

# W2POWER: FLOATING WIND. HERE. NOW.

1ºBEL (Blue Energy Laboratory) Valencia, February 25<sup>th</sup> 2019



W2Power: Development of a floating wind integrated platform in WIP10+ project

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# Company Profile

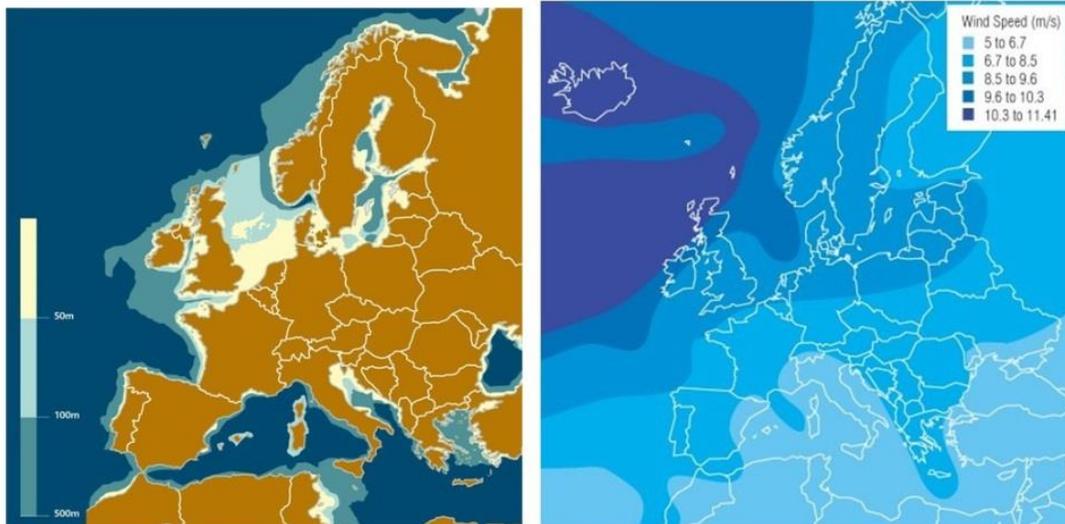


- Lean R&D SME based in Malaga (est. 2007).
- Specialised in Marine Energy Engineering.
- Business scope:
  - Resource & feasibility studies, engineering, commercial exploitation.
- Winner of several awards, tenders and projects.
- Lead Developer of W2Power technology since 2012.
- Owner of all IP related to the W2Power solution.



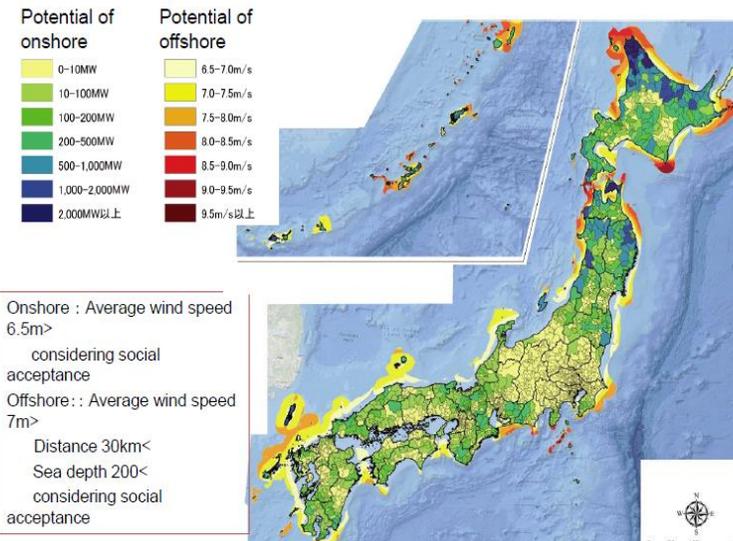
# Offshore wind: Spreading success

- Exploiting better winds at sea is a success: >18.8GW installed by end 2017\*.
- The southern North Sea is being developed using bottom-fixed foundations.
- However, most countries lack shallow seas: Spreading the success to deeper water requires new solutions.
- Floating is the key enabler to expand global scope of offshore wind.



