A view of wave energy

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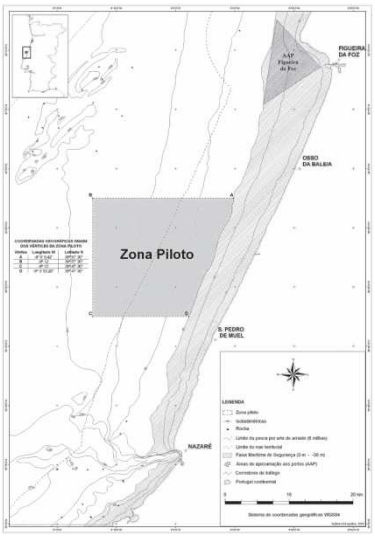
In the development of marine energy Portugal has done an important step towards the future, with the signing of the concession contract for the development of Pilot Zone. After been announce in January 2008, in 20 October 2010, the concession contract was issue to REN (grant for 45 years), which as create a new company for its development, ENONDAS.

The Pilot Zone is a 320 Km^2 of ocean area, open to the development of marine energy with special attention to wave and offshore wind energy.



ENONDAS (not an energy producer), is the company responsible for the development of Pilot Zone, start working, and in 16 May assigned a contract with the Portuguese Hydrographic Institute for the geophysical characterization of Pilot Zone. The data collected in this study (that involves geologic, oceanographic, hydrographic characterization) will be of public domain and available for any developer, free of charge, that wants to establish in the pilot zone.

Still in 2011, ENONDAS expect to have ready the:

- Pilot Zone access regulation (RAZP);
- Basic Engineering studies for infrastructures;
  - Offshore electrical connection to the electric network.

The legal frame work of pilot Zone is base in the following official documents:

- Creating: DECREE Nº 5/2008 de 08 de Janeiro
- Base Lease: DECREE Nº 238/2008 de 15 de December
- Concession agreement: RCM Nº 49/2010 de 1de July

ENEONDAS will act as one stop shop, for the license of marine energy devices in the Pilot Zone.

This open space, on the Atlantic coast, devoted to the development of marine energy, will work in three regimes:

- test (proof of concept)
- development (pre-commercial)
- Exploitation (commercial

The development plan established by ENONDAS is organize in 3 temporal phases being:

Phase 1 (2011-2013)

- to equip the ZP with electrical connection to the network up to 12MW (4x2MW)
- Aim - ZP ready to receive, in demonstration of concepts scheme, electricity generation equipment (wind and waves) in the summer of 2013

Phase 2 & 3 (as needed)

- injection up to 80 MW (phase 2);
- injection 250 MW (phase 3);

So far (without disclosure)

- 7 technologies demonstrated interest in becoming in PZ, in demonstration of concept scheme;
- Of these, 3 with pre-registration;
- One technology is offshore wind;

A View regarding the development of wave Energy[1]

Wave energy has been having some problems in stating, the failure of some projects has bring mistrusting about this form of energy. However we consider those failures as being part of the development process, and with an outlook analyze, we may consider some reasons way this is happening.

What has gone wrong (a very subjective view)

Normally developers come from the energy community and don't have an offshore culture so they normally have poor understanding of the environment where they want to operate, and "forget" simple's aspects of offshore characteristics as; swell and wind waves (It is a spreading, not a mass, on a surface with multiple sources, intensities and directions, which can combine), their destructive power (swell, wind waves and corrosion), the effect of marine life.

This normally tend to a unlike design, thinking first in energy production and then try to adapt to the sea. Most cases without a naval architecture support, witch only appear in the end of the development phase, for certification purpose only.

