

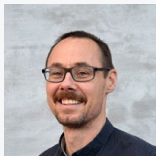


Nov 2022  
Martin von Bülow  
+45 28512259  
mvp@wavepiston.dk  
www.wavepiston.dk



# The Team

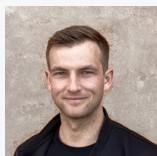
## Denmark



CEO,  
Michael Henriksen



Lead Engineer,  
Kristian Glejbøl



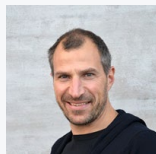
Head of Production,  
Oscar Helmersen



Chairman of the  
Board, Jesper Højer



CTO,  
Steen G. Thomsen



Chief Specialist,  
Martin von Bülow



Development Engineer, Member of the Board,  
Troels V. Lukassen



Torben Arnth Nielsen



CFO,  
Lars Bonnichsen

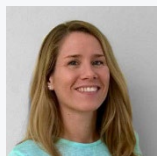


Head of Admin.,  
Tina H. Christensen

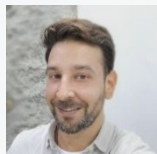


Development Engineer,  
Mian Masoud

## Gran Canaria



Operational Coordinator,  
Esther Capote Kerr



Technical Coordinator,  
Alberto C. González

## Experienced Team and Board – Competences:

- Offshore
- Energy
- Taking an Idea to a Viable Product
- Management
- Execution Power
- Engineering
- Finance

# Wavepiston is solving two of the largest challenges in the world



## Renewable Energy

**€ 330 Bn/year**  
Doubling in next decades

**O&M: € 20 – 30 Bn/year**



## Fresh Water

**€ 16 Bn/year - Desalination**  
Annual growth: 9.5 %

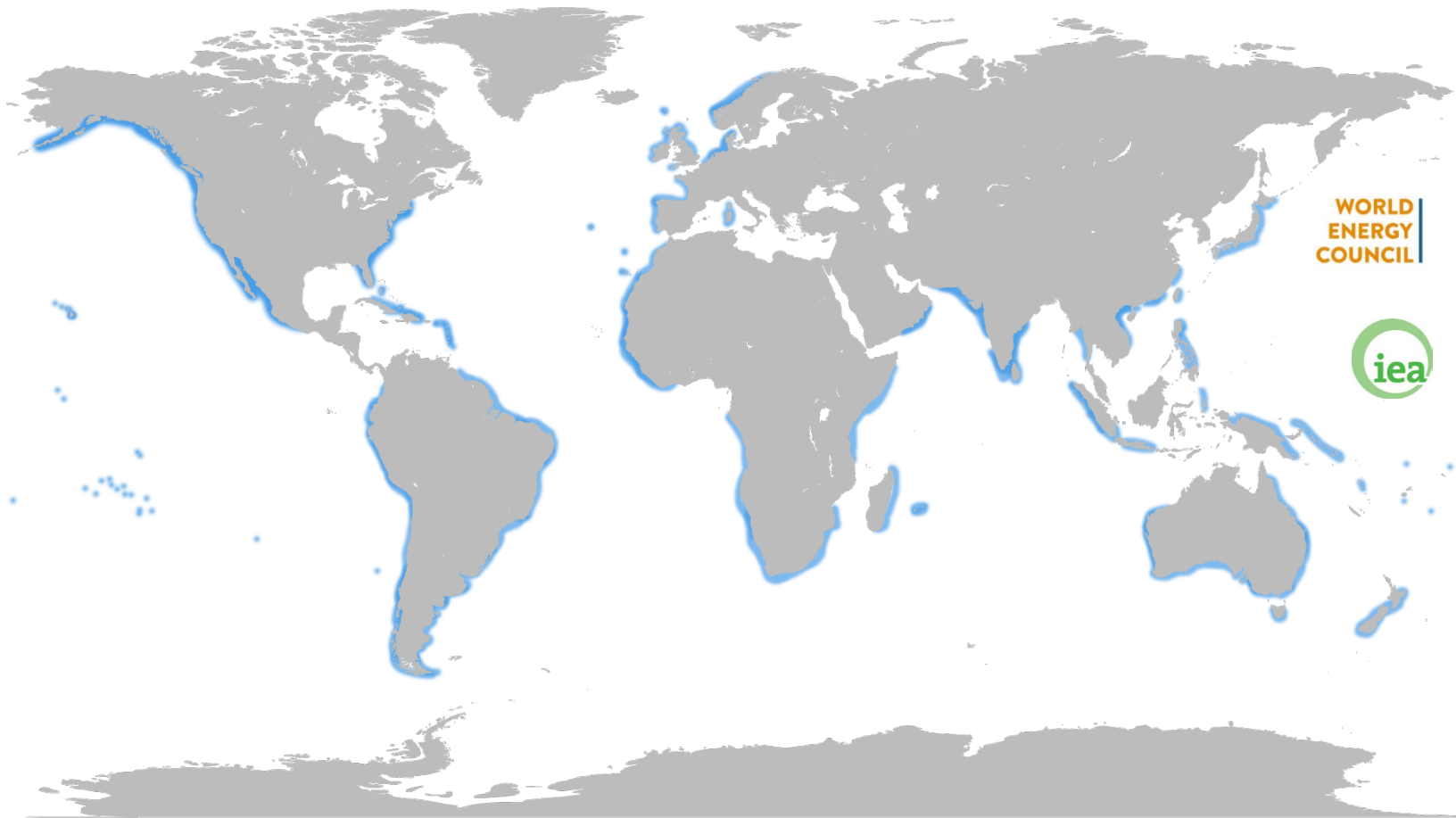
**O&M: € 4 – 5 Bn/year**

Source: IEA, World Energy Investment 2021

Source: Global Desalination Market by Regions,  
Technology, Application, Company Analysis,  
Forecast 2021



# Why Waves? A Very Large Potential & complementing Wind and Solar



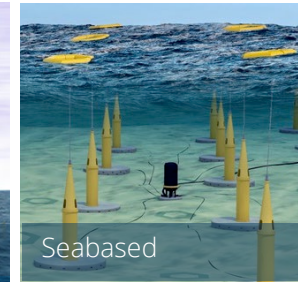
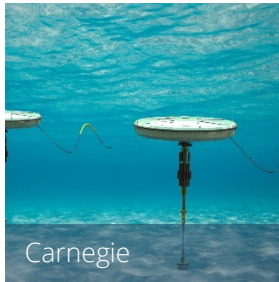
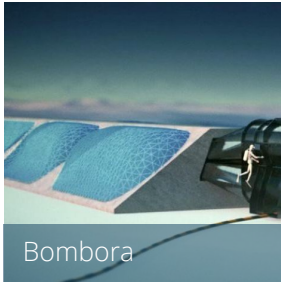
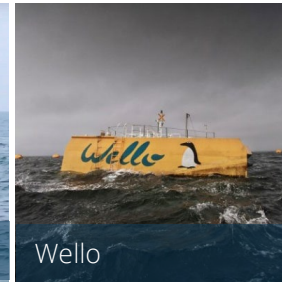
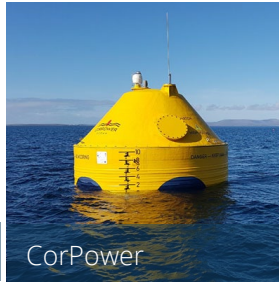
WORLD  
ENERGY  
COUNCIL

