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# *A guide to investing in India's solar energy sector*



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# Abbreviations

## Abbreviations

A&G	Administrative and general
AD	Accelerated depreciation
ADB	Asian Development Bank
CAGR	Compound annual growth rate
CBD	Convention on Biological Diversity
CCA	Common Consent Application
CDM	Clean development mechanism
CERC	Central Electricity Regulatory Commission
CITES	Convention on International Trade of Endangered Species
CMS	Conservation of Migratory Species
COD	Commercial operations date
CRZ	Coastal Regulation Zone
CTE	Consent to establish
CTO	Consent to operate
CUF	Capacity utilisation factor
CVD	Countervailing duties
DC	District collector
DCR	Domestic content requirement
DFO	Divisional forest officer
DIC	Department of industries and commerce
DISCOM	Distribution company
EC	Environmental clearance
EIA	Environment impact assessment
EPC	Engineering, procurement and construction
ESSCI	Electronics Sector Skills Council of India
FCA	Forest Conservation Act
FDI	Foreign direct investment
F&E	Forest and environment
FY	Financial year
GBI	Generation-based incentives
Gol	Government of India
GPS	Global Positioning System
HTL	High Tide Line
IFC	International Finance Corporation
IREDA	Indian Renewable Energy Development Agency
JNNSM	Jawaharlal Nehru National Solar Mission
JV	Joint venture
LTPLR	Long-term prime lending rate
MAT	Minimum alternate tax
MSIPS	Modified Special Incentive Package Scheme
MNRE	Ministry of New and Renewable Energy
MoEF	Ministry of Environment and Forest
MoU	Memorandum of understanding
MoUD	Ministry of Urban Development

NA	Non agricultural
NAPCC	National Action Plan on Climate Change
NBFC	Non-banking financial company
NGO	Non-governmental organisation
NOC	No-objection certificate
NPV	Net present value
NRSE	New and renewable sources of energy
NTPC	National Thermal Power Corporation
NVFN	NTPC Vidyut Vyapar Nigam
O&M	Operations and maintenance
PPA	Power purchase agreement
PSSC	Power Sector Skill Council
PRI	Panchayati Raj institutions
PSC	Power Sector Skill Council
PV	Photovoltaics
R&D	Research and development
R&M	Repair and maintenance
R&R	Resettlement and rehabilitation
RE	Renewable energy
REC	Renewable Energy Certificate
RfS	Request for selection
RGO	Renewable generation obligation
ROC	Registrar of Companies
RPO	Renewable purchase obligation
RRECL	Rajasthan Renewable Energy Corporation Limited
SBI	State Bank of India
SEAC	State expert appraisal committee
SECI	Solar Energy Corporation of India
SEFC	State Electricity Regulatory Commission
SEZ	Special Economic Zone
SIA	Secretariat of Industrial Assistance
SIDC	State Industrial Development Corporation
SIPS	Special Incentive Package Scheme
SPCB	State pollution control board
SPIA	Solar Park Implementing Agency
SPV	Special purpose vehicle
UDA	Urban development authority
UN	United Nations
VAT	Value added tax
VGf	Viability gap funding
WPA	Wild Life Protection Act
YoY	Year over year
<b>Units</b>	
GBP	Great British pound
USD	United States dollar
INR	Indian rupee
W	Watt
Wp	Watt peak
<b>Prefixes</b>	
K	Kilo
M	Mega
G	Giga

# India's current scenario

The past few years have seen increased awareness on climate change and global growth in RE. India continues to be a part of this growth with its tremendous solar energy growth plans in the pipeline. The nation's supportive policy framework and growth enablers have created a favourable investment environment, and unlocked the growth potential this sector has to offer. India's grid-connected solar energy sector has seen exponential growth from around 10 MW in FY 2010 to a current capacity of just over 4 GW, and it targets to establish 100 GW of grid-connected solar installations by FY 2022.

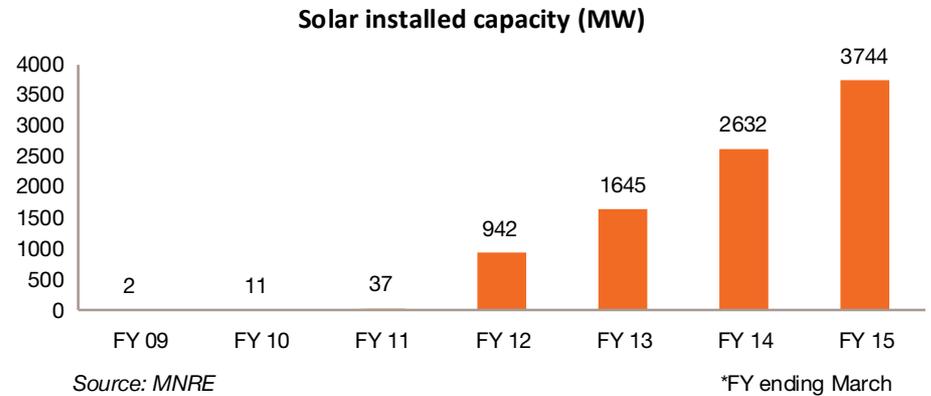
## India's current scenario

As of June 2015, India's installed power capacity stands at 274.82 GW, of which coal power plants are the major source: they account for over 60% of the total installed capacity in the country.

### India's generation capacity (MW)

Total energy	274,817
RE	36,470
Solar energy	4,060

As of June, 2015  
Source: MNRE

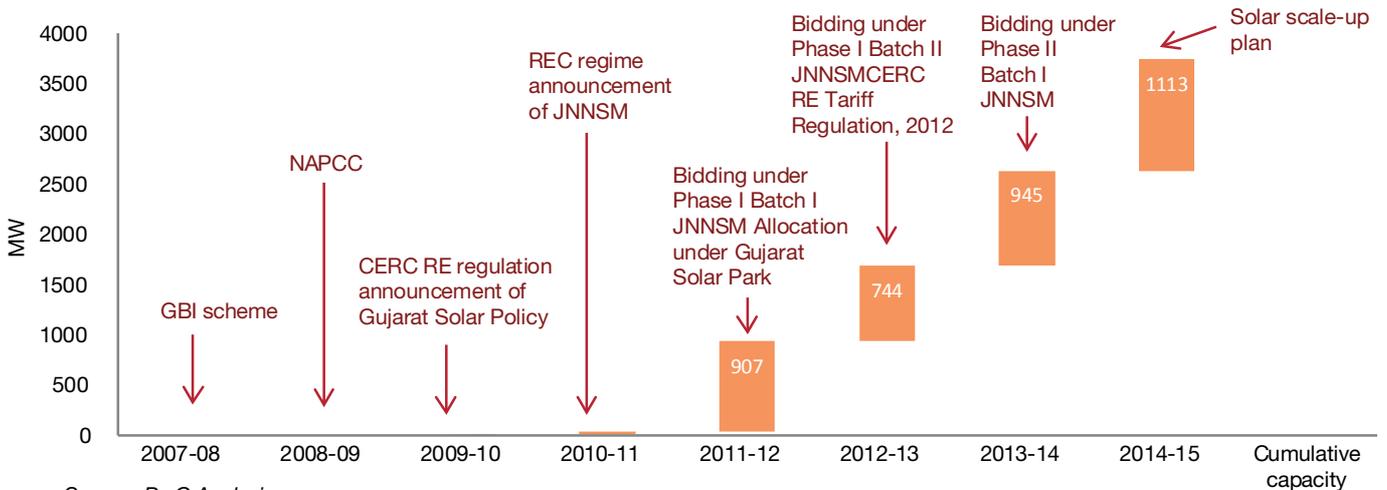


India's location in the tropical region has blessed it with immense solar radiation, leading to a potential of approximately 50 MWp/km<sup>2</sup>. Assuming only 3% of India's wasteland is made available for solar energy installations, this translates to an estimated potential of 748 GW.

