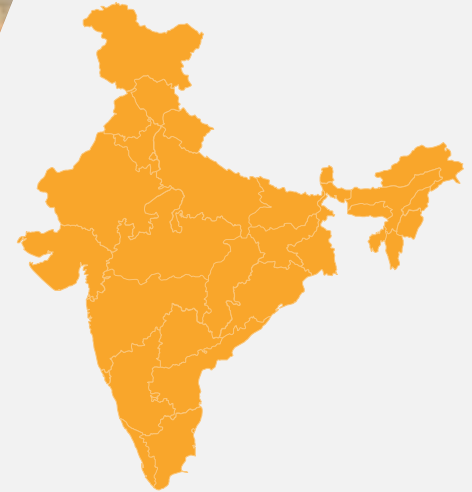




# RENEWABLE ENERGY



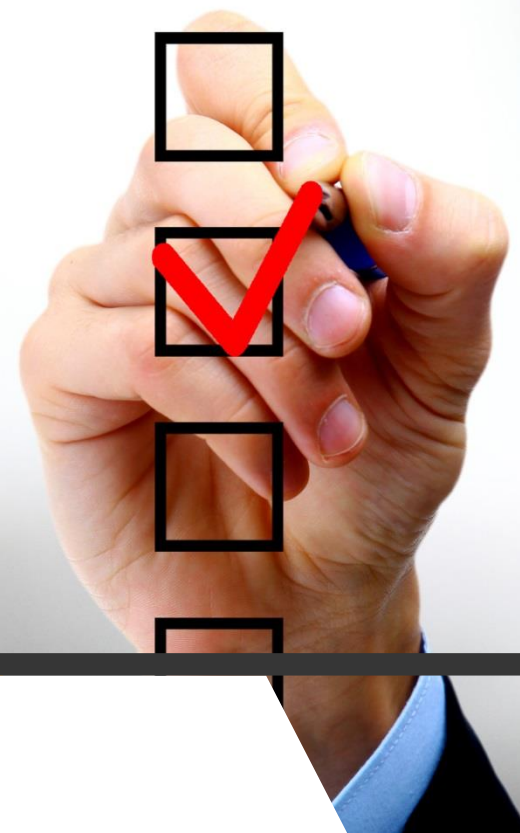
**IBEF**

INDIA BRAND EQUITY FOUNDATION

[www.ibef.org](http://www.ibef.org)

# Table of Content

- ▶ Executive Summary.....3
- ▶ Advantage India.....4
- ▶ Market Overview and Trends.....6
- ▶ Strategies Adopted.....12
- ▶ Growth Drivers .....14
- ▶ Opportunities.....20
- ▶ Industry Associations.....24
- ▶ Useful Information.....26



# EXECUTIVE SUMMARY

## 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. Overall, India is expected to add up to 8.5 GW of renewable energy capacity in 2018-19. 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 and the same level was reached in September 2018 again. The large integrated players are in a better position with higher returns compared to the smaller contractors.

