



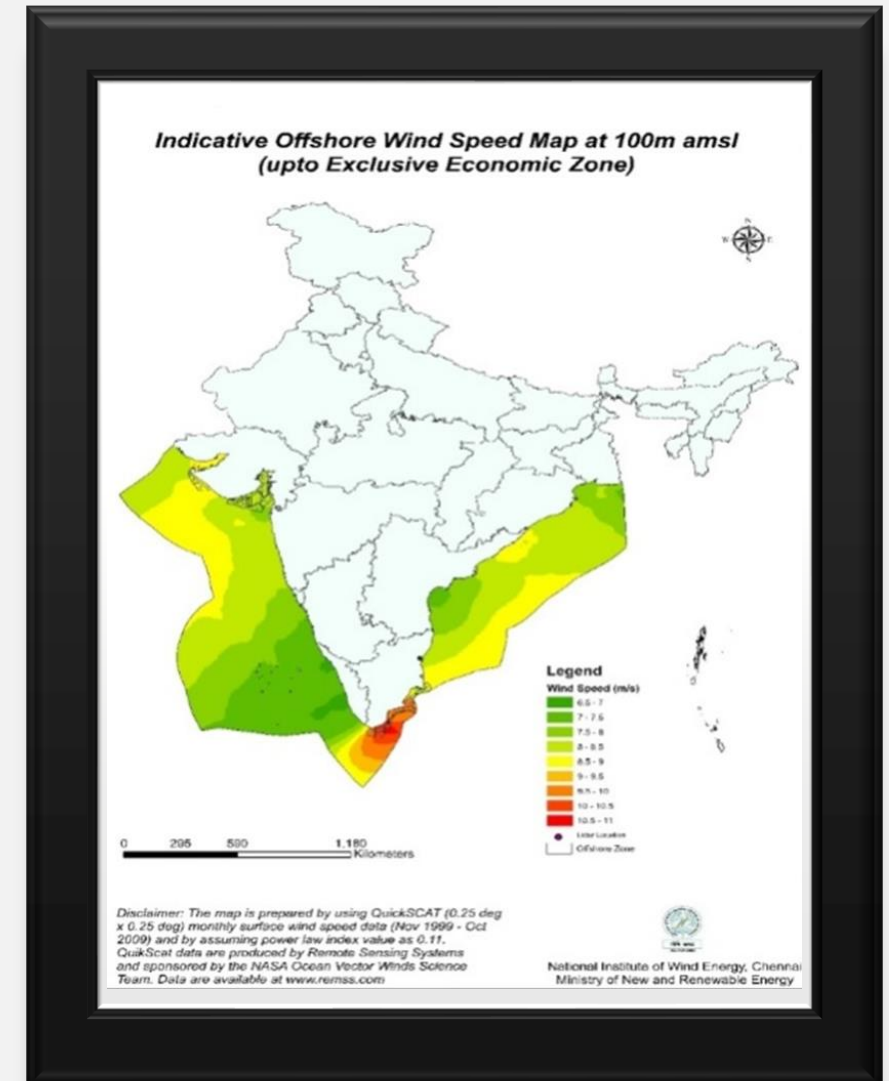
Development of Offshore Wind in India

Ministry of New and Renewable Energy

Government of India

Potential for Offshore Wind Energy in India

- India has a coastline of about 7,600 km and has good potential for offshore wind energy, with annual average wind speed up to 10.5 m/s
- It is expected that offshore wind energy projects off the Indian coast would be able to attain capacity utilization factors of up to 50%
- Owing to the consistency of offshore wind, it is expected to easily integrated into the Indian grid which has 423 GW of capacity from various sources



Advantages of Offshore Wind Energy



Scale of Offshore Wind Energy Projects



250-400 sq km

Approximate area required for 1 GW of offshore wind capacity



Up to 150 m

Hub height of offshore wind energy turbines (onshore wind turbine @ 140 m hub height)



400-750 tons

Typical weight of nacelles used in offshore wind energy turbines (onshore wind turbine nacelle weigh @ 300 tons)

Up to 165 km

Distance of offshore wind energy projects from the coast

Up to 240 m

Rotor diameter of offshore wind energy turbines (onshore wind turbine of 160 m of rotar diameter)

