

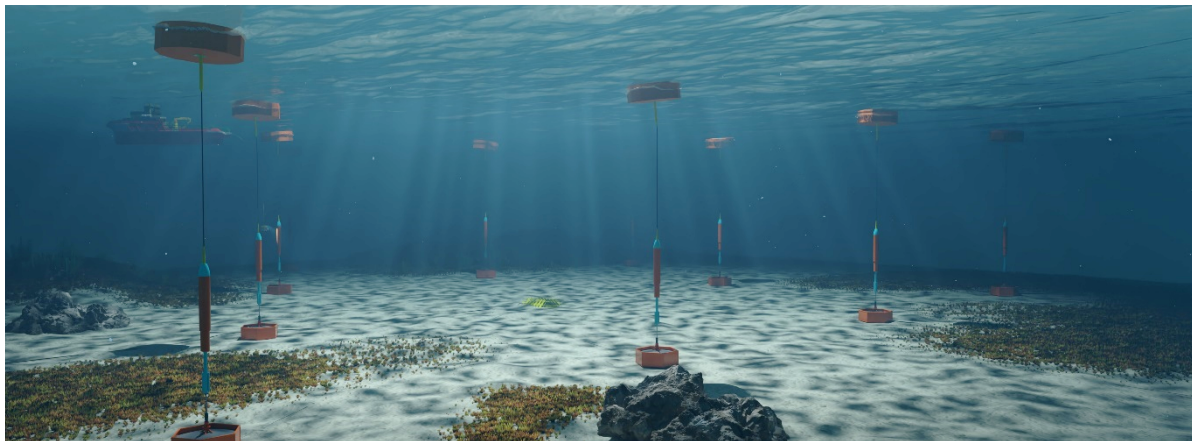
OCEAN HARVESTING

Generating Electricity One Wave at a Time



InfinityWEC to demonstrate performance with enhanced model-based predictive control in scale 1:3 sea trials

Karlskrona/Gothenburg, Sweden; 29 March 2023



Ocean Harvesting is collaborating with experts in model-based predictive control to implement recent research and increase the performance of InfinityWEC in the upcoming scale 1:3 sea trials.

Use of predictive control strategies in a point-absorbing wave energy converter (WEC) greatly increases the annual energy production (AEP) compared to non-predictive reactive control. OHT has shown up to 30% improvement with model predictive control (MPC) in simulations, and similar results have been shown by other WEC developers and in academic research.

InfinityWEC is unique in its capability to host and benefit from predictive control strategies, designed to provide highly efficient instant force control through a combination of ball screw actuators and hydrostatic pre-tension. Ocean Harvesting is collaborating with leading researchers to implement a new type of controller called a nonlinear moment-based MPC, developed at COER, Maynooth University, Ireland. This controller substantially improves energy output and is fast enough to run on a real-time control system.

Ocean Harvesting is also collaborating with AI experts to implement machine learning techniques which will improve the accuracy of the system model in the controller.

“Following the recent update with hydrostatic pre-tension, reducing the weight of InfinityWEC’s PTO by forty percent, the new controller is another step change in Technology Performance Level, or TPL, and material efficiency,” says CEO Mikael Sidenmark.

During 2023 Ocean Harvesting will implement the new controller and optimize InfinityWEC’s performance through numerical simulations. The controller will then be implemented in a high-fidelity simulation environment, and in the real-time control system in our scale 1:10 PTO test rig, in preparation for the scale 1:3 sea trial project planned to start in January 2024.

Ocean Harvesting is raising 3 MEUR to finance the 1:3 scale sea trial in 2024-25. The project has already received a 2 MEUR grant from the Swedish Energy Agency.

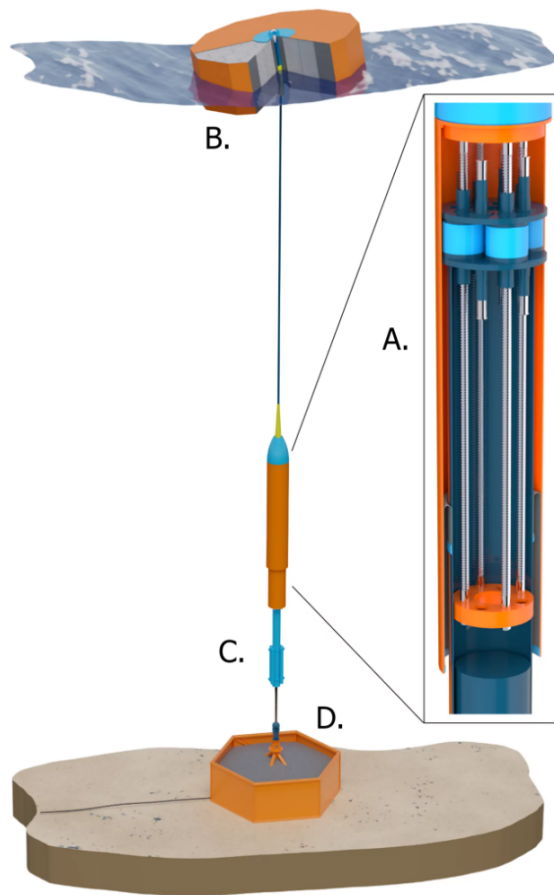
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500 kW InfinityWEC Wave Energy Converter - Generation 6



A. PTO with Instant Force Control

A combination of ball screw actuators and a hydrostatic pre-tension system provides instant force control in the power take-off (PTO), enabling advanced control algorithms to increase energy output, reduce loads and improve reliability.

