disrupting
offshore wind

Sessió Eólica Flotant - PLEMCAT

Enginyers Industrials de Catalunya,
Març 2025

Carlos Casanovas – CTO & Co-founder

X1 Wind history

C. Casanovas develops concept while at MIT

2017: Company established, 1st patent, Cleantech prize

Round 1

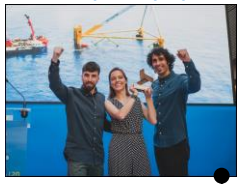
PivotBuoy project start

Round 2

EIC award

Round 3 (Technip Energies)

Spain's AEE Eolos Award (Europe)

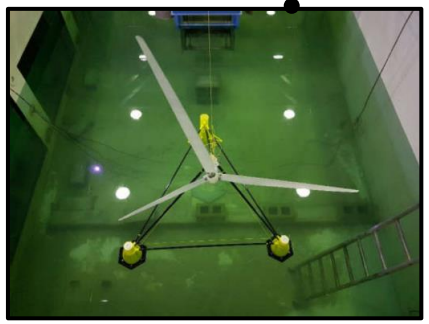


ASEAN WindFuture Awards (Asia)

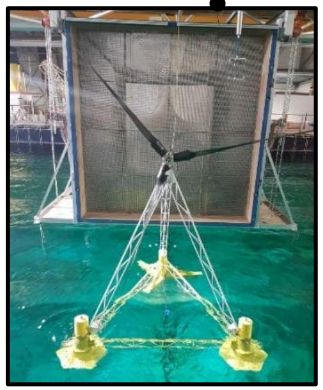
DNV SoF

DNV SoC

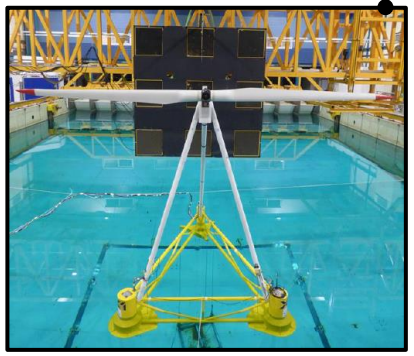
2012-14 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023



