TECHNICAL CONSULTATION WORKSHOP

Metocean and Environmental Site Investigations for OSW

Ha Noi, 17th November, 2025



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1. Introduction
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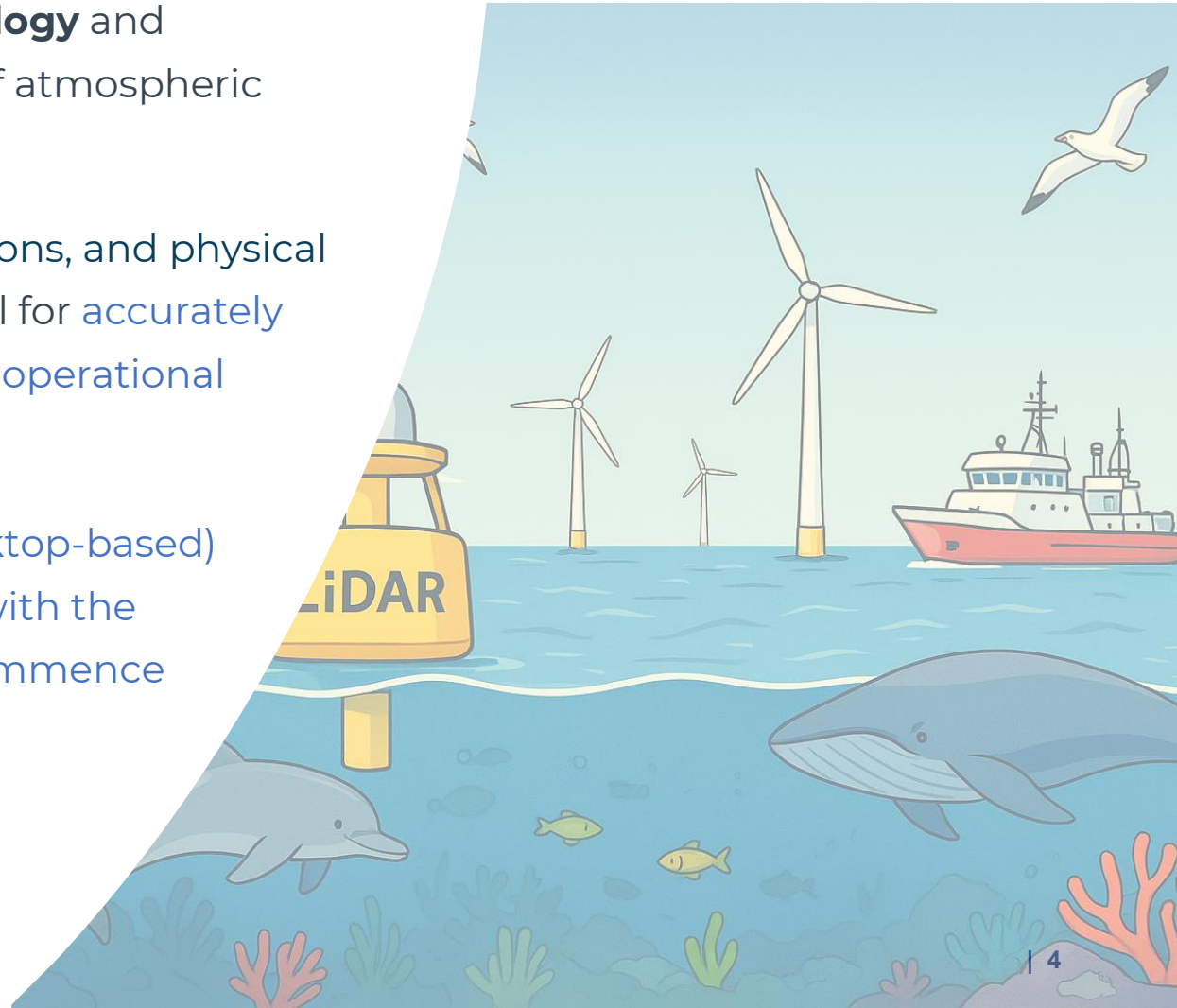


Introduction to Metocean Surveys

Metocean is a compound term derived from **Meteorology** and **Oceanography**, representing the crucial integration of atmospheric and oceanic factors.