## Historic trends and growth enablers of RE

The driving factors for solar energy projects in India include demand/supply (low per capita consumption, large un-electrified areas, technology improvements, cost reductions, and entry of a large number of players),

policy (targets set under the NAPCC, solar scale-up plan, JNNSM, fiscal and other incentives) and other issues (fuel challenges and significant solar energy potential) affecting conventional power generation. The Indian growth story can be seen from the fact that grid connected solar energy in India has seen a CAGR of 240.5% over the last five years.





## State targets

Apart from state RPO targets, several states have set their own solar power capacity installation targets in their policies, which provide an idea of the interest shown by these states towards solar energy. To support the achievement of such targets, such states have introduced a slew of favourable state policies and incentives. The targeted capacity addition of several states as per these has been tabulated alongside.

State	Target	Policy
Chhattisgarh	500-1,000 MW by March 2017	Chhattisgarh State Solar Energy Policy, 2012
Haryana	1,300 MW by March 2022	Haryana Solar Power Policy, 2014; Policy for Promoting Generation of Electricity through Renewable Energy Sources
Jharkhand	2,100 MW solar PV power plants and 500 MW rooftop solar power plants by 2020	Jharkhand State Solar Policy, 2015
Karnataka	2,000 MW by March 2021	The Karnataka Solar Policy, 2014-2021
Kerala	500 MW by 2017 and 2,500 MW by 2030	Kerala Solar Energy Policy, 2013
Maharashtra	Capacity addition of 7,500 MW by 2020	Maharashtra's Policy on Renewable Energy, approved in 2015
Manipur	Rooftop: 5 MW by March 2017	State Policy on Renewable Sources, 2006, and Manipur Grid Interactive Rooftop Solar Photovoltaic (SPV) Power Policy, 2014
Orissa	135 MW by March 2016	Policy Guidelines on Power Generation from Non-Conventional Energy Sources, 2005
Punjab	1,000 MW by 2022	New and Renewable Sources of Energy (NRSE) Policy of Punjab, 2012* *The concerned minister has, however, announced targets of 4,200 MW by 2022.
Rajasthan	25,000 MW	Rajasthan Solar Energy Policy, 2014
Seemandhra	5,000 MW by 2018-2019 and 10,000 MW by 2021-2022	Andhra Pradesh Solar Power Policy, 2015 (revised targets)
Telangana	5,000 MW by 2020	Telangana Solar Policy, 2020
Tamil Nadu	3,000 MW by 2015	Tamil Nadu Solar Energy Policy, 2012
Uttar Pradesh	500 MW by March 2017	Solar Power Policy Uttar Pradesh, 2013
Uttarakhand	500 MW by March 2017	Uttarakhand State Government Policy for Harnessing Renewable Energy Sources, 2008;
West Bengal	100 MW by March 2017 and 500 MW by March 2022	West Bengal Policy on Co-generation and Generation of Electricity from Renewable Sources of Energy, 2012

## Incentives available to RE projects in India

GoI offers various incentives to make the solar sector lucrative for sectoral players, and, eventually, help this sector attain grid parity at a faster pace. The incentives offered are a mix of tax and non-tax incentives involving various monetary benefits, exemptions and easier clearances to facilitate increased participation in this sector. Apart from the major national-level incentives mentioned below, certain states offer separate state-level incentives to players establishing operations in their regions.

Tax incentives	Details
Income-tax holiday	100% for 10 consecutive years—MAT @ 20% to apply
Accelerated depreciation	Accelerated depreciation @ 80% on solar assets
Service tax based on negative list	2,100 MW solar PV power plants and 500 MW rooftop solar power plants by 2020
Customs and excise laws	<ul style="list-style-type: none"> <li>No customs and excise duties on cells and modules, but some raw materials required to manufacture cells and modules attract 5% customs duty and CVD</li> <li>Full exemption from excise duty for solar tempered glass used in the manufacture of solar PV cells/modules, solar power-generating equipment/system and flat plate solar collectors</li> <li>Flat copper wires used in the manufacture of PV ribbons to be used in the manufacture of solar cells/modules are exempt from full customs and excise duty</li> <li>Import of plant and machinery for initial setting up of solar power projects is exempted from additional custom duty</li> <li>Goods required for manufacturing of solar cells and modules have fully been exempted from additional customs duty</li> </ul>

Non-tax incentives	Details
Feed-in-tariffs	<ul style="list-style-type: none"> <li>When solar generators sell to state utilities under the preferential rates prescribed by the SERC</li> <li>Benchmarked feed-in-tariff levels prescribed by the CERC form the ceiling price for developing projects under bidding route</li> </ul>
Rebates	<ul style="list-style-type: none"> <li>Subsidies on capital expenditure on investments in manufacturing solar PV of 20% in SEZs and 25% in non-SEZs</li> <li>15% subsidy for rooftop solar panels on top of educational institutions, hospitals, care homes, government community centres and buildings, establishments for common use and residential buildings</li> </ul>
Solar purchase obligation	<ul style="list-style-type: none"> <li>Determination of solar purchase obligation by SERCs to encourage purchase of solar power</li> <li>Mandate to fulfil the solar purchase obligation through solar RECs</li> </ul>
Favourable land policies	<ul style="list-style-type: none"> <li>By various state governments involving reduction/exemption of stamp duties and registration charges</li> <li>Deemed/easier conversion of land and also government land being provided on lease for the entire project duration at low rates</li> <li>Ease of land allocation</li> </ul>
Government R&D programmes	<ul style="list-style-type: none"> <li>Improvement in solar technologies supporting the attainment of</li> <li>Grid parity of solar technologies</li> <li>Lead to growing performance, importance and reducing costs</li> </ul>



# Financing RE in India

## FDI in the RE sector

- Hundred per cent FDI in RE is permitted.
- FDI inflows in the RE industry in 2014 were 7.4 billion USD.<sup>1</sup>

A variety of investors finance solar energy projects in India, including institutions, banks and registered companies. Institutional investors are state-owned, bilateral or multilateral institutions. Among banks, both private sector and public sector banks are involved. In addition to registered companies, venture capital and private equity investors contribute equity investment. Development banks such as IREDA continue to represent a key source of funds for RE investments, particularly in project finance, over the medium term.

