Business plan

seabreath®
wave energy

innovative startup seabreath s.r.l. unipersonale

Business plan

Introduction

Different countries around the world are increasingly interdependent on energy, as they are in many other areas – i.e. a power failure in one country has immediate effects in others. A radical change is clearly required in the way energy is produced, distributed and consumed.

Finally, a diversified energy mix, both geographically and technologically, will reduce the impact of variability. Wave energy will bring added value to the countries' energy mix in the peak-to-medium-scale base-load, as such complementing wind energy and these would reduce requirements for reserve capacity and lead to annual savings in relation to the annual wholesale cost of electricity.

In this document he economic and financial analysis, for the moment, are especially focused on the further R&D to make a final product.

The successive phase of production and commercialization, seen the product and the typology of target market, will gives not relevant problems. It will gives unavoidable aspects dues to the financial delay joined to the growing of orders; however it can be get around by the commercialization of the technology.

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www.seabreath.it

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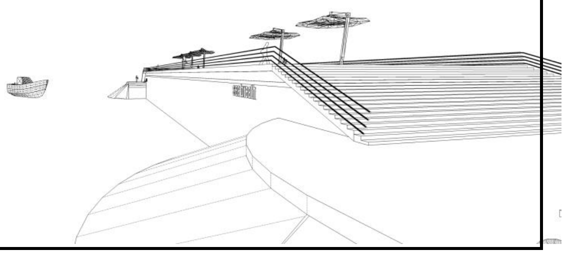


1. PRESENTATION

The Seabreath's idea comes from a research activity aimed at building a WEC (Wave Energy Converter) to solve the problems that are common to this type of device and at the same time to have high levels of efficiency, flexibility, respect for the environment, reliability and lower costs.

The first device will be with modular recycled containers and environmentally friendly materials. The same containers used for the structure will be used for transportation by combining the concept of recycling and the concept of reduce the packaging.

The project includes a plan of evolution continues on several technical aspects and design. Next step will be the design of a larger device for operation of larger waves.

The project is actively supported by two university departments and by a company already present in the market for renewable energy sources.

Many experts of the sector, research centres, governments and local administration have showed their interest.

Was estimated that are available 2100 TWh/y by wave power all around the world. Seabreath can be a part of this Market in order to fully capitalise on a global market now worth US$268 billion[1].

Technology, supported also by laboratory testing, has proven to be very promising. Its aim is to give one of the answers to the growing need of energy especially produced by clean sources in one sector, energy from waves, which still has to show his true potential and take its full place among the other renewable energy sources.

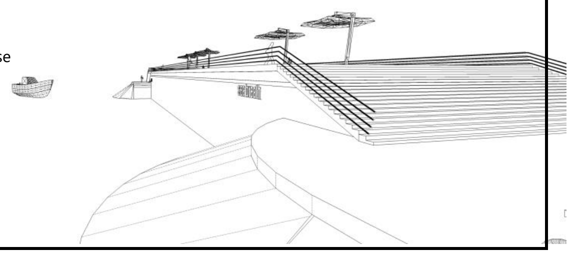
The Seabreath's Challenges is to spread a new source of renewable and clean energy.

Luigi Rubino
Inventor and CEO Seabreath

P.S.:

This document is disclosed in confidence; it requires not forwarding it if not jointly agreed beforehand.
The aim is to meet potential partners with whom to develop patented OWC technology.

[1] Bloomberg New Energy Finance, investment in renewable energy 2012 dropped 11 percent to $268 billion. In 2011, it reached $302 billion, a rise of over 30 percent from the previous year.
More http://phys.org/news/2013-01-renewable-energy.html#jCp



1.1. Our Innovation

Seabreath is Italian project for the production of energy from waves that improves and optimizes the use of OWC (Oscillating Water Column) technology.

It was designed as a float but can be adapted for fixed installations, such as docks or connected to other floating structures.

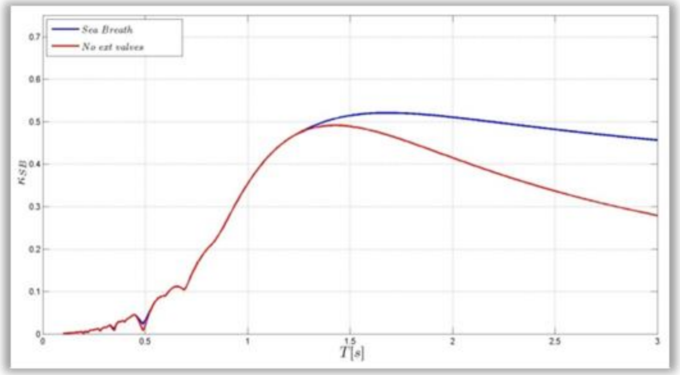
Unlike other devices that use the same principle, we obtain *a continuous unidirectional flow of air* that allows the use of a single turbine with almost double efficiency compared to those commonly used by devices that exploit the oscillating water column.

At the passage of the wave, the system is able to exploit both the thrust of the wave when it rises, the air is pushed into the first duct and then to the turbine, both when the level of the wave goes down, the air is sucked from second duct and the exhaust of the turbine.

"The W.E.C. under consideration has some interesting features and innovative such as to place it out among the myriad of projects that currently exist in the state of art of OWC.

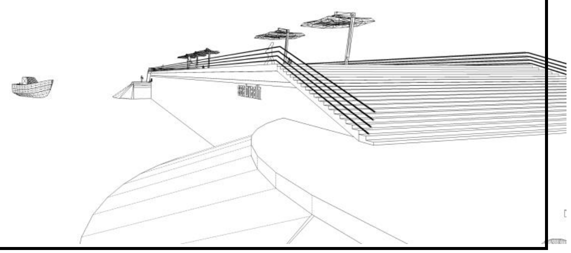
To compensate for variations in air/water, the system have been provided with additional external retention valves that increase the efficiency of the device as in the following picture:

Seabreath Efficiency Vs. No Ext Valves:



With the continue level of innovation growth, Seabreath can benefit from a huge market not yet occupied by virtually anyone. For example, the potential market for the wave energy has been estimated at 80,000 TWh. The exploitation of this type of renewable source is at its inception although it was studied for over a century and there are still not devices making it particularly efficient market in terms of energy production and reliability in critical condition

Ps: other technical details of the utmost importance for the "survival" of the device are omitted here and pictures do not describe accurately the structure.



1.2. Seabreath Technology

Seabreath is a Multi Absorbing Wave Energy Converter (MAWEC) that utilizes the OWC optimizing wave power exploitation. Consists of a structure resting on floats at both ends positioned perpendicularly to the natural wave propagation direction. The Seabreath device is divided into sections open on the underside and connected by two ducts equipped with retention valves.

The passage of a wave creates different levels inside the sectors. When the water level inside a sector rises, the air is pushed into the first duct and then into the turbine. When the level falls, the air is sucked from the second duct and from the turbine’s drain.

Additional external retention valves compensate for the changing volumes of air/water inside the system. In order to optimize the power of the wave, the length of the device must be at least equal to the length of the wave to be harnessed. It has been estimated that at the Cagliari site - which has small wave motion - the industrial device would produce an average 1.5 MW with a 7 MW peak.

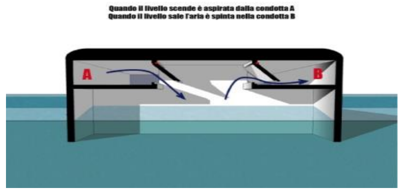
The Seabreath is the first device operating on this principle that exploits a continuous and unidirectional flow of air, in this way permitting the use of just one turbine for nearly twice as much efficiency, with an ideal structure for wave exploitation, sufficient strength under critical conditions, low costs, and virtually environmental impact.

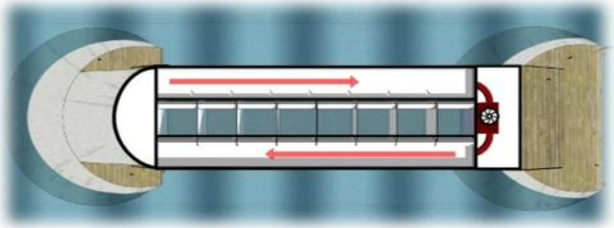
Patent. n.: PCT/IB2009/051646 / Priority: PR2008A000027

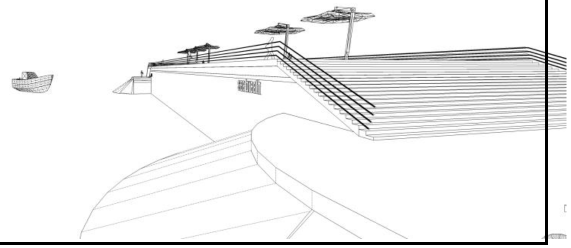
Potential clients are mostly private but also public administrations involved in the production of clean energy from renewable sources.

The position of the implants will be near-shore in the presence of sufficient wave motion.

The device is particularly suitable for the islands, a place not easily accessible from the network, oil platforms, the places that require structures to protect the coast and the facilities to be made available for landing and living room.







Business plan

Seabreath Competitive Advantage

High Technology & Double Efficiency:
• Compared to other devices that use OWC, it has a double efficiency due to a one-way airflow and allows using a common cheaper turbine with more performance to the fact that the flow is unidirectional and exploiting with greater efficiency the flow for the fact that the same is continuous.

