

# Alternative Concepts in Ocean Renewable Energy PART 1

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[www.gero.poli.usp.br](http://www.gero.poli.usp.br)

**gero**  
*energia renovável  
do oceano* POLI - USP



*renewable energy* *POLI - USP*  
*from the ocean*

# Ocean Renewable Energy

Offshore Wind

Wave

Tidal / Current

Thermal

Salinity  
gradient

# Offshore Wind

Ocean breeze...



# Conventional

Offshore Wind



# Offshore Wind Farms

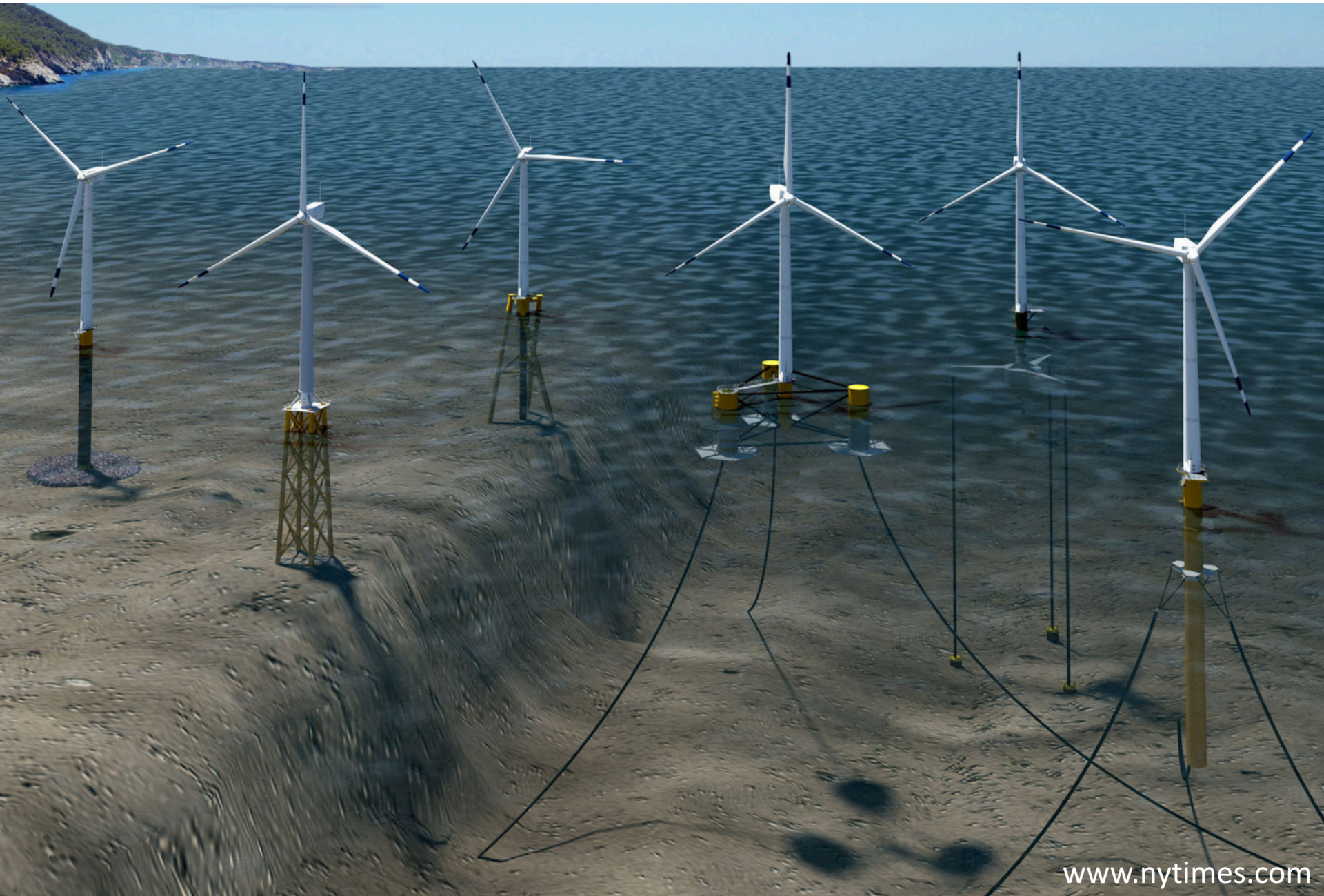


# Alternative concepts

Offshore Wind

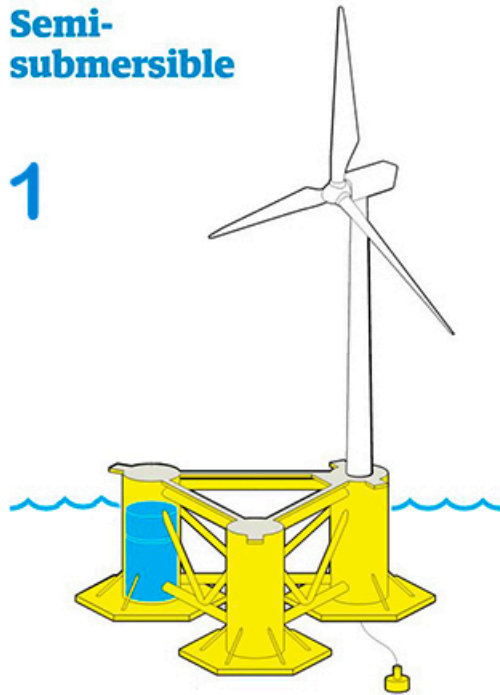