2,000 GW  
€ 600 Bn/year



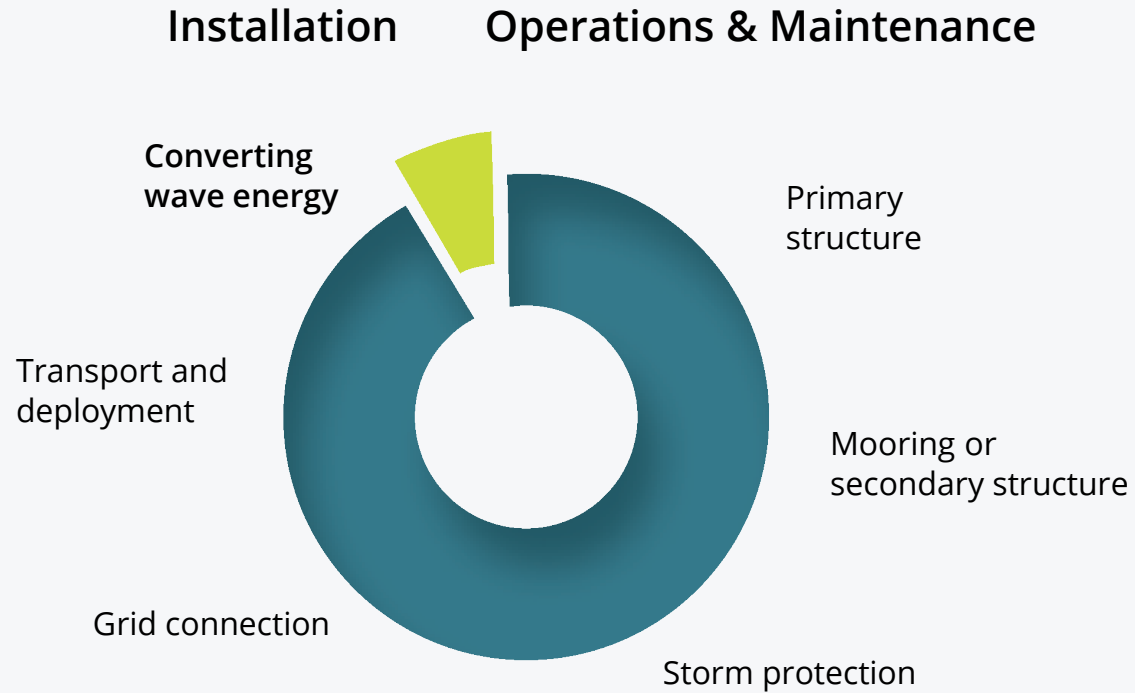
29,500 TWh/year

# Wave Energy – The Dominant Design Competition

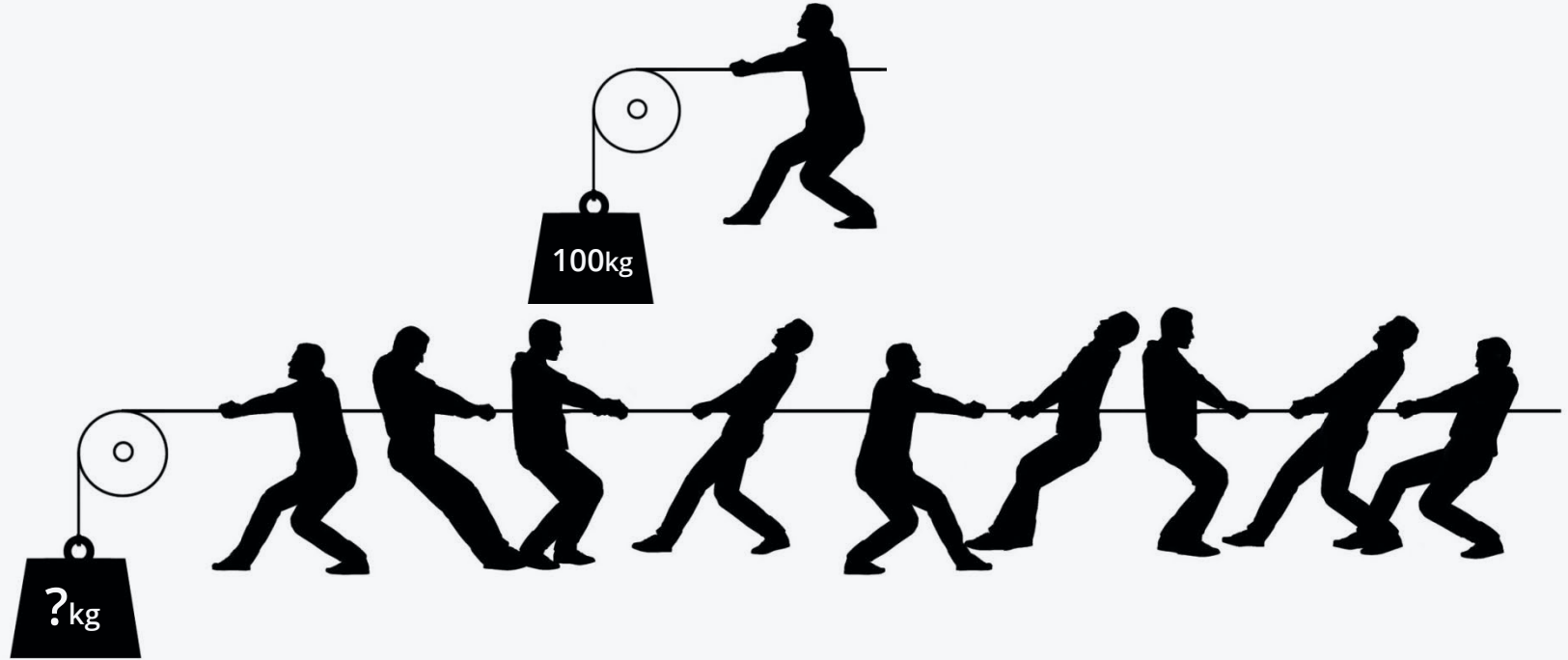


...and many more

# Wave Energy Cost Drivers



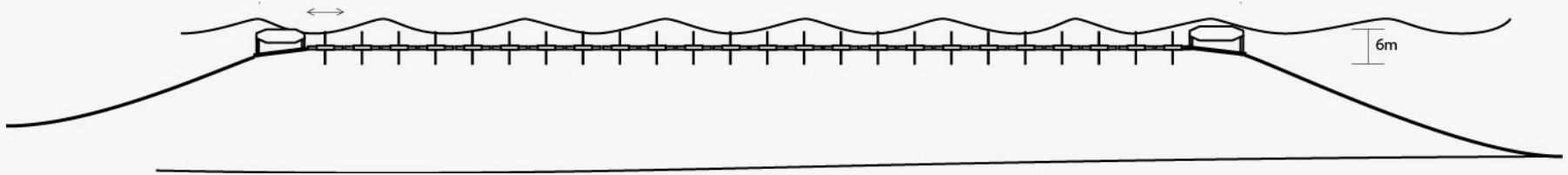
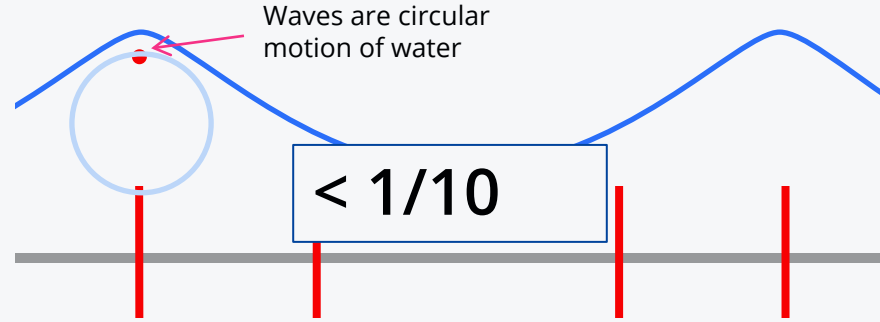
# Force Cancellation



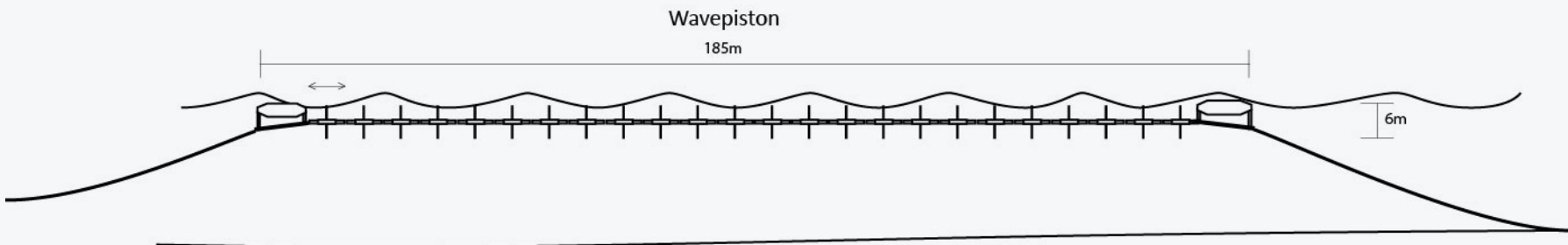
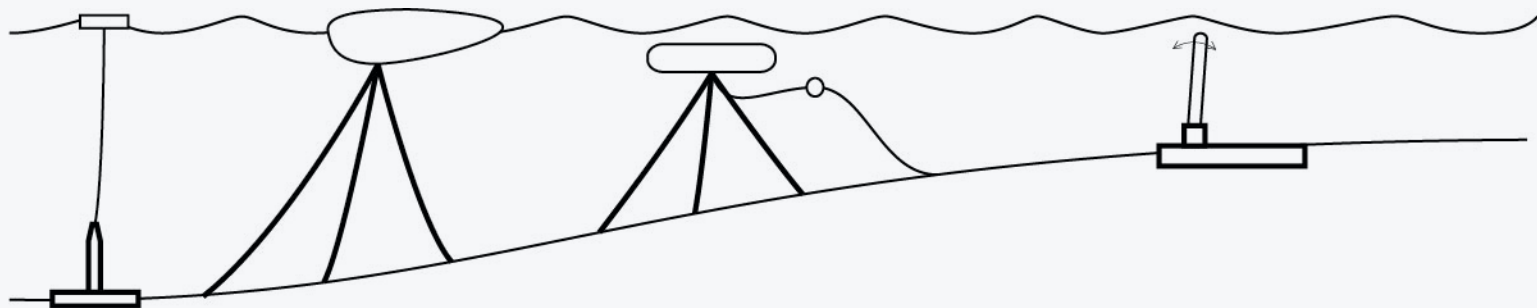