UPC 1:64 scale test

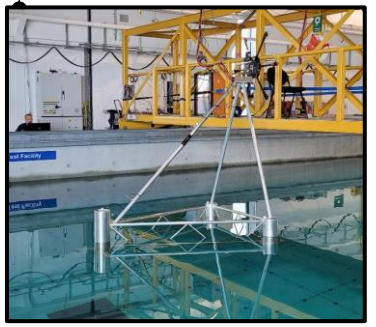


Oceanide 1:50 scale test



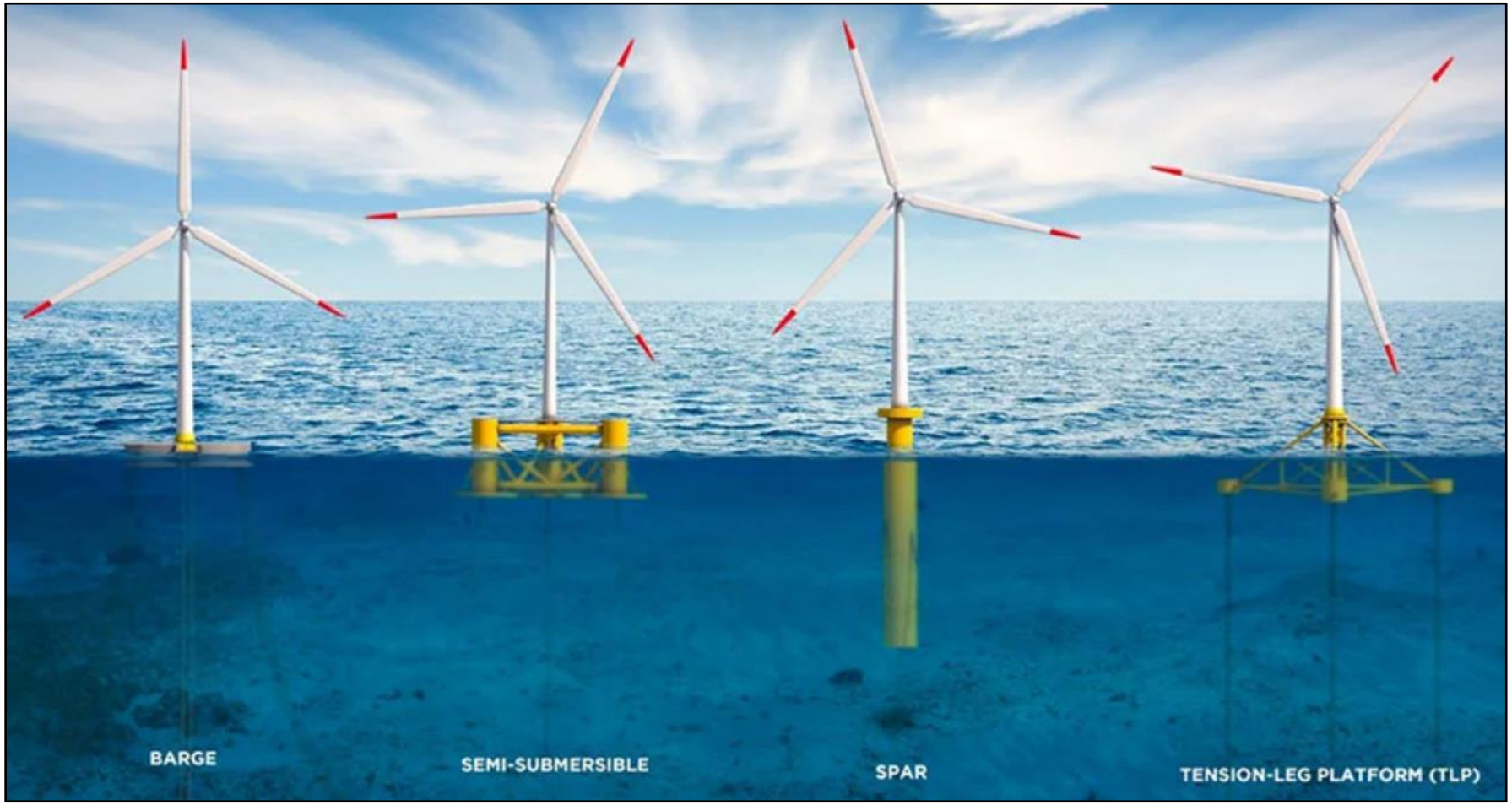
ECN 1:35 scale test

X30 (PivotBuoy) Installation



LIR 1:40 scale test

The industry’s challenge:cost-effective floating wind



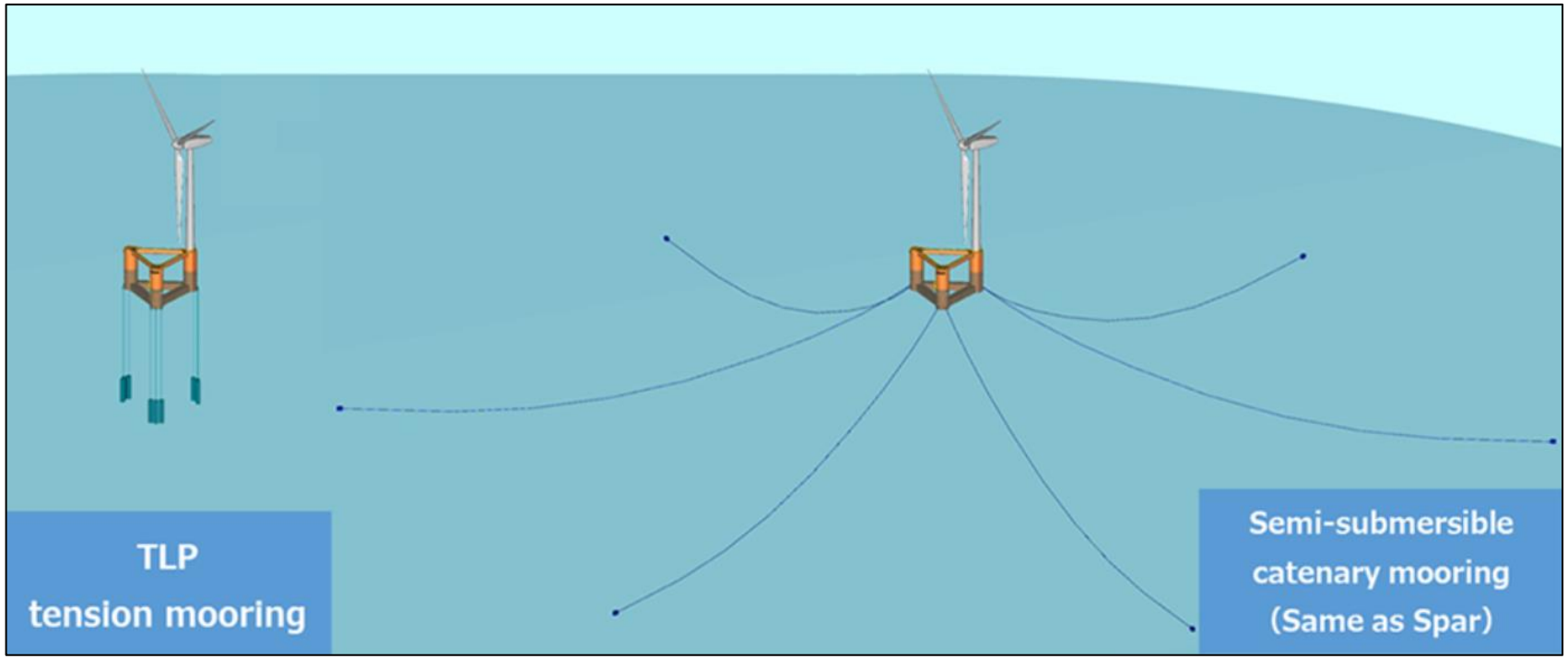
Common issues of traditional designs:

- Require heavy vessels at all stages of the project
- Very large tower base moments due to wind and wave action lead to heavy tower and floater
- Complex tow-to-port operation in case of large component substitution

Image source: UL
https://www.ul.com/sites/default/files/202305/DifferentTypesOfOffshoreWind.jpg

Catenary system is problematic for large wind farms

- Large number of units in wind farm leads to **challenging mooring and electrical cable layout**.
- **Chain dragging damages seabed**
- Conflict with other uses (**fishing**)
- Problems get worse with large water depth



