Journal Name

Crossmark

RECEIVED
dd Month yyyy

REVISED
dd Month yyyy

LETTER

Own trade-off and synergy beliefs, not others' beliefs, drive public acceptance of energy technologies

Simon Montfort[1,*], Jonas Schmid[2,3], Jair Campfens[1], Isabelle Stadelmann-Steffen[2,3] and Claudia R. Binder[1]

[1]Human-Environment Relations in Urban Systems, École polytechnique fédérale de Lausanne (EPFL), Station 2, 1015 Lausanne, Switzerland

[2]Oeschger Centre for Climate Change Research, University of Bern, Hochschulstrasse 4, 3012 Bern, Switzerland

[3]Institute of Political Science, University of Bern, Fabrikstrasse 8, 3012 Bern, Switzerland

[*]Author to whom any correspondence should be addressed.

E-mail: simon.montfort@epfl.ch

Keywords: energy technology, emissions, landscape, biodiversity, trade-offs, belief updating

Abstract
The decarbonisation of energy systems can create both synergies and trade-offs with societal goals such as biodiversity conservation and landscape protection. Although existing research has focused on objective and physical trade-offs, the politics around energy technologies like Alpine photovoltaics (PV), wind energy, and nuclear energy are not least shaped by how trade-offs are perceived by the people (first-order beliefs about trade-offs), including how respondents believe others in society view them (second-order beliefs about trade-offs). However, these remain insufficiently understood. We address this research gap with a population-representative survey experiment among Swiss residents (N = 1,899). We find that most participants perceive biodiversity conservation and landscape protection to be synergetic rather than a null-sum trade-off. Furthermore, most participants underestimate others' preferences for emission reductions over landscape protection. Rural residents — who typically report lower trust in science — are more likely to expect that others favour landscape protection over emission reductions, even though 62% of Swiss residents prefer emission reductions. Strikingly, our survey experiment showing respondents information about the true societal preferences reveals that people are reluctant to revise their own preferences when seeing information about others' trade-off preferences (social influence) or their acceptance of energy projects, like Alpine PV, wind parks, sustaining nuclear stations, and new nuclear power plants. Non-experimental results show that people's own beliefs and a perception of synergies with landscape protection and biodiversity conservation are more important to understand energy technology acceptance than second-order beliefs. This suggests that political debates may overemphasise trade-offs to advance particular agendas, and that societies which are used to forming political opinions and are relatively well-informed about political issues, like Switzerland, preferences remain relatively stable in the face of socially inconform beliefs.

1 Introduction
Achieving net-zero greenhouse gas (GHG) emissions requires a rapid expansion of low-emission energy technologies, yet this transition involves trade-offs between emission reductions, biodiversity conservation, and landscape protection. Such trade-offs can reduce public acceptance of renewable energy projects (1), even when technologies offer substantial climate benefits (2).

How these trade-offs are perceived by the public and key stakeholders is central to political debates and the feasibility of achieving net-zero emissions (3). Arguments about environmental or visual landscape trade-offs are often strategically mobilized to build opposition to certain technologies. For instance, wind energy has become highly politicized in many countries, where right-wing actors frame it as a threat to landscapes and local identities (4; 5). In Switzerland, similar debates surround alpine PV installations in open mountain areas, where trade-offs between biodiversity protection and renewable expansion have gained political salience (1; 6). Recent geopolitical tensions and seasonal energy shortages have also revived discussions around nuclear power. In Switzerland, a popular initiative (called the "Blackout Initiative") has been launched, which would lift the current ban on the construction of new nuclear power plants, often using the argumentation of reduced trade-offs with land use and landscape impacts. In response to this initiative, the Swiss government has announced plans to lift the ban independently of the vote on the initiative to allow a technology-neutral discussion about future energy supply, taking nuclear energy into account(7). These debates illustrate the importance of how trade-offs are perceived and the positioning of political actors.

Despite the importance of trade-offs for the positioning of political actors in energy debates, existing research on how the trade-offs and synergies of renewable energy technologies affect acceptance remains scarce. First, existing work has primarily examined *objective* trade-offs—such as ecological or spatial impacts of renewable deployment (8; 9; 10; 11)—but much less is known about how *perceived* trade-offs shape public support for different energy technologies. Recent studies emphasize that beliefs and perceptions strongly influence climate and energy attitudes (12; 13), yet few investigate how and if trade-offs translate into public opposition. We still know little about how individuals form, interpret, and update their beliefs about trade-offs, such as emission reduction, biodiversity, and landscape protection. Second, while technology acceptance research increasingly considers individual beliefs, it rarely incorporates social aspects such as second-order beliefs—what people think others believe (14; 1). Evidence from social psychology shows that second-order beliefs often shape behavior more strongly than individual preferences (15; 16; 17). However, how first- and second-order beliefs about trade-offs are related to each other, and how they jointly influence technology acceptance, remains underresearched. Third, most existing studies focus on single technologies (18; 2; 1; 19; 20). Cross-technology comparisons are needed to understand whether and how trade-off perceptions and belief dynamics differ across options.

These research gaps are particularly relevant for technologies that face relatively strong social contestation, such as alpine PV, wind, and nuclear energy, for which we still do not know whether and to what extent individuals' own trade-off perceptions and those of others may influence technology acceptance. Therefore, we ask the following research questions:

1. How do people perceive trade-offs among renewable energy technologies, and how accurately do they estimate others' views?
2. Which characteristics of citizens explain the differences between their own and others ' perceived beliefs about trade-offs?
3. Does providing accurate information about others' trade-off beliefs lead citizens to revise their own evaluations of these trade-offs?
4. Do such revisions in others' trade-off beliefs influence acceptance of different energy technologies?

To answer the research questions and address the research gaps, we conducted a population-representative survey experiment in Switzerland. Using a survey-experiment, including specifically established methods to analyse belief-updating(21). Belief-updating describes the process by which individuals revise their existing beliefs when exposed to new information. Prior beliefs refer to the initial assessment or expectation a person holds before receiving new information. After exposure to new information, individuals form so-called posterior beliefs, which reflect their revised (i.e., updated) view(22). We examine these processes for trade-offs on landscape protection vs. CO2-emission reductions and biodiversity conservation vs. CO2-emission reductions. Thus, people are presented with information about what others think of these trade-offs to understand if this shapes societal acceptance of diverse low-carbon energy technologies, namely Alpine PV, wind, new and prolonged nuclear.

2 Methods

2.1 Case selection: Switzerland

We focus on Switzerland, because it can be regarded as the least likely case to observe a relationship between information and technology acceptance(23), given the country's strong reliance on direct-democratic voting on local, regional, and national levels, which frequently includes debates on energy technologies. Voters in Switzerland are used to forming their own opinions on many different issues. To do so, they rely on different types of issue and party information (24; 25). Local referenda and direct democracy are central to energy policy decisions, meaning that citizens are often better-informed than in other countries and participate more actively in policy processes (24; 26). Hence, opinions are often relatively well-grounded and stable for issues that align with established political cleavages, which makes the population less susceptible to peer pressures concerning what "others think". Furthermore, it could be argued that frequent voting and its outcomes allow citizens to make educated guesses of how others think about different issues.

