

# THE FUTURE OF OFFSHORE WIND

What will it take to realise its potential in Vietnam

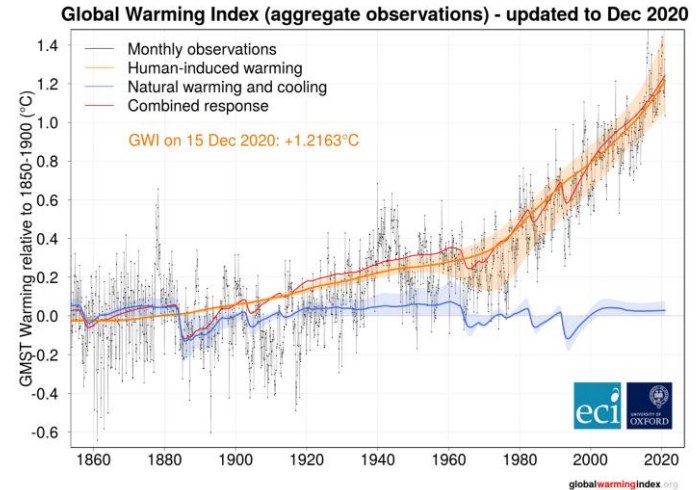
3rd Annual Vietnam Energy and Power Development Summit 2022  
November 8-9, Hanoi, Vietnam

Murthy R Nuni  
Marshal Global Renewable Power  
Singapore - Vietnam



Tel: +44 207 078 3919  
info@marshal-funds.com

# THE FUTURE OF OFFSHORE WIND

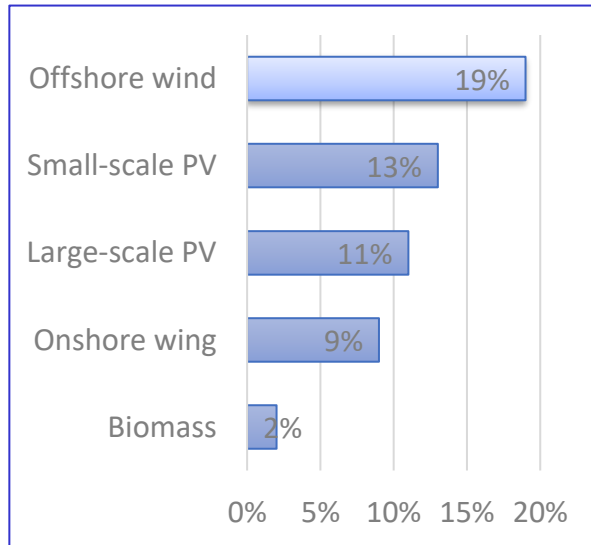


Human-induced warming: +1.261396291 °C

- Renewable Energy in general and Off shore Wind in particular are the key enablers for tackling climate change, limiting Power Sector Carbon Emissions & Global warming
- Offshore Wind : Large Scale Projects, High Capacity Factors and Availability, Cost Competitive at Scale, Stimulate Investments

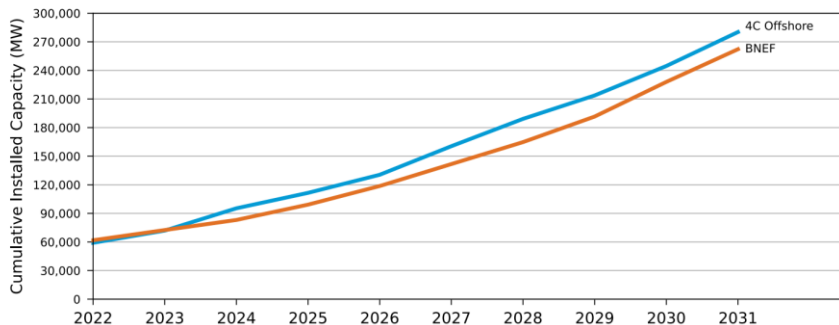
# Offshore Wind is the fastest growing renewable technology

## Global renewable installed capacity CAGR 2020 - 2030



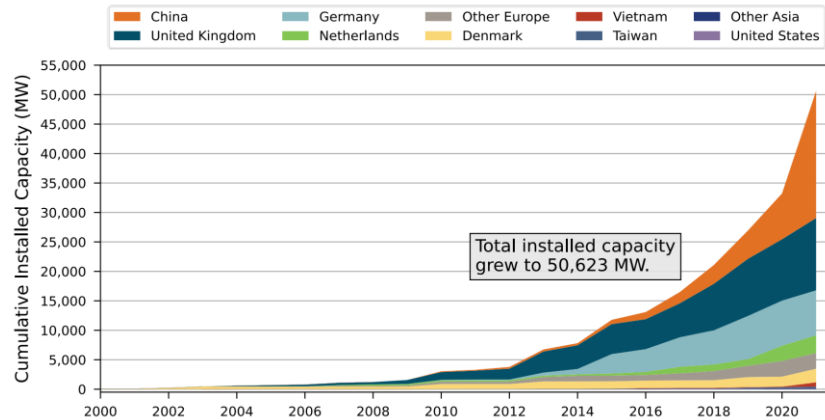
## Presentation Format

- Global Offshore Wind Industry Status
  - Growth, Technology, Cost Reductions, Supply Chain, Leading Markets
- Offshore Wind in Vietnam –
  - Potential, Targets, supply chain development, institutional framework

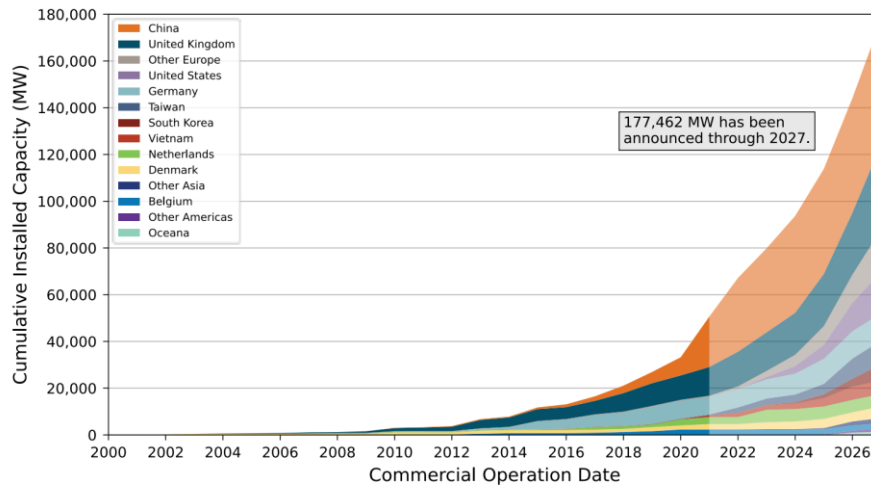


Source BNEF, USDOE

# Global Offshore Wind – Installed Capacity



2021 global  
Installed capacity  
50.6 GW



2027 estimated  
global Installed  
capacity 177.6 GW

Source USDOE

Figure 23. Estimated cumulative offshore wind capacity by country based on developer-announced CODs (the darker areas signify deployed capacity and lighter areas represent projected deployments)

