

# WORLD BANK GROUP OFFSHORE WIND DEVELOPMENT PROGRAM

THE VAST POTENTIAL OF OFFSHORE WIND IN  
EMERGING MARKETS

JUNE 2020





# Opening Remarks

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A photograph of an offshore wind farm. In the foreground, a large white wind turbine with three blades is prominent, its base painted yellow. Several other similar turbines are visible in the distance, receding into the horizon. The sea is dark and choppy, and the sky is filled with heavy, grey clouds, suggesting an overcast or stormy day.

# Agenda

- Why offshore wind for emerging markets? - Sean Whittaker
- Technical potential in emerging markets – Clara Ivanescu
- WBG Offshore Wind Program support – Mark Leybourne
- Q&A





Why offshore wind for Emerging Markets?

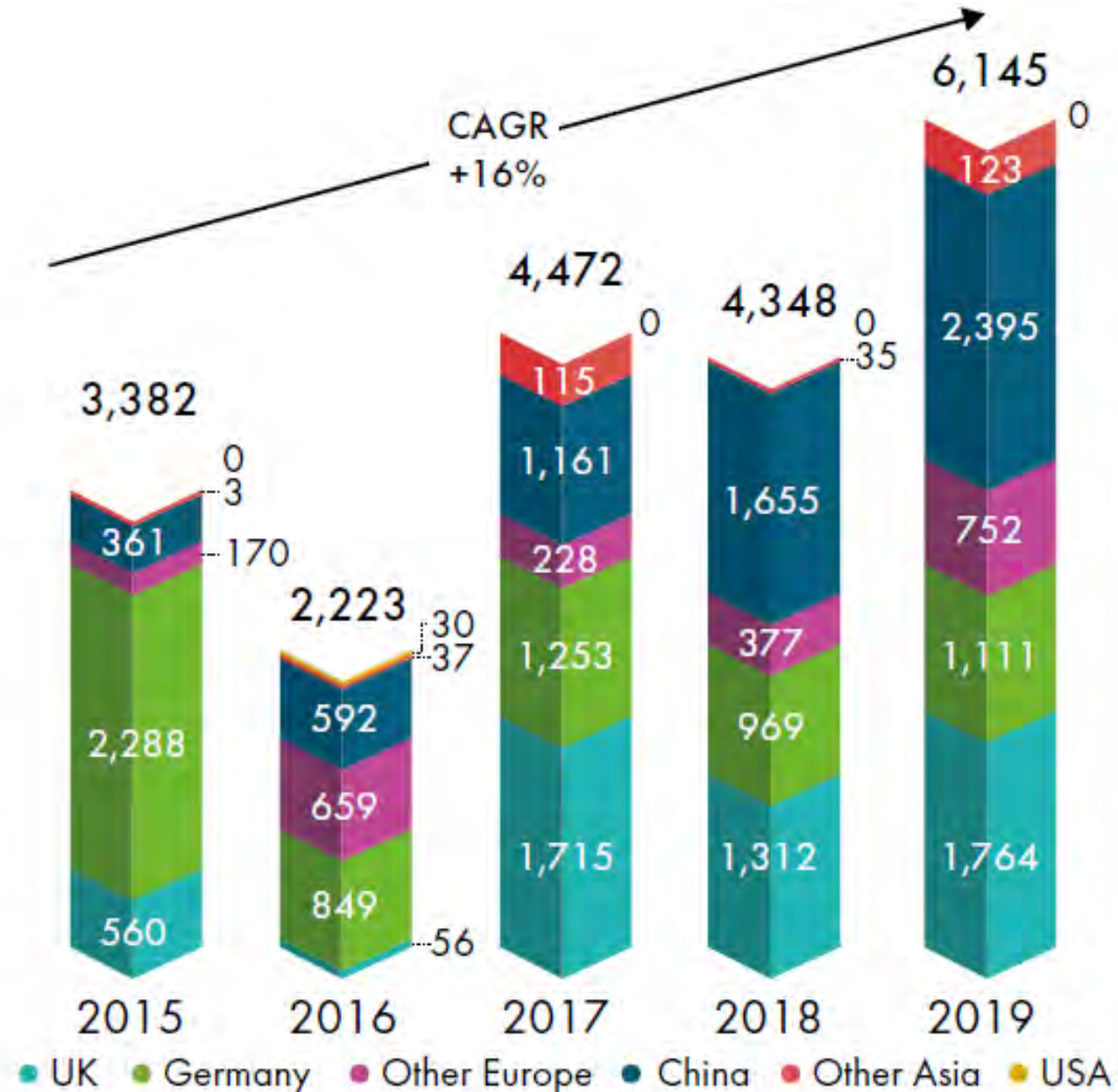


# Offshore wind has grown quickly ...

## New Offshore Wind Installations (GW)

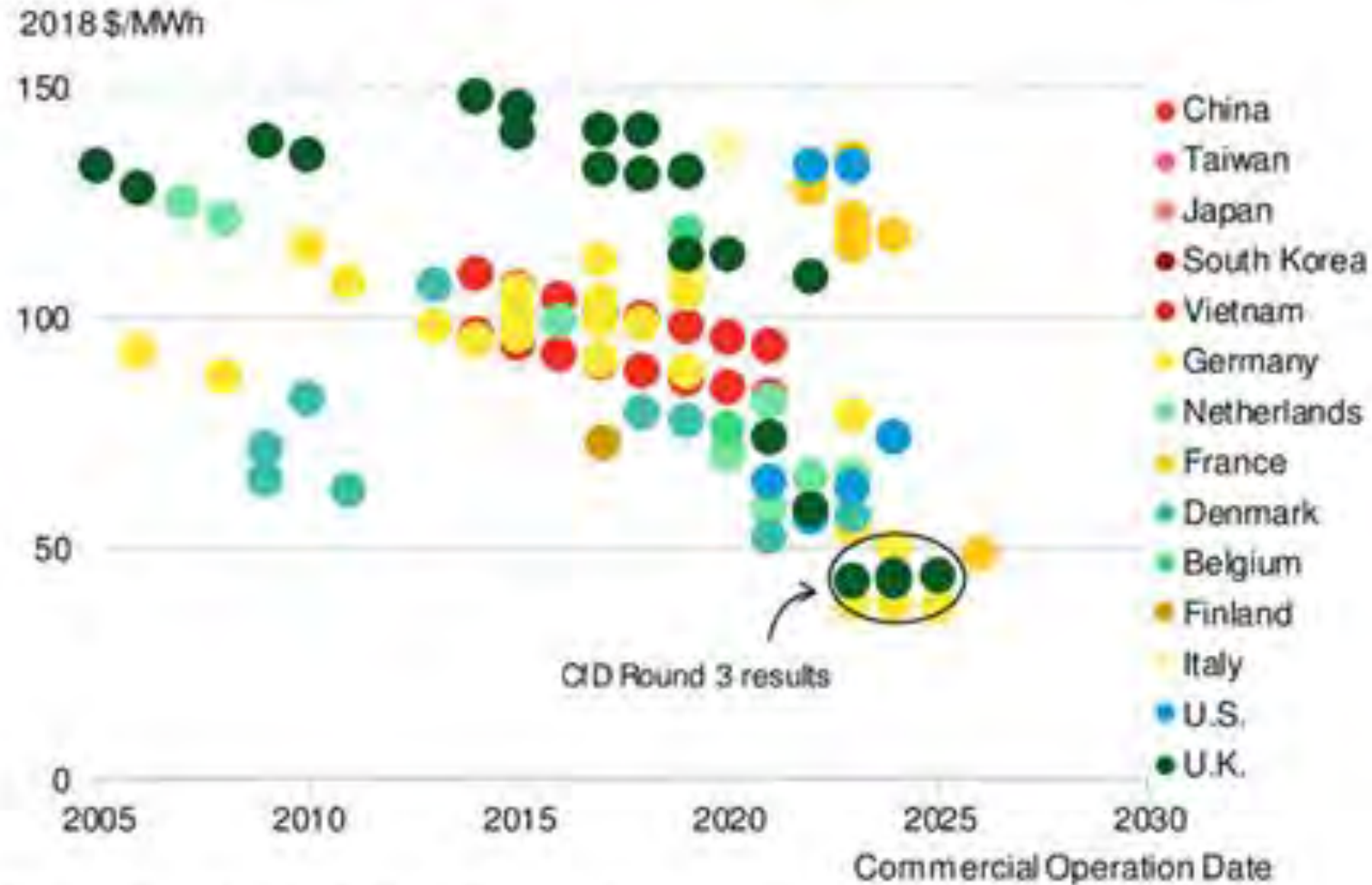
Source: Global Wind Energy Council (GWEC)

