Power Generation in India

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Agenda
~ About IPCL
~ Power Generation Scenario India
**India Power Corporation Ltd (IPCL)** is a customer-focused end-to-end energy solutions provider.

### IPCL Business Areas

#### Generation

- Presence in thermal and renewables segments
- 1,312 MW Thermal
- 105 MW Wind
- 36 MW Solar

#### Distribution

- One of the oldest Distribution Licensees in the country having expertise in efficiently managing distribution systems
- 205 MVA Licensee over 618 sq.km area, Asansol
- 350 MVA Franchisee over 1,630 sq.km, Gaya, Bihar

#### Services

- In partnership with Uniper, IPCL offers a wide range of services to power plants with focus on operational efficiency
- Plant O&M
- Asset monitoring
- Value added services
The Kanoria Foundation is primarily engaged in the business of Infrastructure Development.

- **Infrastructure Finance**: Financial Services Company with AUM of more than USD 7 Billion
- **Equipment Finance**: Major equipment financier, Pan India presence with more than 89 Office Locations
- **Power Sector**: Integrated Power Utility player with Generation Capacity of 1312 MW & More than 2 lacs customers serviced from its distribution network
- **Hospitality & Housing**: ISO 9001:2000 certified infrastructure development company
- **Media**: Business & Economics- Popular fortnightly business magazine offering realistic insights
- **Healthcare**: Suasth Healthcare India (Pvt) Limited is setting up a 400 bed ‘super specialty’ hospital at Navi Mumbai
- **Education**: IISD conducts several programs for skill improvement, entrepreneurship, management etc
- **Technology**: Software solution and services company providing comprehensive range of IT services
India Power - Span of Business

- **350 MVA** Distribution Franchisee, Gaya, Bihar
- **60 MW** Wind Plant, Rajasthan
- **29.8 MW** Wind Plant, Gujarat
- **12 MW** Thermal Plant, Dishergarh
- **36 MW** Solar Power Plant, Uttar Pradesh
- **205 MVA** Distribution Licensee, Asansol
- **2 MW** Solar Power Plant, Seebpore, West Bengal
- **5 MW** Wind Plant, Maharashtra
- **300 MW** Thermal Power Plant, Haldia, West Bengal
- **10.4 MW** Wind Plant, Karnataka
- **1,000 MW** Thermal Power Plant, Nellore, Andhra Pradesh

India Power Viz - Adding Power To Life
Generation Sector
~ Thermal
~ Renewable
~ Hydro
~ Gas
Evolution of Indian Power Sector

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

1956-1991 Nationalization Stage
- Generation and distribution of power under state ownership
- Continuation of State Electricity Boards
- Creation on Central Sector Power Utilities – NTPC, NHPC, NEEPCO, POWERGRID

1991-2003 Liberalization Era
- Private sector participation in generation
- Electricity Regulatory Commissions Act (1998) for establishing Central and State Electricity Regulatory Commissions and rationalisation of tariffs

2003 Onwards Growth Era
- Electricity Act (2003)
- New renewable energy policy
- Promotion of 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) for improving the health of state distribution utilities
- National Tariff Policy (2016) with focus on renewable energy resources

Source: IBEF Report
Power demand in the country is set to grow

Per Capita Electricity Consumption

Electrification Status of Households

India needs to catch up on per capita electricity consumption

Around 15% of Total Households still need access to electricity to be electrified.-(As of Oct’17)

Growth in Energy Demand Across Sectors

Note: India’s figures is for 2015-16
- Significant capacity addition after Electricity Act 2003
- Private sector participation has been phenomenal
- Majority coal based thermal power plants
- Renewable capacity has shown significant growth due to supportive policies
- However, electrification yet to cover all households

Source: IEEFA Estimates, CEA Data
### Vision ‘24x7’ Power for All’
Affordable and quality power for all by March 2019

### Direct Benefit Transfer (DBT) Scheme
Direct Transfer of electricity subsidy

### National Mission on Enhanced Energy Efficiency
Funds energy efficient electrical appliances

### Ultra Mega Power Projects (UMPPs)
Ease of land possession, tariff based competitive bidding

### Ujwal Discoms Assurance Yojana (UDAY)
Reduction in losses and improvement in State Utilities Financials

### Boost to manufacturing
Manufacture of Solar Power Equipment in India

### Green Energy Corridor Project
Dedicated Power Transmission Corridor for renewable project

### Boost to Renewable Energy
No Environment Clearance for Solar, RPO Obligations, Aggressive Target for Capacity Addition

### Saubhagya Scheme
Electricity Access to 40 Million families by Dec’18

### Power to the people (DDUGJY,IPDS)
Reduction in losses and improving electrification

### UJALA Scheme
Distribution of energy efficient LED bulbs

### National Tariff Policy (2016)
Power Purchase through competitive bidding

### Power Purchase Platform
For Medium Term 2500 MW of Electricity

### Coal Reforms
Commercial Mining, GCV based pricing, Mine Auction

### Government Initiatives for Improving the Power Generation Sector
India is likely to attract a massive investment of Rs 11,55,652 Crore or USD 18 Billion in power generation sector in the five-year period between 2017 and 2022 in setting up projects across thermal, hydro, nuclear and renewable segment and close to USD 40 Billion between 2017 and 2017.

