

Gaps in mind: Political and spatial cleavages in local onshore wind attitudes in Germany

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ABSTRACT

Public support for wind energy in Germany is high, yet local opposition can impede project delivery. This study examines which socio-demographic characteristics predict acceptance of onshore wind energy and whether effects differ between urban and rural residents in North Rhine-Westphalia (NRW). We analyze a representative survey of $N = 6284$ adults fielded in September 2021, using survey weights. We focus on wind-salient outcomes (support for local wind expansion and landscape evaluations) and situate preferences for information, participation, conflict handling, and benefit-sharing as actionable process levers. Analytically, we (i) report weighted mean differences by place; (ii) estimate weighted least-squares models in which place of residence, political orientation, education, and age enter jointly; and (iii) test moderated regressions to assess whether urban-rural context conditions the influence of trust and perceived fairness. Results show that political orientation is by far the strongest correlate of wind-salient attitudes; education and age contribute only weak gradients that are not consistently distinguishable from zero, and the direct urban-rural effect is small and statistically indistinguishable from zero once other markers are held constant. Trust in scientists and planning authorities and perceived procedural/distributive fairness are strongly and positively associated with support; moreover, context matters: in rural settings, higher trust and clearly governed fairness arrangements are especially consequential. We discuss planning implications, focusing on the need to: embed co-designed, face-to-face participation alongside transparent disclosures; route information through credible intermediaries; and make siting criteria and revenue-sharing explicit and enforceable. The study clarifies how classic acceptance drivers interact with place and provides actionable guidance for tailoring engagement to different constituencies in Germany.

1. Introduction

Accelerating onshore wind deployment is essential to Germany's decarbonization pathway, as in many other countries, but project delivery ultimately depends on whether nearby publics regard procedures as fair, information as credible, and local impacts as acceptable. In densely used landscapes, biodiversity safeguards, settlement proximity, and competing land uses compress trade-offs, making governance design as consequential as turbine siting itself (Hielscher et al., 2025; Bunzel et al., 2019; Vogel et al., 2024).

Three findings from prior research motivate this study. First, abstract support for renewables often weakens when projects become specific and proximate. Second, this pattern is not well captured by a simple “NIMBY” label; trust, procedural and distributive fairness, and perceived ecological and visual impacts explain acceptance better than distance alone. Third, acceptance evolves over the project life cycle and depends on early, intelligible information, meaningful co-determination, and

collectively governed safeguards and benefits (Rand and Hoen, 2017; Devine-Wright, 2005; Wolsink, 2000; Hübner et al., 2023; le Maitre et al., 2024; Scherhauser et al., 2018).

These processes are increasingly shaped by political identities, place-based narratives, and wider social cleavages. Energy disputes intersect with broader cultural and distributive cleavages over who bears costs, who benefits, and who decides, making credible benefit governance and shared control central to local legitimacy (Devine-Wright and Batel, 2017; Fritz and Eversberg, 2024; Schad and Sommer, 2025; Mau et al., 2026; Radtke and Löw-Beer, 2025).

North Rhine-Westphalia (NRW) is a particularly informative case for this study because it combines dense urban agglomerations, sizeable rural districts, and a politically heterogeneous electorate within one federal state. This makes it possible to examine how place and political orientation interact under a common planning and regulatory framework. The specific demographic, political, and energy-transition characteristics of NRW are outlined in Section 2.

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Within this context, we ask two connected questions: which social characteristics—place of residence, political orientation, education, and age—are associated with local acceptance of onshore wind, and does place condition these associations? Using a representative survey of $N = 6284$ NRW residents fielded in 2021, we report weighted descriptives, estimate multivariate models for wind-salient outcomes, and test moderated regressions for key interactions such as place $\times$ trust and place $\times$ perceived fairness. Analytic N s vary by model and are reported throughout.

Our interpretation is anchored in established acceptance frameworks: procedural and distributive fairness, trust in credible intermediaries and planning authorities, and perceived local impacts. Information, participation, and conflict-resolution preferences are treated as design levers that vary across constituencies rather than as substitutes for these core mechanisms.

The paper proceeds as follows. Section 2 introduces NRW as the study context. Section 3 reviews the international literature. Section 4 presents the data and methods. Section 5 reports the empirical results. Sections 6 and 7 discuss the findings and conclude.

2. North Rhine-Westphalia as the study context

NRW is a particularly demanding setting for studying local wind acceptance in Germany. With 18.0 million inhabitants and the poly-centric Rhine–Ruhr metropolitan area, it combines the country's largest population and one of Europe's most densely populated urban regions with sizeable rural and semi-rural districts. This internal heterogeneity creates pronounced variation in settlement density, land-use pressure, and place-based identities within a single state-level regulatory environment, making NRW well suited for analysing how urban–rural context and political orientation intersect in local wind politics.

NRW is also a consequential energy-transition case within Germany's broader shift toward sustainable electricity generation (Solarin and Bello, 2022). Historically shaped by coal and heavy industry, the state has had to manage decarbonization amid economic restructuring, spatial scarcity, and recurrent conflicts between residents, project developers, environmental organizations, and public authorities. These tensions make the 'how' of the transition especially salient: Debates often turn less on abstract support for renewables than on buffers, siting criteria, landscape impacts, procedural fairness, and the legitimacy of decisions (Radtke et al., 2021). At the same time, NRW has moved to the forefront of onshore wind expansion. In 2024 it recorded the largest amount of newly permitted onshore wind capacity among all German states (4044 MW) (Fachagentur Wind und Solar, 2025), and continued leading new onshore wind commissioning in 2025 (NRW leads the state comparison by a clear margin with 1358 MW) (Fachagentur Wind und Solar, 2026). These acceleration dynamics unfolded alongside contested planning reforms, including the 2023 reversal of the 1000-m minimum-distance rule for turbines that had previously constrained siting options (Clean Energy Wire, 2023).

Because political orientation is central to the analysis, the role of the *Alternative for Germany* (AfD) also requires brief contextualization. Founded in 2013 as a Eurosceptic party, the AfD is widely characterized in the literature as a radical right or far-right populist party in Germany (Berning, 2017). This matters substantively for the present study because right-wing party alignment is closely linked to attitudes toward climate policy, expertise, and energy governance, especially in the wind sector (Lüth and Schaffer, 2022; Otteni and Weisskircher, 2022; Kulin and Sevä, 2024; Arndt et al., 2023; Radtke and Löw-Beer, 2025); comparable polarization dynamics are documented in the US context (McCright and Dunlap, 2011; Hamilton et al., 2019). We therefore use AfD voting intention as the most direct available indicator of right-wing party alignment in the dataset, while recognizing that local attitudes are shaped not only by party choice but also by trust, fairness perceptions, and issue-specific cues.

3. International research on public attitudes toward wind energy

Across countries, public support for onshore wind is generally positive but conditional: abstract approval weakens when projects become concrete and residents weigh procedural fairness, distributive fairness, trusted intermediaries, and locally salient impacts such as landscape change, noise, biodiversity risks, and perceived costs; social norms and economic benefit-sharing amplify – rather than substitute for – high-quality processes (Cousse et al., 2020; Devine-Wright and Peacock, 2024; Solman et al., 2021). Large comparative studies of residents living near wind-energy projects consistently show that perceived planning fairness and trusted information sources are robust correlates of positive attitudes, whereas simple proximity or modeled exposure often has weak or inconsistent links to annoyance and opposition – evidence that the social-psychological and institutional context, not distance alone, structures acceptance (Carley et al., 2020; Hoen et al., 2019; Hübner et al., 2019; Motz, 2026). Building on this, an integrated acceptance model brings together economic effects, impacts on residents and nature, general transition attitudes, trust and process fairness, and social norms, jointly explaining a large share of variance in local acceptance in both operating and early-planning contexts (Hübner et al., 2023). The mismatch between the importance assigned to acceptance-relevant criteria and expectations that projects will actually meet them is particularly pronounced for landscape and procedural aspects and helps differentiate approval, support, rejection, and resistance (Frank et al., 2026).

