History, Evolution and Institutional Structure of the Indian Power Sector: Pre & Post Reform era

MOHAN MENON
PRESENTATION OUTLINE

• HISTORY AND EVOLUTION OF THE INDIAN POWER SECTOR
• INSTITUTIONAL STRUCTURE
• DEVELOPMENTS IN THE ELECTRICITY SECTOR VALUE CHAIN
• TRANSITION FROM VERTICALLY INTEGRATED TO COMPETITIVE POWER MARKET
• GROWTH OF RENEWABLE ENERGY
HISTORY AND EVOLUTION OF THE INDIAN POWER SECTOR
HISTORY AND EVOLUTION OF THE INDIAN POWER SECTOR

1910 - Electricity Act 1910 enacted to regulate supply by licensees to consumers

1948 - Electricity (Supply) Act 1948 (ES Act) - Formation of State Electricity Boards with full powers to control generation, distribution and utilization of electricity within their respective states and Central Electricity Authority for planning and development of power system

1964 - Five Regional Electricity Boards (REBs) were formed by the Government of India with the concurrence of State Governments with a view to ensure integrated grid operation and regional cooperation on power

1975 - Creation of Central Generating Companies for development of super thermal power stations at coal pit heads and large hydroelectric stations leading to creation of NTPC, NHPC, & NEEPCO

1991 - ES Act 1948 amended to pave the way for the formation of private Generating companies. CEA empowered to fix the norms for determining the tariff of all generating companies. RBI allows 100% foreign investment in power sector
1992 - First Gazette Notifications on the criteria for fixing the tariff for sale of electricity by the Generating companies to SEBs or any other agency

1998 - Electricity Regulatory Commission Act 1998 enacted paving the way for the formation of Central Electricity Regulatory Commission (CERC) and State Electricity Regulatory Commissions (SERC). Regulatory power of the State governments transferred to SERC. Consequently, Tariff regulatory function of CEA transferred to CERC

1998 - Act amended to provide for Central Transmission Utility (CTU) and State Transmission Utilities (STU)

1999 - Privatisation of distribution in Odisha

2000 - Indian Electricity Grid Code (IEGC)

2002 - Privatisation of distribution in Delhi
2002 - Availability Based Tariff
2004 - Open Access Regulations
2006 - Tariff Policy, Competitive bidding for procurement of power, Ultra Mega Power Projects
2007, 08 - Power Exchange guidelines and establishment
2008 - Allotment of Coal Blocks to power generators for captive mining
2011 - Competitive bidding for ownership and establishment of inter-State transmission schemes
2015 - Auction of Coal Blocks to power generators for captive mining
INSTITUTIONAL STRUCTURE
INSTITUTIONAL STRUCTURE

• Federal Structure
• ‘Power’ is in the Concurrent List of the Indian Constitution
• Regional Load Despatch Centres RLDCs (Regional system operator) : Apex bodies in regional grid operation; Supervise and control operation of inter-regional and inter-state transmission systems
• RLDCs can give directions to intra-state utilities for security of the grid
• State Load Despatch Centres SLDCs (State-level system operator) : To supervise and control State power transmission systems
INSTITUTIONAL STRUCTURE (CONTD.)

- **Generation**
  - State Gencos
  - CPSUs
  - IPPs
  - Captive Plants

- **Transmission**
  - STUs
  - PGCIL
  - Private Utilities

- **Distribution**
  - Discoms / Franchisees / Private Licensees

- **Consumption**
  - Agricultural
  - Domestic
  - Commercial
  - Industrial
  - Others

- **Power Trading Companies and Power Exchanges**

- **Open Access**

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INSTITUTIONAL STRUCTURE (CONTD.)

Central Sector Companies
- Generating Utilities: NTPC, NHPC, NEEPCO, NPCIL
- Transmission Utility: POWERGRID
- System Operations: NLDC, RLDCs
- Finance: PFC, REC, IREDA

Authorities
- CEA, RPCs,
- CPRI, NPTI, PSTI,

R&D

Central Govt

State Govt.

Trading Co.
- PTC India
- NVVNL

State Sector
- Generation
- Transmission
- Distribution

SLDC

UMPPs

IPTCs

Appellate Tribunal

CERC

SERC

IPPs
DEVELOPMENTS IN THE ELECTRICITY SECTOR VALUE CHAIN
DEVELOPMENTS IN THE ELECTRICITY SECTOR VALUE CHAIN
DEVELOPMENTS IN THE VALUE CHAIN (CONTD.)

Power Generation Capacity - Fuel-wise

- Coal: 175238 MW (61%)
- Gas: 24508 MW (9%)
- Diesel: 994 MW (0.3%)
- Nuclear: 5780 MW (2%)
- Hydro: 42663 MW (15%)
- RES: 38821 MW (13%)

Graph showing the power generation capacity by fuel type.
DEVELOPMENTS IN THE VALUE CHAIN (CONTD.)