# Global Offshore Wind – Installed Capacity Cumulative

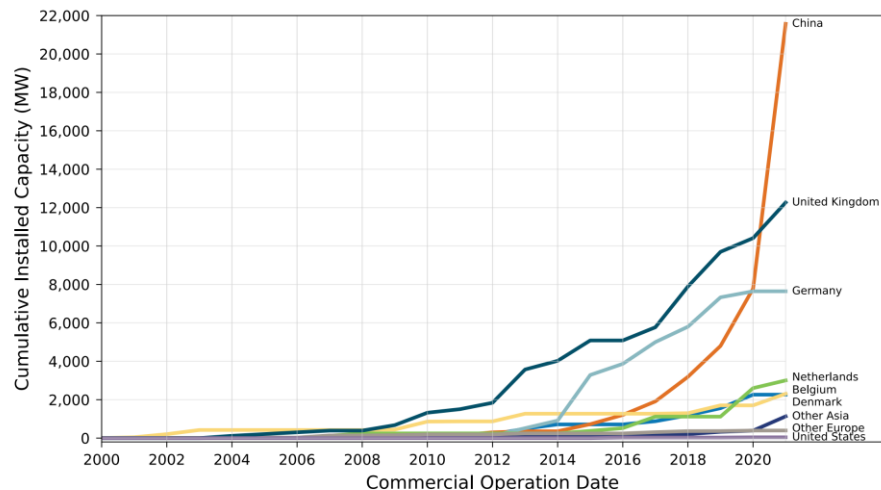
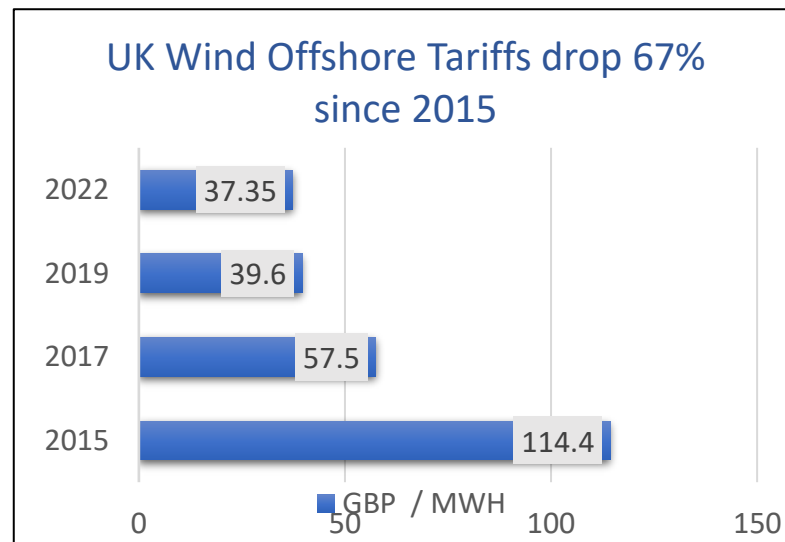
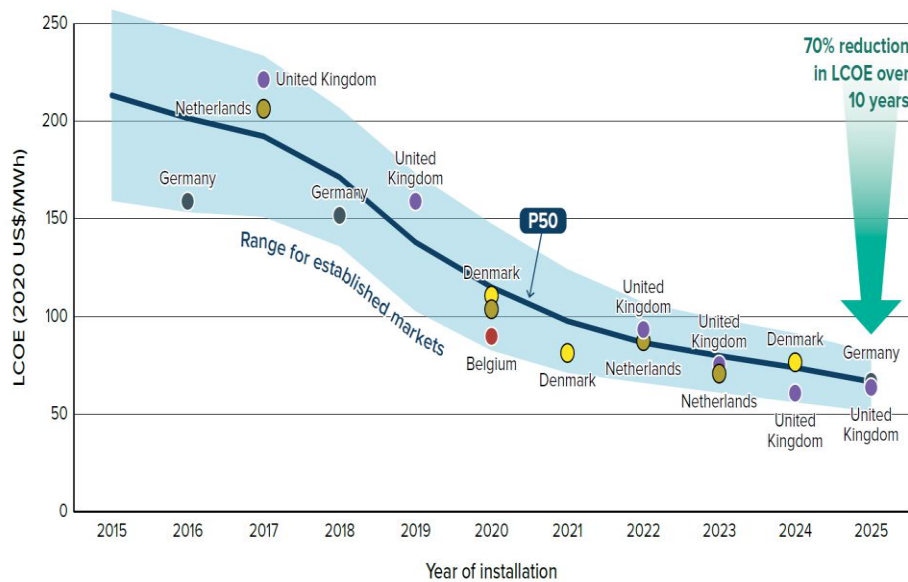


