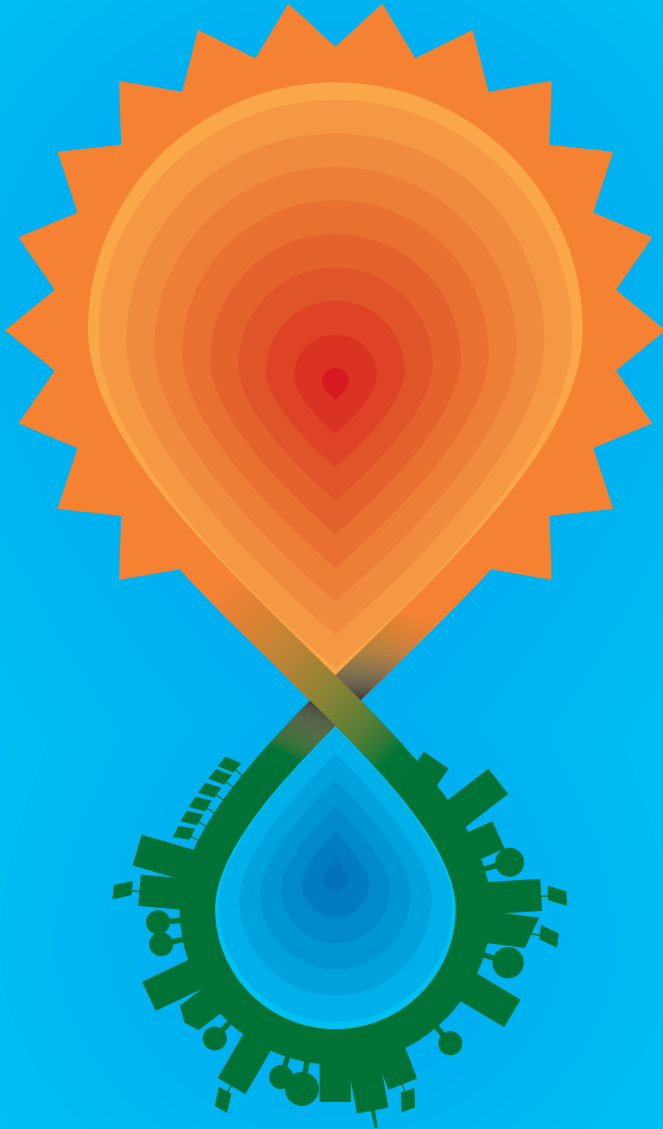




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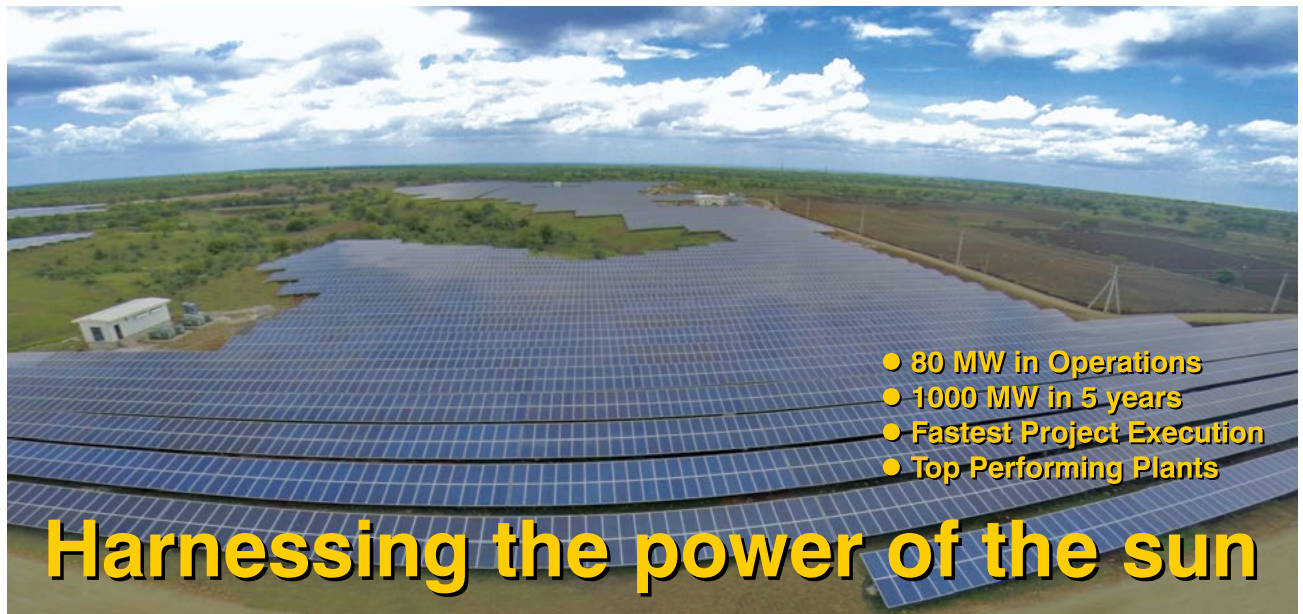


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For further enquiries,
please contact:
contact@bridgetoindia.com

BRIDGE TO INDIA Energy Pvt. Ltd
C - 8/5, DLF Phase I,
Gurgaon 122001
India
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Introduction

Is India's 2022 solar target of 100 GW for real?

Solar fundamentals are so compelling in India that the sector is bound to grow dramatically

It may be an ambitious number but that's missing the point. Solar fundamentals are so compelling in India that the sector is bound to grow dramatically with India likely to become one of the largest solar markets globally in the next 3 years. India is already on track to add more solar capacity than Germany in 2015 and enter the top five solar markets globally.

By changing the solar specific Renewable Purchase Obligation (RPO) target for 2022 from 3% to 10.5% of all power consumption in the country – yet to be ratified under the Electricity Act 2003 – India plans to increase its solar capacity from 20 GW by 2020 to 100 GW by 2022¹.

The 100 GW target is split between 60 GW of utility scale projects and 40 GW of rooftop and other small grid-connected projects. Both central and state governments have announced a number of schemes and policies to accelerate solar project development. The central government has taken the lead with the National Solar Mission (15 GW of projects by 2019) and initiatives such as the solar parks policy and an interest rate subvention scheme. Many states, including Andhra Pradesh (5 GW), Telangana (5 GW), Maharashtra (7.5 GW), Tamil Nadu (3 GW) and Karnataka (2 GW) have followed with huge targets.

There will be several challenges to achieving these plans, including land acquisition, transmission and financing. But the biggest challenge will be the enforcement of RPOs and the poor bankability of India's distribution companies (DISCOMs). As electricity is a concurrent subject, i.e., the center and the states both legislate on it, the states have the option to disregard the central government directives.

Both central and state governments have announced a number of schemes and policies to accelerate solar project development

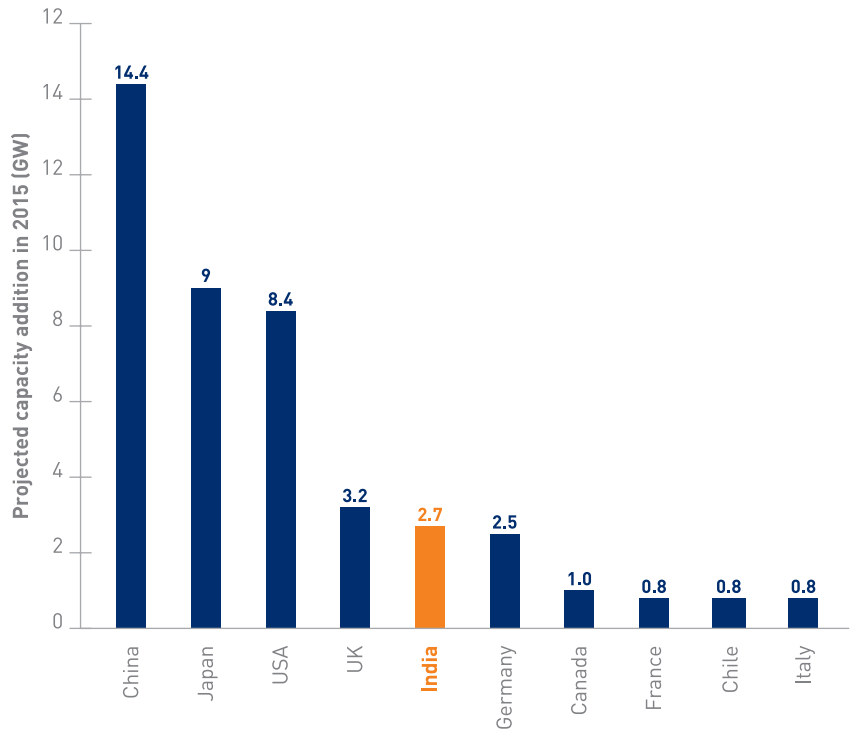
Growth of rooftop solar capacity is largely dependent on its financial competitiveness vis-a-vis grid power. The government has belatedly shown its commitment to this market by announcing encouraging financing initiatives (priority sector lending, interest rate subvention) improving availability and cost of debt financing to go along with wide ranging net-metering policies. But we believe that these measures may not be anywhere near sufficient to achieve the 40 GW rooftop solar target.

