DecomTools:

Eco-innovative concepts for the end of offshore wind energy farms lifecycle

What? Why? How?

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Project Partners

New Energy Coalition

Port of Grenaa
Support your business

UNIVERSITY OF ABERDEEN

Hamburg Institute of International Economics
HWWI

Port Oostende
energy port

POM West-Vlaanderen

De Lauwershorst Groep

University of Applied Sciences
HOCHSCHULE EMDEN·LEER

prezero

SAMSØ KOMMUNE
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energy CLUSTER DENMARK

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MARLOG

marinescotland

The Scottish Government
Riaghaltas na h-Alba

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Introduction – Aims of the project

An overall sustainable approach to the offshore wind farms‘ end of lifecycle is missing. This project shall close this gap by devising and developing eco-innovative concepts that:

Reduce the decommissioning's cost by 20%

Reduce the decommissioning's environmental footprint by 25%

Increase the know-how and expertise of involved stakeholders

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A deeper dive into the outcomes of the economic perspective

Market situation

Increasing amount of OWTs to be decommissioning: around 1000 by 2030

The market is becoming attractive as new business opportunity to more and more stakeholders

Experience and best practice is needed for all stakeholders

Essential requirements

Ports

- Ports are the central HUBs
- Infrastructural adjustments have a long investment horizon and need to be taken now!!!

Vessels

- Availability of suitable vessels for decommissioning needs to be ensured.
- New and more efficient vessels are needed

Recycling

- For some materials recycling processes are well known and work with sufficient capacities (e.g. steel)
- But for other materials like compsites of blades, new procedures are needed

Qualification

- Experience from oil and gas decommissioning are transferable
- A streamlined provision of courses at different levels needs to developed

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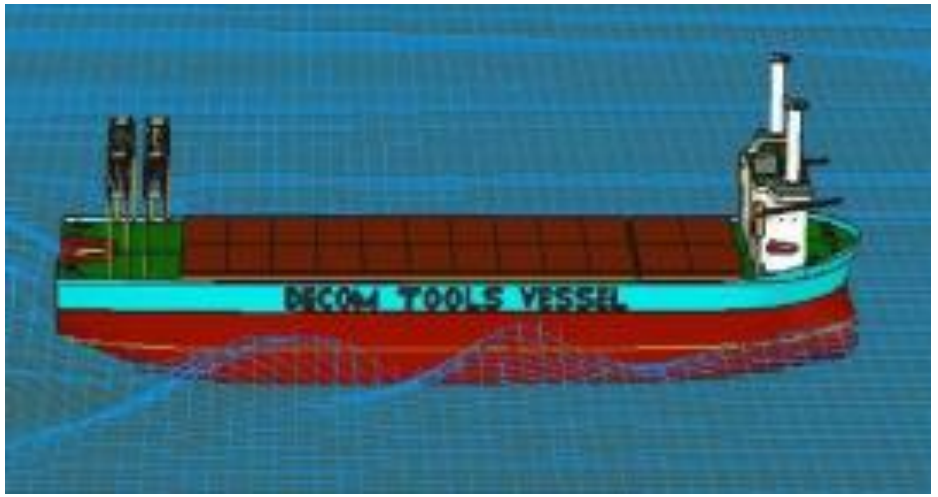
A deeper dive into the outcomes of the technical perspective

- Decision Support System (DSS)
  - Tool to conduct a multi-criteria evaluation of dismantling processes taking into account turbines, foundations, components, site, repowering O&M costs, environmental issues
  - Tool to integrate decommissioning already in offshore parks planning phase

- DecomTool-Vessel
  - Design of a highly specialized vessel for OWT-decommissioning incl. new tools to build an efficient and reliable procedure



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A deeper dive into the outcomes of the logistical perspective

8 Discrete Event Simulation Model

Simulation-Models covering various logistical concepts for offshore decommissioning

- include the two logistics systems of pendulum and feeder systems which are subdivided into three subcategories
- The dismantling strategies include the part-by-part configuration, the bunny-ear configuration, and the star configuration.
- Another model contains exclusively the designed DecomTool Vessel.

