



India: Solar Investment Opportunities

Emerging Markets Task Force Report

Supported by:





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Project information: The SolarPower Europe Emerging Markets Task Force was launched in March 2018 and since then has become an active working group of over 120 experts from more than 60 companies. The objective of the Task Force is to identify business and cooperation opportunities and thereby contribute to the energy transition in emerging markets outside Europe.

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“India continues to be one of the most attractive markets for solar investment in the world. An ambitious solar energy target of 100 GW, a focus on domestic manufacturing, and increased attention to distributed generation – including agricultural pumps and rooftops – are enabling policy initiatives. This report outlines factors that impede the implementation of these policies, which, when taken care of, can go a long way into sustainable implementation.”

Pranav R Mehta

Chairman of the National Solar Energy Federation of India (NSEFI)

SolarPower Europe would like to thank the members of its Emerging Markets Task Force that contributed to this report including:



FOREWORD

BY STEFANO MANTELLASSI, Vice-President Energy Solutions ENI SpA and Chair of SolarPower Europe's Emerging Markets Task Force, and JENS MARTIN, Solutions Manager at E.ON and Vice-Chair of SolarPower Europe's Emerging Markets Task Force.

SolarPower Europe established its Emerging Markets Task Force in March 2018 to identify business and cooperation opportunities in emerging markets outside of Europe with the aim of contributing to the global energy transition. Since its inception, SolarPower Europe's Emerging Market Task Force has become an active working group with more than 120 experts from over 60 companies, working on a series of reports presenting solar investment opportunities in new and emerging markets around the world.

The Task Force operates through a series of physical and virtual meetings, organises visits to the selected markets as well as facilitates speaking opportunities at conferences. Member companies also are involved in relevant initiatives such as the EU-Africa Sustainable Energy Investment Platform, the RenewAfrica initiative and IRENA's Coalition for Action. Moreover, Task Force members exchange and cooperate with international stakeholders such as the European Commission, the International Renewable Energy Agency (IRENA), the International Solar Alliance and GET.invest, as well as key stakeholders such as national industry associations from various countries to shape the global energy transition.

With this report we are proud to present our findings on solar investment opportunities in India. This report developed by E.ON with the support of other Task Force members and supported by the National Solar Energy Federation of India (NSEFI), provides a snapshot of India's business environment and major macroeconomic trends, and analyses issues related to the country's credit and political risk. Moreover, it characterises the country's energy context and relevant stakeholders, as well as the regulatory framework for investment. The research finds that India has huge solar PV potential, which the Indian government encourages to avail. To effectively do so, however, the country's financial, technical and administrative environment, could still be improved. Therefore, the report concludes with some recommendations for investors, policymakers, development finance institutions, and local private stakeholders to take into consideration.

The India report is the sixth in a series of SolarPower Europe market reports. Previous reports focus on Mozambique, Senegal, Ivory Coast, Myanmar and Kazakhstan. All reports can be downloaded from <http://www.solarpowereurope.org/> free of charge. With the support of our Task Force members we are looking forward to the launch of further market reports in 2020.

If you want to be part of our activities and discover new solar business opportunities, join SolarPower Europe's Emerging Markets Task Force.



STEFANO MANTELLASSI
Vice-President Energy Solutions,
ENI SpA.

Chair of the SolarPower Europe
Emerging Markets Task Force.

A handwritten signature in black ink that reads "Stefano Mantellassi".



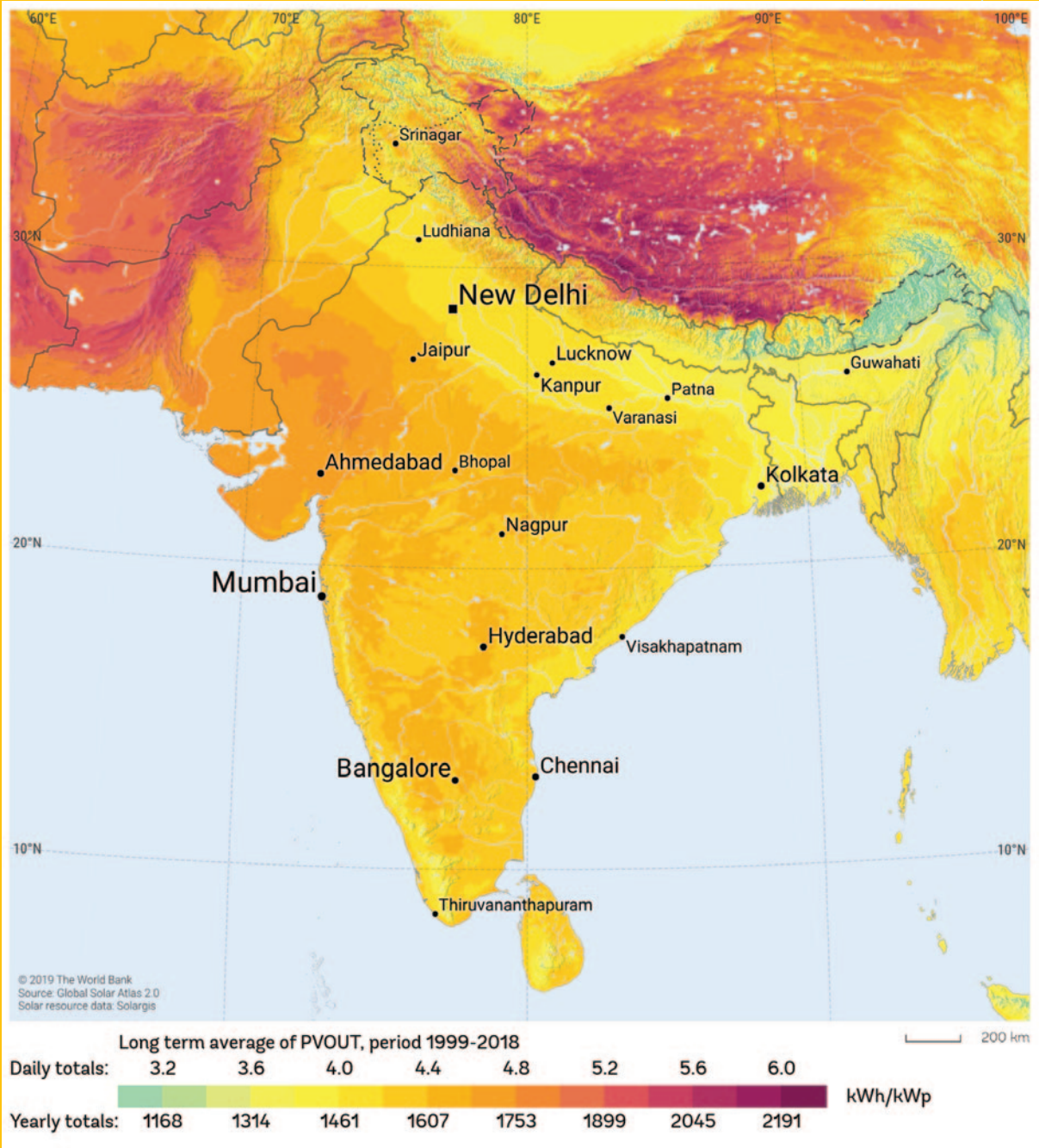
JENS MARTIN
Solutions Manager at E.ON.

Vice-Chair of SolarPower
Europe's Emerging Markets
Task Force.

A handwritten signature in black ink that reads "Jens Martin".



PHOTOVOLTAIC POWER POTENTIAL INDIA



SOURCE: 2019 The World Bank, Source: Global Solar Atlas 2.0, Solar resource data: Solargis.

1. CONTEXT

WORK STREAM

INDIA



OFFICIAL LANGUAGE

CAPITAL

CURRENCY

SURFACE

POPULATION (2018)

POPULATION DENSITY (2018)

EMPLOYMENT IN AGRICULTURE (2014)

GDP (2018)

ASIA GDP GROWTH RATE AVERAGE (2019)

GDP GROWTH (2018)

LITERACY RATE (2015)

INTERNET CONNECTIONS (2018)

MOBILE PHONE CONNECTIONS (2018)

Hindi, English

New Delhi

Rupee (INR)

3,287,263 km²

1.353 billion

454.9 (per km² of land)

47%

2.73 trillion US\$

5.2%

7%

71.2%

34.5% of population

86.9 subscriptions per 100 people

SOURCE: World Bank, 2019; CIA Factbook, 2019; OECD, 2019.

ENERGY GEOGRAPHY

India has a huge potential to generate energy from renewable energy sources, especially solar PV. The country's natural conditions are estimated to offer a renewable energy potential of 900 GW that are commercially exploitable. With an attributed potential of 750 GW, solar power is considered to be the most promising renewable energy source, followed by wind power (102 GW), bio-energy (25 GW) and small hydro-projects (20 GW) (IBEF, 2019). However, among the country's 28 states and 8 union territories the potential to generate solar power varies greatly. As data from the National Institute of Solar Energy in India (NISE) shows, Rajasthan has the highest solar PV potential, followed by Jammu and Kashmir¹, Maharashtra and Madhya Pradesh. Considered together, these four regions account for more than half of India's solar potential.