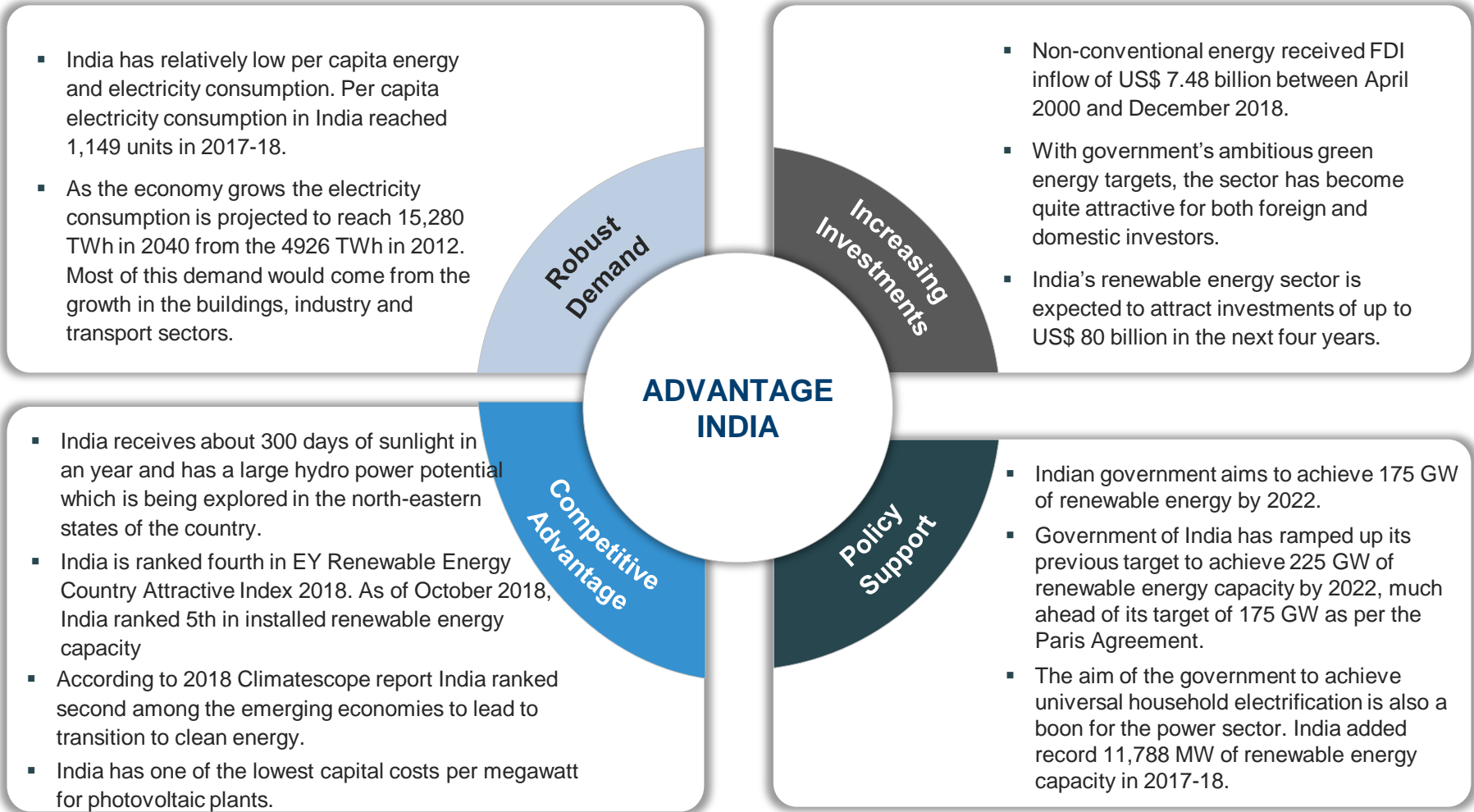
## Increasing Investments

- The renewable energy space in India has become very attractive from investors' perspective and has received FDI inflow of US\$ 7.48 billion between April 2000 and December 2018.
- More than US\$ 42 billion has been invested in India's renewable energy sector since 2014.
- India is ranked fourth in EY Renewable Energy Country Attractive Index 2018.

