



IEA Wind Task 49: Integrated D^Esign of floating wind Arrays (IDEA)

Towards open-access reference sites with key conditions for floating wind arrays

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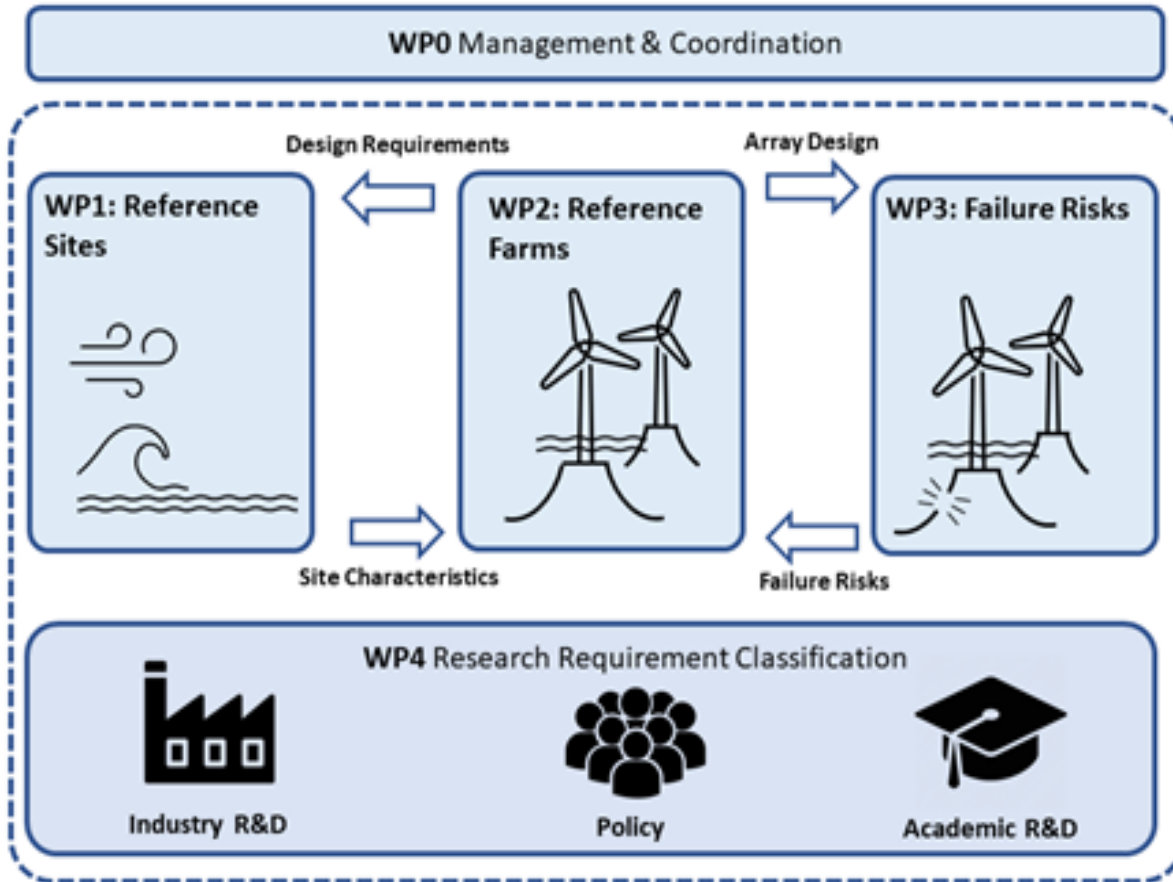
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IEA Wind Task 49:

Integrated Design of Floating wind Arrays (IDeA)



