

**Offshore wind for a sustainable ocean economy:
the key role of geospatial data systems
for marine spatial energy planning.**



**United Nations Committee of Experts on Global Geospatial Information Management
Working Group on Marine Geospatial Information
International Conference
Singapore (May 10, 2022)**

Dr Paul Elsner



Offshore Wind and the Energy Trilemma: Equity

Balancing the 'Energy Trilemma'

Energy Security

The effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of energy providers to meet current and future demand.

Energy Equity

Accessibility and affordability of energy supply across the population.

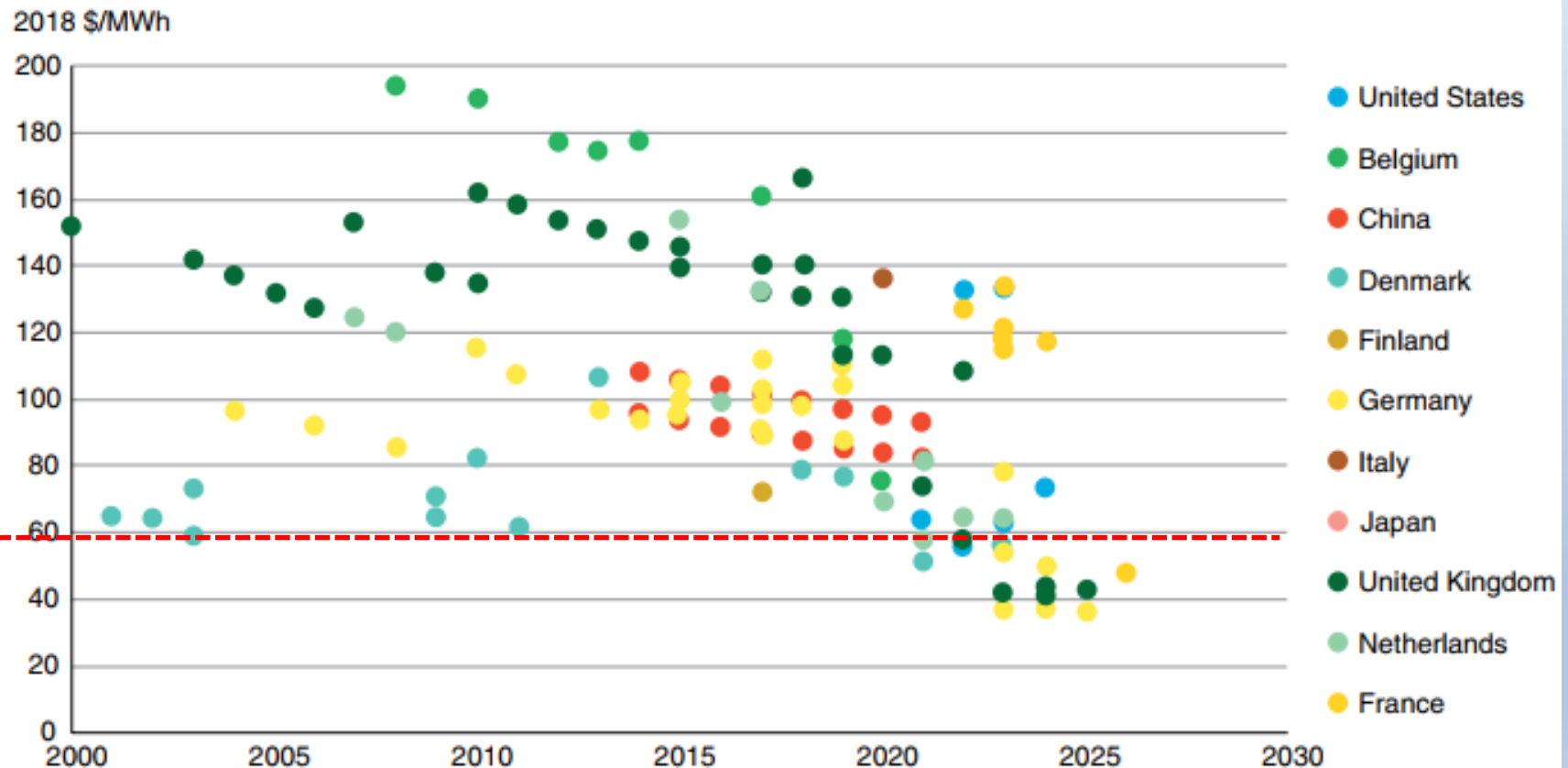
Environmental Sustainability

Encompasses the achievement of supply and demand side energy efficiencies and the development of energy supply from renewable and other low-carbon sources.



Dramatic cost reduction in offshore wind: now cheaper than fossil fuel-based electricity

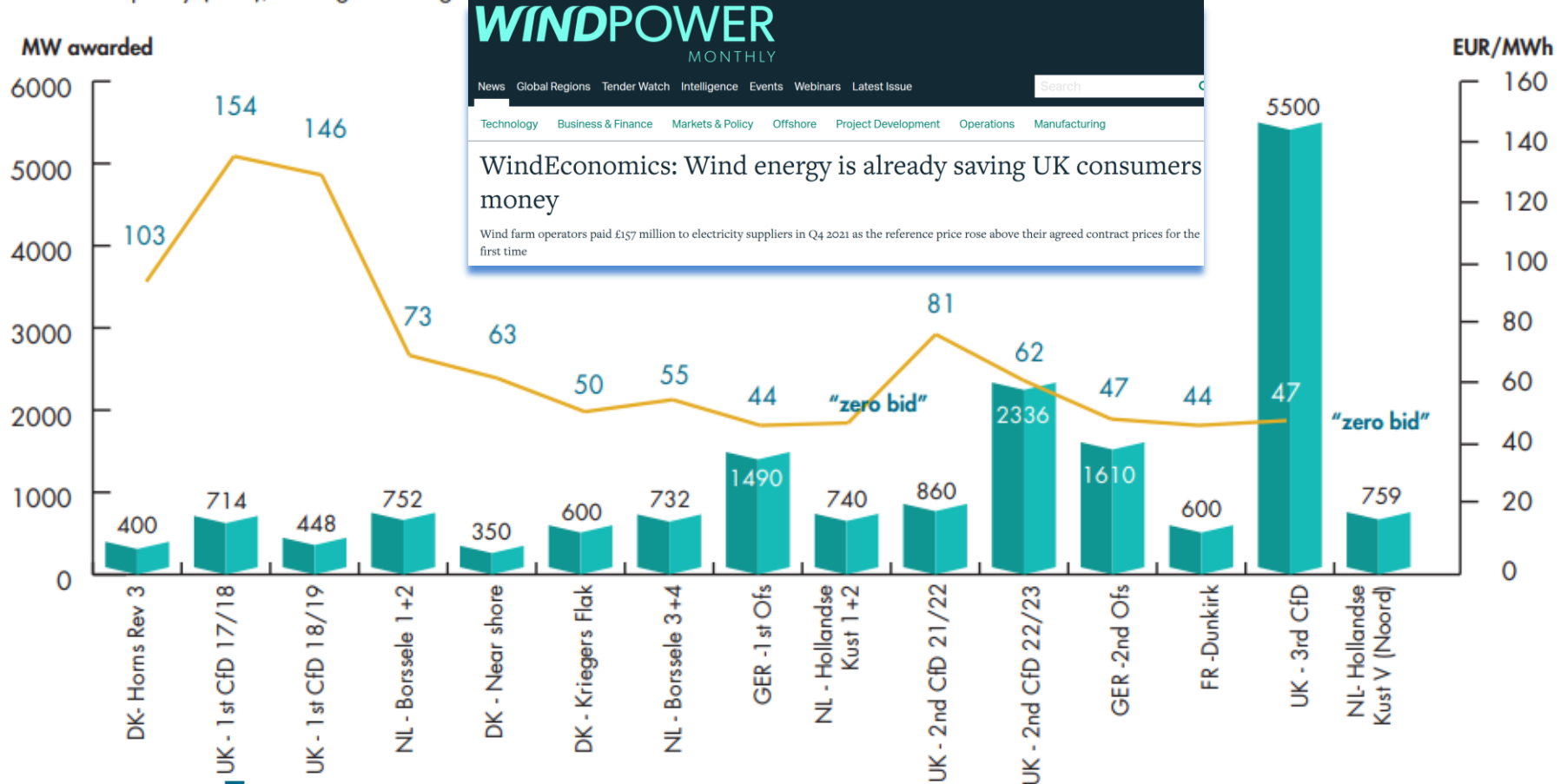
FIGURE 2: LEVELIZED OFFSHORE WIND TARIFFS, 2005–2030 (2018 \$/MWh)



