CELEBRATING 20 Years of VIBRANT GUJARAT (2003-2023) AS THE SUMMIT OF SUCCESS

सत्यमेव जयते
ગુજરાત સરકાર
Government of Gujarat

Development of Offshore Wind Farms at Gujarat

Ports and Logistics
Government of Gujarat

Vibrant GUJARAT 2024
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Project Concept

Introduction

- The Government of India has set a target of installing 500 GW of renewable energy capacity by the year 2030, including 280 GW from solar, 140 GW from wind, and the remaining 80 GW from other sources like biomass, waste-to-energy, and hydropower.
- As per the Union Minister for New & Renewable Energy and Power, a cumulative wind power capacity of 43.7 GW has been installed in the country as on 30.06.2023.
- To achieve the target of 140 GW capacity from wind energy, around 16 GW wind energy capacity is needed to be installed every year, till 2030. Also, MNRE has set up a target of installing 30 GW of offshore capacity by 2030.However there are no offshore wind projects in India.
- An MoU was signed in 2014 for setting up a joint venture company for executing the demonstration project by the Union Ministry of New and Renewable Energy (MNRE), National Institute of Wind Energy (NIWE) and a consortium of public sector agencies.
- Several sites were identified along the coast of Gujarat and Tamil Nadu which have good wind power potentials and Gujarat was chosen as the venue for demonstration.
- According to the NIWE, total offshore wind energy potential is 302 GW at 100 metres and 695.50 GW at 120 metres hub height. Approximately 36 GW of off-shore wind potential exists off the coast in Gujarat and nearly 35 GW exists off the Tamil Nadu coast.

Offshore wind energy

- Offshore wind energy is the clean and renewable energy obtained by taking advantage of the force of the wind that is produced on the high seas
- The wind reaches a higher and more constant speed than on land due to the absence of barriers.
- In order to make the most of this resource, mega-structures are installed that are seated on the seabed and equipped with the latest technical innovations.

Project Concept

Components of Offshore Wind Farms

1.**Offshore Turbines** capture the wind's energy and generate electricity. It consists of a drive drain , hub, blades and nacelle

2.**Foundations** secure turbines to the ocean floor and a network of array cables transmit electricity to an offshore substation

3.**Electricity** flows through a buried cable to an onshore substation and is transferred to the existing transmission network