Having said that, the outlook for the solar sector in India is extremely positive, driven by powerful underlying fundamentals such as the rising cost of conventional power, environmental concerns, falling costs of solar power, high solar irradiation, a high power deficit and the ability of solar to quickly bring power generation capacity online. These fundamentals coupled with several state and central government initiatives should result in India becoming one of the largest solar markets in the world. This publication explains what to expect from the Indian solar market in the years to come and why.

¹ Refer to our blog, "Is raising the solar RPO target to 10.5% a good idea?", <http://bit.ly/1bx69xg>

India in international perspective

Figure 1: India is expected to break into the global top five in 2015²



***Solar in India
will likely grow by
250% in 2015***

In 2015, around 55 GW of solar capacity is expected to be added globally. Asian countries will likely continue to dominate the market with China, Japan and India expected to be in the top five countries. China might add over 14 GW this year and should overtake Germany in terms of cumulative installed capacity by the end of 2015.

With rejection of the proposal to bring dumping duties in India, the sector has gathered steam and the country could well register a capacity addition growth of 250% in 2015. This is likely to improve India's rank for new capacity addition to the fifth position globally. While China overtakes Germany in terms of overall capacity, India is likely to overtake Germany in terms of new capacity additions in the year.

² IHS, "Top Solar Power Industry Trends for 2015"; <http://bit.ly/1DDSHhv>

CANADA

Installed capacity by 2014: 1.7 GW
Target: 6.3 GW by 2020

Key market characteristics:

- Attractive FiT for solar projects < 500 kW
- Recently initiated Large Renewable Procurement process could support the projects > 500 kW

US

Installed capacity by 2014: 18,3 GW
Target: Different RPS for states, 20% power consumption from renewables

Key market characteristics:

- Investment tax credit for solar available until 2016
- Grid parity for solar in over 50% of the states

MEXICO

Installed capacity by 2014: 0.2 GW
Target: 35% from renewables by 2024

Key market characteristics:

- Mexico's energy reforms, 2014, has allowed private companies to build and operate power plants
- Renewables has been assigned higher priority for power purchase by state utility company CFE

CHILE

Installed capacity by 2014: 0.4 GW
Target: 20% from renewables by 2025

Key market characteristics:

- Chile is one of the few solar markets where solar has already reached parity on the generation side
- Country has approved around 8 GW of solar projects with another 2.5 GW under review

UK

Installed capacity by 2014: 5.1 GW
Target: 15% power consumption from renewables by 2020: 7-20 GW for solar

Key market characteristics:

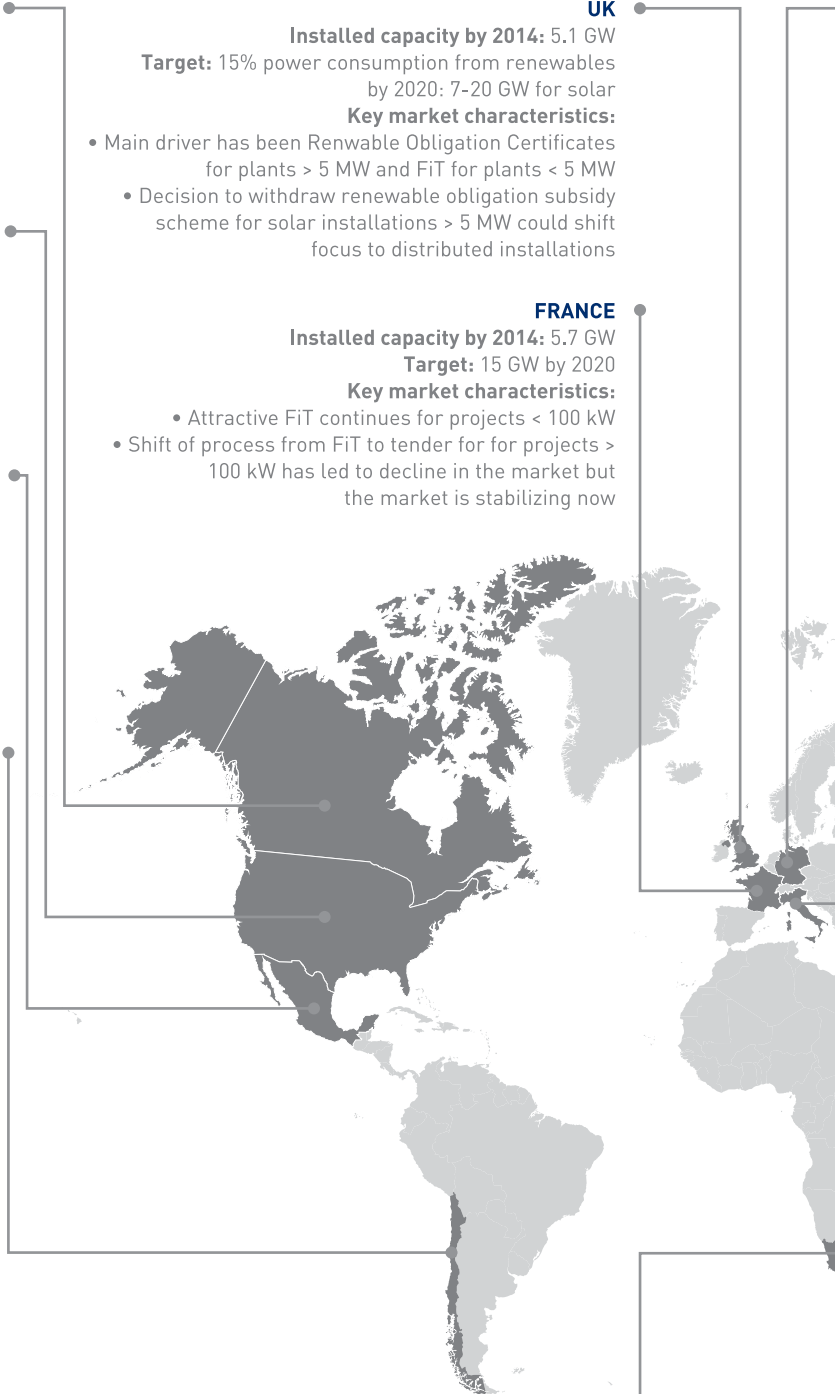
- Main driver has been Renewable Obligation Certificates for plants > 5 MW and FiT for plants < 5 MW
- Decision to withdraw renewable obligation subsidy scheme for solar installations > 5 MW could shift focus to distributed installations

FRANCE

Installed capacity by 2014: 5.7 GW
Target: 15 GW by 2020

Key market characteristics:

- Attractive FiT continues for projects < 100 kW
- Shift of process from FiT to tender for projects > 100 kW has led to decline in the market but the market is stabilizing now



SOUTH AFRICA

Installed capacity by 2014: 0.9 GW
Target: 8.4 GW by 2030

Key market characteristics:

- Government tenders has created a pipeline of around 2 GW in the country
- With high irradiation and high grid tariffs, solar has already reached parity

3 Installed capacity by 2014: IEA PVPS, Snapshot 2014 of Global PV markets; <http://bit.ly/1dsdgsb>

Key market characteristics: Deutsche Bank, Market Research Report, <http://bit.ly/1wDnK0q>

Target

China: National Energy Administration, <http://bit.ly/1OCSDdL>;

Japan: Japanese Photovoltaic Energy Association, <http://bit.ly/1GGAS93>;

US: US Climate Action Plan report 2013, <http://1.usa.gov/1GF8m4E>;

UK: Department of Energy and Climate Change, <http://bit.ly/1bSFqMC>;

India: Ministry of New and Renewable Energy, <http://bit.ly/1bUDIqK>;

Germany: Federal Republic of Germany, <http://bit.ly/1dsilki>;

France: French Environment and Energy Management Agency, <http://bit.ly/1EneQV0>;

Canada: Canadian Solar Industries Association, <http://bit.ly/16tgiJv>;

Italy: National Energy Strategy, <http://bit.ly/1EQ2bxj>;