TLP-type mooring solves these issues, <u>but</u> traditional designs are very complex to install and tow to port in case of turbine failure

Image source: Furukawa Electric
https://www.offshorewind.biz/2020/11/02/japanese-trio-developing-next-gen-floating-wind-platform/

X1 Wind next-generation floater

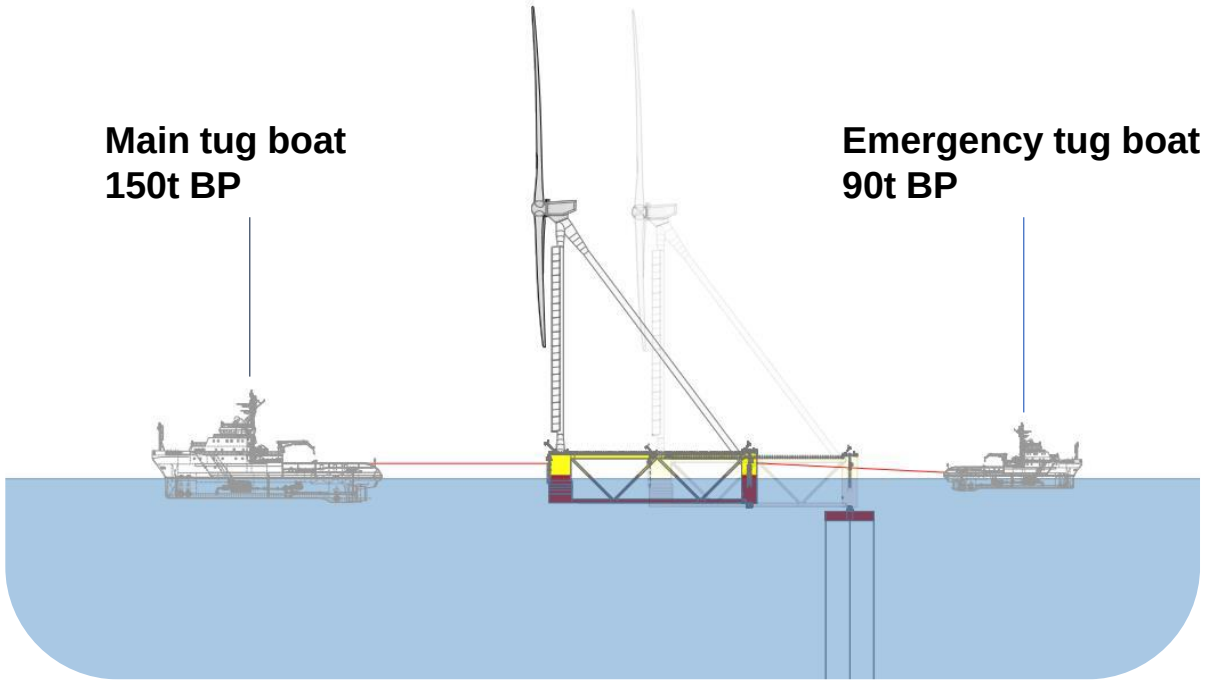
Light, scalable tripod design
Lower bending moments, less steel required

Easy to tow and connect
Quick SPM connector, local vessels

Deeper waters
Current TLP design for 300-400m and now assessing up to 1.000m depth. Simplified wind farm layout

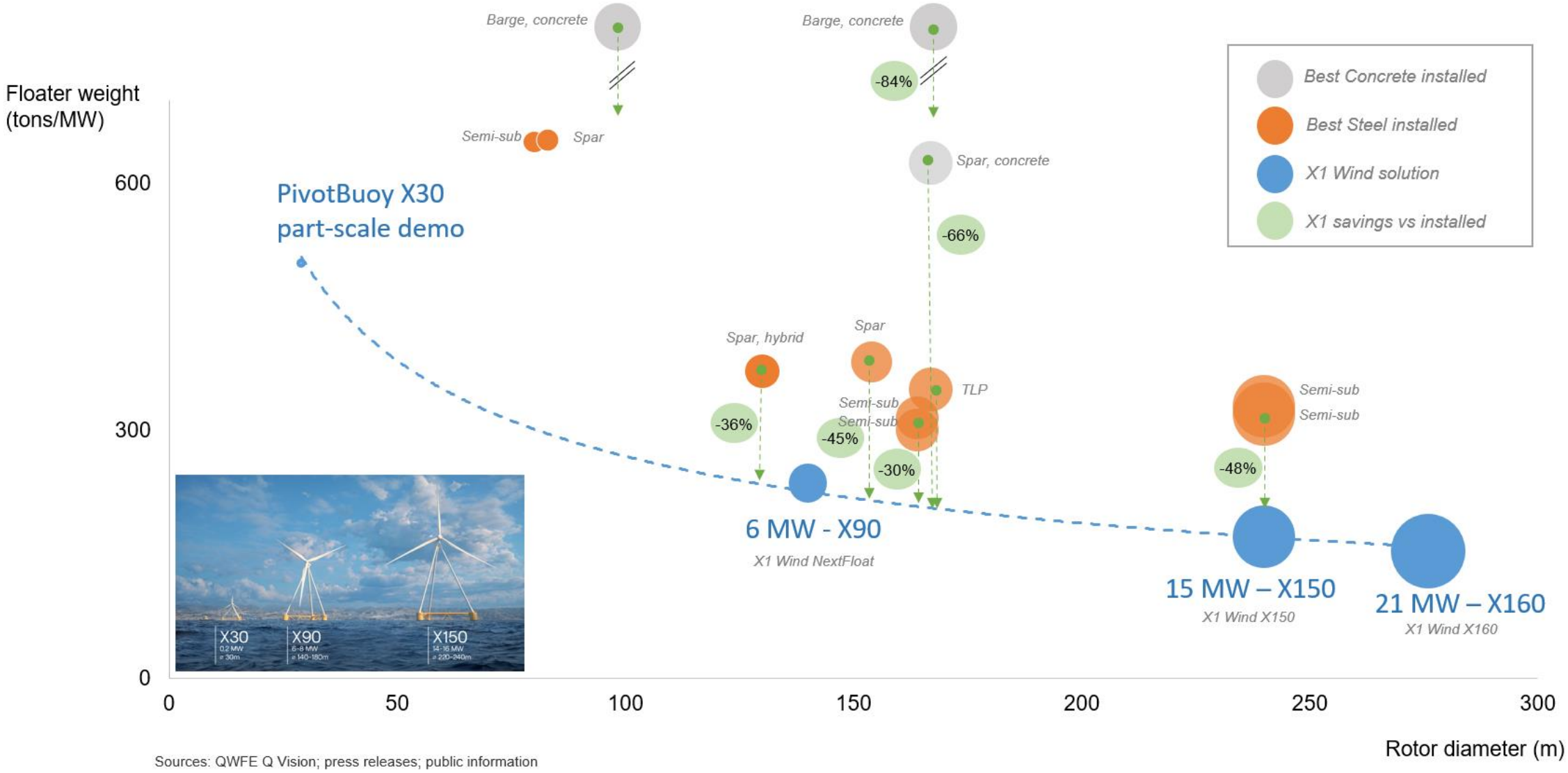
Low environmental impact
TLP has no chain-dragging on seabed better compatibility with fishing, virtually no underwater noise

