India’s Green Transition – Missing Long Duration Energy Storage

Prelims: *Current events of national and international importance | Energy*

Why in News?

Recently, India’s peak demand touched 270.8 GW, highlighting the need for long-duration energy storage (LDES) to balance renewable generation.

India’s Current Energy Storage Roadmap

- **National Resource Adequacy Plan (2026)** – envisages:
  - **80 GW battery energy storage** (4-hour discharge).
  - **94 GW pumped hydro storage (PHES)** (6-hour discharge).
- **Limitation –** Adequate for short-term fluctuations, but insufficient for extreme weather (heatwaves, prolonged low generation).

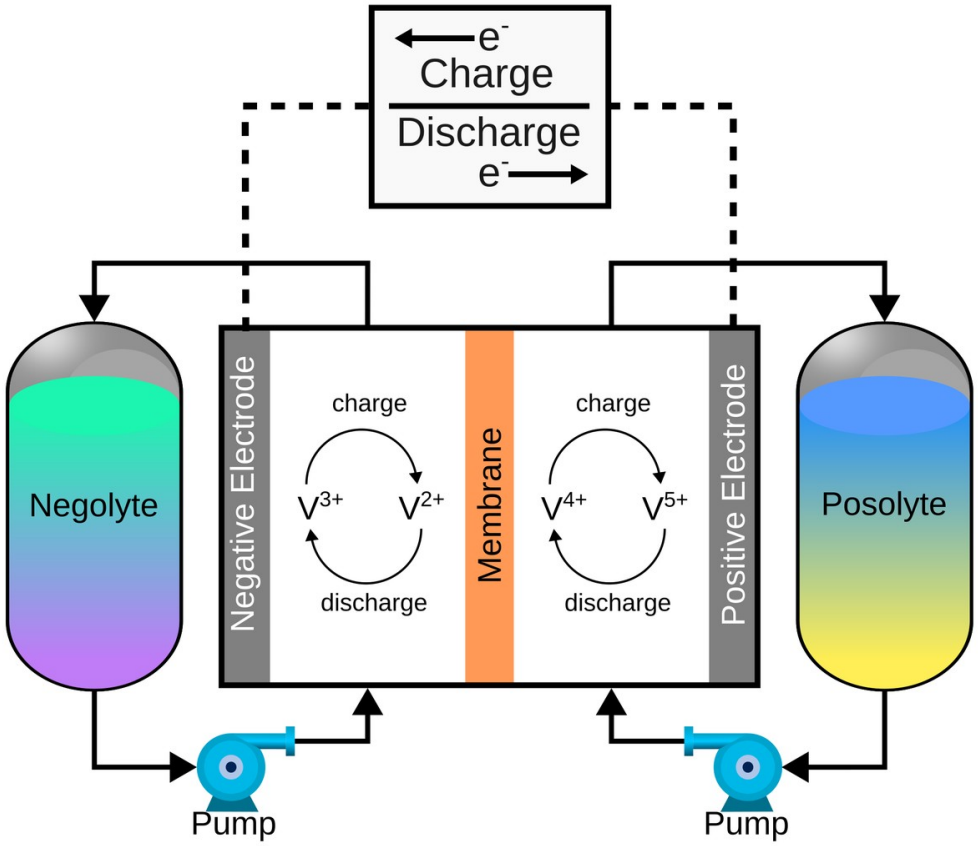
LDES

- **Definition –** Technologies storing energy for 8 hours to days or weeks or seasons.
- **Role –** Provides reliability, balances supply-demand, eases grid congestion, enhances resilience and ensures multi-day stability during periods of peak demand or low generation.

LDES Technologies

- **Pumped Hydro (PHES) –** Uses two reservoirs at different heights; very efficient (70–80%) but possible only in suitable geography.
- **Compressed Air (CAES) –** Stores air in underground caverns or containers; releases it through turbines to make electricity.
- **Thermal Storage –** Keeps heat or cold in materials like molten salt; can supply power for 200 hours; still developing.
- **Hydrogen Storage –** Stores energy chemically as hydrogen; can last up to 1,000 hours; efficiency is lower.
- **Vanadium Flow Batteries –** Store liquid electrolytes in tanks; easy to

scale; provide steady power for 10–24+ hours.



Reference

[The Hindu | LDES]

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