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Interactive comment on "Exploitation of the far-offshore wind energy resource by fleets of energy ships. Part A. Energy ship design and performance" *by* Aurélien Babarit et al.

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Overall this is a very thorough and well written paper. It is It serves as a comprehensive overview of the methanol energy ship concept however, some elements mentioned need further clarification or could be improved.

1. Introduction:

The introduction should be laid out better. The concept of using a sub-mounted water turbine is only briefly introduced along with other configurations. Other ideas should be first discussed in terms of their relevance to this paper, before then justifying and

further explaining your choice. Not until figure 2 does the concept take shape. Example introduction structure: - First energy ship concepts - Advances and alternative configurations - Use of flettner rotors and water turbines for maximum efficiency

2. Line 60-65 – Hydrogen and methanol:

Energy losses of 50% for hydrogen are stated without calculation or justification. The given reference also does not provide any energy or cost calculations matching this figure or provide a conclusion in line with your assumption. Neither is a comparison of losses with methanol/others provided. Given the additional complexity of a methanol system over a hydrogen system, and the fact hydrogen production is required in either case, the trade-offs that exist must be explored more. Currently the choice of methanol is significantly under detailed and appears to be more arbitrary than anything else. More consideration of end use should also be made, if methanol is intended as a drop-in fuel for petrol/gasoline, considering the rise of the EV what will the demand be by the time a FARWIND ship is built and launched? Would a different product such as ammonia for chemical production or HVO for biodiesel be more lucrative and provide higher GHG savings?

Suggested reference on methanol: Varone A, Ferrari M. Power to liquid and power to gas: An option for the German Energiewende. Renew Sustain Energy Rev 2015;45:207–18. doi:10.1016/j.rser.2015.01.049.

3. Axial induction factor:

This term is used often and quite important to your overall calculations. It needs greater explanation as I imagine this paper will appeal to people outside of wind energy and thus, who would be familiar with these calculations.

4. Electrolysis – Lines 220 - 230:

This review should be updated as the assumptions will be outdated upon publication as efficiency values for all technologies have improved significantly and will favourably affect end results. Although AEL is a suitable choice, PEM is expected to be the dominant technology by 2030, due to its higher efficiency and solid electrolyte (AEL requires a supply of KOH in solution). Suggested reference: O. Schmidt, A. Gambhir, I. Staffell, A. Hawkes, J. Nelson, S. Few, Future cost and performance of water electrolysis: An expert elicitation study, Int. J. Hydrogen Energy. 42 (2017) 30470–30492. doi:10.1016/j.ijhydene.2017.10.045. Previous works have also shown that modest advantages in efficiency of 5% (greater differences quoted in literature) lead to better overall financial performance, even when PEM systems are up to 47% more expensive. See Appendix D of the following paper. Suggested reference: S. McDonagh, R. O'Shea, D.M. Wall, J.P. Deane, J.D. Murphy, Modelling of a power-to-gas system to predict the levelised cost of energy of an advanced renewable gaseous transport fuel, Appl Energy, 215 (2018), pp. 444-456, 10.1016/j.apenergy.2018.02.019

5. Water recycling:

Recycling of the water produced in the methanol plant should be considered. Figure indicates that 33% of freshwater needs could be met in this way. Although it does not significantly contribute to parasitic energy demand, it will improve system maintenance and lifetime.

Excellent work, and I look forward to reading part B of this paper.

In a recent piece of work some colleagues from EAWE and I calculated the levelised cost of hydrogen from offshore wind. It should provide a good comparison if you intend to try calculating the same for your concept.

McDonagh S, Ahmed S, Desmond C, Murphy JD. Hydrogen from offshore wind: Investor perspective on the profitability of a hybrid system including for curtailment. Appl Energy 2020. doi:10.1016/j.apenergy.2020.114732.

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