Now ~29GW currently operational worldwide



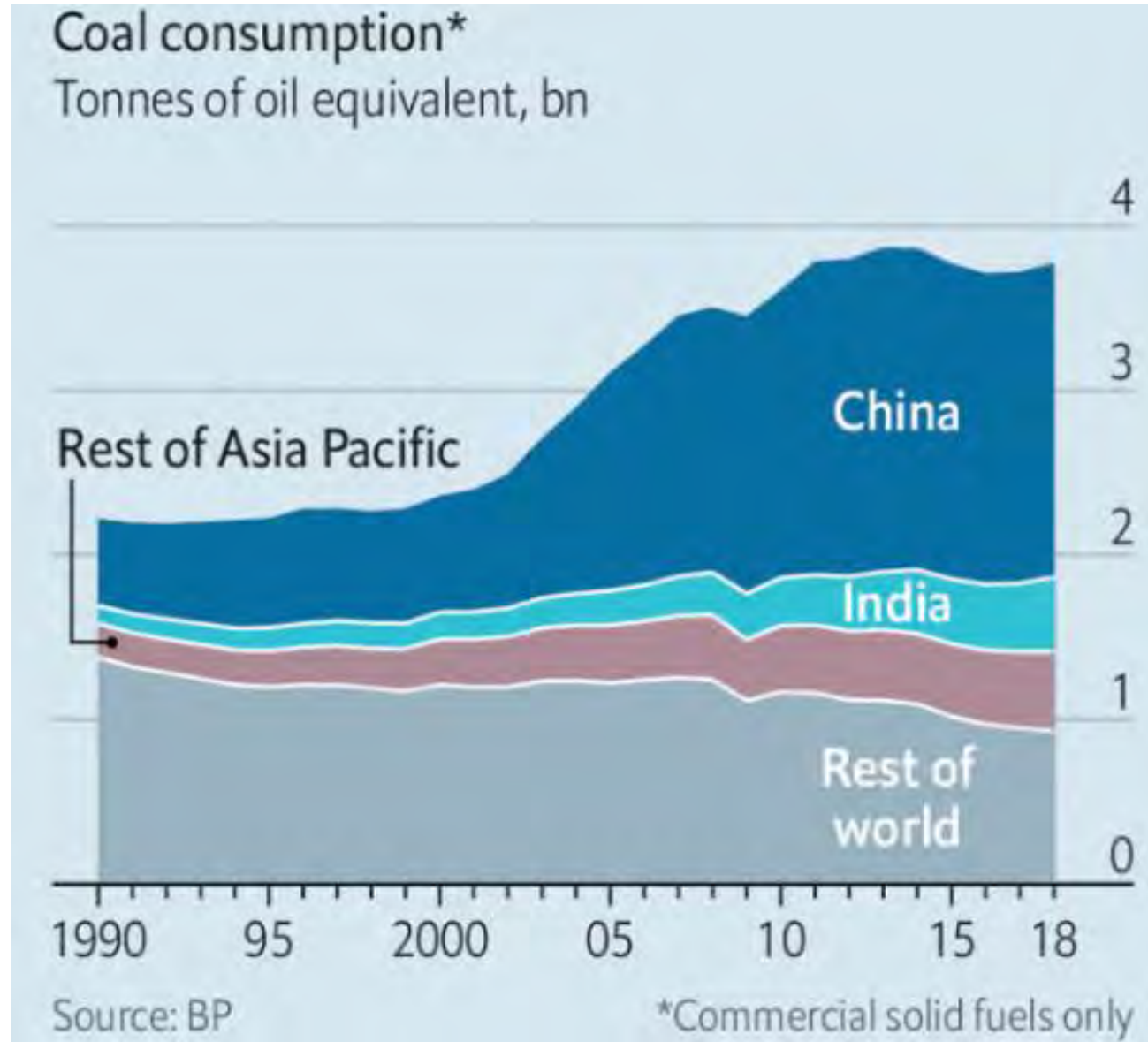
# Why? Power at a competitive price ...

Levelized offshore  
wind tariffs,  
2005 – 2030  
(2018 \$/MWh)



Source: BloombergNEF. Note: Figures refer to an estimated levelized price, taking into account tariff price and length, inflation, a merchant tail assumption and a 25-year lifetime. Prices above \$150/MWh were omitted. The full cost of transmission to shore is included in some but not others.

