

Ocean Energy – A Certain Kind of Hydropower

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ABSTRACT

In the previous years the harnessing of ocean energy has become an interesting topic within the renewable energy family. As it happened to many other technologies in the past the starting up is the crucial but also most challenging phase. It is strongly suggested, to apply all the experience in RE technologies to facilitate a successful development. The comparison between OE and SHP shows impressively parallelisms serving as a kind of guidance how to proceed and how to succeed. The similarities are given in technical, political, environmental and finally economical terms. The final result of further exploiting OE should be seen in a significant contribution of renewable energy.

1 INTRODUCTION

Renewable energy is undoubtedly a very important strategy to combat the world's complex energy problems. Research and testing is an unavoidable process in any renewable resource although some of them are already highly developed. Hydropower is said to be a mature technology but that must not imply the renouncement of scientific research. Many examples within the previous years have shown that impressively.

Ocean energy is also said to be a new technology. That's not correct because more than 200 years ago, exactly in 1799 a first patent was taken out by father & son GIRARD in Paris. They got the idea of a gigantic lever with its fulcrum on the shore and its "body" floating on the sea. The patent specification completes that this kind of installation "*could directly be applied to pumps, to bucket wheels, to saws, to mills, to hammers....*" Seen from the SHP point of view its exactly the same range of application as being well known from the very beginnings of SHP. Of course at that time it was by far too early for such a revolutionary idea.

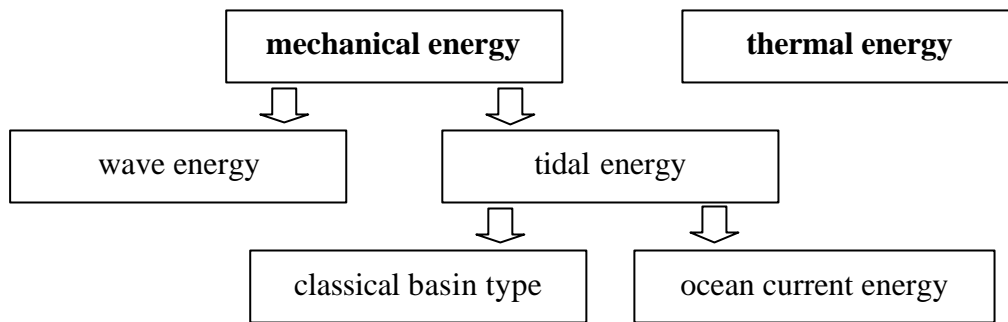
Nowadays ocean energy is an upcoming member of the renewable energy family and the methods how to harness reached a tremendous diversity. In many parts of the world researchers and potential investors try to find the best solution on how to harness this kind of energy.

It has to be said, that any resource has to pass this first and of course both very challenging and risky period of technological development. Nobody knows up to now, who will be the winner and it will last another few years to gain at least some basic experiences in operating such a plant. Anyhow its an obligation of some other already well established resources to support this technology in an atmosphere of departure. Offering decades of experience may ease and shorten a usually bumpy way.

2 TYPOLOGY

To find out family relations between OE and HP it seems recommendable to design a rough but concise typology.

Oceans offer both mechanical energy and thermal energy. The potential is tremendous in both cases. Nevertheless the presentation will focus just on the mechanical part of ocean energy. The following sketch gives an overview:



3 THE TECHNOLOGIES IN MORE DETAIL

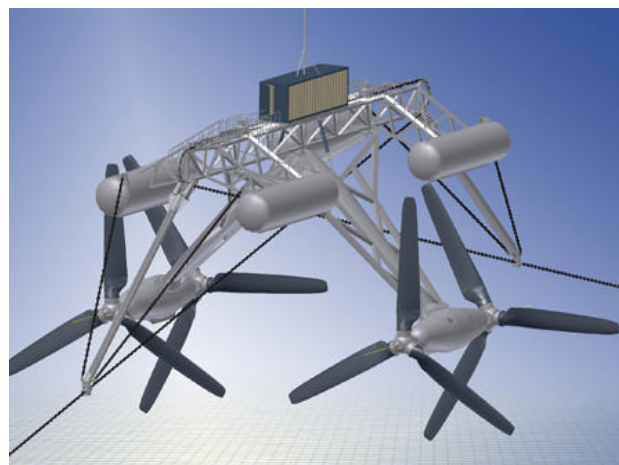
3.1 Tidal Energy

Speaking very shortly about the classical type: there are a few bigger and some medium size plants still existing. The very beginning started in the 11th century at the coastline between England and France. The “father” of this type was erected between 1961 and 1966 at the mouth of River Rance near Saint Malo in France. The tidal range is between 12 and 16m, which is extremely high. The total power of the plant, equipped with 24 turbines is 240 MW, producing about 600 GWh per year. Some smaller plants have been erected in Canada, Russia and China. All these plants can be named as typical HPP including some special features.