Eco-Friendly and Innovative Design:
• Reduced environmental impact due to the floating installation and unsettled and that it can then be removed or moved at any time
• Absence of mechanical parts subject to corrosion and/or rupture
• Absence of polluting fluids or materials and exclusive use of eco-friendly components
• Shape of the structure that better integrates environmental context and that creates a surface which can be used for other purposes.
• Recycling
• Less packaging

Reduced CAPEX and OPEX:
• Less capital invested per KWh produced
• Lower cost per KWh for the final consumer
• Use of recycled materials with a higher ethical content and lower cost (currently because of the contraction of international transport there is plenty of unused containers)
• No costs and waste of packing material: the system contains itself
• Reduced transportation costs because they use common commercial channels for the transport of containers
• Less maintenance and almost zero operating costs

Easy to Install: Modular Structure that facilitates transport and installation

Resistant to Extreme Conditions: High survivor under extreme conditions

On Shore-Near Shore-Off Shore Adaptation: Ability to easily adapt the system to the characteristics of the installation site

1.3. Seabreath's Comparative Advantages VS. Other Renewable Technologies

SEABREATH VS HYDRO POWER

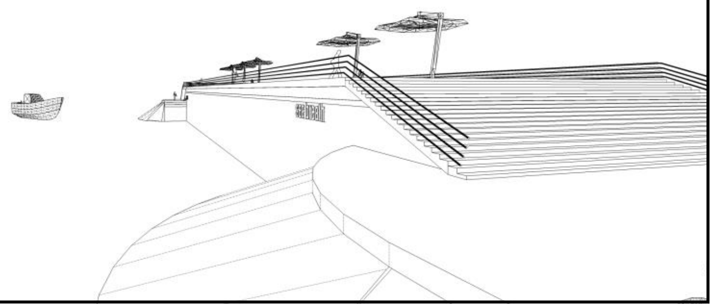
SEA BREATH	HYDRO POWER
Less capital invested per KWh produced	Dams are extremely expensive to build and must be built to a very high standard
Less maintenance and almost zero operating costs	High operational costs
Seabreath is environmentally friendly and does not cause any harm to people	Dams construction causes re-location of people nearby**:** people are forcibly removed so that hydro-power schemes can go ahead
No waste produced ,the system contains itself	Destruction of water table of rivers and aqua life

SEABREATH VS WIND POWER

SEA BREATH	*WIND POWER*
Flow is unidirectional and exploiting with greater efficiency the flow for the fact that the same is continuous	The strength of the wind is not constant and it varies from zero to storm force: production level is not stable or can fall to zero
Absence of polluting fluids or materials and exclusive use of eco-friendly components	When wind turbines are being manufactured some pollution is produced
Shape of the structure that better integrates environmental context and that creates a surface which can be used for other purposes	Large wind turbines are unsightly structures and not pleasant or interesting to look at.

SEABREATH VS SOLAR ENERGY

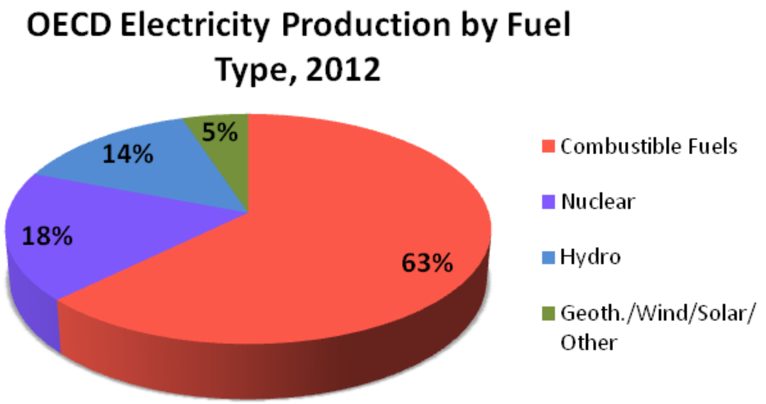
SEA BREATH	*SOLAR ENERGY*
Less capital invested per KWh produced	High initial cost of the equipment used to harness the suns energy
Ability to easily adapt the system to the characteristics of the installation site	A solar energy installation requires a large area for the system to be efficient in providing a source of electricity
Performance is relatively stable	Pollution and clouds can be a disadvantage to solar panels, as pollution can degrade the efficiency of photovoltaic cells
High survivor under extreme conditions	The location of solar panels can affect performance, due to possible obstructions from the surrounding buildings or landscape

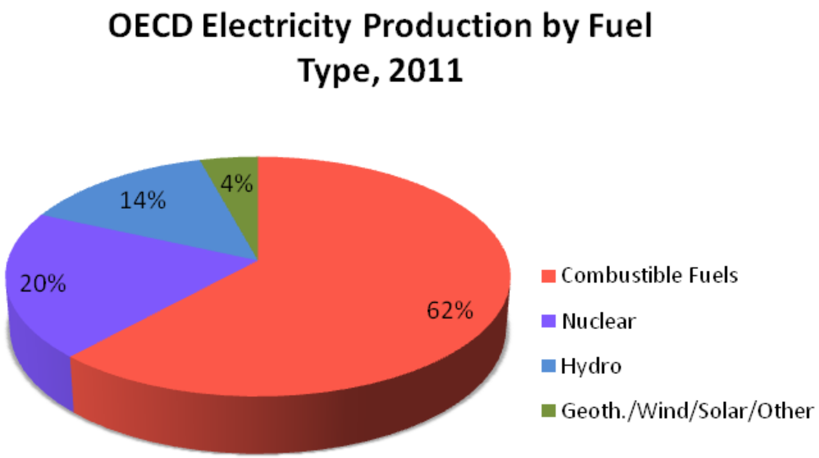


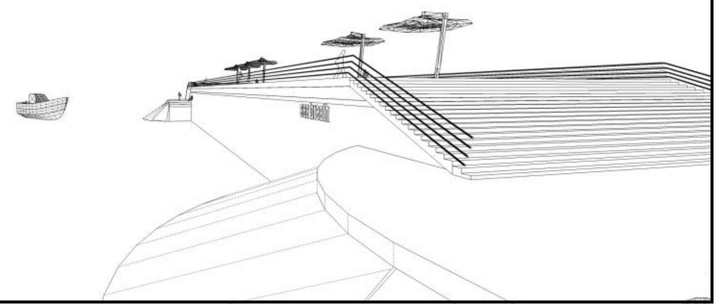
2. BUSINESS AREA

2.1. Renewable energy market

Renewables is one of the most important sources of energy and particularly electricity generation in the modern world. In 2011 and 2012 they accounted for shares as much as 18% and 19% correspondingly in the prime electricity production in OECD. Whereas the biggest contributor in this mix is hydropower, the share of other sources constantly increases and has been 4% and 5% in 2011 and 2012 respectively.







OECD Electricity Production by Fuel Type, 2011-2012* [2]

TWh

	dic-12	Year-to-Date Jan-Dec 2012	% change	Past Year 2011
+ Combustible Fuels	544,1	6 411,9	1,2%	6 339
+ Nuclear	168,6	1 857,5	-9,0%	2 041
+ Hydro	126,2	1 439,9	-0,1%	1 441
+ Geoth./Wind/Solar/Other	49,4	516,1	18,9%	434
= Indigenous Production	**888,3**	**10 225,4**	**-0,3%**	**10 255**
+ Imports	38,6	445,0	6,5%	418
- Exports	37,3	447,8	8,5%	413
= Electricity Supplied	**889,6**	**10 222,6**	**-0,4%**	**10 260**

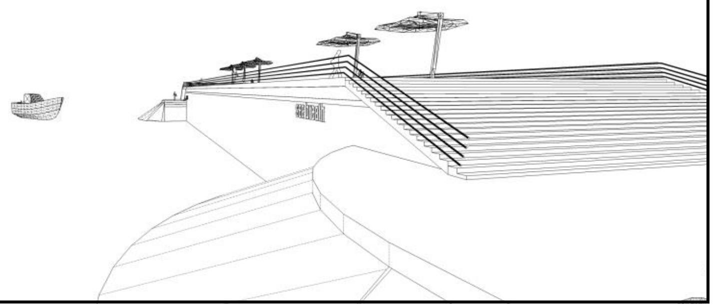
*- Total production for the year-to-date was 10 225.4 TWh.

Comparing this to the same period last year shows that:

- Total production was lower by 29.1 TWh, or 0.3%.
- Combustible Fuels production grew by 1.2% compared to the same period last year with an increase of 73.1 TWh.
- Geoth/Wind/Solar/Other production showed an increase of 18.9% or 81.9 TWh.
- Trade volume increased by 62.3 TWh, or 7.5%.

2.2. Overview of the wave energy industry

Wave energy is the transport of energy by ocean surface waves, and the capture of that energy to do useful work – for example, electricity generation, water desalination, or the pumping of water (into reservoirs). Machinery able to exploit wave power is generally known as a **wave energy converter (WEC).**The first known patent to use energy from ocean waves dates back to 1799 and was filed in Paris by Girard and his son. An early application of wave power was a device constructed around 1910 by Bochaux-Praceique to light and power his house at Royan, near Bordeaux in France. It appears that this was the first oscillating water-column type of wave-energy device. From 1855 to 1973 there were already 340 patents filed in the UK alone Modern scientific pursuit of wave energy was pioneered by Yoshio Masuda's experiments in the 1940s. A renewed interest in wave energy was motivated by the oil crisis in 1973. A number of university researchers re-examined the potential to generate energy from ocean waves, among whom notably were Stephen Salter from the University of Edinburgh, KjellBudal and Johannes Falnes from Norwegian Institute of Technology (now merged into Norwegian University of Science and Technology), Michael E. McCormick from U.S. Naval Academy, David Evans from Bristol University, Michael French from University of Lancaster, Nick Newman and C. C. Mei from MIT.



[2] http://iea.org/

In the 1980s, as the oil price went down, wave-energy funding was drastically reduced. Nevertheless, a few first-generation prototypes were tested at sea. More recently, following the issue of climate change, there is again a growing interest worldwide for renewable energy, including wave energy.

The market for the production of energy from renewable sources is definitely the economic sector of maximum expansion and not expected to slow down but instead will cover the market given the decreasing availability of non-renewable sources.

The production of energy from wave motion is in fact already a reality with devices still inefficient, but that in some cases closer to the cost of wind energy production.

2.3. Potential Resources

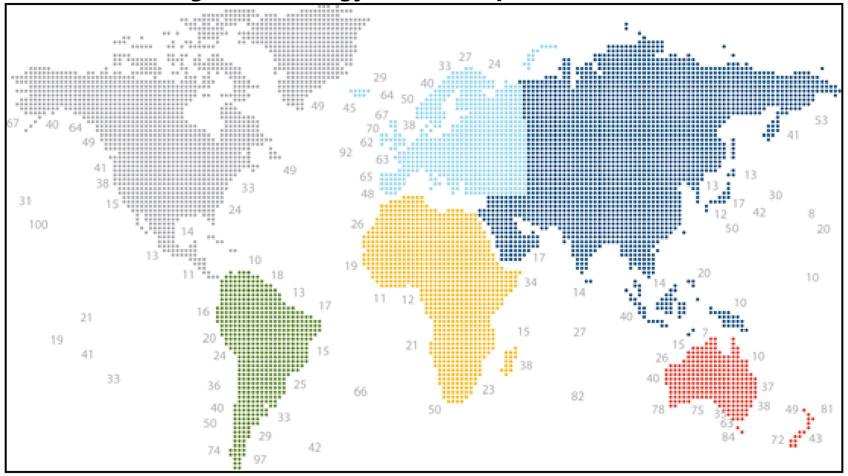
Given the growing demand for energy from emerging countries and the increasing cost of fossil fuels, unit to the need to limit emissions of CO2 and the emission of pollutants into the environment, the future of production energy can only be given to the use of renewable energy sources.