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

# ADVANTAGE INDIA



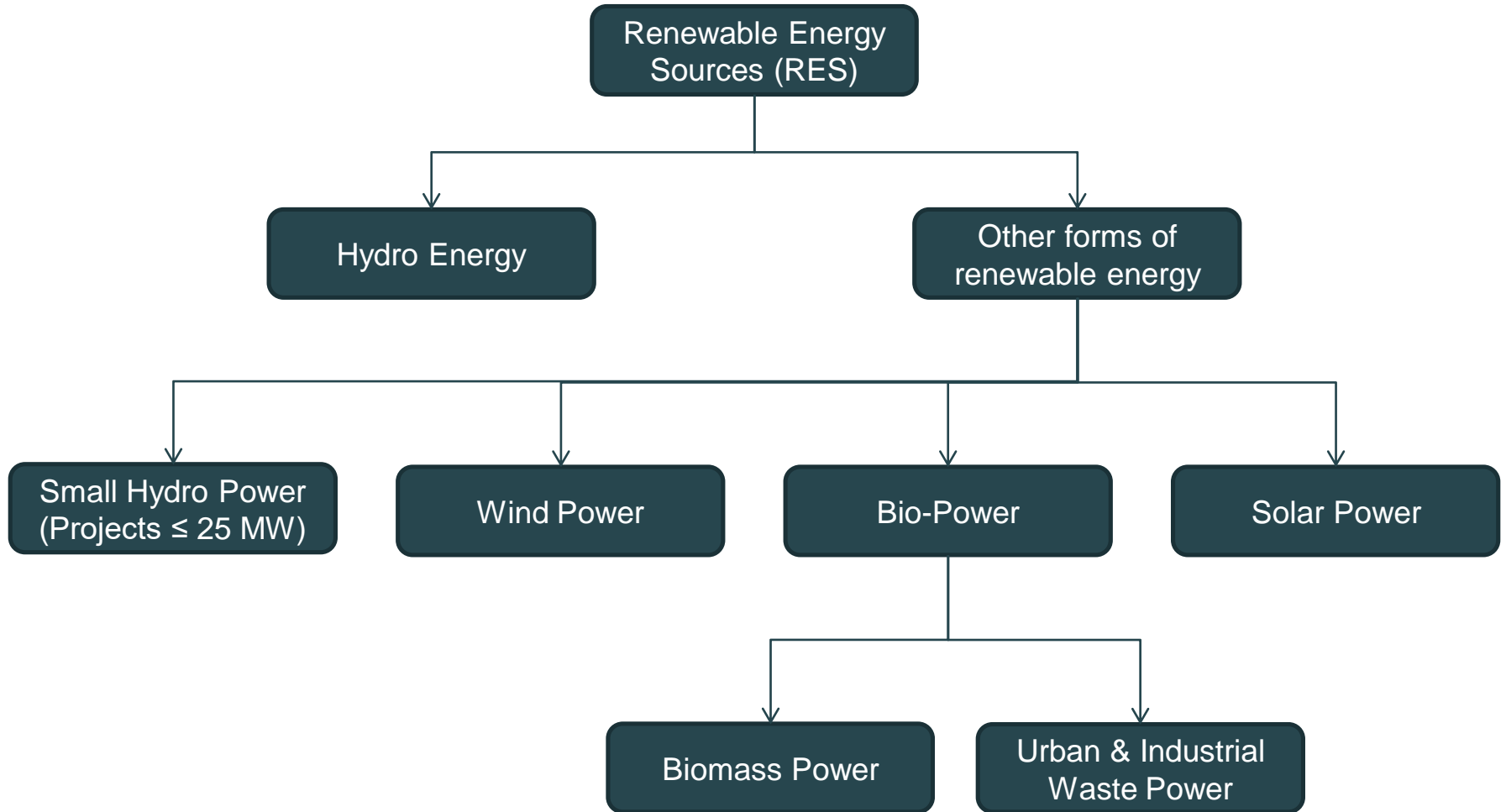


*Note: TWh – Terawatt Hour*

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

# MARKET OVERVIEW AND TRENDS

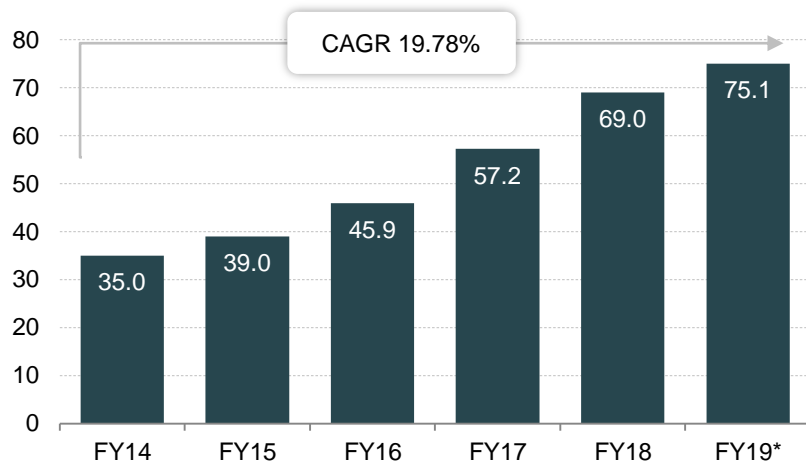




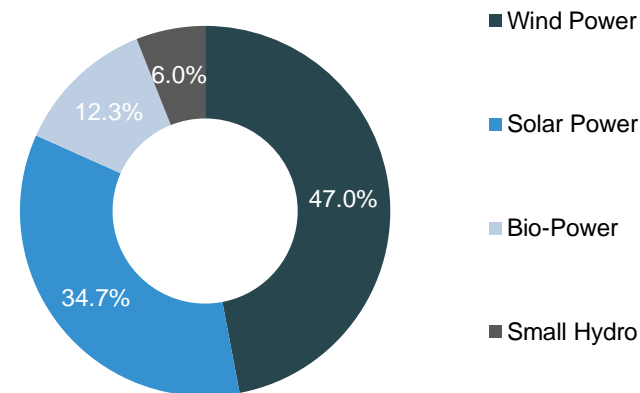
Source: Central Electricity Authority (CEA)

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

Installed Renewable Energy<sup>1</sup> Capacity (GW)



Installed Renewable<sup>1</sup> Capacity Breakup – January 2019



- India accounts for approximately 4 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 at a fast pace over the past few years, posting a CAGR of 19.78 per cent between FY14–18. India added record 11,788 MW of renewable energy capacity in FY18.
- As of February 2019, total renewable<sup>1</sup> power installed capacity (excluding large hydro) in the country stood at 75.06 GW.

**Notes:** RES – Renewable Energy Source, \*as of February 2019, GW – Gigawatt; <sup>1</sup>Large Hydro power projects not included as they are not included in renewable energy targets of GOI

