EXECUTIVE SUMMARY

Third largest producer and fourth largest consumer globally

- With production of 1,278.91 TWh in 2015, India was the third largest producer and fourth largest consumer of electricity in the world. The country also has the fifth 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

- As of September 2016, the installed power capacity in the country reached 306.36 GW.
- 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.
POWER

ADVANTAGE INDIA
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 and increasing investments across the value chain
- Diversification into renewable sources increasing growth avenues

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

Advantage India

Higher investments

- Total FDI inflows in the power sector reached USD10.48 billion during April 2000 to March 2016, accounting for 3.63 per cent of total FDI inflows in India
- Investment for 7 new transmission systems that includes strengthening of national grid have been sanctioned

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
MARKET OVERVIEW AND TRENDS
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

For updated information, please visit www.ibef.org
INDIA AMONG TOP FOUR POWER PRODUCERS AND CONSUMERS

* With a production of 1,278.91 TWh, India is the third largest producer and the fourth 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         5682
US            4324
India         1368
Russia        1062
Japan         995
Germany       638
Canada        632
```

Source: Enerdata, TechSci Research,
Note: TWh - Terawatt Hours
Figures mentioned in the graph is as per latest data available
POWER

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)

<table>
<thead>
<tr>
<th>Year</th>
<th>BU</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>876.9</td>
</tr>
<tr>
<td>FY13</td>
<td>912.1</td>
</tr>
<tr>
<td>FY14</td>
<td>967.2</td>
</tr>
<tr>
<td>FY15</td>
<td>1048.7</td>
</tr>
<tr>
<td>FY16</td>
<td>1107.8</td>
</tr>
</tbody>
</table>

CAGR: 6.21%

Source: BP Statistical Review, Ministry of Power, TechSci Research; Notes: FY - Indian Financial Year (April-March), BU – Billion Unit
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 and 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.

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

<table>
<thead>
<tr>
<th>Source</th>
<th>Capacity</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>

\(^{(1)}\) - Data as on 30th September 2016

Source: Ministry of Coal, NHPC, Central Electricity Authority (CEA), Corporate Catalyst India, TechSci Research

Notes: MW - Megawatt, GW – Gigawatt
GENERATION CAPACITY HAS INCREASED AT A HEALTHY PACE … (1/2)

* Installed capacity increased steadily over the years, posting a CAGR of 8.7 per cent in FY09–16\(^{(1)}\)

**Installed electricity generation capacity (GW)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY07</td>
<td>132.3</td>
</tr>
<tr>
<td>FY08</td>
<td>143.1</td>
</tr>
<tr>
<td>FY09</td>
<td>148</td>
</tr>
<tr>
<td>FY10</td>
<td>159.4</td>
</tr>
<tr>
<td>FY11</td>
<td>173.6</td>
</tr>
<tr>
<td>FY12</td>
<td>199.9</td>
</tr>
<tr>
<td>FY13</td>
<td>223.3</td>
</tr>
<tr>
<td>FY14</td>
<td>237.7</td>
</tr>
<tr>
<td>FY15</td>
<td>272.5</td>
</tr>
<tr>
<td>FY16</td>
<td>280.3</td>
</tr>
</tbody>
</table>

Source: CEA (Central Electricity Authority), TechSci Research
Notes: GW – Gigawatt, CAGR - Compound Annual Growth Rate
\(^{(1)}\) - Data is for April-October 2015
Among the different sources of power in India, the CAGR in installed capacity over FY07–16\(^{(1)}\) was

* 10.6% for thermal power
* 21.3% for renewable energy, the fastest among all sources of power
* 2.4% for hydro power
* 4.5% for nuclear power

**Comparison of installed capacity (GW)**

Source: CEA, TechSci Research,  
Note: CAGR - Compound Annual Growth Rate  
\(^{(1)}\) – Data as on September 2016

### Comparison of installed capacity (GW)

<table>
<thead>
<tr>
<th>Source</th>
<th>End of 10th Plan</th>
<th>End of 11th Plan</th>
<th>FY16*</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>131.6</td>
<td>39</td>
<td>44.23</td>
</tr>
<tr>
<td>Renewable</td>
<td>213.22</td>
<td>43.11</td>
<td>3.9</td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
<td></td>
<td>4.8</td>
</tr>
</tbody>
</table>

**POWER**
<table>
<thead>
<tr>
<th>Company</th>
<th>Business description</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 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 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 10.0 GW in FY16. 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. 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, and generation and distribution of power. It owns and operates three 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 6.5 GW; it has drawn up a massive capacity expansion plan of adding 6.7 GW by 2017  
  • NHPC is constructing nine projects, aggregating an installed capacity of 4.2 GW. NHPC added 1.9 GW and 1.1 GW during the 10th and 11th Plan periods, respectively |

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

For updated information, please visit [www.ibef.org](http://www.ibef.org)
<table>
<thead>
<tr>
<th>Company</th>
<th>Business description</th>
</tr>
</thead>
</table>
