

On-line workshop:

Avanzamento Delle Energie Rinnovabili Marine: Strategia Europea, Attività In Corso In Italia, e Aggiornamento Del Piano D'azione Nazionale Del Cluster-Big

24-25 Febbraio 2022

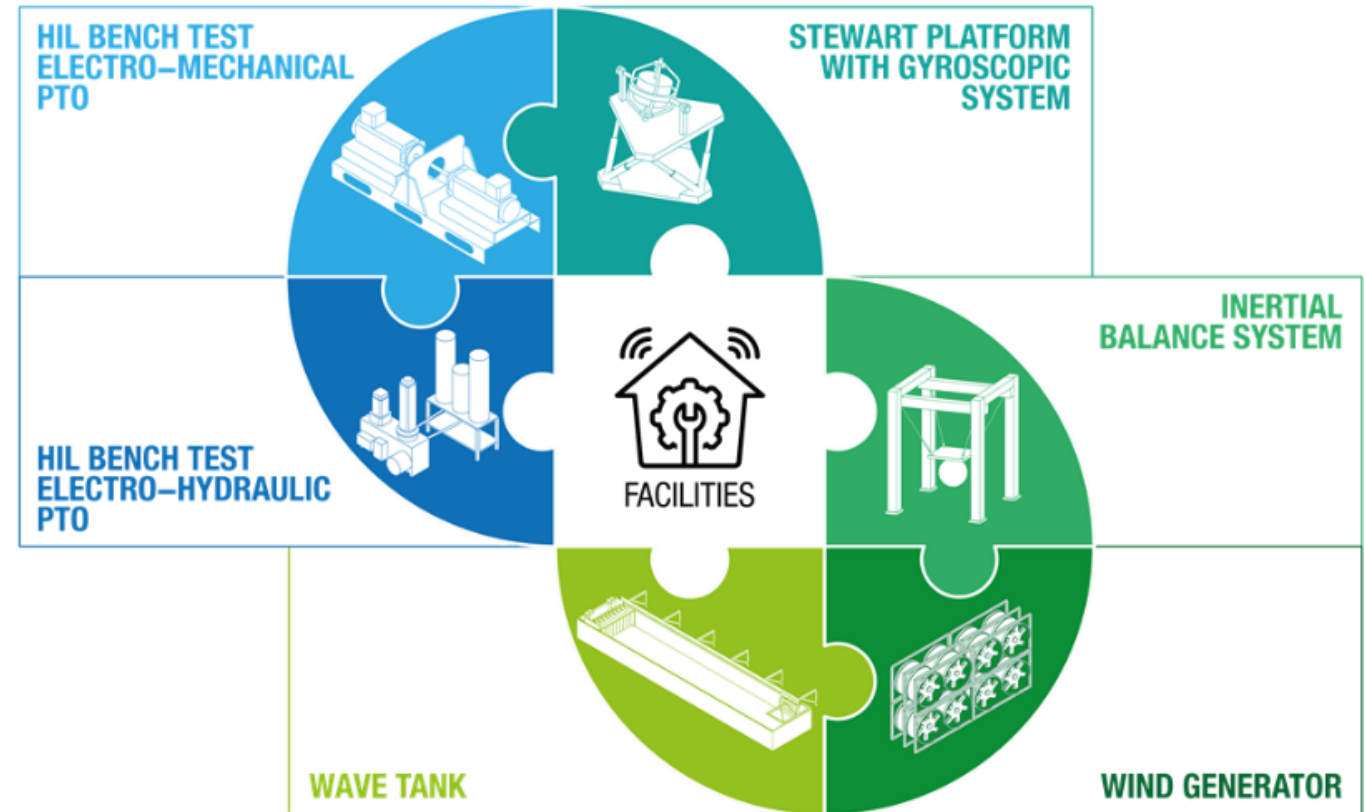
Research laboratories and infrastructure of MORE LAB