DEMOGRAPHICS

India's population of around 1.353 billion people is predominantly young and makes up a share of around 17.7% of the world's total population (World Bank, 2019). In terms of population size, India comes second to China, which remains the world's most populated nation. India's population size doubled within the past

40 years, growing by around 181.5 million people between 2001 and 2011 alone. Over the next couple of decades India's population size is expected to further increase and with a current annual growth rate of 1.08% expected to overtake China's by 2030.

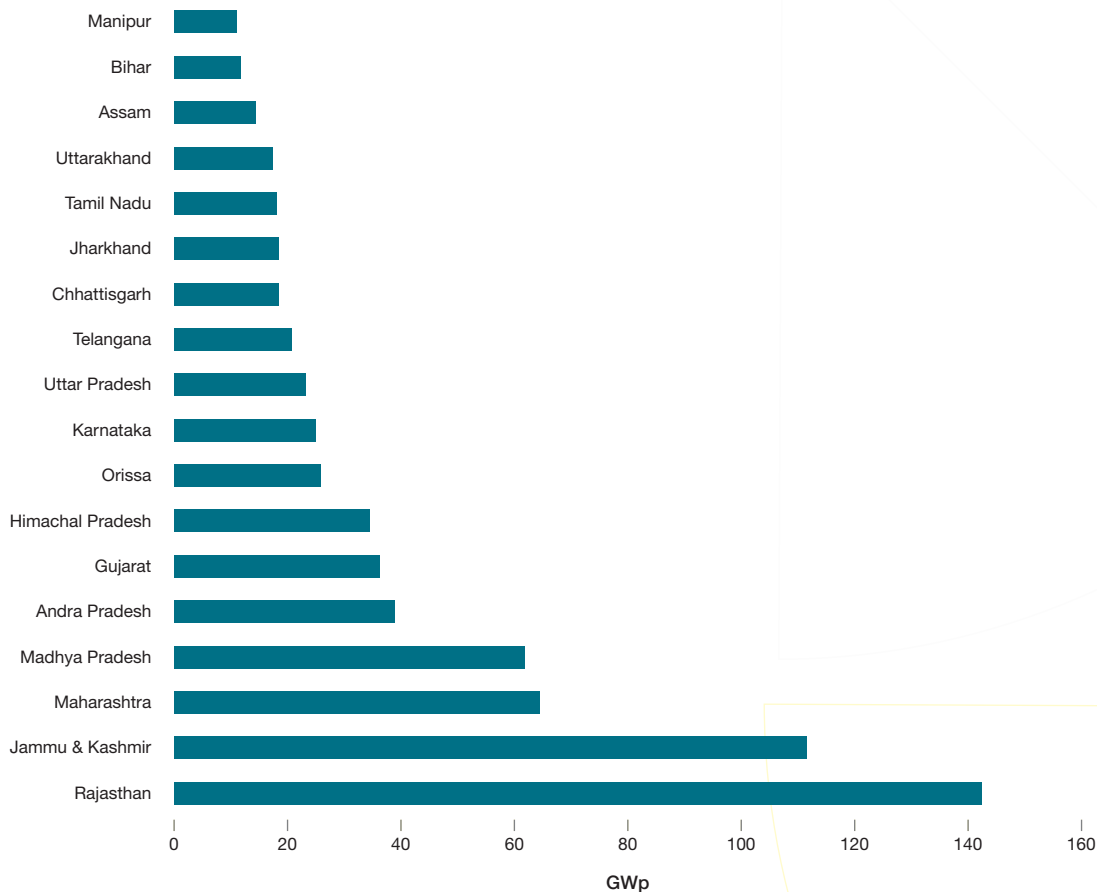
More than 60% of the anticipated growth is expected to take place in the country's poorer and less dynamic states, such as Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh – a development that is likely to increase regional disparities as well as trigger political and social tensions.

India has a population density of around 454.9 people per km², which also makes it one of the most densely populated countries in the world (ranking 28th out of 232 according to the World Population Review, 2019). While urbanisation has been accelerating at a fast pace and the amount of people living in cities is expected to reach 600 million by 2030, India – for now – remains predominantly rural (IRENA, 2017). Indeed, 67% of all people in the country still live in rural areas.

Population density within the country also varies greatly, with Uttar Pradesh – India's largest state – being home to almost 200 million people, compared to Sikkim – India's smallest state – with a population of just over half a million (607,688).

¹ Which as of 31.10.2019 formally have become two independent union territories, namely Jammu and Kashmir and Ladakh.

FIGURE 1 ESTIMATED SOLAR POWER POTENTIAL PER STATE



SOURCE: MNRE, 2014a.

MACROECONOMIC CONTEXT

India had a nominal Gross Domestic Product (GDP) of USD 2,726.32 billion in 2018 (World Bank, 2019). Therefore, compared internationally, India is the sixth largest economy in the world, falling slightly behind the UK with a GDP of USD 2,825.21 billion. The Gross National Income (GNI) per capita in 2018 was USD 2,020 – compared to only USD 1,600 in 2015 – and is expected to continue rising (Macrotrends, 2019).

After independence, India’s economy was characterised by strong regulation, protectionism and state-owned enterprises. The national economic policies of Prime Minister Nehru (1947-1964) and his successors were centralised, socialist and focused on self-sufficiency rather than international trade. Only in 1991 when India was facing serious balance of payments problems did the country’s economic policy change. The then

government of Narasimha Rao pushed through far-reaching reforms towards a market-oriented system. From then on, the economy was gradually liberalised and competition promoted. International companies were being granted access to the Indian market in many areas. Between 2003 and 2008, economic growth (GDP) remained constant at between 8% and 10%. In 2008, it fell to just over 4% due to the global financial crisis, only to settle between 8% and 10% in 2009 and 2010 again (World Bank, 2019a).

Since 2011, however, growth has slowed. India’s real GDP growth was slower than expected for the 2018/19 financial year (FY) – reaching its slowest pace in five years. While the country still was able to record an 8% growth rate during the April-June quarter of 2018, it only managed to achieve 5% over the same period in 2019. Meeting the official target of 7% growth for FY 2019/20 will remain challenging (COFACE, 2019). However, India’s

FIGURE 2 MAJOR MACROECONOMIC INDICATORS

	2017	2018	2019	2020 (F)
GDP growth (%)	8.2	7.2	6.8	7.0
Inflation (yearly average, %)	3.3	4.0	4.0	4.5
Budget balance (% GDP)	-3.9	-3.6	-3.2	-3.5
Current account balance (% GDP)	-0.6	-1.5	-1.5	-1.5
Public debt (% GDP)	69.5	71.0	70.0	69.0

NOTE: The Indian financial year (FY) runs from 1st April to 31st March. 2019 data represents FY 2019 which end on 31st March 2020. (F): Forecast

FIGURE 3 STRENGTHS AND WEAKNESSES OF THE INDIAN ECONOMY

STRENGTHS	WEAKNESSES
<ul style="list-style-type: none"> • Diversified growth drivers • High levels of savings and investment • Efficient private sector, notably services • Moderate level of external debt, comfortable foreign exchange services 	<ul style="list-style-type: none"> • High corporate debt and non-performing assets (NPA) • Net importer of energy resources • Lack of adequate infrastructure • Weak public finances • Bureaucratic red tape • Uncertainties over the Kashmir issue

SOURCE: COFACE, 2019.

government currently is implementing measures to improve the economy, so that it is estimated that India's economy will be the second largest in the world after China by 2050.

While it is difficult to pinpoint the exact reason for India's slowdown, the reason seems to be home-made. Structural shortcomings in the Indian economy (such as the underdeveloped industrial sector), the lack of necessary reforms as well as the country's dependency on energy imports (primarily coal and oil) continue to strain growth.

Adding to this, is the country's decreasing domestic consumption (60% of GDP), partly due to the 2016 demonetisation program that comprised the withdrawal of all 500- and 1000- rupee notes in circulation as well as the introduction of a harmonised goods and services tax (GST) in July 2017. While difficult to measure, these changes can be identified to have significantly impacted the country's informal sector. Tighter credit conditions also led to weaker private investment – which in turn translated into fewer jobs, so that unemployment reached a level of 6.1% in 2019 (COFACE, 2019).

