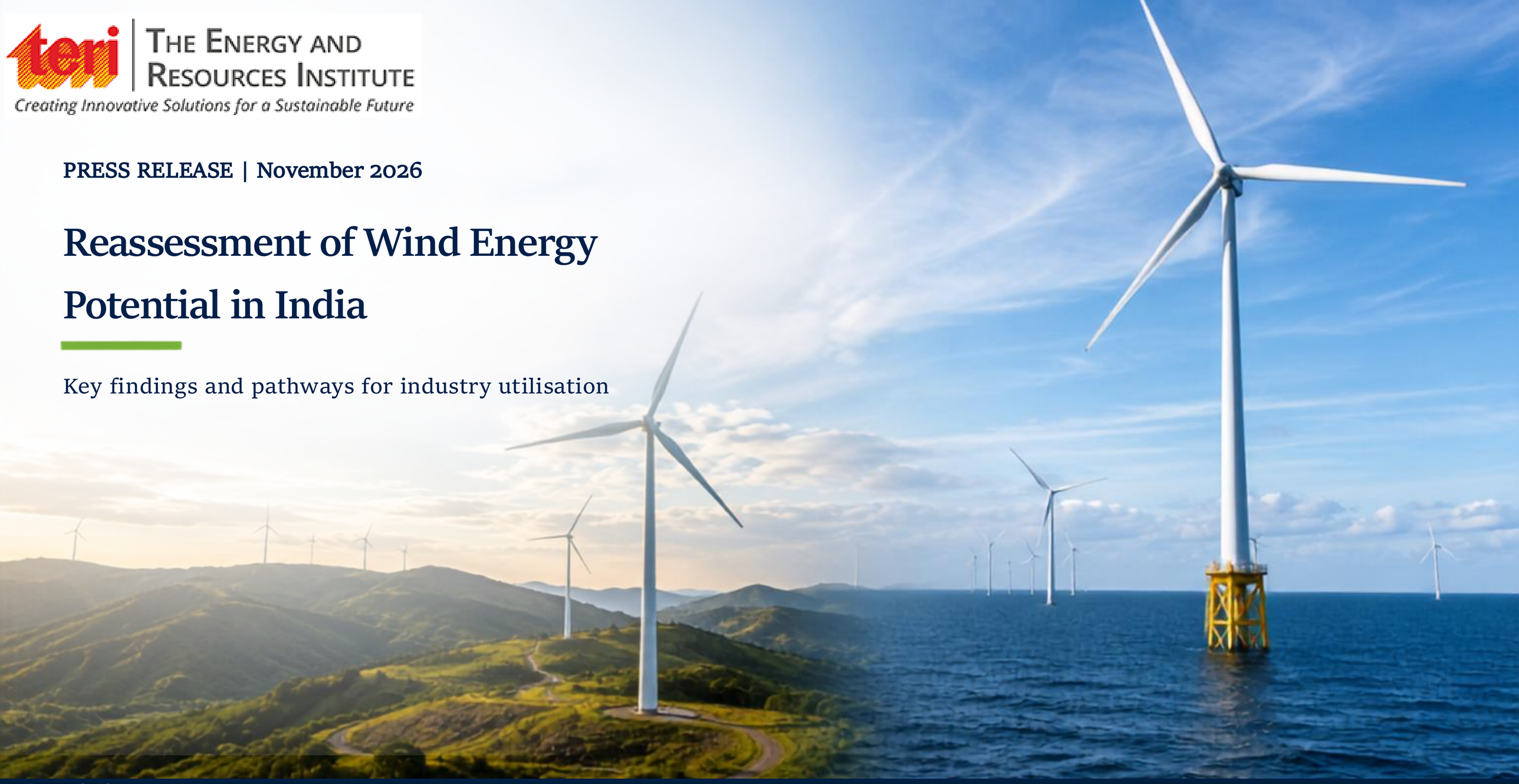
THE ENERGY AND RESOURCES INSTITUTE

Creating Innovative Solutions for a Sustainable Future

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Reassessment of Wind Energy Potential in India

Key findings and pathways for industry utilisation



AUTHORS

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Importance of Wind Energy in India's Evolving Power System

59.20 GW
Installed wind capacity as of 30 September 2026

6.05 GW
Wind capacity additions in FY2025–26

106 TWh
Wind generation in FY2025–26

Why reassess India's wind potential?

- Advancements in turbine technology, particularly larger rotor diameters and higher hub heights, are expanding the geographical possibilities for wind development.
- Increasing solar penetration highlights the importance of diversifying renewable generation across different hours and seasons.
- Growing procurement of hybrid and firm renewable power creates opportunities for greater utilisation of wind resources.
- Land availability, transmission infrastructure and project-development constraints require more detailed spatial assessment.

An updated understanding of India's wind resources can support future resource validation, infrastructure planning and the identification of new development opportunities.

Objectives and Scope of the Study

Access Onshore and Offshore Wind Potential

Assess indicative installable wind capacity at 150 m and 200 m hub heights, for onshore (state-wise) and offshore (fixed and floating).

