



RENEWABLE ENERGY

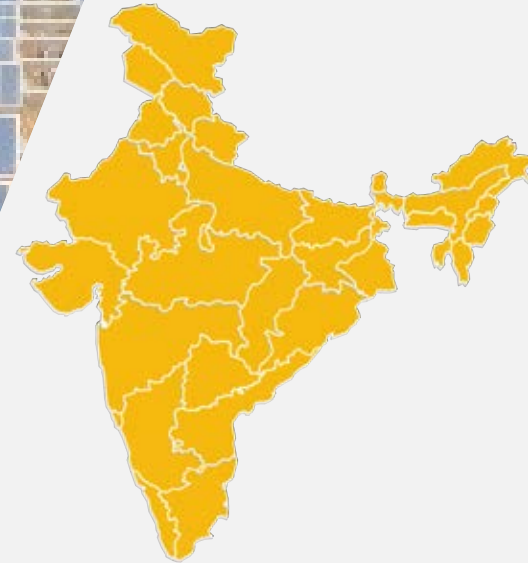
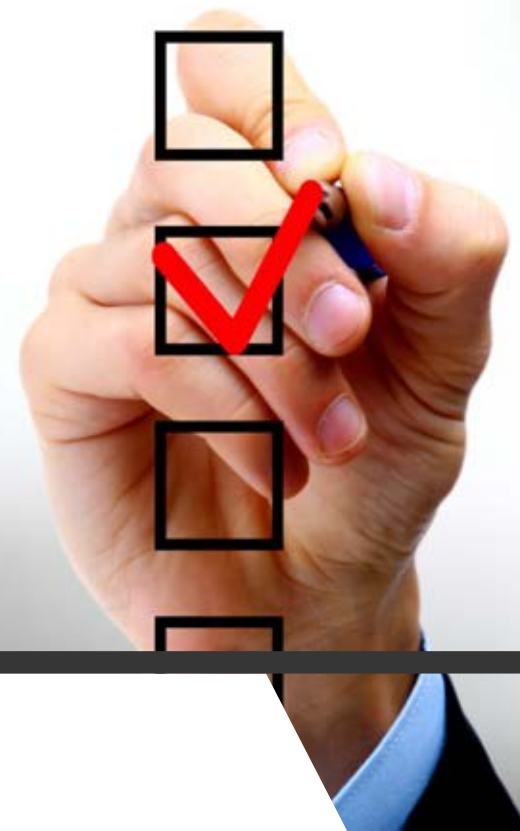
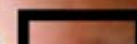
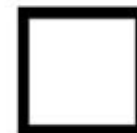
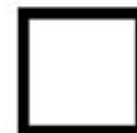


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Ambitious targets

- As 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 adding 100 GW of solar capacity and 60 GW of wind power capacity.
- Government plans to establish renewable energy capacity of 500 GW by 2030.
- The renewable energy will account for 55 per cent of the total installed power capacity by 2030.

Immense growth potential

- India has low conventional energy resources compared to its required energy needs driven by 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 across states in the northeast.
- India had 87.26 GW of renewable energy capacity as on April 2020, including 34.81 GW from solar and 37.74 GW from wind power. It is expected that India will overachieve its Paris Agreement goals.
- India plans to add 30 GW of renewable energy capacity along the desert on its western borders of Gujarat and Rajasthan.

