Power Sector Overview

Policies, Reforms and Key Chal leges

August 2016
Contents

Introduction

Power Sector in India- Generation, Transmission & Distribution

Demand Supply Scenario

Rural Electrification in India- 24*7 Supply to Every Household

The Rising Sun- Roadmap for Renewables

Electric Vehicle- Developing Urban Infrastructure

Key Policies, Reforms & Regulations of Power Sector
Introduction
The Grid Transition in India

New Developments are accelerating the Transition
Changing Business Environment (1/3)

- Renewable Focus
  - 175000 MW by 2022, Renewable Attaining Grid Parity
  - Big Data to play a major role

- Separation of Carriage and Content

- Energy Efficiency, DSM Focus

- Home Automation, Automated Demand Response

- Rising Fuel Costs
  - Reduce dependence on imported coal

- Smart and Communicating Grid
  - Infusing Competition

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TATA POWER-DDL

Non-Stop
Changing Business Environment (2/3)
Changing Business Environment (3/3)

Utilities of the Future and Future of the Utilities

- Electricity Distribution
- Electricity Markets
- Renewable Energy
- Energy Storage
- Transport
- Industrial Energy Efficiency
- Building Energy Efficiency
- Home Automation and Security
- Smart Cities and Shared Services

Changing Customer

Tech Savvy

Seeks Value Proposition

Environment Conscious

Socially & Globally Connected

Knowledgeable & Informed

Consumer Digitization
The Buzz Around the Sector….

- **Energy Security**
  - Enhanced Power Production, 100% Rural electrification

- **Digital India**
  - Smart grid, Smart Metering, IT enablement, National Power Portal Real time tracking (DELP.in)

- **Skill India**
  - Skilling people for IT enablement, Gram Vidyut Abhiyanta

- **Smart Cities**
  - IPDS covers 82 out of 98 smart cities

- **Energy Efficiency**
  - LED lighting, Industrial Efficiency, Agricultural Pumps

- **Climate change**
  - Renewable Energy, INDC

- **Make in India**
  - $250 Bn Investment with substantial local manufacturing

- **Swachh Bharat**
  - 1.28 lakh Toilets constructed for Swachh Bharat

Power for All
24 x 7
Power Sector Overview - Generation
# Total Installed Capacity – Source Wise & Sector Wise

*(as on 30.06.2016)*

<table>
<thead>
<tr>
<th>Total Capacity</th>
<th>UoM</th>
<th>State Sector</th>
<th>Private Sector</th>
<th>Central Sector</th>
<th>Total</th>
<th>% Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>MW</td>
<td>64130.50</td>
<td>70692.38</td>
<td>51390.00</td>
<td>186212.88</td>
<td>61.43%</td>
</tr>
<tr>
<td>Gas</td>
<td>MW</td>
<td>7210.70</td>
<td>9742.60</td>
<td>7555.33</td>
<td>24508.63</td>
<td>8.08%</td>
</tr>
<tr>
<td>Diesel</td>
<td>MW</td>
<td>363.93</td>
<td>554.96</td>
<td>0.00</td>
<td>918.89</td>
<td>0.30%</td>
</tr>
<tr>
<td>Hydro</td>
<td>MW</td>
<td>28157.00</td>
<td>3120.00</td>
<td>11571.43</td>
<td>42848.43</td>
<td>14.13%</td>
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<tr>
<td>Nuclear</td>
<td>MW</td>
<td>0.00</td>
<td>0.00</td>
<td>5780.00</td>
<td>5780.00</td>
<td>1.9%</td>
</tr>
<tr>
<td>Total</td>
<td>MW</td>
<td>99826.37</td>
<td>83115.34</td>
<td>76296.76</td>
<td>259238.46</td>
<td>-</td>
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<tr>
<td>Renewable Energy Sources</td>
<td></td>
<td>1999.57</td>
<td>418850.17</td>
<td>0.00</td>
<td>43879.75</td>
<td>14.47%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>101825.94</td>
<td>124995.51</td>
<td>76296.76</td>
<td>303118.21</td>
<td>-</td>
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</table>

<table>
<thead>
<tr>
<th>% Share</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>33.59%</td>
<td>41.23%</td>
<td>25.17%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: CEA Report – Mar 16*
## Total Installed Capacity – 5 year Plan Wise