GIS based Assessment

Combine wind resource with terrain, environmental and infrastructure constraints through a GIS-based analysis

Classify Offshore Resource

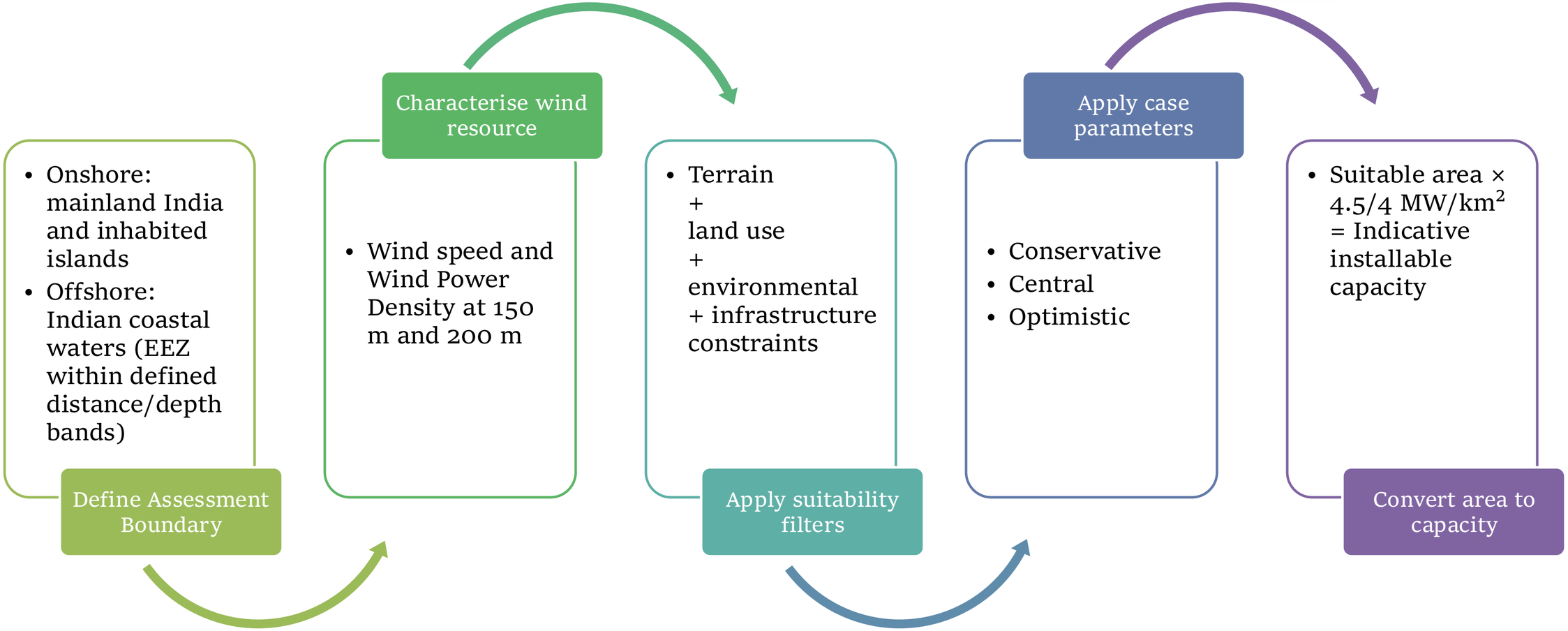
Identify offshore potential by water depth and distance from shore, distinguishing fixed-bottom and floating opportunities.

Spatial Sensitivity Analysis

Assess how potential changes under Restrictive, Reference and Expanded siting parameters.

Output: Spatially explicit technical potential estimates that provide an updated basis for wind planning, transmission assessment and future project development

Methodology



Parameter	Wind speed	Wind power density	Capacity density
Onshore	≥5.0 m/s	≥200 W/m²	4.0 MW/km²
Offshore	≥7.0 / 7.5 / 8.0 m/s	≥300 W/m²	4.5 MW/km²

Key Assumptions & Constraints

Key Assumptions

Assessment framework

- Onshore and offshore wind resources assessed at 150 m and 200 m hub heights.
- Wind-speed and wind-power-density criteria applied before spatial screening.
- Restrictive, Reference and Expanded cases use the same resource thresholds but different spatial parameters.

Capacity estimation

- Onshore: 4 MW/km^2
- Offshore: 4.5 MW/km^2

Offshore depth classification

- 0–60 m: Fixed-bottom
- >60 m: Floating

Spatial Screening Considerations

Onshore

- Built-up areas and major water bodies.
- Protected and environmentally sensitive areas.
- Terrain slope and elevation.
- Settlements and airports.
- Road accessibility and proximity to transmission infrastructure

Offshore

- Marine protected areas.
- Shipping and anchorage restrictions.
- Oil and gas infrastructure.
- Coastal-distance criteria.
- Bathymetry and other available marine-use information.