Mauro Bonfanti, Politecnico di Torino

On-line workshop, 24-25 Febbraio 2022

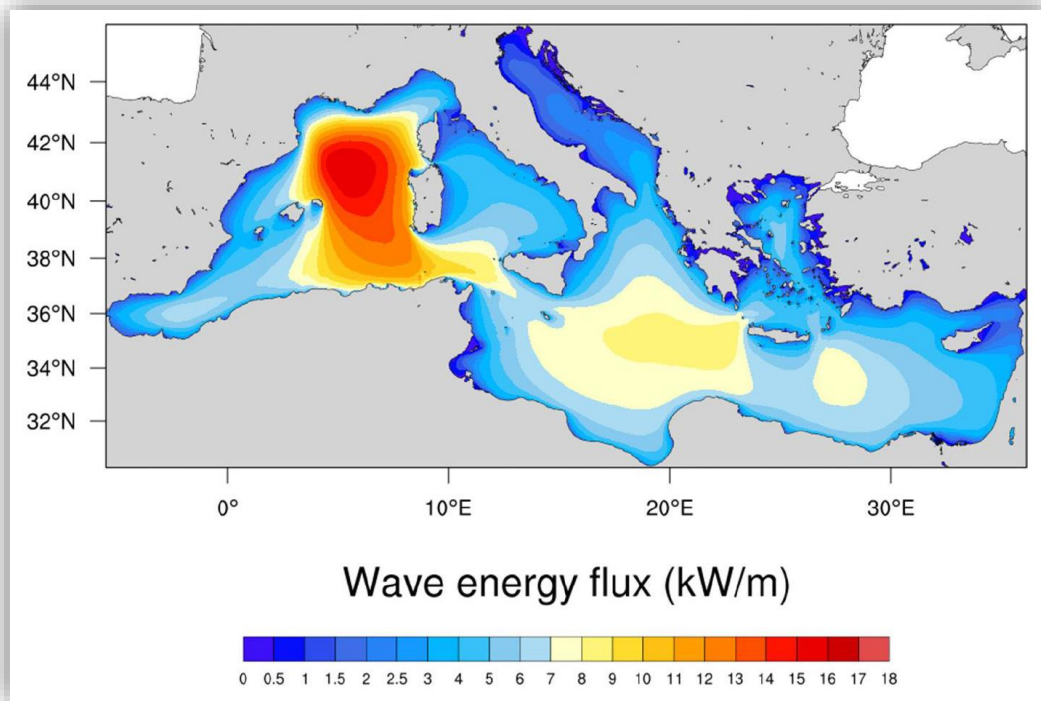
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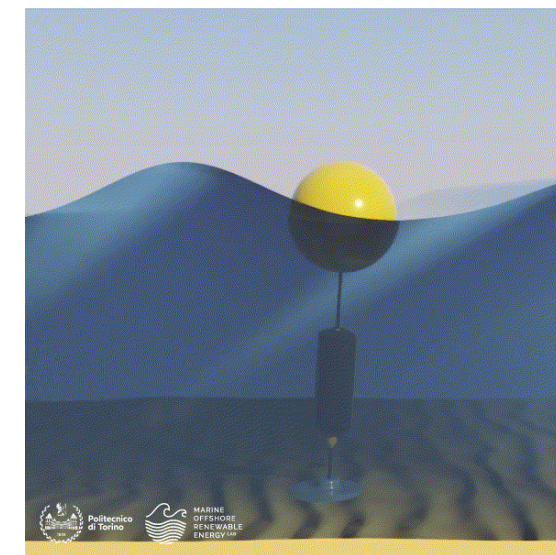
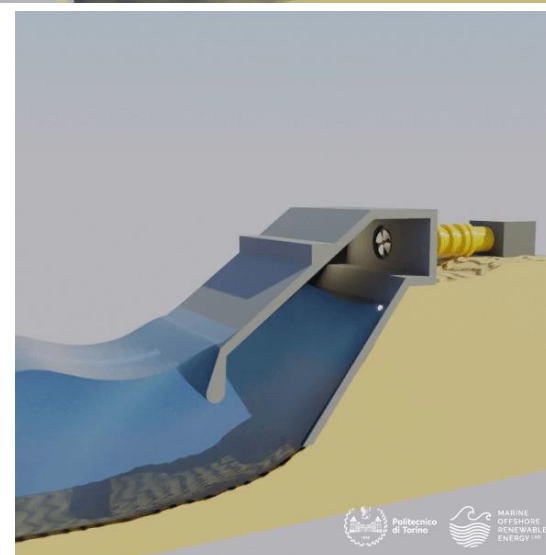
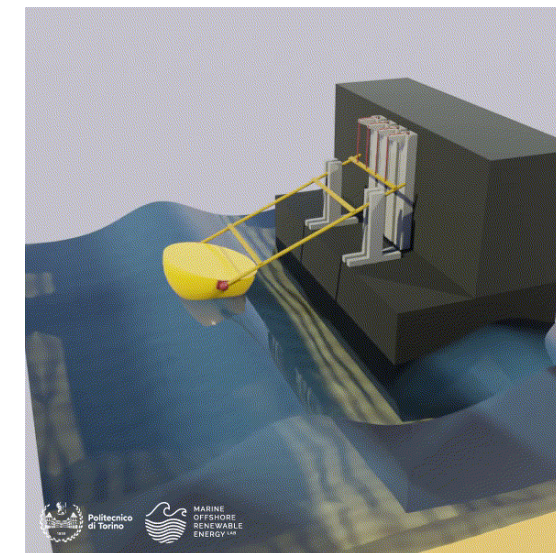
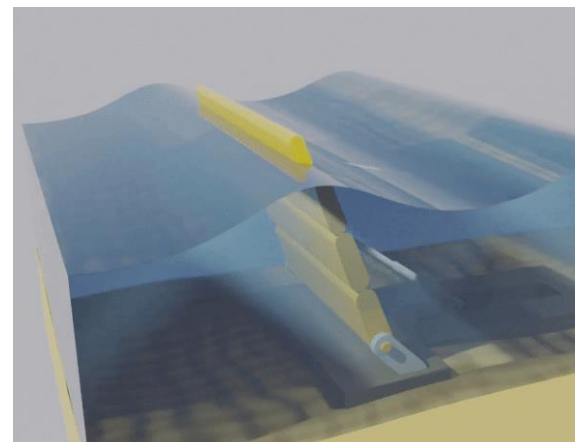
Wave Energy Context