Easy to install and maintain



- Pre-installed TLP. Line pretension obtained through buoyancy; no heavy vessels needed to tension lines *(note: 400 ton typical Bollard Pull required for pre-tensioning traditional catenaries @15MW!)*
- Platform towing with small tug boats (150 ton Bollard Pull for 15MW scale).
- Hook-up operation in one day, thanks to quick connector system.
- Mooring re-tensioning not needed after tow-to-port operations, TLP and electrical cable stay in place.

X1 floater weight scaling



Sources: QWFE Q Vision; press releases; public information

PivotBuoy demo Project (2019 – 2023)

The first fully operational TLP wind turbine platform

PivotBuoy Project

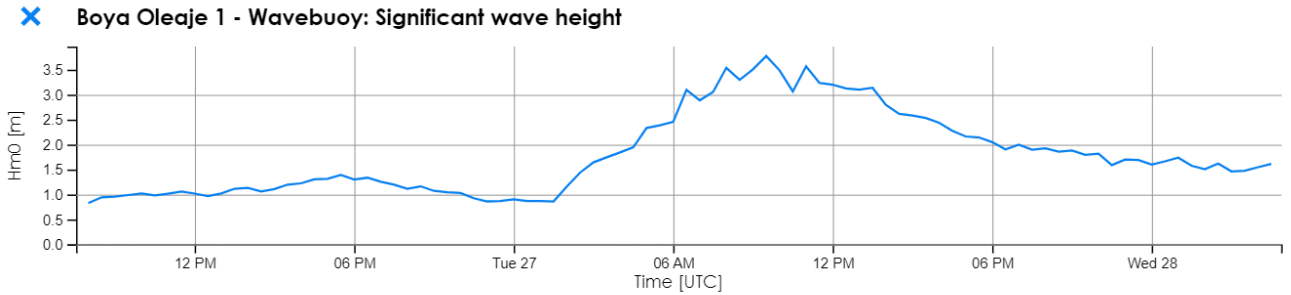
- 4M€ project
- PLOCAN test site (Canary Islands, Spain)
- X30 platform - 1:3 scale fully operational
- 50m water depth
- Vestas V29 fully operational, pitch regulated, ABB full power converter
- 20kV cable connection