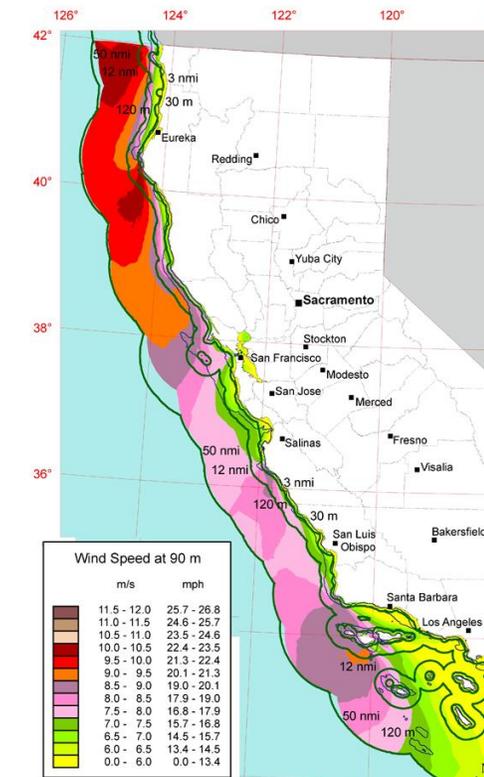
Simplified pan-European bathymetry and wind speed maps, highlighting the limited area available for wind energy development in shallow water vs. in areas for which deepwater solutions are required. (Source: Acciona, 1-Tech)

## Japan has Huge Wind Energy Resources



Source: NEDO, JWPA.

## California - 90 m Offshore Wind Speed



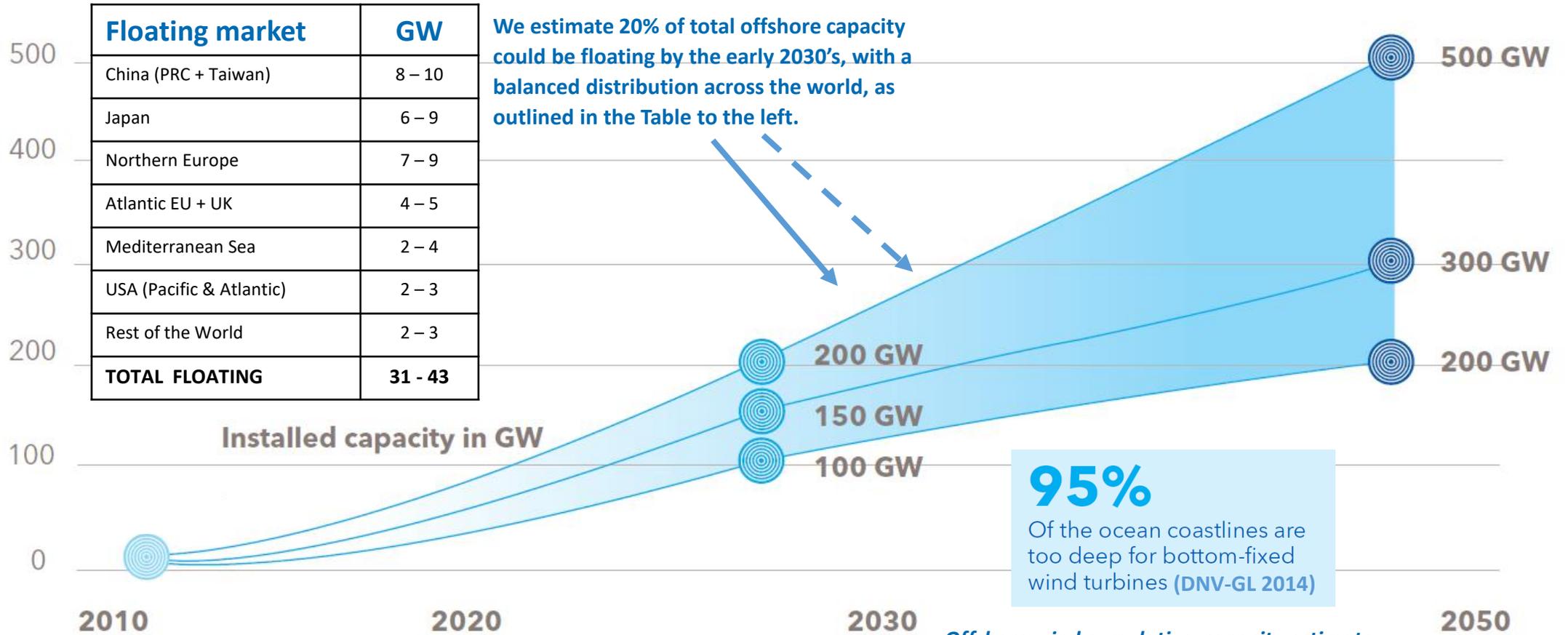
Source: NREL.

