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Cambodia Solar Report

Prepared by J.v.G. Technology GmbH

J.v.G. Technology GmbH is a German engineering company specializing in turnkey solar module production lines and manufacturing consulting, with project experience ranging from 20 MW to 500 MW per production line, including multi-line and gigafactory projects exceeding this scale.

This Solar Report is part of the **PVKnowHow** Knowledge Network.
The data, analysis, and conclusions in this document are based on real research, consulting insights, and international solar market data.

Gain comprehensive insights into the statistics and metrics surrounding the solar production industry in Cambodia

KEY POINTS

All figures have been converted into USD

Yearly sunshine (sun hours per year)

Average yearly sunshine hours:
- Average: 2741 hours
- Monthly average: 228.42 hours

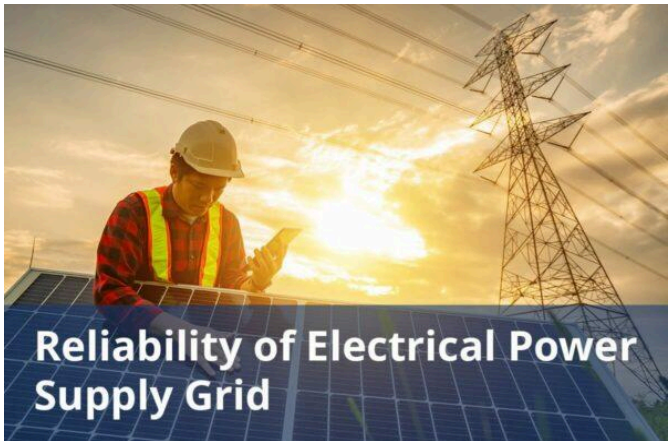
kWh per kWp installed

kWh generated per kWp:
- Average: 1200 kWh/kWp
- Optimal conditions: 1400 kWh/kWp

Average cost per kWh from utility company

Average cost of electricity:
- Residential: $0.130/kWh

- Commercial: $0.119/kWh
- Industrial: $0.107/kWh



Reliability of electrical power supply grid

Reliability of solar installations:
- Average uptime: 95%
- Maintenance frequency: 1-2 times per year




DETAILED INFORMATION

All figures have been converted into USD

Total solar panel production capacity (installed)

Total solar panels installed in the region:
- Amount: 500000 panels

- Capacity: 150 MW

Total solar panel production capacity (projected)

Projected solar panel installations over the next 5 years:
- Year 1: 60000 panels
- Year 2: 80000 panels
- Year 3: 100000 panels
- Year 4: 120000 panels
- Year 5: 150000 panels

Average costs of various electricity generation sources (coal, natural gas, solar, etc)

Average costs associated with solar energy:
- Installation: $3000/kW
- Maintenance: $200/year

Percentages of various electricity generation sources (coal, natural gas, solar, etc)

Percentages of electricity generated from renewable sources:
- Solar: 25%
- Wind: 15%
- Hydro: 10%

Average daily availability of electricity from the national grid (measured in hours)

Daily availability of solar energy:
- Clear days: 70%

- Partly cloudy days: 20%
- Overcast days: 10%

Number of residential solar panel installations

Number of residential solar panels:
- Average per household: 20 panels
- Total residential installations: 80000 households

Total number of solar farms (installed and projected)

Number of solar farms in the area:
- Total: 25 farms
- Largest farm capacity: 50 MW

Off-grid market demand for solar panels (current and projected)

Current Off-Grid Solar Demand:
- Over 28% of Cambodia's population lacks access to reliable electricity, driving immediate demand for off-grid solar solutions in rural areas.
- Approximately 4 million rural residents without reliable energy access require solar home systems and solar mini-grids to meet basic energy needs.
- Existing mini-grids, heavily reliant on imported diesel, face unsustainable costs, creating an urgent demand for solar PV systems to replace or complement diesel-based setups.
- Seasonal flooding disrupts energy infrastructure in areas like Kampong Thom and Pursat, creating a need for resilient off-grid solar systems.