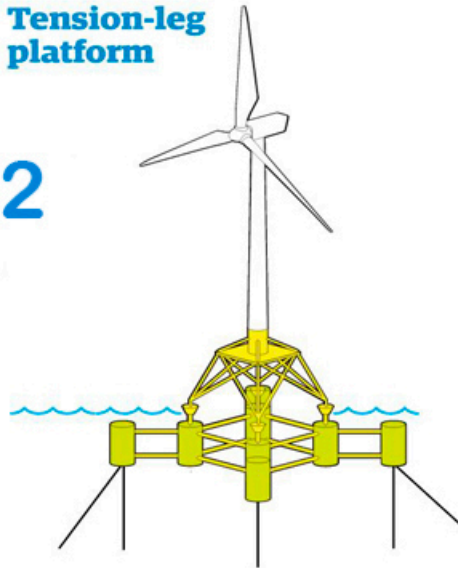
**Semi-submersible**

**1**



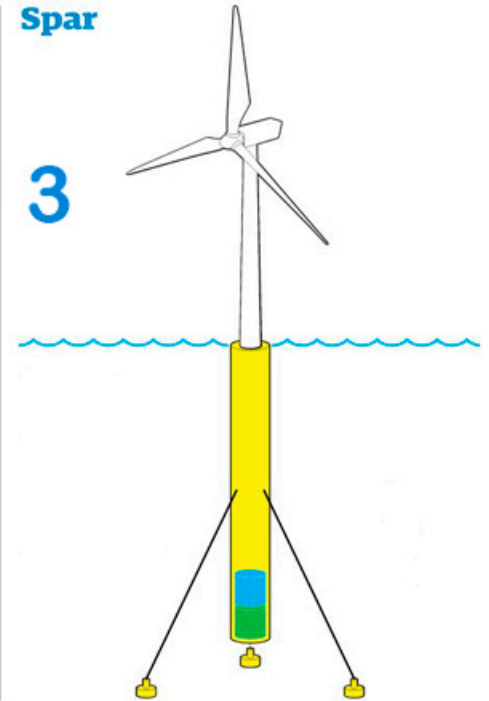
**Tension-leg platform**

**2**



**Spar**

**3**





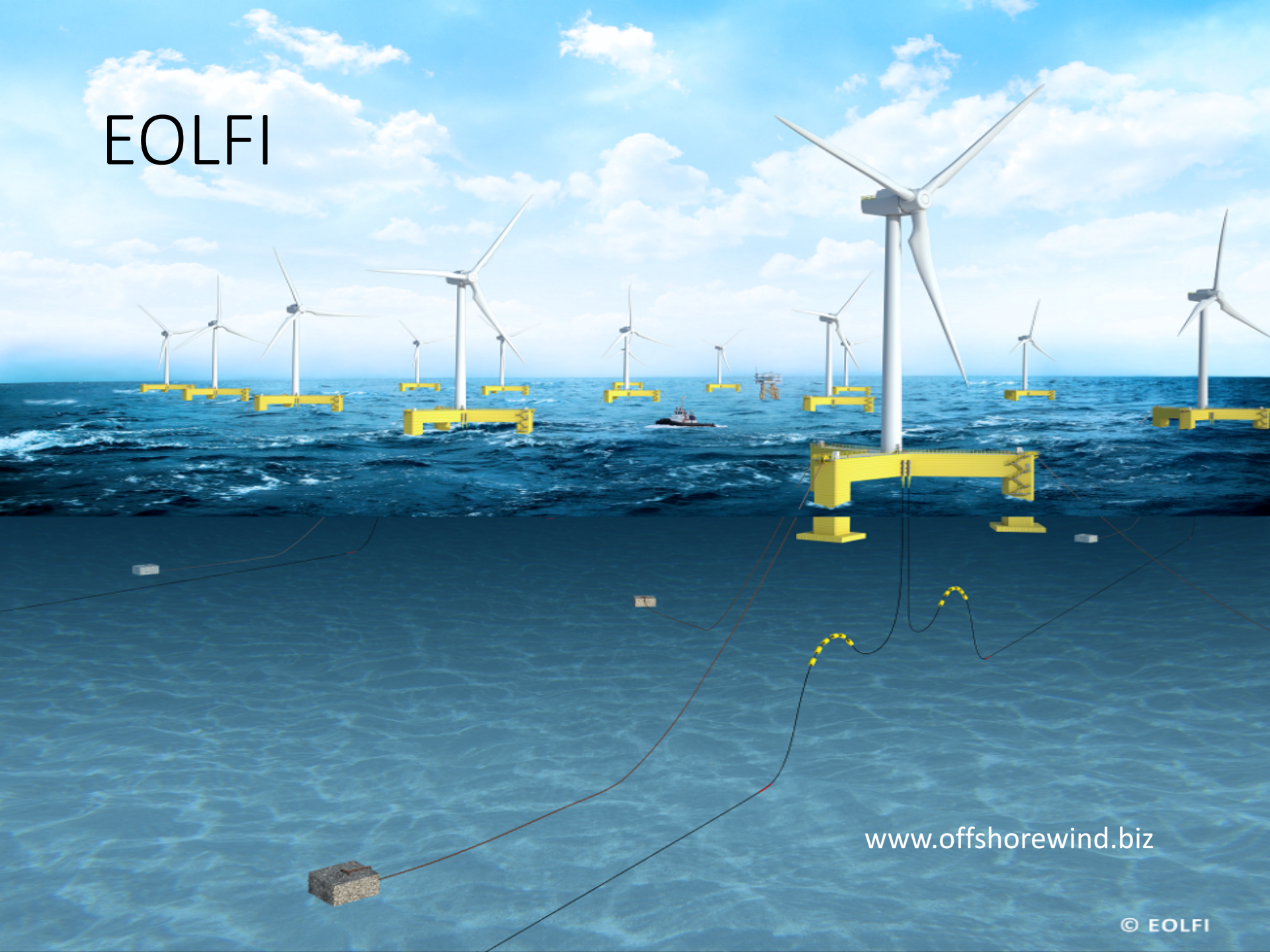
# Offshore Wind Farms



[www.offshorewind.biz](http://www.offshorewind.biz)



# EOLFI



[www.offshorewind.biz](http://www.offshorewind.biz)

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# DCNS and Nass



[www.offshorewind.biz](http://www.offshorewind.biz)



# Hexicon




[www.offshorewind.biz](http://www.offshorewind.biz)

