Response to Editor 1 Comments

Nico Galarza and Brent Houchens on behalf of the authors, August 3, 2026

Dear Editor,

We greatly appreciate the detailed and constructive feedback on our manuscript. Responses are included below and throughout the paper. This review process has greatly improved the quality of our manuscript, and we are very grateful for the opportunity to have our revised manuscript considered.

Best regards,

Brent and Nico, on behalf of the authors

<u>EC1 Comments</u>

> The study describes the use of the Microgrid Design Toolkit (MDT), developed by Sandia National Labs, to compare an AWES-only microgrid with an AWES plus solar PV microgrid deployed on a Caribbean island. A major point of concern is the many assumptions made regarding performance, losses, and cost elements, often without reference, with only marginal justification, and without any possibility of validation. This renders the study highly speculative. There is nothing we can do about it, since the technology is not yet commercialized, and this information is simply not available.

> We agree completely with these concerns and have now clearly detailed all of our assumptions and provided references as justification, even when those are for related but different technologies such as towered wind. Since the technology is not fully commercialized, we thought a revised approach using limiting bounds would be more useful, so we also reran the simulations and are now presenting all results considering both optimistic and conservative estimates on each of:
> a) losses of AWES performance,
> b) wind resource, and
> c) OpEx.

> Even if the information is not fully knowable yet, this allows us to show which effects are most important, and help interpret where to put the most effort toward pilot projects.

> System losses are now described in detail in Section 3.1.1 AWES Operational Uncertainties. The TEA considerations have been greatly expanded in Section 3.3 showing all cost assumptions. Two bounding scenarios – assuming a best-case wind resource year for all 20 years, and a worst-case wind resource year for all 20 years – were investigated to demonstrate the sensitivity of the microgrid configurations to the wind resource extremes.

Then, although at the core of the study, the MDT is not explained in any way. What is missing is a section, or at least a subsection, that outlines the architecture of the toolkit, and how it works, what it can do, and what it can't. How is it optimizing? Are there other tools that can do something similar?

We agree – this was an oversight on our part. We have added Section 3.2.1 Microgrid Design Toolkit which introduces the software, points to the version used (which is freely available for download) and describes how we used it in sufficient detail that we believe others could replicate our findings.

Units need to adhere to the journal standard - see https://www.wind-energy-science.net/submission.html#math. For example, m/s should be written as ms^{-1}

We have corrected these to the journal standard. Also we have accepted detailed suggestions in the text or rephrased appropriately.

The reference height for Skysails PN-14 is 200 m. Please adjust this.

We added a discussion about the reference height for the power curve in Section 3.1:

"Note that the SkySails power curve was measured over a range of operating altitudes around and above 200 m, which was used as the reference height, with 500 m of tether taken as indication of the start and end of a power cycle. A primary reason cited for using 200 m as the reference height is the high availability of the LiDAR data being greater than 97% at this altitude. SkySails claims that extension to 250 m has less than a 2% estimated impact on the annual energy production (AEP) (Bartsch 2024)."

More importantly, we discuss the assumptions required to carry out the analysis at 300 m, which offers the best compromise between wind resource and required tether length/drag.

"Here the goal is to estimate optimum potential performance, so this analysis assumes that the system operating at an average of 300 m follows the same power curve. This notably requires either operating at a steeper tether inclination angle or increasing the tether length to maintain the same tether inclination angle, both of which could impact the power curve. Here it is assumed that the tether length is increased, allowing operating altitude to increase from the 200 m power curve reference height to 300 m at that same inclination angle, but additional drag on the tether is neglected. Furthermore, this assumes the percentage of time and energy consumed during reel-in is unchanged from that in the measured power curve."

We do calculate the AEP at both 200 m and 300 m and show there is a ~2% difference in

“For operation at 200 m the wind resource is only marginally reduced…. The AEP based on hourly averaged wind data at 200 m is between 2.1 and 2.3% less than the values in Table 1 (at 300 m).”

We hope that this justifies the desire to both calculate the optimum potential of the system while also fairly representing the assumptions required.

The analysis only deals with CapEx, yet recent studies have shown that a considerable fraction of the CapEx is shifted to the OpEx for AWES, due to the required regular replacements of flexible fiber and membrane materials.

This is a very good point. To address the uncertainty around OpEx, we added Section 4.3 AWES OpEx Sensitivity for Wind-only Configurations.

It was found that the impact of OpEx between the extreme high (\$135/kW-yr) and extreme low (\$67.5/kW-yr) values considered was less than 10% of the overall cost, whereas the AWES efficiency ranges we considered had around 11% impact, and comparison of the worst to best wind resource year was the largest driver at around 20%. Thus, we presented most results with just the largest OpEx assumed as it was the tertiary driver.

It should be noted that these findings are in part due to the methodology of setting a target LCOE for the AWES and working backward to allowable CapEx. This is really only relevant for pilot projects such as that considered here, with the expectation that such projects in the near-term will have high CapEx, but that as the technology matures the CapEx will come down and OpEx will then be a bigger fraction of costs. OpEx for pilot projects is even harder to estimate, so a large range of values is used but these are more justified as long-term OpEx costs, not near-term costs. To clarify this, we have added the following in Section 4.3:

“It is important to note that this paper focuses on a pilot project, where the CapEx is dominate because the technology is not fully commercialized. As AWES technology matures, CapEx will decrease and OpEx will become a more important fraction of the costs.”