Not assessed

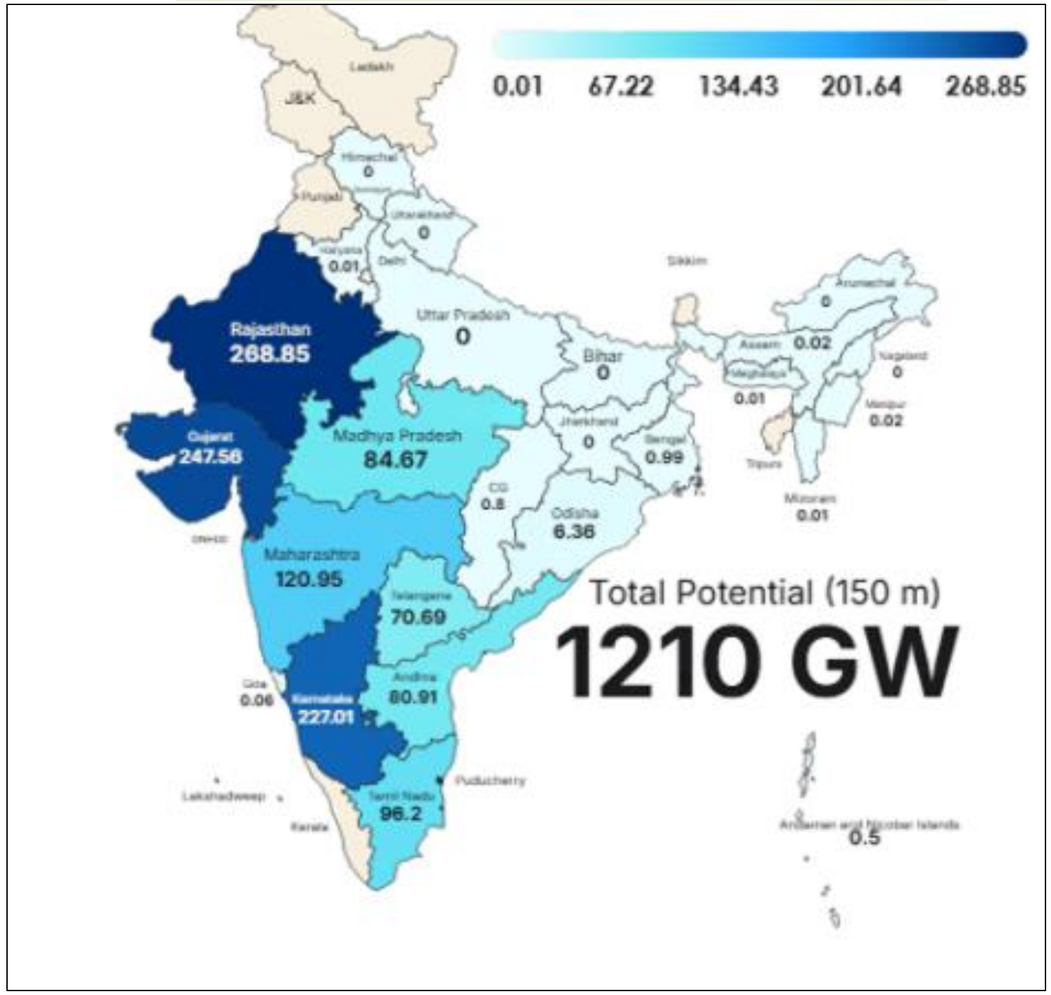
- Small/distributed wind
- Repowering potential
- Annual generation/CUF
- Offshore state/district-level potential

Key Parameters Considered

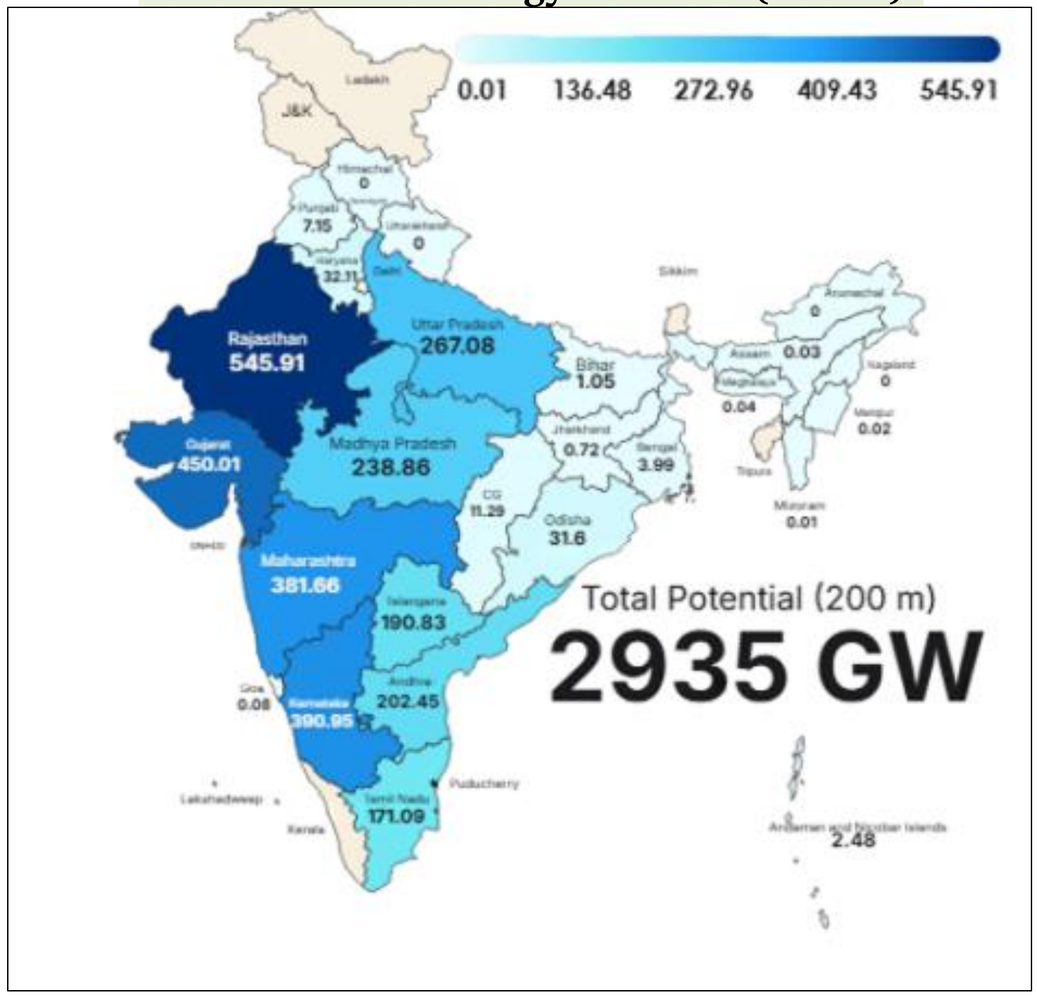
Parameter	Restrictive	Reference	Expanded
Maximum terrain slope	10%	15%	20%
Maximum distance to 132 kV or higher transmission line	20 km	50 km	100 km
Protected area screening buffer	1.5 km	1 km	0.5 km
Settlement setback	1000 m	750 m	500 m
Airport screening buffer	12 km	10 km	8 km
Maximum distance to major road	10 km	15 km	25 km
Maximum elevation	≤ 1,000 m	≤ 1,500 m	≤ 2,000 m
Offshore minimum distance from coast	20 km	15 km	10 km
Offshore maximum distance from coast	50 km	100 km	200 km
Offshore MPA screening buffer	2 km	1 km	0.5 km
Offshore oil and gas infrastructure buffer	3 km	2 km	1 km

