

GREEN ENERGY, GREENER HABITATS. EXPLORING PUBLIC PERCEPTIONS OF THE BALANCE BETWEEN UTILITY-SCALE PHOTOVOLTAICS AND BIODIVERSITY CONSERVATION

Themenbereich: ZUKUNFT DER ERNEUERBAREN ENERGIEN (EE)

Robert Gennaro SPOSATO¹, Rafaela KLIC², Nina HAMPL³

Motivation and Research Questions

The study presented here addresses two of the most pressing challenges of our time: biodiversity loss and climate change [1][2][3]. In this context, solar energy has emerged as a key pillar of the transition from fossil-based to renewable energy systems, as highlighted in recent research and international policy agendas [4]. Meeting decarbonization targets will therefore require a broader system perspective that includes utility-scale photovoltaics [5][6]. Large-scale renewable energy infrastructure, however, can adversely affect local biodiversity, creating a “green-on-green” dilemma where clean energy goals intersect with nature conservation and social acceptance becomes a seesaw battle between local environmental concerns and global climate considerations [7][8][9]. Against this background, the study investigates the social acceptance of utility-scale photovoltaics, a field that remains underexplored compared to wind energy despite its growing relevance for sustainable energy transitions [10][11].

Methods and Data

Between 9 and 22 January 2025, a web-based survey was conducted among residents living in or near three Austrian biosphere reserves (Lungau, Wienerwald, Unteres Murtal) (n=512). Participants provided socio-demographic information and answered questions on their attitudes toward renewable energy as well as a randomized framing experiment. Several validated psychometric scales were included, capturing constructs such as environmental concern, perceived impacts of utility-scale photovoltaics, energy justice values, beliefs about renewable energy technologies, and activist intentions. Participants were then asked to complete a choice-based conjoint (CBC) experiment consisting of twelve choice tasks, each comparing three USPV project scenarios. The study design was developed within an interdisciplinary framework and informed by place attachment and energy justice, supported by a stakeholder group from NGOs, policy, the energy sector, and environmental organisations. Their involvement underscores the role of participatory planning in a just energy transition and, by integrating societal values with biodiversity considerations, provides a pathway to ecologically sensitive and publicly supported solar strategies.

¹ University of Klagenfurt, Klagenfurt am Wörthersee, Austria, +43 463 2700 3657, robert.sposato@aau.at

² Department of Environmental Systems Sciences, University of Graz, Graz, Austria., +43 316 380 7420, nina.hAMPL@uni-graz.at

³ Department of Environmental Systems Sciences, University of Graz, Graz, Austria., +43 316 380 7420, rafaela.klic@uni-graz.at

Results and Conclusion

The survey revealed strong overall support for photovoltaic technologies (79 %), though approval decreased for utility-scale ground-mounted PV (66 %) and was lowest for installations within biosphere reserves (mean 54 % across regions). Participants expressed substantially higher concern for classic environmental issues, with 83 % indicating strong worry about habitat loss and degradation of natural areas, whereas concern about renewable energy expansion was comparatively low. The conjoint analysis showed that land use constituted the most influential attribute in project evaluation (35.86 %), followed by biodiversity measures (21.65 %) and visibility (19.42 %), with procedural and distributive justice playing more limited roles. The regression model predicting support for utility-scale ground-mounted PV in biosphere reserves demonstrated strong explanatory power and was statistically significant, $p < .001$. Support was significantly associated with renewable energy activism ($p < .001$), perceived social norms ($p < .001$), perceived positive impacts ($p = .003$), and perceived negative impacts ($p = .004$), while all other predictors were non-significant. These results indicate that acceptance of utility-scale ground-mounted PV is shaped primarily by ecological siting considerations and central psychological factors.

Literature

- [1] C. Mikovits *et al.*, 'A Spatially Highly Resolved Ground Mounted and Rooftop Potential Analysis for Photovoltaics in Austria', *ISPRS Int. J. Geo-Inf.*, vol. 10, no. 6, Art. no. 6, June 2021, doi: 10.3390/ijgi10060418.
- [2] M. Wilzing, A. Vaselli, D. J. H. van Herwaarden, K. Walma, L. Hommes, and C. Sanchis-Ibor, 'Contestations of energy transitions in peri-urban areas: The solar parks of the Vall d'Albaida (Spain)', *Belgeo*, vol. 3, 2023, doi: 10.4000/belgeo.62801.
- [3] IPCC, 'Renewable Energy Sources and Climate Change Mitigation — IPCC', Cambridge University Press, England, 2011. Accessed: Nov. 04, 2024. [Online]. Available: <https://www.ipcc.ch/report/renewable-energy-sources-and-climate-change-mitigation/>
- [4] RIS, § 4 Abs. 4 EAG. Accessed: Oct. 31, 2024. [Online]. Available: <https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20011619>
- [5] M. Enserink, R. Van Etteger, A. Van den Brink, and S. Stremke, 'To support or oppose renewable energy projects? A systematic literature review on the factors influencing landscape design and social acceptance', *Energy Res. Soc. Sci.*, vol. 91, p. 102740, Sept. 2022, doi: 10.1016/j.erss.2022.102740.
- [6] B. Sütterlin and M. Siegrist, 'Public acceptance of renewable energy technologies from an abstract versus concrete perspective and the positive imagery of solar power', *Energy Policy*, vol. 106, pp. 356–366, July 2017, doi: 10.1016/j.enpol.2017.03.061.
- [7] P. Devine-Wright, 'Reconsidering public acceptance of renewable energy technologies: A critical review', *Deliv. Low Carbon Electr. Syst. Technol. Econ. Policy*, Jan. 2008.
- [8] P. Devine-Wright, 'Beyond NIMBYISM: Towards an Integrated Framework for Understanding Public Perceptions of Wind Energy', *Wind Energy*, vol. 8, pp. 125–139, Apr. 2005, doi: 10.1002/we.124.
- [9] C. R. Warren, C. Lumsden, S. O'Dowd, and R. V. Birnie, "Green On Green": Public perceptions of wind power in Scotland and Ireland', *J. Environ. Plan. Manag.*, vol. 48, no. 6, pp. 853–875, Nov. 2005, doi: 10.1080/09640560500294376.
- [10] S. Fast, 'Social Acceptance of Renewable Energy: Trends, Concepts, and Geographies', *Geogr. Compass*, vol. 7, no. 12, pp. 853–866, 2013, doi: 10.1111/gec3.12086.
- [11] R. Wüstenhagen, M. Wolsink, and M. J. Bürer, 'Social acceptance of renewable energy innovation: An introduction to the concept', *Energy Policy*, vol. 35, no. 5, pp. 2683–2691, May 2007, doi: 10.1016/j.enpol.2006.12.001.