Up to now there is little experience with the oceans current energy, which is not necessarily a tidal initiated case. Gulf stream and similar phenomena represent an exemption.



Seafloor visualisation

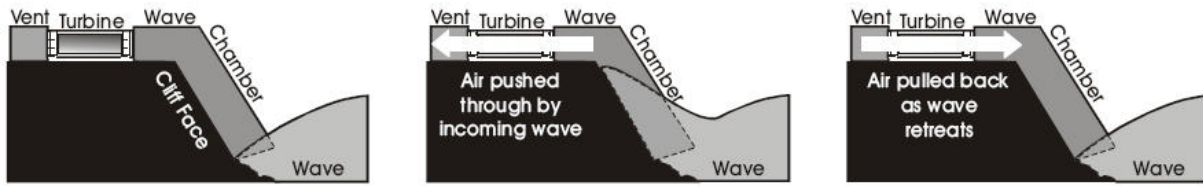


Morild demonstration plan

3.2 Wave Energy

3.2.1 Oscillating Water Columns (OWC)

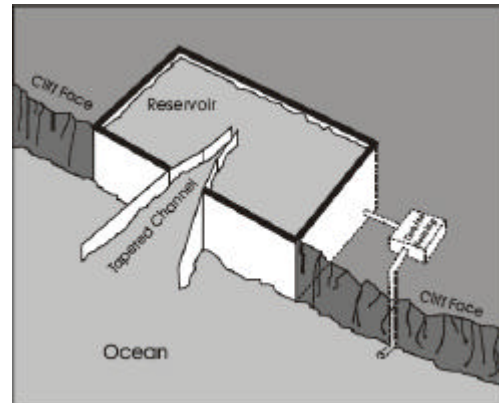
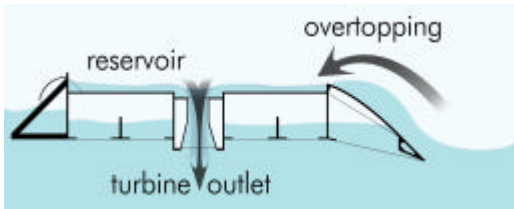
These devices generate electricity from the wave-driven rise and fall of water in a cylindrical shaft. The rising and falling water column drives air into and out of the top of the shaft, powering an air-driven turbine.



3.2.2 Wave Surge or Focussing Devices

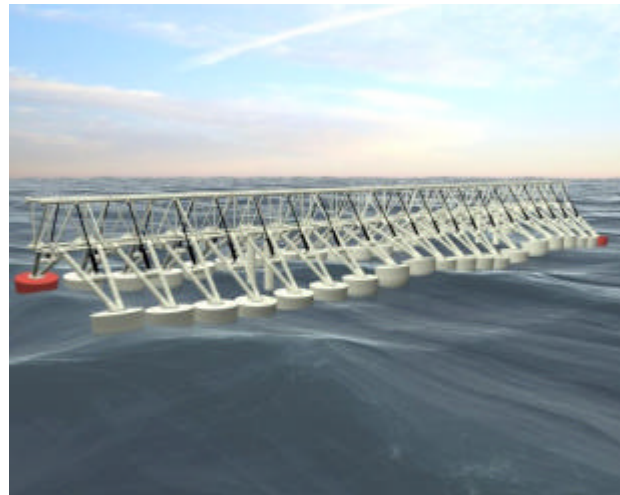
These shoreline devices rely on a shore-mounted structure to channel and concentrate the waves, driving them into an elevated reservoir. Water flow out of this reservoir is used to generate electricity, using standard hydropower technologies.

The new concept of the wave dragon belongs in principle to that category although it's a floating installation.



3.2.3 Floating Devices

These devices generate electricity from the bobbing or pitching action of a floating object. The object can be mounted to a floating raft or to a device fixed on the ocean floor. The wave star is a good example for that type.



4 THE SYNERGIES

On basis of the short analysis of structure and parallelisms it gets clear that also interests are going in parallel in several topics which are on technical terms, on political level, concerning environmental demands and finally on economical items. Within these groups one can define more in detail aspects of common activities.