Meanwhile, Switzerland exemplifies the tensions between energy security, environmental protection, and public acceptance (3): the country has relatively ambitious climate goals, high reliance on hydropower, and a nuclear phase-out policy that is currently rediscussed (27; 28). Renewable energy debates center on landscape and biodiversity concerns (29). These issues intersect with broader narratives around nuclear energy, particularly as proponents frame nuclear as a land-efficient alternative. Thus, trade-offs about energy technologies are a critical aspect of political debates (1; 6; 29).

2.2 Analysis of belief-updating and energy technology acceptance

Belief updating offers a useful theoretical framework for examining how individuals revise their views when exposed to new information (22) and to understand how this could influence energy technology acceptance. Building on the belief-updating framework, we have developed an experiment that presents individuals with tailored information about what others think (Figure 1). This setup enables us to isolate the causal effect of peer pressure on preferences (21), such as respondents' own trade-off evaluation and energy technology acceptance rates. This method is well-established to understand the cognitive processes that lead to changes in beliefs (14; 30; 31; 32; 33; 34).

Our belief-updating experiment was embedded in an online survey, programmed using the survey implementation software Qualtrics. It was fielded on 12.05.2025 with a median response time of 42 minutes. A stratified random sample based on a location quota was obtained from the Federal Statistical Office population register, comprising Swiss residents. A total of N = 6000 invitations were sent out via postal mail, inviting recipients to participate in an online survey on the future of Swiss energy. 1,899 good completions were used in the analysis. The experiment was carried out in three steps (Figure 1; for details on the survey set-up, see Supplementary Materials, p. 2).

Step 1: Eliciting beliefs before treatment (prior beliefs) We measured (i) individuals' own trade-off evaluations ('first-order prior beliefs') and (ii) their expectations of what the majority of the respondents in Switzerland would have stated ('second-order prior beliefs'), and iii) their confidence in prior first- and second-order trade-offs. For first-order beliefs, respondents were asked: "Would you regard lower CO2 emissions as more or less important than higher biodiversity and lower land use?" Two bipolar slider items (see Supplementary Materials Figure 1 for an example) recorded responses for (a) emissions vs biodiversity conservation and (b) emissions vs landscape protection (phrased as "a beautiful, calm, and non-industrialized landscape"). The sliders ranged from -4 ("emissions are much less important") to 4 ("emissions are much more important"), with 0 = "equally important"; respondents could select any integer value on this scale. For second-order beliefs, we asked respondents to "guess, even if you may not know exactly, what the majority of Swiss residents would respond", using the same slider format. After each second-order item, we asked respondents to rate their confidence in their guess on a five-point Likert scale.

Step 2: Experimental treatment and control groups. Respondents were randomly assigned to treatment or control groups. Treated respondents received personalized feedback on the accuracy of their second-order beliefs derived from an independent survey conducted in 2024 in Switzerland (35). We used the Analytical Hierarchical Process (AHP) (36) method, with respondents rating repeated pairwise comparisons of relevant energy transition dimensions, including biodiversity conservation vs. emission reductions and biodiversity conservation vs. landscape protection. The data provide population estimates of perceived trade-offs between these three dimensions of interest. Combining this population information with the respondents' individual slider values [-4...4] on second-order beliefs in our survey, we computed the share of the population that rated emissions as more important, equally important, or less important than respondents expected: i) the treatment thus displayed the respondent's own expectation of how the population evaluates these trade-offs (second-order beliefs) in comparison to the (true) population distribution (Figure 2); ii) treated respondents were asked again about their own first-order beliefs. Comparing first-order responses before and after treatment identifies whether belief updating about others' beliefs led to changes in the respondents' own trade-off evaluations (social influence).

Step 3 — eliciting support for energy technology acceptance. To understand whether information about others' beliefs on trade-offs influences technology acceptance, we then asked all respondents to indicate their acceptance of four energy technologies. We used the same 9-point slider adapted from the SURE survey (35) as in the previous questions to ensure comparability. The question reads: "To what extent do you personally support or oppose the expansion of the following types of electricity installations in Switzerland?" Responses ranged from -4 ("strongly oppose") to 4 ("strongly support") for: (i) alpine photovoltaic installations, (ii) wind parks, (iii) prolongation of existing nuclear power plants, and (iv) the construction of new nuclear power plants.

Finally, we contextualised the findings of our experimental analysis with correlational evidence on drivers of technology acceptance of the four energy technologies. These rather exploratory steps seek to qualify our null findings from the experiment and help inform future research.

2.3 Analytical procedure

Descriptive baseline. We first report descriptive statistics on prior second-order beliefs, namely the share of respondents who expected others to prefer biodiversity over emission reductions, or landscape protection over emission reductions. This provides a baseline for understanding misperceptions relative to the true population distribution.

Explaining prior beliefs. We then examine the determinants of respondents' prior beliefs using Ordinary Least Squares (OLS) regressions. Two dependent variables capture (i) first-order prior beliefs (own trade-off evaluations) and (ii) second-order beliefs (expectations about the majority view). We selected the following explanatory variables: left–right ideology for its key influence for political positions (37), particularly when related to trade-offs (38); trust in science and belief confidence as these influence information credibility of the experiment and willingness to change beliefs (39; 21), urban–rural residence due to the differences in exposure to the renewable energy projects (1), as salience of climate change influences policy support (40); gender, and income as demographic controls. This allows us to assess how different social groups weigh emission reductions, biodiversity conservation, and landscape protection, and the extent to which they misperceive others' views.

Estimating first-order posterior trade-off beliefs and energy technology acceptance. Next, we analyze the causal impact of information about others' actual beliefs, focusing on two