1 CONTEXT / CONTINUED

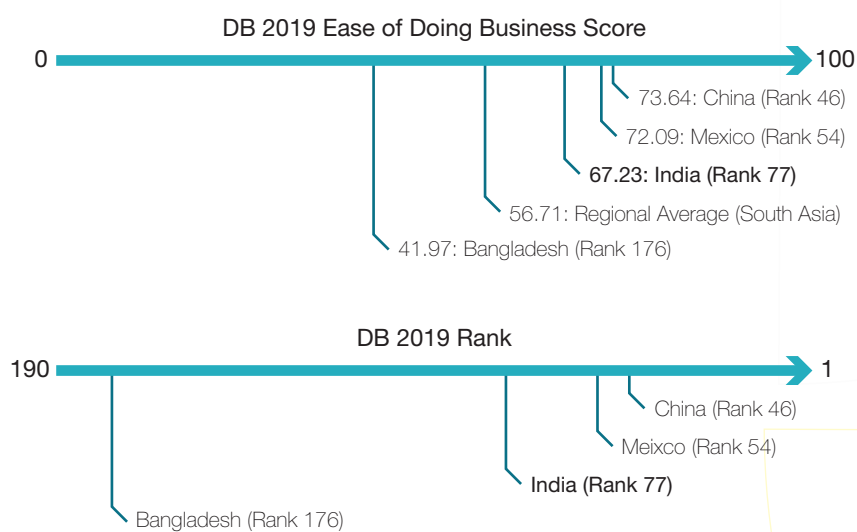
BUSINESS ENVIRONMENT

Despite India's difficult economic situation, the country has managed to significantly improve its ranking in the World Bank's Doing Business Report over the past two years, climbing up 23 spots to rank 77 out of 190 states in the 2019 edition. For this improvement, as well as being

acknowledged as part of top 10 improvers for the second consecutive year, the country is accredited special merit.

The country improved most in the following areas: Starting a business, dealing with construction permits, getting electricity, getting credit, paying taxes and trading across borders.

FIGURE 4 EASE OF DOING BUSINESS IN INDIA, 2019



SOURCE: World Bank.

NOTE: The ease of doing business score captures the gap of each economy from the best regulatory performance observed on each of the indicators across all economies in the *Doing Business* sample since 2005. An economy's ease of doing business score is reflected on a scale from 0 to 100, where 0 represents the lowest and 100 represents the best performance. The ease of doing business ranking ranges from 1 to 190.

BUSINESS ENVIRONMENT IMPROVEMENTS

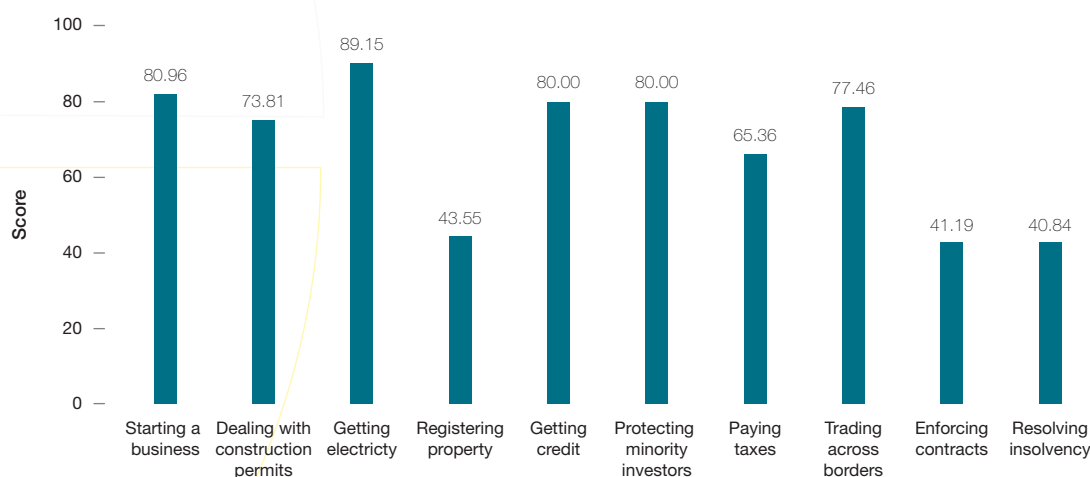
- **Starting a business:** India has made starting a business easier by fully integrating multiple application forms into a general incorporation form. India also replaced the value added tax with the GST (Goods and Services Tax) for which the registration process is faster. At the same time, Mumbai abolished the practice of on-site inspections for registering companies under the Shops and Establishment Acts.
- **Dealing with construction permits:** India streamlined the process of obtaining a building permit and made it faster and less expensive to obtain a construction permit. It also improved building quality control by introducing decennial liability and insurance.
- **Getting electricity:** The Delhi Electricity Regulatory Commission reduced charges for low voltage connections. Getting electricity was also made easier

through a reduction in the time for the utility to carry out external connection works.

- **Getting credit:** India strengthened access to credit by amending its insolvency law. Secured creditors are now given absolute priority over other claims within insolvency proceedings.
- **Paying taxes:** India made paying taxes easier by replacing many indirect taxes with a single indirect tax, the GST, for the entire country. India also made paying taxes less costly by reducing the corporate tax rate and the employees' provident fund scheme rate paid by the employer.
- **Trading across borders:** India reduced the time and costs to export and import through various initiatives, including the implementation of electronic sealing of containers, the upgrading of port infrastructure, and allowing electronic submission of supporting documents with digital signatures.

SOURCE: World Bank Group, 2019.

FIGURE 5 EASE OF DOING BUSINESS SCORE ON DIFFERENT TOPICS



SOURCE: World Bank Group, 2019.

POLITICAL AND SOCIAL CONTEXT

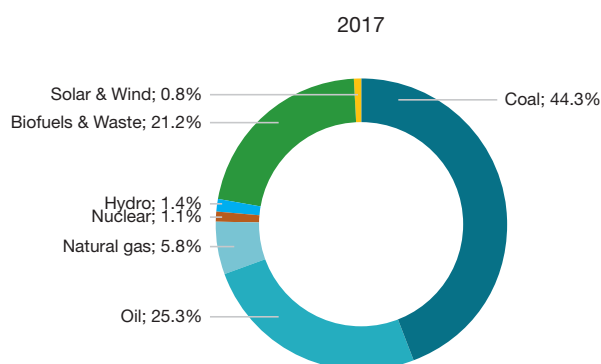
India has a stable government which also is positive for investors. The current ruling party of India, the Bharatiya Janata Party (BJP), renewed its strong majority in the 2019 general election (bringing the National Democratic Alliance, NDA, to hold 353 out of 542 seats). This makes it easy for the party to implement decisions. Under Prime Minister Narendra Modi, there is currently also a very positive political climate to support renewable energy development in India.

Indeed, the deployment of renewable energies has become a prestigious project for Prime Minister Modi and the country has introduced several government initiatives and incentives to promote renewable energies in the past few years. For instance, in its first mandate (2014-2019), Prime Minister Modi scaled up the country's renewable energy target from 20 GW to 100 GW by 2022 (for more information on India's current renewable energy targets see Section 3: stakeholders, regulatory framework and tariffs).

While measures are being taken on a political level to lead the country towards a more sustainable future, on the society's level, awareness of the benefits of renewable energies as well as government incentives remains limited. This partly explains why the development of rooftop solar has not yet picked up as envisioned per government targets. More than environmental consciousness, private PV installations in India are driven by financial benefits. For now, rooftop solar is most viable for commercial and industrial (C&I) clients since their tariff is much higher than for residential energy in-feeders. Moreover, despite there being government subsidy schemes in place, many residential clients are slow to make their decisions and are reluctant to engage in long-term commitments due to a lack of trust.

2 INDIA'S ELECTRICITY MARKET

FIGURE 6 INDIA'S ENERGY MIX (2017)



SOURCE: IEA, 2019.

India's electricity market is facing major challenges. While the country has made significant progress in various areas of infrastructure – such as road construction, the development of telecommunications infrastructure or airports and ports – the power infrastructure can hardly keep up with the country's rapidly growing demand. Together with population growth and urbanisation, India's energy demand has been rising. Already in 2013, the country was the third-largest energy consumer in the world closely following China and the United States. In June 2019, the country recorded an unprecedented power demand of 183.67 GW. In order to meet demand – projected to increase to 285 GW by 2021/2022 and 690 GW by 2035/2036 – it is estimated that India will require an additional power supply capacity of at least 450 GW by 2034 (IBEF, 2019). This creates an important opportunity for renewable energy deployment, in which solar power can play a major role.

Traditionally, India has been relying mostly on fossil fuels. The most important source of power for India by far remains coal, which accounts for almost half of the country's primary energy. Oil, which is largely imported, is the second most important source of energy, followed by biofuels and waste, natural gas, hydropower and nuclear and renewable energy (solar and wind).

