plants in global solar-grade polysilicon production. Finally, it details the production volumes of electronic-grade polysilicon for each manufacturer and explains purity specifications for electronic grade.
- ▶ The **demand** chapter quantifies the polysilicon demand of the semiconductor and photovoltaic (PV) industries from 2016 through 2024. It uses a bottom-up approach, based on forecasts for 29 countries and world regions, in order to arrive at three different scenarios of global PV demand. The 14 most important countries and regions have been surveyed individually. In particular, the chapter provides a wealth of data on market shares of various solar cell technologies, cell efficiencies, wafer thickness and kerf loss, which all influence the specific silicon consumption.
- ▶ The **balance** chapter reconstructs the supply/demand balance for electronic-grade polysilicon since 2009, compares the various demand scenarios with supply on the total polysilicon market through 2024, and takes a special look at how close the market-clearing scenario (no oversupply) came to actual PV installations in the past. In addition, the chapter presents a scenario of the polysilicon demand for high-efficiency n-type solar cells.
- ▶ The **duty** chapter provides background on the anti-dumping measures of the Chinese Ministry of Commerce and shows data from customs statistics to assess the effect of Chinese anti-dumping duties on polysilicon imports from 2010 through 2020.
- ▶ The **price** chapter examines the factors that have influenced the polysilicon spot price since 2017. Based on an analysis of industry cost curves, the chapter forecasts how the spot price will develop through 2024. It also provides data on cash production costs of 25 polysilicon plants from 2020 through 2024.



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Content Highlights

After three years of nearly stagnant demand, the polysilicon industry is entering a new phase of dynamic growth. As photovoltaic power plants have become the cheapest source of energy, global PV installations will increase in the coming years more rapidly than many think today. This will drive the demand for polysilicon.

While supply constraints are almost certain in 2021, there is a risk of upcoming oversupply in 2022, which will intensify in 2023. In order for the market to remain balanced, global PV installations would have to grow by 30% annually both in 2022 and 2023 to reach 270 GW in 2023. That is not impossible, but would require the PV market to speed up enormously. For 2020, Bernreuter Research expects an installation volume of 127 GW.

The huge polysilicon volumes will come from the massive capacity expansion of the big Chinese polysilicon manufacturers – led by Tongwei, which has superseded German incumbent Wacker as the world's largest producer in 2020. This expansion is fueled by the strongly rising demand for mono-grade polysilicon in general and the rapid growth of Longi and Zhonghuan Semiconductor, the two largest makers of monocrystalline solar wafers, in particular.

As a result, 14 small and medium-sized Chinese polysilicon companies, which mainly produced lower grade for multicrystalline wafers, were pushed out of the market between 2017 and 2019; in addition, all three South Korean polysilicon manufacturers have abandoned production of solar-grade material; U.S.-based REC Silicon has mothballed its plant and Hemlock Semiconductor has halved its production capacity. In total, the second shakeout wave in the polysilicon industry has eliminated a capacity of around 275,000 metric tons (MT), compared to 135,000 MT during the first wave between late 2010 and early 2013. Consequently, China's share in global polysilicon production – including electronic grade for semiconductors – has increased from little more than 50% in 2017 to nearly 75% in 2020.

Among the big Chinese players, GCL-Poly is boldly betting on fluidized bed reactor (FBR) technology to produce polysilicon granules in two new, large plants. It still remains to be seen if GCL can smoothly ramp up its new capacities. But no matter which scenario ultimately comes true, all the new Chinese low-cost plants will drive the polysilicon spot price down to values below US\$8 or even US\$7 per kilogram in 2022.

With the latest technology developments, individual production and cash cost data on more than 40 polysilicon plants, in-depth analysis of demand, sophisticated supply/demand scenarios and price forecasts through 2024, *The Polysilicon Market Outlook 2024* provides comprehensive, detailed and up-to-date information on the global markets for solar-grade and electronic-grade polysilicon.



About the author

Johannes Bernreuter, 55, is head of the polysilicon market research specialist Bernreuter Research. Before founding the company in 2008, Bernreuter became one of the most reputable photovoltaic journalists in Germany because of his diligent research, clear style and unbiased approach. He has earned several awards, among others the prestigious RWTH Prize for Scientific Journalism from the RWTH Aachen University, one of the eleven elite universities in Germany. Originally an associate editor at the monthly photovoltaic magazine Photon, Bernreuter authored his first analysis of the upcoming polysilicon bottleneck and alternative production processes as early as 2001. After preparing two global polysilicon market surveys for Sun & Wind Energy magazine in 2005 and 2006, he founded Bernreuter Research to publish in-depth polysilicon market reports.

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Companies covered

USA

Wacker Polysilicon North America
Hemlock Semiconductor
REC Silicon
Mitsubishi Polysilicon America

Germany

Wacker Chemie
Sitec

Japan

Tokuyama
Osaka Titanium technologies
Mitsubishi Materials

South Korea

OCI Company
Hanwha Chemical
Hankook Silicon
SMP

Arabian Peninsula

Qatar Solar Technologies
Polysilicon Technology Company

China

Sichuan Yongxiang Polysilicon (Tongwei)
Inner Mongolia Tongwei
Yunnan Tongwei
Jiangsu Zhongneng (GCL-Poly)
Xinjiang GCL
Leshan GCL

Xinte Energy (TBEA)

Daqo New Energy

Xinjiang East Hope

Asia Silicon

Shaanxi Non-ferrous Tianhong REC

Inner Mongolia Dunan PV

Jiangsu Kangbo

Inner Mongolia Erdos Polysilicon

Inner Mongolia Dongli PV

Guodian Jingyang

Inner Mongolia Shenzhou

Jiangsu Xinhua Semiconductor (GCL)

LDK PV Silicon

Yichang CSG

Sichuan Renesola

Yunnan Metallurgical

Henan Hengxing

Luoyang China Silicon

Qinghai Huanghe Hydropower

Shaanxi Tianhong

Ningxia Dongmeng

Xinjiang Hejing

Hubei Jingxing

Hebei Dongming

Taiwan

Powertec Energy

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Ferrosolar

Silicor Materials

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