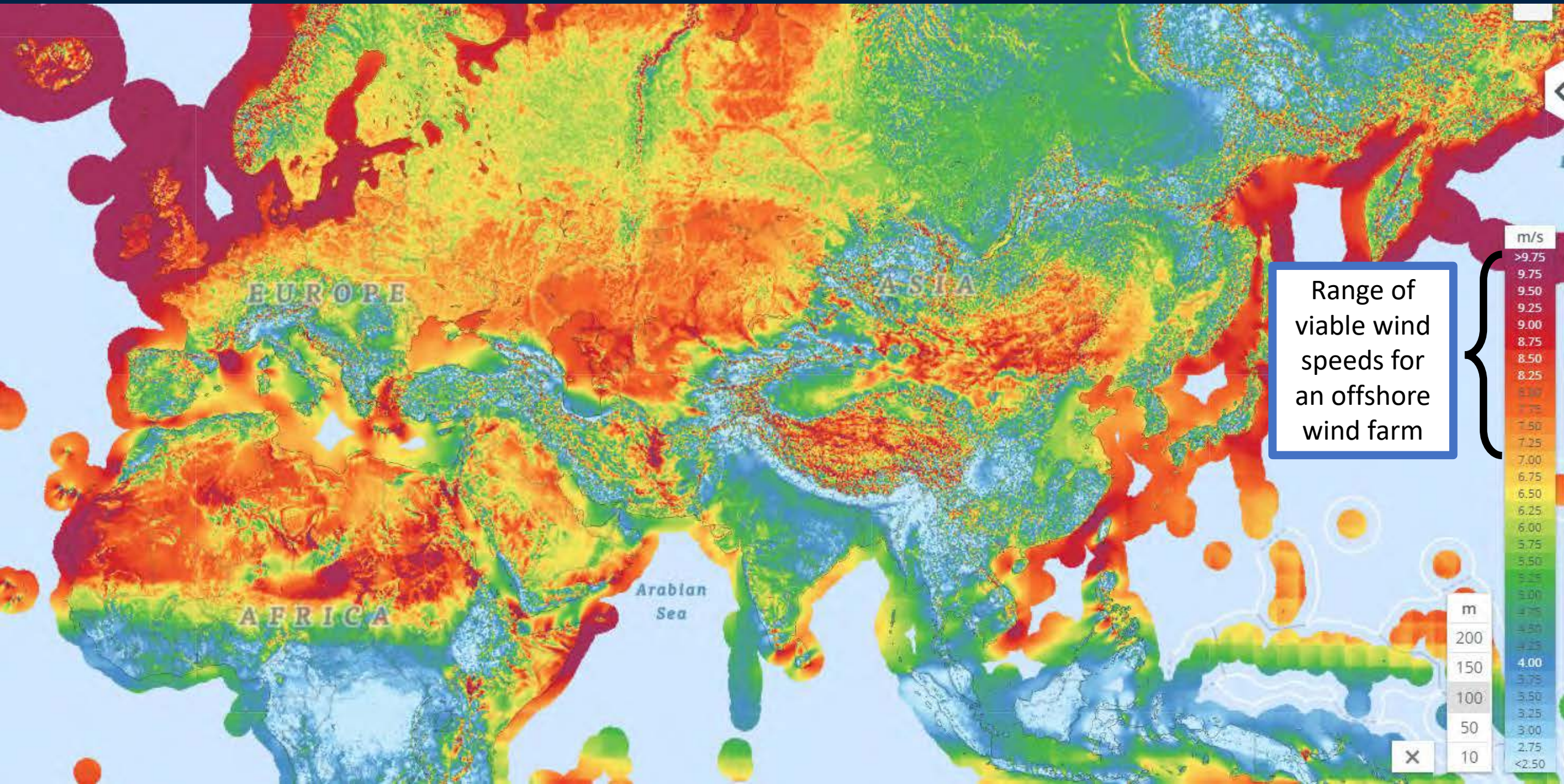
# Why? Clean power with energy security



Source: The Economist



# Why? Power where you need it with no land constraints



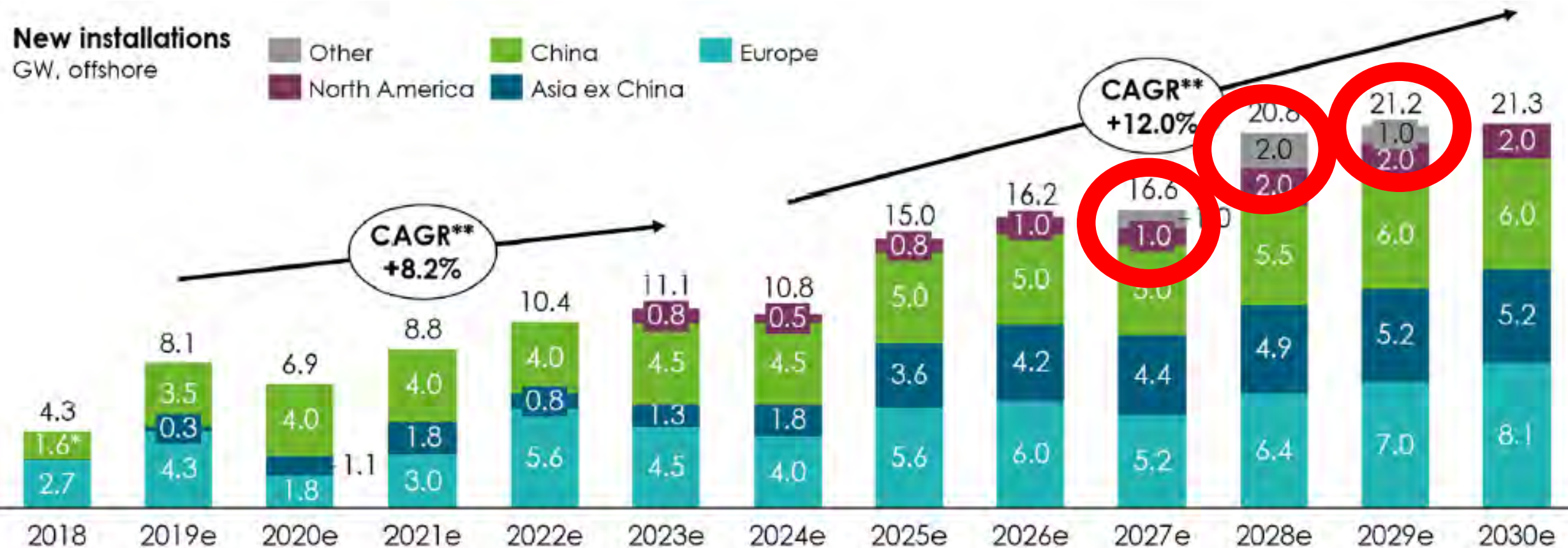


# Why? Power even in deep waters ...





# But will a rising tide raise all boats?



\* Chinese installation adjusted to 1.6 GW new installations for 2018, Source: CWEA

\*\* CAGR = Compound Annual Growth Rate

Source: GWEC Market Intelligence Offshore Wind Outlook 2030 (June 2019)



# What are the challenges in Emerging Markets?

## Need for infrastructure:

- Need large ports and staging areas for installation
- Need fleet of installation and service vessels

## Need for adapted technology:

- Need typhoon-class turbines for high-risk areas
- Need special foundations for seismic conditions

## Need to consider environmental and social:

- Manage impacts on avian and marine fauna
- Active engagement with stakeholders

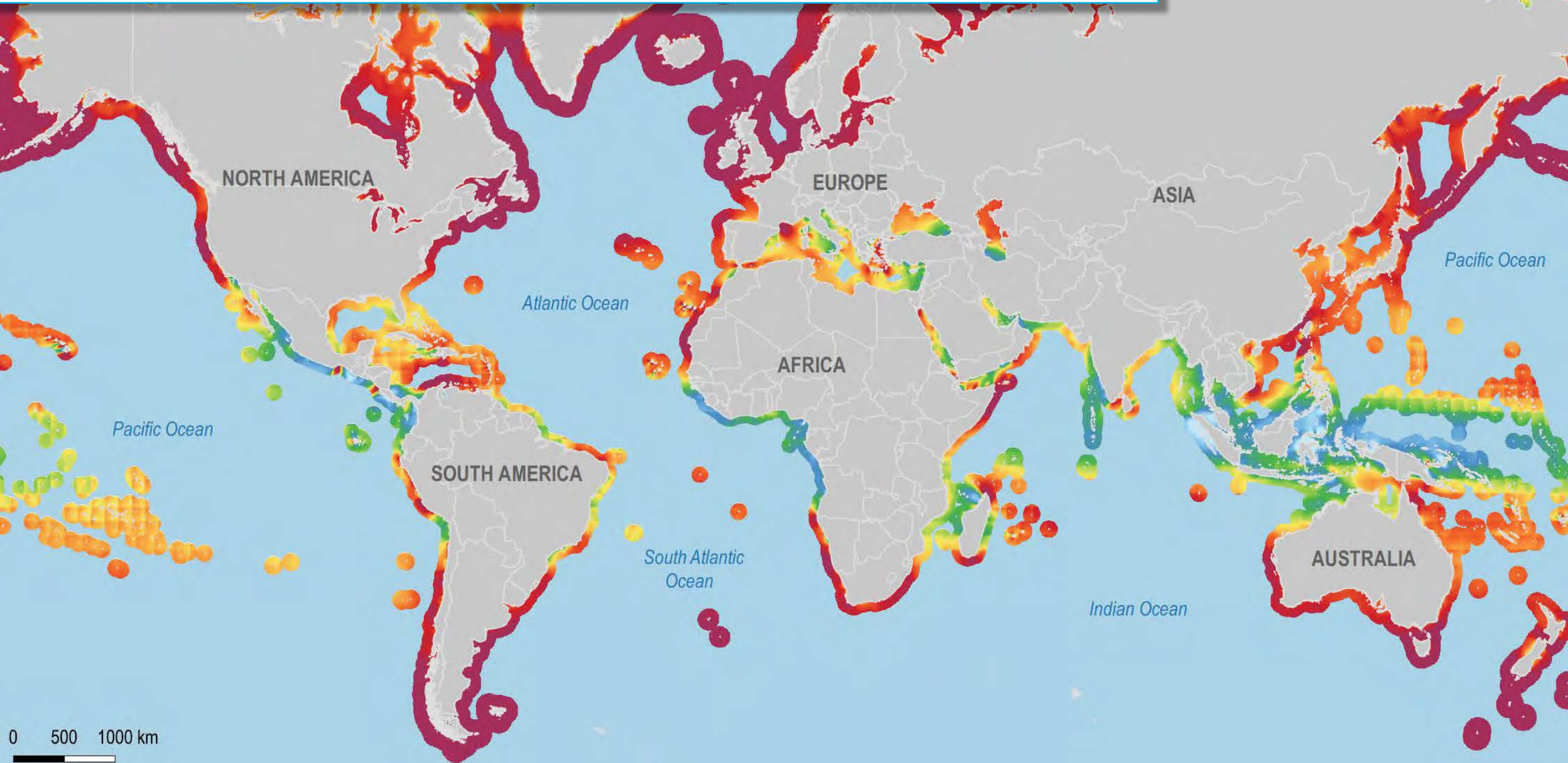
## Need for bankable projects:

