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NEW DEFENSE OF THE COASTES TO PREVENT THE SEA LEVEL RISING ALSO

If we want to try to reach a 50% reduction of the current 80 billion tons/year of global CO_2 emissions in 2050, it is essential to support other realistic initiatives, the increase in renewable energy, beyond hydroelectric power, from the current 4% at least 30% (EU sets at 32% in 2030).

In this connection, a valid contribution comes from marine energy, especially when combined with the defense of the eroded coastlines, which for many time is based on cliffs and nourishment, in an anti-ecological and anti-economic way.

The idea starts from the observation that the energy of the wind produces pulsing vertical waves on the sea, until the bottom is deep; then, approaching the coast, for seabed around 6 m the same waves are converted into direct horizontal currents towards the shore (Fig. 1).

This occurs about 500 meters on average from the shore, when the currents then proceeding on lower bottoms, 3 ÷ 4 meters, are converted into storms.

The patented turbines are made up of blades fixed to a floating spinning top (Fig. 2) so as to be in indifferent equilibrium in water and then turn by the minimum currents, with hours of electricity production higher than the eolic and photovoltaic.

After the offshore/inshore calm area, the *inshore mature formation of horizontal currents* can be exploited by barriers of simple vertical turbines, that:

1. produce energy transforming starting from 2 ÷ 3 kW/m of the waves and so on.
2. slow down the speed of the currents, so as to the sand into suspension falls and accumulates instead of eroding the coast.

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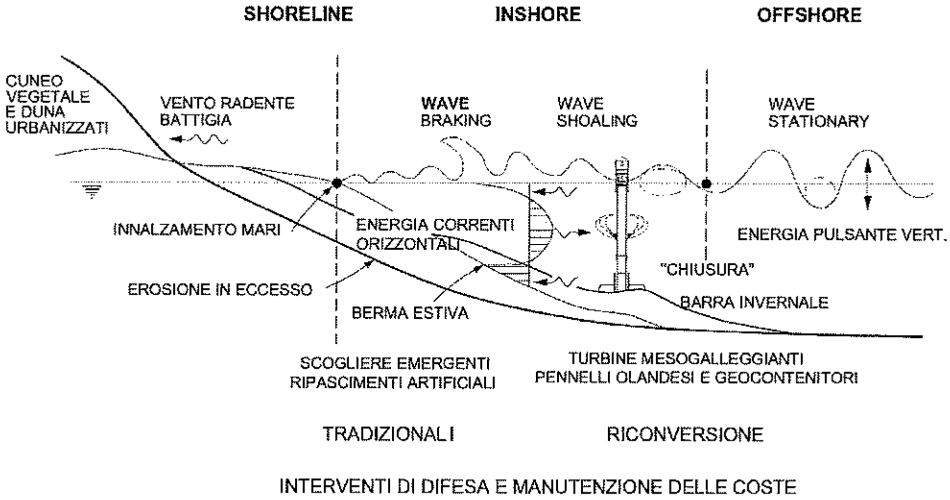

Fig. 1 – Turbines location, similar to the coral barriers, is where the energy of the waves (offshore) is turned in horizontal sea currents (inshore), with electric energy production.

3. delineate a coastal strip about 300 ÷ 400 meters wide, where it will be possible to reproduce grasslands of algae, poseidonia and to plan a no fishing zone.