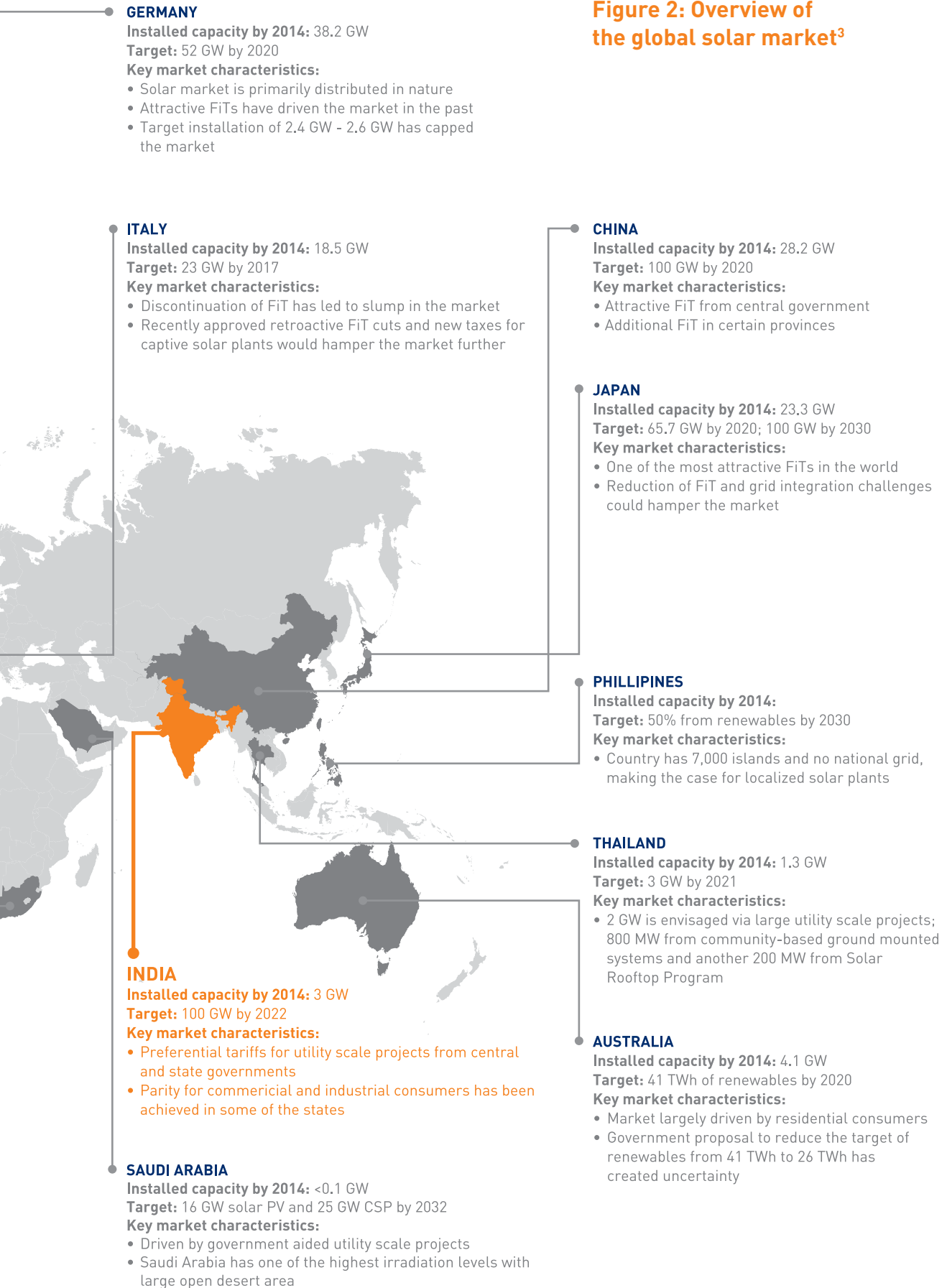
South Africa: Energy Department, <http://bit.ly/1Nx4GFq>;

Australia: Clean Energy Regulator, <http://bit.ly/1I9xsMz>;

Chile: UNFCCC, <http://bit.ly/1Fxnsl>;

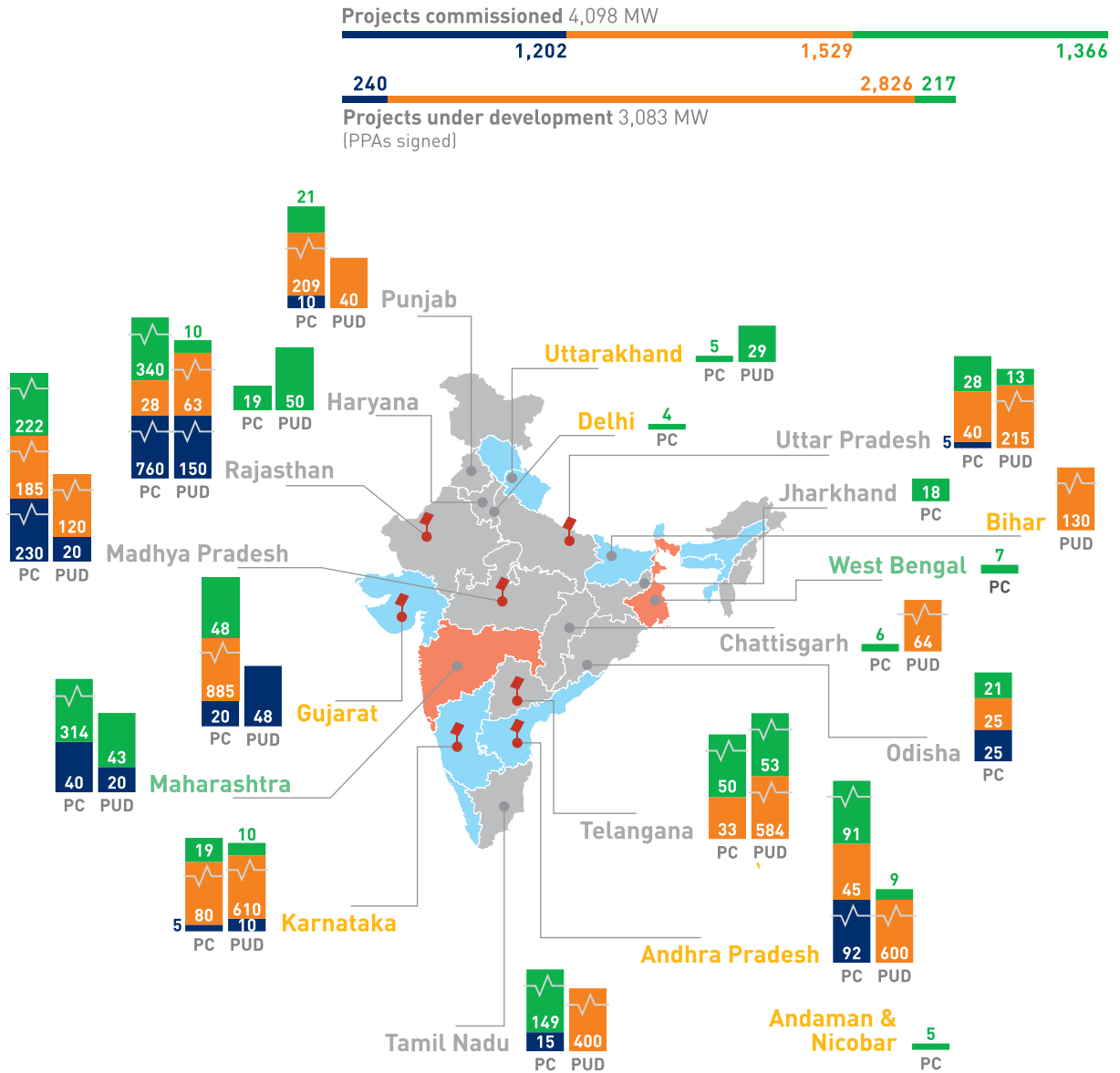
Mexico, Philippines, Thailand and Saudi Arabia: Deutsche Bank, <http://bit.ly/1wDnK0q>

Figure 2: Overview of the global solar market³



Utility scale solar

Figure 3: India has installed 4.1 GW of utility scale solar as of May 2015



Policy
 NSM State Policy Others

DISCOM rating
 Good Average Bad

📍 Solar Parks being developed by SECI

PC Projects commissioned
 PUD Projects under development

All figures in MW

Source: BRIDGE TO INDIA project database

National Solar Mission

Out of the 60 GW of utility scale solar planned by 2022, 15 GW is expected to be developed under the National Solar Mission (NSM) by 2019 using a combination of different structures including bundling of power⁴, dollar dominated bids, Viability Gap Funding (VGF)⁵ and interest rate subvention⁶.