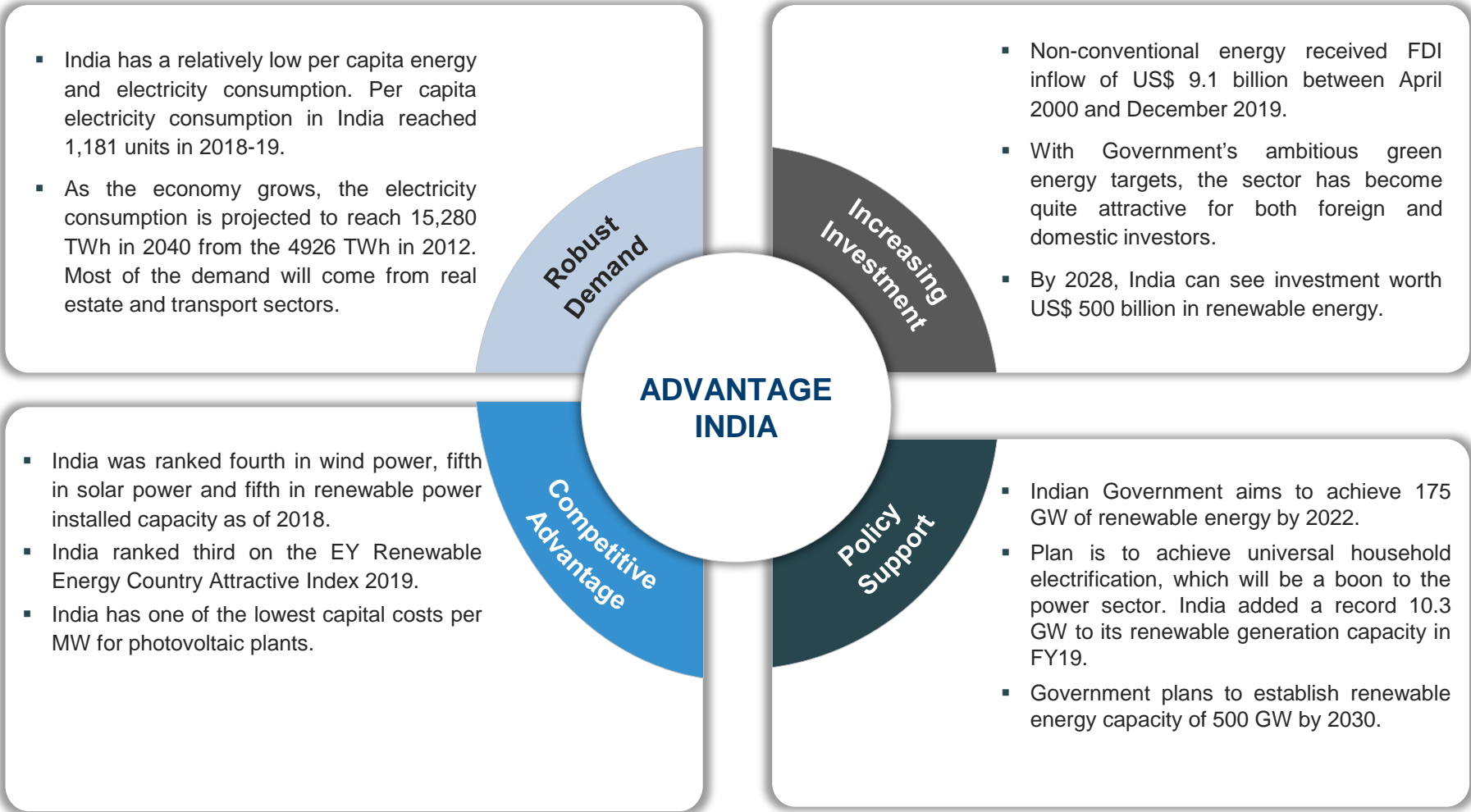
Increasing investment

- The renewable energy space in India has become very attractive from investors' perspective and received FDI inflow of US\$ 9.1 billion between April 2000 and December 2019.
- More than US\$ 42 billion has been invested in India's renewable energy sector since 2014.
- India ranked fourth on the EY Renewable Energy Country Attractive Index 2019.

Source: EY Recai (November 2018) , Central Electricity Authority, MNRE, DPIIT, Livemint, IWTMA

