

SeeOff – Strategieentwicklung zum effizienten Rückbau von Offshore Windparks

(Development of efficient strategies for offshore wind farm decommissioning)



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Background

At the end of 2017 more than 1,100 offshore wind turbines with an installed capacity of more than 5.3 GW are operating in the German North Sea and Baltic Sea (Deutsche WindGuard 2018). According to the EEG 2017, the expansion is to be increased up to 6.5 GW by 2020 and up to 15 GW by 2030. Over the next ten years, more than 15 offshore wind farms (OWFs) will be decommissioned in the European North Sea and Baltic Sea after 20 to 25 years of operation.

Due to a lack of experience - so far only four offshore wind farms have been dismantled worldwide - the industry faces a multitude of challenges. At present, neither the techniques and procedures for dismantling, logistics and recycling, nor the resulting costs and effects on humans and environment are sufficiently known.

Objective

The joint project *SeeOff - Strategieentwicklung zum effizienten Rückbau von Offshore-Windparks* (Development of efficient strategies for offshore wind farm decommissioning) aims to support stakeholders at developing and assessing efficient, project specific decommissioning strategies. Efficient decommissioning strategies comply with legal requirements, are cost-minimizing, ensure safety at work and environmental protection and are publicly accepted. By providing a handbook, the stakeholders are enabled to develop decommissioning strategies independently and to evaluate them with regard to their efficiency.

Targeted outcomes

- **Requirements catalogue for offshore wind farm decommissioning**

Legal, economic, environmental, safety and acceptance requirements for offshore wind farm decommissioning as well as such resulting from dismantling, logistics and recycling are determined and compiled in a catalogue of requirements.

- **Decommissioning scenarios**

Innovative options of dismantling, logistics and recycling are investigated and transferred into process models. Decommissioning options will be analysed, parametrised and combined to decommissioning scenarios.



- **Methods for analysing and assessing decommissioning strategies**

In order to examine the decommissioning scenarios with regard to their impact on economic, ecological, safety-related and social aspects, analysis and evaluation procedures are being developed. Methods for the investigation of complex decision situations with multi-objective problems are identified and applied within the framework of a holistic investigation of the decommissioning strategies, taking into account the diverging interests of different stakeholders.

- **Potential for improvement**

Potential for improvement of dismantling, logistics and recycling as well as of prior project phases are investigated and described.

- **Handbook for efficient strategies for offshore wind farm decommissioning**

Based on the results and findings of the research project, a handbook will be drawn up to support the companies involved in the decommissioning process to identify their individual project specific efficient decommissioning strategies.

Project duration:

1st November 2018 – 31st October 2021

Funding body:

Supported by:



on the basis of a decision
by the German Bundestag

The project is funded by the Federal Ministry of Economics and Energy (BMWi) within the framework of the 6th Energy Research Programme.

Collaborative Partners

**City University of Applied Sciences
Bremen,
Hochschule Bremen**



Brief description

The City University of Applied Sciences Bremen has extensive experience in modelling, analysing and evaluating complex systems with use cases of operation and maintenance of offshore wind farms (research projects SystOp Offshore Wind - Optimierung des Leistungssystem Offshore-Windpark and KrOW! Kosten- und risikogesteuerter Betrieb von Offshore-Windparks). In addition, the City University of Applied Sciences Bremen has in-depth knowledge in the determination of environmental indicators for the operation of offshore wind farms and in the preparation of environmental protection and waste concepts within the framework of HSE (Health-Safety-Environment) plans. The City University of Applied Sciences Bremen also provides sound economic expertise in the areas of corporate financial reporting, project evaluation and financing, and efficiency measurement.

Sub-project

Development of approaches for determination and valuation of different decommissioning strategies regarding their economic, ecological and safety aspects

Requirements analysis

- Determination of economic and HSE-associated requirements
- Preparation of a requirements catalogue

Development of decommissioning strategies

- Transformation of techniques, procedures and concepts of dismantling, logistics and recycling in process models (Modelling with the software IYOPRO der Firma Intellivate GmbH)
- Analysis of decommissioning processes and development of decommissioning strategies

Analysis of decommissioning strategies

- Development of procedures to analysis economic and HSE-related impacts of decommissioning scenarios
- Development of procedures to assess decommissioning scenarios under consideration of diverging interests of multiple stakeholders

Potential for improvement

- Determination of potential for improvement of prior project phases of offshore wind farms

Handbook for efficient decommissioning strategies

Team

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German Offshore Wind Energy Foundation, Stiftung Offshore-Windenergie



Brief description

The German Offshore Wind Energy Foundation was founded in 2005 on the initiative and moderation of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). It brings together the interests of a wide range of players from the offshore wind energy sector and acts as a communication platform between industry, politics, and research. The aim of the foundation is to consolidate the role of offshore wind energy in the energy mix of the future in Germany and Europe and to promote its expansion in the interest of environmental and climate protection. The curators of the foundation include representatives of the ministries at federal and state level as well as representatives of all major groups of offshore wind energy players in Germany (representatives of industry associations, manufacturers of offshore wind turbines, suppliers, energy supply companies, offshore planners, banks, financing companies, and representatives of the maritime industry). The foundation is involved in national and international projects as well as in research projects. As the holder of the approval rights for OWF *alpha ventus*, the foundation accompanied and supported the development and implementation of the first German offshore wind farm. As part of its support during the approval and construction phases of various OWFs, the foundation has been dealing with the issue of the acceptance of offshore wind energy.