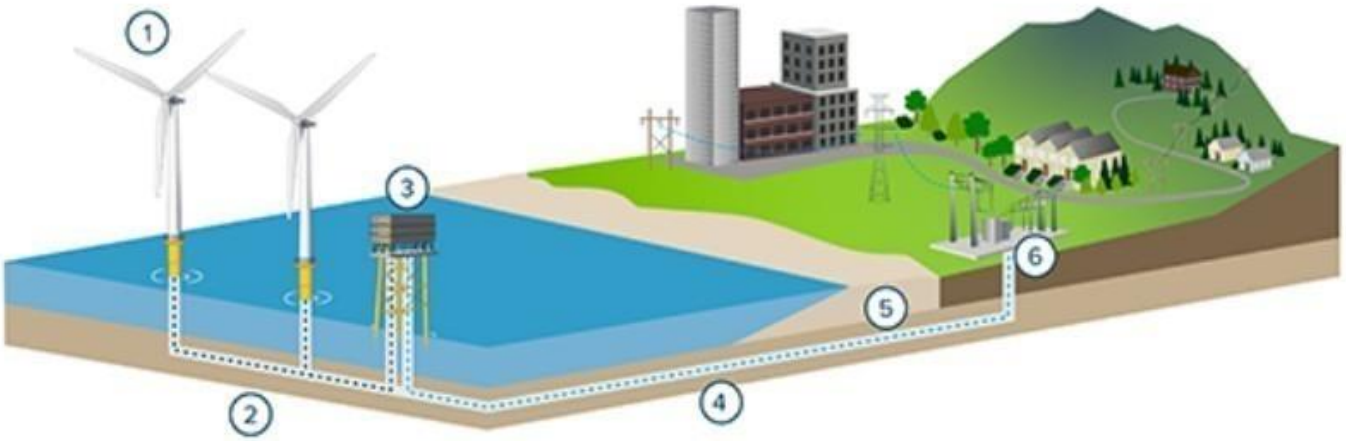


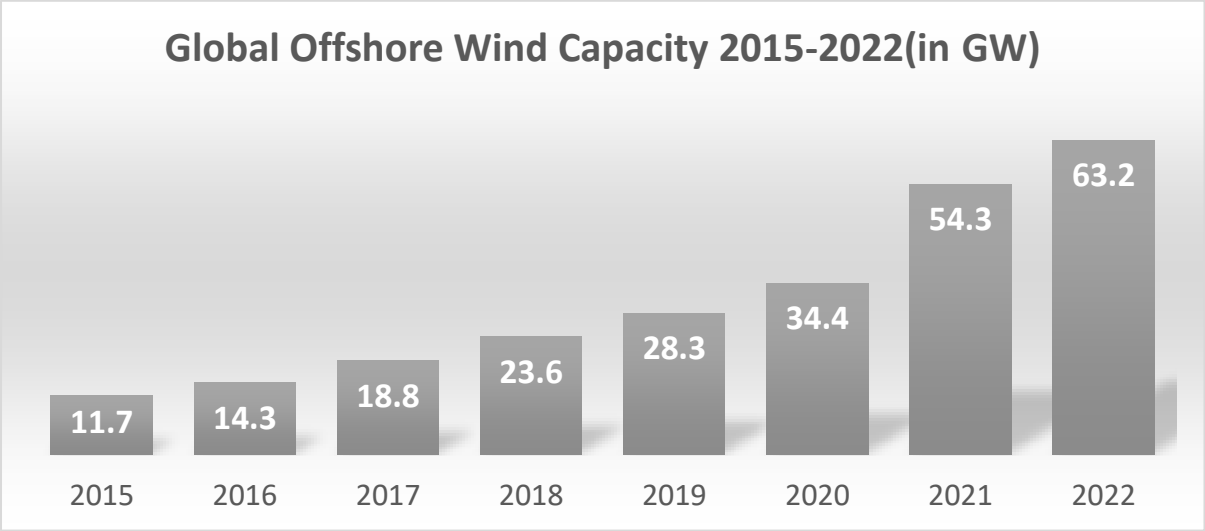
Figure Not to Scale

Benefits of Offshore Wind Farms

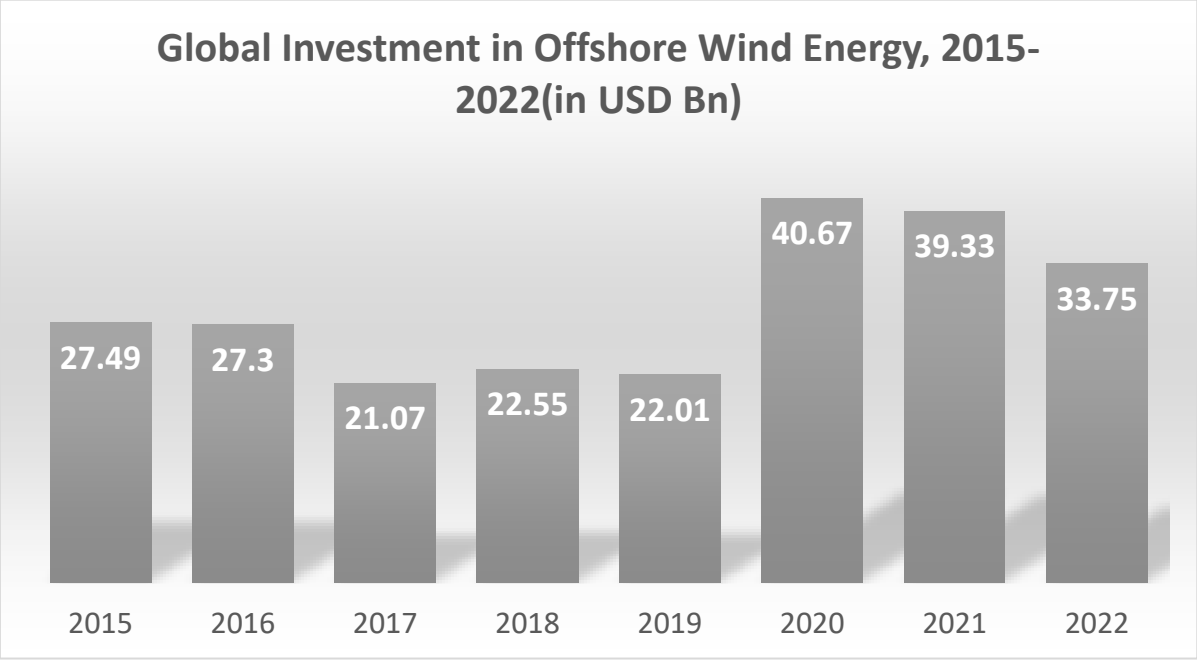
- Abundance of space offshore to develop capacity at scale
- Higher wind speeds and more consistent wind resource, resulting in more generation and higher capacity factors
- Reduced visual impact due to the distance from populated areas
- Use of larger turbines – bigger and taller turbines can be used offshore, resulting in more electricity generation
- Current offshore turbines being installed range from 6 MW – 14 MW, with larger models being announced and industry sights on 20 MW and beyond