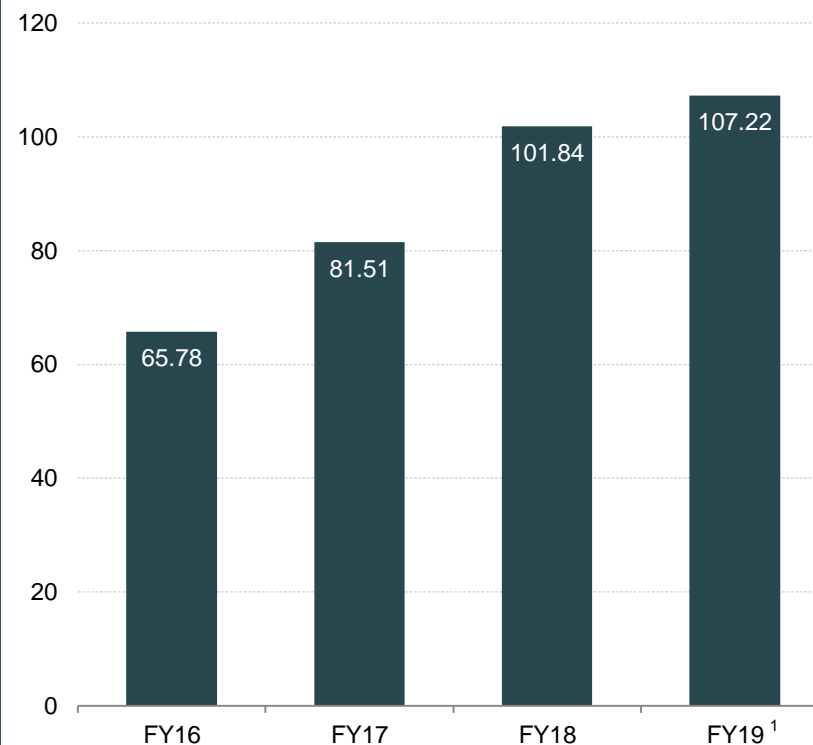
**Source:** Central Electricity Authority (CEA), International Renewable Energy Agency (IRENA), MNRE



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

- Power generation from renewable energy sources (excluding large hydro) in India reached record 101.84 billion units in FY18 and has reached 107.22 billion units between April 2018-January 2019.
- The country ranks fourth in the world in terms of total installed wind power capacity. In 2018 (up to September), India added the second highest solar capacity in the world, after China.
- 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.
- Off-grid renewable power capacity has also increased. As of October 2018, generation capacities for Waste to Energy, Biomass Gasifiers, SPV systems stood at 175.28 MWeq, 163.37 MWeq and 767.51 MWeq, respectively.
- The total solar energy production was 30.98 billion units between April 2018-January 2019.

Electricity Generation from RES\* (billion units)



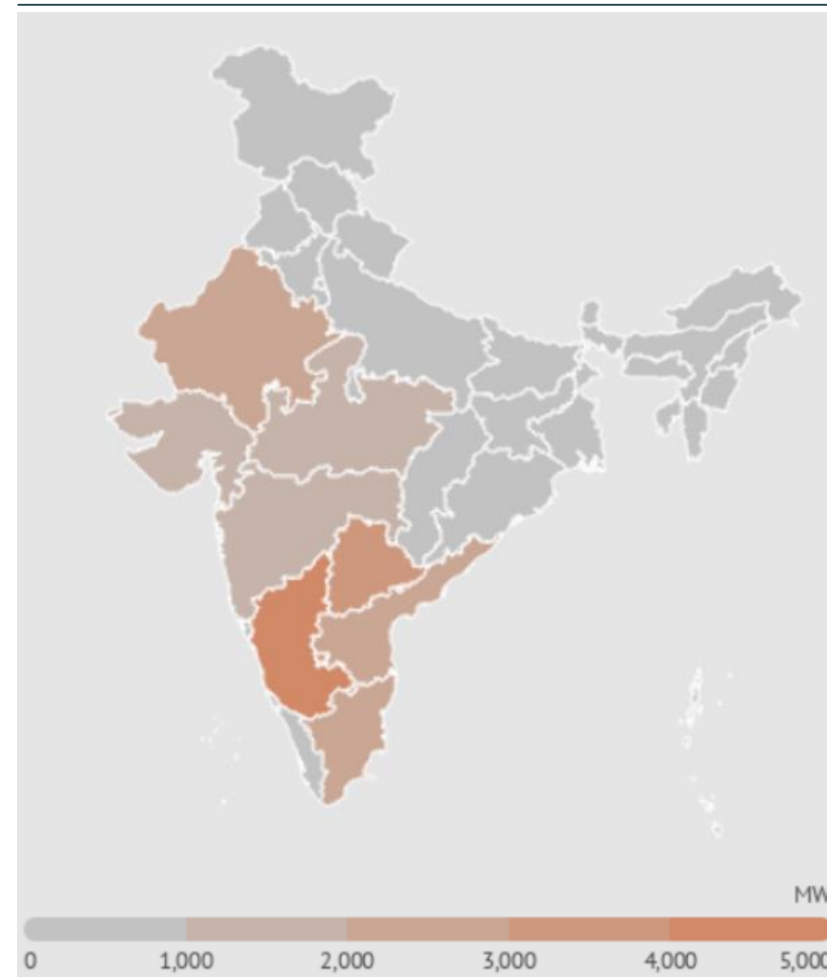
**Note:** RES – Renewable Energy Source, \*Large Hydro power projects not included, <sup>1</sup> up to February 2019, SPV – Solar Photovoltaic System, MWeq – Megawatt Equivalent