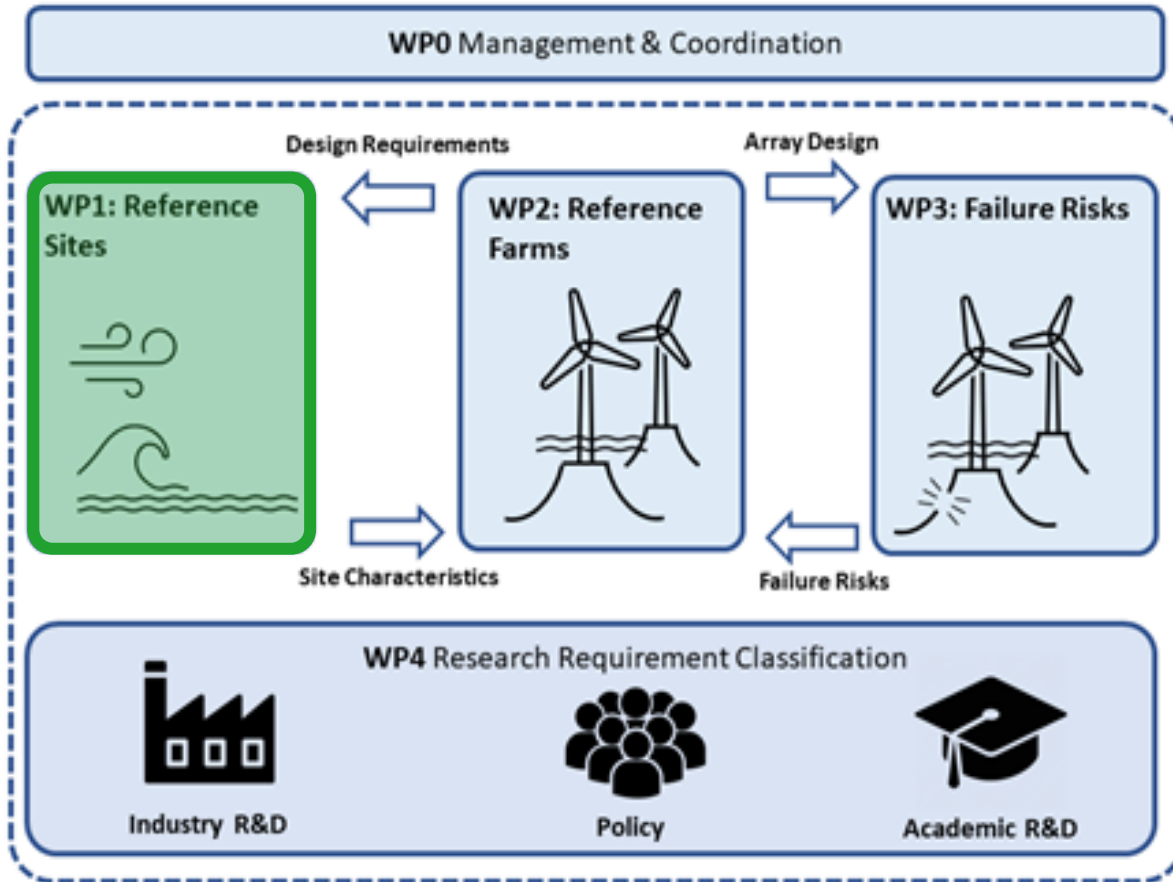
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robust **open access** testbench for
multidisciplinary research seeking
to maximise the **social, economic
and environmental** benefit of
floating wind arrays



