Revenue and Tariff Analysis for Electric Utilities
(RATE) model for Andhra Pradesh

Scenario based Analysis and Observations
Prayas (Energy Group)
January 8, 2018
Hyderabad

Outline

• Background and Context

• About RATE-AP

• Scenarios and related variables, assumptions

• Major scenario results
Outline

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• Major scenario results

Utility Business Model at crossroads

- Renewable energy boom
  - ↓ Solar PV, wind price
  - Wheeling, CSS concessions
  - Net metering
  - RE – 175 GW

- Uncertainty in Demand Growth
  - ACOS @ Rs. 6/unit and ↑
  - ↑ in open access, captive sales migration
  - Impact of EE efforts
  - Unmetered demand
  - Make in India

- Generation and Power Procurement
  - Performance of power plants
  - Backing down
  - Coal, gas: ↑ prices, issues with availability, quality

- New thinking needed for power procurement
  - Surplus management: Backing down strategies, sale of surplus power
  - New opportunities for medium term contracts

- Tariff design needs to be re-imagined
  - Sales migration leaves little room to ↑ cross subsidy
  - Additional surcharge, increased fixed charges etc. could encourage further migration to captive

- Major trends to inter-related need to think of assessing cumulative impacts
  - An analytical tool for ‘what-if’ scenario based sense making of various trends/possibilities
RATE Model: Features and Possibilities

• **Features**
  – Excel-based financial and performance analysis model *developed by Prayas*
  – Provision for disaggregated inputs for various components of utility operations
  – Structured to assess cumulative impacts of changes in various parameters
  – Useful for medium term sense making (5-6 year time horizon)
  – Annual treatment of most cost and performance heads
  – Customisable to suit State/DISCOM/Genco needs

• **Possibilities with RATE**

<table>
<thead>
<tr>
<th>What RATE can help with:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- 'What-if?' scenario impacts</td>
</tr>
<tr>
<td>- Understanding cumulative impacts</td>
</tr>
<tr>
<td>- Identification of key issues</td>
</tr>
<tr>
<td>- Evaluate innovative ideas, regulatory decisions</td>
</tr>
<tr>
<td>- Sense making for different stakeholders</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>What RATE is not designed for:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Dispatch modeling</td>
</tr>
<tr>
<td>- Accurate ARR estimation</td>
</tr>
<tr>
<td>- Monthly, quarterly seasonal analysis</td>
</tr>
<tr>
<td>- Transmission pricing</td>
</tr>
<tr>
<td>- Load profile estimation</td>
</tr>
</tbody>
</table>

Background and Context

• PEG developed RATE, a scenario building model to inform power sector decision making

• RATE in other states
  – customized for Maharashtra
    • Used for regulatory interventions in Genco and DISCOM matters
  – Gujarat RATE adaptation in 2018
    • Based on consultations with the GUVN and GERC

• APERC requested PEG to adapt model for AP
  – RATE-AP developed between June and October 2017
  – Model based on discussions with APERC staff, relevant regulations, orders and petitions, state government policies
  – Model is highly flexible and thus key assumptions can be changed as required
  – All assumptions and estimations for the model are made by PEG
Purpose of the presentation

• Scope of Presentation
  – Showcase usefulness and functions of RATE-AP
  – Not about numbers and conclusions but about ways in which model can be used
  – Sense-making scenarios to compare order of magnitude impacts due to changes.
  – Presentation is part of the documentation that goes with the excel-based model along with user guide, narrative on scenarios

• Scenarios and Results
  – The results and scenarios presented are by PEG
  – The scenarios and results are not prescriptive. They are only examples to demonstrate the functions of the model
  – Any sense-making and scenario building for prescriptive purposes can be done by APERC, utilities, consumers and other stakeholders

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ABOUT RATE-AP

1. Need
2. Features
3. Structure

Need for sense-making for AP utilities

- Power sharing with Telangana
- Managing contracted thermal capacity
- Sales migration to open access, captive, rooftop
- Falling RE prices, advent of storage
- Reducing room for cross subsidy
- Renewable energy capacity addition
Features of RATE-AP: Power Procurement

- **Firm power procurement**
  - Station-wise disaggregation of generation and costs
  - Treatment of costs based on type of PPA
  - Option to specify PLFs and escalation rates for fixed and variable costs
  - Reconciliation of RE capacity addition with RPO targets
  - Possible to assess cost impact of capacity addition in excess of RPO