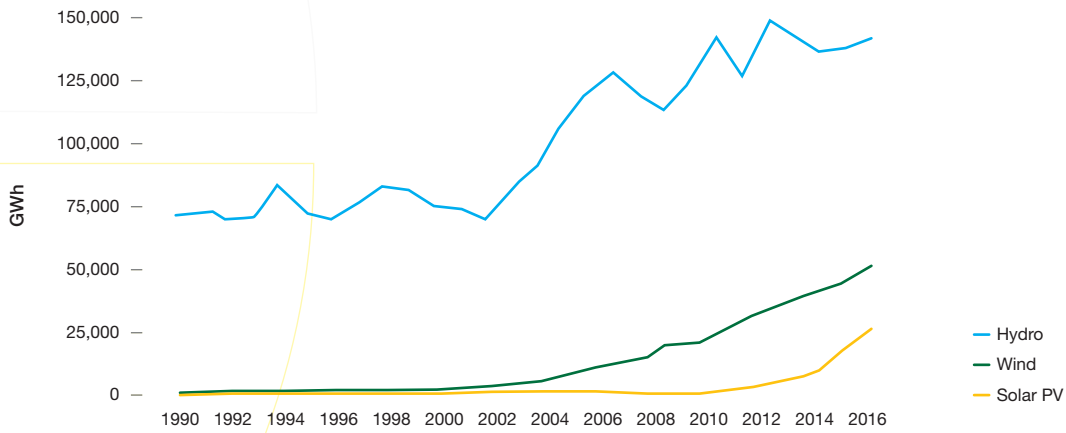
However, as mentioned, the share of renewables in India's energy mix is being promoted and hence has been progressively increasing. India's renewable energy power generation capacity indeed has been rising at a fast pace, growing by a compound annual growth rate (CARG) of 18.17% over the period of 2014/2015 to 2017/2018, leading to a record generation of 101,893 GWh of renewable energy in 2018.

Among other reasons, this is due to the fact that India's current energy supply is heavily dependent on imports. Since the country has only relatively small energy resources on its own – in relation to its large population – the share of imports will probably continue to increase with India's expected economic growth. For coal and oil, the proportion is the highest by far. As large parts of the country's foreign currency revenues are already currently being spent on these resources, renewable energy promotion has been defined as a political priority.

It is envisioned that by 2030, 40% of India's power needs – projected to reach 15.280 TWh – are covered by renewable energy (IBEF, 2019), up from 21.4% today (SolarPower Europe, 2019). Most of this demand will come from the infrastructure, industry and transport sectors. The development of solar PV microgrids in rural areas, however, also presents an interesting opportunity as there are currently an estimated 240 million people in India that remain without access to electricity (IEA, 2019). To guarantee secure energy access for all, political plans envisage that an additional 175 GW of renewable energy capacity should be installed by 2022, including 100 GW of solar, 60 GW of wind, 10 GW of biomass and 5 GW of small hydropower. Recently, the Indian government announced that it will overachieve this target and will install 225 GW of renewable energy capacity by the end of the set timeframe. India's official government target, however, remains at 175 GW.

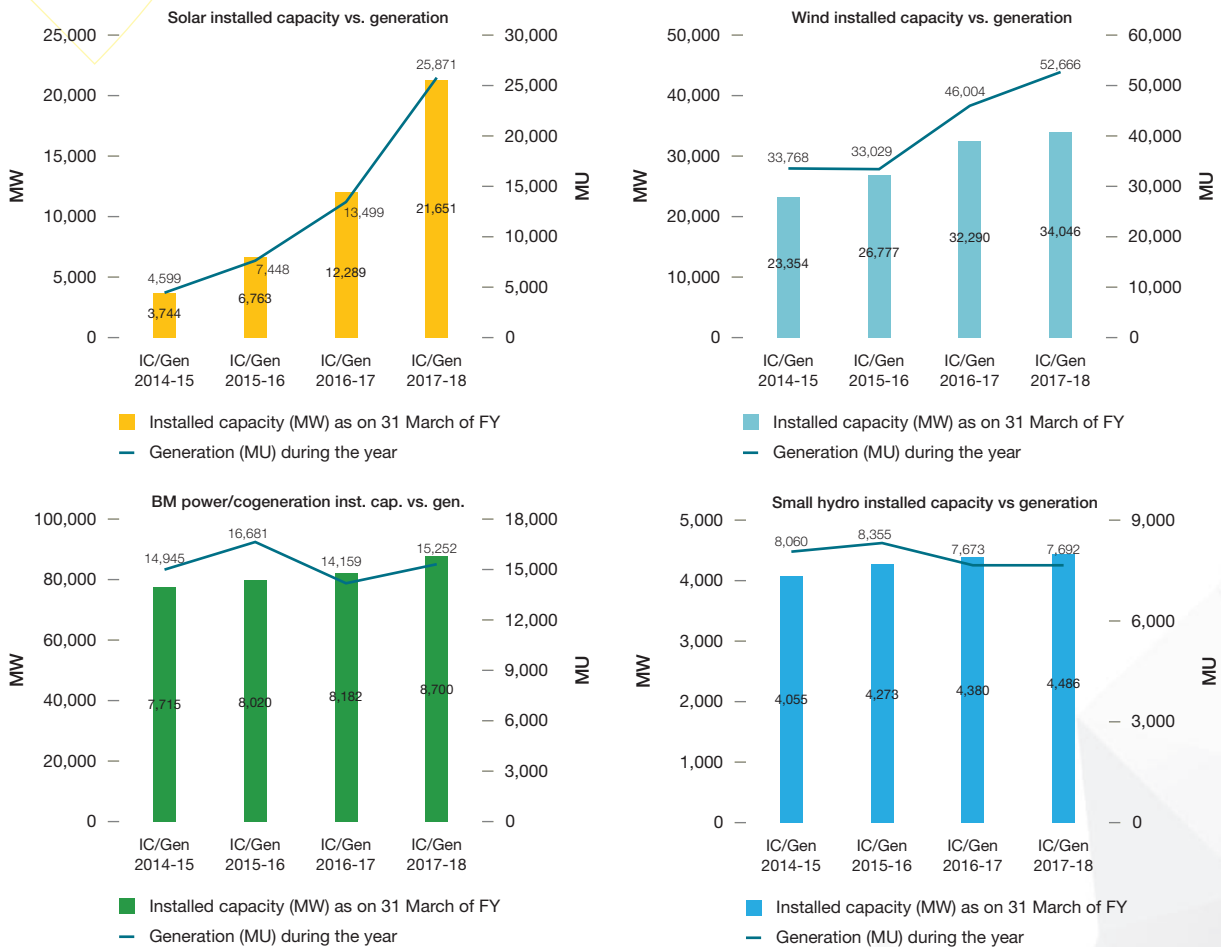
This target is in line with India's nationally determined contributions (NDCs) to the 2015 Paris Agreement, requiring the country to reduce its GDP emission intensity by 33-35% over 2005 levels by 2030, as well as the country's National Solar Mission and has been proving to be a major boost for the renewable energy sector in India. For more information on the country's power sources please visit India's National Power Portal: <https://npp.gov.in/>.

FIGURE 7 RENEWABLE ENERGY GENERATION BY SOURCE, GWH



SOURCE: IEA, 2019. NOTE: Excluding municipal and industrial waste and biofuels. Hydro includes generation from pumped-hydro power stations.

FIGURE 8 RENEWABLE ENERGY INSTALLED CAPACITY VS GENERATION



SOURCE: CEA, 2018.

2 INDIA'S ELECTRICITY MARKET

ELECTRICITY INFRASTRUCTURE

India's national electricity grid developed in a phased manner. The country's power system is composed of five interconnected network zones – Northern, Eastern, Western, North Eastern and Southern Region – together forming a national grid with one frequency. Transmission lines account for only about 5% of the country's network length, while the rest consists of distribution lines.

India's network suffers from one of the highest shares of electricity loss in the world. Transmission and distribution (T&D) losses make up a share of almost 20% of the country's generation, which is more than double the world average (EIA, 2015). T&D losses are driven by technical and commercial factors. Technical losses increase with ambient temperatures and distance between generation sources and demand centers. Ageing and poorly maintained networks are more prone to technical losses than modern and efficient installations. On the commercial side, theft, unmetered consumption and inadequate revenue collection add to network losses. India has taken big steps in bringing down network losses over time and, in light of current efforts, is very likely to manage to reduce its T&D loss share to below 16% in the decades to come. This will help India's transmission and distribution companies to re-establish their financial viability and provide them with the necessary funds to carry out much needed network investments.

Apart from bringing down losses, India will have to prioritise the expansion of its electricity network in the future. This is to accommodate growing power demand, to integrate the growing share of utility-scale wind and solar projects, and to improve interconnectivity with neighboring power systems, as well as to improve energy access to in remote and badly connected areas. It is estimated that India's network length will increase by over 70% in the period to 2040; a development that should be supported as it will permit a more efficient dispatch of power plant fleets, as well as reduce generation costs (IEA, 2019).