Develop representative reference site conditions

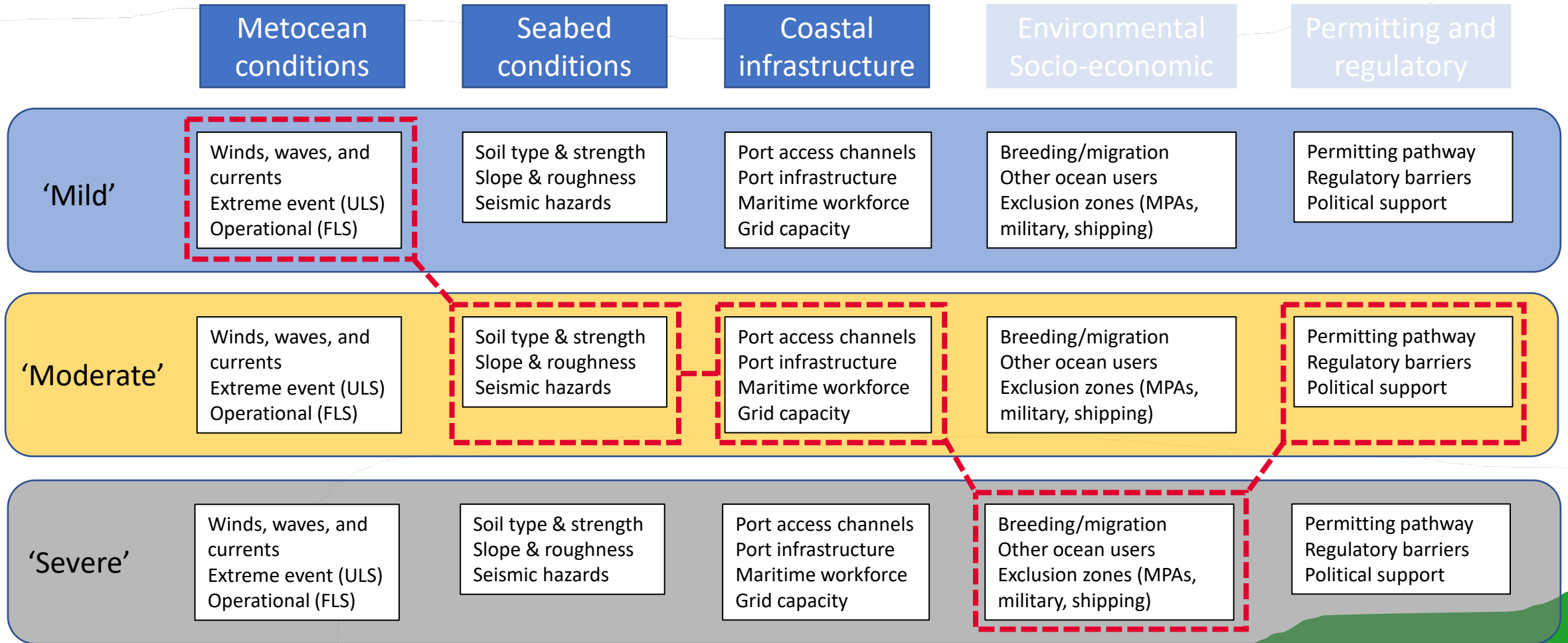


WP1: Reference Site Conditions

- Identify “site parameters that a developer would collect and use to inform the *project design phase*”
- Develop “hypothetical reference sites that are *representative* of the types of conditions in which the *initial phase of commercial scale floating wind* may be deployed”
- Develop a *design basis* for the design of reference floating wind farms in WP2
- *Publish reference site design bases* in an industry-accepted format, publicly available to the floating wind community (OEMs, developers, researchers)

'Building block' concept for assembling synthetic reference site conditions

Select building block combinations that are most representative of commercial project pipeline

