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ITEG

Integrating Tidal Energy into the European Grid

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Elogen

June 15th 2021

Interreg North-West Europe ITEG
European Regional Development Fund

Agenda

Introduction to Elogen
High Level Review of Tidal Energy
Hydrogen Enables Sector Coupling and Increased Renewables
The ITEG Project
The O2 Tidal Turbine
The Elogen Electrolyser
Future Energy Hubs

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Elogen, part of the GTT group

Technological expert in containment solutions for liquefied gases

Key Figures (as of 31 December 2020)

Revenues	396 M€
Net income	200 M€
Employees	553
Market capitalization(1)	2,5 Md€

(1) As of 31/03/2021 – The GTT group is listed on the SBF120 index.

GTT and Elogen share the same DNA:

R&D and innovation – helping technology build a more sustainable world

Elogen, Empowering a sustainable world

Elogen, experts in technology for green hydrogen

Elogen develops cutting-edge PEM electrolysers for mobility, heavy industry and energy storage.

- Areva H2Gen was acquired by the GTT group in October 2020, and became Elogen in February 2021.
- Elogen provides its customers with the best technical solution to produce green hydrogen.
- Drawing on its robust R&D and a passion for innovation, Elogen offers its customers competitive, reliable, tailor-made solutions.

Elogen Key Information

Elogen at a glance

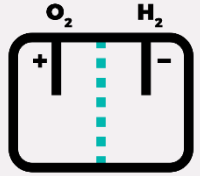
The Elogen headquarters in Les Ulis (Greater Paris) centralises all the necessary facilities to develop and manufacture its PEM electrolysers.

- Innovation, Sales, Operations, Customer Service
- Assembly of electrolysers and stacks, R&D test benches, engineering

Elogen also has an office in Cologne, Germany, where its sales, project management and R&D teams are located.

In the UK, Elogen has a long-standing sales and project management presence.

Over 15 years' experience
in electrolysis using PEM technology



3 continents
Electrolysers in operation in Europe, Asia and the US

40 highly-skilled employees,
covering all disciplines

400 MW
Minimum objective for annual sales of electrolysis capacity by 2030

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Our ambition

Support the expansion of green hydrogen

- Develop our R&D activities
- Diversify our technologies to produce larger-scale electrolysers
- Scale up manufacturing processes, with a first ramp-up in 2021

Geographic reach

Target markets

Technologies

The tidal **landscape**

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The Marine Environment

Key to scaling renewable energy production

- **Offshore Renewables are the EU's Cornerstone Technology**
- **EU is targetting 40 GW by 2030, and 300 GW by 2050**
- **Requires less than 3% of maritime space**
  - within EU Marine Biodiversity Strategy restrictions
- **Currently, tidal and offshore wind accounts for 0.75% of global energy requirements**
- **Offshore wind has the potential to provide 18 times the global electricity demand (IEA)**

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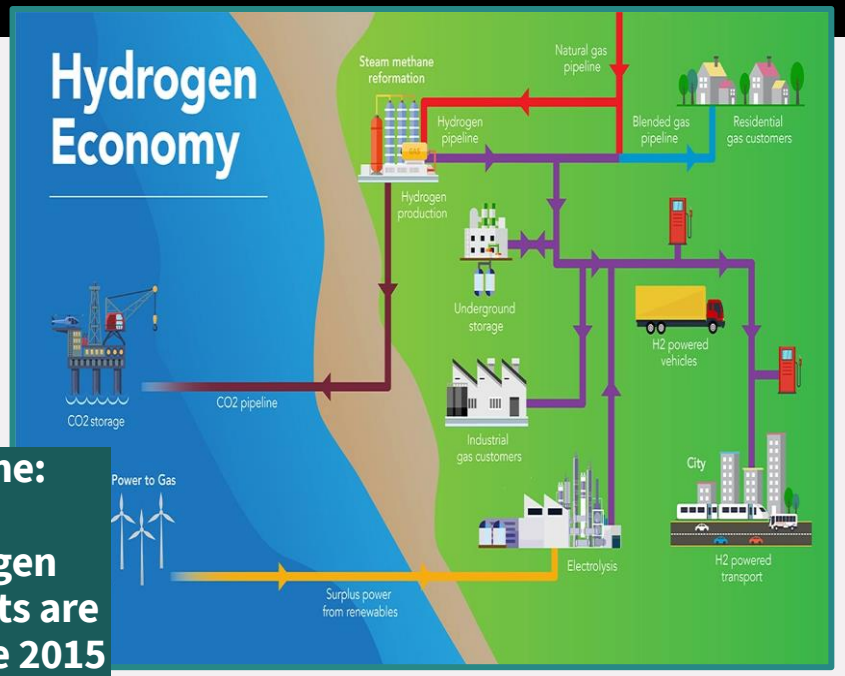
SECTOR COUPLING: WIDENS ELECTRIFICATION OF ENERGY



