ESTEYCO

ATOMS

ATtachable Operation and Maintenance System for offshore wind turbines

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- **About ESTEYCO**
- ATOMS Technology
- ATOMS Operation
- Conclusions

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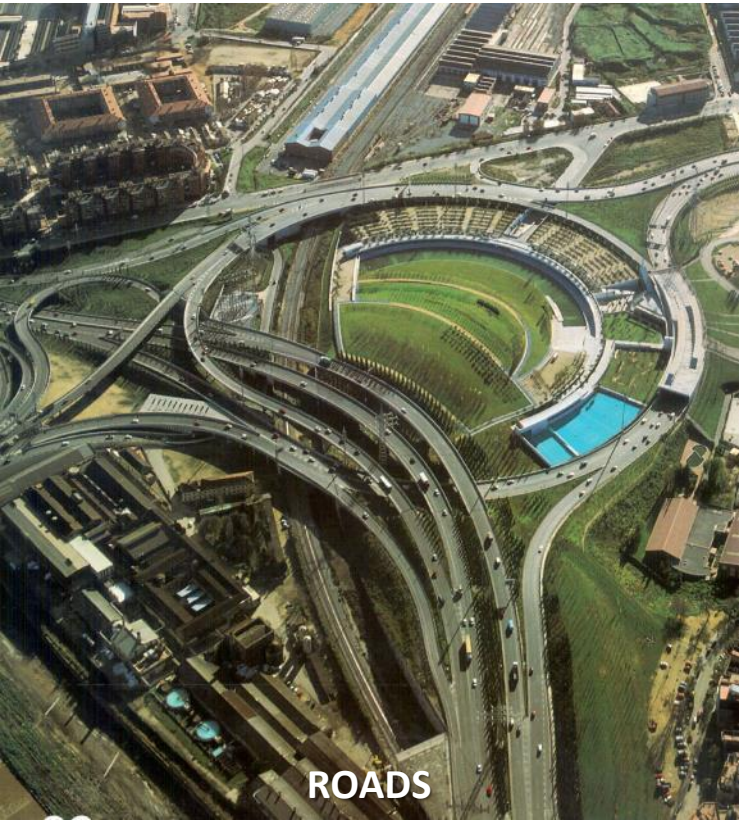
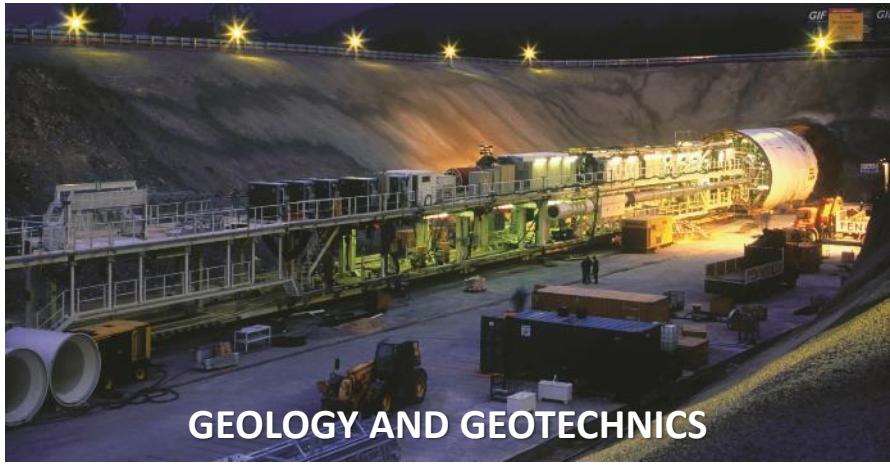
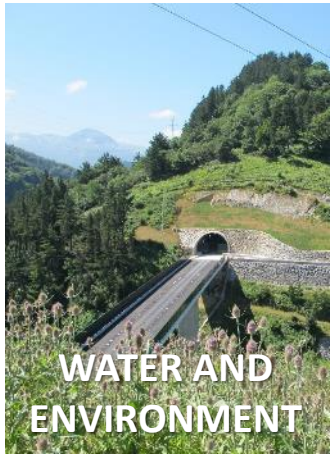
ESTEYCO: +50 years experience in engineering and architectural consulting







ESTEYCO: +25 years - evolution to energy sector

ESTEYCO: leaders in civil works design in wind energy sector

ESTEYCO: evolution to the sea, products and advanced engineering services

ELISA GBS Technology

First and only bottom-fixed solution allowing for the installation of OWT without heavy-lift vessels

WHEEL floating solution

Floating concept for unparalleled reduction in floater width, harbour draft, material usage and carbon footprint

ATOMS O&M System

Solution for large corrective maintenance of bottom-fixed or floating WTGs with no need for jack-ups

ELISA self-installing foundation, predecessor of the ATOMS technology

https://www.youtube.com/watch?v=y1HaokUSulw

- First bottom fixed substructure in the world installed with no need of heavy lift vessels.
- Based on the use of the TIM auxiliary structure which can be temporarily coupled to the substructure during its installation process.