# Force Cancellation

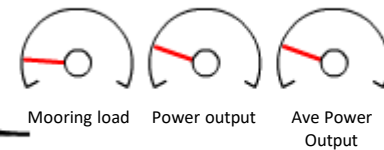
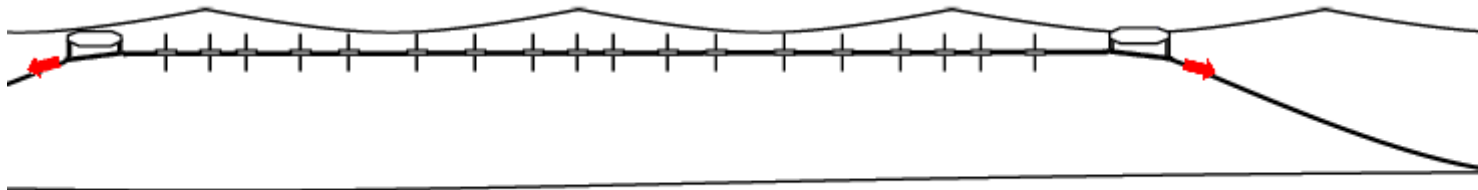
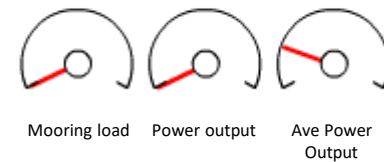
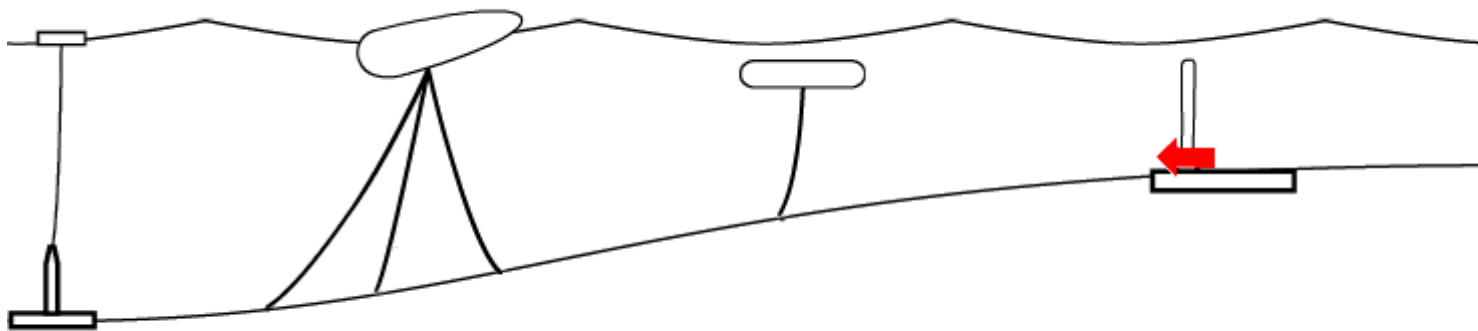
Force Cancellation