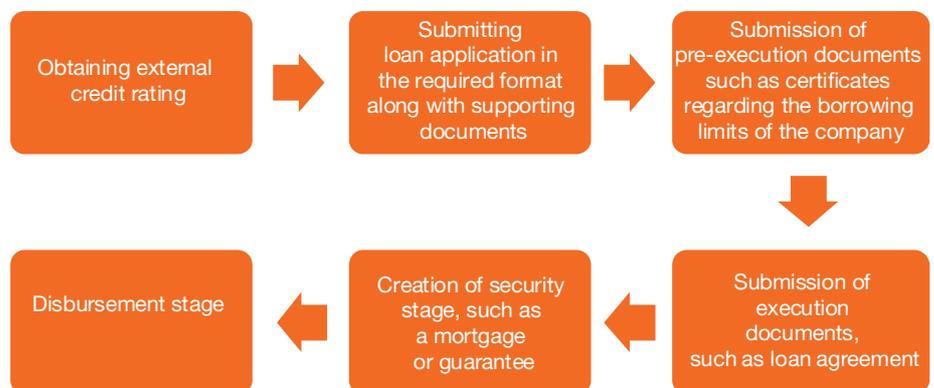
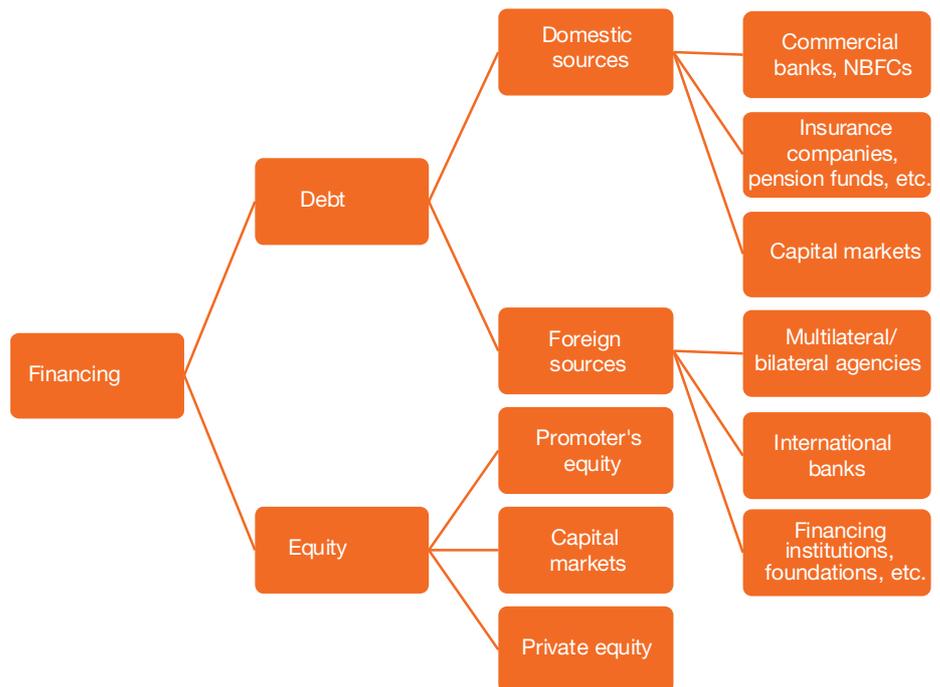
## Obtaining financing

As mentioned above, financing for solar energy projects may be obtained from foreign, domestic sources or a mix of both. Generally in the current scenario, the debt–equity ratio for solar energy projects is to the tune of 70:30 of the total project cost. This may, however, differ from case to case, mainly as per the financing institution involved, the tender guidelines and the financial strength of the loan applicant.

For projects that are awarded through the process of competitive bidding, loans are awarded to developers after the signing of PPAs. There are minute differences in the loan application procedures of different institutions. However, the overall process is more or less similar. An example of some of the main steps involved and requirements for obtaining a loan have been depicted below by considering the process while applying a loan with IREDA.<sup>2</sup>

Financing cost for RE projects in India

Entity	Rate of interest
Scheduled commercial banks	>12%
EXIM Banks (post currency hedging)	~ (10-12%)
NBFCs	~ (11.5-13%)
Multilaterals and bilateral (ADB, IFC, etc.)	>11%



Source: PwC Analysis

## **Financing initiatives**

In the first half of 2015, GoI came up with various financing initiatives to facilitate and support the increased deployment of RE, particularly solar energy, in India. The main initiatives taken up during this duration are:

### **Priority sector lending for renewables**

The RE sector figures among the priority sectors for lending in India. Under the priority sector norms, banks are mandated to disburse 40% of their adjusted net bank credit to priority segments. This increases finance availability for the RE sector from both domestic as well as foreign banks, enabling the sector to grow at a much faster rate. Lending will especially increase more for established international players in the market.

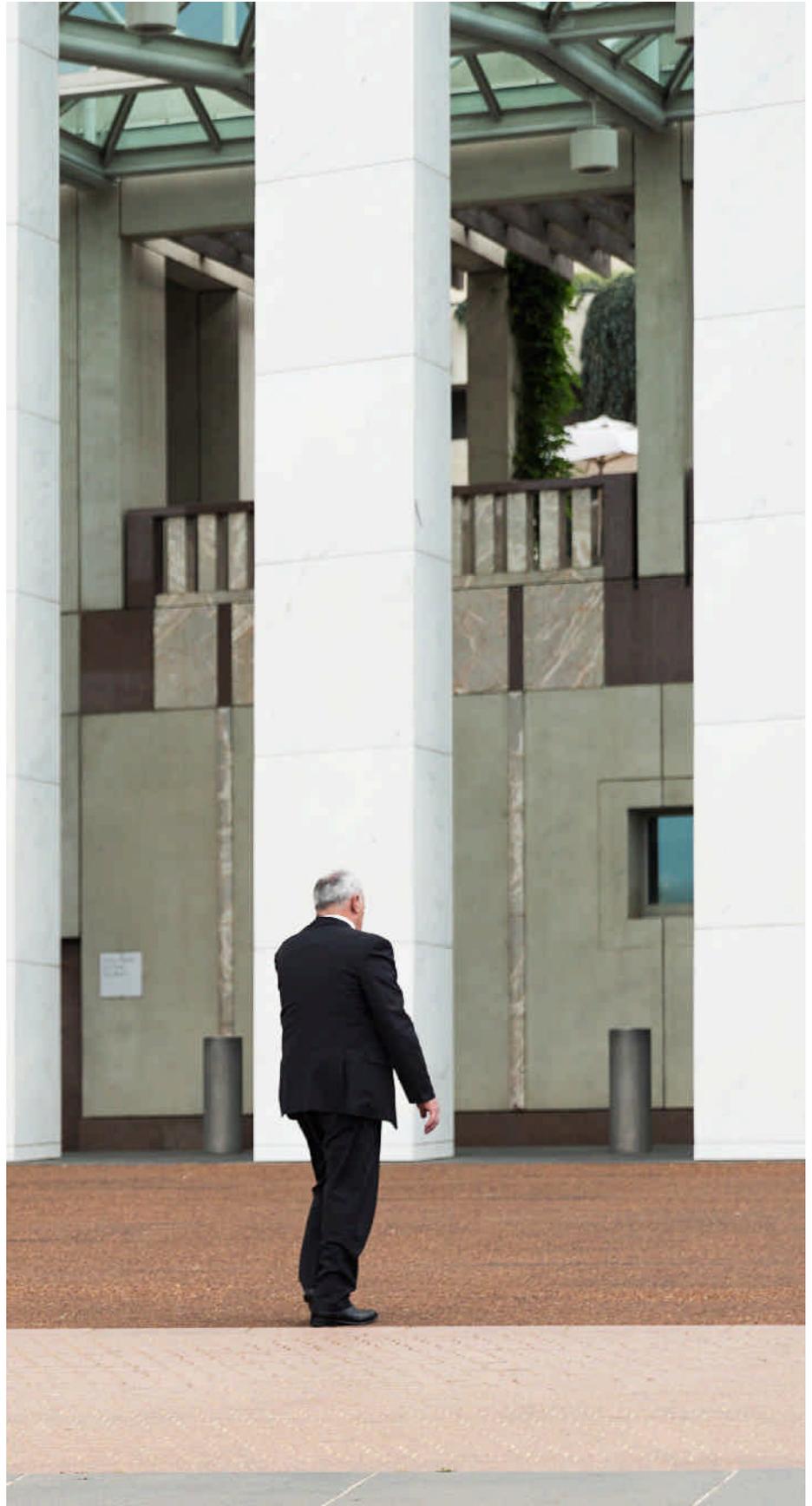
### **Rooftop solar as part of housing loan**

Rooftop solar power plants on houses can be set up through bank loans, which would be part of home loans or home improvement loans. Individuals can borrow a maximum of 1 million INR (about 10,000 GBP) under this scheme. The MoUD will further give some concession for making green buildings and ensure additional incentives for them.