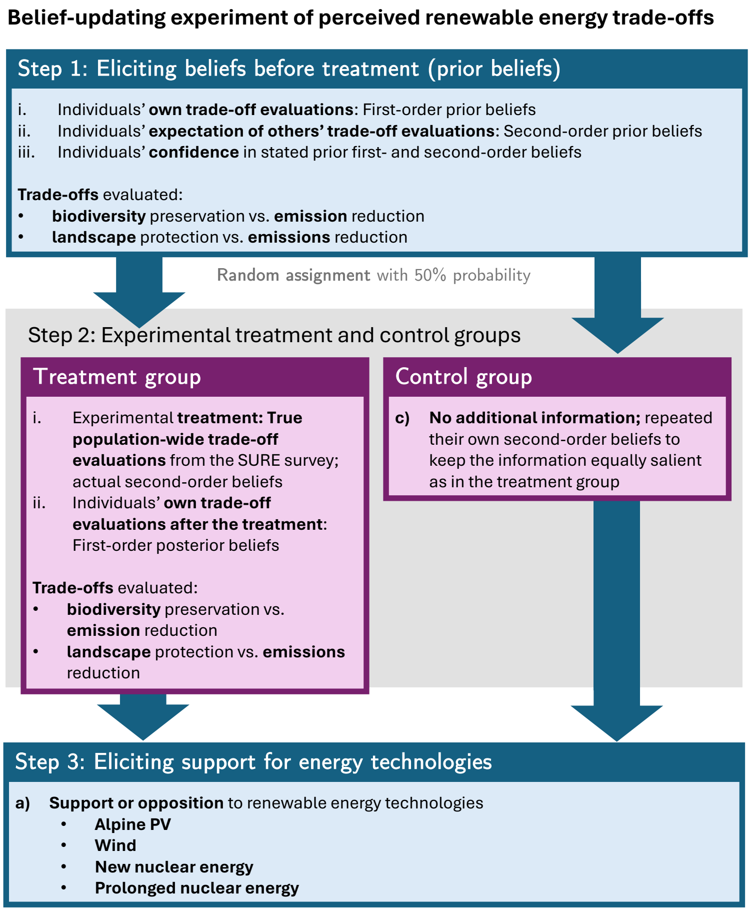

Figure 1. Experimental setup in three steps: Eliciting beliefs before treatment (prior beliefs), experimental treatment and control groups, and eliciting support for energy technology acceptance. The second-order information treatment was taken from the SURE survey (35).

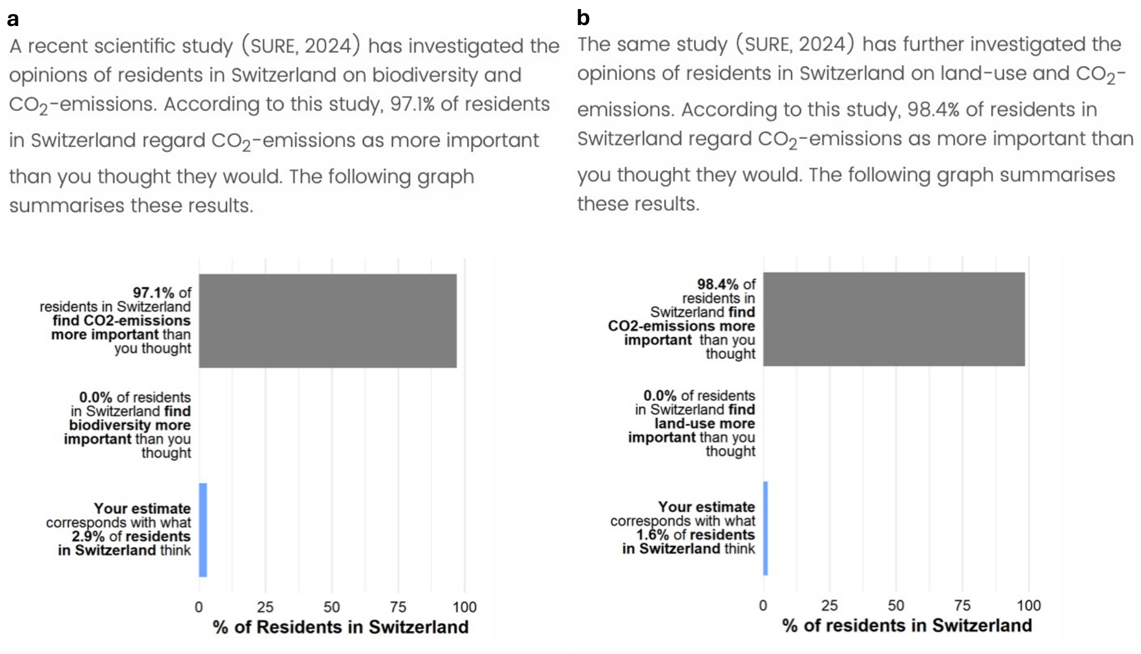

Figure 2. Experimental treatment about true population distribution, i.e., what share of the population indicated a higher, equal, or lower emission reduction preference compared to biodiversity conservation (in a) and landscape protection in (b).

outcomes: (i) social influence, measured as changes in respondents' first-order beliefs before and after treatment, and (ii) energy technology acceptance, measured post-treatment. We compare treated respondents, who received information about the true population distribution, with control respondents, who did not. Analyses

The treatment is inherently directional. Respondents may receive information that they over- or underestimated public support for emissions reductions (vis-à-vis landscape protection or biodiversity conservation). We provide correlative evidence and examine heterogeneous effects by prior misperception. For each trade-off dimension, respondents are classified as (CO2-) underestimators (believing others prioritize biodiversity conservation/landscape protection more strongly than the population actually does), overestimators (the inverse), or mixed (underestimating on one dimension and overestimating on the other). This cross-classification enables us to test whether correcting misperceptions increases respondents' own valuation of emissions mitigation and whether it shifts acceptance of specific technologies.

We report experimental results as marginal means, which represent regression-adjusted group averages and are invariant to the choice of reference category (41). Confidence intervals capture the uncertainty around these predictions. Marginal means significantly different from zero indicate systematic directional beliefs or preferences relative to neutrality.

3 Results

3.1 People underestimate others' emission reduction preference compared to landscape protection and mostly perceive synergies, not trade-offs

Figure 3 compares the prior expectations of the respondents about the trade-off perceptions of others (second-order beliefs) with the measured distribution of the population(35).

First, regarding the biodiversity conservation–emissions reduction trade-off, respondents were relatively accurate in judging societal views. Expectations were closely aligned with actual population preferences. 40% of respondents expected the majority to prioritise emission reductions, 29% expected the majority to attribute equal importance, and 31% expected the majority to prioritise biodiversity conservation. These figures match the true distribution almost exactly (40%, 26%, and 34%, respectively).

For the landscape protection–emissions reduction trade-off, however, we observe pronounced misperceptions. People overestimate others' preferences for landscape protection and underestimate others' emission reduction preferences. While 37% of respondents expected others to prefer emission reductions, nearly double – 62% of the population actually prioritise emission reductions. Moreover, 37% expected others to prioritise landscape protection, compared to only 22.5% in the population.

These findings indicate that misperceptions are not uniform across trade-offs involving emission reductions. Whereas biodiversity conservation trade-offs with emission reductions are perceived accurately, landscape protection is systematically overestimated. Because energy technologies such as alpine PV and wind technologies visually impact the landscape at their location, this bias may reinforce local resistance: if rural residents (where alpine PV and wind energy projects are very likely to be situated) believe that "everyone else" also prioritises landscape protection (Fig. 3), they may feel socially validated in opposing such projects.