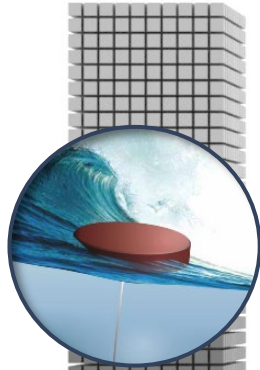
# Force Cancellation



# Force Cancellation



# Weight = Costs



1000 - 3200 Tons  
Other Wave Energy



200 - 1000 Tons  
Offshore Wind

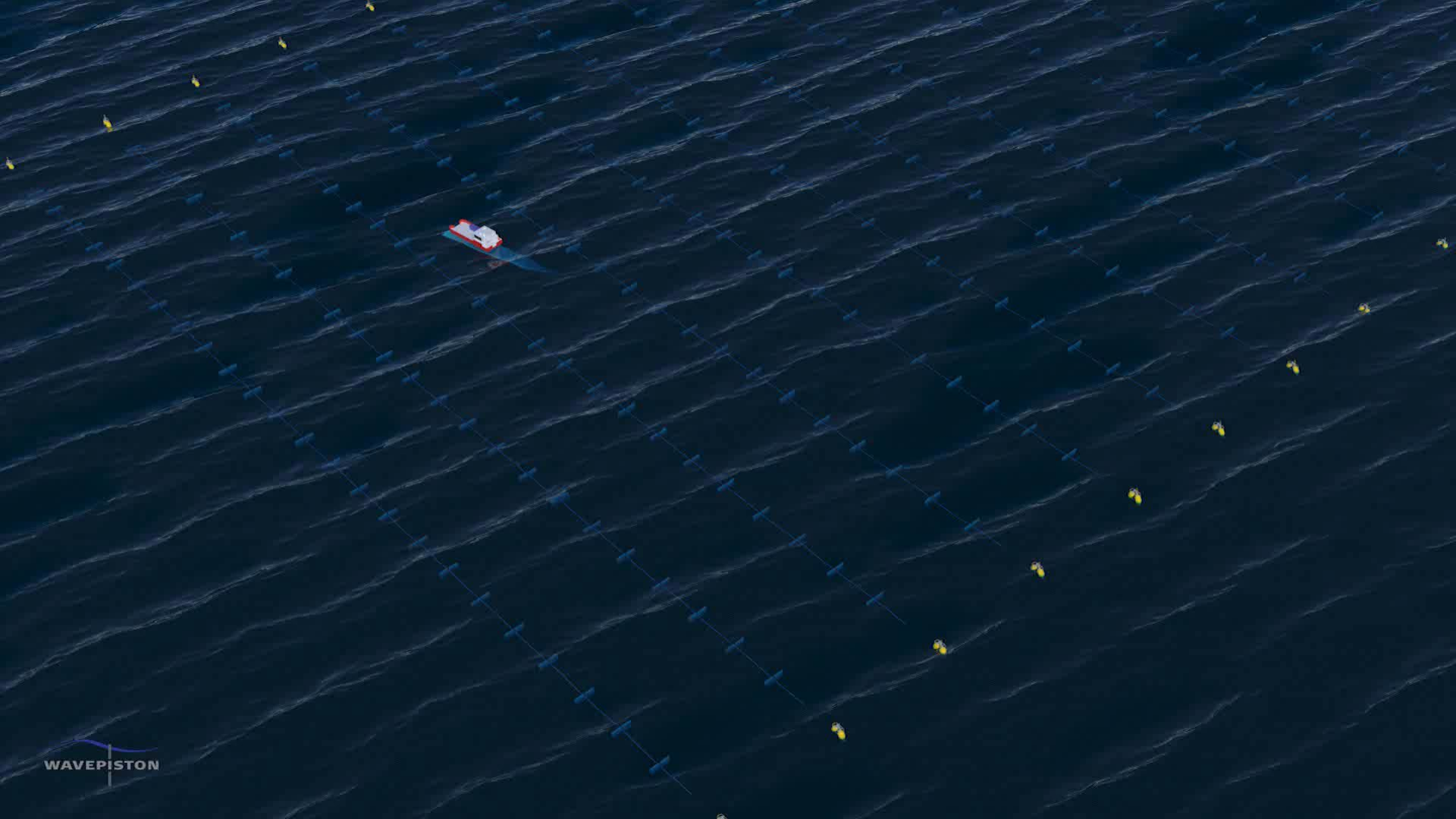


350 Tons  
Wavepiston

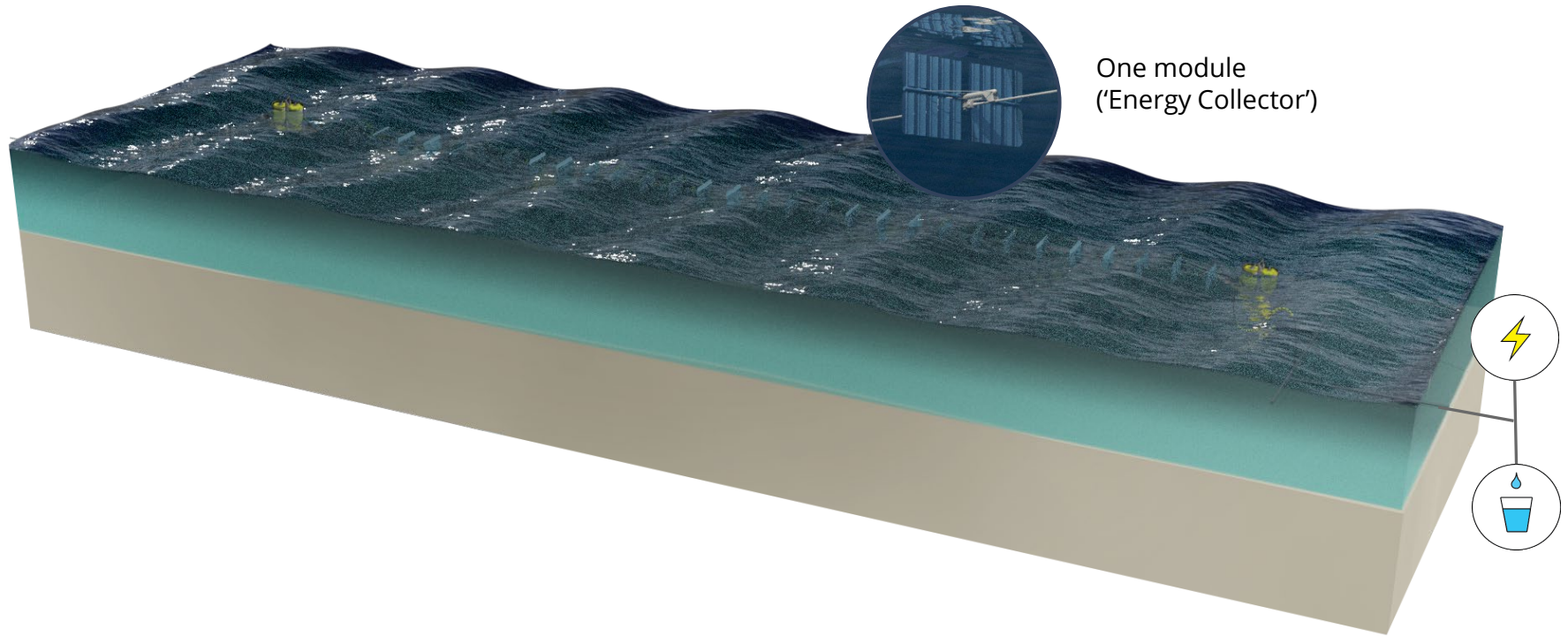
**1 MW energy output**

Total weight including mooring





# Many modules – One system



# The Wavepiston System

An aerial photograph of the ocean surface showing a large-scale wave energy harvesting system. The system consists of numerous parallel lines of buoys or floats stretching across the water. A small boat with a red and white cabin is positioned on one of these lines. The water is dark blue with visible wave patterns.

A system of strings and modules

- Large Scaleability
- Large Redundancy

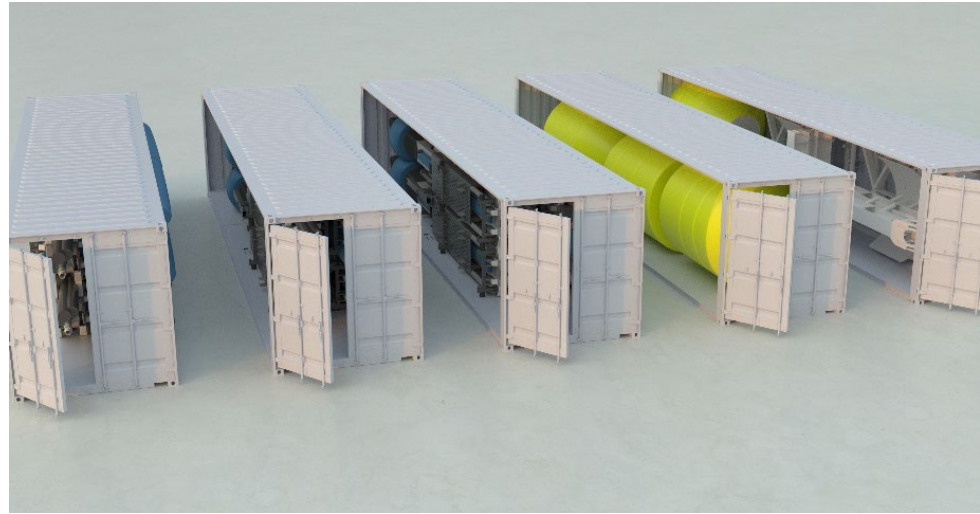


# Inspired by the "Flat Pack" principle

High Automation ✓



Standard Transportation ✓





# Combining Electricity and Water

## Higher Efficiency



SUSTAINABLE  
DEVELOPMENT  
GOALS

6 CLEAN WATER  
AND SANITATION



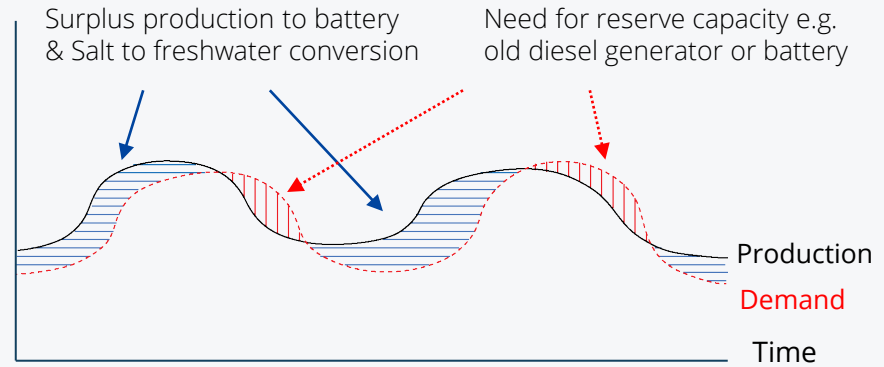
7 AFFORDABLE AND  
CLEAN ENERGY



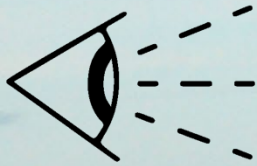
13 CLIMATE  
ACTION



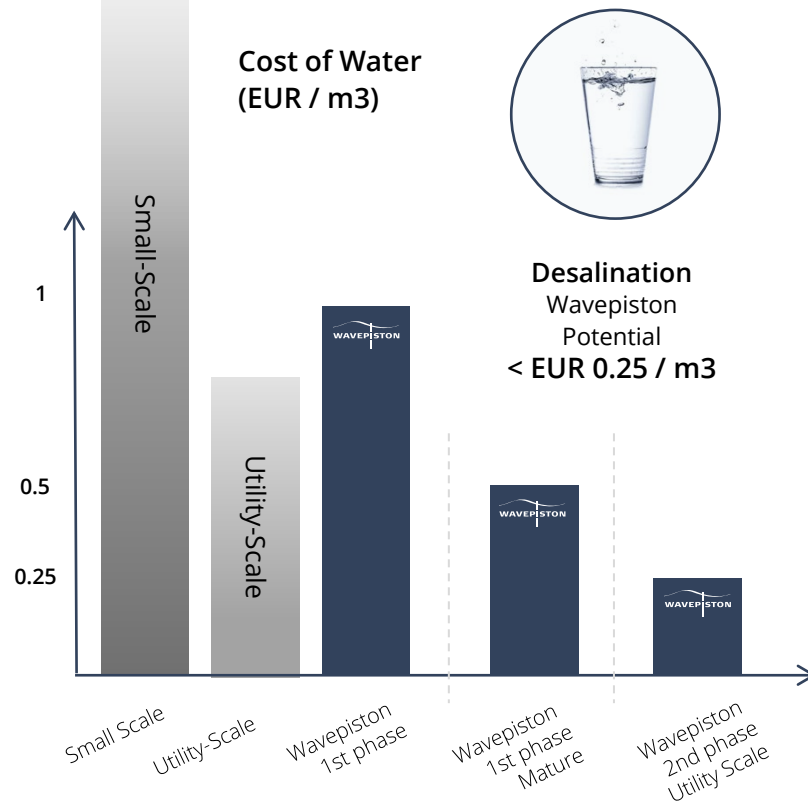
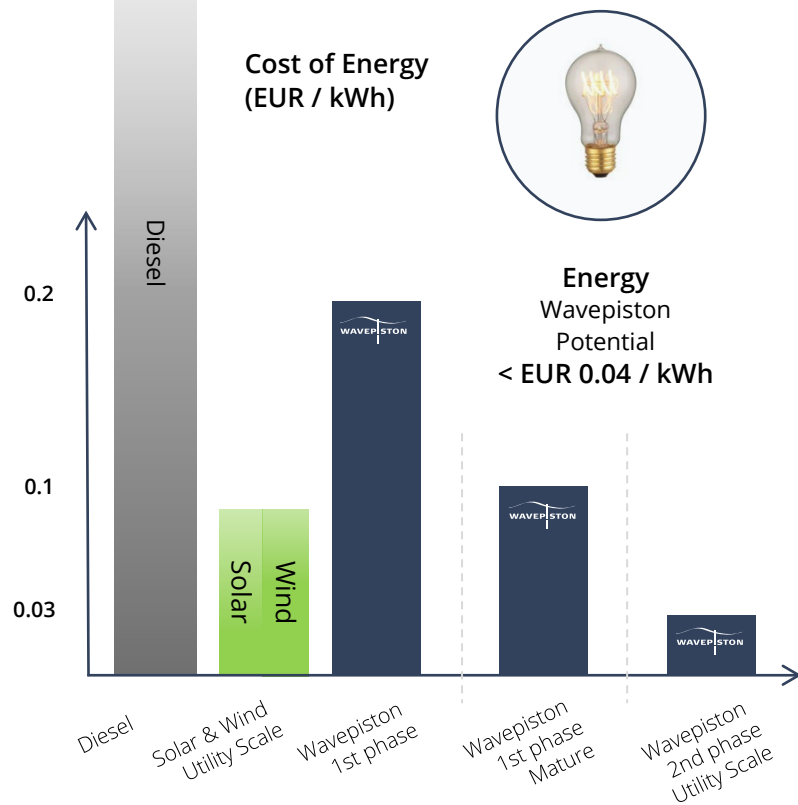
kWh