- Attract experienced international players
- Reduced risks = reduced prices





# Technical Potential in Emerging Markets

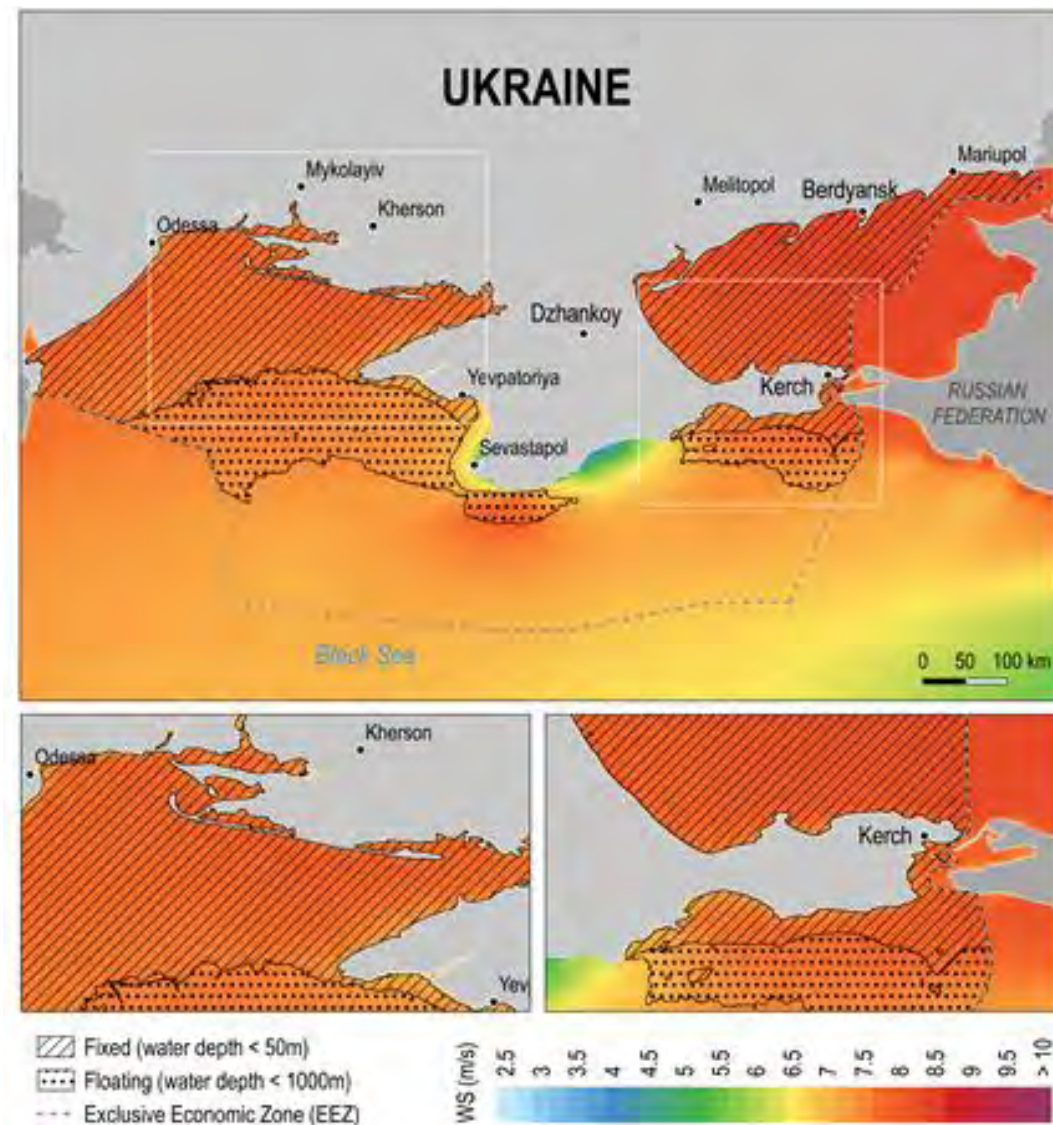




# Mapping the Technical Potential

Dataset	Value Threshold	Details
Wind speed*	> 7m/s	Wind speeds above 7 m/s are assumed as optimal resources
Bathymetry	< 50 m	Water depths of 50 m or less for fixed foundation offshore wind projects
Bathymetry	50 – 1,000 m	Water depths between 50m and 1,000m are considered suitable for floating foundations
Resulting Areas	> 10 km <sup>2</sup>	The resulting areas were further filtered by size, with areas covering a minimum of 10 km <sup>2</sup> considered suitable for the installation of an offshore wind farm
Technical Potential (in GW installed capacity)	3MW/km <sup>2</sup> 4MW/km <sup>2</sup>	The <b>technical potential</b> for each opportunity zone has been computed by assuming: <ul style="list-style-type: none"> <li>• a density of 3 MW per km<sup>2</sup> for wind speeds between 7–8 m/s</li> <li>• a density of 4 MW per km<sup>2</sup> for wind speeds greater than 8 m/s.</li> </ul>

Note: All wind speeds used were annual average wind speeds, taken at 100m elevation from the sea surface – approximately the hub-height of an offshore wind turbine



# Findings – Countries Analyzed

## Going Global report

- Brazil
  - India
  - Morocco
  - Philippines
  - South Africa
  - Sri Lanka
  - Turkey
  - Vietnam
- Algeria
  - Argentina
  - Azerbaijan
  - Bangladesh
  - Bulgaria
  - Chile
  - China
  - Colombia
  - Costa Rica
  - Djibouti
- Dominican Republic
  - Egypt, Arab Rep.
  - Eritrea
  - Fiji
  - Haiti
  - Honduras
  - Indonesia
  - Jamaica
  - Kazakhstan
  - Kenya
  - Lebanon
  - Libya
  - Madagascar
  - Maldives
  - Mauritania
  - Mexico
  - Mozambique
  - Myanmar
  - Namibia
- Nicaragua
  - Pakistan
  - Papua New Guinea
  - Peru
  - Poland
  - Romania
  - Senegal
  - Tanzania
  - Tunisia
  - Turkmenistan
  - Ukraine
  - Uruguay
  - Vanuatu
  - Venezuela, R.B.
  - Yemen, Rep.
- Caribbean Islands
  - Caspian Sea
  - Black Sea

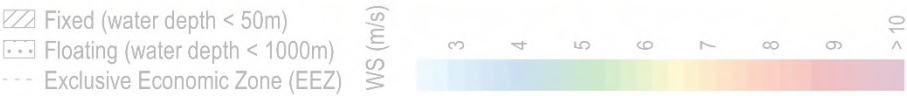
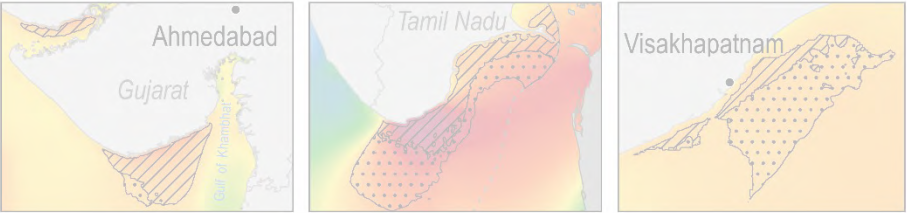
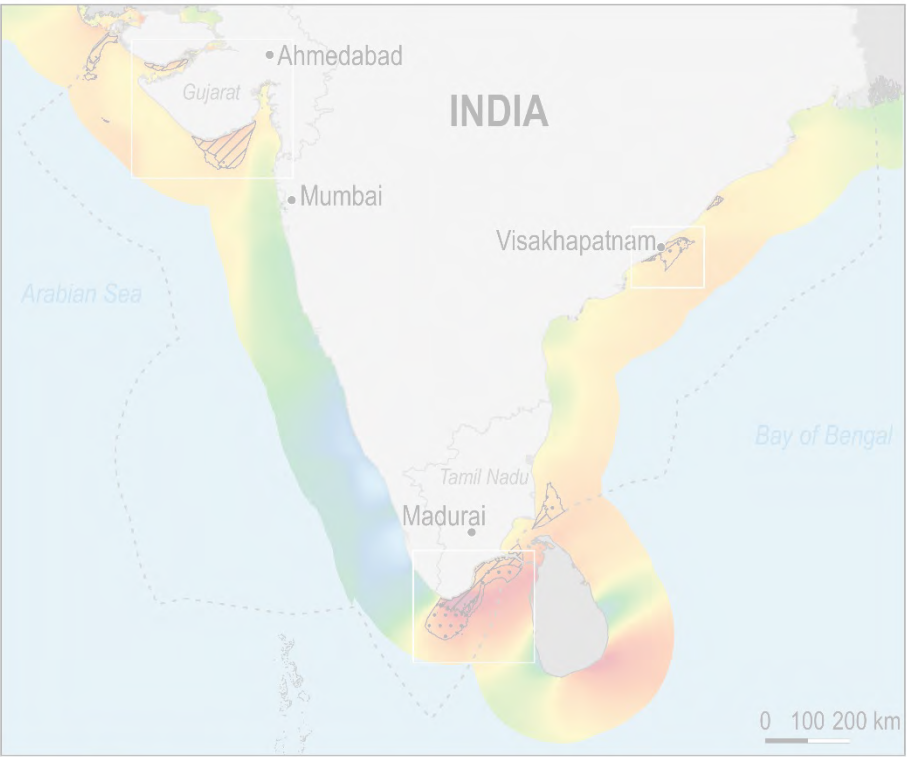
Check out all maps online: <https://esmap.org/offshore-wind>





