



## The First Wave Energy Farm of the World...It's About Time...

Posted by [Luis de Sousa](#) on October 2, 2008 - 9:15am in [The Oil Drum: Europe](#)

Topic: [Alternative energy](#)

Tags: [pelamis](#), [portugal](#), [wave energy](#) [[list all tags](#)]

On Tuesday the 23<sup>th</sup> of September, the deployment of the first commercial wave energy farm in the world started. A Pelamis unit was towed into the sea, connected to an underwater cable and moored to the sea floor, at a site where it will stay for the next 15 years. The Industry was present at the highest level, as so a Minister and even the Navy showed up with a frigate to join the celebration.



But is it all roses? Below the fold are a few thoughts and calculations that show how this is truly a green energy source. Green as in immature, that is.

---

*The basics on Pelamis and the Aguçadoura I Project can be found [here](#).*

## Celebration

Two and a half years behind schedule, after legal and technical delays and the sale of the main commercial company (Enersis) to Babcock & Brown, the first pelamis was finally permanently deployed. A high profile event was staged to signal the day, with the Minister of Economy (Manuel Pinho) and an entourage of CEOs and journalists embarking on the Portuguese Navy frigate Corte Real to follow the tug boat trailing the red serpent to its final resting place, 5 Km off the coast, by the village of Aguçadoura.

The pelamis units spent much of the last two years in the port of Peniche waiting for this day. After legal clearance the company struggled with technical difficulties, especially concerning the undersea cable that connects the mini-farm to the shore. The Pelamis engineers developed a floating plug that allows the connection to the cable without the help of divers. But unfortunately the system had been tested in shallow waters and failed in the deployment site, where a deeper water column exerted different hydrostatic pressure on the plug. Solving this issue alone took more than a year.

After a few rehearsals at sea and some tuning of the units for better adaptation to the site, the green light was given. The first serpent is in place with the next two being deployed these days, depending on the weather.

Manuel Pinho compared the event to the dawn of Wind Energy, that fifteen years turned is a story of success. He hoped that the same can be said about Wave Energy fifteen years from now:

The future of wave energy starts today.

Finland is very good in mobile phones, Portugal wants to be good in renewable energy. We are among the top five in the world, and we are just in the beginning of the process.

Renewable energy is the source of energy for the future and we think this can create an industrial revolution and a lot of opportunities for jobs and research and we want to be ahead of the curve.



*The red serpent being put in place. Picture by [João Abreu Miranda/EPA](#).*

## **The Cluster**

A new agreement was signed at the occasion with Pelamis Wave Power (the technological partner) having a 23% stake, Babcock & Brown 46.2%, EDP 15.4% and Efacec 15.4%. This new consortium will proceed with the Aguçadoura II project, that will be a larger scale farm, constituted by 25 pelamis units, summing up 18.75 MW of installed capacity. The press is quoting the project as costing up to 70 million €.

But these companies have longer term horizons; Leocádio Costa, Enersis' CEO:

What's programmed in the second phase is for 40% of the project being built nationally by Efacec, which is our largest producer of transformers, and with which makes all the sense he had talked to for the set up of a *Cluster*.

The Government providing us the licences, we are ready to go up to 500 MW in three or four different zones [along the Portuguese coast].

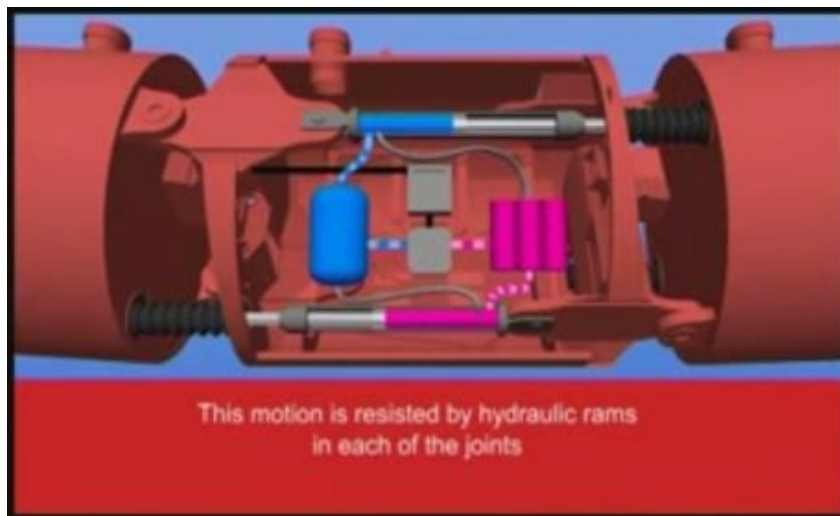
Alberto Barbosa, Efacec's CEO:

Through the years we will grow in Portugal and increase installed capacity, but afterwards we can proceed with that technological development at world level.