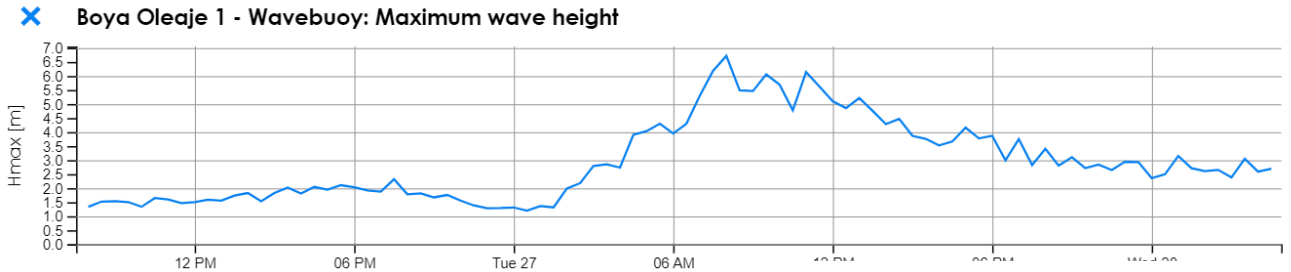
Project Partners

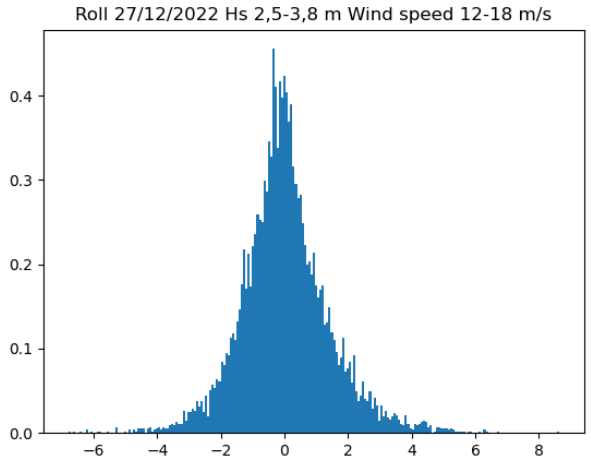
X1 WIND · edp · NEW ENERGY WORLD 新能源世界 · DNV·GL · Worley energy | chemicals | resources · DEGIMA · ESM · DTU Technical University of Denmark · WavEC Offshore Renewables · PLOCAN Consorcio Plataforma Oceánica de Canarias · Ministerio de Economía y Competitividad · Gobierno de Canarias

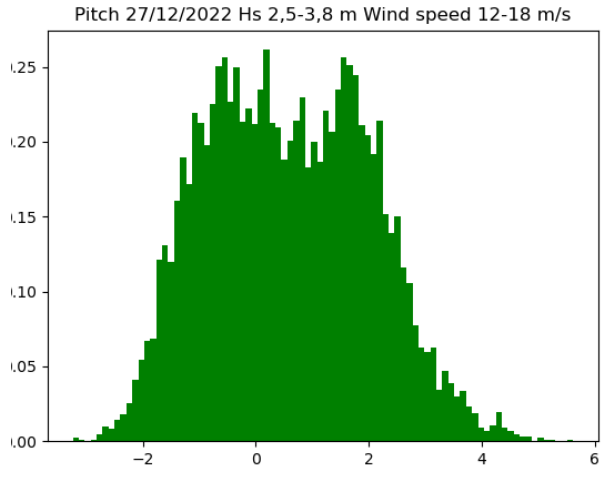
This project has received funding from the European Union's H2020 research and innovation programme under grant agreement N°815159

Survivability proven in extreme conditions. No active orientation or active ballast required → lower failures









The largest storm (December 27) with:

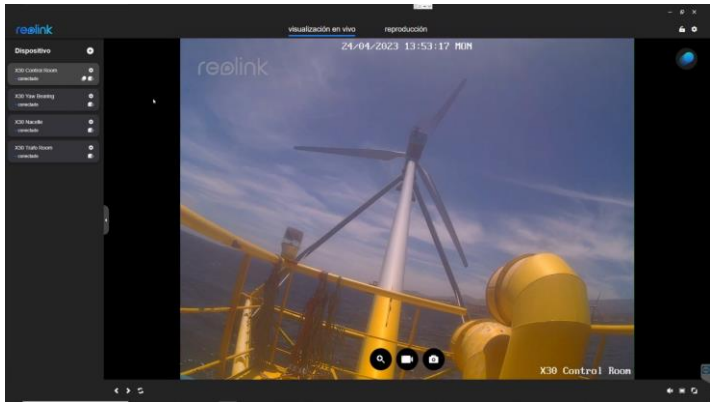
-Hs = 3,78 m,

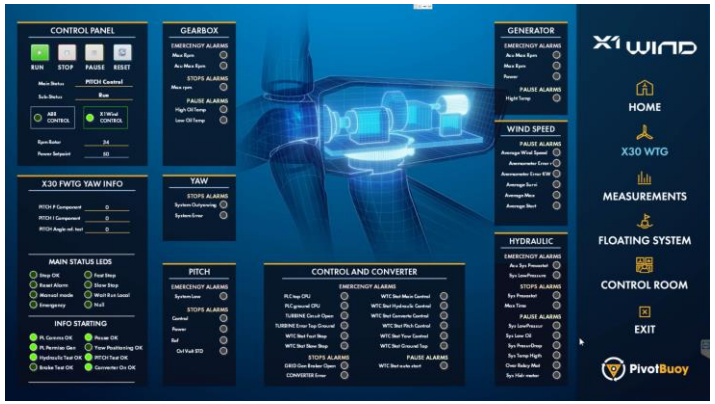
-Hmax = 6.72 m (equivalent to. Hmax = 20.16 m in 1:1))

