

# **On-Site Photovoltaic Solar Power for Data Center Market - Global Industry Size, Share, Trends, Opportunity, and Forecast, Segmented, By Application (Power Generation, Energy Storage, Backup Power), By System Type (Grid-Tied Systems, Off-Grid Systems, Hybrid Systems), By End-User (Cloud Data Centers, Enterprise Data Centers, Colocation Data Centers), By Technology (Monocrystalline, Polycrystalline, Thin-Film), By Region, By Competition, 2020-2030F**

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## **Abstracts**

### **Market Overview**

Global On-Site Photovoltaic Solar Power for Data Center Market was valued at USD 27.37 Billion in 2024 and is expected to reach USD 84.50 Billion by 2030 with a CAGR of 20.49%. The On-Site Photovoltaic Solar Power for Data Center Market refers to the segment of the renewable energy and data center infrastructure industry focused on deploying solar photovoltaic (PV) systems directly at data center locations to generate electricity for on-site consumption. This market encompasses the planning, installation, integration, and maintenance of solar PV panels and related equipment, including inverters, energy storage systems, and monitoring technologies that allow data centers to harness solar energy as a primary or supplemental power source. On-site solar installations help reduce dependency on traditional grid power, minimize carbon footprints, and ensure greater energy autonomy and reliability, especially during peak loads or power outages.

The market includes standalone solar arrays, rooftop solar installations, and solar carports that are either connected directly to the data center's internal grid or coupled with battery energy storage systems to optimize power usage and support continuous operations. It is driven by the growing demand for sustainable and energy-efficient solutions across hyperscale, colocation, and enterprise data centers, all of which are under increasing pressure to meet environmental regulations, reduce operational costs, and achieve corporate sustainability goals. This market is also influenced by advancements in photovoltaic technology, improvements in solar panel efficiency, and the declining costs of solar components, which make on-site generation more financially viable for data center operators.

## **Key Market Drivers**

### **Rising Energy Demand and the Need for Cost-Efficient Power Supply in Data Centers**

The exponential growth of data consumption, fueled by digital transformation, cloud computing, edge technologies, and artificial intelligence, has led to a surge in data center energy demands across the globe. As data centers are highly energy-intensive, operators face rising electricity costs that directly impact operational expenditure. In this scenario, on-site photovoltaic solar power emerges as a viable solution to help meet the growing energy needs while significantly lowering long-term energy costs. Solar installations provide a predictable and often lower-cost energy supply, shielding operators from volatile grid electricity pricing and peak demand charges. As solar technology matures and installation costs continue to decrease, the return on investment for on-site solar panels becomes increasingly attractive, especially for hyperscale and colocation data centers with large-scale, power-intensive operations.

By generating electricity on-site, data center owners reduce dependency on utility companies, avoid transmission losses, and achieve greater energy autonomy, particularly in regions with high solar irradiation. Moreover, solar power allows data centers to operate in a more decentralized energy model, which is more resilient to power outages and grid instability. This autonomy is critical for facilities providing mission-critical services that require uninterrupted operations. Additionally, financial incentives, such as tax credits and accelerated depreciation for solar energy systems, further enhance the economic feasibility of integrating solar panels directly into the data center infrastructure. Many organizations are also exploring hybrid systems that combine on-site solar with battery storage, ensuring continuous operation even during periods of low solar generation.

The shift towards on-site generation also supports the optimization of load management strategies and enhances power usage effectiveness (PUE), a critical metric for data center efficiency. This trend is particularly significant in emerging economies where grid infrastructure is less reliable, and solar energy offers a stable and cost-effective alternative. As electricity prices fluctuate and sustainability mandates become stricter, the economic logic of leveraging on-site photovoltaic solar systems to support high-density computing environments becomes increasingly compelling. Data center operators who adopt on-site solar power are not only achieving significant cost savings over the long term but also positioning themselves for future energy demands in a sustainable and financially responsible manner. Global data center electricity consumption is estimated to exceed 1,000 TWh annually, contributing to around 2% of total global electricity use. Power usage in hyperscale data centers is expected to grow at a CAGR of over 10% through 2030. The average power density in modern data centers has reached approximately 7–15 kW per rack, with some exceeding 20 kW. Energy costs account for up to 40% of total operational expenses in large-scale data centers. Deployment of renewable and cost-efficient power systems could reduce energy expenditures by 20–30% over the long term. The global data center market is projected to add over 50 GW of capacity by 2030, amplifying the need for efficient power supply solutions.

## **Key Market Challenges**

### Limited Space and Infrastructure Constraints for On-Site Solar Deployment

One of the significant challenges in the On-Site Photovoltaic Solar Power for Data Center Market is the physical limitation of available space for installing sufficient solar infrastructure. Data centers are typically built for maximum computing efficiency rather than optimal solar exposure, often in urban or industrial areas where rooftop or ground space is severely restricted. The sheer size of photovoltaic systems required to power energy-intensive data center operations is substantial, and in many cases, on-site installation cannot meet the full energy demand, making it more of a supplemental solution rather than a primary one. Additionally, structural limitations of existing rooftops can prevent the addition of heavy solar panel systems without significant retrofitting, which can be costly and logistically complex.