**Source:** CEA, Make in India, MNRE, Mercom India, India Economic Survey 2017-18

# 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. In the first half of 2018, India installed 1 MW of solar capacity every hour. As of January 2019, installed solar power capacity in the country was 26.03 GW and ranked 5th in the world in terms of installed solar capacity.
- Rapidly falling costs have made Solar PV the largest market for new investment.
- A total of 47 solar parks with generation capacity of 26,694 MW have been approved in India up to November 2018, out of capacity of 4,195 MW has been commissioned.
- Solar sector in India received investments of over US\$10 billion in CY2017.
- The biggest solar projects financed in India is 709MW NLC Tangedco PV plant at a cost of about \$500 million. India is one of the countries with the lowest capital costs per megawatt for photovoltaic plants.
- 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.

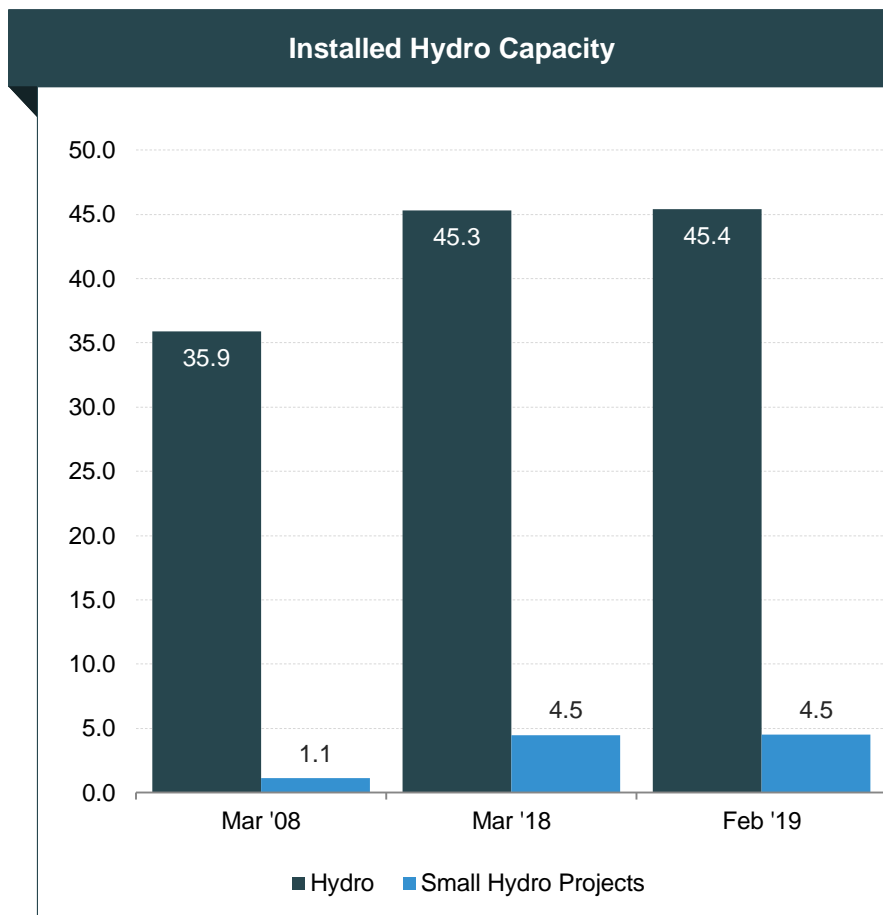
## State Wise Solar Installations in India (August 2018)



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

# 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 45.40 GW in February 2019 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.
- Off-Grid solar power is growing at a fast pace in India. In the first half of 2018, India accounted for 44 per cent of global off-grid product sales, with sales of 1.3 million products.

## 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, 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.
- 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.
- As on December 2018, Bids of 500 MW each of wind power projects have been finalised by the states of Tamil Nadu, Gujarat and Maharashtra.
- 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 the interim budget 2019-20 for development of solar power projects including both grid-interactive and off-grid and decentralized categories.

## Investments

- The renewable energy space in India has become very attractive from investors' perspective and has received FDI inflow of US\$ 7.48 billion between April 2000 and December 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, News Sources