Ball screws convert linear motion and force into high speed rotatory input to direct drive generators/motors, providing high efficiency, high power density and high reliability.

The PTO hull is split in two halves, being pushed together by the surrounding water pressure close to the seabed. This way half of the PTO control force is provided "for free", reducing cost and improving overall efficiency.

Optimal Force Control

Predictive optimal control of the PTO force to maximize power output in every individual wave.

Depending on wave resource, the annual energy production is increased 25-50% compared with sea state tuned (non-predictive) optimal control.

B. Concrete Buoy

Buoy as a honeycomb structure with thin walls made of high-performance concrete and EPS cores. Compared to steel:

Same weight, 4x lower cost, 3x lower CO2 footprint

Manufactured on site, 10x faster

Unsinkable, solid structure

C. Protection Spring

Soft end-stop spring in the form of a pre-charged gas accumulator integrated with the hydraulic tidal cylinder.

Maximum end-stop force reduced to half

Power produced also in storm conditions

D. Easily Deployed Anchor

Concrete anchor cage, easily deployed and then filled with ballast through a down pipe from a transportation vessel.

Manufactured on site

Low cost

About Ocean Harvesting and InfinityWEC

Ocean Harvesting is a privately held company with offices in Karlskrona and Gothenburg, Sweden. After years of research within the wave energy sector, the company started in 2017 to develop the InfinityWEC wave energy converter.

InfinityWEC is:

- **Efficient** – Breakthrough power take-off ensuring maximum power output from every wave in combination with a structurally efficient design.
- **Reliable** – Holding the buoy submerged through the crest of large waves to secure survival and enable continued power production also in the harshest wave conditions.
- **Scalable** – High volume roll-out enabled by factory production of the PTO in a size that can be transported efficiently to the site, while the buoys are manufactured on the site with locally sourced materials.
- **Ideal partner for Wind & Solar** – Producing power at different times, improving balance between electricity supply and demand. Shared infrastructure and operational costs.
- **Low Levelized Cost of Energy (LCOE)** – Annual energy production of 2 GWh per WEC estimated to 100 EUR/MWh at 100 MW deployed capacity and <35 EUR/MWh at 5 GW deployed capacity, highly competitive compared to all other energy production.

What makes InfinityWEC so competitive is the advanced power take-off system, which uses a combination of ball screw actuators and a constant pre-tension force using hydrostatic pressure, to provide instant control of the force applied on the buoy to control its motion (phase control) and capture energy. This enables the use of model based predictive force control, maximizing the electricity production from every individual wave, which dramatically increases the annual energy production compared to sea state tuned force control. A unique survival function holds the buoy submerged through the crest of large waves, protecting the system from excessive load and enabling electricity to be produced also in the most severe wave conditions.

InfinityWEC is engineered for sustainable large-scale production and effective logistics. InfinityWEC's prime mover (buoy), is made of concrete casted with locally sourced materials at the installation site in a process common in civil engineering, minimizing transportation. A special high strength and sustainable concrete mix has been developed in collaboration with RISE Research Institutes of Sweden, enabling a prime mover with equivalent weight to a conventional steel hull, but at 1/4 of the cost, a 1/3 of the CO2 footprint and which is 10x faster to manufacture.

The excellent performance and reliability, combined with a modular design where all critical parts are easily manufactured, transported, installed and maintained, make InfinityWEC a very competitive solution for the future global energy market.

The market for InfinityWEC ranges from utility-scale wave farms for electricity and hydrogen production to the power and H2-gas grid on the mainland, to off-grid power supply for island communities and other offshore industrial installations such as oil- & gas platforms and aquaculture.

Read more: oceanharvesting.com

About Wave Power

The estimated global theoretical potential of wave power exceeds the global use of electricity¹ and is available in coastal areas where most of the population lives.

Wave power produces electricity more consistently than wind and solar power, and therefore needs only half as much energy storage to balance electricity generation to a constant power level throughout the year, reducing the overall cost of balancing electricity supply and demand. In addition, electricity is produced at different times compared to wind and solar power, which helps to reduce variations and interruptions in the grid, further reducing the overall cost of electricity.

Wave power will be an important part of the future renewable energy mix, contributing both to lower cost of energy and a more stable energy system.

1. OES An International Vision for Ocean Energy 2017