EXECUTIVE SUMMARY

Third largest producer and fourth largest consumer globally

- India is the third largest producer and fourth largest consumer of electricity in the world, with the installed power capacity reaching 334.1 GW as of February 2018. The country also has the fifth largest installed capacity in the world.

Large-scale government initiated expansion plans

- The government targets capacity addition of around 100 GW under the 13th Five-Year Plan (2017–22)
- In June 2017, the government announced intentions to set up an asset reconstruction company for handling the stressed assets in power sector. This would also help in the transfer of stressed power generation assets of stalled power projects, which would then be auctioned.

Robust growth in renewables

- Wind energy is estimated to contribute 60 GW, followed by solar power at 100 GW by 2022.
- The target for renewable energy has been increased to 175 GW by 2022.

Favourable policy environment

- 100 per cent FDI is allowed under the automatic route in the power segment and renewable energy.

Notes: TWh - Terawatt Hours, GW – Gigawatt,
Source: Make in India website, Ministry of New and Renewable Energy, IEA, CEA (Central Electricity Authority), Aranca Research, Assorted articles
ADVANTAGE INDIA
ADVANTAGE INDIA

- Expansion in industrial activity to boost demand for electricity
- Growing population and increasing penetration and per-capita usage to provide further impetus
- Power consumption is estimated to increase from 1160.1 TWh in 2016 to 1,894.7 TWh in 2022

- Ambitious projects and increasing investments across the value chain
- Diversification into renewable sources increasing growth avenues

- Total FDI inflows in the power sector reached US$ 12.97 billion during April 2000 to December 2017, accounting for 3.52 per cent of total FDI inflows in India
- Investment for 7 new transmission systems that includes strengthening of national grid have been sanctioned

- 100 per cent FDI allowed in the power sector has boosted FDI inflows in this sector
- Schemes like Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY) and Integrated Power Development Scheme (IPDS) have already been implemented for rural and urban areas respectively

Notes: FY - Indian Financial Year (April – March), FDI - Foreign Direct Investment, E - Estimates, TWh - Terawatt-Hour, FY22 estimates as per IEA forecasts FY171 - Data for April 2016 – August 2016
Source: CEA, DIPP (Department of Industrial Policy and Promotion), Aranca Research
MARKET OVERVIEW
EVOLUTION OF THE INDIAN POWER SECTOR

- Electricity (Supply) Act 1948
- Establishment of semi-autonomous State Electricity Boards (SEBs)

- Legislative and policy initiatives (1991)
- Private sector participation in generation
- Fast-track clearing mechanism of private investment proposals
- Electricity Regulatory Commissions Act (1998) for establishing Central and State Electricity Regulatory Commissions and rationalisation of tariffs

Before 1956 Introductory Stage

- Industrial Policy Resolution (1956)
- Generation and distribution of power under state ownership
- Power losses, subsidies, infrastructure bottlenecks and resource constraints

1956–1991 Nationalisation Stage

- Electricity Act (2003)
- National Tariff Policy (2006)
- New renewable energy policy have been announced
- Amendments made in Electricity Act so as to create competition
- Implementation of Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY) and Integrated Power Development Scheme for rural and urban areas respectively
- Implementation of Ujwal DISCOM Assurance Yojana (UDAY) which would enable electrification to all villages and tracking it using the Grameen Vidyutikaran App
- Amendment in National Tariff Policy (2016) has been made, wherein government is focusing more on sustainable utilisation of renewable energy resources

Source: MNRE, Corporate Catalyst India, IFLR, Aranca Research
INDIA AMONG TOP FOUR POWER PRODUCERS AND CONSUMERS

- With a production of 1,423 TWh, India is the third largest producer and the third largest consumer of electricity in the world.
- Although power generation has grown more than 100-fold since independence, growth in demand has been even higher due to accelerating economic activity.
- India to become the world's first country to use LEDs for all lighting needs by 2019, thereby saving Rs 40,000 crore (US$ 6.23 billion) on an annual basis.
- India’s energy firms have made significant progress in the global energy sector, according to the latest S&P Global Platts Top 250 Global Energy Rankings, with 10 out of 14 Indian energy companies making it to the list and RIL and IOC ranking third and seventh respectively.

**World's leading electricity producers in 2016 (TWh)**

<table>
<thead>
<tr>
<th>Country</th>
<th>Production (TWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>6015</td>
</tr>
<tr>
<td>US</td>
<td>4327</td>
</tr>
<tr>
<td>India</td>
<td>1423</td>
</tr>
<tr>
<td>Russia</td>
<td>1088</td>
</tr>
<tr>
<td>Japan</td>
<td>1013</td>
</tr>
<tr>
<td>Germany</td>
<td>653</td>
</tr>
<tr>
<td>Canada</td>
<td>643</td>
</tr>
</tbody>
</table>

*Note: TWh - Terawatt Hours Figures mentioned in the graph is as per latest data available*

*Source: Enerdata, Aranca Research,*
POWER GENERATION HAS GROWN RAPIDLY OVER THE YEARS

- With electricity production of 1,160.1 BU in India in FY17, the country witnessed growth of around 4.72 per cent over the previous fiscal year. Electricity production stood at 1,095.756 BU between April 2017 - February 2018.
- Over FY10–FY17, electricity production in India grew at a CAGR of 7.03 per cent.
- In March 2017, the Power Ministry has launched an application named - GARV-II, to provide real time data related to rural electrification regarding all un-electrified villages in India. A total of 16,877 villages out of 18,452 un-electrified villages in India have been electrified up to March 2018 as part of the target to electrify all villages by May 1, 2018.