Table 1: Tentative structure of capacity addition under phase two of the NSM (2014-2019)⁷

	Implementing authority	Primary off-taker	Investment	Capacity (MW)	Mechanism for allocation	Timeline for allocation (expected)	Comments
Batch II Tranche 1	NTPC	NTPC	Private sector	500	Tariff based bidding	2015 (underway)	To be set up in a solar park in Andhra Pradesh. This is expected to be the first operational solar park under India's new Solar Parks Policy.
Batch II Multiple tranches	NTPC	NTPC	Private sector	2,500	Tariff based bidding	2015 to 2016	This is expected to be divided into multiple tranches and state-wise bidding can be expected across 6-8 states.
Batch III Tranche 1 to 5	SECI	SECI	Private sector	7,000	VGF based bidding	2015 to 2018	The government plans to announce 3,250 MW of allocations in 2015. These allocations may be spread across at least six-seven states in India. Depending on the states' willingness to procure more power, future projects may be accelerated.
Batch IV	-----	-----	-----	NA	-----	-----	-----
Batch V	SECI	CPSUs	CPSUs	2,000	Fixed VGF	2016	SECI is expected to develop this project on behalf of CPSUs such as ONGC and OIL. This capacity is expected to be split up into multiple 250/500 MW projects. Note: this was originally announced as a 1,000 MW batch

⁴ Bundling of power allows for solar power to be bundled with unallocated thermal power, so that it can be sold to state DISCOMs at a nominal tariff

⁵ Under VGF, the government provides upfront capital subsidy to the project to allow it to sell power to DISCOMs at a nominal price

⁶ Under interest rate subvention, the government of India proposes to allow project developers to avail debt at a discounted rate

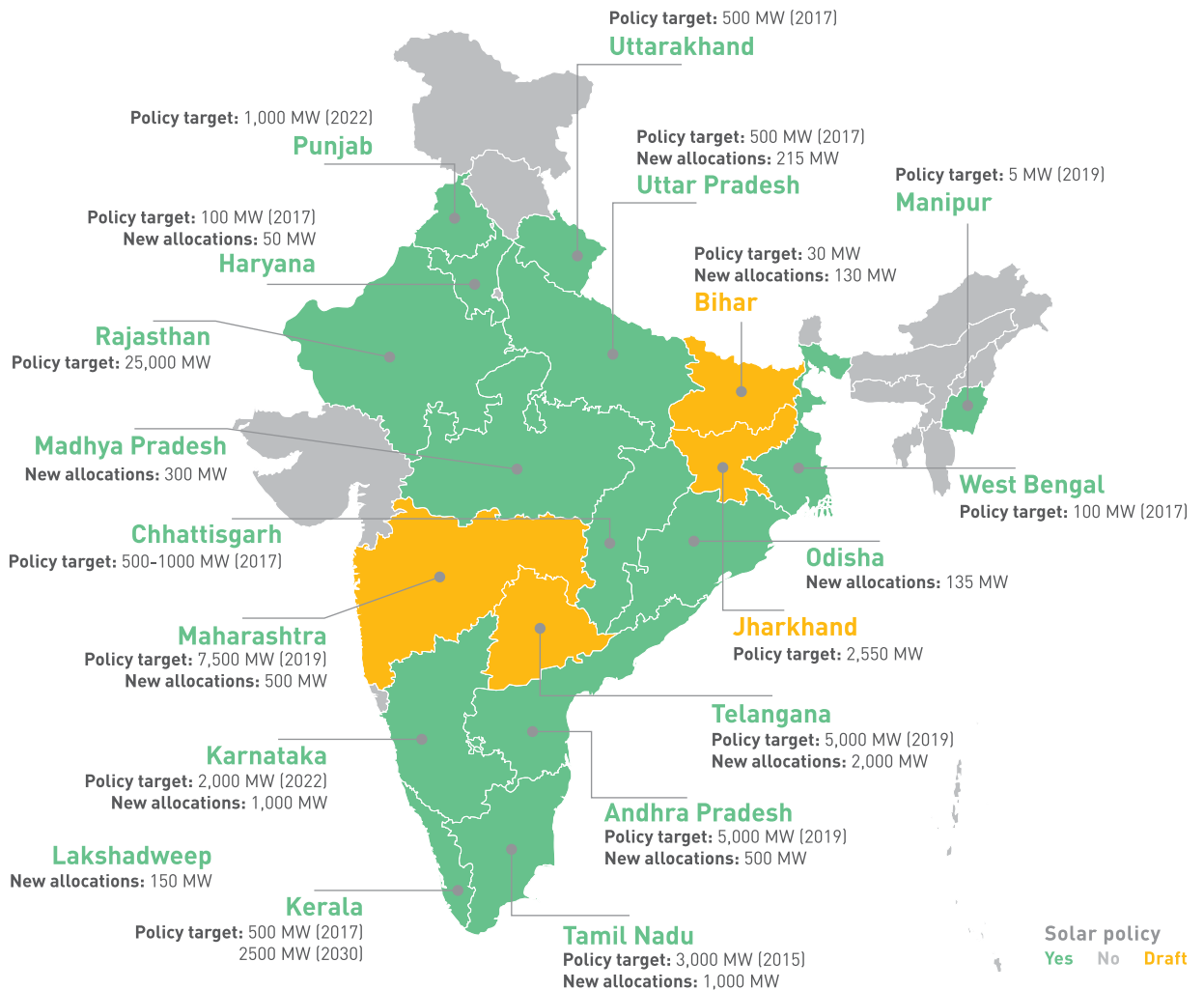
⁷ BRIDGE TO INDIA estimate

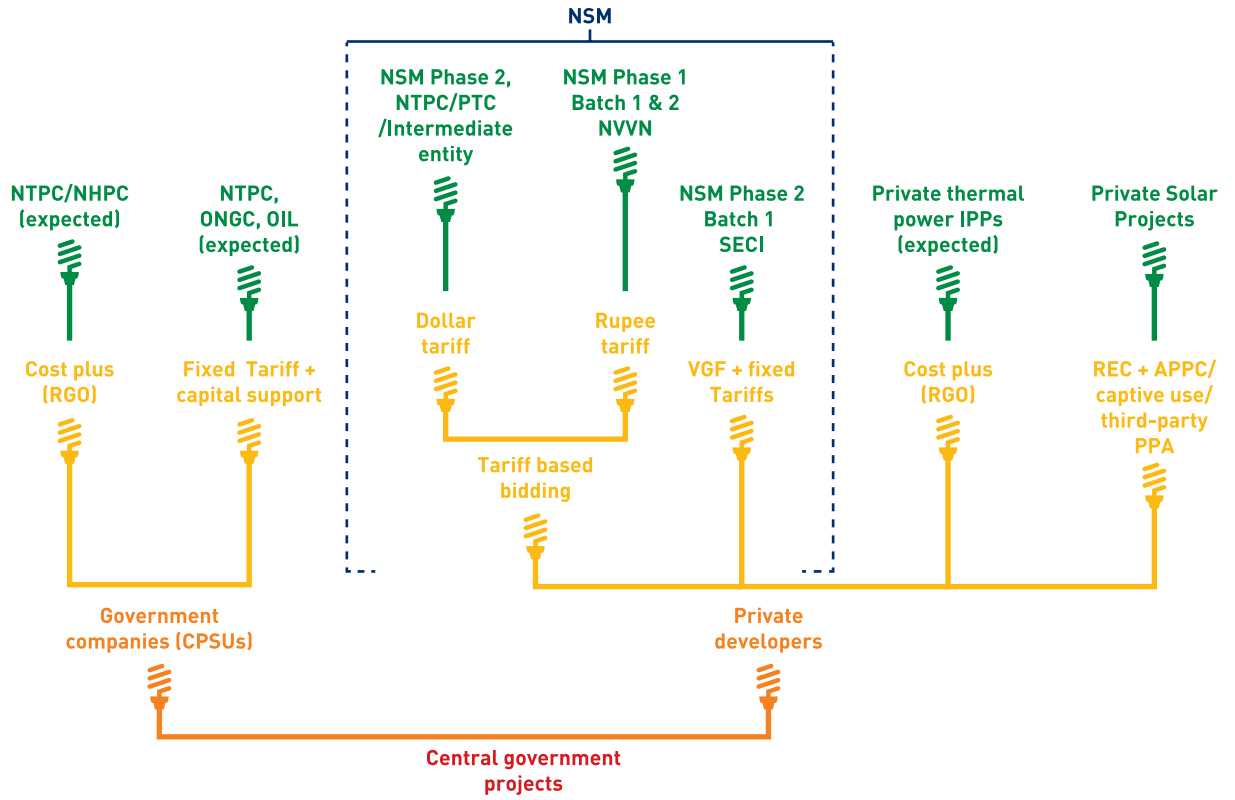
Implementing authority	Primary off-taker	Investment	Capacity (MW)	Mechanism for allocation	Timeline for allocation (expected)	Comments
SECI	DISCOMs	Public Private Partnership (PPP)	750	VGf and low cost debt	2015	The project is being developed as a single solar park in Madhya Pradesh. World Bank is expected to provide low cost debt to the project. Private participation may be allowed on a revenue sharing basis.
NTPC	DISCOMs	NTPC	2,000	Sale of bundled power on cost plus basis	2016-2017	Apart from the 15 GW target for phase II, NTPC has a plan to develop 10,000 MW of capacity for its renewable generation obligations.
SECI/Ministry of Defense	Ministry of Defense	Ministry of Defense	300	Fixed VGf	2014-2019	
Total			15,050			

State government projects

State solar policies and capacity addition are usually driven by three broad factors: RPOs, demand for new power generation capacity and political commitment to the renewable sector.

