Power Sector Trends: Focus on States

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CSIS has engaged with senior power sector officials from 17 Indian states:

- **Key Stakeholders:**
  - Secretary/Principal Secretary of Power
  - Secretary of New & Renewable Energy Nodal Agencies
  - Chairman or Managing Director of the State Generation, Transmission, or Distribution Companies (Public and Private)
  - Regulators
  - Directors of National and State Research Institutions
Power Reforms in India: Timeline

- Key Features:
  - Unbundling of state electricity boards
  - Private power generation
  - Setting up of State Electricity Regulatory Commissions
  - Universal Access
  - Improving Operational Standards
  - RE Addition

Image Source: Pagal and Mayer 2013
Power Sector: Generation

Key Features:
- Private Generation at 44 percent of total installed capacity
- State and Central Generation Combined at 55.6 percent
- Power Deficit to Power Surplus
- Net Importer to Next Exporter

Image Source: Bloomberg
Power Sector: Transmission

• Key Features:
  • Integrated Grid (All five regional grids connected)
  • Green Energy Corridors- Evolving infrastructure to integrate large scale renewable energy

Image Source: CEA
Power Sector: Distribution

- Key Features:
  - Financial Debt
  - Technical and Commercial Losses
  - Unconnected consumers

- UDAY (Ujwal Discom Assurance Yojana)
  - 31 States and Union Territories
  - Improving operational efficiency
  - Reduction of cost of power
  - Reduction in interest cost of DISCOMs
  - Enforcing financial discipline on DISCOMs through alignment with State finances

Image Source: UDAY National Dashboard, Ministry of Power
## India’s Key Power Projects

### 24 x 7 “Power for All”

*Objective:* to supply 24x7 “quality, reliable and affordable power to all domestic, commercial and industrial consumers by 2019.”

Actions taken under the initiative include:

1. village electrification
2. providing access to households
3. feeder separation
4. strengthening of sub-transmission and distribution network and
5. roll out of meters

### Saubhagya Initiative

*Objective:* to electrify all households (rural and urban) by December 31, 2018.

Actions undertaken will be as follows:

1. Extending grid lines
2. Providing Solar power packs with 5 LED lights, one DC fan, one DC power plug
3. Free to low cost electricity connections

### 175 GW of Renewable Energy by 2022

*Objective:* The BJP-led government has revised the country’s renewable energy targets and aims to install 175 GW by 2022.

Distribution of national target:

1. Solar: 100 GW
2. Wind: 60 GW
3. Biomass: 10 GW
4. Small Hydro: 5 GW
Engaging Indian States
Solar Performance Tracker

NATIONAL TARGET CONTRIBUTION

Each Indian state has been assigned a solar power capacity target that it needs to achieve in order for India as a whole to reach 100 GW of solar power by 2022. State targets are based on their potential to produce solar power, including land area and days of sun per year, and thus vary widely. This map represents each state’s solar capacity target as a percentage of the national target.

INDIVIDUAL STATE TARGETS

This chart tracks the progress each state has made towards reaching its own target for solar power capacity.

<table>
<thead>
<tr>
<th>State</th>
<th>Target</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANDAMAN AND NICOBAR ISLANDS</td>
<td>20%</td>
<td>27MW</td>
</tr>
<tr>
<td>ANDHRA PRADESH</td>
<td>20.83%</td>
<td>9834MW</td>
</tr>
<tr>
<td>ARUNACHAL PRADESH</td>
<td>0.69%</td>
<td>39MW</td>
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<tr>
<td>ASSAM</td>
<td>1.69%</td>
<td>663MW</td>
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<tr>
<td>BIHAR</td>
<td>3.85%</td>
<td>2493MW</td>
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<tr>
<td>CHANDIGARH</td>
<td>10.59%</td>
<td>153MW</td>
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<tr>
<td>CHHATTISGARH</td>
<td>7.58%</td>
<td>1783MW</td>
</tr>
<tr>
<td>DADRA AND NAGAR HAVELI</td>
<td>0.13%</td>
<td>4149MW</td>
</tr>
<tr>
<td>DAMAN AND DIU</td>
<td>2.01%</td>
<td>199MW</td>
</tr>
<tr>
<td>DELHI</td>
<td>1.40%</td>
<td>2762MW</td>
</tr>
<tr>
<td>GOA</td>
<td>0.01%</td>
<td>358MW</td>
</tr>
<tr>
<td>GUJARAT</td>
<td>15.74%</td>
<td>8020MW</td>
</tr>
<tr>
<td>HARYANA</td>
<td>1.77%</td>
<td>4142MW</td>
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<tr>
<td>HIMACHAL PRADESH</td>
<td>0.04%</td>
<td>776MW</td>
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<tr>
<td>JAMMU AND KASHMIR</td>
<td>0.09%</td>
<td>1155MW</td>
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<tr>
<td>JHARKHAND</td>
<td>0.88%</td>
<td>1995MW</td>
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<tr>
<td>KARNATAKA</td>
<td>22.13%</td>
<td>5697MW</td>
</tr>
<tr>
<td>KERALA</td>
<td>16.92%</td>
<td>12791MW</td>
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</tbody>
</table>