Sub-project

Development of strategies for efficient decommissioning of offshore wind farms - SeeOff; sub-project: Legal and social framework conditions for the dismantling of offshore wind farms

Requirements analysis

- Determination of regulatory requirements
- Analysis of requirements for the determination of acceptance regarding offshore wind farm decommissioning of the public, affected industries, and stakeholders

Analysis of decommissioning strategies

- Definition of questions and development of indicators to assess the degree of acceptance

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Deutsche Windtechnik Repowering GmbH & Co. KG



Brief description

Deutsche Windtechnik is a specialist for the maintenance of wind turbines on land and at sea. Planning and carrying out maintenance, repairs, improvements, and inspections is part of everyday business. The unit Deutsche Windtechnik Repowering GmbH & Co. KG deals with the technical, organisational, and approval-relevant issues within the framework of onshore repowering projects. Over 100 deconstruction projects with wind turbine classes between 20 kW and 3000 kW have been successfully completed within the last five years. The service portfolio includes the preparation of project-specific deconstruction concepts, the planning and implementation of the deconstruction, the professional recycling and disposal as well as the marketing and sale of old plants.

Through the company's internal cooperation with Deutsche Windtechnik Offshore und Consulting GmbH, extensive expertise in the areas of service, logistics, operation, and project management for offshore wind farms can also be drawn upon. This includes the exchange of large components at the offshore wind farm *alpha ventus*, supervision of the construction and commissioning of the offshore wind farms *DanTysk*, *Butendiek*, and *Nordergründe*, and maintenance of the offshore substation and transition pieces in *Butendiek* and *Nordergründe*.

Sub-project

Determination of the technical, organizational and legal requirements for the dismantling and logistic of offshore wind farms as well as the development of dismantling and logistic options

Requirements analysis

- Implementation of a system analysis to describe reference offshore wind farms, including system elements and system boundaries, that constitute the foundation for the research project
- Determination of technical and organisational requirements on dismantling and logistics of offshore wind farm decommissioning

Development of decommissioning strategies

- Development of different dismantling alternatives
- Development of different logistic concepts

Potential for improvement

- Determination of potential for improvement for dismantling and modification of dismantling alternatives
- Determination of potential for improvement for logistics and modification of logistic concepts

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Nehlsen GmbH & Co. KG



Brief description

The Nehlsen GmbH & Co. KG with its headquarter in Bremen stands for reliable, efficient, and customer-oriented services in the fields of recycling, disposal, and cleaning. In total, the Nehlsen Group disposes and recycles approx. 1.0 million t/a of waste. These consist of municipal waste (household waste, plastic waste, organic waste, paper, waste wood, bulky waste) and commercial waste (construction waste, packaging waste, etc.) as well as approx. 250,000 t/a of other hazardous waste ("industrial waste", chemicals, waste oil, etc.). With innovative disposal concepts and recycling methods, Nehlsen makes an active and sustainable contribution to environmental and climate protection. Since 2015, Nehlsen GmbH & Co. KG has been operating the world's only plant for raw material recycling of rotor blades composed of glass fibre reinforced plastic (GRP) through its subsidiary neocomp GmbH. By the end of 2017, a total of 7000 tonnes of rotor blades had been crushed and recycled in a cement plant.

Sub-project

Development of recycling scenarios for offshore wind farms

Requirements analysis

- Investigation of technical requirements for disposal and recycling

Potential for improvement

- Identification of potential for development regarding existing disposal routes, techniques and procedures

Development of decommissioning strategies

- Determination of potential disposal routes and conditions for incoming wastes of suitable recycling facilities (Development of new and innovative approaches)

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Associated partner

The project is supported by the associated partners Vattenfall Europe Windkraft GmbH, EnBW Energie Baden-Württemberg AG, and TenneT Offshore GmbH in terms of provision of asset-specific expertise, data, and other information.

Vattenfall Europe Windkraft GmbH



Brief description

Vattenfall is one of the pioneers of the offshore wind industry in Germany and with an installed capacity of over 1699 MW one of the largest offshore wind farm operators worldwide. As one of three project partners, Vattenfall realised the first German offshore wind farm alpha ventus and also operates the wind farms DanTysk and Sandbank. Vattenfall is also one of the first operators that has initial experience in decommissioning of offshore wind farms. Lely (2016), Yttre Stengrund (2016) and Utgrunden (2018) are already successfully decommissioned.

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TenneT Offshore GmbH



Brief description

TenneT is one of the leading grid operators in Europe. TenneT supplies around 41 million end consumers in the Netherlands and Germany with electricity via its high-voltage and extra-high voltage grids. TenneT as grid operator operates eleven offshore grid connection systems with a transmission capacity of 6.232 MW in the German North Sea. Eight of these grid connection systems are high-voltage direct current transmission systems with a converter platform at sea.

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EnBW Energie Baden-Württemberg AG



Brief description

EnBW is one of the leading developers and operators of offshore wind farms. With the commissioning of EnBW Baltic 1 in 2011 the first commercial offshore wind farm in the German Baltic Sea went into operation. EnBW's second offshore wind farm EnBW Baltic 2 is operating since 2015. Commissioning of EnBW Hohe See and EnBW Albatros is scheduled for 2019. EnBW also holds the rights for the construction of the wind farm EnBW He Dreiht which will be operated without EEG funding.

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Advisory board

The research project is supported by a broad advisory board consisting of companies, authorities, research institutions and other organisations of the offshore wind farm industry. Members of the advisory board support the project by participating in expert interview, surveys and workshops.

Publications

Some publications within the research project *SeeOff* will be in English language. Please check "[Veröffentlichung](#)" on our project website.

Events

Upcoming events will be announced under "[Veranstaltungen](#)" on our project website. If you have problems registering online or if you have any questions regarding events, please contact Vanessa Spielmann (+49 421 5905 2394, vanessa.spielmann@hs-bremen.de).