Wave energy resource



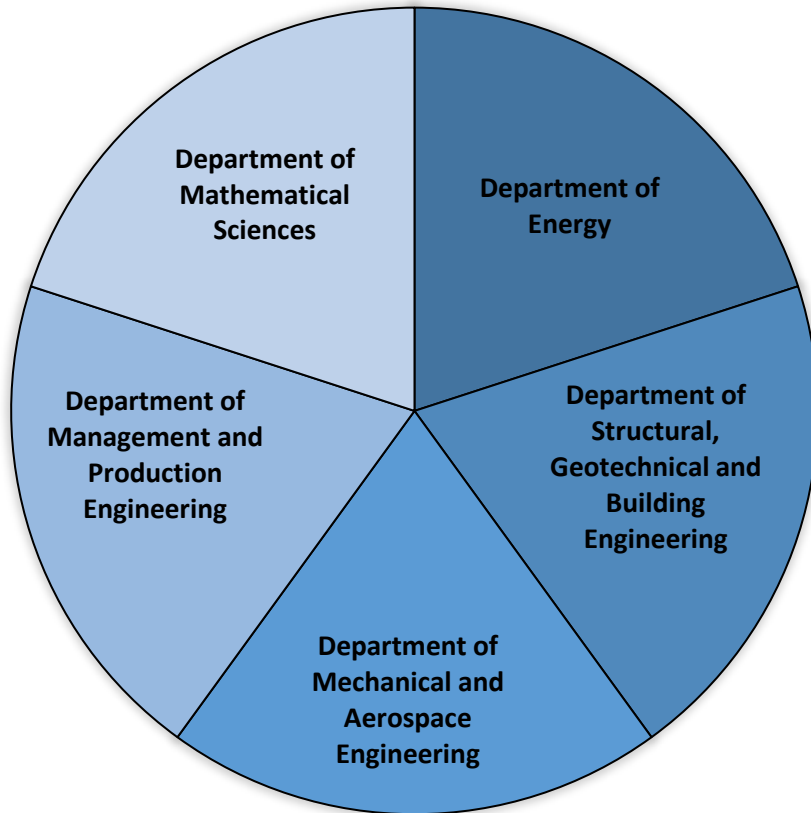
The global ocean wave power potential is approximated to be up to 10 TW, and the annual ocean wave energy is approximated to be up to 93,000 TWh [1]

Wave Energy Converters (WECs)



[1] Melikoglu, M. Current status and future of ocean energy sources: A global review.

The Marine Offshore Renewable Energy (MORE) Lab



Politecnico di Torino: more than 50 scholars (20 at MOREnergy Lab), including professors, researchers, PhD students and fellows

The MORE Lab is a research centre at Politecnico di Torino, specialised in offshore renewables.

