



RENEWABLE ENERGY

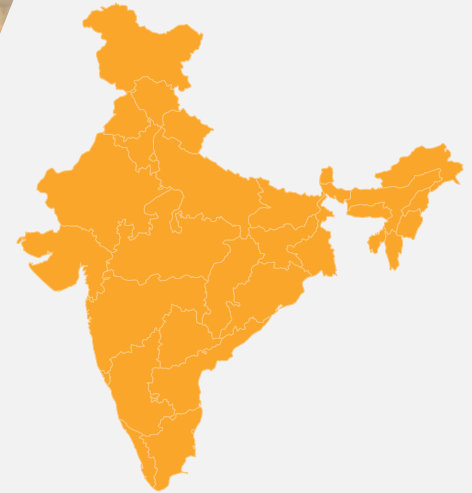
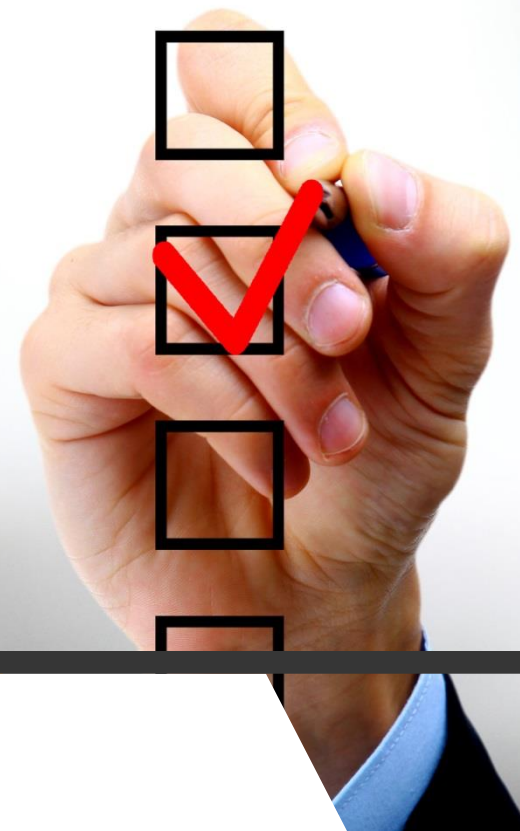


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Ambitious Targets

- As a part of its Paris Agreement commitments, the Government of India has set an ambitious target of achieving 175 GW of renewable energy capacity by 2022. These include 100 GW of solar capacity addition and 60 GW of wind power capacity.
- Government of India has ramped up its previous target to achieve 225 GW of renewable energy capacity by 2022, much ahead of its target of 175 GW as per the Paris Agreement.
- 60 solar cities will be developed in India as part of Ministry of New and Renewable Energy's Solar Cities program.

Immense Growth Potential

- India has very low conventional energy resources compared to the required energy needs of its huge population and rapidly increasing economy. But India can harness the huge potential of solar energy as it receives sunshine most of the year. It also has vast potential in hydro power sector which is being explored in the north-eastern states of the country.
- India added record 11,788 MW of renewable energy capacity in 2017-18 and 1,832.26 MW (grid interactive and off-grid) in April-July 2018. It is expected that India will overachieve its Paris Agreement goals.
- Renewable sources are expected to help meet 40 per cent of India's power needs by 2030.

Competition

- The competition in the sector has risen recently, especially in the solar power segment, where tariffs reached record low of Rs 2.43 (US\$ 0.037) per unit in December 2017. The large integrated players are in a better position with higher returns compared to the smaller contractors.

