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Q7

Examine the potential of wind energy in India and explain the reasons for their limited spatial spread.

UPSC Civil Services Mains 2022 · GS I · 10 marks · World's Physical Geography

Salient features of world's physical geography.

Core demand of the question

- Examine the potential of wind energy in India and explain the reasons for their limited spatial spread
- Cover resource geography and the grid, land, and policy reasons spread stays clustered
- Keep the explanation within a 10-mark length

Revision summary

NIWE maps strong onshore wind in Tamil Nadu, Gujarat, Karnataka, Maharashtra, Rajasthan, and Andhra Pradesh.

Offshore potential is large but still little built.

Turbines stay clustered because wind density, land, forests, and evacuation are uneven.

Early policy and substations locked in those corridors.

Hybrids and offshore can widen the map; they cannot put a farm in every district.

Introduction

India has a large wind resource on western and southern corridors, mapped by the National Institute of Wind Energy. Installed capacity is serious, yet turbines cluster in a few states because wind, land, and the grid do not spread evenly.

Body**Potential**

- **NIWE**'s wind atlas shows strong winds along Tamil Nadu's **Palghat gap**, Gujarat's coast and Kachchh, interior Karnataka, western Maharashtra, Rajasthan, and Andhra Pradesh.
- Onshore potential is the present workhorse; offshore estimates for **Gujarat and Tamil Nadu** are large but still early in deployment.
- Wind matches evening and monsoon pulses in some belts, which can complement solar's daytime peak if the grid can take both.
- Manufacturing and a long private-sector history since the 1990s make wind a mature Indian renewable, not a pilot toy.

Why spatial spread is limited

- Mean wind power density is high only in corridors; the eastern plains, interior north, and much of the north-east are weak for utility turbines.

- Land for large rotors is scarce near cities, and forest or agricultural objection blocks many otherwise windy ridges.
- Grid evacuation, until recent green corridors, lagged in new districts, so developers stayed where substations and old farms already existed, as at **Muppandal**.
- Intermittency needs balancing power and forecasting; weaker state utilities hesitated to add remote wind.
- Policy and renewable purchase history favoured early movers such as Tamil Nadu and Gujarat, which locked in a clustered map.

Way forward for spread

- Hybrid wind-solar parks, better forecasting, and offshore pilots can widen the map without pretending every district is Denmark.

Flow diagram

NIWE wind atlas -> TN Gujarat KA MH RJ AP
Weak inland east -> Limited spread
Grid land forest -> Limited spread
TN Gujarat KA MH RJ AP -> Clustered capacity
Clustered capacity -> Limited spread

Conclusion

India's wind potential is real on western-southern corridors and in offshore estimates. Limited spatial spread follows the wind itself, land and forest limits, and a grid that grew around the first farms rather than around every state equally.

Facts & figures

NIWE

National Institute of Wind Energy, which publishes India's wind atlas and resource maps.

Muppandal

Major Tamil Nadu wind cluster in a gap-flow corridor.

Gujarat and Tamil Nadu

Long-standing leading states for onshore wind capacity.

Palghat gap

Western Ghats break that funnels strong winds into Tamil Nadu.

Offshore Gujarat-Tamil Nadu

Coasts identified for future offshore wind, still at early commercial scale.

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