It owns a wide range of capabilities that exploits for applied research. Research activities are aimed at technology transfer.



Milestones:

- **2006:** research activity in offshore renewable energy begins.
- **2010:** university spin-off Wave For Energy established
- **2016:** collaboration with Eni on wave power starts
- To date:

17 PhD students

> 20 research assistants

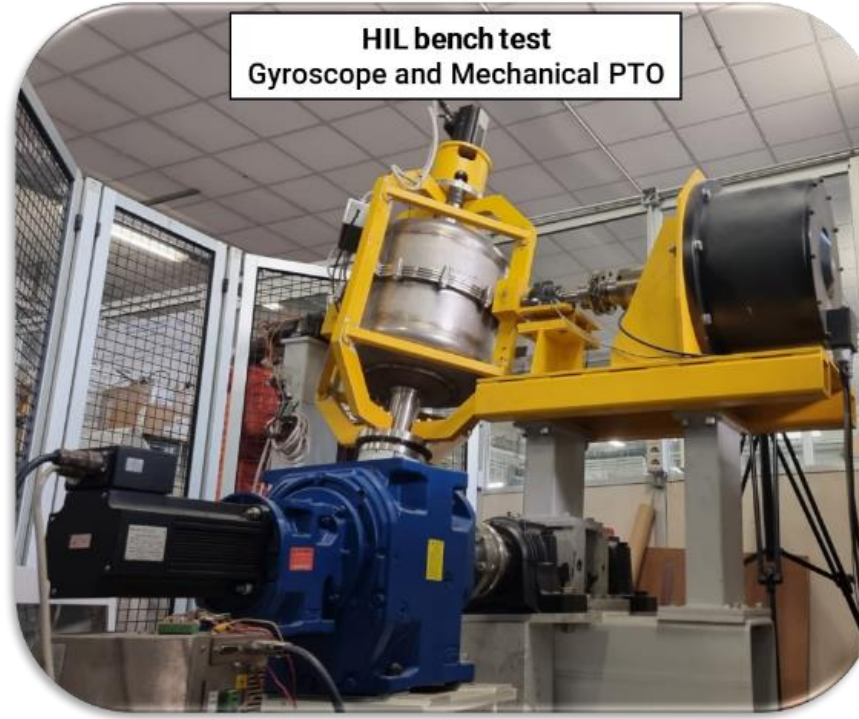
> 200 graduation theses

Laboratories and equipments



(a)

**Hardware In the Loop
(HIL) bench for
hydraulic PTO**



(b)