# Nova Project





# Nova Project

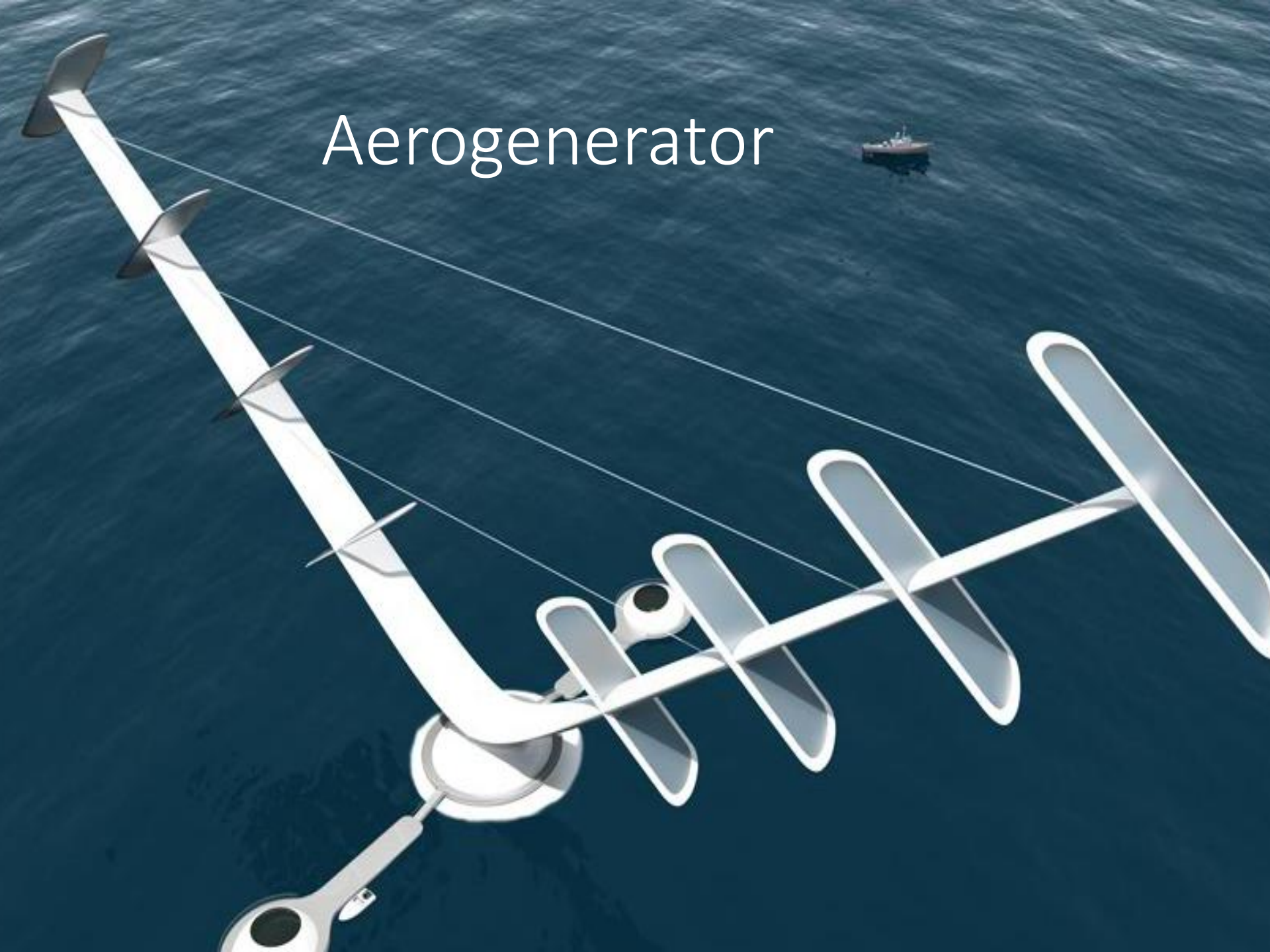


Energy Technologies Institute (ETI), Wind Power Ltd, OTM Consulting, Cranfield University, the University of Strathclyde, Sheffield University, James Ingram & Associates, CEFAS and QinetiQ

To examine vertical axis offshore wind turbines from an economic, environmental, and technical viewpoint. Project: \$4.5 million

<http://cleantechnica.com/2011/03/25/offshore-vertical-axis-wind-turbines/>

# Aerogenerator





An aerial photograph of a vertical-axis wind turbine (VAWT) under construction over a deep blue ocean. The long, white tower of the turbine extends diagonally from the bottom left towards the top left. Several horizontal blades are visible, some attached to the tower and others floating nearby. A small support vessel is visible in the upper right quadrant of the image. The sky is not visible, as the focus is on the turbine and the sea.

# Aerogenerator

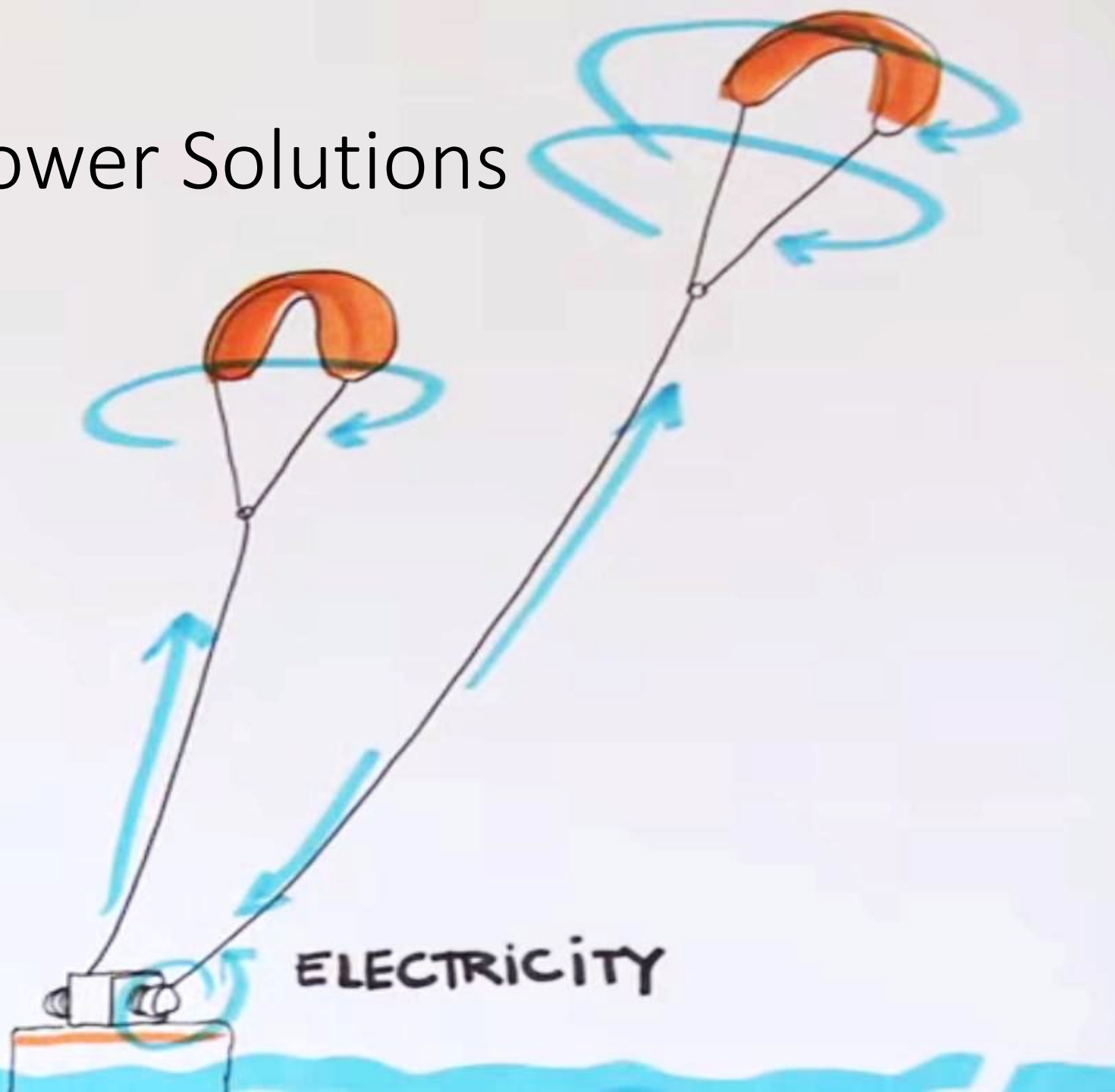
5 and 10 MW

Wind Power Ltd, David Sharpe, Grimshaw Architect

Wind Power says combined output from offshore wind plants of these designs could hit 1 GW by 2020.