ADVANTAGE INDIA



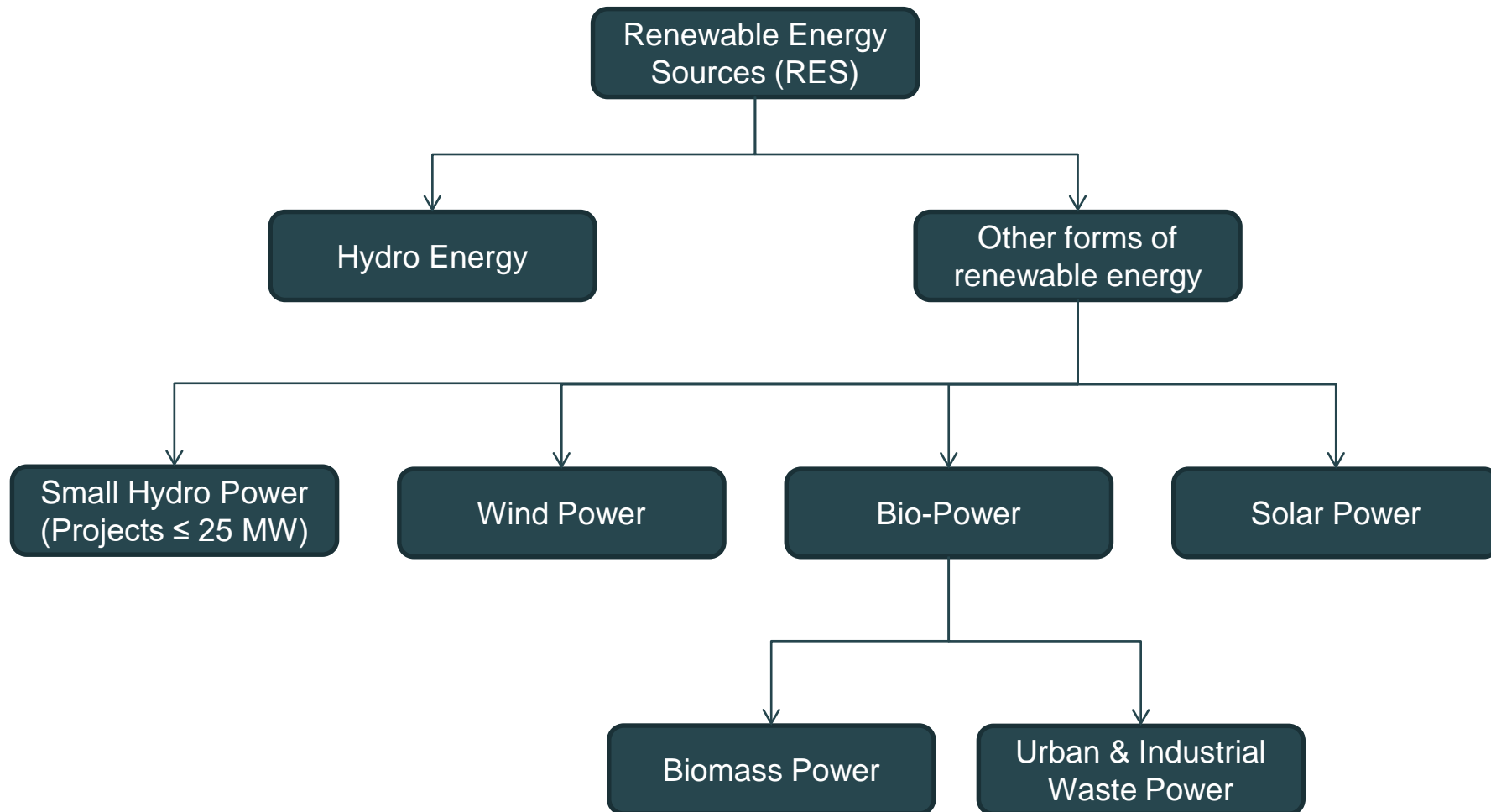


Note: TWh – Terawatt Hour

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

MARKET OVERVIEW AND TRENDS

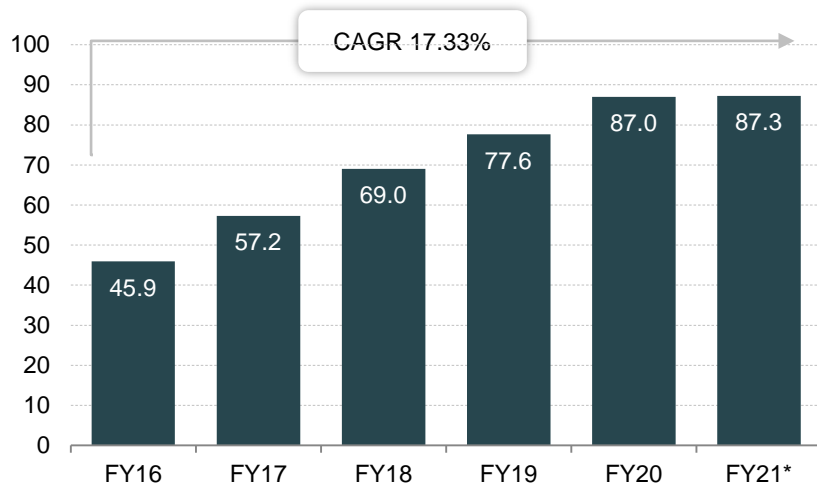




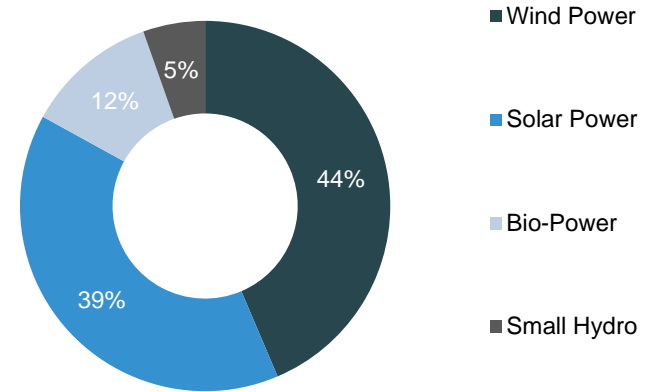
Source: Central Electricity Authority (CEA)

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

Installed Renewable Energy¹ Capacity² (GW)



Installed Renewable¹ Capacity² Breakup –April 2020



- 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 at a fast pace over the past few years, posting a CAGR of 17.33 per cent between FY16–FY20. India added a record 87 GW in renewable energy capacity in FY20.
- As on April 30, 2020, the installed renewable energy capacity stood at 87.26 GW, of which, solar and wind comprised 34.81 GW and 37.74 GW, respectively. Biomass and small hydro power constituted 9.86 GW and 4.68 GW, respectively.