Market Potential

Global Offshore Wind market



Top 10 countries in terms of Offshore wind capacity: China, UK, Germany, Netherlands, Denmark, Belgium, Taiwan, Sweden, South Korea & Vietnam

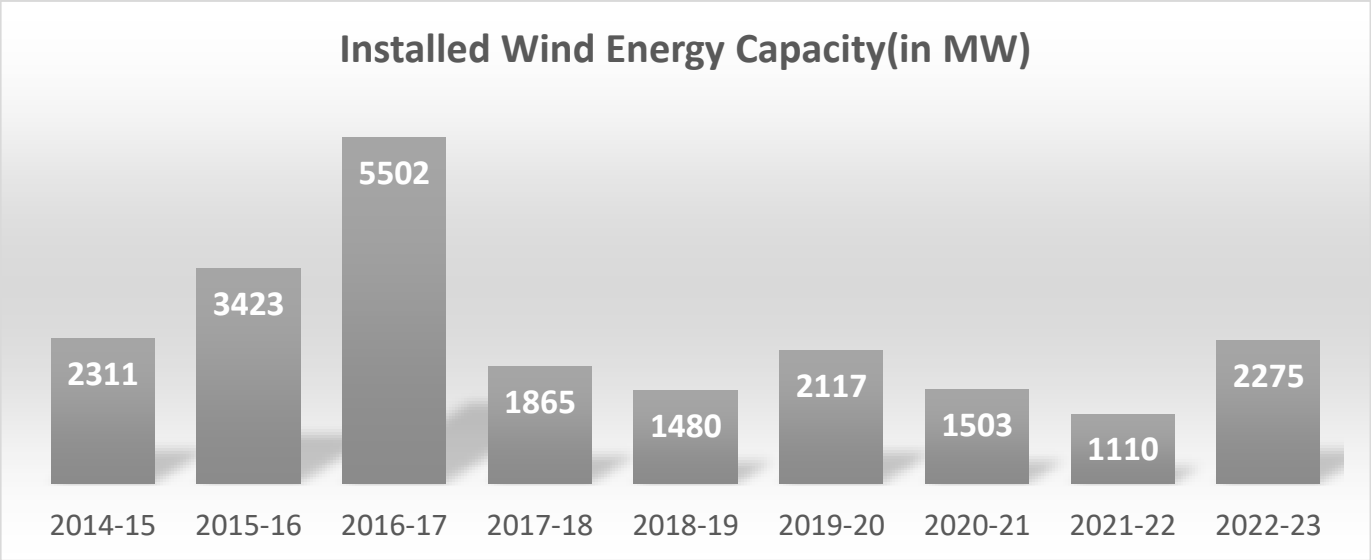


Top countries in terms of investment in Offshore wind assets: China, UK, Germany, Netherlands, Denmark, Belgium, Taiwan, Sweden, South Korea & Vietnam

Market Potential

Wind Energy: India scenario

- Wind installed capacity in India have doubled in the last 9 years from 21 GW in 2014 to 44.2 GW in 2023.
- Estimated installed capacity of wind energy by 2029-30 is approximately 99.9 GW.



Top 8 states in terms of wind energy installed capacity

Gujarat (11.1 GW), Tamil Nadu (10.3 GW), Karnataka (5.3 GW), Rajasthan (5.1 GW), Maharashtra (5.1GW), Andhra Pradesh (4 GW) & Madhya Pradesh (2.8 GW)

Offshore Wind Energy: India scenario

- **Facilitating Offshore Wind Energy in India (FOWIND)** Is a project implemented from December 2013 to March 2018 by a consortium led by Global Wind Energy Council (GWEC) and supported by European Union (EU) to assist India on its offshore wind power development and in turn contribute to India's transition towards use of clean technologies in the power sector.
- The project focused on the States of **Gujarat** and **Tamil Nadu** for identification of potential zones for development through techno-commercial analysis and preliminary resource assessment.
- As per NIWE,**36 GW** and **35 GW** of offshore wind energy potential exists off the coast of Gujarat and Tamil Nadu respectively.

Growth Drivers

- India blessed with a coastline of about 7600 km surrounded by water on 3 sides

- Total off-shore wind energy potential is 302 GW at 100 metres and 695.50 GW at 120 metres hub height.
- 36 GW of offshore wind potential exists off the coast in Gujarat

- National Offshore Wind Energy Policy notified on October 2015
- Ministry of New & Renewable Energy(MNRE) will act as nodal ministry
- National Institute of Wind Energy(NIWE),Chennai will be the nodal agency

- GOI is promoting the adoption of renewable energy resources by offering several incentives, such as Government Based Incentives (GBI), capital and interest subsidies, viability gap funding, concessional finance, fiscal incentives etc