### in MW (as on 30.06.2016)

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Thermal</th>
<th>Nuclear</th>
<th>Hydro</th>
<th>RES</th>
<th>Total</th>
<th>Year Wise Net Addition</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Coal</td>
<td>Gas</td>
<td>Diesel</td>
<td>Thermal Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Plan (1951 – 56)</td>
<td>1597</td>
<td>0</td>
<td>228</td>
<td>1825</td>
<td>0</td>
<td>1061</td>
</tr>
<tr>
<td>2nd Plan (1956 – 61)</td>
<td>2436</td>
<td>0</td>
<td>300</td>
<td>2736</td>
<td>0</td>
<td>1917</td>
</tr>
<tr>
<td>3rd Plan (1961 – 66)</td>
<td>4417</td>
<td>134</td>
<td>352</td>
<td>4903</td>
<td>0</td>
<td>4124</td>
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<tr>
<td>4th Plan (1969 – 74)</td>
<td>8652</td>
<td>165</td>
<td>241</td>
<td>9058</td>
<td>640</td>
<td>6966</td>
</tr>
<tr>
<td>5th Plan (1974 – 79)</td>
<td>14875</td>
<td>168</td>
<td>164</td>
<td>15207</td>
<td>640</td>
<td>10833</td>
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<tr>
<td>6th Plan (1980 – 85)</td>
<td>26311</td>
<td>542</td>
<td>177</td>
<td>27030</td>
<td>1095</td>
<td>14460</td>
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<tr>
<td>7th Plan (1985 – 90)</td>
<td>41237</td>
<td>2343</td>
<td>165</td>
<td>43746</td>
<td>1565</td>
<td>18308</td>
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<tr>
<td>8th Plan (1992 – 97)</td>
<td>54154</td>
<td>6562</td>
<td>294</td>
<td>61010</td>
<td>2225</td>
<td>21658</td>
</tr>
<tr>
<td>9th Plan (1997 – 2002)</td>
<td>62131</td>
<td>11163</td>
<td>1135</td>
<td>74429</td>
<td>2720</td>
<td>26269</td>
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<tr>
<td>10th Plan (2002 – 07)</td>
<td>71121</td>
<td>13692</td>
<td>1202</td>
<td>86015</td>
<td>3900</td>
<td>34654</td>
</tr>
<tr>
<td>11th Plan (2007 – 12)</td>
<td>112022</td>
<td>18381</td>
<td>1200</td>
<td>131603</td>
<td>4780</td>
<td>38990</td>
</tr>
<tr>
<td>12th Plan (2012 – 17)</td>
<td>186212.88</td>
<td>24508.63</td>
<td>918.89</td>
<td><strong>211640.04</strong></td>
<td>5780.00</td>
<td>42848.43</td>
</tr>
<tr>
<td>% Share</td>
<td>61.43%</td>
<td>8.08%</td>
<td>0.30%</td>
<td>69.82%</td>
<td>1.9%</td>
<td>14.13%</td>
</tr>
</tbody>
</table>

Source: CEA Report – Mar 16
Capacity addition during the Eleventh Plan (2007-2012) – Source Wise & Sector Wise

<table>
<thead>
<tr>
<th>Total Capacity</th>
<th>UoM</th>
<th>State Sector</th>
<th>Central Sector</th>
<th>Private Sector</th>
<th>Total</th>
<th>% Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal</td>
<td>MW</td>
<td>11691</td>
<td>12158</td>
<td>21739</td>
<td>45588</td>
<td>67.49</td>
</tr>
<tr>
<td>Hydro</td>
<td></td>
<td>1594</td>
<td>1523</td>
<td>1219</td>
<td>4336</td>
<td>6.42</td>
</tr>
<tr>
<td>Nuclear</td>
<td></td>
<td>0</td>
<td>880</td>
<td>0</td>
<td>880</td>
<td>1.30</td>
</tr>
<tr>
<td>Total</td>
<td>MW</td>
<td>13285</td>
<td>14561</td>
<td>22958</td>
<td>50804</td>
<td>75.21</td>
</tr>
<tr>
<td>Renewable Energy Sources</td>
<td></td>
<td>2538</td>
<td>0</td>
<td>14205</td>
<td>16743</td>
<td>24.79</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>15823</td>
<td>14562</td>
<td>37163</td>
<td>67547</td>
<td>100</td>
</tr>
<tr>
<td>% Share</td>
<td></td>
<td>23%</td>
<td>22%</td>
<td>55%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source - CEA Input Paper 11th Plan and CEA Monthly Report – Mar 12; Captive Generation added during 11th Plan: 9300 MW approx. (Not included in above)
### Proposed Capacity addition during XII Plan (FY 2012-17) – Sector Wise

<table>
<thead>
<tr>
<th>Total Capacity</th>
<th>State Sector (Target)</th>
<th>Achieved till May 16</th>
<th>Central Sector (Target)</th>
<th>Achieved till May 16</th>
<th>Private Sector (Target)</th>
<th>Achieved till May 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal</td>
<td>13,922.00</td>
<td>18,829.10</td>
<td>14,878.00</td>
<td>12,638.10</td>
<td>43,540.00</td>
<td>50,222.50</td>
</tr>
<tr>
<td>Hydro</td>
<td>1,608.00</td>
<td>712.00</td>
<td>6,004.00</td>
<td>2504.02</td>
<td>3,285.00</td>
<td>595.00</td>
</tr>
<tr>
<td>Nuclear</td>
<td>0</td>
<td>0</td>
<td>5,300.00</td>
<td>1000.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>15,530.00</td>
<td>19,541.10</td>
<td>26,182.00</td>
<td>16,142.12</td>
<td>46,825.00</td>
<td>50,817.50</td>
</tr>
</tbody>
</table>