Onshore Wind Potential (150 m and 200 m)

Onshore Wind Energy Potential (150 m)



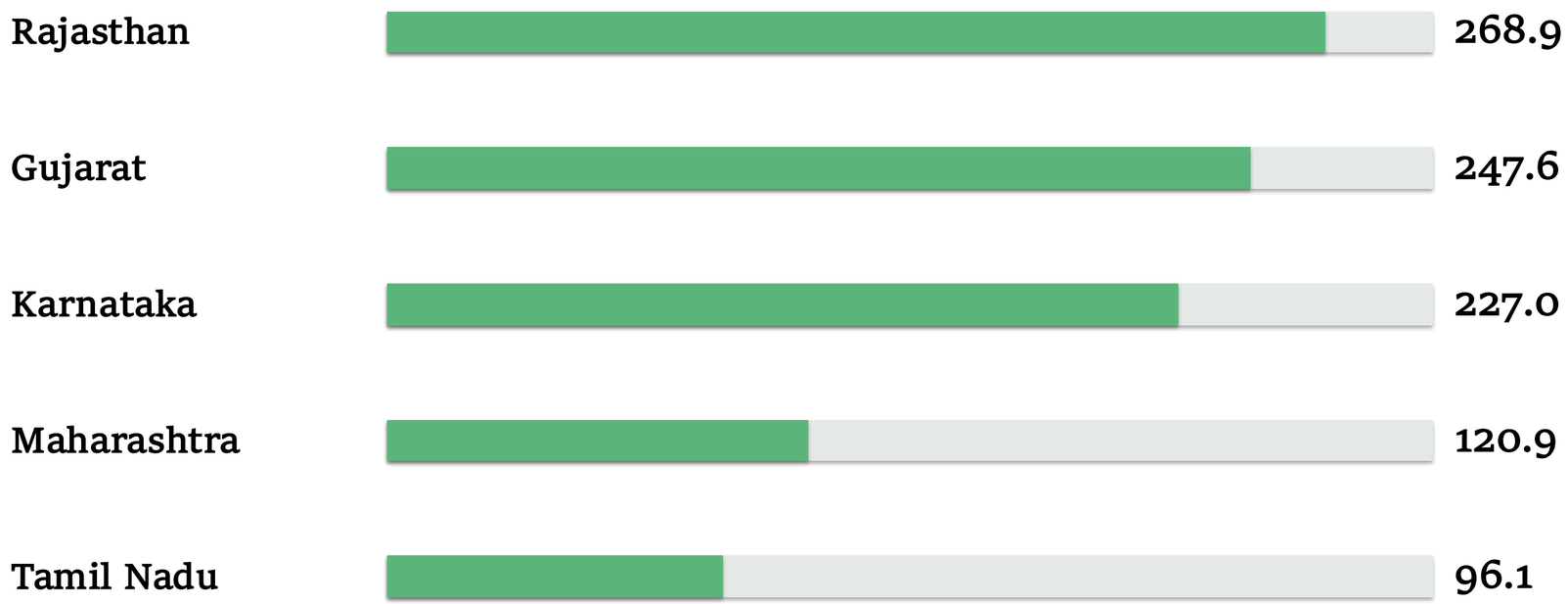
Onshore Wind Energy Potential (200 m)



Potential of established windy states (150 m)

ONSHORE | REFERENCE CASE

Leading states by screened onshore potential (GW)



61%

of national potential in Rajasthan, Gujarat and Karnataka

79%

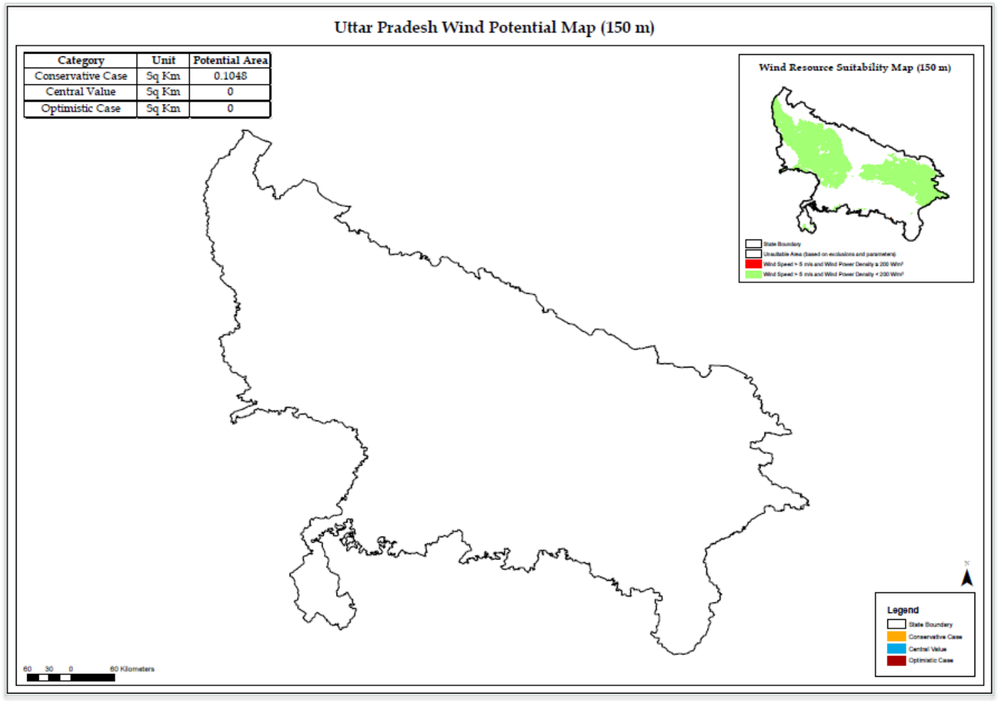
in the five leading states

These established corridors are the starting point for cluster-level land and grid assessment.