- **‘Surplus’/Shortage management**
  - Annual estimates for backing down in the face of surplus
  - Options for purchase/sale in case of annual shortage/surplus

- **Intra/inter-state transmission charges**
  - Based on historical trends
  - Bottom up calculation not present

Features of RATE-AP: Distribution

- **Separate treatment for APEPDCL and APSPDCL**

- **Category wise sales and revenue from tariff estimates**
  - Further differentiation based on voltage and tariff slabs.
  - Option to input tariff increase and change tariff design
  - Energy accounting based on transmission and distribution loss trajectories

- **Category wise sales migration**
  - Due to Open Access, Captive and Rooftop solar
  - Estimation of revenue from sales migration charges

- **Distribution cost**
  - Capital Expenditure (Tariff regulations)
  - Operation and Maintenance (past trends)
SCREENSHOTS OF THE MODEL

Power Procurement

<table>
<thead>
<tr>
<th>Plant specification</th>
<th>Contracted Capacity</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Unit</th>
<th>Fuel</th>
<th>Date of commercial Operation (CoD)</th>
<th>Capacity (MW)</th>
<th>Normalised availability (MW)</th>
<th>Availability (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OTJP-I</td>
<td>Coal</td>
<td>01/01/2009</td>
<td>FY14 184, FY15 184</td>
<td>FY16 184, FY17 184</td>
<td>FY18 184, FY19 184</td>
</tr>
<tr>
<td>OTJP-II</td>
<td>Coal</td>
<td>01/01/2009</td>
<td>FY14 184, FY15 184</td>
<td>FY16 184, FY17 184</td>
<td>FY18 184, FY19 184</td>
</tr>
<tr>
<td>OTJP-III</td>
<td>Coal</td>
<td>01/01/2009</td>
<td>FY14 184, FY15 184</td>
<td>FY16 184, FY17 184</td>
<td>FY18 184, FY19 184</td>
</tr>
<tr>
<td>NTEPS-IV</td>
<td>Coal</td>
<td>01/01/2009</td>
<td>FY14 184, FY15 184</td>
<td>FY16 184, FY17 184</td>
<td>FY18 184, FY19 184</td>
</tr>
<tr>
<td>NTEPS-V</td>
<td>Coal</td>
<td>01/01/2009</td>
<td>FY14 184, FY15 184</td>
<td>FY16 184, FY17 184</td>
<td>FY18 184, FY19 184</td>
</tr>
<tr>
<td>NTEPS-VI</td>
<td>Coal</td>
<td>01/01/2009</td>
<td>FY14 184, FY15 184</td>
<td>FY16 184, FY17 184</td>
<td>FY18 184, FY19 184</td>
</tr>
<tr>
<td>NTEPS-VII</td>
<td>Coal</td>
<td>01/01/2009</td>
<td>FY14 184, FY15 184</td>
<td>FY16 184, FY17 184</td>
<td>FY18 184, FY19 184</td>
</tr>
<tr>
<td>NTEPS-VIII</td>
<td>Coal</td>
<td>01/01/2009</td>
<td>FY14 184, FY15 184</td>
<td>FY16 184, FY17 184</td>
<td>FY18 184, FY19 184</td>
</tr>
</tbody>
</table>

Plant name, fuel type, CoD

Availability ...
### Sales Migration

#### % Sales Migration

| Category-wise/ slab-wise sales | Quantum of Sales Migration |

#### Revenue

| Category | Consumer Categories | Tariff Increase |

#### Average Billing Rate
Outline

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Scenarios and Key Variables

1. Brief Description of Scenarios
2. Variables, assumptions related to
   i. Power Procurement
   ii. Sales and sales migration
   iii. Cost escalation and tariffs
### Baseline Scenario: Power Procurement