Partners

ESTEYCO SIEMENS Gamesa RENEWABLE ENERGY ALE SMARTER, SAFER, STRONGER DEWI PLOCAN

Project funded by the European Commission through Horizon 2020

European Commission | Horizon 2020 European Union funding for Research & Innovation

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The opportunity: challenges in offshore wind O&M

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TODAY

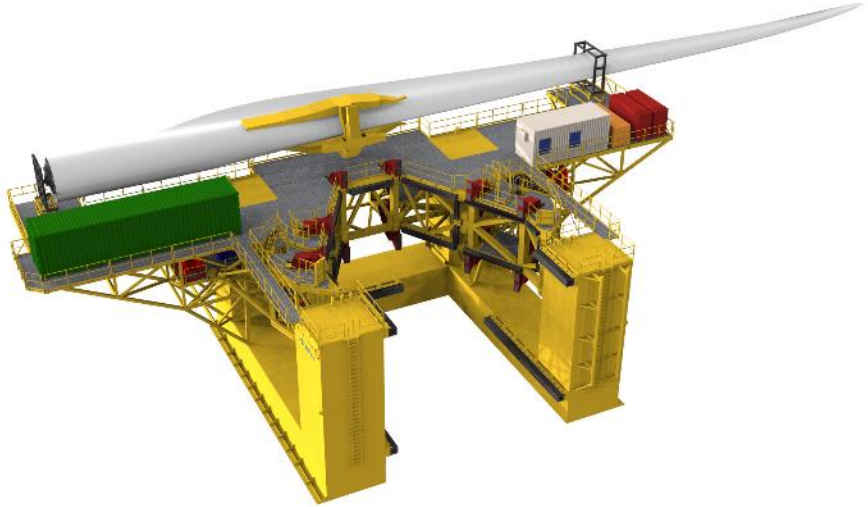
- **O&M** costs account for **~30% of the total cost** of offshore wind energy.
- Almost half of this corresponds to maintenance, and around half of maintenance costs are linked to the large means required for Large Corrective Maintenance (LCM) (exchanging a large component for which a crane is needed)
- The only commercial option for bottom fixed solutions are **jack-ups**
- There is no solution for on-site large corrective of **floating wind turbines**

NEW CHALLENGES

- **Deeper waters using larger hub heights**, thus limiting even more the availability of capable jack-up vessels and further increasing their high costs.
- More installations in **emerging offshore wind markets** → low or even inexistent availability of jack-vessels
- **Floating wind farms** will be key in tomorrow's offshore wind market and the industry is strongly demanding solutions to service such turbines on the wind farm. The possibility to disconnect floating units and tow them back to harbour means very large costs (mooring disconnection & hook-up, power cables, electrical systems…) and long periods of inactivity.

ATOMS technology has been developed to overcome these challenges and **deliver a low-cost and scalable solution for LCM of both bottom-fixed and floating offshore wind turbines**

The solution: ATOMS technology (ATtachable O&M System)