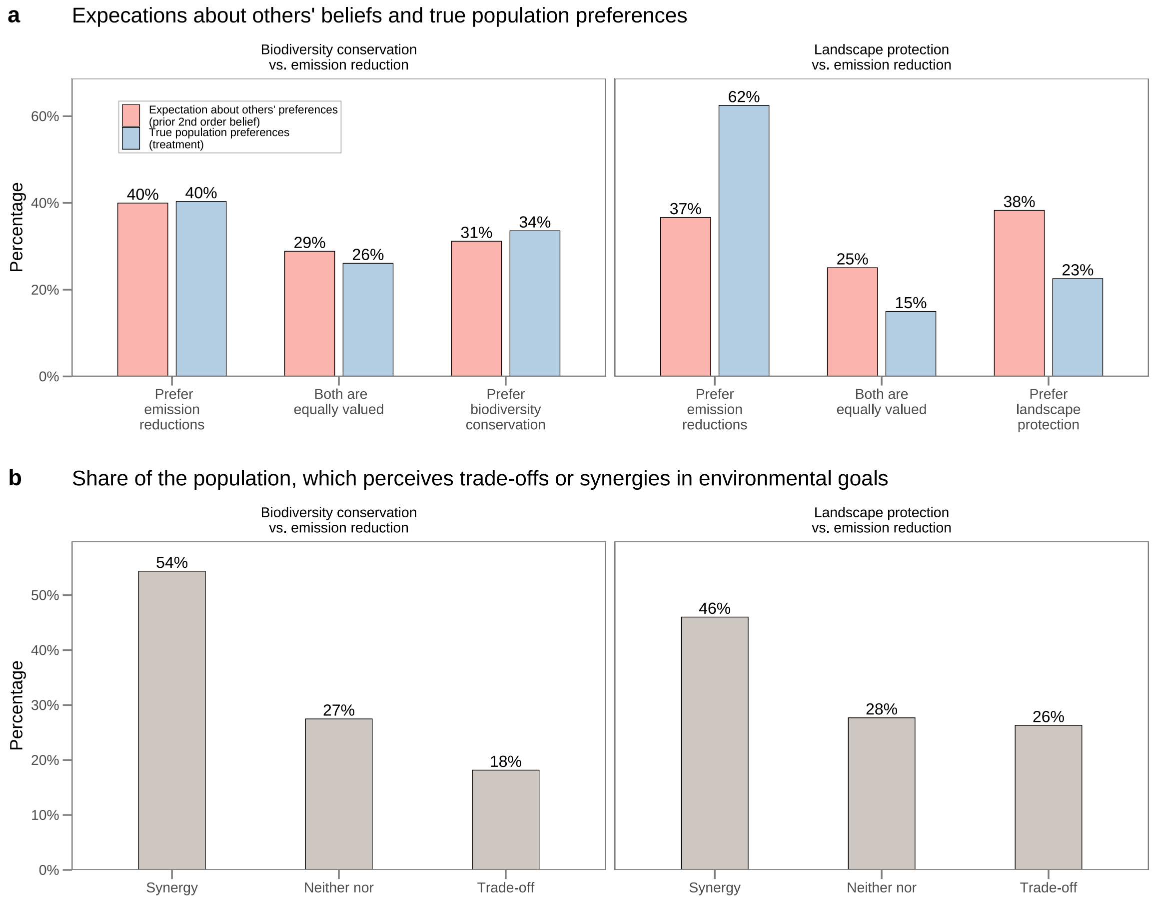

Figure 3. For the trade-offs between biodiversity conservation vs. emission reduction and landscape protection vs. emission reduction (in Panel a), the figure shows the share of respondents who expected others to (red) prefer emission reductions, value both aspects equally, or prefer biodiversity/landscape protection. These expectations are compared to the true population distribution from the SURE survey (35). For both dimensions (biodiversity conservation vs. emission reduction and landscape protection vs. emission reduction) we asked whether respondents perceived them as trade-offs or as synergies (in b). The slider response categories were collapsed into three bins: preference for emission reductions (values 1 to 4), equal importance (0), and preference for biodiversity/landscape protection (-4 to -1) (in a and b)

3.2 Ideology, climate salience, and income drive own trade-off beliefs; belief confidence, trust, and rural residence shape expectations about others' trade-off beliefs

Figure 4 summarizes the results from four regressions, two of which explain respondents' own preferences (first-order beliefs) and two of them explain their expectations about others' preferences (second-order beliefs). We find that these two sets of beliefs are shaped by different factors. Ideology, income, and climate salience primarily influence respondents' own trade-offs between emission reductions, biodiversity conservation, and landscape protection. Specifically, right-leaning respondents tend to prioritise societal goals other than emission reductions, while wealthier respondents show lower acceptance for emission reductions relative to landscape protection, and they similarly downweight the likelihood that others prefer emissions reductions over landscape protection. Higher climate salience, by contrast, is consistently related to first-order preferences for emission reductions at the expense of biodiversity conservation or land protection.