Within this framework, socio-demographic markers matter because they proxy value profiles, social identities, information ecologies, and lived contexts through which fairness, trust, and impacts are judged (Sposato and Hampl, 2018). Education and political orientation repeatedly emerge as the strongest correlates of support for renewables, while effects of age and income are smaller, heterogeneous, and context-dependent; crucially, many demographic gradients attenuate once process perceptions and political identity are modeled (Hamilton et al., 2019; Hoen et al., 2019; Hübner et al., 2019; Rand and Hoen, 2017). Party preference is more strongly associated with renewable-energy attitudes in Germany than standard socio-demographic variables, with AfD and Green support showing the strongest opposing associations and partisan differentiation being sharper for wind than for solar (Weisskircher et al., 2026). These patterns reflect a broader realignment in which educational attainment increasingly organizes political preferences and issue salience, creating differentiated responses to identical policy designs across groups and cohorts (Crulli and Emanuele, 2025; Garritzmann, 2025; Schäfer and Steiner, 2025). Place also matters, but best as a contextual moderator: urban–rural and regional differences are meaningful yet typically shrink after accounting for party identification, education, trust, and perceived fairness, indicating that “where people live” structures identities and institutions that filter wind projects rather than serving as a standalone cause (Sonnberger and Ruddat, 2017; Suškevičs et al., 2019; Bretter and Schulz, 2024). Climate-policy attitudes and populist orientations account for additional variation, while place attachment has no independent association and acceptance remains lower in eastern than in western Germany (Hübner and Dirksmeier, 2026).

A growing literature links variation in wind attitudes to political polarization. Partisan sorting, selective news exposure, media ecosystems, and conflict entrepreneurship can amplify localized grievances into categorical opposition, elevating the role of credible, non-partisan intermediaries (Holowach and Parkins, 2025; Olson-Hazboun et al., 2016; Winter et al., 2024). Cross-national evidence shows that nativist–authoritarian (“TAN”: Traditionalist–Authoritarian–Nationalist vs. “GAL”: Green–Alternative–Libertarian) value complexes are strongly associated with lower climate and wind energy support even after standard ideology controls, while urban–rural gaps remain contingent once identity and trust are modeled (Kulin and Sevä, 2024; Sælen and

Aasen, 2023). In Europe, center/periphery dynamics further depress support where people anticipate income losses and reduced purchasing power, underscoring that socio-economic context conditions individual predispositions (Arndt et al., 2023). The comparative evidence has since sharpened this into a claim about geography itself: across ten Western European countries, opposition to environmental protection is channeled into far-right voting most strongly in economically disadvantaged rural areas, producing what the authors describe as a territorial cleavage between green voters in metropolitan areas and far-right voters in rural and peripheral ones (Halikiopoulou et al., 2025). Whether such a cleavage is spatially constituted or merely spatially expressed is precisely what a single-region design can help adjudicate. At the level of organized opposition, place appears to work through networks rather than exposure: a spatial analysis of German anti-wind initiatives observed between 1990 and 2017 finds no support for the proposition that existing turbine stocks systematically increase mobilization, whereas proximity to existing initiatives raises the likelihood that new ones emerge, pointing to organizational learning and supra-local mobilization structures rather than to local burden (Gardt et al., 2026). The current review of record places both findings in a wider context of misinformation, institutional distrust, and populism, and argues that engagement, equity, and deployment speed are inextricably linked, so that projects must be changed in response to concerns rather than concerns dismissed (Boudet et al., 2025).

What, then, moves acceptance? Design levers with the most consistent evidence are meaningful participation and collectively governed, transparent benefit-sharing – where these are conceived as complements. Conjoint and discrete-choice studies show higher willingness to accept when residents can influence outcomes, when information is credible and independent, when ownership is citizen-based, and when compensation is locally fair; “more money” cannot compensate for low-quality process (Langer et al., 2017, 2018; Liebe et al., 2017). Justice framings tend to shift the ambivalent middle more than staunch opponents, and collective, municipal compensation often enjoys a fairness premium relative to individualized investor schemes; hence, benefit-sharing should be embedded in broader, rules-based conflict resolution architectures rather than offered as isolated pay-offs (Lindvall et al., 2024). Benefit-sharing does not operate uniformly or independently of context: perceived benefit-sharing is more consistently associated with local acceptance than decision-making participation in the Jeju cases, while compensation effects remain modest and vary across countries and prior attitudes (Lee et al., 2026; Lindvall et al., 2026).

Communication and experience interact with these levers in ways that map onto socio-demographics. Immersive 360° visualizations, extended-reality tools, and site visits recalibrate expectations most among low-knowledge audiences, narrowing perception gaps that often track education and urban-rural residence; everyday exposure and occupational ties can even tilt proximity toward greater support (Cranmer et al., 2020; Grassi and Klein, 2016; Caporale et al., 2024; Radtke, 2025a). Visual “fit” judgments, meanwhile, embed moral associations (ostensibly similar mast-like structures attract different scenic ratings depending on their ethical meanings) explaining why value profiles and identities correlate with claimed visual impacts (Kirchhoff et al., 2022). Perceived wind-farm impacts are best treated as a multi-dimensional balance of visual, social, environmental, economic, and energy-production effects, with expectations and experience jointly related to support (Vedder et al., 2026). Acceptance also evolves across the project life cycle: attitudes often dip during uncertain planning and partially recover later, with trust in sources, expectations of local benefits, tourism concerns, and perceived community discord shaping trajectories in nearest zones (le Maitre et al., 2024). These dynamics argue against “check-the-box” approaches and in favour of life-cycle socio-technical governance that can carry legitimacy through contested stages while accommodating agonistic moments rather than pathologizing conflict (Müller and Buchecker, 2025). Communication requirements vary across project stages: anticipated turbines and existing wind farms

raise different uncertainties and concerns, while legitimacy gaps shift across regulatory, normative, and cultural-cognitive dimensions rather than remaining fixed project attributes (Schmid-Petri and Klimmt, 2026; Schnell and Mattes, 2026).

A distinct, additive pathway runs through community embeddedness. Membership in (and identification with) local energy initiatives is uniquely associated with more conservation behavior, more efficiency upgrades, and stronger communal engagement intentions, even after controlling for biospheric values and environmental self-identity, indicating that group processes diffuse trust and fairness norms beyond individual households (Sloot et al., 2018). This helps explain why identical participation or ownership offers are experienced differently across places and publics, and why co-determination often proves more consequential than one-off compensation. Community embeddedness can deepen when infrastructures become linked to local identity, meaningful control, and durable municipal–citizen practices rather than remaining externally imposed arrangements (Alpuche-Alvarez, 2026; Lüder et al., 2026).

System and spatial contexts set outer bounds for feasible acceptance. European assessments show that steering build-out toward low-conflict areas and calibrating settlement setbacks, land-use suitability, and biodiversity buffers can meet ambitious targets at lower social and ecological cost – provided that countries invest in anticipatory spatial planning and transparent trade-off communication (Gauglitz et al., 2019; Wiehe et al., 2021; Kiesecker et al., 2024). Power-system modeling that embeds empirically derived acceptance constraints finds modest effects on total costs but large regional reallocation of investment and heightened salience of transmission, underscoring why siting, social license, and grid expansion should be planned and explained jointly (Plaga et al., 2024). Regulatory detail matters too: setback regimes and planning rules shape both technical potential and where conflicts can even arise, making rule design itself a lever for legitimacy as well as feasibility (Lehmann et al., 2023, 2024; Reutter et al., 2024). Comparative governance studies add that “tensions become conflicts” where speed and macro-targets are prioritized without commensurate investments in procedural justice and multi-level coordination (an early warning for jurisdictions scaling up at pace (Koelman et al., 2022)) and that litigation and referenda, while shaping timelines, rarely substitute for upstream participation in producing durable consent (Töller et al., 2024).