\* Source: GWEC. More than 3GW are outside Europe.

# The opportunity: Floating- The fastest growing part of offshore wind

Floating market	GW
China (PRC + Taiwan)	8 – 10
Japan	6 – 9
Northern Europe	7 – 9
Atlantic EU + UK	4 – 5
Mediterranean Sea	2 – 4
USA (Pacific & Atlantic)	2 – 3
Rest of the World	2 – 3
<b>TOTAL FLOATING</b>	<b>31 - 43</b>

We estimate 20% of total offshore capacity could be floating by the early 2030's, with a balanced distribution across the world, as outlined in the Table to the left.

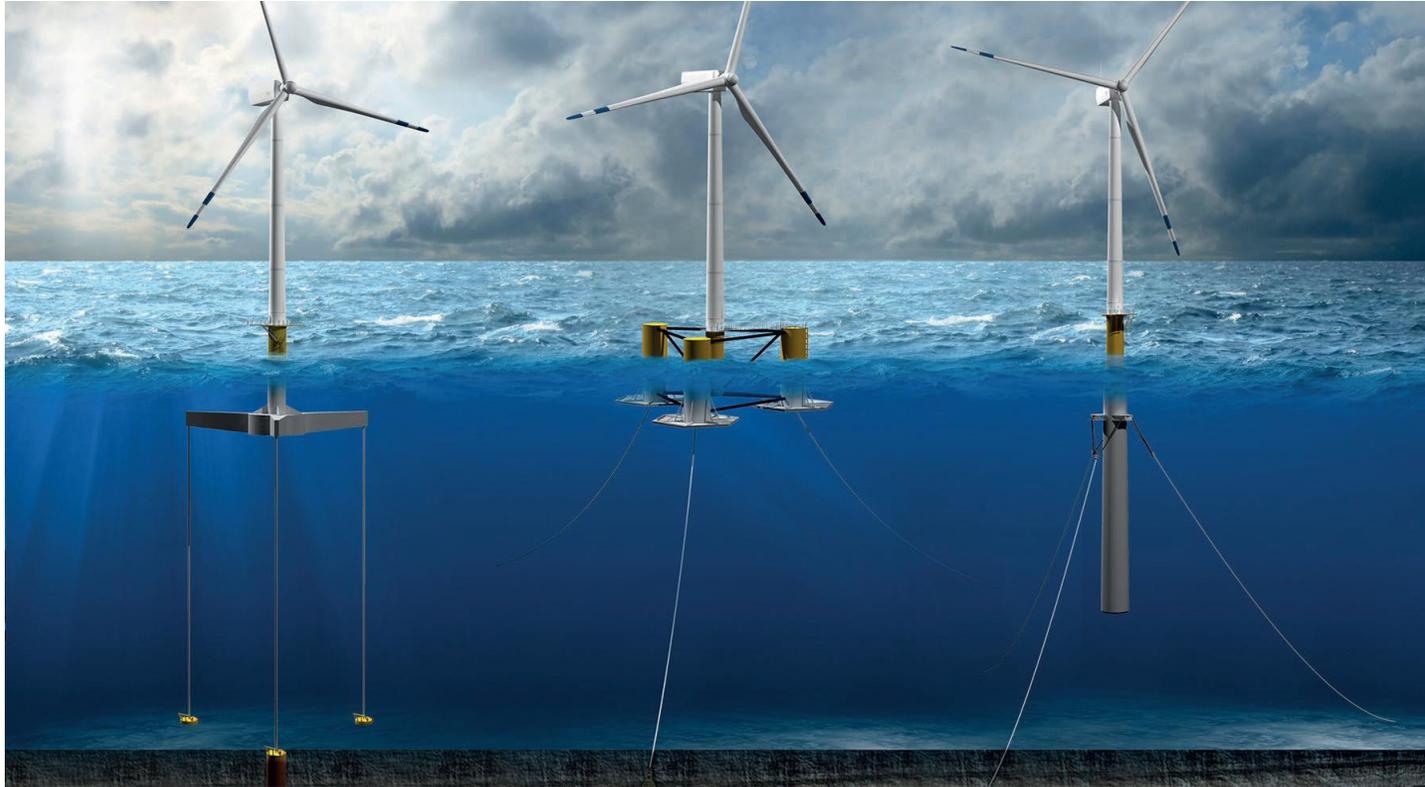


**95%**  
Of the ocean coastlines are too deep for bottom-fixed wind turbines (DNV-GL 2014)

Offshore wind cumulative capacity estimate from DNV-GL "Electrifying the Future", 2014