<p>Indian Ocean Rim Association (IORA)</p>	<ul style="list-style-type: none"> <li>▪ In October 2018, 21 countries adopted the Delhi Declaration on Renewable Energy in the Indian Ocean Region for a common renewable energy agenda, increased collaboration and promotion of regional capacity building.</li> </ul>
<p>Repowering Policy</p>	<ul style="list-style-type: none"> <li>▪ Promotes optimum utilisation of wind energy resources by creating facilitative framework for repowering.</li> <li>▪ An interest rebate of 0.25 per cent over the interest rebate offered to new wind energy projects will be provided.</li> <li>▪ All fiscal and financial benefits offered to new wind power projects will be extended to repowering projects</li> </ul>
<p>Wind-Solar Hybrid Policy</p>	<ul style="list-style-type: none"> <li>▪ Aims to achieve a hybrid wind-solar capacity of 10GW by 2022.</li> <li>▪ Hybridisation of the two technologies will help in:             <ul style="list-style-type: none"> <li>• Minimising Variability</li> <li>• Optimal utilization of infrastructure including land and transmission systems</li> </ul> </li> </ul>
<p>Renewable Purchase Obligations (RPO's)</p>	<ul style="list-style-type: none"> <li>▪ RPO's are a mechanism by which State Electricity commissions are obliged to purchase certain percentage of power from renewable energy sources.</li> <li>▪ 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.</li> </ul>
<p>Scheme for Development of Solar Parks and Ultra Mega Solar Power Projects</p>	<ul style="list-style-type: none"> <li>▪ Aims to set up 25 Solar Parks and Ultra Mega Solar Power Projects targeting 20,000MW of solar power installed capacity by 2019-20.</li> </ul>

**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.

- 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.
- As of January 2019, Gujarat expects an investment of Rs 2.2 trillion (US\$ 30.49 billion) in renewable energy sector in the next ten years, says State Energy Minister, Saurabh Patel.

## Green Energy Corridor

**Budget 2019-20  
Ministry for New and  
Renewable Energy  
Allocation is  
Rs 5,254.83 crore  
(US\$ 728.32 million)**

## 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.
- As of December 2018, Government of India has installed 35 GW of wind power capacity against the target of 60 GW by 2022.
- 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.

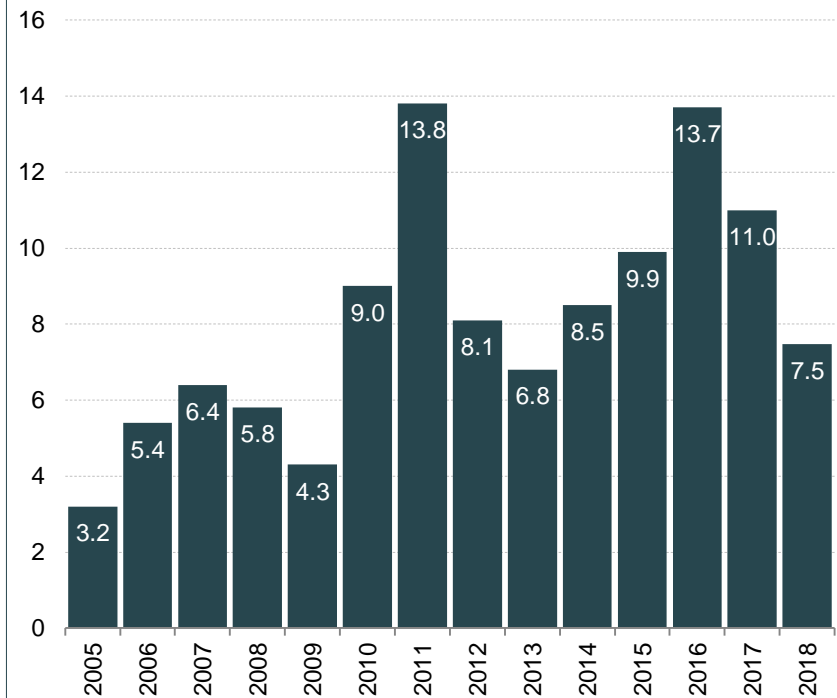
*Notes : GW – Gigawatt, MW – Megawatt, PPA – Power Purchase Agreement, PSA- Power Sale Agreement*

*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\$ 11.1 billion in 2018.
- The non-conventional energy sector has received a total FDI equity inflow of US\$ 7.48 billion during April 2000 to December 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.
- Avaada Energy Pvt Ltd has signed an agreement with the Asian Development Bank under which it will receive an investment worth US\$ 50 million. This investment will help the company to scale up its business.
- As of March 2019, Eversource Capital, a Joint venture of Everstone and Lightsource plans to invest US\$ 1 billion in renewable energy in India through its Green Growth Equity Fund.