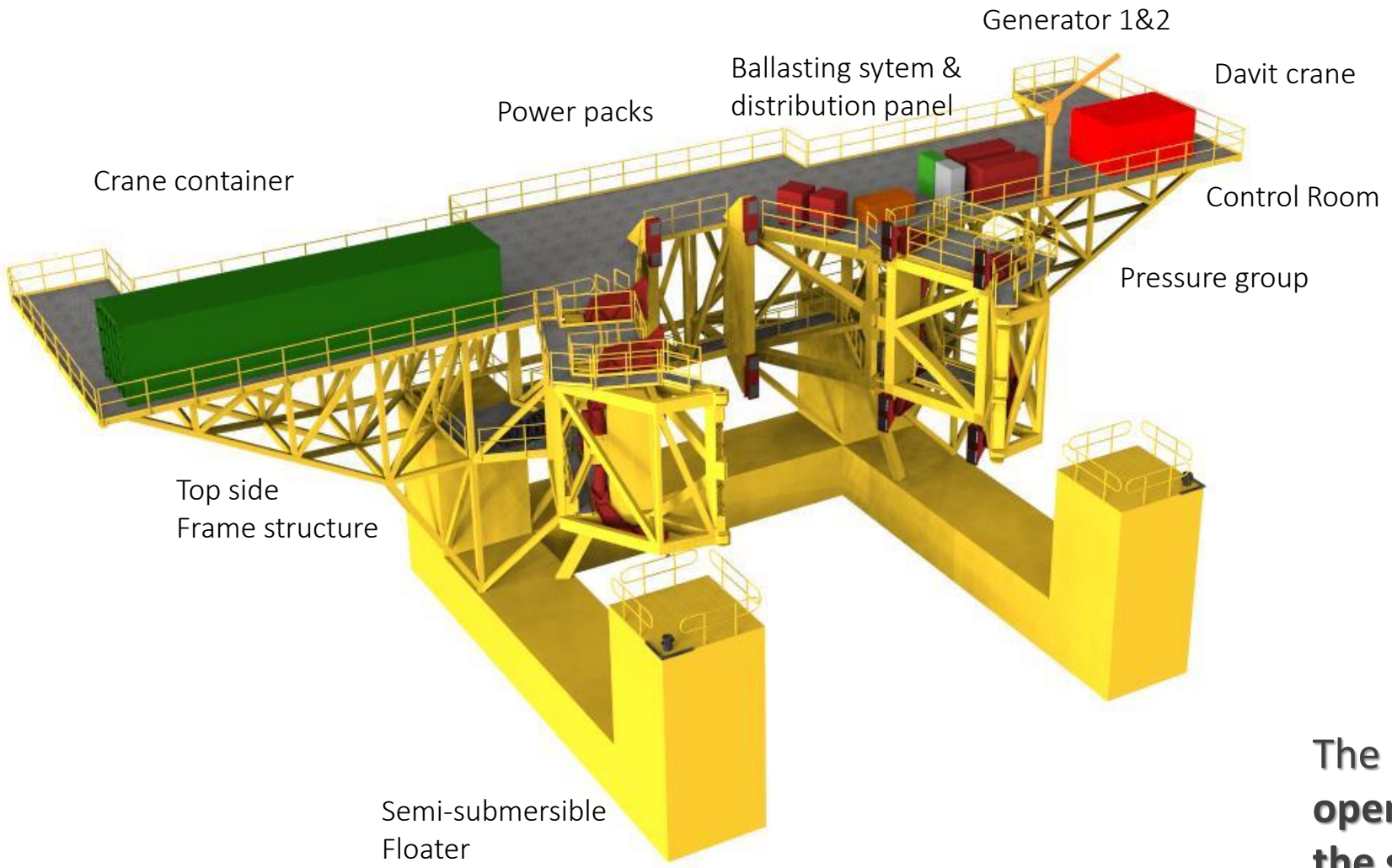


The ATOMS platform (top) uses the Coupling Ring System (CRS) already developed and proven as a tool for installation of ELISA GBS units (bottom).

The ATOMS platform can be coupled to the substructure, be it a monopile or a floater

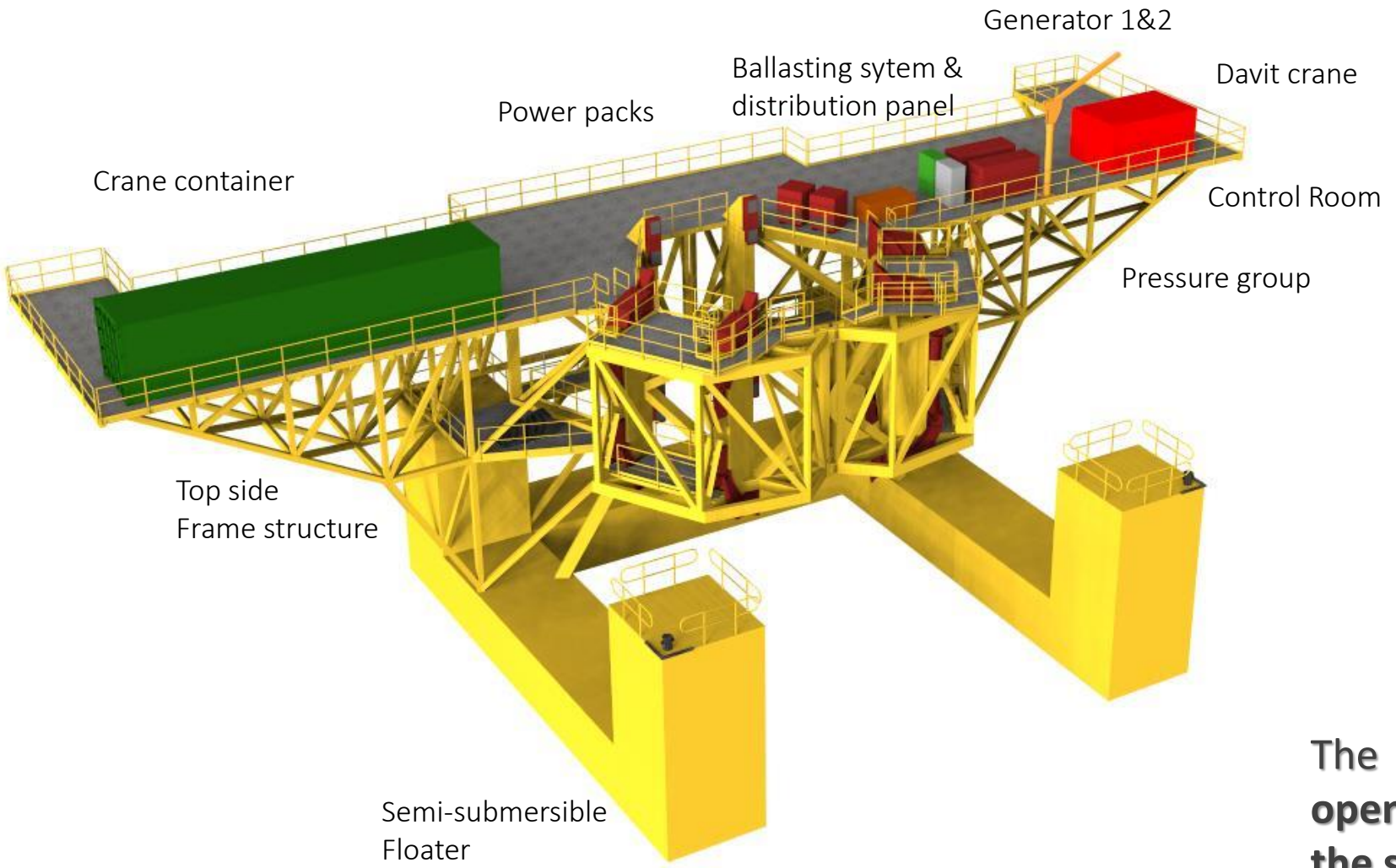
- ATOMS gives the capacity to **couple to the tower a solidary working deck** from which proven commercial **add-on cranes** can be installed and operated to service the turbine.
- ATOMS will become the first system ever to allow for large corrective operations of bottom-fixed offshore wind turbines **without heavy-lift vessels,** slashing the linked costs.
- ATOMS is based on a coupling ring system, already **proven** for a much more demanding application: the installation of ELISA GBS units.
- The specific **demonstration** of the ATOMS shall be concluded in 2024 with the support of the EU Blue Economy initiative, with a fully operative ATOMS platform that shall be tested offshore in a 5MW operating turbine

ATOMS Coupling Ring System (CRS)



The coupling ring can **open and close around the substructure**

ATOMS Coupling Ring System (CRS)