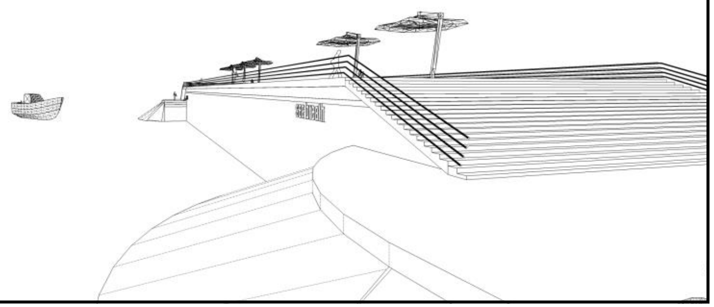
Renewables are by their nature "discontinuous", therefore it is desirable a mix of sources renewable for the future to create a smart grid.

In addition to traditional energy sources it looms for the future the use of a source that until now it has been excluded: the exploitation of the enormous amount of energy contained in the oceans.

The waves are a form of renewable energy created by wind. The capture of wave energy has been shown to be technically feasible in different forms.

Annual average wave energy flux in kW per meter of wave front





Wave energy has significant global potential with the USA, North & South America, Western Europe, Korea, Japan, South Africa, Australia and New Zealand among some of the best wave energy sites around the world

Compared to other forms of renewable energy, such as solar photovoltaic (PV), wind or ocean currents, energy from wave motion is continuous but highly variable, even though the levels of wave at a given location can be confidently predicted a few days in advance and the PLF (Power Load Factor) linked to this source may be very high: 80-90%.

$$f_{Load} = \frac{\text{Average load}}{\text{Maximum load in given time period}}$$

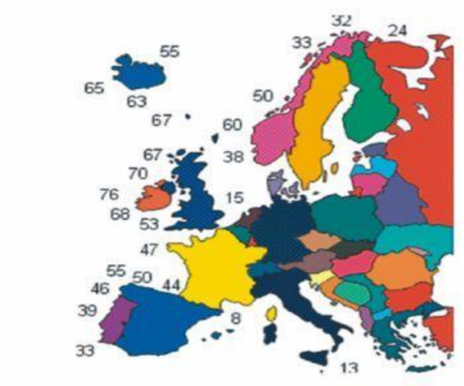
Because the wind is generated by an irregular solar heating, the energy of the waves can be considered a form of concentrated solar energy. The levels of solar radiation which are of the order of 100 W/m2 are transferred into waves with (...) of wave front. The transfer of solar energy to the waves is greater in areas with strong winds (especially between 30 ° and 60 ° of latitude), near the equator thanks to the persistent winds, and near the poles due to storms polar, and also, at the increase of distances the quantity of energy stored increase.

The waves are also effective "carriers" of solar energy. In deep water waves can travel thousands of miles and to hold on much of the energy. The wave energy[3] is dissipated after it reaches sea bottom that are less than ~ 200 m depth. At a depth of 20 m the wave energy is reduced generally to about one third of the initial energy. It has been estimated that the total annual energy available from waves off the coast of the United States (including Alaska and Hawaii), calculated at a water depth of 60 m, is 2,100 terawatt hours (U.S. Department of the Interior). This estimate was performed at a water depth of 60 m indicate (regardless of the distance from the coast in which this occurred depth) in order to allow comparison of 'energy from wave motion between the different coastal areas, and to eliminate the possible and unpredictable loss of energy of the wave given by its interaction with the seabed of smaller depth. The wave energy is available in the U.S.: in areas of open sea in the Atlantic 2-6 kW / m, 12 to 22 kW / m in regions like Hawaii and 36-72 kW / m in the North

[3] The common measure of wave power, P, is as follows: $P = \rho g T H^2 {}^2 / 32\pi$ watts per meter (W / m), the length of ridge (distance along a ridge individual), where: ρ = density of 'seawater = 1025 kg/m3, g = acceleration due to gravity = 9.8 m / s / s, T = wave period (s), and H = wave height (m).

West of the United States in coastal areas near Washington and Oregon.

European potential

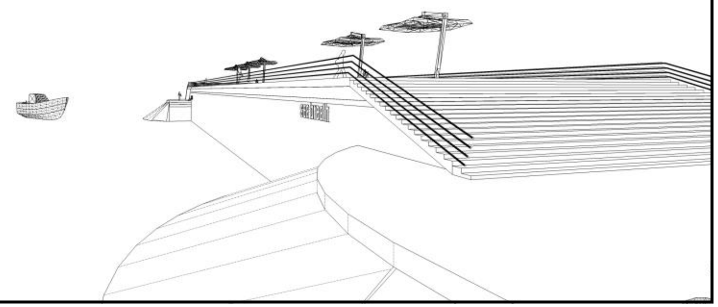


EU Member States are increasingly interdependent for energy, as they are in many other areas –i.e. a power failure in one country has immediate effects in others. A radical change is clearly required in the way energy is produced, distributed and consumed. This means transforming Europe into a highly efficient, sustainable energy economy. Europe's dependence on imported energy has risen from 20% at the signing of the Treaty of Rome in 1957 to its present level of 50%, and the EC forecasts that imports will reach 70% by 2030. If energy trends and policies remain as they are, the EU's reliance on imports will continue.

Ocean energy generation has the potential to rise to 3.6 GW of installed capacity by 2020 and close to 188 GW by 2050, a significant proportion of this to come from wave energy. It is projected that wave energy could have 529 MW installed by 2020 and nearly 100 GW by 2050. This represents 1.4 TWh/ year by 2020 and over 260 TWh/year by 2050, amounting to 0.05% and 6% of the projected EU-27 electricity demand by 2020 and 2050 respectively.
Seabreath can be the industry leader with the largest market share. Because today is unique patented device does not need a wave climate particularly energy load and is suitable for almost the totality of the types of coasts with a minimum activity of wave motion with minimal cost and high efficiency.

2.4. Policy Landscape

The number of policies in place to support investments in renewable energy continued to increase in 2011 and early 2012. Governments continued to revise policy design and implementation in response to advances in technologies, decreasing costs and prices, and changing priorities. Policymakers are increasingly aware of renewable energy's wide range of benefits—including energy security, reduced import dependency, reduction of GHG emissions, prevention of biodiversity loss, improved health, job creation, rural development, and energy access—leading to closer integration in some countries of renewable energy with policies in other economic sectors.



2.4.1. Targets for Renewable Energy

Targets for renewable energy in 2011 existed in at least 118 countries, more than half of which are developing ones.

Targets for renewable energy include indicators like following: renewable energy shares in primary or final energy supply, in heat supply; installed electric capacities of specific technologies, and others.

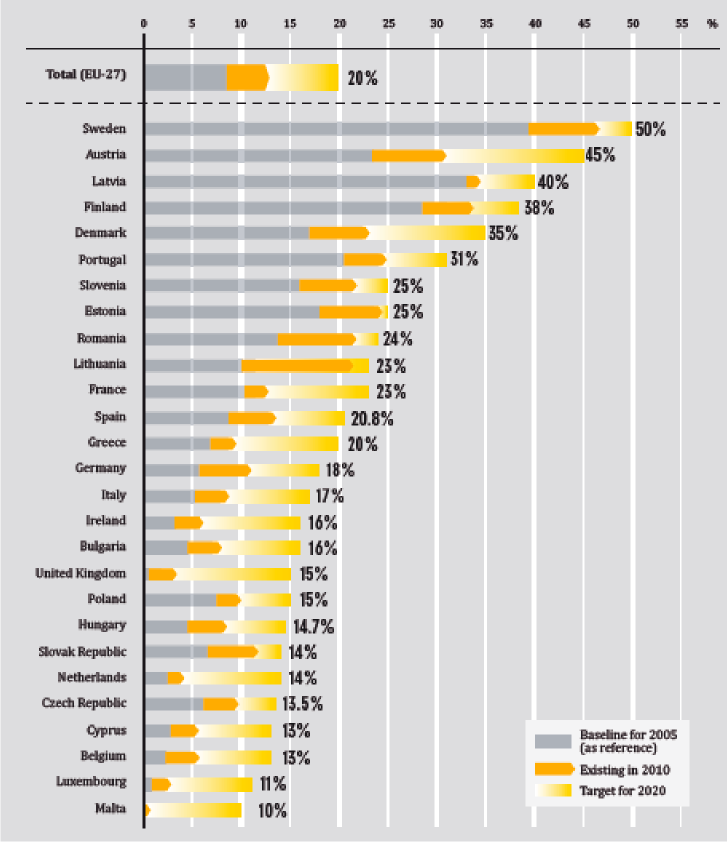
Figure 2 represents 27 EU countries renewable sources shares in final energy, for 2005, 2010, and objects for 2020. 13 of them has set 20% or even more ambitious targets.

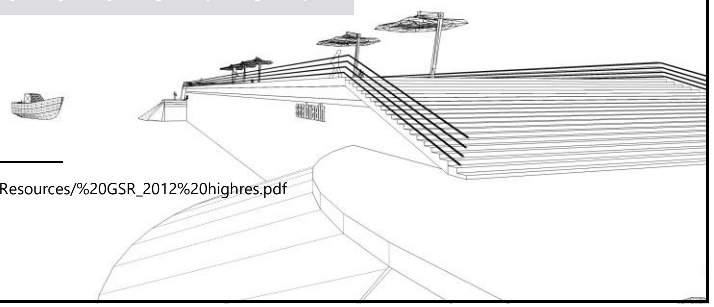
Some of the countries (world) adopted particular targets for electric capacities of Ocean energy technologies.