# What are the opportunities in eight key emerging markets?

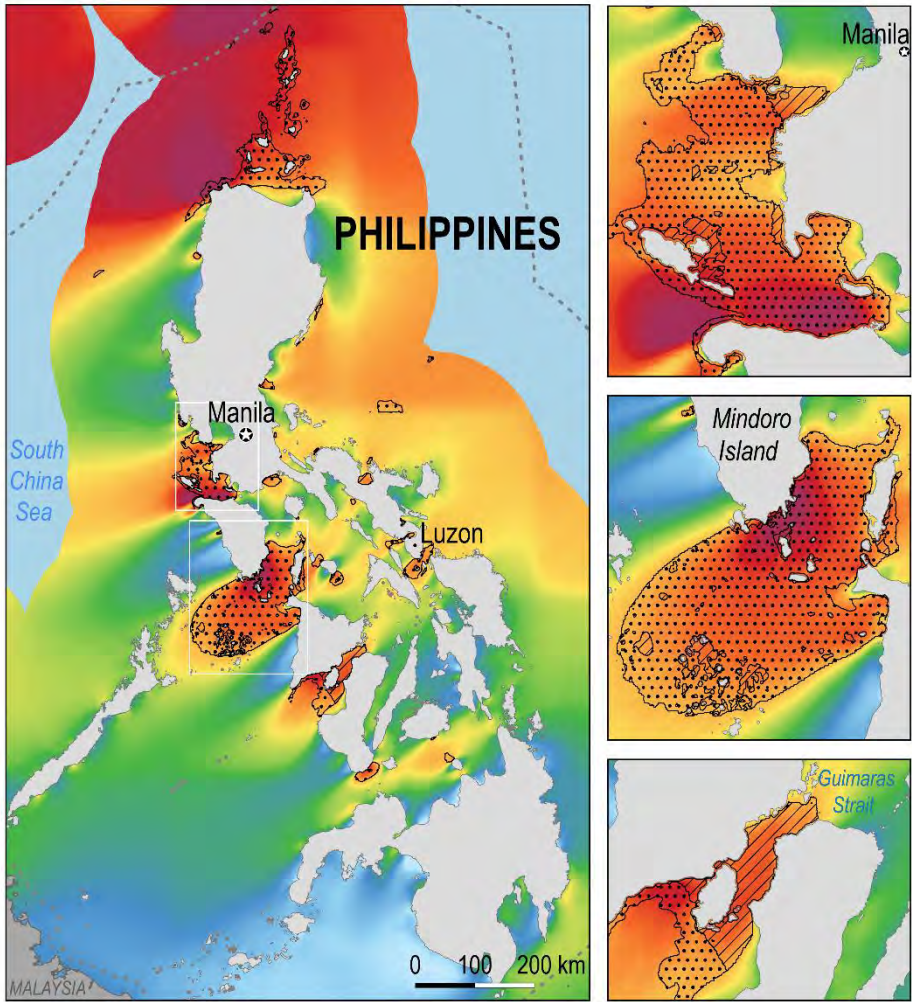
## India



Within 200 km of coast

Country	Fixed (GW)	Floating (GW)
India	112	83

## Philippines



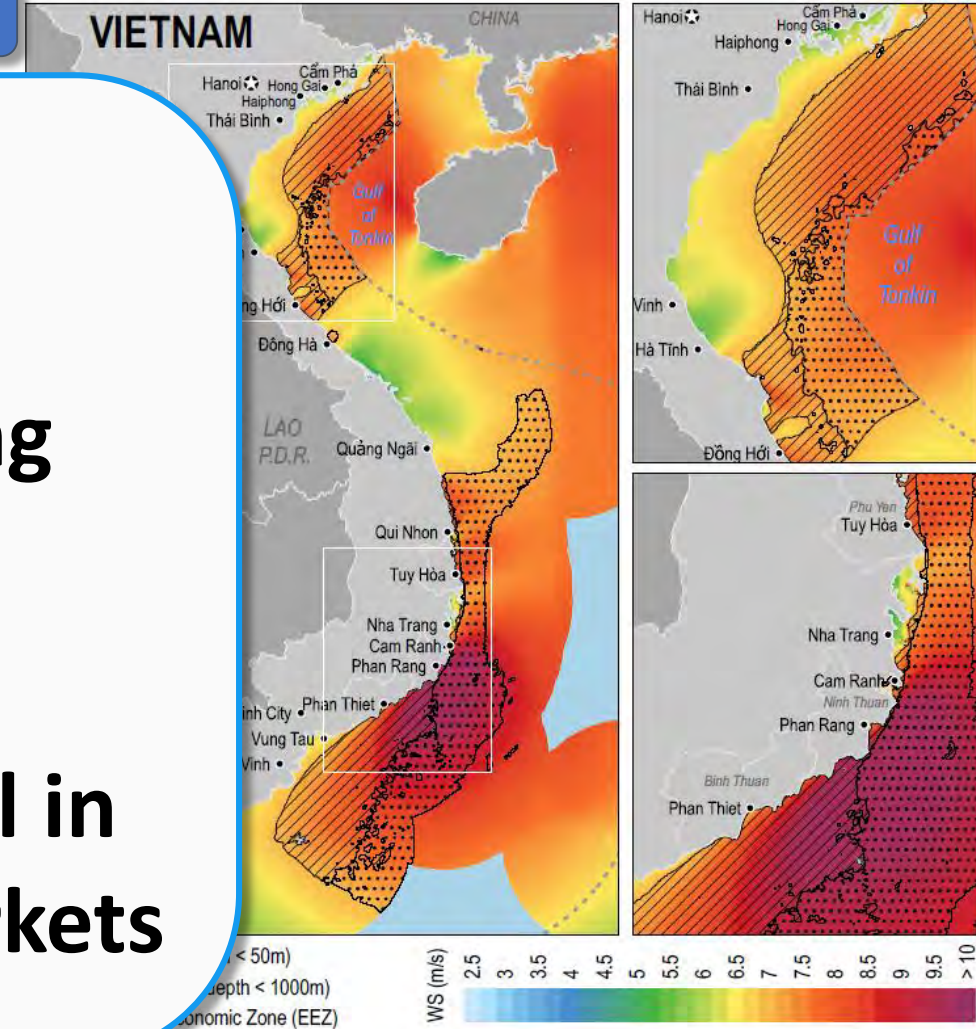
# What are the opportunities in eight key emerging markets?