- Financial challenges for mini-grid operators highlight the demand for cost-effective and scalable off-grid solar solutions.
- Programs like the /Rural Electrification Fund/ have initiated solar-based projects, but demand outpaces current supply due to limited outreach and infrastructure.

Future Off-Grid Solar Demand:
- Cambodia's goal to achieve 100% village electrification by 2025 and 70% household electrification by 2030 underscores significant future demand for off-grid solar systems.
- Expansion of solar mini-grids and solar home systems is required to electrify approximately 1,300 unelectrified villages, prioritizing remote and underserved regions.
- The growing need for agricultural energy solutions, such as solar-powered irrigation pumps under the /Scaling Up Renewable Energy Program (SREP)/, will drive demand.
- Climate-resilient solar infrastructure will be in high demand to address seasonal flooding and the effects of climate change on energy systems.
- Innovative financing mechanisms like pay-as-you-go (PAYG) models will increase accessibility and drive demand for off-grid solar systems among low-income households.
- The development of battery storage technology and hybrid systems will support growing off-grid solar demand by ensuring consistent energy supply and reliability.
- Capacity-building initiatives to train skilled labor for installing, operating, and maintaining solar systems will be critical to supporting the future growth of the off-grid solar sector.
- International collaborations and projects, such as those funded by the /World Bank/ and /UNDP/, will bolster demand by providing financial and technical support for large-scale solar initiatives.

On-grid market demand for solar panels (current and projected)

Current On-Grid Solar Demand in Cambodia:
- As of 2018, Cambodia had an installed on-grid solar capacity of 75 MW, contributing to approximately 3% of the national energy mix. This was part of the initial steps toward diversifying the energy portfolio.
- By 2023, solar energy's share in the energy capacity rose to 7%, equivalent to about 300 MW of installed solar power, showcasing a steady demand increase due to policy initiatives and private sector engagement.
- Several approved solar projects aim to elevate the installed capacity to over 400 MW, driven by growing urbanization and industrialization that demand a more sustainable and reliable energy supply.
- The Cambodia National Energy Statistics 2021 reported that solar power installations are concentrated in regions with higher energy consumption, such as Phnom Penh and its neighbouring provinces.
- Industrial parks, economic zones, and commercial facilities are increasingly adopting on-grid solar solutions to reduce operational costs and meet corporate sustainability goals.

Future On-Grid Solar Demand in Cambodia:
- By 2040, solar photovoltaics are projected to contribute nearly 30% of Cambodia's electricity production, with an installed capacity exceeding 3,000 MW. This reflects the government's commitment to transitioning toward renewable energy sources.
- The energy development master plan targets 70% renewable energy generation by 2030, with solar energy playing a central role alongside hydroelectric power. This plan prioritizes scaling up utility-scale solar farms.
- Initiatives like public-private partnerships are being encouraged to attract foreign investments, with favourable policies such as tax

incentives and feed-in tariffs boosting investor confidence in the solar sector.
- The Ministry of Mines and Energy has identified 20 strategic locations for large-scale solar farm development, aiming to serve both domestic and export energy markets.
- Future demand will also be driven by grid modernization projects, including smart grid technologies and interconnectivity with regional grids, enabling more efficient distribution and utilization of solar energy.

Average monthly income of workers in solar industry (labor cost)

Average Salary:
- /~$8,900/year/
- /Lowest Salary: ~$4,100/year/
- /Highest Salary: ~$14,100/year/

Population of the country

The current population of /Cambodia/ is /17,751,609/.

