BOREAS

Belgian Ocean Energy Assessment

DURATION OF THE PROJECT
01/06/2009 – 31/05/2011

BUDGET
179.351 €

CONTEXT

The new Climate Action – Energy for a Changing World of the European Commission proposed several measures to fight climate change and promote renewable energy. One of those measures includes legally enforceable targets to increase the share of renewable in the energy mix. The target of the renewable share in the European Union is set to 20% by the year 2020, and the European Commission has set individual targets for every member states. In the case of Belgium, the target is set to 13%, whereas the renewable share in 2007 was only 3.1 % (Eurostat, 2010).
Basically, this is the consequence of the (post)-Kyoto-agreements. But apart from this, consumption of energy is increasing year by year whilst it is proving increasingly difficult to find and extract sufficient fossil fuels to cover the annual increase in consumption. Contributions to the share of renewables are required from various sources, such as biomass, wind, hydropower and solar energy. In particular, offshore wind has boosted during recent years.
Offshore wind energy is now at a stage where it is becoming a competitive energy source. The cost of power generated from onshore wind farms is now reaching the level of most fossil fuel sources. During recent years a number of wind farms have been developed in shallow seas around the European coasts. Offshore developments give larger sites and the advantages of economies of scale. Offshore sites also have the advantage of being “out of sight, out of mind“, in addition to providing greater and more regular wind energy supplies. However, offshore wind developments are facing a number of technological challenges specifically related to turbine tower foundations, and maintenance of the installations.
Ocean energy is an unexploited source of energy, and is getting more attention of technology developers and policy makers. The main forms of ocean energy are wave energy and tidal current energy. They both have several advantages over wind energy such as: higher energy density, more predictable and less visible than windmill farms. Wave energy is also more persistent than wind: waves will transfer energy from windier areas to coastal zones and remain long after the wind has dropped. Tidal current energy is extremely predictable, as the most important driving force is the astronomical tide.
Consequently, a number of different technologies for wave or tidal current energy conversion have been developed, but up to now few of them have resulted in commercial development beyond the prototype stage.