By starting to establish a Green Energy Corridor in FY 2015/2016, India's Union government has started to take on this challenge. The Corridor – which is expected to be finalised in 2020 – is constructed to allow the large-scale transmission of renewable energy from eight renewable-rich states – Tamil Nadu, Rajasthan, Karnataka, Andhra Pradesh, Maharashtra, Gujarat, Himachal Pradesh and Madhya Pradesh – to states with lower renewable energy capacity. Once finalised, the project will include approximately 9,400 km of transmission lines and substations of a total capacity of around 1,900 MVA. The project was launched with the aim of evacuating approximately 20,000 MW of renewable energy, as well as to significantly improve the grid in states with important renewable sources.

An additional challenge, but also a large opportunity, is the modernisation of India's metering infrastructure. If successful, this would not only help reduce commercial losses, but also allow India to roll out smart metering and other information technology-based solutions in support of establishing the ground for demand-side management and smart grid projects.

STAKEHOLDERS, REGULATORY FRAMEWORK AND TARIFFS

At the level of the central government in Delhi, there are two principal ministries whose spheres of responsibility extend into the electricity market: The Ministry of Power (MoP) and the Ministry of New and Renewable Energy (MNRE).

The Ministry of Power (MoP) is responsible for handling power supply planning, overriding policy guidelines, processing investment decisions for state projects, training professionals, administering and implementing fossil fuel and large-scale hydropower (over 25 MW) legislation, as well as guaranteeing that India's electricity power transmission and distribution functions well. In particular, the MoP is responsible for the implementation of the Electricity Act of 2003 and the Energy Conservation Act of 2001. Important authorities such as the Central Electricity Authority (CEA), the Central Electricity Regulatory Commission (CERC), the Power Finance Corporation (PFC) and the Rural Electrification Corporation (REC), as well as state-owned enterprises such as the National Thermal Power Corporation (NTPC), are subject to the MoP's control.

The Ministry of New and Renewable Energy (MNRE), which was established in the early 1980s, is the second ministry regulating India's electricity sector and, as per legislative decree, responsible for promoting the development and use of renewable energy sources. The MNRE also oversees associated state-owned technical and financial institutions, such as the National Institute for Solar Energy (NISE), the Solar Energy Corporation of India (SECI), the Centre for Wind Energy Technology (c-WET) and the Indian Renewable Energy Development Agency (IREDA). Moreover, the MNRE works in close collaboration with national associations, such as the National Solar Energy Federation of India (NSEFI). (For more information on these organisations see Appendix 1).

Within the country, both the Union Parliament as well as the country's 28 states can enact laws on electricity, whereby it applied that in case of inconsistency or conflict, the laws enacted by the former override the ones drafted by the latter. The Union Parliament's Electricity Act of 2003 provides the overall framework for generation, transmission, distribution, trading and use of electricity in India and is overseen by the Central Electricity Authority (CEA) that was established alongside its enactment. Concretely, the CEA is in charge of developing technical standards for the construction of electric plants, electric lines and grid connection as well as enforcing safety requirements and grid operation and maintenance standards.

Among other policies, private sector participation in renewable energy generation in India is supported by:

- The National Electricity Policy of 2005, which allows for preferential tariffs for electricity produced from renewable energy sources.
- The Tariff Policy of 2006, which defines a minimum percentage of energy consumption per state to be derived from renewable energy sources (also known as renewable purchase obligations, RPO) and which is highest for Maharashtra, Uttar Pradesh, Tamil Nadu, Gujarat, Rajasthan and Karnataka.
- India's National Action Plan on Climate Change (NAPCC, 2008), which enunciated missions such as the intensification of solar energy deployment and advised RPOs to be set at 5% of total grid purchase and to increase by 1% each year for 10 years; and

- Renewable Energy Certificates (RECs), which were introduced in 2011 to enhance renewable energy capacity by levelling inter-state divergences of renewable energy generation and the requirement of obliged entities to meet their RPOs with differentiated prices for solar and non-solar.

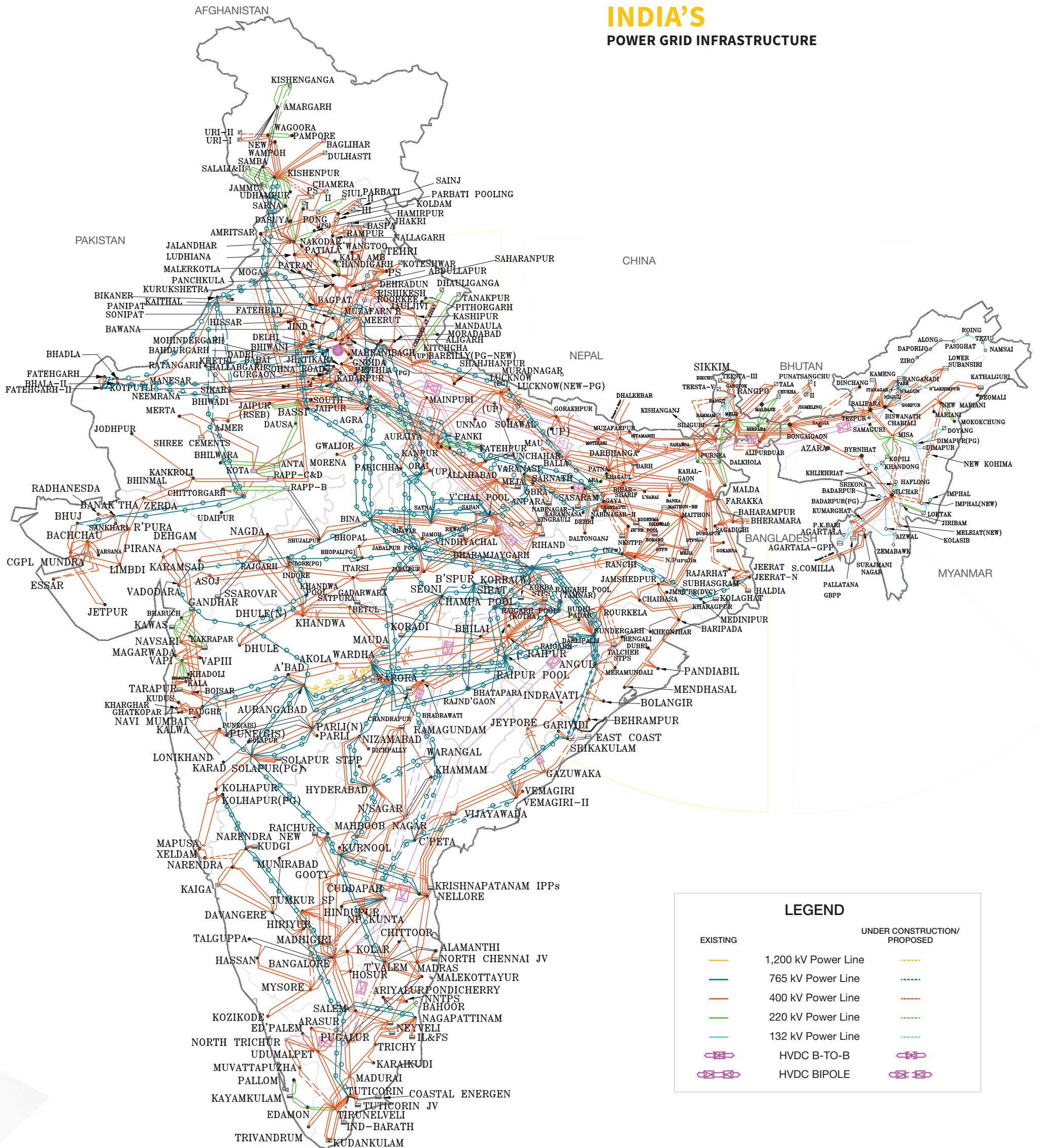
Next to these policies, various other instruments promote the development of solar within the country. The 'Jawaharlal Nehru National Solar Mission', also known as India's National Solar Mission, is the country's framework program supporting solar PV. Introduced in 2010, the program was set out to achieve the deployment of 20 GW of grid connected solar power by 2022; an objective that was revised in 2015 and scaled-up to 100 GW. The target comprises 40 GW of rooftop and 60 GW of medium – and large-scale grid connected solar power projects. As defined in the program's documents, this objective is to be achieved in three phases: up to 2012/2013, from 2013 to 2017 and from 2017 to 2022. Incentives offered by the Indian Government that form part of this program include, tax reduction or exemption on imports of relevant capital goods, accelerated depreciation for relevant capital goods, subsidised loans and grants for solar PV rooftop systems.

The current state of India's Central Financial Assistance (CFA) schemes, which are subsidy programmes implemented by the MNRE or commissioned agencies such as the Solar Energy Corporation of India (SECI) to support India's attainment of its National Solar Mission, is summarised below. Tenders for the development of parts of these projects (including the ones that are implemented on a state level) are published by the MNRE or SECI.