# Main floater types and depth ranges



## TLP's

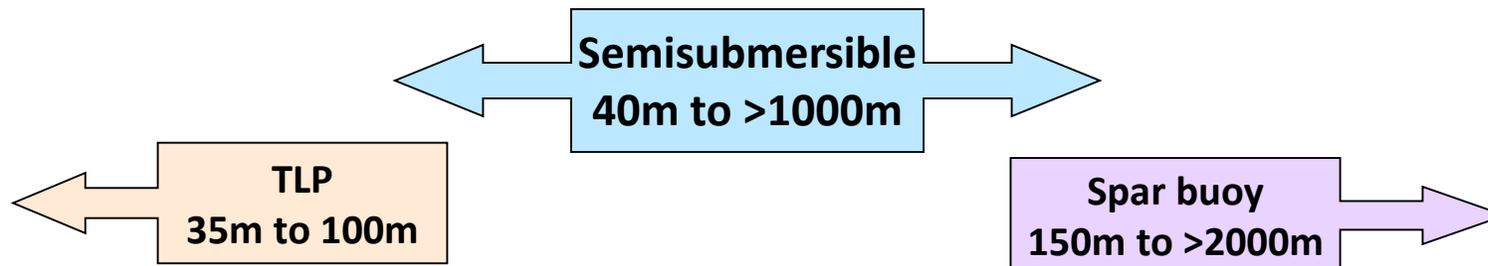
stabilised by tendons or highly pretensioned wires.

## Semi's

stabilised by their water plane area, can be pontoon or column-buoyant.

## Spars

mooring-stabilised.