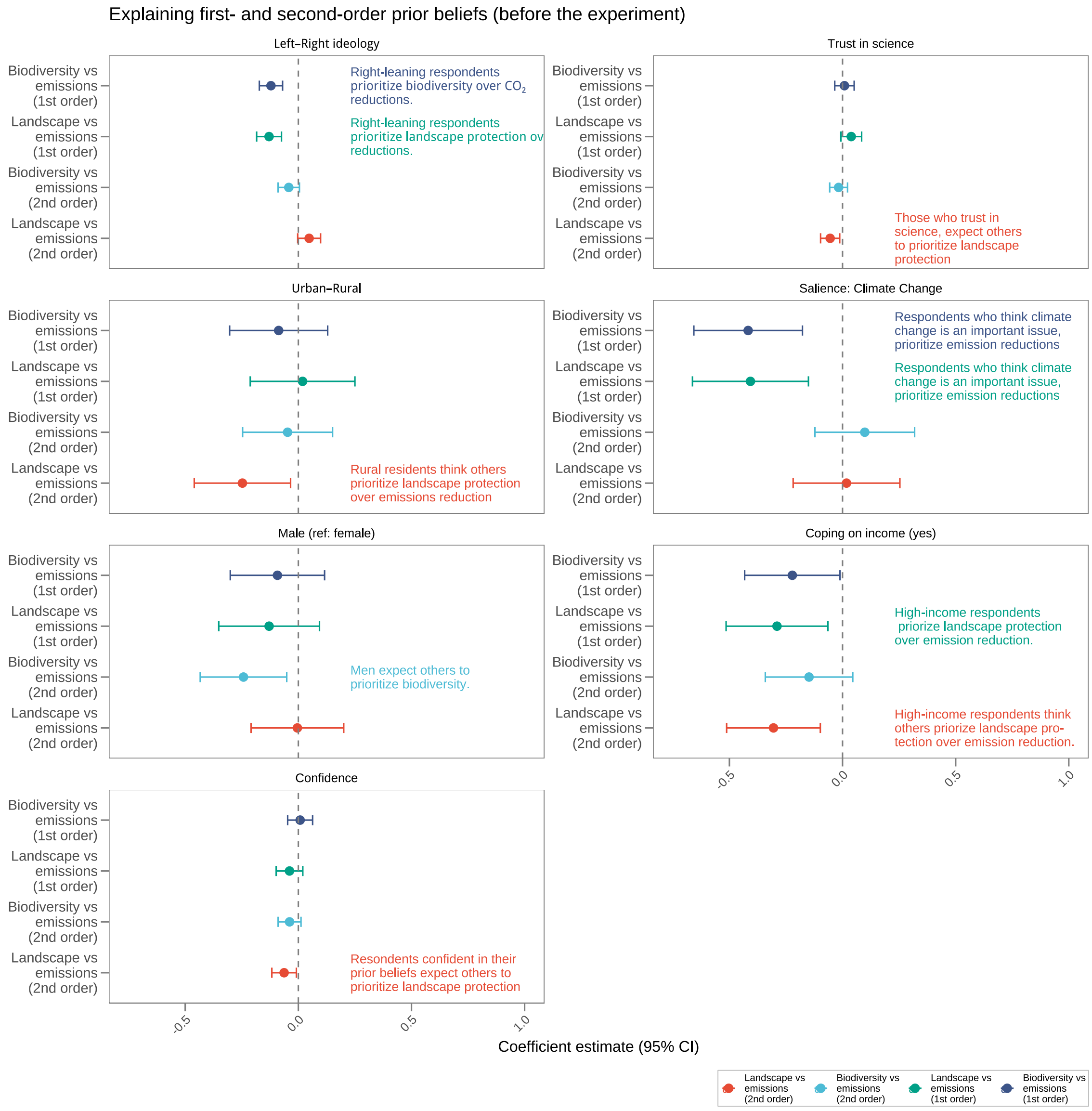

Figure 4. We explain first-order trade-offs i) biodiversity conservation vs. emission reductions, i) landscape protection vs. emission reductions, and second-order trade-offs, i.e., what people think that others think for iii) biodiversity conservation vs. emission reductions, iv) landscape protection vs. emission reductions (the dependent variables in individual regressions). The explanatory variables we use are left-right, trust in science, urban-rural, salience of climate change, gender, income, and prior belief confidence (for full results, see Supplementary Materials, Table 2). A point estimate (indicated by the dot) to the right of the dashed line indicates that emission reductions are preferred over the other dimension (either biodiversity preservation or landscape protection).

Concerning the explanation of others' beliefs, we find that a higher confidence in one's own preferences (first-order) about the trade-off on emission reduction versus landscape protection is associated with a lower second-order preference for emission reductions vis-à-vis landscape protection. As people systematically underestimate others' emission reduction preferences vis-à-vis landscape protection (Figure 3a), this suggests that confidence in one's own opinion might reinforce systematic misperceptions about societal preferences, which may in turn amplify perceived opposition to renewable energy projects. Higher-income respondents also systematically overestimate others' priority given to landscape protection.

Gender, urban-rural, and trust in science are also associated with expectations about what others value. Rural residents, who are typically more exposed to the visible landscape impacts of energy infrastructure, such as alpine PV or wind projects, are more likely to believe that others prioritise landscape protection over emission reductions. This contrasts with actual aggregate preferences, which are balanced (Figure 3). Relatedly, respondents with higher trust in science (which is slightly more common in urban areas, see Supplementary Materials, Figure 3) are more likely to expect that others favour landscape protection over emission reductions.

3.3 Information about others' trade-offs does not lead to social influence on people's own beliefs

Overall, the results show little evidence that information about others' trade-off preferences shifts respondents' own beliefs: preferences appear highly stable and resistant to social influence.

Figure 5a compares the treatment and control groups to test whether exposure to information about societal preferences affects respondents' first-order or second-order beliefs. The observed differences are small and statistically insignificant, even for landscape protection vs. emission reductions, where people's expectations of the true population preferences are systematically biased.

Figure 5b further shows that the direction of the information treatment — whether others were described as prioritising emissions reductions over other societal goals or not — had no systematic effect on respondents' own trade-offs. Interestingly, respondents who underestimated societal support for emissions reductions expressed higher baseline support for emissions themselves. Respondents most committed to climate mitigation systematically assume that others are less supportive, even though this is not the case. Such underestimation may help these respondents maintain a view of themselves as more ambitious than society at large. Yet, even when presented with corrective information, respondents did not revise their own evaluations.

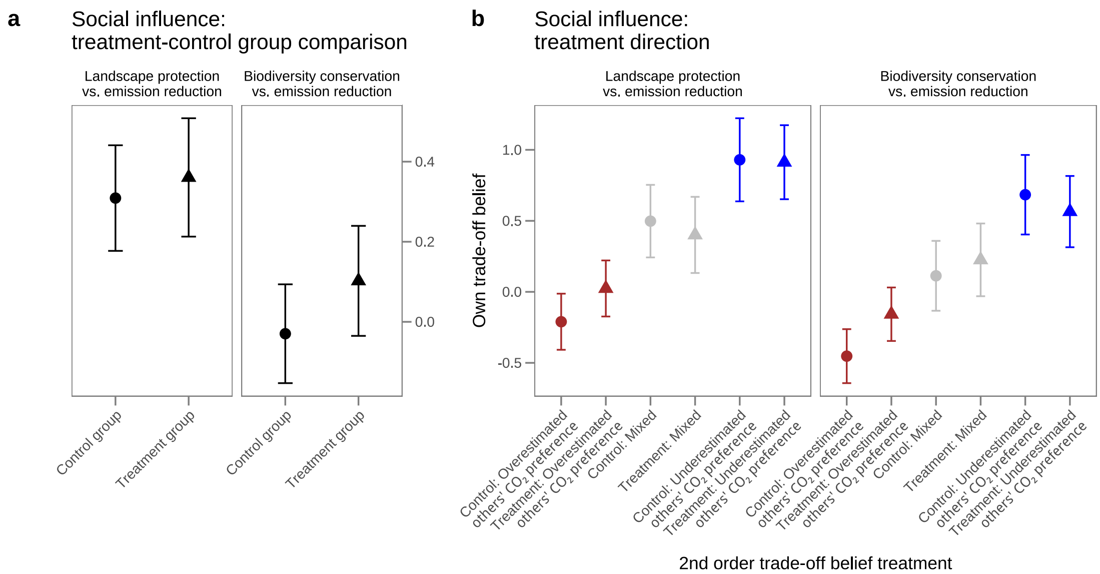

Figure 5. Marginal mean estimates regressing the treatment groups on respondents' own beliefs after the experiment. Points indicate estimated coefficients, and whiskers show 95% confidence intervals. The vertical axis lists four outcomes: (i) own beliefs about the trade-off between biodiversity and emissions (1st-order), (ii) own beliefs about the trade-off between land use and emissions, (iii) expectations about how others prioritize biodiversity vs. emissions (2nd-order), and (iv) expectations about how others prioritize land use vs. emissions. The horizontal axis represents the extent to which each predictor shifts prioritization toward emission reductions (relative to the reference category), holding all other covariates constant (for full results, see Supplementary Materials, Tables 3-5; robustness checks in Tables 6-7).

3.4 Stable energy technology acceptance in the face of information about others' preferences' on renewable energy trade-offs

Figure 6a presents technology acceptance by control and treatment groups, showing that overall acceptance of energy technologies is broad and robust to information interventions. The treatment, which provided respondents with information about population preferences regarding renewable energy trade-offs, did not affect technology acceptance—potentially because people were already relatively accurate in estimating others' beliefs (Figure 3b). Figure 6b compares baseline acceptance across groups defined by misperceptions of others' trade-off preferences, corroborating the null effect of the information treatment.