### **India exploring solar bids in dollar terms to bring down tariffs**

MNRE plans to introduce dollar-denominated tariff bidding to make energy from solar projects affordable. This will make way for more investments from foreign players, who fear exchange and currency rate risks.

This type of bidding will allow developers to raise dollar-backed loans without bearing the hedging costs, and will, thus, enable them to supply electricity at a cheaper rate. This will particularly favour international players with access to cheaper finance in foreign currencies and enable them to actively participate in the Indian market.



# Entering the Indian market

India as a destination to do business has attracted many countries around the world and today it is one of the leading emerging economies. Almost all the sectors in India have grown by and large in the last couple of decades after the liberalisation of the economy in the early '90s. India has long-term and sustainable business possibilities owing to its large domestic consumption and business growth on an international level in the past.

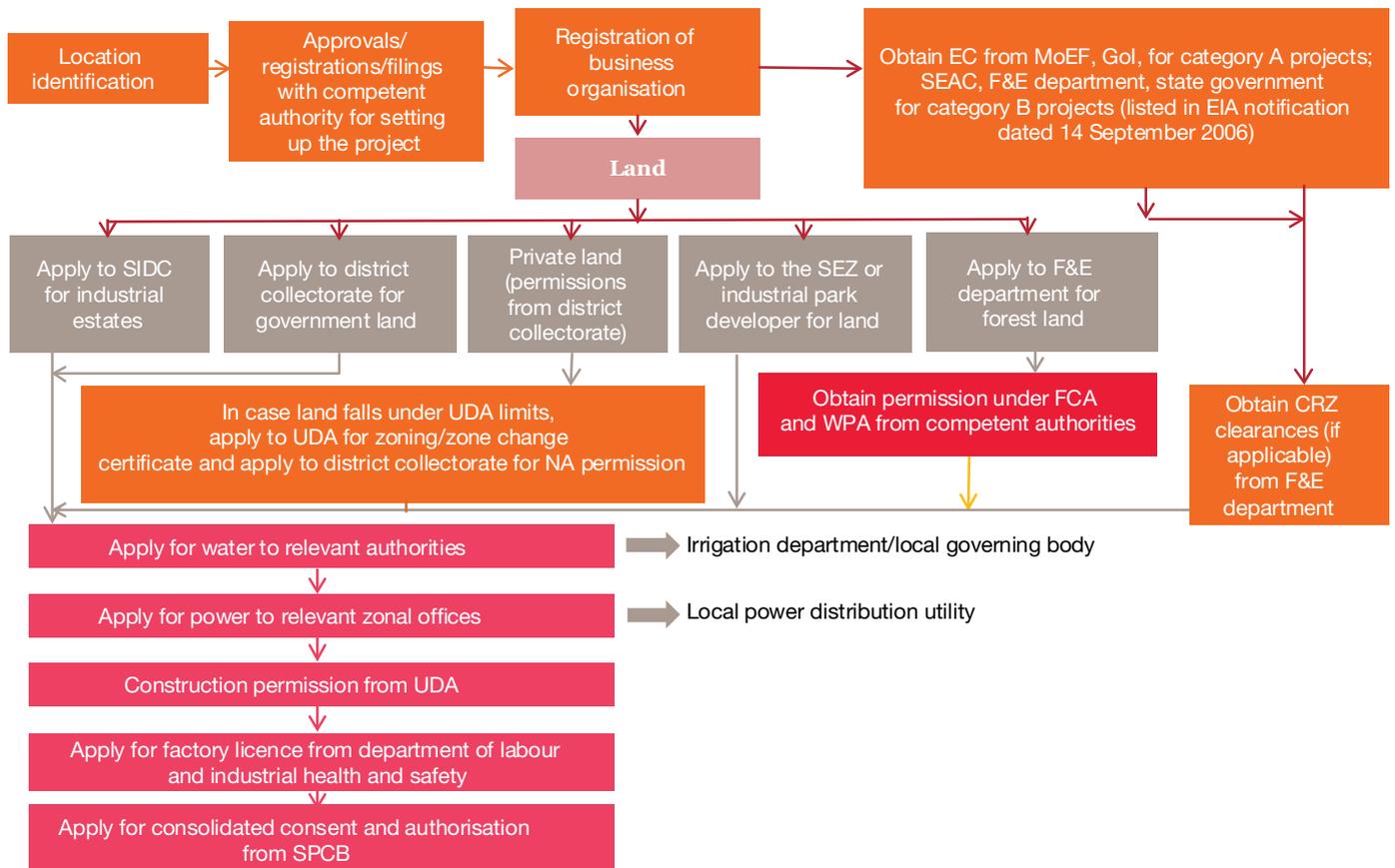
The RE sector, predominantly the solar energy space, is one such area which fetches the interest of global companies and entices them to India. Some companies have a predetermined way of entry into this market, owing to their long business relations with India. However, a very clear entry mode should be chosen

by companies from the options available when planning to associate business with India. The entry options elucidated for clients are as follows:

- Establishment of a 100% wholly-owned Indian subsidiary of the parent company
- JV
- Strategic acquisition of an existing Indian company
- Operating through an agent/representation, distributor/partner in India

It is important for a company to keep certain things in mind while choosing a specific location to set up its business. This includes the demographics, right infrastructure, tax rules of the state,

proximity to suppliers, human resource availability, SEZ, price parity, and exit options in case of dissolution. Typically, the framework for setting up industries in India starts with the identification and selection of the land. After this, registration of the project with the appropriate authority (ROC) is to be completed. The next step includes identification of the land and securing clearance of the identified land for the project. Once the authorities grant the land clearances and approvals, the developer has to then seek other clearances for water, electricity, construction and pollution.



Clearances required for setting up RE projects

India's regulatory system and implementing agencies ensure that environmental quality and social concerns are not compromised, and any arising concerns are addressed while implementing solar energy projects. To be compliant with these regulations, projects have to get appropriate clearances.

- **Consent process**

- SPCBs grant consent to establish CTE and CTO to projects.
- CTE is issued to projects after evaluating the potential environmental impacts and the design of pollution control installations and upon verification of compliance with these conditions. A CTO is issued with emission and effluent limits based on industrial sector-specific standards.
- Some states like Gujarat issue consolidated consents for air and water pollution and hazardous waste based on CCAs. Others states like Chhattisgarh issue water and air consents as well as waste management authorisations separately.

- **CRZ clearance**

CRZ clearance regulates development in areas located along the Indian coast. Coastal areas are considered sensitive zones and classified by the MoEF as CRZ I, II, III and IV for regulating development activities in the coastal stretches within 500 metres of HTL. Various activities are allowed in the different zones and rapid EIA is used as a tool for CRZ clearance. The project proponent has to ensure that CRZ clearance has been obtained and the project is not located in environmentally sensitive zones as notified under the CRZ classification.