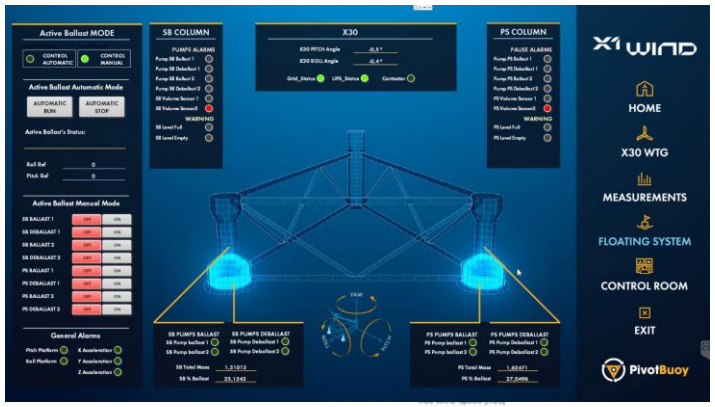
-Maximum wind speed = 18 m/s

Preliminary verification of the model with the extracted data

Average yaw misalignment below 3º for winds >7.5m/s

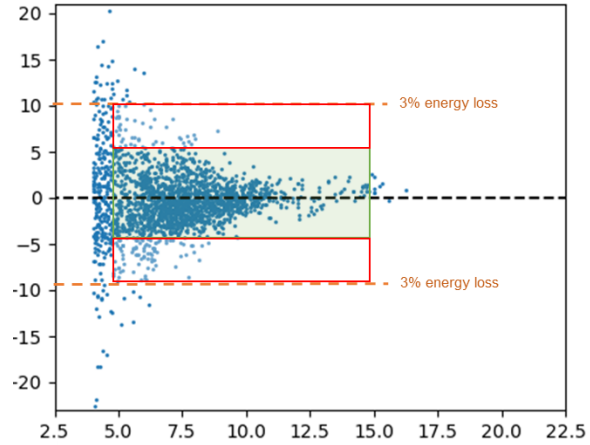




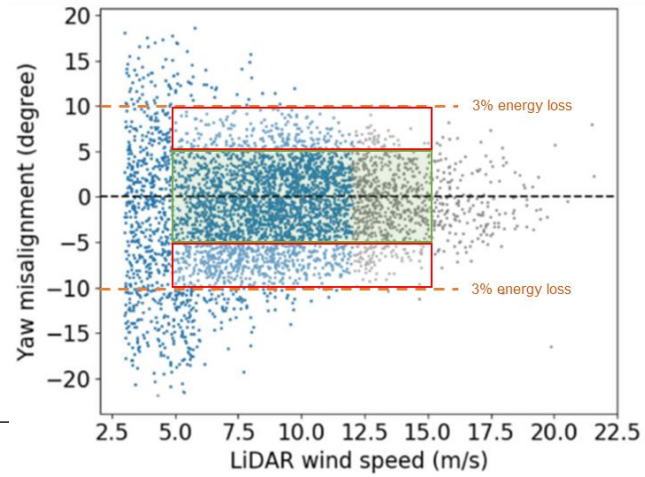


Real time data monitoring with **X1 FMS SCADA**

X30 misalignment distribution during with passive yaw (30 days)



Misalignment for an upwind fixed turbine with active yaw control[1]



[1] (Senvion 3.2 MW) https://ventus.group/case-study/lidar-based-turbine-performance-verification-2

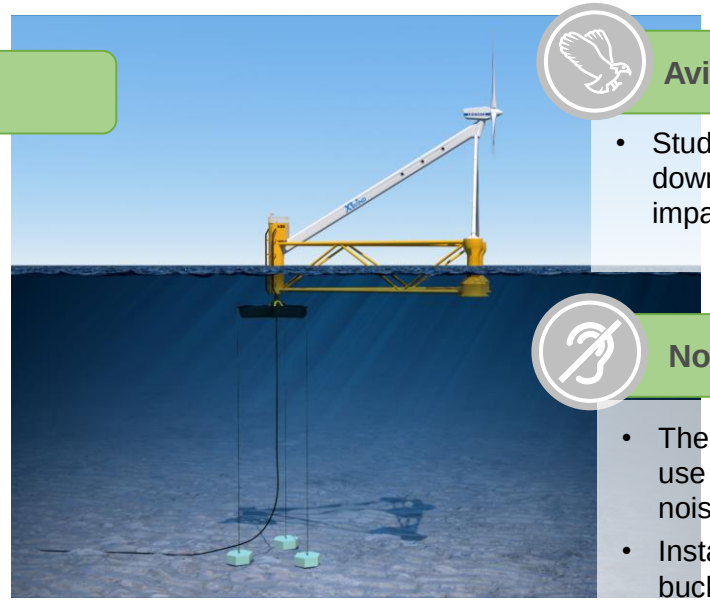
X1 WIND disrupting offshore wind

Lower environmental impact compared to traditional FOW systems

(lower seabed impact, noise, less material use & CO2, better compatibility)

Benthic Habitats

- Lower spread of the mooring system
- Vertical tendons do not lie on the seabed, while catenary chains might erode the surface beneath
- X1's impact on the seabed is limited to installation phase, while for semisubs it continues during operations.



Avifauna

- Studies have already indicated that downwind turbines may have a lower impact on bird communities

Noise & underwater vibrations

- The reduced movement of TLP and use of synthetic lines producing less noise than catenary chains
- Installation methods with suction buckets or gravity anchors

Fishing & Aquaculture

- Much smaller water surface occupation – up to 55 times smaller than a semisub
- Seabed occupation much smaller, as a result of the TLP mooring, limited to the anchors' area.