“Wind farm operators paid £157 million to electricity suppliers in Q4 2021 as the reference price rose above their agreed contract prices for the first time”

European executed offshore tenders / auctions 2015-2020

Awarded capacity (GW), average winning bid (EUR/ MWh)*



*Tenders above 100MW capacity and no innovation auctions, tenders in order of execution from 2015 to end of 2020

Source: GWEC Market Intelligence, GWEC Global Auction Database Q1 2021

Offshore Wind and the Energy Trilemma: Energy Security and Environmental Sustainability

Balancing the 'Energy Trilemma'

Energy Security

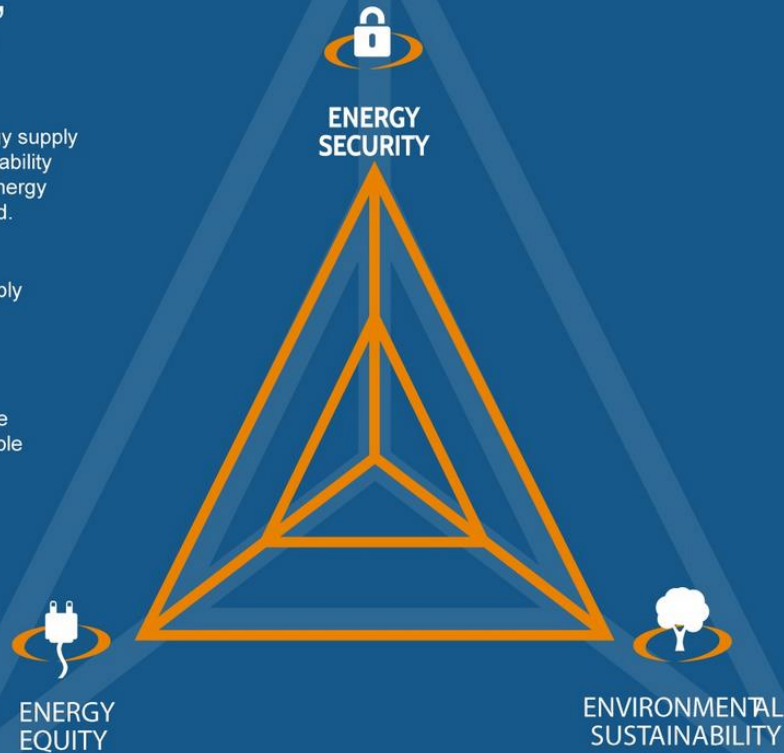
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Energy Equity

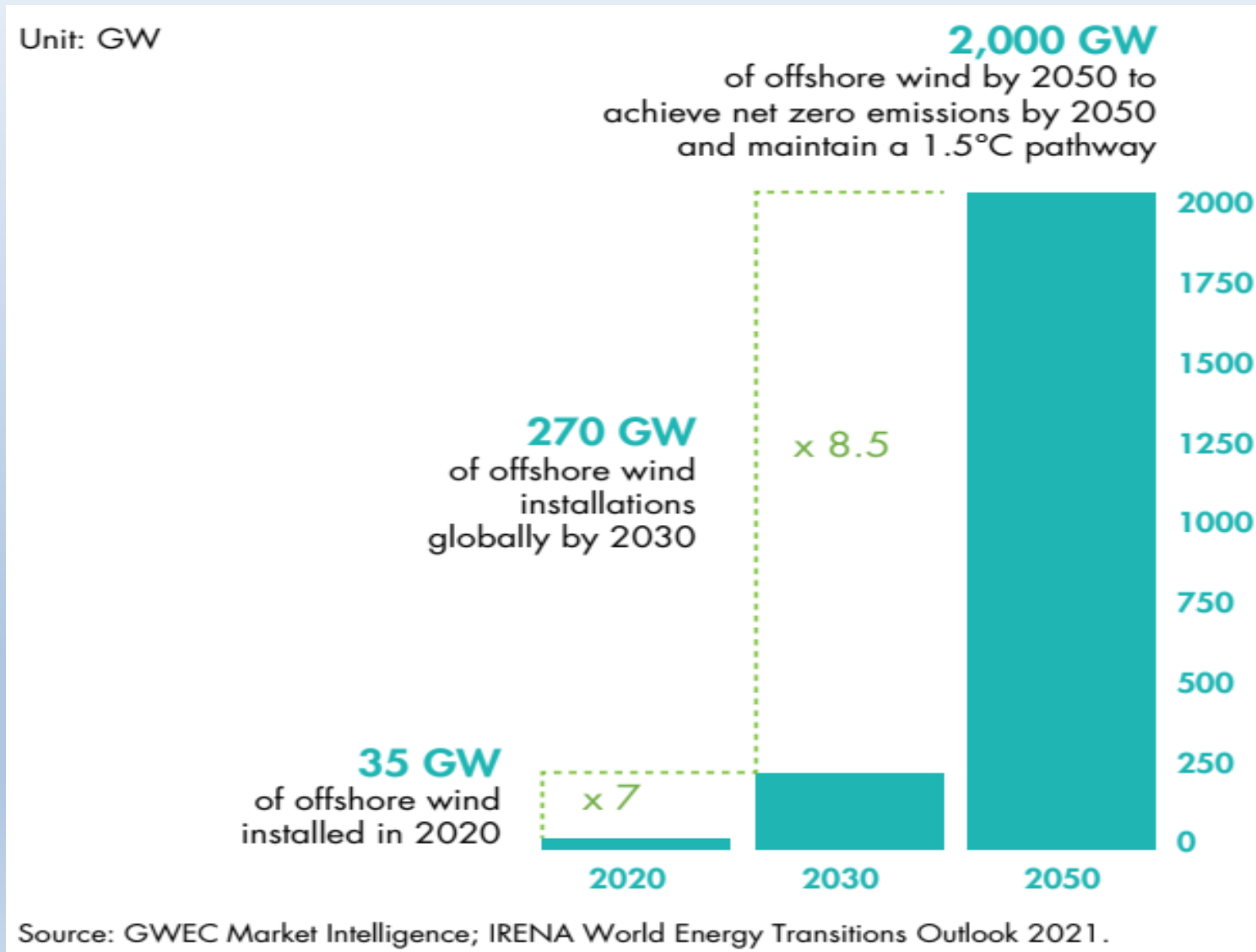
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Environmental Sustainability

