

[E-5]: Mass production and reduce cost used "Inshore structure with C-SEP method"

Summary of Research & Development of GI phase-2

Background & Challenges

- Achieve the mass production and reduce cost target, most of WTG assemble will be done in calm weather conditions.
- Optimizing lead times and minimizing downtime are essential for efficient wind turbine assembly operations.
- TOA has Japanese patent licence about this method with GI phase-1 R&D in June/2025. (Patent No.7692456)
- TOA examines optimization of work methods and infrastructures to satisfy 30units/year, as government-target* for WTG assembly works. (*Scenarios for the future of ports to promote the introduction of offshore wind power generation)

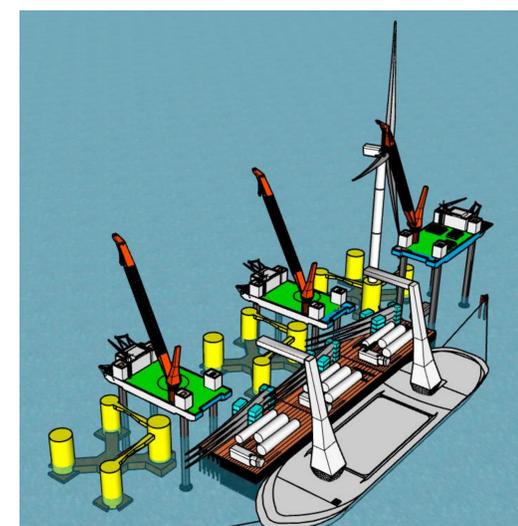
TOA will conduct mass production & reduce costs for large WTG assembly works using brush up the outcome of phase-1 in commercial market.

Contents of phase-2 Research & Development

- Construction standardization of "Inshore structure with C-SEP method"
- Development of detail design, trial work with prototype for "Tower upend hinge".

Issue of social implementation and future development (prospects for resolution)

- "SIMOPS" implementation (Simultaneous Operation for floater, WTG, SEP and other work)
 - Adjust a schedule including pre-and-post WTG installation (WTG transport, Floater wet storage, towing tag boats just in time)
 - Reduction cost of install and removal work for inshore structure (Pre-Casting Jetty (PCa) , Bulk installation by SEP)
- In addition, we start investing and expecting to resolve

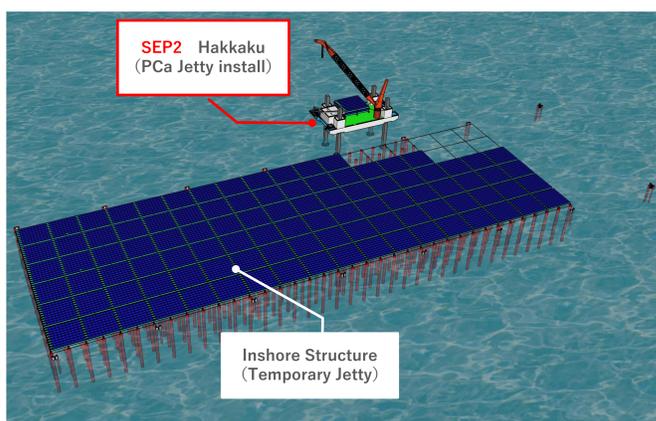


Outcome of phase-1 : WTG Assembly works on Inshore structure with SEP
<image>
(SEP shifts for installation)

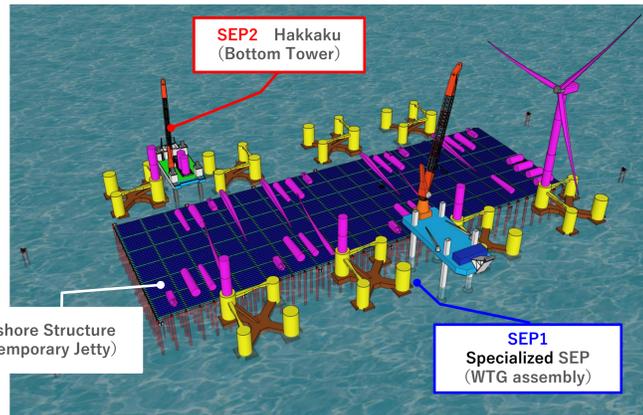
Detail contents of Research & Development (Released)

□ Construction standardization of Inshore structure with "C-SEP method"

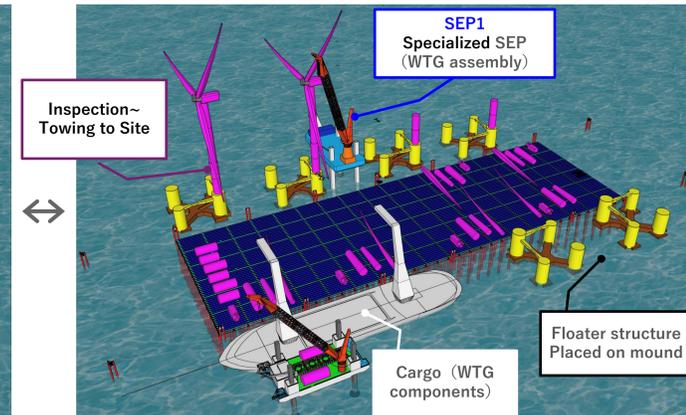
C-SEP method (Circular-SEP around the structure and assemble WTG, during pre-commissioning~tow-out, supply WTG components, Floaters)