Figure 4: 50 GW of state level policy targets have already been indicated





- Type of Demand
- Project implementation entities
- Types of allocation
- Examples

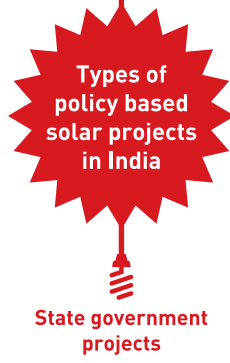
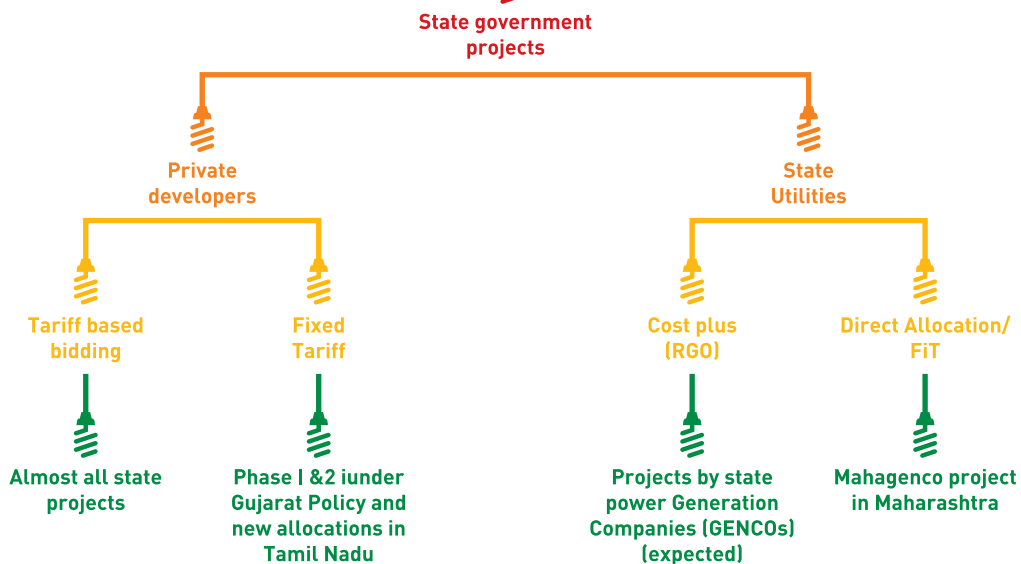


Figure 5: Utility scale project structures in India



Source: BRIDGE TO INDIA analysis

Issues and challenges

Poor financial health of DISCOMs

Bankability of DISCOMs is a major concern as most utilities are in a bad financial health. As a result, states are reluctant to buy power despite a power deficit in the state. BRIDGE TO INDIA believes that the poor financial health of DISCOMs is an issue that is not going away anytime soon. We believe that this is the most fundamental hurdle for achieving India's solar targets.

While Indian banks and financial institutions are large enough to meet the demand for financing, many of them are already reaching power sector exposure limits

Ability of the grid to absorb a high share of renewables

100 GW of solar would mean 10.5% share for solar power in total power generation terms. The government also plans to install 60 GW of wind by 2022. Such large share of intermittent sources requires huge investments in the power grid infrastructure for transmission, storage and smart supply and demand management. Without a timely up-gradation of grid, high penetration of intermittent sources would result in curtailing of power in areas of high renewable concentration. BRIDGE TO INDIA expects India's inability to quickly upgrade its grid and grid management processes in line with the new targets as a key technical hurdle for achieving the targets.

Land acquisition issues

Land acquisition is time consuming, costly and cumbersome. Even the government's own plans for creating solar parks have seen delays in most states⁸. BRIDGE TO INDIA is of the opinion that land acquisition will be a key reason for project delays at the implementation stage. Such delays are expected to impact timelines of both capacity addition and project allocation.

Availability of debt-financing

To achieve a capacity addition of 60 GW for utility scale projects by 2022, there would be a requirement of around \$40 billion of debt. The government currently expects a large share of this to come from international sources. But international debt appetite for solar projects in India is very limited and BRIDGE TO INDIA is of the opinion that bulk of this amount will need to come from domestic lenders. While Indian banks and financial institution are large enough to meet this demand, many of them are already reaching power sector exposure limits and their willingness to take on further DISCOM exposure is unknown.

Land acquisition is time consuming, costly and cumbersome. Even the government's own plans for creating solar parks have seen delays in most states

Project development landscape

- International utilities or companies backed by international utilities such as EDF (along with ACME), Fortum and Semcorp (Green Infra)
- International renewable developers such as SunEdison, First Solar, SolaireDirect, 8 Minute Energy and Focal Energy
- Private Equity (PE) backed Indian renewable IPPs such as Welspun, Azure Power and Renew Power

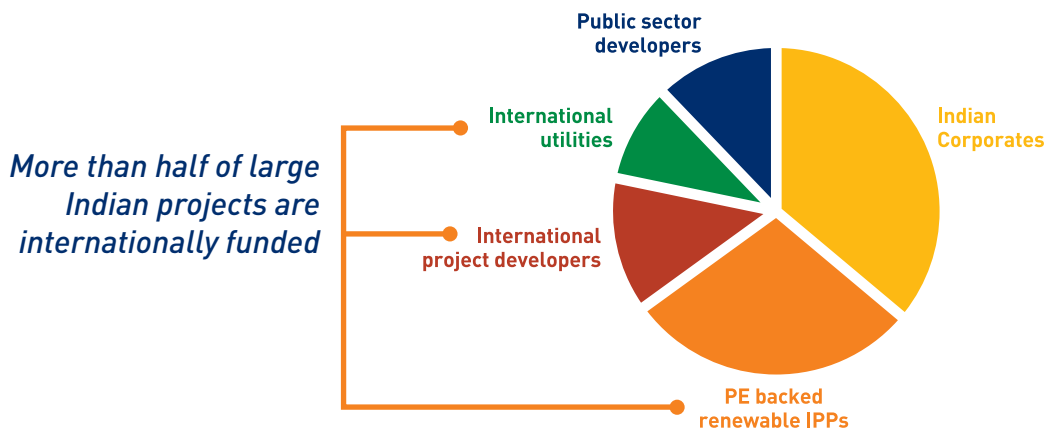
⁸ Refer to our blog, "Will land be the main hurdle for India's solar dreams?" <http://bit.ly/1bx6UGq>

- Indian corporates such as Aditya Birla Group, Reliance Group, Adani Group, Hero Group, Mahindra Group and Essel Group to Today Group and Mohan Breweries.
- Public sector developers such as NTPC, NHPC and ONGC

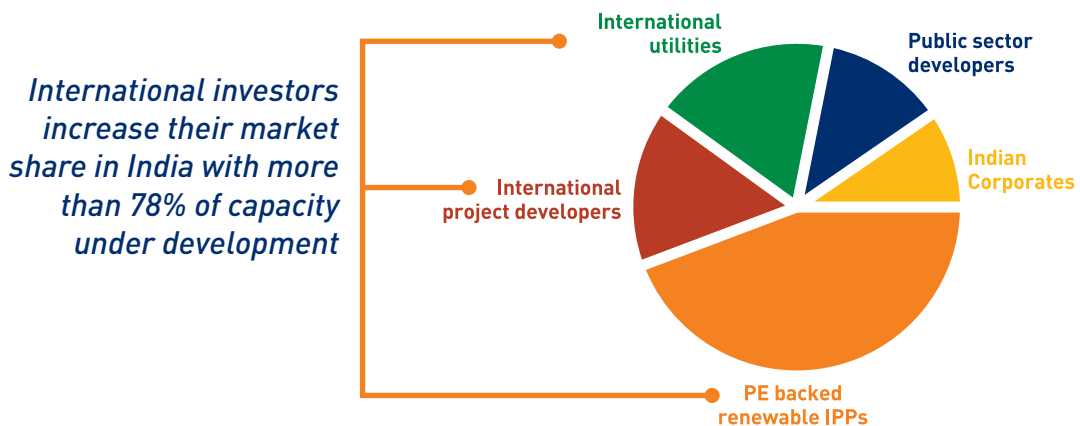
As the Indian solar market grows and project sizes increase, international utilities and IPPs with strong balance sheets and lower cost of capital are likely to play a greater role. We have already witnessed this trend growing over the last one year.