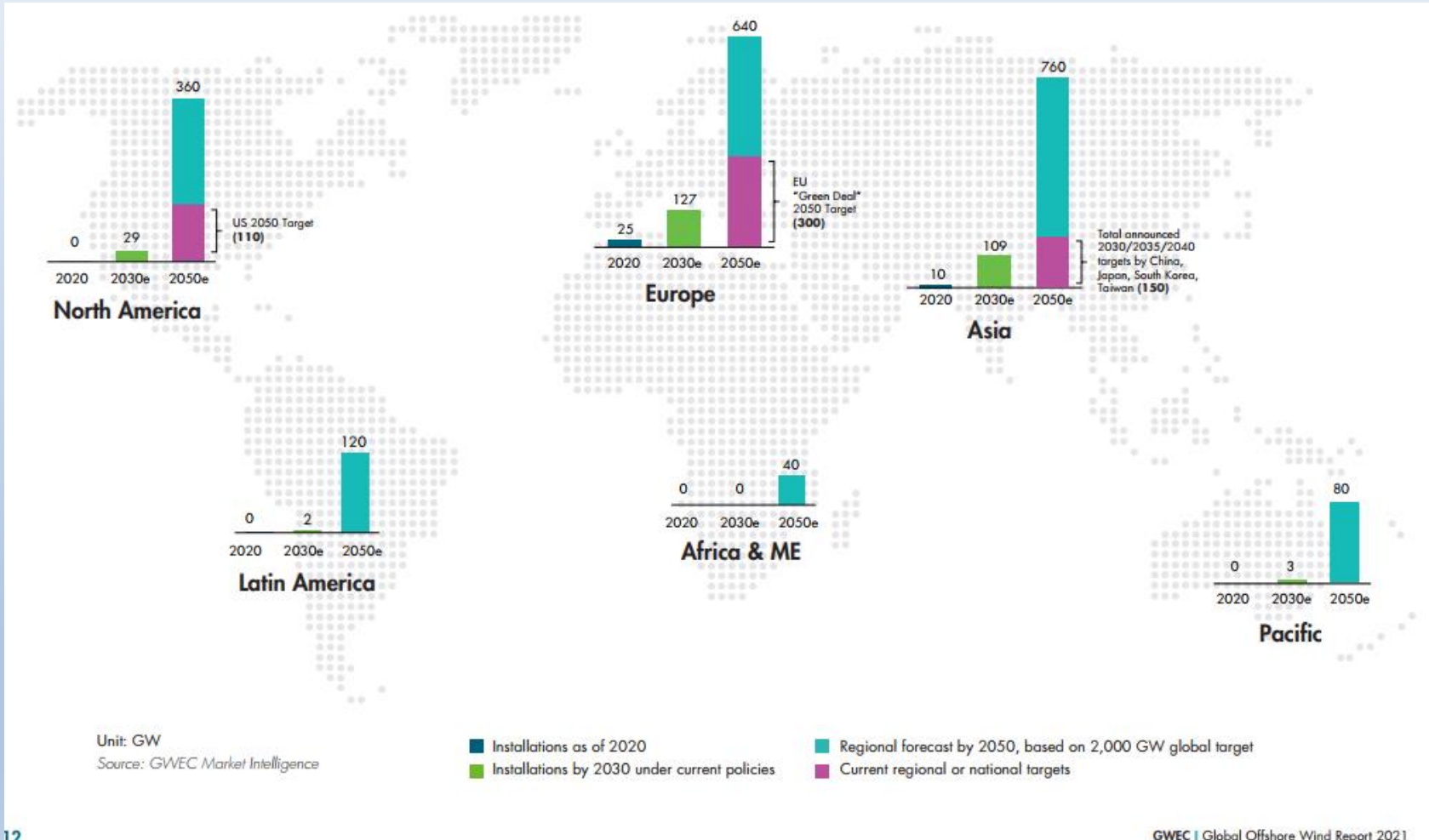
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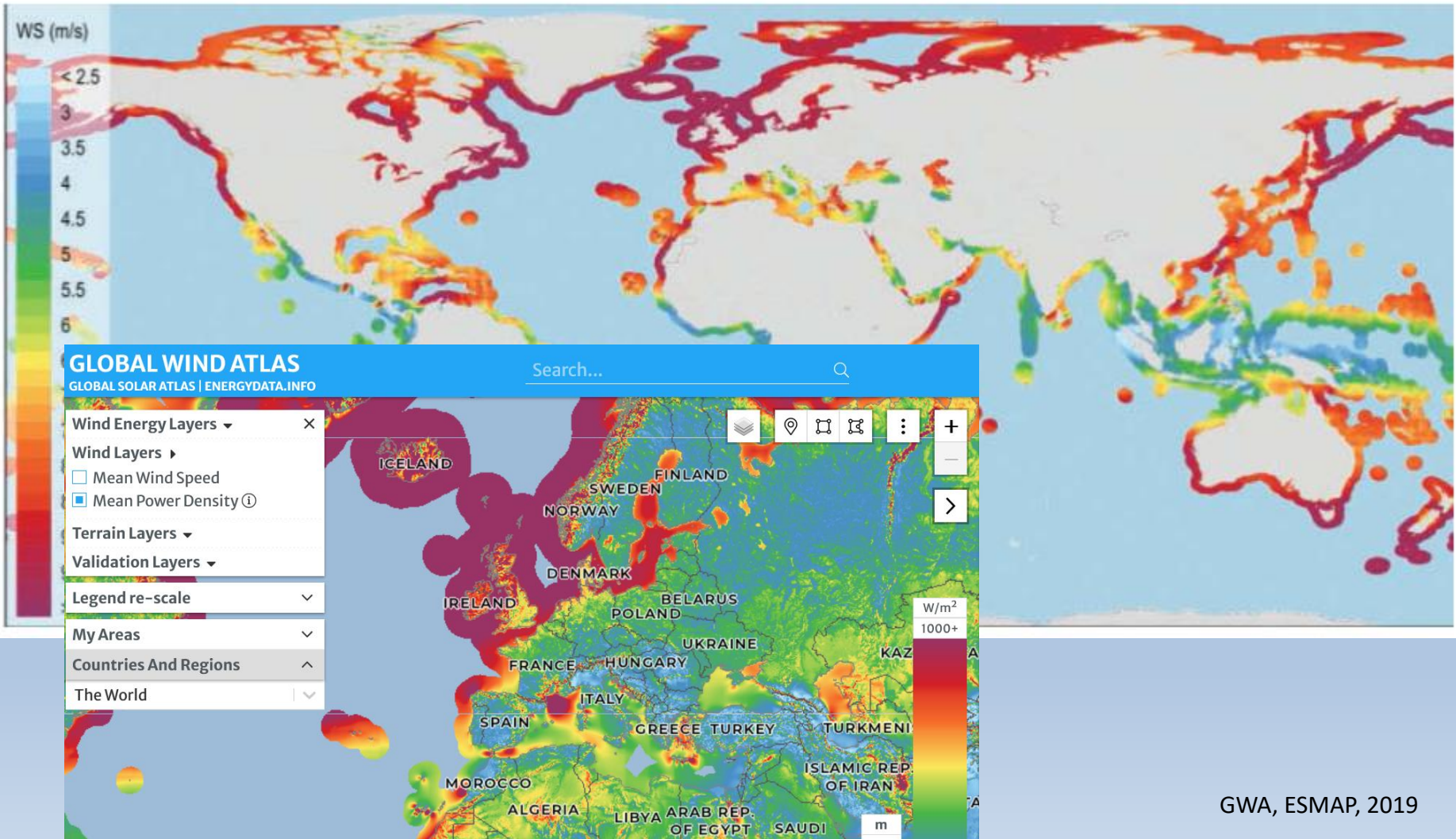
Offshore Wind: 2000 GW needed by 2050 to meet Paris Agreement Targets