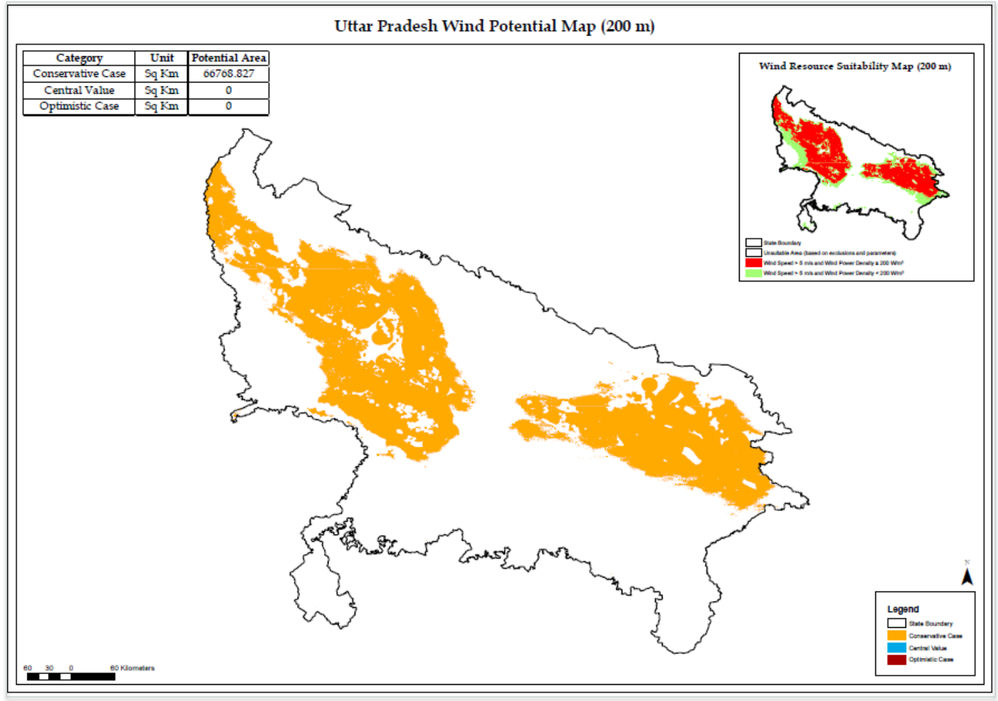
At higher hub heights, the onshore resource geography widens

EXAMPLE | UTTAR PRADESH (ONSHORE WIND)

Uttar Pradesh: GIS-screened areas under the same wind thresholds



150 m



200 m

267

GW

at 200 m

The additional resource identified at 200 m requires long-term wind measurements, turbine-suitability assessment and evaluation of project economics before development prospects can be established.

Onshore potential varies little across the tested GIS cases

ONSHORE WIND | POTENTIAL UNDER THREE GIS CASES (GW)

Assessment	Restrictive	Reference	Expanded
150 m	1,207.5	**1,209.7**	1,209.8
200 m	2,930.2	**2,933.9**	2,935.5

0.2%

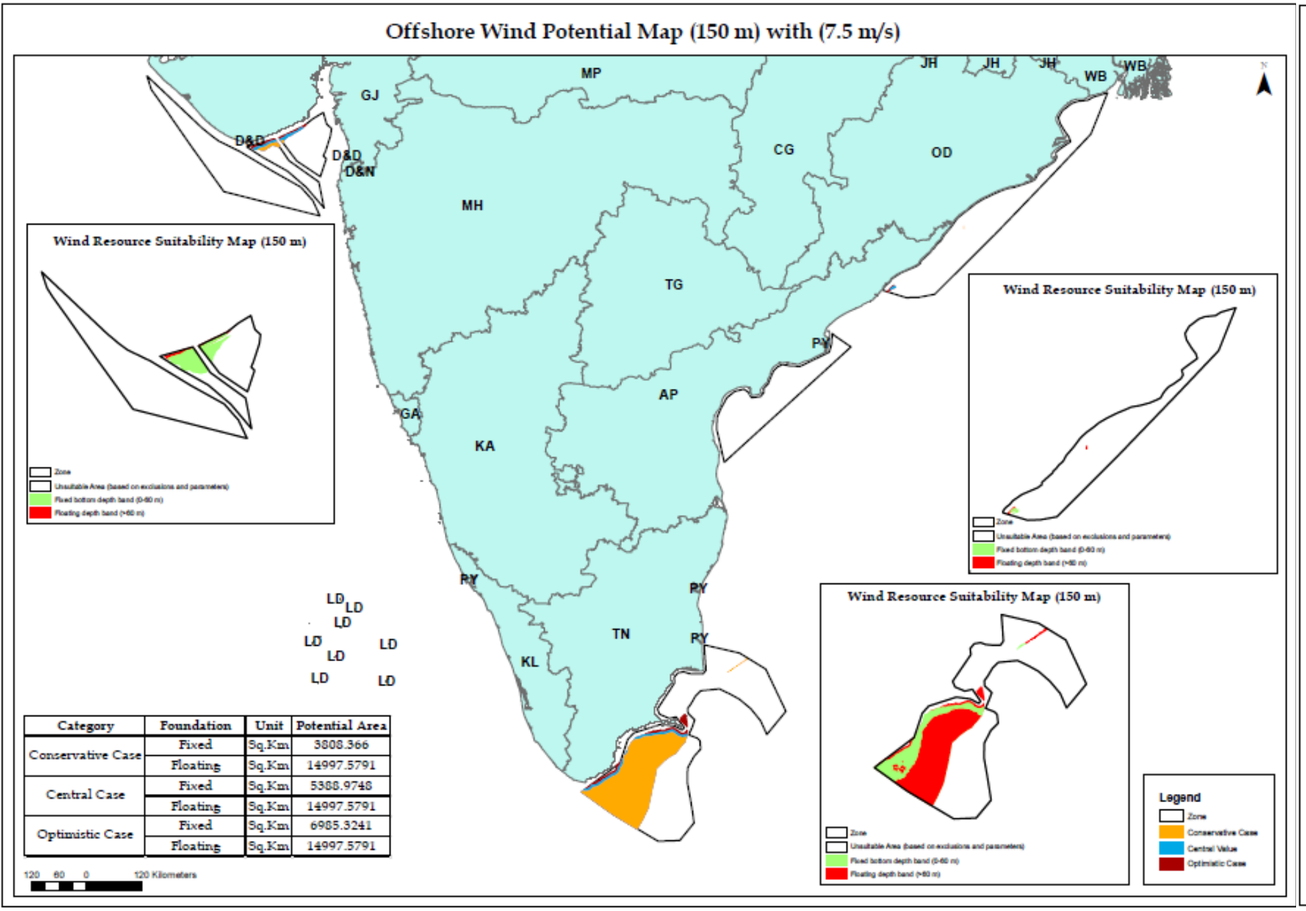
variation across the tested Restrictive and Expanded cases at either height