800 – 7,000 tons

Weight of offshore substation assemblies used in offshore wind power projects

Up to 57 m

Depth at locations where fixed offshore wind energy projects are installed

Up to 45,000 m²

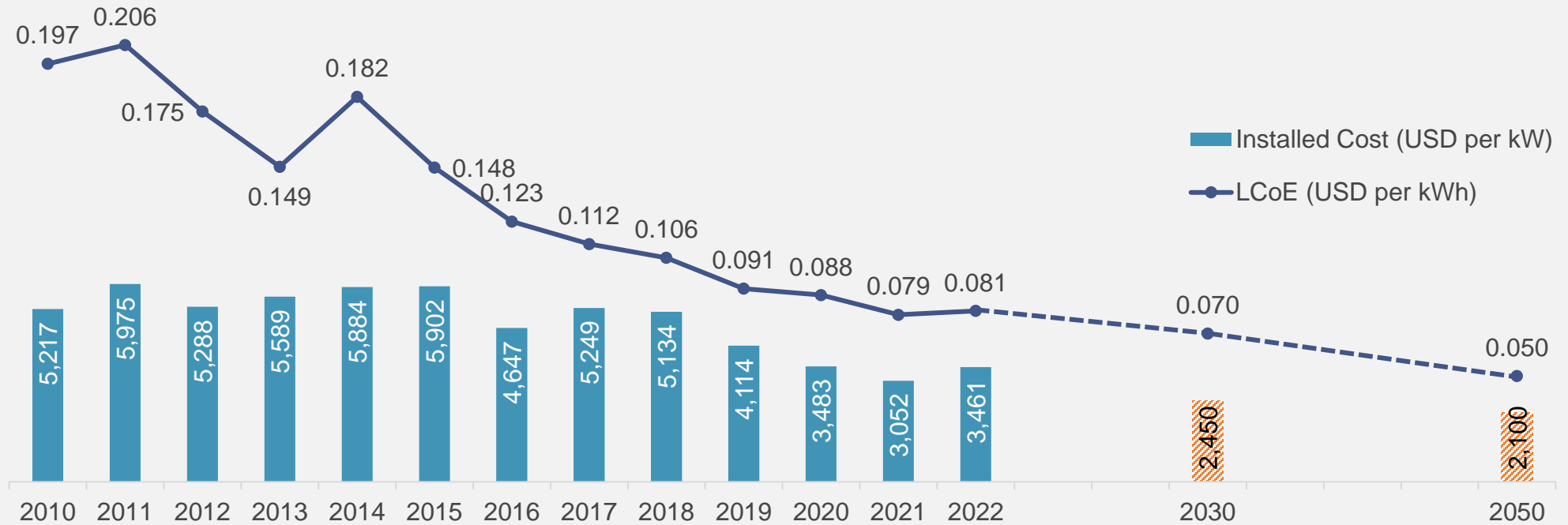
Swept area of offshore wind energy turbines

8.5 lakh+

Number of households that could be powered by 1 GW of offshore wind power capacity in India

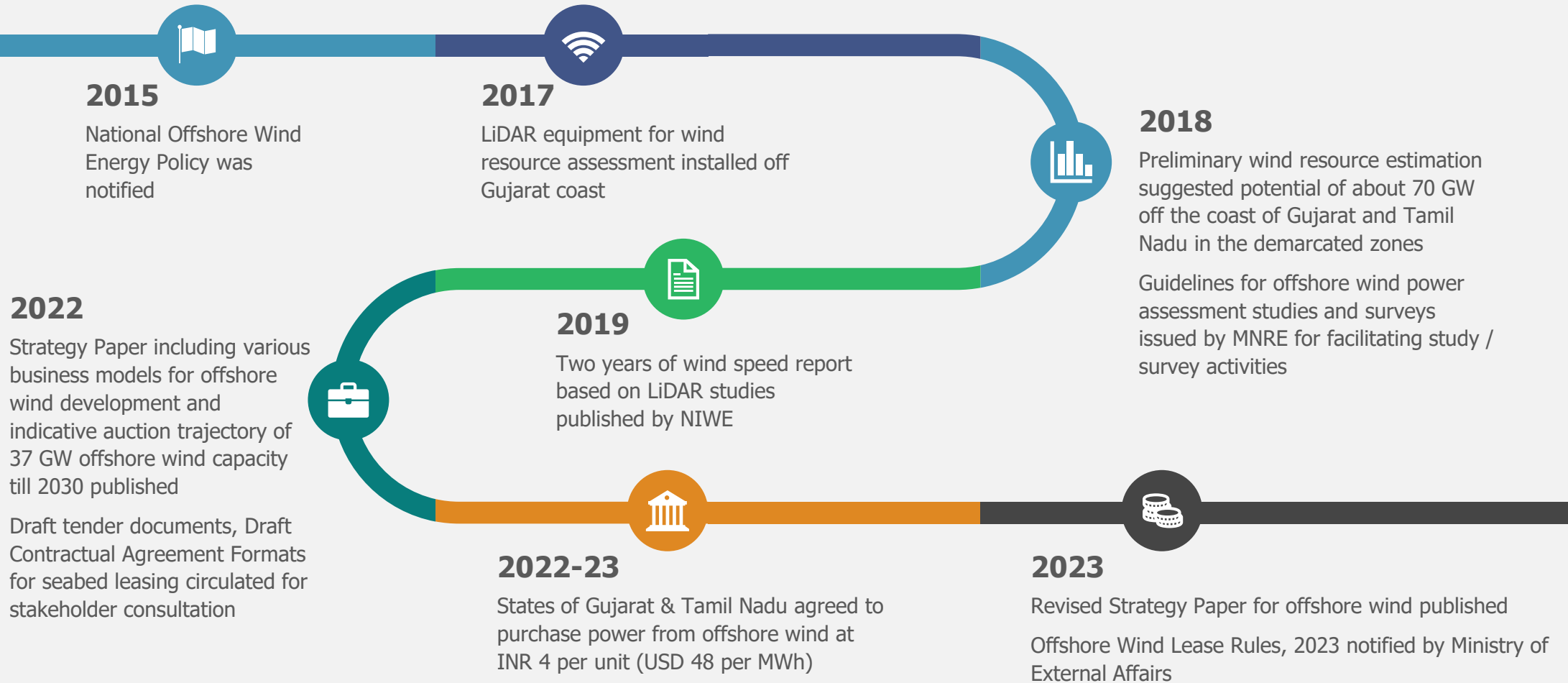
Global trends in Offshore Wind Energy

Global weighted average LCoE and installed cost of offshore wind power plants



Source: IRENA 2023, Renewable Power Generation Costs in 2022. IRENA 2019, Future of Wind Report.