Source: CEA Report – Mar 16
Despite record generation capacity addition driven by private sector, acute power shortages coexisting with idle power assets

Progress

11th plan
- Capacity added (incl. renewables) - 67,547 MW
- Private sector contribution - 37,163 MW (~55%)
- Private sector share in total capacity - 13% → 27%

12th Plan
- Capacity addition envisaged (incl. renewables) – 107037 MW
- Capacity added (incl. renewable) – 67760 MW
- Private sector contribution – 46825 MW (~53%)

Challenges
- Stranded investment due to financially stressed projects and suboptimal PLF

Major factors causing the distress
- Unviability due to under recovery of costs, caused by
  - Fuel shortage/non availability and higher cost of alternate fuel
  - Change in regulatory norms/ law in coal source countries
  - Abnormal fluctuations in commodity prices/interest rates/foreign exchange
  - Delays in development due to land acquisition/ E&F clearance timelines, etc. Denial of allocated mines
  - Absence of peaking capacities
  - Transmission constraints and low off-take by Discoms
  - Plants operating at ~65% PLF

Rescue and revitalize stranded asset and capital before additional capacity plan
Sector Scenario: Transmission
Transmission bottlenecks – improve network availability/ utilization and Regulatory Framework to be in sync with competitive power market

Progress so far

– 341551 ckt. kms. network length stands up to Mar2016
– This is 118.57% of the annual target of 23,712 ckm fixed for this year

Challenges

– Evacuation Constraints – Growing demand in SR has led to severe congestion in W3 region and WR-NR and NEW-SR links. Inadequate new capacity creation aggravating the constraint
– Inadequate Interregional transmission capacity
– Clearances Delay - Right of Way (RoW) / Environment/ Forest.
– Regulatory/Planning Issues
  – High level of uncertainty regarding path of power flow due to lack of bidding opportunities and growing open access users.
  – Generators have to pay committed transmission charges even when projects are delayed for reasons beyond their control

Source: CEA Transmission Report – Mar 16
Sector Scenario: Distribution
# Financial Performance of Utilities 2012-14

## Profit/ (Loss) on subsidy received basis (Rs. Crores, per year)

<table>
<thead>
<tr>
<th>Region</th>
<th>2013-14</th>
<th>2014-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>(3,600)</td>
<td>(3,021)</td>
</tr>
<tr>
<td>North Eastern</td>
<td>(1,905)</td>
<td>(2,136)</td>
</tr>
<tr>
<td>Northern</td>
<td>(31,576)</td>
<td>(37,538)</td>
</tr>
<tr>
<td>Southern</td>
<td>(29,415)</td>
<td>(13,616)</td>
</tr>
<tr>
<td>Western</td>
<td>(4,067)</td>
<td>(6,512)</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>(70,564)</strong></td>
<td><strong>(62,462)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UDAY States</th>
<th>2012-13</th>
<th>2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bihar</td>
<td>(1,227)</td>
<td>(367)</td>
</tr>
<tr>
<td>Chattisgarh</td>
<td>(502)</td>
<td>(1,317)</td>
</tr>
<tr>
<td>Gujarat</td>
<td>589</td>
<td>583</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>(2,668)</td>
<td>(1,511)</td>
</tr>
<tr>
<td>Harayana</td>
<td>(3,835)</td>
<td>(3,315)</td>
</tr>
<tr>
<td>Punjab</td>
<td>253</td>
<td>642</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>(12,510)</td>
<td>(15,926)</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>(13,154)</td>
<td>(17,678)</td>
</tr>
<tr>
<td><strong>Grand Total for all States</strong></td>
<td><strong>(33,896)</strong></td>
<td><strong>(38,889)</strong></td>
</tr>
</tbody>
</table>
## Financial Performance of Utilities 2012-14