<http://www.windpowerengineering.com/featured/business-news-projects/is-the-vertical-axis-turbine-key-to-offshore-success/>

# Kite Power Solutions



# Kite Power Solutions

3MW floating offshore arrays (by 2021)

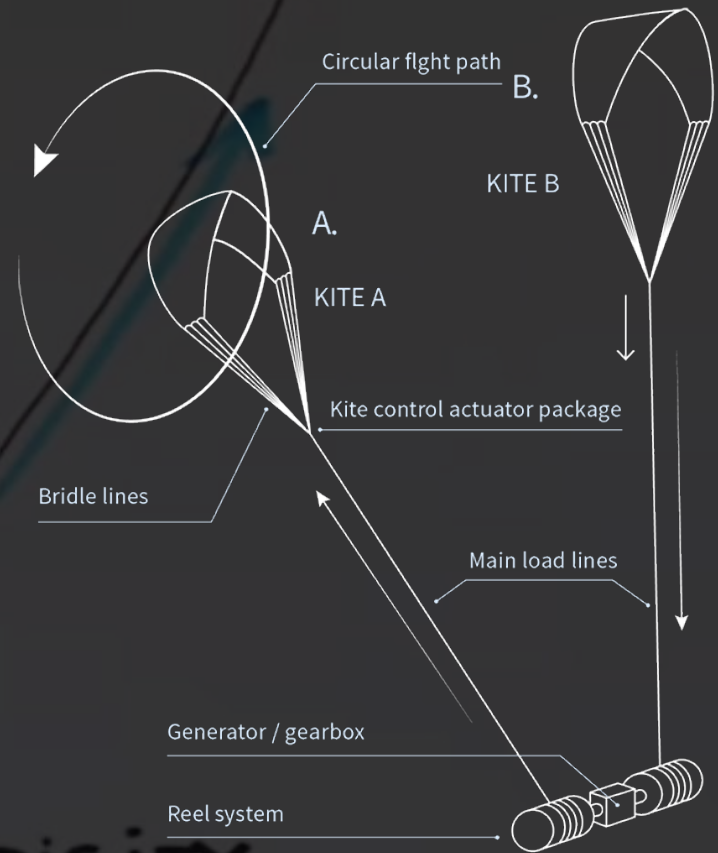
Cheaper to manufacture and easier to deploy and maintain.

Tether: 500-750m

Flight speeds: 45m/s (in 9m/s winds)

KPS-led consortium: BVG Associates, Artemis Intelligent Power, Imperial College London, The National Composites Centre, Keynvor Morlift Ltd, and Banks Sails.

[www.kitepowersolutions.com](http://www.kitepowersolutions.com)



# Wave

Up and down...

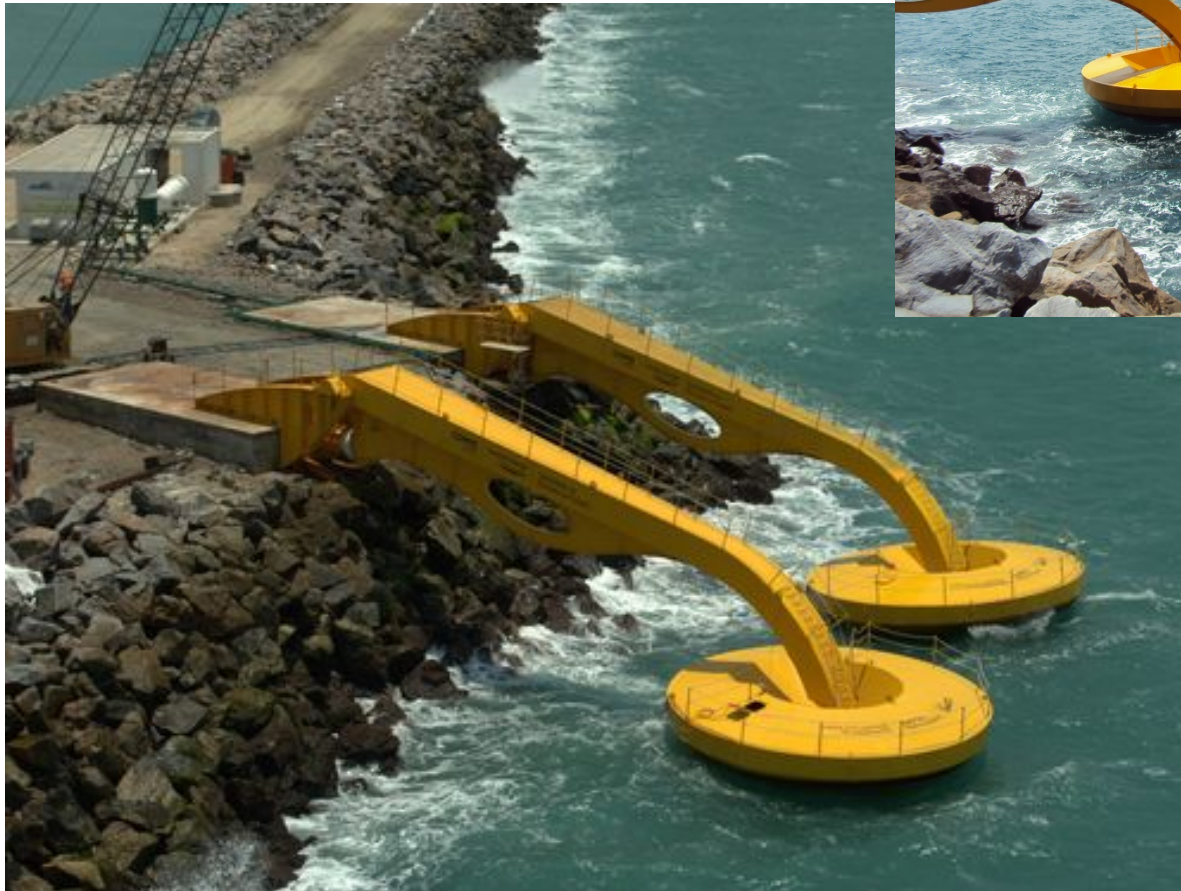


# Conventional

Waves

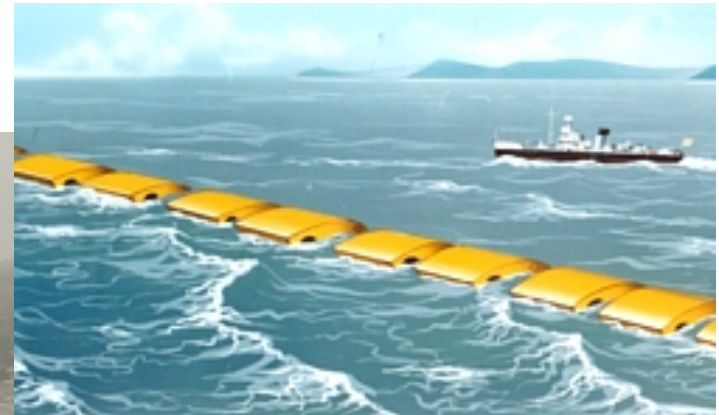


# Coastal support

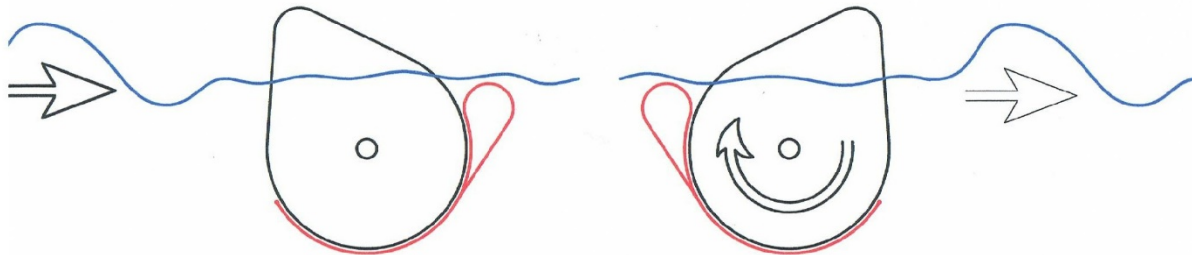


COPPE, UFRJ  
Porto de Pecém, CE  
Brazil

# The Duck



Prof. S. Salter,  
Univ. of Edinburgh, UK





# Pelamis



[www.pelamiswave.com](http://www.pelamiswave.com)



