INDIAN POWER SECTOR
AN OVER-VIEW

NEERJA MATHUR
CHIEF ENGINEER, PLANNING
CENTRAL ELECTRICITY AUTHORITY
November 2011
• India - poised for an economic and Industrial revolution. Power Industry an important Infrastructural arm of Indian economy

• Electricity Act 2003 and Policies of the Government created conducive environment for growth of Power Sector commensurate with economy

• Need of the hour – Strategic planning of energy resources for sustainable development over long time horizon
EVOLUTION OF POWER SECTOR

- Installed Capacity – from 1362 MW in ’47 at the time of Independence to 1,82,689 MW on 31/10/11

- Gross Electricity Generation – from 4073 MU in ’47 to 789,013 MU ON 31/3/11

- Per capita consumption – from 16.3 Units in ’47 to 813.5 Units in 2010-11

- All India PLF of thermal stations – from 52.4 % in ’5-86 to 76.8% in 2010-11
GROWTH OF INSTALLED CAPACITY

IC in MW

Years

31.12.47 1362
31.12.50 1713
31.3.56 2813
31.3.61 5063
31.3.66 9583
31.3.69 13703
31.3.74 18282
31.3.79 28484
31.3.80 30283
31.3.85 42710
31.3.90 64112
31.3.92 69915
31.3.97 86337
31.3.02 105456
31.3.07 132329
31.3.11 182689

31.1.47 0
31.1.50 20000
31.3.56 40000
31.3.61 60000
31.3.66 80000
31.3.69 100000
31.3.74 120000
31.3.79 140000
31.3.80 160000
31.3.85 180000
31.3.90 200000
GROWTH OF PER CAPITA CONSUMPTION

Year

KWh

31.12.50 31.03.56 31.03.61 31.03.66 31.03.69 31.03.74 31.03.79 31.03.85 31.03.90 31.03.92 31.03.97 31.03.2002 31.03.2007 31.03.2008 31.03.2009 31.03.2010* 31.03.2011*

18.2 30.9 45.9 73.9 97.9 126.2 171.6 172.4 228.7 329.2 347.5 464.6 599.2 671.9 717.1 733.5 778.7 813.5
ALL INDIA PLANT LOAD FACTOR (%) OF COAL FIRED THERMAL POWER STATIONS

YEARS


PLF (%)

53 55.3 57.1 61 60 63 64.4 64.7 64.6 67.3 69 69.9 72.2 72.7 74.8 74.3 77.03 78.61 77.7 77.48 76.8
Installed Capacity as on 31.10.2011
(Type Wise)

- Hydro: 38706 MW (21%)
- Coal: 100098 MW (55%)
- RES: 20162 MW (11%)
- Nuclear: 4780 MW (2%)
- Gas: 17742 MW (10%)
- Diesel: 1200 MW (1%)

Installed Capacity = 1,82,689 MW
<table>
<thead>
<tr>
<th></th>
<th>11&lt;sup&gt;th&lt;/sup&gt; plan end (expected)</th>
<th>12&lt;sup&gt;th&lt;/sup&gt; plan Additions (Likely)</th>
<th>12&lt;sup&gt;th&lt;/sup&gt; plan end (expected)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inter regional capacity (MW)</td>
<td>25,650</td>
<td>37,800</td>
<td>63,450</td>
</tr>
<tr>
<td>HVDC capacity (bipole/BTB)(MW)</td>
<td>13,500</td>
<td>13,000</td>
<td>26,500</td>
</tr>
<tr>
<td>Transmission lines (Ckm)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HVDC Bipole 765 KV</td>
<td>9452 4164</td>
<td>9440 27,000</td>
<td>18,892 31,164</td>
</tr>
<tr>
<td>Total- lines all levels (ckm)</td>
<td>2,69,571</td>
<td>1,09,440</td>
<td>3,79,011</td>
</tr>
<tr>
<td>Substation (MVA) (AC+HVDC)</td>
<td>3,72,894</td>
<td>2,70,000</td>
<td>6,42,894</td>
</tr>
<tr>
<td>Period</td>
<td>Peak Demand (MW)</td>
<td>Peak Met (MW)</td>
<td>Peak Deficit/Surplus (MW)</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
<td>---------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>2007-08</td>
<td>108866</td>
<td>90793</td>
<td>-18073</td>
</tr>
<tr>
<td>2008-09</td>
<td>109809</td>
<td>96785</td>
<td>-13024</td>
</tr>
<tr>
<td>2009-10</td>
<td>119,166</td>
<td>104,009</td>
<td>-15,157</td>
</tr>
<tr>
<td>2010-11</td>
<td>122,287</td>
<td>110,256</td>
<td>-12,031</td>
</tr>
</tbody>
</table>
### Power Supply Position
(April, 2011 - Oct., 2011)

