

India Renewable Energy and Solar Photovoltaic Market Opportunities for US Companies

India is gradually shifting focus towards its renewable energy resources. Driven by an increasing demand for electricity and widening gap between demand and supply, India has targeted 20GW of Solar Power by 2022 in its Jawaharlal Nehru National Solar Mission. India has been enduring a pressing need to reduce its high and increasing greenhouse gas emissions.

India's renewable energy capacity reached 14.8 GW in 2009, accounting for 9.7% of the total installed power capacity. Though solar energy accounts for only 1% of total capacity, it has witnessed a quick growth in the last five years. During 2005–2009, total revenues were \$22.8 billion representing a compound growth rate of 11%. The market consumption volumes increased by 8.3% annually between 2005–2009 and reached a total of 149.9 billion kilowatt hours (kWh) by 2009.

With the current growth momentum the market's volume is expected to rise to a 189.8 billion kilowatt hours (kWh) by the end of 2014, representing a CAGR of 4.8% for the 2009–2014 period.

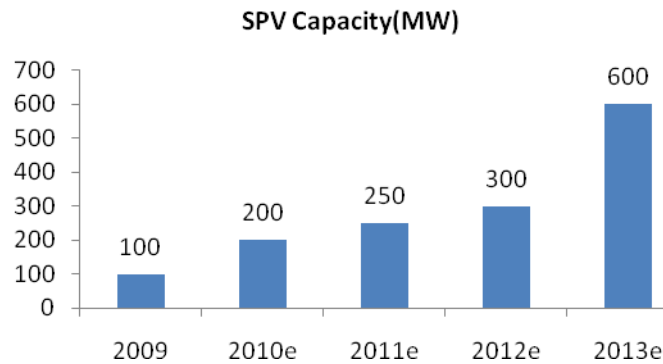
Solar Photovoltaic (SPV) Capacity

Bulk of India's installed SPV capacity is in the form of non-grid applications. SPV market in India is mostly organized. There are 15 entities engaged in the production of solar cells. 20 companies in the PV modules space and 50 companies are engaged in the assembly and supply of PV Systems (PV cell and PV modules)

PV cells– India's installed capacity for PV cells is expected to increase to 750 MW in 2010 from 400 MW in 2009. The actual production of PV cells in 2009 was 75 MW.

PV Modules– Installed capacity for PV modules expected to increase to 1250 MW in 2010 from 1000 MW in 2009. The actual production of PV modules in 2009 was 240 MW

With the beginning of new projects and government the SPV capacity is expected to grow exponentially over the years:



Usage

Solar PV based applications usage in India is not in accordance with that in the global market. Globally, grid-connected PV applications account for 75% of the overall PV applications while in India off-grid applications account for ~97% of the overall applications. Ministry of New and Renewable Energy (MNRE) is aiming to achieve 50 MWp grid-connected SPV capacity by 2012.

Overview of the usage :

Sources/Systems	Cumulative Achievement 2008-09	Cumulative Achievement 2009-10
Distributed Renewable Power		
Solar power	8.01 MWp	9.13 MWp
Decentralized Energy Systems		
Solar Street Lighting	70,474 nos.	88,297 nos.
Home Lighting System	4,34,692 nos.	5,84,461 nos.
Solar Lantern	6,97,419 nos.	7,92,285 nos.
Solar Photovoltaic Power Plants	2.12 MWp	2.41 MWp
Solar Photovoltaic Pumps	7,148 nos.	7,334 nos.

Capacities of SPV Products Available in India

SPV Products	Capacity Range
Solar Lanterns	2-15 Wp
Solar Home Lighting Systems	37-74 Wp
Solar Pumps	1-2 KWp
Solar Street Lights	26-74 Wp
Solar Power Plants for Village	1 KWp-110 KWp

Value Chain – SPV Market

Solar panel production uses two technologies

- Crystalline silicon cells – Most dominant technology with more than 87% market share
- Thin-film cells – Fastest growing technology due to silicon shortage

Solar Industry Value Chain

The value chain of solar industry consists of four main segments:

Silicon and thin film producer

- Crystalline Silicon PV: Involves low cost of production
- Thin Film: Higher cost of production requiring adequate technology

Appliance Manufacturer

- Standalone players Involved in product design, marketing and distribution
- Develops products such as solar heater, solar cooker, street and home lighting Systems