It is important to acknowledge that electricity tariffs in India vary from state to state. In general, however, commercial and industrial (C&I) clients are charged higher tariffs in the country, while residential customers are provided with a subsidised tariff. As mentioned, this incentivises commercial and industrial clients in particular to develop rooftop solar, compared to residential in-feeders. The tariff also changes depending on the monetary energy use. Most states follow slab rates depending on usage.

2 INDIA'S ELECTRICITY MARKET

INDIA'S POWER GRID INFRASTRUCTURE



2 INDIA'S ELECTRICITY MARKET

Scheme: Solar Parks and Ultra-Mega Solar Power Projects

In December 2014, the Government of India introduced a scheme to establish a minimum of 25 solar parks and ultra-mega solar power projects, adding 20 GW of installed solar power capacity. India's central government provides financial support for the construction of these solar projects, notably:

- INR 2 million per MW, or 30% of a project's cost, including grid-connectivity costs, depending on which is cheaper. An additional INR 2.5 million per plant is available for the preparation of Detailed Project Reports (DPRs) and conducting surveys, etc.
- *The scheme has been increased from 20 GW to 40 GW. As of 11th January 2018, 35 solar parks totaling 20.514 GW have been approved in 21 states.*

Scheme: 300 MW of solar PV for defence establishments and paramilitary forces

The MNRE supports setting up 300 MW grid-connected and off-grid solar PV power projects by defence establishments as well as paramilitary forces via the Viability Gap Funding (VGF). Support worth INR 750 million is provided to companies benefitting from this scheme as a capital subsidy.

- Successful bidders are selected based on the lowest bids for these funds. It is a requirement that developers must supply solar power at a rate of INR 5.50 (\$0.086)/kWh for 25 years. Only domestic content can be used under this scheme.
- Earlier, the upper limit of VGF varied according to system size. However, considering technology upgrades and economies of scale, this was revised on 17th February 2017 to INR 11 million per MW for all projects irrespective of size.
- *As of 31st July 2017, 357.5 MW have been approved. Of this, 66 MW are under construction and 7 MW have been commissioned.*

Grid-connected rooftop scheme

India's central government pays 30% of the benchmark installation cost of rooftop PV systems. This subsidy is applicable in states that are in the general category. However, a subsidy of up to 70% of the benchmark installation cost is offered in some states that lie in the special category – North MNRE Rooftop Cell. These include states such as Uttarakhand, Sikkim, Himachal Pradesh, Jammu and Kashmir, and Lakshadweep. The subsidy scheme is applicable for institutional, residential and social sectors. However, it is not applicable for commercial and industrial (C&I) clients.

Scheme for development of grid-connected PV plants on canal banks and canal tops

The Government of India supports the installation of solar PV generation plants on un-utilised areas on top of canals and vacant government land along canal banks, wherever available, with: INR 30 million per MW or 30% of the project cost – whichever is lower – for canal top projects, and INR 15 million per MW or 30% of the project cost – whichever is lower – for canal bank projects.

- A total CFA of up to INR 2.25 billion for 100 MW (50 MW on canal tops and 50 MW on canal banks) can be disbursed over a period of maximum two years post sanctioning of the plants as follows: up to 40% on the sanctioning of the projects, and 60% on the successful commissioning of the projects.
- The service charge to SECI is 1% of the project cost.
- *As of 31st March 2017, an 8 MW canal top project and a 16 MW canal bank project have been commissioned.*

Off-grid schemes: PV lightening systems, power plants and solar pumps

Subsidies are issued for off-grid schemes, including:

- A: Lightening systems:
 - Home lights/lanterns/streetlights with lead acid batteries: Benchmark Cost = INR 340/W; CFA = INR 102/W
 - Streetlights with lithium ferro phosphate batteries: Benchmark Cost = INR 475/W; CFA = INR 142.5/W
- B: Power packs with a battery bank at 7.2 VAh/W:
 - Up to 300 W: Benchmark Cost = 200/W; CFA = INR 60/W
 - 300 W to 1 kW: Benchmark Cost = INR 135/W; CFA = INR 40.5/W
- C: Solar power plants with battery bank at 7.2 VAh/W and capacity up to 10 kW:
 - Benchmark Cost = INR 135/W; CFA = INR 40.5/W
- D: Solar pumps:
 - Up to 3 HP (DC): Benchmark Cost = INR 120,000/HP; CFA = INR 30,000/HP
 - 3HP to 5 HP (DC): Benchmark Cost = INR 95,000/HP; CFA = INR 19,000/HP
 - Up to 3 HP (AC): Benchmark Cost = INR 100,000/HP; CFA = INR 25,000/HP
 - 3HP to 5 HP (AC): Benchmark Cost = INR 85,000/HP; CFA = INR 17,000/HP
- As of 30th November 2018, more than 4.18 million solar lighting systems, 142,000 solar pumps, and power packs of 181.52 MW combined output have been installed across the country.

Pradhan Mantri Kisan Urja Suraksha evam Utthan Mahabhiyan (PM-KUSUM) Scheme (which roughly translates to Prime Minister's Farmer Energy Protection and Welfare Scheme):

While large-scale solar power generation projects are being installed to achieve the ambitious target of 100 GW of solar power generation by 2022, India simultaneously plans to develop decentralised solar energy. India's government recently published guidelines for the implementation of the KUSUM scheme for the installation of solar pumps and grid-connected solar power plants by farmers. Under this scheme, which was approved in July 2019, the government targets to develop decentralised solar energy and other renewable energy generation plants with capacities up to 2 MW.

Central Public Sector Undertaking (CPSU) Scheme Phase II

In March 2019, India's central government also approved INR 85.8 billion (around USD 1.2 billion) for the second phase of the Central Public Sector Undertaking (CPSU) Scheme, which aims at setting up 12,000 MW of grid-connected solar PV power projects by government producers with Viability Gap Funding support for self-use or use by the government/government entities, either directly or through distribution companies.

SRISTI Scheme II: Rooftop Solar Power Plant Subsidy (upcoming: 2021-2022)

Under the Sustainable Rooftop Implementation for Solar Transfiguration of India (SRISTI), the Indian government recently approved a total funding of USD 1.7 billion for phase 2 of the grid-connected rooftop solar scheme to accelerate the installation of rooftop solar, which has a target of 40 GW by 2022. This funding is aimed at improving the proliferation of rooftop solar.

SOURCE: PV magazine India, 2018.

2 INDIA'S ELECTRICITY MARKET / CONTINUED

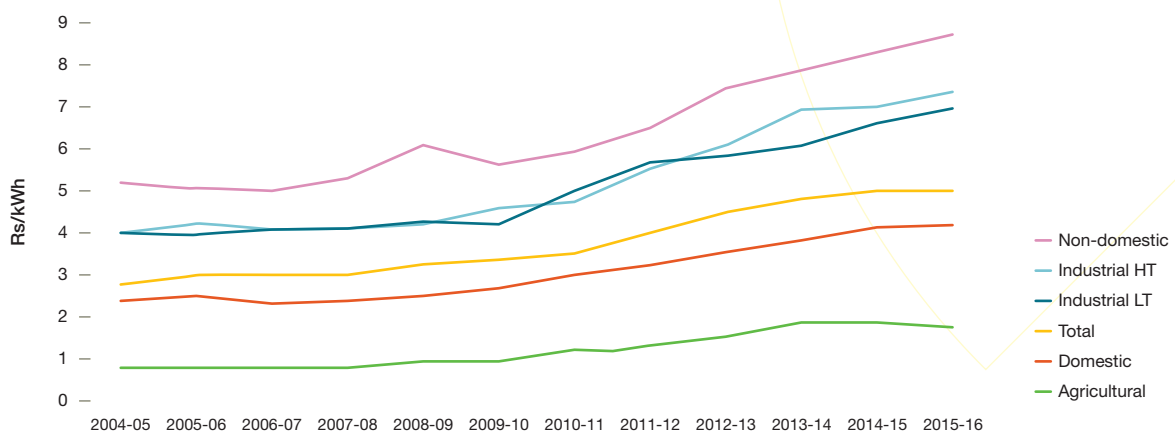
NEW DEVELOPMENTS FOR SOLAR POWER

Solar PV is considered to be India's most promising renewable energy source. This is due to India's favourable climatic conditions that provide the country with an average solar irradiation of 4-7 kWh/m²/day, with about 300 sunny days a year (MNRE, 2014b). To utilise this potential, the Union Government has identified solar as a key pillar for its power supply strategy and is committed to one of the largest solar energy capacity expansion programmes in the world. While wind is still the major contributor to renewable energy sources, solar is expected to overtake wind by 2020 (Climate Investment Fund, 2018). Along with falling panel prices and available government subsidies, solar power is increasingly being perceived in a positive light and is promoted in both on- and off-grid areas.

For now, India's solar market is driven by large-scale, ground-mounted projects. As of September 2019, 82.3% of India's installed solar capacity came from utility-scale plants. The country has an installed capacity of around 28.9 GW ground-mounted and 2.2 GW rooftop solar electricity (MNRE, 2019b; SolarPower Europe, 2019).

