Offshore Wind Energy: Site Screening, Fixed and Floating Foundations, Installation and LCOE



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Introduction:

Offshore wind energy projects commit capital years before first power, so a wrong call on water depth, foundation type, vessel availability or discount rate can erase a project's margin long before construction starts. This Core Concept course takes developers, engineers, project managers and investors, including oil and gas professionals moving into renewables, through the offshore wind value chain: site and seabed data, turbine sizing, fixed and floating support structures, cables and substations, installation, O&M access and cost of energy. Participants build an Offshore Wind Concept and LCOE Screening Report for a case site.

Course Objectives:

- Screen offshore wind sites against water depth, distance to shore, shipping, environmental and grid landfall constraints using metocean and seabed survey data
- Estimate net annual energy for an offshore array by applying wake, electrical and availability losses to a selected turbine size
- Select between monopile, jacket, gravity base, suction caisson and floating spar, semi-submersible or tension-leg concepts for a given seabed and depth
- Specify inter-array and export cable routes, offshore substation needs, installation vessels and marshalling port requirements for a wind farm layout
- Plan construction risk controls and an O&M access strategy using crew transfer vessels, service operation vessels and major component exchange options
- Calculate a screening LCOE with capex, opex, capacity factor and discount rate sensitivity and explain the project finance view of it

Target Audience:

- Project developers who screen seabed lease areas and prepare offshore wind projects for investment decisions
- Engineers who assess metocean data, foundations, cables and electrical systems for offshore wind concepts
- Project managers who plan fabrication, installation campaigns, vessels and port logistics for offshore construction
- Investors, lenders and commercial analysts who review cost of energy, risk and technical due diligence findings
- Oil and gas professionals moving marine, subsea or project experience into offshore wind roles

Course Outline:

Day 1: Offshore Wind Market, Value Chain and Site Screening

- Offshore Wind Value Chain and Project Phases: Developer, Turbine Supplier, Fabricator, Installer and Operator Roles
- Site Selection Constraint Mapping: Water Depth, Distance to Shore, Shipping Lanes and Grid Landfall
- Metocean Campaign Scope: Floating Lidar Buoys, Wave Buoys and Current Profilers
- Seabed Survey Sequence: Bathymetry, Sub-Bottom Profiling and Cone Penetration Tests
- Environmental and Stakeholder Screening: Seabirds, Piling Noise on Marine Mammals and Fisheries Coexistence

Day 2: Energy Yield, Turbine Sizing and Support Structure Concepts

- Offshore Energy Yield Chain: Gross Output, Array Wake Losses, Electrical Losses and Availability
- Offshore Turbine Sizing: Rotor Diameter, Rated Power, Hub Height and Direct-Drive versus Geared Nacelles
- Fixed-Bottom Foundation Selection Matrix: Monopile, Jacket, Gravity Base and Suction Caisson under DNV-ST-0126
- Floating Platform Archetypes: Spar-Buoy, Semi-Submersible and Tension-Leg Platform Compared
- Station-Keeping Options: Catenary Chain, Taut Synthetic Rope and Tension-Leg Tethers

Day 3: Electrical Infrastructure, Installation Vessels and Marine Logistics

- Inter-Array Cable Layout: String Configuration, Burial Assessment and Cable Protection Systems
- Export Transmission Choice: HVAC versus HVDC Cables and Landfall Horizontal Directional Drilling
- Offshore Substation and Converter Platform Topsides Arrangement
- Installation Vessel Selection: Jack-Up WTIVs, Dynamically Positioned Heavy-Lift Vessels and Motion-Compensated Feeders
- Marshalling Port Requirements: Quayside Load Capacity, Laydown Area, Tow-Out and Wet Storage

Day 4: Construction Risk, O&M Strategy and Cost of Energy

- Offshore Construction Risk Register: Weather Windows, Unexploded Ordnance, Pile Refusal and Cable Damage
- O&M Access Strategy: Crew Transfer Vessels, Service Operation Vessels with Walk-to-Work Gangways and Helicopters
- Major Component Exchange and Tow-to-Port Repair Planning for Floating Units
- LCOE Build-Up: Capex, Opex, Capacity Factor, Decommissioning Provision and Discount Rate
- Project Finance Overview: Revenue Contracts, Cash-Flow Debt Sizing and Lender Technical Due Diligence

Day 5: Capstone: Offshore Wind Concept and LCOE Screening

- Case Site Brief Review: Metocean Records, Seabed Survey Results and Grid Connection Point
- Fixed-Bottom versus Floating Concept Scoring for the Case Site
- Turbine, Array Layout and Export Route Selection with Net Yield Estimate
- LCOE Screening Model with Capex, Opex and Discount Rate Sensitivity Tornado
- Concept and LCOE Screening Report Presentation and Investment Panel Challenge

Skills You Will Gain:

- Offshore Site Constraint Analysis
- Metocean and Seabed Data Interpretation
- Offshore Array Yield Estimation
- Support Structure Concept Selection
- Cable and Substation Scoping
- Installation Vessel Planning
- O&M Access Planning
- Cost of Energy Modelling

Why Attend This Course:

- Return with an Offshore Wind Concept and LCOE Screening Report built for a case site with real survey-style data
- Question consultant yield figures, foundation choices and vessel plans before they drive an investment decision
- Translate oil and gas marine, subsea and project experience into the vocabulary offshore wind developers and lenders use
- Compare fixed-bottom and floating options with peers from developers, contractors, utilities and investment teams

Conclusion:

Offshore wind projects succeed when site data, technology choices, construction planning and cost of energy are assessed together rather than in separate silos. The one week move from the value chain, site screening and seabed and metocean surveys, through energy yield, turbine sizing and fixed and floating support structures, to cables, substations, installation vessels and ports, then construction risk, O&M access, LCOE and project finance. The final day produces an Offshore Wind Concept and LCOE Screening Report ready for panel challenge.