

## II Jornada sobre el Estado Actual y Perspectivas de las Energías Renovables Marinas en España



# Offshore Wind Generator Projects

Rodrigo Pérez Fernández  
SENER, Ingeniería y Sistemas

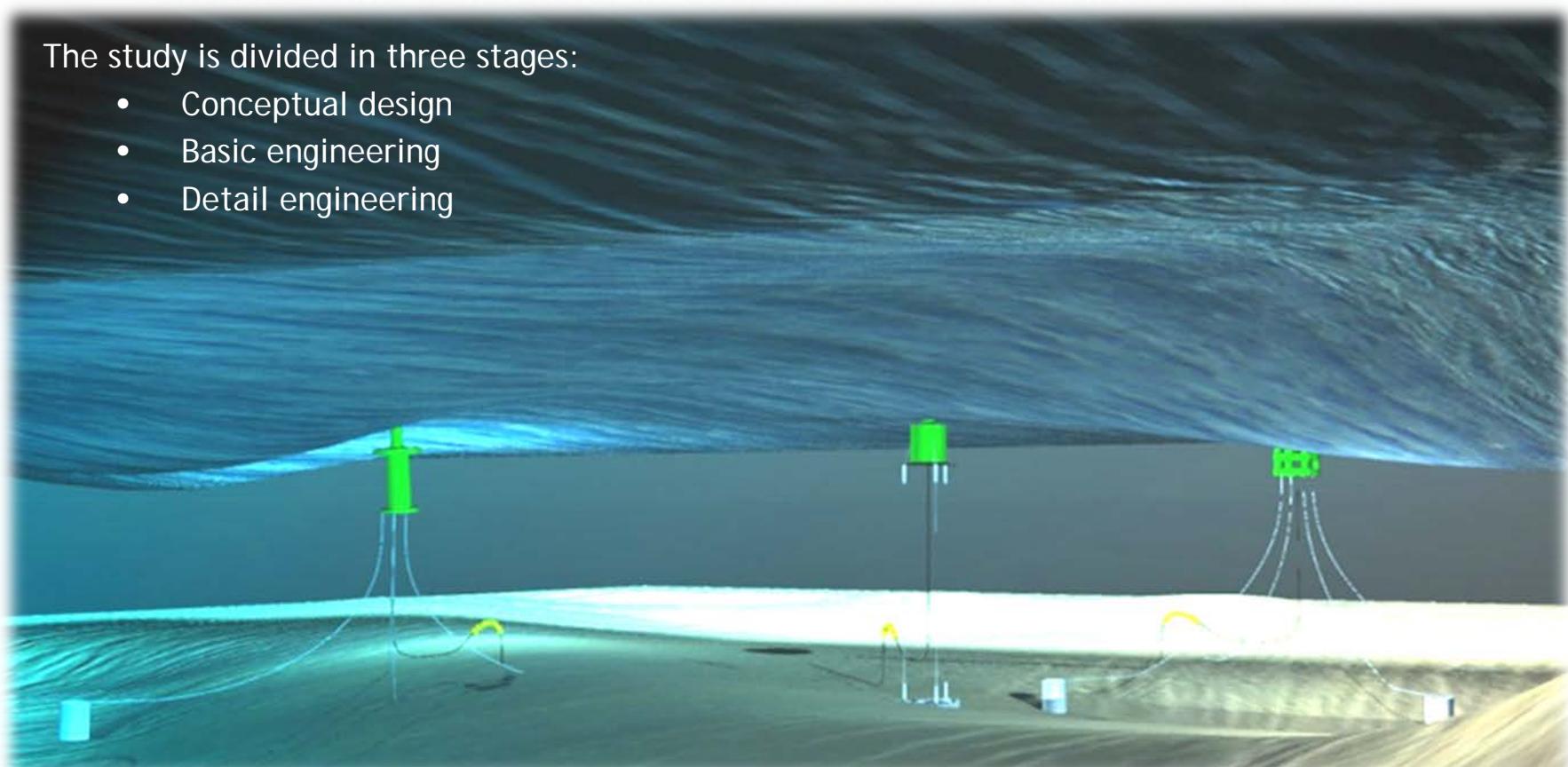
- During the last years SENER has developed new projects in relation with renewable energies.
- Including the following Marine Energy Recovery projects:
  - Emerge Project
  - Ocean Lider Project
  - Mtorres Project
  - OWA Contest
  - BIMEP Project
- SENER has had active part in the design of floating supports, anchoring and mooring equipment and supporting vessels for Offshore wind farms.