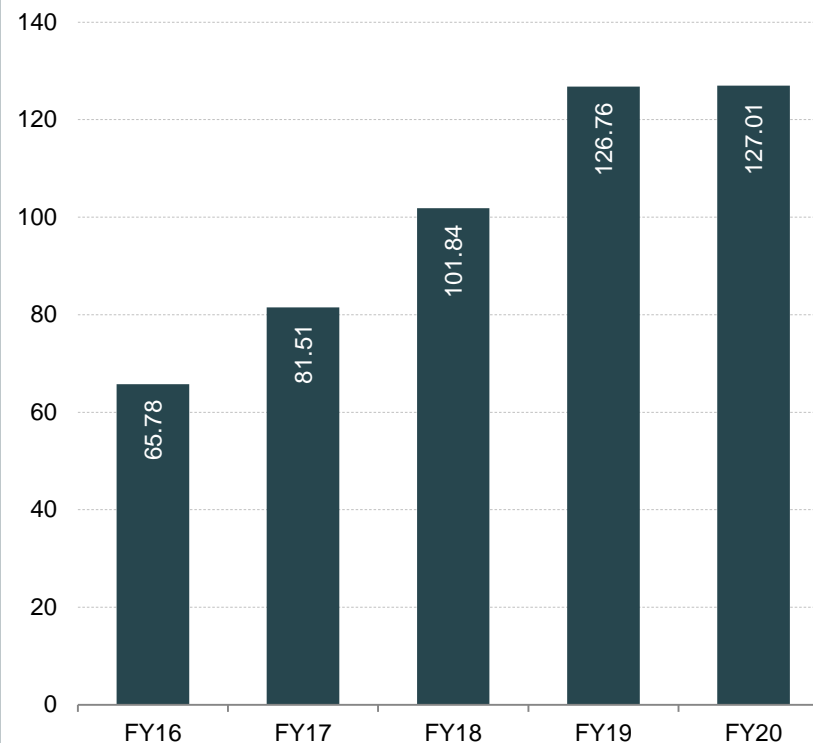
Notes: ¹Large Hydro power projects not included as they are not included in renewable energy targets of GOI, ²grid interactive capacity, *- till April 2020

Source: Central Electricity Authority (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 record 127.01 billion units in FY20.
- The country ranks fourth in the world in terms of total installed wind power capacity.
- 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.
- Government plans to establish renewable energy capacity of 500 GW by 2030.
- Solar installation in India is expected to increase 360 per cent by 2020.
- Off-grid renewable power capacity has also increased.
- In 2019, India installed 7.3 GW of solar power across the country, establishing its position as the third-largest solar market in the world.

Electricity Generation from RES* (billion units)



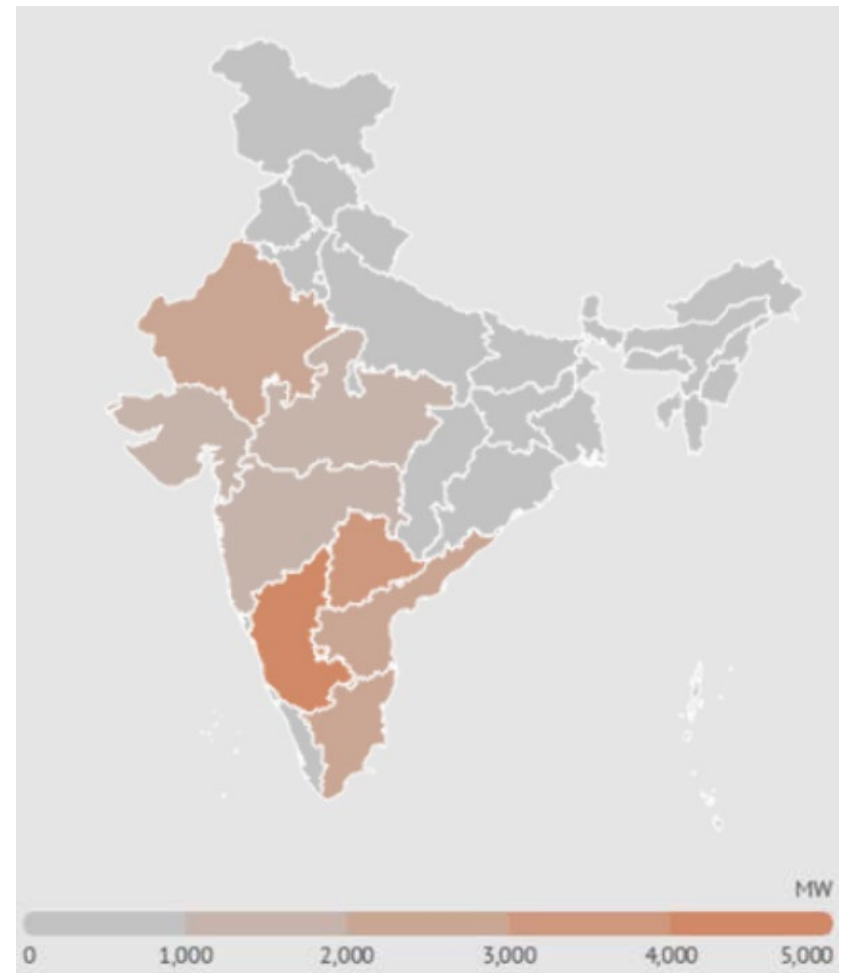
Note: RES – Renewable Energy Source, *Large Hydro power projects not included, SPV – Solar Photovoltaic System, MWeq - Megawatt Equivalent

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 (400 S to 400 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. A total of 42 solar parks were approved in India until May 2019.
- As of October 2019, India started working on its solar power plant in Rajasthan, which will be the world's largest solar plant with a capacity of 2,255 MW.
- The biggest solar project financed in India is the 709 MW NLC Tangedco PV plant – which is coming up at a cost of about US\$ 500 million.
- Over the past five years, India's installed solar generation capacity has risen over 10 times including the usage of green technologies and E-vehicles.
- The solar power sector had a cumulative installed capacity of 31,101 MW (Ground-mounted: 28,863 MW; Rooftop: 2,238 MW) during April-September 2019 .
- In November 2019, Renew Power, Avaada, UPC, Tata unit won solar projects of total 1,200 MW in an auction of the Solar Energy Corp of India.
- Adani Group aims to become the world's largest solar power company by 2025 and the biggest renewable energy firm by 2030.