- **Forest clearance**

Solar projects being set up on forested land have to obtain a two-stage approval from the MoEF. This two-stage process involves approvals by the divisional forest officer and subsequently the MoEF, or its regional office. In addition, as per MoEF rules, developers have to identify land contiguous to forestland for afforestation. This compensatory afforestation activity is also permitted in private land.

- **Environmental assessment for externally funded projects**

Solar projects funded by bilateral and multilateral agencies have to meet additional environmental and social performance standards prescribed by the respective funding agency.

- **International acts and treaties**

Projects should not violate any regional/multilateral treaty India is signatory to. Solar proponents and regulators have to ensure that environmental conservation and biodiversity preservation is not compromised due to project activities. These treaties include UN's CBD, CITES and Convention on Conservation of Migratory Species (CMS).

- **Social governance clearances**

Projects have to comply with acts addressing social concerns such as the 73rd Constitutional Amendment Act, 1992, Tribal Rights Act, 2006, India's Resettlement and Rehabilitation (R&R) Policy 2007 and Land Acquisition Act, 1894. Furthermore, these projects should be compliant with local laws and get approvals from the local bodies/institutions. Two major clearances in this regard are:

- **Local governments**

- Projects are subject to local laws and have to get approvals from local bodies.
- As per the 73rd Constitutional amendment, rural local bodies or Panchayati Raj institutions (PRIs) are to decide on clearing developmental projects by providing them legal status.
- Under the Panchayat Act, the PRIs or gram sabha at the village level has to be consulted by the project proponent before establishing a project in areas falling under its jurisdiction. This gives villagers/locals the right to raise their project development concerns.

- **Land acquisition**

- Solar projects are established on private, revenue or forestland, for which different states have different policies for land purchase/allotment. Apart from the major clearances, other clearances such as an NOC from the energy department and an NOC from the district collector are also required.

### ***Land availability for RE projects***

Land is a vital component for solar energy installations and land requirements for such projects are quite significant. Various state governments in India have announced favourable land policies that have been instrumental in reducing the capital cost for solar projects. For instance, Rajasthan, under its solar policy, has announced availability of land to developers at a low cost. Madhya Pradesh has announced investor-friendly land allocation measures that have resulted in the increase of solar installations.

Renewable power projects are established on private, revenue or forestland. Different states have different policies for land purchase/allotment.

## Private land

Most of the acquisition of private land for RE projects occurs through mediations directly with the landowners.

1. Certain states allow purchase of land without any conditions. Tamil Nadu has the most investor- friendly policy, wherein agricultural land can be directly purchased for setting up RE projects. In Rajasthan too, as per their recently announced solar policy, landowners are permitted to set up solar power projects on their land, or sublet their land for the establishment of such projects without any land conversion requirements.
2. Other states require that private/ agricultural land be converted to non-agricultural land for industries to purchase the land. States have a set procedure for this conversion. In Karnataka, this requires an amendment in the Karnataka Land Reforms Act, 1961, sections 79A and 79B. In Maharashtra, before purchasing private land, permission from the DIC has to be obtained, for which the survey/gut numbers of the

locations have to be submitted. These procedures consume additional time in the gestation periods of the projects.

## Revenue land

1. Certain states such as Gujarat and Rajasthan have developer- friendly procedures in acquiring revenue land. Revenue land files in Gujarat are cleared at the DC level, whereas in Rajasthan, government land is allotted by the DC on the recommendations of the RRECL at a concessional rate.
2. Certain other states require clearances by higher authorities, thus involving additional time.
3. Other states such as Maharashtra do not have any clear-cut policies for execution of RE projects on revenue land.

## Forestland

India's Land acquisition Act, 1894 (as amended in 1985), allows the use of forestland for developmental purposes. However, this land can be acquired only on lease and is subject to clearances from

the forest department. Furthermore, India's R&R Policy, 2007, ensures that minimum displacement takes place in large-scale projects. Of all the project options, the one with the least displacement is selected and an adequate resettlement package is decided to compensate the displaced communities.

Forest areas are identified using Forest Atlas and GIS maps, and alternatives have to be considered to minimise forestland use during this process. Allocation of this land on lease for RE projects takes place through a detailed two-stage process by the MoEF.

Stage-I: DFO assesses the NPV of the current forested area to make recommendations for forestland diversion and determines the areas for compensatory afforestation.

Stage-II: The MoEF, or its regional office, reviews the document and gives a go-ahead for the project.

As per MoEF rules, the developer has to identify the land contiguous to forestland for afforestation and undertake compensatory afforestation.



# Power sale options

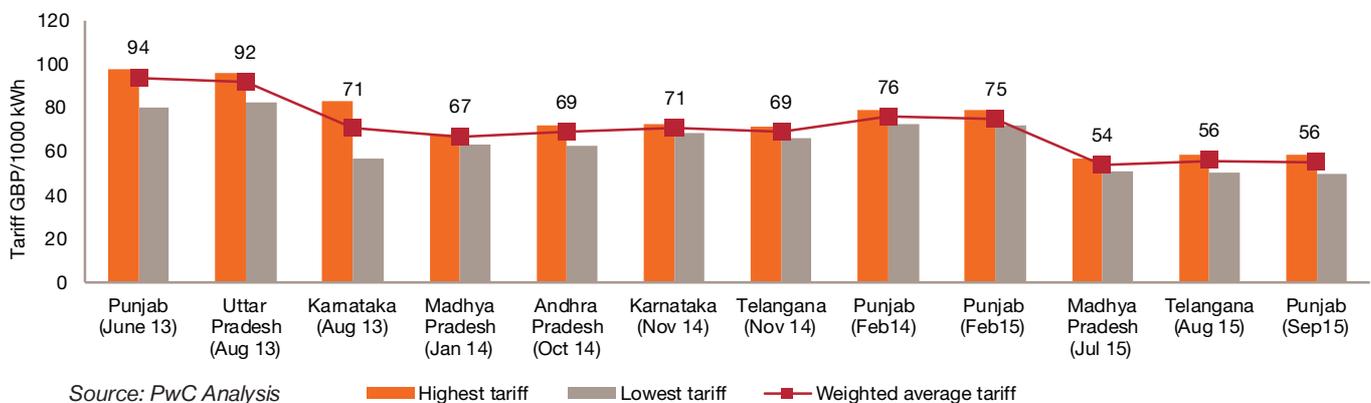
The RE sector has witnessed the evolution of several market models pursuant to the timely policy and regulatory framework formulated at the central and state level. The provisions of the National Electricity Policy and National Tariff Policy on preferential tariff and preferential treatment of non-conventional sources of energy have led to a feed-in-tariff regime, which has marked significant solar capacity addition in the country. The current policy and regulatory framework offers the promising market model of REC-based off-take models which provide a pan-nation market for solar energy.

## PPA allotment via reverse bidding

Most of the solar capacity addition in India is taking place via this route, wherein developers bid against tenders released for the procurement of power

by state agencies or central agencies such as the NTPC and SECI. There is a set of qualifying criteria that all developers have to meet, after which the developers with the lowest quoted tariff against the capacity put forward are issued letters of intent and awarded PPAs. According to the nature of the bid, these PPAs may be for a fixed tariff or have a variable tariff. Generally, the PPAs awarded are for a period of 25 years and have clauses for extensions post this period of 25 years.

