EXECUTIVE SUMMARY

Third largest producer and fourth largest consumer globally

- With production of 1,278.91 TWh in 2015, India was the 3rd largest producer & 4th largest consumer of electricity in the world, with the installed power capacity reaching 306.36 GW by September 2016. The country also has the 5th largest installed capacity in the world.

Large-scale government initiated expansion plans

- The government targets capacity addition of 88.5 GW under the 12th Five-Year Plan (2012–17) and around 100 GW under the 13th Five-Year Plan (2017–22)
- Investments of around USD250 billion are planned for the power sector during the 12th Plan Five-Year Plan.

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.

Source: Make in India website, Ministry of New and Renewable Energy, IEA, CEA (Central Electricity Authority), TechSci Research, Assorted articles
Notes: TWh - Terawatt Hours, GW – Gigawatt
Growing demand
- 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 1174.07 TWh in 2015 to 1,894.7 TWh in 2022

Attractive opportunities
- Ambitious projects & increasing investments across the value chain
- Diversification into renewable sources increasing growth avenues

Higher investments
- Total FDI inflows in the power sector reached USD11.43 billion during April 2000 to December 2016, accounting for 4 per cent of total FDI inflows in India
- Investment for 7 new transmission systems that includes strengthening of national grid have been sanctioned

Policy support
- 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

Source: CEA, DIPP (Department of Industrial Policy and Promotion), TechSci Research
Notes: FY - Indian Financial Year (April – March), FDI - Foreign Direct Investment, E - Estimates, TWh - Terawatt-Hour, FY22 estimates as per IEA forecasts

For updated information, please visit www.ibef.org
**EVOLUTION OF THE INDIAN POWER SECTOR**

**Before 1956 Introductory Stage**
- Electricity (Supply) Act 1948
- Establishment of semi-autonomous State Electricity Boards (SEBs)

**1956–1991 Nationalisation Stage**
- Industrial Policy Resolution (1956)
- Generation and distribution of power under state ownership
- Power losses, subsidies, infrastructure bottlenecks and resource constraints

**1991–2003 Liberalisation Era**
- 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

**2003 onwards Growth Era**
- 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, TechSci Research*
With a production of 6896 TWh, India is the 5th largest producer & the 3rd 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.

World’s leading electricity producers in 2015 (TWh)

- China: 30703 TWh
- US: 23399 TWh
- Russia: 15595 TWh
- Saudia Arabia: 7559 TWh
- India: 6896 TWh
- Canada: 5303 TWh
- Indonesia: 4663 TWh

*Source: Enerdata, TechSci Research,
Note: TWh - Terawatt Hours
Figures mentioned in the graph is as per latest data available*
POWER GENERATION HAS GROWN RAPIDLY OVER THE YEARS

* With electricity production of 1,107.8 BU in India in FY16, the country witnessed growth of around 5.64 per cent over the previous fiscal year.

* Over FY10–FY16, electricity production in India grew at a CAGR of 6.21 per cent.

* During April-September 2016, electricity production in India reached 584.22 BU.

* The 12th Five Year Plan projects that, by 2016–17, total domestic energy production would reach 669.6 million tonnes of oil equivalent (MTOE) and would further increase to 844 MTOE by 2021–22.

---

Electricity production in India (BU)

CAGR: 6.21%

<table>
<thead>
<tr>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
</tr>
</thead>
<tbody>
<tr>
<td>771.6</td>
<td>811.1</td>
<td>876.9</td>
<td>912.1</td>
<td>967.2</td>
<td>1048.7</td>
<td>1107.8</td>
</tr>
</tbody>
</table>

Source: BP Statistical Review, Ministry of Power, TechSci Research; Notes: FY - Indian Financial Year (April-March), BU – Billion Unit
## SOURCES OF POWER WITH SHARES IN TOTAL INSTALLED CAPACITY … (1/2)

<table>
<thead>
<tr>
<th>Source</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>69.8%</td>
</tr>
<tr>
<td>Gas</td>
<td>14.14%</td>
</tr>
<tr>
<td>Hydro</td>
<td>14.14%</td>
</tr>
<tr>
<td>Renewable</td>
<td>14.14%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

India has large reserves of coal. By the end of 2015, total coal reserves in India stood at 303.60 billion tonnes; of which, 42.93 billion tonnes were proven reserves.

India’s proven natural gas reserves measure about 1.5 trillion cubic metres as on 30th March 2016.

With a large swathe of rivers and water bodies, India has enormous potential for hydropower; the 12th Five-Year Plan (2012–17) includes additional 30GW of hydroelectric power generation. In FY16 (till October 2015), India has 42.47 GW of hydro power generating capacity.

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.

Currently, India has 5.78 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.

*Source:* Ministry of Coal, NHPC, CEA, BP Statistical Review 2015, Corporate Catalyst India, Indian Power Sector, Ministry of Power, TechSci Research

Notes: MW - Megawatt, GW - Gigawatt
As of September 2016, total thermal installed capacity in the country stood at 213.22 GW, while hydro & renewable energy installed capacity totalled to 43.11 GW and 44.23 GW, respectively.