<table>
<thead>
<tr>
<th>Region</th>
<th>Peak Demand (MW)</th>
<th>Peak Met (MW)</th>
<th>Surplus/Deficit (MW)</th>
<th>Surplus/Deficit (%)</th>
<th>Energy Requirement (MU)</th>
<th>Energy Availability (MU)</th>
<th>Surplus/Deficit (MU)</th>
<th>Surplus/Deficit (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>40248</td>
<td>37117</td>
<td>-3131</td>
<td>-7.8</td>
<td>164922</td>
<td>155486</td>
<td>-9436</td>
<td>-5.7</td>
</tr>
<tr>
<td>Western</td>
<td>42042</td>
<td>36007</td>
<td>-6035</td>
<td>-14.4</td>
<td>156328</td>
<td>142314</td>
<td>-14014</td>
<td>-9.0</td>
</tr>
<tr>
<td>Southern</td>
<td>33937</td>
<td>31489</td>
<td>-2448</td>
<td>-7.2</td>
<td>147438</td>
<td>138887</td>
<td>-8551</td>
<td>-5.8</td>
</tr>
<tr>
<td>Eastern</td>
<td>14505</td>
<td>13971</td>
<td>-534</td>
<td>-3.7</td>
<td>57944</td>
<td>55509</td>
<td>-2435</td>
<td>-4.2</td>
</tr>
<tr>
<td>N-Eastern</td>
<td>1920</td>
<td>1782</td>
<td>-138</td>
<td>-7.2</td>
<td>6700</td>
<td>6069</td>
<td>-631</td>
<td>-9.4</td>
</tr>
<tr>
<td>All India</td>
<td>128907</td>
<td>114233</td>
<td>-14674</td>
<td>-11.4</td>
<td>533332</td>
<td>498265</td>
<td>-35067</td>
<td>-6.6</td>
</tr>
</tbody>
</table>
MAJOR LEGISLATIVE/POLICY INITIATIVES BY GOVERNMENT

• Electricity Regulatory Commission Act, 1998
• Energy Conservation Act 2001
• Electricity Act, 2003

➢ REFORM INITIATIVES
• Guidelines for procurement of electricity
• National Electricity Policy
• National Tariff Policy
• Rural electrification policy
# Capacity addition during 11th Plan

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity addition target during 11th Plan</td>
<td>78,700</td>
</tr>
<tr>
<td>Capacity addition likely as per MTA</td>
<td>62,374</td>
</tr>
<tr>
<td>Capacity addition likely as per latest assessment</td>
<td>52,895</td>
</tr>
<tr>
<td>Capacity Commissioned during 11th Plan (as on 15.11.2011)</td>
<td>44,548</td>
</tr>
<tr>
<td>(Hydro - 5260 MW, Thermal - 38,408 MW, Nuclear - 880 MW)</td>
<td></td>
</tr>
<tr>
<td>(Private Sector - 17,428 MW, State Sector - 14,510 MW, Central Sector -</td>
<td></td>
</tr>
<tr>
<td>12,610 MW)</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

- Capacity addition during Nov, 2011 till 15.11.2011: 2,585 MW
- Capacity addition from Renewable during 11th Plan till 31.03.2011: 9,717 MW
- Captive Capacity commissioned during 11th Plan till 28.02.2011: 8,186 MW
GENERATION PLANNING FOR 12th & 13th Plan

- Capacity required to meet the demand
- Planning Norms as per CERC Notification
- Generation Planning for 12th & 13th Plan

Corresponding to:

- LOLP (Loss of Load Probability) of 0.2 %
- Energy Not Served (ENS)-0.05%
Low Carbon Growth Strategy

- Highest priority to setting up of Hydro and Nuclear power plants.

