MODEC

Presentation

TLP concept of FOWT suitable for characteristics of Japan

7th July 2022

MODEC, Inc.

Why MODEC ?

Only enterprise in Japan that is involved in Oil & Gas industries, as a supplier of floating facilities such as FPSOs※ and TLPs.
Using project experience in TLP technology from Oil & Gas industry, MODEC has developed a new TLP concept for Floating Offshore Wind (FOW).

FPSO※

TLP for Oil & Gas

TLP for FOW

※Floating Production, Storage & Offloading system

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Feature of MODEC TLP

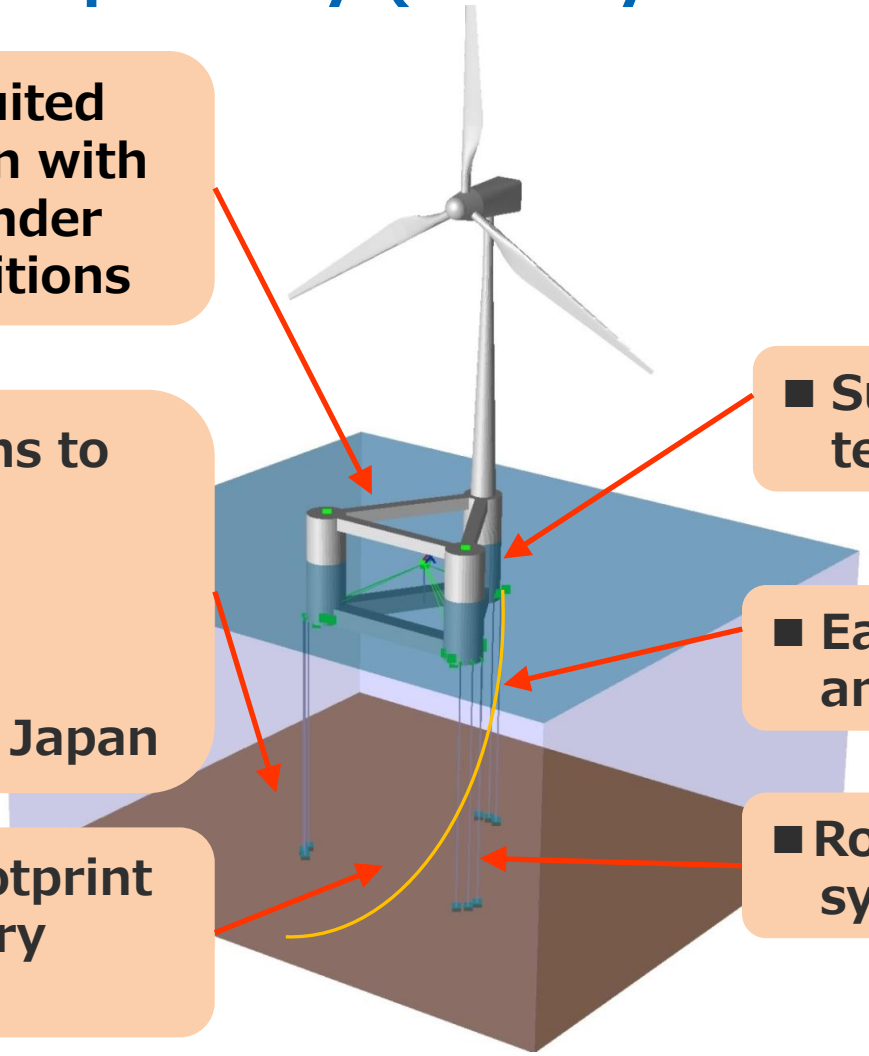
- Floater for large WT to realize low LCOE
- Suitable Floater for Japanese harsh wind & wave
- High social acceptability (affinity to fishery industry)

■ Reliable structure suited for power generation with large capacity WT under harsh weather conditions