For the 12th Five-Year Plan, a total of 88.5 GW of power capacity addition is targeted; of which, 72.3 GW constitutes thermal power, 10.8 GW hydro power and 5.3 GW nuclear power.

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.

By generation & attaining a capacity of 1000 Mwe in January 2017, the 2nd unit of Kudankulam Nuclear Power Project (KNPP) has strengthened the overall power generation capacity of the country.

In February 2017, a 40-kilowatt solar power plant was inaugurated at Don Bosco Higher Secondary School, in Jorhat city, Assam to use the energy resource. So to encourage the use, the state government sanctioned US$ 73,471.56 for solar power generation in the state.

Installed capacity for different sources of power – 2016\(^{(1)}\) (GW)

<table>
<thead>
<tr>
<th>Source</th>
<th>Capacity (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal</td>
<td>213.22</td>
</tr>
<tr>
<td>Hydro</td>
<td>43.11</td>
</tr>
<tr>
<td>Renewables</td>
<td>44.23</td>
</tr>
<tr>
<td>Nuclear</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Source: Ministry of Coal, NHPC, Central Electricity Authority (CEA), Corporate Catalyst India, TechSci Research
Notes: MW - Megawatt, GW – Gigawatt
\(^{(1)}\) - Data as on 30th September 2016
**POWER**

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

* Installed capacity increased steadily over the years, posting a CAGR of 10.10 per cent in FY09–17\(^{(1)}\)
* As of November 2016, energy generation from conventional sources stood at 777.506 billion units (BU), registering a Y-o-Y of 4.99 per cent over the previous year.

---

### Installed electricity generation capacity (GW)

<table>
<thead>
<tr>
<th>FY07</th>
<th>FY08</th>
<th>FY09</th>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
<th>FY17</th>
</tr>
</thead>
<tbody>
<tr>
<td>132.3</td>
<td>143.1</td>
<td>148.0</td>
<td>159.4</td>
<td>173.6</td>
<td>199.9</td>
<td>223.3</td>
<td>237.7</td>
<td>272.5</td>
<td>280.3</td>
<td>314.6</td>
</tr>
</tbody>
</table>

**Source:** CEA (Central Electricity Authority), TechSci Research

**Notes:** GW – Gigawatt, CAGR - Compound Annual Growth Rate

\(^{(1)}\) – As on January 2017
Among the different sources of power in India, the CAGR in installed capacity over FY07–FY17\(^1\) was

- 10.6 per cent for thermal power
- 21.3 per cent for renewable energy, the fastest among all sources of power
- 2.4 per cent for hydro power
- 4.5 per cent for nuclear power

Comparison of installed capacity (GW)

<table>
<thead>
<tr>
<th>Source</th>
<th>End of 10th Plan</th>
<th>End of 11th Plan</th>
<th>FY17*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal</td>
<td>86</td>
<td>34.7</td>
<td>7.8</td>
</tr>
<tr>
<td>Hydro</td>
<td>39</td>
<td>39</td>
<td>24.5</td>
</tr>
<tr>
<td>Renewable</td>
<td>43.11</td>
<td>44.23</td>
<td>4.8</td>
</tr>
<tr>
<td>Nuclear</td>
<td>5.8</td>
<td>3.9</td>
<td>4.8</td>
</tr>
</tbody>
</table>

Source: CEA, TechSci Research, Note: CAGR - Compound Annual Growth Rate
\(^1\) – Data as on September 2016
### Company | Business description
--- | ---
**NTPC** | • NTPC is the largest power producer in India & is also the 6th largest thermal power producer in the world, with installed capacity of 47.17 GW (including JVs). 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 & gas exploration, power trading & distribution.

**Tata Power** | • Tata Power is India’s largest integrated power company, with significant presence in solar, hydro, wind & 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 10.0 GW in FY16. By 2022, the company plans to increase the generating capacity to 18 GW, distribution networks by 4 GW & energy resources by 25 million tonnes per annum.

**Reliance Power** | • The company has more than 35,000 MW of power generation capacity, both operational & under development. Reliance Power has an operational power generation capacity of 6 GW. FY13 saw the development of 3,960-MW Sasan UMPP in Madhya Pradesh.  
• In FY15, the company accounted for a generation performance of 1048 billion units.

**CESC Limited** | • CESC Limited is a vertically integrated player engaged in coal mining & generation & distribution of power. It owns & operates 3 thermal power plants generating 1225 MW of power. These are Budge Budge Generating Station (750 MW), Southern Generating Station (135 MW) & Titagarh Generating Station (240 MW).

**NHPC** | • NHPC is the largest hydro power utility in India, with an installed capacity of 6.5 GW; it has drawn up a massive capacity expansion plan of adding 6.7 GW by 2017.  
• NHPC is constructing 9 projects, aggregating an installed capacity of 4.2 GW. NHPC added 1.9 GW & 1.1 GW during the 10th & 11th Plan periods, respectively.