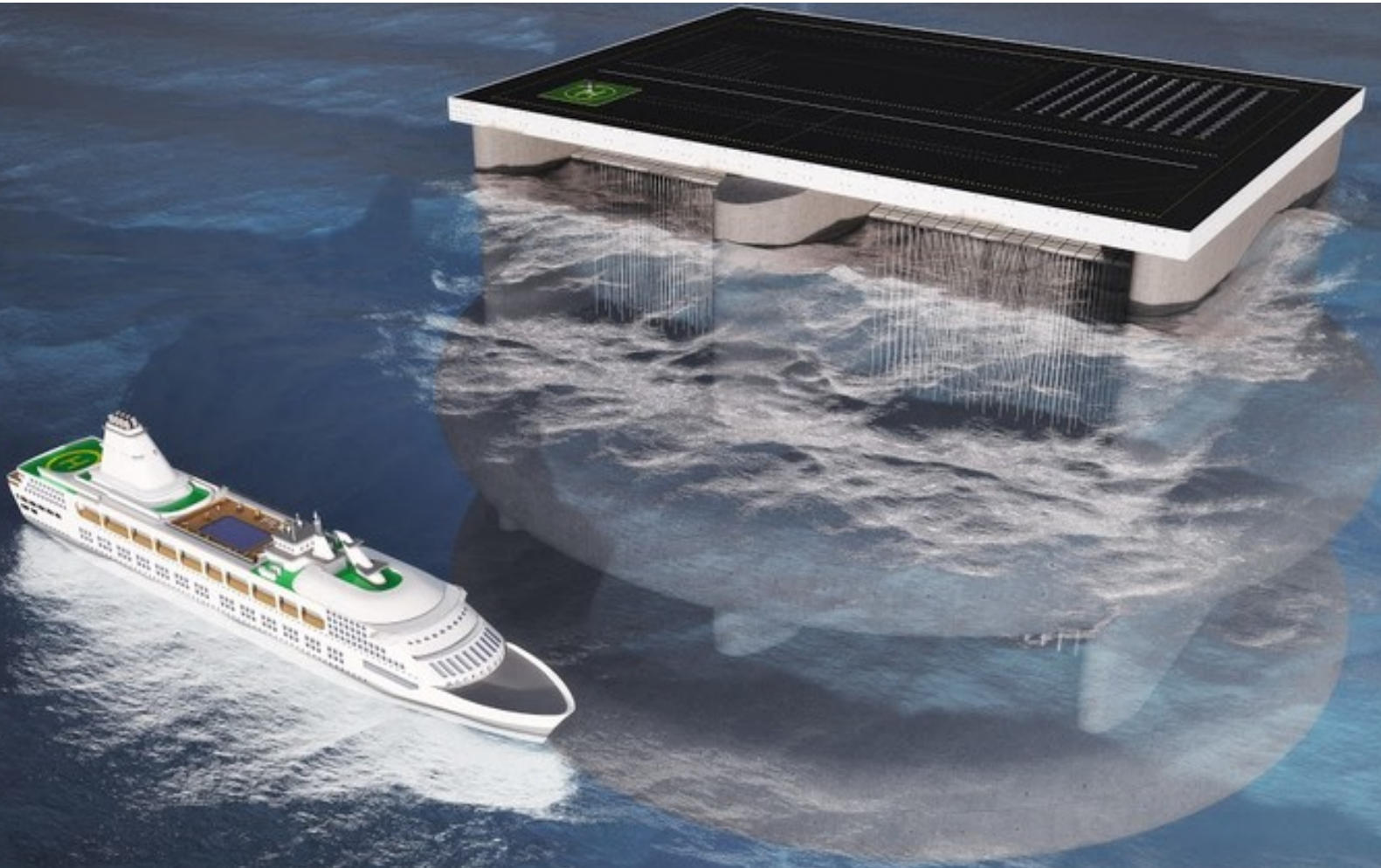
# Alternative concepts



# Ocean grazer

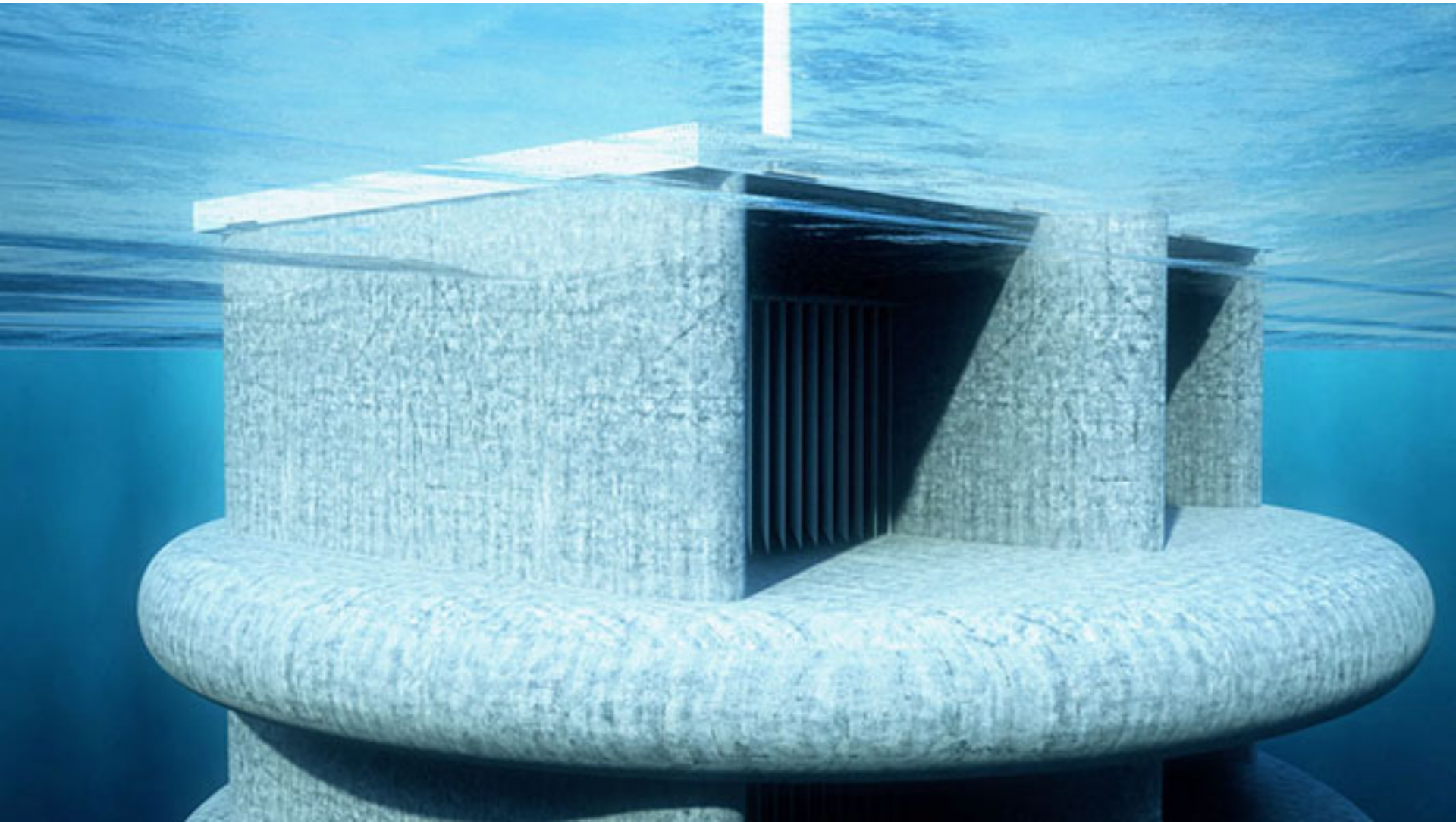
[www.oceangrazer.com](http://www.oceangrazer.com)