Taken together, the international literature converges on a clear theoretical lens for our analyses. Procedural and distributive fairness, trusted intermediaries, and perceived local impacts are the proximate determinants of acceptance; social norms and benefit-sharing modulate their effects; and socio-demographics are analytically relevant insofar as they structure exposure to, and evaluation of, these pathways. Against this backdrop we ask which socio-demographic factors, defined here as place of residence (urban vs. rural), political orientation, education, and age, are most strongly associated with local attitudes toward onshore wind once core acceptance constructs are considered, and to what extent place conditions these relationships. The literature treats these markers not as causes in themselves but as proxies for value profiles, information ecologies, trust, and lived exposure through which fairness and impacts are judged (Hamilton et al., 2019; Hoen et al., 2019; Rand and Hoen, 2017). This motivates modelling them jointly with proximal perceptions. It also yields a specific expectation about place: cross-national evidence that urban-rural gaps remain contingent once identity and trust are modeled (Kulin and Sevä, 2024) implies that residence should operate mainly as a contextual moderator rather than as a standalone divide, a proposition we test directly rather than assume.

4. Data and methods

The empirical basis for the analysis is a representative online survey carried out by the German polling institute Civey in 2021 (for a full overview of survey facts, see Table A1 in the appendix). The survey

comprised 14 questions developed to capture attitudes on climate protection, renewable energy (especially wind power), and citizen participation preferences.

The survey targeted residents of NRW and collected responses from 6284 verified participants. To ensure representativeness, we implemented quota sampling and statistical weighting, aligning the survey sample with population distributions in the survey region. The variables used for weighting included: age group, gender, school education, place of residence (urban vs. rural), voting intention. This process mitigates common biases in online surveys, such as overrepresentation of politically active, urban, or higher-educated users.

To analyze the survey data, we applied both multiple linear regression models and logistic regression models, depending on the nature of the dependent variables. Specifically, multiple linear regressions were used for questions where the response options were measured on continuous or ordinal scales (e.g., levels of agreement or importance), allowing us to assess the relationship between explanatory variables and the intensity of attitudes. In contrast, logistic regression models were employed for binary outcomes, particularly for questions with yes/no or multiple-choice response formats where respondents could select more than one option. This mixed modeling approach enabled us to differentiate between general trends in opinion and specific choices or actions while accounting for a wide array of demographic, political, and socio-cultural factors. Before proceeding with statistical analyses, the raw dataset underwent a rigorous data cleaning and weighting process. This was necessary because the raw data included observable distortions in respondent characteristics compared to the general population (e.g., skewed gender or age ratios, disproportionate political affiliation).

To quantify bivariate relationships, we report Pearson correlation coefficients (r), which range from -1 (perfect negative association) to $+1$ (perfect positive association). In addition, multivariate regression models are evaluated using the coefficient of determination (R^2), which indicates the share of variance explained by the predictors. We use these statistics descriptively and diagnostically rather than as substitutes for the factorial and multivariate analyses.

We report R^2 (and adjusted R^2) for all multivariate models. The socio-demographic models are intended as cleavage diagnostics rather than comprehensive explanatory models: they quantify how much variation in wind-salient attitudes is organized by structural divides (above all political orientation), not the full predictability of individual attitudes. To keep this transparent, we report two nested specifications for each wind-salient outcome. The parsimonious 2×2 model (place of residence $\times$ political orientation) yields $R^2 \approx 0.115$ for local support and ≈ 0.07 for landscape evaluation. The full socio-demographic model (which additionally includes age cohorts, sex, employment status, and children in the household, and is the specification displayed in the regression panels of Figs. 1 and 3) yields $R^2 \approx 0.135$ (support) and ≈ 0.148 (landscape); the climate-threat model reaches $R^2 \approx 0.19$. The increment from the 2×2 to the full model is modest and driven by age, not by place: across both specifications political orientation is by far the dominant predictor, while the direct urban–rural coefficient remains statistically indistinguishable from zero. Explained variance then rises substantially once proximal perceptions are added (trust and perceived landscape fit; $R^2 \approx 0.58$ for support). This pattern is itself a finding: political orientation is the strongest structural correlate, but local wind acceptance is shaped predominantly by project-specific, perception-based factors that planning can influence.

Analytically, the study seeks to describe and account for variation in wind-salient attitudes in the population, in associational terms, and to identify proximal levers through which those attitudes can plausibly be shifted in practice. Two outcomes anchor the analysis, each measured on five-point scales and coded so that higher values indicate “more” of the construct: support for expanding onshore wind in one’s own county (Q4) and evaluation of the landscape in the wind context (Q6). Additional question blocks (planning priorities, desired pre-construction information, motivations for financial participation, trust in information

sources, conflict resolution preferences, and participation formats) serve to test mechanism-adjacent hypotheses and to contextualize the two primary outcomes. Baseline climate beliefs and general views about expanding renewables are treated as context, not as targets of explanation.

For transparent descriptive presentation at the item level, we report survey-weighted distributions and selected weighted contrasts based on the 2×2 factorial decomposition of place of residence (urban vs. rural) and political orientation (right-wing vs. non-right-wing) introduced below.¹

The inferential analysis is based on a 2×2 factorial decomposition that separates the two constitutive dimensions into analytically independent variables: place of residence (urban vs. rural) and political orientation (right-wing vs. non-right-wing). This produces four internally defined and mutually comparable groups: urban non-right-wing, urban right-wing, rural non-right-wing, and rural right-wing respondents. Two considerations motivated this strategy. First, statistical validity required sufficiently large and reasonably balanced comparison cells. Several alternative segmentations available in the dataset (such as detailed age cohorts, occupational status, vocational education, employment status, marital status, children in the household, or religion) produced highly uneven cell sizes, which reduced statistical power and made estimates unstable. By contrast, the 2×2 decomposition yields adequately large cells throughout (Appendix Tables A3.5–A3.8). Second, the purpose of segmentation in this paper is not to maximize typological granularity but to isolate the core cleavage that explains the strongest and most policy-relevant differences in local wind attitudes. Exploratory survey-weighted regressions showed that additional socio-structural variables were generally smaller, less consistent across outcomes, and often not statistically significant once political orientation and urban–rural residence were included. The appendix confirms this pattern: political orientation is the strongest and most robust predictor across key outcomes, while the direct urban effect is comparatively small and most interaction terms are limited in size or statistically weak.

Because attitudes toward infrastructure are often mediated by proximal perceptions, we construct a TrustIndex from the available “K-items” (e.g., trust in local/state authorities, independent science, the press, environmental organizations, citizen initiatives, and planning authorities).² Items are oriented to a common direction, rescaled to $[0,1]$, and averaged; higher scores mean greater trust. Where conceptually related sets of survey items exist (e.g., perceived fairness in procedures, information/participation preferences), we form indices only when internal consistency meets a minimal standard (Cronbach’s $\alpha \geq .60$). If a candidate bundle falls short, we retained theoretically central items as single indicators and created full item-level diagnostics (α , item–total correlations, α -if-deleted).³

5. Empirical results

Before turning to the item-level evidence, we state the analytical expectations that organize this section and link it to the literature reviewed in Section 3. If structural cleavages rather than place per se drive local wind attitudes, we expect (i) political orientation to be the dominant socio-demographic correlate of wind-salient outcomes, with education, age, and urban–rural residence contributing weak or context-dependent gradients (Section 5.1); (ii) the proximal “process levers”

¹ In earlier descriptive work we summarized the data using a single cosmopolitan/non-cosmopolitan contrast. Because that composite confounds residence and political orientation, all analyses in this paper are based on the factorial 2×2 decomposition (urban–rural $\times$ political orientation); the earlier contrast is not used. Main-text figures display the four 2×2 groups throughout.

² See Appendix A3 for a detailed description of the methodological procedure.

³ See the results of the statistical analyses in Appendix A3.5.