## Project: EMERGE Offshore wind turbines

Emerge project is focused in the study of supporting structures for offshore wind generators, in deeper seas than considered up to now >50 (m). This leads to new studies of the structures and their behavior.

The study is divided in three stages:

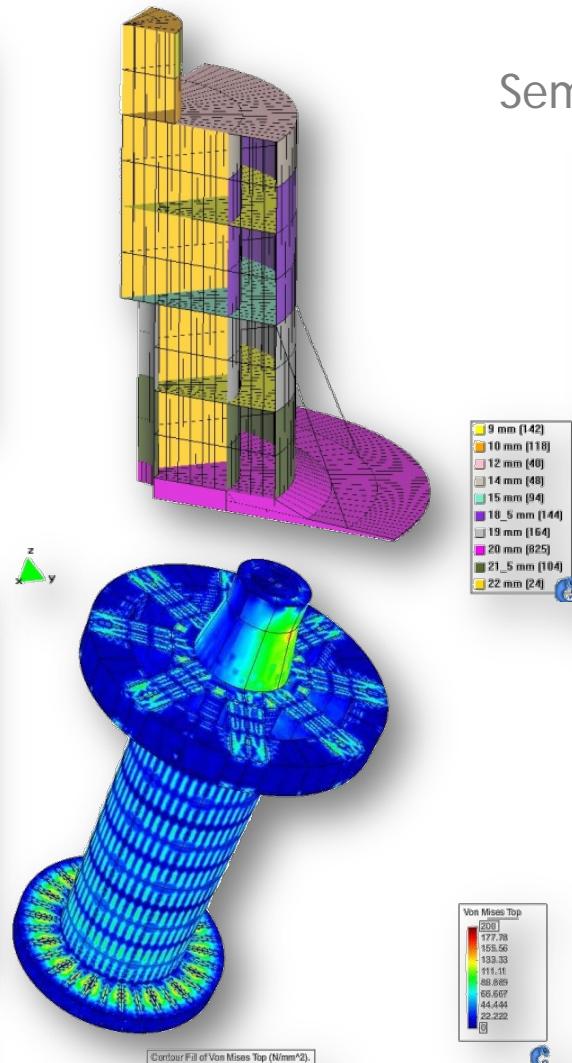
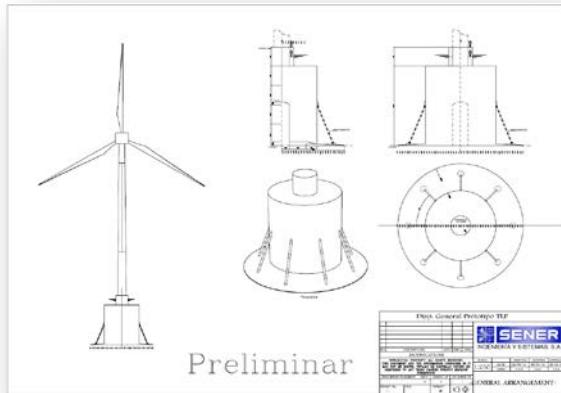
- Conceptual design
- Basic engineering
- Detail engineering



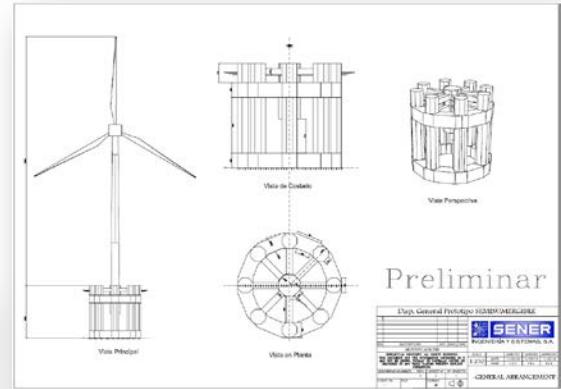
## Conceptual Design:

- In this stage the following works were developed:
  - State of the Art
  - Design basis
  - Study of three possible location
  - Conceptual design of three alternatives (TLP, Spar & Semisubmersible)
  - Technical and economical evaluation
- For each alternative it has been studied:
  - Preliminary stability (towing and operation)
  - Preliminary scantling
  - Budget

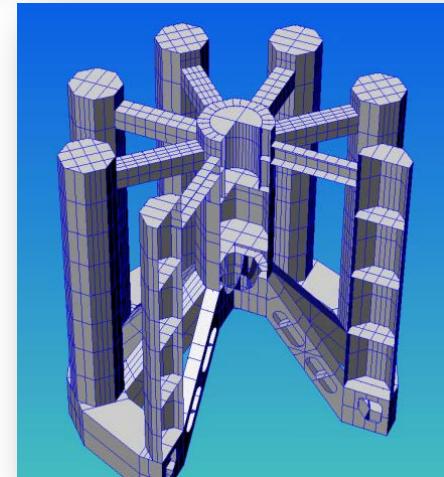
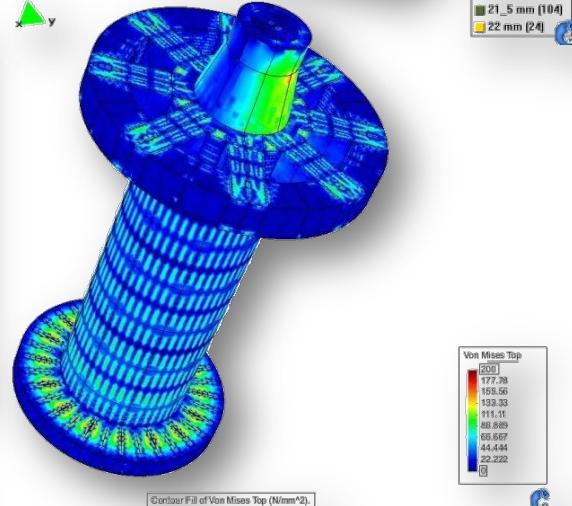
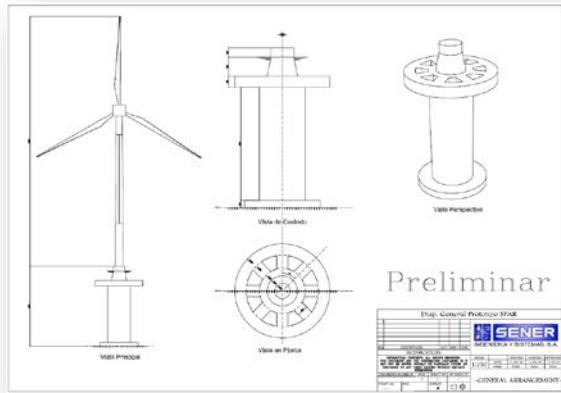
## TLP type structure