Beyond the null treatment effect, baseline acceptance varies across technologies. Alpine PV enjoys the highest acceptance, on par with wind, while new nuclear elicits only modest support, and prolonging existing plants is viewed negatively (Figure 6a). Beyond the null treatment effect, baseline acceptance varies more clearly across technologies. Alpine PV enjoys the highest acceptance, on par with wind, while new nuclear elicits only modest support, and prolonging existing plants is viewed negatively (Figure 6b).

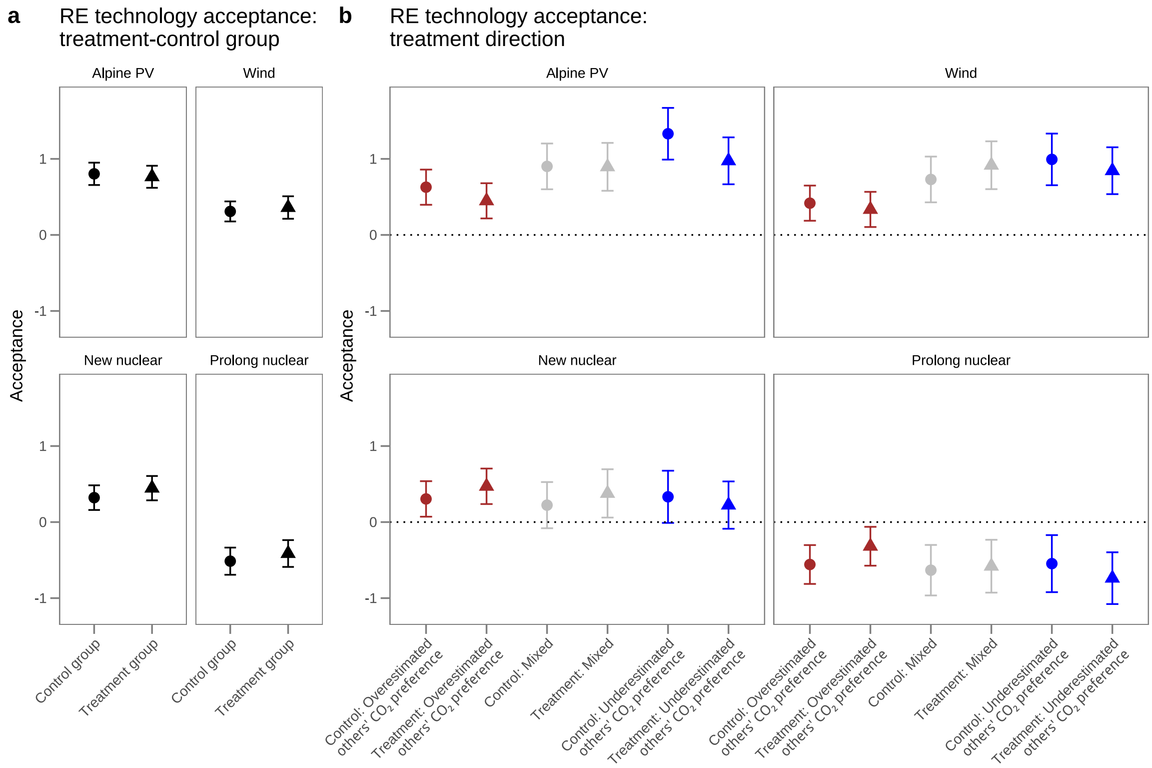

Figure 6. Marginal mean estimates regressing the treatment groups on respondents' technology acceptance. The circle and triangle represent the control and treatment groups, respectively. The treatment group saw information about how others optimize the trade-offs between biodiversity and emission reductions, and land use and emission reductions. We compare the control and the treatment groups (in a) and the treatment based on the directionality: i) an overestimation of others' CO2 reduction preference, ii) an underestimation of others' CO2 reduction preference, and iii) mixed (under and overestimation of one of the two) between control and treatment groups (in b). In the latter, we control for left-right, trust in science, urban-rural, climate salience, gender, income, and the confidence in how people estimated others' optimization of trade-offs before the experiment (for full results, see Supplementary Materials, Tables 8-12; robustness checks for speeding in the survey, attention check verifying that the treatment was correctly understood, and heterogeneous treatment effects in Tables 13-26).

3.5 People's own trade-offs and perception of synergies matter more than what they expect to perceive as trade-offs

Across all four technologies, respondents' *own* perceptions of trade-offs and synergies were more strongly related to acceptance than their second-order expectations about others' views (Figure 7). Acceptance of renewables (Alpine PV and wind) increased when respondents prioritized emission reductions over biodiversity or landscape protection and when they perceived biodiversity protection and emission goals as complementary. Second-order beliefs are not consistently associated with acceptance across any of the technologies, with only a modest effect of land-use trade-offs for Alpine PV.

For nuclear technologies, the pattern was reversed: stronger perceptions of biodiversity–emissions trade-offs reduced acceptance of prolonging nuclear plants, while seeing biodiversity and emissions as complementary was negatively associated with acceptance of both prolonging and new nuclear plants. Land-use-related beliefs were weak, and second-order beliefs were consistently unrelated to acceptance.

4 Discussion

Using a population-representative survey experiment in Switzerland (N=1,899), we analysed trade-offs between emission reductions, biodiversity conservation, and landscape protection. Beyond people's own (first-order) beliefs, we examined expectations about others' views (second-order beliefs), combining analysis of their drivers and biases with a belief-updating experiment to test whether accurate information shifts perceptions of trade-offs and technology acceptance.

Our findings have several important implications for the socio-political processes surrounding decarbonisation. First, we show that individuals in Switzerland are fairly good at estimating what others think regarding the trade-off between biodiversity conservation and emissions, but much less