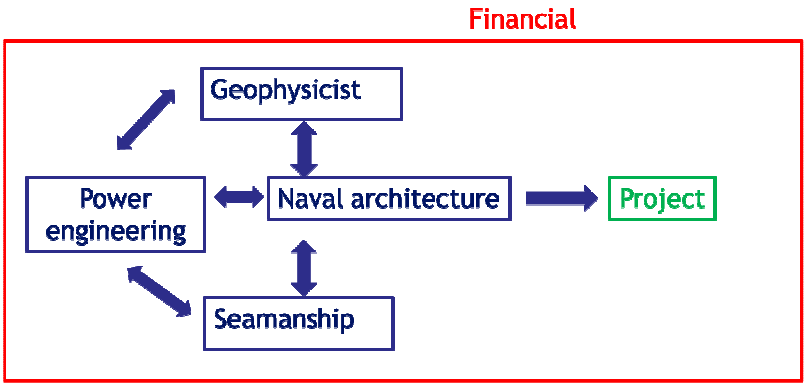
This bring to major basic design errors in development, namely, import inshore development concepts, use solutions designed and tested in other "seas", complicate the solutions, which causes difficulty in sea operations and costs increased.

[1] This a private view of João Cardoso. It does not reflect any official view of REN or ENONDAS.

Some facts, in our opinion, for the developer take in account.

- Think “offshore", in all decisions and options;
- Have multidisciplinary design team;
  - Financial - this is s business and as to be profitable, so cost control is a must;
  - Geophysicist – resource and the extreme situations;
  - Power engineering – energy extraction technology;
  - Seamanship – how will be operate;
  - Naval architecture – integrates the needs and develops the project

The naval architecture, the power engineering and financial has to be in the first line of decision process.



Other aspects in the design of a project that should always be in mind of the wave developer:

- Work with the "sea", not against the "sea”;
- Don't hold on most common conceptions, be imaginative;
  - Searches for new (or not) materials such as concrete and composite or ceramic materials, new designs and new approaches;
- Be simple, everything will be more difficult at sea (this may be the most difficult task);
- Considering the technical solutions for production gains versus deliverables in project (the gain outweighs the cost or not).

A few demonstrating examples of most common problems, seen in projects:

- Mooring systems extremely complex and difficult to operate at sea;
- Designs that don’t allow the resource (waves), when are in excess, to disperses naturally;
- Use of equipment which tend to break down (pumps and valves);
- Solutions that work well in the laboratory, but forget the marine environment;
- Complex projects, with complex sea operations;
- Complex platforms, with intricate construction.

For a successful project we may give some suggestions:

Think Financial

Energy production is a business. It has to pay its project and take profit. This idea has to be present since the beginning of any project.

Although a prototype does not comply with this aspect, this ultimate goal must always be present. If this is not taking in consideration, the project can overrun the financial estimations and will be difficult to be attractive to investors. Finally, in the end of day, it will be more difficult that it will be a commercial feasible project.

Environment

Understanding where the wave converter devices will operate, the “SEA”, with as is on characteristics that are different form place to place, like the, swell and wind waves, depth, type of seabed, saltwater, wind and marine life. These will have important effect how we gone produce energy (use the resources), which will be the most suitable platform and how it interacts with their environment, as the corrosion, the destructive power of the sea, the operation of platform and the mooring system

Everything that will be developed has to take into account the combined effect of the environment. As said, the "sea" varies from location to location. There is not a "sea", but several "seas“.

Platform

Has to survive the environment, namely the swell and wind waves (cooperate with the sea), the corrosion and the marine life. May have to be articulated which poses a new difficulty;

The O&M, must be think beforehand, namely how we gone to operate ate sea (Seamanship) and that the device will be unmanned;

We consider that the technology already exists namely Oil & Gas and special purpose vessels. The problem is to adapt it to the cost

Energy production (PTO – power take off)

Has to be efficient, resisting the environment, namely absorbing shocks and the corrosive and humid environment. Be easy to maintain and operate, thought for the location, ie, for "sea" and in its operation;

<u>In Conclusion</u>

Wave energy is one of potential ways to have renewable energy. It’s abundant, more stable than the wind, and probably cheaper than the solar. It does not use land scape and it`s not so intrusive as other renewables form of energy.

It has some problems in its development, due to the international financial crisis, and down of oil prices and some problems in early stages of development.

We consider that, with the right approach, this will be one of the futures ways to have clean energy.