■ Steel pile foundations to eliminate economic bottleneck

■ Piles designed for robustness due to earthquake loads in Japan

■ Minimum seabed footprint with affinity to fishery industry



■ Superior **stability** due to tether system

■ Easily disconnectable tether and power cable

■ Robust steel wire tether system

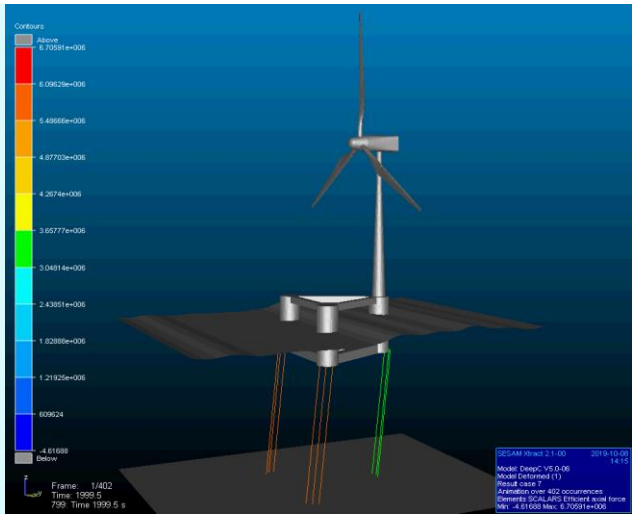
Bottom Founded Floating Platform

TLP stability is equivalent to a fixed structure

Stability of TLP

- Negligible vertical motion
- Negligible Pitch/roll

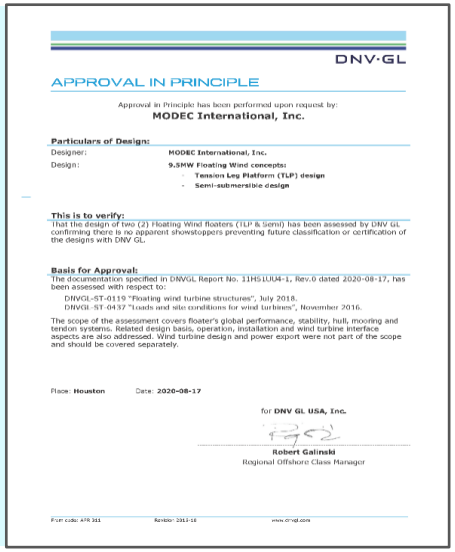
  Less than 1/100 of Semi's pitching under harsh condition



Robust Structure

- Turbine tower is supported by fatigue resistant structure

  AIP obtained from Classification Society（DNV）



DNV·GL

APPROVAL IN PRINCIPLE

Approval in Principle has been performed upon request by:
MODEC International, Inc.

Particulars of Design:

Designer: MODEC International, Inc.

Design: 9.5MW Floating Wind concepts:
- Tension Leg Platform (TLP) design
- Semi-submersible design

This is to verify:

That the design of two (2) Floating Wind floaters (TLP & Semi) has been assessed by DNV GL confirming there is no apparent showstoppers preventing future classification or certification of the designs with DNV GL.

Basis for Approval:

The documentation specified in DNVGL Report No. 11HS1LUU4-1, Rev.0 dated 2020-08-17, has been assessed with respect to:

DNVGL-ST-0119 "Floating wind turbine structures", July 2018.
DNVGL-ST-0437 "Loads and site conditions for wind turbines", November 2016.

The scope of the assessment covers floater's global performance, stability, hull, mooring and tendon systems. Related design basis, operation, installation and wind turbine interface aspects are also addressed. Wind turbine design and power export were not part of the scope and should be covered separately.

