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# *Interactive comment on* "Wind tunnel comparison of four VAWT configurations to test load-limiting concept and CFD validation" *by* Jan Wiśniewski et al.

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Thank you for the input. The reply comments on the points are being made in order.

"The paper has a clear abstract with limited objectives enabling systematic investigation concerning VAWT rotor configurations and their influence on the cyclic bendingmoments seen at the base of the support tower/main shaft. In general nice connections are made in references to relevant previous work."

Thank you very much.

"The swept area of a VAWT is in general rectangular. The configurations shown appear



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to have a height, H to diameter, D ratio of about 2.5. If the design tip speed and rated power are fixed and we compare with say height to diameter ratio,H/D of 1, the design with H/D= 2.5 has the advantage of lower rated torque but disadvantages of more blade area required and higher base moments. I don't think this impacts too much on your study as I would expect that the results in terms of comparing loads in the K,A,B,C configurations would be similar at other H/D ratios. However this is not proven and it would be good to recognize it as another variable affecting in principle the generality of your conclusions."

Those are very good points. The 3D validated scenario is optimized in terms of cost-efficiency, however as the materials and cost analysis were performed as part of a non-published commercial outside study, this is a troubling matter reference-wise. You are very correct that this matter has to be addressed.

"There is no mention of spiral bladed VAWTs. The idea that distributing the position of blade elements around the rotor circle will smooth torque and loads is already well appreciated and this should be acknowledged. The spiral bladed VAWT is the ultimate in that respect doing it continuously. Your study is a special case where the distribution is in only two discrete blade sets. The case for your idea could then be that while the spiral blades are structurally efficient at small scale, they would be problematic at large scale."

Not mentioning spiral bladed VAWTs was an attempt at limiting the scope of the discussion and to avoid inadvertently leaking intellectual property too early. Right now I would love to add some content about spiral bladed VAWTs. However it must be noted that typical designs of such turbines are not optimal in smoothing bending moments – there is an effect, but as the upper sections have greater leverage than the lower ones the effect achieved is far from perfect. The solution to this, described in a soon to be published patent application PCT/PL2020/000054 lies in a non-linear twist – operating on a similar principle to the upper portion of the 2-part H-VAWT rotor being a specific different size than the lower portion. Finally, both structural concerns and increased weight

of spiral blades makes the technology very interesting in small to medium scales, but far less cost-efficient than the presented scenario in the scale presented and above.

As a general point on presentation, ahead of section 4, I find too many figures showing the configurations. In the space to the right of Fig 2 for example two vertical schematics of 3 blades for K and 6 for A,B,C would show all the configurations more clearly. Perhaps 4,5,6 could be collapsed into 1 or 2 composite figures. On the other hand, figures with graphical display of the results of Tables 1,2, 3 and 4 would be rather helpful. The model testing lacks mention of Reynolds number effects until line 209 starting the conclusions. The comment is out of place there. Its not really a conclusion and should be discussed with the experimental results."

Noted.

"How low was Re or the range of Re in themodel tests?"

Around 10 000 to 50 000 – a very poor range for symmetrical NACA characteristics.

In line 99 "started oscillating" . What kind of oscillations, bending, torsion?

Thank you for the comment – bending.

"English in the paper is generally good but from line 114, the word "growth" is not at all wrong but reads rather strangely. Better is "increase in bending moment values". The way it is written "growth" sounds as if the increase is unusual behaviour when, until stall and unsteady effects occur most significantly, we would expect increase in moments (perhaps as square of wind speed). The graphical presentation of Table 2would definitely help here. The mention of the effects of resonance here is not telling us much with no definition of its nature or suggested explanations."

Thank you for the corrections.

"Finally in your conclusions I think it is pushing it to say more "cost efficient". The results show how bending moments can be reduced and this is certainly useful information





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for a designer that may assist design optimisation. In a fully engineered system it is unclear how the cross arm structures (sizes and drag impacts) for K will compare with the cross arm structures required for blades in a sense cut into two , A, B,C" While this hypothesis has proven to be true, it is based on unpublished outside work – I am very open and thankful for pointing out the issue and possible suggestions whether it is better to make the statement weaker as I do not think we have a right to reference the validation materials; or whether it is better to solve the issue some other way.

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