- Growth across diversified industries with marked entry of foreign players leading to investment in energy sector and logistic/warehouse such as retail, agriculture, pharma, automobile, FMCG etc

Ecosystem Players

Prominent wind turbine manufacturers – India

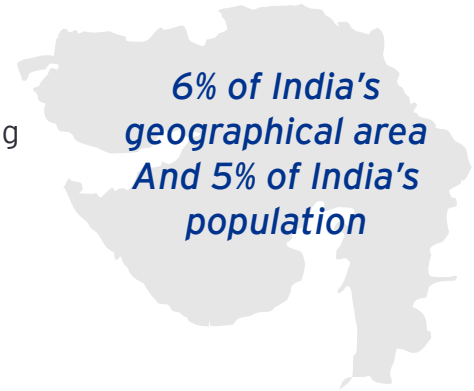
SN.	Company Name	Location	License/ Collaboration/ Joint Venture
1	M/s. Adani New Industries Limited (Formerly known as Mundra Windtech Limited),	Gujarat	W2E Wind to Energy GmbH, Germany
2	M/s Envision Wind PowerTechnologies India(Pvt.) Ltd	Karnataka	Envision Energy(JIANGSU) Co., Ltd., China
3	M/s. GE India Industrial Private Limited Division	Karnataka	General Electric Renewables, Espana, S.L.
4	M/s. Suzlon Energy Limited	Maharastra	Nil
5	M/s. Vestas Wind Technology India Private Limited	Tamil Nadu	Vestas Wind Systems A/S, Denmark
6	M/s. Inox Wind Limited	Uttar Pradesh	AMSC Austria GmbH, Austria
7	M/s. Senvion Wind Technology Private Limited	Maharastra	RE Technologies Gmbh, Germany
8	M/s. Siva Wind Turbine India Private Limited	Tamil Nadu	No
9	M/s. Siemens Gamesa Renewable Power Private Limited	Tamil Nadu	Siemens Gamesa Renewable Energy Innovation and Technology, S.L, Spain
10	M/s. Nordex India Private Limited(Formerly known as M/s. Acciona Wind Power India Pvt. Ltd.)	Karnataka	Nordex Energy Spain S.A.U, Spain
11	M/s Pioneer Wincon Energy Systems Pvt.Ltd.	Tamil Nadu	No
12	M/s Southern Wind Farms Limited	Tamil Nadu	No

Source: Ministry of New and Renewable Energy

Gujarat - Competitive Advantage

Gujarat overview

- 9% of India's GDP: GSDP at current price ~US$ 269 Bn
- 35% share of manufacturing sector in State's GDP
- 18% of India's industrial output
- 30% share in India's total exports



6% of India's geographical area And 5% of India's population

- 39% cargo of the entire country is handled by Gujarat Ports
- Complete maritime ecosystem which includes Gujarat Maritime University (GMU), Gujarat Maritime Cluster (GMC), Gujarat International Maritime Arbitration Centre (GIMAC)

Location advantage of Gujarat

Gujarat acts as a gateway to West and to major states across India

- 48 minor and 1 major port are strategically located across a 1600 kms coastline, which is the longest among the Maritime States of India
- Nearest maritime outlet to Middle East, Africa and Europe
- Gujarat's non-major ports capacity is expected to reach 638 MMTPA by FY25
- Gujarat has strong presence of industries such as Chemicals & Petrochem, Textiles, Pharmaceuticals, Automobiles, Gems & Jewellery, Ceramics, etc.

Gujarat - Competitive Advantage

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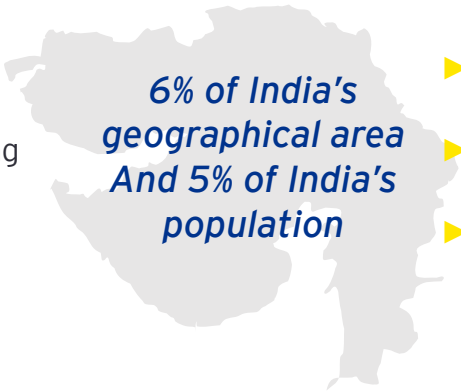
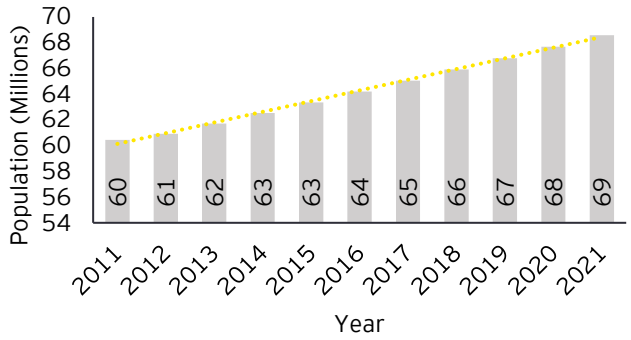