Renewable energy targets – Ocean energy

Country	Capacity target
South Korea	6,159 GWh by 2030
UK	2 GW by 2020
France	800 MW by 2020
Ireland	500 MW by 2020
Denmark	500 MW by 2020
Portugal	300 MW by 2020
Spain	100 MW by 2020
Philippines	70.5 MW by 2030

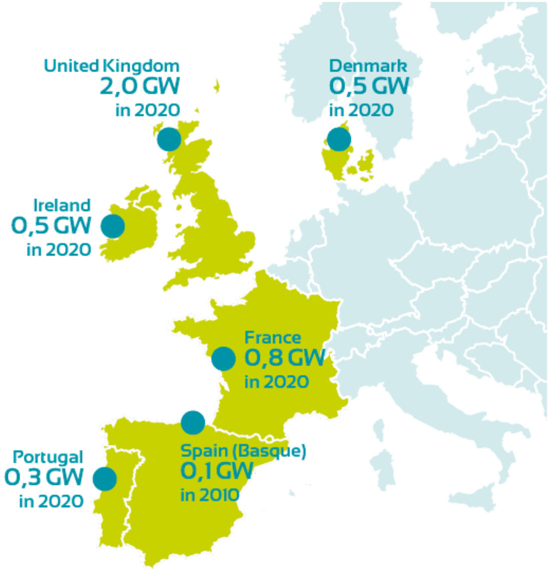
EU Renewable shares of final energy, 2005, 2010, and targets for 2020. % [4]





[4] http://www.ren21.net/Portals/0/documents/Resources/%20GSR_2012%20highres.pdf

Current and future targets for ocean energy in European countries (EU-OEA, 2010)



With the adoption of the most recent Renewable Energy Directive (2009/28/EC), the EU has committed to reducing its greenhouse gas emissions by 20% by 2020. A reliable mix of electrical power generation will have to be established to meet these objectives. Wave energy is a renewable source of energy and as such it does not emit carbon dioxide or other particles.

As a result, wave energy is suitable for replacing energy generation from fossil fuels. It has been estimated that 300 kg of CO2 could be avoided for each MWh generated by ocean energy. Therefore, for 20 GW (49 TWh/year) of installed wave energy, the CO2 emissions avoided could be as much as 14.5 Mt/year.

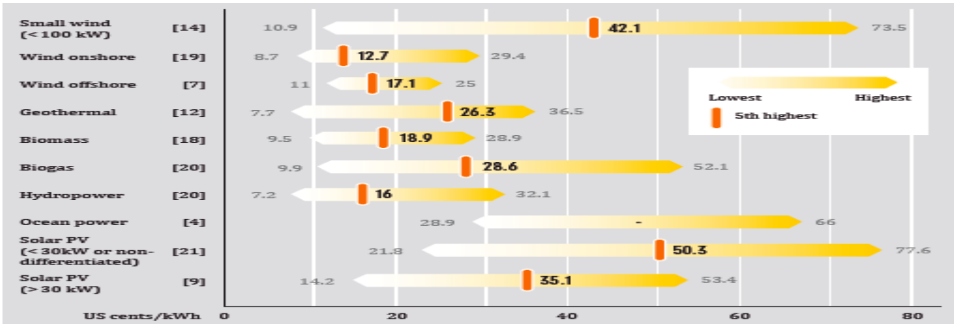
2.4.2. Power generation policies

At least 109 countries by early 2012 had some type of renewable support policy to promote renewable power generation. More than half of these countries are emerging economies.

All these policies can be divided into three categories: Regulatory policies, Fiscal incentives, and Public financing. The most common policies/incentives are the following:

- Feed-in-tariffs (FIT): is a policy mechanism designed to accelerate investment in RE technologies. It achieves this by offering long-term (15-25 years) contracts to renewable energy producers based on the cost of generation of each technology. There are many variations in FIT design. Levels of support provided under FITs vary widely and are affected by technology cost, resource availability, and installation size and type:

FIT payments in selected countries, 2011-2012



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• Electric utility quota obligation/renewable portfolio standard (RPS): a mechanism that places an obligation on electricity supply companies to produce a specified fraction of their electricity from renewable energy sources.

•Capital subsidy, grant and rebate

•Investment and production tax credits

•Reductions in sales taxes, energy taxes, CO2 taxes, VAT and other taxes

•Energy production payment

•Public investment, loans and grants

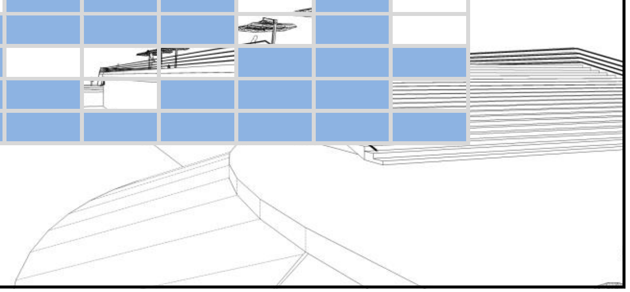
•Public competitive bidding

Renewable Energy support policies

Number of incentives		
2-3	4-5	6-8
Australia	Belgium	Canada
Cyprus	Estonia	Denmark
Ireland	Finland	France
Japan	Germany	Italy
Malta	Greece	Netherlands
Norway	Israel	Portugal
	Malaysia	United Kingdom
	South Korea	United States
	Spain	
	Sweden	
	United Arab Emirates	

Analysis Renewable Energy support policies

	Feed-in-tariffs (FIT)	Electric utility quota obligation/ renewable portfolio standard (RPS)	Capital subsidy, grant and rebate	Investment and production tax credits	Reductions in taxes	Energy production payment	Public investment, loans and grants	Public competitive bidding
Australia	■		■				■	
Belgium			■	■	■			■
Canada	■		■	■	■		■	■
Cyprus	■						■	
Denmark	■		■	■	■		■	■
Estonia	■		■		■	■		
Finland	■		■		■	■		
France	■		■	■	■		■	■
Germany	■		■	■	■		■	
Greece	■		■	■	■		■	
Ireland	■							■
Israel	■				■		■	■
Italy	■	■	■	■	■		■	■
Japan	■		■				■	
Malaysia	■	■			■		■	■
Malta	■		■		■			
Netherlands	■		■	■	■	■	■	
Norway			■		■		■	
Portugal	■		■	■	■		■	■
South Korea		■	■	■	■		■	
Spain	■		■	■	■		■	
Sweden		■	■	■	■		■	
United Arab Emirates		■				■	■	■
United Kingdom	■	■	■		■	■	■	
United States	■	■	■	■	■	■	■	■



Analyzing ocean energy targets and renewable energy policies and incentives in various countries the most attractive countries for development and implementation of marine technologies are: in EUROPE: Italy, France, Spain, Portugal, Denmark, UK and Ireland; ASIA: South Korea and all isles; AMERICA: US and Canada.

Adaptability and cost-efficient and high demand of Renewable Energy Resources in developing countries: East African Coast, (South Africa, South America Colombia, Chile, Argentina and Brazil) and Caribbean Islands (Haiti, Dominican Republic, Cuba and Jamaica).

2.5. Competitors Analysis: The Technologies Already Used

Currently, only few plants use the energy of the sea in commercial installations, are much more numerous experimental facilities and prototypes, which are showing in many cases full economic feasibility and leave great hope for the future of these technologies.

Recently begin to emerge environmental impact problems given by both wind and photovoltaic plants. Notwithstanding that small plants spread of these sources do not subtract land and have little impact or almost zero, the problem arises for large industrial plants, as well as landscape problems begin to arise also problems of disposal of old systems, especially solar. These two areas are in decline.

Take in consideration the possibility of producing energy from cold fusion even if they are from a few decades that follow each other announcements and denials and is yet to be verified the possibility of having production levels that are economically convenient.

The other sources of energy from the oceans[5] according with the U.S Department of Energy are:

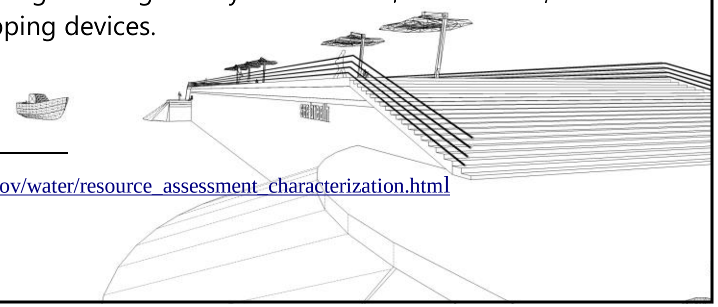
- **Ocean currents.** global resource potential estimated at below 1,000 TWh/yr.
- **Salinity gradient** with global potential resources estimated around 2,000 TWh/yr.
- **Thermal conversion** with global potential resources estimated at around 10,000 TWh/yr.
- **Tidal** with global potential resources estimated at around 250 TWh/yr

These systems above have limits given by: small number of sites available for installations, greater environmental impact both landscape and wildlife, and lower efficiency.

The industrial production of energy from wave, with estimated global potential energy up to 80,000 TWh/y exploitable, does not present too many problems landscaped and does not require the use of toxic or polluting substances.

A variety of technologies are being studied for capturing energy from waves.

The various technologies are given by: terminators, attenuators, absorbers, and overtopping devices.



[5] Source http://www1.eere.energy.gov/water/resource_assessment_characterization.html

Terminators:

Devices such as "Terminator" are usually installed on the ground or near-shore, floating versions have been designed for off-shore applications. The oscillating water column (OWC) is a form of termination in which the water enters, from an opening located below the surface, into a chamber in which air is contained. Wave action causes a movement of the level as a piston and pushes the air towards a turbine. A prototype full-scale 500-kW was designed and built by Energetech (2006) is being tested in the sea at Port Kembla in Australia, another project is under development in Rhode Island.

A project, which under construction has moved much closer to Seabreath, is the IVEC PTY LTD Australian, but has less efficiency because it does not provide by external valves of compensation.

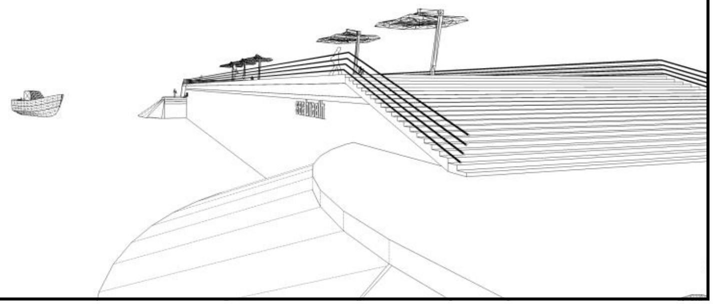
Floating offshore project that uses the OWC is also the "Mighty Whale", under development at the Marine Science and Technology Center in Japan since 1987.

Attenuators:

Attenuators are long multi-segment floating structures. The different heights of level along the length of the device causes a bending in the connecting segments which are connected to hydraulic pumps or other converters. Among the attenuators with more advanced development is worth mentioning the McCabe and Pelamis by Ocean Power Delivery, Ltd. (2006).

