RENEWABLE ENERGY
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
<td>3</td>
</tr>
<tr>
<td>Advantage India</td>
<td>4</td>
</tr>
<tr>
<td>Market Overview and Trends</td>
<td>6</td>
</tr>
<tr>
<td>Strategies Adopted</td>
<td>12</td>
</tr>
<tr>
<td>Growth Drivers</td>
<td>14</td>
</tr>
<tr>
<td>Opportunities</td>
<td>20</td>
</tr>
<tr>
<td>Industry Associations</td>
<td>24</td>
</tr>
<tr>
<td>Useful Information</td>
<td>26</td>
</tr>
</tbody>
</table>
## 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 plans to establish renewable energy capacity of 500 GW by 2030.
- 60 solar cities will be developed in India as part of Ministry of New and Renewable Energy’s Solar Cities program.
- The renewable energy will account 55 per cent of the total installed power capacity by 2030.

### 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 has 86.32 GW of renewable energy capacity as on January 2020 which includes 34.03 GW from Solar & 37.60 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 a desert on its western border such as Gujarat and Rajasthan.

### 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. India’s wind power tariff also fell to a record low of Rs 2.64 (US$ 0.04) per unit.

### Increasing Investments
- The renewable energy space in India has become very attractive from investors’ perspective and has 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.

*Source: EY Recai (November 2018), Central Electricity Authority, MNRE, DPIIT, Livemint, IWTMA*
India has relatively low per capita energy and electricity consumption. Per capita electricity consumption in India reached 1,181 units in 2018-19.

As the economy grows the electricity consumption is projected to reach 15,280 TWh in 2040 from the 4926 TWh in 2012. Most of this demand would come from the growth in the buildings, industry and transport sectors.

Non-conventional energy received FDI inflow of US$ 9.1 billion between April 2000 and December 2019.

With government’s ambitious green energy targets, the sector has become quite attractive for both foreign and domestic investors.

By 2028, India can see renewable energy investments worth US$ 500 billion.

India is ranked fourth in wind power, fifth in solar power and fifth in renewable power installed capacity as of 2018.


According to 2018 Climatescope report India ranked second among the emerging economies to lead to transition to clean energy.

India has one of the lowest capital costs per megawatt for photovoltaic plants.

Indian government aims to achieve 175 GW of renewable energy by 2022.

The aim of the government to achieve universal household electrification is also a boon for the power sector. India added record 10.3 GW of renewable generation capacity in FY19

Government plans to establish renewable energy capacity of 500 GW by 2030.

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Note: TWh – Terawatt Hour

Source: Central Electricity Authority, Ministry of New and Renewable Energy, Mercom India, EY, News sources, BloombergNEF
MARKET OVERVIEW AND TRENDS
Renewable Energy Sources

Renewable Energy Sources (RES)

Hydro Energy
  - Small Hydro Power (Projects ≤ 25 MW)

Other forms of renewable energy
  - Wind Power
  - Bio-Power
    - Biomass Power
  - Solar Power
    - Urban & Industrial Waste Power

Source: Central Electricity Authority (CEA)
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 17.28 per cent between FY14–19. India added record 11,788 MW of renewable energy capacity in FY18 and 8.6 GW in FY19.

The renewable energy sector’s capacity during the first quarter of fiscal year 2019-20 is higher at 2,151 MW.

As on January 31, 2020, the installed renewable energy capacity is 86.32 GW, of which solar and wind comprises 34.03 GW and 37.60 GW respectively. Biomass and small hydro power constitute 9.86 GW and 4.67 GW, respectively.

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

**Source:** Central Electricity Authority (CEA), International Renewable Energy Agency (IRENA), MNRE
- Power generation from renewable energy sources (excluding large hydro) in India reached record 101.84 billion units in FY18 and has reached 126.76 billion units in FY19.
- 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.
- 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.
- As of December 2019, the electricity generation from wind, solar, biomass stood at 54.39 BU, 34.79 BU and 2.07 BU, respectively.
- Off-grid renewable power capacity has also increased.
- The total solar installations as on January 2020 reached 34.03 GW.

**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, 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. A total of 42 solar parks have been approved in India up to May 2019.

- As of October 2019, India is getting its solar power plant in Rajasthan, which will be world’s largest solar plant, with a capacity of 2,255 MW.

- During January – March 2019, solar sector received an investment of US$ 2.8 billion.

- 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.

- The solar power sector had a cumulative installed capacity of 31,101 MW (Ground-mounted: 28,863 MW; Rooftop: 2,238 MW) during the April-September 2019.

- In November 2019, Renew Power, Avaada, UPC, Tata unit won solar projects in 1,200 MW auction of the Solar Energy Corp of India.

- Adani Group aims to become the world’s largest solar power company by 2025 and biggest renewable energy firm by 2030.

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 of which 45 GW is been utilised so far.

- 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 Hydropower 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 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.

- 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) approved by the government of India.

Source: CEA, Ministry of Power
STRATEGIES ADOPTED
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**
  - 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 and 1.18 million units in second half of 2018. India became the largest cash market for off-grid solar products, with 1.2 million units sold in 2017 with a value of $58 million.