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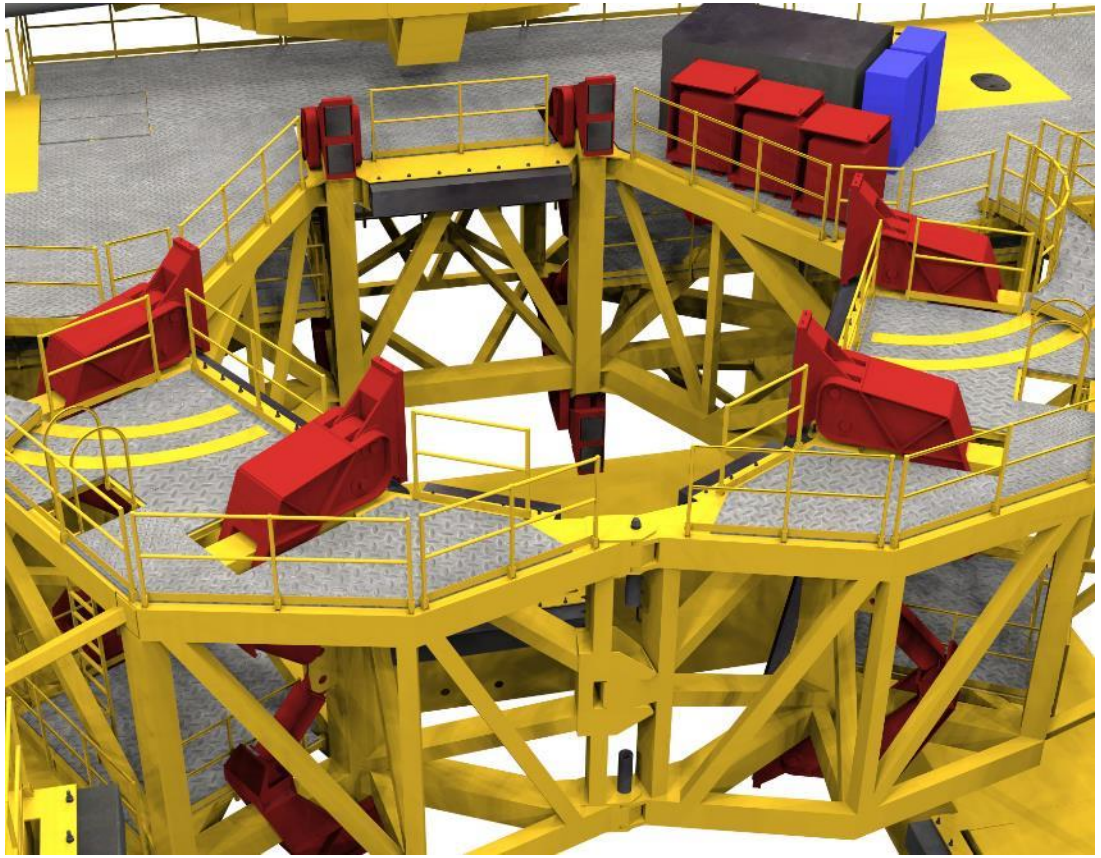

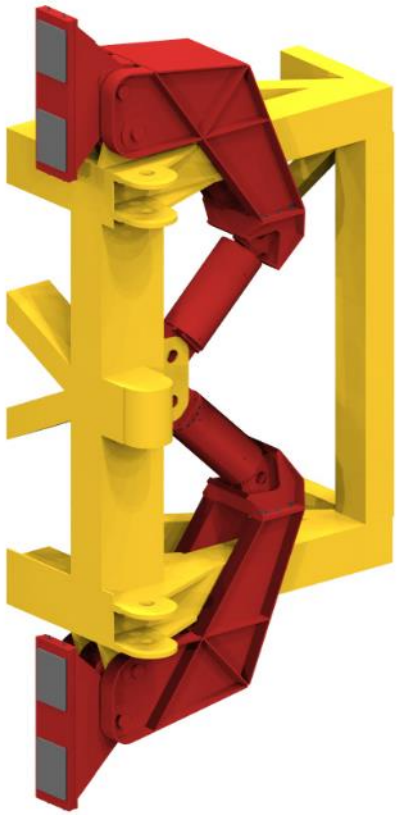

- **Active hydraulic guides** can transfer and monitor bending forces acting at coupling interface.
- **<u>High redundancy</u>** levels are provided
- The grabbing force can be regulated to **allow or impede vertical relative motions** as needed
- **Number, size and position of contact pads can be varied to <u>control/limit acting forces</u> and adapt to the local structural capacity of different substructures** (design global capacity of offshore substructures is as a rule much larger than required for the coupling)

The ATOMS platform uses the Coupling Ring System already developed and proven as a tool for installation of ELISA GBS units as shown in the TIM in pictures above where it is depicted in the ELICAN project..