## Semisubmersible type structure

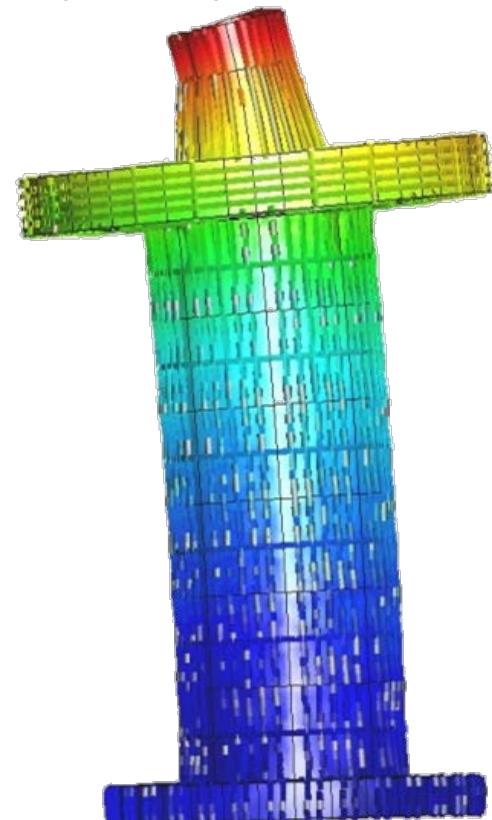
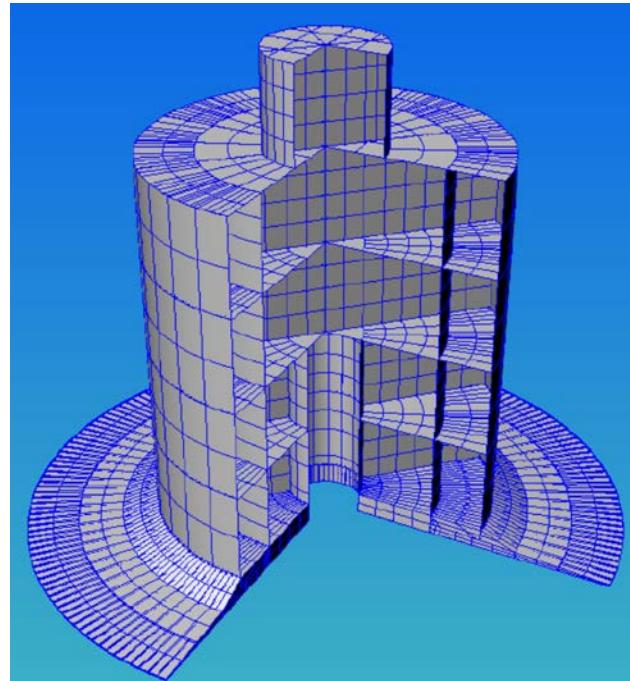
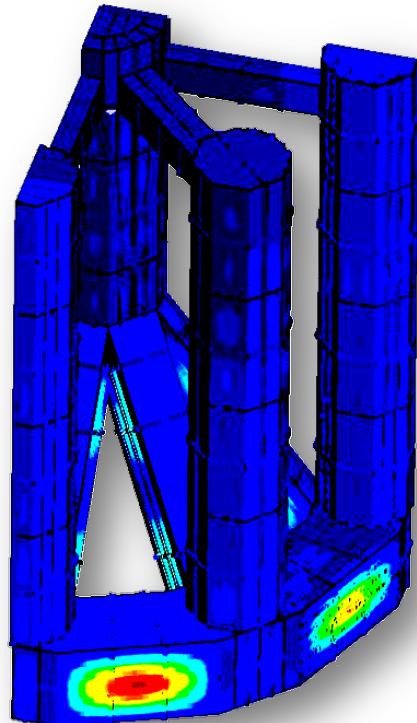


## SPAR type structure



## Basic and Detail Engineering:

Once the data from the previous stages are analyzed and the location has been decided, one of the alternatives will be selected to carry out the Basic & Detail Engineering, specially the structure and the anchoring system studies. Additionally towing tank test will be carried out to check the behavior in different waves and wind conditions, modifying as necessary to obtain operative platforms.



