

Reviewer Comments: Insuring the green economy against natural hazards – charting research frontiers in vulnerability assessment

The paper presents data on which hazards to green infrastructure have been estimated in a way that can be useful to insurers looking to provide coverage. To do this, they identify 37 asset classes and 28 hazards, and show which of the combinations of asset class and hazard have existing research on the topic. This is very useful for research moving forward, as it identifies areas of the green economy where there is little to no research on the possibility of damage to green infrastructure.

The main deficiency of the paper is that there is little insight to how important each intersection is, apart from excluding the cases that are unlikely to occur and so do not have research. Some of the asset classes identified will be, or already are, a major part of the green economy, such as land-based PV farms. The paper makes a start on this question by breaking it down into plausible impacts and implausible impacts. This is a good start, and generally good enough to publish the paper as a way to move the discussion forward. However, it may be useful to address which of the plausible but understudied impacts might be most relevant.

Main points of consideration

1. The paper does not currently distinguish between direct damage to infrastructure versus losses due to reductions in performance. Both are discussed throughout, but it is not made clear how insurance contracts typically work in this context, if they only generally cover direct damage, or if there is usually cover for performance, or if it is context dependent. Additional context would be useful to understand where the main gaps are, and which are most relevant for insurance markets. As an example, it is noted that quantitative studies were found for 4% of the intersections, but it would be useful to have a sense of what share of the value this represents.
2. While insurance is one way to prevent losses from climate-related damage, there may also be adaptation measures that can be taken to reduce or eliminate losses. For example, the authors note that flywheels operating in dust storms have not been researched, however, there may be low cost ways to protect flywheels from the effects of these storms. Other adaptations may be more costly, such as shielding solar PV from hail damage, in which case insurance may be the better way to reduce risks. While the authors do not need to conduct an analysis of the potential for adaptation in each case, there should be some discussion of how this may factor into the analysis of which combinations are plausible. It may also be reasonable to ignore this possibility, but then this assumption should be stated.
3. Relatedly, it is noted that volcanic risks for example are generally avoided by prohibiting development nearby. This would seem to raise some ambiguity as to whether these risks are then “Unknown” or “Not Applicable.” It would help to have some guidance on how this ambiguity is resolved.

Minor Comments

4. At the top of page 2, it is highlighted that the expansion of green assets presents an opportunity for insurers, but it could also be noted that the provision of insurance may help to encourage the further expansion of green assets. It may be useful to have an estimate of the total size of the green asset market that may be insurable, to give an overall sense of scale.
5. The rules for the inclusion of assets are not entirely clear. For example, it seems that pumped hydro storage could fit into the category of energy storage infrastructure along with electric batteries and hydrogen, but is not included. This is similar for the exclusion of new buildings that are not mass timber.
6. In Table 1, there is no need for 3 separate columns under CL2. Tiers 2-4 all fall under CL2, they can be in the same column. The additional columns may create confusion.
7. The sentence beginning on line 178 does not appear to be complete, it is difficult to understand what is meant.
8. In Table 3, it is unclear what is meant when a rating of “Unknown” has a confidence level. While most of them are level 3, some are also level 2, indicating there is some qualitative evidence. It should be explained what is meant by this combination.
9. Table 3 may be difficult to read for people with red/green colorblindness.
10. In Table 4, there should be a legend explaining the meaning of the colors that appear on the heatmap. It is also not clearly explained what it means to have no circle, an empty circle, or a filled circle.
11. In Section 3.2, it would be useful to have a specific discussion of how the taxonomy would be used by insurers, or how the lack of a taxonomy is hindering the provision of insurance, rather than simply stating that the paper “highlights the need for an asset-hazard taxonomy tailored to the green economy.”
12. The sentence beginning on line 402 is not clear (I assume it is meant that no quantitative evidence for losses due to cable failures was found).
13. In the Conclusion, there could be some discussion on how much insurers generally rely on scientific research to inform their understanding of risks, compared to how much do they have to rely on it because it is a new and emerging sector. Presumably they could conduct their own studies as well, if there is a potential market in a given sector.