

## Response to reviewers

To the editor and reviewers,

Thank you for taking the time to consider our paper for *Energy Strategy Reviews*. The suggestions and feedback have been incorporated into the revised manuscript, and a point-by-point response to feedback with changes made is detailed below. We hope the revised manuscript can be considered for publication.

Best regards, Sebastian Zwickl-Bernhard and Hans Auer

Reviewer #1: We thank the authors for this revised version and the changes made. We have no further comments.

**Author's response:** We thank Reviewer #1 for the review comments provided, which allowed us to significantly improve the quality of the manuscript. In particular, the additional sensitivity analysis requested in the previous round of review was helpful and completed the results from our viewpoint. We acknowledge the contribution to improve this manuscript in the acknowledgments. Thank you very much!

Reviewer #2: Dear authors,

**Review comment:** Please explain why there is no fluctuation in Future contract curve within a 2-day interval in different hours.

**Author's response:** In the manuscript, Equation (11) describes the constant future contract generation of the hydro power plant. It is assumed that the future contract is a constant generation band throughout the year, which results in a constant generation in each hour. Therefore, there is no fluctuation in future contract curves, such as shown in Figure 2a and 2b. This fact is already described in the methodology section of the manuscript. In particular, it is explained in Section 3.2 Leader's mathematical framework. We refer to the following text which is stated in the Constraints paragraph at page 15:

*Equations (11)-(13) ensure a constant future electricity contract and hydrogen production at each time step  $t$ . For simplicity, annual future electricity contracts are considered only. Therefore, a constant electricity generation during the year is modeled.*

In order to make this point even more clear, we added the following text to the last sentence of the aforementioned text: *Therefore, a constant electricity generation during the year is modeled and thus there is no fluctuation in the future contract curve.* We do think that this point is now clear in the manuscript. Thank you for the comment.

**Review comment:** The feasibility of the proposed scheme is still a matter debate.

**Author's response:** Regarding the feasibility of the proposed scheme, we would like to refer to our response for the previous rounds of revisions where we carefully addressed the issues related to the general approach of the paper. From our viewpoint, at least the following points are important when considering our proposed non-cooperative game between the hydrogen producer (hydro power plant) and hydrogen consumer (transportation firm):

- Our study primarily focuses on the cost-optimal trade-off decision for a hydropower plant owner on where to place its available electricity generation. In our work here, we propose a (non-cooperative) game-theoretical approach, which allows us to investigate the optimal strategy for each agent individually (i.e., both hydrogen producer and consumer).
- From our viewpoint, a high number of utilization hours for the hydrogen production facilities are crucial in order to enable a profitable penetration of hydrogen to the market. Again we refer to Section 5.5 in the revised manuscript which covers from our perspective the more flexible generation of hydrogen. In that case, the constant hydrogen production constraint is excluded.
- The used benchmark indicator of the number of utilization hours (or utilization ratio) provides highly relevant information of the profitability of (green) hydrogen production. Therefore, ensuring a constant hydrogen production in case that the hydropower plant owner decides so from an economic-driven perspective could lead to a business case in practice. We do want to show that hydrogen production based on hydropower competes with producing and selling electricity at different markets. Particularly, repurposing hydropower capacities might take place only when the power plant owner gets monetary incentives for this action. Otherwise, it is more likely that generation capacities are used for electricity only.