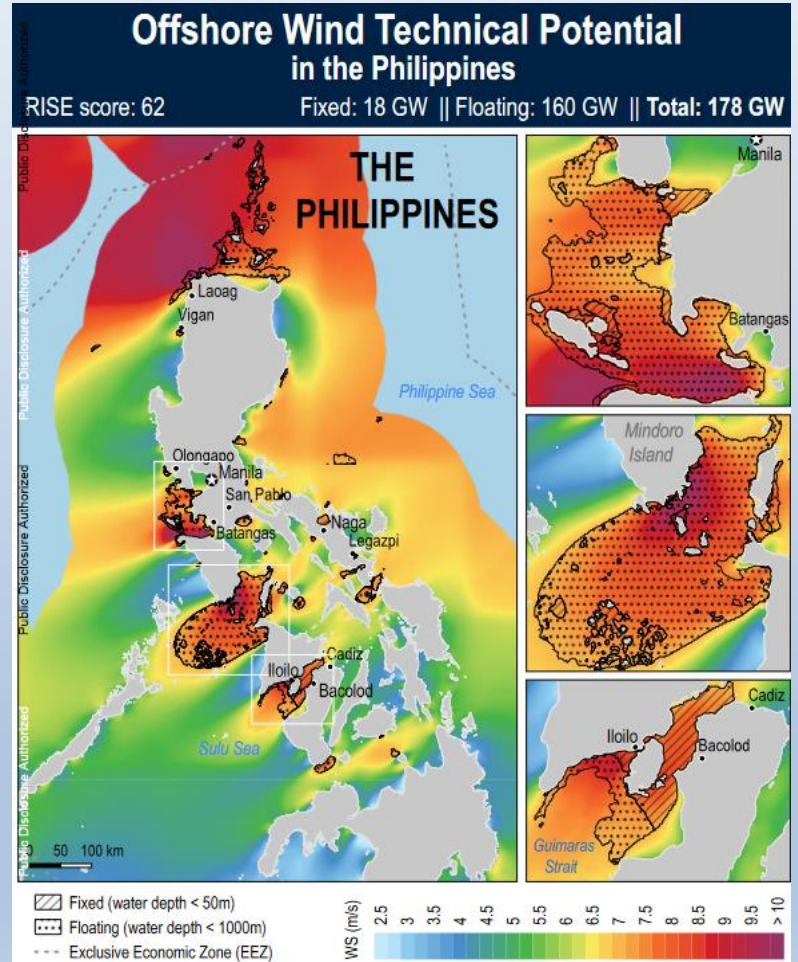
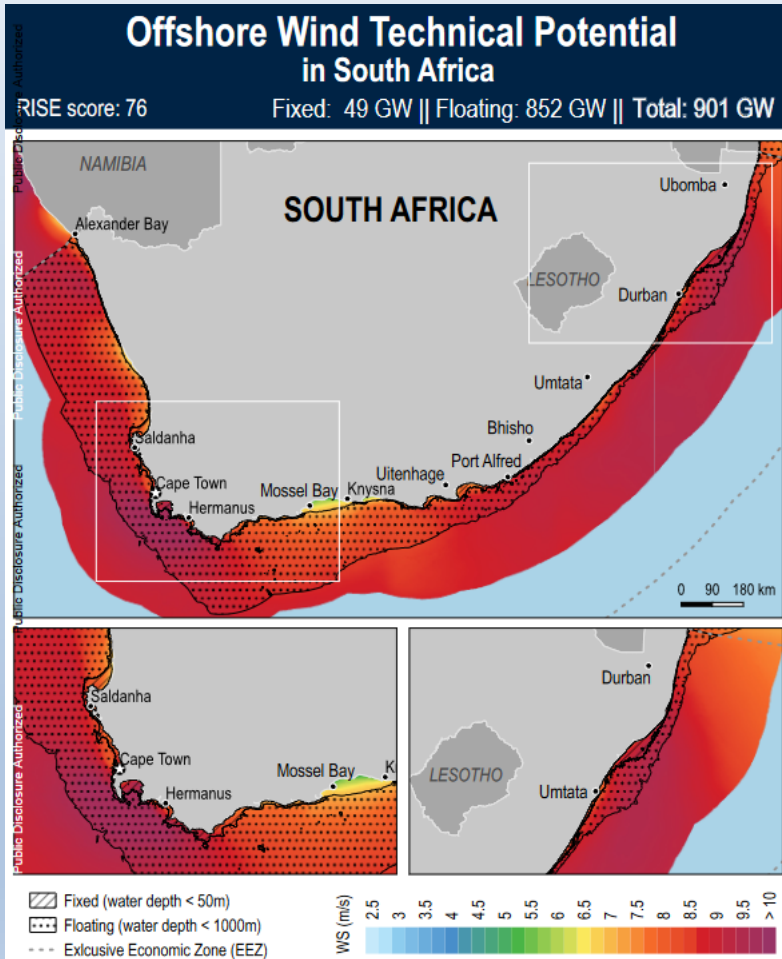


1965 GW Offshore Wind GW by 2050: Where?



Global Wind Atlas: high resolution data for wind resource modelling up to 200 km offshore