<table>
<thead>
<tr>
<th>Conventional Capacity Addition</th>
<th>FY 18</th>
<th>RTPP IV (600 MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 20</td>
<td></td>
<td>SDSTPS III (800 MW)</td>
</tr>
<tr>
<td>FY 22</td>
<td></td>
<td>VTPS V (800 MW)</td>
</tr>
<tr>
<td>PLF for GENCO Projects</td>
<td>Across Years</td>
<td>80%</td>
</tr>
<tr>
<td>Capacity Charge Escalation Rate</td>
<td>Across Years</td>
<td>2-5%</td>
</tr>
<tr>
<td>Energy Charge Escalation Rate</td>
<td>Across Years</td>
<td>4%</td>
</tr>
<tr>
<td>RE Tariffs (Rs./kWh)</td>
<td>Year</td>
<td>FY 18</td>
</tr>
<tr>
<td>Wind</td>
<td></td>
<td>4.20</td>
</tr>
<tr>
<td>Solar</td>
<td></td>
<td>4.00</td>
</tr>
<tr>
<td>Biomass</td>
<td></td>
<td>5.15</td>
</tr>
<tr>
<td>SHP</td>
<td></td>
<td>2.33</td>
</tr>
<tr>
<td>Transmission Losses</td>
<td>Across Years</td>
<td>~3%</td>
</tr>
<tr>
<td>Transmission Cost Escalation</td>
<td>Across Years</td>
<td>13%</td>
</tr>
</tbody>
</table>

### Baseline Scenario: Distribution

<table>
<thead>
<tr>
<th>Power Purchase Share</th>
<th>SPDCL</th>
<th>66%</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPDCL</td>
<td>34%</td>
<td></td>
</tr>
<tr>
<td>Sales growth projections</td>
<td>SPDCL</td>
<td>7.2% p.a</td>
</tr>
<tr>
<td>EPDCL</td>
<td>12.7% p.a</td>
<td></td>
</tr>
<tr>
<td>Sales migration charges</td>
<td>CSS</td>
<td>As per NTP</td>
</tr>
<tr>
<td>Additional Surcharge</td>
<td>Rs.1/kWh from 2018</td>
<td></td>
</tr>
<tr>
<td>Wheeling</td>
<td>As per FY17 charges</td>
<td></td>
</tr>
<tr>
<td>RE rebates</td>
<td>100% of wheeling charges 100% of CSS for in-state solar</td>
<td></td>
</tr>
<tr>
<td>% tariff increase</td>
<td>Overall, across years</td>
<td>1.2% p.a</td>
</tr>
<tr>
<td>Distribution cost escalation rates</td>
<td>Across Years</td>
<td>14-16%</td>
</tr>
<tr>
<td>Strategy and Rate of Sale of Surplus</td>
<td>Power Exchange</td>
<td>30% sale @ Rs. 2.70/kWh</td>
</tr>
<tr>
<td></td>
<td>Bilateral</td>
<td>50% sale @ Rs. 3.00/kWh</td>
</tr>
<tr>
<td></td>
<td>DSM</td>
<td>20% sale @ Rs. 1.25/kWh</td>
</tr>
</tbody>
</table>
## Scenario Assumptions

<table>
<thead>
<tr>
<th>Assumptions by FY 22</th>
<th>Baseline Scenario</th>
<th>High RE Scenario</th>
<th>Sales Migration Scenario</th>
<th>No sharing Scenario</th>
<th>Sales Migration + High RE Scenario</th>
<th>Sales Migration + High RE + No Sharing Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE Capacity</td>
<td>4,687 MW</td>
<td>15,053 MW</td>
<td>Same as Baseline Scenario</td>
<td>Same as Baseline Scenario</td>
<td>Same as High RE Scenario</td>
<td>Same as High RE Scenario</td>
</tr>
<tr>
<td>Sales Migration</td>
<td>HT sales: 9-10% RTPV: 1.3-1.6%</td>
<td>Same as Baseline Scenario</td>
<td>HT sales: 46-50% RTPV: 6.3-8.8%</td>
<td>Same as Baseline Scenario</td>
<td>Same as Sales Migration Scenario</td>
<td>Same as Sales Migration Scenario</td>
</tr>
<tr>
<td>Sharing of Power</td>
<td>AP: 46% TS: 54%</td>
<td>Same as Baseline Scenario</td>
<td>Same as Baseline Scenario</td>
<td>Same as Baseline Scenario</td>
<td>Same as No Sharing Scenario</td>
<td>Same as No Sharing Scenario</td>
</tr>
</tbody>
</table>

### Assumptions: Total capacity contracted across scenarios

- FY 18: Rayalseema IV- 600 MW
- FY 20: Sanjeeviah III - 800 MW and VTPS V- 800 MW
- FY 22: Polavaram HEP - 960 MW
- Due to issues with gas availability, gas based IPP plants shut down
  - Spectrum Kakinada, Lanco Kondapalli, GMR Vemagiri and Rajahmundry etc.
**Assumptions- RE contracted capacity and prices**