Notes: FY - Indian Financial Year (April-March), BU – Billion Unit, 1 - Data up to February 2018
Source: BP Statistical Review, Ministry of Power, Aranca Research;
**Sources of Power with Shares in Total Installed Capacity … (1/2)**

**Thermal**
- **Coal**: 65.71%
- **Gas**: India has large reserves of coal. By the end of February 2018, total installed coal capacity in India stood at 193,821.50 MW.

**Hydro**
- 13.46%
- With a large swathe of rivers and water bodies, India has enormous potential for hydropower. As of February 2018, India has 44.96 GW of hydro power generating capacity.

**Renewable**
- 18.81%
- Wind energy is the largest renewable energy source in India; projects like the Jawaharlal Nehru National Solar Mission (aims to generate 20,000 MW of solar power by 2022) are creating a positive environment among investors keen to exploit India’s potential. There are plans to set up four solar power plants of 1GW each. As of February 2018, India has 62.85 GW of renewable energy capacity.

**Nuclear**
- 2.03%
- As of February 2018, India has 67.80 GW of net electricity generation capacity using nuclear fuels (across 20 reactors) and aims to increase it to 45 GW by 2020; with one of the world’s largest reserves of thorium, India has a huge potential in nuclear energy.

**Notes:** MW - Megawatt, GW - Gigawatt  
**Source:** Ministry of Coal, NHPC, CEA, BP Statistical Review 2015, Corporate Catalyst India, Indian Power Sector, Ministry of Power, Aranca Research
As of February 2018, total thermal installed capacity in the country stood at 219.56 GW, while hydro and renewable energy installed capacity totalled to 44.96 GW and 62.85 GW, respectively.

For the 12th Five-Year Plan, a total of 88.5 GW of power capacity addition was targeted; of which, 72.3 GW constitutes thermal power, 10.8 GW hydro power and 5.3 GW nuclear power. As of March 2017, 99.21 GW of installed power capacity was achieved, of which 91.73 GW is thermal, 5.48 GW is hydro and 2 GW is nuclear.

As a part of the green corridor project, the power lines would transmit 20 gigawatts of power capacity from 34 solar parks across 21 states.

In January 2017, the 2nd unit of Kundankulam Nuclear Power Project, attained a capacity of 1000 Mwe and this is anticipated to strengthen the overall power generation capacity in India.

In May 2017, the government approved the raising of bonds worth US$ 351.03 million for renewable energy through the Indian Renewable Energy Development Agency (IREDA). The funds will be then used by the Ministry of New and Renewable Energy for the approved schemes for green corridor, CPSU, defence solar projects, solar parks, generation-based incentives for wind projects, etc.

**Notes:** MW - Megawatt, GW – Gigawatt; FY18* - Data up to February 2018

**Source:** Ministry of Coal, NHPC, Central Electricity Authority (CEA), Corporate Catalyst India, Aranca Research
GENERATION CAPACITY HAS INCREASED AT A HEALTHY PACE … (1/2)

- Installed capacity increased steadily over the years, posting a CAGR of 10.57 per cent in FY09–17.
- Energy generation from conventional sources stood at 989.50 billion units (BU) between April 2017-January 2018.
- Coal-based power generation capacity in India, which currently stands at 194 GW is expected to reach 330-441 GW by 2040.
- Initiatives taken by the Energy Efficiency Services (EESL) have resulted in energy savings of 37 billion kWh and reduction in greenhouse gas (GHG) emissions by 30 million tonnes.

Note: GW - Gigawatt, CAGR - Compound Annual Growth Rate; FY18* - data upto February 2018
Source: CEA (Central Electricity Authority), Aranca Research
Among the different sources of power in India, the CAGR in installed capacity over FY07–FY17 was - 10.57 per cent for thermal power, 22.06 per cent for renewable energy, the fastest among all sources of power, 2.51 per cent for hydro power and 5.68 per cent for nuclear power.

India is expected to become the third biggest solar market across the globe in 2017, with 8.8 gigawatt (GW) of capacity addition projected for the year ahead.* Moreover, the country’s solar capacity is expected to reach 18.7GW by 2017, which is about 5 per cent of global solar capacity.

In August 2017, Bridge to India (BTI) has increased its forecast for India’s solar power capacity addition to 9.4 gigawatts (GW) in 2017 from the previous 8.8 GW as solar power is becoming a more attractive new source of power with decreasing costs.