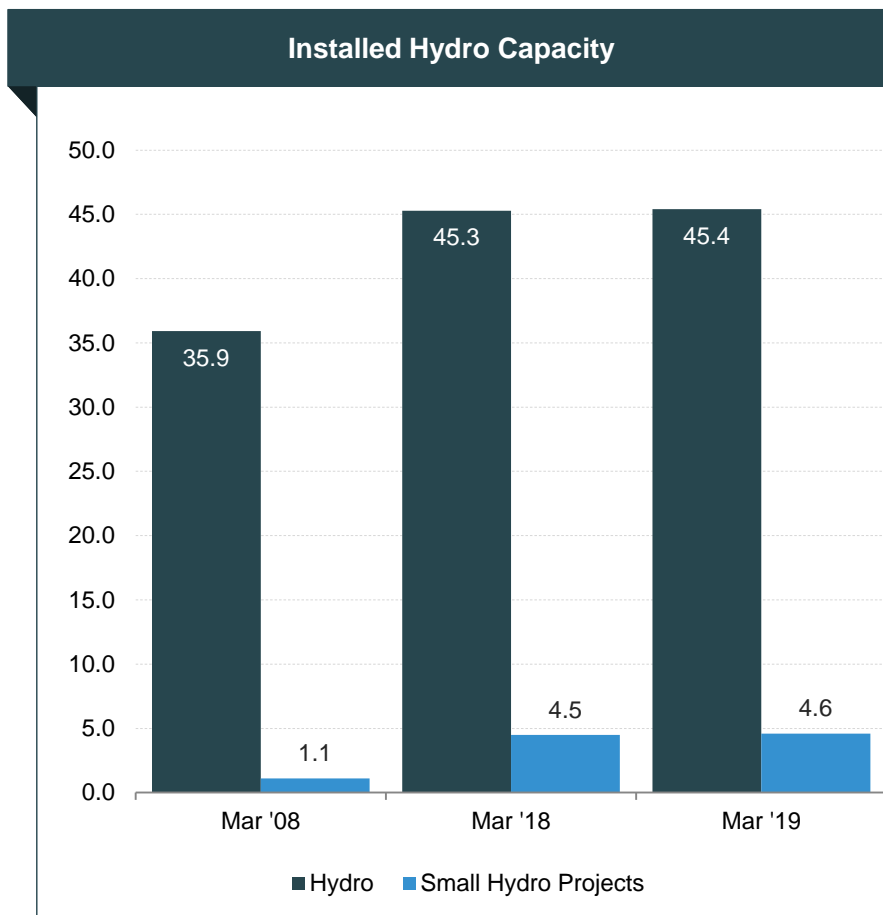
State Wise Solar Installations in India (August 2019)



Source: CEA, Make in India, India Solar Handbook 2017, MNRE, Mercom India, Bloomberg NEF

GROWTH IN HYDRO POWER

- India has the hydro power potential of around 145 GW, of which 45 GW is already been utilised.
- 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.
- In March 2019, large hydro power Projects (HPO) were declared as part of non-solar Renewable Purchase Obligation (RPO).
- Installed capacity from large hydel projects in India increased from 35.9 GW in March 2008 to 45.93 GW in March 2019, while capacity from small hydel plants increased four-fold to 4.5 GW during the same period.
- A new hydro power policy for 2018-28 has been drafted for the growth of hydro projects in the country.
- Construction of Kiru hydro project (624 MW) by Chenab Valley Power Projects Private Ltd (CVPPPL) with an investment of Rs 4,287.59 crore (US\$ 613.48 million) has been approved by the Government of India.



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, installing and maintaining all wind turbines. It has service support centres across the globe.
- Adani Power also aims to become a fully-integrated solar PV manufacturer.
- The return of fully integrated players exceed engineering, procurement and construction (EPC) contractors.

Decentralised solar power

- 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.
- Off-grid solar power is growing at a fast pace in India. In H12018, India accounted for 44 per cent of the global off-grid product sales with sale of 1.3 million products. India sold 1.18 million units in H22018. The country became the largest cash market for off-grid solar products by selling 1.2 million units 2017, valued US\$ 58 million.