<table>
<thead>
<tr>
<th>Source</th>
<th>FY18</th>
<th>FY22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind</td>
<td>4.20</td>
<td>3.50</td>
</tr>
<tr>
<td>Solar</td>
<td>4.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Biomass, Bagasse, Waste to Energy</td>
<td>5.15</td>
<td>5.07</td>
</tr>
<tr>
<td>SHP</td>
<td>2.33</td>
<td>2.33</td>
</tr>
</tbody>
</table>

- Solar RPO: 3% in FY 18 → 7% in FY 22
- Non Solar RPO: 6% in FY 18 → 10% in FY 22
- RE assumed must-run in all scenarios

**Assumptions: Surplus Management strategy**

- **PLF and surplus**
  - Normative PLF of 80% in all scenarios
  - In case of surplus, utility can sell power or back down
    - ~1,000 MU of surplus available for sale, rest is backed down
  - Backing down: modeled by PLF adjustments
    - TS units are first backed down to 0%
    - Then, reduce PLFs to 50% for plants with highest variable cost as per Merit Order
    - In high surplus scenarios, reduce PLFs to 25% or 0% as applicable
  - Strategy assumed for sale of surplus power
    - 50% of power through bilateral traders @ Rs. 3/unit, 30% through power exchanges @ Rs. 2.70/unit and 20% via DSM at Rs. 1.25/unit
    - Average sale of surplus is at Rs 2.56/unit, i.e., 18% lower than the average variable cost of backed down units at Rs. 3.12/unit
- **Plants often backed down as per MoD across scenarios in FY 22:**

<table>
<thead>
<tr>
<th>Name of Unit</th>
<th>Variable charges (Rs./kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RTPP I–IV</td>
<td>3.57</td>
</tr>
<tr>
<td>Simhadri I &amp; II</td>
<td>3.04</td>
</tr>
<tr>
<td>NTTPS I–III</td>
<td>3.03</td>
</tr>
<tr>
<td>NTTPS IV-V</td>
<td>2.74</td>
</tr>
</tbody>
</table>
Assumptions: Sales and sales migration

- Sales Projections
  - Gross sales growth at 7.2% p.a for EPDCL and 11.9% p.a for SPDCL

Sales migration assumptions and impact on sales growth

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Sales Migration Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>~10% of total HT sales move to open access and captive sources</td>
</tr>
<tr>
<td>High RE</td>
<td>~1.5% of total LT sales move to rooftop solar</td>
</tr>
<tr>
<td>No sharing</td>
<td></td>
</tr>
<tr>
<td>Sales Migration</td>
<td>~50% of total HT sales move to open access and captive sources</td>
</tr>
<tr>
<td>Sales Migration + High RE</td>
<td>6-9% of LT total move to rooftop solar</td>
</tr>
<tr>
<td>All combined</td>
<td></td>
</tr>
</tbody>
</table>

- Power loss trajectories same as AP DISCOM Resource Plans:
  - Transmission Losses at 3% across years
  - Distribution Losses:
    - SPDCL @ 11% in FY 18 and FY 22, EPDCL @ 10% in FY 18 and 9% in FY 22

Assumptions: Sales Migration potential and charges

- Sales migration potential
  - In FY 17, 60% of non-agricultural sales in EPDCL and SPDCL is eligible - have tariffs above Rs.5/unit
  - With a 10% increase in tariff, about 70% of sales will have tariffs above Rs.5/unit
  - At this rate, even LT consumers can migrate to rooftop solar options

- Sales migration charges across scenarios
  - CSS: as per NTP formula, Additional Surcharge: Levy of Rs.1/kWh from FY 18
  - Wheeling charges: FY17 estimates used across years, scenarios
  - Rebates for RE: Wheeling and CSS
  - Standby power: 1.5 times applicable tariff, based on assumed deviation for RE and conventional power.
Assumptions: Cost escalation and tariffs

- Power Procurement
  - Variable cost escalation at average of 4% p.a
  - Fixed cost escalation at average of 2-5% p.a
- Distribution: Capex and O&M related costs to increase at 14% p.a
- Subsidies: Assumed to be Rs. 4000 crores for both DISCOMs from FY 17 to FY 22.
  - Share of SPDCL is Rs. 2800 crores and Share of EPDCL is Rs. 1200 crores
- Tariffs: Considering today's tariffs (without subsidy), overall tariff escalation at 1.2% p.a
  - based on 3 year and year on year trends