The 2026 forecast for India’s non-hydro renewable energy capacity has been increased to 155 GW from 130 GW on the back of more than expected solar installation rates and successful wind energy auctions, according to a statement by BMI Research.

*Note: CAGR - Compound Annual Growth Rate; * - According to the India Solar Handbook 2017 released by Bridge to India (BTI), Source: CEA, Aranca Research, India Solar Handbook 2017, BMI Research, Bridge To India, Livemint
# MAJOR PLAYERS IN THE POWER SECTOR

<table>
<thead>
<tr>
<th>Company</th>
<th>Indian company</th>
</tr>
</thead>
</table>
| **NTPC**                     | ▪ NTPC is the largest power producer in India and is also the sixth largest thermal power producer in the world, with installed capacity of 53.00 GW. By 2032, NTPC plans to reach 128,000 MW of power capacity. Coal-based power accounts for more than 84.7 per cent of the total capacity.  
▪ It has also diversified into hydro power, coal mining, power equipment manufacturing, oil and gas exploration, power trading and distribution |
| **Tata Power**               | ▪ Tata Power is India’s largest integrated power company, with significant presence in solar, hydro, wind and geothermal energy space. The company accounts for 52 per cent of total generation capacity in the private sector. The company has an installed capacity of 10,463 MW in FY17. By 2022, the company plans to increase the generating capacity to 18 GW, distribution networks by 4 GW and energy resources by 25 million tonnes per annum. |
| **Reliance Power**           | ▪ The company has more than 35,000 MW of power generation capacity, both operational and under development. Reliance Power has an operational power generation capacity of 6 GW. Reliance Power will double the capacity of its Rosa power plant in Uttar Pradesh to 2,400 MW and Butibori power plant in Maharashtra to 1,200 MW |
| **CESC Limited**             | ▪ CESC Limited is a vertically integrated player engaged in coal mining and generation and distribution of power. It owns and operates 3 thermal power plants generating 1225 MW of power. These are Budge Budge Generating Station (750 MW), Southern Generating Station (135 MW) and Titagarh Generating Station (240 MW) |
| **NHPC**                     | ▪ NHPC is the largest hydro power utility in India, with an installed capacity of 6.7 GW from 21 hydro power stations. It is constructing 3 projects, aggregating an installed capacity of 3.1 GW.  
▪ It had drawn an extensive plan to add about 6 GW of hydropower capacity by 2022. |

*Source*: Company websites, News articles, Industry sources, Aranca Research
### MAJOR PLAYERS IN THE POWER SECTOR ... (2/2)

<table>
<thead>
<tr>
<th>Company</th>
<th>Indian company</th>
</tr>
</thead>
</table>
| ![PFC](image) **Power Finance Corporation Limited (PFC)** | ▪ Power Finance Corporation Limited (PFC) is an NBFC engaged in financing and development activities within the Indian power sector  
▪ Major products and services include project term loans, lease financing, direct discounting of bills, short-term loans and consultancy services |
| ![Adani](image) **Adani Power** | ▪ Adani Power is one of India’s largest private thermal power producers, with total capacity at 10.5 GW in 2016; the company aims to generate 20 GW of power by 2020  
▪ The company is one of the world’s largest single-location thermal power plants in Mundra, Gujarat |
| ![PGCIL](image) **Power Grid Corporation of India Limited (PGCIL)** | ▪ Power Grid Corporation of India Limited (PGCIL) is the single largest transmission utility in India; it is responsible for planning, co-ordination, supervision and control over inter-state transmission systems  
▪ As of January 2018, inter-regional capacity is 78.05 GW. |
| ![DVG](image) **Damodar Valley Corporation** | ▪ Damodar Valley Corporation is engaged in power generation, distribution and transmission of electric power, irrigation and flood control |
| ![SJVN](image) **SJVN Limited** | ▪ SJVN Limited is the second largest hydro power company in India  
▪ The company plans to diversify into wind power projects soon |

**Note:** NBFC - Non-Banking Financial Company  
**Source:** Company websites, News articles, Aranca Research
Porter’s Five Forces Framework Analysis

**Bargaining Power of Suppliers**
- Bargaining power of suppliers is high as presence of bigger players block the new entrants

**Competitive Rivalry**
- Rivalry is not intense due to oligopoly structure
- In India, the projected demand is already above the supply levels
- Competitive rivalry is expected to increase due to government encouraging private players to enter the sector

**Threat of Substitutes**
- Does not have any substitutes

**Threat of New Entrants**
- Capital intensive nature of the industry makes it difficult for new entrants
- Regulatory approvals, land remain a major problem