University of Groningen





# Ocean grazer

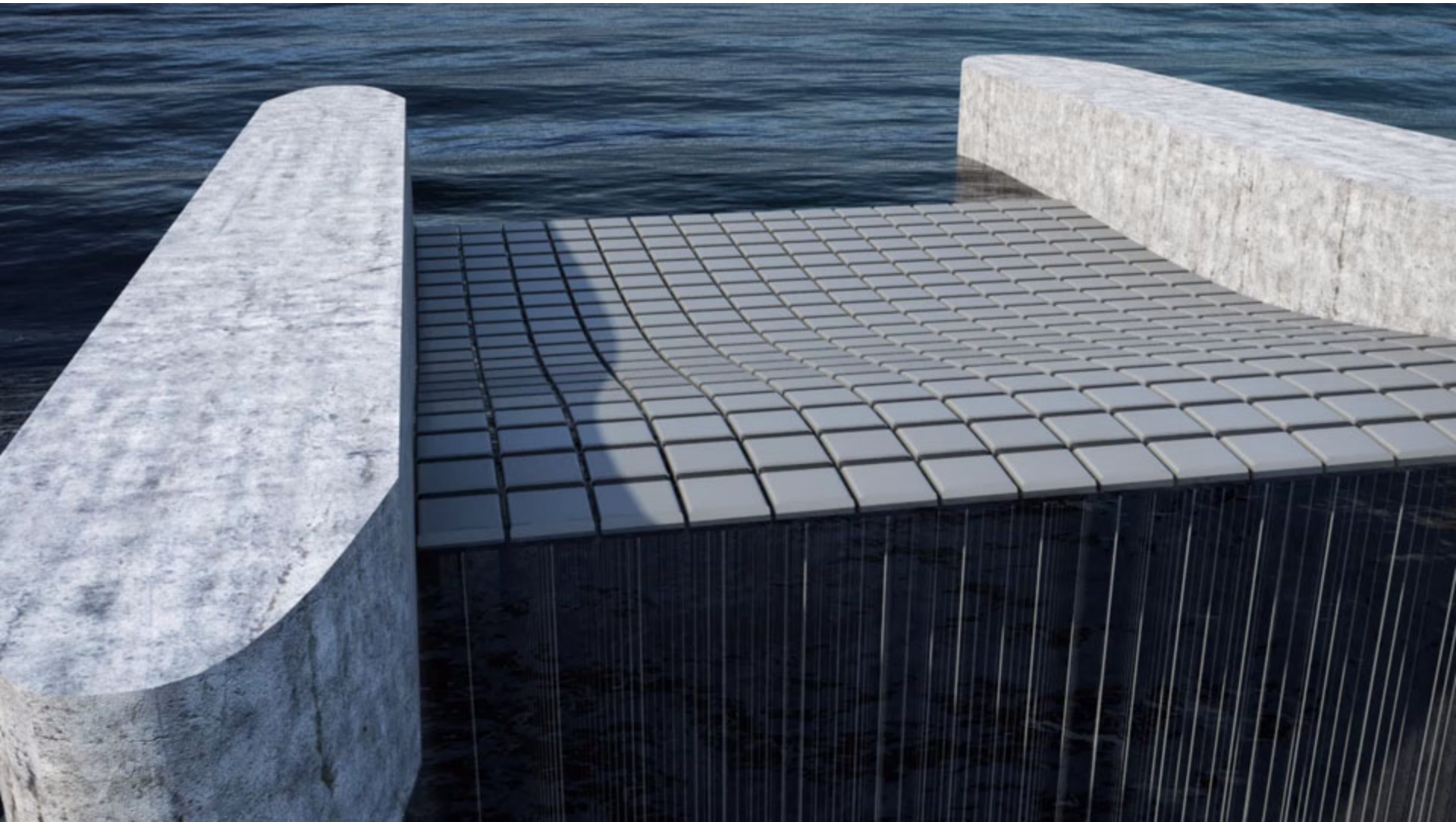


Ocean grazer



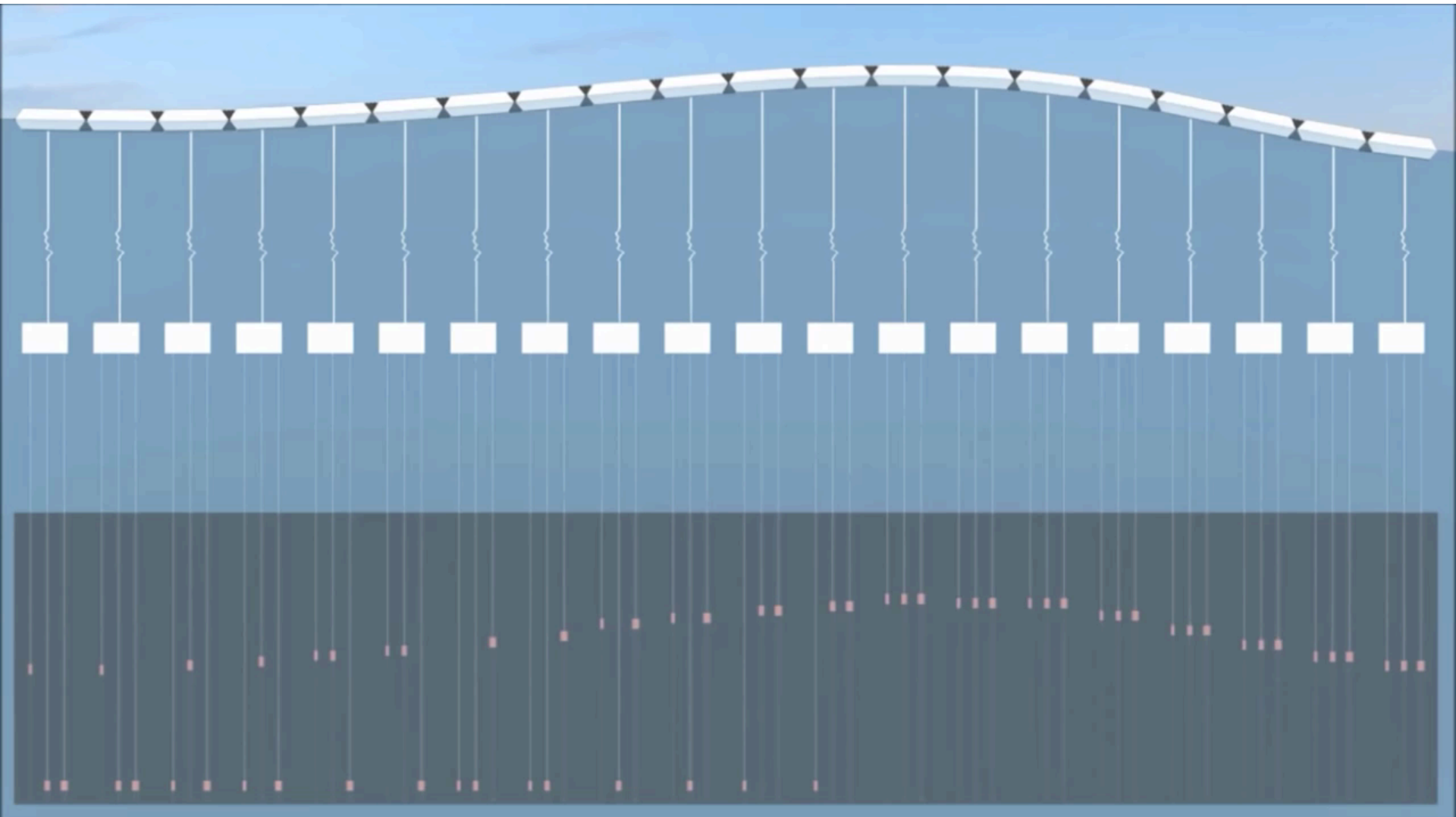


# Ocean grazer



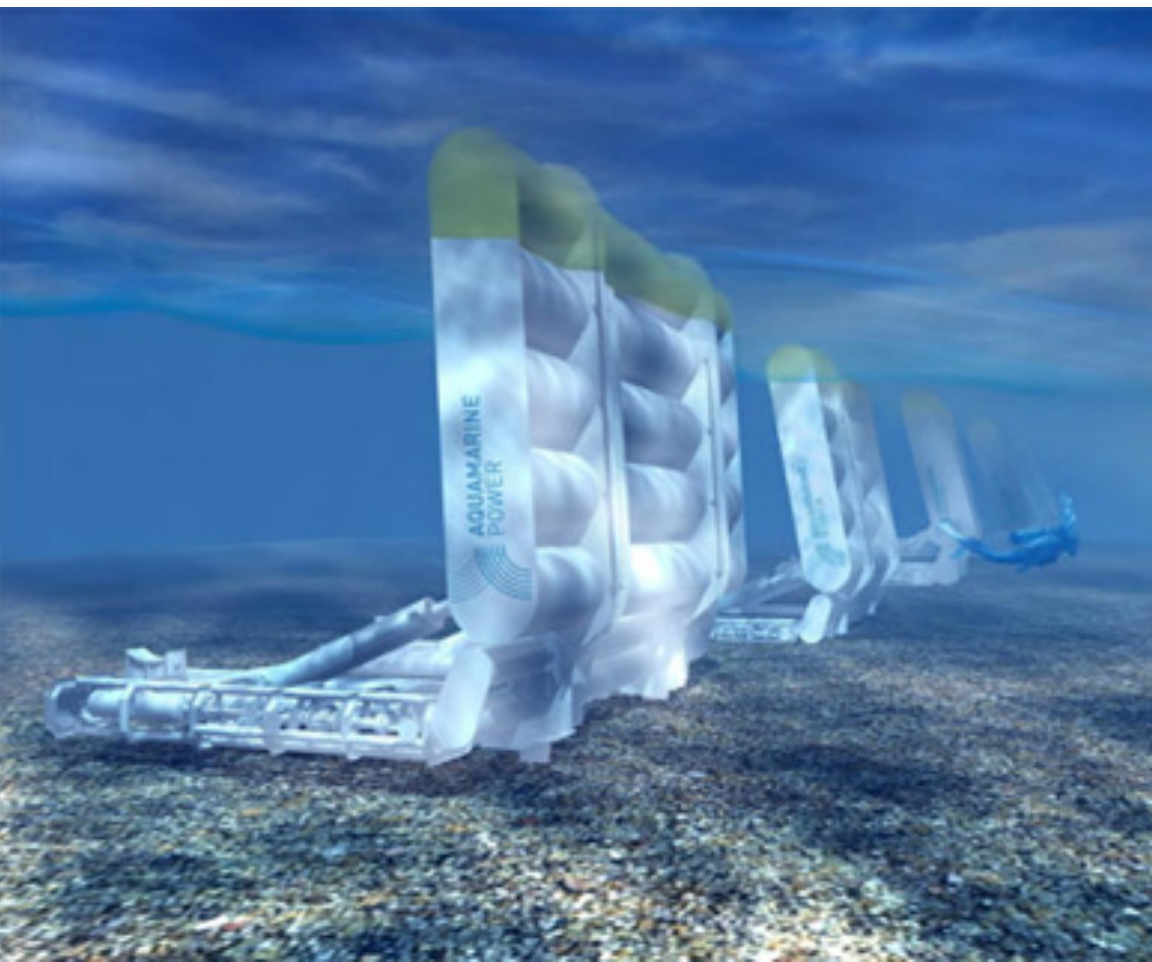
# Ocean grazer

MULTI-PUMP MULTI-PISTON POWER TAKE-OFF