Place: Houston Date: 2020-08-17

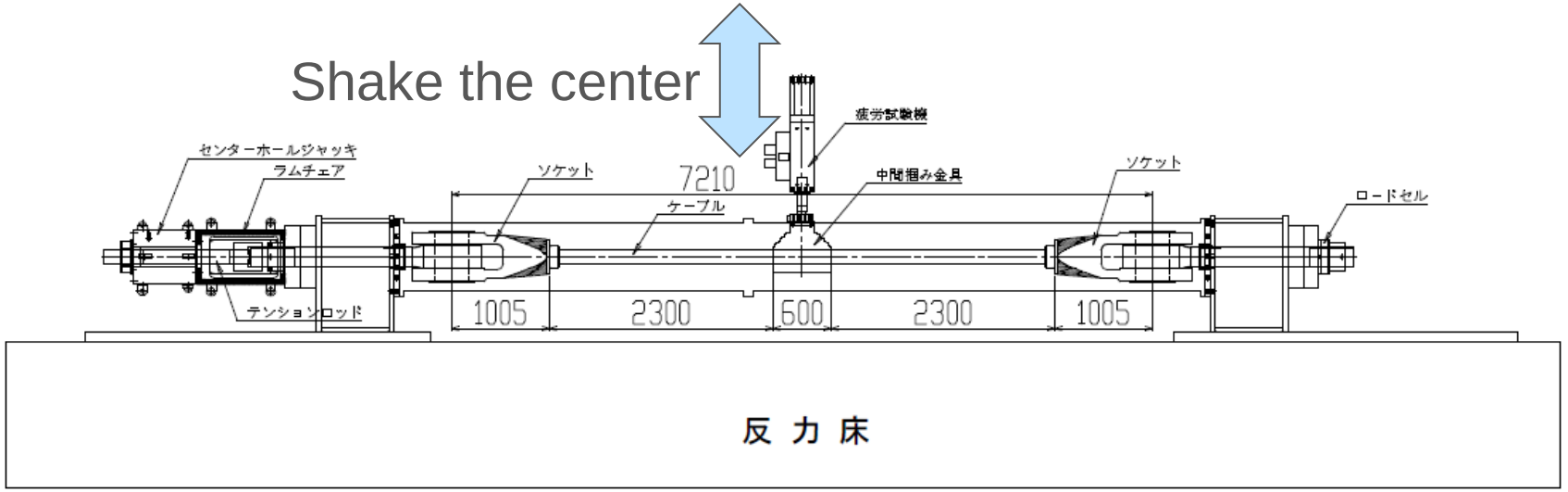
for DNV GL USA, Inc.

Robert Galinski
Regional Offshore Class Manager

Maintenance-free tether system 1/2

Performed a full-scale durability test of the local bending load acting on tether end

- Steady tension (for TLP): **460ton**
- Local bending angle: **0.4 deg. (angle by the bearing slip)**
  (evaluate the strength of tether end against local bending)
- Number of cycles: **30 million times (significant number of load)**
  (equivalent to loading in 25 years of operation)