**Bargaining Power of Buyers**
- Medium, as for retail consumers, government sometimes interferes to regulate prices. However, prices are not regulated for industrial customers

| Source: Aranca Research |
STRATEGIES
ADOPTED
<table>
<thead>
<tr>
<th>STRATEGIES ADOPTED</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control generation costs</td>
<td>- Companies are developing captive coal fields to reduce price volatility and ensure uninterrupted supply of fuel to control generation cost</td>
</tr>
<tr>
<td></td>
<td>- Most of the power companies are now located near energy source. This helps minimise costs of fuel transport</td>
</tr>
<tr>
<td>Acquiring sources of fuel supply</td>
<td>- Power companies are now looking at securing adequate supplies of fuel by targeting not only domestic but also overseas resources</td>
</tr>
<tr>
<td></td>
<td>- Reliance Power already has coal reserves in Indonesia</td>
</tr>
<tr>
<td></td>
<td>- Essar Power have captive coal mines in Indonesia from which it extracts coal for power plants in India</td>
</tr>
<tr>
<td></td>
<td>- Government has enabled the power utilities for swapping their coal supplies with the nearest sources so as to save miscellaneous costs</td>
</tr>
<tr>
<td></td>
<td>and decongest the rail network</td>
</tr>
<tr>
<td>Diversifying generation technologies</td>
<td>- Companies are using multiple-generation technologies based on a project’s requirement</td>
</tr>
<tr>
<td></td>
<td>- Companies such as NTPC and Reliance Power already have coal-fired, gas-fired and hydroelectric capacity</td>
</tr>
<tr>
<td></td>
<td>- This helps them diversify, reduces dependence on a single source</td>
</tr>
<tr>
<td>Additional revenue streams</td>
<td>- Most of the companies are now looking to sell their carbon credits to generate additional revenue by employing supercritical technology</td>
</tr>
<tr>
<td>Digital India</td>
<td>- Launch of smart grid mission with 14 DISCOMS as a pilot</td>
</tr>
<tr>
<td></td>
<td>- Smart metering for high – end users of electricity</td>
</tr>
</tbody>
</table>

*Source: Aranca Research*
GROWTH DRIVERS
INDUSTRIAL EXPANSION AND STRONG GDP GROWTH DRIVING POWER DEMAND … (1/2)

- Multiple drivers (industrial expansion, growing per-capita incomes) are leading to growth in power demand; this is set to continue in the coming years
- India is set to become a global manufacturing hub with investments across the value chain
- India’s power demand is expected to rise up to 1,905 TWh by FY22

Share of electricity consumption in industrial sector

Note: TWh - Terawatt Hours, RGGVY - Rajiv Gandhi Grameen Vidyutikaran Yojana, CEA
Source: Aranca Research, Ministry of Statistics and Program Implementation
INDUSTRIAL EXPANSION AND STRONG GDP GROWTH DRIVING POWER DEMAND … (2/2)

- 98 GW of generation capacity was added during FY11-16; future investments will benefit from strong demand fundamentals, policy support and increasing government focus on infrastructure. Around 21.67 GW of generation capacity was added during 2016-17.

- The Government of India had targeted power capacity addition of 88,537 MW by FY17 during the 12th five year plan. India exceeded the target and achieved capacity addition of 99,209.47 MW by March 2017.

- Per capita electricity consumption in the country grew at a CAGR of 5.39 per cent, during FY11-FY17, reaching 1,122 KWh in FY17.

Note: RGGVY - Rajiv Gandhi Grameen Vidyutikaran Yojana P: Provisional, data as per latest available figures.
Source: CEA, Aranca Research
### POLICY SUPPORT AND INITIATIVES…(1/4)

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Details</th>
</tr>
</thead>
</table>
| **Electricity Act, 2003**                       | - Elimination of licensing for electricity generation projects  
- Increased competition through international competitive bidding  
- Demarcation of transmission as a separate activity |
| **National Tariff Policy, 2006**                | - Adequate return on investment to companies engaged in power generation, transmission and distribution  
- Uniform guidelines to SERCs for fixing tariffs  
- Assured electricity to consumers at reasonable and competitive rates |
| **Ultra Mega Power Projects (UMPPs)**           | - Launch of the UMPP scheme through tariff-based competitive bidding  
- Ease of land possession, provision of fuel, water and necessary clearances for enhancing investor confidence |
| **R-APDRP**                                     | - R-APDRP was launched by Ministry of Power with the purpose of reducing AT&T losses up to 15 per cent by upgradation of transmission and distribution network  
- Linking disbursement of central government funds (to states), with actual reduction in transmission and distribution losses. Sanctioned projects of more than US$ 5.8 billion |
| **Saubhagya Scheme**                           | - The ‘Pradhan Mantri Sahaj Bijli Har Ghar Yojana’, with an outlay of Rs 16,320 crore (US$ 2.51 billion), has been launched by the Government of India with the aim of providing electricity access to over 40 million families in the country by December 2018.  
- Under the Union Budget 2018-19, the Government of India has allocated Rs 16,000 crore (US$2.47 billion) towards this scheme. |
| **UJALA Scheme**                               | - Over 280 million LED bulbs were distributed to consumers in India by Energy Efficiency Services Limited (EESL) under Unnati Jyoti by Affordable LEDs for All (UJALA) as on December 19, 2017 and 524.3 million LED bulbs were sold by private players till October 2017. |