ATOMS Add-on Crane

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ATOMS work sequence

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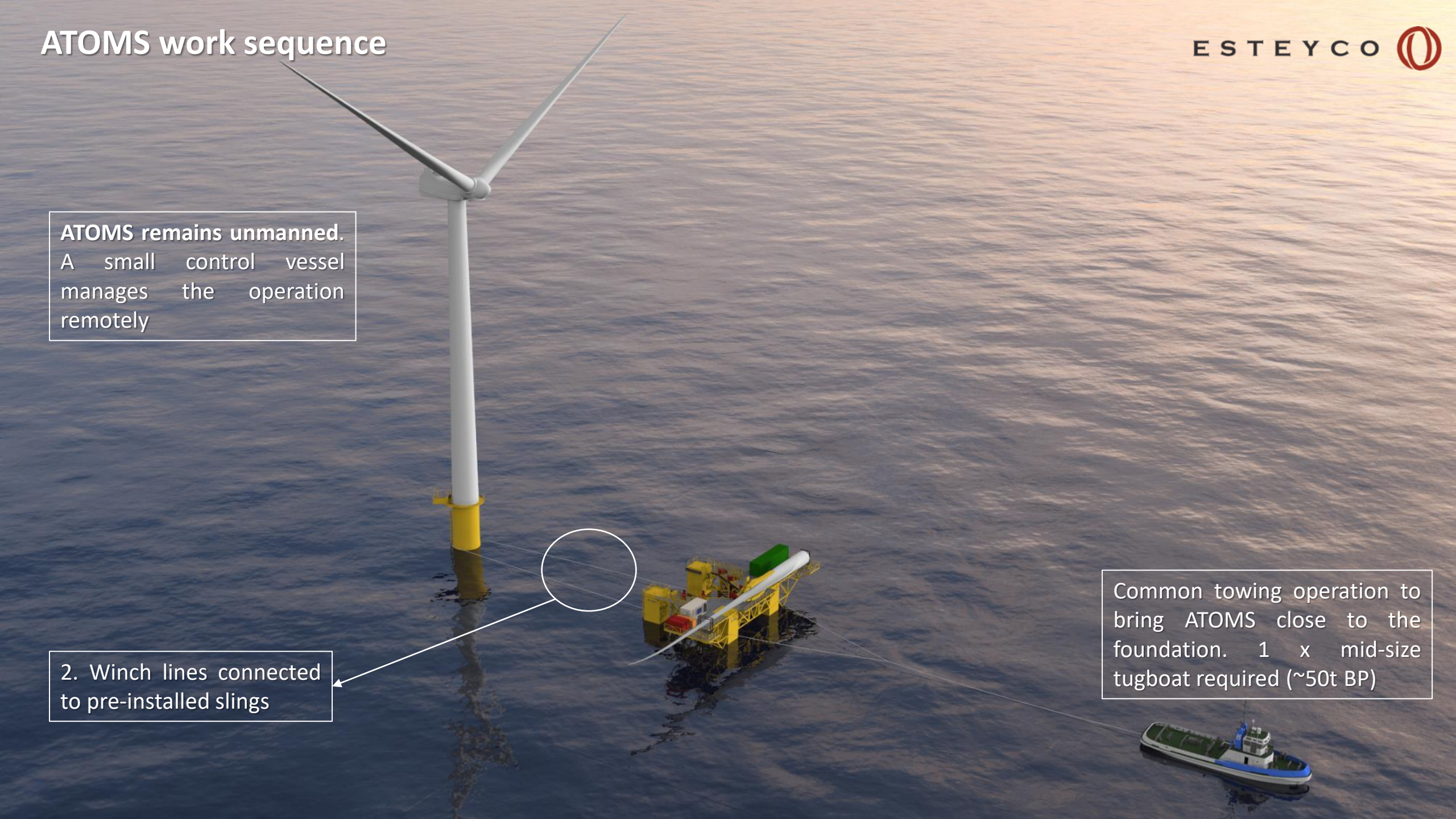
ATOMS remains unmanned. A small control vessel manages the operation remotely



2. Winch lines connected to pre-installed slings

Common towing operation to bring ATOMS close to the foundation. 1 x mid-size tugboat required (~50t BP)

ATOMS work sequence

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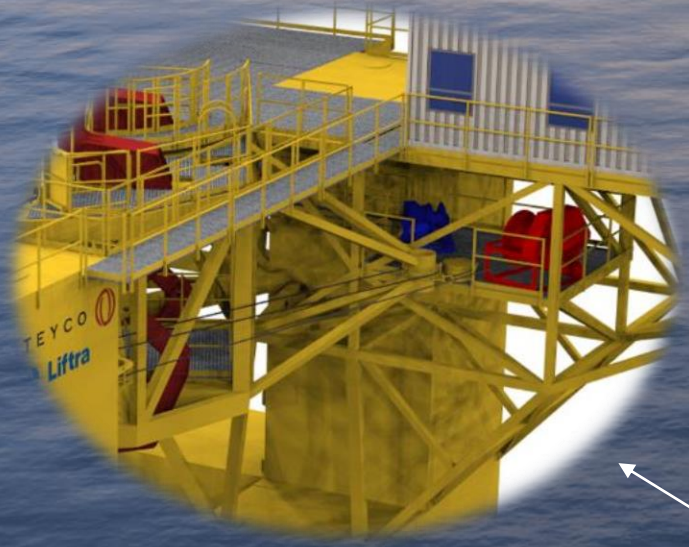
ATOMS is fitted with elastic fendering system for first approach contact.

Tugboat keeps low tension in the towline (<25t) to retain ATOMS while winding-in.

ATOMS work sequence



Once positioned the winchlines will maintain the ATOMS platform pressed against the monopile, with fenders in all contact points

Auxiliary **remote-operated winches** will be activated to close the CRS around the tower.

ATOMS work sequence

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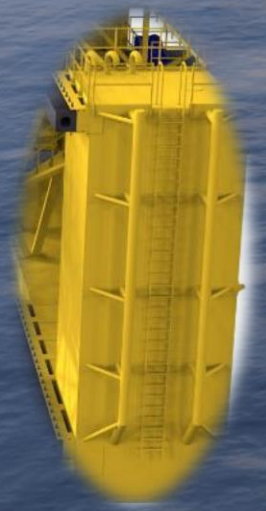


The CRS is closed around the foundation

Main hydraulic system activated to press with gripping pads and complete the coupling

ATOMS is now securely attached to the tower with no relative motions. Personnel can **get on board as a normal offshore wind access operation** with a **standard-size boat landing** designed for typical CTVs.