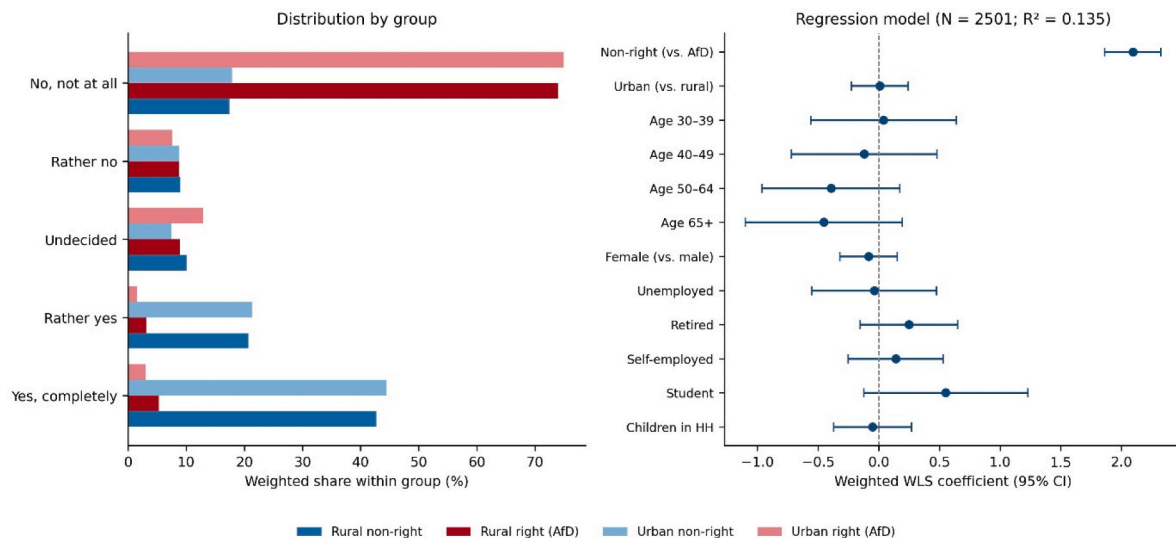


Fig. 1. Support for local onshore wind expansion in the respondent's district (Q4). Left panel: survey-weighted response distribution by 2×2 group. Right panel: the full socio-demographic WLS model (N = 2501; $R^2 = 0.135$), in which non-right political orientation is the dominant predictor and the urban–rural coefficient is not distinguishable from zero. The R^2 shown here is for the full socio-demographic specification; the parsimonious 2×2 model (place $\times$ politics) yields $R^2 \approx 0.115$ (see Section 4).

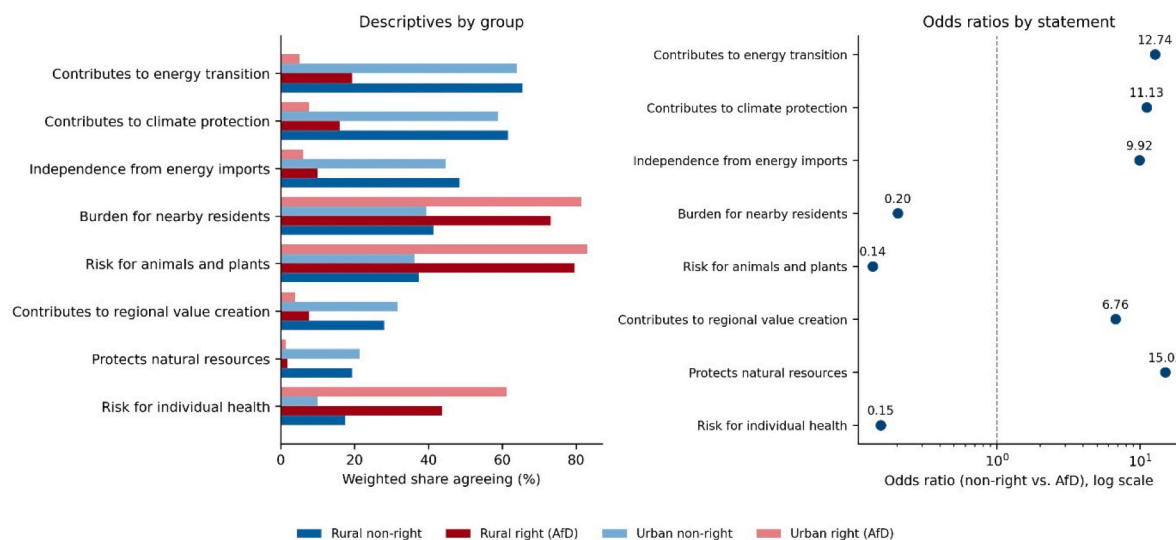


Fig. 2. Perceptions of wind energy (Question 5). Left panel: survey-weighted share agreeing with each statement, by 2×2 group. Right panel: odds ratios for agreement (non-right vs. AfD) on a log scale; values above 1 indicate higher agreement among non-right respondents.

(trust, perceived fairness, information, participation, and conflict handling) to differ across the four place–politics constituencies in ways that matter for engagement design, rather than to separate neatly by geography (Section 5.2); and (iii) preferences for information channels and visualization tools to track education and digital access more than age (Section 5.3). We report survey-weighted results and, throughout, treat the socio-demographic models as cleavage diagnostics: they identify which structural divides organize attitudes, while the larger share of explained variance arises from the proximal perceptions examined in 5.2.

5.1. Core attitudes to onshore wind energy: local support and landscape evaluation

This subsection tests whether the core wind-salient attitudes, namely local support (Q4), perceptions of what wind energy does (Q5), and

evaluation of the landscape change it brings (Q6), are structured primarily by political orientation rather than by place, education, or age. All three are organized far more by political orientation than by place. For local support (Q4, Fig. 1), both non-right groups average about 3.6 on the 1–5 scale (rural 3.62, urban 3.66), whereas both AfD-leaning groups average about 1.5 (rural 1.57, urban 1.50); the urban–rural difference within each political bloc is negligible (≤ 0.05 points), while the political gap exceeds two scale points.

Perceptions of what wind energy does (Q5, Fig. 2) split even more sharply along the political axis than by place. Non-right respondents far more often associate wind power with climate protection and the energy transition (odds ratios for agreement, non-right vs. AfD, ≈ 11 and 13), whereas AfD-leaning respondents are markedly more likely to frame it as a burden for nearby residents and a risk to nature and health (odds ratios ≈ 0.14 – 0.20). Within each political bloc the urban and rural shares largely coincide, so this divide too is political rather than spatial.

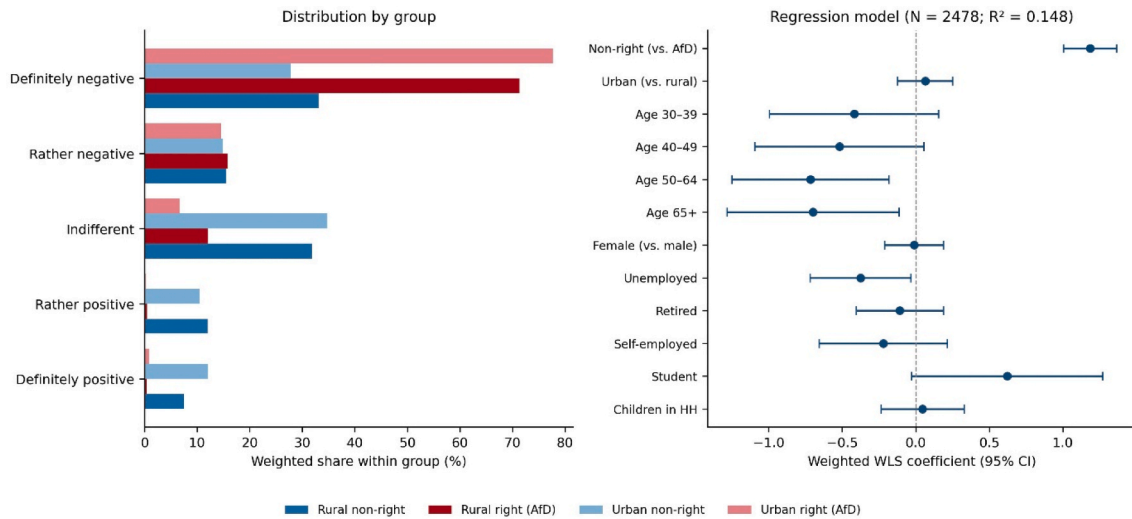


Fig. 3. Visual impacts of wind energy (Question 6). Left panel: survey-weighted response distribution by 2×2 group. Right panel: the full socio-demographic WLS model ($N = 2478$; $R^2 = 0.148$); the parsimonious 2×2 model yields $R^2 \approx 0.07$ (see Section 4). Political orientation dominates in both specifications, while the urban-rural coefficient is not distinguishable from zero.

