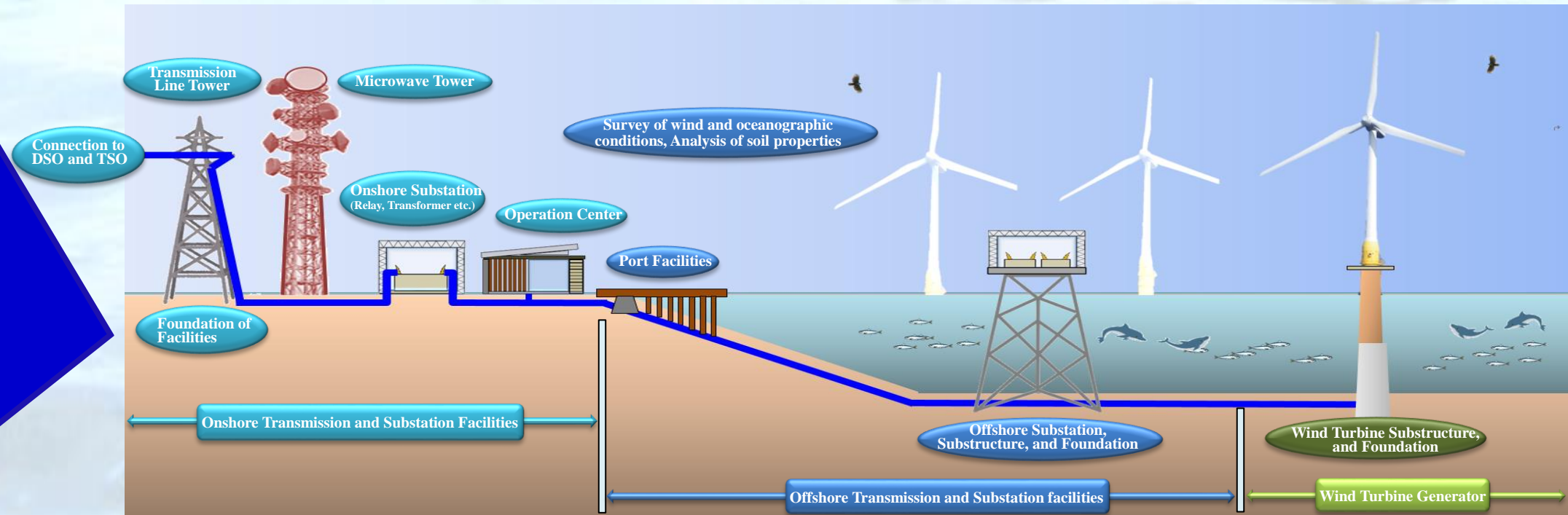


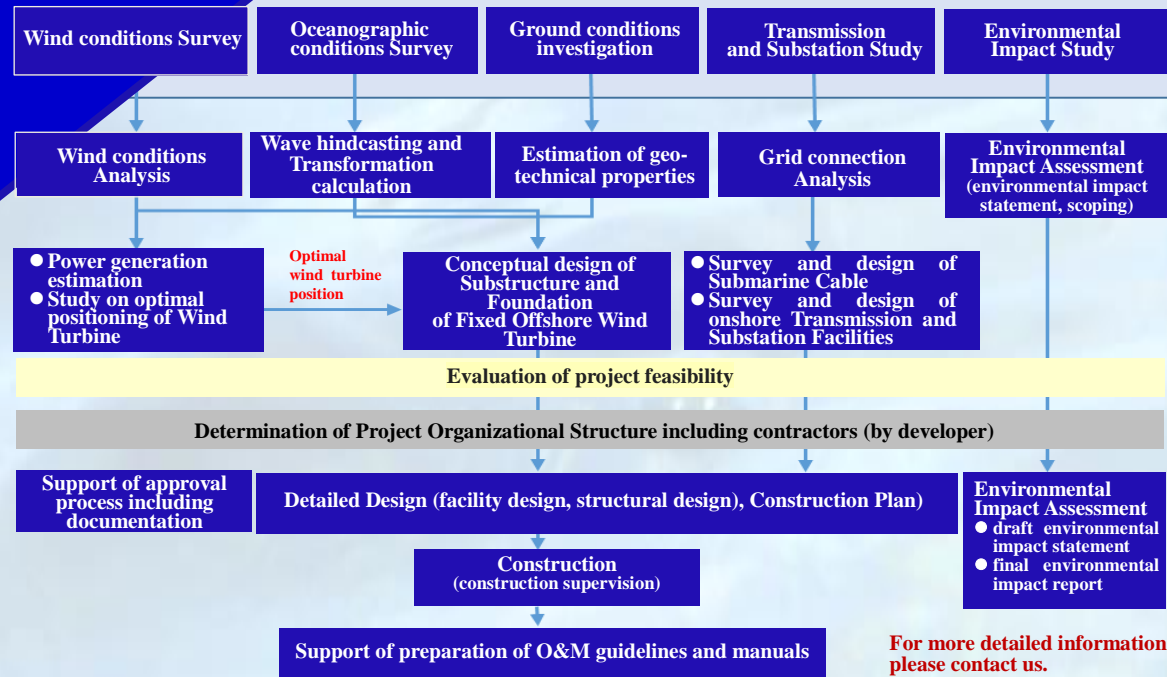
NEWJEC is dedicated to support the worldwide transition to a carbon-free society with advanced technology “to harmonize people with nature”.

