REPORT

STRATEGIC PATHWAYS FOR ENERGY STORAGE IN INDIA THROUGH 2032

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SUMMARY FOR POLICYMAKERS

This study, through comprehensive grid simulations, examines key aspects of energy storage in India, including required capacity, optimal locations, duration, technologies, costs, and policy framework, to meet growing electricity needs in a least-cost manner, while preventing the stranding of thermal assets.

KEY FINDINGS FROM THE STUDY ARE AS FOLLOWS:

- **India Can Meet the 2030 Clean Power Target Without Raising Costs**: Non-fossil capacity will exceed 500 GW by 2030 and 600 GW by 2032, with inflation-adjusted power procurement cost stable at ₹5.4/kWh. But unlocking $380 billion in financing and easing supply chain constraints is critical.
- **Significant Energy Storage Needed for Grid Stability**: India will need 61 GW/218 GWh of energy storage by 2030 and 97 GW/362 GWh by 2032 to ensure grid reliability. Battery storage will lead, though pumped hydro may gain ground if battery prices do not fall as anticipated.
- **Co-locating Storage with Solar is Cost-Effective**: Energy storage should be co-located with solar in high-capacity, high-demand regions like Gujarat, Rajasthan, Maharashtra, Uttar Pradesh etc.
- **2-Hour Storage Leads Initially, 4-Hour Storage Dominate Later**: Until 2027, 2-hour batteries will help meet evening peak demand. From 2027 onwards, 4-hour batteries will become predominant, offering deeper grid balancing and greater flexibility.
- **No Additional Coal Capacity Needed if Storage is Deployed**: Beyond the 27 GW of coal under construction, no new coal is economically justified by 2030—unless storage deployment is delayed, which may trigger additional coal capacity for firming needs.

KEY POLICY AND REGULATORY RECOMMENDATIONS TO ACCELERATE THE STORAGE DEPLOYMENT ARE AS FOLLOWS:

- **Co-located Storage**: Add 15–20 GW of storage at existing and under-construction solar plants without requiring new transmission. Encourage co-located storage in all new RE projects, targeting 25–30% of daily generation to meet peak demand and balance the grid.
- **Viability Gap Funding (VGF) for Solar + Storage**: Expand the VGF scheme to include solar + storage projects, unlocking 50–100 GW of solar and 16–32 GW of storage capacity by 2027.
- **Technology-Neutral ESOs**: Ensure all state regulators adopt national Energy Storage Obligations (ESO), with coordinated oversight by CERC, FOR, and SERCs.
- **Strengthen Resource Adequacy (RA) Planning**: Develop clear RA methodologies and performance-based capacity crediting to fully value storage across durations and regions.
- **Enable Revenue Stacking**: Update market rules to allow storage to participate in multiple services—energy arbitrage, capacity provision, and ancillary services.
- **Boost Domestic Manufacturing**: Expand PLI incentives, promote local mineral sourcing, and establish a national battery recycling program to build resilient, sustainable supply chains.

SECI auctions revealed a storage adder of about ₹ 1/kWh for 33% DC solar energy stored. So storage adder for 66% DC solar energy storage would be ~2 times or Rs 2/kWh. Assuming a solar LCOE of Rs 2.5/kWh, flat block solar + storage price would be 2.5 + 2 = ~₹ 4.5/kWh. Given the global trends in the batteries market, the storage adder may further reduce by 15-20% by 2030, solar + storage flat block cost could be under Rs. ~4.0/kWh. This is lower than the LCOE of most new coal power plants, implying the economic viability of any new thermal investments need to be seriously reassessed.

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