The pump wave McCabe has three pontoons linearly hinged together. The pontoon in the middle is connected to a submerged damper plate which causes a resistance than caissons placed on the bow and stern. Hydraulic pumps are applied between the center and frames and are activated by the movement of the same. The hydraulic fluid under pressure can be used to activate a generator or to pressurize the water for desalination. A prototype full-size of 40 m has been tested off the coast of Ireland in 1996, and the device is already in the process of commercialization.

A similar concept is used by the Pelamis (designed by Ocean Power Delivery Ltd. [2006]). The Pelamis has four cylindrical floating caissons are 30 m long and 3.5 m in diameter connected by three hinged joints. The decline of the hinge joints, caused by the movement of the waves, active hydraulic pumps located in the joints. A full-scale prototype in four segments of 750 kW has been tested sea for 1,000 hours in 2004. For this test was followed by a first order in 2005 and a commercial WEC by a consortium led by Portuguese electricity Enersis SA. Currently the project Pelamis is stopped due to problems of structural failure.



Absorbers

A device of this kind is the PowerBuoyTM developed by Ocean Power Technologies. The construction includes a floating structure with a relatively immobile component, and a second component in motion caused by the waves (a buoy floating within a fixed cylinder). The relative motion is used to drive energy converters electromechanical or hydraulic. A demonstrator prototype PowerBuoy of 40 kW was installed in 2005 for a sea trial opened in Atlantic City, New Jersey. In the Pacific Ocean have been made other tests in 2004 and 2005 off the coast of Oahu Hawaii basis.

The WEC AquaBuOYTM under development by the Group AquaEnergy, Ltd. (2005) is an absorber which exploits the vertical movement of the buoy as a piston contained in a long tube under the buoy. The movement of the piston puts pressure sea water. The AquaBuOY was tested on a scale prototypes, and a demonstration plant offshore of 1 MW has been realized in Makah Bay, Washington. The Makah Bay demonstration consists of four units rated at 250 kW located 5.9 km (3.2 nautical miles) offshore in water about 46 m deep.

Other absorbers tested are the Archimedes Wave Swing (2006), which consists of a cylinder full of air which moves up and down to move the wave. This movement with respect to a second cylinder fixed to the seabed is used to drive an electric generator linear. A device with a capacity of 2 MW has been tested at sea in Portugal.

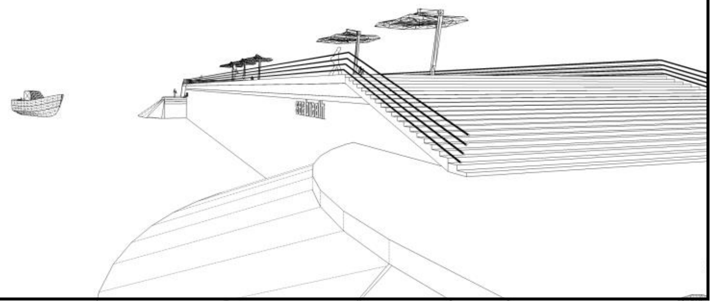
Overflow devices

The devices have overflow tanks which are filled by 'shock waves to levels above the surrounding media. The released water tank is used to drive turbines or other conversion devices.

The overflow devices have been designed and tested both for onshore and offshore floating. The devices include the offshore DragonTM Wave (Wave Dragon 2005), which provides that wave reflectors focus waves towards the center of the structure and therefore increase the effective height of the wave.

The device overflow WavePlaneTM (WavePlane Production 2006) has a smaller tank. The waves are channeled directly into a room that conveys the water to a turbine or a conversion device.

Other minor tens of devices are currently under study and experimentation. *However Seabreath has the highest level of technology known for the production of energy from wave motion.*



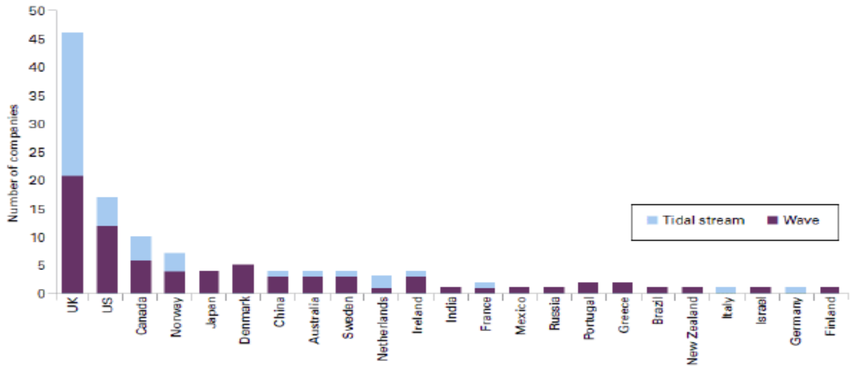
Types of ocean energy sources and technologies

OCEAN ENERGY SOURCES	DESCRIPTION	TECHNOLOGY TYPES
Ocean wave	Energy sourced from movements of water near the surface of the earth in an oscillatory or circular process	Attenuator, Collector, Overtopping, Oscillating Water Columns, Oscillating Wave Surge Converter (OWSC), Point Absorber, Submerged Pressure Differential, Terminator, Rotor.
Tidal current	Energy sourced by natural currents created by the movement of the tides.	Horizontal/Vertical-axis turbine, Oscillating Hydrofoil, Venturi.
Salinity Gradient	The application of salinity gradients to store solar energy or to exploit the entropy of mixing fresh and salt water.	Semi-permeable Osmotic Membrane.
Ocean Thermal Energy Conversion	OTEC draws energy from the thermal gradients that exist between the warm surface water and the cold deep water of the ocean.	Thermo-dynamic Ranking Cycle

2.6. Technologies Innovation

Unlike large wind turbines, there is a wide variety of wave energy technologies, resulting from the different ways in which energy can be absorbed from the waves, and also depending on the water depth and on the location (shoreline, near-shore, offshore). Recent reviews identified about one hundred projects at various stages of development.

The number does not seem to be decreasing: new concepts and technologies replace or outnumber those that are being abandoned. Several methods have been proposed to classify wave energy systems, according to location, to working principle and to size ("point absorbers" versus "large" systems). See Top Ocean technologies in Figure 11, according with the level of development.

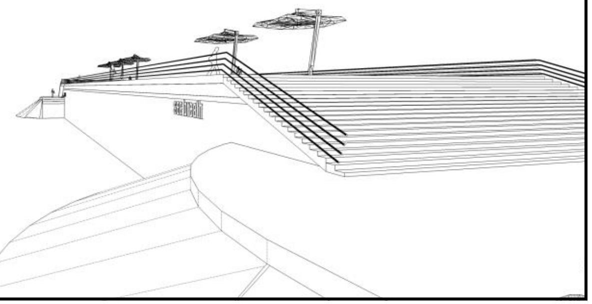


Some links of ocean top technologies:

Fixed:[6] Isolated: Pico, In breakwater: Sakata, Tapchan

Floating: Mightywhale,Oceanenergy,Sperboy,Oceanlinx, Aquabuoy, IPS , Buoy,FO3,Wavebob,PowerBuoy, Pelamis ,PS frog, Searev, Waveroller,oyster, AWS, Wavedragon

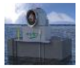
Oscillating water column: IEA Technology



[6] : , 2013

Seabreath's comparative analysis[7]

The comparative analysis shown are not supposed to form an exhaustive list and were chosen among the projects that reached the prototype stage or at least were object of extensive development effort.

BENEFIT	Oceanlinx	Aquamarine power	Wavegen	Ocean Energy	IVEC FWP	SEA BREATH
Type of DEVICE	OWC 	Oyster 	OWC 	OWC 	OWC 	OWC 
Deployment	Near Shore	Near Shore	On Shore	Off Shore	Near Shore	Near shore
Stage of Development	5	4	4	4	2	2
Peak Power	100kW to 1.5MW	1.5MW	500kW	500kw	20kW to 10MW	20KW to 5 MW
Design Complexity	Med	Med	Low	Med	Low	Low
Unidirectional Air Flow	no	no	no	n/a	yes	Yes
Survivability in Heavy Seas	High	High	High	High	medium	Hight
Maintenance Requirement	Med	Med	low	Med	low	Low
Initial Capital Cost	High	High	High	Low	Low	Low
Scalable Deployment	Near Shore	Near Shore	On Shore	Off Shore	Near Shore	On/Off/ Near Shore
Expected Electricity Cost (perKWh)	USD$0.5 to $0.8	USD$0.2 to $0.5	USD$0.2 to $0.6	USD$0.2 to $0.6	USD$0.2 to $0.4	USD 0,2 to 0,3

[7] http://www.seabreath.it/index.php?lang=en

2.7. Comparative Analysis- Capital investments

Oceanlinx

Oceanlinx has since become a leading international company in the field of wave energy. For more than 15 years Oceanlinx have developed, deployed and operated 3 prototypes of technology in the open ocean. The technology can produce electricity from ocean waves, alongside an

energy saving system to produce desalinated seawater and can provide coastal protection from sea erosion.

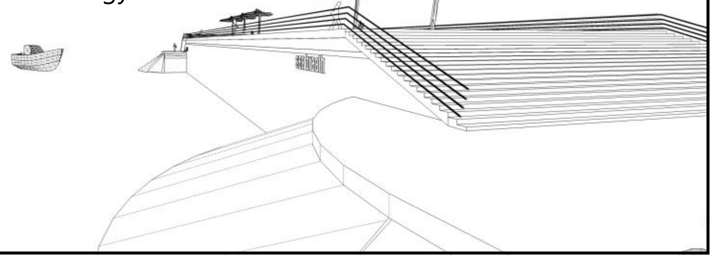
2002 - Three European investment groups specializing in innovative energy technology invest US$3.75 million, and German based RWE Dynamics invests US$750,000

2004 May - Oceanlinx is awarded a A$1.21 million research & development grant by the Australian Federal Government, facilitating its Wave Energy Optimization program

2007 February - £6.0 million fundraising with institutional investors

ORECon

ORECon Limited ("ORECon") a wave energy device developer today announces the completion of its first institutional funding round led by Advent Venture Partners ("Advent Ventures"). A powerful syndicate of international VCs including Advent Ventures, Venrock, Wellington Partners and Northzone Ventures is investing a total of $24m. With the investment ORECon will build and deploy a full-scale device, then move on to commercial roll-out of its technology.



