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ACHIEVE Programme Objectives

Validating next-generation CETO technology and its commercial potential through the 80 kW ACHIEVE demonstrator



ACHIEVE PROGRAMME CONTEXT

A first-of-a-kind offshore demonstration

80 kW

rated, ½ physical scale ACHIEVE CETO demonstrator unit

Simple as possible, but not simpler

We believe that economic solutions need high energy extraction for the capital expended. CETO balances simplicity with performance and commercial viability.

Time invested up front

To ensure a strong result, extra time is going to engineering validation, operational readiness, installation planning and integration.

Meaningful performance data

The aim is safe deployment and valuable real-world data from the demonstration at sea.

Commercial objectives

Modular, fully submerged, all-weather generation for modern markets.

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Six CETO objectives

01	**Commercial objectives**	Modular, scalable and accepted due to fully submerged design
02	**Energy capture**	Capacity factors and spatial density
03	**Control system**	AI-enabled algorithms working in real conditions
04	**Survivability and reliability**	Active and passive mitigation strategies in extreme seas
05	**Operations and maintenance**	Rapid generator module swaps with minimal offshore work
06	**Technology development**	Multi moorings, continuous depth control, rotary power conversion

OBJECTIVE 01

Commercial objectives

ACHIEVE will validate features designed to reduce lifecycle costs, simplify deployment and maintenance, support large-scale manufacturing and maximise community support.

Modular architecture

Aims to ease fabrication, transport, assembly and integration using existing industrial supply chains and port infrastructure.

Potential for scalable manufacturing, flexible logistics and simpler installation with smaller vessels.

Fully submerged operation

Operates completely beneath the surface to enhance safety in storms and avoid visual impact from shore, minimising the social licence impediment seen in offshore wind.

OBJECTIVE 02 · CAPACITY FACTOR

Energy capture and power conversion

30–50%

expected capacity factor range for future commercial scale deployments

Capacity factor = average production / capacity

What ACHIEVE will test

The power production of CETO, validating models showing commercial deployments can achieve capacity factors consistent with pre-deployment modelling.

Where it applies

Selected sites in Spain, Portugal, France, UK, Ireland, Australia, the United States and other comparable wave resources.

Potential upside

Higher capacity factors are possible as control algorithms improve.

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OBJECTIVE 02 · SPATIAL DENSITY

More energy from a smaller footprint that’s hidden from view



ACHIEVE energy production data will support validation of the spatial density forecasts.

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OBJECTIVE 03

Advanced control system evaluation

Algorithms designed to optimise power capture while managing structural and operational loads will be tested in the real ocean.

HPE collaboration

Joint work shaped the control algorithm design

AI – Reinforcement learning and machine learning

Controller that learns and wave predictor demonstrated

Real-world data

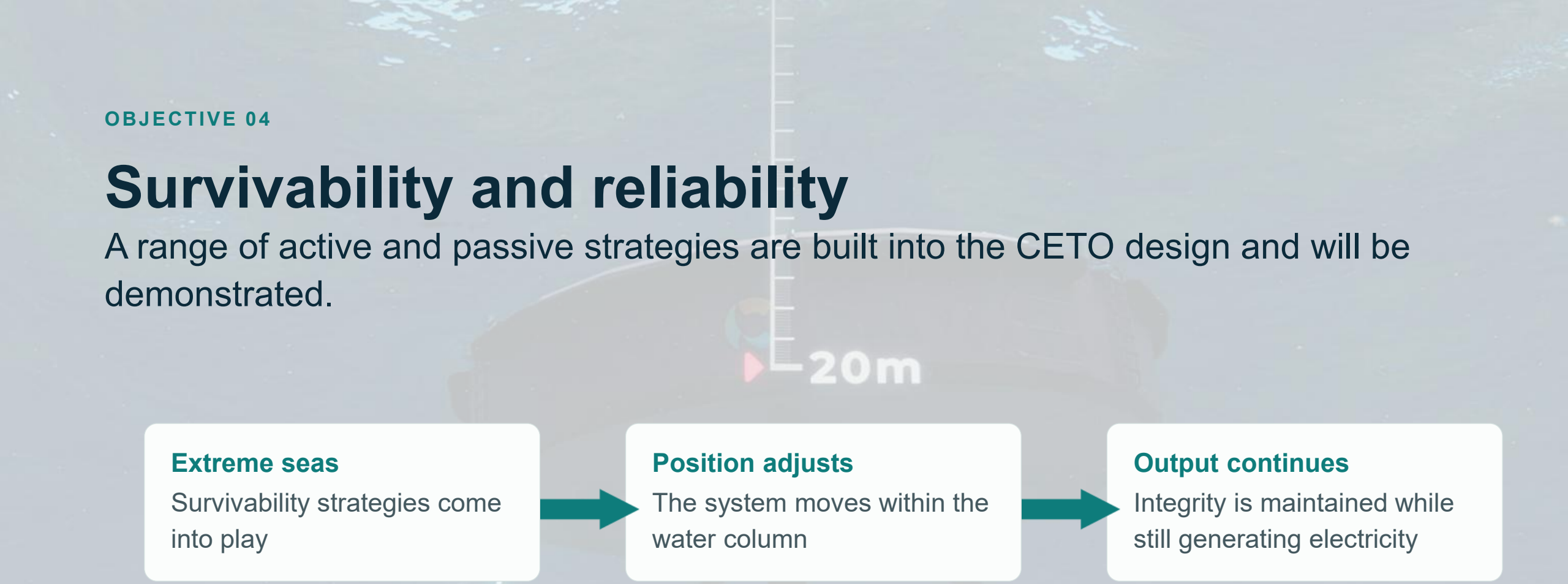
Valuable, hard-to-attain data collected and analysed