# Project: OCEAN LIDER Offshore wind farm

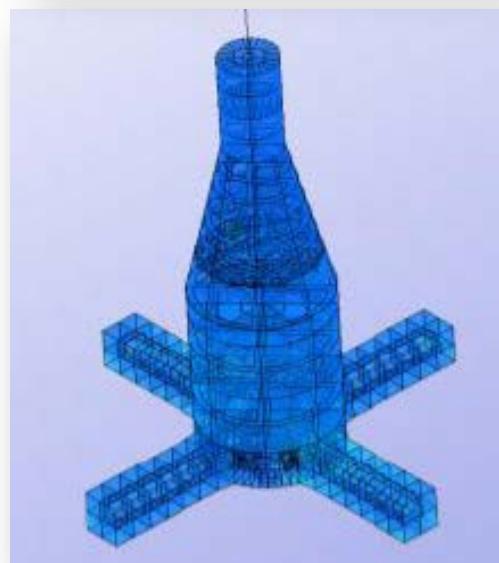
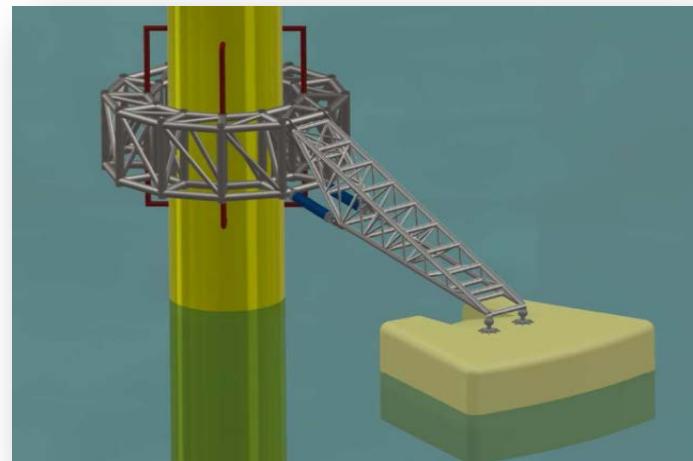
- Consortium of companies with high research capacity.
- Main objective: Research and Creation of the necessary technologies for integrated facilities for the use of renewable energy (wave, stream, wind and hybrid systems).



The project is divided into six different activities (AI, AII....AVI), SENER takes part in two of these activities, **AII** and **AV**:

### AII. Basic Design of different mix-generation devices

- Stability, structural and longitudinal resistance studies of three mix-generation devices, TLP, SPAR and Semisubmersible.
- Finite elements model for structure analysis.
- Selection of a device to be studied at the towing tank.