Source: NEP, CEA Data
While PLF of thermal IPPs is already below 60%, over 45 GW of coal based capacity continues to be under development.

Low PLF has resulted in both financial and operational distress for such plants. Large scale renewable addition is aggravating PLF for such plants.

Based on underlying demand drivers and policy actions (Power for All, manufacturing focus, Electric Vehicles etc.), we believe market would have supply deficit in medium term.

Government Initiatives For Thermal Generation Sector

Compliance to Environmental Norms by 2022
• Requirement of retrofitting and implementation pollution control equipments in plants e.g FGD (Flue Gas Desulphurization) SCR (Selective Catalytic Reduction), ESP (Electrostatic Precipitator)

Renovation & Modernization Program for Aging Plants
• 30 GW of thermal capacity have been identified for R&M/LE program for FY 2012-17. R&M works for 7.2 GW has already been completed.
• Further 15 GW of capacity have been identified for R&M/LE Works in FY 2017-22

SHAKTI
• Policy for auction and allocation of coal linkages for plants with PPA and without PPA

Coal Reforms
• Introduction of commercial coal mining to reduce imports
• Pricing of non coking coal based on GCV value
• Emphasis on reduction of grade slippage in coal supply
• Coal Swapping & rationalization of coal linkages

Integrated Approach towards strengthening the sector

Source: Draft NEP-Generation, CEA, Jan 2018
Thermal Capacity Plans for Future

Net Capacity Addition (MW) – Coal Fired Plants

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross Thermal Capacity Addition (MW)</th>
<th>Closures (MW)</th>
<th>Net Thermal Capacity Addition (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>19927</td>
<td>104</td>
<td>18893</td>
</tr>
<tr>
<td>2014</td>
<td>16725</td>
<td>42</td>
<td>16683</td>
</tr>
<tr>
<td>2015</td>
<td>20643</td>
<td>188</td>
<td>19961</td>
</tr>
<tr>
<td>2016</td>
<td>21777</td>
<td>883</td>
<td>20960</td>
</tr>
<tr>
<td>2017</td>
<td>7655</td>
<td>-3896</td>
<td>-3241</td>
</tr>
<tr>
<td>2018 Est</td>
<td>5750</td>
<td>-2500</td>
<td>3250</td>
</tr>
<tr>
<td>2019 Est</td>
<td>5500</td>
<td>-2500</td>
<td>3000</td>
</tr>
<tr>
<td>2020 Est</td>
<td>5500</td>
<td>-2500</td>
<td>3000</td>
</tr>
</tbody>
</table>

Capacity Addition Plan (MW) - As per Technology Type

<table>
<thead>
<tr>
<th>Technology Type</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>Total</th>
<th>% Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subcritical</td>
<td>4,970</td>
<td>650</td>
<td></td>
<td></td>
<td></td>
<td>5,620</td>
<td>12.94%</td>
</tr>
<tr>
<td>Supercritical</td>
<td>10,403</td>
<td>15,640</td>
<td>4,100</td>
<td>2,920</td>
<td>1,320</td>
<td>34,383</td>
<td>79.19%</td>
</tr>
<tr>
<td>Ultra super critical</td>
<td>1,320</td>
<td></td>
<td>1,320</td>
<td></td>
<td></td>
<td>1,320</td>
<td>3.04%</td>
</tr>
<tr>
<td>Others</td>
<td>420</td>
<td>1,150</td>
<td>525</td>
<td></td>
<td>2,095</td>
<td>2,095</td>
<td>4.83%</td>
</tr>
<tr>
<td>Grand Total</td>
<td>17,390</td>
<td>18,308</td>
<td>7,859</td>
<td>6,090</td>
<td>3,866</td>
<td>43,418</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Renewable Generation: Increasing Contribution In Generation Mix

Indian Renewable Generation Sector is witnessing rapid growth aided by both policy incentives and private participation.

Renewables generation to grow backed by environmental concerns and focus on green power.