Cases of some recent bids are provided below to serve as an indication of the tariffs currently being bid in the Indian market. A decline in solar electricity generation tariffs over the past two years is evident from this graph. Owing to the targets of installation of 100 GW of solar energy, India has recently seen an increase in the number of PPAs being awarded and tenders being released.



### ***Sale to third party under open access regime***

The model involves sale of energy to an open access consumer of the same DISCOM area within which the generator is located, or to a different DISCOM within the state. The network of DISCOMs or transmission companies is used to wheel power from the point of injection to point of usage. Such a market model of third-party sale is largely made feasible with the introduction of the provisions for open access transactions specified in the Electricity Act, 2003, and through the subsequent regulations framed by the SERC. The Electricity Act, 2003, defines open access vide section 2(47), reproduced as under.

‘Open access’ means the non-discriminatory provision for the use of transmission lines or distribution system or associated facilities with such lines or system by any licensee or consumer or a person engaged in generation in accordance with the regulations specified by the appropriate commission

According to the framework developed by the appropriate commission, open access allows a bulk consumer to contract directly with the generation company or with any other source of supply (other than the incumbent distribution licensee in whose area the consumer is situated). The open access framework also offers freedom to the generating company to supply power to consumers who are eligible to avail of open access.

### ***Sale through group captive under open access regime***

This model is very similar to that of the third-party sale model discussed in the above section. However, in this model, consumers need to have a minimum level of stakeholding in the renewable power plant set-up. Hence, in case a developer wants to set up power projects and sell power through the group captive route, then the shareholding/capital structure of the power plant should be such that the power plant qualifies as a captive generation plant. In accordance with the captive power policy notified by the GoI, for any power plant to qualify as a captive power plant, it needs to abide by two major conditions:

- Not less than 26% of the ownership is held by the captive user(s), and
- Not less than 51% of the aggregate electricity generated in such a plant is consumed for captive use on an annual basis. Provided that in the case of a power plant set up by a registered cooperative society, the conditions mentioned above shall be satisfied collectively by the members of the cooperative society.
- Structure of this power sale option: The developer/captive users may wheel the power generated to the point of consumption through dedicated lines or through the network of the transmission and/or the distribution licensee after paying necessary transmission and wheeling charges.

### ***Sale to distribution licensee under feed-in-tariff regime***

The model essentially involves sale of power generated by a solar power plant to the distribution utility at a rate approved by the SERC. Under this power off-take option, the utility will have to enter into a PPA with the purchaser or the distribution utility. Such a model is a time tested and comparatively less complex one. However, the lesser complexity of this power sale model comes at a price as it involves dependence on the willingness of the utilities to procure solar power and their creditworthiness to pay for the power purchase.

### ***Sale under the REC mechanism***

Under the REC mechanism, one REC will be issued to the RE generator for every 1 MWh of electrical energy fed into the grid. The RE generator may sell electricity to the distribution company at the regulated price equivalent to the average pooled cost of power purchase by the utility from all sources excluding RE sources. Further, its RECs can then be sold to obligated entities at the market price through a transparent exchange mechanism. The RE generator may sell certificates only through power exchange to obligated entities who have to meet with their RPO target. The purchase of RECs will be deemed as a purchase of

power generated from renewable sources and accordingly will be allowed for compliance with the RPO target. The REC mechanism enables obligated entities in a state to procure RECs generated from any of the states in India and to surrender the same to fulfil their RPO target.



## CERC regulations in 2015 and tariffs of the last five years

India's CERC has established guiding principles for SERCs to deal with matters related to energy generation from RE sources.

Salient features of tariff regulations for solar energy projects are mentioned alongside.



### CERC tariff order on solar power for 2015–16

The RE tariff order 2015–16, which defines the financial, operational and other technology-specific norms for determining the tariff of solar power projects commissioned during 2015–16, has been provided below.

Assumptions of the CERC tariff order on solar PV for 2015–16 are tabulated alongside.

State	Target
Control period	5 years
Tariff period	25 years
Tariff structure	Single part tariff-fixed components shall be: <ul style="list-style-type: none"> <li>• Return on equity</li> <li>• Interest on loan capital</li> <li>• Depreciation</li> <li>• Interest on working capital</li> <li>• Operation and maintenance expense</li> </ul>
Tariff design	The generic tariff shall be on levelised basis for the tariff period.
Dispatch principles	All plants with an installed capacity of 10 MW and above shall be treated as 'MUST RUN' power plants.
Discounting factor	Weighted average of cost of capital
Debt equity ratio	70:30
Loan and finance charges	Loan tenure: 12 years
Interest rate	<ul style="list-style-type: none"> <li>• It is the average long-term prime lending rate (LTPLR) of SBI prevalent during the first six months of the previous year plus 300 basis points.</li> <li>• Repayment of loan shall be considered from the first year of COD</li> </ul>
Return on equity	Pre-tax of 20% for the first 10 years and pre-tax of 24% from the 11th year onwards till useful life
Depreciation	<ul style="list-style-type: none"> <li>• Value base shall be the capital cost of the asset</li> <li>• 5.83% for the first 12 years and spread over useful life from the 13th year onwards</li> </ul>
Interest on working capital	<ul style="list-style-type: none"> <li>• O&amp;M for 1 month</li> <li>• Receivables for 2 months of energy charge on normative CUF</li> <li>• Maintenance spare @ 15% of O&amp;M expense</li> </ul>
Operation and maintenance expense	R&M expense + A&G expense + employee expense
Rebate	For payment of bills through letter of credit, a rebate of 2% shall be allowed. For payments made other than through letter of credit within 1 month of presentation of bills by the generating company, a rebate of 1% will be allowed.
Late payment surcharge	Delay beyond the period of 60 days from the date of billing attracts a late payment surcharge of 1.25% per month.
Sharing of CDM benefits	100% of the gross proceeds to be retained by the developer in the first year. In the second year, the share of beneficiaries shall be 10%, which shall be progressively increased by 10% every year until it reaches 50%. After that, the proceeds shall be shared in equal proportion by the generating company and the beneficiaries.
Subsidy or incentive	Accelerated depreciation or generation-based incentive shall be factored in while determining the tariff.
Taxes and duties	Taxes and duties shall be passing through on actual incurred basis.
Assumption head	Specification
Useful life	25 years
Tariff period	25 years
Capital cost	605.85 lakh INR/MW (~0.62 million GBP/MW)
Debt: equity	70:30
Interest rate	13%
Return on equity (pre-tax)	Return on equity for first 10 years: 20% Return on equity from the 11th year onwards: 24%
Depreciation	Depreciation rate for the first 12 years: 5.83% Depreciation rate from the 13th year onwards: 1.54%
O&M cost (base year- FY 15)	13 lakh INR/MW; escalation: 5.72% YoY
CUF	19%
Applicable tariff	Without AD: 7.04 INR/kWh (~0.072 GBP/kWh) With AD: 6.35 INR/kWh (~0.065 GBP/kWh)

### ***Sale to third party under open access regime***

The CERC has also specified benchmark capital cost norms for solar power projects that enter into PPAs after 31 March 2011. The table below presents the capital cost specified by the commission for the projects proposed to be commissioned during different financial years. Taking into consideration the benchmark capital cost norm and other norms specified by the CERC, the tariff applicable for solar PV and thermal projects commissioned during the respective years is also mentioned.