2020 Headline:

Green hydrogen production costs are down 40% since 2015 and are expected to fall by a further 40% by 2025

2025 Headline:

Imports of renewable energy begin in Europe in the form of ammonia and methanol

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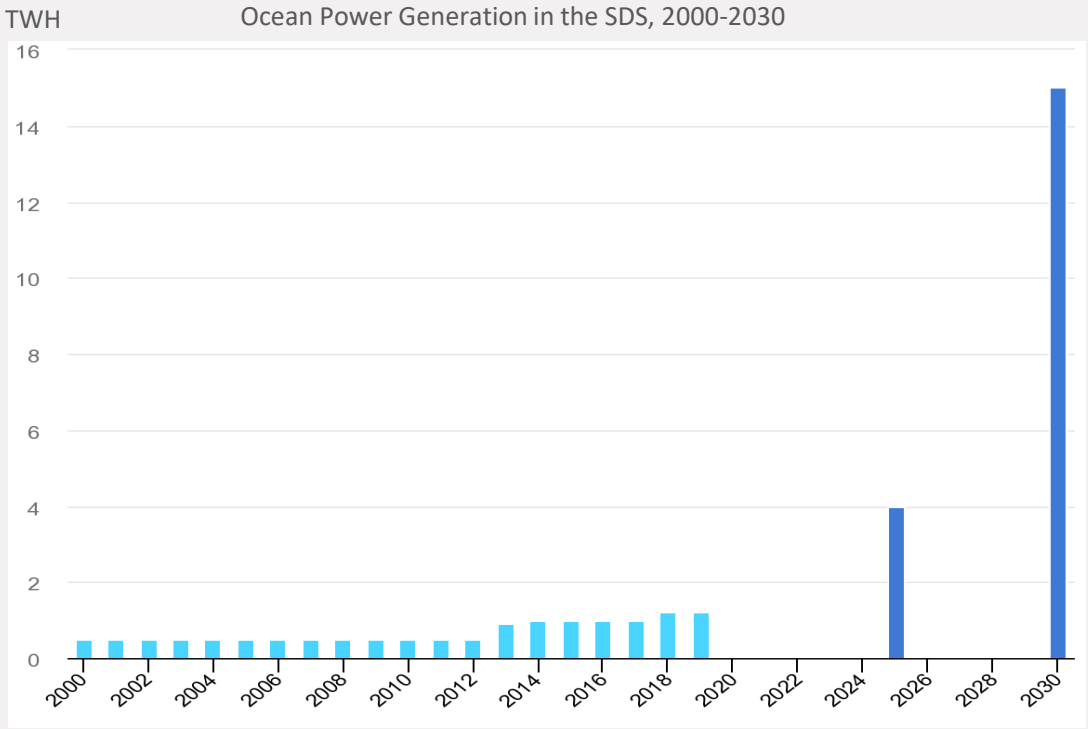
TIDAL ENERGY: TIME TO SCALE UP…



- Tidal energy has massive potential
- Electrical power generated from marine sources saw an increase of 13% in 2019
- ‘Europe could have up to 100 GW of wave and tidal energy installed capacity by 2050, delivering 260 terawatt hours (TWh) of electricity.’ (*EC Report)*
- However, the IEA classify marine energy as ‘not on track’ with the requirements of it’s Sustainable Development Scenario
- Will need a growth rate of 23%/yr to 2030 to meet target

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The ITEG Project

- North West Europe Interreg funded project
- Use hydrogen production and energy storage to demonstrate options for future markets for the ocean energy sector
- Optimisation of an Energy Management System to manage and store clean energy as hydrogen to deliver commercialisation
- Gain risk reduction experience for future projects
- Build a roadmap for future implementation of integrated systems in remote areas