Government Targets for Expansion

<table>
<thead>
<tr>
<th>Source</th>
<th>Total Installed Capacity (MW)*</th>
<th>2022 target (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solar power</td>
<td>18,455</td>
<td>1,00,000</td>
</tr>
<tr>
<td>Wind power</td>
<td>32,877</td>
<td>~60,000</td>
</tr>
<tr>
<td>Bio-energy</td>
<td>8,527</td>
<td>~10,000</td>
</tr>
</tbody>
</table>

*As on 31 Jan’18.

Solar and Wind Tariffs cheaper than ever

Indian Renewable Generation Sector is witnessing rapid growth.
Renewable Energy Potential & Government Initiatives

Potential vs Installed Capacity for Renewables

- Solar: 750
- Wind: 102
- Bio-Mass: 25
- Small Hydro: 20

Policies & Initiatives for Renewable Sector

- Repowering Policy for Wind Sector
- Wind-Solar Hybrid Policy
- Renewables Purchase Obligations (RPOs)
- Scheme for development of solar Parks
- Aggressive Target of 175 GW of renewable by 2022
- Development of Green Corridor for power evacuation

Source: IBEF Report Mar’18
A Hydro Electric Project has a long useful life extending to well over 50 years and helps in conserving scarce fossil fuels. Hydro power stations have the inherent ability for instantaneous starting, stopping and managing load variability which helps in improving reliability of the power system which makes them very significant for managing the integration of renewable.

### Trend in Hydro Power Capacity Addition

<table>
<thead>
<tr>
<th>Year</th>
<th>Under Operation</th>
<th>Under Construction</th>
<th>Under Approval Stage</th>
<th>Yet to be Explored</th>
<th>Total Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2004</td>
<td>44,4784</td>
<td></td>
<td></td>
<td></td>
<td>241,844</td>
</tr>
<tr>
<td>FY 2005</td>
<td>11,9285</td>
<td></td>
<td></td>
<td>61,352</td>
<td></td>
</tr>
<tr>
<td>FY 2006</td>
<td></td>
<td></td>
<td></td>
<td>124,0851</td>
<td></td>
</tr>
</tbody>
</table>

### Region Wise Hydro Power Capacity Development

- **Northern**: 45%
- **Western**: 33%
- **North Eastern**: 11%
- **Southern**: 10%
- **Eastern**: 1%

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*Graphs and data sourced from various reports and statistical publications.*
**Government Initiatives for Hydro Power**

<table>
<thead>
<tr>
<th>National Electricity Policy, 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Emphasis on full development of feasible hydro potential in North Eastern and Northern States</td>
</tr>
<tr>
<td>- Debt Financing for Longer Tenure recommended, Full Support from Central Government</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hydro Power Policy-2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Transparent Selection Criteria for private developers</td>
</tr>
<tr>
<td>- Provision of merchant sale of upto 40% of saleable energy to recover costs</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Tariff Policy 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Cost Plus Tariff Regime for HEP</td>
</tr>
<tr>
<td>- Promotion of HEP f, No obligation of RPO</td>
</tr>
<tr>
<td>- Certainty of long term PPA (60%), balance as merchant sales</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fair Compensation-Land Acquisition</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Increasing participation from locals in land acquisition</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Time bound appraisal of DPRs by CEA</td>
</tr>
<tr>
<td>- Proactive Monitoring of projects</td>
</tr>
<tr>
<td>- Collaboration to remove infrastructural issues</td>
</tr>
</tbody>
</table>
Gas Based Power Capacity In India

Importance of Gas Based Power Plants

Grid Balancing-Renewable Integration
Meet Peak Demand & Quick Ramping Requirement
Less Environmental Impact

Gas Based Capacity Addition (MW) & PLF (%)

Demand Supply Scenario for Gas

Optimisation studies indicate that for integrating renewable of 175 GW by 2021-22, PLF of gas based capacity during 2021-22 is likely to be around 37% compared to around 22% at present. The gas requirement is of the order of about 45.27 MMSCMD.

To achieve success in gas based generation-primary need is to have reliable and low cost gas supply

Source: Draft NEP-Generation, CEA, Jan 2018
Government Initiatives for increasing gas supply

- Encouraging import of gas in the form of Liquefied Natural Gas (LNG)
- Efforts for import of gas through international pipelines projects
- Introduction of scheme for utilization of gas based generation capacity
- Formulation of Hydrocarbon Exploration & Licensing Policy (HELP)
- Policy for marketing freedom for gas from deepwater areas
- Augmentation of production from existing fields under New Exploration Licensing Policy

Source: Draft NEP-Generation, CEA, Jan 2018