History of Offshore Wind Energy in India





India's National Offshore Wind Energy Policy - At a glance

- Specifies that the entire Exclusive Economic Zone (EEZ) of India spanning up to 200 nm from the coast to be available for development of offshore wind energy
- Established the Ministry of New and Renewable Energy (MNRE) as the nodal ministry and the National Institute of Wind Energy (NIWE) as the nodal agency and defines their roles
- Tasks NIWE with facilitation of a “single-window” mechanism for obtaining clearances from all relevant Ministries and Departments for offshore wind energy projects
- Identifies all the essential elements that need to be considered for development of offshore wind energy projects and the challenges anticipated throughout the process



Models for award & development of Offshore Wind Energy projects

Model

A

- Includes offshore sites where MNRE / NIWE has carried out detailed studies / surveys
- Awarded through transparent competitive bidding with VGF support to the developers to attain a pre-determined tariff
- Under this model, 2 projects of 500 MW capacity each are planned off the coast of Gujarat and Tamil Nadu

Model

B

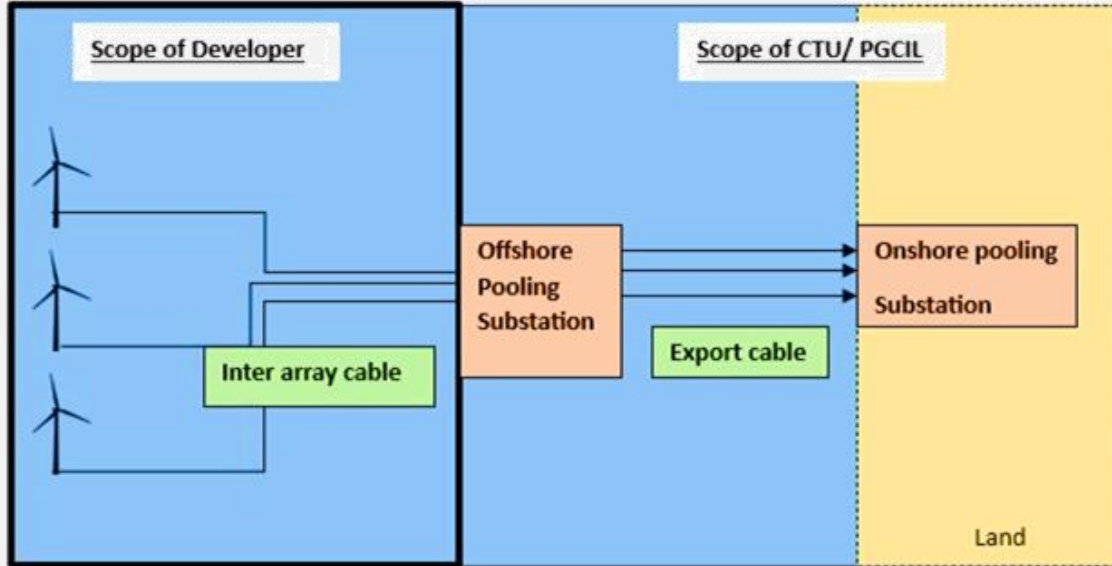
- Under this model, developers will have exclusive access to seabed blocks to carry out studies / surveys and project development
- Seabed blocks to be identified by NIWE and leased out through bidding on techno-commercial basis
- Projects under this model would be allowed to sell power through open access route or on power markets without any financial assistance

Model

C

- Sites within the EEZ excluding those under Models A & B to be identified by a developer for studies / surveys
- First right of refusal shall rest with the developer for development of the site, following which sites would be awarded through bidding
- Criteria for award of sites shall be decided by the Government such as lease, tariff, allocation fee, revenue sharing, but there shall be no financial assistance