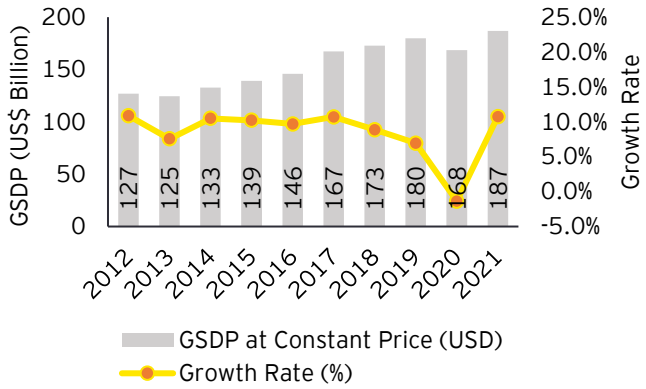
- 30% share in India's total exports
- 39% cargo of the entire country is handled by Gujarat Ports
- Huge base of MSMEs (~830,000)

Macroeconomic trend

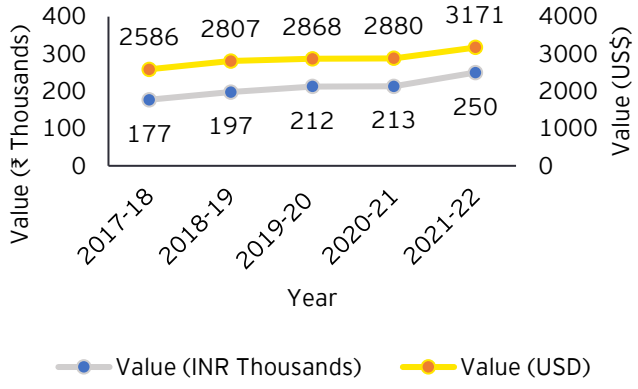
Population



GSDP at Constant Price & Growth Rate



Per Capita Income



Industrial Production Data

- Gujarat contributes to 18.14% share to Country's industrial output, the largest among the states of India in the year 2019-20.
- The NVA has increased from ₹8,944.8 bn 2010-11 to ₹1,902.57 bn in 2019-20.
- The number of factories has increased by 6.10% from 26,842 in the year 2018-19 to 28,479 in the year 2019-20.

Source: CEIC; https://gujecostat.gujarat.gov.in/

Gujarat - Competitive Advantage

Key advantages

Ease of doing business

- Ranked among the top achievers in 'Ease of Doing Business' ranking as per BRAP Ranking 2020
- State has the highest number of Operation ports and commercial cargo ports, who handled 39% of national maritime trade in FY23
- 1st Rank in Logistics Performance Index (LEADS Index) in 2018, 2019, 2021 and in Achievers category in 2022 & 2023
- 1st Rank in NITI Aayog's Export Preparedness Index of states – 2020 & 2021
- 1st Rank in Good Governance Index (GGI) in 2021
- Gujarat attracted FDI US$ 31 Bn between Oct'19 and Mar'23.
- National Start-Up Rankings in 2022 (Best Performer), 2021 (Start-Up Megastars), 2019 and 2018
- Located on the west coast of India, Gujarat is well connected to the major cities of the world by air and sea routes.

Gujarat - Competitive Advantage

Infrastructure & connectivity

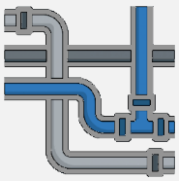
Longest coastline
1,600 km
48 seaports

7,938 km
Railway
network

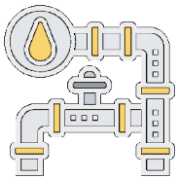
19 Airports
(including
2 international
airports)
Upcoming airport at Dholera SIR

75,000+ km of road
network
7,885 km of national
highways

Power surplus State
48 GW total capacity
44% from renewables



State-wide water
network of
63,773 km of
Narmada Canal



1st state-wide
extensive
piped natural gas
grid - 3,370 km
network

Ahmedabad-Mumbai
High-speed Rail
(upcoming)

Delhi-Mumbai
Industrial corridor -
DMIC covering 23/33
districts

239 GIDC
Industrial estates
with
Plug & play facility

1st Global
Business District
- GIFT City

1st Platinum rated
Green industrial city
- Dholera Semicon
City

Offshore Wind Farm Development in Gujarat

Factors to considered for Offshore Wind Farm Site Selection

- Port facilities are essential for offshore wind projects, as they are used for fabrication, installation, and maintenance of wind turbines.
- Port facilities to have adequate workshops, storage areas, quayside, road/rail links, cranage, workforce, and location to support the wind project activities.
- These facilities should also be close to the project site, accessible in all weather conditions, and not limited by tidal or lock gate constraints.
- It needs to be ensured that berthing facilities have sufficient ground bearing capacity and sufficient storage space to handle large and heavy wind turbine components.