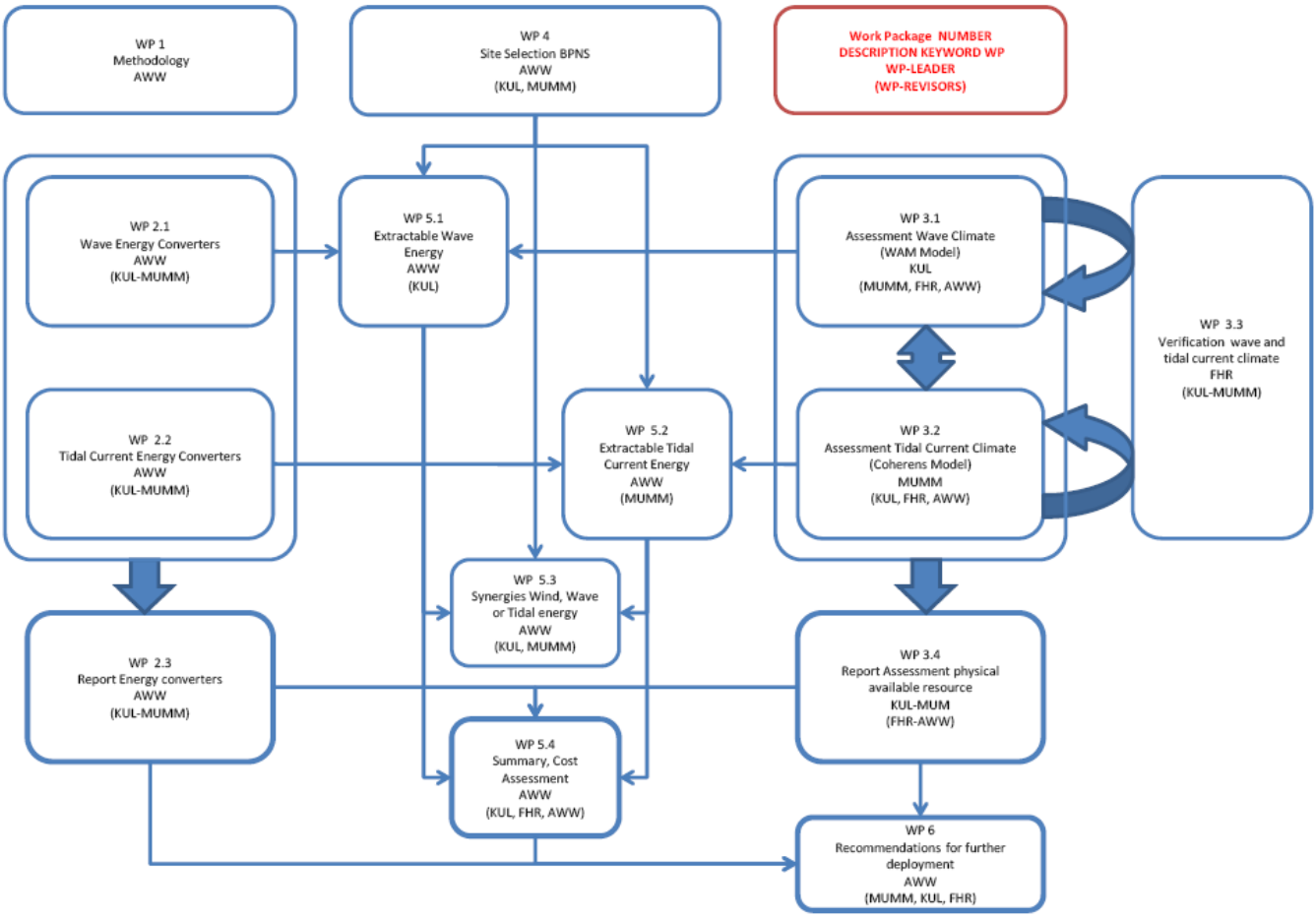
PROJECT DESCRIPTION

Objectives, Methodology and Interaction between the different partners.

So far, the OPTIEP study, also funded by BELSPO, was the only study to made a first assessment of the resource of the wave or tidal current energy climate on the entire Belgian Part of the North Sea (BPNS). BOREAS is building further on this study and aims at being a comprehensive study regarding wave and tidal energy applications on the BPNS.
This project involves 5 main themes:
1) An overview of the existing wave or tidal current converters (“long-list”) based on scientific literature and publically available information provided by the device developers or third parties such as, Ocean Marine Energy Centre (EMEC), Ocean Energy Systems Implementing Agreement (IEA-OES), Electric Power Research Institute (EPRI) and The Carbon Trust. A selection of the most appropriate converters for the specific conditions on the BPNS (“short-list”) will be discussed in detail.
2) An assessment of the wave and tidal current climate, and hence the available potential. This assessment will be based on numerical results from the coupled WAM-COHERENS model, that allows both wave and tidal current modelling. With these 10 year hindcast, it will be possible to determine yearly, seasonally and monthly variations. Furthermore, the results will be verified against other numerical models (both for wave and tidal energy).
3) Based on the current or expected space claims on the BPNS (either fixed, such as navigation ways or non-fixed such as fishery) and the knowledge of the available ocean energy potential, a selection and description of the most promising sites on the BPNS can be made.
4) An assessment of the extractable potential, based on the limitations of the converters (the “short-list”) and the optimal sites. Starting from the extractable potential, an estimation of the cost of the electricity for several converters can be established. Based on the extractable potential, a possible synergy between offshore wind, wind and/or tidal current energy can be assessed.
5) Further recommendations for the further deployment and potential exploitation of wave and tidal current energy on the BPNS.