2.43×

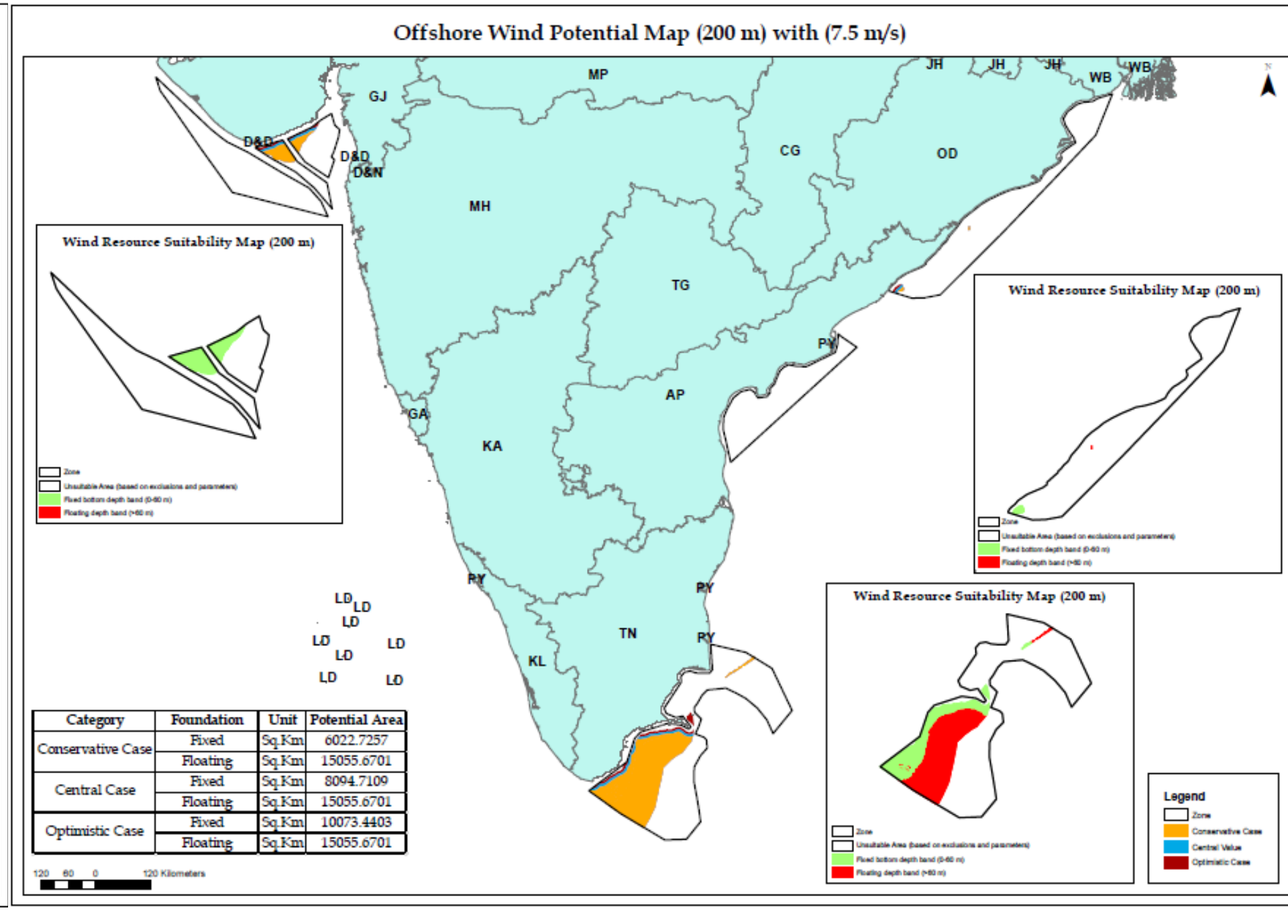
reference-case onshore potential at 200 m compared with 150 m

The limited variation reflects sensitivity to the selected GIS parameters only. It does not represent overall data uncertainty or site-level constraints.