Current Partners

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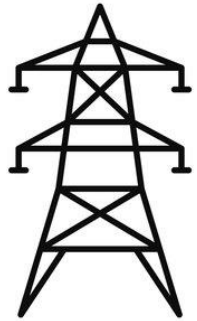
Tidal to Grid and Hydrogen

- Orbital's O2 2MW is the world's most powerful operational tidal turbine
- It's innovative design and engineering makes it extremely appropriate for this project
- Represents 80% UK supply content

ORBITAL MARINE POWER

Energy Management System



EMEC THE EUROPEAN MARINE ENERGY CENTRE LTD

- Elogen's Elyte electrolyser will produce low cost hydrogen
- Capable of running at up to 1MW capacity

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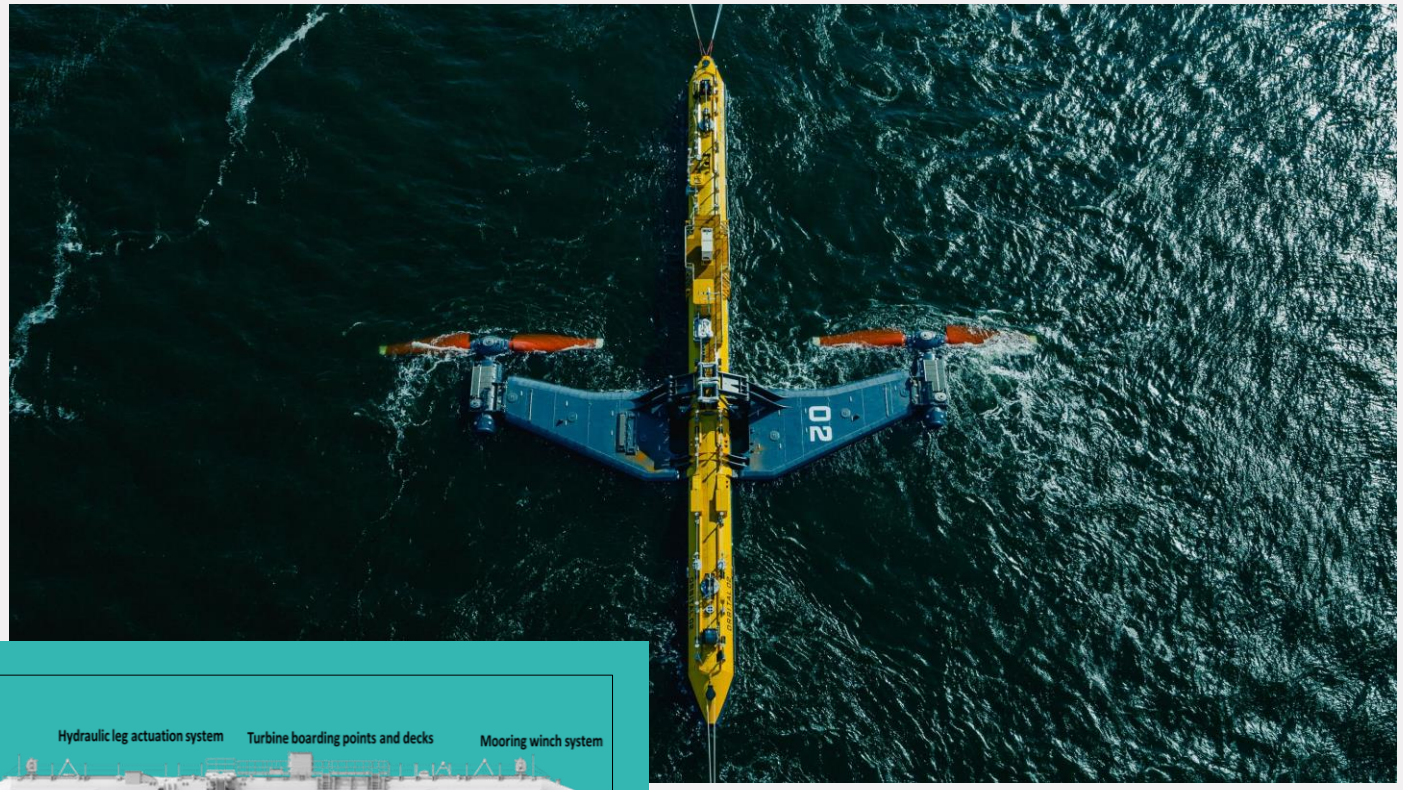
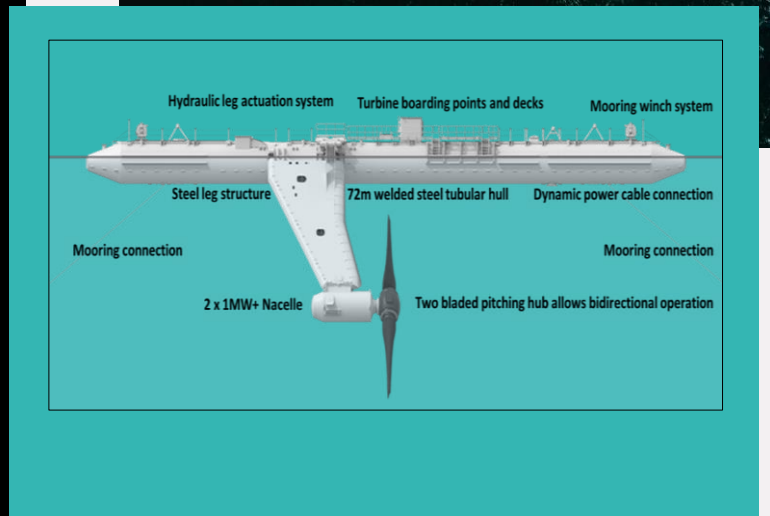
Orbital O2