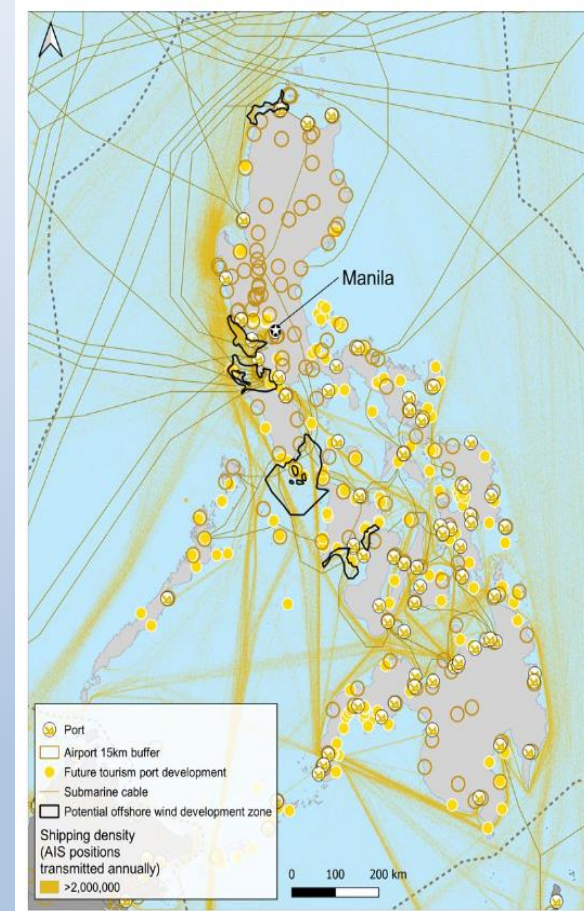
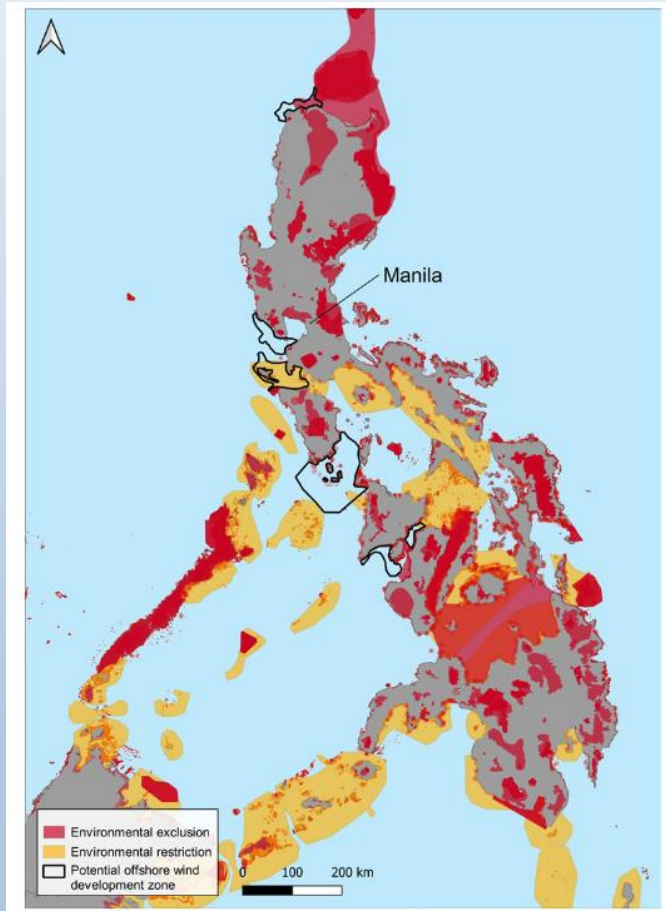
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World Bank Group actively supporting offshore wind in new markets



https://esmap.org/esmap_offshore-wind

Additional data needed to specify actual project costs (LCOE)



<https://esmap.org/ESMAP-Offshore-Wind-Roadmap-for-the-Philippines>

Spatial Data Layers

Data layer	Notes	Data Source	Reference
ENVIRONMENTAL CONSIDERATIONS			
Marine protection areas	Areas legally protected under the National Integrated Protected Area System (NIPAS) Act. Includes Locally Managed Protected Areas (LMPAs) as listed below.	DENR-BMB	https://data.unep-wcmc.org/datasets/44
Critical habitats	Areas of known habitats of threatened species, designated under Wildlife Resources Conservation and Protection Act No. 9147 (the Wildlife Act).	DENR-BMB	https://data.unep-wcmc.org/datasets/44
Key Biodiversity Areas (including alliance for zero extinction sites and Important Bird Areas [IBA])	Areas of international importance in terms of biodiversity conservation.	IBAT	https://www.ibat-alliance.org/sample-downloads?tab=gis-downloads&anchor_id=resource-header
Ramsar sites	Wetlands of international importance that have been designated under the criteria of the Ramsar Convention on Wetlands for containing representative, rare or unique wetland types, or for their importance in conserving biological diversity.	IBAT	http://ihp-wins.unesco.org/layers/geonode:sites
Important Marine Mammal Areas (IMMAs)	IMMAs are habitats important to marine mammal species that have the potential to be delineated and managed for conservation.	Tethys Research Institute	https://www.tethys.org/
UNESCO World Heritage Natural Sites	The natural World Heritage spatial data are updated annually in the World Database on Protected Areas (WDPA), after the World Heritage Committee meeting, hosted on Protected Planet. The current version is August 2017.	UNEP	http://www.unep-wcmc.org
UNESCO-MAB biosphere reserves	The Man and the Biosphere (MAB) program is an intergovernmental scientific program that aims to establish a scientific basis for enhancing the relationship between people and their environments. It combines the natural and social sciences with a view to improving human livelihoods and safeguarding natural and managed ecosystems, thus promoting innovative approaches to economic development that are socially and culturally appropriate and environmentally sustainable.	UNESCO	http://ihp-wins.unesco.org/layers

<https://esmap.org/ESMAP-Offshore-Wind-Roadmap-for-the-Philippines>

Data layer	Notes	Data Source	Reference
Coral reefs	Important natural habitat.	Allen Coral Atlas (via TBC)	https://allencoralatlas.org/resources/
Seagrass beds	Important natural habitat.	Allen Coral Atlas (via TBC)	https://allencoralatlas.org/resources/
Mangrove forests	Important natural habitat.	UNEP-WCMC	https://data.unep-wcmc.org/datasets/45
Locally managed marine protected areas	The Biodiversity Management Bureau (BMB) of the DENR implements a Coastal and Marine Ecosystem Management Program (CMEMP), which includes all coastal and marine areas of the Philippines. LMPAs that are designated by the Fisheries Code include fish reserves, sanctuaries, and refuges; seagrass sanctuaries; marine parks; and marine reserves, sanctuaries, and refuges. LMPAs include all waters within a municipality that are not included in protected areas under the NIPAS Act.	Philippines geo-portal	https://www.geoportal.gov.ph/
Ecologically or biologically significant marine areas	Internationally agreed marine areas of importance.	CDB	http://www.cbd.int/
Cartilaginous fish	Areas of sensitive marine species, specifically sharks, rays, and chimaeras.	TBC National Stock Assessment Program (NSAP) under Department of Agriculture Bureau of Fisheries and Aquatic Resources (DAR-BFAR) Sharks Assessment Report dataset 2009–2016.	See references for KBAs and MPAs
Endemic bird areas (EBAs)	Areas of overlapping breeding ranges of restricted range bird species.	BirdLife International Data Zone.	http://datagone.birdlife.org/eba/