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Source: Company websites, News articles, Industry sources, TechSci Research

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## MAJOR PLAYERS IN THE POWER SECTOR … (2/2)

<table>
<thead>
<tr>
<th>Company</th>
<th>Business description</th>
</tr>
</thead>
</table>
| ![PFC](image) **Power Finance Corporation Limited (PFC)** | • Power Finance Corporation Limited (PFC) is an NBFC engaged in financing & development activities within the Indian power sector  
• Major products & services include project term loans, lease financing, direct discounting of bills, short-term loans & 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  
• Target to enhance inter-regional capacity to about 72.25 GW at the end of XII Plan. In 2016, inter-regional capacity is 47.45 GW. |
| ![DVC](image) **Damodar Valley Corporation** | • Damodar Valley Corporation is engaged in power generation, distribution & 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 |
### PORTER'S FIVE FORCES ANALYSIS

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

#### Substitute Products
- Does not have any substitutes

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

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

---

Source: TechSci Research
POWER

STRATEGIES ADOPTED
### STRATEGIES ADOPTED

| Control generation costs | • Companies are developing captive coal fields to reduce price volatility & ensure uninterrupted supply of fuel to control generation cost  
• Most of the power companies are now located near energy source. This helps minimise costs of fuel transport |
|---|---|
| Acquiring sources of fuel supply | • Power companies are now looking at securing adequate supplies of fuel by targeting not only domestic but also overseas resources  
• Reliance Power already has coal reserves in Indonesia  
• Essar Power have captive coal mines in Indonesia from which it extracts coal for power plants in India  
• Government has enabled the power utilities for swapping their coal supplies with the nearest sources so as to save miscellaneous costs & decongest the rail network |
| Diversifying generation technologies | • Companies are using multiple-generation technologies based on a project’s requirement  
• Companies such as NTPC & Reliance Power already have coal-fired, gas-fired & hydroelectric capacity  
• This helps them diversify, reduces dependence on a single source |
| Additional revenue streams | • Most of the companies are now looking to sell their carbon credits to generate additional revenue by employing supercritical technology |
| Digital India | • Launch of smart grid mission with 14 DISCOMS as a pilot  
• Smart metering for high – end users of electricity  
• Under Union Budget 2017, government approved the ‘Pradhan Mantri Gramin Digital Saksharta Abhiyan’ (PMGDISHA) for 6 crore rural households |
GROWTH DRIVERS
STRONG DEMAND AND POLICY SUPPORT DRIVING INVESTMENTS

Growing demand
- Increase in industrial activity
- Increasing penetration, per-capita consumption
- Growing middle class & consumer base

Policy support
- Electricity Act (2003): highly liberal framework for generation
- Fuel supply agreement of power companies with Coal India Ltd
- Development of UMPPs
- National Tariff Policy (2016): focus on renewable energy & private investment through competitive bidding

Increasing investments
- Rising FDI inflows: FDI of USD8547 million was made till FY15, which increased to USD11,437.34 million till December’16
- Growing M&A activity
- Large investments in equipment manufacture & power generation

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

  * During FY15-16, GDP growth is likely to average 7.6 per cent
  * 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

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Share of electricity consumption in industrial sector

<table>
<thead>
<tr>
<th>Year</th>
<th>37.60%</th>
<th>37.70%</th>
<th>37.80%</th>
<th>38.30%</th>
<th>38.60%</th>
<th>39.00%</th>
<th>44.40%</th>
<th>44.90%</th>
<th>43.80%</th>
<th>44%</th>
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<td>FY07</td>
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<td>FY15</td>
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<td>58%</td>
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<td>FY16</td>
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<td></td>
<td>44%</td>
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</tr>
</tbody>
</table>

Source: TechSci Research, Ministry of Statistics and Program Implementation
Notes: TWh - Terawatt Hours, RGGVY - Rajiv Gandhi Grameen Vidyutikaran Yojana, CEA
98 GW of generation capacity was added during FY11-16; future investments will benefit from strong demand fundamentals, policy support & increasing government focus on infrastructure

- Per capita consumption has grown at a CAGR of 10 per cent between FY06 and FY15

- Per capita consumption grew 4.7 per cent in FY14 but tapered to 5.5 per cent in FY15, reaching 1010 KWh

- During the 12th Plan, Government of India planned for capacity addition of 1,18,537 MW, which includes 88,537 MW through conventional sources & 30,000 MW through renewable sources, by 2016-17

- Per capita electricity consumption in the country grew at a CAGR of 9.63 per cent, during FY06-FY16, reaching 1075 KWh by FY16

Source: CEA, TechSci Research
Notes: RGGVY - Rajiv Gandhi Grameen Vidyutikaran Yojana
P : Provisional
## Policy Support Aiding Growth in the Sector