- **Primary purpose:** quantify weather, marine conditions, and physical characteristics of the water column. This data is vital for accurately evaluating their impacts on structural integrity and operational performance of offshore installations

- Surveys steps: generally 2 phases, Preparation (desktop-based) Phase and Development phase. When integrated with the Geological Survey, the Development phase may commence from Phase 2 of the survey.



Introduction to Environmental Surveys

Offshore Wind (OSW) projects, while beneficial for clean energy, also pose several potential negative impacts on the marine environment, particularly on sensitive ecosystems and marine species.

- **Primary purpose**: aim to establish a baseline understanding of marine and coastal ecosystems, identify sensitive species and habitats, and evaluate potential impacts from OSW activities; Ensure that clean energy development proceeds responsibly and sustainably, minimizing ecological footprints.
- Surveys steps: generally, 2 phases, Preparation (desktop-based) Phase and Development phase. When integrated with the Geological Survey, the Development phase may commence from Phase 2 of the survey.



2. Metocean surveys

- Reference Documents
- Survey steps
- Parameters & Analysis



Metocean Surveys: National Reference Documents

Compliance with Vietnamese laws and circulars is fundamental for any offshore wind site investigation.

- **Law No. 82/2015/QH13:** Law on Marine Resources, Environment, and Islands (2015)
- **Law No. 61/2024/QH15:** Electricity Law (2024)
- **Decree No. 58/2025/NĐ-CP:** Government Decree detailing certain provisions of the Electricity Law regarding renewable and new energy power development
- **Circular No. 57/2017/TT-BTNMT:** Technical regulations for integrated marine resource and environmental surveys at depths from 20 meters and above
- **Circular No. 31/2024/TT-BTNMT:** Technical regulations for hydrographic and environmental surveys in coastal and island areas

The above regulations only refer to the required survey contents (Decree 58/2025/ND-CP) or general survey techniques (Circular 57/2017/TT-BTNMT), and have not yet defined specific requirements for surveys serving OSW projects.





Metocean Surveys: International Standards

Adherence to global best practices ensures robust data collection and analysis for offshore wind projects.

- **IEC 61400-50 Series:** International Standards for Wind energy generation systems, focusing on wind measurement via meteorological masts, nacelle and spinner mounted instruments, ground-mounted remote sensing, and nacelle-mounted lidars.
- **IEC TS 61400-50-4 ED1:** Technical Specification for the use of floating lidars for wind measurements.
- **IEC 61400-15-1 ED1:** Proposed International Standard for site suitability input conditions for wind power plants.
- **ISO 19901-1:2015:** Petroleum and natural gas industries - Specific requirements for offshore structures - Part 1: Metocean design and operating considerations.
- **Offshore Renewables Special Interest Group:** Metocean Procedures Guide for Offshore Renewables, Issue 3 – May 2024.



Metocean Surveys: Key Steps

Preparation Phase

Review existing documents, identify data sources, summarize findings, and develop a preliminary survey program.

- Proposed site description
- Data gap analysis
- Hazard identification
- Preliminary metocean conditions (wind, wave, current & water level)
- Survey program proposal

Development Phase

Collect and analyze metocean data from diverse sources to build a comprehensive understanding of site conditions.

- Field Measurements (LiDAR buoys)
- Numerical Modeling (simulations long-term conditions)
- Satellite Observations (large-scale data)
- Published Reports (literature review)

Metocean Survey: Parameters and Data Analysis

Operational Climate

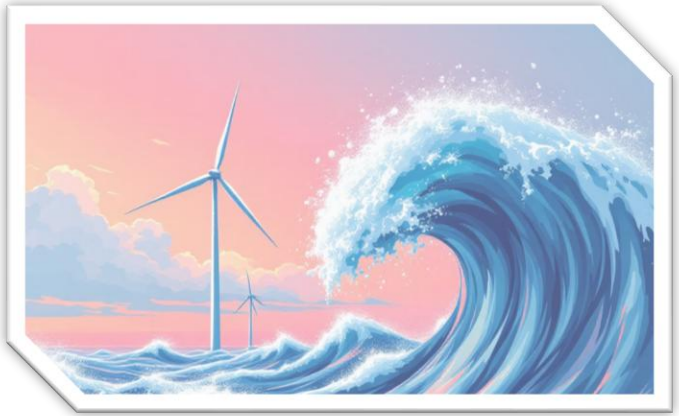
Statistical characteristics representing typical meteorological and oceanographic conditions:

- **Wind:** Monthly speed at various heights, speed vs. direction at different elevations.
- **Waves:** Monthly significant wave height, significant wave height vs. wave direction, mean and peak wave periods, wave spectra for vessel response and fatigue assessment.
- **Currents:** Surface and near-bottom current speed vs. direction, depth-averaged current speed vs. mean direction, vertical current profiles.
- **Water Levels:** Amphidromic points, chart datum (CD), extreme water level (EWL), still water level (SWL), tidal water level.

Extreme Climate

Statistical descriptions of abnormal meteorological and oceanographic conditions:

- **Extreme Value Analysis (EVA):** Estimates of metocean parameters for various return periods (1, 10, 50, 100, 1,000, and 10,000 years).
- **Interannual Variability:** Requires sufficiently long time series (typically over 30 years) with high temporal resolution to capture peak values effectively.



3. Environmental surveys

- Reference Documents
- Survey Steps
- Survey components



Environmental surveys: National Reference Documents

Adherence to Vietnamese national regulations and guidelines is paramount for conducting thorough and compliant environmental surveys.

- Law No. 82/2015/QH13: Marine Resources, Environment, and Islands (2015)
- Law No. 61/2024/QH15: Electricity Law (2024)
- Law No. 72/2020/QH14: Environmental Protection (2020)
- Decree No. 58/2025/NĐ-CP: Detailing the Electricity Law on renewable energy
- Decree No. 05/2025/NĐ-CP: Amending Decree No. 08/2022/NĐ-CP on Environmental Protection
- Circular No. 57/2017/TT-BTNMT: Technical regulations for integrated marine surveys (20m+ depth)
- Circular No. 10/2021/TT-BTNMT: Technical regulations on environmental monitoring
- Circular No. 02/2022/TT-BTNMT: Detailed regulations for Environmental Protection Law

The above regulations only refer to the required survey contents (Decree 58/2025/ND-CP) or environmental surveys for general industries (Decree 05/2025/ND-CP, Circular 02/2022/TT-BTNMT), and have not yet defined specific requirements for surveys serving OSW projects.

Environmental Surveys: International Standards & Guidelines

Incorporating international best practices ensures comprehensive and globally recognized environmental assessme

1. **ISO 18406:2017**
   Underwater acoustics – Percussive pile driving noise measurement.

2. **Danish Energy Agency**
   Guideline for underwater noise from impact/vibratory piling (2023).

3. **BOEM Guidelines**
   Marine mammal and sea turtle information for Atlantic OCS renewable energy (2019).

4. **BSH (Germany)**
   Standard for offshore wind turbine environmental impact investigation (StUK4, 2013).

5. **DCCEEW (Australia)**
   National Guidelines for Cetacean, Marine Turtle, and Dugong surveys (2024).

6. **NRDC (USA)**
   Monitoring of Marine Life during Offshore Wind Energy Development (2023).

Environmental Surveys: Key Steps

Preparation Phase

- Review existing documents and identify data gaps.
- Describe site, assess vulnerabilities, and estimate impacts.
- Propose an environmental survey program to support EIA/ESIA reporting

Development Phase

- **Field Surveys:** Collect data on natural conditions, environmental parameters, and biodiversity. Ensure seasonal and spatial representation.
- **Modeling:** Forecast impacts like underwater noise and oil spill dispersion,...
- **Literature Review:** Integrate findings from previous studies and technical publications.



Environmental Survey Components: Underwater Noise

Underwater noise, primarily from pile driving, significantly impacts marine life. Understanding and mitigating these effects is crucial.

Key Impacts

Behavioral changes, acoustic masking, hearing damage, and risk of injury or mortality.

Acoustic Parameters

Pulse Duration, SPL, SEL, SELss, SELcum for comprehensive measurement.