	Capital cost		Tariff	
	Crore INR/MW	Million GBP/MW	INR/kWh	GBP/kWh
2009-10	17	2.24	18.44	0.24
2010-11	16.9	2.38	17.91	0.25
2011-12	14.42	1.88	15.39	0.20
2012-13	10	1.17	10.39	0.12
2013-14	8	0.83	8.75	0.09
2014-15	6.91	0.70	7.72	0.08
2015-16	6.06	0.62	7.04	0.07

Source: CERC



# Manufacturing outlook

India's manufacturing policy recognises solar manufacturing as an industry with 'strategic importance'. Solar manufacturing can also create direct employment of more than 50,000 in the next five years, assuming local manufacturing captures 50% of the domestic market share and 10% of the global market share. Another at least 1,25,000 indirect jobs will be created in the supply chain. The crystalline silicon (c-Si) production capacity in India is currently 2,348 MW. The market currently consists of 20 companies engaged in the business of production of solar PV modules, while 15 are in the business of production of cells. Thin film solar manufacturing capacity in India is almost negligible: Moser Baer Solar is the lone player and has 50 MW of amorphous silicon (a-Si) based thin film module manufacturing capacity. A few other players were operational in the market a few years ago (HHV, Shurjo, etc.), but most of these capacities now lie abandoned.

Manufacturing of solar PV is a technology-intensive process. The government promotes the solar PV industry by giving incentives for solar manufacturing and its use for electricity generation. Currently, three key incentives are offered by the GoI to promote solar PV manufacturing in India.

- SEZ Policy, 2005: The SEZ policy of 2005 promises to encourage solar manufacturing in the country. It encourages 100% FDI in areas earmarked for manufacturing SEZs. Additionally, it provides import duty exemption on products used for manufacturing in SEZs and also promises to provide single-window clearance for setting projects in SEZs to be developed under this policy.
- MSIPS: Introduced in 2012, this scheme allows for subsidies on capital expenditure across investments in SEZs established for solar manufacturing. The subsidy on capital expenditure for investments in SEZs is 20%, while that on capital expenditure in non-SEZs is 25%. Incentives are also available for relocation of units from abroad. Further, incentives are available for units across the value chain, starting from raw materials and including assembly, testing, packaging and accessories of solar PV.

- Make in India programme: The government's Make in India initiative encourages indigenous production of solar components. The projects participating under this scheme are exempted from excise duty on machinery and equipment. Also, exemption from customs duty on flat copper wire used in the manufacture of PV ribbons (tinned copper interconnect) for solar PV cells/modules is being offered under the scheme.

GoI has launched the Solar Scale-up Plan, which aims to install 100 GW of solar power generation projects by FY22. In order to achieve this target, it is necessary to create substantial solar manufacturing capacity in the country. As per PwC estimates, an investment to the tune of 32.40 billion GBP will be required in the solar manufacturing segment. The estimated investment in the manufacturing segment is shown below.

The incentives offered by GoI to promote solar manufacturing encourage foreign manufacturers to form and adopt joint ventures and to partner with local manufacturing industries. There have been instances where foreign companies have entered into MoUs with local entities to establish manufacturing units in the country.

Year	Planned solar capacity addition (MW)	Market size of manufactured components	
		Crore INR	Billion GBP
2015-16	4,000	16,737.00	1.72
2016-17	10,000	40,168.80	3.99
2017-18	15,000	57,843.07	5.57
2018-19	16,000	59,231.31	5.53
2019-20	17,000	60,415.93	5.47
2020-21	17,500	59,705.16	5.24
2021-22	17,500	57,316.95	4.88
Total	97,000	3,51,418.22	32.40

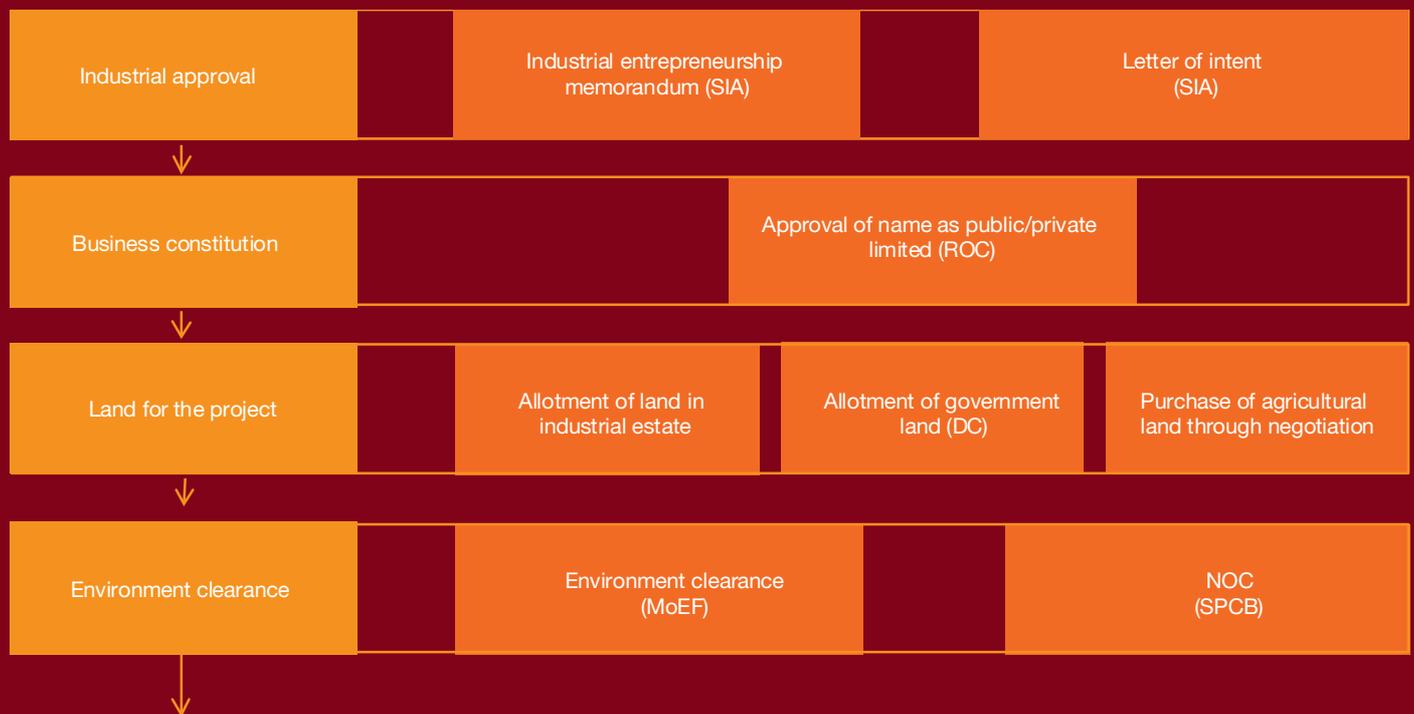
Source: PwC Analysis

# Establishing manufacturing operations in India

The process of establishing a manufacturing unit in India starts with seeking industrial approval from the Secretariat of Industrial Approval. The intended company submits the Industrial Entrepreneurship Memorandum to the Secretariat of Industrial Approval and after the relevant clearances have been obtained, a letter of intent is issued. The company then undertakes business development. In this context, the intended company files an application with the office of Registrar of Companies.

After obtaining approvals at the central level, the interested company approaches the state government/state government department to seek some more approvals and clearances. In this regard, the first step is towards securing the land. If the project proponent is interested in the development of a manufacturing unit in an industrial estate, it has to approach the state industrial corporation. On the other hand, if government land is to be acquired, then the respective district collector is to be approached.