<table>
<thead>
<tr>
<th>Policy/Programme</th>
<th>Key Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Act, 2003</td>
<td>• Elimination of licensing for electricity generation projects</td>
</tr>
<tr>
<td></td>
<td>• Increased competition through international competitive bidding</td>
</tr>
<tr>
<td></td>
<td>• Demarcation of transmission as a separate activity</td>
</tr>
<tr>
<td>National Tariff Policy, 2006</td>
<td>• Adequate return on investment to companies engaged in power generation, transmission and distribution</td>
</tr>
<tr>
<td></td>
<td>• Uniform guidelines to SERCs for fixing tariffs</td>
</tr>
<tr>
<td></td>
<td>• Assured electricity to consumers at reasonable and competitive rates</td>
</tr>
<tr>
<td>Ultra Mega Power Projects (UMPPs)</td>
<td>• Launch of the UMPP scheme through tariff-based competitive bidding</td>
</tr>
<tr>
<td></td>
<td>• Ease of land possession, provision of fuel, water &amp; necessary clearances for enhancing investor confidence</td>
</tr>
<tr>
<td></td>
<td>• According to Union Budget 2015-16, 5 new UMPPs, each of 4000MW, have been proposed to setup in the plug- and – play mode</td>
</tr>
<tr>
<td>R-APDRP</td>
<td>• R-APDRP was launched by Ministry of Power with the purpose of reducing AT&amp;T losses up to 15 per cent by upgradation of transmission and distribution network</td>
</tr>
<tr>
<td></td>
<td>• Linking disbursement of central government funds (to states), with actual reduction in transmission and distribution losses. Sanctioned projects of more than USD5.8 billion</td>
</tr>
<tr>
<td>Fuel Supply Agreement</td>
<td>• Fuel supply agreement with Coal India Ltd will ensure the availability of coal for power companies over the long term</td>
</tr>
</tbody>
</table>

Source: Ministry of Power, TechSci Research
Notes: R-APDRP - Restructured Accelerated Power Development and Reform Programme, SERC - State Electricity Regulatory Commission, AT&T - American Telephone & Telegraph Systems
### 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

### National Tariff Policy (2016)

- The National Tariff Policy for Electricity was amended by the Union Government on 20 January, 2016
- 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

Source: Ministry of Power, TechSci Research

Notes: R-APDRP - Restructured Accelerated Power Development and Reform Programme, SERC - State Electricity Regulatory Commission, AT&T - American Telephone & Telegraph Systems

For updated information, please visit [www.ibef.org](http://www.ibef.org)
### POLICIES ADOPTED DURING BUDGET FY15 & FY16

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
</table>
| Generation-based incentives      | • Government to reintroduce ‘generation-based incentives’ for wind power projects to boost capacity addition in the sector; Cutting of excise duties by 2 per cent on capital goods import  
  • USD147.3 million would be allocated to the Ministry of New & Renewable Energy                                                      |
| Public Private Partnership (PPP) | • To reduce dependency on imported coal, a Public Private Partnership (PPP) policy framework would be devised with Coal India Limited to increase coal production                                                                  |
| Liberalised FDI policy           | • During FY13, the Government liberalised FDI policy for Power Trading Exchanges  
  • Foreign Investment in power exchanges registered under the CERC Regulations, 2010, allowed up to 49 per cent (FDI-26 per cent and FII-23 per cent)                                                 |
| Low-interest funds               | • Low-interest–bearing funds to be provided from National Clean Energy Fund (NCEF) to Indian Renewable Energy Development Agency Ltd (IREDA) for on-lending to viable renewable energy projects  
  • Funding of USD746.82 million from (NCEF) and USD775.63 million from IEBR has been planned for year 2016-17 to develop & use renewable energy resources in an eco-friendly & sustainable manner |
| Growing investments              | • As per Union Budget, the total planned outlay for power sector for FY17 is estimated at USD11.18 billion                                                                                                       |
| Tax benefits                     | • Benefit under section 35 (2AA) of the Income Tax Act to industry/private sponsored research programmers  
  • Further incentives are available for setting up of projects in notified areas                                                                                                         |

**Source:** Union Budget, Various News articles, TechSci Research,  
**Notes:** PSUs - Public Sector Units, CERC: Central Electricity Regulatory Commission

For updated information, please visit [www.ibef.org](http://www.ibef.org)
### RECENT POLICIES ADOPTED

<table>
<thead>
<tr>
<th>Policy</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spinning Reserve</strong></td>
<td>In order to meet the peak load shortages and grid stability, spinning reserves have been created</td>
</tr>
<tr>
<td><strong>Energy Conservation Campaign</strong></td>
<td>Replacing nationwide street lights with LED lights</td>
</tr>
<tr>
<td></td>
<td>Plan to save 10 per cent energy that would light up 11 crore lives</td>
</tr>
<tr>
<td></td>
<td>Replacing 1 crore bulbs in Delhi within one year</td>
</tr>
<tr>
<td><strong>National Mission on Enhanced Energy Efficiency</strong></td>
<td>In August 2014, Government had launched the policy with an investment of USD128 million</td>
</tr>
<tr>
<td></td>
<td>Funds energy efficient electrical appliances</td>
</tr>
<tr>
<td><strong>Power to the people</strong></td>
<td>Implementation of 2 schemes – Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY) &amp; Integrated Power Development Scheme (IPDS) for rural &amp; urban areas</td>
</tr>
<tr>
<td></td>
<td>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</td>
</tr>
<tr>
<td><strong>Ujwal Discoms Assurance Yojana (UDAY)</strong></td>
<td>In February 2017, India Ratings &amp; 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 first state government revenue-supported bond</td>
</tr>
<tr>
<td><strong>National Tariff Policy (2016)</strong></td>
<td>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</td>
</tr>
<tr>
<td></td>
<td>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</td>
</tr>
</tbody>
</table>