Average overhead costs of solar panel production (with a brief breakdown)

Estimate for Factory Rent
Monthly Average Warehouse Rental Cost

Highest Warehouse Rent
- Rent: $11,500 per month
- Location: Krang Thnong, Sen Sok, Phnom Penh
- Floor Area: 3000m²
- Land Area: 4755m²

Lowest Warehouse Rent
- Rent: $1,100 per month
- Location: Boeung Tumpun, Meanchey, Phnom Penh
- Floor Area: 360m²

Key Components of Administrative Costs

Salaries and Wages:
- Average Salary: /~$8,900/year/
- Lowest Salary: /~$4,100/year/
- Highest Salary: /~$14,100/year/

Monthly Rents for Office Space

The highest office rent is /$19.0/m²/ per month in Tonle Bassac, Chamkarmon, Phnom Penh, while the lowest is /$5.0/m²/ per month in Chroy Changvar, Phnom Penh.

A summary of the energy infrastructure

Electricity Generation:
- Cambodia's domestic electricity generation totaled 9,255 GWh.
- The country's total installed capacity in 2022 reached 4,495 MW, with hydro and coal being the major sources of power.
- Cambodia also imported 1,030 MW of electricity from neighboring countries, particularly during the dry season.
- The government is transitioning towards renewable energy, with plans to phase out coal power plants after 2024.

Transmission & Distribution:
- There are 310 transmission towers spanning the 230/115kV Kampong Cham substation and the 230/22kV Kratie substation.

- The transmission line is energized by hydropower supplied from the north of Cambodia, as well as cross-border power imports from Laos.

Energy Access:
- In 2022, the World Bank reported that 92.3% of the Cambodian population had access to electricity.

Some of the government regulations surrounding solar panel production

2018 Solar Energy Regulations
- The Cambodian government adopted its first solar energy regulations in 2018, providing official guidance for both solar power plants and rooftop solar systems.
- However, the 2018 regulations included several challenges, including a /capacity charge/ for rooftop solar projects and restrictions on project size, which hindered the financial viability of many solar initiatives.
- The capacity charge, which was based on the total installed capacity rather than actual electricity consumption, made rooftop solar projects less attractive for businesses.

2023 Solar Guidelines
- To address the barriers and attract more investment in rooftop solar, the Ministry of Mines and Energy issued the /2023 Solar Guidelines/, which provide clearer and more favorable conditions for rooftop solar projects.
- Rooftop solar systems are now allowed to feed excess electricity into the national grid, which is an important step for companies aiming to reduce their carbon footprint.
- The guidelines remove the /capacity charge/ and require a new tariff structure based on actual electricity consumption rather than the installed capacity of the system. This new tariff is expected to improve the financial viability of rooftop solar projects.

- The guidelines introduce a /Compensation Tariff for Variable Energy from Rooftop Solar/, which aims to ensure that the cost of electricity for solar users is comparable to that of non-solar users.

Environmental and Natural Resources Code (2023)
- On June 29, 2023, Cambodia adopted the /Environmental and Natural Resources Code/ (Environmental Code), which is a significant piece of legislation that addresses renewable energy and environmental management.

Government initiatives in solar panel production (includes investments and subsidies)

Incentives and subsidies for solar energy in Cambodia include a range of measures designed to stimulate the adoption of renewable energy, particularly solar power:

Tax Incentives for Solar Equipment:
- The Environmental Code mandates tax incentives for materials used in the installation of renewable energy technologies.
- This provision signals that businesses engaged in solar energy projects will likely benefit from reduced taxes on equipment and materials essential for solar installations.

Compensation Tariff for Rooftop Solar:
- The 2023 Solar Guidelines remove the capacity charge previously imposed on rooftop solar systems, which was a barrier to the financial viability of such projects. Instead, a new tariff system will be set, based on actual electricity consumption rather than the installed capacity.
- This aims to make rooftop solar systems more financially feasible for businesses and consumers alike.

Feed-in Tariff (Expected Development):

- Although no feed-in tariff has been established yet, the 2023 Solar Guidelines indicate that the Cambodian government plans to set up a preferential tariff system for renewable energy, including solar.
- This system would likely include compensation for power fed into the national grid, offering financial incentives for solar energy producers.