Key information

- 72m long floating structure
- 2 off 1MW turbines either side
- 20m rotor diameter = 600m^2 area
- 2 MW at a current speed of 2.5m/s
- ‘gullwing’ legs to allow access for maintenance
- It’s pretty cool….

Orbital Marine’s O2 tidal turbine





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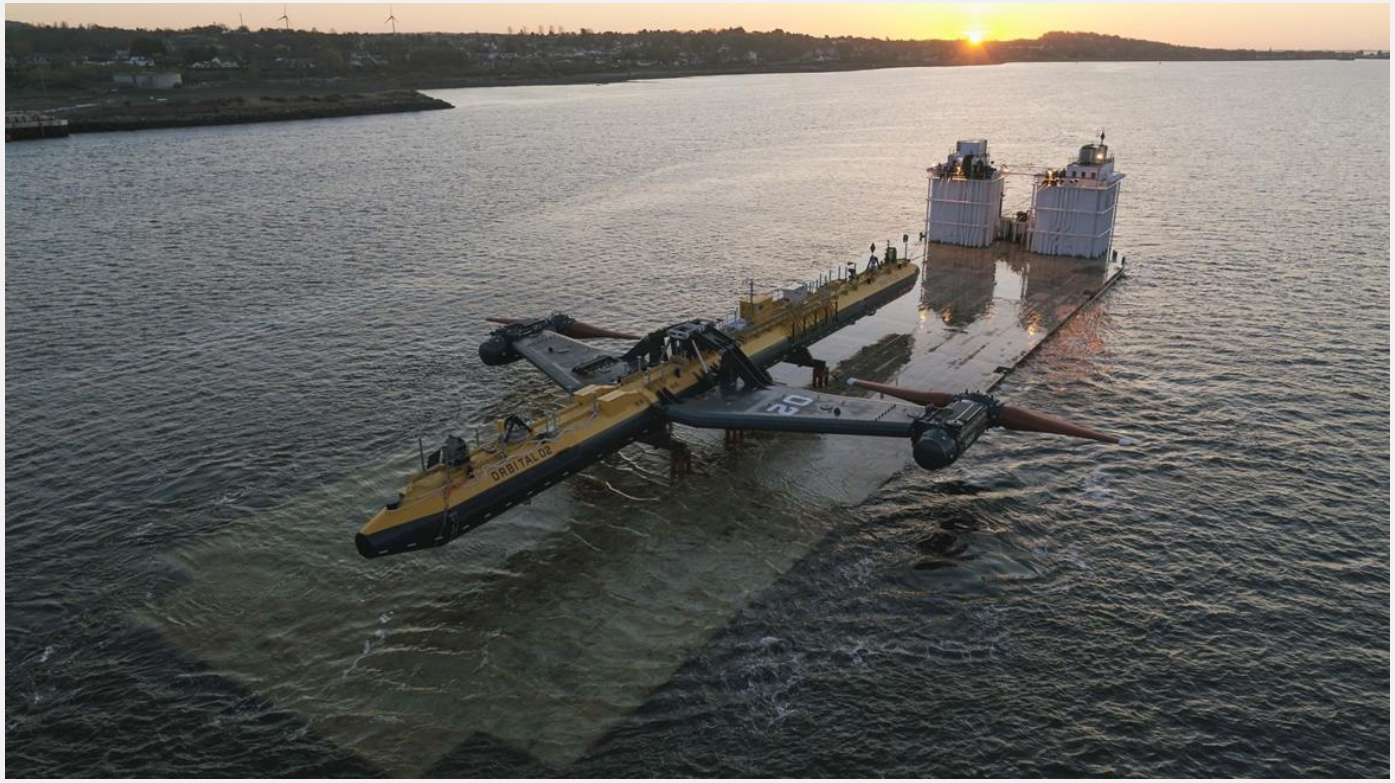
Orbital O2

