Our Competition Feedback

Wednesday, May 13, 2015 8:12 PM

Kansas State University

	Design Overview	Design Modeling	Design Diagrams	Design Specifications
Judge 1	60	134	74	55
Judge 2	25	125	50	65
Judge 3	60	135	90	80
Average	48.3	131.3	71.3	66.7
Rubric	60	140	100	100

We received the best score of any report, but we have a lot of room for improvement. See below for specific comments related to judge feedback.

Our power curve was much better than we anticipated, but the turbine performance was not spectacular. We received the lowest score for testing of any team at competition. More information on the competition turbine performance results is given in the "Competition Results Report.docx" and "S15 Competition Results Analysis.xlsx" files. -Shane Smith

Power Curve

Wind Speed/Power in watts	5	6	7	8	9	10	11	12	13
	0	0	0	0.475	4.25	8.35	12.05	15.65	19.5
Wind Speed/RPM	5	6	7	8	9	10	11	12	13
	0	97	2423	3155	3626	4008	4417	4843	5286

Design Review Judges Notes

Judge #1: One of the best overall reports.
- Great report structure, good descriptions, nice aesthetic feel
- Good descriptions of design process showing choices along the way
- Good description of testing process
- Many of the diagrams were scaled and difficult to read
- Could have had blade & tower drawings
- Biggest shortfall was lack of final specifications table and power vs. wind speed data. These are the first things many would look for.

Judge #2: The report was very well-written. There was a good balance of description complemented by analysis and reporting of testing results. It was nice to see a description of the rotor design process from airfoil selection, to software used, to the type of FEA analyses preformed. It would be good to have seen some results of the analysis beyond the single plot of Cp versus TSR in figure 1.
Generally, it would have been nice to see some loads analysis and structural analysis for the main load-bearing components. The drawings were nice but they don't add a lot on their own.
It was excellent to see the decision making process that considered the interactions between the design aspects of the major turbine components. The analysis of the generator speed as it complements the design TSR was great – especially since it was used in the subsequent decision about what generator to use; and further, the testing results used to inform the addition of the gearbox to step up the speed to the generator for increased power. It is important to remember that a wind turbine is a coupled system and that decisions about design of one component affect the rest of the system.
The electrical and control system design was also well presented. The block diagrams were well complemented by the text and the more detailed circuit diagram. It was good to see that a variety of tests were performed on the whole system but it would have been nice to see some analysis and testing of the electrical sub-system on its own. There was no mention of the software used in the design of the electrical system and analysis conducted with it.
The overall specifications of the turbine were not provided and there wasn't much in the way of a high-level design overview, but the report overall was well-organized.

Judge #3: Very nice cover sheet that acquaints the reader to the turbine with a nice 3D CAD screenshot. Overall, a very well written report that is clear and concise!
Design Overview:
Good focus on simplicity. The simplest solution usually works better in the long run and costs less. When creating new products, it is always best to build on what has been learned before. By taking the same airfoils as NREL turbines, you are building off of others. Good to include the Cp vs. TSR chart from Q-Blade. Note that when Cp is discussed, it is good to declare if it is mechanical efficiency (as it is in your plot) or total efficiency which includes electrical losses of the machine. In table 1, be careful about using too many significant figures. Good identification of the multi-disciplinary needs of wind turbines and how the rotor torque interacts with the generator. Nice drawings showing an overview of the size of each component.
Flow charts are an excellent way to simply show the control system and circuits.
Modeling and Testing:
Good to use FEA to confirm safety of the turbine. However, I doubt that fatigue is load constraint due to the short life of you turbine. Extreme/maximum loads should be focused on.
Good job learning from testing what was and was not working. Adding a gearbox is large change in torque and design that should have been included initially. However, learning from testing is key! In figure 9, your lines are not labeled. Whenever you get out of the ordinary results, you should indicate why it is happening. You should say why power plateaus at 6W for a little bit around 3500 RPM.
Good report. In industry we are often posed with the same type of project: develop a turbine with specified requirements. When communicating the solution, you should include the design requirements and address how your solution meets those requirements. I would have liked to see a table showing the spanwise distribution of chord, twist, and performance of your blades.

We scaled our diagrams to try and fit under the suggested page limit. We also omitted many drawings, especially blade specifications to allot more report space to the electrical component and testing segments of the report. Due to the limitations of our testing, we did not have prepared specifications or experimental power curves. Our successful test of our turbine came after the submission of this report. -Shane Smith

It is clear that more testing and analysis information needs to be included in future reports. Part of this is time management and good design practices to allow sufficient testing before report submission, the rest is writing the report concisely enough to allow that much information and figures to be included in the page numbers allotted. -Shane Smith

Q-Blade provides a handy table of the distribution of chord and twist of the blades. It also shows the loading along the blades in the normal and tangential directions. That data should have been included in our report. -Shane Smith