*Source: Ministry of Power, Various News articles, TechSci Research*
In April 2014 to September 2016, India recorded FDI of US$ 1.77 billion in non-conventional energy sector. New and renewable energy sector witnessed maximum power generation capacity addition, since 2014.
INCREASING INVESTMENTS: FDI INFLOWS AND KEY DEALS … (2/3)

- Private equity investments in the sector have surged since 2010
- Asian Development Bank (ADB), Goldman Sachs & Global Environmental Fund have together invested USD140 million in ReNew Wind Power Pvt Ltd on July 03, 2014
- EIG Global Energy Partners made an investment of USD125 million in Greenko Group, which is planning to develop its wind farms & hydropower assets in India by means of Greenfield projects & acquisitions
- GE Energy Financial Services plans to invest USD24 million in a solar power project by Welspun Renewables Energy Pvt Ltd.
- The Ministry of New & Renewable Energy (MNRE) signed an agreement with Germany-based KfW Development Bank, to fund floating solar projects in Maharashtra & Kerala, at an estimated cost of USD44.47 million in June 2016. Both the plants are expected to generate over 310 GW of green energy
- On 20 June, 2016, CLP India, which is among the largest foreign investors in India’s power sector, acquired 49 per cent stake in Suzlon’s 100 mw-solar power project in Telangana
- 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 & solar projects in the country by 2022

Notes: FDI - Foreign Direct Investment, PE - Private Equity, Thomson One Banker
### Private Equity deals

<table>
<thead>
<tr>
<th>Acquirer</th>
<th>Target</th>
<th>Deal date</th>
<th>Value (USD mn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tata Power</td>
<td>Welspun Energy</td>
<td>14 June 2016</td>
<td>1,528</td>
</tr>
<tr>
<td>GIC</td>
<td>Greenko Group plc</td>
<td>August 2015</td>
<td>255</td>
</tr>
<tr>
<td>EIG Global Energy Partners</td>
<td>Greenko Group</td>
<td>October 2014</td>
<td>125</td>
</tr>
<tr>
<td>Standard Chartered Private Equity Ltd</td>
<td>Sterlite Power Grid Ventures Ltd</td>
<td>07 July 2014</td>
<td>83.4</td>
</tr>
<tr>
<td>ADB, Goldman Sachs, Global Environment Fund</td>
<td>ReNew Wind Power Pvt Ltd</td>
<td>03 July 2014</td>
<td>140</td>
</tr>
<tr>
<td>ADB, DEG</td>
<td>Welspun Renewables</td>
<td>June 2014</td>
<td>85</td>
</tr>
<tr>
<td>IDFC</td>
<td>GMR Energy</td>
<td>24 Feb 2014</td>
<td>-</td>
</tr>
<tr>
<td>Consortium led by Deutsche Investitions, FE Clean Energy Group &amp; IFC</td>
<td>NSL Renewable Power Pvt Ltd</td>
<td>29 April 2013</td>
<td>60.0</td>
</tr>
<tr>
<td>Ascent Capital Advisors India Pvt Ltd, VenturEast, Draper Fisher Jurvetson Intl.</td>
<td>Bharat Light and Power Pvt Ltd</td>
<td>22 January 2013</td>
<td>18.6</td>
</tr>
<tr>
<td>GSPC Distribution Networks Ltd</td>
<td>Gujarat Gas Co Ltd</td>
<td>3 October 2012</td>
<td>674.2</td>
</tr>
<tr>
<td>Foundation Capital; Helion Venture Partners</td>
<td>Azure Power India Pvt Ltd</td>
<td>7 September 2012</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Notes: FDI - Foreign Direct Investment, PE - Private Equity, Thomson One Banker
POWER

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 expected 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.

Electricity demand forecast (TWh)

- FY07: 690.59 TWh
- FY15: 1174.07 TWh
- FY17E: 1348.4 TWh
- FY22E: 1894.7 TWh

CAGR: 7%

Source: International Energy Agency (IEA), CEA, Demand estimates based on IEA forecasts, TechSci Research
Notes: TWh - Terawatt Hour,
CAGR - Compounded Annual Growth Rate
E - Estimated
The government is targeting capacity addition of around 88.54 GW under the 12th (2012–17) and around 100 GW under the 13th (2017–22) Five-Year Plan.