<https://esmap.org/ESMAP-Offshore-Wind-Roadmap-for-the-Philippines>

SOCIAL CONSIDERATIONS			
UNESCO World Heritage Sites	Cultural and/or natural heritage sites with outstanding universal value to humanity. No sites identified within the Philippines analysis area.	UNESCO	http://ihp-wins.unesco.org/layers/worldheritagesites:geonode:worldheritagesites
Fishing ports	Municipal and regional fishing ports.	Philippines geo-portal	https://www.geoportal.gov.ph/
Landscape and seascape	Sites with protected status due to their landscape or seascape value.	BMB, DENR, Philippine Government	Manually digitized from information in - https://www.denr.gov.ph/images/DENR_Publications/PA_Guidebook_Complete.pdf
Tourism areas	Tourism ports development pipeline.	DOTR	DOTR

- <https://esmap.org/ESMAP-Offshore-Wind-Roadmap-for-the-Philippines>

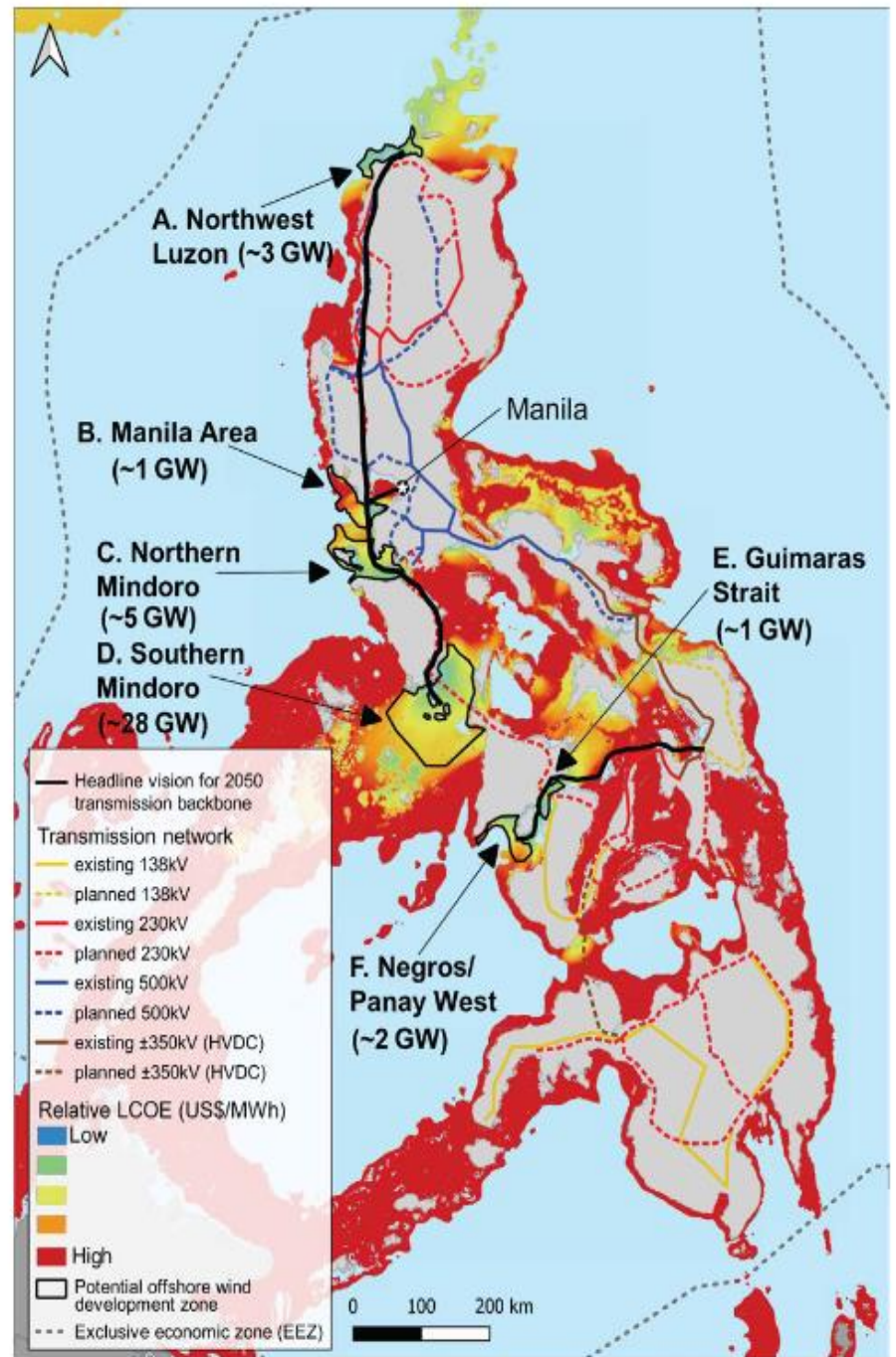
Data layer	Notes	Data Source	Reference
Mean wind speed	Used to determine AEP and LCOE.	The Global Wind Atlas v3.0, released in 2019 (Danish Technical University [DTU] and the World Bank Group [WBG])	https://globalwindatlas.info/
Military bases	Locations of military bases in the Philippines.	Arup/Google Earth	Manually digitized from Google Earth
Offshore oil and gas activity	Locations of offshore oil and gas activity.	Philippines geo-portal	https://www.geoportal.gov.ph/
Ports	Locations and size of ports.	Humdata/Philippines geo-portal	https://www.geoportal.gov.ph/
Seismic activity	Used for information.	PREVIEW Global Data Risk Platform	https://preview.grid.unep.ch/
Shipping density	<p>The raster layers were created using International Monetary Fund's (IMF) analysis of hourly AIS positions received between January 2015 and February 2021 and represent the total number of AIS positions that have been reported by ships in each grid cell with dimensions of 0.005 degree by 0.005 degree (approximately a 500 meters x 500 meters grid at the Equator).</p> <p>The AIS positions may have been transmitted by both moving and stationary ships within each grid cell; therefore, the density is analogous to the general intensity of shipping activity.</p>	World Bank	https://datacatalog.worldbank.org/search/dataset/0037580/Global-Shipping-Traffic-Density
Undersea cables	Datasets include official submarine cable system name, cable system length in kilometers, and landing points. Additional information such as the owners of the cable systems can be found on www.subamrinecablemap.com . The routes of the cables do not accurately reflect the exact route taken by each cable but give an indication of approximate location.	Submarine Cable Map	
Water depth	Used to determine areas of fixed/floating foundations and as input to the LCOE model.	The General Bathymetric Chart of the Oceans	https://www.gebco.net/data_and_products/gridded_bathymetry_data/

