Science & Technology · GS - III

Discuss the role of pumped storage hydropower projects in India's renewable energy transition. What policy and institutional measures are required to accelerate their development?

EXAM YEAR	PAPER	SUBJECT
DAILY PRACTICE 27/11/2026	GS - III	Science & Technology

MARKS	WORD LIMIT
15	~250 words

Answer Hint

Grid-scale storage, renewable energy integration, peak-load management, energy security, viability gap funding, environmental clearances, Centre-State coordination

Model Answer

India's growing renewable energy capacity, particularly solar and wind power, requires reliable energy storage to manage fluctuations in electricity generation. Pumped storage hydropower (PSH) can provide large-scale and long-duration energy storage.

Significance of pumped storage projects

1. **Renewable energy integration:** They store surplus solar and wind electricity and release it when generation declines.
2. **Grid stability:** They help balance electricity supply and demand, regulate frequency and manage peak loads.
3. **Energy security:** Domestic storage capacity can reduce dependence on fossil-fuel-based peaking power.
4. **Long-duration storage:** Unlike many battery systems, pumped storage can support electricity storage over extended periods.
5. **Economic benefits:** Project development can generate employment and strengthen regional infrastructure.

Challenges in development

- High initial investment and long construction periods.
- Land acquisition, rehabilitation and ecological concerns.
- Delays in statutory and technical clearances.
- Financing constraints, particularly for state-owned utilities.
- Policy and regulatory uncertainties affecting project viability.

Measures required

The Centre should consider extending appropriate viability gap funding to eligible state utilities, alongside transparent eligibility criteria. Faster Central Electricity Authority clearances, coordinated Centre-State planning, environmental safeguards and innovative financing mechanisms are also essential.

Conclusion

Pumped storage can become an important pillar of India's clean energy infrastructure. Its expansion requires financial support, institutional coordination and environmentally responsible project implementation.

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