- **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.
  - The tariff for grid-connected solar power projects is decided by competitive bidding process involving reverse e-auction.

*Source: Company websites, Livemint, Mercom*
## 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 the 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 develop it into 5,000 KW solar park.
- Rajasthan government in Budget 2019-20 exempted solar energy from electricity duty and focuses on the utilization of solar power in its agriculture and public health sectors.

### Investments
- The renewable energy space in India has become very attractive from investors’ perspective and has received FDI inflow of US$ 8.06 billion between April 2000 and September 2019.
- More than US$ 42 billion has been invested in India’s renewable energy sector since 2014 and require US$ 500-700 billion.

### 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 of India will launch transmission line tenders worth US$ 5 billion. This phased process would help in achieving 175 gigawatts (GW) renewable energy capacity in India by 2022.

*Source: Invest India, KPMG, MNRE, News Sources*
**GOVERNMENT POLICIES**

<table>
<thead>
<tr>
<th>Program</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indian Ocean Rim Association (IORA)</strong></td>
<td>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.</td>
</tr>
</tbody>
</table>
| **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.  
Hybridisation of the two technologies will help in:  
• Minimising 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. |

*Note: GW - Gigawatt  
Source: Ministry of New and Renewable Energy (MNRE), News Articles*
GOVERNMENT INITIATIVES

- 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.
- 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.
- 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.
  - The total installed capacity of wind power stood at 37.60 GW till January 2020.
  - Inter-state distribution of wind power was started in August 2018.
  - As of December 2019, 15,100 MW of wind power projects have been issued, out of which projects of 12,162.50 MW capacity have been awarded.
- 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.

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

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.
- Around Rs 36,729.49 crore (US$ 5.26 billion) investment has been 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 of Everstone and Lightsource plans 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 to invest US$ 800 million in ReNew Power

Source: DPIIT, EY, Bloomberg NEF
### Major FDI Investments in Renewable Energy Sector

<table>
<thead>
<tr>
<th>Foreign Collaborator</th>
<th>Country</th>
<th>Indian Company</th>
<th>FDI Equity Inflow (US$ mn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asian Development Bank</td>
<td>India</td>
<td>Avaada Energy Pvt Ltd</td>
<td>50</td>
</tr>
<tr>
<td>Asian Development Bank</td>
<td>Philippines</td>
<td>Renew Power Ventures Pvt. Ltd.</td>
<td>44.69</td>
</tr>
<tr>
<td>AIRRO Singapore Pte Ltd</td>
<td>Singapore</td>
<td>Diligent Power Pvt. Ltd.</td>
<td>41.07</td>
</tr>
<tr>
<td>ORIX Corporation</td>
<td>Japan</td>
<td>Lalpur Wind Energy Pvt. Ltd.</td>
<td>37.75</td>
</tr>
<tr>
<td>ENEL Green Power Development B.V.</td>
<td>Netherlands</td>
<td>BLP Energy Pvt. Ltd.</td>
<td>32.61</td>
</tr>
<tr>
<td>DEG-DEUTSCHE-InvestitionsUnd-Entwicklun</td>
<td>Germany</td>
<td>WELSPUN Renewables Energy Pvt Ltd</td>
<td>32.50</td>
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<tr>
<td>ENERK International Holdings Ltd</td>
<td>Seychelles</td>
<td>RKM POWERGEN Pvt Ltd</td>
<td>32.50</td>
</tr>
<tr>
<td>OSTRO Renewal Power Limited</td>
<td>Mauritius</td>
<td>OSTRO Energy Pvt Ltd</td>
<td>32.21</td>
</tr>
<tr>
<td>AREVA Solar Inc</td>
<td>U.S.A</td>
<td>AREVA Solar India Pvt Ltd</td>
<td>31.53</td>
</tr>
</tbody>
</table>
OPPORTUNITIES
India is estimated to have renewable energy potential of 900GW from commercially exploitable sources viz. Solar energy- 750 GW, Wind power\(^1\) - 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 500GW by 2030.

In India, there is an estimated potential of about 8,000 MW of tidal energy.

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**Notes:** GW – Gigawatt, \(^1\)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
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 till December 2019.

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.
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 21.80 per cent by March 2019.
- 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.

Note: 1 - Renewable Energy Attractiveness Index by EY, *-Till January 2020
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/](https://nise.res.in/)

## National Institute of Wind Energy (NIWE)

Address: Velachery - Tamaram Main Road, Pallikaranai, Chennai - 600 100
Tel: 91 44 2246 3982/ 83 / 84
Fax: 91 44 2246 3980
Website: [http://niwe.res.in/](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/](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

## 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, cvj1933@yahoo.com
Web site: [http://seci.gov.in](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)

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<td>2018–19</td>
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### Exchange Rates (Calendar Year)

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<thead>
<tr>
<th>Year</th>
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<td>2005</td>
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<td>2018</td>
<td>69.89</td>
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<tr>
<td>2019</td>
<td>68.36</td>
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*Source: Reserve Bank of India, Average for the year*
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