Ecological Research at the Offshore Windfarm *alpha ventus*

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Challenges, Results and Perspectives

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Foreword

In a February 2002 strategy paper, the German government adopted the ambitious and trailblazing goal of building 20,000 to 25,000 MW of offshore wind power capacity off the German coast by 2025 to 2030. The government and all parties in the German parliament adhere to that goal in principle to this day. But merely setting goals is not enough. Attaining them takes action, and the way there is often long, hard and full of obstacles. The development of offshore wind power has involved learning the hard way, and we are far from the end of the learning curve.

Yet we embarked on the journey, committed, and confident despite all the setbacks. *alpha ventus* is a key milestone marking the breakthrough for offshore wind power in Germany. It is an important industrial and energy policy demonstration project, and numerous other offshore windfarms since built, planned or started in Germany and elsewhere in Europe have benefited from the engineering and environmental experience and expertise gained in its construction and operation.

Relying on the government's policy framework, a number of mainly mid-sized companies with experience in planning, building and operating windfarms on land set about planning windfarms at sea, in most cases between 30 and 100 km or more off the German coast. This task has not been made easier by Germany's federal structure and the resulting distribution of responsibilities, or indeed by the geography of its marine areas.

The Borkum West offshore windfarm, the pioneer project later renamed *alpha ventus*, was approved by the Federal Maritime and Hydrographic Agency (BSH) in November 2001. The German Offshore Wind Energy Foundation, which was launched in 2005, used a € 5 million grant from the German Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) to buy the rights to the windfarm in September 2005. A little over a year later, the foundation leased the rights out to the Deutsche Offshore-Testfeld und Infrastruktur GmbH (DOTI), a consortium formed by energy utilities EWE, Vattenfall and E.ON. Initial construction work began in autumn 2008.

Under the strict German regulations on marine facilities, the interplay between offshore windfarms and the marine environment was a key issue for *alpha ventus* from the outset – both during approval and in the ensuing planning, construction and operation phase. A major consideration was the impact on birdlife, marine fauna and life on the sea floor. The highest priority was and remains to minimize the impact on the natural environment.

An integral part of the approval notice for *alpha ventus* was the BSH Standard for Environmental Impact Assessment (StUK). From the start, DOTI assigned the task of meeting this standard to the German Offshore Wind Energy Foundation. Environmental assessments under the standard have three stages:

- A one-year programme before commencement of construction, to evaluate the findings and assessments on which approval is based (for *alpha ventus* this was shortened to six months given the trial nature of the windfarm and because of time constraints)
- Impacts of the construction activity on benthos, fish, marine mammals, resting birds and migrating birds; noise emissions
- Finally, a further environmental assessment – on the same topics – during a three-year operating phase, which was completed this year.

A brief anecdote illustrates the timespan covered by this major programme of study: When the first part of the research was commissioned, one of the contributors was expecting a baby. This spring, at the final briefing on results of the operating stage, I asked the husband how their child was coming along. He answered, 'Our little boy starts school this summer'. So here's to a bright future for their son – and for the ongoing expansion of offshore windfarms, which will go on providing electricity in harmony with nature and the marine environment for generations to come.

Jörg Kuhbier
Chairman, German Offshore Wind Energy Foundation

Preface

Offshore wind energy is vital in providing Germany with secure energy supplies for the long term. Fourteen years after the Federal Maritime and Hydrographic Agency (BSH) received the first application for approval of an offshore windfarm, 128 approval proceedings are now in progress for the building of offshore windfarms with some 9,500 wind turbines in the German Exclusive Economic Zone (EEZ). We have so far approved 33 windfarms with 2,250 wind turbines (as of September 2013).

Whatever the technical obstacles to building and operating windfarms far offshore, the technology has obvious advantages: Wind conditions out at sea are outstanding and subject to little turbulence, making for high and reliable performance yields. The energy is eco-friendly and incurs neither fuel costs nor carbon emission costs. No resources have to be acquired to harvest it. There is no environmentally hazardous waste to dispose of. And offshore windfarms offer low-disturbance areas where new natural habitats can evolve.

For industry, scientists and the public authorities alike, building and operating offshore windfarms beyond the twelve mile zone meant breaking new territory in terms of the engineering, scientific and legal challenges involved. While companies could make some use of experience with offshore wind energy in Denmark and the Netherlands, there was no such body of practical experience with wind turbines at depths of 40 m and distances of 30 to 100 km from the coast. Today, Germany is the industry leader and innovation driver. It is the only country in the world that builds offshore windfarms in such extreme conditions.

Offshore wind energy will only gain lasting, widespread acceptance, however, if shipping safety and protection of the marine environment are assured. In recognition of this, the Fourth National Maritime Conference on 24 and 25 January 2005 paved the way for Germany's first offshore windfarm project to be made the German test site for offshore windfarm research and development. Sited in 30 m of water some 45 km northwest of the island of Borkum, the windfarm Borkum West – subsequently renamed *alpha ventus* – thus presented the first opportunity to study the environmental impacts and gain a better understanding of marine environmental processes in and around a 'real life' offshore windfarm.

For five years, researchers and scientists accompanied the windfarm's construction and operation in a research project, 'Accompanying ecological research at the *alpha ventus* offshore test site for evaluation of the BSH Standard for Environmental Impact Assessment (StUKplus)'. The

research was funded by the Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and coordinated by BSH. Its aim was to find out more about construction and operation impacts on the marine environment, including birds, marine mammals, fish and benthic (seabed) organisms. In evaluating and analysing the project's impacts, the scientists were able to draw upon meteorological, oceanographic and ecological data collected and analysed since 2003 – before work started on the first wind turbines – at the FINO1 research platform on the periphery of the *alpha ventus* windfarm. This data made it possible to separate out impacts that specifically related to construction and operation of the windfarm.

At the *alpha ventus* test site, scientists, industry and public agencies undertook pioneering work to chart the impacts on the marine environment. This knowledge is now being incorporated in the revised BSH Standard 'Investigation of the Impacts of Offshore Wind Turbines on the Marine Environment' (StUK4). Monitoring methods during the construction and operation phase of windfarms have been adapted to offshore conditions. As the planning approval and enforcement agency for offshore plans, BSH can now require monitoring on the basis of improved scientific foundations to meet marine environmental protection needs while remaining economically viable for offshore operators.

The study findings also provide a valuable basis for further research in ecology, oceanography, geology and engineering – to the benefit of shipping, maritime technology and marine environment protection.

Monika Breuch-Moritz
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