The result of six years of planning and development, ORECon's patented MRC (multi-resonant chambers) technology has addressed the problems encountered by other wave energy devices. The ORECon MRC uses multiple wave chambers of differing draughts integrated into a single buoy to produce a very efficient device with high power output of 1.5 MW

Wavegen

Voith Hydro Wavegen Limited is a wholly owned subsidiary of Voith Hydro, a Group Division of Voith AG with a workforce of around 2,500 employees and sales of over EURO 600 million in the past business year - Voith Hydro is a world leader in the supply of hydro power equipment.

Ocean Energy

OceanEnergy Limited is a specialized commercial company developing wave energy technology. The company has over the past 7 years developed and tested its OE Buoy technology to the stage where it is now the most commercially viable technology for harnessing the power of the oceans. The device through careful development has the advantages of a robust and practical design, one moving part and proven survivability having withstood more than 2 years of live sea trials in Atlantic waves. To date no other Wave Energy systems can claim success in these areas to a similar or greater extent.

€1m towards a world class, state-of-the-art National Ocean Energy facility in UCC. The Facility will now have an advanced wave basin for the development and testing of early ocean energy devices.

€2m to support to develop a grid-connected wave energy test site.

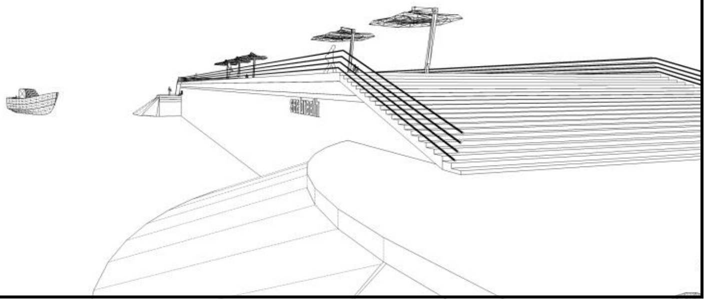
Grants under the Ocean Energy Prototype Fund. This will help developers to make their devices commercial.

The introduction, of a new feed-in-tariff under the REFIT scheme for wave energy of €220 per MWh.

€500,000 to establish an Ocean Energy Development Unit as part of Sustainable Energy Ireland (SEI). Operating with the support and assistance of the Marine Institute, this unit will oversee the implementation of the initiative.

IVEC FWP

IVEC is a R&D company delivering robust and high competitive solutions for clean energy and transport. Founded in 2005, IVEC takes pride in more than 5 years of technology innovation delivering the technologies to build competitive advantage. IVEC provides a comprehensive range of technologies that promote rapid return on investment and low total cost of ownership, whether operating business on a local, regional or global scale. We have simple and clear business development models for each our project. We are ready to provide well developed business plans to the potential investors or business partners.



3.1 Team

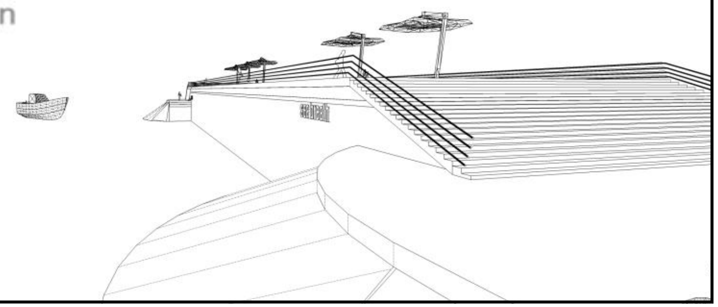
the team

- **doctor in economics and trade** - inventor of the device: general management and designing
- **mechanical engineer** - inventor, scientist: design and technical direction
- **naval engineer** - designer, tester: designing
- **industrial engineer** - expert in green economy: research materials, market and logistics
- **electronic engineer** - electrical an electronic design
- **designer** - graphic and industrial design
- **specialized technicians** - support for technical realizations

collaborations

design companies special marine constructions: overhaul, anchorage and technical advice

design center and research on renewable sources: electrical and electronic design



3.2. Abstract from report “*Dipartimento di Ingegneria Idraulica Marittima Ambientale e Geotecnica (IMAGE) – University of Padua*

Abstract:

“The report of experimental evidence of the skill of SeaBreath to convert wave energy into electricity. On the basis of three series of experiments in channel, and following is a well-established experimental practices, the device on a reduced scale 1:66 has proven to be able to generate energy to an extent of about 10% of the incident wave, placing themselves at the equal of the best devices currently being tested worldwide.

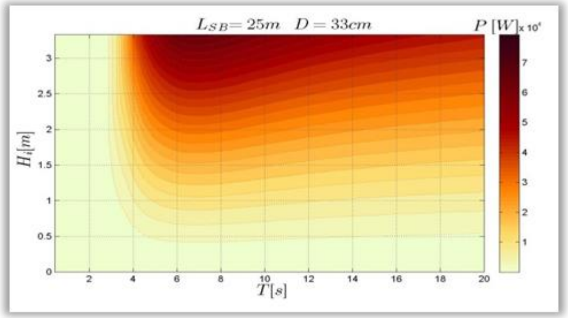
An initial estimate provided by the client shows a possible application of the model off the coast of Cagliari - Sardinia - Italy, where the average force of the sea is relatively small but translatable through the "Seabreath" in average powers range from 1.7MW to 7MW.

Thanks to a numerical model of interpretation, some elements have been identified that may lead to a considerable development of the potential of the device, and diagrams of the project were provided to estimate the ideal size to changing wave conditions.

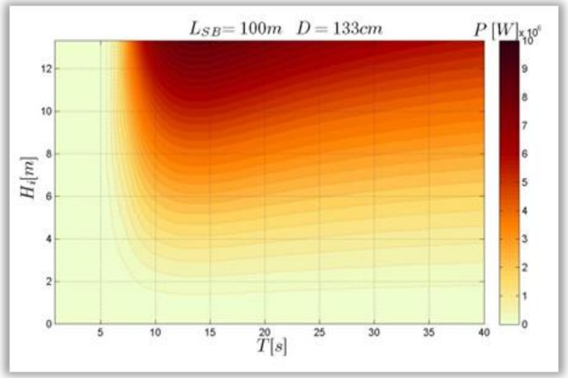
On the basis of the evaluations developed in the report shows the model of energy efficiency to evaluate the maximum power extractable from a series of prototypes of possible dimensional evolutions of the Seabreath’s system.

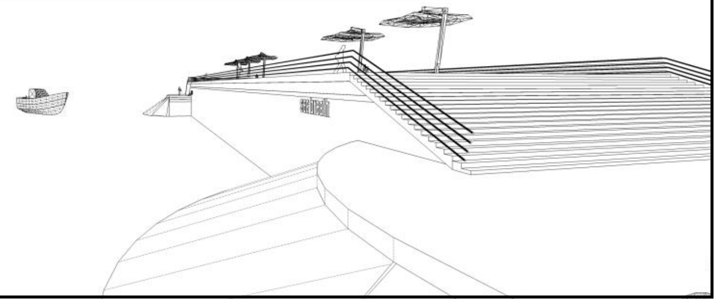
The following charts will appreciate the maps of power extractable from systems and length dimensions close to those proposed in this Business Plan:

Potential energy of Recycling Containers - length of the absorber 25 meter, diameter pipe: 33cm

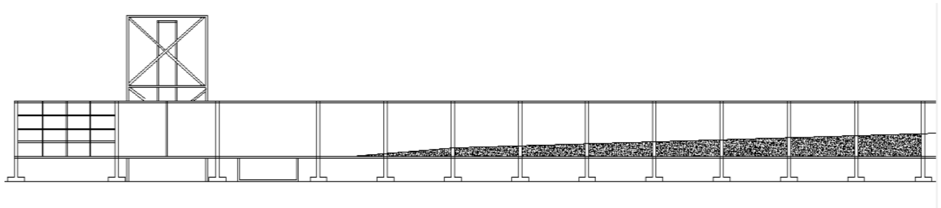


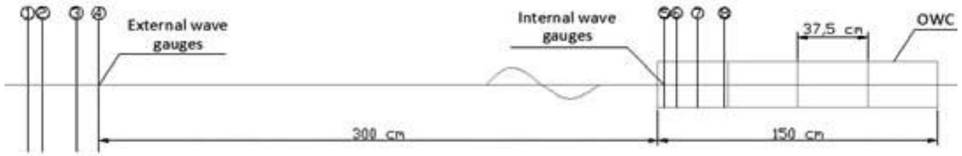
Potential energy full length Prototype -total length of the absorber 100 meters, diameter pipe: 133cm

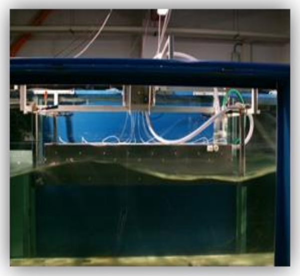


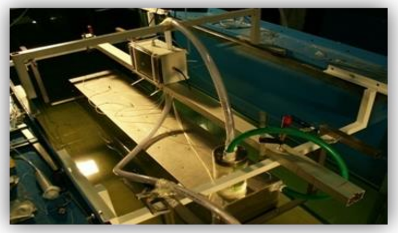


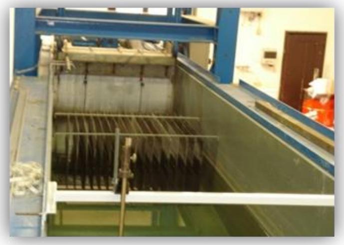
Test Set up:

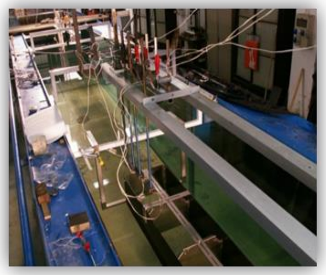


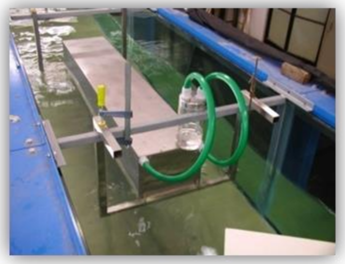

External wave gauges
Internal wave gauges
37,5 cm
OWC
300 cm
150 cm

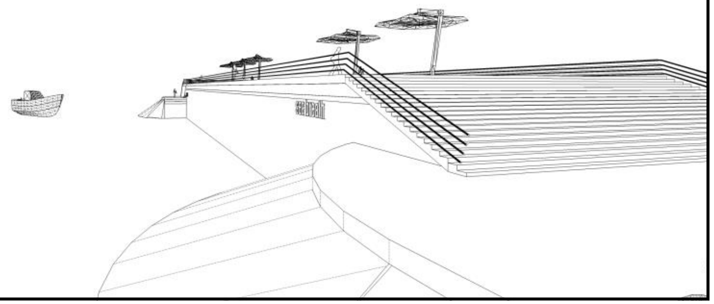






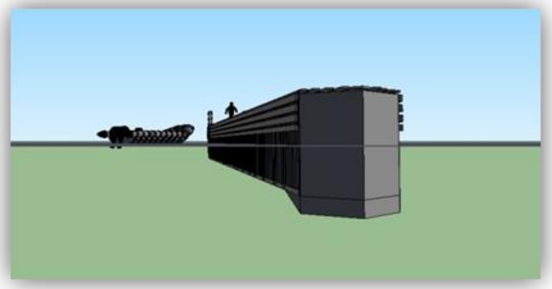






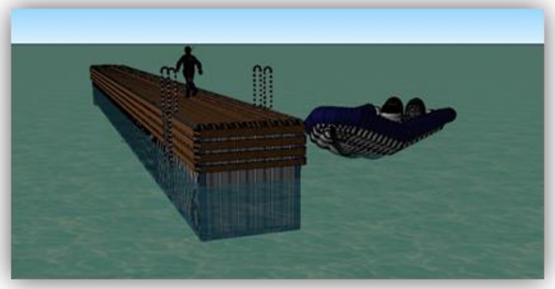
3.3. Engineering and construction of the prototype

We have pre-designed and estimated to create a product that is ready to the market in two years using recycled container of 20' feet and eco-friendly materials in line with the philosophy of recycling, reducing packaging and however optimal for our scope.



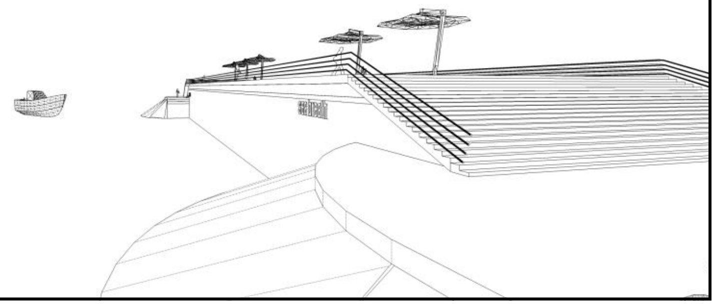
Strength of the project is the type of turbine used that combines a high efficiency at low cost and a decrease of localized pressure losses of the collectors, with an electronical generator dedicated to optimize the production of energy.

The valves are a sensitive point of the system and have already been identified commercial products, both for materials and for features optimal for this scope, however at the same time we are devoted to the study of a valve that it will be the subject of future developments.



There are several design solutions identified by the Team that should make the structure resistant, stable and to ensure life in extreme conditions.

Estimated time implementation and tests: 14 months



3.4. Prototype design: Fixed/Floating devices

"Seabreath" is a multi-rooms (WEC Wave Energy Converter), which uses the OWC optimizing the exploitation of the wave.

The study of the OWC and that of greatest interest to the international scientific community in research on the exploitation of wave and the Seabreath device has a high percentage of efficiency and simplicity of structure.

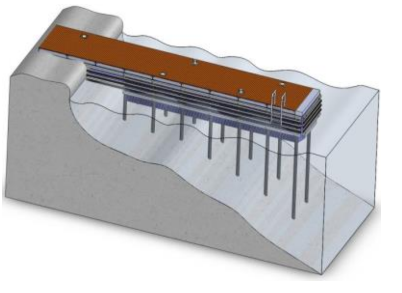
It consists of a floating structure which is perpendicular to the natural propagation of the waves and is divided into sectors open from the bottom and connected by two pipelines equipped with valves retention.

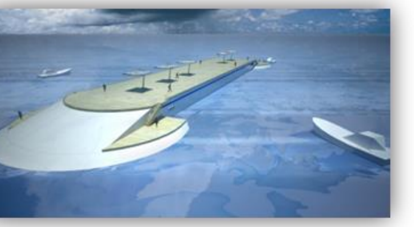
To maximize yields the structure must be at least equal to the average wavelength you want to use.

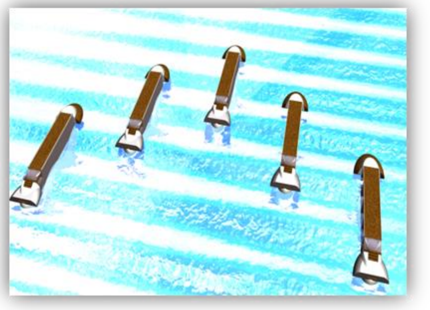
The structure can be adapted to any height and wavelength and the devices can be made larger for an industrial use to be anchored at depths of at least 60 meters and more little devices for sea bottom that degrade slowly.

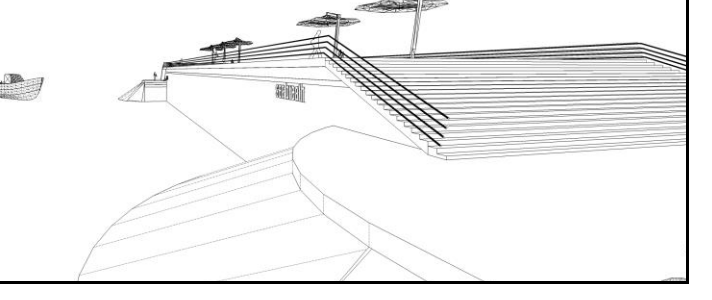
The first prototype will be constructed with recycled container, will be modular and will be the same container packaging. It is expected to use almost all of the materials with characteristics environmentally friendly and recyclable.

The device can be a tool to defend the coast from the waves and also a solution for fish restocking.









3.5. Environmental impact

The conversion of energy from wave motion to usable forms of electricity or other sources of energy is generally thought to be of low environmental impact. However, as with any emerging technology, the nature and extent of environmental concerns remains uncertain. The impact that occurs is still to be verified for specific sites where the installations are made.

However it is not far-fetched to think that such structures as well as having a low environmental impact, it is also useful for restocking of game in the area.

There have already been studies of the impact on coastal physiography, the oceanographic conditions, marine and biological resources, and the land use compatibility of land and marine resources, cultural resources, infrastructure, recreation, public safety, visual impact, and none of these resources were found to be significantly influenced by plant type as WEC.

Environmental factors require monitoring:

The visual impact and the noise:

For the type of device are specific in relation to the height of the freeboard and the generation of noise above and below the water surface.

The OWC devices typically have the highest free edge and are the most visible. For navigation on the high seas is required hazard warnings such as lights, sound signals, radar reflectors.

In the OWC devices, the air is sucked and ejected and likely sources of noise above the water. This does should not happen in *Seabreath* or should be attenuated for the fact that it is always the same air used in the air duct, only in particular conditions there is an exchange with the outside via the compensation valves.

The underwater noise you should have from devices with turbines, pumps, and other moving parts immersed in water, case that not applied to the *Seabreath*.

The type of frequency of the entire system is important in assessing the impact of noise.

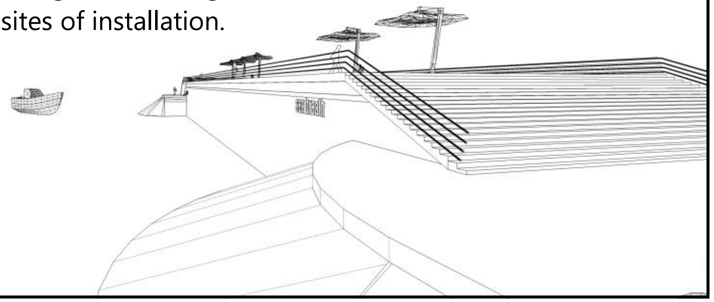
Impact near-shore

The reduction of the wave given by the converters of energy from wave motion might be a factor to take into account, however, the impact on the characteristics of the waves are to be observed at 1-2 km away from the WEC device in the direction of wave's move. There should not be a significant impact on the coast in terms of reducing the wave if the devices are placed at more than this distance from the shore.

Little information is available on the impact given to biological communities to reduce the height of the waves. The marine habitat may be affected both positively and negatively.

The surfaces of the WEC devices could provide substrates for various biological systems and may be a positive complement to the natural habitat.

A potential conflict with other users of marine space, as commercial shipping, fishing and boating, can occur when there is a careful selection of the sites of installation.



The impact may be potentially be positive for sport fishing and commercial.

Toxic releases:

May be linked to accidental leaks or spills of liquids used in systems working with hydraulic fluids.

Possible impacts can be minimized through the choice of non-toxic liquid and with careful monitoring, with appropriate intervention plans for a plan to contain the leakage. The use of biocides to control the growth of marine organisms can also be a source of toxic emissions.

However Seabreath does not provide for the use of liquids and, except for certain sensitive parts, any bio proliferations do not compromise the functioning.