The expected investments in the power sector during the 12th Plan (2012–17) is USD250 billion.

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

For ensuring transparency in the implementation of rural electrification programme, a new app will be launched by the Power Ministry namely GARV-II, which will provide real time data. Earlier the GARV mobile phone app would provide data for rural electrification for 18452 un-electrified villages only.

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

Source: Business Standard, Capacity addition estimates by CEA, TechSci Research
Notes: TWh - Terawatt-hour
The per-capita electricity consumption of India stood at 1000 KWh in FY15 lower than the global average of 2,803 KWh, representing huge potential for growth.

The addition of approximately 106 GW to the existing capacity is expected to boost GDP growth to 8 per cent by FY17.

The peak power requirement by the country in FY16 stood at 153 GW.

To meet the rising electricity demand, the Central Government plans to expedite market opportunity of US$ 14.94 billion for power transmission.
CURRENT TRENDS POINT TO OPPORTUNITIES ACROSS THE VALUE CHAIN

**Generation**
- **Adani Power**
- **Germac Energy and Sepco III (JV)**
- **Tata Power**
- **Reliance Power**

**T&D**
- **Power Grid Corporation of India Ltd (PGCIL)**

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- Estimated investment of USD6.6 billion for setting up 10,000 MW solar plant in Rajasthan
- In 2015, company with total capacity of 10.4 GW plans to increase capacity to 20 GW by 2020
- In Feb 2016, investment of ~USD1.53 billion was made for setting up 1,600 MW power plant in Jharkhand
- Coal-fired plant in Tamil Nadu; investment of USD1.3 billion
- Nuclear power ambition; studying entry strategy with minimum investment of USD3.0 billion
- Developing 3000 MW gas – based power plant in Bangladesh; investment of USD3 million in phases
- Developing a 6,000 MW solar park in Rajasthan by 2025
- Loan from ADB of USD600 million for development of high-voltage transmission system
- Plans to invest USD3.7 billion that would fuel its expansion plans
- Developing an integrated national grid, including strengthening of five regional grids; project investment is worth about USD16 billion
- Proposed an investment outlay of USD2.8 billion for setting up nine transmission corridors

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

**FEBRUARY 2017**


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RENEWABLE ENERGY IS FAST EMERGING AS A MAJOR SOURCE OF POWER

- As of October 2015, total installed power capacity from renewable energy sources (excluding Hydro power) was 36.5 GW. This accounts for 13.0 per cent of the total installed power capacity and forms 6.5 per cent of the total electricity mix.
- Wind energy is the largest source of renewable energy in India; it accounts for an estimated 64.77 per cent of total installed capacity (24.7 GW). There are plans to double wind power generation capacity to 20 GW by 2022.
- 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.
- Solar energy accounts for 12 per cent of total renewable energy installed capacity. The country’s true potential for solar power stands at an estimated 5,000 TWh per annum.
- Capacity addition of 30 GW is planned using various renewable energy technologies during the 12th Five-Year Plan. Wind Energy is estimated to contribute 15 GW, followed by solar power at 10 GW & the remaining by other sources.
- As of February 2017, low solar tariffs tendered in India at auction, is expected to catalyse green investments & help in reducing the dependency on fossils fuels.
- Mahindra Renewables, a wholly owned subsidiary of Mahindra Susten Pvt Ltd., was one from three companies, that quoted extremely low prices of US$ 0.044 in the 1st year, and US$ 0.049 averaged over 25 years, for solar power in the recent tariff-based auction of capacity in Madhya Pradesh.

Hydro power generation capacity in 2015 (GW)

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

Currently, the country has net installed capacity of 5.8 GW, using nuclear fuels, across 20 reactors. Of the 20 reactors, 18 are Pressurised Heavy Water Reactors (PHWR) and two are Boiling Water Reactors (BWR).

The government aims to quadruple India’s nuclear power generation capacity to 20 GW by 2020; currently, 3 nuclear power reactors of 5,780 MWe capacity are under construction.

Nuclear Power Corporation of India Limited (NPCIL) plans to construct 5 nuclear energy parks with a capacity of 10,000 Mwe.

The Kudankulam Atomic power project, Tamil Nadu, by NPCIL is expected to start operating by 2016-17 with an installed capacity of 1000 MW.

Unit II of Kudankulam plant has started functioning in May 2016 with an installed capacity of 1000 MW. The Kudankulam nuclear power plant’s 2nd unit attained criticality on 10th July, 2016.

As estimated by Nuclear Power Corporation of India, the plant would start generating 400 MW in 45 days, after attaining criticality.

FEBRUARY 2017
As on 31.03.2015, NTPC accounted for 16 per cent of the country’s capacity, though it contributed 25 per cent of total power generation.

As of June 6, 2016, the company had an installed capacity of 47.17 GW, and is aiming to attain a capacity of 128 GW by 2032.

As of 2016, 24 GW of additional capacity is under construction.

The company plans to set up an 800-MW advanced ultra supercritical plant, a first-of-its-kind in India.

