



Master Thesis

The impact of offshore wake effects on system planning

“Wind farms extract considerable kinetic energy from the atmosphere, causing a reduction in mean wind speeds and an increase in turbulence in the downwind area” (Platis, 2018). This reduction of energy potential behind wind farms is known as the wake effect. The existence of Wake effects has been proven in several experiments and studies; however, their actual magnitude and atmospheric conditions influencing them are still subjects of ongoing research (Platis et al. 2021). Additionally, current area and energy system plans in Germany might underestimate the impact of wake effects in the German maritime area (Stratmann, 2024).

The goal of this thesis is to investigate the wake effects in the German maritime regions and their impact on energy system planning. The analysis includes a familiarization with wake effects in offshore wind farms and a quantitative assessment of their impact (e.g. with a numerical energy system model). Potential question could concern the quantification of the misestimation in German system scenarios (Prognos, 2022), the evaluation of German wind offshore areas, and/or the impact on costs of wind offshore generation.

Key tasks and objectives of the thesis

- Conduct a thorough review of studies on wake effects in the German maritime area
- Find a suitable representation of wake effects in offshore wind generation
- Use statistical and/or numerical methods to evaluate the impact of the wake effects on key figures of German energy system planning, e.g., costs of offshore wind energy, misestimations in energy system scenario, evaluation of offshore area plans.

Your profile

- Student of economics, best with a background in energy economics
- Interest in numerical methods
- Analytical thinking and the ability to carry out independent scientific work

Literature

- Stratmann, Klaus. Werden zu viele Windparks vor der deutschen Küste geplant? (2024). Handelsblatt.
- Prognos (2022): Vergleich der “Big 5” Klimaneutralitätsszenarien.
- Platis, A., Siedersleben, S. K., Bange, J., Lampert, A., Bärfuss, K., Hankers, R., ... & Emeis, S. (2018). First in situ evidence of wakes in the far field behind offshore wind farms. Scientific reports, 8(1), 2163.
- Platis, A., Hundhausen, M., Lampert, A., Emeis, S., & Bange, J. (2021). The role of atmospheric stability and turbulence in offshore wind-farm wakes in the German bight. Boundary-Layer Meteorology, 1-29.
- Fraunhofer IWES (2024). Ad-Hoc Analyse: Ertragsmodellierung der Ausbauszenarien 16-21. Bundesamt für Seeschifffahrt und Hydrographie (BSH).

Contact



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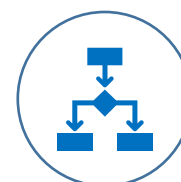
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Topics



- Wake effects
- Offshore wind generation
- Energy system planning

Methods



- Data analysis
- Numerical modeling