### Accumulated Profit / (loss) (Rs. Crores)

<table>
<thead>
<tr>
<th>Region</th>
<th>2012-13</th>
<th>2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>(17,764)</td>
<td>(21,225)</td>
</tr>
<tr>
<td>North Eastern</td>
<td>(9,434)</td>
<td>(11,414)</td>
</tr>
<tr>
<td>Northern</td>
<td>(182,579)</td>
<td>(218,010)</td>
</tr>
<tr>
<td>Southern</td>
<td>(57,302)</td>
<td>(73,848)</td>
</tr>
<tr>
<td>Western</td>
<td>(23,593)</td>
<td>(29,962)</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>(290,672)</td>
<td>(354,460)</td>
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<table>
<thead>
<tr>
<th>States</th>
<th>2012-13</th>
<th>2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bihar</td>
<td>(1,782)</td>
<td>(2,148)</td>
</tr>
<tr>
<td>Chattisgarh</td>
<td>(3,721)</td>
<td>(5,038)</td>
</tr>
<tr>
<td>Gujarat</td>
<td>2,077</td>
<td>2601</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>(11,958)</td>
<td>(13,468)</td>
</tr>
<tr>
<td>Harayana</td>
<td>(23,517)</td>
<td>(24,551)</td>
</tr>
<tr>
<td>Punjab</td>
<td>(1,836)</td>
<td>(1,194)</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>(55,981)</td>
<td>(71,900)</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>(78,371)</td>
<td>(96,200)</td>
</tr>
<tr>
<td><strong>Grand Total for All States</strong></td>
<td>(175,089)</td>
<td>(211,898)</td>
</tr>
<tr>
<td>Region</td>
<td>2012-13</td>
<td></td>
</tr>
<tr>
<td>---------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>ACS</td>
<td>Avg Revenue (Subsidy Recd basis)</td>
</tr>
<tr>
<td>Eastern</td>
<td>4.93</td>
<td>4.40</td>
</tr>
<tr>
<td>North Eastern</td>
<td>5.23</td>
<td>3.47</td>
</tr>
<tr>
<td>Northern</td>
<td>4.99</td>
<td>3.96</td>
</tr>
<tr>
<td>Southern</td>
<td>5.90</td>
<td>4.54</td>
</tr>
<tr>
<td>Western</td>
<td>4.33</td>
<td>4.10</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>5.04</strong></td>
<td><strong>4.19</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UDAY States</th>
<th>2012-13</th>
<th></th>
<th>2013-14</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ACS</td>
<td>Avg Revenue (Subsidy Recd basis)</td>
<td>Gap (subsidy recd basis)</td>
<td>ACS</td>
</tr>
<tr>
<td>Bihar</td>
<td>5.33</td>
<td>4.67</td>
<td>0.63</td>
<td>5.00</td>
</tr>
<tr>
<td>Chhattisgarh</td>
<td>3.26</td>
<td>3.04</td>
<td>0.22</td>
<td>5.52</td>
</tr>
<tr>
<td>Gujarat</td>
<td>4.09</td>
<td>4.08</td>
<td>0.01</td>
<td>5.22</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>6.10</td>
<td>3.66</td>
<td>2.44</td>
<td>5.52</td>
</tr>
<tr>
<td>Haryana</td>
<td>5.14</td>
<td>4.23</td>
<td>0.91</td>
<td>5.25</td>
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<tr>
<td>Punjab</td>
<td>4.49</td>
<td>4.47</td>
<td>0.02</td>
<td>4.71</td>
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<tr>
<td>Rajasthan</td>
<td>5.84</td>
<td>3.58</td>
<td>2.26</td>
<td>6.59</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>4.92</td>
<td>3.45</td>
<td>1.47</td>
<td>6.19</td>
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<tr>
<td><strong>Grand Total</strong></td>
<td><strong>5.84</strong></td>
<td><strong>4.09</strong></td>
<td><strong>1.75</strong></td>
<td><strong>5.81</strong></td>
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</tbody>
</table>
# Financial Performance of Utilities 2012-14

## AT&C Loss (%)

<table>
<thead>
<tr>
<th>Region</th>
<th>2012-13</th>
<th>2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern</td>
<td>42.04</td>
<td>38.02</td>
</tr>
<tr>
<td>North Eastern</td>
<td>38.31</td>
<td>33.94</td>
</tr>
<tr>
<td>Northern</td>
<td>28.89</td>
<td>24.86</td>
</tr>
<tr>
<td>Southern</td>
<td>17.40</td>
<td>19.08</td>
</tr>
<tr>
<td>Western</td>
<td>23.36</td>
<td>18.37</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>25.45</strong></td>
<td><strong>22.70</strong></td>
</tr>
</tbody>
</table>

## UDAY States

<table>
<thead>
<tr>
<th>UDAY States</th>
<th>2012-13</th>
<th>2013-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bihar</td>
<td>54.64</td>
<td>46.33</td>
</tr>
<tr>
<td>Chhattisgarh</td>
<td>25.12</td>
<td>23.17</td>
</tr>
<tr>
<td>Gujarat</td>
<td>19.87</td>
<td>15.93</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>47.49</td>
<td>42.17</td>
</tr>
<tr>
<td>Haryana</td>
<td>32.55</td>
<td>34.33</td>
</tr>
<tr>
<td>Punjab</td>
<td>17.52</td>
<td>17.91</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>20.00</td>
<td>26.76</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>42.85</td>
<td>24.65</td>
</tr>
<tr>
<td><strong>Grand Total for all states</strong></td>
<td><strong>25.45</strong></td>
<td><strong>22.70</strong></td>
</tr>
</tbody>
</table>
State’s resolve and sustainable commitment to distribution reforms process