In FY16, with an investment of USD2.37 billion, 2360 MW capacity has been approved for NP Kunta Ultra Mega Solar PV Project, Mandsaur Solar PV Project, Bhadla Solar PV Project and coal based project.
NTPC: A PUBLIC SECTOR SUCCESS … (2/3)

* NTPC has taken over and successfully turned around numerous sub-optimally performing stations
* High operational efficiency (indicated by plant load factor and availability factor) is NTPC’s trademark
* It is a pioneer in high-efficiency supercritical and ultra supercritical coal-bed power plants in India
* NTPC has formulated a business plan for capacity addition of around 1,000 MW through renewable resources by 2017
* As on 9 May 2016, NTPC commissioned 9 solar PV projects (Renewable energy projects) with an installed capacity of 310 MW.
* As on August 2015, the company had commissioned its first hydro project at Koldam
* In FY16, NTPC coal stations achieved highest PLF amongst Central, State and Private Sector, accounting for PLF value of 78.61 per cent
* In terms of PLF, top 3 power stations in the country belong to NTPC which includes Talcher Thermal - PLF 93.15 per cent, Singrauli - PLF 92.61 per cent and Talcher-Kaniha - PLF 90.95 per cent

Impact of NTPC takeover of sub-optimal plants (PLF)

<table>
<thead>
<tr>
<th>Plant</th>
<th>As of Acquisition</th>
<th>For March 31, 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Badarpur</td>
<td>32%</td>
<td>67%</td>
</tr>
<tr>
<td>Unchahar</td>
<td>18%</td>
<td>86%</td>
</tr>
<tr>
<td>Talcher</td>
<td>19%</td>
<td>95%</td>
</tr>
<tr>
<td>Tanda</td>
<td>15%</td>
<td>93%</td>
</tr>
</tbody>
</table>

Source: NTPC website, Annual Reports, TechSci Research
Notes: PLF - Plant Load Factor, MW - Megawatt
NTPC: A PUBLIC SECTOR SUCCESS … (3/3)

* Highest ever capacity addition of 43.05 GW during FY15. Average annual capacity addition of approximately 21 GW required till 2017

* 26 per cent of the existing capacity needs to be added by FY17 to achieve 8 per cent GDP growth

* As of 2016, the total installed power generation capacity of the company stood at 47.17 GW

* By March 2017, the state owned company is targeting to attain 50,000 MW installed power generation capacity

NTPC: Generation capacity over the years (GW)

Source: NTPC website, Annual Reports, Economic Times, TechSci Research
Notes: PLF - Plant Load Factor, GW – Gigawatt
⁽¹⁾Data is for April-August 2015
⁽²⁾Data as on 4th May 2016
During FY09–16, Tata Power’s revenues increased at a CAGR of 5.92 per cent, with the revenues for FY16 reaching to USD5.7 billion.

In FY16, the company has an installed generation capacity of 10.0GW 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 & wind stands at 1.2 GW.

The company is developing its first 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 & a hydro project in Bhutan in partnership with The Royal Government of Bhutan.

The company is eyeing the clean energy segment; it recently acquired stakes in 2 Australian companies in the sector in October 2014.

Tata Power’s defense engineering unit is planning to invest around USD83.3 million in Vemagal, Kolar district.

**Revenue (USD billion)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY09</td>
<td>3.81</td>
</tr>
<tr>
<td>FY10</td>
<td>4.04</td>
</tr>
<tr>
<td>FY11</td>
<td>4.26</td>
</tr>
<tr>
<td>FY12</td>
<td>5.55</td>
</tr>
<tr>
<td>FY13</td>
<td>6.08</td>
</tr>
<tr>
<td>FY14</td>
<td>5.91</td>
</tr>
<tr>
<td>FY15</td>
<td>5.5</td>
</tr>
<tr>
<td>FY16</td>
<td>5.7</td>
</tr>
</tbody>
</table>

**Source:** Company website, Annual Reports, Economic Times, TechSci Research

**Notes:** MW - Megawatt
The company estimates its installed capacity to expand fivefold in the next five 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 2014, the company acquired a 39.2 MW wind farm at Jamnagar in Gujarat and commissioned a 25-MW solar power project at Palaswadi in Maharashtra.

As of FY16, the company has an installed capacity of 9,183 MW.

In comparison to FY15, the company’s generation capacity increased by 5 per cent in FY16.