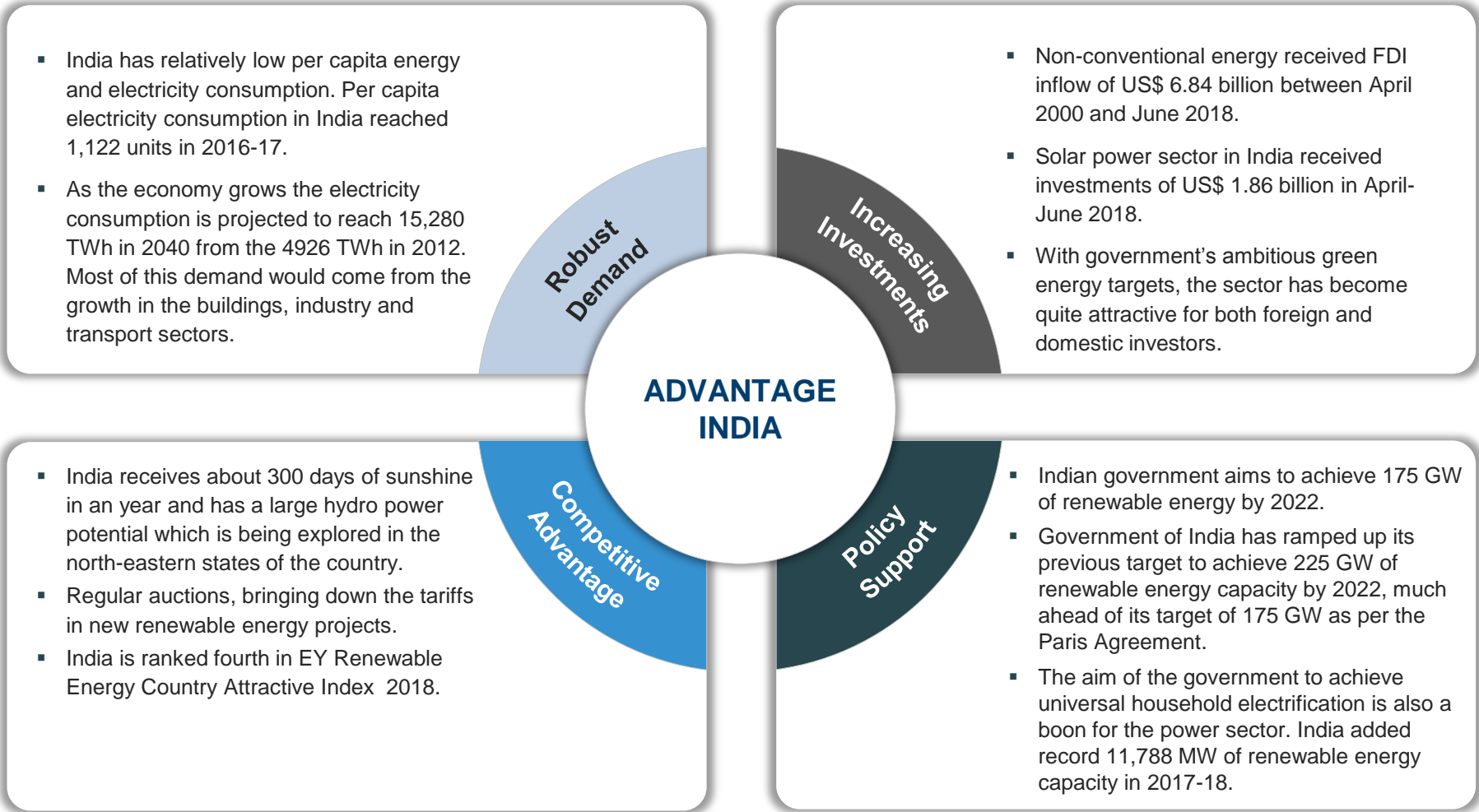
Increasing Investments

- The renewable energy space in India has become very attractive from investors' perspective and has received FDI inflow of US\$ 6.84 billion between April 2000 and June 2018. India has also ranked second in the Renewable Energy Attractiveness Index 2017 as there is ample push from the government and the economics of the market is improving.
- More than US\$ 42 billion has been invested in India's renewable energy sector since 2014.

Source: EY, Central Electricity Authority, MNRE, DIPP, Livemint, IWTMA

ADVANTAGE INDIA



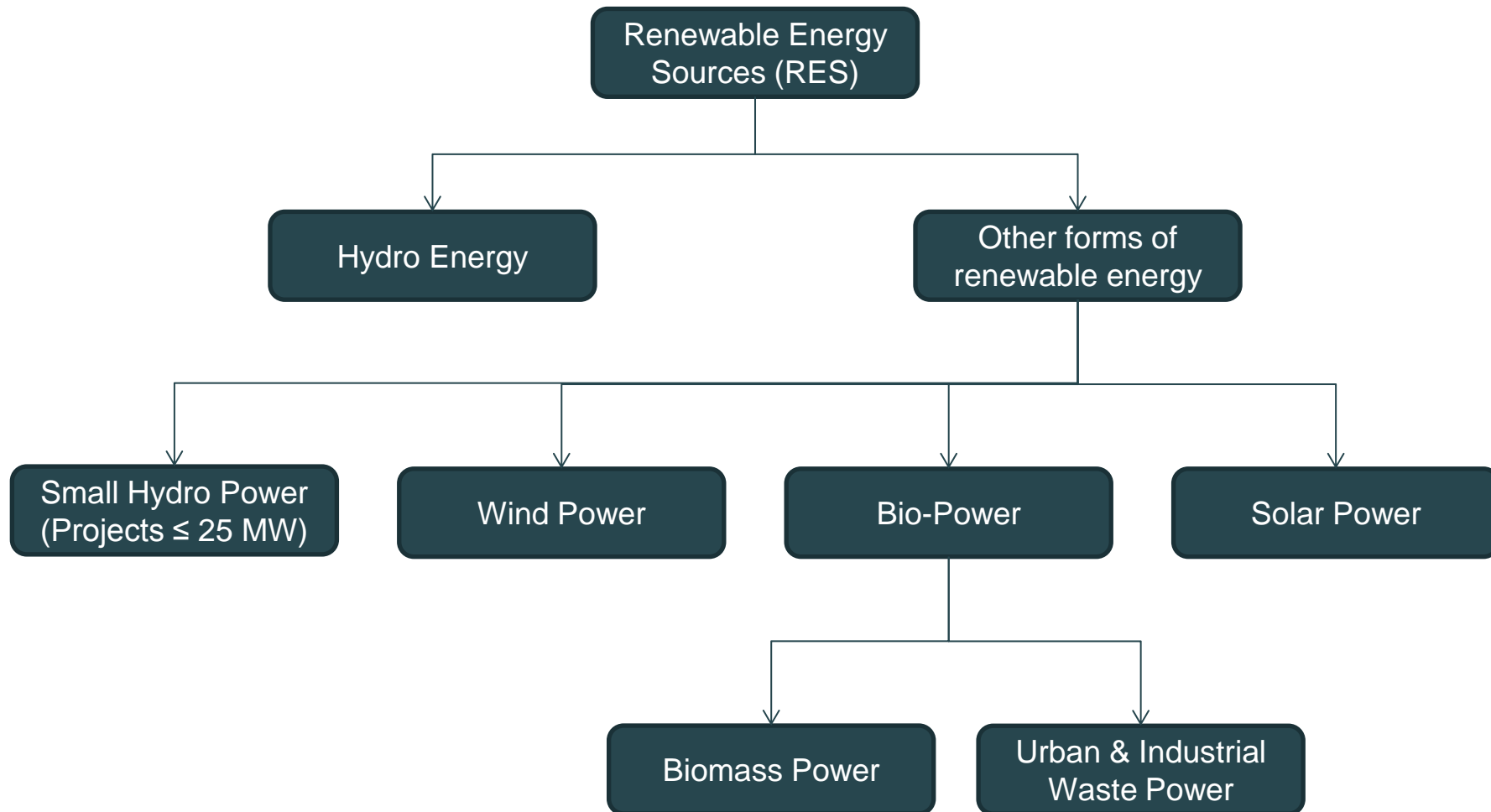


Note: TWh – Terwatt Hour

Source: Central Electricity Authority, Ministry of New and Renewable Energy, Mercom India, EY

