16th of September 2020 – Offshore Decommissioning Summit 2020

Development of Sustainable Offshore Wind Farm **Decommissioning Strategies**

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SeeSff

Strategieentwicklung zum effizienten Rückbau von Offshore-Windparks Development of efficient strategies for offshore wind farm decommissioning

Agenda

- Project description SeeOff in view of decommissioning challenges
- Objectives for a sustainable decommissioning
- Process analysis and parametrisation
- Process options and development of decommissioning scenarios
- Analysis and evaluation of decommissioning scenarios
- Transfer of potential for improvement
- Conclusion



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SeeOff - Development of efficient strategies for offshore wind farm decommissioning

• Project funding:

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

• Funding body:

Projektträger Jülich

• Project duration:

3 years

(1st November 2018 – 31st October 2021)

• Project coordination:

Prof. Dr.-Ing. Silke Eckardt

City University of Applied Sciences Bremen

Supported by:



Federal Ministry for Economic Affairs and Energy

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Project partners HSB Interested Deutsche Windtechnik Interested parties parties OFFSHORE WINDENERGIE Nehlsen ALTIO Associated partners TENNET VATTENFALL THÜNEN Project advisory board SIEM WINDEA OFFSHORE GeoSea WAAS Infra Solutions enova Offshore Erneuerbare Energien WindManShip **BDE** Bundesverband der Deutschen Entsorgungs-, Wasser- und Rohstoffwirtschaft e.V. bremenports dena pwc Wirtschafts- und Arbeitgeberverband BUNDESAMT FÜR Bremen Bremerhaven GmbH & Co. KG Deutsche Energie-Agentur SEESCHIFFFAHRT FLEETHAMBURG UND HYDROGRAPHIE RECHTSANWÄLTE | SOLICITORS | BARRISTER Planungsgemeinschaft Umweltplanung Offshore Windpark **ITW** Performance Polymers MGC Interested Interested parties parties

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Development of

efficient strategies for offshore wind farm decommissioning



Uncertainties and challenges of decommissioning OWF

Only few experiences from decommissioning of OWF

- Uncertainties of legal framework
- Technical feasability / use of dismantling techniques
- Material flows / quantity and quality of materials & components
- Calculation of decommissioning costs / accruals



Need for sustainable OWF decommissioning strategies

- cost-efficient
- environmentally friendly
- safe and
- publicly accepted

Not just an engineering problem! Aim of the project: support with method to find sustainable decommissioning strategies



Scope of the research project





Objectives for a sustainable OWF-decommissioning

		Sustainable decommissioning of offshore wind farms					
Category	Economy		Enviro	nment		Health and safety	Acceptance
Aspect	Economic efficiency	GHG-Emission	Biodiversity	Ecosystem services	Resource efficiency	Safety at work	General acceptance
Objective	Economic efficient	Low GHG- Emission	Minor local impact	Minor local impact	High resource efficiency	Few hazards	High public acceptance
Attribute	€/MW	CO2-Equivalent	Species richness	Secondary production	Recycling rate	Hazard level	Level of acceptance

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1 Offshore Dismantling/Decommissioning Area of responsibility: OWF 1.2 1.3 1.5 1.4 1.1 Dismantling of WTG Decommissioning of Dismantling of Decommissioning of Dismantling of WTG foundation inner-array cable OSS scour protection Area of responsibility: TSO 1.6 Dismantling of 1.7 Dismantling of transmission cables to converter station converter station 2 Waste Management Onshore 2.1 Dismantling and preparation at the harbour 2.1.5 2.1.1 2.1.4 Pretreatment of 2.1.2 2.1.3 Dismantling of Dismantling of

rotor blades Dismantling of nacelle Dismantling of tower OSS foundation WTG foundation Level 2, sub-processes [...] 2.2 Processing and disposal 2.2.1 Processing of 2.2.2 Processing of 2.2.3 2.2.5 2.2.4 glassfibre carbonfibre Processing of Processing Processing of cables reinforced plastics reinforced plastics of metal scrap construction waste [...]

Process analysis

Level 1, main

processes

9







Acceptance: acceptance level

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Process analysis

Process parametrisation and indicator measurement





Travel to harbour

oad the

and MPs

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Monopile dismantling completed

Process parametrisation – level of detail Dismantling the lonopile foundati e.g. Hazards Jack-Up Vessel Travel to constructio site Ps with WA MPs with WAS Start Monopile dismantling Work system description i <u>Output parameter</u> I Input parameter **Dismantling the** Device type - manhours TPs with WAS Tools and materials + slight Method description Consequence permanent injury/ no conminor damage to Activity parameter: Duration of hazard illness health sequences injury - activity-related hazard factors <5 Min 0 0 2 - Duration (h) of hazard factor 5-30 Min 0 3 - consequence of hazard factor 30 min-2h 0 - probability of occurence (y/n)>2h 2 - activity-independent hazards - Duration of activity 3 continuously - number of iterations

serious

2

permanent

damage to

health, death



Scope of the research project



Handbook decommissioning strategies for OWF for determiniation and evaluation of individual decommisioning strategies



Baseline Scenario Offshore WTG FOU

	Process		Base Scenario
	1.2 Dismantling of WTG	Extent of decommissioning	Cut min. 1 m below seabed level
tion	FOU	Process of dismantling	Cut below TP to separate from MP
		Dismantling technology TP	Abrasive cutting from inside
		Dismantling technology MP	Abrasive cutting from inside
		Disassembly offshore	None
		Logistics	Jack-Up vessel
		Unloading	With crane of Jack-Up vessel

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Development of efficient strategies for offshore wind farm decommissioning





Analysis and Evaluation of decommissioning scenarios

- Weighting of objectives regarding their importance
- Comparative analysis of different scenarios under consideration of all attributes
- Possible conclusion regarding the sustainability of the decommissioning scenarios for the specific offshore wind farm



Scope of the research project



Handbook decommissioning strategies for OWF For determiniation and evaluation of individual decommisioning strategies



Improvement potentials

Transfer of improvement potentials to preceding OWF project phases





Handbook

- Will contain research results
 - Requirements catalogue
 - Dismantling, logistic and recycling techniques and procedures
 - Economic, environmental, safety and social assessment indicators
 - Structured procedure to develop and assess sustainable decommissioning strategies
 - \circ Potentials for improvement
- Will be published for free use



Conclusion

- Uncertainties of durations of decommissioning techniques and concepts → estimations are difficult but have high influence on costs
- Legal framework not yet fixed
- Some discussed technologies of offshore dismantling not yet state-of-the-art-> feasibility, e.g. overpressure extraction
- Onshore concepts needed, e.g. for harbour operators & onshore recycling facilities
- \rightarrow New business cases for harbours, scrap yards and other recycling facilities; plan capacities
- Assessment of sustainable decommissioning is more complex but required for offshore wind. It is not just an engineering problem!



Start investigation early enough, set up your algorithm, change input data as needed!

Thank you very much for your attention

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