<table>
<thead>
<tr>
<th>Consumer category</th>
<th>% of total sales (FY 17)</th>
<th>FY 17 ABR (Rs/kWh)</th>
<th>Tariff increase per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT Consumers</td>
<td>35%</td>
<td>6.89</td>
<td>2%</td>
</tr>
<tr>
<td>LT Domestic</td>
<td>28%</td>
<td>3.17</td>
<td>6%</td>
</tr>
<tr>
<td>LT Commercial</td>
<td>6%</td>
<td>9.30</td>
<td>3%</td>
</tr>
<tr>
<td>LT Industrial</td>
<td>3%</td>
<td>7.18</td>
<td>2%</td>
</tr>
<tr>
<td>LT Agriculture</td>
<td>23%</td>
<td>0.03</td>
<td>2%</td>
</tr>
</tbody>
</table>

(Average for with and without DSM)

Weighted average tariff escalation is lower than category-wise tariff escalation due to change in sales mix due to variations in sales growth, migration.

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**Major Scenario Results**

- *Power Procurement costs under various scenarios*
- *Impact of surplus management strategies with High RE capacity*
- *Impact of strategies to eliminate revenue gap*
  - Increase tariff
  - Increase subsidy
  - Sale of surplus at rates high enough to compensate revenue gap (theoretical)
- *Tariff design to manage sales migration*
  - Increase fixed cost while keeping average tariffs the same
  - Levy of additional surcharge, concessions for renewable energy based open access

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**Power Procurement across scenarios**

1. *Costs impact across scenarios*
2. *Sensitivity of cost related parameters*
3. *Impact of backing down across scenarios*
4. *Impact of surplus management strategies with high RE capacity*
Power Procurement across scenarios

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Year</th>
<th>Baseline</th>
<th>Sales Migration</th>
<th>High RE</th>
<th>No sharing</th>
<th>Sales Migration + High RE</th>
<th>All Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>% RE Generation</td>
<td>FY 22</td>
<td>17%</td>
<td>21%</td>
<td>44%</td>
<td>17%</td>
<td>52%</td>
<td>52%</td>
</tr>
<tr>
<td>Surplus (MU)</td>
<td>FY 22</td>
<td>8,800</td>
<td>21,300</td>
<td>31,600</td>
<td>12,000</td>
<td>45,200</td>
<td>48,400</td>
</tr>
<tr>
<td>APPC (Rs./unit)</td>
<td>FY 18</td>
<td>3.69</td>
<td>3.74</td>
<td>3.78</td>
<td>3.80</td>
<td>3.85</td>
<td>3.89</td>
</tr>
<tr>
<td></td>
<td>FY 22</td>
<td>4.10</td>
<td>4.25</td>
<td>4.23</td>
<td>4.14</td>
<td>4.52</td>
<td>4.55</td>
</tr>
<tr>
<td>Total power procurement cost across scenarios (Rs. Cr.)*</td>
<td>FY 18</td>
<td>21,000</td>
<td>-2.9%</td>
<td>2.2%</td>
<td>2.8%</td>
<td>0.9%</td>
<td>2.0%</td>
</tr>
<tr>
<td></td>
<td>FY 22</td>
<td>34,700</td>
<td>-11.6%</td>
<td>3.2%</td>
<td>1.0%</td>
<td>-6.0%</td>
<td>-5.3%</td>
</tr>
</tbody>
</table>

*Order of magnitude analysis- all numbers rounded off to nearest hundred. All % to one decimal point

Power Procurement costs across scenarios

Baseline 5 year growth in power procurement: 13% ↑ in APPC, 84% ↑ in total costs.

Sales Migration: In spite of backing down, total power purchase cost falls by 12% due to savings in variable cost. However, APPC goes up by 4%.

High RE: Cost increases by 3% with 10,366 MW additional RE capacity addition by FY22.

No sharing: Additional ~320 Cr increase in fixed costs. Deviation reduces due to variable costs saving with increased backing down.

