High RE in Southern India

Impact on transmission network
Objective and Methodology

Assess the feasibility of achieving high RE shares for Southern Region (SR) states by 2030, through:

- GIS-based mapping of current and future RE zones
- Steady-state power flow studies for SR
- Identification of transmission strengthening requirements
Geospatial analysis

Unsuitable Area

Existing and Planned RE Plants

Legend
- Solar Plant Buffer
- Wind Plant Buffer
- Airport Buffer
- Protected Buffer
- Population Buffer
- Railway Buffer
- Road Buffer
- Cyclone Buffer

- Existing Wind Plants
- Existing Solar Plants
- Planned Solar Plants
- Planned Wind Plants
Proposed sites for RE expansion

Parcel capacity
>50 MW size

Wind Parcels

- Andhra Pradesh: 12934 km², 62 GW
- Telangana: 213 km², 1 GW
- Tamil Nadu: 7555 km², 36 GW
- Kerala: 256 km², 1 GW
- Karnataka: 18447 km², 88 GW

Total SR Wind: 188 GW

Solar Parcels

- Telangana: 815 km², 40 GW
- Andhra Pradesh: 2101 km², 104 GW
- Karnataka: 2631 km², 130 GW
- Tamil Nadu: 1029 km², 51 GW
- Kerala: 78 km², 4 GW

Total SR Solar: 329 GW
Demand-supply Balance – 2030

Generation (GW)

Peak load | Off peak load | Peak solar | Off peak solar | Peak wind | Off peak wind | Peak of solar+wind
---|---|---|---|---|---|---
21 Mar | 11 Nov | 10 Apr | 15 Jul | 21 Jul | 29 Sep | 21 Jun
10 PM | 3 AM | 1 PM | 3 PM | 2 PM | 9 AM | 11 AM

Solar (GW) | Wind (GW)
---|---
AP | Planned | CSTEP Proposed | Planned | CSTEP Proposed
---|---|---|---|---
5.4 | 0.0 | 9.2 | 0.0
KA | 5.7 | 8.0 | 4.9 | 5.5
KL | 1.9 | 2.6 | 0.4 | 1.2
PD | 0.9 | 0.0 | 0.2 | 0.0
TN | 8.2 | 10.6 | 11.7 | 11.6
TS | 4.5 | 13.2 | 3.6 | 0.0
All | 26.5 | 34.4 | 30.1 | 18.3

- Nuclear
- Hydro
- Thermal
- Pumped Hydro
- Solar
- Wind
- Demand
- Net exchange [Import (+ve), Export (-ve)]
Transmission network

Number of substations

<table>
<thead>
<tr>
<th>Voltage Level</th>
<th>KA</th>
<th>TN</th>
<th>TS</th>
<th>KL</th>
<th>AP</th>
<th>PD</th>
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<td>765 kV</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>0</td>
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<td>11</td>
<td>41</td>
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<tr>
<td>220/230 kV</td>
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<td>130</td>
<td>89</td>
<td>42</td>
<td>98</td>
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Network Validation

SCADA snapshot

CSTEP grid model
## Network Strengthening

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<th>State</th>
<th>Overloaded Substations</th>
<th>Overloaded Transmission lines</th>
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<td>400 kV &amp; above</td>
<td>220/230 kV</td>
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<td>Andhra Pradesh</td>
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<td>Karnataka</td>
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<td>Kerala</td>
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<td>Tamilnadu</td>
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<td>Telangana</td>
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<td>Puduchery</td>
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<table>
<thead>
<tr>
<th>Grid Element</th>
<th>Unit</th>
<th>Capacity addition proposed</th>
<th>Cost (INR Crore)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>765 kV</td>
<td>400 kV</td>
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<td>Transmission line</td>
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<td>Transformation capacity</td>
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<td><strong>Total cost</strong></td>
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Summary

• With current targets for 2030, SR will act as power exporter

• Inter-regional transmission corridor to other regions needs enhancement

• Significant intra-regional overloading seen

• RE must-run and role of storage need to be looked into
Transmission Visualisation Portal

• Entire network model uploaded on CSTEP interactive portal
• Can be accessed at [http://darpan.cstep.in/highre/](http://darpan.cstep.in/highre/)
• Demo of the portal available at [https://www.youtube.com/watch?v=5eWRG-CaInI&feature=youtu.be](https://www.youtube.com/watch?v=5eWRG-CaInI&feature=youtu.be)