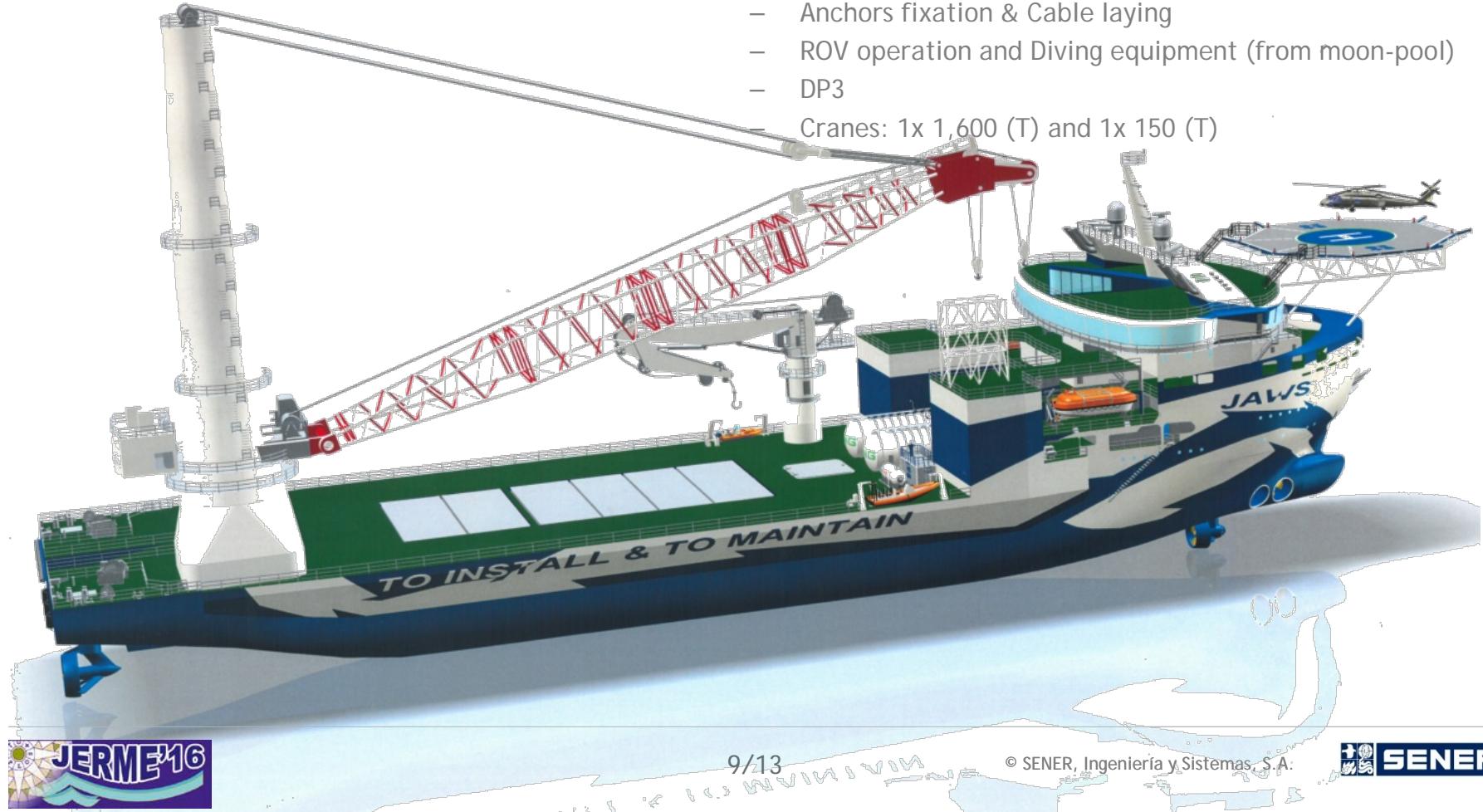


## AV. Technology research and design of installation and maintenance ship.

- Analysis of the critical design factors

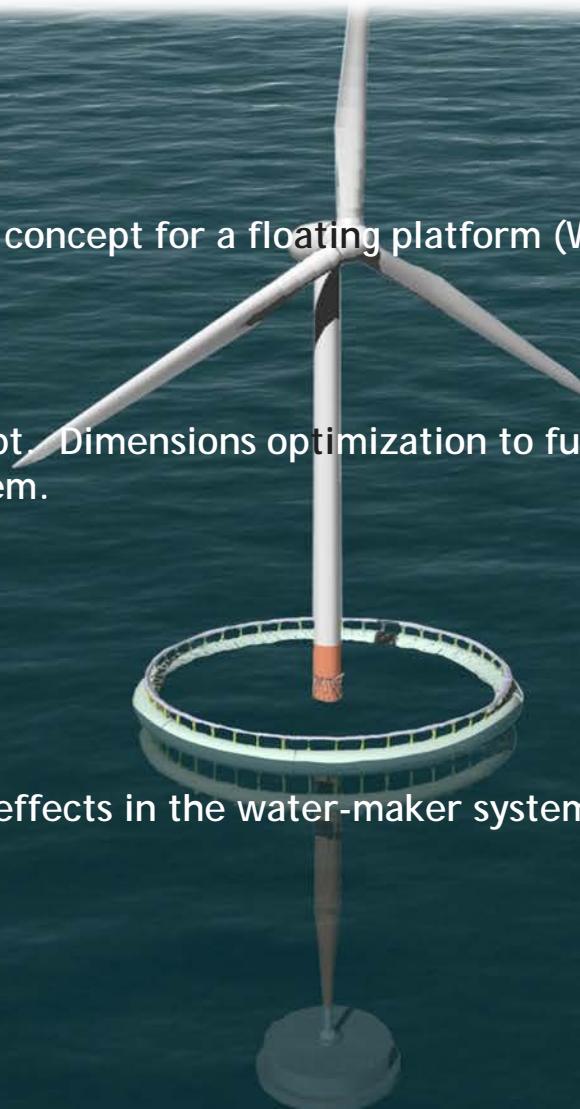
- Vessels characteristics:

- Towing & Helideck
- Equipment transportation, maintenance, installation
- Anchors fixation & Cable laying
- ROV operation and Diving equipment (from moon-pool)
- DP3
- Cranes: 1x 1,600 (T) and 1x 150 (T)