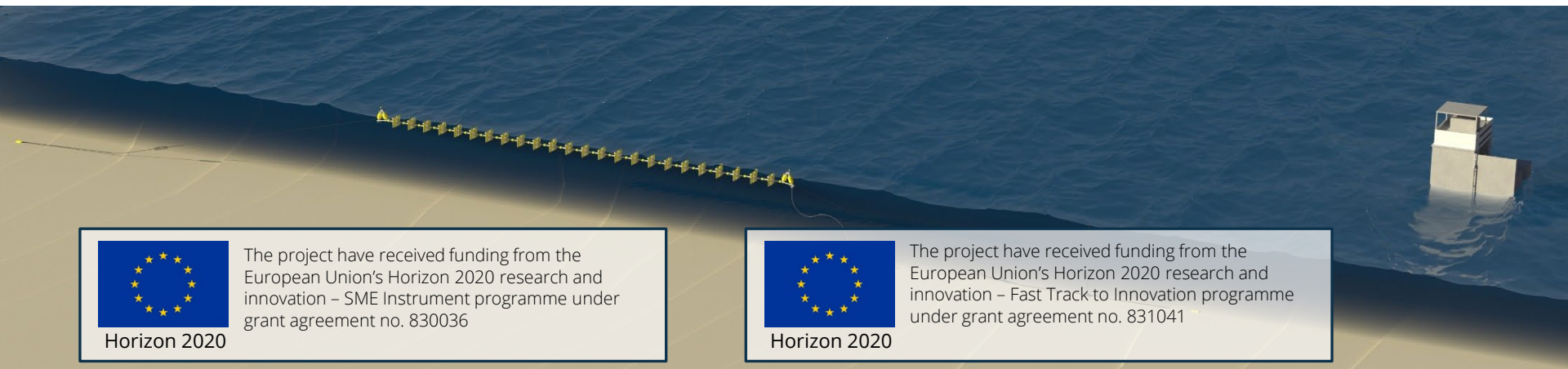
Non-intrusive



# A Very Competitive Price



# Wavepiston an Industry Frontrunner – Full Scale Pilot Projects



Horizon 2020

The project have received funding from the European Union's Horizon 2020 research and innovation – SME Instrument programme under grant agreement no. 830036



Horizon 2020

The project have received funding from the European Union's Horizon 2020 research and innovation – Fast Track to Innovation programme under grant agreement no. 831041

## Competitive Wave Energy on Islands



2019 – 2023



EUR 4.5M



200 kW, 547,000 kWh/year

## Wave to Energy and Water (W2EW)



2019 – 2023



EUR 5.2M



150 kW, 350,000 kWh/year (80%)  
28,000 m<sup>3</sup> water/year (20%)





# Installed at PLOCAN, Pre-Installation

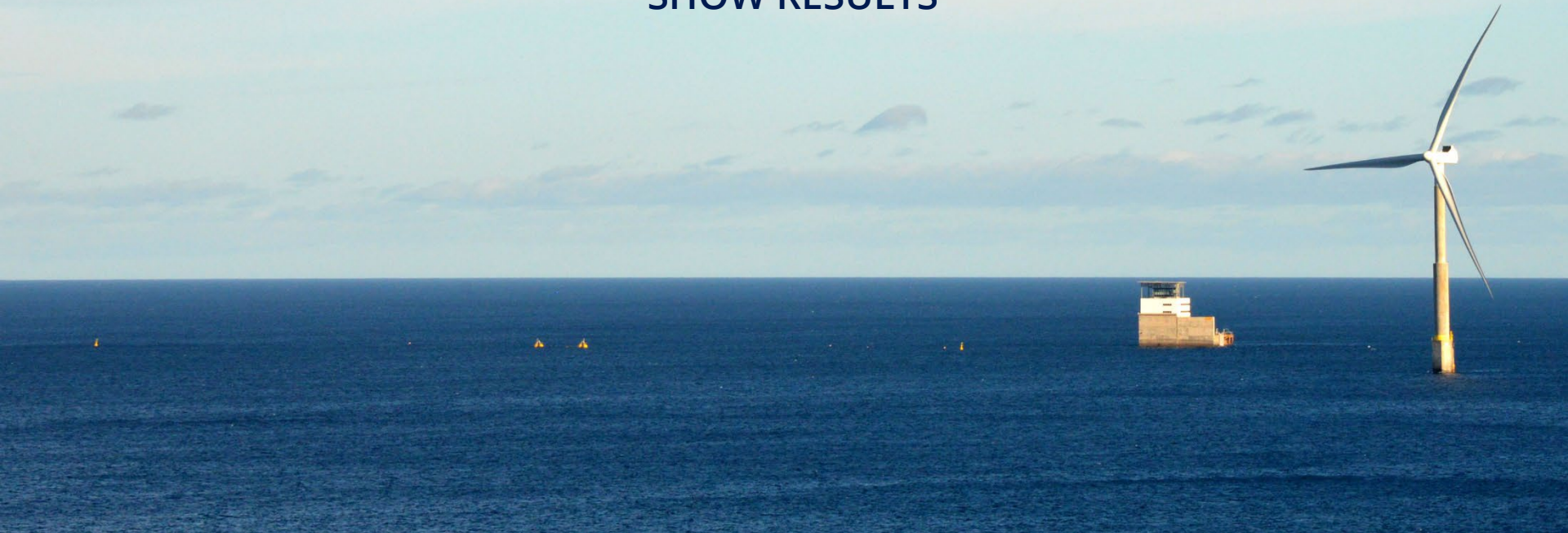
- December 2020 – March 2021





Full-scale Installation 2022 - 2023

SHOW RESULTS













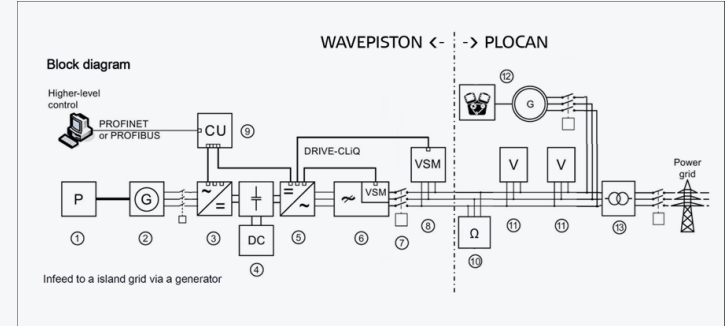




# W2EW Project - Power Generation unit (250 kW)



Standard 20' container



Generator 250kW

Calder Pelton turbine

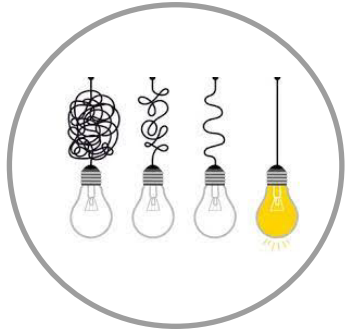
Grid 3x400 VAC, 50 Hz



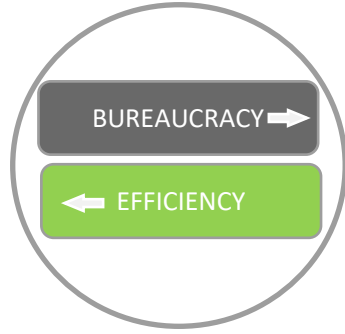
# W2EW Project - Desalination



# Challenges



Technology




Deployment



Cost and  
lead time



Cost and  
lead time



Renewable  
Energy &  
Desalination

Broad,  
Conceptual  
Patent

Simple,  
Robust,  
Standard,



*"For WECs, the key to successful commercialization is the right combination of **low cost, good conversion efficiency, and survivability.** Wavepiston, because of its unique design is poised to offer a **break-through in all three categories.**"*