Grid connectivity and evacuation of power from the Offshore Wind Energy projects



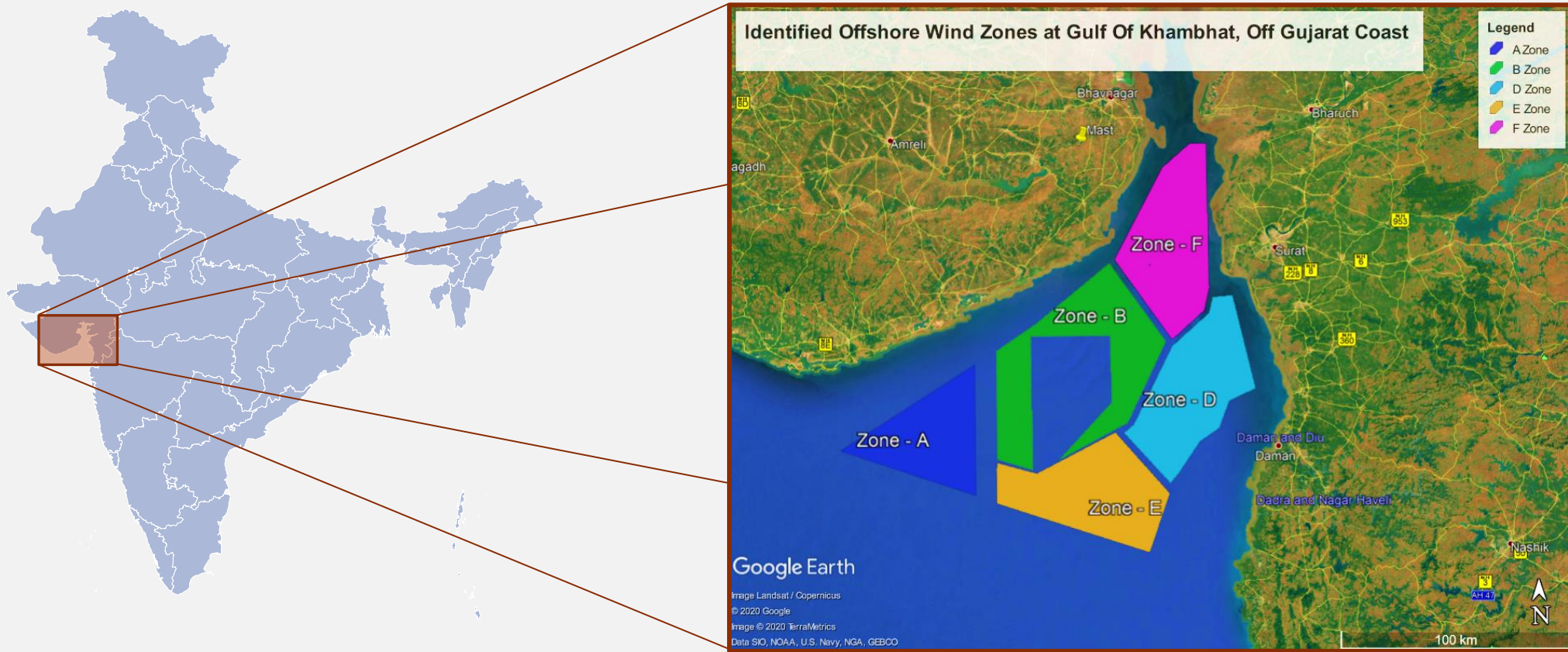
- Central Transmission Utility of India (CTU / PGCIL) shall develop the transmission infrastructure till the offshore substation for all offshore wind projects under all models
- All offshore wind energy projects commissioned till 31 Dec 2032 are provided the benefit of transmission cost waiver on the Inter-State Transmission System

Trajectory for auction of Offshore Wind Energy projects in India

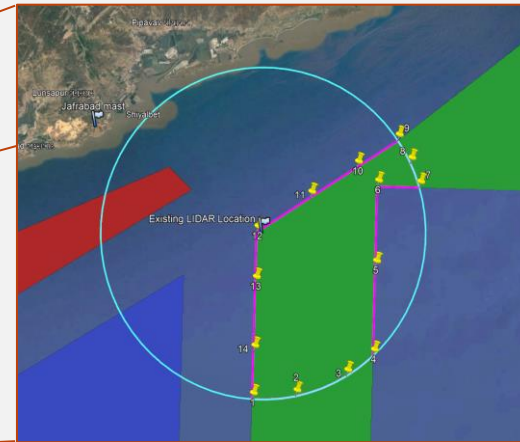
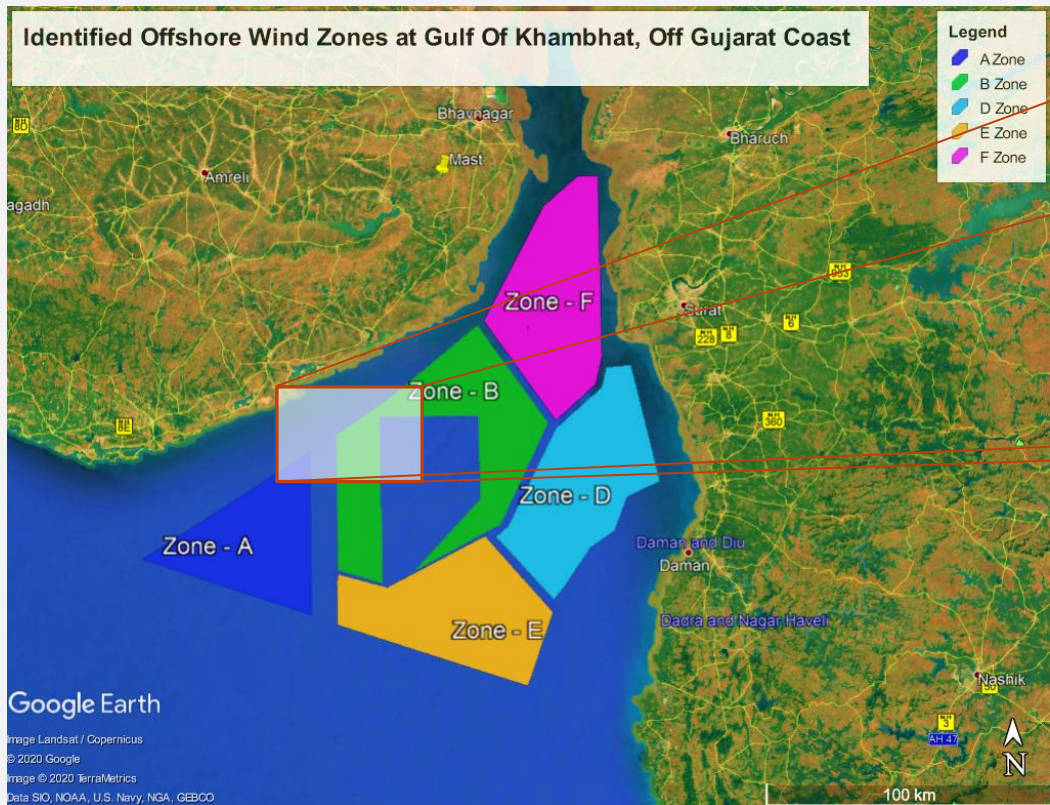
Under the 3 models, 37 GW of offshore wind energy capacity would be awarded till 2030