Combination Scenarios: 10%-11% increase in APPC due to cumulative effects.
Sensitivity to cost assumptions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Values</th>
<th>Changed Range</th>
<th>Effect on Power Purchase Cost across scenarios in FY22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Cost</td>
<td>Escalation: 5% 2% for depreciated plants</td>
<td>-2% to +2%, 1% to -1% for depreciated plants</td>
<td>-2% to 2.1%</td>
</tr>
<tr>
<td>Thermal Variable Cost</td>
<td>Escalation: 4%</td>
<td>-2% to 1%</td>
<td>-3.7% to 1.9%</td>
</tr>
<tr>
<td>Solar Tariff</td>
<td>Rs. 3 in FY22</td>
<td>-1 to +1 Re/unit in FY22</td>
<td>-0.8% to 0.8% in Baseline -2.5% to 2.5% in High RE</td>
</tr>
<tr>
<td>Wind Tariff</td>
<td>Rs. 3.5 in FY22</td>
<td>-1 to +0.7 Re/unit in FY22</td>
<td>-0.4% to 0.3% in Baseline -1.7% to 1.5% in High RE</td>
</tr>
<tr>
<td>Cumulative Cost Impact</td>
<td></td>
<td></td>
<td>-6.9% to 5.1% in Baseline -8.4% to 7.2% in High RE</td>
</tr>
</tbody>
</table>

- Significant uncertainty in RE costs
- Above changes result in 7% variation in non-RE costs, 13% variation in RE costs
- Variation in total power purchase costs:
  - 7% in baseline scenario, 8.5% in the High RE scenario

Extent of backing down across scenarios

<table>
<thead>
<tr>
<th>Year</th>
<th>Scenarios</th>
<th>Fixed cost payments as a % of total power procurement costs</th>
<th>‘Surplus’ Power Backed down (MU)</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 18</td>
<td>Baseline</td>
<td>30%</td>
<td>16,600</td>
</tr>
<tr>
<td>FY 22</td>
<td>Sales Migration</td>
<td>34%</td>
<td>20,600</td>
</tr>
<tr>
<td></td>
<td>High RE</td>
<td>29%</td>
<td>30,900</td>
</tr>
<tr>
<td></td>
<td>No sharing</td>
<td>30%</td>
<td>11,400</td>
</tr>
<tr>
<td></td>
<td>Sales Migration + High RE</td>
<td>32%</td>
<td>44,400</td>
</tr>
<tr>
<td></td>
<td>All Combined</td>
<td>33%</td>
<td>47,700</td>
</tr>
</tbody>
</table>

Order of magnitude analysis—all numbers rounded off to nearest hundred.

- As RE tariffs are accounted as variable costs, share of fixed cost payments is lower in High RE scenarios
- Higher share of fixed cost in Sales migration scenarios and No sharing scenarios due to backing down
- Impact of backing down is high in Sales Migration and High RE scenarios where about 1/3rd of the fixed cost paid to generators is due to backing down
- Impact is aggravated in the combination scenarios with more than ½ the fixed cost payments to generators is for capacity that is backed down.
Surplus Management Strategies with High RE Capacity

- Significant surplus of 30,000 MUs with High RE capacity addition
  - Backing down with average PLF at 45%
  - MoD based scheduling may not be able to address balancing and seasonal issues due to VRE

- **Strategy 1: Shut down high cost plants all year, in case of significant all year surplus**
  - Rs 500 to Rs 600 Cr savings as compared to MoD

- **Strategy 2: To facilitate integration, run plants at >50% PLF and sell surplus at market rate (less than VC)**
  - ~Rs 2600 Cr additional variable cost as opposed to shutting down high cost units.

- Managing VRE has significant cost implications

Strategies to manage revenue gap

1. Revenue gap across scenarios
2. Strategies to manage revenue gap
   - Increase tariffs
   - Increase subsidy
Revenue gap across scenarios

Revenue gap increase for DISCOMs across scenarios
Baseline Revenue gap after subsidy in FY 18: Rs. 3800 cr.
Baseline Revenue gap after subsidy in FY 22: Rs. 32,000 cr.
Agricultural subsidy quantum: Rs. 4000 cr. across years, scenarios

Revenue gap across scenarios...2

- **Baseline**:  
  - Over 5 years, revenue gap after subsidy ↑ from Rs. 3,800 cr. to Rs. 32,000 cr.  
  - This accounts for about 13% to 68% of total expenses.