Key information

- The O2 turbine started construction in the second half of 2019 and reflects approximately 80% UK supply content
- The build of the O2 is estimated to have supported over 80 jobs within the UK economy
- The launch of the O2 marks the first vessel launch from Dundee since ship building ended over forty years ago

Orbital Marine's O2 tidal turbine



Orbital O2

Key information

- The world's powerful tidal generating unit to date
- O2 has the ability to generate enough clean, predictable electricity to meet the demand of around 2,000 UK homes and offset approximately 2,200 tonnes of CO2 production per year.
- First pitching blade for floating tidal stream energy

Orbital Marine's O2 tidal turbine

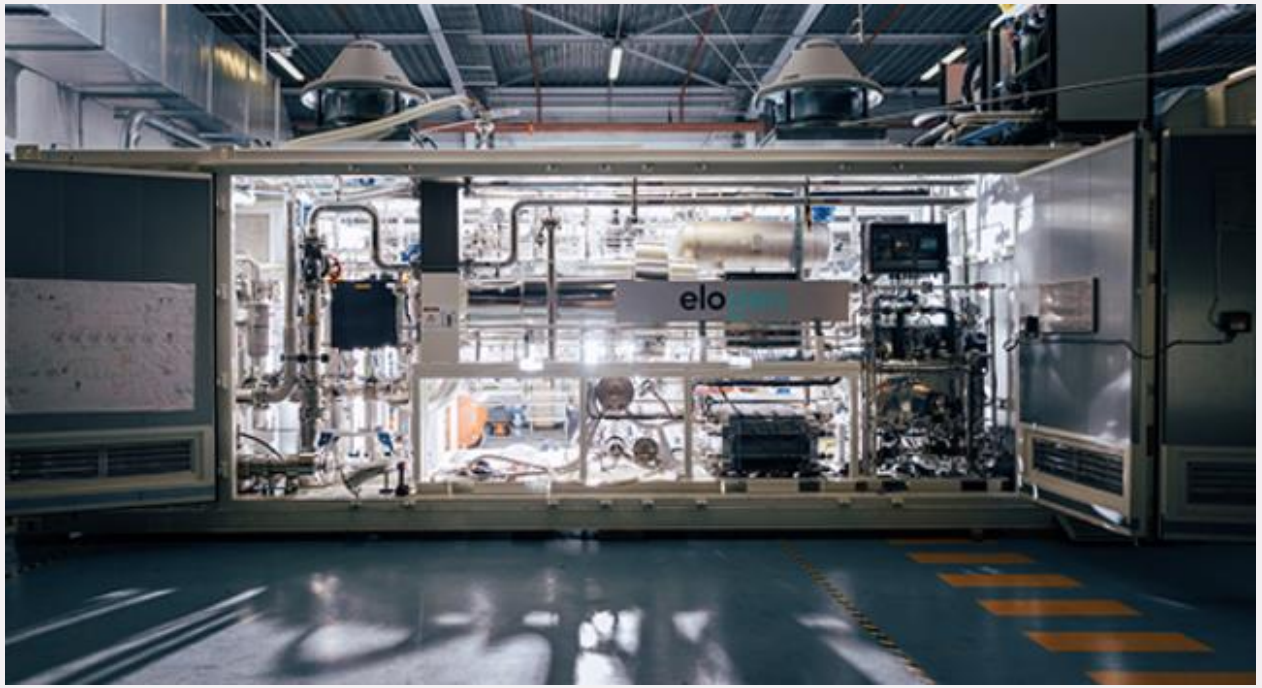
Orbital O2
Key information

- The floating structure is held on station with a 4-point mooring system; each mooring chain has the capacity to lift over 50 double decker buses
- The O2 has been designed so that installation of the turbine, and its associated moorings, can be carried out by low-cost work vessels and servicing can be carried out by RIBs