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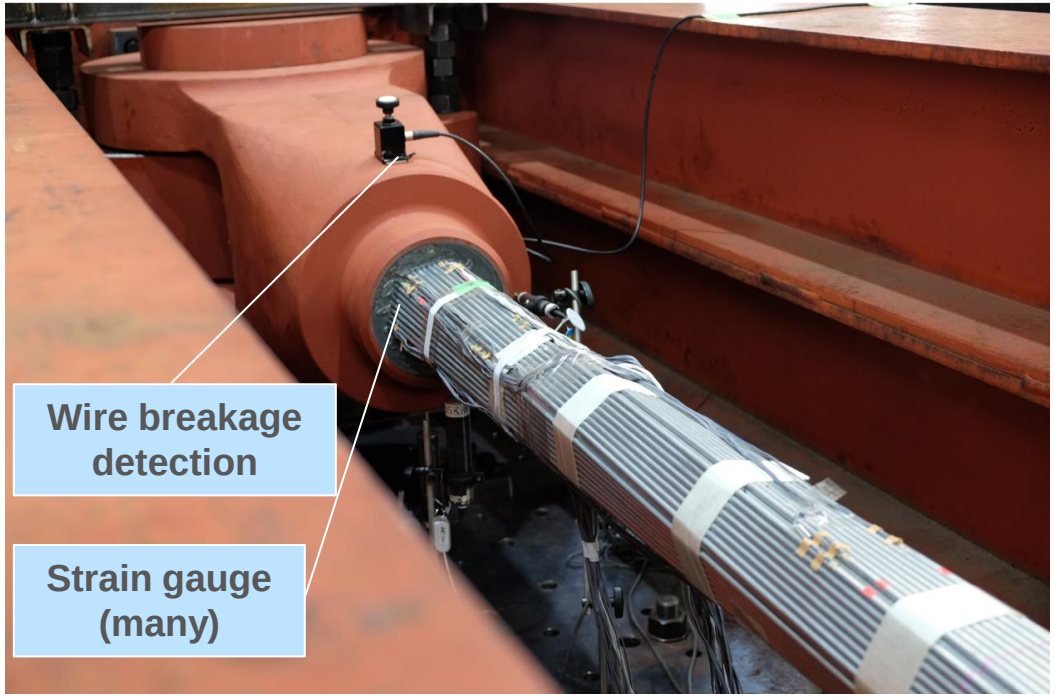
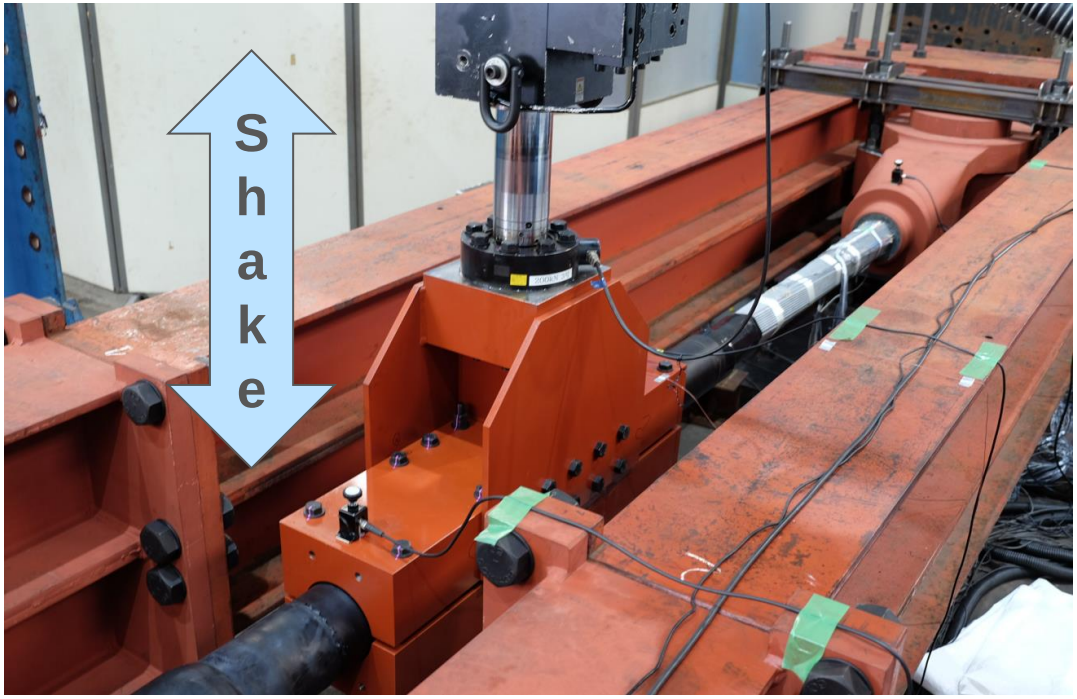
Maintenance-free tether system 2/2