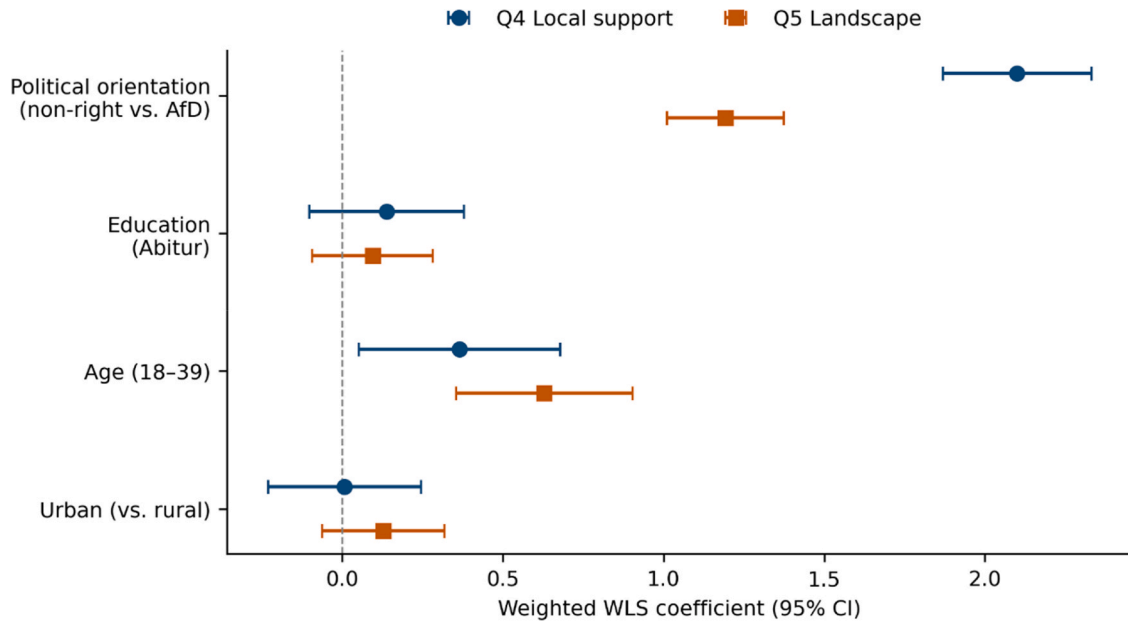


Fig. 4. Partial effects of socio-demographic markers on wind-salient outcomes (weighted WLS coefficients with 95% CIs) (note: Abitur = high school diploma; AfD = German right-wing political party).

Evaluations of the landscape change brought by wind farms (Q6, Fig. 3) follow the same structure: non-right respondents are markedly more positive (rural 2.45, urban 2.64) than AfD-leaning respondents (rural 1.43, urban 1.32), while the urban-rural contrast within each bloc is small. Intermediate categories overlap across groups, indicating a continuum within each bloc rather than two homogeneous camps. A generational gradient is visible (younger respondents evaluate visual change more favourably), and because scenic evaluation and local support move together, concrete, verifiable demonstrations of visual integration (e.g., siting rationales, before-after views) are especially pertinent where attitudes are most malleable.

To move beyond by-eye impressions, a compact forest summary places the four core socio-demographic markers side by side in joint,

survey-weighted models estimated separately for Q4 and Q5. Political orientation (non-right vs. AfD) shows by far the strongest positive association; education (Abitur = high school diploma) and age (18–39) contribute only weak gradients that are not consistently distinguishable from zero, and the urban-rural coefficient is small and statistically indistinguishable from zero once other markers are held constant (see Fig. 4).

Two proximal constructs sharpen interpretation. Trust in credible intermediaries and institutions is strongly and positively associated with both outcomes and attenuates the education and political coefficients without reversing them, consistent with trust operating as a channel rather than a substitute. Perceived landscape fit (Q6) is strongly linked to Q4 support and absorbs part of the socio-demographic pattern while

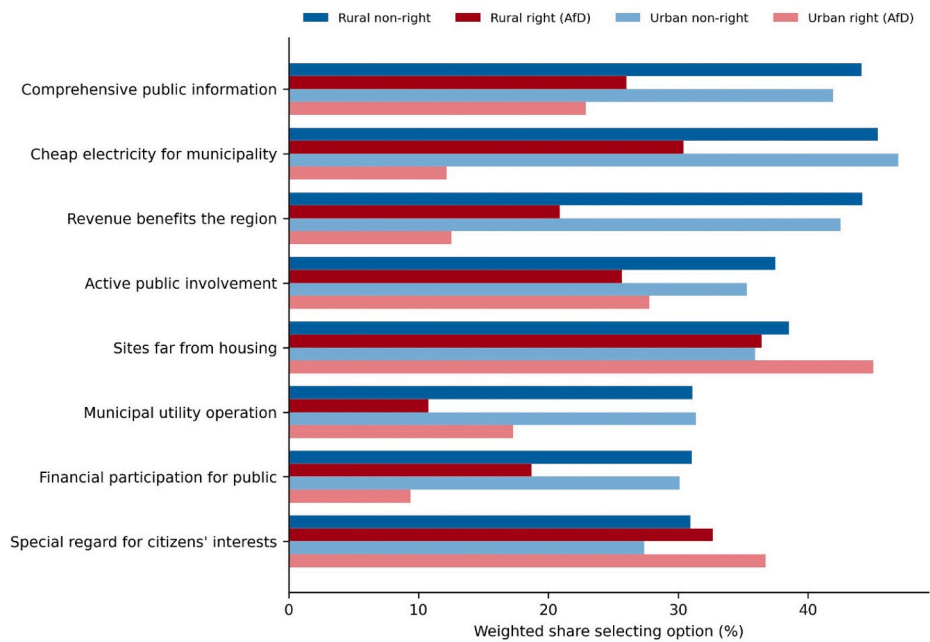


Fig. 5. Planning priorities (Question 7).