| 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  | • 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  | • 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    | • Damodar Valley Corporation is engaged in power generation, distribution and transmission of electric power, irrigation and flood control |
| SJVN   | • SJVN Limited is the second largest hydro power company in India  
         • The company plans to diversify into wind power projects soon |
PORTERS 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
STRATEGIES ADOPTED
Control generation costs

- Companies are developing captive coal fields to reduce price volatility and 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 and decongest the rail network

Diversifying generation technologies

- Companies are using multiple-generation technologies based on a project’s requirement
- Companies such as NTPC and Reliance Power already have coal-fired, gas-fired and 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
- In 2015, Companies like Uttar Gujarat Vij Company, Tata Power and Essel have installed machine-to-machine (M2M) based smart metering systems in India
POWER

GROWTH DRIVERS
STRONG DEMAND AND POLICY SUPPORT DRIVING INVESTMENTS

Growing demand
- Increase in industrial activity
- Increasing penetration, per-capita consumption
- Growing middle class and 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 and private investment through competitive bidding

Increasing investments
- Rising FDI inflows: FDI of USD8547 million was made till FY15, which increased to USD10,476.15 million till March’16
- Growing M&A activity
- Large investments in equipment manufacture and power generation

Source: Corporate Catalyst India, Ministry of Power, TechSci Research,


For updated information, please visit www.ibef.org
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

* Consumption of electricity in industrial sector in India grew at a CAGR of 10.69 per cent during FY06-FY15

Share of electricity consumption in industrial sector

<table>
<thead>
<tr>
<th>Year</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY07</td>
<td>37.60%</td>
</tr>
<tr>
<td>FY08</td>
<td>37.70%</td>
</tr>
<tr>
<td>FY09</td>
<td>37.80%</td>
</tr>
<tr>
<td>FY10</td>
<td>38.60%</td>
</tr>
<tr>
<td>FY11</td>
<td>39.30%</td>
</tr>
<tr>
<td>FY12</td>
<td>44.90%</td>
</tr>
<tr>
<td>FY13</td>
<td>44.40%</td>
</tr>
<tr>
<td>FY14</td>
<td>43.80%</td>
</tr>
<tr>
<td>FY15</td>
<td>58%</td>
</tr>
<tr>
<td>FY16</td>
<td>44%</td>
</tr>
</tbody>
</table>

Source: TechSci Research, Ministry of Statistics and Program Implementation
Notes: TWh - Terawatt Hours, RGGVY - Rajiv Gandhi Grameen Vidyutikaran Yojana, CEA
82 GW of generation capacity is set to be added during FY11–FY15; future investments will benefit from strong demand fundamentals, policy support and 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 and 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
### POLICY SUPPORT AIDING GROWTH IN THE SECTOR

<table>
<thead>
<tr>
<th>Policy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electricity Act, 2003</strong></td>
</tr>
</tbody>
</table>
| • 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  
  • According to Union Budget 2015-16, five new UMPPs, each of 4000MW, have been proposed to setup in the plug- and – play mode |
| **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 USD $5.8 billion |
| **Fuel Supply Agreement** |
| • Fuel supply agreement with Coal India Ltd will ensure the availability of coal for power companies over the long term |

*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
POLICY SUPPORT AIDING GROWTH IN THE SECTOR

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
### POLICIES ADOPTED DURING BUDGET FY15 & FY16

**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 and 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**
- 100 per cent FDI is allowed under automatic route for power sector except atomic energy.
- 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 and use renewable energy resources in an eco-friendly and sustainable manner.

**Growing investments**
- The total plan outlay for the power sector for FY16 is estimated at USD10.05 billion.
- While the proportion of plan expenditure in the total outlay was 59 per cent in FY13, that for FY14 is a whopping 96 per cent.
- As per Union Budget, the total planned outlay for power sector for FY17 is estimated at USD11.18 billion, of which the amount of budgetary support for 8 major grouping of schemes is estimated at USD1.82 billion.

**Tax benefits**
- Benefit under section 35 (2AA) of the Income Tax Act to industry/private sponsored research programmers.
- Write – off can be availed for expenditure to be made on R&D to in-house R&D centres.
- 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*
# Power

## RECENT POLICIES ADOPTED

<table>
<thead>
<tr>
<th>Category</th>
<th>Policy Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinning Reserve</td>
<td>In order to meet the peak load shortages and grid stability, spinning reserves have been created.</td>
</tr>
<tr>
<td>Energy Conservation Campaign</td>
<td>Replacing nationwide street lights with LED lights&lt;br&gt;Plan to save 10 per cent energy that would light up 11 crore lives&lt;br&gt;Replacing 1 crore bulbs in Delhi within one year</td>