# The Oyster

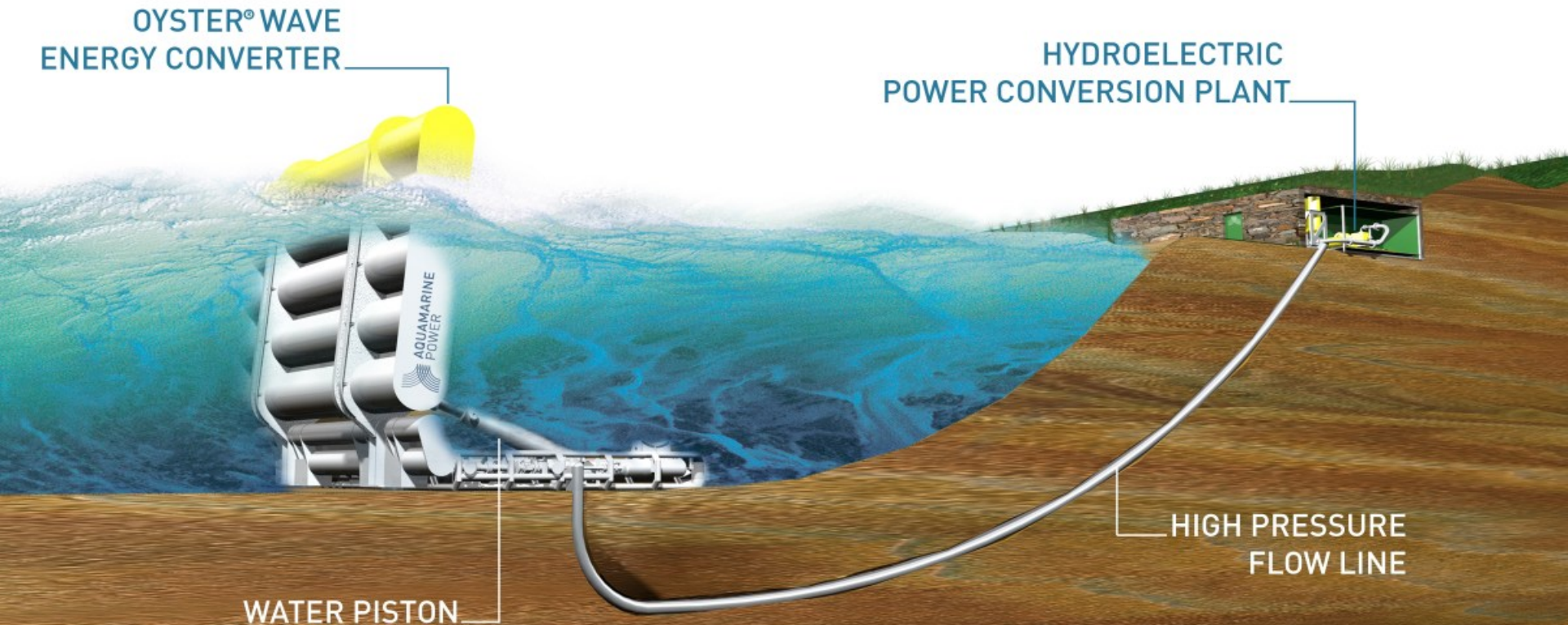
[www.aquamarinepower.com](http://www.aquamarinepower.com)



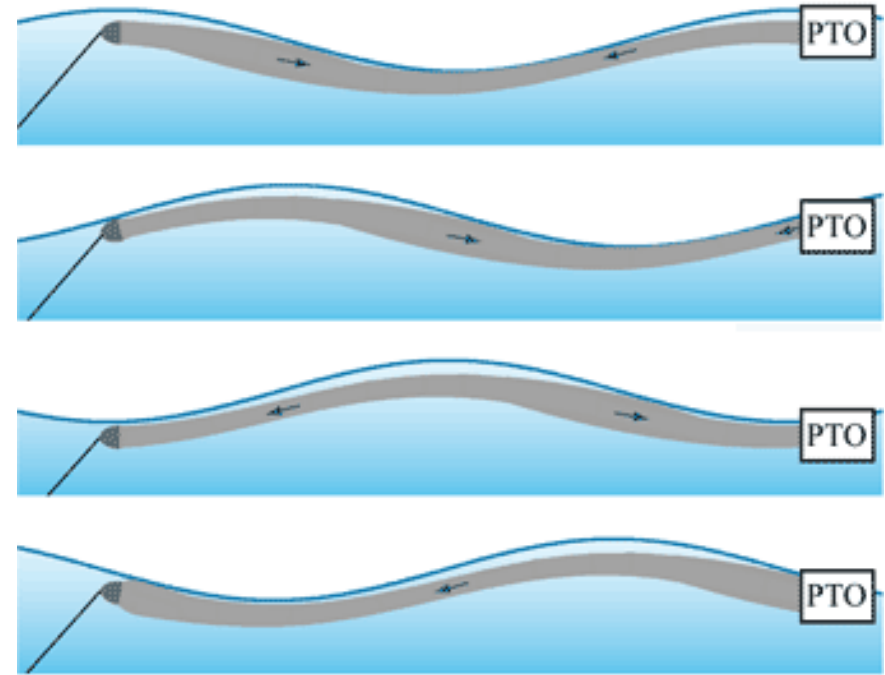
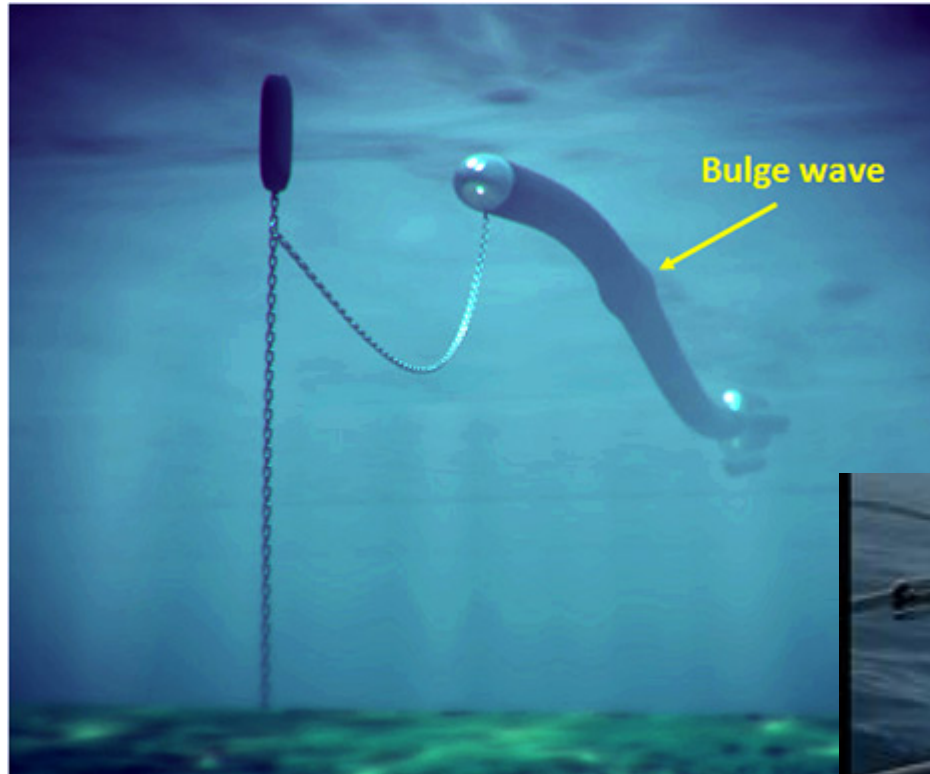


# The Oyster

- Near-shore ocean waves
- Water depth: 10 to 12 metres (2m above water line)
- Pumps water to a turbine: 315 kW electrical generator



# Anaconda



[www.checkmateukseaenergy.com](http://www.checkmateukseaenergy.com)



 ANACONDA®

# Thank you

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