ATOMS work sequence

A nacelle-mounted add-on crane solution can be installed and operated from the solidary deck of the ATOMS platform

ATOMS work sequence

All major components such as gearboxes, generators or blades can be exchanged as required…

ATOMS work sequence

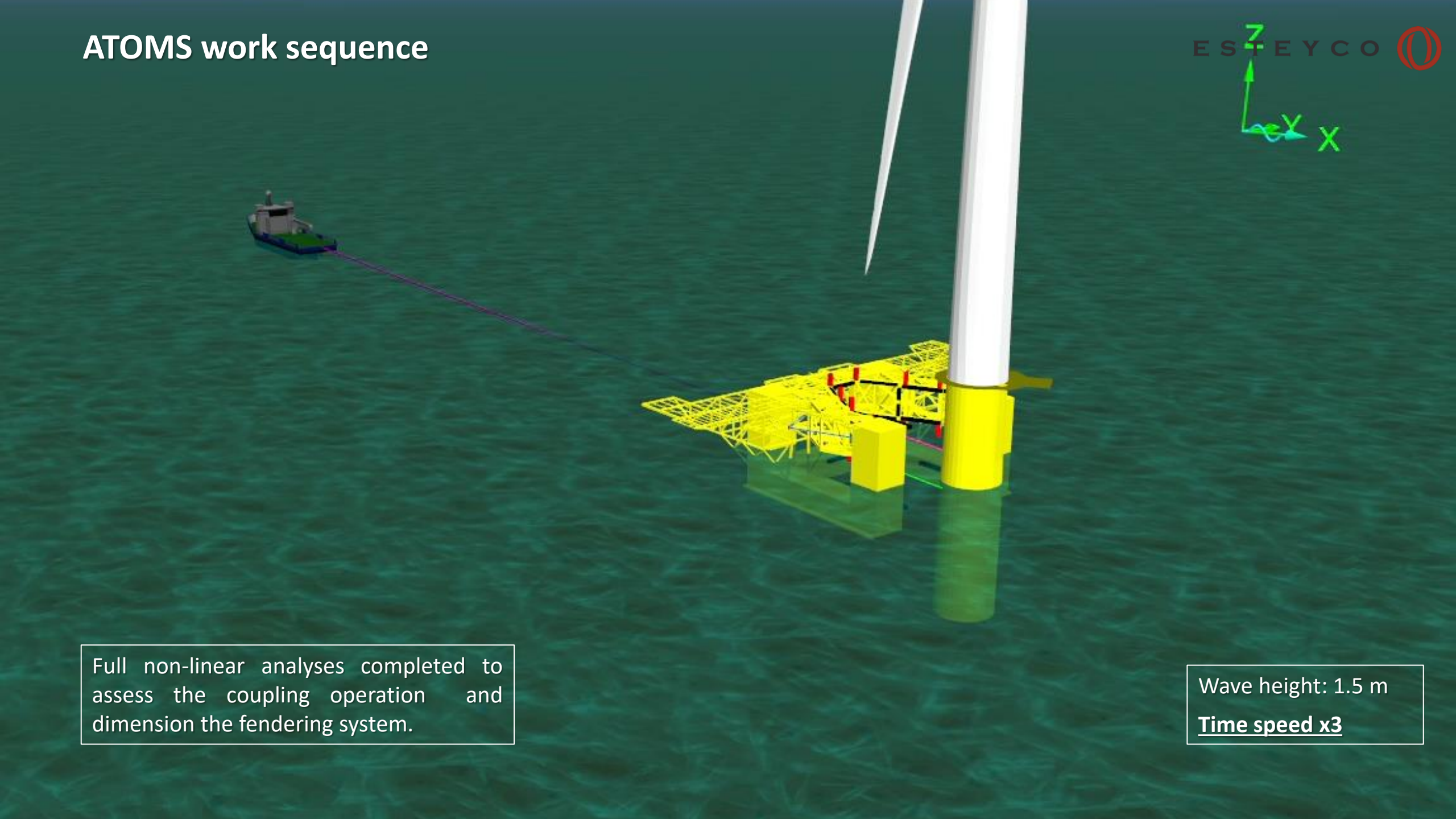
…using ATOMS as an indispensable fixed working platform where components can be lowered or lifted.

ATOMS work sequence

The coupling process is reversed, and ATOMS platform is decoupled and towed back to harbour.

Safety is the key design driver in the conception of ATOMS operability

ATOMS work sequence



Full non-linear analyses completed to assess the coupling operation and dimension the fendering system.