Figure 19. Cumulative installed offshore wind capacity by country



Source BNEF, USDOE



# Offshore Wind – Capacity Installed in 2021

# Offshore Wind – Capacity under construction after 2021

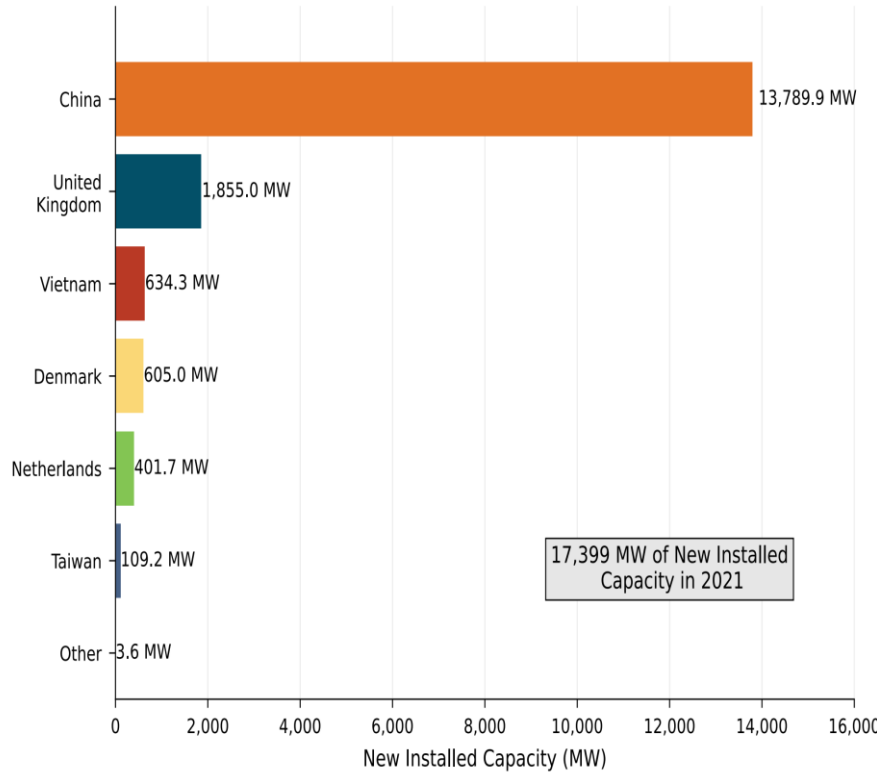


Figure 18. Global offshore wind energy installations in 2021

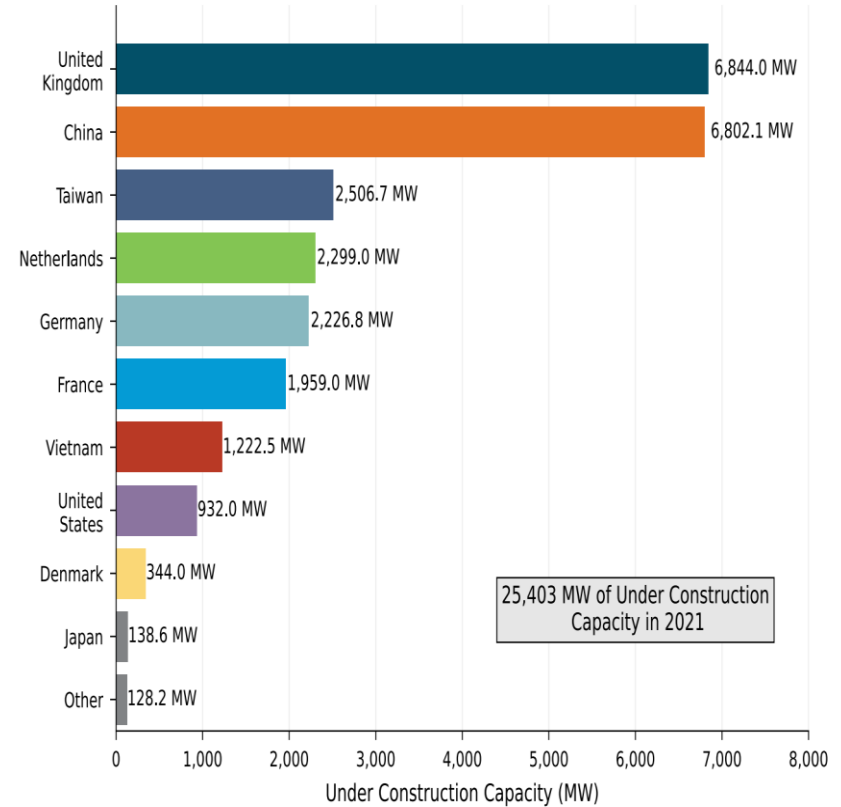
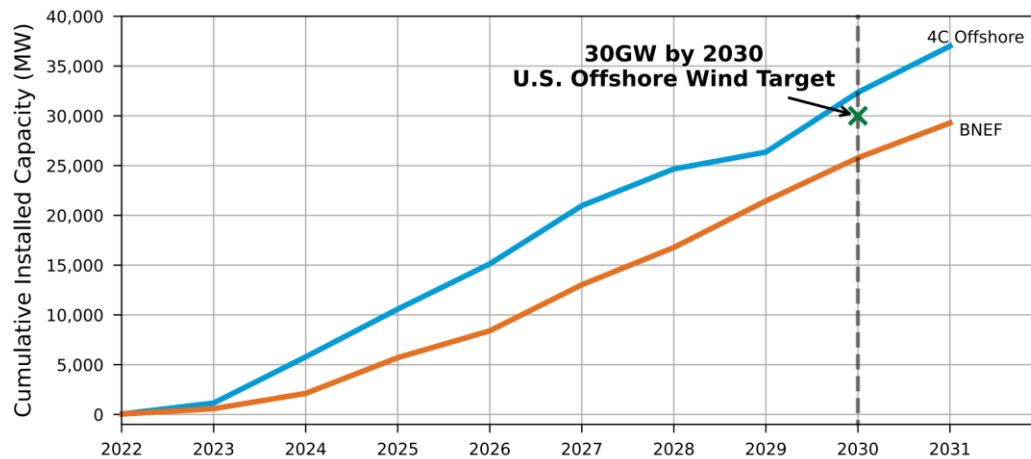


Figure 21. Offshore wind capacity under construction by country as of 2021

Source : USDOE

# USA Offshore Wind - Estimated Cumulative Capacity



## Block Island Wind Farm

- Operating since 2016
- Capacity = 30 MW
- 5 6-MW Haliade 150 turbines
- Jacket substructures

## Coastal Virginia Offshore Wind

- Operating since 2020
- Capacity = 12 MW
- 2 6-MW SWT-6.0-154 turbines
- Monopile substructures



Equipment	Nos	Est Cost
Offshore wind turbines & towers	2057	\$43.9 billion
Offshore turbine & substation foundations	2110	\$17.0 billion
Kilometers of export & array cables	8000	\$12.9 billion
Offshore & onshore substations	53	\$10.3 billion
Other CAPEX1		\$16.0 billion
Development Expenditure (DEVEX)		\$6.16 billion
Operational Expenditure (OPEX)		\$2.83 billion
<b>Total Expenditure (TOTEX)</b>		<b>\$109 billion</b>