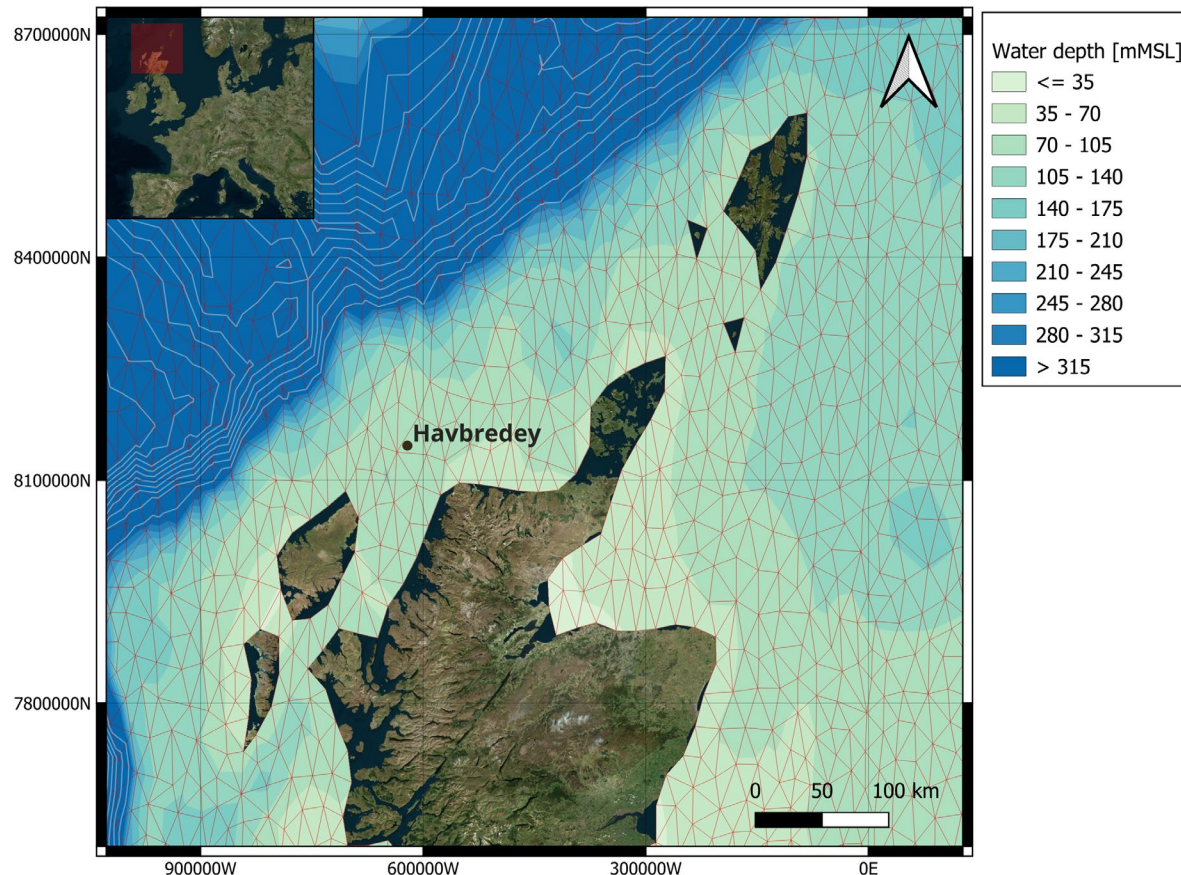




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Example: metocean design basis - Havbredey

A representative location from the ScotWind N2 lease area was selected for detailed metocean conditions analysis (58.843°N, 5.581°W) – Water Depth = 86.2 mMSL



Design Parameter	Numerical Data Source	Spatial Resolution	Temporal Resolution	Temporal Extent
Wind	ERA5	~30 km	Hourly	1979-2021
Waves	MIKE21-SW-ERA5	~7 km	Hourly	1979-2021
Still water level	MIKE-HD3D-UKNS	~2 km	Hourly	2001-2022
Depth-averaged currents	MIKE-HD3D-UKNS-SGEO	~2 km	Hourly	2001-2022
Current profiles	MIKE-HD3D-UKNS-SGEO	~2 km	Hourly	2018

Havbredey reference point (58.843°N, 5.581°W) with mesh and bathymetry used for MIKE21-SW-ERA5



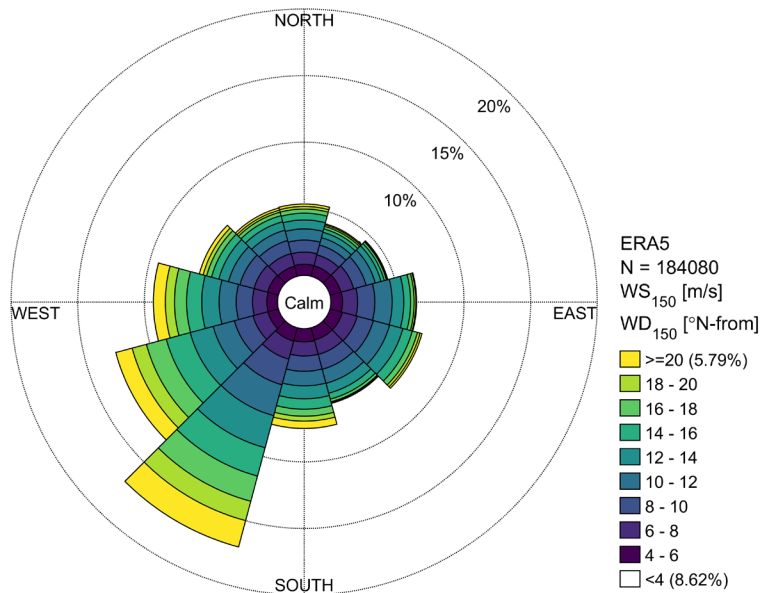
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Example metocean design basis - Havbredey