Figure 6: Role of international developers and PE backed renewable IPPs has been increasing in the Indian solar market

Project developer profile for commissioned projects (>10 MW) as of May 2015



Project developer profile for projects under development (>10 MW) as of May 2015

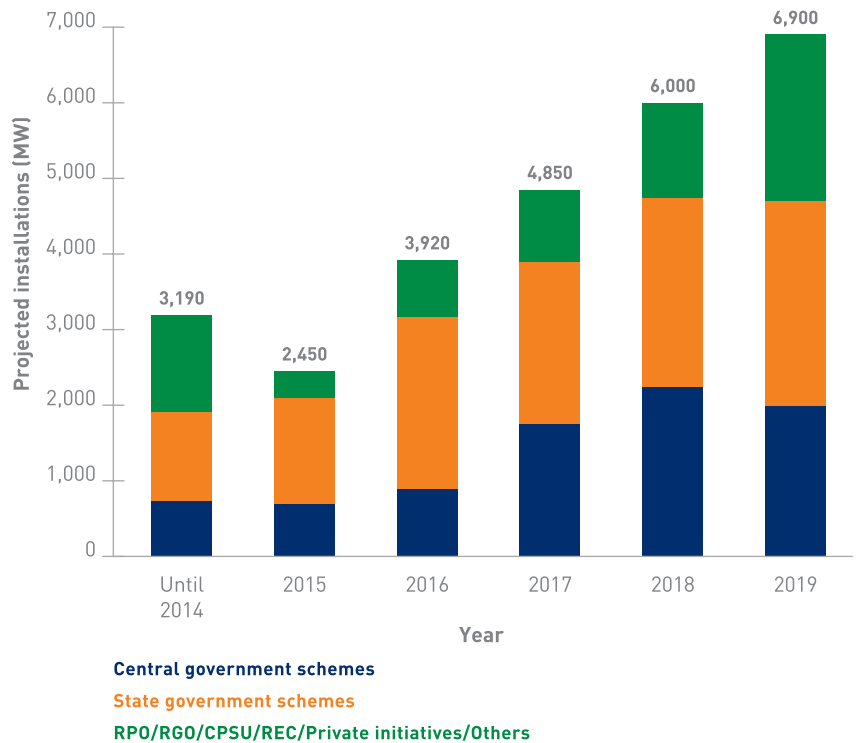


Market projections

According to BRIDGE TO INDIA, India is expected to add 24 GW of utility scale solar PV capacity between 2015 and 2019. Out of this, 7.6 GW is expected to come from central government schemes, 11 GW from state government schemes and the remaining 5.5 GW from other projects.

7.6 GW of new capacity is expected to come from central government schemes, 11 GW from state government schemes and the remaining 5.5 GW from other projects

Figure 7: BRIDGE TO INDIA expects 24 GW of cumulative utility scale capacity addition in India until 2019



Maharashtra, Tamil Nadu and Gujarat are the leading states with close to 30% share (>100 MW) of total rooftop capacity

Rooftop solar

Installed Capacity

Rooftop solar has been relatively lackluster in India with no clear policy thrust so far and only about 350 MW of rooftop solar being installed (<10% of total solar capacity).

Maharashtra, Tamil Nadu and Gujarat are the leading states with close to 30% share (>100 MW) of total rooftop capacity.

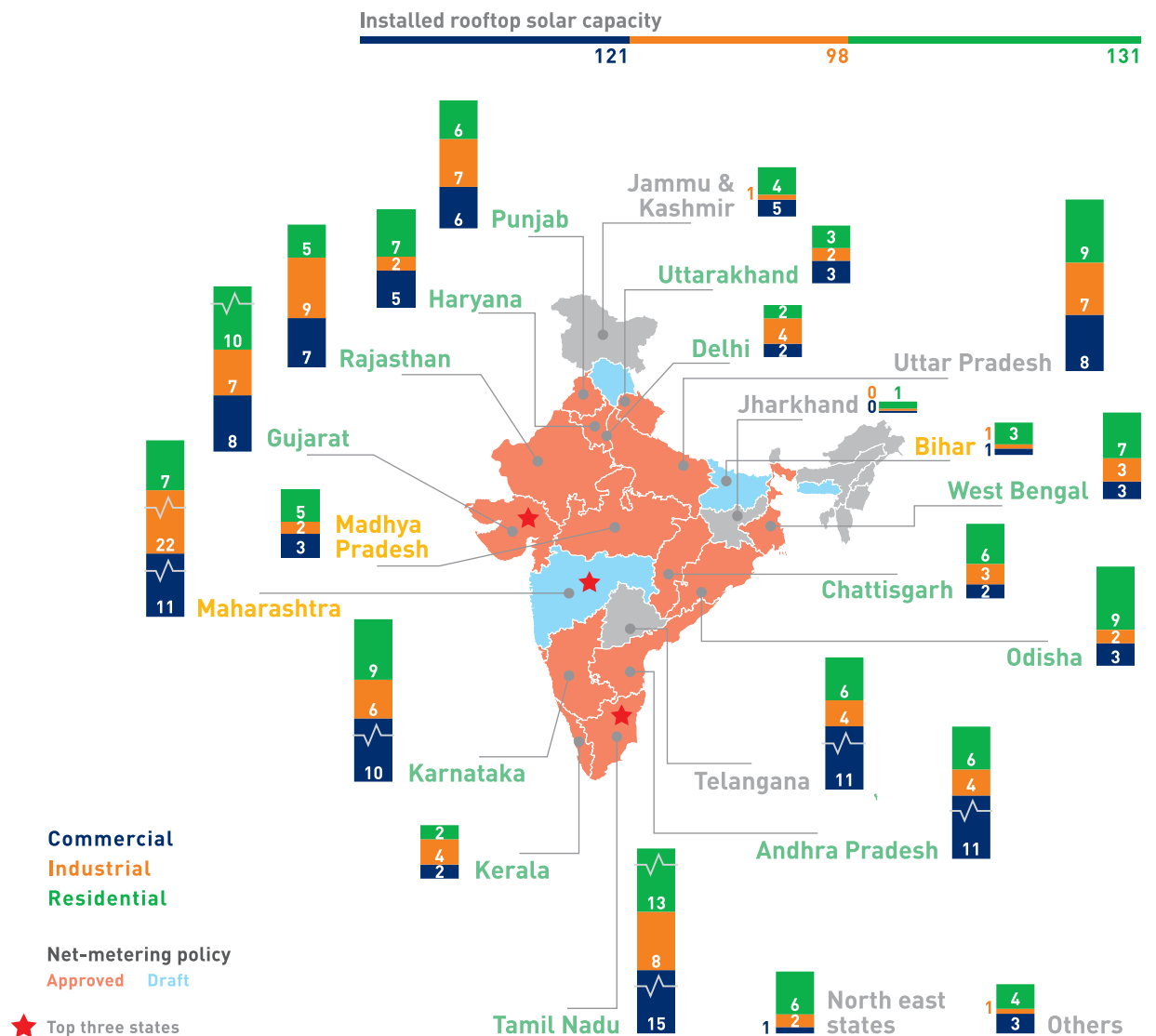
Rooftop solar drivers in top three states

Maharashtra rooftop sector is driven by high commercial and industrial grid tariffs (highest among all states).

Tamil Nadu has a high concentration of industrial consumers, poor grid power supply and an existing experience of procuring wind power.

Gujarat is third in overall installations primarily because of state rooftop policy under which 9 MW has already been commissioned and 60 MW is planned to be installed across five cities.

Figure 8: India has installed 350 MW of rooftop solar capacity and 25 states and union territories have proposed net-metering policy as of May 2015



Policies

In the past, there have been mainly two planks of rooftop policies through which the government has tried to grow this market – 1) capital subsidies and 2) accelerated depreciation.

Capital subsidy model has been used by MNRE and SECI but has failed because of poor implementation and lack of funds

Capital subsidy model has been used by MNRE and SECI but has failed because of poor implementation and lack of funds. We expect this mechanism to be dropped altogether in the coming months. Accelerated Depreciation (equivalent to 25% of the capital cost of the system) is expected to continue at least until March 2017.