MARKET OVERVIEW AND TRENDS

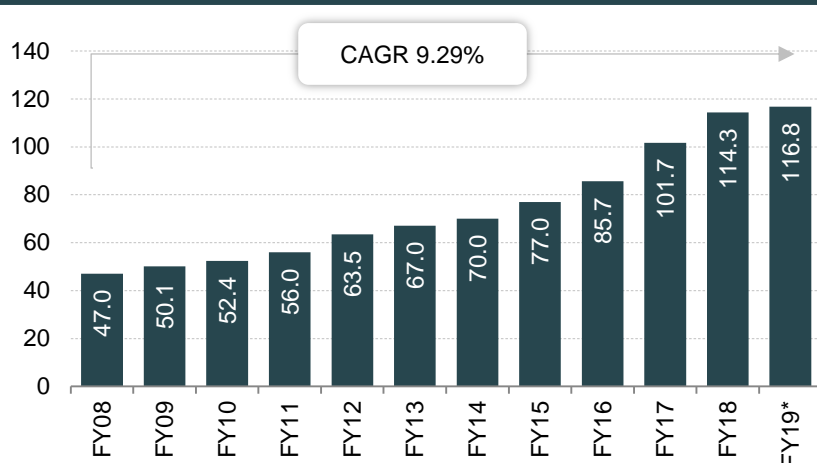




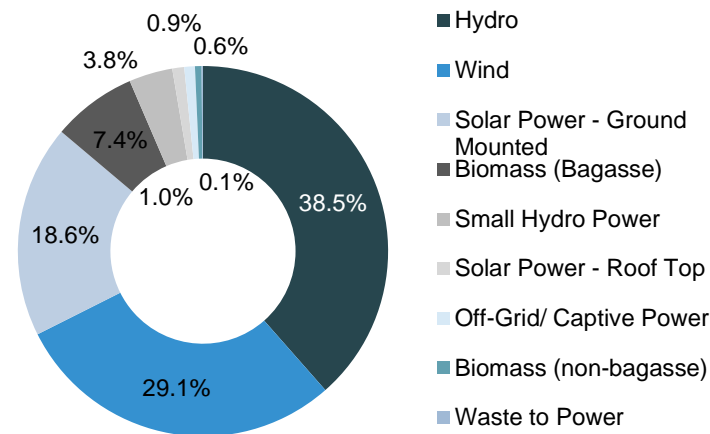
Source: Central Electricity Authority (CEA)

GENERATION CAPACITY HAS INCREASED AT A HEALTHY PACE...(1/2)

Installed Renewable Energy Capacity (GW)



Installed Capacity Breakup– July 2018



- India accounts for approximately four per cent of the total global electricity generation and contributes 4.43 per cent to the global renewable generation capacity.
- The International Energy Agency’s World Energy Outlook projects a growth of renewable energy supply to 4,550 GW in 2040 on a global basis.
- Installed renewable power generation capacity has increased steadily over the years, posting a CAGR of 9.29 per cent over FY08–18. India added record 11,788 MW of renewable energy capacity in 2017-18.
- As of July 2018, total renewable¹ power generation installed capacity (grid interactive) in the country stood at 116.82 GW, which is 33.81 per cent of the total installed capacity of 345.49 GW.

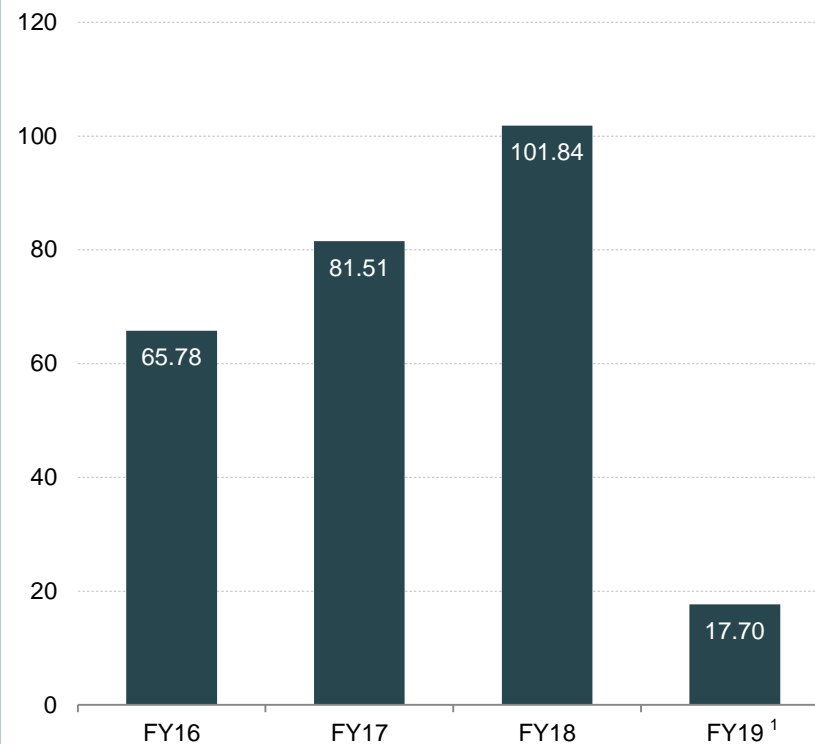
Notes: RES – Renewable Energy Source, *up to July 2018, GW – Gigawatt; 1Large Hydro power projects included here but not included in renewable energy targets of GOI

Source: CEA, International Renewable Energy Agency (IRENA), MNRE

GENERATION CAPACITY HAS INCREASED AT A HEALTHY PACE...(2/2)