**Notes:** R-APDRP - Restructured Accelerated Power Development and Reform Programme  
SERC - State Electricity Regulatory Commission  
AT&T - American Telephone and Telegraph Systems  
Source: Ministry of Power, Aranca Research
### POLICY SUPPORT AND INITIATIVES…(2/4)

| National Electricity Policy | ▪ Provide electricity to all areas  
▪ Prepared in consultation with state governments, CEA, and other stakeholders  
▪ Supply of reliable and quality power in an efficient manner and reasonable rates |
| Feed – in Tariff | ▪ This Scheme used for promoting generation of electricity from renewable energy sources  
▪ Allows Power Producers to sell renewable energy generated electricity to an off-taker at a pre-determined tariff for a given period of time |
▪ The policy aims to achieve the objectives of UDAY scheme  
▪ Special focus on renewable energy has been laid. In order to promote use of renewable energy, solar Renewable Purchase Obligation (RPO) is proposed to increase to 8 per cent by 2022 |
| BIMSTEC Trans-Power Exchange and Development Project | ▪ In April 2017, the Indian Government approved the proposal of the Ministry of Power for signing of an MoU for establishment of the BIMSTEC Grid Interconnection. The MoU will be signed at the upcoming 3rd BIMSTEC Energy Ministers’ Meeting.  
▪ The BIMSTEC is an international organisation involving a group of South Asia and South-East Asia countries, namely, Bangladesh, India, Myanmar, Sri Lanka, Thailand, Bhutan and Nepal. |
| Fuel Supply Agreement | ▪ Fuel supply agreement with Coal India Ltd will ensure the availability of coal for power companies over the long term |
| Spinning Reserve | ▪ In order to meet the peak load shortages and grid stability, spinning reserves have been created |

**Notes:** R-APDRP - Restructured Accelerated Power Development and Reform Programme  
SERC - State Electricity Regulatory Commission  
AT&T - American Telephone and Telegraph Systems  
UDAY – Ujwai DISCOM Assurance Yojana  
**Source:** Ministry of Power, Aranca Research
### POLICY SUPPORT AND INITIATIVES…(3/4)

**Energy Conservation Campaign**
- Replacing nationwide street lights with LED lights
- Plan to save 10 per cent energy that would light up 11 crore lives
- Replacing 1 crore bulbs in Delhi within one year

**Power to the people**
- Implementation of a new scheme – Ujwal DISCOM Assurance Yojana (UDAY) which would enable electrification for all villages by reducing losses through programmes that involve public participation.
- The Union Budget 2018-19 has allocated Rs 3,800 crore (US$ 586.96 million) towards the Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY) and Rs 4,900 crores (756.87 million) towards the Integrated Power Development Scheme (IPDS).

**Ujwal Discoms Assurance Yojana (UDAY)**
- In February 2017, India Ratings and Research (Ind-Ra) assigned UP Power Corporation (UPPCL)’s proposed US$ 1.48 billion bond a provisional ‘IND AA(SO)’ rating. This makes it India’s 1st state government revenue-supported bond
- The Government of India has signed four Memorandum of Understanding (MoU) with the state of Nagaland and Union Territories (UTs) of Andaman & Nicobar Islands, Dadra & Nagar Haveli & Daman & Diu under the Ujwal DISCOM Assurance Yojana (UDAY) to improve operational efficiency of electricity departments in these places.

**National Tariff Policy (2016)**
- The National Tariff Policy for Electricity was amended by the Union Government on 20 January, 2016, and aims to achieve the objectives of UDAY scheme
- Special focus on renewable energy has been laid. In order to promote use of renewable energy, solar Renewable Purchase Obligation (RPO) is proposed to increase to 8 per cent by 2022

**Coal Mining Auction**
- The Cabinet Committee on Economic Affairs (CCEA) has approved commercial coal mining for private sector and the methodology of allocating coal mines via auction and allotment, thereby prioritising transparency, ease of doing business and ensuring the use of natural resources for national development.

*Source: Ministry of Power, Various News articles, Aranca Research*
### POLICY SUPPORT AND INITIATIVES…(4/4)

<table>
<thead>
<tr>
<th>Policy/Initiative</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rent a roof policy</td>
<td>The Union Government of India is preparing a 'rent a roof' policy for supporting its target of generating 40 gigawatts (GW) of power through solar rooftop projects by 2022.</td>
</tr>
<tr>
<td></td>
<td>- Funds energy efficient electrical appliances</td>
</tr>
<tr>
<td>Direct Benefit Transfer (DBT) Scheme</td>
<td>The Union and state governments have agreed to implement the Direct Benefit Transfer (DBT) scheme in the electricity sector for better targeting of subsidies.</td>
</tr>
<tr>
<td>Vision ‘24x7’ Power for All’</td>
<td>All the states and union territories of India are on board to fulfil the Government of India's vision of ensuring 24x7 affordable and quality power for all by March 2019, as per the Ministry of Power and New &amp; Renewable Energy, Government of India.</td>
</tr>
<tr>
<td>Boost to manufacturing</td>
<td>The Government of India is planning to invite bids for the largest solar tender in the world, for installing 20 gigawatts (GW) of solar power capacity, to give a boost to manufacturing of solar power equipment in India.</td>
</tr>
<tr>
<td>No environment clearance required for solar projects</td>
<td>The Ministry of Environment, Forest and Climate Change, Government of India has clarified that solar PV (photovoltaic) power, solar thermal power projects, and solar parks will not require the environment clearance which was mandatory under the provisions of Environment Impact Assessment (EIA) notification, 2006.</td>
</tr>
<tr>
<td>Green Energy Corridor Project</td>
<td>Under the Union Budget 2018-19, the Government of India has allocated Rs 4,200 crore (US$ 648.75 billion) to increase capacity of Green Energy Corridor Project along with other wind and solar power projects.</td>
</tr>
</tbody>
</table>