Offshore Wind Potential (150 m and 200 m)



Category	Foundation	Unit	Potential Area
Conservative Case	Fixed	Sq.Km	3808.366
	Floating	Sq.Km	14997.5791
Central Case	Fixed	Sq.Km	5388.9748
	Floating	Sq.Km	14997.5791
Optimistic Case	Fixed	Sq.Km	6985.3241
	Floating	Sq.Km	14997.5791



Category	Foundation	Unit	Potential Area
Conservative Case	Fixed	Sq.Km	6022.7257
	Floating	Sq.Km	15055.6701
Central Case	Fixed	Sq.Km	8094.7109
	Floating	Sq.Km	15055.6701
Optimistic Case	Fixed	Sq.Km	10073.4403
	Floating	Sq.Km	15055.6701

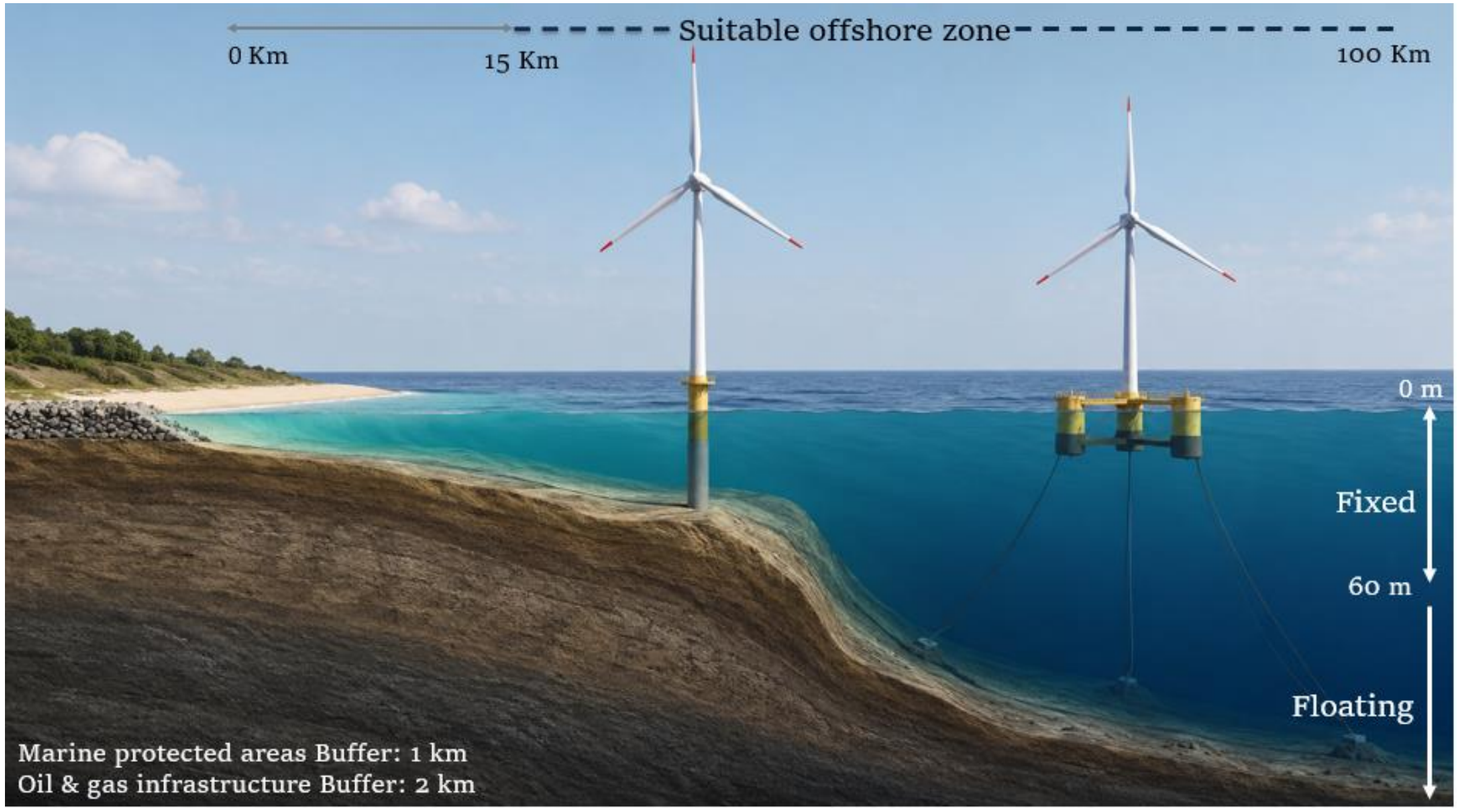
Offshore potential's sensitivity to wind-speed criteria

Reference Case | Minimum wind power density ≥300 W/m^2

Minimum mean wind speed	150 m	200 m
≥7.0 m/s	220.2 GW	276.6 GW
≥7.5 m/s	91.8 GW	104.2 GW
≥8.0 m/s	79.2 GW	81.2 GW
Potential when increasing minimum wind speed from 7.0 to 7.5 m/s	–58%	–62%

Fixed-bottom and Floating Offshore Wind Potential Classification

WATER DEPTH SHAPES TECHNOLOGY AND INFRASTRUCTURE



EXAMPLE | REFERENCE CASE

150 m

60%

of screened potential in waters deeper than 60 m

200 m

62%

of screened potential in waters deeper than 60 m

Depth is an analytical classification; actual foundation choice requires seabed, metocean and project studies.