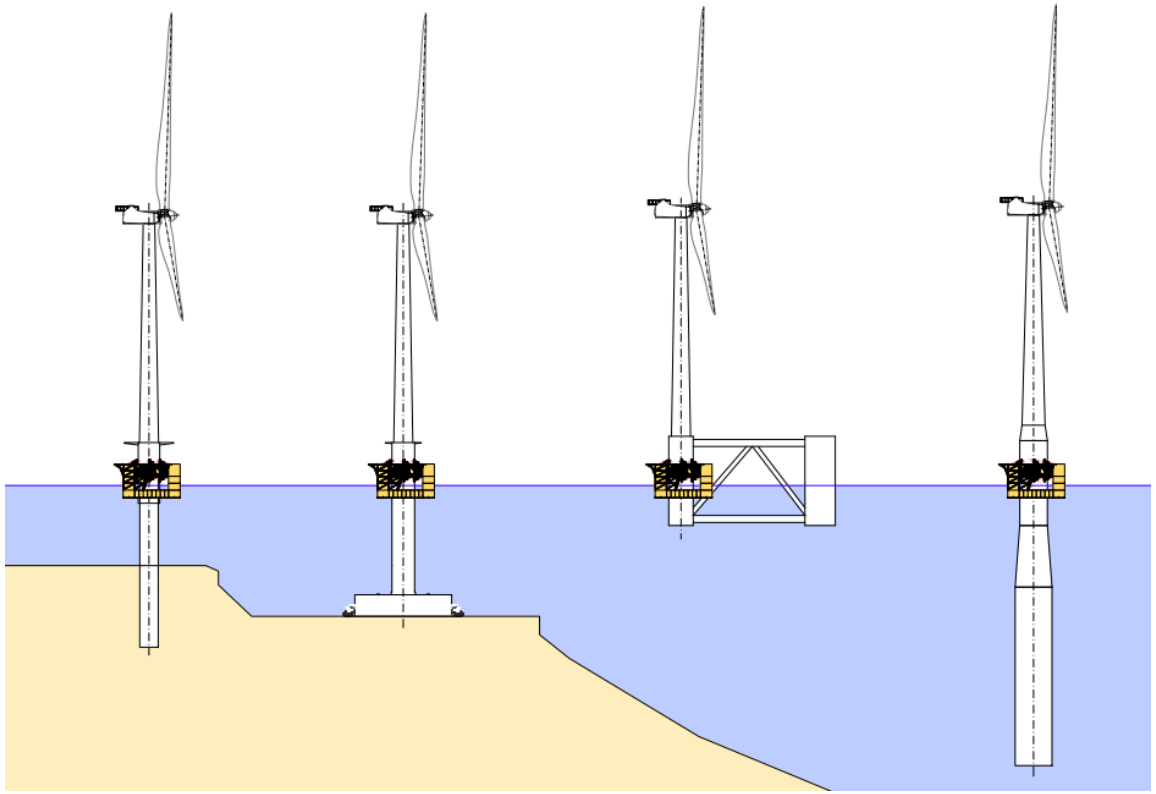
Wave height: 1.5 m

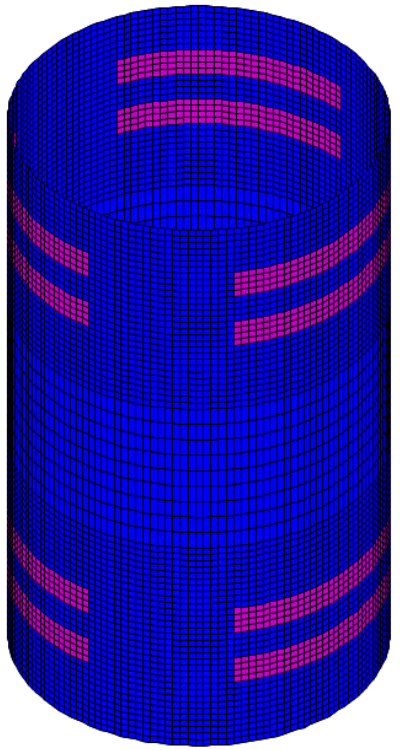
Time speed x3

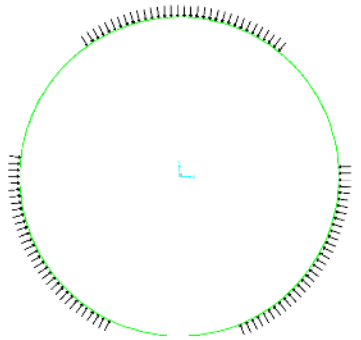
CONCLUSIONS

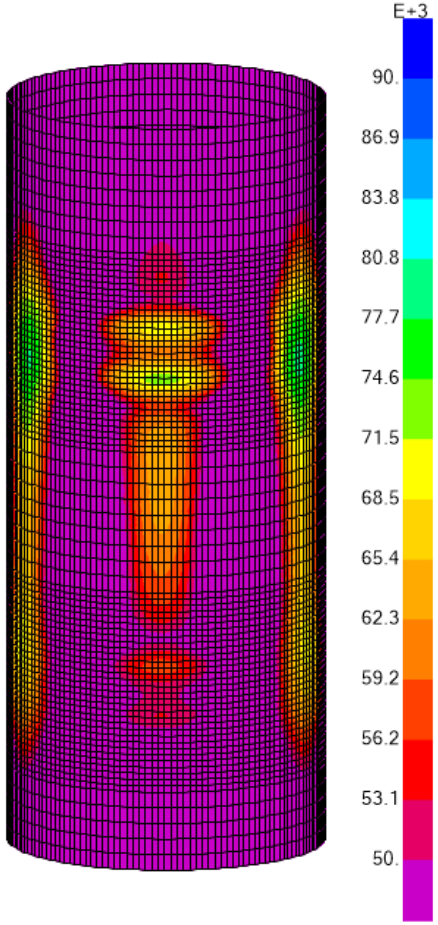
- ATOMS will become the first system ever to allow **Large Corrective Maintenance Operations with no need for a Jack-Up Vessel**
- A demonstration Project is currently ongoing, and a **fully operative pilot** of the ATOMS platform will be on the water and tested on a 5MW offshore wind turbine in **early 2024.** This pilot can service turbines in the 2-6MW range.
- ATOMS is **adaptable** to different substructures, but its first design is aimed to monopiles as the main target market today.
- **ESTEYCO** is in advanced talks with **Liftra** for the creation of a **Joint Venture** that will **bring ATOMS to the market**, offering Large Corrective Operations at **extremely competitive cost as compared to current market**.
- ATOMS technology is also applicable to many floating wind platforms and will thus become the first operative system that can allow **on-site large corrective maintenance for floating wind turbines**
- ATOMS can provide **cost control & logistical de-risking**: rely only on conventional and ready-available tugboats, key in emerging markets with low or no availability for jack-ups.
- ATOMS can be specifically built and assigned to serve a given region or WF cluster to remain available 24/7: **quick response to reduce downtimes** and energy loss in damaged OWTs