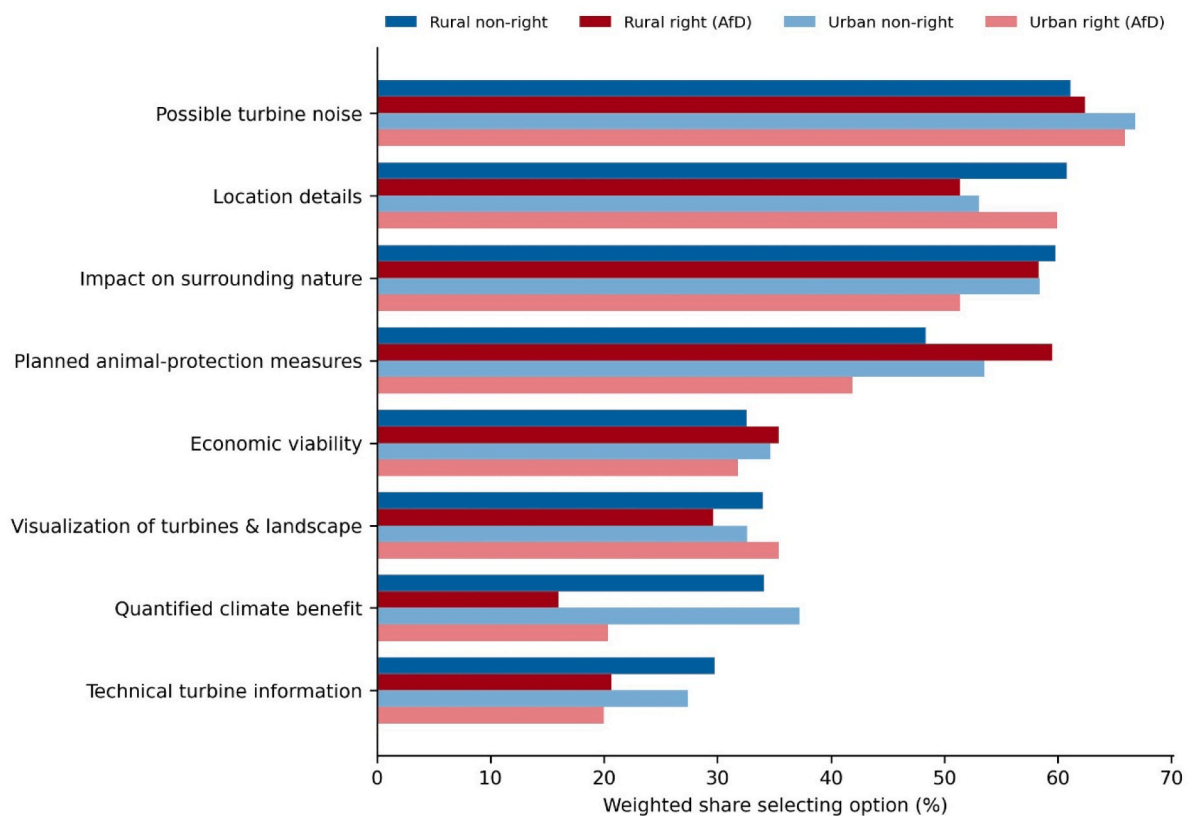


Fig. 6. Desired pre-construction information (Question 8).

leaving the ordering intact, tying scenic evaluation directly to local policy preferences. Model-specific N s, survey weights, and heteroskedasticity-robust inference are reported alongside the figures; ordered-response specifications yield the same substantive conclusions.

Three implications follow for the remainder of the results. First, political orientation exerts by far the largest association with wind-salient attitudes; education and age contribute only weak gradients, and place has no robust direct effect once other markers are included.

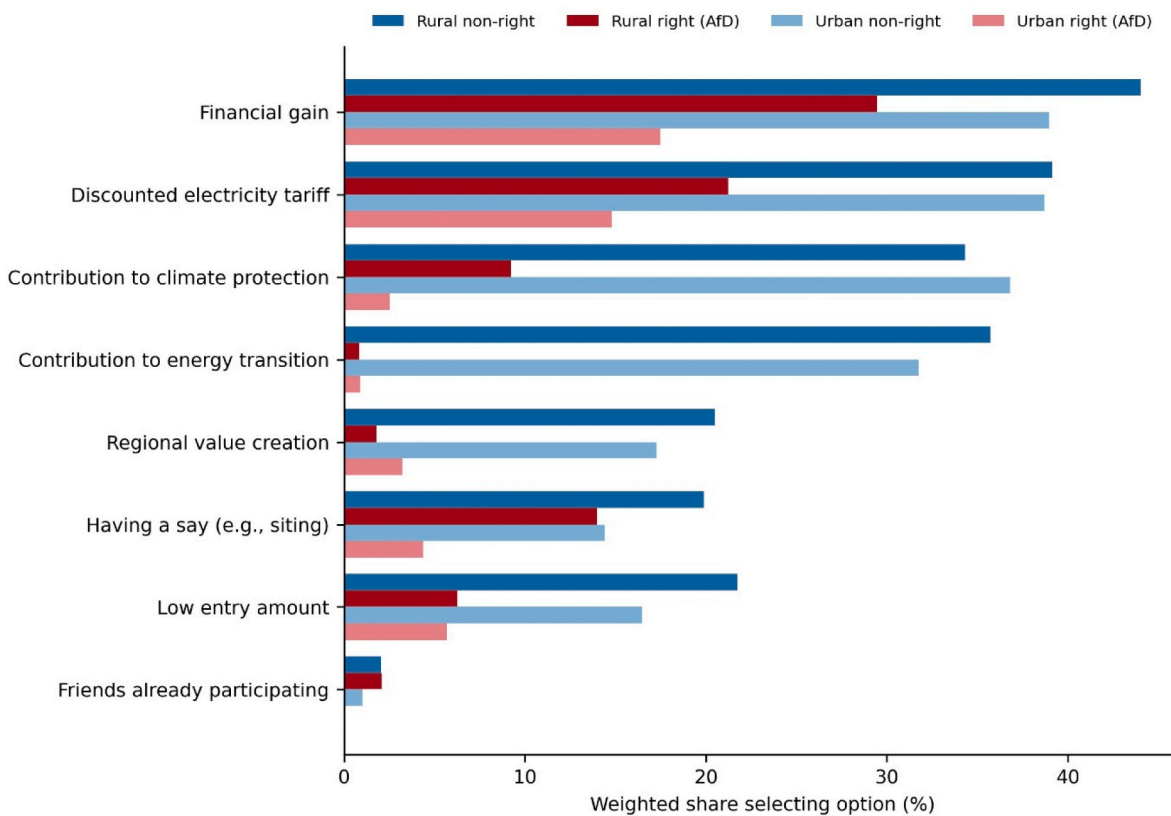


Fig. 7. Motivation for financial participation (Question 10).

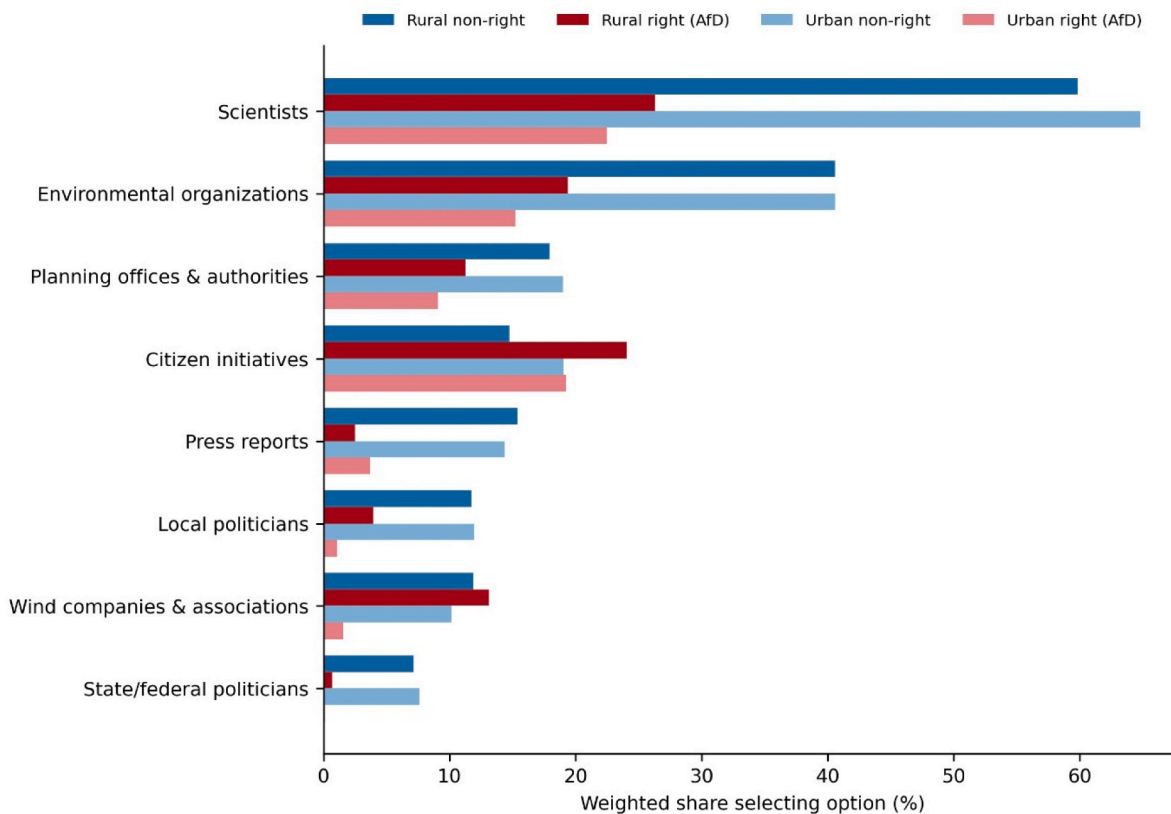


Fig. 8. Trust in information sources (Question 11).