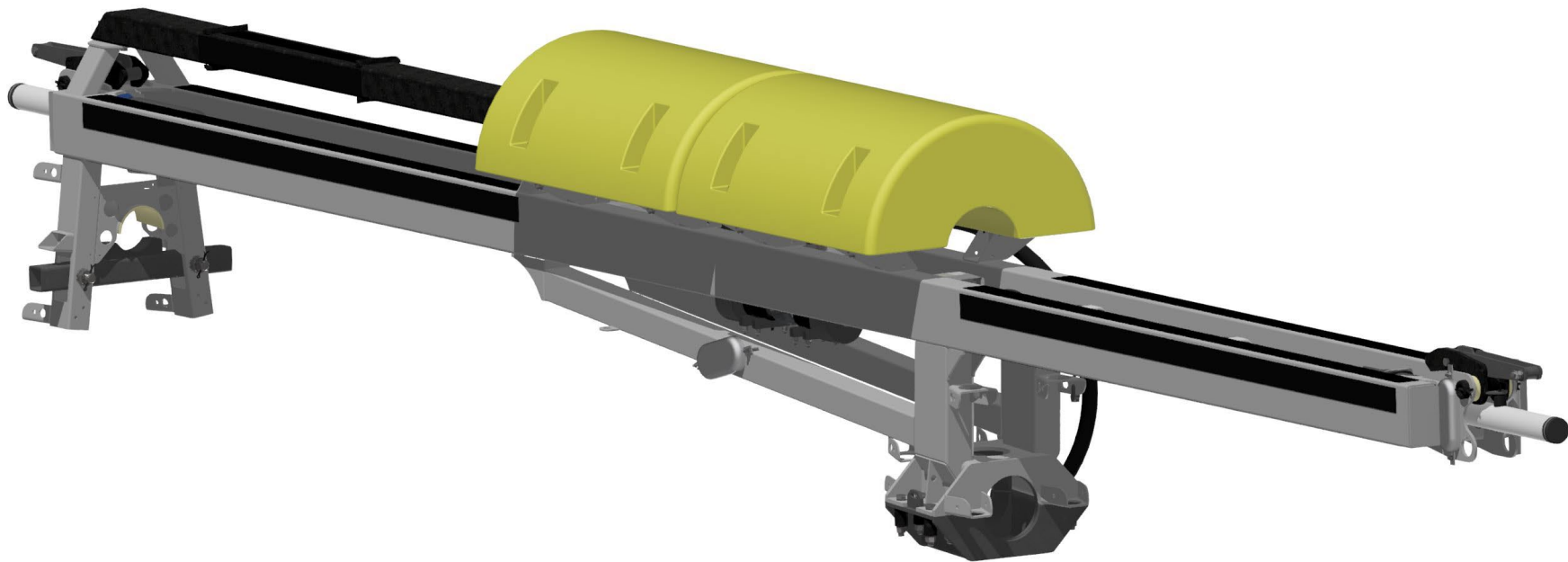
*C.A. Goudey & Associates*

*"...Wavepiston have come up with what is in my opinion likely to be **the first commercial viable wave energy harvesting device.**"*

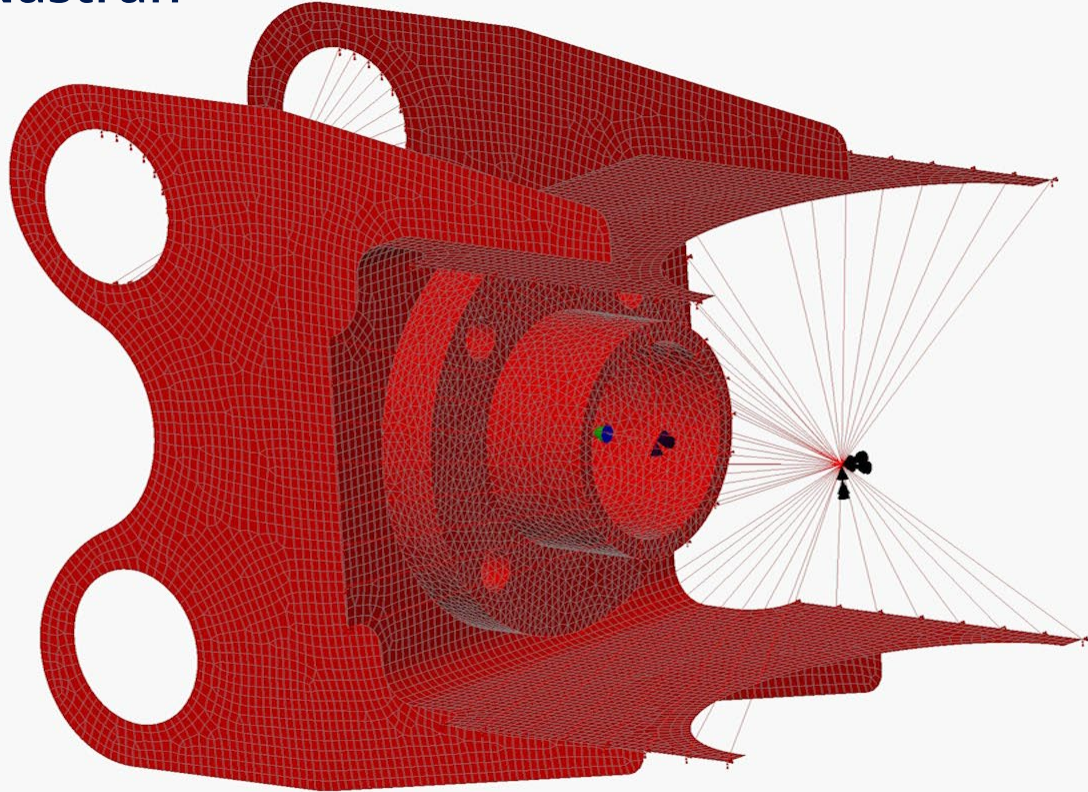
*Julian Smith, CENG MRINA. Naval Architect and Structural Engineer*



# Autodesk Inventor



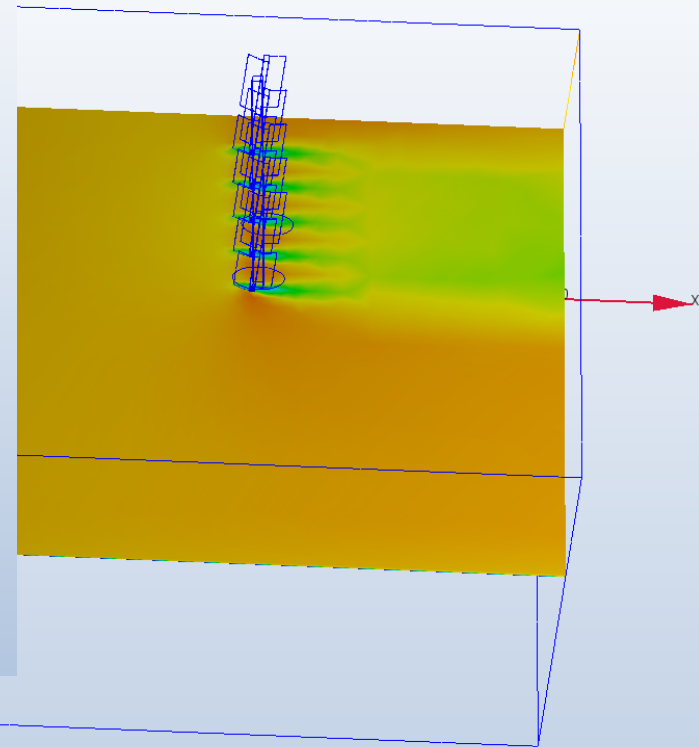
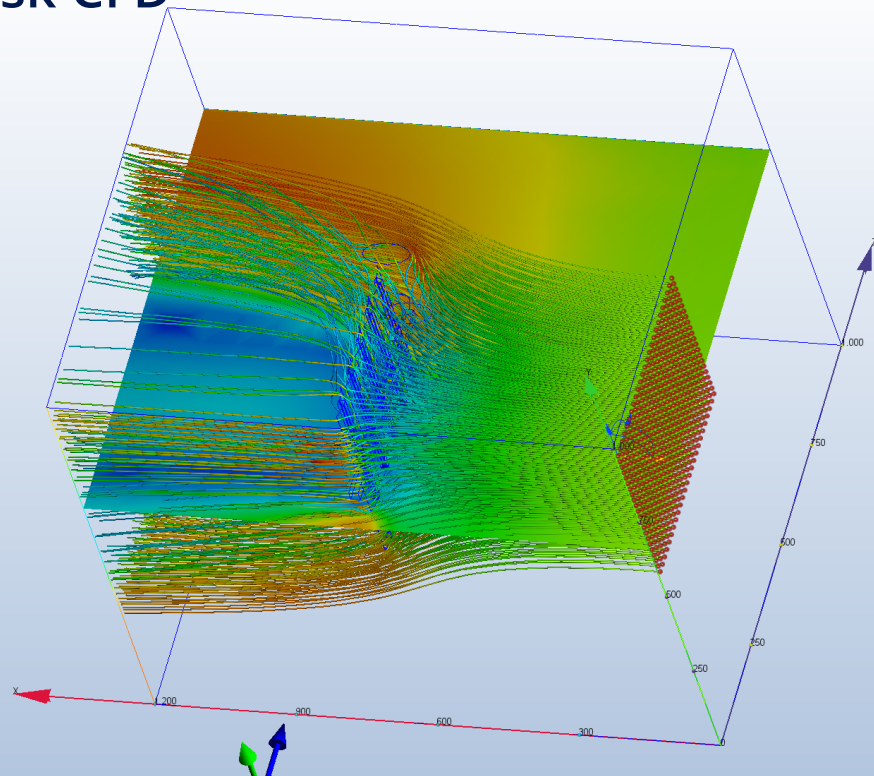
# Autodesk Nastran