With many utility-scale projects in the pipeline, this trend is likely to continue. Ground-mounted solar projects – which mainly fall under the Solar Parks and Ultra Mega Solar Power Projects scheme – are tendered by the government through a reverse bidding process. Rooftop solar is yet to pick up in India. In rooftop solar, commercial and industrial clients contribute to the major chunk of the installations. While there is no doubt that India will manage to achieve its ground-mounted solar target of 60 GW by 2022 – as envisioned by the National Solar Mission (even exceeding it) – meeting its rooftop solar target of 40 GW remains a challenge.

FIGURE 9 ELECTRICITY PRICES FOR MAJOR CONSUMER CATEGORIES (Rs/kWh)



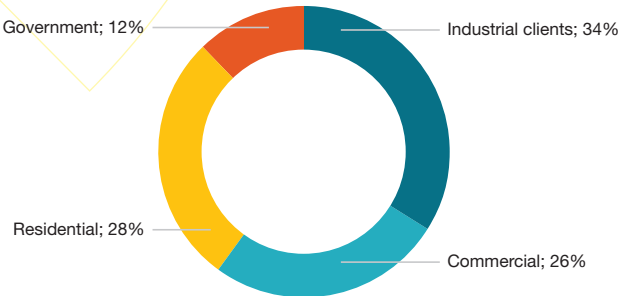
SOURCE: Powerline, 2017.

This is not unusual for emerging markets. Installing large quantities of utility-scale solar is much easier than establishing a distributed PV rooftop market, which takes a substantial period of time with having to educate many consumers. This is why emerging markets usually begin their solar chapter with tenders for utility-scale solar and struggle to set up the distributed rooftop segment (SolarPower Europe, 2019).

A swift modernisation of India’s metering infrastructure could accelerate this process. Net metering was first introduced in India in 2012 to facilitate the connection of small home systems with the grid in order to incentivise residential rooftop installations. Today, almost all states have notified their regulations to provide net metering infrastructure. Implementation, however, is still an issue.

Taxes, import duties and organisation barriers have made 2018 a ‘slow year’ for solar in India. According to latest estimates by the National Solar Energy Federation of India (NSEFI), the country’s newly installed solar capacity in 2019 was closest to SolarPower Europe’s low scenario as outlined in the figures below. Nevertheless, India remains on its growth path and is expected to be the second largest PV market over the next five years, with close to 90 GW of newly installed capacity between 2019 and 2023. India’s government recently also approved a total of 1.7 billion USD in funding for phase 2 of its grid-connected rooftop solar programme, which is very likely to also accelerate installations in this segment.

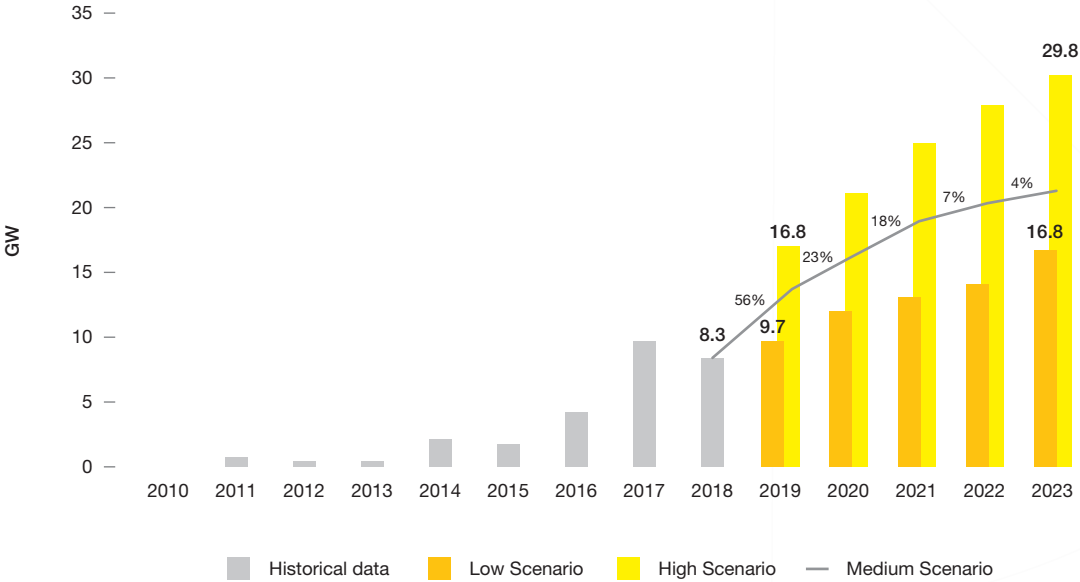
FIGURE 10 ROOFTOP SOLAR



SOURCE: Bridge to India 2017/2019 data.

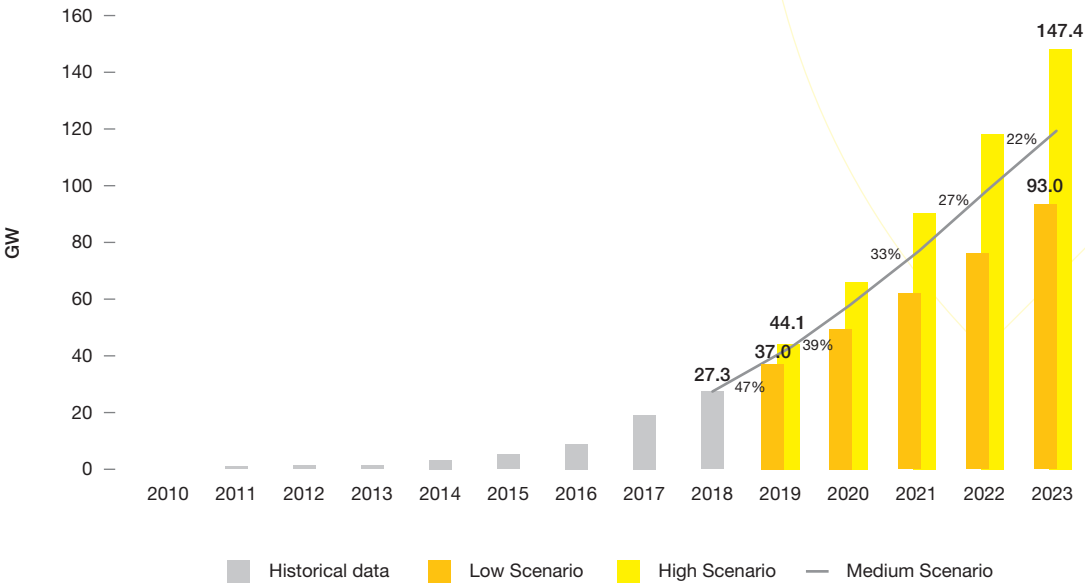
2 INDIA'S ELECTRICITY MARKET / CONTINUED

FIGURE 11 ANNUAL INSTALLED CAPACITY



SOURCE: SolarPower Europe, 2019.

FIGURE 12 CUMULATIVE INSTALLED CAPACITY



SOURCE: SolarPower Europe, 2019.

3 RECOMMENDATIONS

FOR INVESTORS

India is counted among the countries with the highest solar irradiation. Recognising this potential, India's government has taken large steps to develop solar PV and to create opportunities for national and international investors, ensuring the sector's consistent growth. The country's ambitious National Solar Mission illustrates this, as well as the country's various development finance institutions investing and backing investments in solar.

India's solar market, however, is also attractive for its low labour costs. By comparison on an international scale, India has one of the lowest costs of labour, allowing investors to employ large numbers of people. Given the fact that building a solar plant requires only between 20-30% of high-skilled manpower, the expansion of India's solar market does not only allow for large segments of society to be employed but also investors to rapidly complete their projects.

India is a highly price-sensitive market. On the one hand, this requires international investors to adapt their pricing strategies. On the other hand, it allows for a high availability of components, like solar panels, inverters, junction boxes, etc. at competitive prices. This has helped India to achieve low solar tariffs and furthered economies of scale, which in return has driven prices of components even lower.

Next to India's solar market being very interesting from a supply-side perspective, the country's expected economic growth and current rate of electrification, moreover, guarantees sufficient demand, which India's government aims to absorb promoting both on- and off-grid solar expansion. This comes with vast market entry opportunities for investors, who are encouraged to benefit from India's various subsidy schemes implemented by the MNRE or SECI.

European investors and companies looking to enter India's solar market are encouraged to contact their embassies, national business chambers or Invest India (<https://www.investindia.gov.in>), an agency facilitating contact between foreign investors and state and central agencies. To obtain useful advice, investors should ideally develop activities in collaboration with local partners such as NSEFI, India's umbrella organisation for all stakeholders in the market. NSEFI is active in the area of policy advocacy and is the national platform for addressing all issues connected to solar energy growth in India.