</tr>
<tr>
<td>National Mission on Enhanced Energy Efficiency</td>
<td>In August 2014, Government had launched the policy with an investment of USD128 million&lt;br&gt;Funds energy efficient electrical appliances</td>
</tr>
<tr>
<td>Power to the people</td>
<td>Implementation of Two schemes – Deen Dayal Upadhyay Gram Jayoti Yojana (DDUGJY) and Integrated Power Development Scheme (IPDS) for rural and urban areas&lt;br&gt;24/7 power for rural homes&lt;br&gt;Farmers will get power from a separate line&lt;br&gt;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>
</tbody>
</table>

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

* Power is one of the key sectors attracting FDI inflows into India

* FDI inflows into the sector increased from USD4627 million in FY07 to USD10,476.15 million in FY16

* Power sector accounted for 3.63 per cent of total inflows till March 2016

* Cumulative FDI inflows into the sector in April’00–March’16 were USD10.48 billion

* 100 per cent FDI in power sector has boosted FDI inflows in this sector.

FDI inflows into the power sector (USD million)

<table>
<thead>
<tr>
<th>Year</th>
<th>FDI Inflows (USD million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY10</td>
<td>4627</td>
</tr>
<tr>
<td>FY11</td>
<td>5900</td>
</tr>
<tr>
<td>FY12</td>
<td>7299</td>
</tr>
<tr>
<td>FY13</td>
<td>7834</td>
</tr>
<tr>
<td>FY14</td>
<td>8900</td>
</tr>
<tr>
<td>FY15</td>
<td>8547</td>
</tr>
<tr>
<td>FY16</td>
<td>10,476.15</td>
</tr>
</tbody>
</table>

Source: DIPP, TechSci Research
Note: FY16⁽¹⁾ – Data Till March 2016
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 and 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 and hydropower assets in India by means of Greenfield projects and 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 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 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

Notes: FDI - Foreign Direct Investment, PE - Private Equity, Thomson One Banker
## Increasing Investments: FDI Inflows and Key Deals … (3/3)

<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>
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<td>255</td>
</tr>
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<td>EIG Global Energy Partners</td>
<td>Greenko Group</td>
<td>October 2014</td>
<td>125</td>
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<td>Standard Chartered Private Equity Ltd</td>
<td>Sterlite Power Grid Ventures Ltd</td>
<td>07 July 2014</td>
<td>83.4</td>
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<td>ADB, Goldman Sachs, Global Environment Fund</td>
<td>ReNew Wind Power Pvt Ltd</td>
<td>03 July 2014</td>
<td>140</td>
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<td>ADB, DEG</td>
<td>Welspun Renewables</td>
<td>June 2014</td>
<td>85</td>
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<tr>
<td>IDFC</td>
<td>GMR Energy</td>
<td>24 Feb 2014</td>
<td>-</td>
</tr>
<tr>
<td>Consortium led by Deutsche Investititions, FE Clean Energy Group &amp; IFC</td>
<td>NSL Renewable Power Pvt Ltd</td>
<td>29 April 2013</td>
<td>60.0</td>
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<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>
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<td>GSPC Distribution Networks Ltd</td>
<td>Gujarat Gas Co Ltd</td>
<td>3 October 2012</td>
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<td>Foundation Capital; Helion Venture Partners</td>
<td>Azure Power India Pvt Ltd</td>
<td>7 September 2012</td>
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</tbody>
</table>

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

OPPORTUNITIES
**POWER**

**POWER GENERATION: OVERALL FUNDAMENTALS WILL REMAIN STRONG … (1/2)**

- 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 1000 KWh by FY15

![Electricity demand forecast (TWh)](chart)

- **Electricity demand forecast (TWh)**
  - FY07: 690.59 TWh
  - FY15: 1,174.07 TWh
  - FY17E: 1,348.4 TWh
  - FY22E: 1,894.7 TWh

**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 USD 250 billion.

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.

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

<table>
<thead>
<tr>
<th>Plan</th>
<th>Capacity Addition (GW)</th>
</tr>
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<tbody>
<tr>
<td>8th</td>
<td>16.42</td>
</tr>
<tr>
<td>9th</td>
<td>19.01</td>
</tr>
<tr>
<td>10th</td>
<td>21.13</td>
</tr>
<tr>
<td>11th</td>
<td>54.96</td>
</tr>
<tr>
<td>12th</td>
<td>88.54</td>
</tr>
<tr>
<td>13th</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Business Standard, Capacity addition estimates by CEA, TechSci Research
Notes: TWh - Terawatt-hour
INDIAN POWER SECTOR: MARKET WITH ENORMOUS GROWTH POTENTIAL

- Peak power requirement in FY14 stood at 136 GW; of which, a demand of 130 GW was met.
- 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 exploit the market opportunity of US$ 14.94 billion for power transmission.

Source: NTPC presentation, CEA, TechSci Research
Notes: KWh – Kilo Watt Hour, GW - Gigawatt Hour, (¹) – Provisional - Data is upto May 2016
CURRENT TRENDS POINT TO OPPORTUNITIES ACROSS THE VALUE CHAIN

- **Adani Power**
  - 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