Going forward, greater provisioning of debt-financing and net-metering are expected to be the main policy tools in the sector.

Central government support

Interest rate subvention

The central government is working with KfW, Asian Development Bank (ADB) and World Bank to provide financing support in the form of interest rate subvention for rooftop solar in India⁹. This scheme will provide debt at a lower cost of about 8.50% in comparison to the current cost of 12-12.5%. More than \$2,100 million is known to have been committed by these developmental banks for the scheme.

Accelerated depreciation

A company can claim 80% depreciation in the first year of installation. This benefit is equivalent to 25% of the capital cost and can be claimed by profitable corporate entities but is generally unavailable to IPPs. This distortion in the level-playing field is not healthy for the growth of rooftop market.

State government support

Net metering

So far, 25 states and union territories have put in place net-metering guidelines (draft and approved) for rooftop solar installations.

Going forward, greater provisioning of debt financing and net metering are expected to be the main policy tools for the rooftop solar market

⁹ Refer to our blog, "MNRE seeking a rooftop solar target of 10 GW by 2018" <http://bit.ly/1RbPlgh>

Table 2: Overview of state net metering guidelines

State	Cap on solar installation/injection	Grid penetration as % of distribution transformer capacity	Eligibility	Excess electricity settlement	Project capacity limit
Andhra Pradesh	100% of the electricity consumption in a billing month.	Not mentioned	Preferably allowed for 3 Phase service consumers. However, single phase consumers upto 3kW are also eligible.	As per APPC	Upto 1 MW
Bihar (Draft)	Not mentioned	15%	Not mentioned	To be carried forward to next billing cycle	Maximum 1 MWp
Chhattisgarh	Not mentioned	Annual energy injection shall not be more than 49% of the annual net generation.	Not mentioned	To be billed @50% of the solar tariff (in case energy injected is less than 49%of annual net generation)	50kWp to 1 MWp capacity
Delhi	System size less than contracted load	20%	All consumers	As per APPC	Above 1 kW
Goa and Union Territories	Not mentioned	30%	Consumers with single or three phase supply connection.	As per solar tariff	1 kWp to 500 kWp
Haryana	Injection <90% of the consumption in a year	15%	All consumers	To be carried forward to next billing cycle	1 KWp upto 1MWp
Himachal Pradesh (Draft)	Not mentioned	Not mentioned	All consumers	Not mentioned	Maximum 1 MWp
Karnataka	Not mentioned	Not mentioned	All consumers	As per solar tariff (currently ₹9.56 unit (without subsidy) and ₹7.20 unit (with subsidy of 30%))	Upto 500 kW
Kerala	Not mentioned	50%	All consumer categories, availing electricity at voltage level of and below 11 kVA	As per APPC (₹1.99 per unit)	1kWp to 1MWp

State	Cap on solar installation/injection	Grid penetration as % of distribution transformer capacity	Eligibility	Excess electricity settlement	Project capacity limit
Madhya Pradesh	Not mentioned	Not mentioned	All consumers	Not mentioned	Not mentioned
Maharashtra (Draft)	Not mentioned	Not mentioned	Not mentioned	As per APPC	Not mentioned
Meghalaya	Not mentioned	Not mentioned	All consumers	Not mentioned	Maximum 1 MWp
Odisha	Injection <90% of the consumption in a year	30%	All consumers	No payment	Not mentioned
Punjab	System size <80% of the contracted load	30%	All consumers	As per retail supply tariff of that consumer category	1 KWp upto 1MWp
Rajasthan	System size <80% of the contracted load	30%	All consumers	As per solar tariff (currently at ₹6.63 per unit)	1 KWp to 1MWp
Tamil Nadu	Injection <90% of the consumption in a year	30%	Government-run institutions and residential consumers	No payment	Not mentioned
Uttar Pradesh	System size less than contracted load	15%	All consumers	₹0.50 per unit	More than 1 kWp
Uttarakhand	Not mentioned	Not mentioned	All consumers	As per solar tariff (currently ₹9.2 per unit)	5kW to 500kW
West Bengal	Injection <90% of the consumption in a year	Not mentioned	Institutional consumers like hospitals, government departments, academic institutions, etc.	As per APPC	Upto 5kW

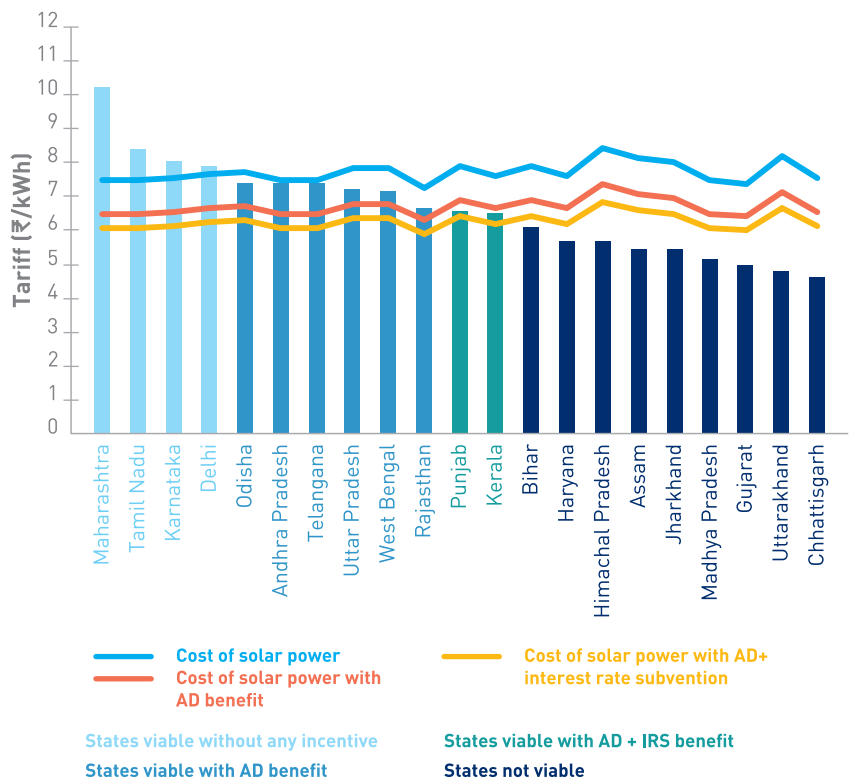
While net-metering guidelines are available in most states now, local implementation authorities are not sufficiently trained in handling execution and technical issues.

Grid parity status of rooftop solar

Grid prices rise across India at about 5-10% annually

As grid prices rise across India at about 5-10% annually, rooftop solar is becoming increasingly competitive in large parts of the country and that is slowly becoming the main growth driver for this market.

Figure 9: Commercial consumers in 12 states already have grid parity¹⁰



¹⁰ Cost of solar power is estimated by BRIDGE TO INDIA using its in-house financial model