Ground-mounted solar installations, while more efficient, require expansive land areas, which are not always available or economically viable near data center locations. Furthermore, geographic and environmental factors such as limited sunlight hours,

cloud cover, and seasonal variations also play a role in reducing the viability of on-site solar deployment in certain regions. Urban data centers, in particular, face shading issues due to surrounding buildings and infrastructure, further diminishing solar efficiency. In densely populated zones where land is at a premium, allocating real estate for solar rather than additional server racks or auxiliary infrastructure presents an economic trade-off.

Moreover, local building codes, zoning regulations, and utility interconnection standards often complicate or delay solar project implementation, adding layers of regulatory uncertainty. Permitting processes can be time-consuming, requiring months of back-and-forth with authorities before installation can begin. These delays impact return on investment and extend the timeline for achieving energy sustainability targets. As data centers continue to grow in size and density, balancing spatial constraints with the goal of integrating renewable power becomes an increasingly complex puzzle. While innovations like solar canopies, building-integrated photovoltaics (BIPV), and vertical solar panels offer partial solutions, their adoption is still limited due to cost, efficiency, and aesthetic concerns. In summary, despite the environmental and financial incentives, the lack of adequate physical space and associated infrastructural challenges significantly hampers the widespread adoption of on-site photovoltaic solar power in the data center industry.

## **Key Market Trends**

### Integration of Smart Energy Management Systems with On-Site Solar PV Installations

The adoption of smart energy management systems (EMS) alongside on-site photovoltaic (PV) solar installations is emerging as a transformative trend in the data center market. Data center operators are increasingly seeking integrated solar-plus-software solutions that not only generate power but also optimize energy usage across facilities. As power demands grow with increasing AI workloads, hyperscale computing, and edge data processing, the need for real-time energy monitoring, predictive load balancing, and dynamic control becomes critical. Smart EMS platforms enable predictive analytics to align solar generation patterns with compute loads, thus maximizing solar utilization and minimizing grid dependency. These systems are also being embedded with AI algorithms that forecast solar output based on weather data, monitor equipment performance, and trigger preventive maintenance, ensuring operational continuity.

Additionally, hybrid systems combining battery storage with on-site solar and EMS allow

for peak shaving and grid-independent operations during high-demand periods or outages. This results in improved power quality and cost savings, which are essential in maintaining service level agreements (SLAs) for data center uptime. Governments and regulators are also pushing for greener infrastructure by offering incentives to facilities using intelligent energy optimization solutions. Thus, the convergence of on-site PV with intelligent control systems not only supports energy transition but also helps meet ESG targets and enhances the long-term resilience of data centers. As this trend evolves, it is expected that more modular EMS-based PV systems will be developed for both hyperscale and colocation data centers, supporting scalability and decentralized grid support.

### **Key Market Players**

Trina Solar

JA Solar

SunPower Corporation

JinkoSolar

Canadian Solar

First Solar

Evergreen Solar

Hanwha Q CELLS

SCHOTT North America

SMA Solar Technology AG

### **Report Scope:**

In this report, the Global On-Site Photovoltaic Solar Power for Data Center Market has been segmented into the following categories, in addition to the industry trends which have also been detailed below:

### On-Site Photovoltaic Solar Power for Data Center Market, By Application:

Power Generation

Energy Storage

Backup Power

### On-Site Photovoltaic Solar Power for Data Center Market, By System Type:

Grid-Tied Systems

Off-Grid Systems

Hybrid Systems

### On-Site Photovoltaic Solar Power for Data Center Market, By End-User:

Cloud Data Centers

Enterprise Data Centers

Colocation Data Centers

### On-Site Photovoltaic Solar Power for Data Center Market, By Technology:

Monocrystalline

Polycrystalline

Thin-Film

### On-Site Photovoltaic Solar Power for Data Center Market, By Region:

North America

United States

Canada

Mexico

Europe

France

United Kingdom

Italy

Germany

Spain

Asia-Pacific

China

India

Japan

Australia

South Korea

South America

Brazil

Argentina

Colombia

Middle East & Africa

South Africa

Saudi Arabia

UAE

Kuwait

Turkey

## **Competitive Landscape**

Company Profiles: Detailed analysis of the major companies presents in the Global On-Site Photovoltaic Solar Power for Data Center Market.

Available Customizations:

Global On-Site Photovoltaic Solar Power for Data Center Market report with the given Market data, Tech Sci Research offers customizations according to a company's specific needs. The following customization options are available for the report:

Company Information

Detailed analysis and profiling of additional Market players (up to five).

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