India's assessed wind resource at a glance

Onshore Wind (GW)

TERI

	150 m	200 m
Reference:	1207.5	2930.2
Restrictive:	1209.7	2933.9
Expanded:	1209.8	2935.5

Offshore Wind (GW)

	150 m		200 m	
	Fixed	Floating	Fixed	Floating
> 7 m/s				
Reference:	73.0	130.8	86.2	169.7
Restrictive:	88.8	131.4	106.0	170.6
Expanded:	104.5	131.6	125.7	170.8
> 7.5 m/s				
Reference:	17.1	67.5	27.1	67.7
Restrictive:	24.2	67.5	36.4	67.7
Expanded:	31.4	67.5	45.3	67.7
> 8 m/s				
Reference:	13.0	63.2	13.2	64.8
Restrictive:	16.0	63.2	16.4	64.8
Expanded:	18.4	63.2	18.9	64.8

NIWE

1,164 GW	Not Assessed	71 GW (Only for fixed bottom and for Gujarat and Tamil Nadu coastal area)	Not Assessed

What does the reassessment establish?

What the study establishes

- Geographical distribution of wind resources at 150 m and 200 m.
- Potential areas meeting specified wind-speed and wind-power-density thresholds.
- Indicative capacity under defined spatial-screening assumptions.
- Differences in estimated potential across three GIS cases.
- Priority geographical areas for future wind-resource assessment and planning.

What requires further assessment

- Site-level wind measurements and energy-yield estimation.
- Land ownership, availability and fragmentation.
- Turbine micro-siting and technology suitability.
- Grid evacuation capacity and transmission augmentation.
- Transportation access and installation logistics.
- Offshore seabed, metocean and marine-use compatibility.
- Project costs and commercial viability.

The reassessment provides a national spatial screening framework. Further technical, environmental, infrastructure and economic assessments are necessary to establish developable potential.

Six industry pathways emerge from the reassessment

ESTABLISHED WIND REGIONS	TURBINES & RTC	OFFSHORE DEVELOPMENT
Greenfield onshore development Identify contiguous resource-rich areas with land availability, grid connectivity and project-development potential.	**Higher-hub-height wind** Validate emerging resource areas through wind measurements and assessment of taller towers and suitable turbine configurations.	**Fixed-bottom offshore wind** Advance priority offshore areas through seabed investigations, port infrastructure, electrical connectivity and project preparation.
Repowering & optimisation Develop turbine inventories and assess mature wind clusters for repowering, infill and improved utilisation.	**Wind-solar-storage** Evaluate hourly generation profiles, renewable complementarity, storage requirements and firm renewable power procurement.	**Floating offshore wind** Develop deeper-water resource assessment, demonstrations and supporting marine technology and supply-chain capabilities.

The transition from assessed resource to industry utilisation will depend on validated wind data, appropriate technologies, infrastructure availability, regulatory approvals and commercial viability.

Enabling India's wind industry beyond resource development

MANUFACTURING AND SERVICES

- Development of turbine components and larger turbine configurations.
- Opportunities in civil and electrical works, installation and operations and maintenance.
- Strengthening resource-assessment, forecasting and technical service capabilities.
- Industry-linked skill development for emerging wind technologies.

LOGISTICS AND TRANSPORTATION

- Assessment of road geometry, bridges and transportation routes for larger turbine components.
- Requirements for specialised trailers, cranes and installation equipment.
- Identification of logistics constraints and infrastructure improvements in major wind-development regions.
- Examination of coastal shipping and rail transportation for selected components, where feasible.

GRID AND TRANSMISSION INFRA

- Mapping potential wind-development areas against existing substations and transmission corridors.
- Assessment of evacuation capacity and network augmentation requirements.
- Coordination with transmission utilities for future wind-development clusters.
- Integration of wind resources with planned renewable-energy development and electricity-demand centres.

Coordinated planning across manufacturing, logistics and transmission infrastructure will be essential to translating screened wind resources into viable development opportunities.

Phased Roadmap

0–2 YEARS

VALIDATE & PRIORITISE

- Undertake detailed GIS assessment of priority onshore resource areas.
- Conduct long-term wind measurements at selected 200 m locations.
- Prepare turbine inventory and identify clusters suitable for repowering.
- Undertake offshore resource surveys and assess small and distributed wind applications.

OUTPUT

Priority development areas, validated resource data, turbine inventory and offshore study areas.

2–5 YEARS

PREPARE FOR DEVELOPMENT

- Align identified wind areas with transmission plans and grid infrastructure requirements.
- Develop cluster-based repowering projects through detailed technical and commercial assessments.
- Evaluate annual generation, capacity utilisation, project costs and hourly generation profiles.
- Advance fixed-bottom offshore project preparation, including port and supply-chain requirements.

OUTPUT

Grid-infrastructure requirements, project-preparation studies, repowering demonstrations and generation assessments.

BEYOND 5 YEARS

EXPAND & INTEGRATE

- Establish periodic updates of national wind-potential estimates.
- Undertake floating offshore wind demonstrations and technology evaluation.
- Develop supporting capabilities in floating foundations, mooring systems, dynamic cables and specialised marine vessels.
- Integrate wind, solar, storage and transmission planning to support future electricity demand.

OUTPUT

Updated resource estimates, deeper-water technology development and integrated renewable-energy planning

Way Forward

Development requires a sequence of evidence and decisions

01

GIS-screened potential

National resource mapping, wind-speed criteria, spatial exclusions and indicative capacity estimates.

→

02

Field-validated resource areas

Long-term wind measurements, higher-resolution land assessment, seabed and marine-use surveys.

→

03

Infrastructure-ready development areas

Grid evacuation, transmission capacity, road access, ports and turbine transportation logistics.

→

04

Project-level feasibility

Micro-siting, energy-yield assessment, turbine selection, regulatory approvals and project economics.

What is needed

- Verified resource and land availability.
- Turbine suitability and micro-siting.
- Grid evacuation capacity and infrastructure readiness.
- Offshore seabed and marine-use compatibility.
- Energy yield and project economics.

GIS-screened potential provides a starting point for development planning. Site-level evidence and infrastructure readiness will determine the potential that can be taken forward as projects.

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Thank You!