Clean energy production with high load factors

- Generation of electricity without emissions of greenhouse gases
- High load factors reaching 57% or c. 5.000 hours of production

Limited (or zero) visual impact

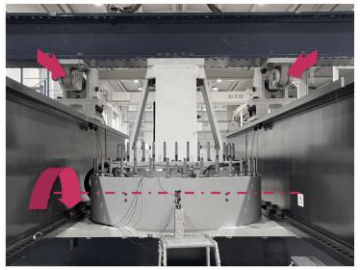
- Limited or zero visual impact for populations
- At 13 km, structures are slightly visible, and at 30 they are already invisible

Atmospheric quality & reduced emissions

- The full life cycle of semisubs estimated to have 40% more CO2 emissions than those of X150 units
- Much lighter structure results in less steel and lower emissions in manufacturing
- Allows the use of smaller vessels, locally available, with lower fuel consumption

Technological roadmap: a stepped approach to reduce the risks, learn and improve the technology

Technology validation in lab (TRL1 → 4) ✓



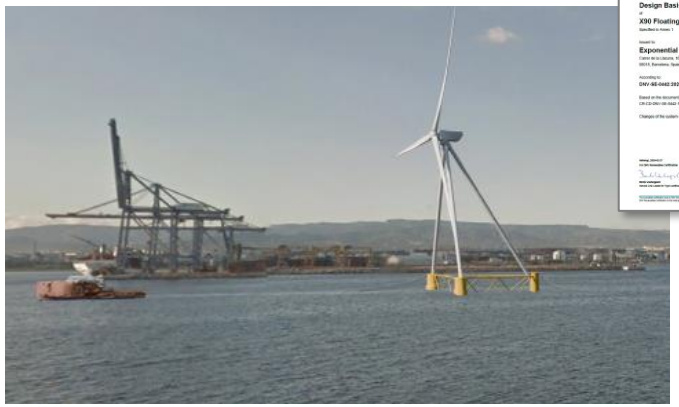
4 tank testing campaigns (scales 1:64 to 1:33) to validate concept and calibrate numerical models

Critical component test & validation in test rigs (e.g. quick-connection tests at 1:7 & 1:1 (ULS-FLS 25years)

Demonstration in relevant environment (TRL 4 → 6) ✓

Part-scale prototype (225kW V29) to **validate performance** and **learn about key aspects to derisk** before jump to full-scale (fabrication, load-out, installation & decommission)

System complete & qualified (TRL6 → 8)

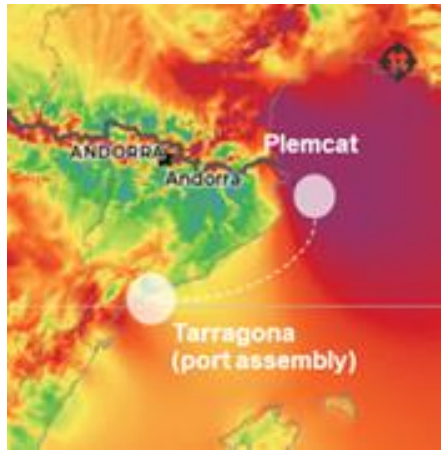


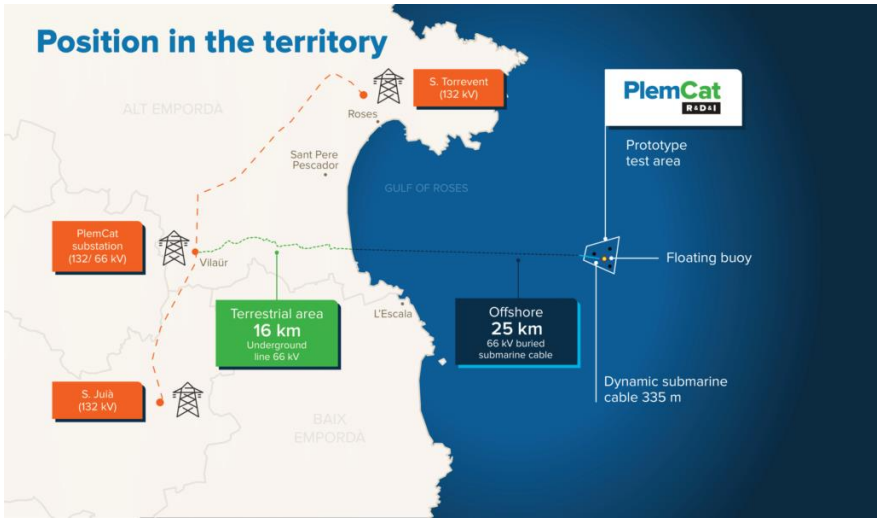
Full-scale pilot (6-8MW) to demonstrate and certify the technology in fully operational conditions and learn about potential long-term O&M and environmental issues to prepare commercial phase

NextFloat Project - PLEMCAT

Main Project Objectives

- Reducing weight, costs and impacts of current FOW
- Demonstrate 6-8MW during 5 years within EU project
- Improvements in key components & processes
- Optimizing the technological solutions for deep waters
- **Validate** technical, economic and environmental performance
- **Test** commercial scale manufacturing, transport, installation and O&M methodology
- **Prepare** the technology, cost models AND the supply chain for commercial deployment.