Source : USDOE, NREL

# USA Supply Chain Development

Component	Location	Investors	Status	Announced Investment (\$ million)
Blades	Portsmouth Marine Terminal (Virginia)	Siemens Gamesa	Announced	200
Nacelles (Final Assembly Only)	New Jersey Wind Port (New Jersey)	Vestas, Atlantic Shores	Announced	Not Announced
	New Jersey Wind Port (New Jersey)	GE, Ørsted	Announced	Not Announced
Towers	Port of Albany (New York)	Marmen Welcon, Equinor	Announced	350
Monopiles	Paulsboro Marine Terminal (New Jersey)	EEW, Ørsted	Under Construction	250
	Tradepoint Atlantic (Maryland)	U.S. Wind	Announced	150
Foundation Platforms	Port of Providence (Rhode Island)	Eversource, Ørsted	Announced	40
Secondary Steel	Port of Coeymans (New York)	Eversource, Ørsted	Announced	86
Transition Pieces	Port of Albany (New York)	Marmen Welcon, Smulders	Announced	Not Announced
Array and Export Cables	Nexans High-Voltage Cable Facility (South Carolina)	Nexans	Operational	200
	Kerite (Connecticut)	Kerite, Marmon Group, Vineyard Wind	Operational	4
	Tradepoint Atlantic (Maryland)	Ørsted, Hellenic Cables	Announced	140
	Brayton Point (Massachusetts)	Prismian, Avangrid	Announced	200
Offshore Substations	Ingleside (Texas)	Kiewit, Eversource, Ørsted	Operational	Not Announced <sup>17</sup>
Total Announced Investments Made in 2021-2022 (\$ million)				1,166

Source : USDOE



# Floating Offshore

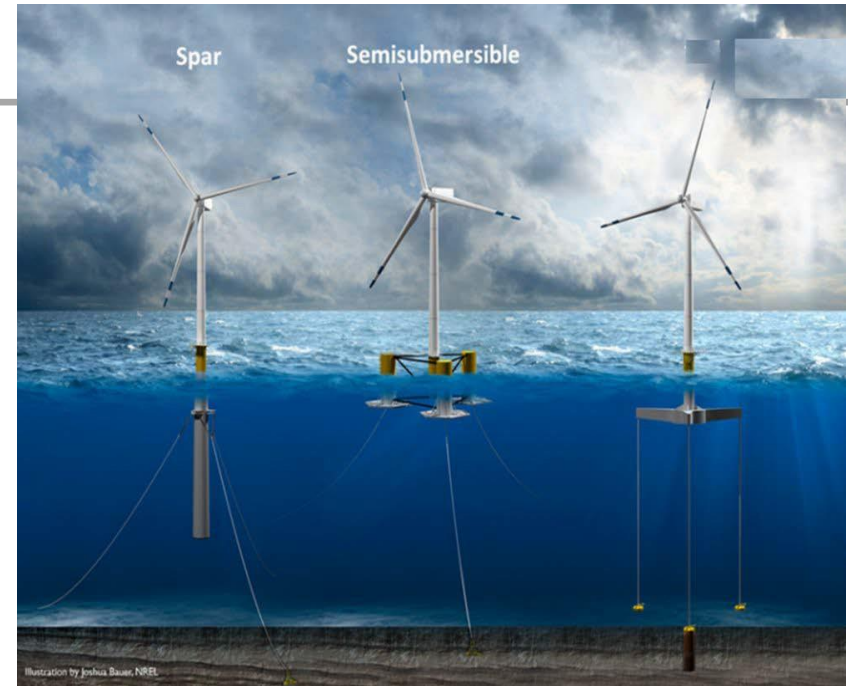
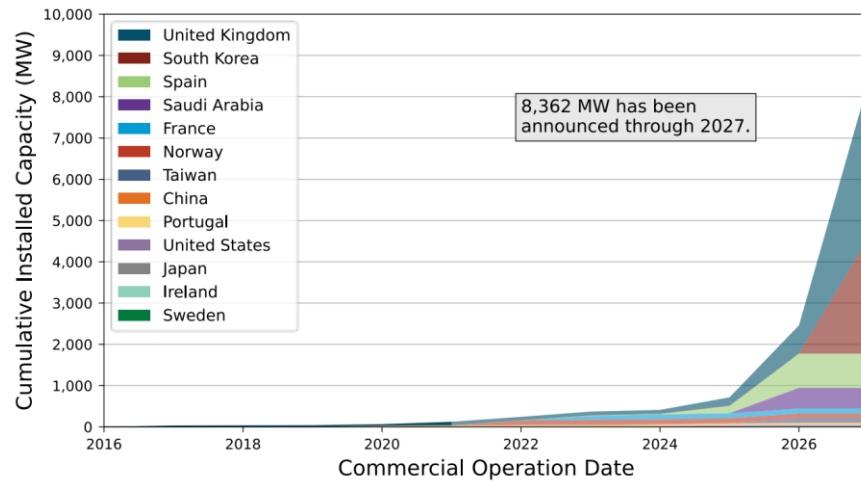
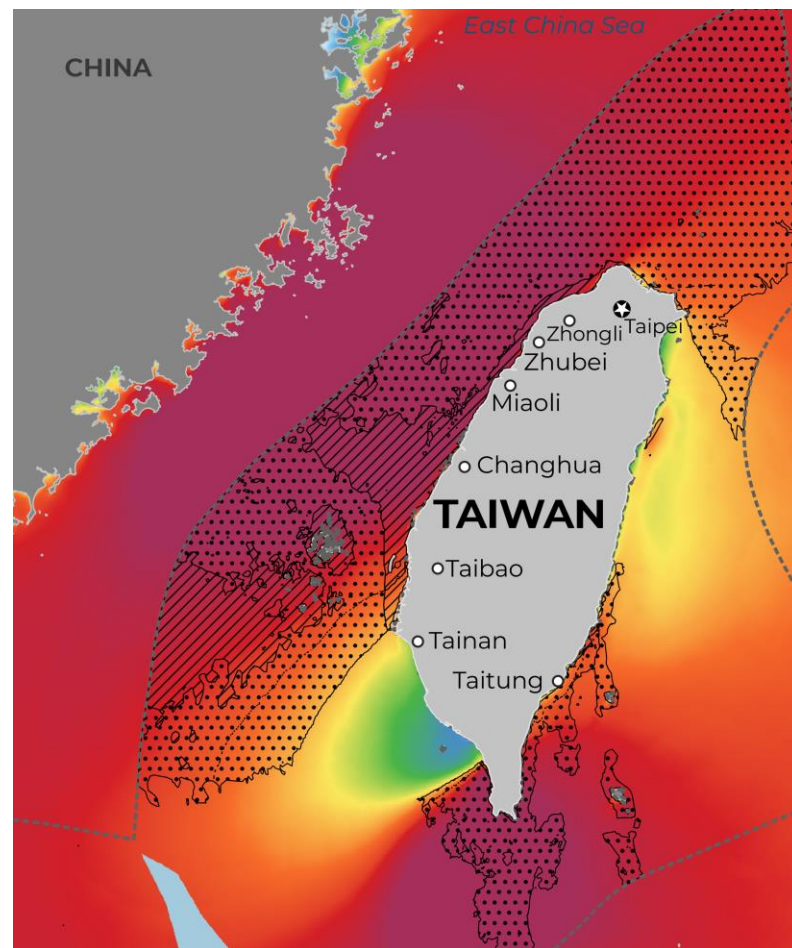
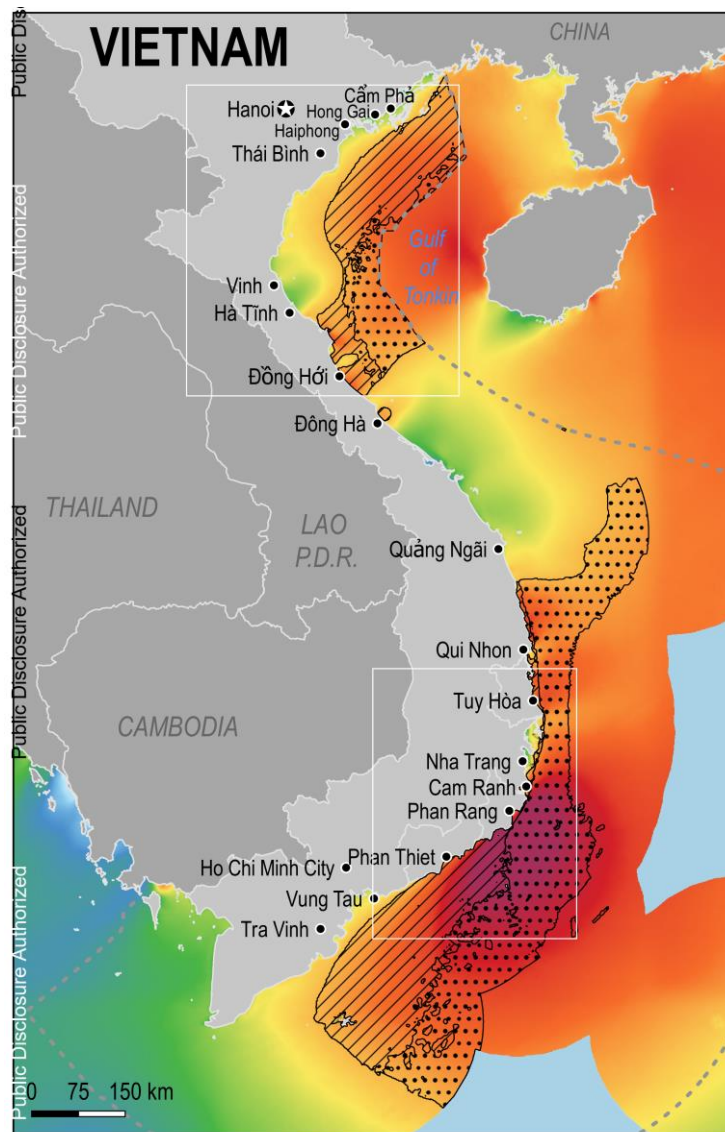