Benefits to the Port Sector

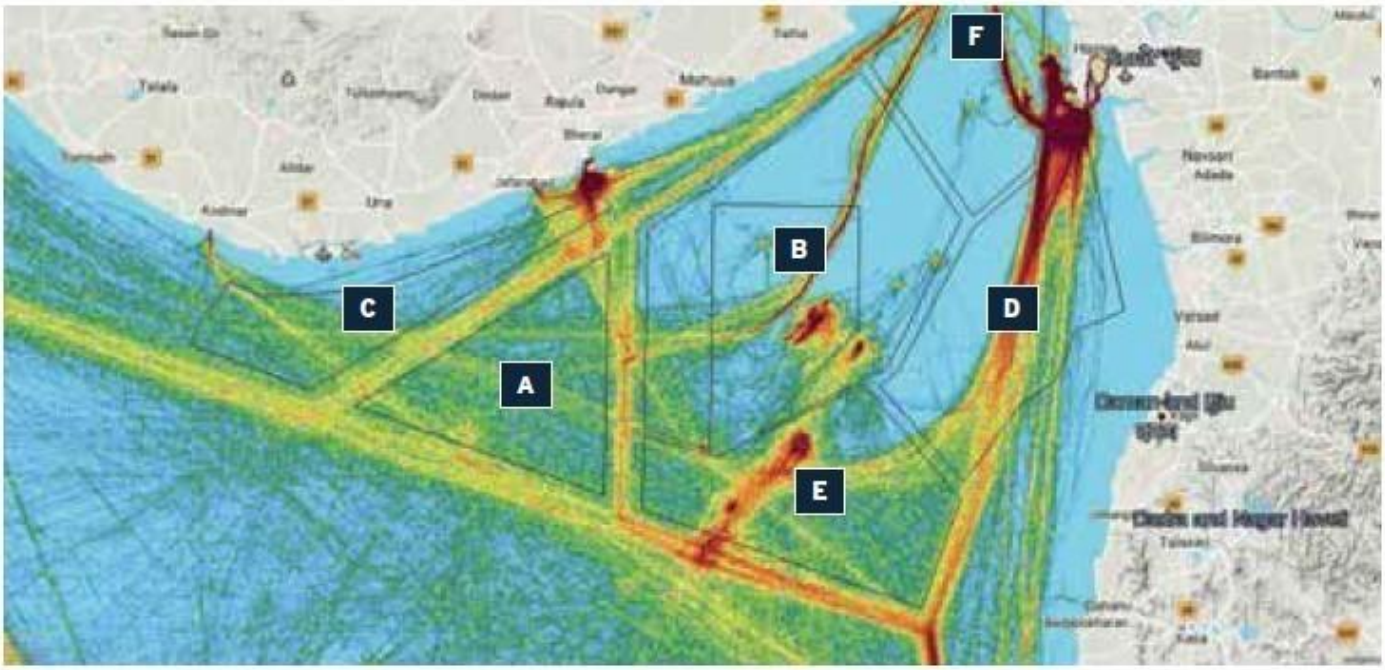
- Installation port will facilitate offshore wind farms to be developed in **Gulf of Khambhat**. Such facility shall enable to generate Project Cargo and movement of Offshore vessels.
- It will harness stronger and more consistent wind resources compared to onshore wind farms.
- It will have significantly smaller land footprint compared to their onshore counterparts. By locating wind farms at sea, valuable land resources can be preserved for cargo handling operations.
- Offshore wind power plays a crucial role in transitioning towards a low-carbon economy and achieving climate targets set forth in international agreements like the Paris Agreement.

Offshore Wind Farm Development in Gujarat

Regions for Offshore Wind Farm Development in Gujarat

- Gujarat blessed with a long coastline of 1600 km
- Gulf of Khambhat in Gujarat has been identified as the most suitable region for the development of offshore wind farms
- Regions has been further divided into zones ranging from Zone A to F in Gulf of Khambhat whereas Zone G and H on the west side of Gujarat near Porbandar and Okha

- The eight zones identified have estimated mean wind speeds from the mesoscale wind map in the range of 6.8 to 7.0 m/s (at 120 m AGL) and water depths in the range of -15 to -43 mLAT
- In February 2023, Union Government granted in-principle approval for a 2,000 MW (2 GW) offshore wind power generation on the Gujarat coastline
- Jafrabad cluster can also be considered as a suitable location for the development of offshore wind terminal in Gujarat



Project Information

Logistics & Connectivity

The port can handle incoming and outgoing trains simultaneously, with 11 rail sidings to support loading and offloading.
Pipapav became the first Indian port to be connected to the Western Dedicated Freight Corridor.