Challenges

- Discoms are in dire situation due to the following
  - Growing gap between the ACS and tariff realization (113 p/unit)
  - AT&C losses (~25%) and infrequent and inadequate tariff increases. Most states hovering at 40%. 16 utilities had losses below 15 per cent, while 40 had losses below 30 per cent
  - Total exposure amount till date of Indian Banks are Rs. 3,20,238 crs.
- Distribution utilities are preferring load shedding to meeting DSM obligations
- Competition through Open Access – A non-starter
- Increased cross subsidization in last 5 years – an unsustainable trend
- Slow or virtually no Reforms in Distribution Sector despite successful reforms in Delhi in 2002
- State Governments only pursuing the Franchisee Model, whereby O & M contract(s) for 10-15 years in particular areas are tendered to private parties.
- Approx. rise of 40-50% in the cost of Generation over last 2 years and ~100% in last 5 years
- Inefficient Power Procurement and Management

![Graph showing Avg. Cost of Supply & Tariff Realized (Paise/ Kwh)](chart.png)

**Table: Avg. Cost of Supply & Tariff Realized (Paise/ Kwh)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost of Supply</th>
<th>Average Tariff</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009-10</td>
<td>327 (Actual)</td>
<td>471 (Actual)</td>
</tr>
<tr>
<td>2010-11</td>
<td>367 (Actual)</td>
<td>506 (Actual)</td>
</tr>
<tr>
<td>2011-12</td>
<td>387 (Prov.)</td>
<td>570</td>
</tr>
<tr>
<td>2012-13</td>
<td>439</td>
<td>593 RE</td>
</tr>
<tr>
<td>2013-14</td>
<td>480</td>
<td>593 AP</td>
</tr>
</tbody>
</table>

*Source: Planning Commission Report March 2014*
Reason for Poor Financial Health of Discoms

1. Under recovery from the highly Subsidized tariff of Agriculture and Domestic Consumers

Solution: The National Tariff Policy 2006 stipulates that the SERCs should endeavour to set the tariffs within ±20% of the average cost of supply latest by the end of year 2010–11. In practice, few States complied with the above guideline.

2. Non Recovery of Subsidy Disbursed from State Government

Solution: The EA 2003 stipulates that the subsidy from the government should be available to the discom upfront. However, in many cases utilities witness huge gap between the assured amount and actual subsidy received (As Shown in Below Table). Also Utility has to borne additional cost in financing of these Gap. Therefore SERCs have to give mandate to utilities, that subsidy can be disbursed only after receiving it upfront from the government.
3. Huge AT&C Losses

**Solution**: Through government has started various schemes like RAPDRP and NEF etc for funding of infrastructure, Digitization and Loss reduction, however the losses of discoms remain same in last 10 years. It is necessary that the current monopolized structure of the distribution sector be reformed and competition be encouraged. Few of the ways to manifest this is:

1. Separate carriage and content businesses of the distribution segment
2. PPP model like Delhi with certain modification on ownership of assets etc
3. Complete Performance based Outsourcing of Commercial function of Discoms
Reason for Poor Financial Health of Discoms

4. Segregation of Agriculture Feeders and 100% Metering -

**Solution**: Agricultural consumers benefit from electricity subsidies provided by the States but these consumers remain unmetered in many cases. Separating the feeder to irrigation pumps from other uses with assured electricity supply during the stipulated hours can contain excessive electricity consumption. *In the case of low-income households that enjoy subsidized electricity which remain unmetered, prepaid meters can regulate their power consumptions.*

5. Timely Liquidation of Regulatory Assets -

**Solution**: Discoms in many States are incurring massive losses due to increasing, unchecked regulatory assets. The National Tariff Policy 2006 stipulates that the “recovery of Regulatory Asset should be time-bound and within a period not exceeding three years at the most”. Lack of timely cost-reflective tariff revision has resulted in its yearly nationwide magnitude to the tune of more than 70,000 crores and the interest component alone costs around 9,500 crores (The World Bank, 2014). *It is necessary that the SERCs explore ways to liquidate them in a time-bound manner without further Accumulation.*
Power Supply Scenario in India
Power Supply Scenario in India

Anticipated all India power supply position for the year 2016-17

- **All India**: 169,503
- **Peak demand**: 165,253

### Region-wise Supply

- **Northern**:
  - Peak demand: 55,800
  - Met (MW): 54,900
  - Surplus/Deficit: -900

- **Western**:
  - Peak demand: 51,436
  - Met (MW): 56,715
  - Surplus/Deficit: 5,279

- **Southern**:
  - Peak demand: 44,604
  - Met (MW): 40,145
  - Surplus/Deficit: -4,459

- **Eastern**:
  - Peak demand: 21,387
  - Met (MW): 22,440
  - Surplus/Deficit: 1,053

- **North-Eastern**:
  - Peak demand: 2,801
  - Met (MW): 2,695
  - Surplus/Deficit: -106

### Peak surplus/deficit
- **Surplus**: 4,250 MW (2.6%)
State’s resolve and sustainable commitment to distribution reforms process

Power Purchase Cost Comparison

- Andhra Pradesh
- Delhi (TPDDL)
- Bihar
- Gujarat
- Karnataka
- Madhya Pradesh
- Odisha
- Uttarakhand
- Punjab
- Haryana
- Maharashtra
- Uttar Pradesh