Figure 20. Kincardine 47.5-MW floating offshore wind plant. Photo courtesy of Principle Power, Inc.

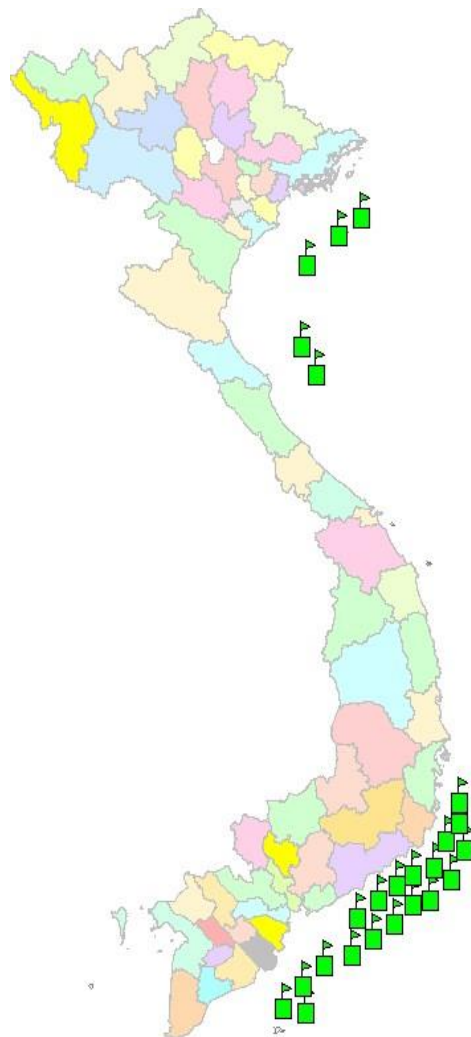
# Offshore Technical Potential Taiwan & Vietnam

In GW	Fixed	Floating	Total Potential
<b>Vietnam</b>	261	338	599
<b>Taiwan</b>	67	427	494



Source : World Bank, ESMAP

# Vietnam PDP8 : Offshore Wind Targets



PDP8 2030 capacity  
4,000MW, Registered  
capacity 51,659 MW

Registered by Province	Capacity (MW)	No of projects
Quảng Ninh	6,000	2
Hải Phòng	16,200	5
Thái Bình	3,700	2
Nam Định	12,000	1
Thanh Hóa	5,000	1
Hà Tĩnh	1,050	2
Quảng Bình	4,109	5
Quảng Trị	3,600	4
<b>Northern Provinces</b>	<b>51,659</b>	<b>22</b>