PCa Jetty installation using SEP Hakkaku



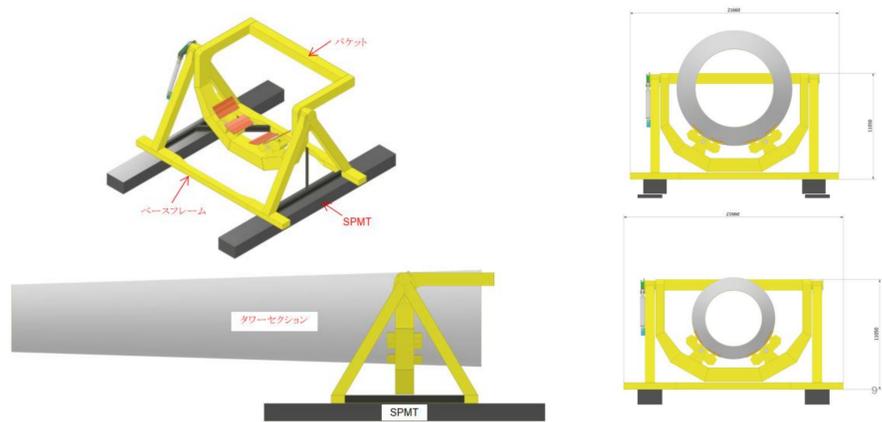
WTG assemble on floater structure using 2-SEP



Inspection, WTG components, Floater, WTG assemble

□ Tower Up End Hinge development (Detail design, Trial work using Prototype)

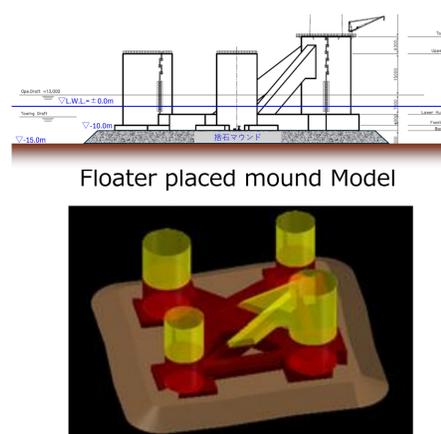
UEH makes possible to upend towers using-only SEP main crane without support of-another huge crane. Therefore, bearing capacity is reduced.



Tower UEH Image (UEH on SPMT with Tower dia. adjustment function)

□ Floater structure temporary storage method development

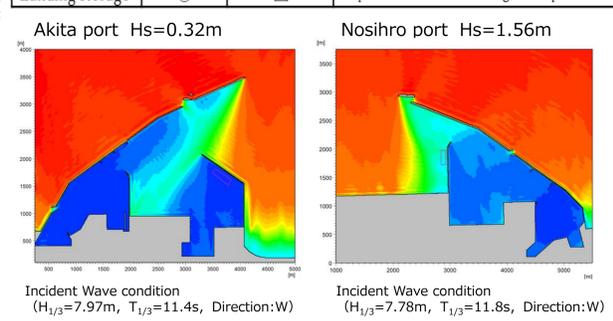
With numeric analysis using Orca flex software, we develop feasible and stable floater structure wet storage method of floater structure.



3D Image

Calmness table of base ports (10year probability)

Candidate port	Akita port	Noshiro port	Remarks
Hs (m)	0.32	1.56	Significant wave H from calmness analysis
Landing storage	○	△	○ possible △ with mooring × impossible



Calmness of base port (Akita & Noshiro Port)

Technical issue for Research & Development and prospects for solutions(New release)

Development progress

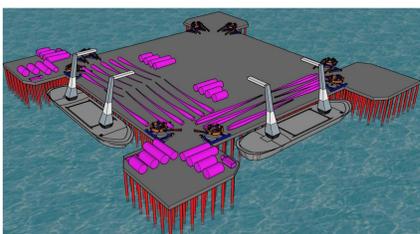
- Regarding WTG install acceleration using C-SEP method, create 2-cases of workflow, i.e., existing case and new ship.
- In addition, optimize case examination (refer below)
- Make detail work area plan at candidate port of WTG installation for coordinate exist user and stake holder.

Remaining technical issue

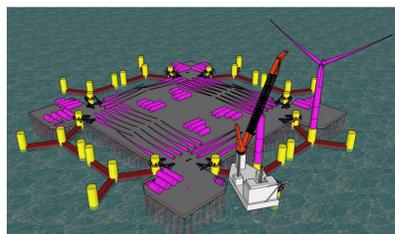
- Regarding WTG install acceleration, calc cycle time, operation rate assumption, estimation LCOE, as organize construction standards.
- Coordination and site investigation at the candidate port, we'll establish work method statement (WMS) and temporary structural design.

Prospects for solution

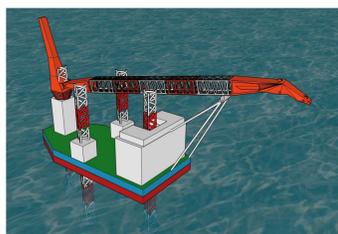
- Resolve the issues by creating a general construction standards draft for obtaining ClassNK and MWS certificate.
- Well in advance to the Phase2 demo, get cooperation from stakeholders by showing stable & feasible work plan.



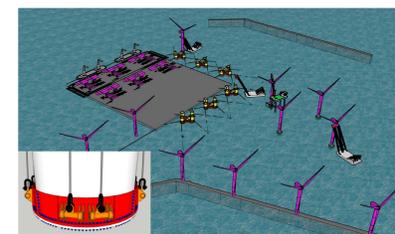
GC-SEP method : Giga-Hub using Circular-SEP method
(Already patent applied)



FOWT Specialized SEP image
(Already patent applied)



BI method (Bulk Installation)
Bottom Left is Lifting tool detail
(Already patent applied)



PRoMiS method
Pile Rope Mooring inshore Storage
(Already patent applied)