◆ We will provide strong support to clients at every phase by making best use of our extensive experiences and broad knowledge as a civil, architectural, electrical and environmental consultant. ◆



Environmental Study
Environmental Impact
Assessment

Standard Procedure of Offshore Wind Power Development



Action Details

Planning	Study on positioning of Wind Turbines, Feasibility Study	Study of optimal allocation of wind turbine based on power generation and cost
Assumption for design conditions	Wind conditions analysis Wave hindcasting and transformation calculation Evaluation of underground physical properties	Determination of designed wind load conditions based on monitored wind data and estimated probabilistic value Determination of designed wave conditions to be used for structural analysis by way of (1) hindcasting of offshore waves and (2) their transformation toward OWT location Estimation of geotechnical properties and judgement of probability of liquefaction based on ground investigation which are to be mainly used for substructure design
Structural design (fixed OWT)	Structural design of Substructure of fixed OWT and Offshore Substation	Structural design of fixed offshore substructure, either monopile or jacket type, using SESAM (software of structural analysis for offshore structures) developed by DNV
Transmission and Substation design	Onshore Transmission Line (either overhead or underground) and Substation design	<ul style="list-style-type: none"> Study on overhead transmission line alignment Design of transmission towers and underground transmission line facilities Design of substation facilities, Consultation of grid connection conditions with TSO and analysis, if required Design of other facilities including microwave, substation and operation center building etc.
Environmental Impact Study and Assessment	Environmental Impact Study Environmental Impact Assessment	Preliminary Survey using existing materials (support for environmental impact statement), Survey plan (support for scoping), Environmental survey (birds, marine mammals, fish, noise and vibrations, impact on fisheries, marine transportation, etc.) Support to plan mitigating countermeasures and draw application documents for obtaining approval of environmental impact assessment.

We are happy to cooperate with clients for customized requests and queries.

Design of substructure and underground foundation for fixed offshore wind turbine, either monopile or jacket, and offshore substation

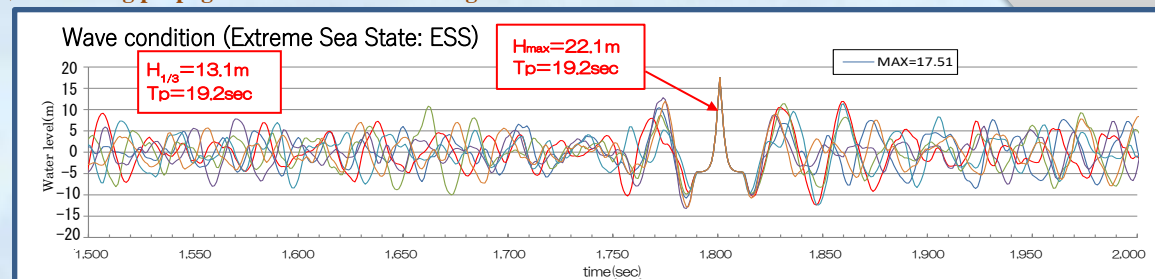
◆Procedure

- ◆Determine designed wind and wave conditions to be used for structural design of OWT facilities. (On site wind and wave surveys need to be implemented separately.)
- ◆Determine site specific geological conditions where OWTs are situated.
- ◆Carry out economical structural design using designed wind, wave, geological, and seismic conditions.
- ◆Pursue best Generation & Costs ratio analysis by iterating case studies of different arrangement of OWTs position.
- ◆Provide continued support for approval process of relevant laws until satisfactory results are acquired.