<https://esmap.org/ESMAP-Offshore-Wind-Roadmap-for-the-Philippines>



Offshore Wind Development Program

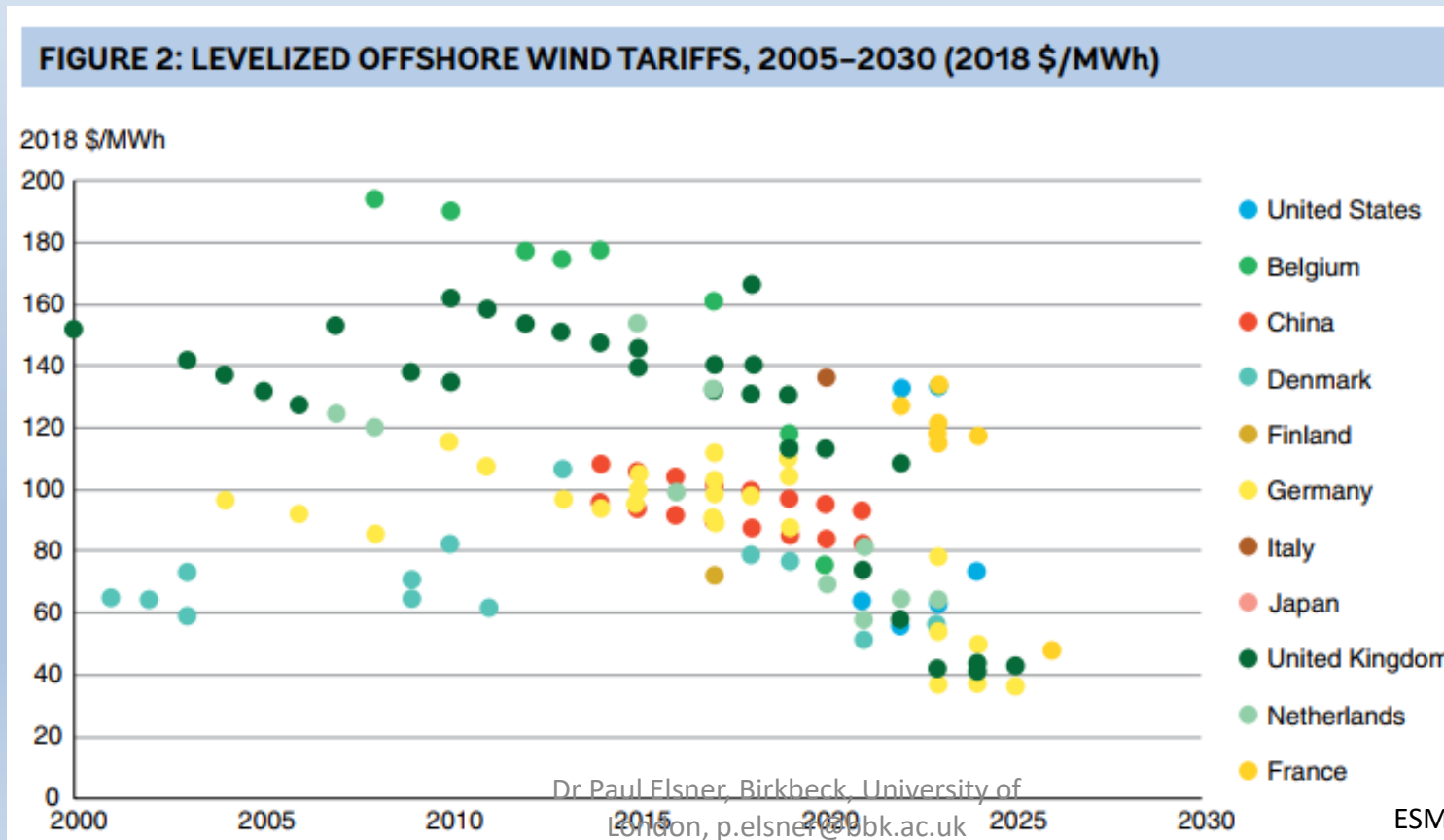
OFFSHORE WIND ROADMAP FOR THE PHILIPPINES



Note: Relative levelized cost of energy (LCOE) is for 2033.

The cost of spatial illiteracy in offshore wind planning

- Power output of 400 MW offshore wind farm: 1400 GWh/year
- Annual cost saving per 1\$/MWh LCOE reduction: 3,400,000 US \$
- Cost saving over 25 year live time: 85 Million US \$



Carbon emission savings of 400 MW wind farm

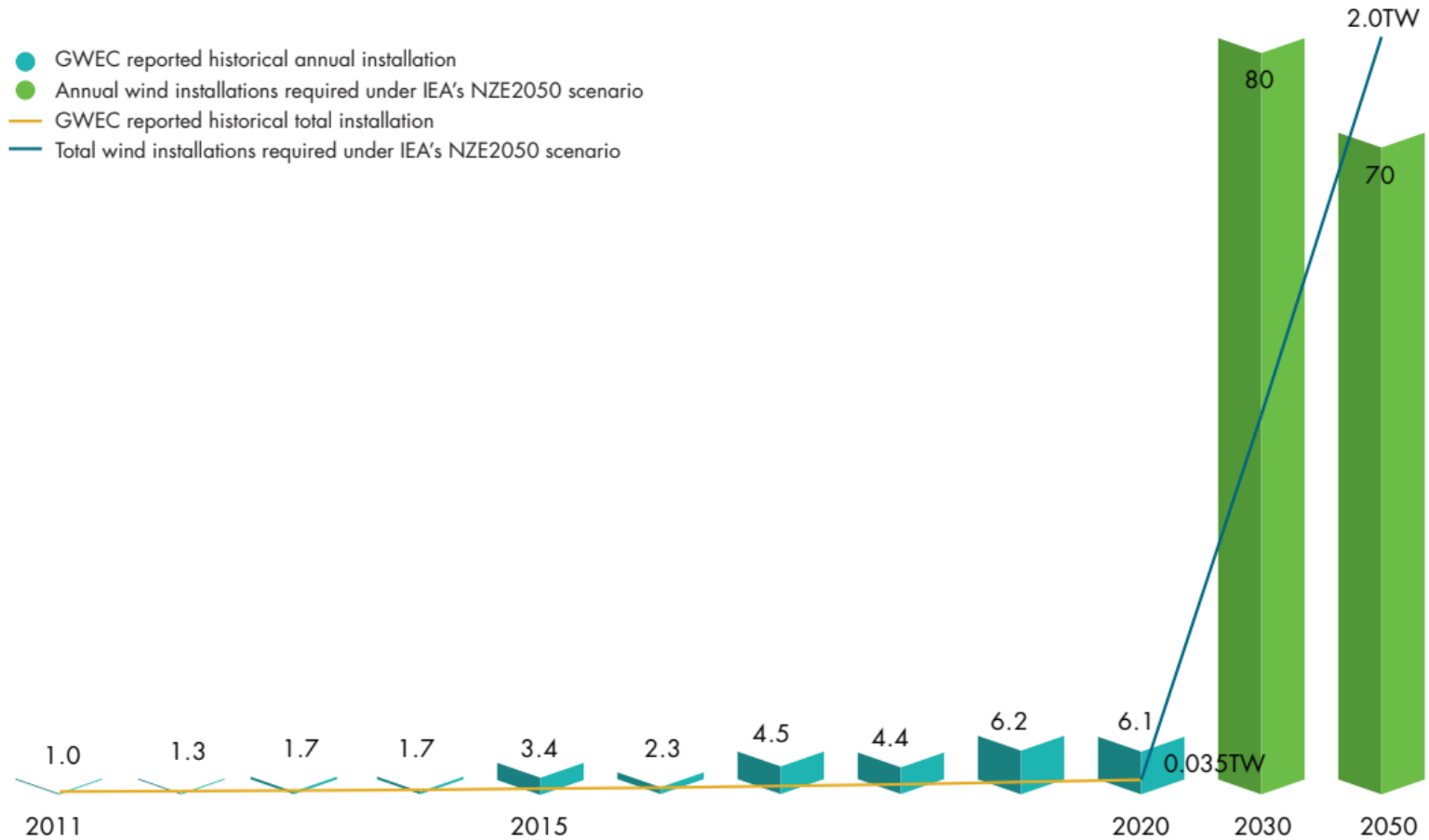
- 420 000 t CO₂ annually
- 10,5 million t CO₂ over 25 years
- every year delay is a year of missed carbon savings