PPA & lower tariffs

- With increasing competition and FDI, players in the solar sector have started bidding at lower prices as solar tariffs reached a record low of Rs 2.44 (US\$ 0.04) per unit in May 2017. Power purchase agreements with states have become an important part of the project cycle for Indian companies. Wind power tariffs reached to a record low of Rs 2.43 (US\$ 0.038) in 500 mw reverse auctions by Gujarat Urja Vikas Nigam Limited (GUVNL) in December 2017.
- The tariff for grid-connected solar power projects is decided by competitive bidding process, involving reverse E-auction.

Source: Company websites, Livemint, Mercom

GROWTH DRIVERS



RENEWABLE 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. Government plans to establish renewable energy capacity of 500 GW by 2030.
- In March 2019, the Government approved the agreement between Ministry of New and Renewable Energy (MNRE) and Denmark's Ministry for Energy, Utilities and Climate with an aim to focus on offshore wind energy and a letter of intent to establish an Indo-Danish Centre of Excellence for renewable energy in India.
- 60 solar cities will be developed in India as part of Ministry of New and Renewable Energy's Solar Cities program.
- The Government of India allocated Rs 3,004.90 crore (US\$ 416.48 million) in Union Budget 2019-20 for development of solar power projects including both grid-interactive and off-grid and decentralized categories.
- Delhi Government decided to shut down thermal power plant in Rajghat and will develop it into 5,000 KW solar park.

Investment

- The renewable energy space in India has become very attractive from investors' perspective – it received FDI inflow of US\$ 9.01 billion between April 2000 and December 2019.
- More than US\$ 42 billion has been invested in India's renewable energy sector since 2014 and requires US\$ 500-700 billion in the next few years.

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.
- In June 2019, the Government planned to launch transmission line tenders worth US\$ 5 billion in phases. The phased process would help in achieving 175 GW renewable energy capacity in India by 2022.

Source : Invest India, KPMG, MNRE, News Sources

Repowering policy	<ul style="list-style-type: none">▪ Promotes optimum utilisation of wind energy resources by creating facilitative framework for repowering.▪ Interest rate rebate of 0.25 per cent over and above the existing interest rate 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	<ul style="list-style-type: none">▪ Aims to achieve a hybrid wind-solar capacity of 10 GW by 2022.▪ Hybridisation of the two technologies will help in:<ul style="list-style-type: none">• minimising variability• optimal utilization of infrastructure including land and transmission systems
Renewable Purchase Obligations (RPO's)	<ul style="list-style-type: none">▪ 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 MW.
Scheme for development of solar parks and ultra mega solar power projects	<ul style="list-style-type: none">▪ Aims to set up 25 solar parks and ultra mega solar power projects, targeting 20,000 MW of solar power installed capacity by 2019-20.

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

**Union Budget 2020-21
Ministry for New and
Renewable Energy
allocated
Rs 5,753 crore
(US\$ 823.15 million)**

- Project for evacuation of renewable energy from generation points to the load centres by creating intra-state and inter-state transmission infrastructure.
 - 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.
 - IREDA plans to set up a Green Window with an investment of US\$ 20 million to provide boost to the renewable energy sector.

Green Energy Corridor

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.
- Inter-state distribution of wind power started in August 2018.
- As of December 2019, 15,100 MW of wind power projects were issued, out of which, projects of 12,162.50 MW capacity have been awarded.

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.

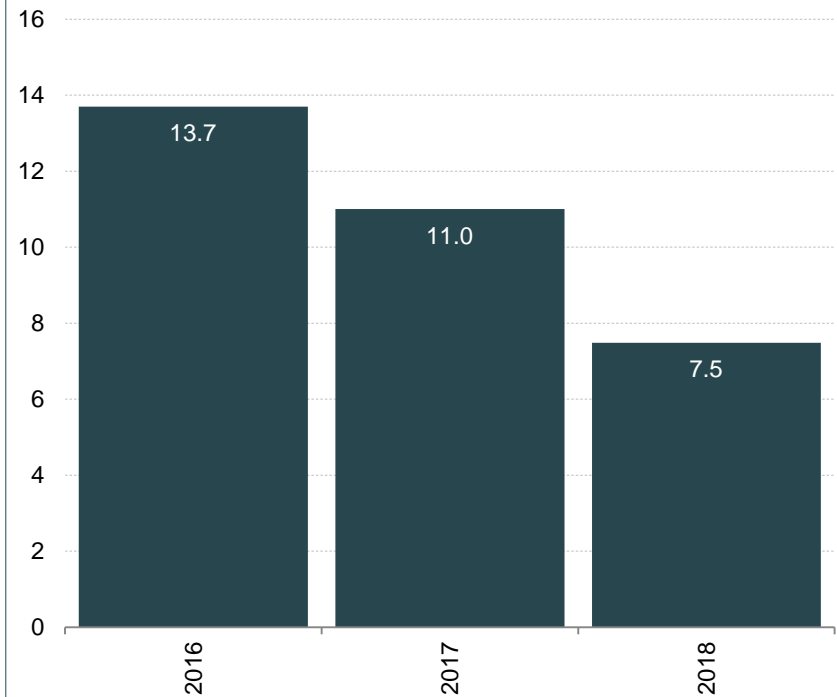
Notes : GW – Gigawatt, MW – Megawatt, PPA – Power Purchase Agreement, PSA- Power Sale Agreement