Year	Auction Capacity under Model-A	Auction Capacity under Model-B	Auction Capacity under Model-C	Total Auction Trajectory
2023-24	0.5 GW	4 GW	-	4.5 GW
2024-25	0.5 GW	3 GW	-	3.5 GW
2025-26	-	3 GW	4 GW	7 GW
2026-27	-	3 GW	4 GW	7 GW
2027-28	-	1 GW	4 GW	5 GW
2028-29	-	-	5 GW	5 GW
2029-30	-	-	5 GW	5 GW
Total	1 GW	14 GW	22 GW	37 GW

5 demarcated Offshore Wind Energy Zones off the coast of Gujarat state



1 site off the coast of Gujarat will be developed under the current auction trajectory



Site under Zone B off Gujarat coast

500 MW project under Model-A with VGF support

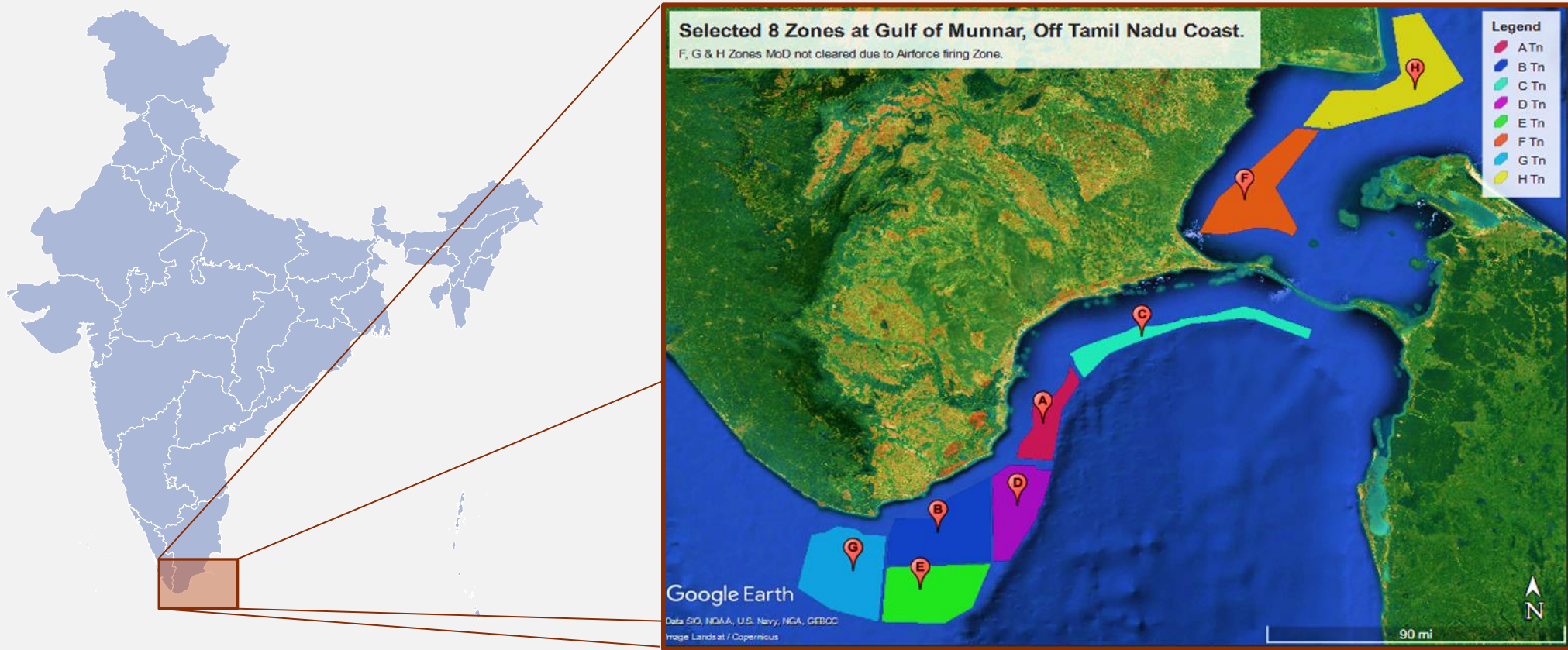
Study / surveys have been already carried out by NIWE