**Source:** Ministry of Power, Various News articles, Aranca Research
INCREASING INVESTMENTS: FDI INFLOWS AND KEY DEALS … (1/3)

- Power is one of the key sectors attracting FDI inflows into India
- From April 2000 to December 2017, India recorded FDI of US$ 6.26 billion in non-conventional energy sector. New and renewable energy sector witnessed maximum power generation capacity addition, since 2000.
- Power sector accounted for 3.52 per cent of total inflows till December 2017
- Cumulative FDI inflows into the sector in April 2000–December 2017 were US$ 12.97 billion

Note: FY18* - data upto December 2017
Source: DIPP, Aranca Research
The Ministry of New and Renewable Energy (MNRE) signed an agreement with Germany-based KfW Development Bank, to fund floating solar projects in Maharashtra and Kerala, at an estimated cost of US$ 44.47 million in June 2016. Both the plants are expected to generate over 310 GW of green energy.

SunEdison, world’s largest renewable energy company, plans to continue its focus on ‘Make in India’ initiative by further reducing the cost of renewable energy and developing over 15 gigawatts (GW) of wind and solar projects in the country by 2022.

In January 2018, Canada Pension Plan Investment Board (CPPIB) acquired 6.3 per cent stake in ReNEW Power Ventures Ltd for US$ 144 million from Asian Development Bank (ADB).

In April 2017, 12 agreements and MoUs worth US$9 billion of investments are to be signed between India and Bangladesh. An agreement worth US$2 billion investments in Bangladesh power sector by Adani Power, a subsidiary of Adani Group is to be signed as well.

In April 2017, L&T’s construction division received an order from Qatar General Electricity and Water Corporation worth US$780.9 million, for network expansion and power transmission.

In May 2017, PE Actis LLP announced plans to invest US$ 500 million in Solenergi Power Pvt. Ltd., its 2nd green energy platform in the country. The company was also awarded Rewa Solar Power Project in Madhya Pradesh.

In July 2017, International Finance Corporation (IFC), the investment arm of the World Bank Group, is planning to invest about US$ 6 billion through 2022 in several sustainable and renewable energy programmes in India.

In September 2017, France-based energy firm, Engie SA entered into a partnership with Dubai-based private equity (PE) firm Abraaj Group for setting up a wind power platform in India.

Energy Efficiency Services Ltd (EESL) has raised US$ 454 million from Global Environment Facility (GEF) for its energy-efficiency projects in an attempt to boost India’s move towards becoming a low carbon economy.

In December 2017, Sterlite Power has won a 1,800 km power transmission project worth US$ 800 million in Brazil, the company’s third project in Brazil and the largest ever project won by an Indian company in Latin America.

In December 2017, IL&FS Financial Services Ltd has partnered with Jammu and Kashmir (J&K) Bank Ltd to finance nine hydropower projects in J&K with a total capacity of 2,000 MW, which require financing of around Rs 20,000 crore (US$ 3.09 billion).
### INCREASING INVESTMENTS: FDI INFLOWS AND KEY DEALS … (3/3)

#### Private Equity deals

<table>
<thead>
<tr>
<th>Acquirer</th>
<th>Target</th>
<th>Deal date</th>
<th>Value (US$ mn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ReNew Power</td>
<td>Ostro Energy</td>
<td>April 2018</td>
<td>1,668.21</td>
</tr>
<tr>
<td>ReNew Power</td>
<td>Wind power assets of KC Thapar Group</td>
<td>21 November 2017</td>
<td>155.55</td>
</tr>
<tr>
<td>India Power Corp. Ltd</td>
<td>Meenakshi Energy Pvt Ltd</td>
<td>16 November 2016</td>
<td>-</td>
</tr>
<tr>
<td>Greenko Energy Holdings (GEH)</td>
<td>SunEdison</td>
<td>4 October 2016</td>
<td>392</td>
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<td>ADB, DEG</td>
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<td>GMR Energy</td>
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<td>GSPC Distribution Networks Ltd</td>
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**Note:** FDI - Foreign Direct Investment, PE - Private Equity, Thomson One Banker

**Source:** Thomson One Banker, Industry News, VC Circle, Aranca Research
OPPORTUNITIES
Demand for electricity is expected to increase at a CAGR of 7 per cent to 1,894.7 TWh over FY07–22

Current production levels are not enough to meet demand; annual demand outstrips supply by about 7.5 per cent

All India per capita consumption of electricity is estimated to reach 1348 TWh by FY17

Various reforms being undertaken by the government are positively impacting India’s power sector. In wake of the surging domestic coal production, the country’s power sector is becoming increasingly stable.