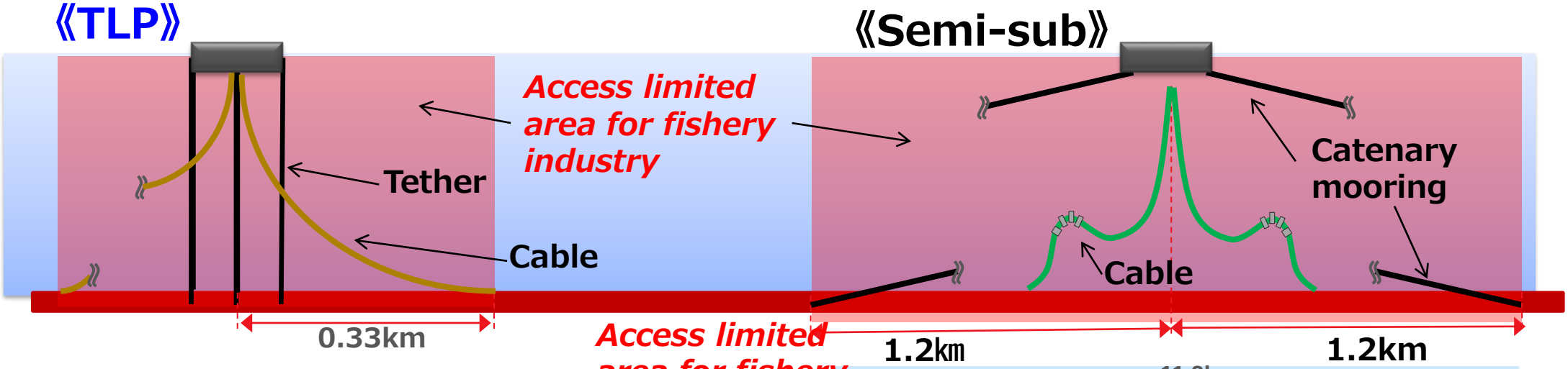
- 5 months shaking ⇒ Achieved the target number of 30 million cycles
- Also, no trace of single wire breakage from the result of wire breakage detection sensor



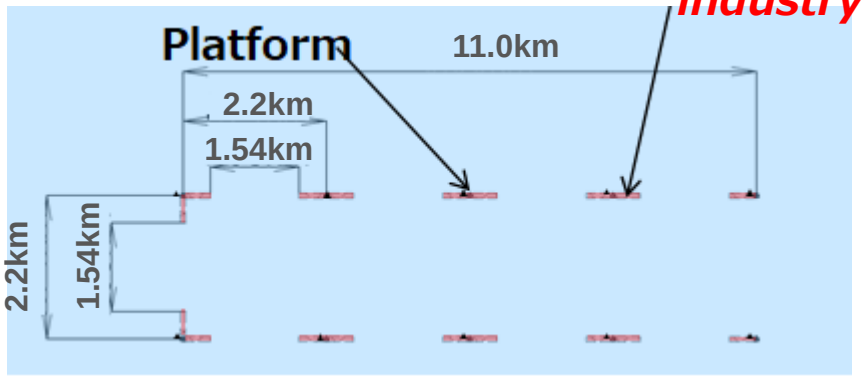


Best solution for Fishery industries

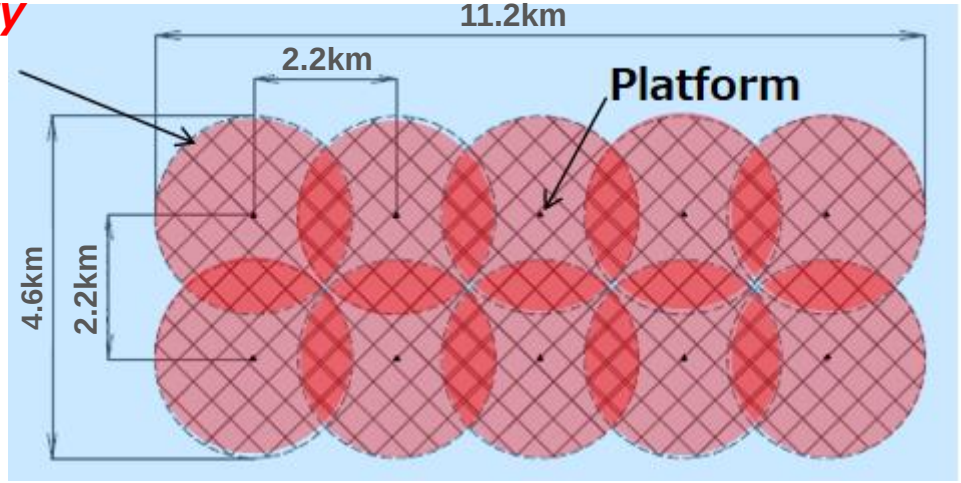
Less impeditive fishery industry because of smaller footprint,
TLP is relatively more acceptable than other floaters types