Directional roses to evaluate wind/wave/current misalignment

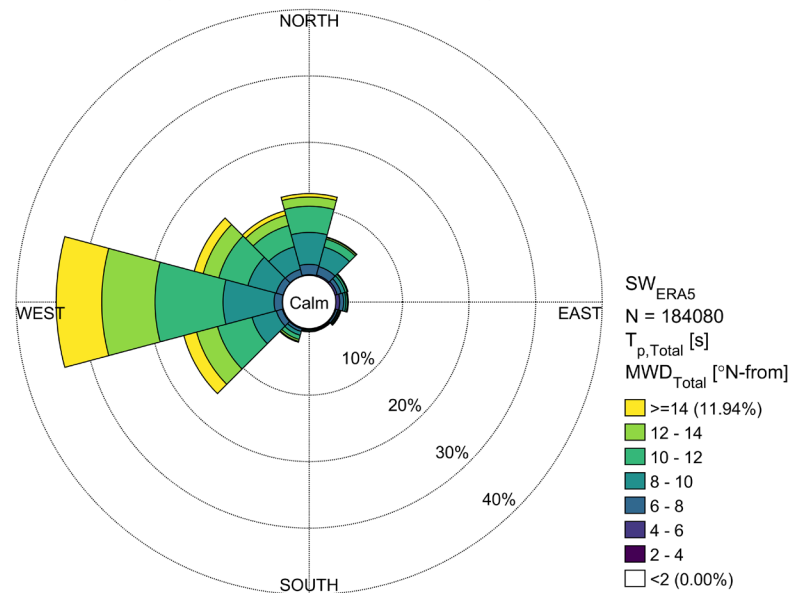
WIND ROSE

N2 (5.580929°W; 58.843280°N; d=150.0mMSL)
Rose plot (2001-01-01-2021-12-31; Δt=1h; T̄=2h) Omni



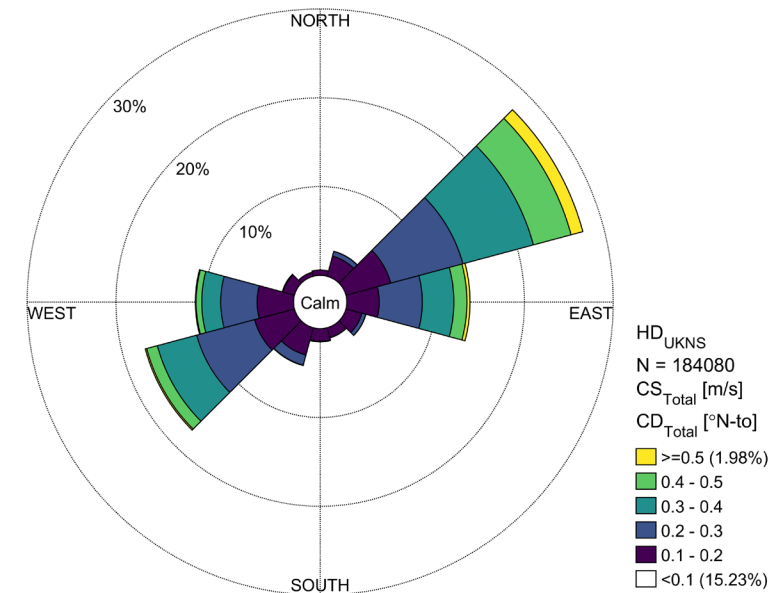
WAVE ROSE

N2 (5.580929°W; 58.843280°N; d=150.0mMSL)
Rose plot (2001-01-01-2021-12-31; Δt=1h; T̄=3h) Omni



DEPTH-AVERAGED CURRENT ROSE

N2 (5.580929°W; 58.843280°N; d=0.0mMSL)
Rose plot (2001-01-01-2021-12-31; Δt=1h; T̄=3h) Omni





Available sites

- Havbredey in Scotland
- Utsira Nord in Norway
- US reference sites being developed
- Fukushima site in Japan
- Korean site
- ...?

→ Representative sites?



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Site database

- 4C Offshore Wind Farms Database – over 580 floating wind sites spanning 34 countries
- Status of sites includes:
 - Concept/Early Planning
 - Consent Application Submitted
 - Consent Authorised
 - Development Zone
 - Pre-construction
 - Under Construction
 - Fully Commissioned
- Representative global dataset for wind and wave conditions:
 - 2 sites for most countries
 - >2 if two couldn't fully represent the range of met-ocean conditions expected
 - 1 if only one existed in the database for that country