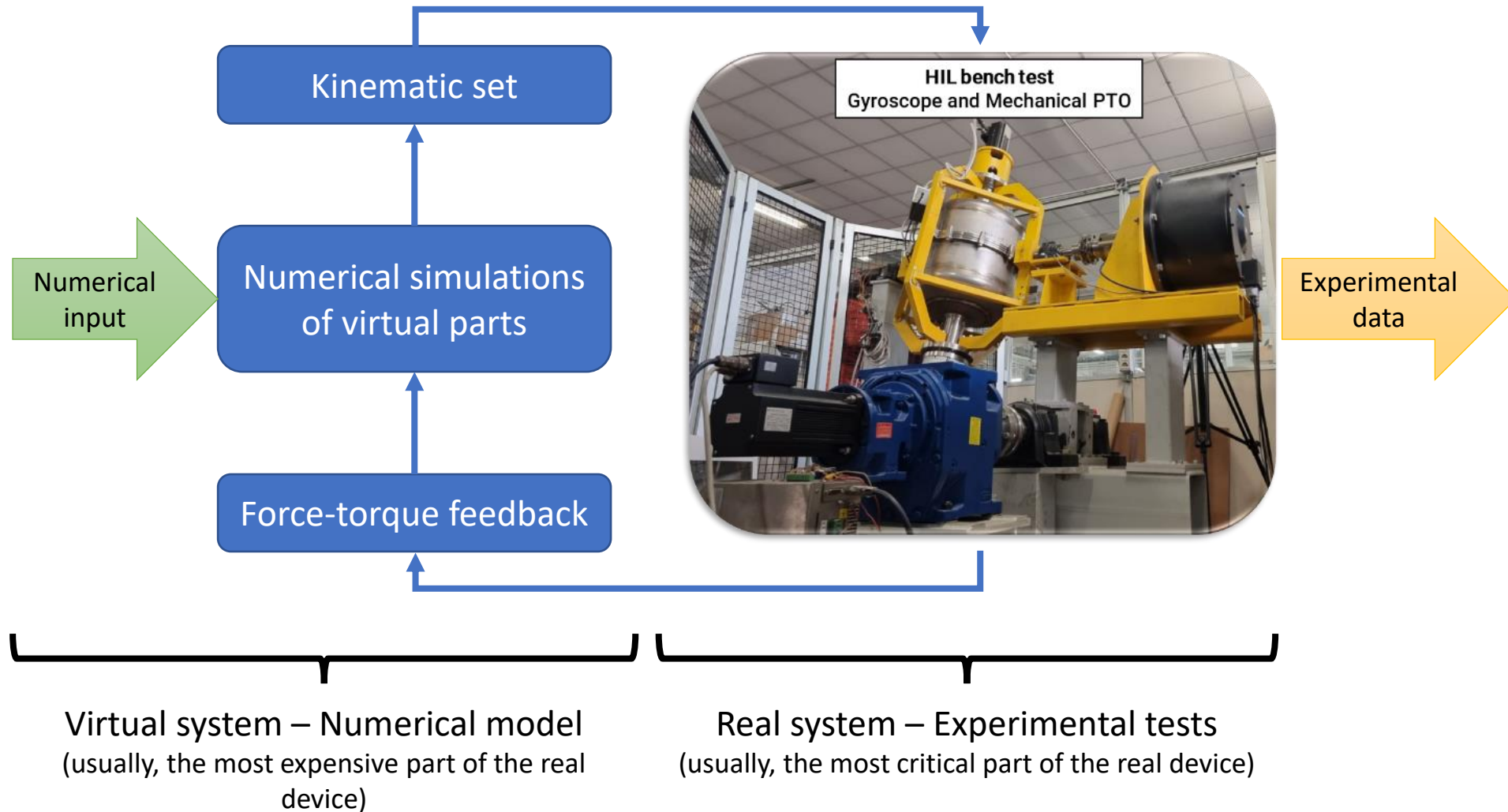
**Hardware In the Loop (HIL) bench
for gyroscopic system**