Footprint：small



Access limited area for fishery industry

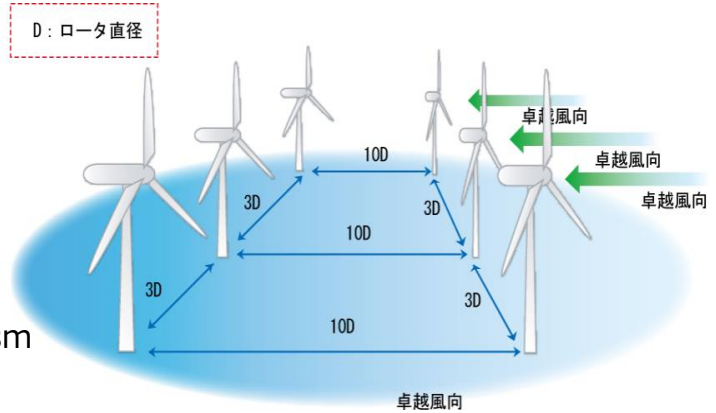


In case of 15MW class device

Footprint of TLP minimizes the impact to fishermen, and allows the fishery industry to operate in a larger area（Compatible with Fishery Industry）

Optimal Use of Wind Farm Site

The small footprint of TLP allows for optimal use of windfarm site thus maximize produced power.

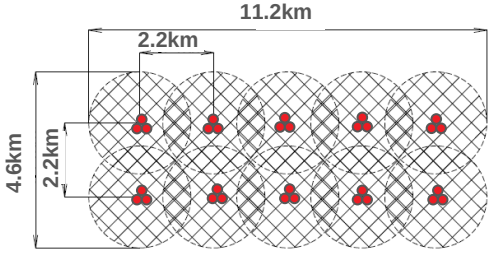


【Source】Japanese Ministry of Land, Infrastructure, Transport and Tourism

【Ref】Comparison conditions

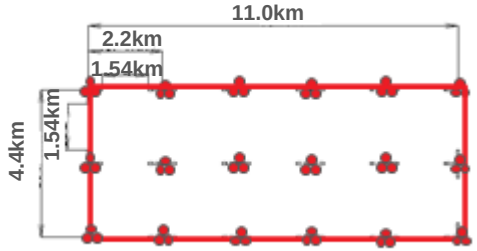
	Semi-sub	MODEC TLP
Capa/FOWT	14MW	
Rotor (D/M)	220m	
Mooring Foot Print	Radius 1,200m	-
Distance between FOWT	See right	
Site Dimension	**4.6km x 11.2km**	

《Semi-sub》



Maximum : 10

《TLP》



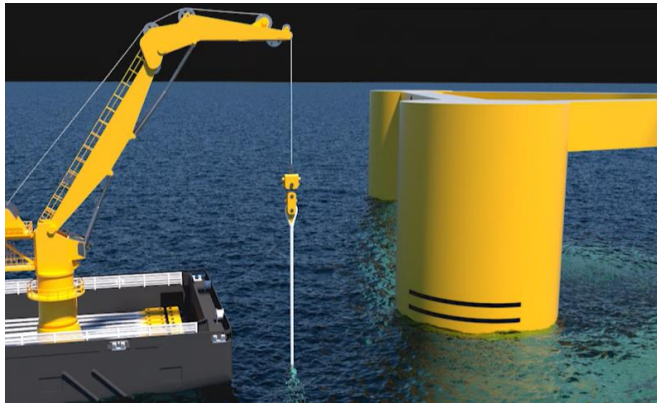
Maximum : 18

Almost Twice

How save the Life Cycle Cost ?

Reduce O&M costs and minimize risk of serious failure

- Robust fatigue and corrosion design minimizes offshore repair risk and minimizes O&M costs
- Disconnectable mooring & cable system allows major turbine maintenance be performed quayside and reduces power downtime and maintenance costs
- In light of above advantage, insurance underwriting has been confirmed by multiple insurance companies.



On-site replacement design for mooring

Disconectable design platform

Roadmap to Commercialization

Commercialization in Early 2030s through Demo.

Early 2030s

Mid-Late 2020s

2022-23

2020-21

Windfarm Commercial Operation

Demonstration

FS on site conditions supported by Green Innovation Fund (NEDO/METI)

Investigation research hosted by NEDO

Basic Design/ Experiment in Tank

Conceptual Design