

Thank you for your thoughtful review of our manuscript, 'A Simplified, Efficient Approach to Hybrid Wind and Solar Plant Site Optimization'. We have made changes in response to each of your comments, and with your help we hope to have produced a significantly strengthened manuscript.

Overall

- Nice work and very interesting. As written, the paper undercuts the novelty of the work in moving towards physical design optimization of HPP (see detailed notes below). The core contributions surround the learnings related to HPP design under different conditions. Too much emphasis is placed on the mechanics of the optimization rather than the results (which are really interesting!). Again, see detailed notes below.

Thank you for your perspective. We have adjusted the abstract, introduction, and conclusion to place greater emphasis on the results and interpretation. Additionally, we have made changes throughout the manuscript to place less focus on the optimization mechanics and more on the results. In particular, additional interpretation has been added to each experimental result subsection in Section 4.

- Lots of acronyms are used without definition on first use – it is particularly important to correct this as many of them are solar related and this is a wind journal. People will not know these.

We have reviewed every acronym used and ensured that it is defined when first used.

- Generally, the article could benefit from a primer for wind people on solar. It is particularly hard to follow section 2.3 which seems to be a very interesting and relevant contribution of the work

We have added a PV design and PV modeling primer to Section 2.

Abstract

- Avoid acronyms in the abstract – if used, you need to put them next to the word on first use (i.e. line 7)

We removed all acronyms from the abstract.

- What is scientifically interesting about the work? The tutorial is not really a scientific contribution. Consider replacing the last sentence with something of interest that was discovered in the optimization process – surprising trends in the designs, tradeoffs that were significant, etc
Introduction

We revised the last sentence to emphasize our findings, as well as reworking the last paragraph of the introduction to focus on these findings rather than the tutorial, which has been moved to Appendix A.

Introduction

- It would be helpful to define hybrid power plants in the intro – don't assume the reader is familiar or has the same understanding of HPPs

We added a definition of HPPs in the first sentences of the intro, and additional supporting information as needed.

- Many WFLO problems in literature focus on cost of energy or cost/energy – work looking only at energy optimization is a bit outdated

We added a mention of LCOE optimization in WFLO, along with a few recent citations using LCOE as an objective. We added a mention of using the Financial Models for calculating NPV to Section 2.

- I think it is important to distinguish a bit more on the topics of hybrid power plant optimization problems. You mention sizing – there is a TON of literature in this space and most of these fall into the category of MILP since they focus on sizing the assets time-series energy production. Here you are going BEYOND sizing to look at physical design – which is a nascent area where little research has been done. Make sure that message is clear in the abstract, intro and conclusions

We added a sentence discussing this to the first paragraph of the introduction, a clear statement to this effect to the abstract, and a statement to this effect in the beginning of the conclusion.

- Please remove the section 1.1 and transform this into a paragraph. Bullets should only be used if absolutely necessary and they are not here.

We removed Section 1.1 and reworked its content into the second to last paragraph of the introduction.

- The last sentence in section 1 "We aim..." reads a bit funny... maybe just say, In this work, we provide a proof of concept of stochastic optimization of low-d parameterized layouts as an effective method...

We rewrote this sentence as suggested and incorporated it into the reworked final two paragraphs of the introduction.

- Consider adding a paper roadmap at the very end of section 1 Hybrid plant model

This suggestion motivated us to rework the last two paragraphs of the introduction and to combine the paper roadmap with the reworked contribution list, which can now be found in the second to last paragraph of the conclusion.

Hybrid Plant Model

- For sections 2.1 and 2.2 can you elaborate a bit more on the limitations of the selected wind and solar plant model – there are many model choices here and they aren't well justified

We added a passage to Section 2.1 justifying our wake model choice and its limitations, and another to Section 2.2 discussing our PV model parameters and choices.

- Section 2.3 is hard to follow. Figure 1 is particularly interesting but only 3 time steps per hour seems like pretty low resolution- is there any validation of this?

We added a discussion of Figure 1 (now Figure 2), including that it was generated as a demonstration using a short time window and lower resolution than used in our model.

- Figure 2 bounds don't need to be so big as there is negligible effects beyond +/-200 and are these meters? Nothing is labeled

We added meters to labels and updated the caption to address this concern.

- Consider putting a picture ahead of figures 1 and 2 that shows the layout of the turbines and PV being simulated. Without having such a visual, its hard to tell what is going on... there is a lot of information described in text where diagrams would be helpful

We added a sub figure to Figure 1 (now Figure 2) showing how the PV modules are laid out all around the turbines in a sub-grid within the turbine layout. Additionally, we added a figure to the beginning of Section 2 visualizing an example layout and setting the stage visually for the reader to contemplate the hybrid plant layouts discussed later in the text.