## New Investments in Clean Energy in India



Source: DPIIT, EY, Bloomberg NEF

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

## Major FDI Investments in Renewable Energy Sector

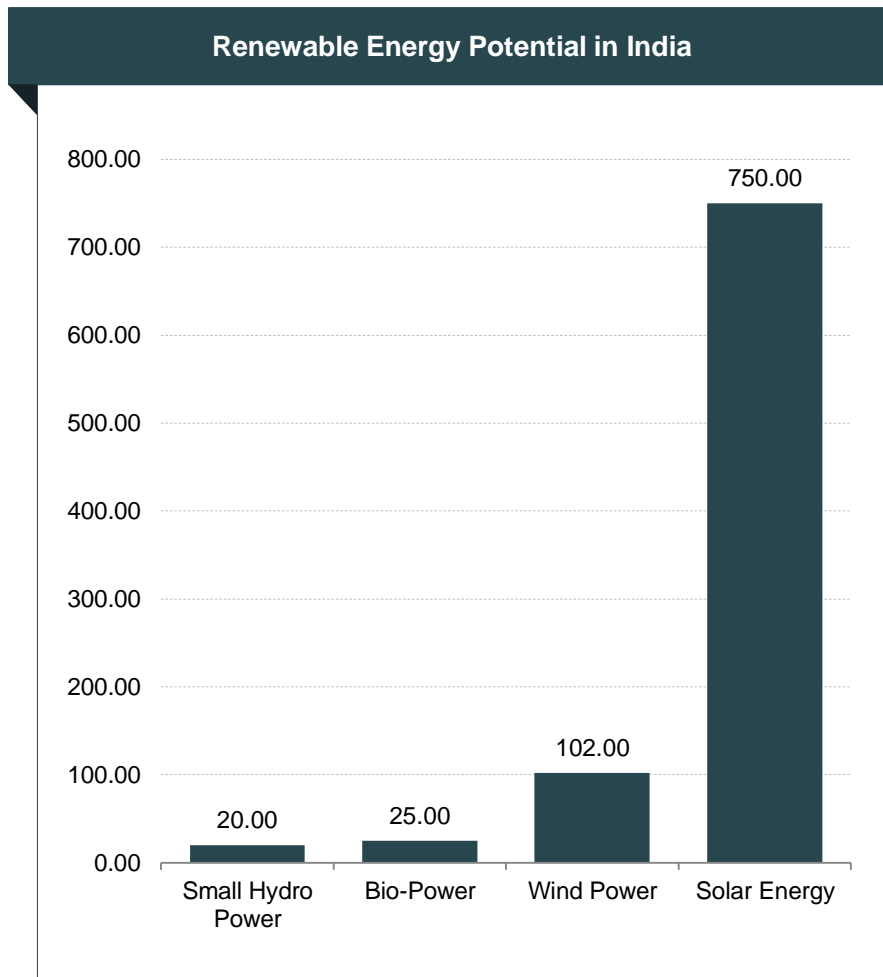
Foreign Collaborator	Country	Indian Company	FDI Equity Inflow (US\$ mn)
Asian Development Bank	India	Avaada Energy Pvt Ltd	50
Asian Development Bank	Philippines	Renew Power Ventures Pvt. Ltd.	44.69
AIRRO Singapore Pte Ltd	Singapore	Diligent Power Pvt. Ltd.	41.07
ORIX Corporation	Japan	Lalpur Wind Energy 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 900GW from commercially exploitable sources viz. Solar energy- 750 GW, Wind power<sup>1</sup> - 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.

