Landscape preservation vs. wind energy: an overstated trade-off?

Comment on: "*Data-driven landscape scenicness mapping for continental-scale onshore wind resource assessment*"

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A recent study by Chen et al. [1] published in *Energy and AI* highlights the relationship between landscape preservation and wind energy deployment. The study finds that high preservation of scenic landscapes could reduce wind energy potential in countries such as Switzerland by approximately 60%. This has been interpreted as evidence of a pronounced trade-off between landscape preservation and the energy transition ([2], [3]).

We appreciate the integration of social and environmental aspects into large-scale energy planning. In particular, Chen et al. advance the field by providing one of the first consistent, continent-scale datasets on perceived landscape scenicness. Integrating this dimension into energy system analyses is an important and necessary step forward. At the same time, we would like to reflect on the study's results based on our ongoing work within SPEED2ZERO.

When assessing constraints on wind energy potential, the significance of any proportional reduction in energy potential depends critically on the definition of the baseline. Remoteness, ruggedness, and limited human impact are important indicators of highly scenic landscapes, but they are also closely associated with practical development constraints such as complex terrain and long distances to roads and energy grid infrastructure. Since some highly remote alpine locations are considered to be prime sites in the study, the eligibility criteria do not appear to capture important practical development constraints, a limitation acknowledged by the authors. The analysis does not account for the substantial investment required to make these remote locations accessible and connect them to the grid. By including such remote locations in the baseline, the reported trade-off between the preservation of scenic landscapes and wind energy deployment seems higher than it is in practice.

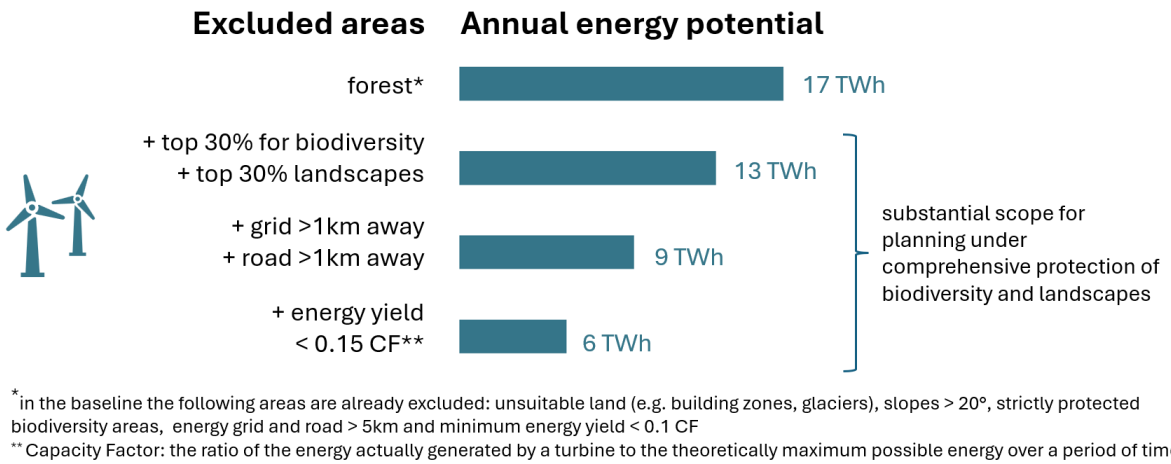
A further issue is the assumption of a single turbine model applied uniformly across Europe. In alpine terrain narrow roads and tight curve radii often make it physically impossible to install turbines of the same size as those in flatter regions. This would further reduce both potential energy production and economic viability. Together, these factors suggest that the study may systematically overestimate the wind energy potential of scenic alpine landscapes, and the reported 60% reduction in potential for Switzerland in a high preservation scenario is likely an overestimate of the real loss in energy potential.

Many areas throughout Europe do not have any data on landscape scenicness and the findings of Chen et al. are a valuable novelty at the continental scale. To consider the national characteristics of Switzerland specifically, data on landscape quality at higher resolution is available ([4], [5]). These datasets capture the regional context more accurately and do not rely on extrapolation from AI models trained on landscapes in Great Britain. In our work within SPEED2ZERO, we combine this local data with technical, regulatory, and economic criteria in the Swiss SolarWind Explorer [6]. When these aspects are considered together, economically viable sites tend to be closer to existing infrastructure, easier to access, and in less complex terrain. These areas are often already influenced by human

activity and, in many cases, are less sensitive from a landscape preservation perspective. Therefore, we observe that the trade-off between preserving scenic landscapes and enabling wind deployment is frequently overestimated.