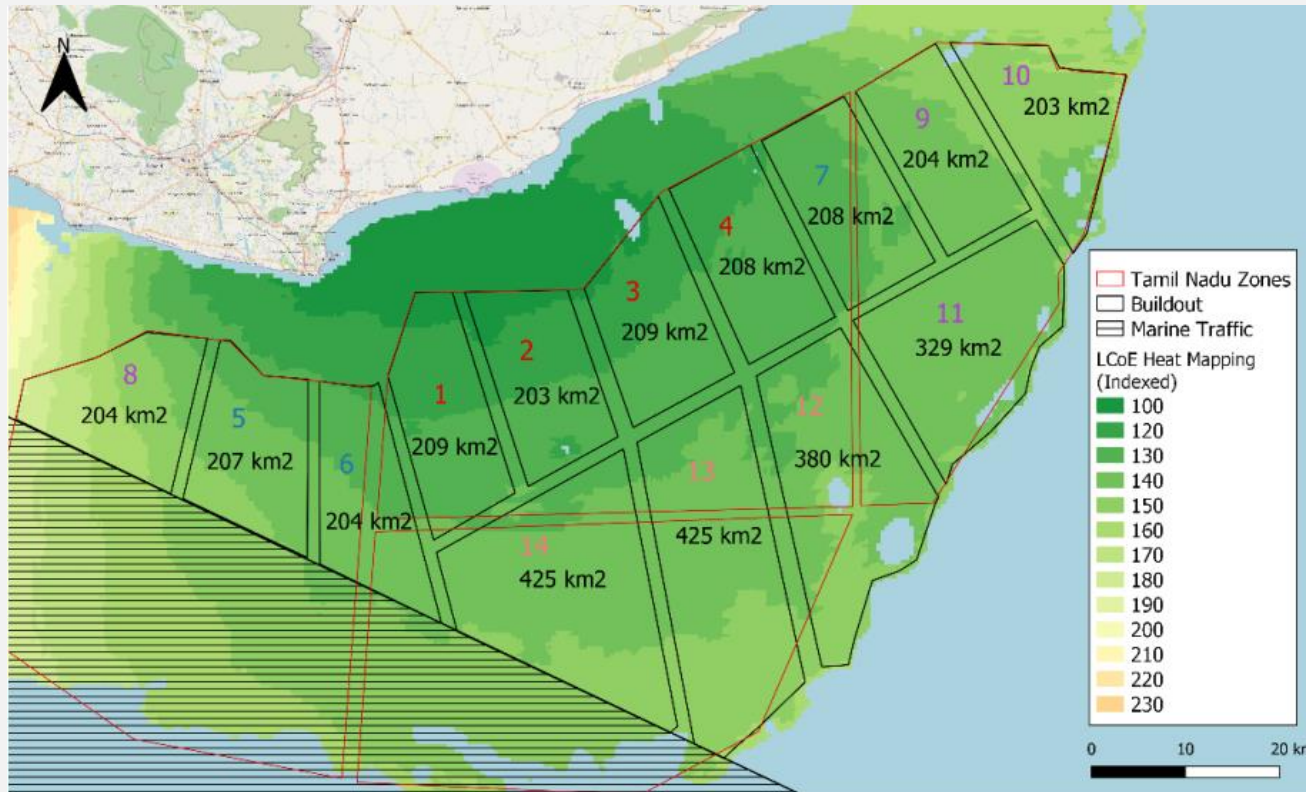
Activities carried out for the 500 MW Offshore Wind Energy project off the Gujarat coast

- Marine Spatial Planning (MSP) has been carried out and a site of about 370 sq km (equivalent to 1 GW capacity) in Zone B has been demarcated
- Wind Resource Assessment was carried out by NIWE using LiDAR and the annual average wind speed was measured at more than 7.5 m/s at height of 100 m which results in CUF of about 38%
- Geophysical and geotechnical studies were carried out by NIWE
- Rapid Environmental Impact Assessment (EIA) was carried out for the proposed site
- NIWE has obtained Stage-I clearance for award of the site to developers
- PGCIL has carried out the necessary transmission evacuation planning at the site
- Proposal for Viability Gap Funding (VGF) incentive is under consideration for the 500 MW project off the Gujarat coast