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OBJECTIVE 04

Survivability and reliability

A range of active and passive strategies are built into the CETO design and will be demonstrated.



Extreme seas
Survivability strategies come into play

Position adjusts
The system moves within the water column

Output continues
Integrity is maintained while still generating electricity

Managing the power of the ocean has been part of CETO's core architecture since inception. It has shaped design, control and operations and maintenance strategies.

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OBJECTIVE 05

Operations and maintenance

Maintenance within existing port infrastructure, with minimal offshore intervention.

Quayside PTO swaps
Power take-off and electrical modules are rapidly removed and installed at the quay

Structure stays put
The primary structure remains in the water, avoiding big lifts

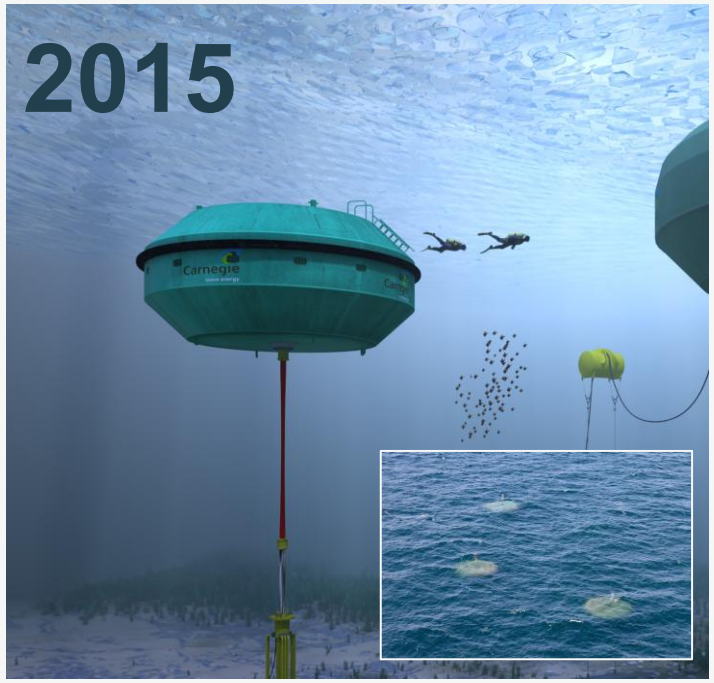
Fewer offshore needs
Reduced reliance on large, specialised vessels and no divers

The goal is to show that rapid and low-cost maintenance is feasible, reducing downtime and improving operational availability.

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OBJECTIVE 06

Technology development progress



Earlier CETO generations

Prior deployments reached TRL 7/8.



Digital Development pathway

A strategic step back in TRL that delivered step-change improvements.



ACHIEVE Programme

Demonstrating multiple moorings, rotary PTO and advanced control.

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COMMERCIAL PATHWAY

From design advances to funding

TOP RANKED EUROPEWAVE PROGRAMME POSITION

Design advances developed during the Digital Development Pathway unlocked CETO's top ranking and the cornerstone funding for ACHIEVE.

SUPPORTING COST OF ENERGY ASSESSMENT

ACHIEVE is generating data for cost of energy assessments. The initial economic modelling was reviewed and verified by an independent expert to win EuropeWave funding.

The deployment is optimised to meet multiple technical objectives within the scope and budget of ACHIEVE.

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MARKET CONTEXT

Aligned with Europe’s ocean energy goals

Europe remains the primary target market. Carnegie also actively engages with other jurisdictions with suitable wave resources, energy market conditions and customer requirements.

1 GW

of installed EU ocean energy capacity by 2030

40 GW

of installed EU ocean energy capacity by 2050

Carnegie is developing plans for a 6MW project at BIMEP in Spain.
Business model demonstrates revenues 3-4 years prior to commercial project commissioning.
Additional opportunities with Defence and Data Centres.

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