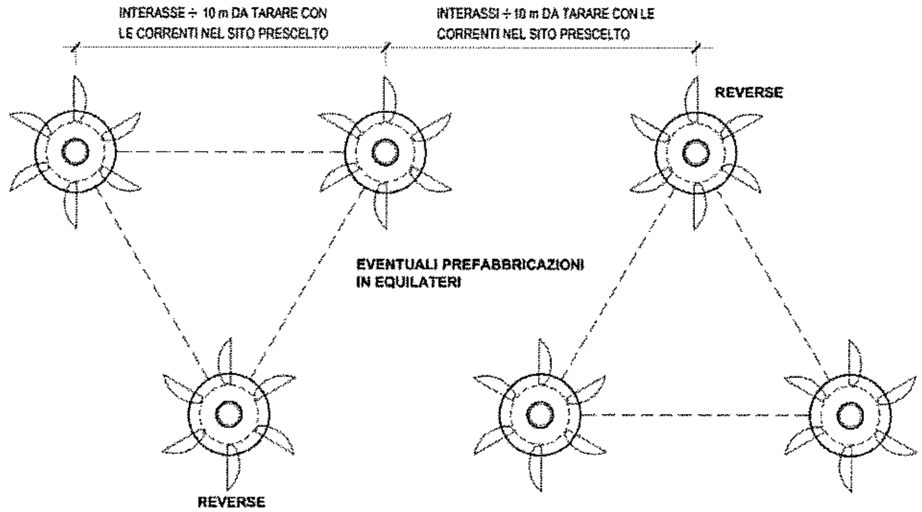

Fig. 2 – Turbines supported on recycled plastic tubes in 3D printed, vibroinfixed in seabed at suitable depth through triangular prefabricated piles foundations.

The cost of such a system for 1 km of coastline with 200 turbines is about €5 million and it produces an average of 5 ÷ 7 GWh for a value of 1.3 ÷ 1.5 million €/year; duration at least 20 years with very favorable economic recovery of the beach of the average size of 1 ha/km.

The current cost of construction of the reefs and nourishment is higher, especially considering that the seasonal maintenance exceeds considerably one million €/km/year without any advantage.

Moreover, if the beach is reformed again by large sediments taken offshore that are completely removed by the winter storms, the costs become exponential.

The laying of turbines in staggered barriers (Fig. 3) creates a soft defense of the coasts that mimics the coral reef, especially for its location in the seabed.

The costs of these barriers are very advantageous compared to the actual coastal defenses and furthermore the electricity production covers the relevant cost amortization and maintenance.

The turbines location is in the transition zone between enormous offshore vertical energy and inshore currents energy; in this zone the electric energy is produced even at low number of laps but long lasting.

The new defense also makes possible to raise the level of the beach through the natural nourishment and re-growth of the marine grasslands, in order to prevent sea level rise due to climate change. The overflowing of the beaches, in progress for some time, of the order of 1 m /10 years, is recovered with the proposed defense up to 1 ha/km.

Advantages

- The barriers of mesofloating turbines allow the raising of the beaches and, at the same time, the defense of the coast in erosion due to the serious anthropizations.
- The barriers in fact reduce the sea currents speed below sea level with the consequent deposition of the suspended sand and, in parallel, the production of electricity that supports the system maintenance, the public lighting and the domestic utilities of the coastal Municipalities through direct dispatching.
- The proximity of the coasts to the Apennines allows the hydraulic storage of renewable energy by pumping water at high places through pump-turbines, so reducing the release of CO_2 into the atmosphere.