Figure 10: Industrial consumers in 12 states already have grid parity

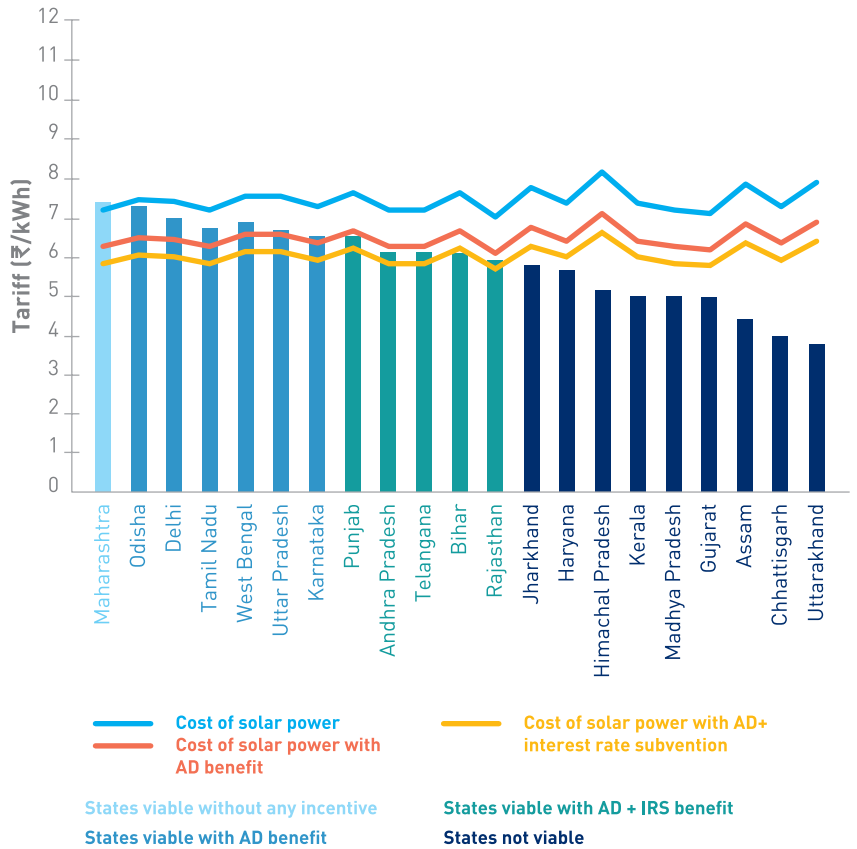
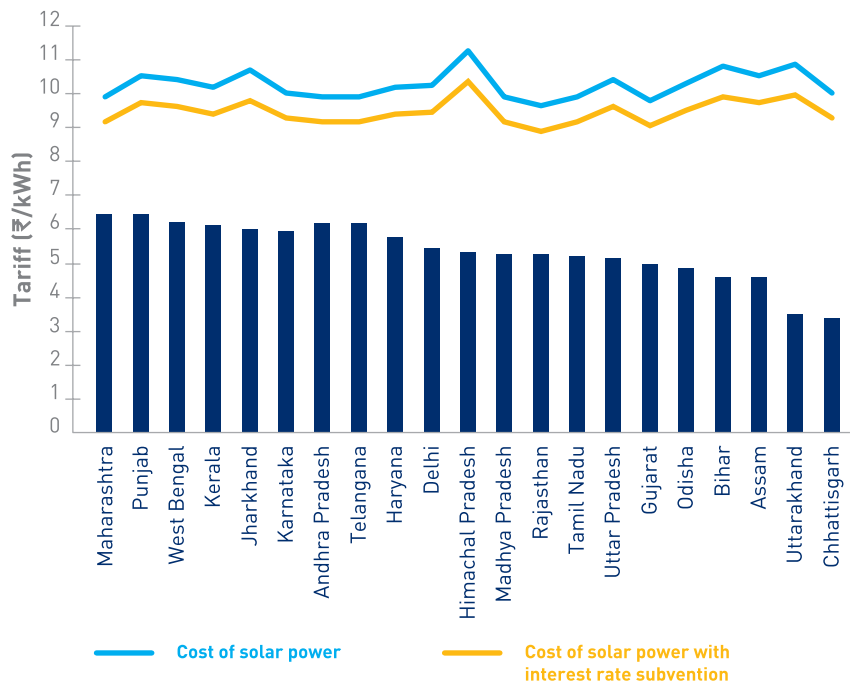


Figure 11: Residential consumers do not have grid parity in any of the states



Issues and challenges

Availability and cost of debt finance

Despite the proposed interest rate subvention scheme and recent announcement on treatment of renewables as a priority sector for lending, debt appetite for rooftop solar projects including availability and cost of debt is expected to be a key challenge. It might also take a long time for lenders to consider rooftop solar projects for non-recourse finance.

Quality concerns

It might take a long time for lenders to consider rooftop solar projects for non-recourse finance

The rooftop solar market in India is very competitive. Excessive cost pressure and poorly trained technicians often lead to poor quality of installations. We already see this happening in the market. A negative feedback for performance of rooftop solar projects by early adopters can be detrimental to the market in the long term.

Legal enforcement of contracts

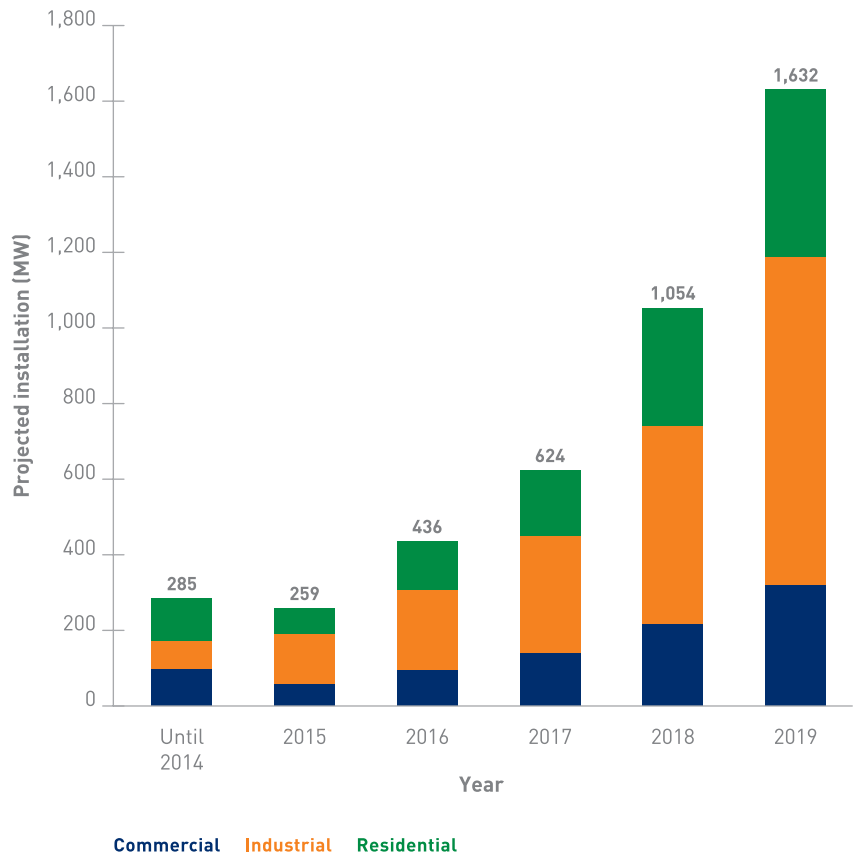
This challenge is pertaining to the Build-Own-Operate (BOO) model for rooftop solar projects. The legal enforceability of contracts in India is not very robust. The problem is more pronounced for solar, with long pay-back period and power purchase contract of over 15 years. Due to this, a model similar to the US based SolarCity is still struggling to find its feet in the Indian market. Such BOO projects account for only around 40 MW (12%) of installed capacity in India.

Market projections

Economic fundamentals for adoption of rooftop solar in India are improving by the day. In 2015 itself, the market is expected to add a capacity similar to the entire capacity added in India till date. The market is expected to grow at an impressive compounded annual growth rate of 58% per annum.

In 2015 itself, the rooftop market is expected to add a capacity similar to the entire rooftop capacity added in India till date

Figure 12: BRIDGE TO INDIA expects 4 GW of new rooftop solar capacity addition in India until 2019





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contact@indiagoessolar.com | 0124-420.4003

www.IndiaGoesSolar.com

About BRIDGE TO INDIA

BRIDGE TO INDIA is a highly focused cleantech consulting and research company, based in New Delhi. It was founded in 2008 by Dr. Tobias Engelmeier.

Our goal is to make sustainability work in rapidly developing countries such as India. We do that through a unique interlinking of consulting services, in-depth market research and transaction advisory, bringing together the views of all relevant stakeholders, including the government, investors, banks, technology companies and international organizations.

Our services



Strategy consulting

We serve our clients with superior analysis and tailor-made consulting services on India's dynamic energy and sustainability market. This includes formulating effective strategies, developing viable business models and identifying specific, actionable business opportunities. We work with technology companies, contractors, policy makers, organizations, project developers and investors. Our clients include, amongst others, IFC, DFID, Climate Group, GE, First Solar, REC, Jinko Solar, Siemens, Bosch, Omron, Jetro and Tata Power Solar.



Transaction advisory

We help our clients in execution of business strategy by assisting them in fund raising, due diligence and valuation, business alliances and mergers and acquisitions. BRIDGE TO INDIA team has extensive all round transaction capabilities including project development and financing. The team brings extensive domain knowledge to improve the transaction value for our clients.



Market intelligence

We provide comprehensive, analytical and up-to-date research on the Indian solar market. Our various reports provide an analysis of the state of solar in India in the form of market updates, overviews, guide books and studies on key topics. Through our weekly updates, blogs, social media channels and our online B2C portal www.IndiaGoesSolar.com, we provide useful educational information and tools to end customers.



BRIDGE TO INDIA is a specialist consulting company focusing on renewable energy in the Indian market. Founded in 2008, the company is based in New Delhi and Munich. BRIDGE TO INDIA offers strategy consulting, transaction advisory and market intelligence services to equipment and technology suppliers, project developers, contractors, investors, financial institutions and developmental agencies.

Contact us at:

contact@bridgetoindia.com

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C 8/5, DLF Phase 1,
Gurgaon 122 001,
Haryana, INDIA