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WIND ENERGY SCIENCE DISCUSSIONS

Interactive comment on "Wind tunnel study on power and loads optimization of two yaw-controlled model wind turbines" *by* Jan Bartl et al.

Anonymous Referee #3

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The paper presents valuable experimental results that could contribute to better understanding the potential of wake steering by yawing applied to wind farms. However, I see the following weak points that could be improved, as well as some minor corrections.

Page 5, Line 14-15: The sentence should be rewritten as follows: "The total uncertainties in power and thrust coefficient are 0.006 (2.5% of the absolute 15 CP -value) and 0.007 (0.9% of the absolute CT -value), respectively."

Page 8, line 2-3: "The asymmetric wake deflection is considered to be the main reason for the asymmetric distribution of T2's yaw moments.". It is quite clear that yawing the upstream wind turbine in two different direction leads to different power gain on

the downstream one. The authors trace back this behavior to not-well specified asymmetric wake deflection. It would be interesting, for the readers, if the authors could provide a deeper insight into this topic, considering that the authors (previously cited publication) already measured the wake shed by the upstream WT for two different yaw misalignment. Is the observed asymmetry due to asymmetric wake displacement or wake recovery?

Page 9, line 4-5: "Moreover, the downstream turbine's power output at low inflow turbulence (inflow A) is observed to be more asymmetric with respect to γT1 than at high inflow turbulence (B)." This is quite surprising since one would expect that as more homogenous the flow is, as higher the symmetry of the phenomena is. It would be interesting if the authors could argue more about the reasons behind the observed data.

Page 10. In a previous sentence, the authors reported that quite substantial wake blockage was observed, leading to an increase of 10% of the speed outside the wake of the upstream model. How much is the blockage affecting the results presented in Figure 5? Moreover, the rotor speed of the upstream model was kept constant even for a very high yaw misalignment, which implies that the upstream model is operating at sub-optimal conditions. Indeed, when yawing a wind turbine it would have been better to keep constant the effective TSR, i.e. the TSR computed by using the component of the wind speed orthogonal to the rotor disk. How much power is lost, on the upstream model, due to the fact the model itself is operating, while yawed, at sub-optimal conditions? How this affects the results presented in figure 5?

Page 11, line 1: the authors claim that the lack of symmetry, in the power output, for a downstream model placed on the right or left side of the upstream one, is due to "not perfectly axis-symmetric velocity deficit at x/D = 3". Since the authors measured the wake shed by the upstream wind turbine, it would be beneficial to add also a quantitative comparison: could the measured not perfectly axis-symmetric velocity deficit quantitatively explain the observed difference of power output?

Page 12: which is the effect of wake blockage on the data reported in Figure 8? As the authors properly write, the high Cp, measured on the downstream turbine experiencing partial-wake conditions, is due to blockage. How would the plots in figure 8 look like if the effects of blockage were compensated?

Page 13, Figure 8. The caption reports: "The upstream turbine yaw angle is kept constant at gamma = 0". It should be "The downstream turbine yaw angle is kept constant at gamma = 0"

Page 16: quite surprisingly, it is found that the downstream wind turbine should be yawed by 10-15 degrees (quite a lot!) in order to improve its power production. However, again the TSR of the second turbine was not changed while varying its misalignment angle. This could again lead to sub-optimal operating conditions. If the models were operated as full-scale wind turbines are (constant effective TSR) the conclusions could have been quite different. The authors should comment on this.

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