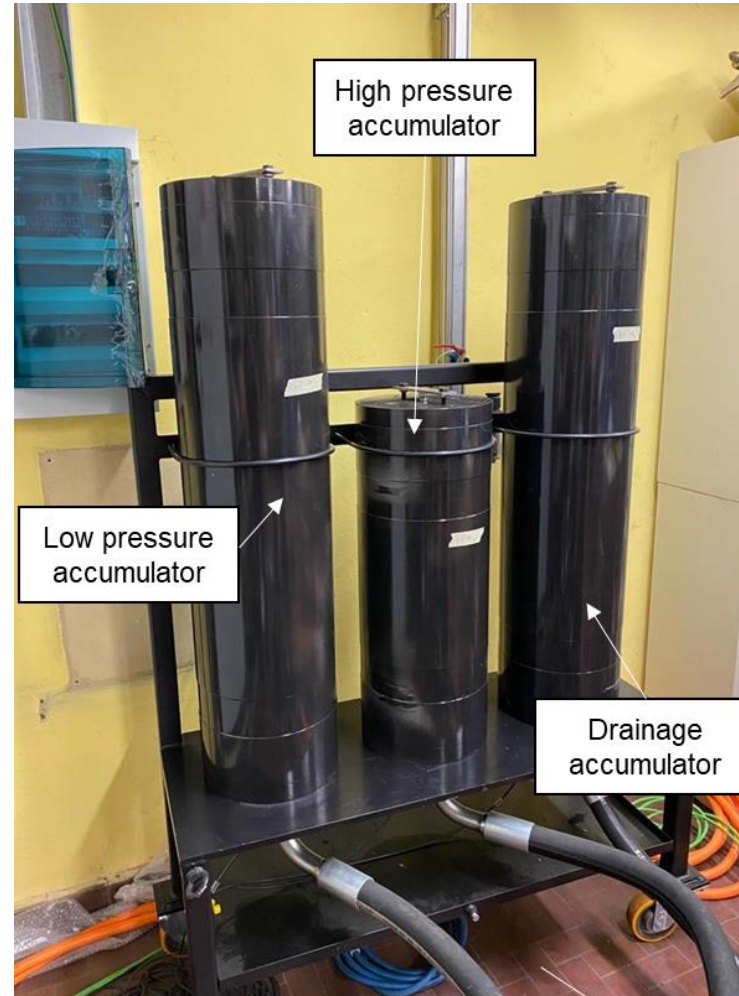
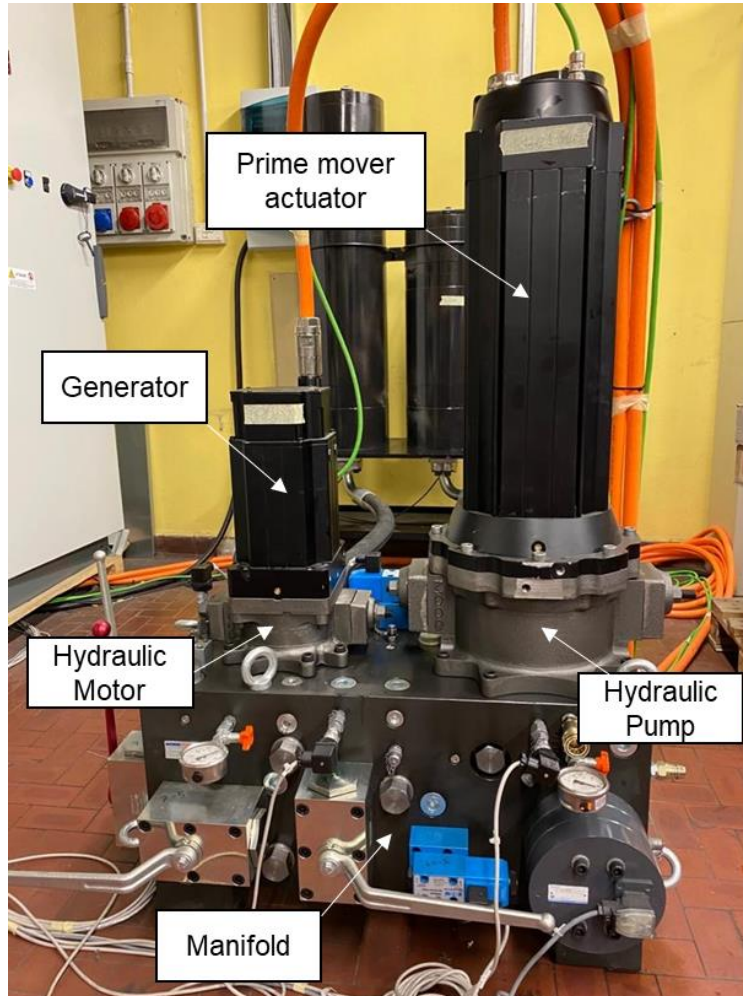
(c)

**Hardware In the Loop (HIL) bench
for electro-mechanical PTO**

Laboratories and equipments – HIL concept



Laboratories and equipments – Hydraulic PTO



Hardware In the Loop (HIL) bench for gyroscopic system:

the system is composed of an oscillating platform that simulates the pitching motion of a floating system. Attached to the platform there is the gyroscopic system of the ISWEC, the primary component of the converter. The alternating drive of the oscillate platform allows the generation of an alternating motion of the gyroscope around its precession axis, which is then converted into electrical energy by the PTO system.