Impact Assessment

Based on thresholds for Permanent Threshold Shift (PTS), Temporary Threshold Shift (TTS), and behavioral impacts (SPL).

Acoustic Threshold Types for Selected Marine Species in Denmark

Species	Hearing group	I-type sounds			Other sounds		
		PTS (SELcum)	TTS (SELcum)	SPL (SELcum)	PTS (SELcum)	TTS (SELcum)	SPL (SELcum)
Harbour porpoise	VHF	155 dB	140 dB	103 dB	173 dB	153 dB	103 dB
White-beaked dolphin Pilot whale	HF	185 dB	170 dB	-	198 dB	178 dB	-
Minke whale	LF	183 dB	168 dB	-	199 dB	179 dB	-
Harbour seal Grey seal	PCW	185 dB	170 dB	-	201 dB	181 dB	-

Environmental Survey Components: Benthic Organisms

Benthic surveys establish a baseline for seabed conditions and marine communities, crucial for assessing potential project impacts.

Benthic Fauna

Species composition, density, biomass, and diversity indices using day grab sampling.

Coral & Seagrass

In case coral & seagrass detected or suspected in the project area
Species identification and percent coverage via underwater video/ROV analysis.

Seabed Sediments

Grain size, total organic matter (TOM), hydrocarbons (THC, PAHs, PCBs), and heavy metals (Cu, Pb, Zn, Cd, Cr, Hg, As).

Seawater Parameters

pH, DO, TSS, mineral oil, arsenic, cadmium, and plankton (zooplankton, phytoplankton) analysis.



Environmental Survey Components: Bird and Bat Surveys

These surveys assess impacts on bird and bat populations, especially migratory species & seabirds that inhabit or forage within the project area.

Survey Period

Minimum of one year, ideally two, with 12 surveys annually (monthly) or at least six in adverse weather.

Key Components

Seabirds, migratory birds, migratory bats, fish-eating birds, raptors, and mosquito-eating bats.

Parameters

Species composition, abundance, distribution, seasonal variation, flight behavior, altitude, and collision risk with turbines.

Bird and Bat Survey Methods

Target	Method	Advantages	Limitations	Equipment	Measurement Unit
Seabirds	Boat-based transects	Wide coverage, visual	Weather-dependent	Binoculars, GPS	birds/km²
Seabirds	Radar monitoring	Weather-independent	High cost	BirdScan MR1	flow rate (birds/h)
Bats	Ultrasonic recording	Accurate detection	Cannot distinguish species	SM4BAT	pass/hour
Bats	Real-time radar	Tracks aerial activity	Distinguishes small birds/bats	Vertical-axis radar	vector, speed

Environmental Survey Components: Megafauna Surveys

Megafauna surveys focus on marine mammals, cartilaginous fish, and sea turtles, vital for assessing biodiversity and potential project impacts.

Survey Period

Minimum of one year, ideally two, with 12 surveys annually (monthly) or at least six in adverse weather.

Parameters

Species presence, distribution range, and estimated population size of marine fauna in the area

Commonly Applied Survey Methods for Megafauna

	Boat-based survey			Fixed station (offshore)			Land-based survey		
	Line-transect	Photo ID	Live PAM	Fixed PAM station	Underwater camera	eDNA	Landing survey	Interviews	Sea turtle nesting
Marine mammals	I	I	I	I	III	II	III	II	IIII
Sea turtles	I	III	III	III	II	II	II	II	I
Sharks	II	II	III	III	I	II	I	I	III

Suitability Levels: I: Optimal, II: Moderately suitable, III: Not suitable.

Environmental Survey Components: Fish Surveys

Fish surveys document species, populations, and habitats, identifying critical areas like spawning grounds and the presence of protected or invasive species.

Survey Period

At least one year, ideally two, with monthly surveys (12 per year) or a minimum of 4 represented for 4 seasons.

Key Parameters

Fish species, population dynamics, habitats, spawning grounds, protected species, and invasive species.

Recommended Methods

Shore-based methods, including landing surveys and interviews with local fishers.



4. Questions & Answers



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VPI

THANK YOU!