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 the provisions of The Electricity Act, 2003.
- Investment worth Rs 36,729.49 crore (US\$ 5.26 billion) was made during April-December 2019 by private companies in renewable energy.
- The non-conventional energy sector in India received a total FDI equity inflow of US\$ 7.83 billion during in FY19.
- As of March 2019, Eversource Capital, a joint venture (JV) between Everstone and Lightsource, planned to invest US\$ 1 billion in renewable energy in India through its Green Growth Equity Fund.
- In April 2019, ReNew Power announced commissioning of its 300 MW solar plant at Pavagada Solar Park in Tumkur district of Karnataka.
- ReNew Power and Shapoorji Pallonji will invest nearly Rs 750 crore (US\$ 0.11 billion) in a 150 megawatt (mw) floating solar power project in Uttar Pradesh.
- Brookfield will invest US\$ 800 million in ReNew Power.
- In April 2020, Vikram Solar bagged a 300 MW solar plant project for Rs 1,750 crore (US\$ 250.39 million) from National Thermal Power Corporation Ltd (NTPC) under CPSU-II scheme in a reverse bidding auction.

New Investments in Clean Energy in India (US\$ Billion)



Source: DPIIT, EY, Bloomberg NEF

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

Major FDI Investments in Renewable Energy Sector

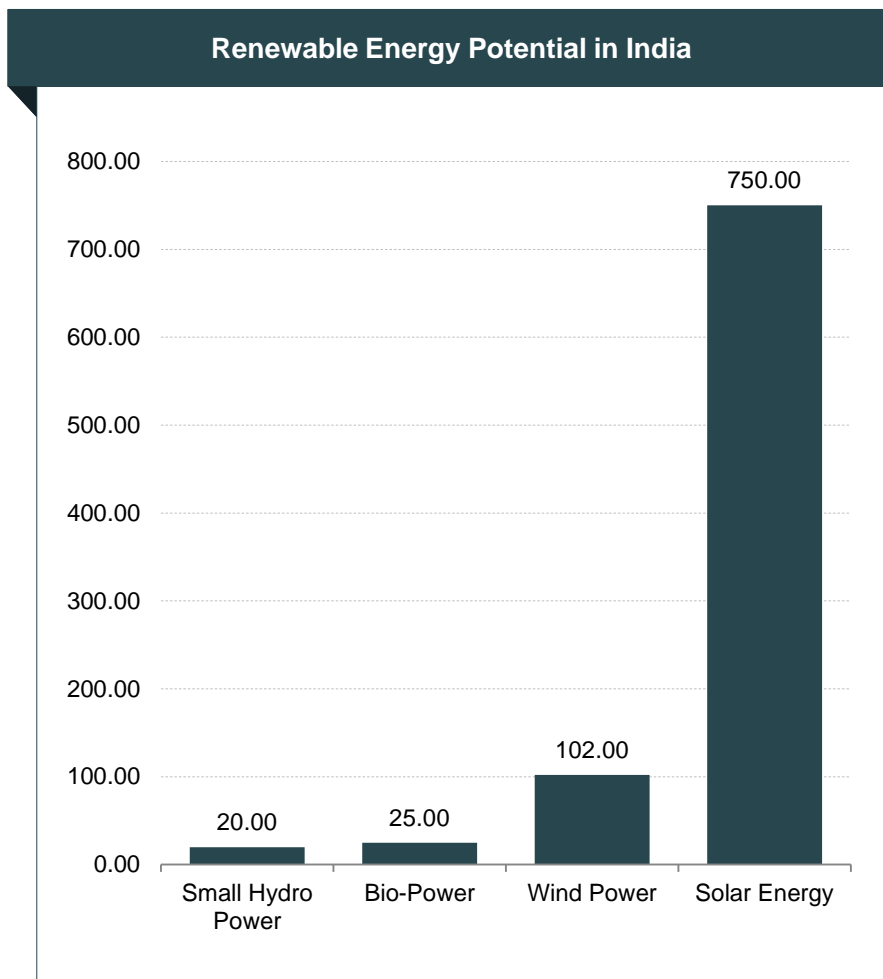
Foreign Collaborator	Country	Indian Company	FDI Equity Inflow (US\$ mn)
Asian Development Bank	India	Avaada Energy Pvt Ltd	50
Asian Development Bank	Philippines	Renew Power Ventures Pvt. Ltd.	44.69
AIRRO Singapore Pte Ltd	Singapore	Diligent Power Pvt. Ltd.	41.07
ORIX Corporation	Japan	Lalpur Wind Energy 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 900 GW from commercially exploitable sources – 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.
- Renewable energy capacity is estimated 500 GW by 2030.
- In India, there is an estimated potential of about 8,000 MW of tidal energy.