SSD SCIENCE FOR A SUSTAINABLE DEVELOPMENT

NORTH SEA



UGent (AWW) is the overall coordinator of the BOREAS-project. Together with the expertise of MUMM, KUL and FHR, the project consortium can present a broad expertise in hydrodynamic knowledge.
Every individual WP is led by a so called WP-leader, who is the contractor and main responsible for a specific task. Every WP also has at least one WP-reviser. The task of the WP-reviser is mainly to internally verify the methodology and results.
The numerical modelling with the state-of-the-art coupled WAM-COHERENS model (operated by K.U.Leuven and MUMM) will be the core of the assessment of the potential ocean energy. The numerical approach is clearly the most appropriate, as it can provide a continuous and coherent dataset, both in time and in space. However, there are some limitations:
- The wave model WAM uses a grid of approximately 1 by 1 km, which is quite coarse in the near-shore area. It is clear that this near-shore area is quite interesting, since visual nuisance of wave and tidal current energy converters is not an issue compared to windmill farms. So, a complementary numerical model or method to quantify the wave climate in the near-shore is undoubtedly an extra asset. These complementary methods or numerical models will be used by the project partner FHR. In order to verify the near-shore wave climate (ranging from approximately 20km offshore to the nearshore region), FHR will operate the so-called Transformation Matrix
- The hydrodynamic model COHERENS is not optimized for the Scheldt Estuary, as the grid is too coarse, not curvilinear and the model does not take the salt gradient due to the fresh water discharges into account. Once again, a complementary numerical model or method, which is capable of describing the local effects in the Scheldt Estuary would be undoubtedly an extra asset. In order to verify the tidal current climate in the Scheldt-Estuary, FHR operates the hydrodynamic-morphological Long-Term-Vision Mud (LTV Mud) model.

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LINK INTERNATIONAL PROGRAMMES

Since wave and tidal energy technologies are new technologies, there is a lot of ongoing research. These are financed both the private as well as the public sector. In the latter case, two European funded projects are worthwile mentioning within the BOREAS framework. These projects are Equimar and Waveplam.
The aim of EquiMar is to deliver a suite of protocols for the equitable evaluation of marine energy converters (based on either tidal or wave energy). These protocols will harmonise testing and evaluation procedures across the wide variety of devices presently available with the aim of accelerating adoption though technology matching and improved understanding of the environmental and economic impacts associated with the deployment of arrays of devices. EquiMar will assess devices through a suite of protocols covering site selection, device engineering design, the scaling up of designs, the deployment of arrays of devices, the environmental impact, in terms of both biological & coastal processes, and economic issues. A series of protocols will be developed through a robust, auditable process and disseminated to the wider community. Results from the EquiMar project will establish a sound base for future standards (e.g. IEC TC 114).
The purpose of WAVEPLAM is to develop tools, establish methods and standards, and create conditions to speed up introduction of ocean energy onto the European renewable energy market, tackling in advance non-technological barriers and conditioning factors that may arise when these technologies are available for large-scale development, by means of a series of activities geared towards supporting creation of a ocean energy market that will harness the great potential of this kind of energy that exists in Europe, contributing to decrease European external energy dependency and leading to a reduction in greenhouse gas emissions.
Both EquiMar and Waveplam are running in parallel with the BOREAS project. It is clear that the results of those European projects will be taken into account as much as possible into the BOREAS project.

PARTNERS

UGent (AWW) is already researching wave and tidal energy, resulting in different PhD thesises, publications and master thesises.
KULeuven has a thorough expertise in Wave modelling, and are the operator of both WAM and SWAN numerical wave propogation models.
Flanders Hydraulics research are the operators of the Transformation matrix (to verify the wave climate) and the LTV-slib model (to verify results in and around the Scheldt estuary).
MUMM is the operator of the COHERENS model and has a strong policy role in the energy exploitation on the Belgian Part of the North Sea, such as advice for the monitoring of environmental effects of offshore wind turbines.

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