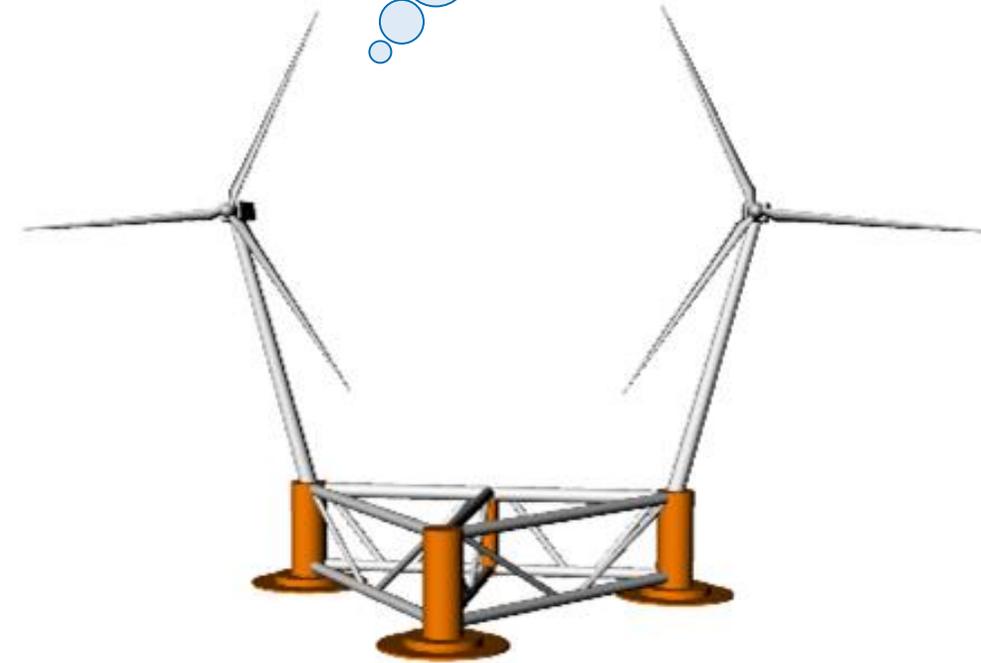


# W2Power: The lowest-cost floating solution

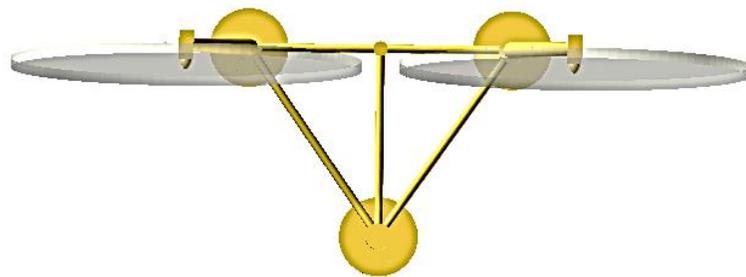
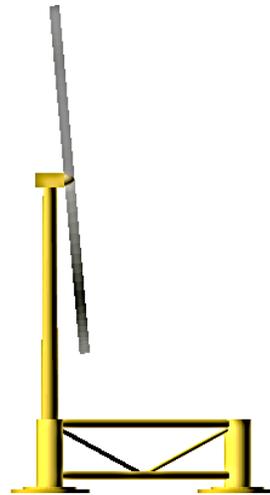
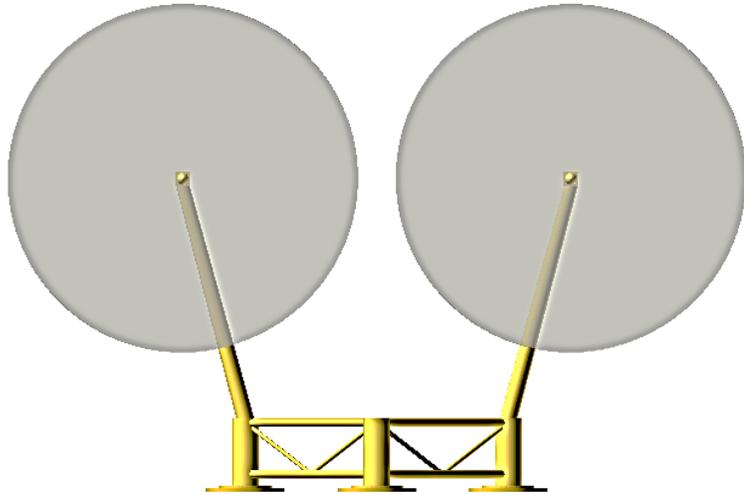


- **Delivers up to 12MW power on one foundation:**
  - Two 6MW WT's: Less weight and much lower loads on the floater
- **Uses bankable turbines, commercially available today:**
  - Multiple suppliers worldwide: cost per MW will drop in near term
- **Installed on a robust, hydrodynamically proven floating platform:**
  - Semi-submersibles proven from oil & gas.
  - Used on all seas for more than 40 years.
  - Greatly simplified for lower cost and easy build.
  - Flexible design allowing multi-use in future.
- **Features many technical innovations and IP, all targeted at reducing CAPEX and OPEX.**
- **Has been systematically developed since 2009 through TRL (Technology Readiness Level) 2 to 6:**
  - Many EU and National projects
  - Sea testing of Prototype 2019 ([Gran Canaria](#))
  - MW scale Pilot Demo planned 2020-2021
  - Pre-commercial Array from 2022

The best  
12MW  
solution is  
two 6MW  
turbines!



# Key technical specifications



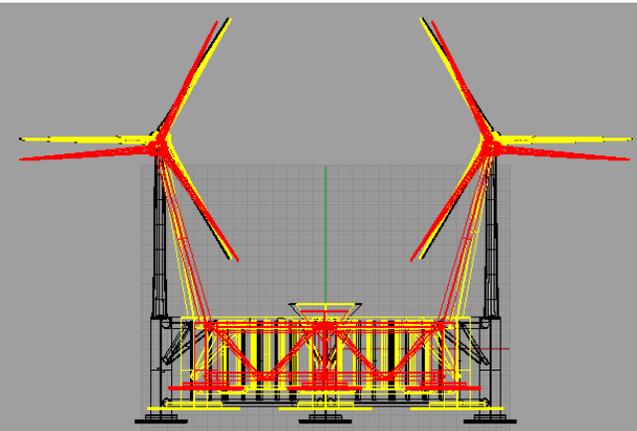
## Main Dimensions

- **Hub height: 90m**
- **Distance between tower bases: 90m**
- **Beam during construction: 72m**
- **Power: up to 2 x 6 MW**