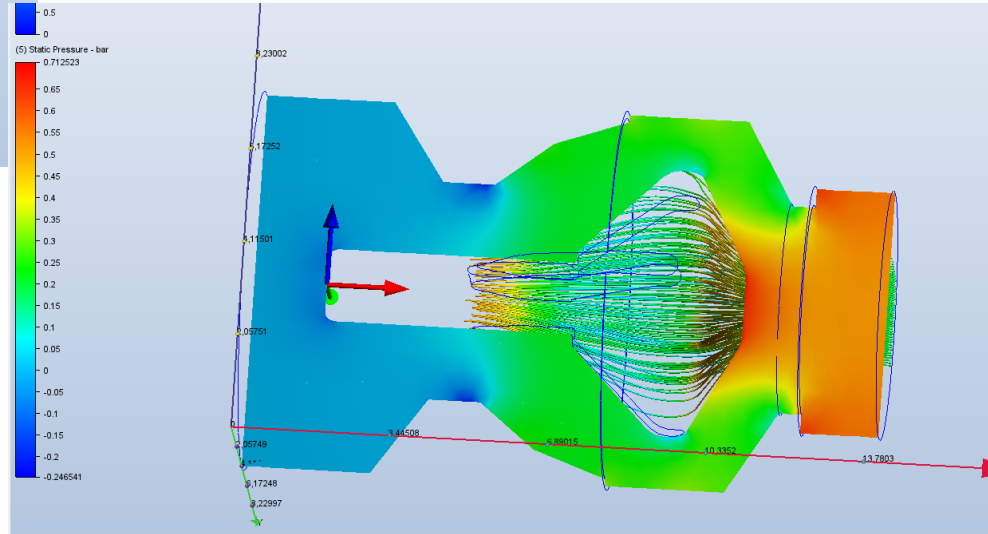


CONTOUR: SHELL EQUIVALENT STRESS (MPa)  
DEFORMED TOTAL: (MIN=0, MAX=6.228054)  
OUTPUT SET: SUBCASE 2 LOOKING FRAME : 0



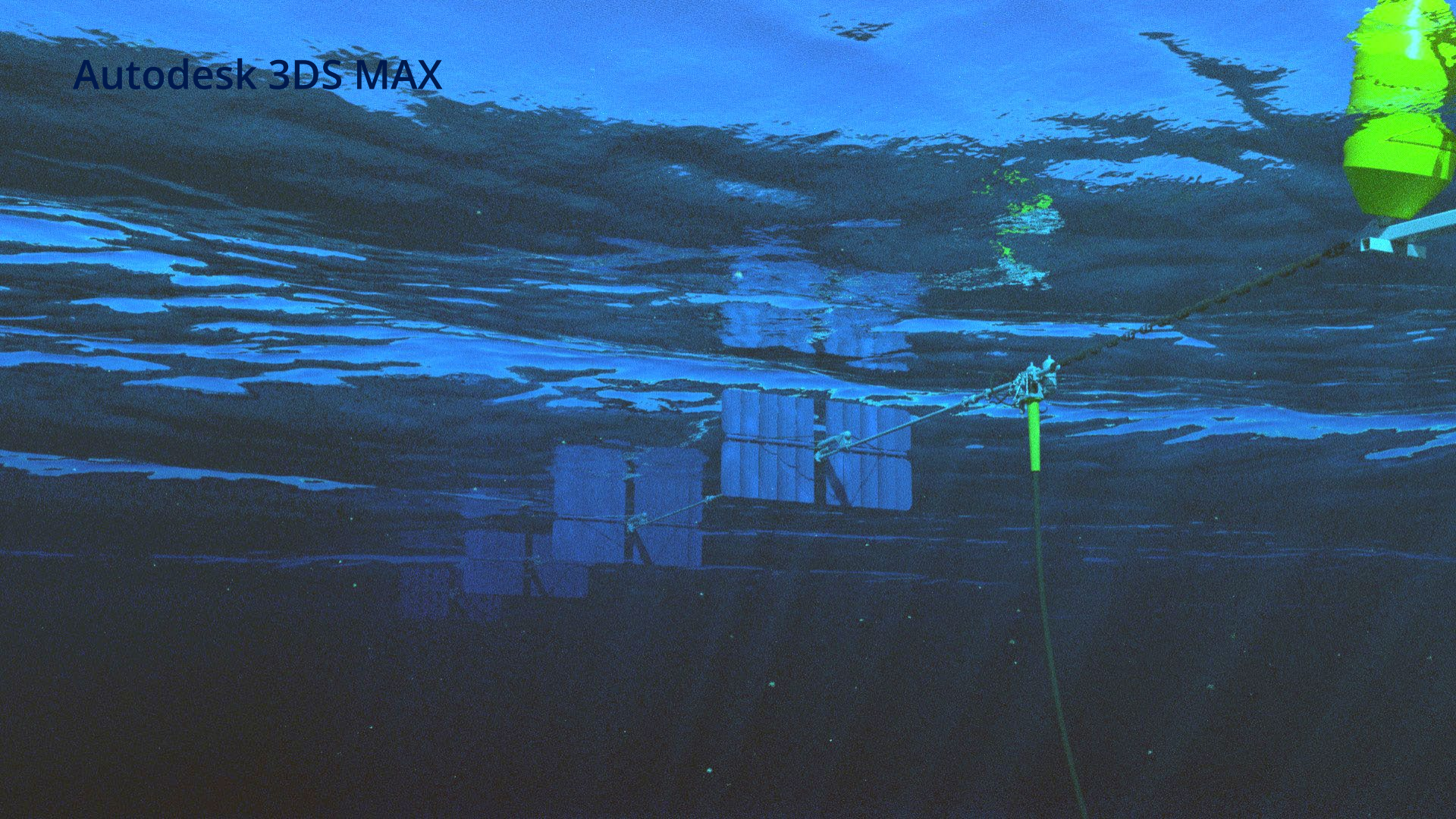
# Autodesk CFD







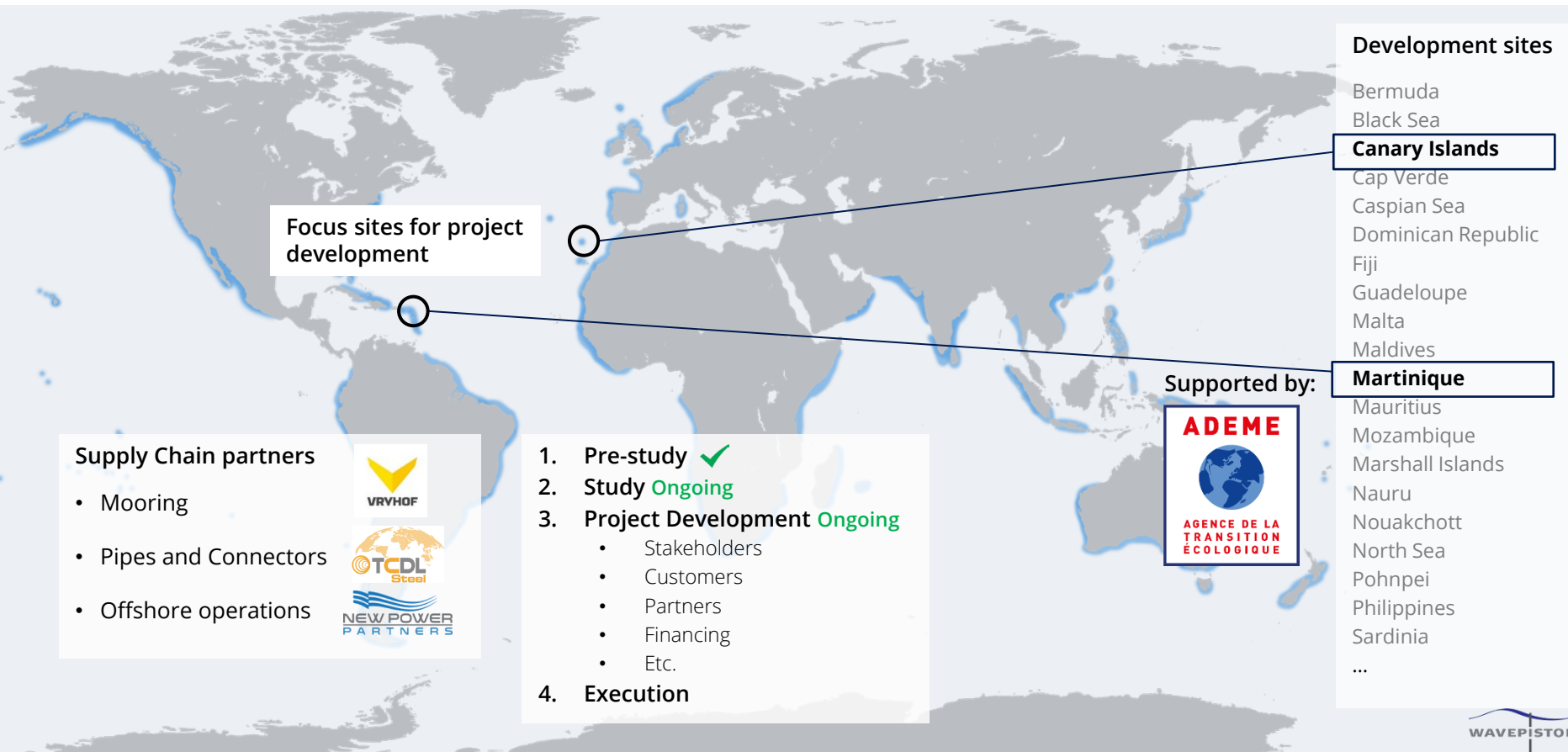
Autodesk 3DS MAX



# APPENDIX

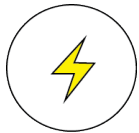
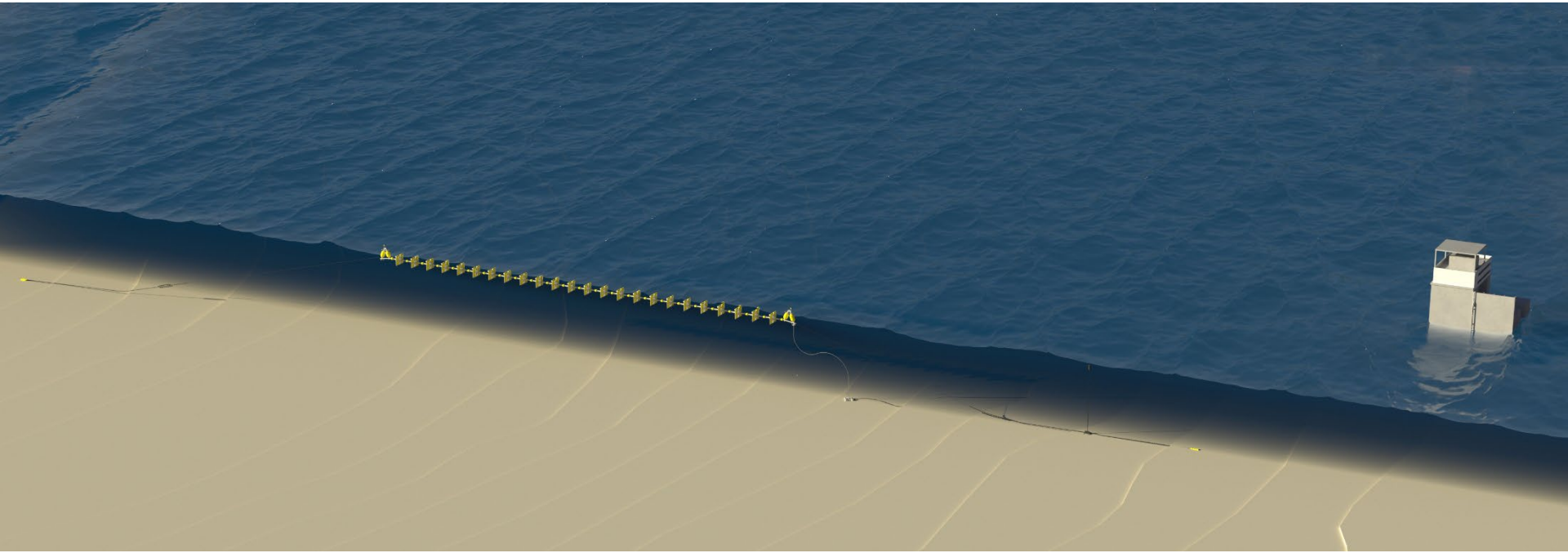


# Locations and Partners for First Commercial Projects





# The PLOCAN Demonstration System



200 kW / 65 kW -  
App. 140 households



150,000 m3 water per year (if 100 % on desalination) -  
App. 900 households

# Waves – What Are They?

“...energy passing through water”

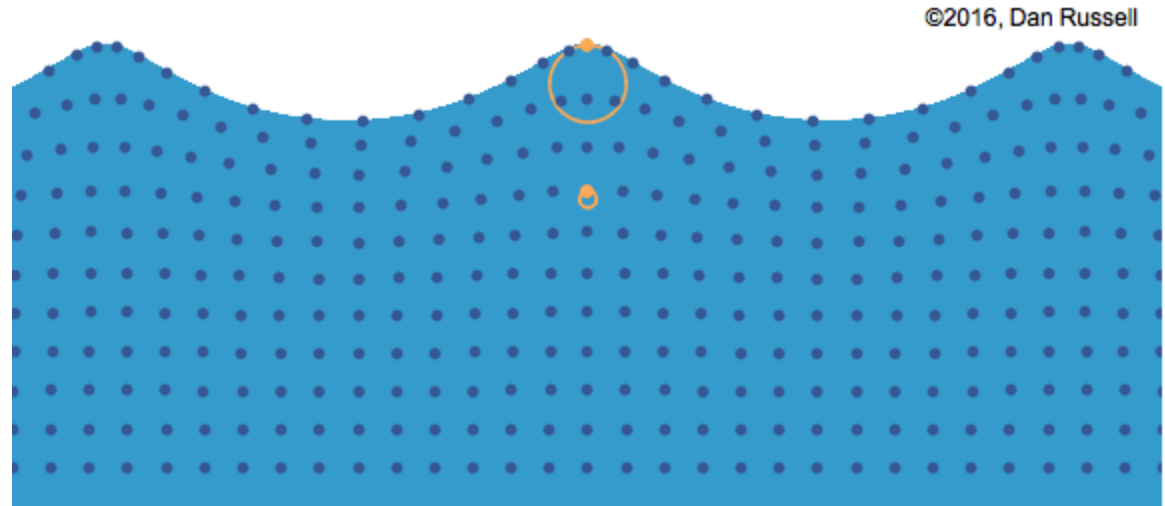
Wind

Speed

Duration

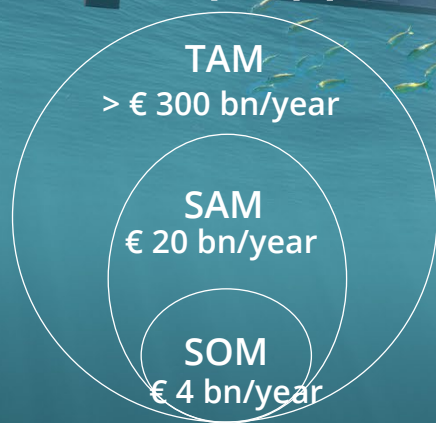
Fetch

*(Bathymetry and Current)*



# Commercial

## Go to Market – 2-step Approach



**Step 1:**  
**Small Scale**  
€ 0.38 per kWh!\*

Large water scarcity



**Step 2:**  
**Utility Scale**  
Electricity and  
desalination



€ 22 bn



€ 6 bn

\* Average LCOE on diesel generated power on islands with 1,000 – 100,000 inhabitants, Reiner Lemoine Institute

# Business Model

## SUPPLIERS/PARTNERS

## TECHNOLOGY PROVIDER

## WAVE FARM OPERATORS/ OWNERS/PROJECT DEV.

## SOCIETY & ENVIRONMENT



Turn-Key Solutions

- Installed Capacity
- O&M

### Customers/ Facilitators

- Project development
- Financing
- Grid connection
- Power purchase agreement

### End-Users

- Residential
- Industry

GOVERNMENT, POLICIES, REGULATION and INCENTIVES

# Business Model

## First Phase

- Blended Finance
- Revenue Support