Portugal can be the Denmark of wave energy. The question is the political will to concede that installed capacity.

This *Cluster* in the prospects of these companies is an inception environment that would propitiate wave energy technology development, promote local component manufacturing and assembly, eventually creating an exporting industry. Talks are under way with steel transforming companies to join the project and new experiments with alternative wave technologies are being planned.

Pelamis Wave Energy will deploy the first water snakes (four in total) in their Scottish home shores next year off Orkney. Following that, seven are planned for deployment off the northern Cornwall in 2010. Other sites are being considered in Spain, France, Norway, North America and even South Africa.



*Click to watch a movie summarizing the concepts behind Pelamis.*

## The Algebra

Now, let's go back to the black board and do a little algebra. [Last time](#) I showed some concerns towards this project given the money involved for such a small installed capacity (the three pelamis together don't sum up to a state of the art wind turbine). With the delays the project's costs are now reaching 9 million €.

Using a base load factor of 30%, the three pelamis of the Aguçadoura I project will generate in a year about 5.9 GWh ( $2.25 \text{ MW} * 8760 \text{ h} * 0.3$ ). In my monthly electricity bill the kWh is rated at 0.12 € (that accounts also for grid maintenance and management, but let's take it at face value as an upper end estimate). Hence the yearly revenue of the project will be just under 700 thousand €. Or putting it another way, it will take 13 years for the break even, at best.

Each pelamis unit has an expected lifetime of 15 years. Considering that those 9 million € are not counting with maintenance costs, it is not a stretch to conclude that the financial return on investment (ROI) is close to 1:1. Where that leaves EROEI is not easy to envision, but it might not be that far off.

This could be a scalability problem, being the Aguçadoura I just a mini-farm, taking much of the

burden of first time tuning to the site. But the press already has the figures for Aguçadoura II, 25 serpents (down from the announced 34 in 2006) and a 70 million € budget. This project will generate circa 49 GWh ( $18.75 \text{ MW} * 8760 \text{ h} * 0.3$ ) of electricity per year resulting in a revenue of 5.8 million €. Break even arrives at 12 years of operation, again with best estimates for electricity prices and without maintenance costs.

The problem (as I stated in 2006) is that while a MW of installed Wind capacity costs about 0,4 million €, Pelamis is costing in the order of 4 million € per installed MW. There is a steep development curve ahead before competitiveness, more over taking in account that offshore Wind energy has a higher load factor (40%) and operates essentially during the same periods (waves are higher when the wind blows stronger).

Even if Pelamis manages to deal with low EROEI, this technology will likely stay in small market niches where Wind power doesn't reach, either be it due to visual impact, water depths or implantation difficulties. Looking long term this type of systems may be used to complement already in place Wind-farms using the space between windmills and taking advantage of the already existent electric connection to shore.



*Is the future of the red serpent as clear as the sky? Picture by [Catarina Pereira](#).*

## An Energy Policy Dilemma

With such prospects, why are these companies so eager to expand the project? The answer is simple, the state pays a feed-in-tarif of 0.23 € per kWh generated by renewable energy producers. This appears to be a good policy, guaranteeing a price for the electricity generated in the country, speeding up the phase out of fossil fuels, that are imported in their entirety. In that way a favourable environment is created for new energy sources to grow and develop.

But there's a huge downside to it: this subsidy is masking the low EROEI of some of these new energy sources, that otherwise should be preventing ill fated projects from surviving in the market. As seen from the Pelamis example, while the Aguçadoura I is an interesting development project from which architects and engineers will learn and improve, the Aguçadoura II does not represent any visibly evolution in technology, presenting essentially the same EROEI. Still it will be a profitable business for the companies involved, at the cost of the Executive Budget, representing a tangible money transfer from tax payers to private business, some even held by foreign capital.

This dilemma faced today by the Portuguese government will be one of the most important issues energy policy makers worldwide will have to deal in the transition away from fossil fuels: how to draw a line between those new energy sources that are really helpful for society and those that are not. Correctly measuring EROEI and determining how it evolves along the development phase of new technologies will have a crucial role in the Energy Policy of the XXI century.

I hope that this *Cluster idea* really turn out to be a success, and that development allows for

*Wave energy to become a useful part in our future energy mix. And not only for the sake of the country's industry but also for the negative social effects that the failure of the policies supporting it may bring.*

*The elements gathered here are based on the following news services:*

[BBC](#)

[RTP](#) (Portuguese)

[Jornal de Notícias](#) (Portuguese)

[Público](#) (Portuguese)

[CleanTech](#)

Previously at TheOilDrum:

[Tapping The Source: The Power Of The Oceans](#)

[Pelamis: A Shot in the Dark?](#)

Luís de Sousa

TheOilDrum : Europe



This work is licensed under a [Creative Commons Attribution-Share Alike 3.0 United States License](#).