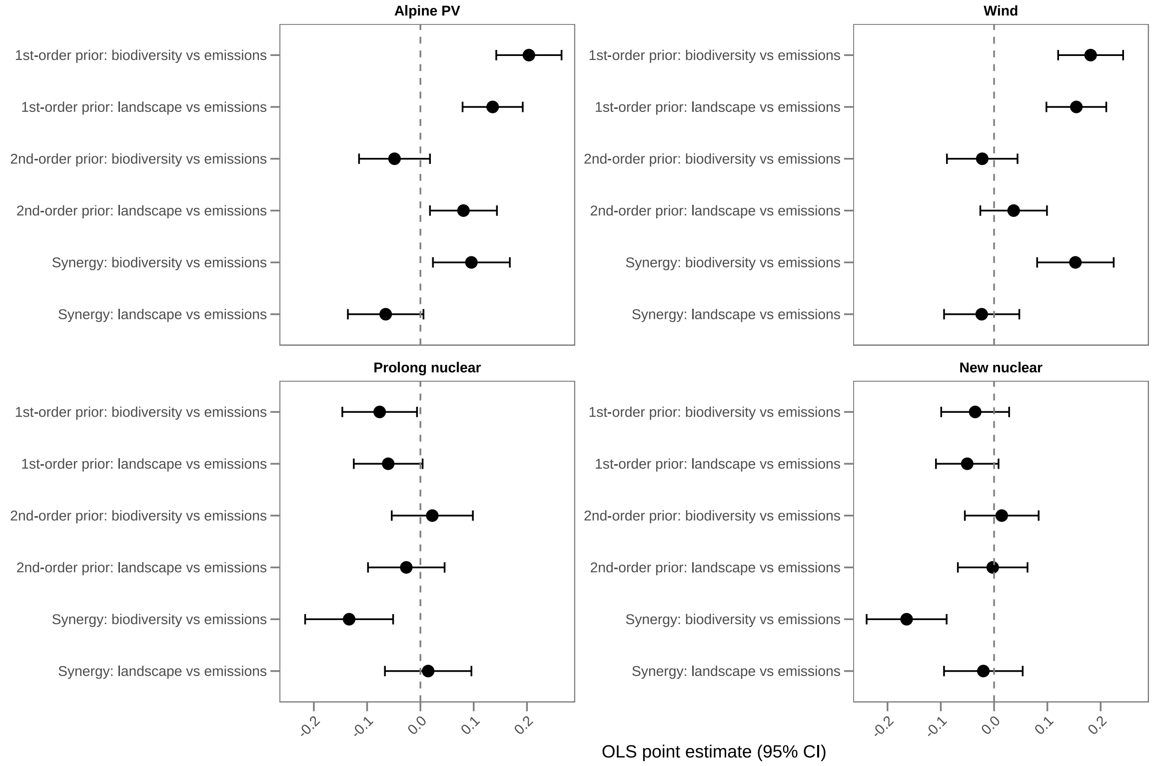

Figure 7. Explaining technology acceptance with first- and second-order trade-offs and first-order synergies. Points indicate estimated coefficients, and whiskers show 95% confidence intervals from OLS regressions. The vertical axis lists the explanatory variables, and the horizontal axis represents marginal means, holding constant the control variables left-right, left-right, trust in science, climate Salience, urban-rural residence, gender, whether the respondents are coping on their current income, and their confidence in the prior beliefs (for full results, see Supplementary Materials, Tables 27-30).

accurate when landscape protection is involved. Many respondents assumed that landscape protection was more popular than it really is, which suggests that misperceptions are domain-specific rather than general. This reflects that many debates about concrete alpine PV and wind projects in Switzerland revolved around landscape issues. More specifically, most opposing organizations and political parties use these issues to politicize against renewable energy projects, and the Swiss political system provides them with many (legal) possibilities to do so and to gain visibility(29; 6; 1). At the same time, in 2024, more than 60% of Swiss voters accepted a new Energy Provision Security Act aimed at facilitating the construction of renewable energy infrastructure. Hence, our findings are well in line with the interpretation that while a clear majority in Switzerland prioritizes emission reduction over landscape protection (see Figure 3a), the relatively small but powerful opposition against the renewable energy project creates the societal perception that landscape protection is valued more than emission reduction. This dynamic may reinforce local resistance to renewable projects, as individuals feel socially validated in opposing developments if they believe that “everyone else” shares their priorities.

Second, respondents tended to see biodiversity and landscape protection as synergies rather than trade-offs. This contrasts with dominant political narratives, which use cross-cutting issues to advance political agendas (42). Our findings resonate with recent work on issue framing, which shows that public opinion may become less polarised when policy challenges are presented as mutually reinforcing synergies rather than zero-sum trade-offs(e.g., 43; 3).

Third, our results reveal a striking stability in perceived trade-offs and technology acceptance. Even when respondents with biased expectations were presented with accurate information about societal views, they rarely revised their own evaluations or their acceptance of specific technologies. This suggests that the close social environment may matter more for belief updating than broad societal views (44). While prior research often finds strong effects of second-order beliefs on policy support and behavior (e.g., 17; 14), we observe only weak or inconsistent associations. This confirms that the cleavage on energy and environmental politics is left unchanged when citizens are well informed about the energy transition, and where extensive public debate and frequent voting may reduce the scope for peer pressure.

Fourth, our results on the stability of energy technology acceptance also indicate that reframing arguments in the political debates can only have a limited effect on shifting attitudes (45; 46; 47), especially when focused on what others perceive as trade-offs. Resistance to renewables seems less a matter of persuasion than of entrenched concerns tied to place, identity, and material stakes (48; 49). For policy, this highlights the need to move beyond communication strategies to combine them with participatory processes (47; 1), procedural fairness, trusted intermediaries, compensation mechanisms (1), and benefit-sharing schemes (20) that directly address the substantive drivers of opposition.

5 Conclusion

Our results indicate that own perceptions of trade-offs are associated with acceptance rates of renewable energy, but expectations about what others believe have a limited influence. At the same time, perceptions of what others think are relatively accurate for the trade-off between biodiversity conservation and emission reductions, while they are systematically biased for landscape protection and emission reductions. The survey experiment that sought to correct for these misperceptions had no systematic influence on respondents' renewable energy acceptance, highlighting the stickiness and difficulty of shifting established beliefs. Future research should investigate more closely perceived synergies and whether more interactive or deliberative settings, peer discussions, or trust-building initiatives with institutions can promote greater openness to belief updating and more accurate perceptions of societal preferences.

Acknowledgments

We are grateful to the anonymous reviewers for their constructive feedback and to the EPFL HERUS and UNIBE teams for valuable exchanges, particularly Matthias Heinrich. We also thank members of the EDGE and ENGAGE consortia for their feedback and discussions. Finally, we extend our sincere gratitude to all survey participants, without whose engagement this work would not have been possible.

Funding

This research was supported by the Swiss Federal Office of Energy within the SWEET consortium EDGE (Grant DB n°202481). Additional co-funding was provided by the ETH Board through the Joint Initiative (JI) – ENGAGE: Evidence-Based Dialogue on Trade-Offs in Wicked Societal Problems within the "Engagement and Dialogue with Society" strategic area (Grant DB n°23880). The authors alone are responsible for the study's results and conclusions.

Author contributions

S.M. and J.S. designed the research with contributions from all other authors. J.S. implemented the survey items in the survey software Qualtrics. S.M. and J.S. analyzed the data. S.M. produced the visualisations used in the article. S.M. wrote the manuscript with contributions from all other authors. I.S. and C.B. supervised the research.

Data availability

All replication data and files can be found under
https://github.com/SimonMontfort/2nd_trade-offs

Supplementary data

The document entitled: "Supplementary Materials: Own trade-off and synergy beliefs, not others' beliefs, drive public acceptance of energy technologies" contains additional analyses supporting the analysis presented in the main text.

Ethical approval The population survey received ethical approval from the University of Bern: No. 192025.