69 sites in total
were selected for
further analysis

Interactive database map at: IEA_49_database_map.html

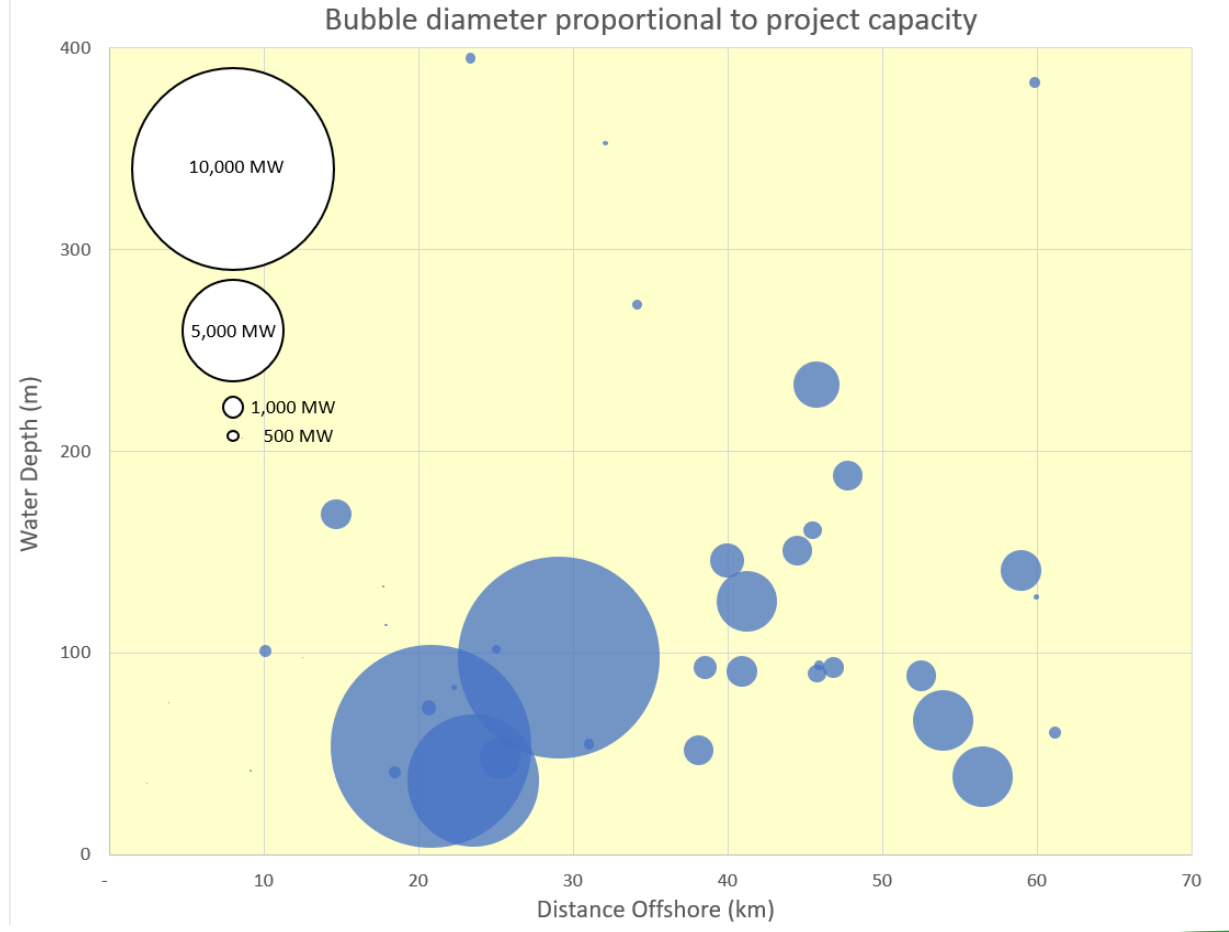
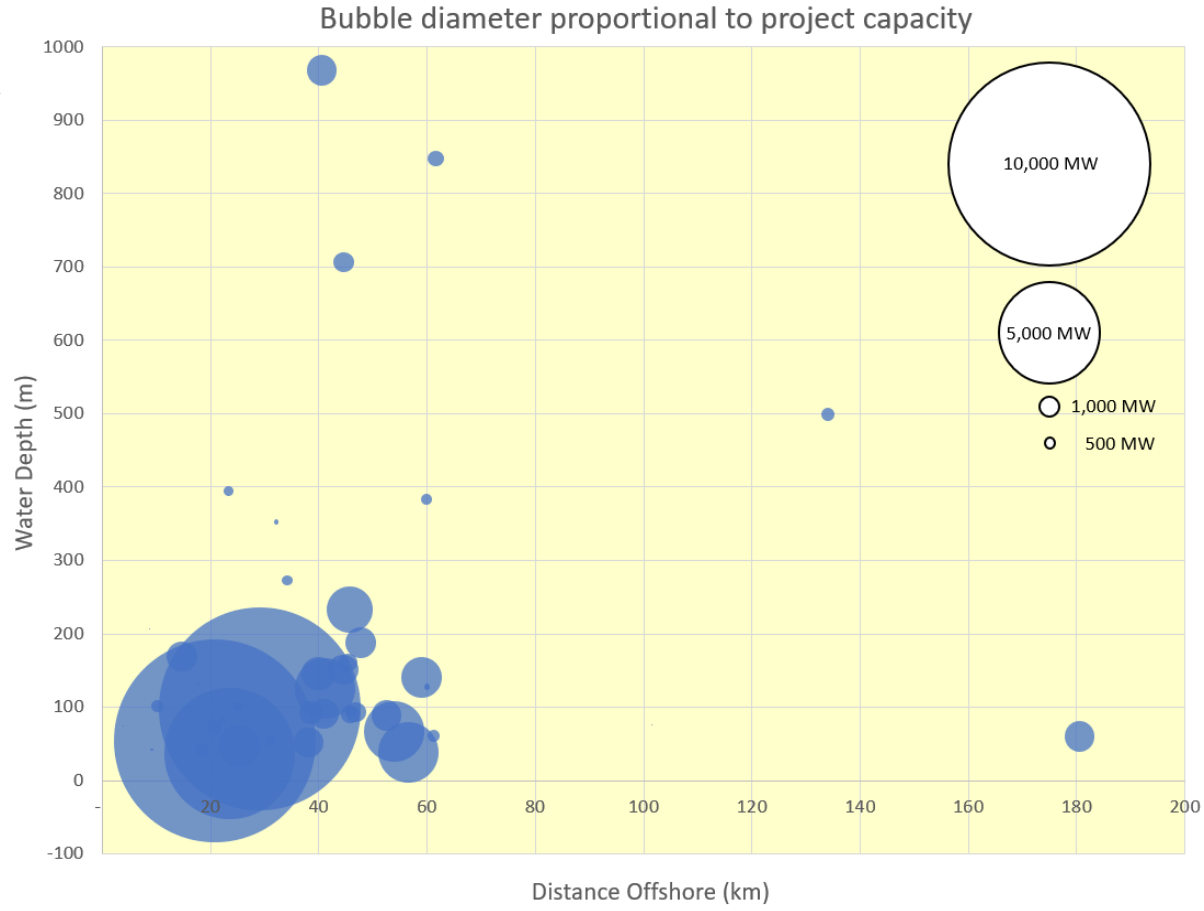


