



# Wave energy in the Port of Civitavecchia (IT)

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# BLUE ENERGY

- **Blue Energy is a growing sector all over the world** – research, pilot projects and fully operational plants are being developed, aimed to optimize the production of renewable energy from waves, tides, offshore wind, salinity gradients, etc.
- **Blue Energy potential still remains largely untapped.** For instance the global technical potential of wave energy is estimated at 11,400 TWh per year
- **Almost 90% of the world's marine renewable energy is produced in Europe,** and Blue Energy is a growing industrial sector especially in the Atlantic regions
- EU considers marine renewable energy as a **driver for employment, innovation and for the fight against climate change** (see i.e. EU Directive 2009/28/EC)
- Renewable energy from marine sources will likely soon become an important **component of the energy policies and strategies** in the Mediterranean Sea.



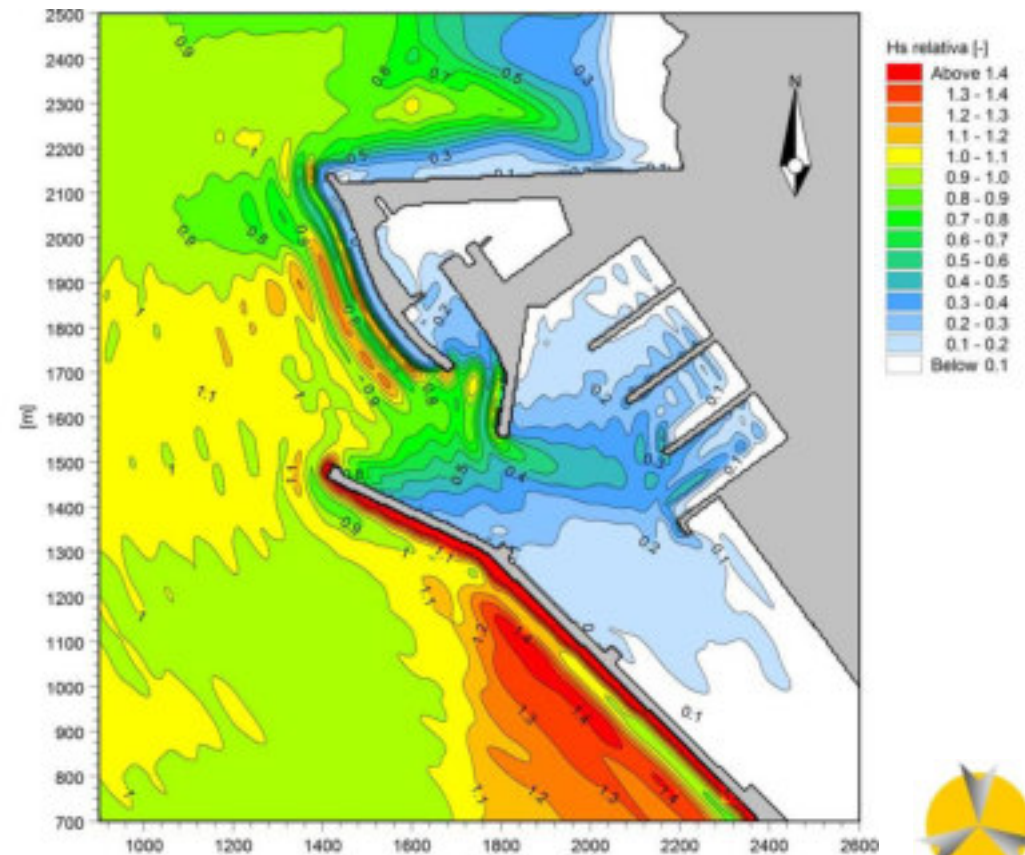
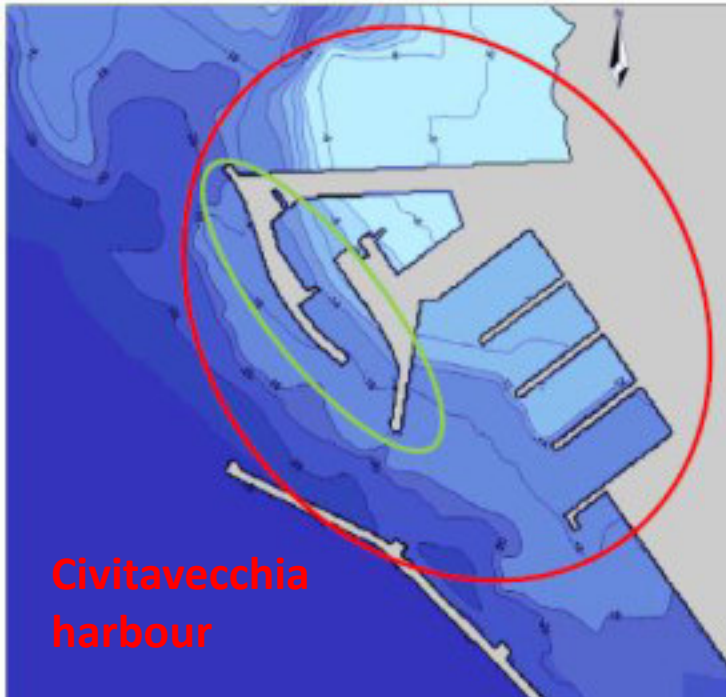
# WAVE ENERGY: A CASE STUDY