- **Observations in scenarios**:  
  - Revenue gap higher in scenarios due to significant increase in costs (RE capacity addition, No sharing with TS) and fall in revenue (sales migration)  
  - Sales migration scenarios responsible for highest losses

- **Unsustainable operations**:  
  - 70% increase in revenue gap per annum due to increase in cost and fall in revenue in Baseline itself  
  - Revenue gap deterioration is significant in combination scenarios

<table>
<thead>
<tr>
<th>% Excess revenue gap over baseline</th>
<th>Sales Migration</th>
<th>High RE</th>
<th>No sharing</th>
<th>Sales Migration + High RE</th>
<th>All Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 18</td>
<td>10%</td>
<td>12%</td>
<td>15%</td>
<td>25%</td>
<td>31%</td>
</tr>
<tr>
<td>FY 22</td>
<td>25%</td>
<td>25%</td>
<td>11%</td>
<td>53%</td>
<td>59%</td>
</tr>
</tbody>
</table>
Strategies to eliminate revenue gaps

- **Strategy 1: Increase tariff till full revenue recovery**
  - Increase in tariff for each category based on average overall tariff increase required
  - Cross subsidy and tariff design remain the same

- **Strategy 2: Increase in subsidy to meet revenue gap**
  - This is over and above the current assumed Rs. 4000 crores for both DISCOMs

---

**Strategy 1 - Tariff increase**

- Without meeting revenue gap
  - Average tariff increase over five years in Baseline: 7.5% (HT: 14%, LT: 17%)
  - Average tariff about 1% (FY18) to 8% (FY22) lower in Sales Migration

<table>
<thead>
<tr>
<th>Tariff increase required to eliminate revenue gap over five years</th>
<th>Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>23% to 24%</td>
<td>Baseline, No Sharing</td>
</tr>
<tr>
<td>26% to 31%</td>
<td>High RE, Sales Migration</td>
</tr>
<tr>
<td>37% to 38%</td>
<td>Sales Migration + High RE, All combined</td>
</tr>
</tbody>
</table>

- Tariffs will now have to increase by 4% to 7% p.a
- Skipping tariff increase for 1 year would > double tariff increase required next year.
- Rate of increase can be determined based on desired cross subsidy design
- Unsustainably high tariffs will encourage sales migration
**SPDCL: Tariff increase required to meet revenue gap with current tariff design**

Average HT ABR across scenarios @ Rs. 13.26/unit – 121% higher than the cost of oversized stand alone PV system with battery backup (Rs. 6/unit for day-time supply)

- Baseline: HT: ABR in FY 17, LT: ABR in FY 17
- High RE: HT: Increase in ABR by FY 22, LT: Increase in ABR by FY 22
- Sales Migration: HT: Increase in ABR required to meet revenue gap by FY 22, LT: Increase in ABR required to meet revenue gap by FY 22

**EPDCL: Tariff increase required to meet revenue gap with current tariff design**

Average HT ABR across scenarios @ Rs. 10.59/unit – 77% higher than the cost of oversized stand alone PV system with battery backup (Rs. 6/unit for day-time supply)

- Baseline: HT: ABR in FY 17, LT: ABR in FY 17
- High RE: HT: Increase in ABR by FY 22, LT: Increase in ABR by FY 22
- Sales Migration: HT: Increase in ABR required to meet revenue gap by FY 22, LT: Increase in ABR required to meet revenue gap by FY 22
Strategy 2 – Increase Subsidy

<table>
<thead>
<tr>
<th>FY 22</th>
<th>Unit</th>
<th>Baseline</th>
<th>Sales Migration</th>
<th>High RE</th>
<th>No sharing</th>
<th>Sales Migration + High RE</th>
<th>All combined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rs. Cr</td>
<td>32,100</td>
<td>40,100</td>
<td>40,000</td>
<td>35,600</td>
<td>49,200</td>
<td>50,900</td>
</tr>
<tr>
<td>Additional Subsidy</td>
<td>Rs. Cr</td>
<td>8,600</td>
<td>10,900</td>
<td>9,800</td>
<td>8,900</td>
<td>12,900</td>
<td>13,100</td>
</tr>
</tbody>
</table>

Order of magnitude analysis: All numbers rounded off to nearest hundred. Rates specified up to two decimal points.

- Subsidies at Rs. 8,600 crores to Rs. 13,100 crores per year by 2022
  - This does not include the Rs. 4000 cr assumed across scenarios in the baseline
  - Subsidy is 3 to 4 times the current assumed subsidy of Rs. 4,000 crores
  - If only 65% of the subsidy payments are given annually:
    - additional Rs. 11,200 crores - Rs.17,800 crores carrying cost will be incurred by FY22.