After securing the land and getting all necessary approvals, the next step is acquiring environmental clearances. The first round of environmental clearance starts with filing an application for approval from the Ministry of Environment and Forest, followed by obtaining an NOC from the state pollution control board. Thereafter, it is imperative to secure water supply for the unit from the state water department and power from the state energy department. With regard to registration of the company, the project proponent has to seek an approval from the chief inspectorate of industries. The flow of approvals and procedures has been illustrated below.



- Securing water supply arrangement (water department) and securing power supply (power department)
  - Securing registration of companies (chief inspector of factories)

## *Manpower availability*

The solar energy sector in India employs sizeable manpower both in the organised as well as unorganised sector for the manufacturing, installation, operation and maintenance of equipment, and for the transmission and distribution of energy generated from RE sources. MNRE has been promoting skill development activities in solar energy by supporting various educational and training organisations, including NGOs and private organisations, in conducting training courses on specific job roles required by the RE industry. In addition, RE as a subject has been incorporated in the regular syllabus of the two-year certificate course of industrial training institutes of seven trades (electronics, electricians, welders, fitters, turners, sheet metal workers and machinists).

In the past, MNRE has supported the ESSCI and PSSC, and is currently working on creating a separate Renewable Energy (Green Energy) Skill Council in

collaboration with the Ministry of Skill Development and Entrepreneurship.

Further, MNRE intends to launch the 'Surya Mitra' scheme under which 50,000 rural unemployed youth with a qualification of Std VII will be given free training in handling solar power plants in order to look into the service and repair requirements of solar plants. A GPS-enabled mobile application will also be launched to connect consumers with the nearest trained Surya Mitra. This will support the targeted installation and maintenance of 40 GW of rooftop solar.

# Links

Names of stakeholders	Links
Ministry of New and Renewable Energy (MNRE)	<a href="http://www.mnre.gov.in">www.mnre.gov.in</a>
Ministry of Power (MoP)	<a href="http://www.powermin.nic.in">www.powermin.nic.in</a>
Solar Energy Corporation of India (SECI)	<a href="http://www.seci.gov.in">www.seci.gov.in</a>
Indian Renewable Energy Development Agency (IREDA)	<a href="http://www.ireda.gov.in">www.ireda.gov.in</a>
Rural Electrification Corporation (REC)	<a href="http://www.recindia.nic.in">www.recindia.nic.in</a>
Power Finance Corporation (PFC)	<a href="http://www.pfcindia.com">www.pfcindia.com</a>
Central Electricity Regulation Association (CERC)	<a href="http://www.cercind.gov.in">www.cercind.gov.in</a>
Central Electricity Authority (CEA)	<a href="http://www.cea.nic.in">www.cea.nic.in</a>
National Institute of Wind Energy (NIWE)	<a href="http://www.cwet.tn.nic.in">www.cwet.tn.nic.in</a>
Sardar Swaran Singh National Institute of Renewable Energy	<a href="http://www.nire.res.in">www.nire.res.in</a>
NTPC Vidyut Vyapar Nigam Ltd. (NVVN)	<a href="http://www.nvvn.co.in">www.nvvn.co.in</a>
Indian Renewable Energy and Energy Efficiency Policy Database (IREEED)	<a href="http://www.ireeed.gov.in">www.ireeed.gov.in</a>
Federation of Indian Chambers of Commerce and Industry (FICCI)	<a href="http://www.ficci.com">www.ficci.com</a>
Associated Chambers of Commerce and Industry of India (ASSOCHAM)	<a href="http://www.assochem.org">www.assochem.org</a>
Confederation of Indian Industry (CII)	<a href="http://www.cii.in">www.cii.in</a>
Agency for Non-conventional Energy and Rural Technology (ANERT)	<a href="http://www.anert.gov.in">www.anert.gov.in</a>
<b>State nodal agencies</b>	
Non-Conventional Energy Development Corporation of Andhra Pradesh Limited (NEDCAP)	<a href="http://www.nedcap.gov.in">www.nedcap.gov.in</a>
Arunachal Pradesh Energy Development Agency (APEDA)	<a href="http://www.apedagency.com">www.apedagency.com</a>
Assam Energy Development Agency (AEDA)	<a href="http://www.assamrenewable.org">www.assamrenewable.org</a>
Bihar Renewable Energy Development Agency (BREDA)	<a href="http://www.breda.in">www.breda.in</a>
Chhattisgarh State Renewable Energy Development Agency (CREDA)	<a href="http://www.new.credacg.org">www.new.credacg.org</a>
Goa Energy Development Agency (GEDA)	<a href="http://www.goa.gov.in">www.goa.gov.in</a>
Gujarat Energy Development Agency (GEDA)	<a href="http://www.geda.gujarat.gov.in">www.geda.gujarat.gov.in</a>
Haryana Renewable Energy Development Agency (HAREDA)	<a href="http://www.hareda.gov.in">www.hareda.gov.in</a>
Himachal Pradesh Energy Development Agency (HIMURJA)	<a href="http://www.himurja.nic.in">www.himurja.nic.in</a>
Jammu and Kashmir Energy Development Agency (JAKEDA)	<a href="http://www.jakeda.nic.in">www.jakeda.nic.in</a>
Jharkhand Renewable Energy Development Agency (JREDA)	<a href="http://www.jreda.com">www.jreda.com</a>
Karnataka Renewable Energy Development Agency Limited (KREDL)	<a href="http://www.kredl.kar.nic.in">www.kredl.kar.nic.in</a>
Energy Management Center (EMC), Kerala	<a href="http://www.keralaenergy.gov.in">www.keralaenergy.gov.in</a>
Ladakh Renewable Energy Development Agency (LREDA)	<a href="http://www.ladakhenergy.org">www.ladakhenergy.org</a>
Urja Vikas Nigam Limited, Bhopal (Madhya Pradesh)	<a href="http://www.mprenewable.nic.in">www.mprenewable.nic.in</a>
Maharashtra Energy Development Agency (MEDA)	<a href="http://www.mahaurja.com">www.mahaurja.com</a>
Manipur Renewable Energy Development Agency (MANIREDA)	<a href="http://www.manireda.com">www.manireda.com</a>
Meghalaya Non-conventional and Rural Energy Development Agency	<a href="http://www.mnreda.gov.in">www.mnreda.gov.in</a>
Zoram Energy Development Agency (ZEDA), Mizoram	<a href="http://www.zeda.co.in">www.zeda.co.in</a>
Orissa Renewable Energy Development Agency (OREDA)	<a href="http://www.oredaorissa.com">www.oredaorissa.com</a>
Punjab Energy Development Agency (PEDA)	<a href="http://www.peda.gov.in">www.peda.gov.in</a>
Rajasthan Renewable Energy Corporation Limited (RRECL)	<a href="http://www.rrecl.com">www.rrecl.com</a>
Sikkim Renewable Energy Development Agency (SREDA)	<a href="http://www.sreda.gov.in">www.sreda.gov.in</a>
Tamil Nadu Energy Development Agency (TEDA)	<a href="http://www.teda.in">www.teda.in</a>
Tripura Renewable Energy Development Agency (TREDA)	<a href="http://www.treda.nic.in">www.treda.nic.in</a>
Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA)	<a href="http://www.neda.up.nic.in">www.neda.up.nic.in</a>
Uttaranchal Renewable Energy Development Agency (UREDA)	<a href="http://www.ureda.uk.gov.in">www.ureda.uk.gov.in</a>
West Bengal Renewable Energy Development Agency (WBREDA)	<a href="http://www.wbreda.org">www.wbreda.org</a>

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