Quantifying the environmental footprint of offshore wind farm decommissioning

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Background

Europe plays an important role within the wind energy sector, as wind farms are installed in 11 different countries with most of them in the North Sea. Therefore the North Sea is the largest offshore wind farm (OWF) in the world with a capacity of 1218 MW and 174 turbines by 2020. [1] This increasing number of OWFs in the North Sea Region as a result of the global energy transition to renewable energy sources raises several critical issues, including in the area of decommissioning of the infrastructures. Considering the fact that last decade the first OWFs reached their end of life, there is not much experience in this field. [2] Although there are several studies on the operations within the decommissioning phase, and their optimization in terms of cost and duration, there currently remains a gap in research concerning the GHG emissions that are released during the operations within the decommissioning of OWF. [3] This gap in research is closely related to the just emerging and still growing knowledge about the complex activities during OWF decommissioning, and therefore models in which GHG emissions during these operations can be evaluated do not yet exist.

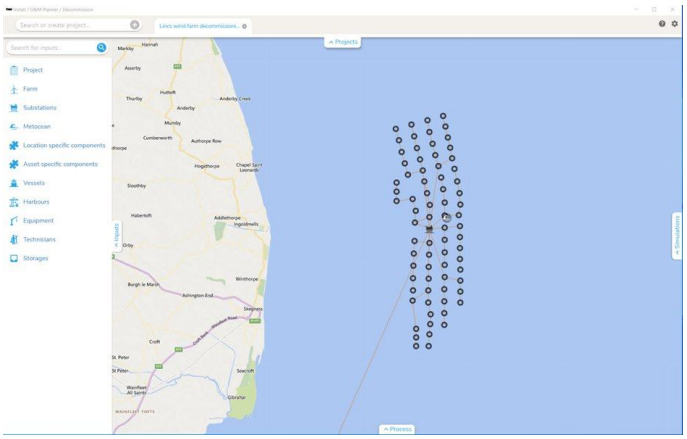

Figure 1 - Screen of the UWiSE decommission software [4]

Objective

At the moment a research gap exists concerning the assessment of GHG emissions during the decommission phase of (OWF). This research aims to bridge this gap by developing a GHG emission assessment model that will support informed decisions during forthcoming large-scale OWF decommissioning projects. This model aims to quantify and minimize environmental impacts of this specific life cycle phase of an OWF. Afterwards, this model could be integrated into the already developed UWiSE decommissioning tool by TNO. [4] In order to investigate the most cost-effective ways to reduce GHG emissions on future large-scale OWF decommissioning campaigns in the North Sea Region. As offshore wind energy continues to expand, understanding and minimizing the environmental impacts of decommissioning becomes critical to sustainability.

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2. Spielmann, V., Brey, T., Dannheim, J., Vajhøj, J., Ebojie, M., Klein, J., & Eckardt, S. (2021). Integration of sustainability, stakeholder and process approaches for sustainable offshore wind farm decommissioning. *Renewable & Sustainable Energy Reviews*, *147*, 111222. https://doi.org/10.1016/j.rser.2021.111222

3. Jalili, S., Maheri, A., Ivanović, A., Neilson, R. D., Bentin, M., Kotzur, S., May, R., & Sünner, I. (2023). Economic and Environmental Assessments to Support the Decision-Making Process in the Offshore Wind Farm Decommissioning Projects. *ELSEVIER*. https://doi.org/10.2139/ssrn.4415949

4. *UWiSE tool voor efficiënte ontmanteling van offshore windparken*. (z.d.). tno.nl/nl. https://www.tno.nl/nl/newsroom/2023/11/uwise-ontmanteling-windparken/