Image Source: CSIS Engaging Indian States
FOUR CHALLENGES AND TRENDS

I. Integration of Renewables

• Grid Scale Additions
• Power Plant Flexibility
• Rooftop Solar
• Smart Grid technologies
In 2022, Tamil Nadu can integrate approximately 40% of its total generation of renewable energy with 4.3% annual wind and solar curtailment (NREL 2017).

- Tamil Nadu’s grid must operate differently
- Net exports of energy from the state will rise by 36%
- Annual plant load factor of coal fleet falls from 66% to 44%

Requires:
- Needs better coordination of scheduling and dispatch of power with neighbors (to reduce production cost, smooth variability and uncertainty and manage flexibility)
- New PPAs to move require RE generators to provide grid services such as automatic generation control and operational data
- Need new tariff structure for coal with specified criteria (like ramping) that addresses value of coal as PLF decline.
FOUR CHALLENGES AND TRENDS
II. Role of Energy Efficiency

- New Institution: EESL (Energy Efficiency Services Limited)
- Building and Appliance Standards
- UJALA Initiative for distribution of LEDs
- SLNP (Street Lighting National Programme)
- Smart Meters
- Agriculture Demand Side Management

Image Source: UJALA Dashboard, EESL
Rajasthan

Rajasthan became the first state to adopt the central government’s street lighting national program (SLNP) in all of its urban local bodies (ULB).

- 838,016 LED street lights have been deployed till date
  - Better management through remote automation
    - Base-line survey indicated tens of thousands of “ghost poles” which were a drain on the coffers of state and city governments
  - >225 tons of CO₂ saved per day
  - $USD 1 million in annual savings to municipalities like Jaipur
FOUR CHALLENGES AND TRENDS

III. Storage Technology

- Evolving Technology and Standards
- Policy
- Managing integration of RE
- Energy Conservation
- Connection with other sectors
Andhra Pradesh, Gujarat and Haryana

GE- IL&FS Energy feasibility study of grid-integrated RE coupled with battery energy storage system (BESS) in Ramagiri (Andhra Pradesh) and Nana Layja (Gujarat)

- BESS can provide grid-level and plant-level balancing services
- Better use of available land
- Decrease of project development cost by 25% by co-locating wind-solar and battery storage in one location and combining permitting and licensing process

Haryana:

- AES and Mitsubishi 10MW grid-scale project for Tata Power Delhi Distribution Limited
  - Demonstrating peak load management, improve reliability and grid flexibility
FOUR CHALLENGES AND TRENDS

IV. Electrification of Mobility

- 100 percent electric fleet by 2030 - FAME India Program
- Charging Infrastructure
- State-level incentives for consumers and industry

Total Number of Vehicles: 171,784

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<tr>
<td>19597367</td>
<td>40858</td>
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<tr>
<td>Saved fuel (in Litres)</td>
<td>Fuel saving per day (in Litres)</td>
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<tr>
<td>102279</td>
<td>49127109</td>
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<tr>
<td>CO₂ Reduction per day (in Kg.)</td>
<td>CO₂ Reduction (in Kg.)</td>
</tr>
</tbody>
</table>

FAME-India
(National Mission on Electric Mobility)

National Automotive Board
Under Department of Heavy Industry

Image Source: FAME-India
Karnataka

Karnataka became the first state in India to release a policy on electric vehicles and energy storage.
- Provision for EV manufacturing parks/zones including test tracks
- Exemption of taxes on e-vehicles
- Transition of existing public fleets
- Mandating EV charging in existing and new public and residential development
  - Special commercial rates of electricity for EV charging
- New Institutions:
  - Skill Development Center
  - Karnataka Electric Mobility & Innovation Research Center