PDP8 Offshore Wind Targets are ambitious particularly after 2030  
The future of Vietnam's Net Zero Targets depend on the success of Offshore Wind

PDP8 Capacity		by Provincial Areas		2030 GW	2045 GW
1	Northern area	Ninh Binh and North		4,000	13,000
2	North Central Coast	Thanh Hoa to Quang Binh			5,000
3	Center Central Coast	Quang Tri to Quang Ngai			3,000
4	South Central Coast	Binh Dinh to Binh Thuan)		3,000	30,500
5	Southern Vietnam	Ba Ria Vung Tau and South			13,000
		<b>Total</b>		<b>7,000</b>	<b>64,500</b>

PDP8 2030 capacity  
3,000MW, Registered  
capacity 95,177 MW

Registered by Province	Capacity (MW)	No of projects
Bình Định	8,600	7
Phú Yên	850	2
Ninh Thuận	25,802	14
Bình Thuận	30,200	10
Bà Rịa - Vũng Tàu	3,760	6
Trà Vinh	10,300	7
Sóc Trăng	4,900	4
Bến Tre	6,460	8
Bạc Liêu	5,255	10
Cà Mau	8,500	6
<b>Southern Provinces</b>	<b>95,177</b>	<b>65</b>

Cumulative operating capacity	Low Growth Scenario WB	High Growth Scenario WB	PDP8 Targets
<b>2030</b>	<b>5 GW</b>	<b>10 GW</b>	<b>7 GW</b>
<b>2035</b>	<b>11 GW</b>	<b>25 GW</b>	
<b>2045</b>			<b>64.5 GW</b>
<b>2050</b>	<b>35 GW</b>	<b>70 GW</b>	
Maximum annual installation rate	1.6 GW	3 GW	3.6 GW

Source : Draft PDP8

# World Bank Vietnam Offshore Wind Road Map Timeline

	2020	2021	2022	2023
<b>Vision and volume targets</b>				
Publish a vision for offshore wind to 2050				
Set offshore wind installation targets to 2030 and 2035				
<b>Leasing, permitting, and power purchase</b>				
Develop a marine spatial plan for offshore wind				
Create a leasing and permitting authority				
Determine preferred approach to seabed leasing and power purchase				
Transition to a competitive system for offshore wind				
Set out leasing competitions (GW leased in period)				
Revise the terms and conditions of the FIT; offer it to 2025				
<b>Project finance</b>				
Ensure bankability of future PPA arrangements				
Encourage financial mechanisms to reduce cost of capital				
<b>Transmission and port infrastructure</b>				
Mandate substantial transmission reinforcements				
Determine approach to transmission investment				
Enable investment in port facilities				
<b>Supply chain development</b>				
Prepare supply chain plan and local content guidance				
Enable investment in local supply chain businesses				
Undertake skills and training assessment				
Address barriers to inward investment				
<b>Standards and regulations</b>				
Create framework for environmental and social impact assessment				
Create health and safety framework for offshore wind				

Cumulative operating capacity	Low Growth Scenario	High Growth Scenario
<b>2030</b>	5 GW	10 GW
<b>2035</b>	11 GW	25 GW
<b>2050</b>	35 GW	70 GW
<b>Maximum annual installation rate</b>	1 .6 GW	3 GW

## Phase 1: Initiation - 2020 to 2023

- Build momentum
- Enable early projects to progress
- Establish frameworks and regulations
- Educate stakeholders
- Start transmission upgrades
- Start port upgrades

## Phase 2: Industrialization - 2024 to 2028

- Increase installation rate x 1.5
- First large conventional fixed projects
- Transition from FIT to auction
- Grow Industrial and skills base
- Implement Transmission upgrades
- Complete port upgrades

## Phase 3: Full capability - 2028 to 2034

- Increase installation rate x 2
- Accelerate exports
- First large floating projects
- Last intertidal projects build out

# Vietnam Offshore Wind Targets & Framework required to achieve these targets

	2030	2040	2050
Offshore wind operating capacity (GW)	10	40	70
Average capacity factor of operating projects (%)	43	54	56
Offshore wind electricity production (TWh/yr)	30	170	330
National average demand (TWh/yr)	580 (65 GW)	980 (110 GW)	1,210 (140 GW)
Electricity supplied by offshore wind (%)	5	17	27
LCOE US\$ / MWh	72	46	37



