

# **Quantum Dot Solar Cells Market Size, Share & Trends Analysis Report By Product Type (Quantum Dot Photovoltaic Cells, Quantum Dot Hybrid Solar Cells) By Material (Cadmium-based, Cadmium-free), By Application, By End-use, By Region, And Segment Forecasts, 2025 - 2030**

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## **Abstracts**

This report can be delivered to the clients within 3 Business Days

### **Quantum Dot Solar Cells Market Trends**

The global quantum dot solar cells market size was estimated at USD 1.24 billion in 2024 and is expected to grow at a CAGR of 16.6% from 2025 to 2030. Advancements in material stability and efficiency are improving the commercial viability of quantum dot solar cells.

As these cells become more efficient, their production costs are expected to decrease, making them more accessible for various applications. This progress will likely spur more partnerships and collaborations between industry leaders, pushing the technology into broader markets.

The increased interest in quantum dot solar cells will likely lead to their adoption in both residential and industrial sectors. As the technology scales, it could transform the solar energy landscape by offering cost-effective and high-performance alternatives to traditional solar cells. This progress is highlighted by recent achievements, such as the record-breaking efficiency demonstrated by researchers at Ulsan National Institute of Science & Technology.

For instance, in January 2024, researchers at Ulsan National Institute of Science & Technology (UNIST) in South Korea achieved a record efficiency of 18.1% for quantum dot solar cells, a significant improvement from 16.6% in 2020. The new solar cells, made with organic perovskite quantum dots, also demonstrated improved stability, maintaining efficiency for 1,200 hours under normal conditions and 300 hours at 80°C.

Quantum dot technology allows for precise tuning of the bandgap, which enhances its ability to absorb light. This adjustment improves the material's efficiency in converting sunlight into electricity. By manipulating the size and composition of quantum dots, researchers can optimize their response to specific light wavelengths. This capability leads to better energy conversion, making quantum dot solar cells more effective than traditional solar technologies. As a result, quantum dots are increasingly seen as a key component for next-generation solar cells. The potential to increase overall solar panel efficiency is a major factor in their growing popularity. This advancement is driving significant investment in research and development in the solar energy field. The trend is expected to push solar technologies toward higher performance and greater sustainability in the near future.

Integrating quantum dot technology with IoT solutions in solar cells enables smart energy systems that optimize power generation. Sensors embedded in quantum dot solar panels monitor energy output in real time. Data collected from these panels allows for adjusting energy distribution based on demand and environmental factors. This combination improves energy management, enhancing efficiency and reducing waste. Quantum dot solar cells can contribute to more intelligent and responsive energy grids. Companies are actively pursuing advancements in this area. For instance, in February 2025, UbiQD, a nanotechnology company in Mexico, acquired BlueDot Photonics to expand its quantum dot technology applications in energy and agriculture. This acquisition enhances UbiQD's capabilities in developing advanced quantum dot materials for various industries.

Advances in production techniques are significantly lowering the cost of manufacturing quantum dot solar cells. Improvements in synthesis methods, such as solution-based processes, are enabling more efficient production of quantum dots. These techniques reduce the reliance on expensive materials, making the production process more cost-effective. As production scales up, economies of scale are expected to drive down costs further, making quantum dot solar cells more accessible. Moreover, automation in manufacturing processes is increasing throughput and consistency, contributing to cost reduction. As these technologies mature, the cost of quantum dot solar cells will

become more competitive with traditional photovoltaic systems. This reduction in cost will encourage wider adoption and integration into the global energy market. The continued progress in production technologies will ultimately make quantum dot solar cells a more commercially viable solution for renewable energy generation.

## Global Quantum Dot Solar Cells Market Report Segmentation

This report forecasts revenue growth at global, regional, and country levels and provides an analysis of the latest industry trends and opportunities in each of the sub-segments from 2018 to 2030. For this study, Grand View Research has segmented the global quantum dot solar cells market report based on the product type, material, application, end-use, and region.

### Product Type Outlook (Revenue, USD Million, 2018 - 2030)

Quantum Dot Photovoltaic Cells

Quantum Dot Hybrid Solar Cells

Quantum Dot with Nanowire in Solar Cells

### Material Outlook (Revenue, USD Million, 2018 - 2030)

Cadmium-Based Quantum Dots

Cadmium-Free Quantum Dots

### Application Outlook (Revenue, USD Million, 2018 - 2030)

Building Integrated Photovoltaics (BIPV)

Multi-Junction Solar Cell

Portable & Wearable Electronics

Single Junction Solar Cell

Transparent Smart Glass & Displays

Others

End-use Outlook (Revenue, USD Million, 2018 - 2030)

Residential

Commercial

Industrial

Regional Outlook (Revenue, USD Million, 2018 - 2030)

North America

U.S.

Canada

Mexico

Europe

UK

Germany

France

Asia Pacific

China

Japan

India

Australia

South Korea

Latin America

Brazil

Middle East & Africa (MEA)

KSA

UAE

South Africa

### **Companies Mentioned**

Hanwha Group

HELIENE Inc.

Nanoco Group plc

NNCrystal US Corporation

Oxford Photovoltaics Ltd.

QDsolar

Quantum Material Corporation

QUANTUM SOLUTIONS

TFQD

UbiQD

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