- Gas based plants to be accorded higher priority as compared to coal/lignite plants, to the extent feasible.

- Capacity Addition from Conventional fuel based plants complemented by Renewable Energy based plants to the maximum extent possible.

- Efficiency improvement of existing stations, R&M of Old thermal power projects, and retirement of less efficient plants/old and small size generating units.
Low Carbon Growth Strategy

- Energy Conservation in generation and at consumer end.
- Other measures to reduce pollution i.e. Reduction in T&D losses, Coal quality improvement.
- Introduction of Clean Coal Technologies (Supercritical Technology, Ultra supercritical technology, IGCC etc).
- Formation of Strong National Grid
PLANNING CAPACITY ADDITION - 12th / 13th PLAN AND BEYOND

12TH PLAN
- Report of Working Group on Power for 12th Plan expected shortly. Likely requirement of capacity addition during 12th Plan - about 80,000 MW. (RES – 18,500 MW; 55% Capacity - Private Sector; 40% - coal based supercritical technology
- Target of energy saving through DSM and Energy Efficiency measures about 60 BU at busbar, avoided peaking capacity about 12,000 MW.

13TH PLAN
- To meet the demand in Full- Likely capacity addition required during 13th Plan would be around one Lakh MW.
- Policy Options to make supercritical units mandatory beyond 12th Plan
  - Issue of advisory by MOP/CEA for Utilities to install supercritical units only
  - Coal Linkage Allocation Policy – priority to supercritical units
  - Suitable provisions in CEA Regulations on Technical standards for construction of electric plants and lines making supercritical units mandatory
DRIVERS FOR HIGHER PLANT EFFICIENCY

- Demand of power growing at par with growing economy. Large capacity addition needed. Inputs such as fuel, land, water etc limited. Higher Efficiency implies more optimum utilization of available resources to maximize generation.

- Increased emphasis on Environmental considerations. Higher efficiency implies lesser pollution for same generation.
An Average increase of 1% points in the Generation Efficiency would result in:

- Coal savings of approx. 10000 tons per annum for a 210 MW machine running at 78% PLF using coal of GCV 3800 kcal/kg (assuming 1 % improvement is 25 kcal)
- CO$_2$ reduction
- Higher productivity from the same resource is equivalent to capacity addition
- Lower generation cost per kWh
MAJOR EFFORTS TO INCREASE EFFICIENCY

• **Introduction of Clean Coal technologies**

**Supercritical Technology** - With the adoption of higher parameters, efficiency gain of about 2% is possible over sub critical units.

• **Renovation & Modernization of old thermal power stations** - CEA has prepared a National Enhanced Efficiency Renovation and Modernization Program for implementation during 11th and 12th Plans. This covers R&M of 18965 MW capacity, Life Extension of 7318 MW during 11th Plan and R & M of 4971 MW and LE of 16532 MW during 12th Plan.
MAJOR EFFORTS TO INCREASE EFFICIENCY

• Retirement of old and small size generating units
  • Units are of non-reheat type having very low design efficiencies

• National Award for improving performance of Thermal Power Stations based on following criteria:
  • Deviation from Design heat rate
  • Auxiliary Power Consumption
  • Specific fuel oil consumption
  • Peaking PLF
• Guidelines published for carrying out Energy Audits in coal based thermal power plants under IGEN programme.

• Mapping studies at 85 thermal units of States Generating companies for identifying problematic areas and suggest remedial measures.
• Coal based generation expected to remain mainstay of Power Sector.

• Strategy Plan to improve efficiency level in generation to facilitate optimum utilization of scarce fuel and to minimize the carbon footprint.

• Technology to play a major role in achieving this objective.
Thanks