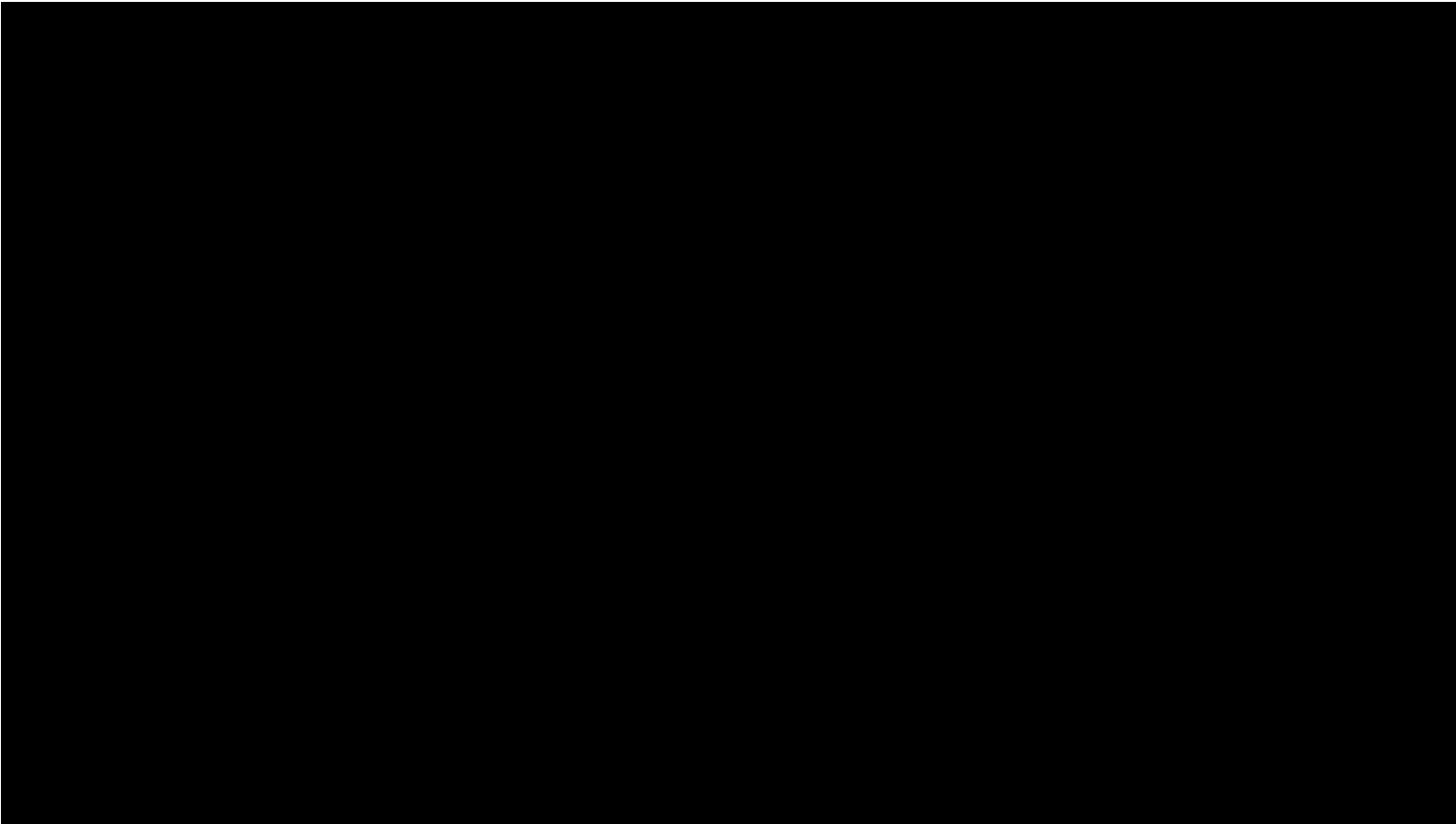
Laboratories and equipments – Gyroscope



Hardware In the Loop (HIL) bench for gyroscopic system:

the system is composed of an oscillating platform that simulates the pitching motion of a floating system. Attached to the platform there is the gyroscopic system of the ISWEC, the primary component of the converter. The alternating drive of the oscillate platform allows the generation of an alternating motion of the gyroscope around its precession axis, which is then converted into electrical energy by the PTO system.

Incoming infrastructure – Wave tank



The infrastructure has the objective to allow aero-hydro-dynamic studies of offshore energy systems. The wave tank aims to reproduce wave and current conditions that would occur in open sea in order to verify the operation of full-scale prototypes and validate the numerical models. Moreover, the wave tank will be equipped with a series of wind generators to simulate the wind conditions acting on offshore wind turbines. The combination of the wave effect and the wind effect can be extensively tested. The goal is to create an infrastructure capable of recreating in the laboratory all the environmental conditions possible in an offshore environment.

Incoming infrastructure – Stewart platform



The equipment consists of a hexapod for testing and validating electro-mechanical components subjected to dynamic loads in their operational and extreme conditions. The platform would improve the HIL bench of the gyroscopic system currently in use and allow the testing of electro-mechanical systems down to a scale of 1:4 compared to their real counterpart. The system consists of a fully controllable 6-degree-of-freedom oscillating platform, a control cabin complete with command computer and motion

Grazie per l'attenzione!

Q&A