The key question is not whether scenic landscapes should be protected, nor how much the theoretical wind energy potential is reduced by doing so. The energy transition does not depend on exploiting the full theoretical resource. When interpreting a reduction in potential, the focus should thus not be on what is lost but rather on what remains. Even under restrictive assumptions, the remaining technically, legally and economically feasible wind potential is still substantial in absolute terms. In our analysis for Switzerland, we find that after consideration of practical development constraints including a maximum distance of 5 km to energy grid and road infrastructure, followed by the exclusion of forests, and the exclusion of the most valuable 30% of areas for biodiversity and landscape preservation, an annual potential of 13 TWh remains ([7]). This is still more than sufficient to meet national energy targets of 4.3 TWh per year by 2050 ([8], [9]). Fig. 1 illustrates the substantial scope for planning that remains under comprehensive protection of biodiversity and landscapes. Applying considerably more restrictive constraints such as limiting deployment to sites with better energy efficiency and within 1 km of energy grid and road infrastructure, still results in sufficient potential to meet the national energy target. A narrative that frames landscape preservation and wind energy deployment as an either-or choice risks distracting from the real challenge: how to best use areas of high suitability.

Overall, Chen et al. make an important contribution by integrating landscape perception into large-scale energy system analyses and advancing much-needed discussion. Simultaneously, when interpreting these results, particularly for Switzerland, it is essential to account for the full set of planning constraints and the availability of more region-specific data. Our analysis suggests that energy transition and landscape preservation are not fundamentally in conflict. With integrated, spatially explicit planning, it is possible to identify locations where wind energy can be deployed efficiently while respecting landscape values and without compromising the overall feasibility of the transition.



*in the baseline the following areas are already excluded: unsuitable land (e.g. building zones, glaciers), slopes > 20°, strictly protected biodiversity areas, energy grid and road > 5km and minimum energy yield < 0.1 CF

** Capacity Factor: the ratio of the energy actually generated by a turbine to the theoretically maximum possible energy over a period of time

Fig. 1. *Annual wind energy potential remaining in different exclusion scenarios in Switzerland.*

Bibliography

[1] R. Chen, T. Pelser, A. Lohrmann, J. M. Weinand, and R. McKenna, “Data-driven landscape scenicness mapping for continental-scale onshore wind resource assessment,” *Energy AI*, vol. 24, p. 100752, May 2026, doi: 10.1016/j.egyai.2026.100752.

[2] J. Laukenmann, „Schutz schöner Landschaften reduziert Schweizer Windkraftpotenzial um 60 Prozent“, SonntagsZeitung, May 17, 2026, S. 60–61.

[3] J. Laukenmann, „Windenergie Schweiz: Ausbau trotz Landschaftsschutz“, Tages-Anzeiger, May 17, 2026. [Online]. Available: https://www.tagesanzeiger.ch/windenergie-schweiz-ausbau-trotz-landschaftsschutz-329592771437.

[4] S. L. Radford, J. Senn, and F. Kienast, “Indicator-based assessment of wilderness quality in mountain landscapes,” *Ecol. Indic.*, vol. 97, pp. 438–446, Feb. 2019, doi: 10.1016/j.ecolind.2018.09.054.

[5] M. Riva, F. Kienast, and A. Grêt-Regamey, “Mapping open spaces in Swiss mountain regions through consensus-building and machine learning,” *Appl. Geogr.*, vol. 165, p. 103237, Apr. 2024, doi: 10.1016/j.apgeog.2024.103237.

[6] M. Reusser, O. Robaina, P. Sieber, J. Schwaab, and A. Grêt-Regamey, *Swiss SolarWind Explorer*. (Dec. 03, 2025). Zenodo. doi: 10.5281/ZENODO.17962422.

[7] Sieber, P., Reusser, M., Hertig, H., Schwaab, J., Seneviratne, S. I., & Grêt-Regamey, A. (2026). Swiss [7] P. Sieber, M. Reusser, H. Hertig, J. Schwaab, S. I. Seneviratne, and A. Grêt-Regamey, “Swiss SolarWindExplorer: Mapping low-conflict areas for ground-mounted solar and wind energy installations,” presented at the SPEED2ZERO Final Event Poster Session, 2026. [Online]. Available: https://speed2zero.ethz.ch/en/poster-session/

[8] Bundesamt für Raumentwicklung ARE, “Konzept Windenergie,” in Basis zur Berücksichtigung der Bundesinteressen bei der Planung von Windenergieanlagen, 2020.

[9] Swiss Federal Office of Energy, “Energy Perspectives 2050+,” Swiss Federal Office of Energy, 2022. [Online]. Available: https://www.bfe.admin.ch/bfe/en/home/policy/energy-perspectives-2050-plus.html/