Due to the country's particular climatic and environmental conditions (i.e. very high levels of

pollution) foreign investors are advised to closely monitor quality and performance risks around their PV plants. India for instance requires more frequent panel cleaning due to higher soiling losses. For larger PPA based plants, investors are advised to not only rely on satellite data but also to employ ground measurements to offset variations in yield assumptions due to bad air quality. SolarPower Europe, in partnership with NSEFI, is planning to adapt SolarPower Europe's O&M Best Practice Guidelines – a reference document for O&M service quality – to the Indian context, a document that will further provide guidance to investors in this area. The Bureau for Indian Standards (BIS), as well as private sector associations, are also good points of reference for guidance.

FOR LOCAL POLICYMAKERS

India's subsidy schemes have been instrumental in adopting solar energy and placing India third in terms of global solar market size (SolarPower Europe, 2019). In 2018, however, India's solar sector declined by 15% in investments year-over-year (YOY). It has also been India's year of failed tenders. GST rate issues, tariff ceilings, safeguard duties, a falling rupee and mandated manufacturing capacity turned 2018 into a year of annulled tenders and no-shows by bidders. This came after the Government of India reduced many of its subsidy schemes in 2017 as an adjustment to the continuously falling price of solar coupled with improved performance. A more pragmatic approach to safeguard domestic manufacturers would have helped all stakeholders. To balance losses and broaden the customer base of solar energy, Indian public decision makers should introduce new subsidy schemes, especially covering underdeveloped sectors such as agriculture and residential rooftop solar as well as small and medium enterprises.

Public decision makers also should clarify India's Good & Service Tax (GST). The ambiguity whether Engineering, Procurement and Construction (EPC) contracts for solar power projects are categorised under the 5% or 18% tax bracket has created an unpredictable environment and leaves many investors reluctant to bid for projects. To sustain the growth of the Indian solar market, it is fundamental that GST guidelines become clear and transparent.

To de-risk business for investors, it is also paramount that India's policymakers continue to improve the financial health of state-owned electricity distribution companies (DISCOMs). These are the largest power off-takers in the

3 RECOMMENDATIONS / CONTINUED

Indian renewable energy sector, engaged to purchase power under long-term power purchase agreements (PPAs) at pre-determined tariffs. Due to liquidity constraints there have been instances in which the DISCOMs of Andhra Pradesh, Karnataka and Uttar Pradesh attempted to renegotiate or cancel signed PPAs with wind and solar power developers. Reducing this risk for investors requires long-term structural fixes aimed at solving the systematic failures of the utilities sector through coordinated efforts by the central and state government and DISCOMs. DISCOMS should be involved in all new government schemes. New PPAs should preferably be short-term, allowing DISCOMs to remain functional.

Furthermore, there is an over-dependence on contracts for the physical delivery of electricity. While it is true that long-term PPAs cannot be amended to wholesale restructuring, they can be supplemented with standardised financial contracts which ensure security for distribution companies, yet, protect the price risk and induce economic procurement in the short-term market. Additionally, short term and innovative contracting models suited for the market should be developed and adopted for future use.

In order to accelerate the issuance of subsidies and incentives to end-consumers, the government should also consider developing and testing a multi-level governance approach where one specific entity such as an energy supplier/distribution grid company pays out investment subsidies for solar rooftop installations to the customer and will then be reimbursed by the government or municipality on a reoccurring basis.

In terms of benefits to small and medium sized enterprises, a certification scheme similar to the one outlined in the EU Directive (EU) 2018/2001 could be tested to further establish quality assurance for solar installations and increase acceptance of rooftop solar. EU member states are required to ensure that certification schemes are available for installers of solar PV systems, or other installations such as solar thermal, shallow geothermal systems, heat pumps, small-scale biomass boilers and stoves.

FOR LOCAL PRIVATE STAKEHOLDERS

India has an ambitious plan to develop rooftop solar: a target of 40 GW capacity by 2022. To facilitate the scaling up of grid-connected solar rooftops, around 20 states have introduced dedicated policies and net metering regulations. Still, the segment has recorded very little growth so far.

According to the MNRE, only 2.2 GWp of solar rooftop systems had been installed in the country as of August 2019, which is less than 10% of the target capacity. Private stakeholders can push this segment's growth by implementing new financing models, which could gain popularity among residential consumers as they account for less than 20% of the total installed rooftop solar capacity.

For ground-mounted installations, competitive reverse auctions that push down bid prices to extremely low levels result in a scenario where cutting corners with regard to quality may become a common practice in India. Poor quality of construction, ill-suited selection of equipment and exorbitant O&M costs resulting from poor engineering, procurement and construction are shaking investors' confidence in the solar sector. Private stakeholders should therefore focus on selecting the right product, reliable construction and O&M quality, trained employees, and health and safety measures. Digital innovations also can help to improve solar power plants' health and return on investment.

FOR DEVELOPMENT FINANCE INSTITUTIONS

Development finance institutions are playing a key role in supporting the scaling of renewable energy. The European Investment Bank (EIB) and the German Development Bank KfW are examples of development finance institutions that are present in India, supporting the development of India's renewable energy sector.

The presence of these institutions reassures investors, not only as they drive investments but also due to their financial and technical expertise in improving the investment environment in the country. In addition, their presence strengthens the trust of foreign investors in the government to establish a sustainable framework for renewable energy and government policies.

To best utilise India's renewable energy potential, development finance institutions should invest in grid related projects. This is important as the country suffers from one of the highest transmissions and distribution losses in the world. The KfW is exemplary of this, providing EUR 1 billion to expand India's electricity grid through investing in the so-called "green corridor" mission. Development finance institutions also should play a vital role in working towards transparent processes and local procedures within the banking sector when it comes to available funds for projects and customers.

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A APPENDIX

FIGURE 13 OVERVIEW OF KEY STAKEHOLDERS IN INDIA'S SOLAR SECTOR

ORGANISATION	AREA OF RESPONSIBILITY
Central Electricity Authority, CEA	India's Central Electricity Authority is a statutory organisation that advises the Indian government on policy matters and formulates plans for the development of electricity systems. Specifically, the CEA is responsible for prescribing standards on matters such as construction of electric plants, electric lines and connectivity to the grid, installation and operation of meters, and grid safety standards.
Central Electricity Regulatory Commission, CERC	Entrusted by the MoP, the CERC is responsible for formulating and overseeing electricity tariffs, transparent policies regarding subsidies, the promotion of efficient and environmentally benign policies, as well as various other matters connected to power tariff regulation.
Power Finance Corporation, PFC	India's PFC is the country's largest non-banking financing institution as well as the country's largest infrastructure finance company. Its vision is to become the leading institutional partner for the power and allied infrastructure sectors in India and abroad.
Rural Electrification Corporation, REC	REC Limited is a public infrastructure finance company in India that finances and promotes rural electrification projects across the country. The company provides loans to central/state sector power utilities, state electricity boards, rural electric cooperatives, NGOs and private power developers for electricity generation, transmission and distribution projects.
National Institute for Solar Energy, NISE	The NISE was set up to assist the MNRE in the promotion of solar PV and function as the apex national research centre for research and technology development and related activities in the area of solar technology in the country. In particular, NISE undertakes activities related to research & development, testing, certification, standardisation, skill development, resource assessment and awareness related to solar power.
Solar Energy Corporation of India, SECI	SECI is a central public sector undertaking of the MNRE dedicated to the solar energy sector. SECI was established to facilitate the implementation of the National Solar Mission and in this context is responsible for the implementation of a number of government schemes, major ones being the VGF schemes for large-scale grid-connected projects under NSM, solar park scheme and grid-connected rooftop scheme, along with a host of other specialised schemes, such as defense and canal-top scheme.
Indian Renewable Energy Development Agency, IREDA	IREDA is a public limited government company established as a non-banking financial institution in 1987 and charged with the task of promoting, developing and extending financial assistance for setting up projects for new and renewable sources of energy and energy efficiency/conservation. The company's main objective is to provide financial support for specific projects and schemes for generating electricity and/or energy through new and renewable sources and conserving energy through energy efficiency.
National Solar Energy Federation of India, NSEFI	NSEFI is an umbrella organisation of all solar energy stakeholders of India. This apex solar organisation works in the area of policy advocacy and is a national platform for addressing all issues connected with solar energy growth in India. It consists of leading international, national and regional companies and includes solar developers, manufacturers, EPC contractors, rooftop installers, and system integrators.



“India’s renewables sector is growing at a strong pace. The country’s government committed to one of the largest solar capacity extension programmes in the world, creating opportunities for national and international players and ensuring the sector’s consistent growth. This report provides an overview and recommendations for investors and local stakeholders alike to foster solar energy in India.”

Jens Martin

Solutions Manager, E.ON and Vice-Chair of SolarPower Europe’s Emerging Markets Task Force



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