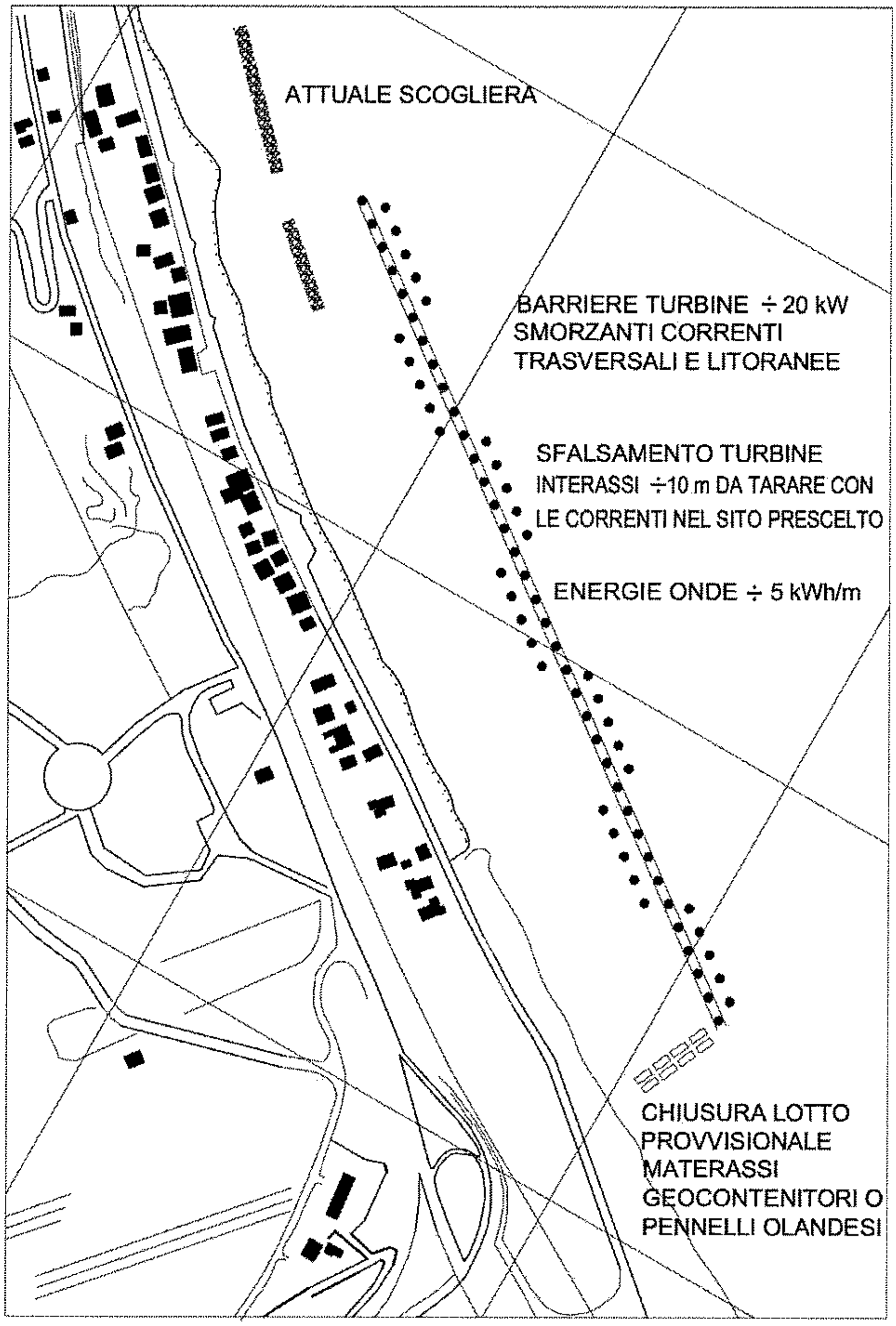

Fig. 3 – Turbines planimetry and distribution to be adapted at marine geomorphology in replacement of the nourishment and the cliffs.

Fig. 4 – Coral reef in the offshore/inshore transition imitated by the energized barrier for the reconversion of the coastal defense.

- The reconversion of artificial nourishment and reefs is carried out by the recovery of the marine ecosystem and of the landscape and promoting the decontamination and landscape retraining.
- The barriers allow the engraftment of marine grasslands that prevent erosion.
- There is a limit to fishing and to recreational navigation, bringing it to regulation distances in favor of safety.
- Because of the increase in sea level due to climate change, the barriers are also useful to raising the lower coasts and the delta river banks and to recovering hectares of beaches with great economic benefits.
- The advantages are such that it is particularly convenient to develop the gradual experimental Research articulated in: collection of marine data, fluid dynamics simulation, real experimentation on a group of turbine prototypes.