Port is connected to NH 8E by four lane expressway. The Ahmedabad-Dholera central spine road will be extended up to the port. It will be a 10-lane road and the extension will provide alternate port connectivity to the Special Investment Region.

Pipavav is well-connected to the following airpots: Diu,Surat,Bhavnagar and Rajkot
.

Pipavav is well-connected to the following ports: Cochin, Tuticorin, Kattupalli, Hazira, Kandla and Mundra.

Storage and Other Facilities

- Capacity to handle 4 MMT Bulk Cargo. The port is well equipped with modern infrastructure like mechanized bagging units and wagon loading systems
- Capacity to handle 2 MMT Liquid Cargo per annum.

- 3 fully functional Container Freight Stations(CFS)
- 2 Warehouses (23657 sqm & 3252 sqm)
- RoRo yard facility can handle 250,000 vehicle annualy

Project Financials

Indicative project cost

Project components	Cost(Mn ₹/MW)
Management	
Development including surveys	5.8
Project Execution	5.4
Equipment	
Foundation	12.7
Wind Turbine	93.3
Grid Connection	
Array cables	20.5
Export cables	15.5
Onshore Windfarm substation	5.6
Offshore Windfarm substation	14.9
Installation	33.7
Total	**207.5**

Energy/Technical Data

Components	Values
Capacity per turbine	15 MW
Gross Capacity Factor*	39%
Project size	1000 MW
Development time	1.5 years
Construction time	2.5 years
Technical lifetime	27 years
Electrical losses	5%
Forced outages & planned outages	4%

** Includes only wake losses and not electrical and outage losses*
Source: Centre of Excellence for Offshore Wind and Renewable Energy Report 2022

Approvals & Clearances

As per **National Offshore Wind Energy Policy**, following clearances are required for development of offshore wind power projects:

S.no	Ministry/Department	Stage-I Clearances	Stage-II Clearances(or NOCs)
1.	Ministry of Environment, Forests & Climate Change	In-principle Clearance	EIA and CRZ clearance
2.	Ministry of Defence	In-principle Clearance	Clearance related to defence & security aspects, related to Army, Navy, Air force, DRDO and other such institutions under MoD.
3.	Ministry of External Affairs	In-principle Clearance	Clearance for development of offshore wind energy projects within the maritime zones of India.
4.	Ministry of Home Affairs	In-principle Clearance	Clearance regarding deployment of foreign nationals in offshore wind energy blocks.
5.	Ministry of Civil Aviation	No clearance needed	Clearance for construction near aviation radars/aerodromes.
6.	Ministry of Petroleum & Natural Gas	No clearance needed	Clearance for offshore wind power installations proposed in Oil & Gas Blocks. NOC for construction outside the offshore Oil & Gas Blocks.
7.	Ministry of Ports Shipping & Waterways	No clearance needed	Clearance for projects near Major Ports. NOC to operate away from shipping lanes.
8.	Department of Space	In-principle Clearance	Clearance from security angle and min safety distance to be maintained from the Dept. of Space installations.
9.	Department of Telecommunication	No clearance needed	NOC to operate outside subsea communication cable zones.
10.	Ministry of Mines	No clearance needed	NOC to operate outside mining zones.