## Turkey

Within 200 km of coast

**1,016 GW fixed**  
**+**  
**2,066 GW floating**  
**=**  
**3,082 GW**  
**Technical potential in**  
**eight emerging markets**

## Vietnam

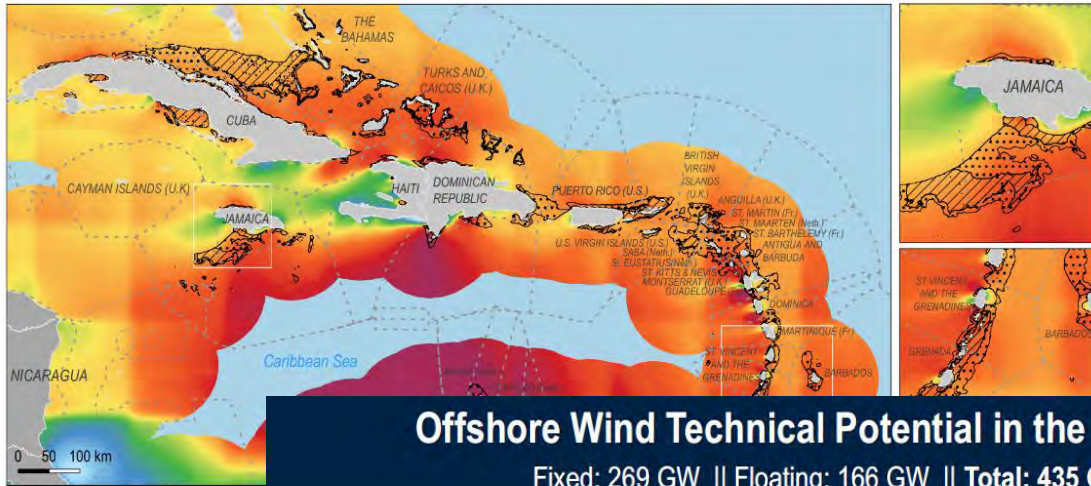




# What are opportunities in regions?

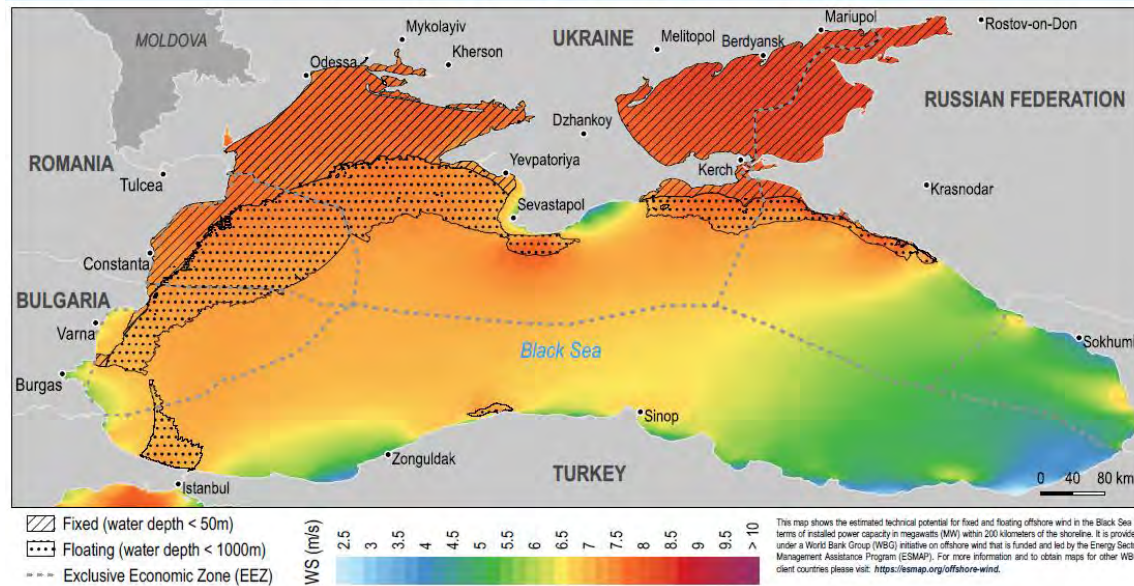
## Offshore Wind Technical Potential in the Caribbean Islands

Fixed: 238 GW || Floating: 513 GW || Total: 751 GW



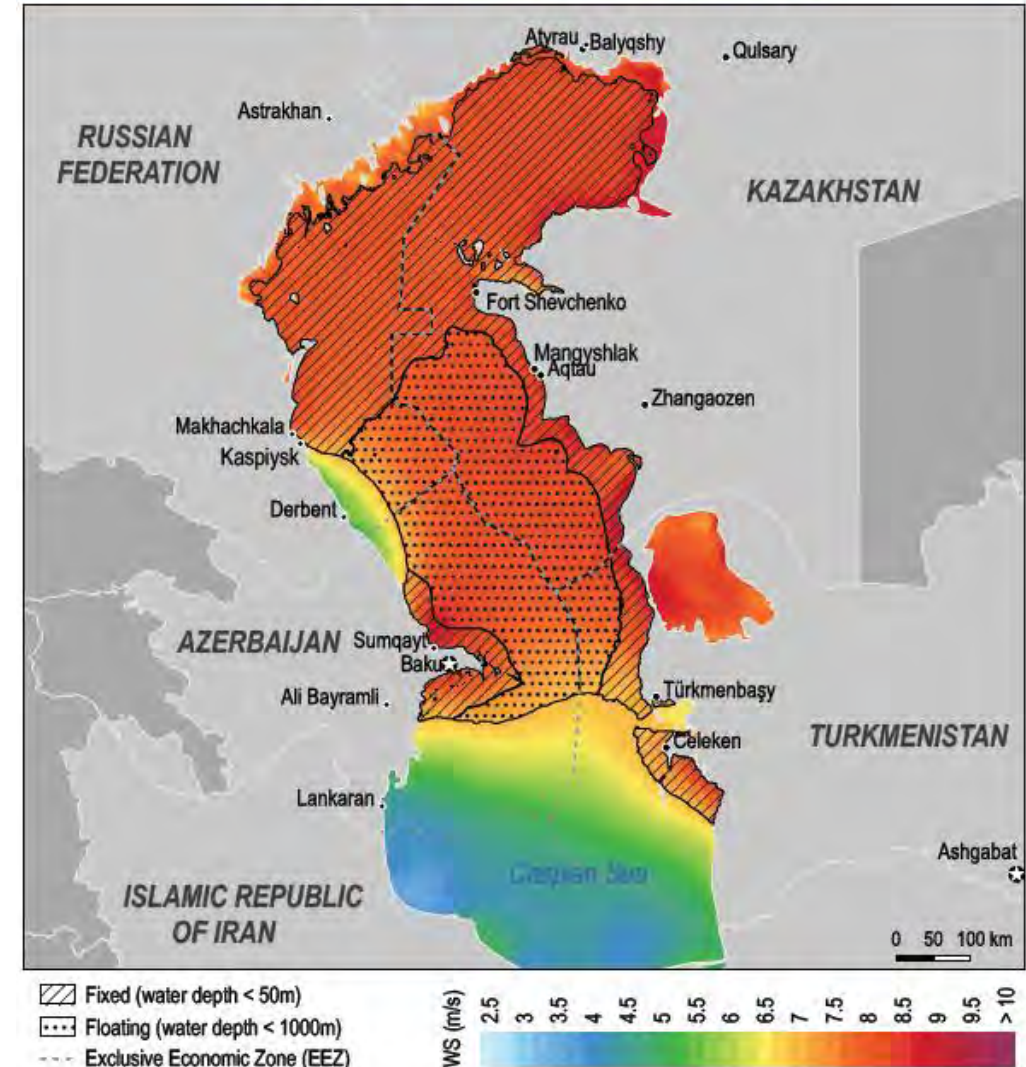
## Offshore Wind Technical Potential in the Black Sea

