

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 “Summary: The manuscript discusses a set of experiments and CFD simulations examining various VAWT configurations to reduce the cyclic shaft loads produced by the standard Darreius-style, 3-bladed VAWT. The authors have spent a good deal of time generating the experimental and numerical results which may have applications to VAWT design and optimization.”

Thank you.

C1

“General Comments: The manuscript could benefit from several revisions. The first of these is to expand the introduction and review sections, as they stand the literature review is weak and incomplete. Many studies have been conducted on the twisted-blade VAWT and these should be included in the review and motivation given as to why the current geometry was chosen.”

We would gladly expand on those points. If possible we would also be thankful for specific important articles that should not be missed within this part.

“There are a large number of typos throughout the manuscript (use of “effect” vs “affect” and “smoothing” instead of the correct “smoothing”). Overall, the data presentation could be improved throughout the paper. Results placed in large tables are difficult to interpret and force the reader to sift through various tables to make comparisons. These data sets should be plotted in an organized fashion. The conclusions section needs revision as well. The comments on the Reynolds number are out of place, with no other mention of the effect of Re anywhere else in the manuscript.”

Thank you for the corrections

“Furthermore, the experimental results (on which the bulk of the paper focuses) are barely discussed, which of the 4 designs performed the best?”

Truth be told which design performed the best changes depending on the criterion one might choose. For a general answer to be justified eg sets of cost-effectiveness studies of the tested designs would have to be generated. Design B was chosen as the favored one, being used as the basis for CFD validation – showing improvement in one of the desired reductions over A and no drop in the other as compared to A – like configuration C did. If that would be helpful we would explain that point in a revision of the article

“How close did the simulation and experiment data match?”

As the cases in the simulation and experiment were different, being made for entirely

C2

different scales, we were concerned it might not be correct to compare them directly. It would be very interesting if one were to make a simulation in the same scale as the experiment and match the results. As the point was mainly to validate the design for large-scale

“Line Comments: The statement on line 33 stating the “high aerodynamic efficiency potential” needs to be further justified besides the Ferreira 2014 paper. Many articles have also shown the lower aerodynamic efficiency of the VAWT as compared with the HAWT, some reference should be made to these. “

The articles claiming lower aerodynamic efficiency are made in regard to small designs or low H/D ratio designs as high H/D ratios are problematic loading-wise, a problem that the tested hypothesis tries to solve. We can include the articles making statements based on less related cases, but are not sure whether it is correct to make a critical stance on the views expressed in them without a thorough shift in the article focus, to deeply explain the stance opposing some of the conflicting claims within different sources.

“There are also other benefits to the VAWT design not mentioned such as insensitivity to wind direction and the ability to mount the generator near to the ground.”

Yes.

“Line 46: What is the blockage of the model in the tunnel?”

That is a very good concern – it is not nearly optimal for many purposes. Around 16% without the step before the rotor, 20% with.

“Were any corrections made to the experimental data to account for the effect of flow acceleration?”

No.

“It appears that the simulations did not reproduce the walls of the tunnel, so some

C3

correction should be used.”

It most probably should be more clearly stated within the article that the experiment and CFD case are not trying to show the exact same case, but closest available cases to experimentally and numerically validate the overall usefulness of the special large VAWT concept showcased within the article.

“Line 60: Figure 2 is very difficult to interpret. Can dimensions be added to each figure and perhaps reduce the shading of the 3D CAD models so that they show up more clearly? The figure caption should also have a brief but clear description of the 4 test-cases to aid the reader. Line 70: “For many conditions up to 6” Use specific language, what does “many conditions” mean? Also in this same sentence “momentarily” should be “momentary” and “effect” should be “affect” (there are other instances of this in the rest of the manuscript). Line 83: The use of “smoothening” is incorrect it should be “smoothing”. This should be fixed throughout the paper. Line 83: What is meant by the term “chamfering”? Again, please use technical and precise language in the discussion. “

Yes, thank you for the corrections.

“Line 86: The entire sentence “While the process performed has no influence on the general nature of the experiment results or conclusions onto the effectiveness of the proposed solution, it is entirely possible it has a very slight influence on the exact result values.” Is self-contradicting. How can a process have no influence on the results but have an influence on the exact result values? Did you mean that it does not change the data trends? Please clarify and re-word.”

Yes, thank you. Numerical and experimental values under specific conditions are not guaranteed to be the same in real life conditions, however they in no way invalidate the load-limiting hypothesis of the concept, rather showing very promising results. Further results based on outside non-published studies sadly cannot be referenced to further showcase this point.

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“Line 90: Table 1 should be made into a plot, there is no need to have tabulated data for these comparison points in the paper (similar comment for other data tables).”

Future work based on results within other authors’ articles cannot accurately be made based on plots

“Line 96: Plot the data sets non-dimensionally with the tip speed ratio, what you will find is that forces/moments scale with the velocity squared so this result is not surprising.”

Yes

“Line 115: Shape of what curve?”

Please excuse us - bending moment data curve.

“Line 165: Some comments about how these results might scale up from the laboratory experiments to full-scale Reynolds numbers would be useful. Comments on the CFD Section: Why are these results (and the plotted data) not compared directly with the experimental results of the previous section? I recommend making new plots showing the comparison directly. ”

That would be somewhat hard to explain as they are not related to the same case – rather they are two distortions of a large-scale real-life scenario that would be beneficial but extremely expensive to validate directly. Therefore the validation of possible advantages of the concept happens partially independently through two methods.

“The section title is “CFD Validation”, but you have not validated anything because there is no comparison to the experiments.”

Validation refers to the turbine concept. We will try to make that goal more clear within the article.

“209: The conclusions section needs to be revised due to several issues. The first is the discussion of the Reynolds number which is not mentioned anywhere else in the manuscript (for instance, what is the Re of the experiment?) It is also not surprising

C5

that the performance of the 0018 was poor, it is an airfoil designed for high Reynolds numbers (3 million and above). Also, the conclusion section makes no mention of the 4 different configurations, which one was the best?”

Thank you for the thorough review, if it would be judged that with such corrections the article could be suitable for publishing we will very gladly clarify those points.

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