Incentives- Viability Gap Funding(VGF) as per MNRE Strategy Paper

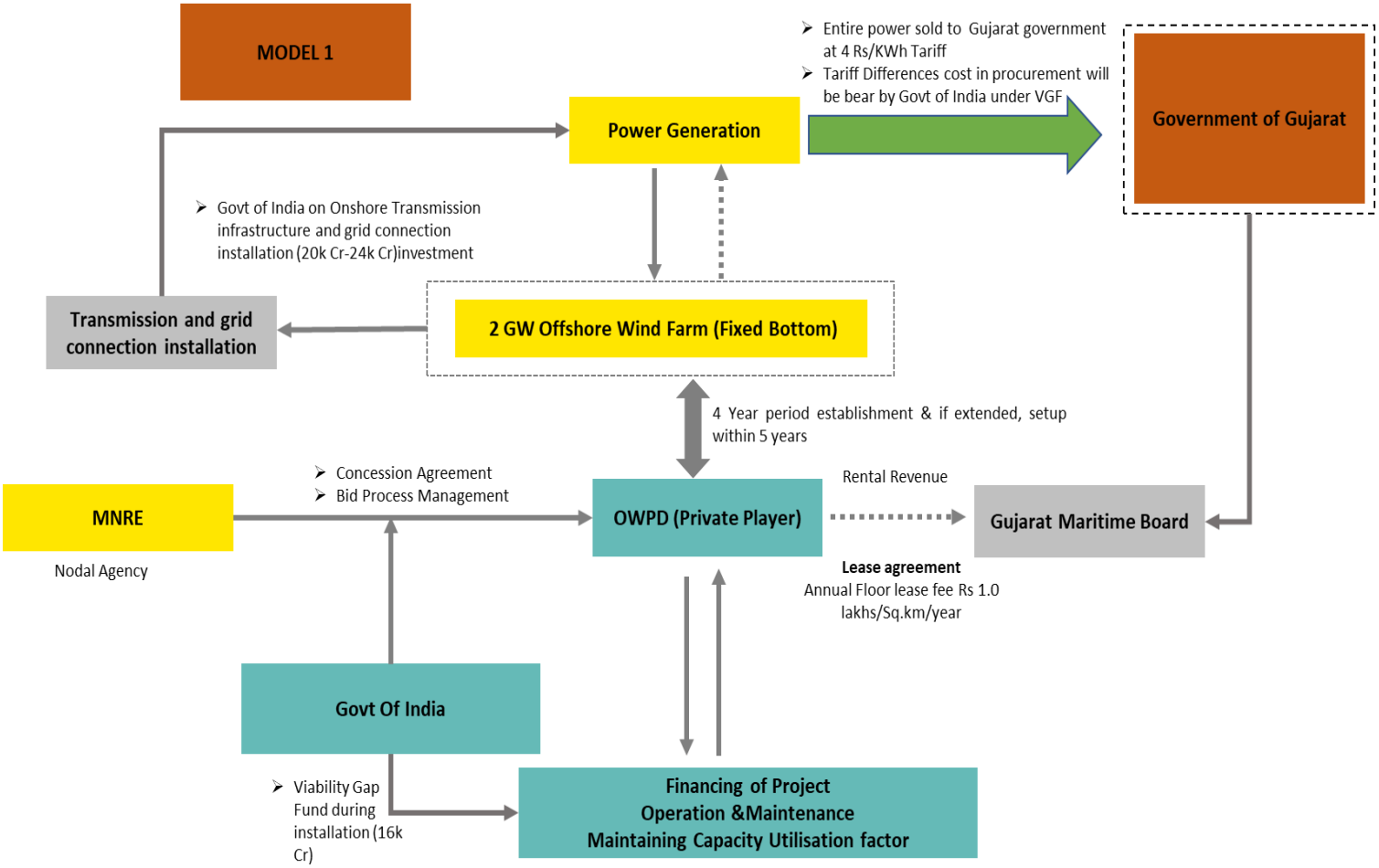
Offshore wind Development process under Model A

S.No.	Details
1	MNRE or its designated agency will enter into the 'Lease Agreement' for 35 years with the successful bidders (Offshore Wind Power Developer (OWPD)) in accordance with 'lease rules' to be notified. The OWPD shall be required to pay the annual floor lease fee of Rs 1.0 lakhs/Sq.km/year for the entire lease period.
2	The successful bidders, shall file the relevant information necessary for obtaining the Stage II clearances, subsequent to which Stage II clearances for the installation and commissioning of the offshore wind farm and transmission infrastructure shall be undertaken.
3	MNRE or its designated agency shall enter into the Offshore Wind project 'Concession Agreement' with the OWPD.
4	The OWPD shall commission the project within four years from the date of the "Concession agreement".
5	The sale of power shall be through Solar Energy Corporation of India Ltd. (SECI) / Implementing agency. A back-to-back Power Sale Agreement will be signed with the State DISCOM of Gujarat / Any other State DISCOM for procuring the power from this particular project.
6	Eligible OWPDs shall be able to avail suitable **financial incentives** such as **VGF** or any other financial mechanism to bridge the gap between the actual tariff and power purchase tariff by the designated entity as decided by MNRE from time to time.

Offshore Wind Sites Proposed to be developed under VGF Model(Model-A)

Source: Strategy Paper for Establishment of Offshore Wind Energy,MNRE

Tentative Project Structuring



Key Department Contacts

Relevant departments and useful links

Ports and Transport Department, Gujarat https://www.pnt.gujarat.gov.in	Gujarat Maritime Board https://gmbports.org/
iNDEXTb - Industrial Extension Bureau https://indextb.com/home	Ministry of New and Renewable Energy https://mnre.gov.in
Industries and Mines Department, Gujarat https://imd.gujarat.gov.in/	Gujarat Energy Development Agency https://geda.gujarat.gov.in
Office of Industries Commissioner https://ic.gujarat.gov.in	Investor Facilitation Portal https://ifp.gujarat.gov.in/

This project profile is based on preliminary study to facilitate prospective entrepreneurs to assess a prima facie scope. It is, however, advisable to get a detailed feasibility study prepared before taking a final investment decision.

GUJARAT MARITIME BOARD
Government of Gujarat Undertaking

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