

# InfinityWEC Design Principles

**OCEAN HARVESTING**

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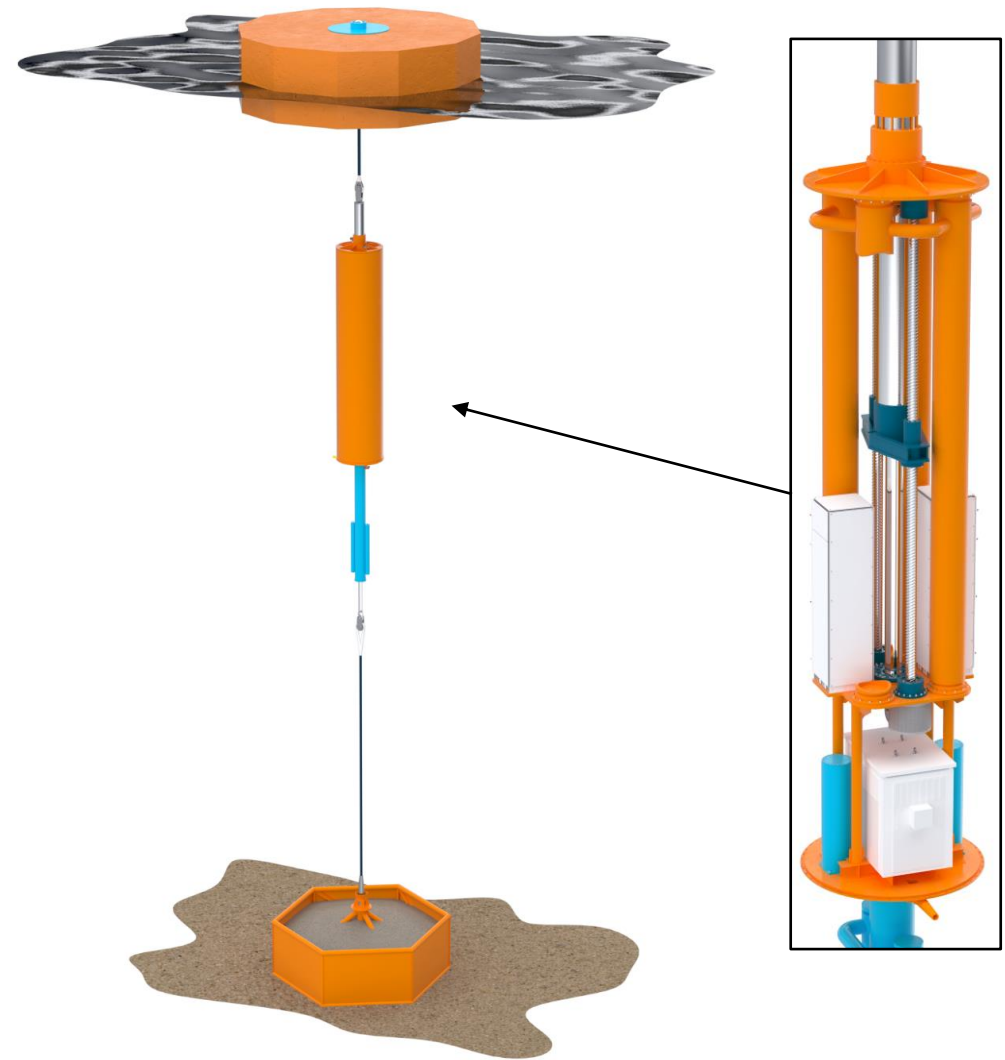
# Introduction to InfinityWEC

InfinityWEC is a wave energy converter with an **advanced power take-off system**, which tunes to every individual wave to efficiently extract energy in all sea states. An innovative **end-stop function** ensures survival and reliable power production even in the harshest wave conditions.

The **buoy is made with high strength concrete**, with similar weight as a conventional steel hull, but at a quarter of the cost, a third of the CO<sub>2</sub> footprint and one tenth of the manufacturing time.