Dropping share of Hydro capacity in India
### Volume of Short-term Transactions with respect to Total Electricity Generation

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Volume of Short-term Transactions of Electricity</th>
<th>Total Electricity Generation (BU)</th>
<th>Total volume of Short-term Transactions of Electricity as % of Total Electricity Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-10</td>
<td>65.90</td>
<td>764.03</td>
<td>9%</td>
</tr>
<tr>
<td>2010-11</td>
<td>81.56</td>
<td>809.45</td>
<td>10%</td>
</tr>
<tr>
<td>2011-12</td>
<td>94.51</td>
<td>874.17</td>
<td>11%</td>
</tr>
<tr>
<td>2012-13</td>
<td>98.94</td>
<td>907.49</td>
<td>11%</td>
</tr>
<tr>
<td>2013-14</td>
<td>104.64</td>
<td>962.90</td>
<td>11%</td>
</tr>
<tr>
<td>2014-15</td>
<td>98.99</td>
<td>1045.0</td>
<td>9%</td>
</tr>
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</table>
TRANSITION FROM VERTICALLY INTEGRATED TO COMPETITIVE POWER MARKET
## Transition from Vertically Integrated to Competitive Power Market

Increasing Private Sector contribution in Installed Capacity addition (in MW)

<table>
<thead>
<tr>
<th>Period</th>
<th>Sector</th>
<th>Coal</th>
<th>Gas</th>
<th>Hydro</th>
<th>Nuclear</th>
<th>Total</th>
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<tbody>
<tr>
<td><strong>2012 - 2015</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>10461</td>
<td>767</td>
<td>2424</td>
<td>1000</td>
<td></td>
<td>14562</td>
</tr>
<tr>
<td>State</td>
<td>12560</td>
<td>2009</td>
<td>672</td>
<td>0</td>
<td></td>
<td>15241</td>
</tr>
<tr>
<td>Private</td>
<td>42464</td>
<td>1583</td>
<td>595</td>
<td>0</td>
<td></td>
<td>44642</td>
</tr>
<tr>
<td>Total</td>
<td>65485</td>
<td>4359</td>
<td>3691</td>
<td>1000</td>
<td></td>
<td>74535</td>
</tr>
<tr>
<td><strong>2007 - 2012</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>12050</td>
<td>740</td>
<td>1550</td>
<td>880</td>
<td></td>
<td>15220</td>
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<tr>
<td>State</td>
<td>12145</td>
<td>1885</td>
<td>2702</td>
<td>0</td>
<td></td>
<td>16732</td>
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<tr>
<td>Private</td>
<td>19189</td>
<td>2531</td>
<td>1292</td>
<td>0</td>
<td></td>
<td>23012</td>
</tr>
<tr>
<td>Total</td>
<td>43384</td>
<td>5156</td>
<td>5544</td>
<td>880</td>
<td></td>
<td>54964</td>
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</table>
TRANSITION TO COMPETITIVE POWER MARKET (CONTD.)

Demand – Supply gaps 2008 – 15
Total Energy and Peak Demand

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Energy</th>
<th>Peak Demand</th>
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<tbody>
<tr>
<td>2008-09</td>
<td>-11.10%</td>
<td>-14.00%</td>
</tr>
<tr>
<td>2009-10</td>
<td>-10.10%</td>
<td>-12.00%</td>
</tr>
<tr>
<td>2010-11</td>
<td>-8.50%</td>
<td>-9.00%</td>
</tr>
<tr>
<td>2011-12</td>
<td>-8.50%</td>
<td>-9.00%</td>
</tr>
<tr>
<td>2012-13</td>
<td>-8.71%</td>
<td>-9.00%</td>
</tr>
<tr>
<td>2013-14</td>
<td>-4.23%</td>
<td>-4.49%</td>
</tr>
<tr>
<td>2014-15</td>
<td>-3.60%</td>
<td>-4.70%</td>
</tr>
</tbody>
</table>
GROWTH OF RENEWABLE ENERGY
GROWTH OF RENEWABLE ENERGY

![Graph showing growth of renewable energy capacity in GW from 2002 to 2022. The bars represent different energy sources: Wind, Small Hydro, Biomass, and Solar. The capacity has significantly increased from 3.5 GW in 2002 to 175 GW in 2022.](image-url)
GROWTH OF RENEWABLE ENERGY (CONTD.)

India – Solar capacity addition path
## GROWTH OF RENEWABLE ENERGY (CONTD.)

### Solar capacity addition programme

<table>
<thead>
<tr>
<th>Year</th>
<th>Rooftop</th>
<th>Ground Mounted Solar Power Projects</th>
<th>Total (in MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>200</td>
<td>1,800</td>
<td>2,000</td>
</tr>
<tr>
<td>2016-17</td>
<td>4,800</td>
<td>7,200</td>
<td>12,000</td>
</tr>
<tr>
<td>2017-18</td>
<td>5,000</td>
<td>10,000</td>
<td>15,000</td>
</tr>
<tr>
<td>2018-19</td>
<td>6,000</td>
<td>10,000</td>
<td>16,000</td>
</tr>
<tr>
<td>2019-20</td>
<td>7,000</td>
<td>10,000</td>
<td>17,000</td>
</tr>
<tr>
<td>2020-21</td>
<td>8,000</td>
<td>9,500</td>
<td>17,500</td>
</tr>
<tr>
<td>2021-22</td>
<td>9,000</td>
<td>8,500</td>
<td>17,500</td>
</tr>
<tr>
<td>Total</td>
<td>40,000</td>
<td>57,000</td>
<td>97,000 *</td>
</tr>
</tbody>
</table>

*3,743 MW commissioned upto 31.03.2015*
GROWTH OF RENEWABLE ENERGY (CONTD.)

Falling prices of Solar power in India
Progress of wind power in India
THANK YOU