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Environmental assessment and guidance for the future offshore wind energy development

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Propositions

Accompanying the thesis

“Environmental assessment and guidance for the future offshore wind energy development” by Chen Li

1. Foreseeable technologies aiming to reduce rare earth elements (REEs) in permanent magnets (PMs) and improve REE efficiency are currently under development. Specific amounts of REEs necessary to produce PM-based nacelle technologies of similar strength could decrease in the near future (Chapter 2).
2. The contributions of operation and maintenance to environmental impacts will likely increase due to the higher failure rates related to turbine size enlarging and moving into deeper waters with harsher marine environments (Chapter 3).
3. Closed-loop end-of-life recycling and wind turbine lifetime extension will reduce material demand, and associated life cycle environmental impacts (Chapter 2 and 3).
4. To what extent the effects of offshore wind farms will impact benthic communities outside the diameter of the wind turbine, in soft sediment, or even the pelagic compartment remains unknown (Chapter 4).
5. Development of offshore wind farms in the central North Sea should be minimized due to the long distance to shore, which results in high demand for copper and associated greenhouse gas emissions, and other environmental impacts across the full turbine life cycle (Chapter 5).
6. How to harness data from a variety of ecosystem components to steer the further development of offshore renewables in an environment-friendly way is still in its infancy (Degraer et al., 2019).
7. Understanding climate-driven impacts on the multivariate global wind-wave climate is paramount to effective offshore/coastal climate adaptation planning (Morim et al., 2019).
8. Geoscience solutions play key roles in sustainable offshore wind energy development windfarm and infrastructure site conditions, and infrastructure for transmission, conversion and energy storage (Velenturf et al., 2021).
9. Three grand challenges in wind energy research require further progress from the scientific community (i) improved understanding of the physics of atmospheric flow in the critical zone of wind power plant operation, (ii) materials and system dynamics of individual wind turbines, and (iii) optimization and control of fleets of wind plants comprising hundreds of individual generators working synergistically within the larger electric grid system (Veers et al., 2019).
10. Analects of Confucius describes a scene: in the waning days of spring, when springtime's robes are donned with pride, a few grown folks and children, venture to the waters for a playful tide. Then, by the riverbank, they catch the breeze with joyful hearts, and return with song.

Chen Li

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