- Power generation from renewable energy sources (excluding large hydro) in India reached 101.84 billion units in FY18 and 17.70 billion units in April-May 2018.
- India has the fourth largest installed capacity of wind power and the third largest installed capacity of concentrated solar power (CSP).
- Government of India is aiming to achieve 225 GW of renewable energy capacity by 2022, much ahead of its target of 175 GW as per the Paris Agreement.
- Solar installation in India is expected to increase 360 per cent by 2020. During January-March 2018, solar installations increased by 34 per cent quarter-on-quarter. During April-June 2018, solar capacity of 1.4 GW was installed in India.
- About 4.96 million household size biogas plants have been installed in India since the inception of National Biogas and Manure Management Programme (NBMMP). 15,000 biogas plants were installed in FY18 (up to December 2017)

Electricity Generation from RES* (billion units)



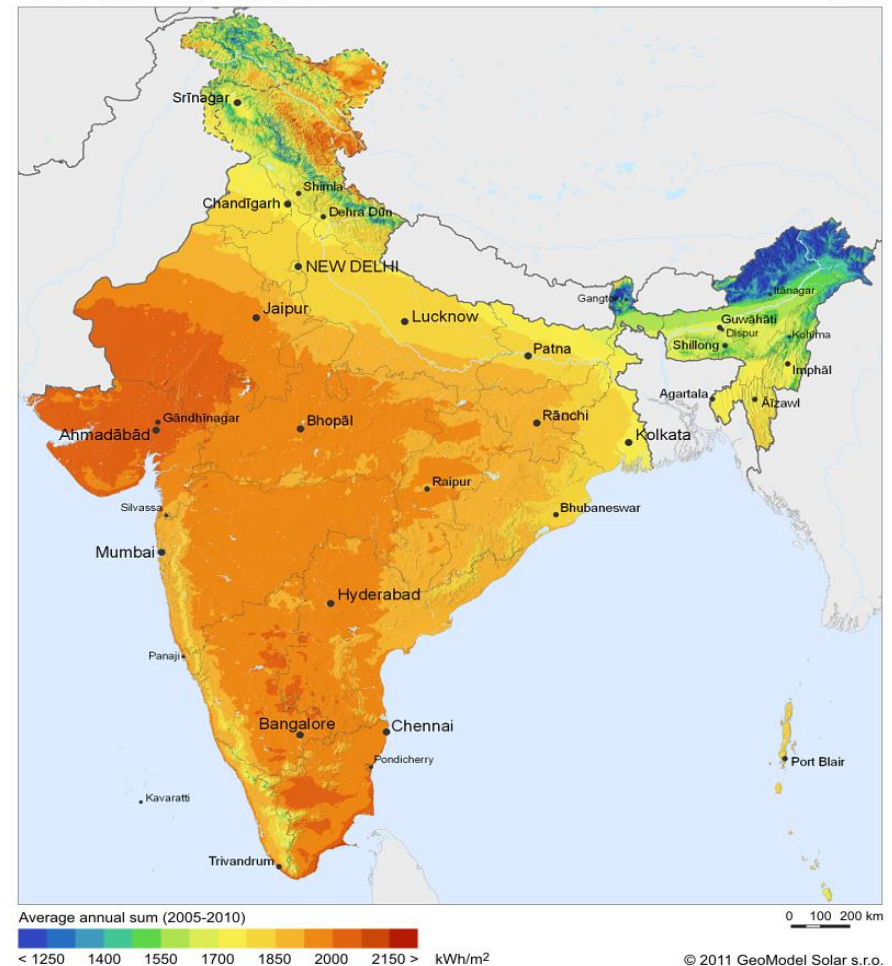
*Note: RES – Renewable Energy Source, *Large Hydro power projects not included, ¹ up to May 2018*

Source: CEA, Make in India, MNRE, Mercom India

SOLAR POWER GENERATION GROWTH LIKELY TO OUTWEIGH OTHER SOURCES BY 2022

- Due to its favourable location in the solar belt (40° S to 40° N), India is one of the best recipients of solar energy with relatively abundant availability
- Growth in solar power installed capacity is expected to surpass the installed capacity of wind power, reaching 100 GW by 2022 from its current levels of 23.12 GW as of July 2018.
- Rapidly falling costs has made Solar PV the largest market for new investment.
- Further, the scaling up of the target of National Solar Mission to 100 GW from 20 GW of grid connected solar power by 2022, creates a positive environment for investors keen to tap into India's renewable energy potential
- Under Union Budget 2018-19, zero import duty on components used in making solar panel was announced to give a boost to domestic solar panel manufacturers.
- World's largest solar park named 'Shakti Sthala' was launched in Karnataka in March 2018 with an investment of Rs 16,500 crore (US\$ 2.55 billion).
- Solar sector in India received investments of over US\$10 billion in CY2017.

