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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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The manuscript discusses the concept of an energy ship and presents a preliminary design. The ship is driven by Flettner rotors and uses water turbines to generate electricity, which is then converted into methanol. The efficiency of the conversion process is estimated using standard formulas and making some assumptions based on current commercially available components. The ship design is very basic and it is unclear how optimal it is or what other solutions might exist in the design space. However, the aim of the authors seem to be to demonstrate the feasibility of such a concept, and for this purpose it is sufficient. The next step is to consider the economics of the design,

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Discussion paper

for which the authors refer to a companion paper.

The paper is well written, easy to understand and concise. The subject is relevant to Wind Energy Science journal. Overall, I recommend publication of this paper.

Some comments:

1. The review of different approaches to offshore wind energy conversion is interesting and valuable.

2. The consideration of safety aspects in the choice of technology (here: motivation for basing the design on Flettner rotors) is commendable.

3. line 82: "A ... difference ... is that we propose that the energy ships are deployed in fleets" - This is mentioned in the introduction, but the idea is not picked up later. In particular, the question remains why a fleet of mid-sized ships is better than a single very large ship? Please discuss. See also my next comment.

4. Eq. 15: This is an interesting result that the efficiency increases for increasing turbine area. This is different from traditional wind turbines where the efficiency (under the same, implicitly made assumptions on the flow) will be constant, and it leads to a different optimum. In particular, it seems that the size of the turbine will not be as limited by the structural cost (as in wind turbines)? The manuscript should explore and discuss these scaling relationships a bit and what can be learned from them.

5. line 200: "The electricity generated ... as function of the true wind speed and wind direction" - The equation given below this is in terms of wind speed and induction factor. How does the wind direction come into play here?

6. Table 1: Is there no rated ship speed? (maybe since there is no hydrodynamic design of the ship?)

7. Section 3: There seems to be a gap here regarding the specification of the proposed energy ship. The previous section discusses some of the constraints and choices made

and has presented some important formulas that need to be considered for designing the ship. This section suddenly presents a design, but most of the additional choices made (e.g. regarding the size of the ship and its rated power) are not motivated. Please provide some more motivation, and show how the theory presented before is used in designing the ship (if it is?).

8. Did I miss this, or what Flettner spin ratio has been chosen for the ship - and why? Can this parameter be optimized mathematically? (For example, Eq. 9 and thereby the ship speed is influenced by the spin ratio) Is it advantageous if the spin is larger? What is the drag to lift ratio dependence on spin (include a figure, if possible)? Is more known about the efficiency of Flettner rotors (i.e., what are the mechanical losses relative on spin ratio?).

9. line 315: "an important question is whether this structural mass is sufficient to ensure that the ship can withstand harsh ocean conditions" - Indeed. It is a bit disappointing to see not even a very basic consideration of hydrodynamic design and its constraints here. For example, hydrodynamic stability seems a critical issue, with the tall Flettner rotors and the low draft of the ship. I hope the authors will pick up this issue, if not now, then in the future.

10. line 369: "a numerical program was developed" - Will this be available to readers as Open Source or public domain software, e.g. on Github? Please include a "Code availability" section in the manuscript!

Minor comments:

1. line 50: "100 to 150,000 deadweight tonnage" - I assume this to be 100,000 to 150,000 dwt? Please clarify.

2. line 78: This should probably read "the lift depends on only one control variable"?

3. line 85: "CO2" would more commonly be written with subscript, I think?

4. line 141: "the drag force generated by the turbine" - It seems strange (and not

entirely correct) to call it this. Isn't this simply the thrust force generated by the turbine?

5. Eq. 17: The font is probably wrong, it should be roman for chemical formulas?

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