- PPC (2012-13)
- PPC (2013-14)
- PPC (2014-15)
- All India Avg. (2014-15)
<table>
<thead>
<tr>
<th>Consumer Category</th>
<th>Units</th>
<th>Delhi (TPDDL)</th>
<th>Mumbai</th>
<th>Kolkata</th>
<th>Chennai</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Rs. / Unit</td>
<td>Rs. / Unit</td>
<td>Rs. / Unit</td>
<td>Rs. / Unit</td>
</tr>
<tr>
<td>Dom - 2 Kw*</td>
<td>200</td>
<td>2.20</td>
<td>5.38</td>
<td>6.51</td>
<td>4.15</td>
</tr>
<tr>
<td>Dom - 2 Kw*</td>
<td>400</td>
<td>2.58</td>
<td>5.97</td>
<td>7.31</td>
<td>5.13</td>
</tr>
<tr>
<td>Non Domestic/Commercial- 20 kW</td>
<td>1500</td>
<td>9.46</td>
<td>7.40</td>
<td>8.68</td>
<td>8.41</td>
</tr>
<tr>
<td>LT Industrial - 20 kW</td>
<td>1500</td>
<td>8.98</td>
<td>8.01</td>
<td>6.95</td>
<td>6.58</td>
</tr>
<tr>
<td>HT Industrial - 100kW/108 KVA</td>
<td>15000</td>
<td>8.3</td>
<td>9.79</td>
<td>6.62</td>
<td>8.61</td>
</tr>
<tr>
<td>Peak Load</td>
<td>In MW</td>
<td>1704</td>
<td>3192</td>
<td>1856</td>
<td>2000</td>
</tr>
<tr>
<td>No of Consumers</td>
<td>In Lakhs</td>
<td>15.15</td>
<td>30</td>
<td>25</td>
<td>11</td>
</tr>
</tbody>
</table>

* Domestic Tariff upto 400 units include 50% subsidy on energy charges
## Tariff Comparison across different Utilities near Delhi NCR

<table>
<thead>
<tr>
<th>Consumer Category</th>
<th>Units</th>
<th>Delhi (TPDDL) Rs. / Unit</th>
<th>Haryana Rs. / Unit</th>
<th>Uttar Pradesh Rs. / Unit</th>
<th>Rajasthan Rs. / Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dom - 2 Kw</strong>*</td>
<td>200</td>
<td>2.20</td>
<td>5.6</td>
<td>5.44</td>
<td>6.02</td>
</tr>
<tr>
<td><strong>Dom - 2 Kw</strong>*</td>
<td>400</td>
<td>2.58</td>
<td>5.69</td>
<td>5.35</td>
<td>6.03</td>
</tr>
<tr>
<td><strong>Non Domestic/ Commercial- 20 kW</strong></td>
<td>1500</td>
<td>9.46</td>
<td>8.25</td>
<td>8.57</td>
<td>7.85</td>
</tr>
<tr>
<td><strong>LT Industrial - 20 kW</strong></td>
<td>1500</td>
<td>8.98</td>
<td>6.29</td>
<td>8.27</td>
<td>6.15</td>
</tr>
<tr>
<td><strong>HT Industrial - 100kW/108 KVA</strong></td>
<td>15000</td>
<td>8.3</td>
<td>6.26</td>
<td>7.60</td>
<td>7.72</td>
</tr>
<tr>
<td><strong>Power Outage During Summer(Avg.)</strong></td>
<td>Hours/ day</td>
<td>0</td>
<td>4-6</td>
<td>4-6</td>
<td>2-2.5</td>
</tr>
<tr>
<td><strong>Peak Demand Met</strong></td>
<td>In MW</td>
<td>1704</td>
<td>8114</td>
<td>8733</td>
<td>10038</td>
</tr>
<tr>
<td><strong>No of Consumers</strong></td>
<td>In Lakhs</td>
<td>15.15</td>
<td>50</td>
<td>239</td>
<td>78</td>
</tr>
</tbody>
</table>

* Domestic Tariff upto 400 units include 50% subsidy on energy charges
The Rising Sun: Roadmap for Renewables
Distributed Renewable Energy in India

Rooftop Solar in Cities

Net Metering:
- Policy
- Technology

Smart Metering with Dual Energy Source and Bidirectional Flow

*16 States have come up with their own state solar policies and 30 states RPO mandates 4%-8%

Solar Minigrids in Remote Villages

Offgrid Minigrid:
- Policy
- Technology

Future integration of Offgrid Minigrid with Discom Grid

*18500 unelectrified villages to come up with Microgrids
India has ambitious target of setting up **175 GW** of Renewable Energy by **2022**.
State Wise target and Current Installed Solar Capacity

Source: Invest Rajasthan, MNRE
MNRE has approved 33 solar parks in 21 states with 19.9 GW capacity.
Electric Vehicle Infrastructure in India
Accelerated electrification of clean transportation, charging infrastructure, and the 21st century electric grid are key contributors to future-proof global energy security, environment, and clean-air objectives.