EPC Player

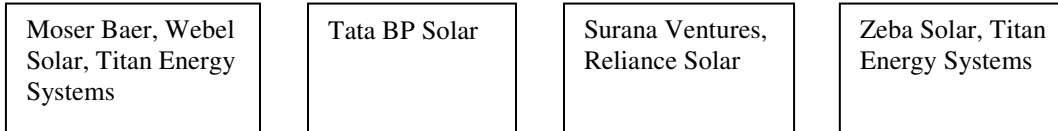
- Operates in grid generation systems
- Major focus on developing ties with suppliers
- Players have strong engineering capabilities

Developer

- Manages various solar power contracts through private and public partnerships
- Arranges land banks for solar installations
- Financial aspect of large scale grid generation systems



Major
Players



In India the solar industry is now dominated by few players, either in the public sector or joint ventures with major global players barely set up 5 years ago. The major government owned players in the domestic industry are BHEL, Central Electronics Ltd., BEL and Rajasthan Electronics & Instruments Ltd (REIL). Several international players, such as Moser Baer PV, TATA BP Solar, Signet Solar and SELCO International USA, are also active suppliers in India. The market is dominated by joint ventures and technical collaboration with foreign firms that specialise in solar products. New firms that are setting up or expanding manufacturing units and developing forward linkages to develop solar power plants are Reliance Industries, Moser Baer, Signet Solar, and Solar Semiconductors at various value chain of the solar industry.

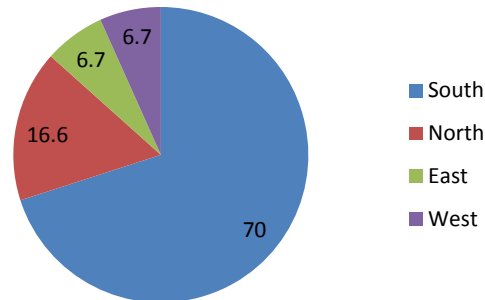
Regional Spread of Manufacturers in India

The southern part of India dominates the market in terms of production of SPV cells and SPV modules

- Out of 9 SPV cell manufacturers in India 6 are located in south India
- While, out of 21 SPV module manufacturer in India 15 are located in south India

Gujarat is gradually becoming an important destination for solar PV developers as it is easier to acquire land located in any part of the state directly from the farmer. Many companies have announced their plans to set up solar PV plants in Gujarat which include Moser Baer, Lanco Solar, Solar Semiconductor, Euro Solar, PLG Power, and Zeba Solar. All these solar PV developers have signed public private alliances (PPA)

Manufacturers PV Cells and Modules(%)



Drivers of growth

- **Rise in polysilicon plants**

Gradually, Indian Companies are planning to foray into the production and processing of polysilicon. Currently, India imports about 4,000 TPA of polysilicon and wafers.

- **Demand supply gap**

India’s power deficit is about 10%, with a peak deficit of 17% leading to chronic power shortage. Power is one of the requirements for the economic development of India but even today almost 1/3rd of the population have no access to grid electricity.

- **Demand for off-grid PV application**

Apart from PV application in the rural areas, there are other PV off-grid applications which have huge scope in India such as

- Off grid lighting system
- Irrigation Pump
- Captive Power
- Urban Application

- **Availability of funds**

Banks and other financial institutions, including foreign financial institutions, are lending necessary funds to the players. The SPV market is also getting boosted by the financial assistance extended by the financial bodies in terms of helping the players in coordinating with interested foreign financial institutions for investing in the projects

- **Growth in foreign trade**

India has consistently been a net exporter of solar PV technology, with about 66% of cumulative domestic PV production till 2009 being exported to overseas markets. India exports PV cells, PV modules to the international markets led by the European nations. India is a major exporter of PV cells with exports accounting for 75% of total capacity. In terms of quantity, exports of solar PV cell increased by 83.4% in 2009 compared to 2008. Most manufacturers of PV cells and PV modules export their products to countries worldwide. Scope of foreign trade in the SPV sector is leading to the entry of increasing number of players to the market.