Rooftop Solar Integration with National Grid:
- The new guidelines allow rooftop solar projects to feed excess electricity into the national grid, which could offset operational costs for businesses and households with solar systems.
- This is an important step in integrating solar energy into the broader energy system.

Tourism Industry and Clean Energy Integration:
- Cambodia's move to incentivize rooftop solar is particularly relevant for the tourism sector, which has seen a recovery in 2023, with a significant increase in international tourist visits.
- The forthcoming regulation, endorsed by the Cambodia Tourism Federation (CTF) and WWF-Cambodia, aims to create clear pathways for the adoption of rooftop solar across tourism facilities.

Notable solar projects in the country (installed and projected)

Current Operational Projects

Bavet City Solar PV Plant (10 MW)
- Location: Svay Rieng, Svay Teab, Cambodia
- Capacity: 10 MW
- Inauguration: 2017

Kampong Chhnang Solar (SchneiTec) (60 MW)
- Location: Kampong Chhnang, Tuek Phos, Cambodia

- Capacity: 60 MW
- Inauguration: 2020

Kampong Speu Solar Farm (80 MW)
- Location: Kampong Speu, Oudong, Cambodia
- Capacity: 80 MW
- Inauguration: 2019

Risen Energy Battambang Solar PV Park (60 MW)
- Location: Battambang, Thma Koul, Cambodia
- Capacity: 60 MW
- Inauguration: 2021

Future Projects (Planned)

Sihanoukville Solar PV Project (200 MW)
- Location: Sihanoukville, Cambodia
- Capacity: 200 MW
- Expected Commissioning: 2025

Prey Veng Solar (80 MW)
- Location: Prey Veng, Cambodia
- Capacity: 80 MW
- Expected Commissioning: 2025

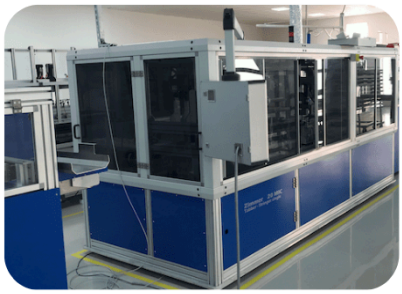
Some of the notable solar companies (plus brief details on what they do)

Kamworks Solar LTD
- Location: Phnom Penh, Cambodia (Address: No. 2, St. Rothasaphea, Tonle Bassac, Chamkarmorn, Phnom Penh, 120101, Cambodia)
- Website: http://kamworks.com
- Products and Services:

- Energy Monitoring
- On-grid Solar
- Off-grid Solar
- Solar Water Pumping

NRG Solar
- Location: Phnom Penh, Cambodia (Address: 71AE0, Street 440, Toul Tom Pong, Phnom Penh, Cambodia)
- Phone Number: +855 095 848 246
- Opening Times: Mon-Fri, 9:00 AM – 5:00 PM
- Website: https://www.nrg-renewables.com/
- Products and Services:
- Engineering and Design (Specific solar solutions design)
- Financing (Project finance available for most clients)
- Consulting (Energy assessments, load monitoring, energy consulting)

Khmer Solar
- Location: Cambodia
- Phone Number: Not specified
- Website: http://www.khmersolar.com/
- Products and Services:
- Solar panels
- Energy storage
- DC-AC inverters
- Grid tie inverters
- Solar home systems for rural electrification



ABOUT THIS REPORT

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All market data, analysis, and conclusions follow JvG's internal consulting standards and international PV market research practices.

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About J.v.G. Technology GmbH

J.v.G. Technology GmbH is a European engineering and advisory specialist for solar production lines and manufacturing equipment, supporting investors and operators with market, location and production-focused decision frameworks.
www.jvg-thoma.com

Contact & Further Information

For further discussion or clarification of manufacturing-related aspects, please contact:

J.v.G. Technology GmbH
www.jvg-thoma.com
info@jvg-thoma.com

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