Notes: TWh - Terawatt Hour, CAGR - Compounded Annual Growth Rate E - Estimated
Source: International Energy Agency (IEA), CEA, Demand estimates based on IEA forecasts, Aranca Research
The government is targeting capacity addition of around 100 GW under the 13th (2017–22) Five-Year Plan.

There is a tangible shift in policy focus on the sources of power. The government is keen on promotion of hydro, renewable and gas-based projects, as well as adoption of clean coal technology.

In March 2017, Bhoruka Power Corp. announced its plans to raise US$ 120 million, to increase their hydro and wind renewable energy capacity to 1 gigawatt by 2020.

The total estimated potential of tidal energy in India is about 8,000 megawatt (MW).

---

**Addition to generation capacity under Five-Year Plans (GW)**

- **8th**: 16.42
- **9th**: 19.01
- **10th**: 21.13
- **11th**: 54.96
- **12th**: 88.54
- **13th**: 100

---

*Note: TWh - Terawatt-hour*

*Source: Business Standard, Capacity addition estimates by CEA, Aranca Research*
The peak power requirement by the country in FY17 stood at 159.54GW.

The peak power demand in the country stood at 164.066 GW between April-January 2018.

To meet the rising electricity demand, the Central Government plans to expedite market opportunity of US$ 14.94 billion for power transmission.

Note: KWh – Kilo Watt Hour, GW - Gigawatt Hour,
Source: NTPC presentation, CEA, Aranca Research
RENEWABLE ENERGY IS FAST EMERGING AS A MAJOR SOURCE OF POWER

- Wind energy is the largest source of renewable energy in India; it accounts for an estimated 52.27 per cent of total installed capacity (62.85 GW). There are plans to double wind power generation capacity to 60 GW by 2022.

- The Ministry of New and Renewable Energy (MNRE) is looking to auction around 3 GW of wind power projects by the end of FY 2017-18 and is also in the final stages of drafting separate bidding guidelines for auctioning wind power projects.

- Biomass is the 2nd largest source of renewable energy, accounting for ~12 per cent of total installed capacity in renewable energy. There is a strong upside potential in biomass in the coming years.

- In May 2017, India’s solar power tariffs fell to a new low of US$ 0.038 per unit during the auction of a 250 megawatt capacity at Bhadla in Rajasthan. This bid was placed by South Africa’s Phelan Energy Group and Avaada Power to win contracts to build capacities of 50MW and 100MW, respectively, at Adani Renewable Energy Park Rajasthan Ltd.

- Declining solar power prices as compared to thermal power has prompted the government to switch to the renewable energy resources. Three coal power projects have been shelved in Odisha, Gujarat and Uttar Pradesh due to low rate of renewable solar energy at US$0.038 / kWh.

- The number of small hydro power projects set up in India stood at 1,085 with total installed capacity of 4,399.355 megawatt (MW) as of November 30, 2017.

Notes: TWh - Tera Watt Hour; GW – Gigawatt, Figures mentioned in the graph is as per latest data available
Source: Renewables 2015 Global Status Report (REN21), Aranca Research, CEA
STRONG UPWARD MOMENTUM IN NUCLEAR ENERGY LIKELY IN MEDIUM TO LONG TERM

- Currently, the country has net installed capacity of 6.78 GW, using nuclear fuels, across 20 reactors. Of the 20 reactors, 18 are Pressurised Heavy Water Reactors (PHWR) and 2 are Boiling Water Reactors (BWR).
- The government aims to quadruple India's nuclear power generation capacity to 20 GW by 2020;
- Nuclear Power Corporation of India Limited (NPCIL) plans to construct 5 nuclear energy parks with a capacity of 10,000 MW.
- Both the units of the Kudankulam nuclear power plant, Tamil Nadu, by NPCIL attained full generation capacity of 1,000 MW each as of December 2017.

Note: GW – Gigawatt, Mwe - Megawatt Electric, PHWR - Pressurised Heavy Water Reactors, BWR - Boiling Water Reactors, E – Estimates, * - as of February 2018
SUCCESS STORIES
TATA POWER: SURGING AHEAD IN THE PRIVATE SECTOR … (1/2)

- In FY17 Tata power’s revenue reached US$ 4.38 billion from US$ 3.81 billion in FY09.
- In 2017, the company has an installed generation capacity of 10.613 GW in India and is present in all segments of power sector.
- The thermal power generation capacity stands at 7.6 GW, while clean energy generation such as hydro, solar and wind stands at 1.2 GW.
- The company is developing its 1st 4 GW Ultra Mega Power Project at Mundra (Gujarat) based on supercritical technology.
- Its international presence includes a 30 per cent stake in coal mines and a geothermal project in Indonesia and a hydro project in Bhutan in partnership with The Royal Government of Bhutan.