- **Fall in prices of raw materials**

In 2009, global polysilicon prices fell by 80%, silicon wafer prices declined by 50% while there was a 37.8% fall in crystalline module prices. These form the basis allowing for the production of solar energy based on photovoltaic technology. Fall in the prices has reduced the cost of generating solar photovoltaic energy. It is expected that in 2010 the crystalline module prices will fall by 20%, silicon wafer prices will fall by 18.2%, polysilicon prices will fall by 56.3%. The fall in prices is likely to continue with the existing prices of PV and with steady fall in the prices of PV along with lower operating expenses, this technology is becoming cost effective. Increasing number of players are now entering the market at these price levels

- **Geographical location**

In India, almost all the regions receive 4–7 KWH of solar radiation per sq mt depending upon the location. India enjoys 300 sunny days every year and 3,000 hours of sunshine each year which is equivalent to over 5,000 trillion KWH. India

being a tropical country receives adequate solar radiation which is a major driver for the SPV market

Market Trends

New Solar Cell Projects in India

Tata BP Solar recently signed an agreement with Calyon Bank (Credit Agricole CIB) and BNP Paribas to raise Rs 3.1 billion to fund its solar cell expansion project from the present installed capacity of 128 MW to 300 MW by 2012. Players such as California-based Signet Solar are also planning three PV manufacturing units in India at an investment of over US\$2 billion. Moser Baer is investing close to US\$1.5 billion; Titan Energy Systems is planning an investment of US\$750 million, Nanotech Silicon India US\$2 billion, and Hindustan Semiconductor Manufacturing Corporation US\$1 billion. Despite polysilicon production for both solar and semiconductor use rising 30% during 2007–2009, it remained the most capacity constrained part of the PV chain. On the demand side, demand from the semiconductor industry is expected to grow at steady one-digit rates, with demand for solar-grade polysilicon expected to reach over 50% of the total demand for high purity silicon in 2008–2009.

Investment Opportunities

There is a large scope for investments in solar energy sector and Government of India is taking all the necessary measures to promote the solar energy generation in the country. The policy measures and incentives taken by the government of India to promote investment in solar energy sector are as follows:

Joint Ventures

A number of companies have entered into joint ventures with leading global PV manufacturers. There are no specific conditions laid down by MNES for the formation of joint ventures. General conditions laid down by the Ministry of Industry, Secretariat for Industrial Approvals and the Reserve Bank of India are applicable for this sector.

Export-oriented Units

It is possible to set up a manufacturing plant as a 100 per cent EOU. Generally, these are permitted duty-free import of raw materials and components. They are also eligible to sell up to 20% of their production in domestic markets.

Technology Transfer

Indian PV industry is interested in seeking technology for the manufacture of PV modules especially based on thin film materials, and is able to offer technology for the manufacture of silicon solar cells, PV modules and PV systems.

Technology Development

R&D projects are supported by the government at Central/state government research organisations, autonomous societies, universities, recognised colleges, IITs, industries (with suitable infrastructure for R&D) and NGOs.

Conclusion

Considering all the Government initiatives and policies, Indian manufacturers are optimistic about the prospects of solar power market. Government's effort to bring grid connected solar power into the commercial market has pushed many companies to become turnkey solution providers and solar farm operators. Rural electrification under the scheme of "Power for all by 2012" is an encouraging initiative for solar power system manufacturers. Private companies' support for achieving future targets is a necessity. India, with more than 300 days of sunshine annually and potential customer base (both urban and rural), offers a great market opportunity. This, combined with investor friendly policies and solar energy promotion, will provide the right platform for growth. There is an enormous potential for off-grid PV deployment in the country such as rural lighting and electrification, powering irrigation pump sets, back-up power generation for cellular towers, captive power generation, urban applications and highway lighting.