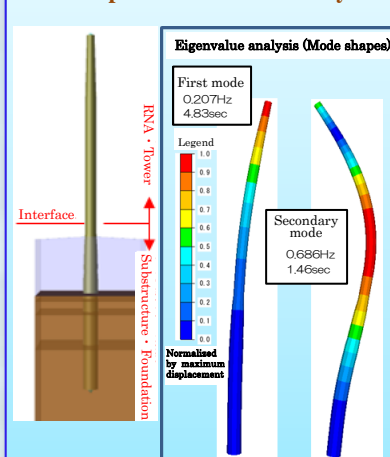
◆Methods of Analysis

- ◆“SESAM” is used for structural analysis of fixed OWT substructure at following limit states;
- ◆**Ultimate limit states design**
Structure is designed to withstand designed forces such as wind and wave conditions with a 50-year return period, Level 1 & 2 earthquake ground motions, and tsunami forces.
- ◆**Fatigue limit states design**
Optimal specifications of steel structural member are determined based on accumulated fatigue damage analysis through project lifetime.

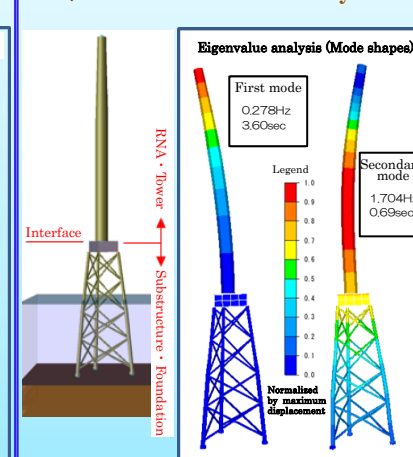
◆Simulating propagation of wave toward targeted ocean area



◆Monopile Deformation Analysis



◆Jacket Deformation Analysis



◆Example of analytic results

- ◆**Monopile**
 - ◆ Natural frequencies are within a permissible range required by wind turbine specifications.
 - ◆ Earthquake is a critical load case for determining structural member specifications.
 - ◆ Fatigue analysis can verify structural resilience throughout overall project life time.
- ◆**Jacket**
 - ◆ Natural frequencies are within a permissible range required by wind turbine specifications.
 - ◆ Acting stress ratio to resistance is higher at legs and joints than at diagonal braces.
 - ◆ Load induced from wind turbine is more critical for structural design than wave loads in case of fatigue analysis.

Environmental Impact Assessment

These studies are processed efficiency making use of our past experiences and achievements.

◆Support of selecting suitable site for wind turbines

- Suitable site will be recommended by taking into consideration of social and environmental conditions, requirement by various regulations, and local opinions.
- [Case 1] Study on the suitable site for the offshore wind power turbines in the Akita port and the Noshiro port (Akita prefecture)
- [Case 2] Pilot project promoted by the initiative of local municipality for determining suitable site (led by Goto city in collaboration with Ministry of the Environment)
- [Case 3] Environmental impact assessment of the wind power project in the Chugoku and Shikoku regions (Ministry of the Environment)

◆Bird Study

Visual observation, radar survey, aerial photography via drone, time lapse photographing at hotspots

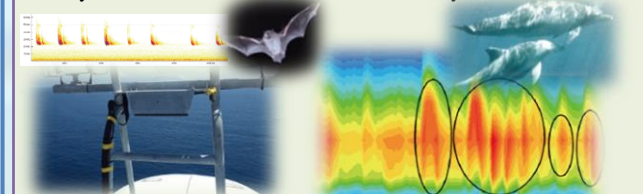


◆Bats Study

Study with bat detector

◆Marine Mammals Study

Acoustic analysis etc.



◆Streamlining of Environmental Impact Assessment

Assessment were successfully shortened by efficient arrangement of sequential surveys. (Procedure normally takes 36-48 months, however our proper initial scoping of survey enabled streamlining of the relevant assessment process into 23 months.)

- (1) Impact statement /2016.9 Public notice
- (2) Scoping document /2017.2 Public notice
- (3) Draft report /2017.11 Public Notice
- (4) Evaluation report /2018.8 Confirmation notice

Shorten about 2 years!!