Fixed: 269 GW || Floating: 166 GW || Total: 435 GW



## Offshore Wind Technical Potential in the Caspian Sea

Fixed: 509 GW || Floating: 336 GW || Total: 845 GW



# What are opportunities across 52 emerging markets?

Region	Total technical potential	Highlights
Latin America & Caribbean	6,343 GW	Highest regional potential, strong wind resource, good proximity to demand centers
Europe & Central Asia	1,192 GW	Favorable conditions in the Black Sea and the Caspian Sea which could become regional markets
East Asia Pacific	4,369 GW	Strong offshore wind resource, China has the largest potential of any country
Sub-Saharan Africa	2,260 GW	Strong potential primarily in floating wind due to relatively deep waters off the southern coast
Middle East & North Africa	1,145 GW	Moderate resource in Northern Africa, primarily in floating wind
South Asia	306 GW	Some good but limited resources, primarily in fixed foundation offshore wind
<b>Total</b>	<b>15,615 GW</b>	

Check out all maps online: <https://esmap.org/offshore-wind>



# What are opportunities in regions?

## Offshore Wind Technical Potential in the ECA Region

Fixed: 6.47 TW || Floating: 12.3 TW || Total: 19.04 TW



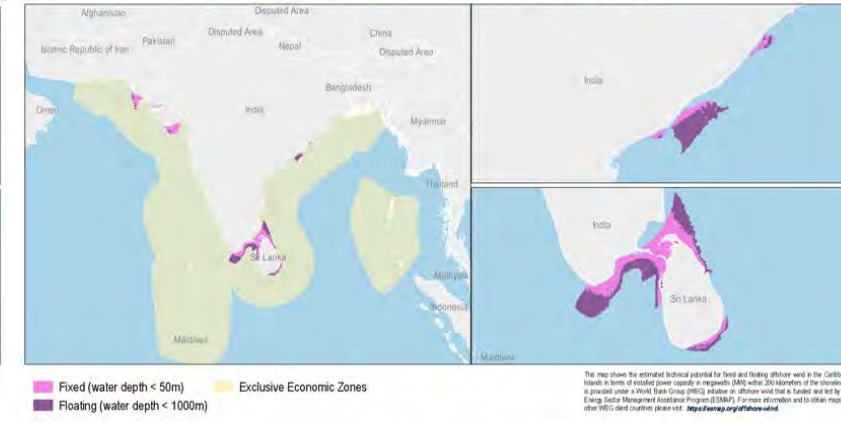
## Offshore Wind Technical Potential in the LAC Region

Fixed: 7.3 TW || Floating: 15 TW || Total: 22.3 TW



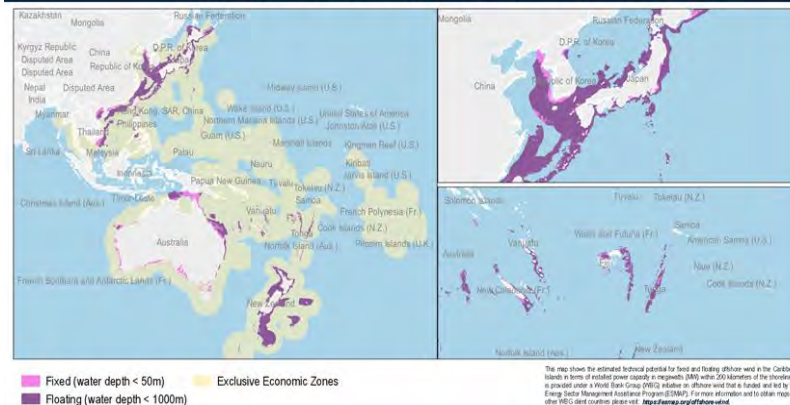
## Offshore Wind Technical Potential in the SA Region

Fixed: 187.4 GW || Floating: 120.1 GW || Total: 307.5 GW



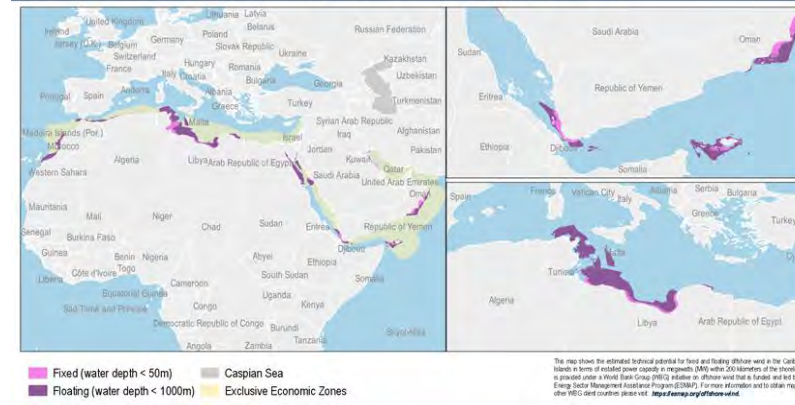
## Offshore Wind Technical Potential in the EAP Region

Fixed: 3.04 TW || Floating: 9.57 TW || Total: 12.61 TW



## Offshore Wind Technical Potential in the MENA Region

Fixed: 0.47 TW || Floating: 1.78 TW || Total: 2.25 TW



Soon on  
**ENERGYDATA.INFO**



# Next steps: assessing country-level hard and soft constraints

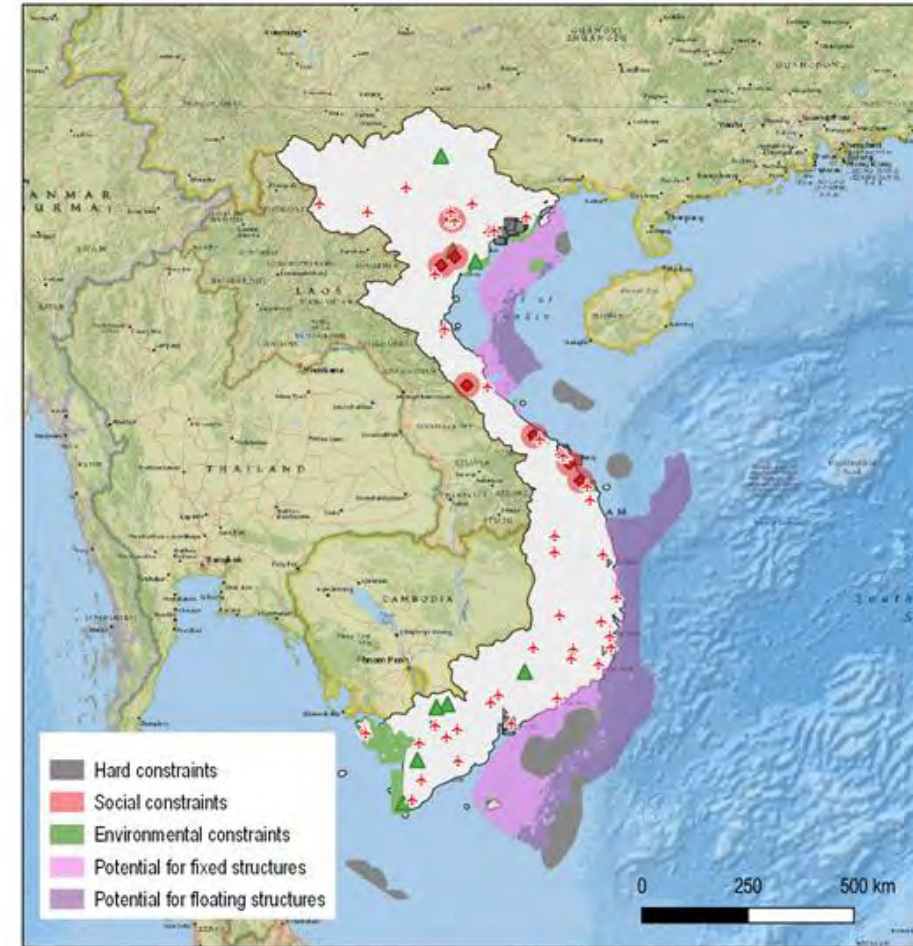


Major commercial shipping routes, oil and gas platforms, cable and pipeline infrastructure, protected wrecks, radar proximity, etc.

Fishing activities, disposal sites, marinas and bathing beaches, tourism spots, sites of cultural/religious importance, indigenous communities, etc.

Coastal and marine protected areas, bird migration routes, key biodiversity areas, sensitive habitats etc.

Electrical transmission grid, location of power plants, location of ports, natural hazard risks, etc.