Strategies to deter sales migration

1. Increase fixed costs while keeping average tariffs the same
2. Rationalise additional surcharge, concessions for RE-based open access.
Strategies to deter sales migration

- Scenarios with higher sales migration have the highest revenue gaps
- ERCs can tweak tariff design to deter sales migration and compensate DISCOM for costs by:
  - **Strategy 1: Change in tariff design**
    - Increase fixed charges for all consumers while keeping average tariffs the same
  - **Strategy 2: Variation in RE rebates and additional surcharge**
    - Both the options under Strategy 2 can be incremental in nature to assess individual effects

### Strategy 1: Change in tariff design

*Impact of 100% increase in fixed charges with the same average tariff*

<table>
<thead>
<tr>
<th>Category</th>
<th>Average per unit fixed cost in 2022 (Rs./kWh)</th>
<th>Average per unit variable cost in 2022 (Rs./kWh)</th>
<th>% decrease in variable cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>APEPDCL</td>
<td>APSPDCL</td>
<td>APEPDCL</td>
</tr>
<tr>
<td>HT Industrial</td>
<td>2.08</td>
<td>2.40</td>
<td>5.16</td>
</tr>
<tr>
<td>LT Commercial</td>
<td>1.16</td>
<td>0.92</td>
<td>9.56</td>
</tr>
<tr>
<td>LT Domestic</td>
<td>0.46</td>
<td>0.53</td>
<td>3.08</td>
</tr>
<tr>
<td>LT Industrial</td>
<td>1.54</td>
<td>1.45</td>
<td>6.42</td>
</tr>
<tr>
<td>Overall</td>
<td>1.09</td>
<td>0.77</td>
<td>4.21</td>
</tr>
</tbody>
</table>

- Variable cost reduction not enough to prevent sales migration, still higher than indicative rooftop solar prices (Rs.5/unit)
- Annual fixed cost payments for 1MW+ consumers increase of Rs.60 lakhs/year/MW to Rs.1.25 crores/year/MW
- This is comparable to 13% to 28% of capital costs needed for a 1 MW solar PV system.
- Thus increase in fixed cost might incentivize migration to captive options
Sales migration

Strategy 2: Variation in rates/concessions

- Additional surcharge removal results in a loss in revenue from sales migration of about 22-26% as compared to the sales migration scenario in each year.

- Removal of RE rebates results in additional revenue from sales migration of about 29-32% as compared to the sales migration scenario in each year.

- Removal of RE concessions results in a 2-6% increase in revenue as compared to a levy of Additional Surcharge on all consumers.

<table>
<thead>
<tr>
<th>Strategies</th>
<th>EPDCL FY18</th>
<th>EPDCL FY20</th>
<th>EPDCL FY22</th>
<th>SPDCL FY18</th>
<th>SPDCL FY20</th>
<th>SPDCL FY22</th>
</tr>
</thead>
<tbody>
<tr>
<td>% change in revenue from sales migration due to removal of additional surcharge</td>
<td>-23%</td>
<td>-24%</td>
<td>-26%</td>
<td>-22%</td>
<td>-23%</td>
<td>-23%</td>
</tr>
<tr>
<td>% change in revenue from sales migration due to removal of all renewable energy related open access concessions</td>
<td>23%</td>
<td>27%</td>
<td>32%</td>
<td>19%</td>
<td>24%</td>
<td>29%</td>
</tr>
</tbody>
</table>

Key Observations

- AP DISCOMs may face severe financial crisis in the near future, especially with sales migration.

- Need for transition support is critical to ensure uninterrupted supply to small consumers.

- Tweaks in tariff design may not make significant impacts.
Way Forward

• **Role of PEG**
  - PEG has designed the scenario building model for use in Andhra Pradesh
  - We would like to thank APERC for support in customizing the model
  - However, the responsibility for scenarios and results in this presentation is with PEG
  - The model and the necessary documentation will be submitted to APERC
  - Request APERC to upload the model and the documentation on their website

• **Need for analysis from various stakeholders**
  - PEG scenarios demonstrate utility of model and showcases options available for analysis
  - Consumer groups, ERCs, utilities must develop own scenarios
  - Different scenarios and strategies need to compared to arrive at a way forward

THANK YOU

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