- **Germac Energy and Sepco III (JV)**
  - Coal-fired plant in Tamil Nadu; investment of USD1.3 billion

- **Tata Power**
  - Nuclear power ambition; studying entry strategy with minimum investment of USD3.0 billion

- **Reliance Power**
  - 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

- **Power Grid Corporation of India Ltd (PGCIL)**
  - 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.


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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.

* India installed wind power capacity of 2.6 GW, accounting for total wind power capacity of 25.1 GW by end of 2015.

* Biomass is the second 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 and the remaining by other sources.

Hydro power generation capacity in 2015 (GW)

China: 296, Brazil: 91.7, US: 79.7, Canada: 79, Russia: 47.9, India: 422.7, Rest of World: 47

* India ranks sixth in the world

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, three nuclear power reactors of 5,780 MWe capacity are under construction.

Nuclear Power Corporation of India Limited (NPCIL) plans to construct five 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. As on November 2015, 98.56 per cent of the project was already completed.

Unit II of Kudankulam plant has started functioning in May 2016 with an installed capacity of 1000 MW. The Kudankulam nuclear power plant’s second 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.
POWER

SUCCESS STORIES
During FY09–15, NTPC’s sales increased at a CAGR of 6.3 per cent; CAGR in profits was 6.3 per cent during FY 09 - 13

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

During FY15, 1290 MW of power generation capacity was commissioned, while 2255 MW of capacity was commissioned during FY16

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 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)

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

- Capacity addition at a CAGR of 17.7 per cent during 1982–2015
- 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 2015, the company’s total installed power generation capacity stood at 45.05 GW
- 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)

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity (GW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY09</td>
<td>30.6</td>
</tr>
<tr>
<td>FY10</td>
<td>31.7</td>
</tr>
<tr>
<td>FY11</td>
<td>34.2</td>
</tr>
<tr>
<td>FY12</td>
<td>37.0</td>
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<tr>
<td>FY13</td>
<td>41.2</td>
</tr>
<tr>
<td>FY14</td>
<td>43.1</td>
</tr>
<tr>
<td>FY15</td>
<td>45.1</td>
</tr>
<tr>
<td>FY16</td>
<td>46.7</td>
</tr>
<tr>
<td>FY17</td>
<td>47.2</td>
</tr>
</tbody>
</table>

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 10.0 GW in India and is present in all segments of the 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 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, and 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 two Australian companies in the sector.

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

Source: Company website, Company Presentation, FY17 Estimates
Notes: MW - Megawatt, CAGR - Compounded Annual Growth Rate
Relevance Power has 6 GW of operational capacity and approximately 15 GW under implementation.

It won three of the four Ultra Mega Power Projects (UMPPs) awarded by the Government of India so far. These three projects are located in Sasan (Madhya Pradesh), Krishnapatnam (Andhra Pradesh), and 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 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.

The company had ~12,000 MW capacity under implementation in FY16.

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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>
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<tbody>
<tr>
<td>FY10</td>
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<td>FY12</td>
<td>876</td>
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<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
INDUSTRY ASSOCIATIONS … (1/2)

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.beenew.org/
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 … (1/2)

* 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
* **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)

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<th>Year</th>
<th>INR equivalent of one USD</th>
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<td>2005–06</td>
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<td>2015-16</td>
<td>65.46</td>
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<tr>
<td>2016-2017E</td>
<td>66.95</td>
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### Exchange rates (Calendar Year)

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<tr>
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<tbody>
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<td>2015</td>
<td>64.15</td>
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<tr>
<td>2016 (Expected)</td>
<td>67.22</td>
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Source: Reserve bank of India, Average for the year

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