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Interactive comment on "Simulation of an offshore wind farm using fluid power for centralized electricity generation" *by* Antonio Jarquin Laguna

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General Comments

This paper deals with a new concept for offshore wind power conversation based on hydraulic transmission. The generator is replaced by a positive-displacement pump that is directly coupled to the wind turbine rotor. Each wind turbine supplies a pressurised source of sea water to a centralised hydro-electric station consisting of a Pelton wheel coupled to a synchronous machine. This study builds on previous work and describes numerical models to simulate the energy conversion processes, taking into account for the unsteady effects in the hydraulic pipeline network. The overall energy conversion efficiency of a typical hydraulic wind farm is compared with that of a conventional farm based on wind turbine generator technology. The paper is well-structured. Use of the

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Discussion paper

English language is very good. The title reflects the general content of the paper. The following are specific comments that have to be addressed for the paper to be suitable for publication

Specific Comments 1. Introduction, Page 2: the paper should present a more detailed overview of work carried out in this area so far and what new work is being presented in this study

2. Page 2, line 8: amend sentence to end as follows: “where the results are compared with those of a typical wind farm based on conventional wind turbine generator technology.

3. Page 3: Equation (3) is missing. The equation number (3) is being indicated.

4. Page 3, line 15: add a fullstop – “. . .both the rotor and support structure. Their effects on the. . .”

5. Page 3, line 16: remove the coma “..degree of freedom will absorb..”

6. Page 3, line 21: add full stop – “..as a first order differential equation. The mass moment. . .”

7. Page 3, line 25: “is obtained for each rotor revolution.”

8. Page 4, Figure 2 caption: “Subsystem block diagram of a single turbine. . .”

9. Page 4, line 9: remove coma – “displacement of the pump are approximated by a . . .”

10. Page 4, Eqt (12): Section 2.1.4 should include a brief explanation of how eqt (2) is used in conjunction with eqts (1,2) to determine the rotor torque.

11. Page 5, section 2.2, line 17: it should be clarified in the text that linearity only holds for laminar flows. For turbulent flow, the non-linear equations have to be applied.

12. Page 7, line 16: a more elaborate explanation is required about the fundamental

physics governing Pelton wheel operation: If the rpm is kept fixed, then the jet velocity and hence the press drop across the nozzle should be also fixed. k should also be fixed at the optimal value of 0.5 for optimal efficiency. An explanation of how this condition is applied in the numerical solution is necessary.

13. Page 9, first line: “so-called”

14. Page 9, line 9: this is linked to comment 12 above. Explain in the text why you have a constant pressure supply. To what extent is the control system able to maintain a constant pressure when intermittent wind conditions cause the water flowrate to change abruptly?

15. Page 9, section 3.2, first line: it is worth mentioning that maintaining a constant pressure supply is beneficial in minimising fatigue damage to the hydraulic system components.

16. Page 19, first line. Explain the difference between the control systems of Buhagiar et al and that being proposal here.

17. Page 11, line 9: Include a table with the derive values for the different gains

18. Page 12, line 15: wouldn’t a compressed air or weighted accumulator help solve the problem of increased activity of the pitch controller?

19. Page 13, Figure 10: if the hydraulic turbine only includes an open-loop system with the pump housed at the nacelle, then a separate boost pump is required to be able to supply the sea water up the hub height. Has this been factored in the analysis?

20. Page 18, line 1: add a full stop – “conventional technology. For the presented. . .”

21. Page 18, line 3: quote here the percentage efficiency of the pump and that of the hydraulic network.

22. Page 18: Conclusions - comment on any opportunities for costs reduction offered by the new concept

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