References

[1] Feller Valero J, Montfort S and Binder C R 2025 Participatory processes and local project leadership can decrease perceived trade-offs of renewable energy projects under review in PLOS Climate

[2] Frischholz Y, Schilt U, Sharma V, Kahl A, Strebel S, Anderegg D, Rohrer J and Lehning M 2024 *Frontiers in Energy Research* **12** 1372680

[3] Stadelmann-Steffen I, Eder C and Liem M 2026 *Renewable and Sustainable Energy Reviews* **226** ISSN 18790690

[4] Siggelkow P 2025 Was ist dran an den behauptungen über windkraft? Faktenfinder“, *tagesschau.de* accessed: 2025-11-05 URL https://www.tagesschau.de/faktenfinder/windenergie-falschbehauptungen-100.html

[5] Bloomberg 2025 German far-right aligns with trump on takedown of wind energy Bloomberg News, online accessed: 2025-11-05 URL https://www.bloomberg.com/news/articles/2025-01-13/german-far-right-aligns-with-trump-on-takedown-of-wind-energy

[6] Stadelmann-Steffen I, Imobersteg C and Heim M *Paper presented at EPG 2025, June 2025, Sachseln (CH)*

[7] DIE ZEIT 2024 Schweizer regierung will atomausstieg rückgängig machen zugriff am: 2025-09-17 URL https://www.zeit.de/politik/ausland/2024-12/schweiz-regierung-atomausstieg-rueckgaengig-atomkraftwerke-neubau

[8] Katzner T E, Nelson D M, Marques A T, Voigt C C, Lambertucci S A, Rebolo N, Bernard E, Diehl R and Murgatroyd M 2025 *Nature Reviews Biodiversity* 1–14

[9] Santangeli A, Di Minin E, Toivonen T, Pogson M, Hastings A, Smith P and Moilanen A 2016 *Gcb Bioenergy* **8** 1191–1200

[10] Picchi P, Van Lierop M, Geneletti D and Stremke S 2019 *Ecosystem services* **35** 241–259

[11] Agha M, Lovich J E, Ennen J R and Todd B D 2020 *Environmental Research Letters* **15** 075004

[12] Montfort S, Fesenfeld L, Stadelmann-Steffen I and Ingold K 2023 *Policy and Society* **42** 454–477

[13] Montfort S 2023 *Plos Climate* **2** e0000145

[14] Mildenberger M and Tingley D 2019 *British Journal of Political Science* **49** 1279–1307

[15] Kallgren C A, Reno R R and Cialdini R B 2000 *Personality and social psychology bulletin* **26** 1002–1012

[16] Cialdini R B, Kallgren C A and Reno R R 1991 A focus theory of normative conduct: A theoretical refinement and reevaluation of the role of norms in human behavior *Advances in experimental social psychology* vol 24 (Elsevier) pp 201–234

[17] Jachimowicz J M, Hauser O P, O'Brien J D, Sherman E and Galinsky A D 2018 *Nature Human Behaviour* **2** 757–764

[18] Abreu J, Wingartz N and Hardy N 2019 *Energy Policy* **128** 347–363

[19] Langer K, Decker T, Roosen J and Menrad K 2018 *Journal of Cleaner Production* **175** 133–144

[20] Vuichard P, Stauch A and Wüstenhagen R 2021 *Renewable and Sustainable Energy Reviews* **138** 110516

[21] Haaland I, Roth C and Wohlfart J 2023 *Journal of Economic Literature* **61** 3–40 ISSN 0022-0515 URL https://pubs.aeaweb.org/doi/10.1257/jel.20211658

[22] Druckman J N and McGrath M C 2019 *Nature Climate Change* **9** 111–119 ISSN 1758-6798 URL https://www.nature.com/articles/s41558-018-0360-1

[23] Seawright J and Gerring J 2008 *Political research quarterly* **61** 294–308

[24] Dermont C and Stadelmann-Steffen I 2021 *International Journal of Public Opinion Research* **32**(3) ISSN 14716909

[25] Stadelmann-Steffen I and Dermont C 2020 *Journal of Social Policy* **49** 383–403

[26] Benz M and Stutzer A 2004 *Public choice* **119** 31–59

[27] Eder C and Stadelmann-Steffen I 2023 *Energy Policy* **177** ISSN 03014215

[28] News L 2025 Swiss public opinion on nuclear energy is shifting accessed: 2025-09-17 URL https://lenews.ch/2025/06/20/swiss-public-opinion-on-nuclear-energy-is-shifting/

[29] Schmid J *Decentralization and Wind Energy Permitting: An Evaluation of Implementation Effectiveness in Switzerland and Europe* (Nomos) ISBN 978-3-7489-4445-4 URL https://www.nomos-elibrary.de/index.php?doi=10.5771/9783748944454

[30] Coutts A 2019 *Experimental Economics* **22** 369–395 ISSN 1573-6938 URL https://doi.org/10.1007/s10683-018-9572-5

[31] Douenne T and Fabre A 2022 *American Economic Journal: Economic Policy* **14** 81–110 URL https://www.aeaweb.org/articles?id=10.1257/pol.20200092

[32] Barron K 2021 *Experimental Economics* **24** 31–58 ISSN 1573-6938 URL https://doi.org/10.1007/s10683-020-09653-z

[33] Ebner M, Kachi A and Montfort S 2024 *SSRN Working Paper* URL https://papers.ssrn.com/abstract=4919490

[34] Ebner M, Kachi A and Montfort S 2025 *Available at SSRN 5426496*

[35] Stadelmann-Steffen I, Brückmann G and El-Ajou W 2023 Sure survey 2024

[36] Khan A U and Ali Y 2020 *International Journal of the Analytic Hierarchy Process* **12**

[37] Busemeyer M R and Rinscheid A 2025 *Journal of Social Policy* 1–21

[38] Armingeon K and Bürgisser R 2021 *Journal of European Public Policy* **28** 489–509

[39] Ebner M, Kachi A, Rhodes E and Andrew K 2025 *Energy Research & Social Science* **127** 104264 ISSN 2214-6296 URL https://www.sciencedirect.com/science/article/pii/S2214629625003457

[40] Rinscheid A, Pianta S and Weber E U 2021 *Behavioural Public Policy* **5** 503–527

[41] Leeper T J, Hobolt S B and Tilley J 2020 *Political Analysis* **28** 207–221 ISSN 1047-1987, 1476-4989 URL https://www.cambridge.org/core/journals/political-analysis/article/measuring-subgroup-preferences-in-conjoint-experiments/4F2C21AC02753F1FFF2F5EA0F943C1B2

[42] Kammerer M, Baker J, Fesenfeld L P, Maier M, Montfort S and Ingold K 2025 *Policy Sciences* 1–38

[43] Baldwin-Cantello W, Tickner D, Wright M, Clark M, Cornelius S, Ellis K, Francis A, Ghazoul J, Gordon J E, Matthews N *et al.* 2023 *Climate policy* **23** 782–799

[44] Schuldt J P, Yuan Y C, Song Y and Liu K 2019 *Journal of Environmental Psychology* **66** 101367

[45] Fesenfeld L P and Rinscheid A 2021 *One Earth* **4** 411–424

[46] Fesenfeld L, Beiser-McGrath L, Sun Y, Wicki M and Bernauer T 2024 *PLoS Climate* **3** e0000297

[47] Montfort S, Fesenfeld L, Ingold K, Lamb W F and Andrijevic M 2025 *npj Climate Action* **4** 14

[48] Wüstenhagen R, Wolsink M and Bürer M J 2007 *Energy policy* **35** 2683–2691

[49] Devine-Wright P 2009 *Journal of community & applied social psychology* **19** 426–441