3 VR-Models

Models demonstrate decommissioning process virtually

- Transfer from CTV to OWT
- Manoeuvring in an OWF
- Prepared model with additional information on the reconstruction of specific OWT components in the nacelle

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A deeper dive into the outcomes of the recycling perspective

special attention on steel, cables, magnets and wind turbine blades (most of them have high monetary potential or critical environmental impact)

The concept of Circular Economy (CE) in disposing of the materials/ components into consideration

3 developed concepts for reycling of blades

1. Shredding of wind turbine for reuse in different products and processes (e.g. cement production)

2. Reuse of blade parts (e.g. playgrounds)

3. separate the composite material under high temperatures -> pyrolysis.

More about this in the upcoming presentations ☺

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Why?

- According to the „Fit for 55“ targets and the EU Green Deal, there will be an expansion of offshore wind energy in the NSR
  - Increasing numbers of installed OWT leads also to a higher volume of dismantling

- Pioneer OWF‘s in the NSR are reaching the „critical stage“ of the 20-25 years runtime within the next years

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Why?

- „2 decommissioning cycles“
  - 1st Cycle: Already ongoing, with a relatively low volume of OWTs → „Test case“ for decommissioning strategies and methods
  - 2nd Cycle: Expected to begin ~2030 corresponds to large volumes in the NSR
    - Requirements: Fully developed solutions and decommissioning strategies

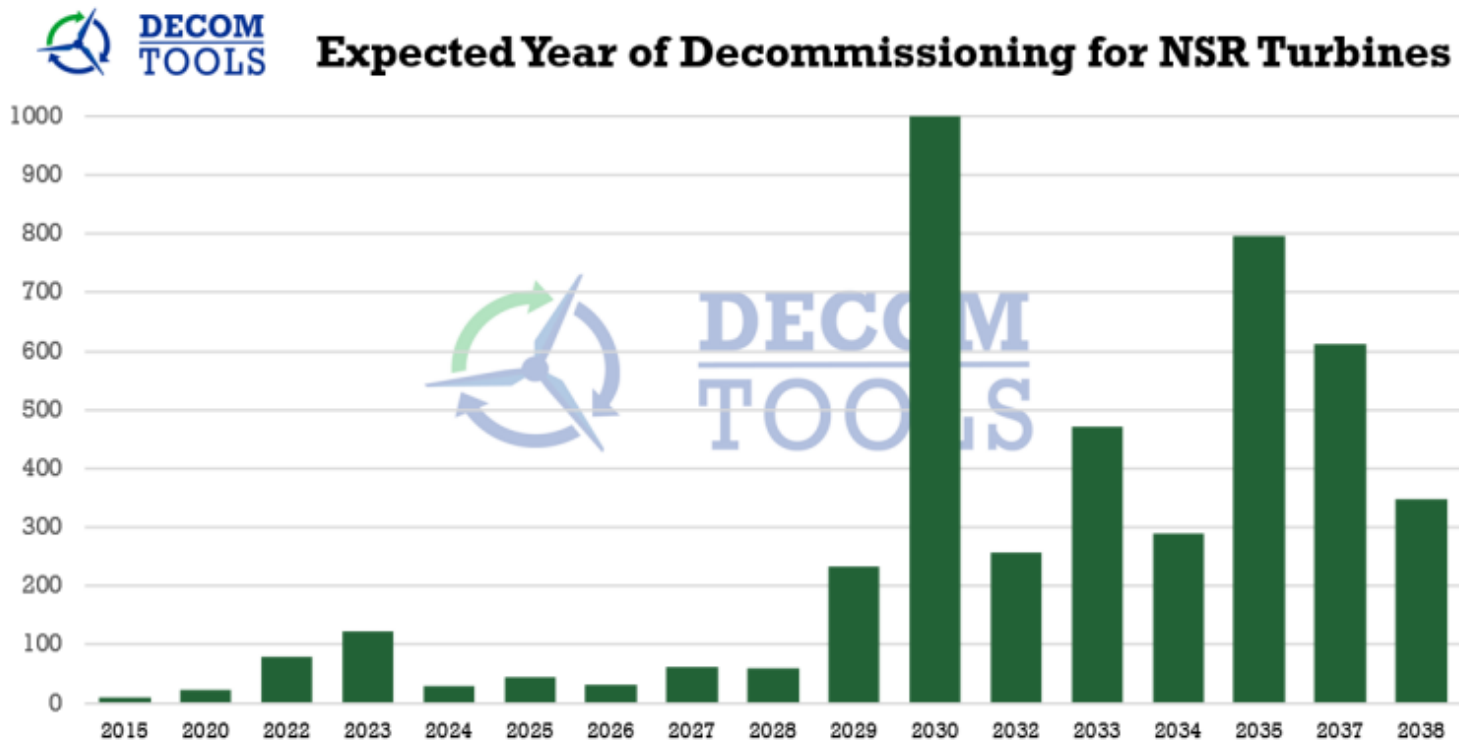

Figure 1: Expected Year of Decommissioning for Offshore Wind Turbines in the NSR

Kruse, M. (2019): Market Analysis Decom Tools 2019, [online], available at: https://northsearegion.eu/media/11753/market-analysis_decomtools.pdf

