Indian Power Sector – A Snapshot

- 340 GW+ generation capacity
- 3.2 million km² area footprint
- 2.5 GW+ international exchanges
- 1.3 billion+ people served
- 5000+ market participants
- 50,000+ market transactions
- 100 TWh+ annual market trades
- 170 GW+
- 10 + HVDCs
- ~ 4 TWh daily energy met
- 390,000 ckm+ EHV transmission
- 70 GW+ renewables
- 86 GW+ inter-regional transmission

Source: POSOCO
Battery Storage revenue streams - India

Primary Use Case - Curtailment Avoidance

Secondary Use Case - Ramp Rate Control

Tertiary Use Case - DSM Penalty Avoidance

Number of Cycles per year
- > 1 cycle/day
- ~6.5 to 8.5 yr operational life
- 1 cycle/day
- ~14 yr operational life

Savings/Cost Ratio
- 2.50%
- 2.00%
- 1.50%
- 1.00%
- 0.50%

Annual Number of Cycles
- 1400
- 1200
- 1000
- 800
- 600
- 400
- 200
- 0

Battery Capacity (upper, MWh) and Battery Power (lower, MW)
A Case Study from an Innovative RE in Chhattisgarh

LCC at Bid Design Stage
- Technology Agnostic Technical Specifications
- Price Bid for Full DSI (incl NPV of 10 years of O&M)
- Battery Supplier kept open (to avoid technology bias)

LCC for Tariff Calculation with Regulators
- Inverter Replacement cost (Every 4200 cycles or 7 Years)
- BESS components replacement cost (10th Year).

LCC while formulating QR for the Bidders
- DSI/EPC experience of similar sized/specifications project in the last 5 years.
- Battery supplier as pure OEM at a later stage to prevent technical cartelization

160 MW (DC)/100 MW (AC)
40 MW/120 MWh
1. The Oversized Solar field (160 MW DC) charges the BESS during the day while delivering cheap solar power to the state grid capped at 100 MWAc at the transformer level.
2. The stored solar power is discharged during the evening peak hours – 1900 – 2200 hours.
3. The BESS output of 40 MW/120 MWhr replaces a coal thermal PPA.
4. This project demonstrates 3 big technical solutions.
   ➢ Energy arbitrage of Solar power.
   ➢ Replacement of a coal PPA.
   ➢ Increased penetration of RE in a coal-heavy state grid, helping meet RPO.
### Project Brief: Repurposing a 40 year old Thermal power plant

#### Summary

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Repurposing Options</th>
<th>Feasible / Not Feasible</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Synchronous Condensers</td>
<td>Feasible</td>
<td>U#8 &amp; U#9 are recommended for conversion to SYNCON based on analysis</td>
</tr>
<tr>
<td>2</td>
<td>Solar PV Based Generation</td>
<td>Feasible</td>
<td>Total 300 MW Generation Potential with 230 MW ground mounted; 69 MW Floating and 1 MW Rooftop</td>
</tr>
<tr>
<td>3</td>
<td>Battery Energy Storage</td>
<td>Feasible</td>
<td><strong>Total recommended rounded off capacity is 440 MWHr</strong></td>
</tr>
<tr>
<td>4</td>
<td>Small Hydro Electric Plant</td>
<td>Feasible</td>
<td>3 x 5 MW to be installed on the Dam Toe</td>
</tr>
<tr>
<td>5</td>
<td>Biomass Firing</td>
<td>Not Feasible</td>
<td>Considering existing boiler type and modification required and lack of availability of biomass in bulk amount in vicinity – Not Feasible</td>
</tr>
<tr>
<td>6</td>
<td>Green Hydrogen</td>
<td>Not Feasible</td>
<td>Considering nonavailability of Off Take infra and lack of local demand – Not Feasible</td>
</tr>
<tr>
<td>7</td>
<td>Wind Power</td>
<td>Not Feasible</td>
<td>Low wind Power Density and speed – Below minimum technical threshold for feasibility</td>
</tr>
</tbody>
</table>
### Battery Energy Storage

<table>
<thead>
<tr>
<th>Charging Source</th>
<th>Purpose / Duty</th>
<th>BESS (MWhr)</th>
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</thead>
<tbody>
<tr>
<td>Unit # 10</td>
<td>To improve flexibility of Generation</td>
<td>212</td>
</tr>
<tr>
<td>Unit # 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solar: 40 MWp</td>
<td>To Reduce Variability of Solar Generation</td>
<td>245</td>
</tr>
<tr>
<td>Solar: 60 MWp</td>
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<td></td>
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<tr>
<td></td>
<td>Total Technical Potential</td>
<td>457</td>
</tr>
<tr>
<td></td>
<td>Commerci ally Recommended Capacity</td>
<td>440</td>
</tr>
</tbody>
</table>
Thank You!