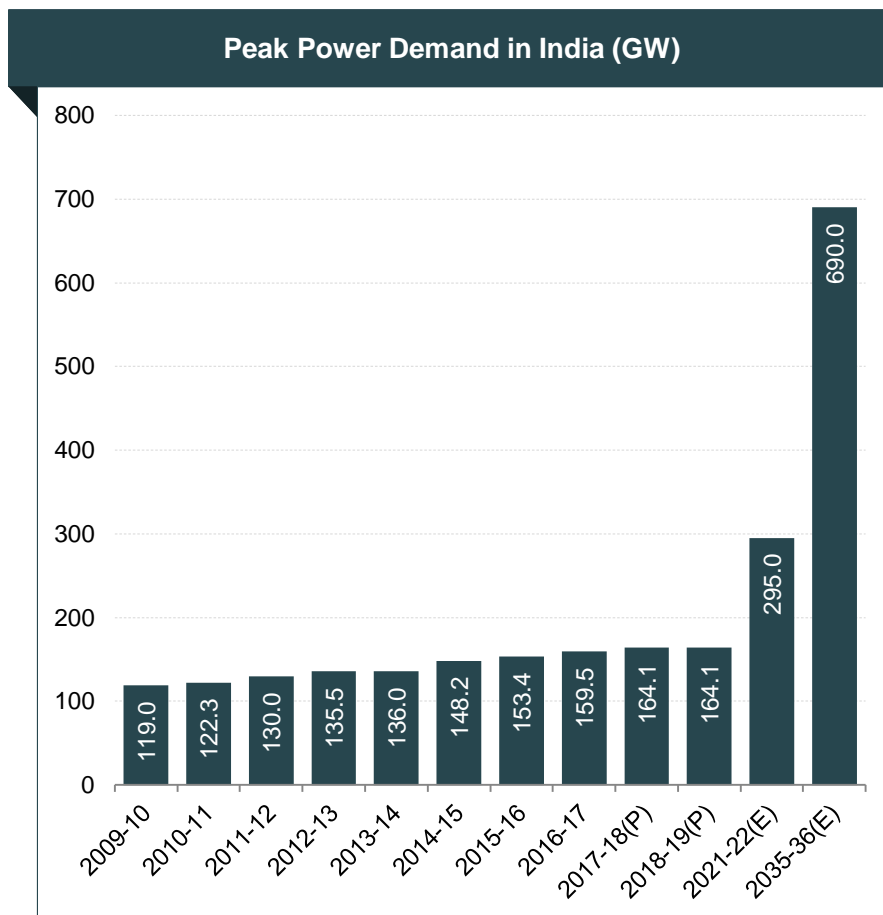


**Notes:** GW – Gigawatt, <sup>1</sup>Wind Power potential is at 80 metres above ground level

**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 February 2019, peak demand was 162.24 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.



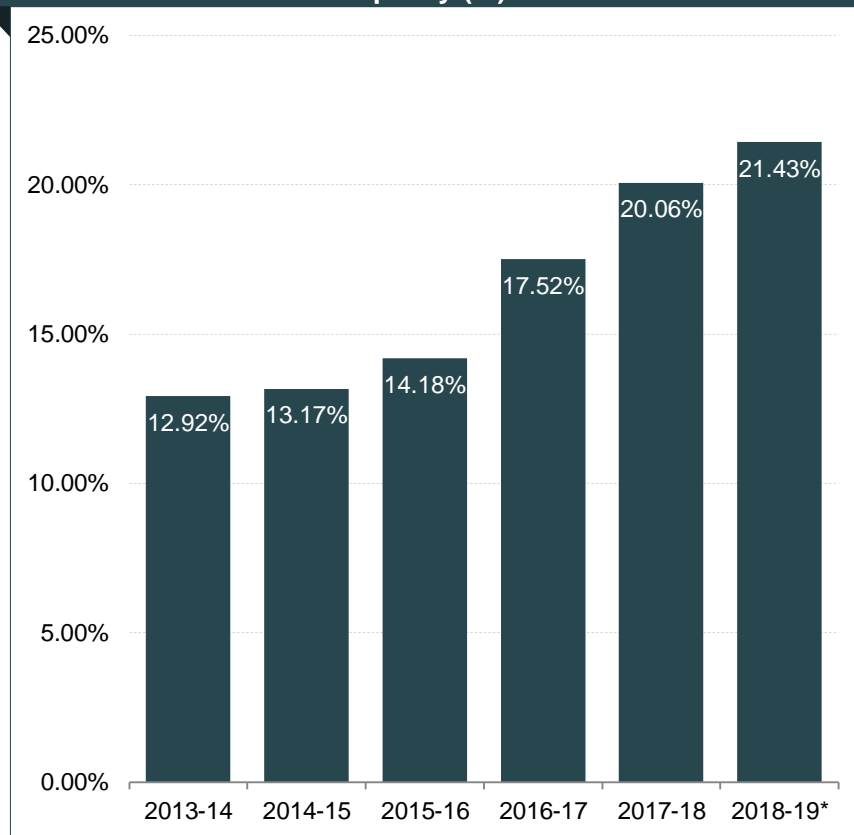
*Note: GW – Gigawatt, P – Provisional, E - Estimated*

*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 21.43 per cent by February 2019.
- 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.
- 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: <sup>1</sup> - Renewable Energy Attractiveness Index by EY, \*as of February 2019*

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

# INDUSTRY ASSOCIATIONS





# KEY 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](mailto: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](mailto:cvjvarma@gmail.com) , [cvjv1933@yahoo.com](mailto:cvjv1933@yahoo.com)  
Web site: <http://seci.gov.in>

# USEFUL INFORMATION



# GLOSSARY

- 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
Q2 2018-19	70.18
Q3 2018-19	72.15

## 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

Source: Reserve Bank of India, FBIL, Average for the year

# DISCLAIMER

India Brand Equity Foundation (IBEF) engaged Aranca to prepare this presentation and the same has been prepared by Aranca in consultation with IBEF.

All rights reserved. All copyright in this presentation and related works is solely and exclusively owned by IBEF. The same may not be reproduced, wholly or in part in any material form (including photocopying or storing it in any medium by electronic means and whether or not transiently or incidentally to some other use of this presentation), modified or in any manner communicated to any third party except with the written approval of IBEF.

This presentation is for information purposes only. While due care has been taken during the compilation of this presentation to ensure that the information is accurate to the best of Aranca and IBEF's knowledge and belief, the content is not to be construed in any manner whatsoever as a substitute for professional advice.

Aranca and IBEF neither recommend nor endorse any specific products or services that may have been mentioned in this presentation and nor do they assume any liability or responsibility for the outcome of decisions taken as a result of any reliance placed on this presentation.

Neither Aranca nor IBEF shall be liable for any direct or indirect damages that may arise due to any act or omission on the part of the user due to any reliance placed or guidance taken from any portion of this presentation.