ATOMS Applicability









Monopile stress distribution example

- ❑ The CRS (ring) is **adaptable to most of the market foundations,** and most of the coming floating ones.
- ❑ Gripping pads can be modified and/or supplemented to adapt to different requirements, **controlling stress levels on the structure**.
- ❑ **Scalable** for attending coming larger WTG
- ❑ Soft fender system to smoothen the coupling operation.
- ❑ **Example monopile assessed showing good stress distribution and low stress levels**

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Liftra

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PROMEM - DESARROLLO Y ENSAYO DE NUEVOS PROCESOS Y MEDIOS NAVALES PARA EL MANTENIMIENTO DE GRAN CORRECTIVO DE AEROGENERADORES OFFSHORE FIJOS Y FLOTANTES

1 Adaptar la tecnología ATOMS sobre cimentaciones fijas de tipo monopilote.

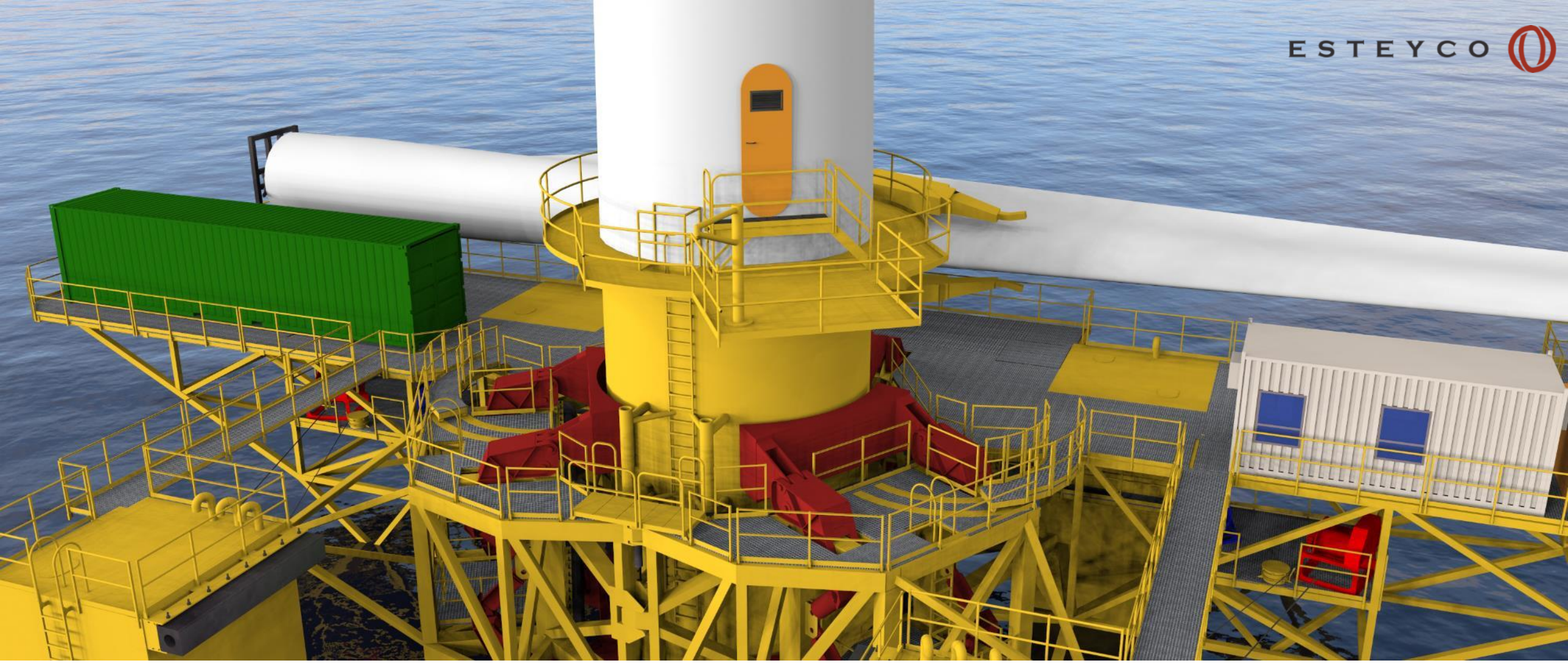
- TESTEO DE EQUIPOS Y COMPONENTES
- DEMOSTRACIÓN A ESCALA REAL DE EQUIPOS Y COMPONENTES

2 Adaptar la tecnología ATOMS sobre subestructuras flotantes para aerogeneradores.

- DISEÑO DE LA PLATAFORMA
- ENSAYO A ESCALA REDUCIDA

3 Progreso de tecnología de grúas add-on para monopilotes

4 Progreso de tecnología de grúas add-on para aerogeneradores flotantes



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ATOMS

Auxiliary Towable Operation and Maintenance System for offshore wind turbines