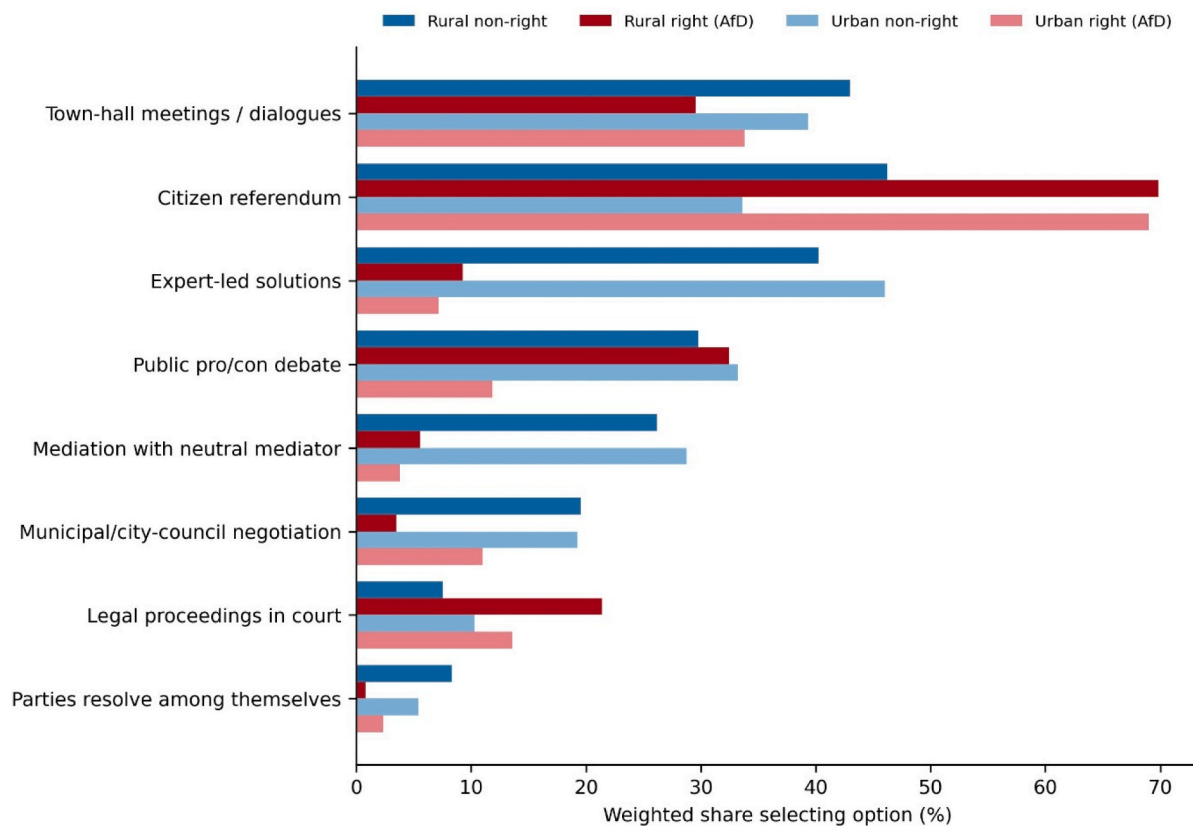


Fig. 9. Conflict resolution preferences (Question 12).

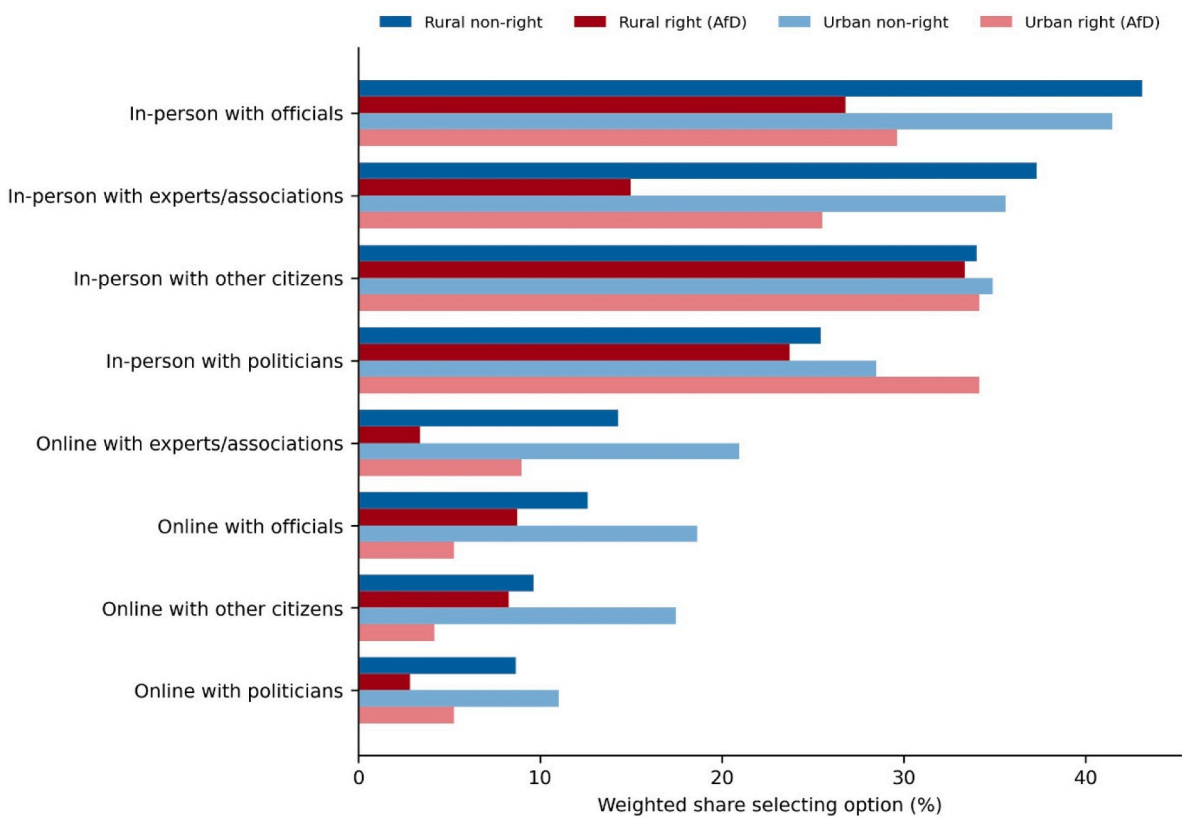


Fig. 10. Participation preferences (Question 13).