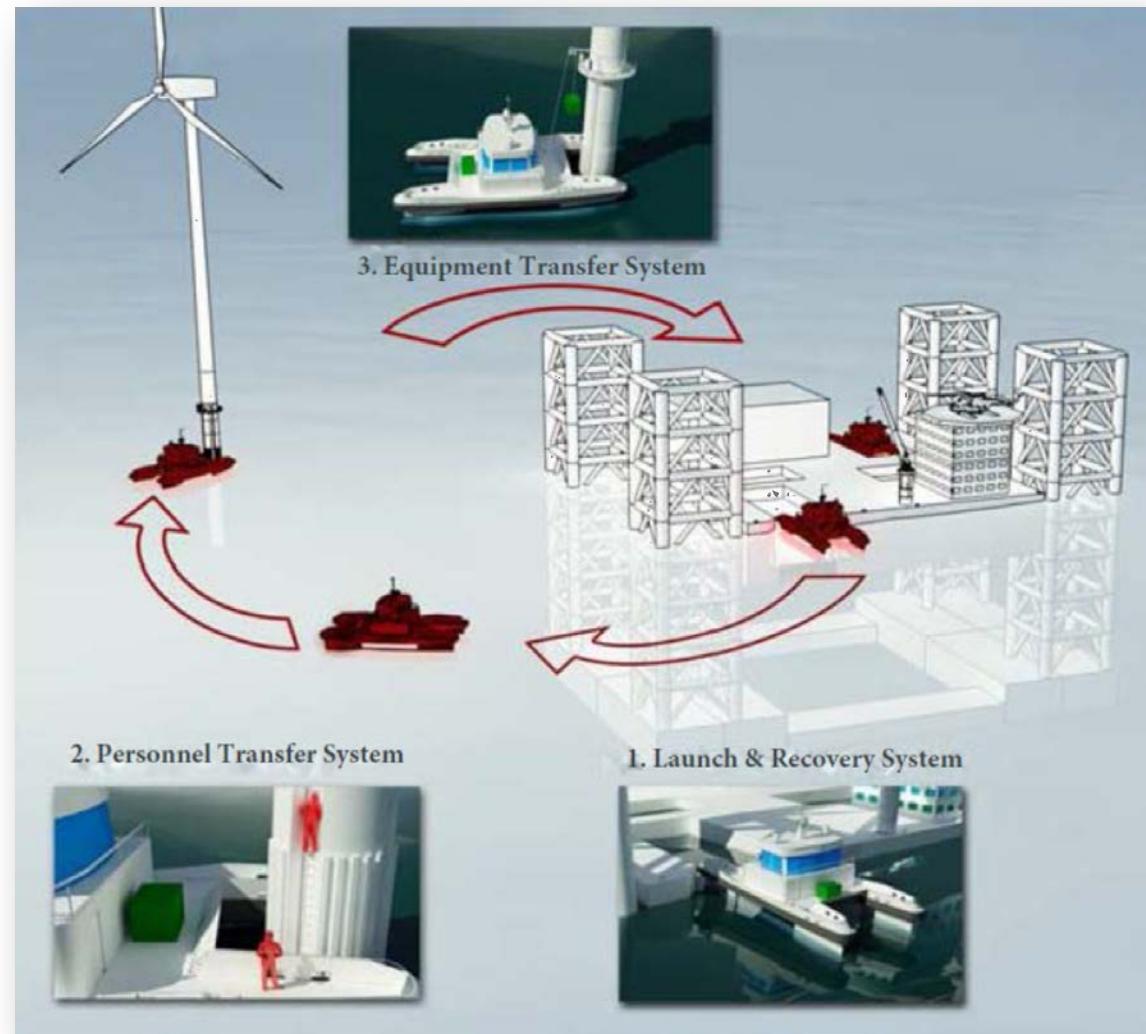
## Project: Mtorres

- Development of Mtorres concept for a floating platform (Wind Turbine & Water-maker System).
- Based on Mtorres concept. Dimensions optimization to fulfill the design requirements and obtain a stable system.
- System's stability study.
- Study of the movement effects in the water-maker system (Towing Tank).
- Basic Design