- Is this model described anywhere else? I don't see any citations. If there is not enough space in situ, an appendix that more thoroughly describes the model would be helpful Optimization methodology

We added a description of the shadow flicker model to Section 2.3, and a link to the source code implementation of the model.

Optimization Methodology

- Again, some diagrams could be helpful here – using the baseline plants for example. It is hard to follow table 1 on first inspection. I had to reread the section several times and scrolled down to figure 5 and 6 to in any case to help interpret it

We found it quite difficult to produce a meaningful diagram, but have clarified the descriptions of the parameters, added Figure 1 visualizing a typical layout under this scheme before the parameters are presented, made the reference to further discussion of the turbine layout parameters more prominent, and added links to the implementation of the parametric layout mapping parameter values to physical layouts.

- I think it is fine to choose AEP as this a first study of this type so it is good to start there rather than add additional complexity. The long discussion is not necessary and could be moved to future work. Again, its important to emphasize in the introduction that this is a physical design study to differentiate from all the work on sizing of HPPs that already exists

We simplified the discussion of objective choice and moved it into the future work section of the conclusion. We adjusted the language here and in the abstract, intro, and conclusion to emphasize physical optimization as primary contribution of this work.

- It seems there is a lot of work going into the constraints handling that is manually programmed. Can you describe this more in an appendix or refer to code documentation? Generally, it would be nice to see references to the code here

We added a link to the source code repository to contributions section. We added a URL pointing to the exact block of code implementing the mapping of parameter values to physical locations of turbines and solar modules to Section 3, and we added a third link to the exact block of code applying soft constraints to the optimization problem.

- ES is a good starting point but certainly an area for future work as well

Agreed. We added a passage to this effect to the future work section.

- Do you have a reference on random search? Experimental results

Random search is such a basic strategy that it is not generally considered as an official approach. Fundamentally RS is just blindly generating random layouts from a fixed distribution. We added a passage to the RS section clarifying its use here as a simple baseline for evaluating the benefits of more complex ES algorithms.

Experimental Results

- Consider using a table for the properties of the two sites. Again, a lot of things are described in text where diagrams or tables would be better

We added a table to the beginning of this section providing a clear comparison of the two sites.

- Interesting that the high correlation sites have a lot more spread in terms of AEP gains... I'd like to see more discussion on this and explanation

We agree. Additional discussion into this trend shown in the data adds significant value to the manuscript. In response, we have added several sentences discussing these results, proposing a possible explanation, and potential resulting design guidelines.

- In section 4.1, A core scientific contribution of this paper is on how the difference in correlation supports different trends (exploiting trade-offs differently) in system design. I would have liked to see a partitioning of the effects of the correlation versus the wind rose. It would be nice to see the wind roses swapped to tease apart the effect of the strength of directionality of the wind rose versus the strength of the correlation in terms of influencing the design trends. Maybe you can speak to this a bit more without having to do the optimizations themselves...

We agree. Just as with the previous point, we expanded the discussion of the influence of resource correlation on optimized layouts, and pointed to future work to further elucidate the impact of resource correlation and other factors of interest on design guidelines.

- Section 4.4 can be an appendix – instead it would be nice to see more elaboration on sections 4.2 and 4.3 – the value of the paper is in explaining and understanding the influence of site conditions and problem formulation on design trends for HPPs. The particulars of the algorithm are secondary.

We agree. We moved Section 4.4 into Appendix A. Just as with the previous two points, we significantly expanded sections 4.2 and 4.3. In Section 4.2, we added discussion and interpretation of the results and the possible design influences of various mixes of solar and wind generation. We proposed explanations and design guidelines informed by our optimization results. In Section 4.3, we added further

interpretation of the results using varying interconnect capacities and a discussion of the design principles these results hint at.

Conclusions

- I recommend rewriting the conclusions completely. The emphasis should be on the results and interpretation of the HPP design optimization – not the optimization mechanics.

We have completely rewritten the conclusion, placing a strong emphasis on the results and their interpretation, and the possible design considerations these results imply.

- Future work could be extended quite a bit – a lot of the discussion in 3.2 could be brought here

We expanded the future work discussion to cover many of the points from Section 3.2, as well as motivating further investigation into the trends and possible design guidelines revealed in Section 4.

Thank you again for your time and valuable feedback. Your assistance has helped us meaningfully improve our manuscript.

Best,

Charles, Darice, Jen, and Aaron.