Source : World Bank, BVG

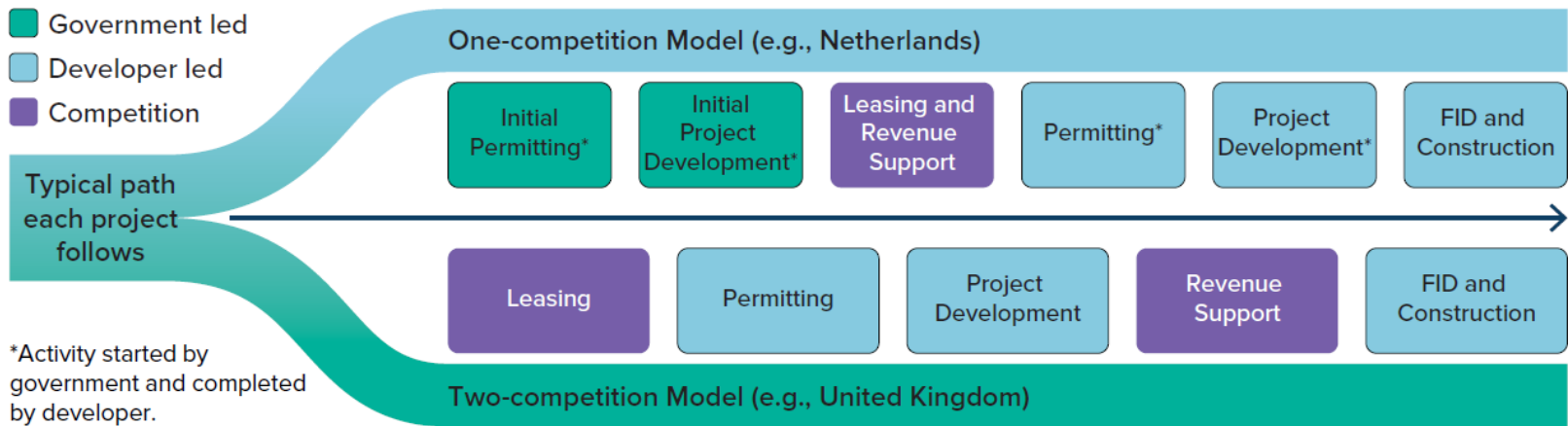


# Supply Chain Investments to meet 2030 Targets

Investment	Low Growth Scenario	High Growth Scenario	Timing	Amount
<b>Turbine towers</b>	Upgrade to existing CS Wind factory to produce 100 offshore Towers annually and provide waterfront loadout	Upgrade to existing CS Wind factory to produce 100 offshore Towers annually and provide waterfront loadout	Investment decision in 2027	US\$5-30 million
<b>Turbine blades</b>	n/a	New factory to produce 100 blade sets a year	Investment decision early 2027	US\$30-100 million
<b>Foundations</b>	Upgrade to fabrication yards	Upgrade to fabrication yards	Investment decision early 2027	US\$5-30 million
<b>Subsea cables</b>	n/a	New factory at waterfront location	Investment decision early 2027	US\$30-100 million
<b>Installation</b>	New cable installation vessels	New turbine, foundation and cable installation vessels	Investment decision	US\$30-300 million