The company being first independent power producer in India has been awarded with OHSAS 18001:2007 certification for its wind operations.
RELIANCE POWER: ON A GROWTH TRAJECTORY … (1/2)

- Reliance Power has 6 GW of operational capacity & approximately 15 GW under implementation
- It won 3 of the 4 Ultra Mega Power Projects (UMPPs) awarded by Government of India so far. These 3 projects are located in Sasan (MP), Krishnapatnam (Andhra Pradesh) & Tilaiya (Jharkhand)
- Additional three units of 660 MW each at the 3,960 MW Sasan project were commissioned in FY14
- Sasan UMPP is the largest integrated power plant & 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 & 5,292 MW of hydroelectric capacity
- The company had ~12,000 MW capacity under implementation in FY16

Revenues and net profit (USD million)

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue</th>
<th>Net Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY10</td>
<td>4.37</td>
<td>144.22</td>
</tr>
<tr>
<td>FY11</td>
<td>231.21</td>
<td>166.69</td>
</tr>
<tr>
<td>FY12</td>
<td>340.72</td>
<td>184.29</td>
</tr>
<tr>
<td>FY13</td>
<td>907.12</td>
<td>186.24</td>
</tr>
<tr>
<td>FY14</td>
<td>848.07</td>
<td>170.32</td>
</tr>
<tr>
<td>FY15</td>
<td>1,136.82</td>
<td>170.59</td>
</tr>
<tr>
<td>FY16</td>
<td>1,630.02</td>
<td>208.06</td>
</tr>
</tbody>
</table>

Source: Reliance Power website, Annual Reports, TechSci Research
Notes: - Decline due to negative translation effect, MW – Megawatt, MTPA - Million Tonnes Per Annum

For updated information, please visit www.ibef.org
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).

As on September 2015, 3 Coal based projects with capacity 5,760 MW, 2 Solar projects with capacity 140 MW, 1 Wind and Coal blocks projects each with capacities 45 MW and 20 MTPA respectively have started production.

Generating capacity (billion units)

<table>
<thead>
<tr>
<th>Year</th>
<th>Generating Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY10</td>
<td>771.6</td>
</tr>
<tr>
<td>FY11</td>
<td>811.1</td>
</tr>
<tr>
<td>FY12</td>
<td>876</td>
</tr>
<tr>
<td>FY13</td>
<td>912</td>
</tr>
<tr>
<td>FY14</td>
<td>966</td>
</tr>
<tr>
<td>FY15</td>
<td>1048</td>
</tr>
</tbody>
</table>

Source: Reliance Power website, Corporate Presentation, Annual Reports, TechSci Research
Notes: MW - Megawatt, E - Estimate
POWER

USEFUL INFORMATION
Council of Power Utilities  
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

Hydro Power Association (India)  
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/

Bureau of Energy Efficiency (BEE)  
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/
Indian Wind Energy Association (INWEA)
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
- **M&A**: Merger and Acquisition
- **MW**: Megawatt
- **NBFC**: Non-Banking Financial Company
- **PE**: Private Equity
- **PLF**: Plant Load Factor
- **R&D**: Research and Development

For updated information, please visit [www.ibef.org](http://www.ibef.org)
GLOSSARY … (2/2)

* **R-APDRP**: Restructured Accelerated Power Development and Reform Programme

* **T&D**: Transmission and Distribution

* **TWh**: Terawatt-Hour

* **RGGVY**: Rajiv Gandhi Grameen Vidyutikaran Yojana

* **USD**: US Dollar

* Wherever applicable, numbers have been rounded off to the nearest whole number
### Exchange rates (Fiscal Year)

<table>
<thead>
<tr>
<th>Year</th>
<th>INR equivalent of one USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004–05</td>
<td>44.81</td>
</tr>
<tr>
<td>2005–06</td>
<td>44.14</td>
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<td>2006–07</td>
<td>45.14</td>
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<td>2007–08</td>
<td>40.27</td>
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<td>2008–09</td>
<td>46.14</td>
</tr>
<tr>
<td>2009–10</td>
<td>47.42</td>
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<tr>
<td>2010–11</td>
<td>45.62</td>
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<tr>
<td>2011–12</td>
<td>46.88</td>
</tr>
<tr>
<td>2012–13</td>
<td>54.31</td>
</tr>
<tr>
<td>2013–14</td>
<td>60.28</td>
</tr>
<tr>
<td>2014–15</td>
<td>61.06</td>
</tr>
<tr>
<td>2015–16</td>
<td>65.46</td>
</tr>
<tr>
<td>2016-2017E</td>
<td>67.23</td>
</tr>
</tbody>
</table>

### Exchange rates (Calendar Year)

<table>
<thead>
<tr>
<th>Year</th>
<th>INR equivalent of one USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>43.98</td>
</tr>
<tr>
<td>2006</td>
<td>45.18</td>
</tr>
<tr>
<td>2007</td>
<td>41.34</td>
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<td>2008</td>
<td>43.62</td>
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<td>2009</td>
<td>48.42</td>
</tr>
<tr>
<td>2010</td>
<td>45.72</td>
</tr>
<tr>
<td>2011</td>
<td>46.85</td>
</tr>
<tr>
<td>2012</td>
<td>53.46</td>
</tr>
<tr>
<td>2013</td>
<td>58.44</td>
</tr>
<tr>
<td>2014</td>
<td>61.03</td>
</tr>
<tr>
<td>2015</td>
<td>64.15</td>
</tr>
<tr>
<td>2016 (Expected)</td>
<td>67.22</td>
</tr>
</tbody>
</table>

Source: Reserve bank of India, Average for the year

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