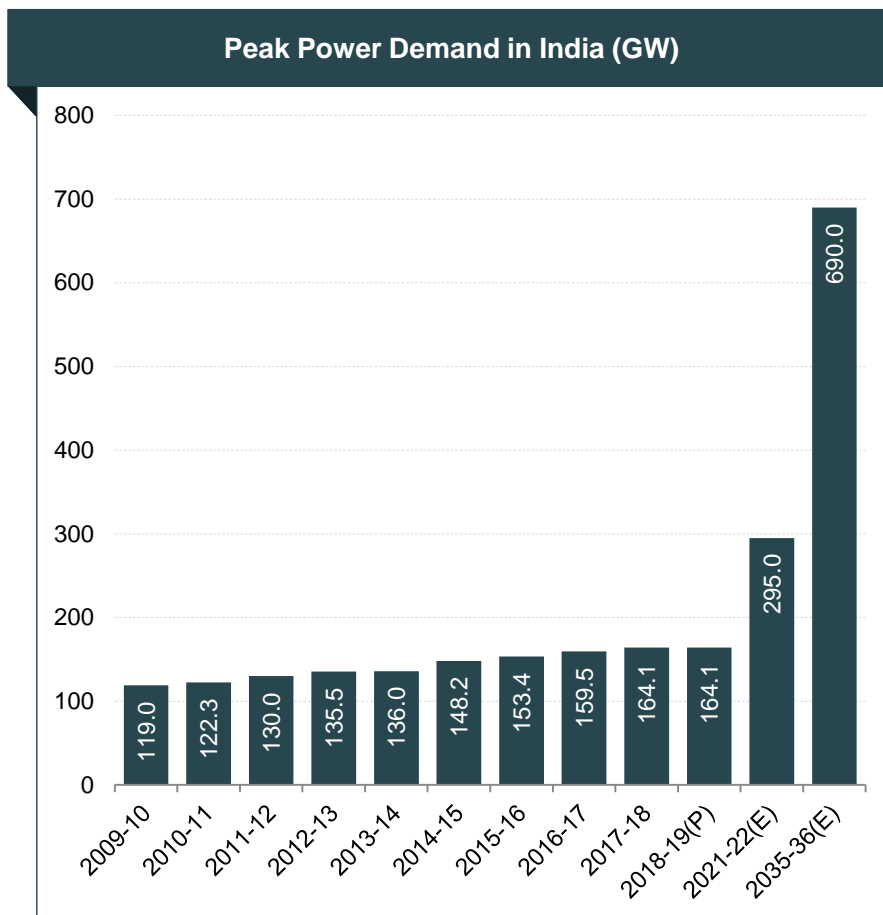


Notes: GW – Gigawatt, ¹Wind Power potential is at 80 metres above ground level

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 reached 183.80 GW until February 2020.
- It is estimated that this demand will rise to 295 GW by 2021-22 and 690 GW by 2035-36.
- 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.



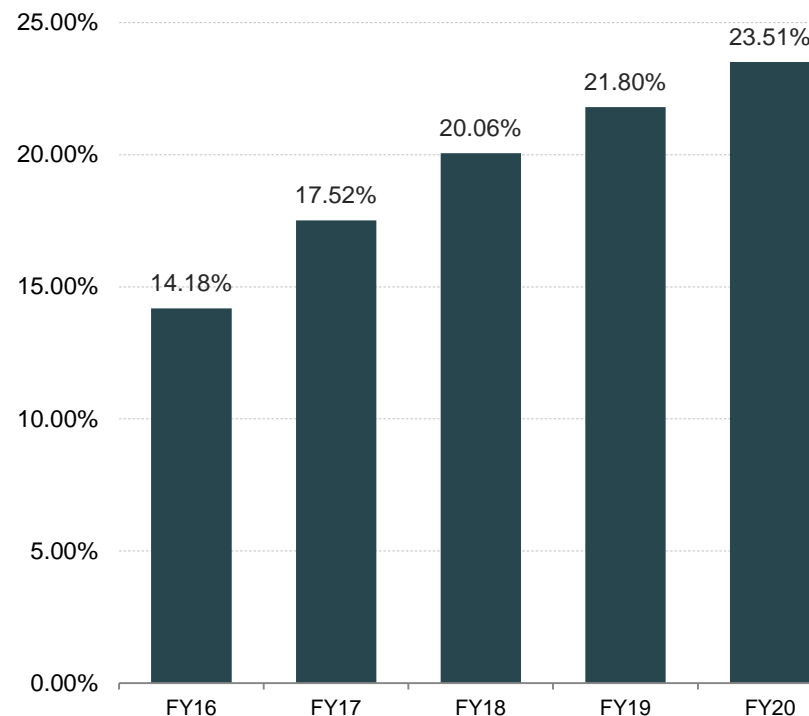
Note: GW – Gigawatt, P – Provisional, E - Estimated

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 increased to 23.51 per cent by March 2020.
- India aims to achieve a total of 175 GW of installed renewable energy capacity by 2022.
- 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.
- About 5,000 compressed bio-gas plants will be set up across India by 2023.

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



Note: ¹ - Renewable Energy Attractiveness Index by EY, *-Till February 2020

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

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
2018-19	69.89
2019-20	70.49

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
2018	68.36
2019	69.89

Source: Reserve Bank of India, Average for the year

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