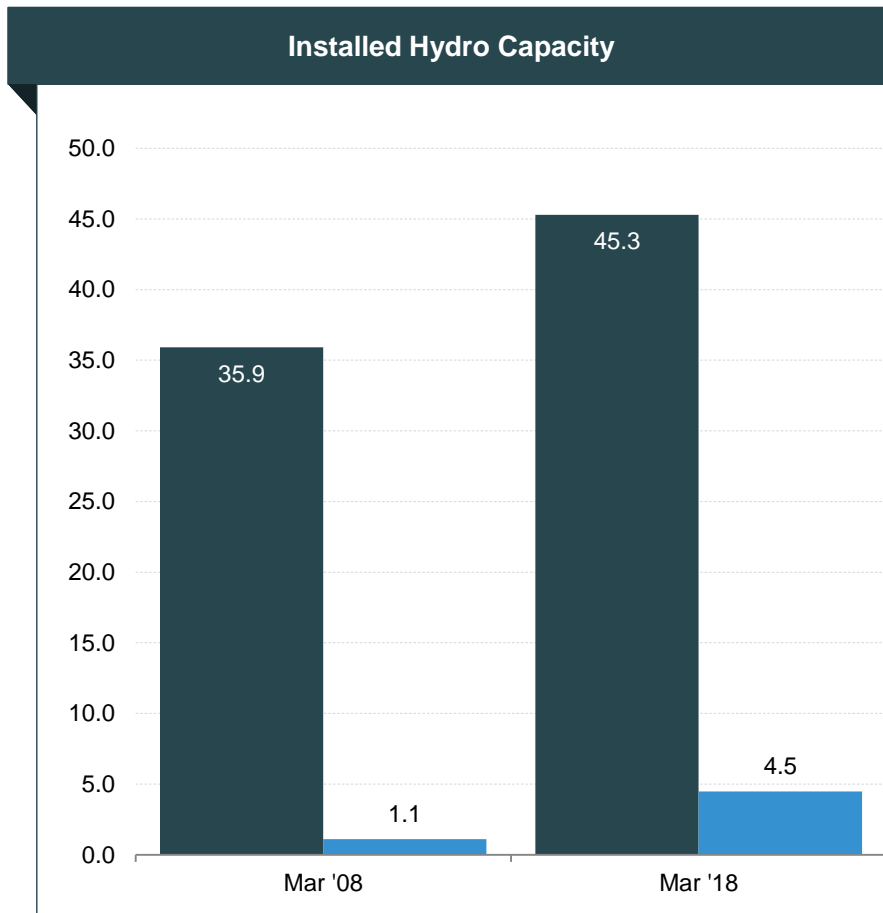
Global horizontal irradiation



Source: CEA, Make in India, India Solar Handbook 2017, MNRE

GROWTH IN HYDRO POWER

- India has the hydropower potential of around 145 GW.
- Hydro power projects in India are classified into conventional hydro projects and small hydro electric projects. Small hydel projects are included in the government's renewable energy sources (RES) targets
- Installed capacity from large hydel projects in India increased from 35.9 GW in March 2008 to 45.3 GW in March 2018 while capacity from small hydel plants has increased more than four times to 4.5 GW in the same period.
- A new Hydropower policy for 2018-28 has been drafted for the growth of hydro projects in the country.



Source: CEA, Ministry of Power

STRATEGIES ADOPTED



Full Integration

- Suzlon, a key player in the wind power segment, is a vertically integrated company. It has been producing all the wind turbines and installing them coupled with the maintenance. It has service support centres across the globe.
- Adani Power also aims to become the a fully-integrated solar PV manufacturer.
- The returns of fully integrated players exceed those of Engineering, Procurement and Construction (EPC) contractors.

Decentralised Solar Power

- Electricity to all has become a major thrust area for Government of India. This includes households and villages and slums which are not currently a part of the grid or centralised distribution. Selco Solar Pvt Ltd started installing solar panels in slums which were not connected to the grid as a pilot project in 2008 and has since expanded into other states as well. They have also used standardized financial packages to get the slum people move from kerosene to solar power.

PPA & Lower Tariffs

- With the increasing competition and increasing FDI, players in the solar sector have started bidding at lower prices with solar tariffs reaching record low of Rs 2.44 (US\$ 0.04) per unit in May 2017. Power Purchase Agreements with states have become important part of the project cycle for Indian companies. Wind power tariff reached record low of Rs 2.43 (US\$ 0.038) in 500 mw reverse auctions by Gujarat Urja Vikas Nigam Limited (GUVNL) in December 2017.

Source: Company websites, Livemint

GROWTH DRIVERS



RNEWABLE ENERGY GROWTH DRIVERS

Government Commitments

- As a part of its Paris Agreement commitments, the Government of India has set an ambitious target of achieving 175 GW of renewable energy capacity by 2022. These include 100 GW of solar capacity addition and 60 GW of wind power capacity. The solar capacity target will be achieved before its 2022 deadline while wind power capacity is expected to reach 60 GW by FY21.
- 60 solar cities will be developed in India as part of Ministry of New and Renewable Energy's Solar Cities program.

Investments

- The renewable energy space in India has become very attractive from investors' perspective and has received FDI inflow of than US\$ 6.84 billion between April 2000 and June 2018.
- More than US\$ 42 billion has been invested in India's renewable energy sector since 2014.

Favourable Policies and Incentives

- Renewable energy projects are included in priority sector lending, which is relatively cheaper than other sources of credit.
- Policies formulated for all sub sectors under renewable energy.
- Fiscal incentives provided to promote renewable energy.

Source : Invest India, KPMG, MNRE

National Offshore Wind Energy Policy, 2015

- Promotes deployment of Offshore Wind Farms up to 12 nautical miles from coast. Research and Development activities to take place up to Exclusive Economic Zone (EEZ) of 200 nautical miles.
- Under the policy single window clearance is offered.
- Tax holiday of 10 years for offshore wind energy generation.

Repowering Policy

- Promotes optimum utilisation of wind energy resources by creating facilitative framework for repowering.
- An interest rebate of 0.25 per cent over the interest rebate offered to new wind energy projects will be provided.
- All fiscal and financial benefits offered to new wind power projects will be extended to repowering projects

Wind-Solar Hybrid Policy

- Aims to achieve a hybrid wind-solar capacity of 10GW by 2022.
- Hybridization of the two technologies will help in:
 - Minimizing Variability
 - Optimal utilization of infrastructure including land and transmission systems

Renewable Purchase Obligations (RPO's)

- RPO's are a mechanism by which State Electricity commissions are obliged to purchase certain percentage of power from renewable energy sources.
- Also, floor prices of the RPO have been set to provide certainty to companies. The floor price has been set at US\$ 144 per Megawatt.

Scheme for Development of Solar Parks and Ultra Mega Solar Power Projects

- Aims to set up 25 Solar Parks and Ultra Mega Solar Power Projects targeting 20,000MW of solar power installed capacity by 2019-20.
- US 83.78 million have already been sanctioned under the scheme.

Note : GW - Gigawatt

Source : Ministry of New and Renewable Energy (MNRE), News Articles

- Targets deployment of 100 GW of solar power by 2022.
- Various incentives are being offered under the scheme:
 - Zero import duty on capital equipment, raw materials
 - Low interest rates and Priority Sector Lending
 - Single window mechanism for all related permissions.

National Solar Mission

- Project for evacuation of renewable energy from generation points to the load centres by creating intra-state and inter-state transmission infrastructure.