4.1 The Synergies in Technical Terms

In ocean energy harnessing the low head represents the great majority. In conventional HP use there is a recent demand on further low head turbine development. High head resources are for sure more attractive and usually cheaper. The research needed concentrates therefore mainly on cost reduction.

Power stations of any kind have to operate continuously and on long term. That means high necessary standard on material. The development of new, more robust materials is a lasting ambition. The transfer of certain experiences may be very helpful.

Although in different kind, water has to be conducted in SHP as in OE plants. Consequently hydraulic features have importance and their optimisation will result in an increase of overall efficiency. It sounds unbelievable but the connection to the grid becomes sometimes a significant cost factor preferably in remote locations. Both SHP and OE will be interested in efficient and economically priced solutions.

Stability and reliability in operation is a general aspect not focussing on one of the sources discussed here. Nevertheless its significance gets higher in smaller and remote located plants, which is the fact in both OE and SHP.

4.2 The Synergies on Political Level

Unfortunately it's a fact that any practical success of an even excellent idea depends on the political reaction on that. Long time experience in renewable energy policy has shown the relevance of consequent interaction, pro-activity, information and intervention on political level, both national and international. Common activities of two or more partners have much more effect than the sum of individual activities at least on European Union level. The renewable energy family should be aware of that.

The renewable energy policy is closely related to any political activity as described previously. The long-term task of any high-level political initiative is to prepare the basis of future law aiming at the same or at least a similar target.

On regional level the development of combined plants can be seen as political effort. Again it's the demonstration of common interest but also of common competence and ability to realise sustainable development.

Probably there is some competition on industrial level to gain a good position in doing business. On political level international networking has become a "must". International does not only mean interaction between two or more countries but worldwide. Industry has already shown impressively how to act worldwide – the renewable energy scene is on the track but it needs immense further efforts to built up the worldwide functioning system.

Finally the promotion of specialised research programs is an important target, because there is urgent need of continuous research in any field of renewable energy technology and the outcome will serve as basis for the practical development. Again the multidisciplinary approach is highly and also rightly appreciated.

4.3 The Synergies Concerning Environmental Demands

The hydropower scene al in all has learned quite well how to deal with environmental aspects and demands. Among the great variety of these the topic of fish protection has always high priority. The experience has got a rich one and the different techniques are well tested. Undoubtedly OE will get in touch with problems of that kind.

Water always and everywhere attracts mankind to throw waste material into water – preferably rivers, serving as transport media. Although the sea is big and still able to absorb a lot the problem of how to manage trash rack material may come up. Due to very restricted possibilities, any management will become a challenging task.

One of the most impressive and convincing values is the net energy gain of a certain technology, which is defined as difference between the energy required to harvest an energy source and the energy provided by that same source. Hydropower has best values up to 200 what means that over life cycle 200 times the energy is produced that is needed for constructing the plant.

4.4 The Synergies on Economical Items

To convince people to invest their money in any new or so-called new technology you have to prove the economical quality, the revenue to be gained. The recent problem, all RE sources are faced with is the

incomplete calculation method of all the non renewables neglecting all kind of secondary costs. That's the main reason why RE sources seem to need public support to get competitive. They are the only calculating completely. Consequently all measures listed below must not be called support but compensation tools.

The best known and probably the one best functioning is the feed in tariff, offering reliability and a certain amount of security. Standing by itself but also as adjoining measure any investment support is an appreciated measure. All that and many other tools are highly experienced by SHP and could serve quite well also for OE.

Additionally some RE sources have got lot of success by using financing and participation models, which are not only helpful seen from the economical point of view but also in terms of public identification which is getting more and more important.

The history of SHP starts up with very simple producer / consumer – partnerships. This old story may also have a future as long as there is a deep gap between consumer prices and buy back rates. That's the case especially with small consumers.

5 CONCLUSIONS

The main targets to be highlighted in that article are the similarities between “conventional” hydropower and ocean energy. There is no doubt about OE being a part of the renewable energy family, sharing lots of problems but also lots of chances. The following thoughts are common to at least most of the renewables:

All the previous investigations have shown impressively that the potential is impressive and worth to be exploited. As many other sources OE has certain demands on available natural resources. The exploitation should focus in a first step on the most attractive locations as all other sources also do.

Experiences in other sources has brought up that master-plans of development are useful. That should be taken into account to avoid any completely uncontrolled development which would lead necessarily to strong opposition against this certain kind of hydropower.