Site database

- 69 sites in total were selected for further analysis
- Geographic Information System (GIS) analysis to determine closest ECMWF ERA5 data point to chosen real sites

	ERA5 dataset details
Spatial resolution	atmospheric variables (wind) 0.25° x 0.25°; ocean wave variables 0.5° x 0.5°
Temporal resolution	1-hour
Timeframe downloaded	1979 – 2021 (inclusive)
Wind variables	u- and v-velocity components at 10 m and 100 m above sea level
Wave variables	Significant wave height (Hs); Peak wave period (Tp); Mean Wave Direction (MWD)

Clustering: Preliminary results (water depth vs. distance offshore)

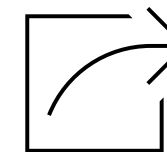
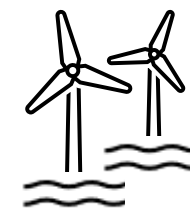
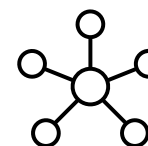
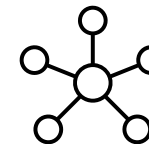
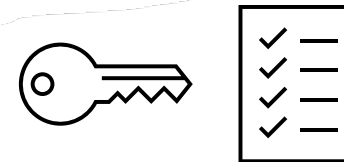