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Logistical ”problems” (Port Infrastructure)

- Upgrading portside infrastructures can take up to a decade and involve significant investment
  - Highly important for ports in the NSR to plan on time and reach a certain level of coordination amoing each other → Building a sufficient supply of infrastructure
  - Exspansions in terms of berths, reinforced quays, storage space, capacity, transportation networks etc.

- Still unclear whether the subsequent steps of decommissioning will be conducted in the ports or in specific facilities in the hinterland
  - Ports becoming crucial hubs in several ways (operational, distributional, storing, processing, recycling etc.)
  - Distances and transportation costs will play an important role along the supply chain

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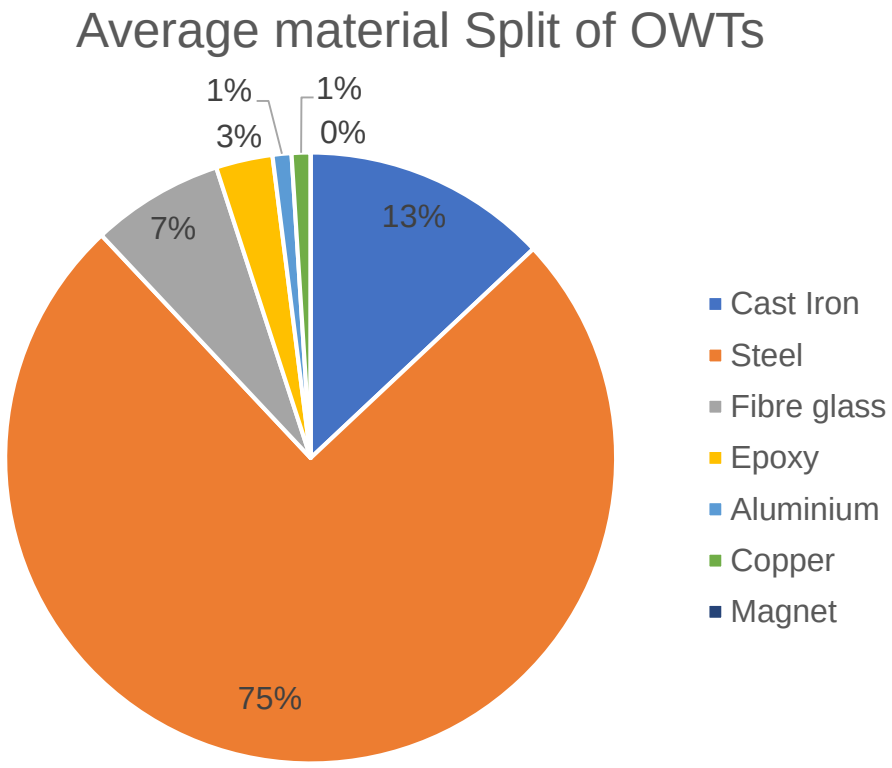
The waste problem - blades

- Several materials are to be distinguished
  - Around 80-90% of wind turbines‘ total mass can be recycled
  - Blades are more challenging due to the composite materials used in their production



OWT-Materials	Recycling Rate (%)
Cast Iron	98 %
Steel	92 %
Fibre glass	15 %
Epoxy	15 %
Aluminium	95 %
Copper	98 %
Magnet	5 %
Foundation	50 %
Cables	90 %