# Where to find our analysis and data?

- **Going Global report:** ESMAP Website [https://esmap.org/going\\_global\\_offshore\\_wind](https://esmap.org/going_global_offshore_wind)
- **Maps for 48 emerging markets :** ESMAP Website <https://esmap.org/offshore-wind>
- **Global Layers (.shp format):**

1. **ENERGYDATA.INFO**<sup>1</sup>: <http://energydata.info/>

2. **DDH**<sup>1</sup>: <https://datacatalog.worldbank.org/>

<sup>1</sup>. soon –pending approval from Cartography Unit



WBG Offshore Wind Program Support



# WBG Offshore Wind Development Program

*Accelerating the uptake of offshore wind in emerging markets*

Led by



*Energy Sector Management Assistance Program*

Partnership between the **World Bank** and 18 partners to help low and middle-income countries reduce poverty and boost growth through sustainable energy solutions.

In partnership with



*International Finance Corporation*

Largest development financial institution focused exclusively on the private sector in emerging markets



# WBG Offshore Wind Development Program

## Objective:

- Support the inclusion of offshore wind into policies
- Help establish a pipeline of bankable projects
- Five year program; budget ~\$US 10 million
- Collaboration with Global Wind Energy Council (GWEC)

## Program components:

1. Knowledge generation, dissemination and exchange
2. Roadmap studies and technical assistance
3. Investment plan preparation





# Typical Activities Supported by the Program

## Global Work

### **Knowledge generation, dissemination and exchange:**

- Reports on good practice, lessons learned and opportunities for emerging markets
- Mapping to identify and quantify offshore wind development potential
- Events, workshops and training to inform, educate and gather country support

## Country Specific Work

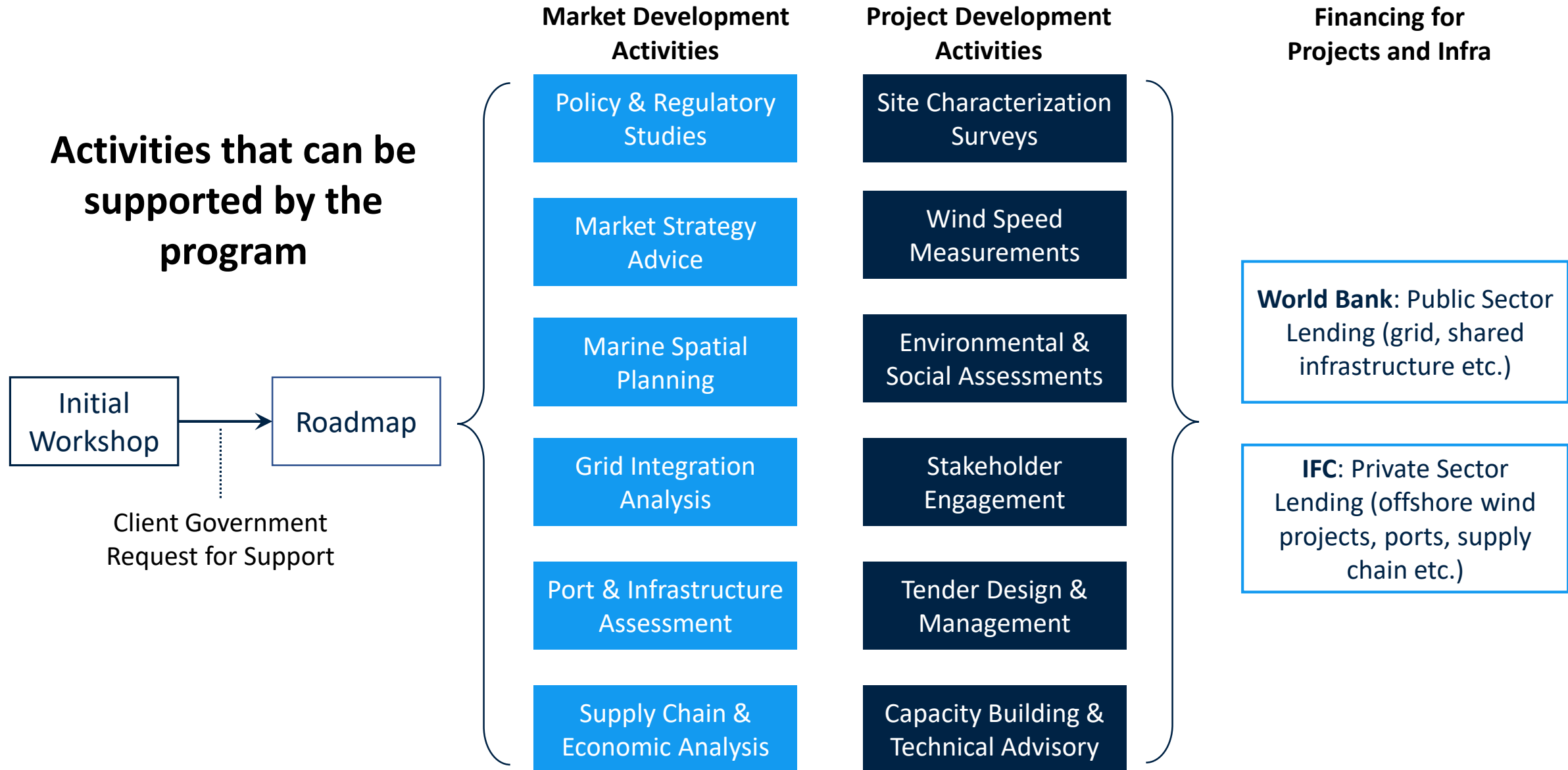
### **Exploratory country studies and planning work:**

- Provide funding for roadmaps, planning and pre-feasibility level activities
- Demand-led, focus on countries with potential for bankable projects within 3-4 years

### **Preparation of investment plans:**

- Assistance in scoping and funding detailed feasibility & site investigation work
- Draw on Good Practices for technical, E&S, procurement

# Typical Country Activities Supported by the Program





# Country Roadmaps - Status

- **Vietnam:** Engaged BVG in February 2020 to undertake roadmap. Initial roadmap drafted for focused consultation
- **Sri Lanka:** Roadmap to be launched in Summer 2020. Highly engaged; focus on Gulf of Mannar – possible link to India grid interconnection
- **Turkey:** Roadmap to be launched in Summer 2020. Focus on economic analysis, regulatory gap analysis, E&S risks.
- **Azerbaijan:** Roadmap under discussion with Government. Roadmap launch anticipated in mid-2020
- **Brazil:** Stakeholder workshop event postponed due to COVID-19. Continued engagement with EPE on possible support options
- **Colombia:** Discussions with government; exploring potential in Caribbean Sea
- **India:** Continuing dialogue with MNRE & SECI. Exploring interest in Tamil Nadu demonstration project.
- **South Africa:** Stakeholder workshop event postponed due to COVID-19. Engagement with CSIR. Possible event at Windaba in late 2020.



# Coming Up...

- **Training: Virtual study tour – September 2020:**
  - Three day event with virtual tours around offshore wind supply chain firms, seminars on key development topics, Q&A sessions with experts – organized by GWEC
- **Training: Offshore Wind MOOC (Massive Open Online Course):**
  - Online training course covering a wide range of topics relevant to offshore wind development
- **Report: Key Factors for the Successful Development of OW**
  - Flagship report to capture important lessons learnt, good practice and relevant recommendations for government and stakeholders
- **Report: Environmental & Social Frameworks:**
  - Support the planning and siting of offshore projects with lower environmental & social risks to help ensure bankability and uptake of good practice
- **Tool: REZoning geospatial planning tool for renewable energy:**
  - Online geospatial planning tool incorporating constraints and economic analysis to identify and prioritize potential development zones
- **Report: Large-scale green hydrogen and offshore wind:**
  - Report analyzing the main design considerations when incorporating green hydrogen production into offshore wind projects






# Concluding thoughts

- Offshore wind is growing quickly and needs to move to emerging markets soon
- Huge technical potential and opportunity is bigger than expected
- WBG Program's activities focused on accelerating this over the next few years



Credit: Ørsted – Block Island OWF



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**Questions?**

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