1. National Electricity Mobility Mission (NEMM) Plan 2020
   • 6 to 7 Million electric vehicles
2. National Smart Grid Mission (NSGM)
   • Primary driver of grid modernization
3. Renewable generation of 175 GW by 2022
   • 6x from current state-of-generation-mix.
4. Reduction in greenhouse gas emissions and improved air-quality
   • 68% power generated from coal.

India now overshadowing China
Average PM2.5 concentration, micrograms per m²
July-November 2015

Source: Greenpeace, Economist.com
Market Analysis: Vehicle Growth

- Indian market expectations in vehicle size, purchasing costs and driving patterns.
  - Mostly 2 wheelers – 15 million/yr
  - Small cars – 2 million/year
    - (≤4 m /ICE 1.2 litre petrol or 1.4 litre diesel)
  - Commercial vehicles
  - Three wheelers, SUV, Vans, Minibus, Buses, Trucks

Source: DHI-DST Survey for India, 2015
EV System Architecture

Legend:
- **Power Flow (Conventional)**
- **Power Flow (V2G)**
- **Communication Flow**
- **Non – Electrical Flow**
Major Policies and Reforms of Power Sector
UDAY Scheme for Discoms

UDAY (Ujjwal Discom Assurance Yojna) scheme helps in reduction in tariff by facilitating operational improvements. It’s key highlights are:

• States shall take over 75% of DISCOM debt as on 30 September 2015 over two years - 50% of DISCOM debt shall be taken over in 2015-16 and 25% in 2016-17.

• Achievement of 24X7 Power for All

• Speedy achievement of electrification of remaining 18,500 villages

• Reduce Current Account Deficit (CAD) from higher diesel import (current annual imports of around Rs. 50,000 crore)

• Lower cost of power - Typical 3,000 MW NTPC plant running at 60% Plant Load Factor (PLF) has a fixed cost of Rs. 2.67 / unit, vs Rs. 1.80 at 90% PLF

• Avoid banking contagion (Rs, 40,000 crore of repayments due to banks in 2015-16) which will create significant NPAs

• Increased procurement of power by DISCOMs revives existing power projects suffering from low PLFs
Scope of UDAY Scheme

**Improvement of Operational Efficiency**
- Compulsory smart metering
- Energy efficiency measures like efficient LED bulbs, agricultural pumps fans etc.
- Upgradation of transformers, meters etc.

**Reduction of Cost of Power**
- Increased supply of cheaper domestic coal
- Coal linkage rationalization
- Liberal coal swaps from inefficient to efficient coal plants
- Coal price rationalization based on GCV and supply of washed and crushed coal

**Reduction in Cost of Interest to DISCOMs**
- States to take over 75% of DISCOM debt
- Government of India will not include debt taken over by the state in circulation of fiscal deficit
Separation of Content & Carriage…

Are We Ready for the Competition??
National Smart Grid Mission

• An institutional mechanism for planning, monitoring and implementing policies and programmes related to smart grids in India.

• It entails implementation of a Smart Grid based on state-of-the-art technology in the fields of automation, communication, IT systems that can monitor and control power flows from points of generation to points of consumption.

12th Plan
- Smart Grid Pilots
- Infrastructure for AMI for all consumers with load >20KW
- Development of micro grids in 1000 villages/industrial parks/commercial hubs
- Development of 5 smart cities

13th Plan
- SG rollout in all urban areas
- Nationwide AMI rollout for customers with 3-phase
- Development of micro grids in 10000 villages/industrial parks/commercial hubs
- Development of 25 smart cities

14th Plan
- SG rollout nationwide
- Nationwide AMI rollout for all customers
- Development of micro grids in 20000 villages/industrial parks/commercial hubs
- Development of 100 Smart Cities
Government of India has taken a number of measures to promote sustainable development and address the threat of climate change at national and sub-national level.

(40% Renewables by 2030)

- Revisiting the National Missions under the National Action Plan on Climate Change.
- Government is proposing to set up new missions on Wind Energy, Health, Waste to Energy, Coastal Areas and redesigning the National Water Mission & National Mission on Sustainable Agriculture.
- Mitigation Strategies (for e.g. More than 5 times increase in Renewable capacity from 35 GW to 175 GW by 2022)
- Adaptation Strategies (For e.g. National Mission for clean Ganga)
- Climate Finance Policies (For e.g. Coal cess quadrupled from INR 50 to INR 200 per tonne to help finance clean energy projects, Reduction in subsidies on fossil fuels including diesel, kerosene and domestic LPG)
NSM bids have been between INR 5.21/kWh and INR 6.45/kWh which are comparable to the cost at which new generation plants are willing to sell power.

Future volatility of coal is really high as compared to the locked-in cost of solar (for 20 years).

The energy payback time, that is the time needed to produce again the energy used in the manufacture of the PV system, is between 3-4 years for crystalline solar modules and between 1.5-2.5 years for thin-film modules.