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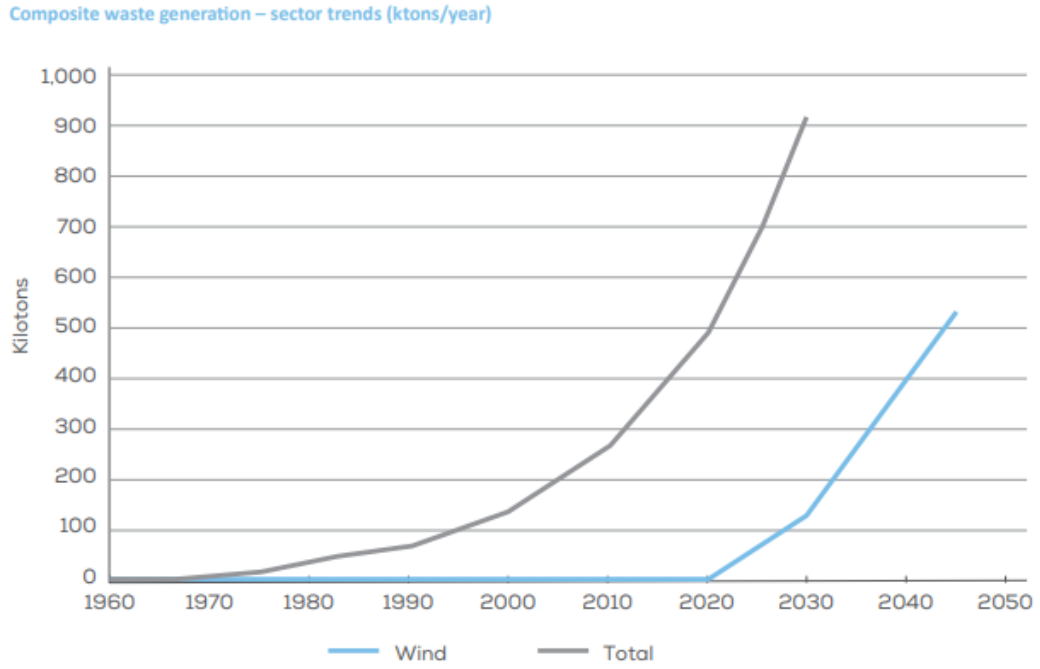
The waste problem - blades

- EuCIA estimates approx 60 kilotons of composite waste in 2025 → Rising tendecy ~ >100 kto by 2030

- Considering about 1.000 OWT have to be dismantled in 2030 about 1/3 of the total composite waste comes from OWT



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The waste problem - blades

- Blades could be „upcycled“, e.g. used for
  - Playgrounds
  - Shelter facilities for bikes/people (e.g. bus stop)
  - Seatings
  - ….
- Dumping and using them for landfill is no option!

BUT:

It‘s not a comprehensive solution for the upcoming volumes of dismantled rotorblades at their end of life cycle

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The challenge we have all together

- We all will depend on recycling concepts in the future to be more independend in the international supply chains
- We all have to save CO2
- Each windpark owner needs to dissassemble in the end. It is important to discuss with other industry and partners
- The wheel does not to be evented again
- Here a cooperation in the North Sea region was very productiv. Each partner had his strength the other could benefit from.

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Transnational collaboration

By Charlotte Baumgartner, Energy Cluster Denmark

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Intercultural challenges/ learnings from DecomTools

- **International backgrounds:** European citizens - international background => a worldwide perspective to the project and an additional network.

- **Cultural diversity:** Cultural diversity makes communication difficult as the mindset of people of different cultures are different, the language, signs and symbols are also different.
  - Effective communication => eliminate causes of cultural communication barriers
  - Increase of cross-cultural understanding to avoid cultural diversity miscommunication => bad partner collaboration. Increase of understanding our own cultural values and know that differences exists and that they can be the cause of misunderstandings and bad communication
  - There might be different cultural ways to handle conflicts: Some cultures view conflict as a positive thing, while others view it as something to be avoided
  - Potential cultural and linguistic differences need to be considered in ALL activities
  - Difference in the approach of completing tasks => importance of standard requirements for deliverables

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Communication and administrative activities in Interreg

- **Broad communication effort** than most national projects - development of independent channels such as LinkedIn, Newsletter, Webpage etc.
- **Target group and cultural differences:** Considering the different target groups but NOT only. Remember to consider the potential cultural differences in the partner countries – this can influence both internal and external project communication.

Administrative learnings

- **Platform:** OMS platform is a very good tool for project administration. Access for all project partners is giving which makes the handling of documentation and communication most effective
- **Project period:** Long project period risks - Fluctuation in staff (especially with private companies) => Knowlegde loss
- **Formal requirements:** Working in international projects it is important to KNOW ALL formal requirement (i.e., logo size, font requirements etc.)
- **Communication with Interreg** itself is very easy, quick and solution-oriented

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If you want to get more detailed insights into the outputs, check out our website!

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