Green Energy Corridor

- India received a US\$ 1.15 billion soft loan from German development bank for implementation of green corridors project. 40 per cent of Intra state and 70 per cent of inter state transmission schemes will be funded through the soft loan.

**Budget 2018-19 -
Ministry for New and
Renewable Energy
Allocation is
US\$ 1.6 billion**

Wind Bidding Scheme

- Scheme for setting up 1000 MW Inter State Transmission Systems (ISTS) connecting wind power projects.
- Projects of 50 MW and above will be connected to ISTS point.
- Around 1,739.14 MW of wind power capacity was added in 2017-18. Wind power capacity addition is expected to reach 3 GW in FY19.
- Inter-state distribution of wind power was started in August 2018.

Skill Development

- Solar and wind energy sectors in India are expected to generate over 300,000 jobs by 2022.
- To meet the rising demand of trained manpower, a target of achieving 50,000 “Surya Mitras” of skilled manpower in solar energy sector by 2019-20 has been set.

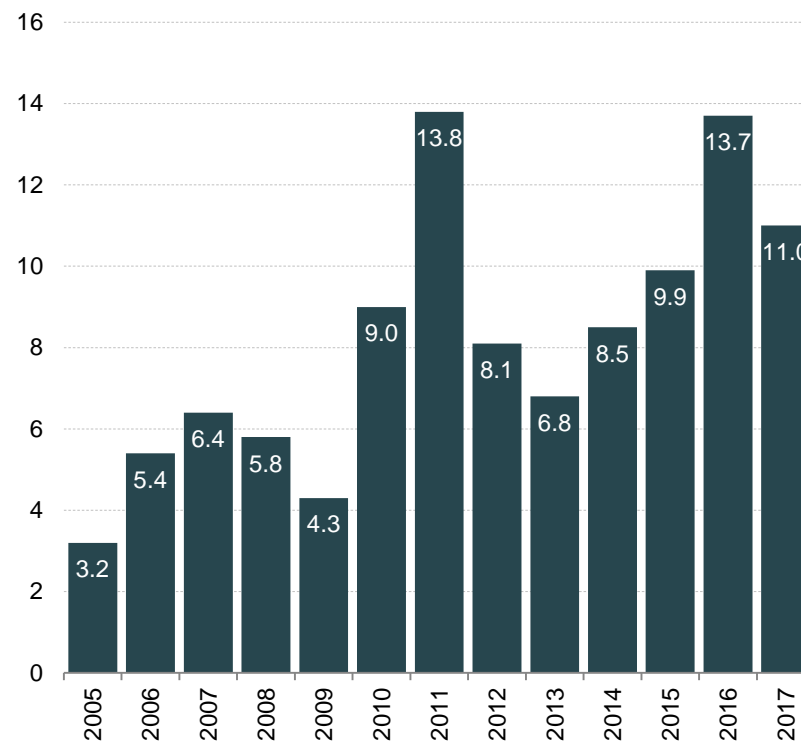
Notes : GW – Gigawatt, MW – Megawatt, PPA – Power Purchase Agreement, PSA- Power Sale Agreement

Source : Ministry of New and Renewable Energy (MNRE), Make in India, International Labour Organization , Bloomberg Quint

INCREASING INVESTMENTS: FDI INFLOWS AND KEY DEALS ... (1/2)

- 100 per cent FDI is allowed under automatic route for projects of renewable power generation and distribution subject to provisions of The Electricity Act, 2003.
- New investments in clean energy in the country reached US\$11 billion in 2017. In the first half of 2018, investments in clean energy increased 22 per cent year-on-year.
- The non-conventional energy sector has received a total FDI equity inflow of US\$ 6.84 billion during April 2000 to June 2018.
- With 28 deals, clean energy made up 27 per cent of US\$ 4.4 billion merger and acquisition (M&A) deals which took place in India's power sector in 2017.

New Investments in Clean Energy in India



Notes: FDI - Foreign Direct Investment, Pvt. Ltd. – Private Limited Company

Source: DIPP, EY, Bloomberg NEF

INCREASING INVESTMENTS: FDI INFLOWS AND KEY DEALS ... (2/2)