Source: KPMG - The Rising Sun 2015
COP 21 will aim to achieve a legally binding and universal agreement on climate with aim of keeping global warming below 2°C.

Before COP 21, all countries will publish details of what they will do to contribute to the 2°C goal, known as Intended Nationally Determined Contributions (INDCs).

Another objective is to mobilize flow of US $100 billion per year from developed countries to developing countries to help reduce emissions and adapt to the effects of climate change. The funds will come from public and private sources 2020 onwards.
Igniting EV

Driving EV

Charging EV

EV Industry is Technology Driven vs. Policy Driven

- NEMMP 2020 Central Govt Policy on EV Development in India.
- In Delhi Policy Framing is under Process. MCD will be nodal body for Licensing.
- Subsidy Planned for HEV/BEV (25-35%) to improve EV penetration.
- In Developed Countries, Regulated Asset Base & Public Space are used with mix of Franchisee & OEM Model.

- EV 2-Wheeler has highest Share (92%) among 2W/3W/4W EV (NEMMP).
- E-Rickshaw Market Size in TPDDL Area: 48000.
- E-Rickshaw Cost: 85,000 to 105,000.
- Lead Acid Battery with Life of 1 Yr.(400 Cycles) Charging Time: 8-10 Hrs. (5 Unit/charge).
- M/s Hero Electric ambitious plan to Setup 10,000 Charging kiosk pan India (One at Jangpura).
- Lithium-ion used worldwide for faster charging, superior performance & life.
- Li-ion battery cost 5-7 times to Pb-Acid which is Rs 20000 for 48V/100 AH.

- Private EV owner use Home Charging through Domestic Tariff.
- Commercial EV Charging in Delhi- Home Charging, Park-n Charge & Direct Theft of Electricity.
DDUGJY- Rural Electrification

Deendayal Upadhyaya Gram Jyoti Yojana (DDUGJY): (launched- Nov ’14)

(i) to separate agriculture and non agriculture feeders facilitating judicious rostering of supply to agricultural and non-agricultural consumers in rural areas and

(ii) strengthening and augmentation of sub transmission and distribution infrastructure in rural areas, including metering of distribution transformers/feeders/consumers.

The estimated cost of the scheme for above two components is Rs.43,033 crore which includes the requirement of budgetary support of Rs.33,453 crore from Government of India over the entire implementation period.

The scheme would bring in more opportunities for TPDDL in terms of:

- Micro Grid based REM
- Storage solution for Off-Grid location in villages
- Smart Appliances and Inverters
IPDS Scheme

Integrated Power Development Scheme (IPDS) is one of the flagship programme of the Ministry of Power launched on 28th June 2015 which will be at the core attempt to ensure 24x7 power for all.

• The Scheme, announced in the Union Budget 2014-15, aims at strengthening of sub-transmission network, Metering, IT application, Customer Care Services, provisioning of solar panels and the completion of the ongoing works of Restructured Accelerated Power Development and completion of the Reforms Programme (RAPDRP).

• Government of India will provide budgetary support of Rs. 45,800 crore over the entire implementation period of IPDS.

• The Scheme includes upgradation of the electrical assets at Sub – centers, lines and distribution transformers, capacity enhancement and renewal of the old sub – stations and installation of roof-top solar panel in government buildings.

Source: http://www.powermin.nic.in/
National Tariff Policy 2016

4 E’s of Electricity: Electricity for all, Environment for a sustainable future, Efficiency to Ensure affordable tariffs, Ensure financial viability and Ease of doing business to attract investments.

Key Highlights of New Amendments in National Tariff Policy 2006: (Approved: 20\textsuperscript{th} Jan 2016)

**Electricity**

- 24X7 power supply will be ensured to all consumers. In this case state governments and regulators will devise appropriate power supply trajectory to achieve this.
- Micro Grids will provide power to remote unconnected villages. It will have provision for purchase of power into the grid.
- People near coal mines will be provided with affordable power through procurement of power from coal washery reject based plants.

**Efficiency**

- Reduce power cost to consumers through expansion of existing power plants.
- For reduction in overall power cost, benefit from sale of un-requisitioned power to be shared.
National Tariff Policy 2016

Efficiency

• Through competitive bidding process, transmission projects will be developed in order to ensure faster completion at lower cost.
• To enable Time of Day metering installations of smart meters will be fasten. It will help to reduce theft and allow net-metering.
• Creating transmission capacity for accessing power from across India for lower power cost.

Environment

• Renewable Power Obligation (RPO): By March 2022, 8% of electricity consumption shall be from solar energy in order to promote renewable energy and energy security.
• Renewable Generation Obligation (RGO): New thermal plants based coal/lignite to establish/purchase/ procure renewable capacity. Transmission charges and losses will be not levied for solar and wind power between inter-State power transmission. 100% power procurement produced from Waste-to-Energy plants in order to give big boost to Swachh Bharat Mission.

Ease of Doing Business

• Investments will be encouraged in coal rich states like West Bengal, Odisha, Jharkhand and Chhattisgarh to generate employment.
Thank You