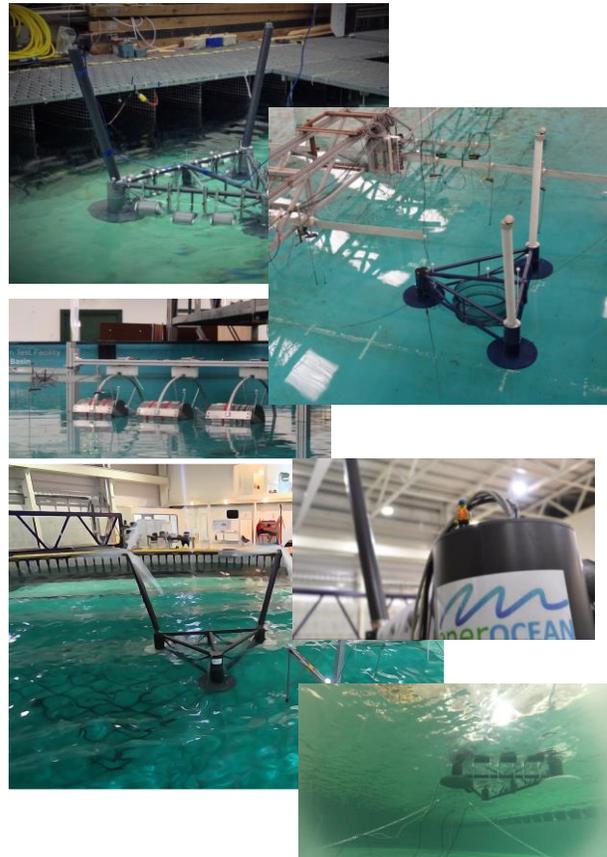
- A light-weight semi-submersible platform enclosing a large water plane area securing hydrodynamic stabilisation far greater than other semi-sub floaters.
- Commercial, already bankable offshore turbines. Current design accommodates up to 132m rotors.
- Extensive testing in EU/national R&D projects. Completed TRL advancement in 8 tank-test campaigns, using 4 laboratories in 3 countries.
- TRL 6 on-going: Sea testing of Prototype (1 : 6 Scale) offshore Gran Canaria (PLOCAN test site). Launch Spring 2019. EU funded through DemoWind.

# Systematic step by step development

Intense design optimization of structure and components... from 2009 artist's conception through repeat design cycles.



Use of the best European labs to test models and key components: Marintek (NO), U.Edinburgh (UK), U.C.Cork (IE), FloWave (UK).



Sea testing of scaled prototype is fully financed and on-going: WIP10+ at PLOCAN (2016-19)



# Ongoing project

- Prototype at sea
- Fully functional floater all subsystems, 1:6 scale, pitch-controlled WT pair.
- PLOCAN test site
- TRL = 6 on completion:  
Relevant environment

# Technical advantages = Lower energy cost

- Benefits of platform self-orientation
  - Platform yaw in the front column, always facing wind direction
  - Allows closely spaced turbines (smaller platform)
  - Platform yaw means less absolute misalignment (zero yawing threshold). Elimination of active turbine yaw system, known to cause long downtime periods / expensive breakdowns.
- Benefits of leaning towers and twin wind turbines
  - Smaller wind turbines for the same power
    - Lower cost per MW and today's technology
    - Lower height. Cheaper assembly and maintenance
  - Leaning towers allow for smaller floating platform (< rotor diameter) and vertical reach of nacelle from barge (cheap O&M without crane vessels).
- Benefits of a light but large semi-submersible platform,
  - You can have smaller volume and draft in the columns for the same stability (reduces construction steel need).



# EASY AND COST EFFICIENT MAINTENANCE

- Option to use a permanent or temporary winch or service crane in the nacelle.
- Option to replace any component (blade, hub, gearbox, generator, converter, HVAC systems).
- Use of simple barges, no expensive cranes, no accurate Dynamic Positioning (DP) needed.