## SUPPLIERS/PARTNERS

## TECHNOLOGY PROVIDER

## WAVE FARM OPERATORS/ OWNERS/PROJECT DEV.

## SOCIETY & ENVIRONMENT



- Turn-Key Solutions
- Installed Capacity
  - O&M

## Customers/ Facilitators

- Project development
- Financing
- Grid connection
- Power purchase agreement

## End-Users

- Residential
- Industry

GOVERNMENT, POLICIES, REGULATION and INCENTIVES



# Wavepiston Plan

## - Use cases and commercialisation

### Ongoing

#### Full Scale Use Case Demo Projects

- Commercial Potential
- Showcases
- Prepare first commercial projects
- Prepare partnerships



### Upcoming

#### Commercial Projects

##### STEP 1 – Islands / Remote Coast.

- Develop projects with customers in Canary Islands, Martinique, Sardinia...
- Enter partnerships with project developer and industry
- Funding scheme for first projects



#### Commercial Projects

##### STEP 2 – Utility Scale

- Strategic partnership with industrial company
- Utility customers
- Part of national energy strategies



Demonstration



Pre-commercial



Commercial STEP 1



STEP 2

2022

2023

2024

2025

2026

2027

2028

# Reference System – W2EW in Gran Canaria

Rated power: 15 MW  
Capacity factor: 33.5 %

50 % for electricity: 30 GWh per year  
50 % for desalination: 7 hm3 per year

Availability: 95 % (5 % downtime)

Pressure loss in valves, strings and pipes: 10 %

Efficiency turbine: 85 %  
Efficiency generator: 95 %

Farm life time: 20 years

CAPEX: € 93 mn

- Electricity: € 37 mn
- Water: € 56 mn

OPEX: € 3.4 mn/year

- Electricity: € 1.5 mn/year
- Water: € 1.9 mn/year



€ 0.2/kWh



€ 1/m3