

In this paper, the authors describe a comparison of the main bearing unit for two different versions in a 2.3 MW wind turbine: one with a standard cast iron shaft and the other with an air hardened ductile (AHD) shaft. They then compare the masses, costs and global warming potential of each variant. In general the article is well written and quite detailed. Having said that, I offer the following comments for consideration to improve the article, in many cases for the more general wind energy reader who might not be very familiar with steel processing.

#### Abstract

- Line 18: Instead of the somewhat vague “greatly reduced” I think it would be better to state the figure from the Conclusions such as “reduced by X%”. Please see later comment on the Conclusions though regarding the exact percentage.
- Line 19: As noted in the Conclusions, I think it would be beneficial to the reader to add the caveat that “the GWP of hollow forging is comparable to casting and each are actually less than one-third of the GWP of the entire MBU.”

#### 1 Introduction

- Line 37: I am not sure I understand the explanation here regarding a higher inner shaft diameter, section modulus, area, and outer shaft diameter. A fixed section area  $A$  and outer diameter  $D$  means a fixed inner shaft diameter  $d$  as well. In looking at Figures 2 and 3, it appears the outer diameters are similar (1000 mm), but the inner diameter and section area of the AHD shaft in Figure 2 is smaller than the case diameter shaft in Figure 3.

#### 3.2 MBU designs and power density analysis

- I believe the main points of this section are to summarize the design characteristics of the original maxcap 141 MBU, then the hollow forged shaft MBU, then the cast shaft MBU. I think the main point of including the maxcap 141 characteristics is to show that the other designed MBUs discussed in the remainder of the paper are “similar enough” to the actual maxcap 141. Having said that, I’ll admit that I got a bit lost by the relatively long text explanations. A summary mass Table I think would be really helpful and shorten some of the text, especially as related to lines 145-162. Tables are used elsewhere in the article to good effect.
- Line 80 and Figure 1: Terminology in this sentence, the figure, and the remainder of the paper are not quite the same, leading to a little bit of confusion. I believe it would be clearer to label both the “Upwind main bearing” and “Downwind main bearing” rather than just one “Main bearing” in the figure. Are the assembly components the same as the red components? Also, the “Machine frame” is labeled twice for both the green and grey components, with the green component (I think) called the “Main bearing housing” in the remainder of the paper (for example, in Section 3.3.3 and Table 5) and the grey component separate and not in the scope of the study. Additionally, the text states “The bearing housings...connect...gearbox to the azimuth bearing”. I don’t believe this is correct: as far as I can tell from the figure the gearbox is only connected to the grey “Machine frame”, but not the “Main bearing housing”. But I could be wrong here. It does not seem to be worth mentioning the azimuth bearing, as it is not shown in the figure and not in the scope of the paper either.
- Line 85: Not being an expert in this area, I am not familiar with the term “...requires a surface surcharge...”. Can this be explained a bit? Does this effectively mean a “...requires a higher wall

thickness...”? It is used throughout the paper, so a short statement here to its meaning would be beneficial.

### 3.3.1 (Hollow) forging manufacturing costs

- Lines 199-203: Is it a correct understanding that the cost of the drilling of the solid forged shaft is not included in the analysis?

### 3.3.2 Casting manufacturing costs

- Line 207 and Equation 6: It’s minor, but is there a reason with the mass is denoted with subscript RS,C compared to Shaft in Equations 4 and 5?

### 3.3.5 Manufacturing cost comparison

- Line 242: Again, not being an expert in this area, I am not familiar with the term “...axial upsetting”. Can a brief description be added here? Does this refer to standing the shaft upright, such that gravity has some compressive effect on it?

## 4 Conclusions and Outlook

- Line 350: Here I am not clear on the percentages “total forging surcharges need to be reduced to around 50%”. Does this literally mean in line 347 that instead of “160% in total compared to 32% for casting” it would have to be “50% in total compared to 32% for casting” to have similar costs, or would it be “80% in total compared to 32% for casting”. I hope this question makes sense – it is a matter of discussing percentages of percentages. I think it is the former, thus when discussing the surcharge it has to be reduced from 160% to 50% for similar costs.
- Lines 352 onward: Maybe missing in the discussion of the GWP is that both shafts contribute less than 1/3 of the GWP of the total MBU. A larger portion actually comes from the bearings and housing. I wouldn’t have necessarily expected this.
- Figure 6: In the middle figure, what does “Rotor shaft (lower)” and “Rotor shaft (spread)” mean? I don’t believe I’ve seen this explained yet. Does this indicate the lower bounds and upper bounds for the shaft (i.e. the spread)?

### Minor grammatical comments:

- Line 14: I think it would be clearer to say “...main bearing unit (MBU), consisting of the rotor shaft, main bearings, and bearing housings, are...”
- Line 18: I think it would be clearer to add “...the manufacturing GWP of hollow forging...”
- Line 172: Although it’s October and near Halloween, “costumer” should be “customer” here 😊.
- Line 181: Rather than “calculates to 2”, is this more accurately “assumed to be 2”? Or was this truly “calculated” somehow?
- Line 230: Rather than “economically”, I think “economical” is better.
- Line 258: A space is needed for “fromTable 6”.