8 Demarcated Offshore Wind Energy Zones off the coast of Tamil Nadu state



14 sites off the coast of Tamil Nadu will be developed under the current auction trajectory



- 14 sites spread across Zones B, D, E and G off the coast of Tamil Nadu state
- 500 MW capacity to be developed at site 7 under Model-A with VGF support
- Remaining sites to be awarded under Model-B between 2023 and 2028; Estimated capacity - 17 GW



Port Infrastructure required for Offshore Wind

- **Kandla:** Feasible location for staging turbine components and foundations within the existing port can be along berths 14 – 16, to accommodate two berths, part of berth 15 is adjoined to berth 16
- **Tuticorin:** An OW terminal can be established at the place of existing coal yard with multiple berths (up to four) and a total berth length of approximately 900 m and yard with a potential area of 50 ha.
- Average Cost of Upgradation of each port considered as about Rs. 750 Cr. Out of this 40% of total cost i.e. Rs. 300 Cr would be supported through Grant to the respective Port Authority.

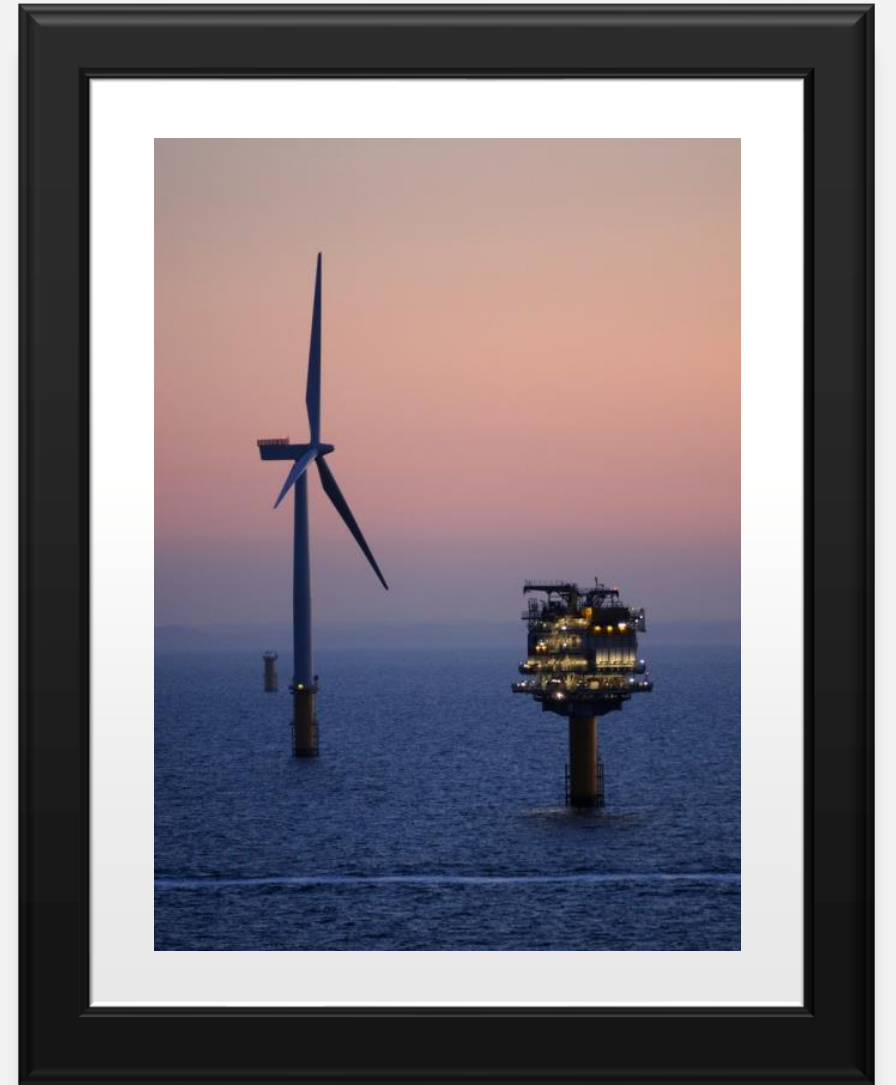
Cost levels of Offshore Wind Projects

S.No.	Project Development Processes/Activities	Tentative cost of OWF per MW (Amt. in Cr.)	% of Total CAPEX
1.	Resource Assessment Activities	1.07	5%
2.	Wind Turbines	8.95	42%
3.	Transmission Infrastructure	5.33	25%
4.	Installation and Commissioning	5.97	28%
5.	Total CAPEX	21.32	100%
6.	O & M Cost	25 Lakh with 5% escalation each year	
7.	Seabed Lease	1 Cr annually	