Major FDI Investments in Renewable Energy Sector

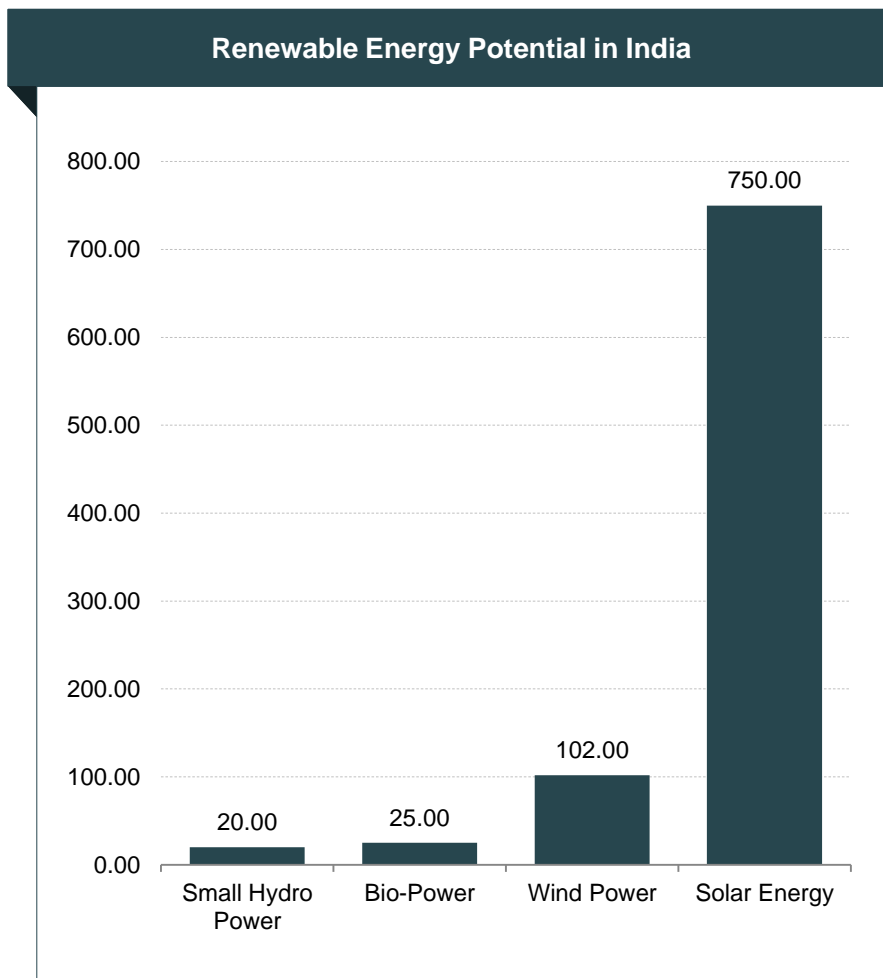
Foreign Collaborator	Country	Indian Company	FDI Equity Inflow (US\$ mn)
Asian Development Bank	Phillipines	Renew Power Ventures Pvt. Ltd.	44.69
AIRRO Singapore Pte Ltd	Singapore	Diligent Power Pvt. Ltd.	41.07
ORIX Corporation	Japan	Lalpur Wind Energy Pvt. Ltd.	37.75
ENEL Green Power Development B.V.	Netherlands	BLP Energy Pvt. Ltd.	32.61
DEG-DEUTSCHE-InvestitionsUnd-Entwicklun	Germany	WELSPUN Renewables Energy Pvt Ltd	32.50
ENERK International Holdings Ltd	Seychelles	RKM POWERGEN Pvt Ltd	32.50
OSTRO Renewal Power Limited	Mauritius	OSTRO Energy Pvt Ltd	32.21
AREVA Solar Inc	U.S.A	AREVA Solar India Pvt Ltd	31.53

OPPORTUNITIES



HUGE UNTAPPED POTENTIAL

- India is estimated to have renewable energy potential of 900GW from commercially exploitable sources viz. Solar energy- 750 GW, Wind power¹ - 102 GW, Bio-energy – 25 GW and Small Hydro – 20 GW.
- Recognizing this potential, a target of 175 GW of renewable energy capacity by 2022 has been fixed.
- In India, there is an estimated potential of about 8,000 MV of tidal energy.

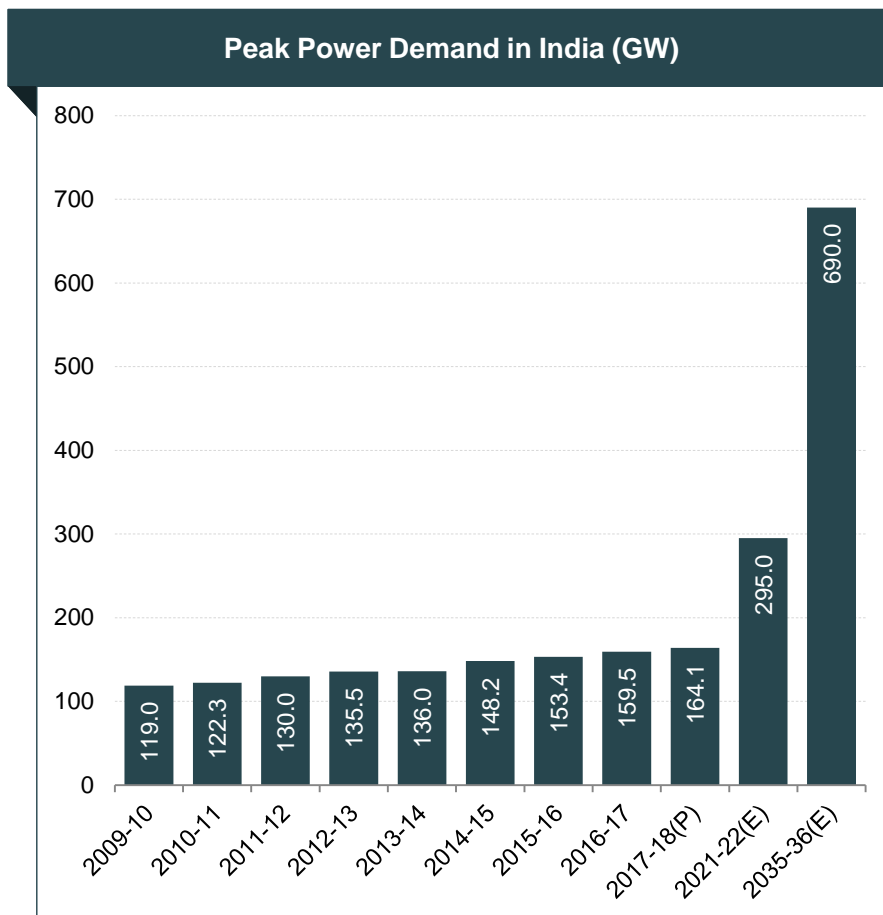


Notes: GW – Gigawatt, ¹Wind Power potential is at 80 metres above ground level

Source: Ministry of New and Renewable Energy (MNRE), Central Electricity Authority (CEA), IIT Chennai Study

RISING POWER DEMAND

- India's power demand has been rising at a fast pace. It is estimated that India will require an additional power supply capacity of 450 GW by 2034.
- The peak power demand of the country was reached 164.07 GW in 2017-18. In June 2018, peak demand was 171 GW.
- It is estimated that this demand will rise to 295 GW by 2021-22 and 690 GW by 2035-36.
- Also, India has an electricity-GDP elasticity ratio of 0.8. A seven per cent growth in energy supply will be required if India is to grow at eight per cent. This shows that electricity will continue to remain a key input in India's GDP growth.