Project consortium:

T.EN TECHNIP ENERGIES · X1 WIND · SCHWARTZ HAUTMONT CONSTRUCCIONES METALICAS, S.A. · HELLENIC CABLES · Tersan SHIPYARD · Hydro

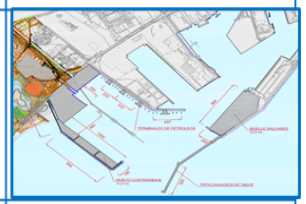
Ocean Ecostructures · Cocas · CENTRALE NANTES · DTU · 2BENERGY · Naturgy

X1 WIND disrupting offshore wind

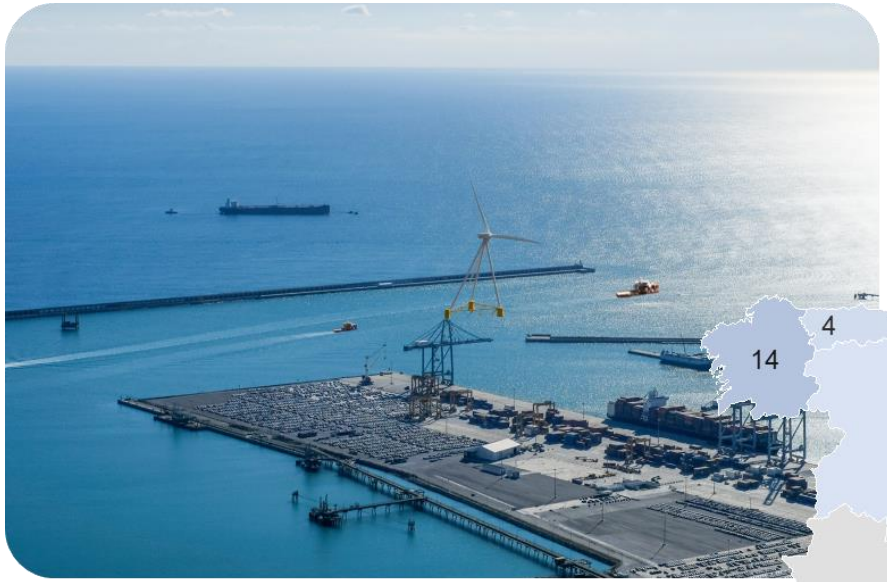
This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101084300

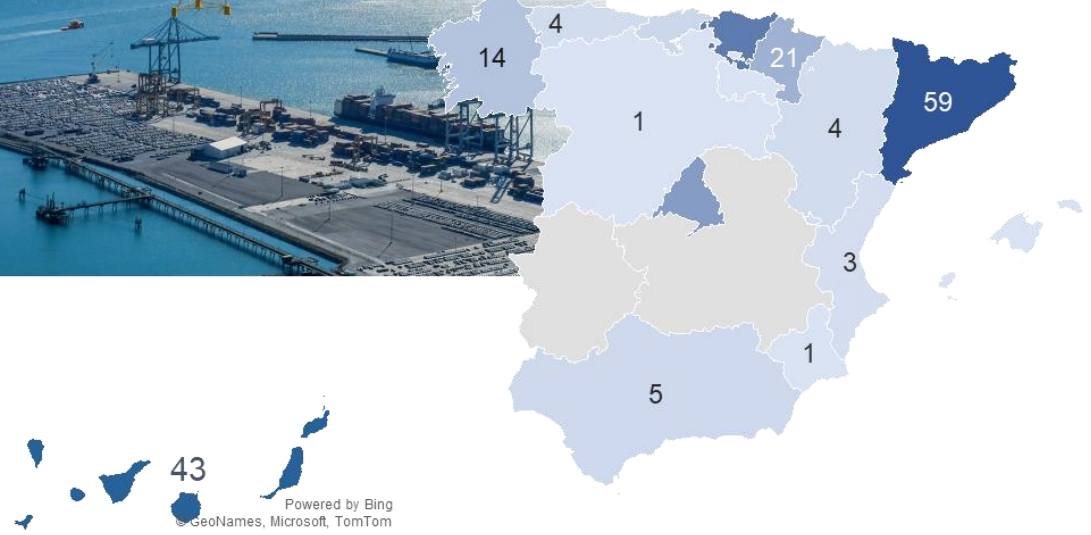
Port of Tarragona selected for floater and turbine integration acting as a pole for research and innovation and industrial development

Tarragona Port has adequate conditions & close to areas under development in Spain and France

		REQUIREMENTS	PORT TARRAGONA Nuevo Contradique & Muelle Baleares
Logistics	*Quayside length [m]*	TBD	NC: 460+1000+250; MB: 800+200
Storage / Construction	*Total Area [Ha]*	38	NC: 42; MB: 23
	Number of assembly slots	3	1-2
	GBC [t/m²]	5 / 10	
Load-out	*Quayside depth [m]*	14,5	NC: 16; MB:
	Crane area [m]	TBD	
	Crane area GBC [t/m²]	25	
Tow-out	*Min. outbound width [m]*	TBD	390
	Min. outbound depth [m]	14,5	
	Distance to wind farm [km]	Flexible	360
Environmental Conditions	*Operational timeframe [months]*	Flexible	12 (All year)
	Mean wind speed (150m) [m/s]	Max. = 10 m/s	5.79
Wet Storage	*Number of units*	Flexible	
	Seabed conditions	Flexible	Muddy sand
Cost		TBD	
Port Layout			
Overall suitability	X / 10		

Working on industrialization strategy involving more than 100 local companies and organizations (**59 in Catalonia region**)






X1 WIND
disrupting
offshore wind
Thank you for your interest!
Gràcies per la vostra atenció!
For publicly available information, please visit our website www.x1wind.com.