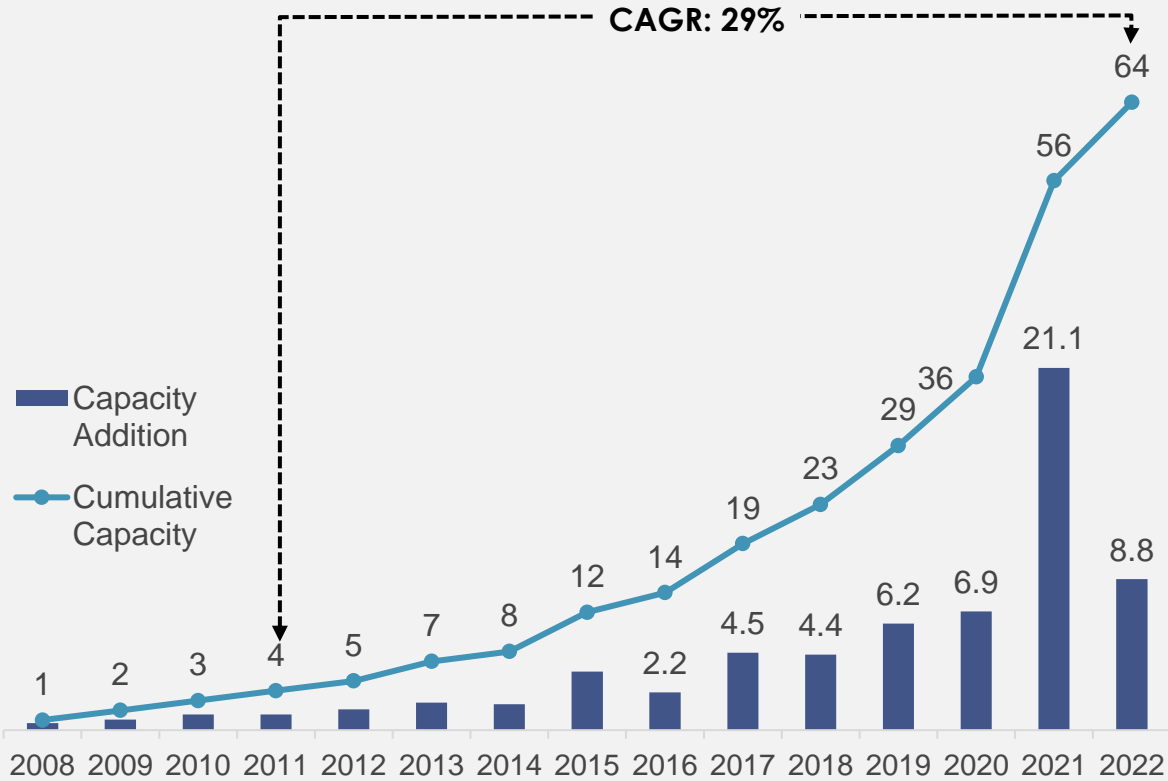
Thank You

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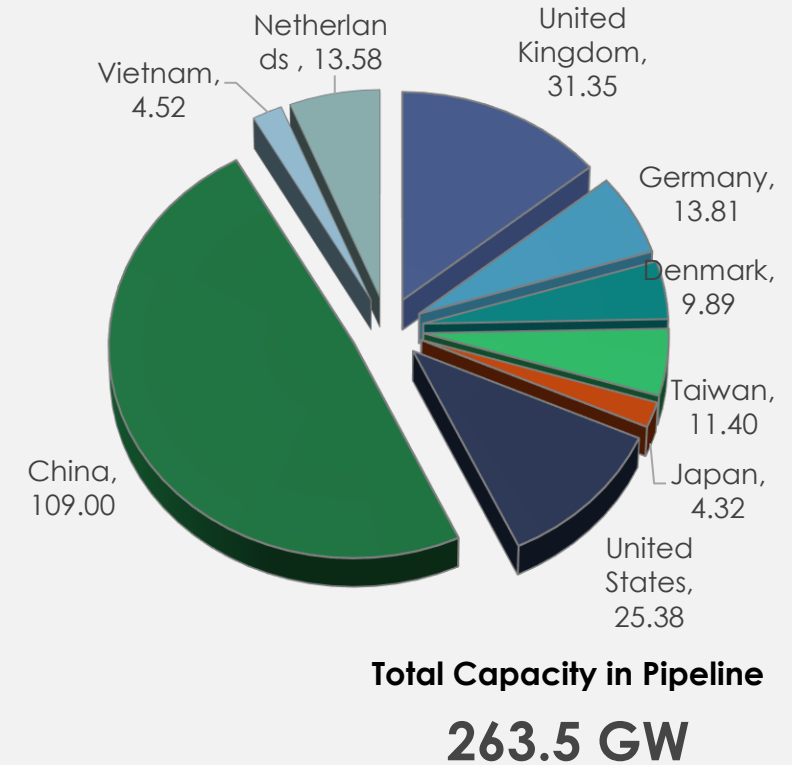


Global Offshore Wind Energy Scenario

Installed capacity of offshore wind power globally (in GW)



More than 250 GW offshore wind power capacity is in the pipeline around the world:



Global trends in Offshore Wind Energy

- **Size and scale of offshore wind energy turbines keeps on increasing year-over-year**
- Globally, projects continue to be built in deeper waters, farther from shore
- Floating offshore wind energy represents an opportunity to tap into new wind resources over deeper waters
- Supply chain constraints, high inflation, and rising interest rates have resulted in significant project cost increases of 11%–30% during 2022