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

*Ocean Harvesting Technologies AB is a Swedish company that develops novel technology to transform ocean waves into clean, reliable and cost-efficient electricity.*



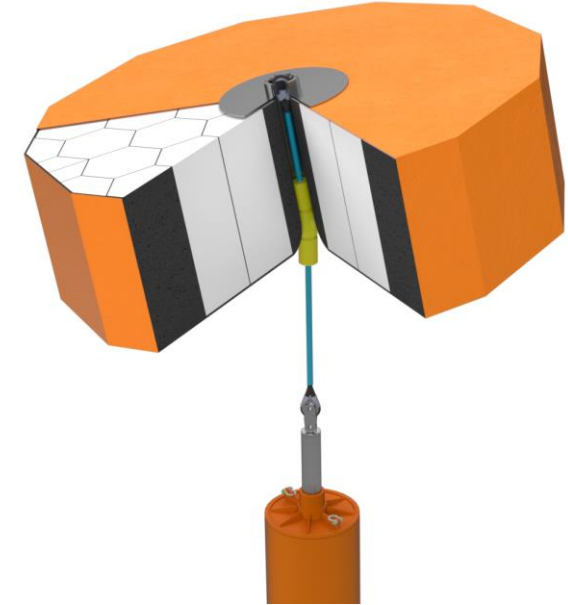
# InfinityWEC Design Principles

1. InfinityWEC is a **point absorber** type of wave energy converter because:
  - It has the highest hydrodynamic efficiency leading to smaller size per energy output compared to other types wave energy converters
  - It is suitable for large scale wave farms built as modular clusters of InfinityWEC units
  - It is suitable for installation depths between 40 – 200 meter, making it possible to deploy wave farms at many locations with strong wave resources
  
2. InfinityWEC has been designed as a direct-drive system with **instant force control** functionality because:
  - It is critical to match the buoy motion to the highly varying wave motion, using a force applied by the power take-off on the buoy (phase control)
  - Maximum power capture is achieved when the buoy oscillates in resonance with the waves, but this state typically causes high losses from circulating power flows due to the amplified motion
  - Maximum power output is achieved near the resonant state, with power capture reduced to balance the circulating power flows and its losses
  - Optimizing the force control for every individual wave increases annual energy production substantially compared to sea state tuned control
  - Reinforcement learning (AI) can be used, further increasing the annual energy production
  
3. InfinityWECs Power Take-Off (PTO) uses **ball screw actuators** combined with a **hydraulic pretension spring** because:
  - It is a highly efficient way to achieve instant force control
  - Ball screws is the simplest way to convert high linear force and slow motion into high speed and low torque input to the motor/generator
  - The pre-tension spring has very high efficiency and reduces the force in the ball screws by 50%, reducing cost and the circulating power flows through the ball screws and motor/generator
  - It enables power production in both up and down motions and ensures station keeping of the buoy also in standby mode

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## 4. InfinityWEC has a **wide concrete buoy** because:

- It can absorb more energy due to the increased area of the buoy on the water surface, compared to a narrower buoy with the same net buoyancy (volume and mass)
- It reduces the need for resonance, thereby reducing the circulating power flows through the power take-off and the associated losses
- It reduces the stroke length and maximum speed of the power take-off, reducing cost and making it possible to use heavy-duty ball screw actuators
- Power capture is less sensitive to higher weight of the buoy, making it ideal for very cost-efficient on-site manufacturing with high strength concrete
- Concrete is a very robust and corrosion resistant material, offering over 50-year lifetime with low maintenance



## 5. InfinityWEC has its **PTO separated from the buoy** because:

- The mooring line between the buoy and the PTO minimizes the bending loads on the heave and level cylinders extending from the PTO
- It makes the PTO system vertically fixed in normal heave motion, with a minimum of mass moving with the buoy
- It allows for adjustment of the size and shape of the PTO module, enabling cost-efficient production, transport, installation and maintenance
- It simplifies the structure of the concrete buoy, which can be manufactured on site from locally sourced materials
- Separated PTOs allow for multiple PTOs to be attached to one buoy, efficiently scaling power output