Orbital Marine's O2 tidal turbine

ELECTOLYSER SPECIFICATION

PARAMETERS	VALUE	UNIT
SPECIFICATION MAX POWER (PEAK)	1	MW
SPECIFICATION NOMINAL POWER	0.5	MW
OPERATIONAL PRESSURE		
H_2 LOOP	30	BARG
O_2 LOOP	15	BARG
OUTLET PRESSURE		
H_2	30	BARG
O_2	VENT	BARG
H_2 QUALITY	99,999	%
H_2O	≤ 5	ppm
O_2	≤ 5	ppm

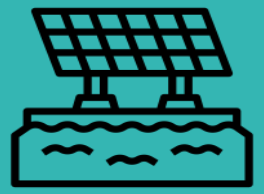


- Tidal energy production will be partially sent to the Elogen electrolyser located on Eday
- PEM electrolyser technology is good at ramping to match power input
- As tidal energy is produced at regular intervals the Elogen electrolyser has been designed to be capable of ramping to excess of its nameplate capacity for short periods
- Testing marine environment on electrolyser operation

Eday Site Preparation

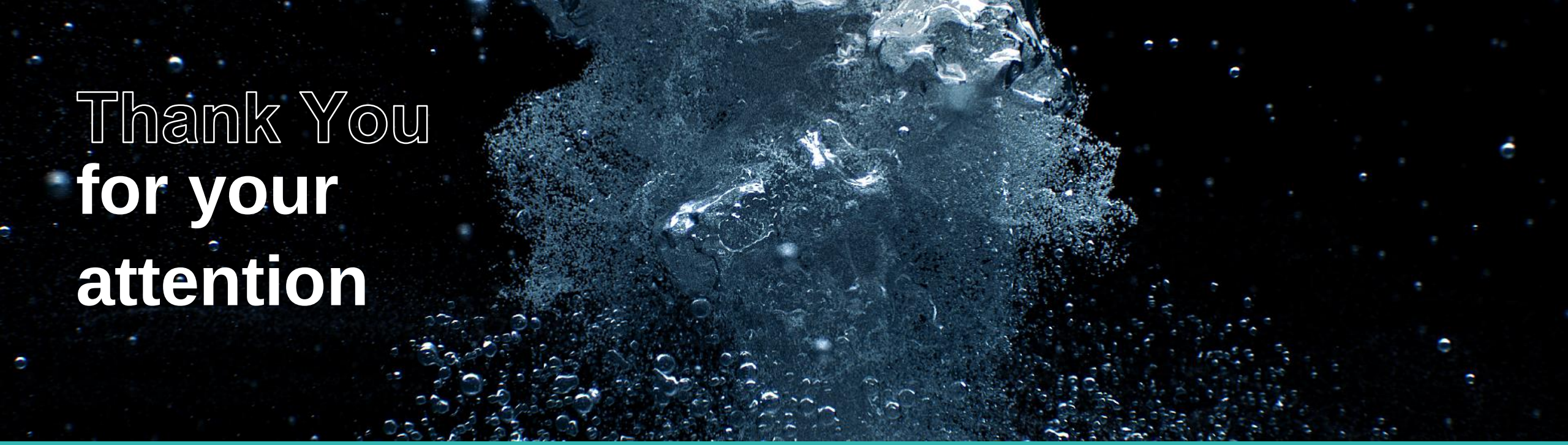
Construction of plinth and compound progressing

Maximising sector coupling, re use of existing infrastructure and energy islands will all help deliver EU goals…with tidal playing its part…



Summary

1. Hydrogen enables renewables
2. Tidal energy resource in under exploited
3. The ITEG project demonstrates integration of tidal and hydrogen
4. Orbital’s O2 tidal turbine is world leading
5. Elogen’s PEM electrolysis systems are tested to deliver flexible hydrogen production in marine environments



Thank You for your attention

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