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Comment on wes-2022-37

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Referee comment on "The eco-conscious wind turbine: design beyond purely economic metrics" by Helena Canet et al., Wind Energ. Sci. Discuss.,
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The manuscript of Canet et al. on "The eco-conscious wind turbine: bringing societal value to design" is a timely and important contribution that shows a way forward how to quantify and trade the value of wind energy beyond the economical cost of energy. This way it can facilitate discussions beyond speculation and preconceived notions.

There are key insights in the work that may be stressed even more clearly by the authors in the abstract and conclusions than they already do:

- similar as in economic metrics, like LCoE, one needs to look at the difference between value and costs (and not costs alone), here it is that wind energy also displaces CO₂ production by an order of magnitude more than it produces.
- "value-based metrics are location- and time-dependent quantities", so here the merit order in the electricity market needs to be accounted for to quantify the CO₂ displacement effect.
- There are likely trades possible at little economic costs, or even none, that benefit society at large if quantified and traded in design, e.g. via multi-disciplinary design analysis and optimization (MDAO).

The authors are very much aware of the limitations of their study, but here are a few points to consider, although these likely make their conclusions rather stronger:

- In their MDAO, rating of the turbines was kept constant. This is reasonable at first, but when a larger rotor was found to be beneficial for societal impact, some economic penalty (compared to a pure LCoE optimization) had to be paid. However, for this larger rotor, a larger rating may then pay off for LCoE.
- Often their optimization led to an optimum design at boundaries, e.g. the lowest specific power allowed. Besides the question what bounds to choose, here, allowing for a variable rating could also help.
- Sensitivity analysis and uncertainty quantification will be important for (future) robust designs using their methodology.
- The authors found the "environmental net value at the two locations (...) very similar". Is this due to being in the same electricity market with the same merit order?

Overall, I consider this well-written and well-structured manuscript a significant contribution to the literature and are looking forward to follow up work by the authors, our research community and beyond!