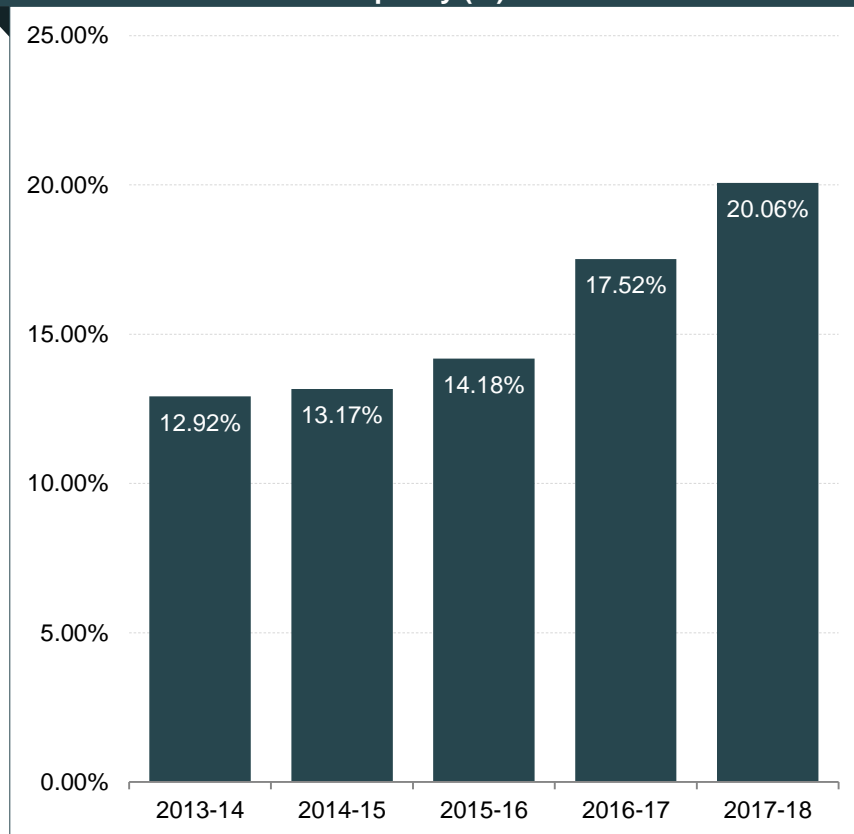
Note: GW – Gigawatt, P – Provisional, E - Estimated

Source: Business Standard, Capacity addition estimates by CEA

MOVE TOWARDS RENEWABLE SOURCES

- It has been estimated that renewables will comprise 49 per cent of India's power generation by 2040.
- Over the last few years there has been an increase in percentage contribution of renewable energy to total installed capacity. In 2013-14 the contribution was 12.92 per cent which has increased to 20.06 per cent by March 2018.
- India aims to achieve a total of 175 GW of installed renewable energy capacity by 2022. It is estimated that India will become the third largest solar market in 2017 while India already has the fourth largest wind power installed capacity globally.
- Replacing coal plants with renewable sources is expected to save India Rs 54,000 crore (US\$ 8.4 billion) annually due to reduced power costs.

RES (excluding large hydro) as a percentage of total installed capacity (%)



Note: ¹ - Renewable Energy Attractiveness Index by EY

Source: Ministry of New and Renewable Energy (MNRE), Central Electricity Authority (CEA), Greenpeace India

INDUSTRY ASSOCIATIONS



National Institute of Solar Energy (NISE)

Address: National Institute of Solar Energy Gwal Pahari,
Faridabad, Gurugram, Haryana- 122 003
Website: <https://nise.res.in/>

National Institute of Wind Energy (NIWE)

Address: Velachery - Tambaram Main Road , Pallikaranai, Chennai -
600 100
Tel: 91 44 2246 3982/ 83 / 84
Fax: 91 44 2246 3980
Website: <http://niwe.res.in/>

Sardar Swaran Singh National Institute of Bio- Energy (SSS-NIBE)

Address: 12th K. M. Stone, Jalandhar - Kapurthala Road, Wadala
Kalan, Kapurthala - 144601 (Punjab), India
Tel: 91 1822 255544/ 507403/ 507406
Fax: 91 1822 255544
Website: <http://www.nibe.res.in/>

The Indian Renewable Energy Development Agency (IREDA)

Address: India Habitat Centre Complex, Core- 4A, East Court, 1st
Floor, Lodi Road, New Delhi- 110 003
Tel: 91 11 24682214/ 21
E-mail: cmd@ireda.gov.in
Web site: <http://ireda.gov.in/>

Solar Energy Corporation of India (SECI)

Address: A-2/158, Janakpuri, New Delhi-110058, India
Tel: 91 11 25618472, 45652708
Fax: 25611622
E-mail: cvjvarma@gmail.com , cvjv1933@yahoo.com
Web site: <http://seci.gov.in>

USEFUL INFORMATION



- CAGR: Compound Annual Growth Rate
- FDI: Foreign Direct Investment
- FY: Indian Financial Year (April to March)
- GOI: Government of India
- INR: Indian Rupee
- US\$: US Dollar
- Wherever applicable, numbers have been rounded off to the nearest whole number

EXCHANGE RATES

Exchange Rates (Fiscal Year)

Year INR	INR Equivalent of one US\$
2004–05	44.95
2005–06	44.28
2006–07	45.29
2007–08	40.24
2008–09	45.91
2009–10	47.42
2010–11	45.58
2011–12	47.95
2012–13	54.45
2013–14	60.50
2014-15	61.15
2015-16	65.46
2016-17	67.09
2017-18	64.45
Q1 2018-19	67.04

Exchange Rates (Calendar Year)

Year	INR Equivalent of one US\$
2005	44.11
2006	45.33
2007	41.29
2008	43.42
2009	48.35
2010	45.74
2011	46.67
2012	53.49
2013	58.63
2014	61.03
2015	64.15
2016	67.21
2017	65.12

Source: Reserve Bank of India, Average for the year

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