# Partnering Update

Our Canarian partners:



Our Global certification partner:



- Work is starting up, first stage completed by December 2018.
- Work designed in order to obtain dual certification BV (Europe focused )-CLASS NK (Japan focused)

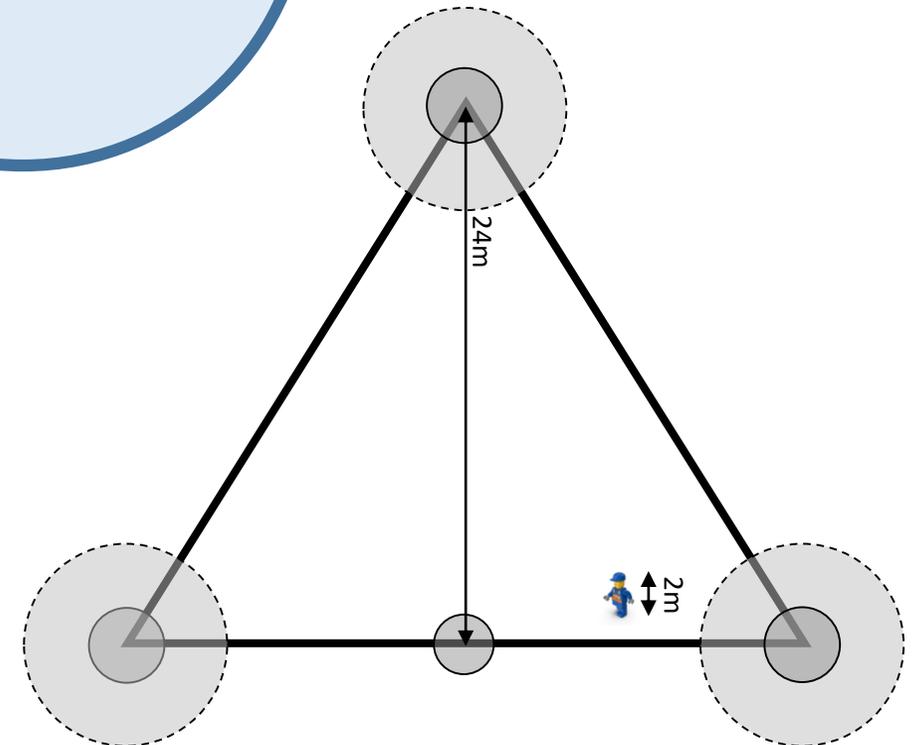


# Next step: Extended Pilot Demo

- **MW class power export to grid**  
(at a fraction of the cost of full size)
- **All features of W2Power system**
- **Scaled for lower construction cost**  
full value of Pilot testing secured
- **Pilot Demonstration at TRL = 7**  
(in full operational environment)
- **Potential multiuse demonstration**

**W2Power 1.2MW**  
**Scaled up to 1:2.5-3 size:**

- 2 x Prototype size
- Innovative tower design



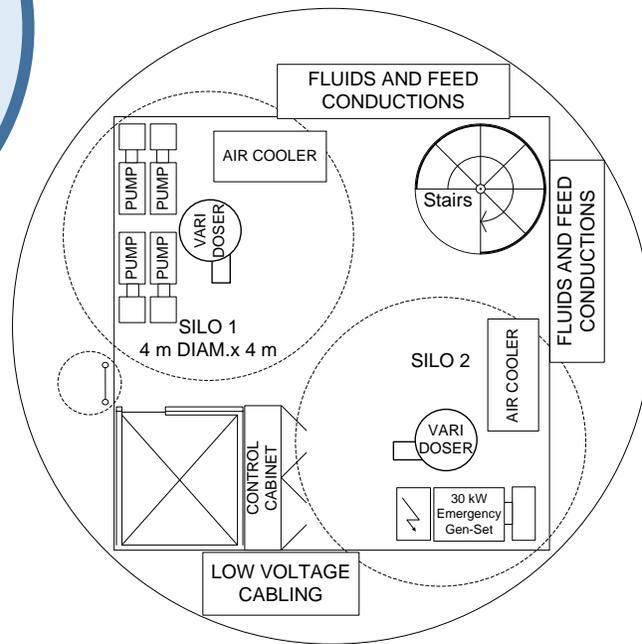
# W2Power: Wind Energy and Aquaculture



Integration of modules in the columns:

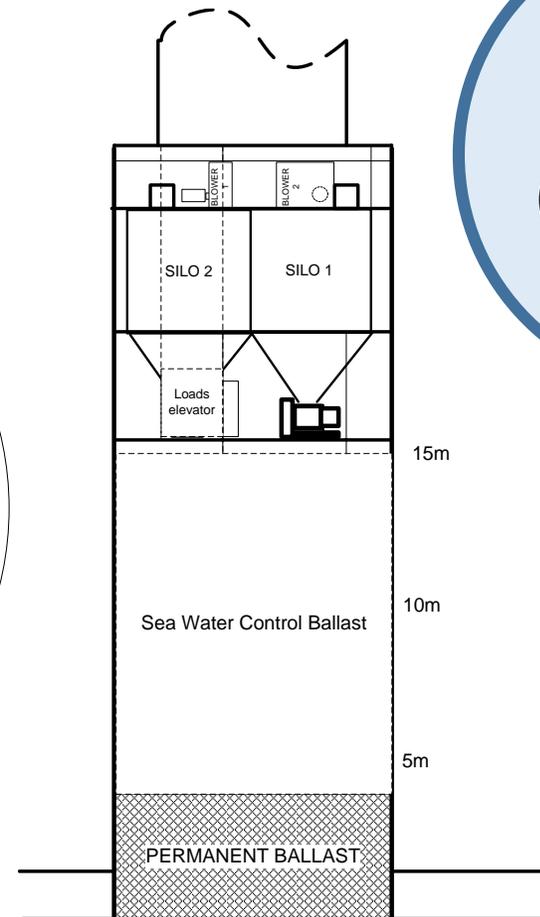
## Functions

(control of modules, transformer, fish food storage, emergency generators, ...).



COLUMN C LOW LEVEL (15.5 m over keel, 0.5 m over MWL)  
 PUMPS, VARI-DOSER AND AIR COOLING LEVEL  
 HEIGHT 4.0 m (Max height: 3.045 m)  
 Total Weight: 4 x 500 kg (Pumps) + 950 kg (Gen-set) + 1500 kg (Vari-doser + air cooling) = 4500 kg

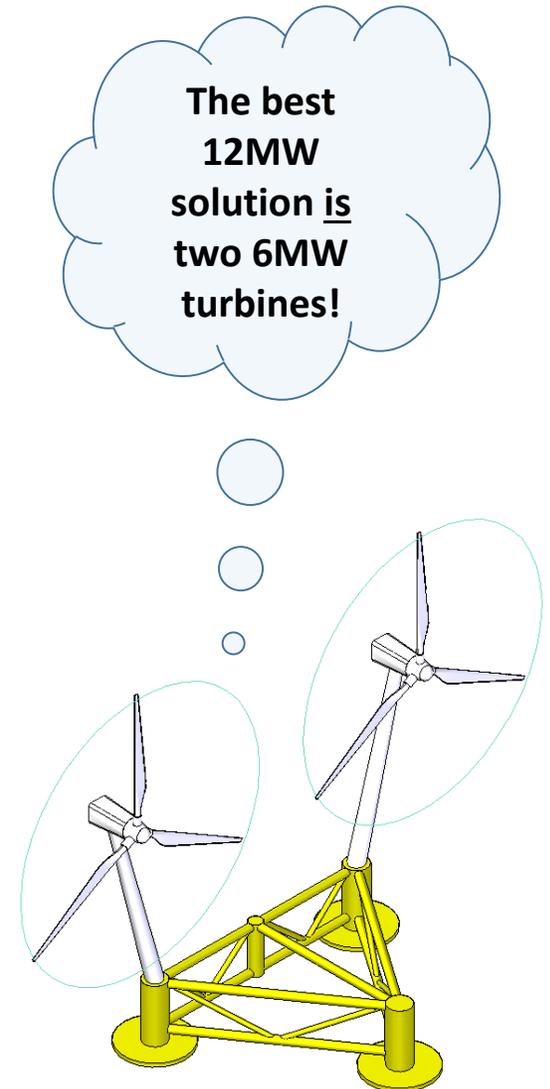
Distribution of weights (ballast) and volumes.



Connection, access and autonomy.

# Summary

- W2Power is a patented solution that uses wind turbines available today and proven platform technology. **This allows major de-risking of floating wind.**
- **Industry-leading** power per foundation and connection point: **12 MW**
- Can be built, installed at any depth, maintained and repaired world-wide.
  
- W2Power's unique design enables most efficient use of floater, cabling, installation, lowering operation & maintenance, decommissioning costs.
- Platform is wind-variant, eliminates turbine yaw, lower cost, increased uptime – reduced OPEX as well as CAPEX
- **Lower LCoE** than any other known contenders (on all sites investigated)
- Superior multi-use capability for additional **economic upside potential**. **Aquaculture most attractive and close to market option for a multiuse version.**



**Thank you for your attention...**