**Note:** MW - Megawatt

**Source:** Company website, Annual Reports, Economic Times, Aranca Research
TATA POWER: SURGING AHEAD IN THE PRIVATE SECTOR … (2/2)

- The company estimates its installed capacity to expand fivefold in the next 5 years to 25 GW
- Recognising the enormous potential in renewable energy, the company intends to increase the share of renewable sources to 25 per cent of its total generating capacity in the near future
- In the year 2017 the company commissioned a 100 MW wind farm in Andhra Pradesh.
- As of FY17, the company has an installed capacity of 10,463 MW
- In comparison to FY16, the company’s generation capacity increased by 13.94 per cent in FY17
- The company being first independent power producer in India has been awarded with OHSAS 18001:2007 certification for its wind operations
- In March 2017, Tata Power entered into partnership with Nokia, to modernise electrical grids with advanced communication network. Tata Power Delhi Distribution Ltd. was allowed access to internet protocol/multiprotocol label switching network to support management of electrical grids in Delhi, by Nokia.

**Note:** MW - Megawatt, CAGR - Compounded Annual Growth Rate  
**Source:** Company website, Company Presentation
RELIANCE POWER: ON A GROWTH TRAJECTORY … (1/2)

- Reliance Power has 5.9 GW of operational capacity and approximately 15 GW under implementation.
- It won 3 of the 4 Ultra Mega Power Projects (UMPPs) awarded by the Government of India so far. These 3 projects are located in Sasan (MP), Krishnapatnam (Andhra Pradesh) and Tilaiya (Jharkhand).
- Sasan UMPP is the largest integrated power plant and coal mining project globally.
- The company's coal production capacity has reached ~100 MTPA. It is the largest private sector coal producer in India.
- The company's ongoing projects would increase its production capacity to 20,000 MW of coal-fired capacity, 2400 MW of gas-fired capacity and 5,292 MW of hydroelectric capacity.

Notes: Decline due to negative translation effect, MW – Megawatt, MTPA - Million Tonnes Per Annum  
Source: Reliance Power website, Annual Reports, Aranca Research
Both units of the 600-MW Butibori coal project in Maharashtra are ready for production.

At the 2.4 GW gas project in Samalkot, Andhra Pradesh, four gas turbines are ready for generation.

Hydro power projects with capacity of 5.3 GW are currently under development in Arunachal Pradesh (4.2 GW), Himachal Pradesh (672 MW) and Uttarakhand (400 MW).

Reliance Power is in the process of setting up a 3,000 MW of combined cycle gas power plant in Bangladesh. The company has signed the agreements for the execution of the first phase of the US$1 billion project. The Asian Development Bank (ADB) approved loan worth US$ 583 million to Reliance Power for this project.

**Note:** MW - Megawatt

**Source:** Reliance Power website, Corporate Presentation, Annual Reports, Aranca Research
KEY INDUSTRY ASSOCIATIONS
### INDUSTRY ASSOCIATIONS

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<tr>
<th>Council of Power Utilities</th>
<th>Bureau of Energy Efficiency (BEE)</th>
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| **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: www.indiapower.org | **Address:** Ministry of Power, 4th Floor, SEWA Bhawan, R. K. Puram, New Delhi – 110066, India  
Tel: 91 11 26179699  
Fax: 91 11 26178352  
E-mail: webmanager-bee@nic.in  
Website: http://www.beeindia.in/ |

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<tr>
<th>Hydro Power Association (India)</th>
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| **Address:** Flat no 6, Green Park Apartment, Shriram Society, Warje, Pune - 411058, Maharashtra, India  
Tel: 91 20 25233338  
E-mail: hypaindia@gmail.com, president@hpaindia.org, secretary@hpaindia.org  
Website: http://hpaindia.org/ | **Address:** PHD House, 3rd Floor, Opp. Asian Games Village, August Kranti Marg, New Delhi-110016, India  
Tel: 91 11 26523042  
E-mail: manish@inwea.org  
Web site: http://www.inwea.org/ |
GLOSSARY

- CAGR: Compound Annual Growth Rate
- FDI: Foreign Direct Investment
- FY: Indian Financial Year (April to March)
  - So FY10 implies April 2009 to March 2010
- GW: Gigawatt
- MandA: Merger and Acquisition
- MW: Megawatt
- NBFC: Non-Banking Financial Company
- PE: Private Equity
- PLF: Plant Load Factor
- RandD: Research and Development
- R-APDRP: Restructured Accelerated Power Development and Reform Programme
- TandD: Transmission and Distribution
- TWh: Terawatt-Hour
- RGGVY: Rajiv Gandhi Grameen Vidyutikaran Yojana
- 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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<th>Year INR</th>
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### Exchange Rates (Calendar Year)

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*Source: Reserve bank of India, Average for the year*
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