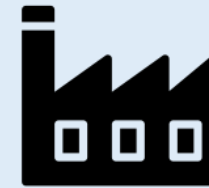
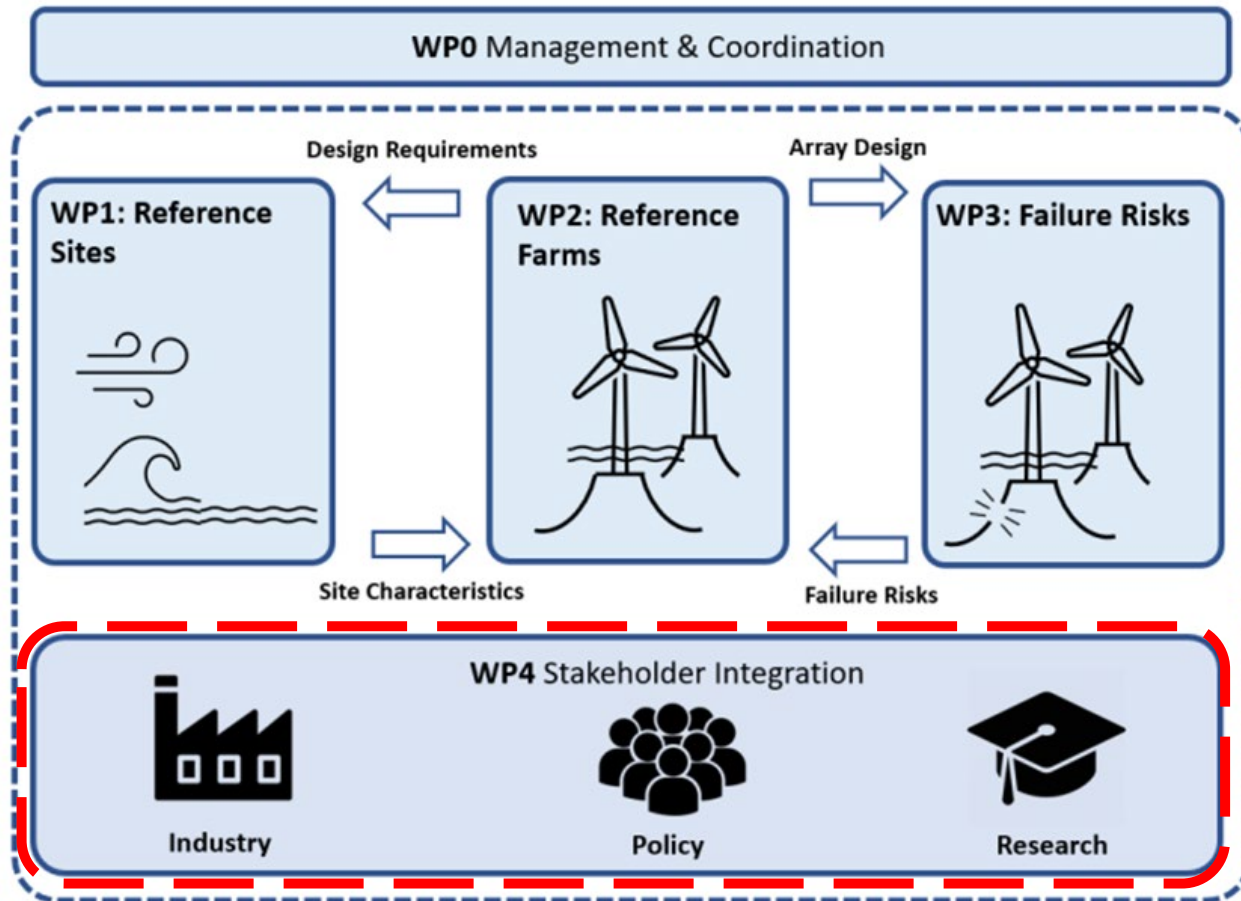
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Outlook WP1 – Reference sites

- Finalization of reference sites with key parameters
- From sites database to reference sites
- From reference sites (WP1) to reference farms (WP2)
- Public database



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Industry



Research



MSP

- Assess & facilitate international MSP collaboration for FOW zoning.
- Identify future development zones.
- Align Task work to real world research questions and analysis methods.
- Curate a floating wind innovation register.
- Score for social, economic and environmental benefit.



HUGE OW & FLOATING WIND BUILD OUT ON THE HORIZON!

Marine Spatial Planning crucial to:

1. Efficient Resource Allocation
2. Avoidance of Conflicts and Uncertainty
3. Environmental Protection and Sustainable Development
4. Infrastructure and Grid Integration
5. Long-Term Planning and Policy Framework



IEA Wind Task 49

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Thank you!