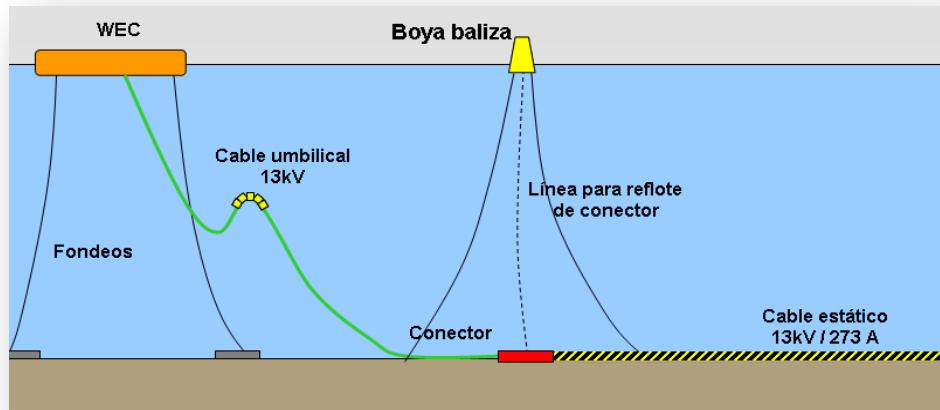
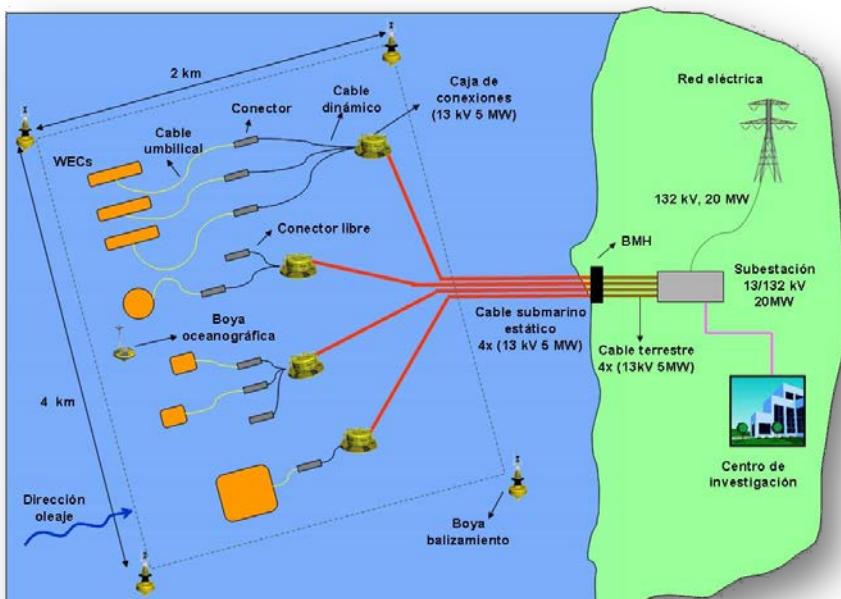
## OWA contest: OFFSHORE WIND ACCELERATOR

- Offshore Wind Accelerator.
- Conceptual design for CARBON TRUST public contest.
- SENER takes part in the contest of three possible developments:
  - Launch and Recovery System
  - Personnel Transfer System
  - Equipment Transfer System



# Project: BIMEP Wave Energy Converters

BIMEP Platform (**B**iscay **M**arine **E**nergy **P**latform) is an infrastructure for testing and demonstrating open-sea wave energy converters with an installed capacity of 20 (MW), distributed across four off shore connection points, with 5 (MW) each. It will include an electric substation on land, to which each converter will be connected, that will be used to evacuate power.



## SENER services:

- Drawing up or supervising technical and administrative specifications
- Assessing tenders and proposals in order to select the winner
- Supervising the supplies to certify that they comply with the specifications of each element of the infrastructure
- Supervising the progress of the works on each one of the four main contracts
- Managing the project and coordinating the companies awarded contracts as regards building and installing the various infrastructure elements.

Thank you for your attention