FACT SHEET

ABOUT US

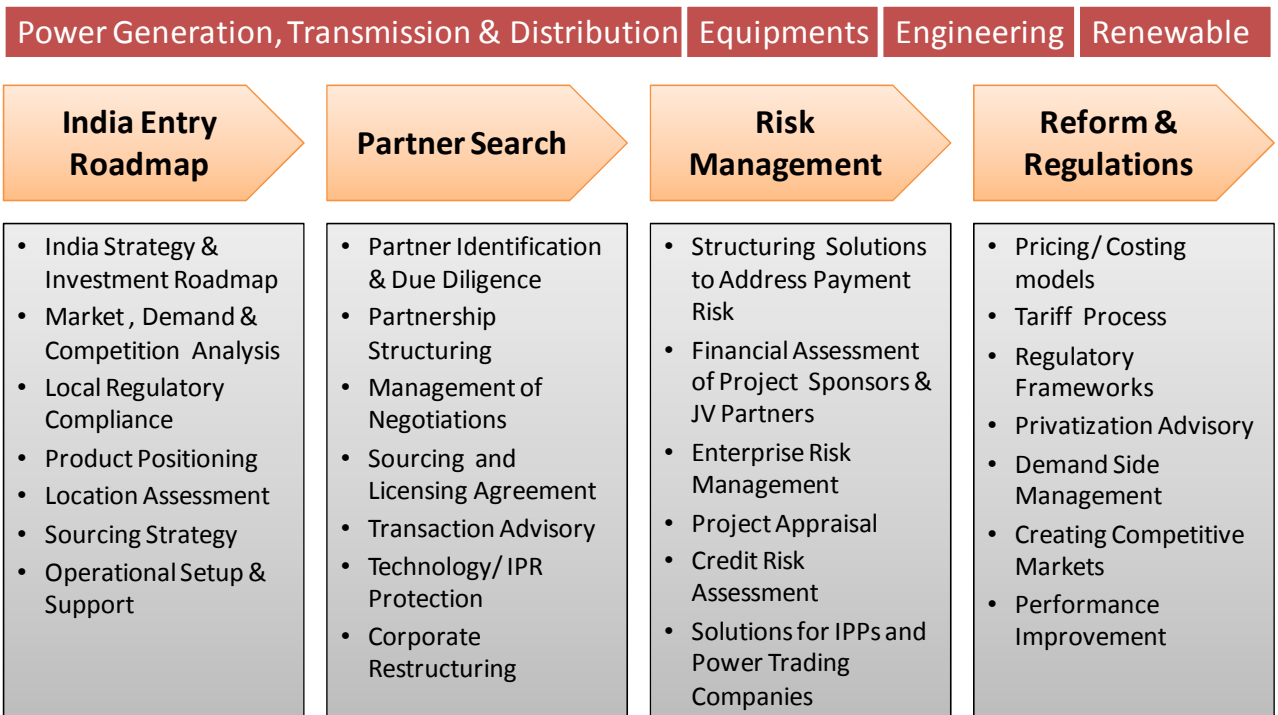
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Our mission is to enable our clients to transform their business by adding India as a key part of their global footprint. Our clients benefit from our local presence, strong relationships, knowledge of local business practice, experience, and financial expertise.

OUR PROFESSIONALS

Our team possesses a deep understanding of the business environment, both in the US and India and is well connected with companies, financial institutions, governmental agencies, and private equity firms in both markets. We have an established track record of over 15 years and 1,000 engagements providing advisory services to a diversified client base across energy, manufacturing, infrastructure, and retail. We also work with multilateral and bilateral government agencies, banks and financial institutions, and regulators. We are headquartered in New York with eight offices in India.

OUR SERVICES



REPRESENTATIVE EXPERIENCE

Below is a partial list of our power related engagements in India for North American and European companies:

- ✚ India Entry Strategy for a global power developer, including location assessment, investment roadmap, and partner search
- ✚ Risk Assessment of a copper cathode manufacturing project for a financial investor that included market, technical, business, and financial risks
- ✚ India Market Study and Commercial Viability Assessment for setting up a 150 MW power plant in India for a global power generation company
- ✚ Preparation of India Entry Strategy for a leading global EPC contractor, including power sector policy and regulatory framework, market size, and investment/ implementation roadmap
- ✚ Assessment and Due Diligence of joint venture partner for a global power project investor
- ✚ Assistance in developing a cost-to-serve model for a leading power distribution company, including collection of field data, consumer based load curve, and voltage-level losses
- ✚ Entry Strategy into the gas transportation business, including analysis of bulk supply to industrial consumers, availability, and price elasticity of gas
- ✚ Contracting strategy for a proposed coal based power plant, including demand-supply situation, simulation of merit order situation, assessment of financial health of utilities and market analysis
- ✚ Power sector financing and strategy study for the Asian Development Bank (ADB)

REPRESENTATIVE GLOBAL CLIENTS IN POWER



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