Increased Urgency to accelerate Offshore Wind Development in new markets

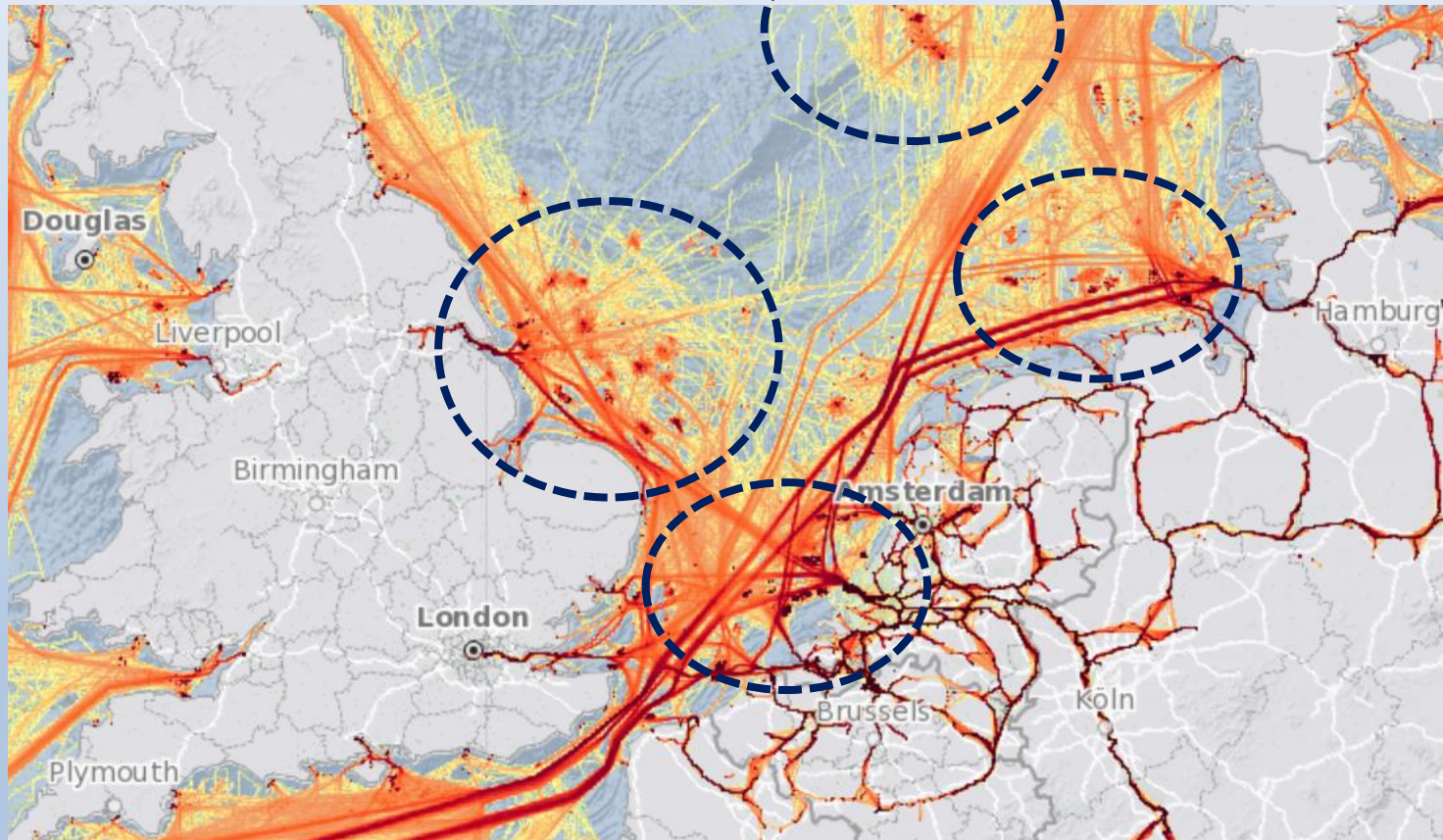
Permitting plays a critical role in accelerating annual installations to reach net zero

- GWEC reported historical annual installation
- Annual wind installations required under IEA's NZE2050 scenario
- GWEC reported historical total installation
- Total wind installations required under IEA's NZE2050 scenario



Source: GWEC Market Intelligence; IEA Net Zero by 2050 Scenario (May 2021)

Significance of OWE Infrastructure for marine traffic and maritime safety



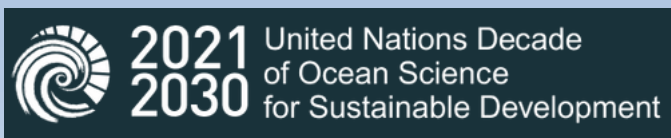
<https://globalmaritimetraffic.org/gmtds.html>

Marine Geospatial Information

- Emerging datascape in context of offshore wind
- Efforts by user community to generate own global data sets (global wind atlas, shipping density)
- Seabed 2030 excellent contribution to improve resource assessment. Priority for offshore wind candidate regions?
- Many relevant data sets not available on global/regional level.

Scope for coordinated effort to establish bespoke data family and standards for Offshore Wind

- Multitude of data sets
- Multitude of data owners
- Multitude of data formats and standards
- Lack of coordination causing delay and carbon footprint
- UN Decade of Ocean Science for Sustainable Development excellent framework to address this.



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Thank you

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