Installation and decommissioning:

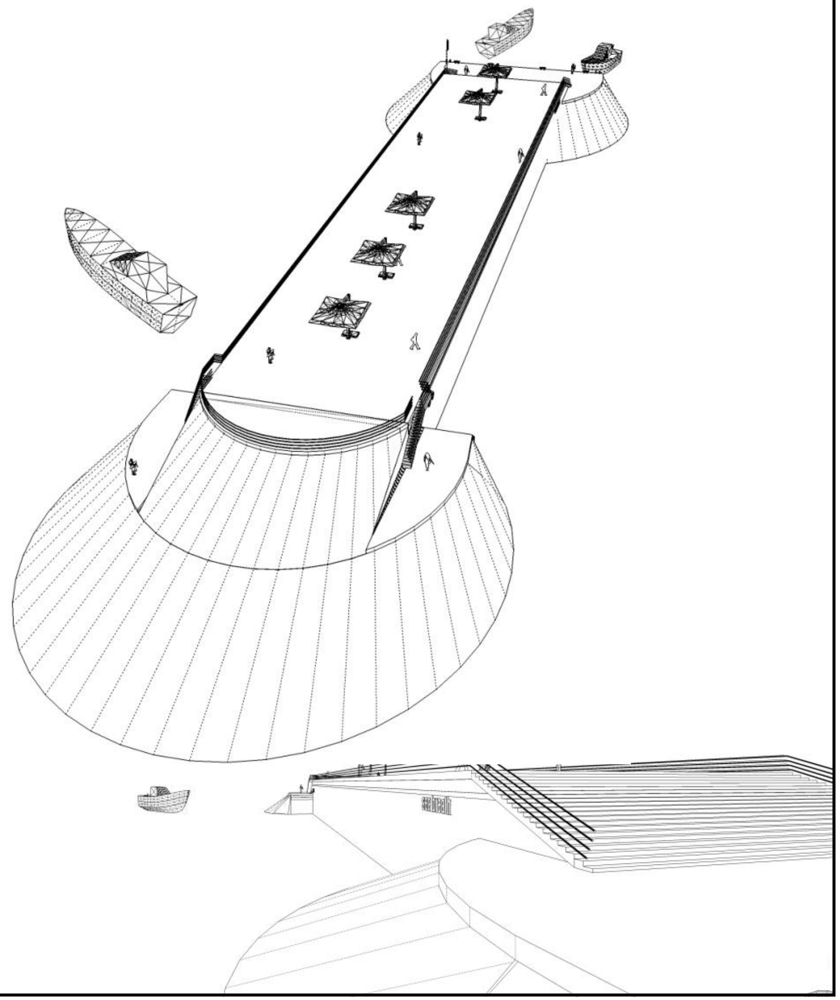
For the Installation the only possible interference to the bottom of the ocean is given by the presence of energy cables to the transport of the energy to the coast that may have negative impacts on marine habitats.

For the decommissioning, the potential impacts of decommissioning are mainly related to the disturbance in the marine habitat that has adapted to the presence of the structure.

The installation procedure should be designed to minimize impacts on the lives of benthic communities and areas rich in biological diversity.

The growth of benthic organisms, such as corals and sponges, we supposed that the support provided by the device from the system components can be beneficial to the ecosystem.

Even the visual pollution and noise is of low intensity.



4. ECONOMIC CONSIDERATIONS

4.1. Investiment cost

Estimates of the costs of energy produced from WECs depends on many physical factors, such as system design, the energy of the wave, water depth, distance from the coast and the characteristics of the seabed. For example, this is the road map of UK Deployment Cost, where Seabreath (Cost-efficient device) is very well positioned:

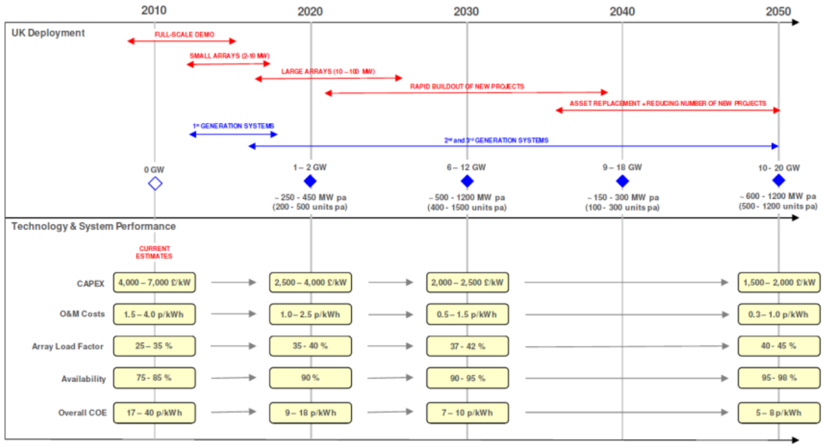


Figure 14: Examples of UK Cost Goals (p/KWh=pounds/kWh) [8]

Economic factors, such as the assumptions about the discount rate, reducing the cost of a proven mature technology, and tax incentives, are also important. A detailed assessment of the development potential energy of the waves in the coastal areas of the United States was carried out, taking into account the variability of these factors (Bedard et al., 2005).

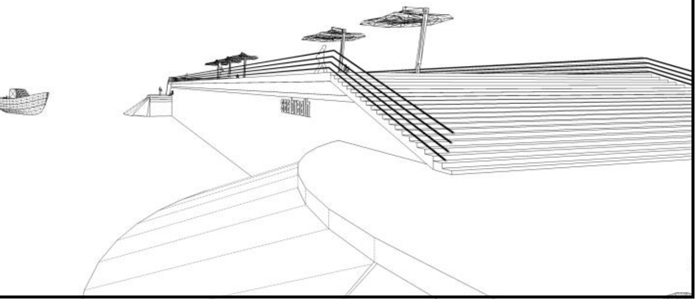
The estimated cost of electricity from the first offshore on a commercial scale in California, Hawaii, Oregon, and parts of Massachusetts with wave energy was relatively high in the range of $ 0.09 to $ 0.11/KWh, after tax incentives.

Estimates of the costs of capital investment for different types of devices ranging from $ 4,000 to $ 15,000 / kW.

The estimates of production costs for Seabreath are about $ 0.20-0.30/KWh without incentives also taking into account a reasonable margin of expenditure for maintenance.

As capital investment is between **2.000-4.000** USD / kW for a commercial product by taking into account a scenario production carried out in sites with intermediate wave motion.

The average life of the device is set at 20 years, but with careful use of materials and also view the decision to build the structure so "mudulare" with parts easily replaceable, it could also extend this period.

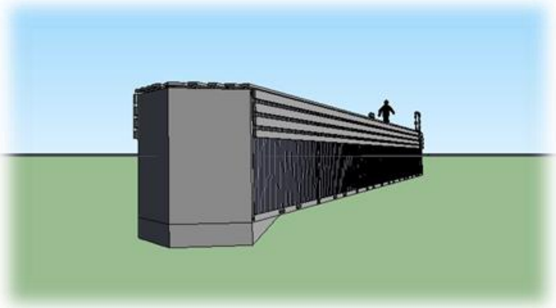


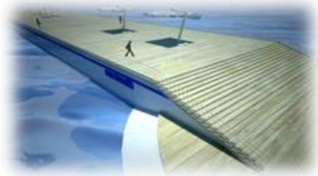
[8] Marine Energy Technology Roadmap , 2010

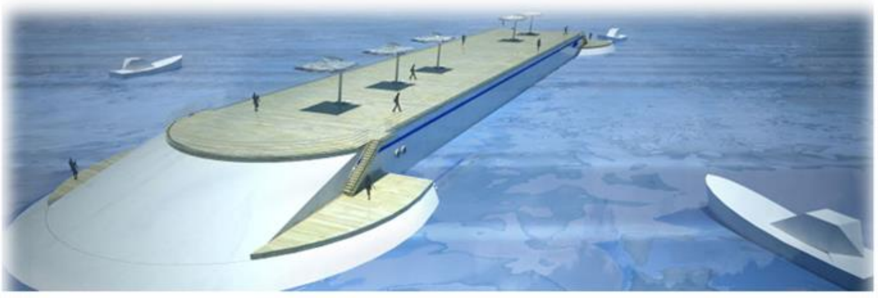
Maintenance is to quantify. It is not unlikely predict that the device, having regard to the simplicity of construction, has lower maintenance costs compared to similar devices

Particularly interesting is that this devices for the production of energy from wave motion have a PLF (Power Load Factor) very high.

A precise estimate of returns can be made only after the identification of the site of installation. (around 4/5 years)

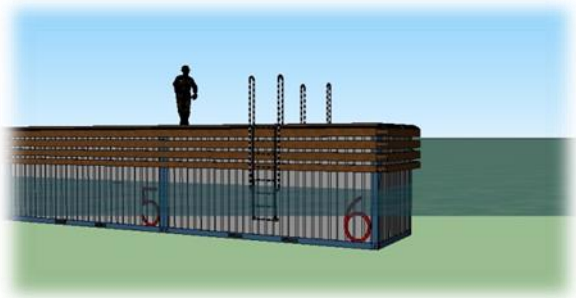


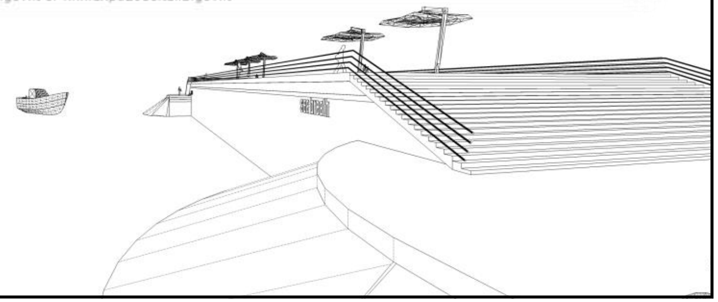




Seabreath was been on display at Expo 2010 Shanghai.
"Italy of Innovators" was conducted jointly by the Ministry of Public Administration and Innovation and the Commission of Italy for Expo Shanghai 2010, for information go to www.innovazionepa.gov.it or www.expo2010italia.gov.it

Estimated 20kW turbine/generator with a annual production of 80MW/year.
Cost of the prototype: 500.000 euros





5. NEXT STEPS:

Further possible and future developments are:

- factories with more devices,
- devices of long dimensions,
- WEC piers
- oceanic industrial device,
- big oceanic devices not anchored,
- production of hydrogen.

Think of the motion of the waves, the ebb and flow of the tides and the coming and going of the waves. What is the ocean? An enormous lost strength. How stupid the earth, not to make use of the ocean! " Victor Hugo.

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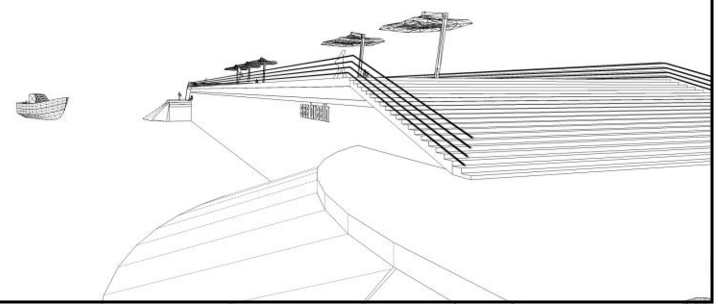

seabreath®
wave energy

prizes and awards

expo shanghai 2010
上海世博会意大利馆

Ministero
per la Pubblica Amministrazione e l'Innovazione
italia degli innovatori
innovazione selezionata expo shanghai 2010

Silver medal
FME
IV International Invention Fair of the Middle East

premio Lamarck
GGI CONFINDUSTRIA - SMAU

MAREVIVO
Secondo classificato
Concorso di idee:
"Le energie rinnovabili per le isole minori
e le aree marine protette italiane"
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