## Resonant Wave Energy Converter REWEC3 in Civitavecchia harbour

**Client: Port Authority of Civitavecchia**

- **U-OWC (Oscillating Water Column)** device conceived and patented in Italy, able to obtain a natural resonance with random wind-generated waves, allowing to absorb a large amount of wave energy
- A **prototype** has been built in the Civitavecchia's harbor (Italy) in the Tyrrhenian Sea (Central Mediterranean) for the enlargement of an existing breakwater (**total length: 600m**)
- The project was technically supported by the WAVENERGY.it S.r.l., a **spin-off of the Mediterranean University of Reggio Calabria (IT)**.

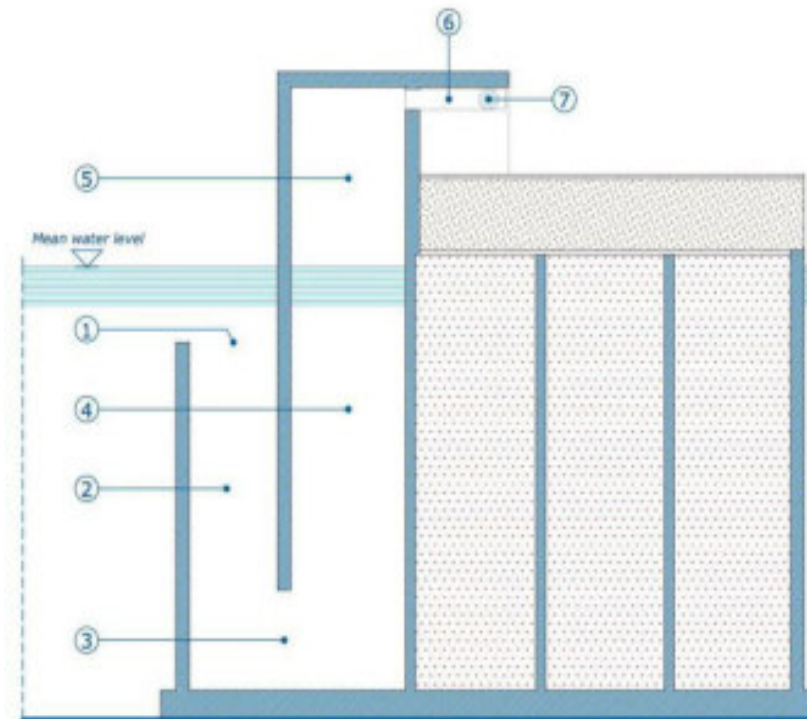
# REWEC3 LOCATION

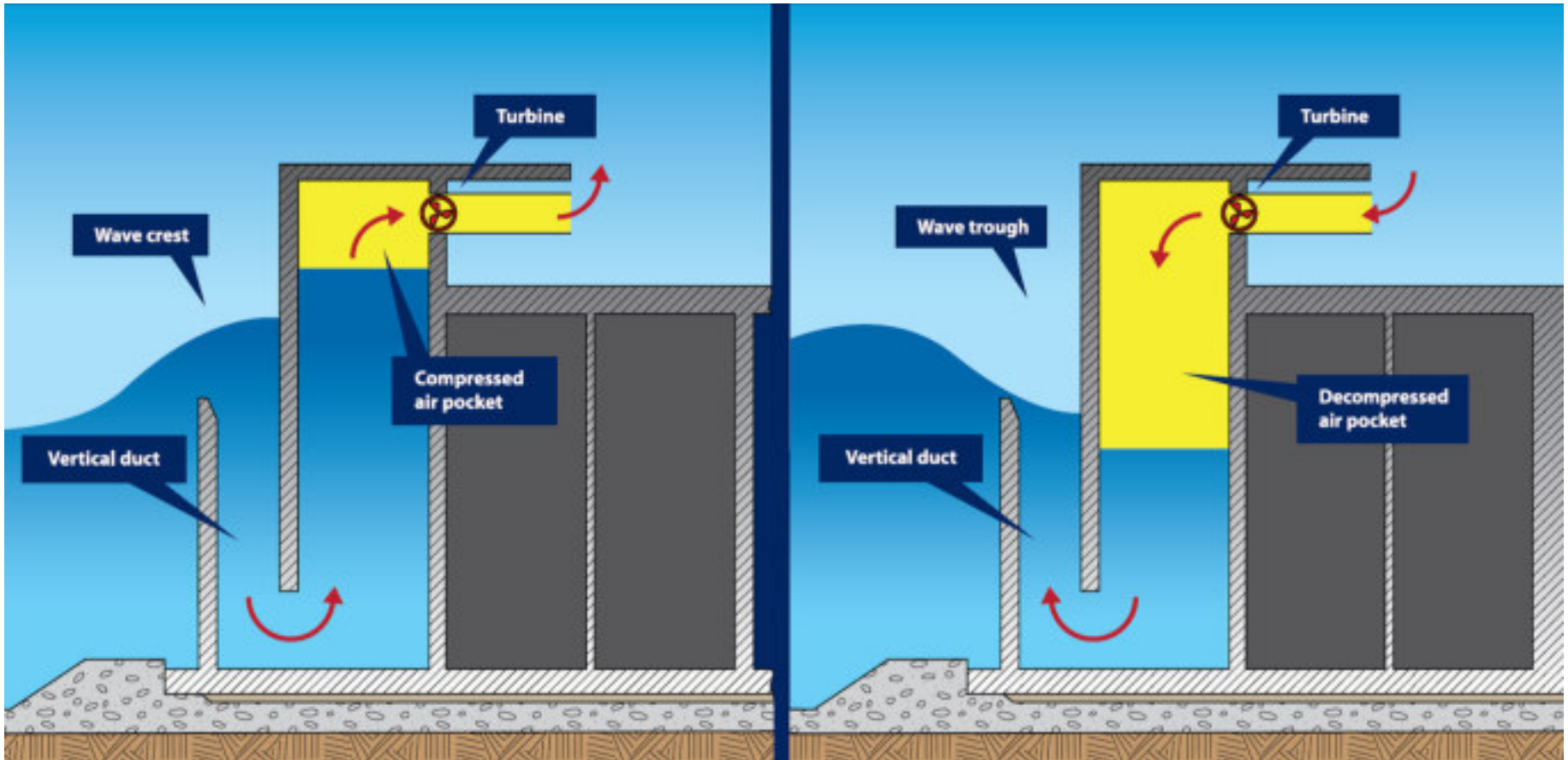




# HOW DOES REWEC3 WORK?

- An U-OWC plant consists, on the wave-beaten side, by a **vertical duct (2)**, which is connected to the sea through an **outer opening (1)** and to an **inner room (4-5)** through a **lower opening (3)**. The inner room contains water (4) below and an air pocket (5) above. An **air-duct (6)** contains a **self-rectifying turbine (7)** connected to a **generator**
- Under wave motion the air in the chamber is alternately **compressed and decompressed**, so that the air produces a flow in the duct, which drives the turbine to produce electrical power.







# TECHNICAL ASPECTS

The introduction of the U duct between the air pocket and the sea, allows:

- Absorbing **more wave energy** in every sea conditions
- Adapting the design to the peak period of the incident wave pressures to which the greater amount of wave energy is associated, thus **amplifying the plant performance**
- Achieving **high structural resistance** thanks to the two vertical walls partially overlapping on the wave-beaten side

**Average production for a 1 km-long REWEC3 plant in the Tyrrhenian Sea:**

**4.000÷6.000 MWh/Km/year**





# POINTS OF ATTENTION

- Integration within port infrastructure
- Landscape/visual impact
- Noise mitigation
- Ongoing research and testing
- Economical feasibility/convenience
- Turbines maintenance