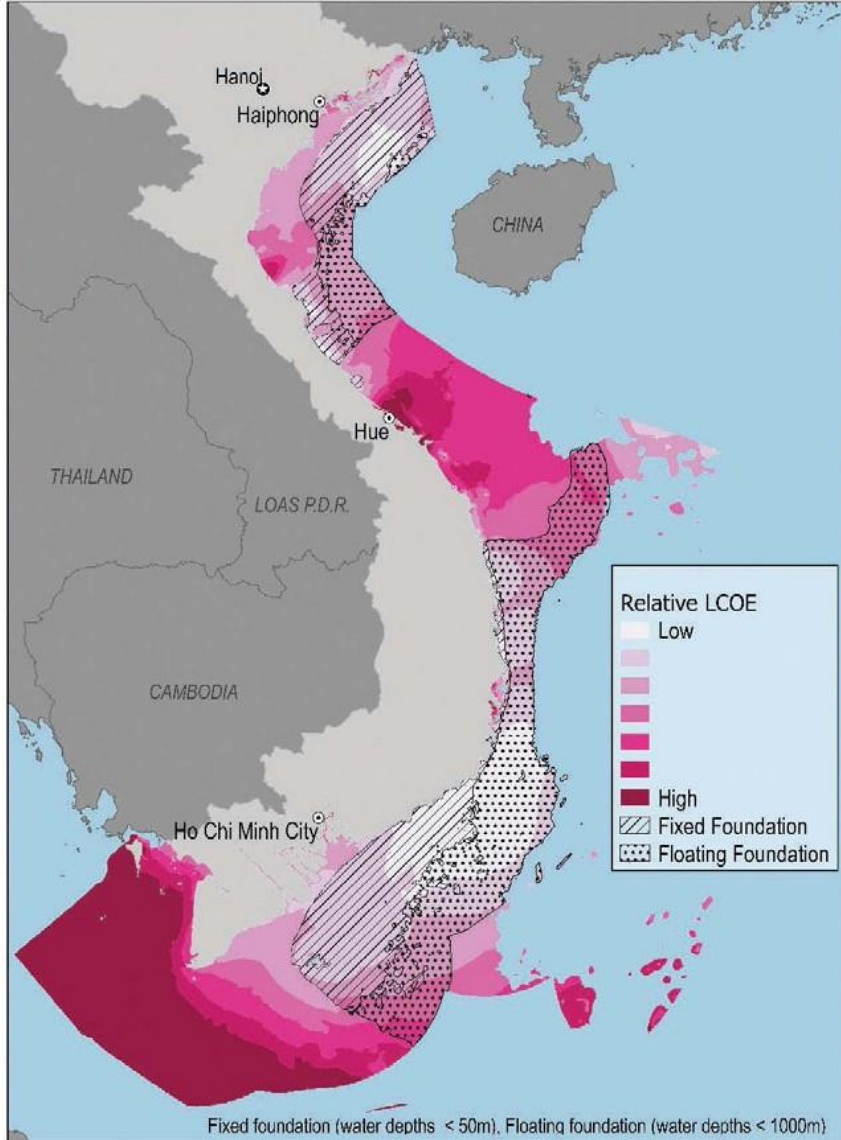
Source : World Bank, BVG

# Permitting Models for Offshore Wind



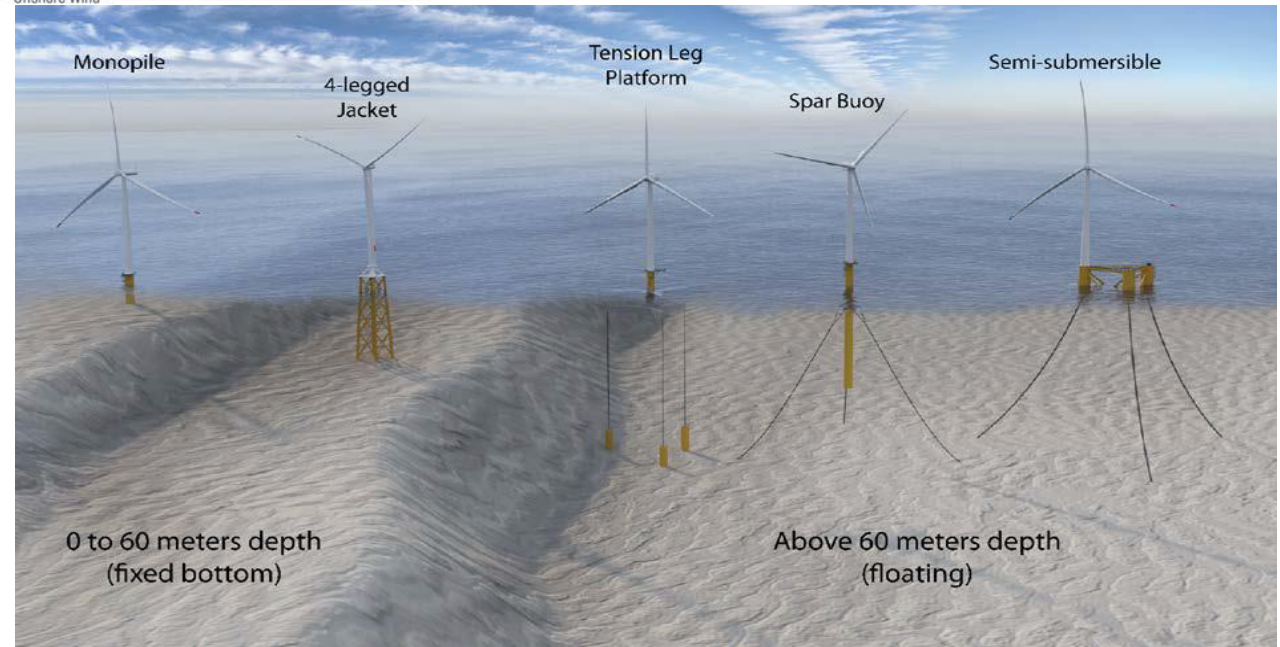
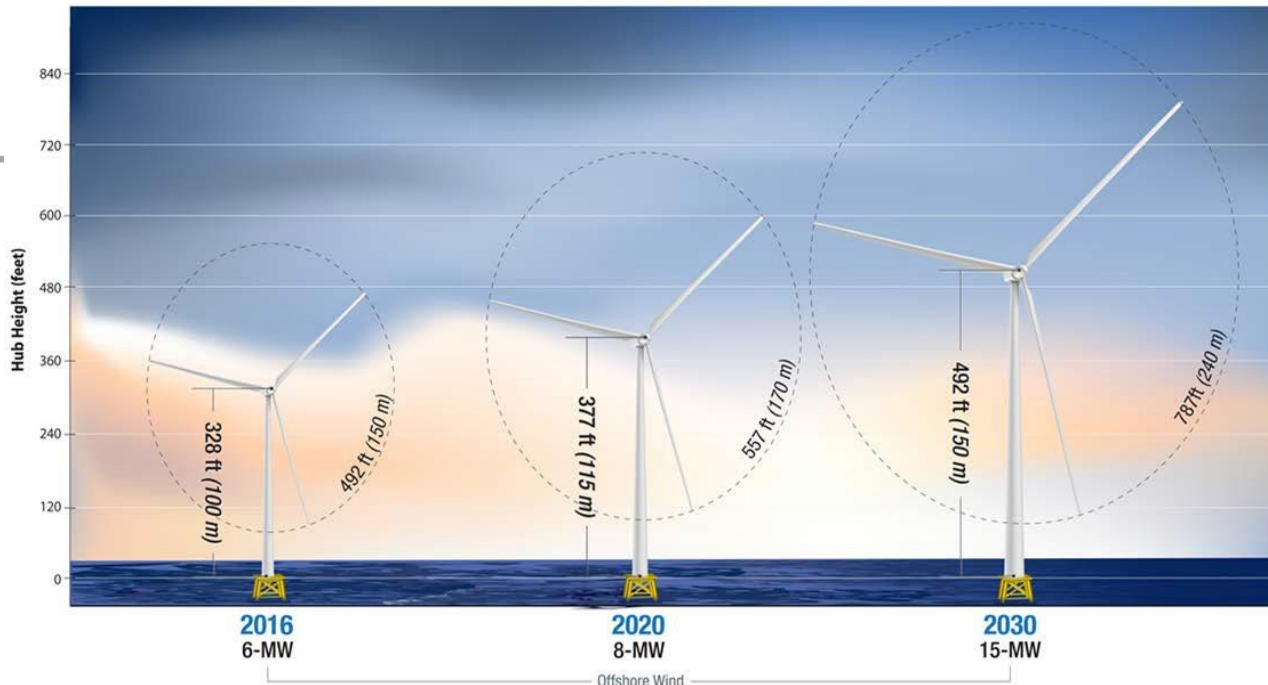
	Centralized one-stage approach	Decentralized two-stage approach
<b>Risk or cost to government</b>	<ul style="list-style-type: none"> <li>+ Could lead to lower bid prices</li> <li>+ More opportunity for government to plan efficiently where the wind farms go</li> <li>- Higher risks and up-front cost to government</li> </ul>	<ul style="list-style-type: none"> <li>+ Lower risk and up-front cost to government</li> <li>+ Competition between best projects</li> <li>- Less opportunity to cluster projects to benefit grid connection and supply chain</li> </ul>
<b>Attractiveness to developers</b>	<ul style="list-style-type: none"> <li>+ Less up-front risk</li> <li>- Less control; some developers find this inefficient</li> <li>- Less opportunity for project innovation and differentiation</li> </ul>	<ul style="list-style-type: none"> <li>+ Greater control for developers</li> <li>+ Greater chance to innovate and differentiate</li> <li>- Greater risk to developers</li> </ul>
<b>Supply chain investment impact</b>	<ul style="list-style-type: none"> <li>+ Allows government to spread deployment over time, which is good for supply chain investment</li> <li>- Less opportunity for relationships to form between developers and local supply chain</li> </ul>	<ul style="list-style-type: none"> <li>+ Allows for long-term relationships to form between developer and local suppliers</li> <li>- If combined with capacity constrained auctions, could deliver less opportunity for suppliers</li> </ul>

# LCOE along the Vietnam coastline





# Turbine Sizing and Foundations



Source : USDOE, NREL

# THE FUTURE OF OFFSHORE WIND IN VIETNAM – KEY TAKEAWAYS



- Offshore wind is growing rapidly worldwide, offering clean power at a large-scale; high capacity factors and availability; cost-competitive with fossil fuel led generation; and provide a strong stimulus for investment
- Offshore Wind is set to play a major role in limiting Greenhouse gas emissions, enabling major countries to achieve net zero targets.
- Vietnam Government as per latest PDP8 draft documents, has set ambitious targets to realize the potential of Offshore Wind along its long 3200 km coastline, perfectly suitable for large scale installations
- Following the success of the last Solar and Wind tariff regimes over the last 3 years, Vietnam has the drive and capacity to implement institutional framework to achieve these targets.
- Offshore Wind requires access to state-of-the-art technology and large-scale investments. Strong Institutional Framework to provide sufficient confidence to all the stakeholders in this nascent industry is essential. Bankability is perhaps most critical in addition to predictable, pre- announced guidelines for permitting, leasing and tariff mechanism.

---

# Thank You

---

Disclaimer : This presentation has been prepared for informational purposes only. No representative or warranty (express or implied) is made or can be given by Marshal Funds group with respect to the accuracy or completeness of the information in this Presentation