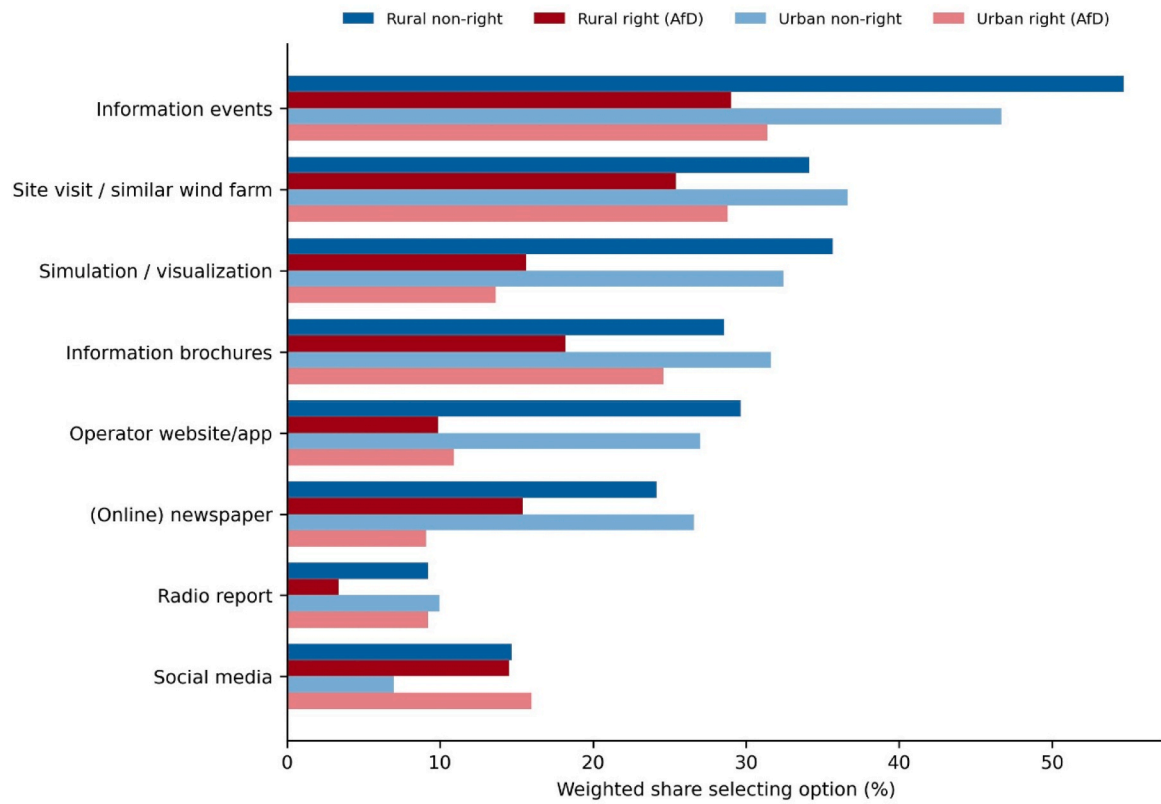


Fig. 11. Preferred information channels (Question 9).

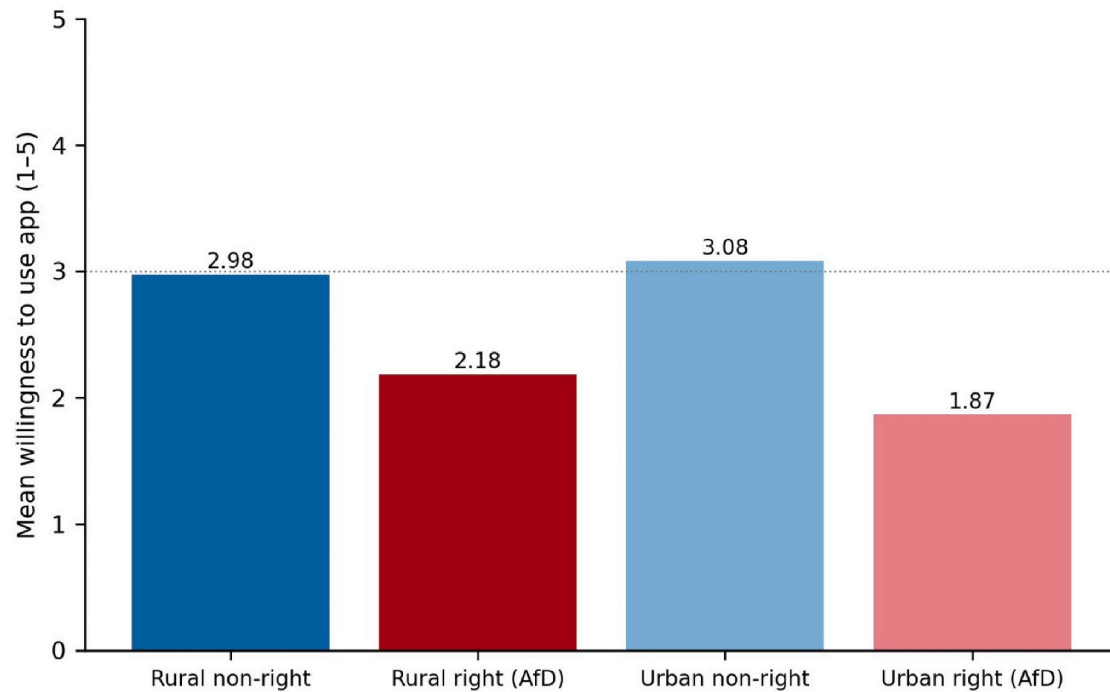


Fig. 12. App usage for visualization (Question 14).

Second, place matters indirectly as context (through trust and perceived fit) more than as a standalone divider, which helps explain why broad segment overlaps persist even when average differences are visible.

Third, because the undecided middle is large and rejection tails are comparatively thin, practical gains hinge on credible, concrete, and legible communication: show visual trade-offs, explain siting criteria,

and anchor information in trusted intermediaries. These conclusions motivate the examination of the survey questions that operationalize the main acceptance levers (information, fairness, participation, conflict handling, and trust) in the next subsection, where we assess how these mechanisms map onto item-level preferences and, ultimately, onto support.

5.2. Process levers of acceptance: planning, information, financial participation, trust, conflict handling, and participation formats

This subsection asks whether the process levers of acceptance, namely planning priorities (Q7), desired pre-construction information (Q8), motivations for financial participation (Q10), trust in information sources (Q11), conflict-resolution preferences (Q12), and participation formats (Q13), differ across the four place-politics groups in ways that engagement design can address.

Planning priorities (Q7, Fig. 5). Both blocs rank comprehensive information and active involvement highly. Non-right respondents place more weight on revenue accruing to the region ($\approx 43\%$ vs. 17%), municipal-cheap-electricity and municipal operation, and broad public information; AfD-leaning respondents are the only group to rate distance from housing ($\approx 41\%$) and “special regard for citizens’ interests” ($\approx 35\%$) more highly than the non-right. The shared core of information and involvement provides a workable baseline for project design.

Pre-construction information (Q8, Fig. 6). Information needs are largely consensual: noise ($\approx 64\%$ in both blocs), exact location ($\approx 57\%/56\%$), impact on nature ($\approx 59\%/55\%$) and animal-protection measures ($\approx 51\%$ in both) are demanded almost identically across groups. The main difference is that non-right respondents more often want a quantified climate benefit ($\approx 36\%$ vs. 18%). Credible, experience-near information on local impacts therefore speaks to all constituencies.

Financial participation (Q10, Fig. 7). Motives diverge most here. Non-right respondents are far more motivated by contributions to the energy transition ($\approx 34\%$ vs. 1%) and to climate protection ($\approx 36\%$ vs. 6%); both blocs value financial gain ($\approx 42\%$ vs. 24%) and a discounted tariff. AfD-leaning respondents express low motivation across nearly all motives, suggesting that financial offers alone will not mobilise this group.

Trust (Q11, Fig. 8). Source credibility is the sharpest cleavage. Non-right respondents trust scientists ($\approx 62\%$ vs. 24%) and environmental organizations ($\approx 41\%$ vs. 17%) far more, whereas AfD-leaning respondents trust citizen initiatives somewhat more than the non-right do ($\approx 22\%$ vs. 17%) and distrust nearly all institutional sources. This points to credible, locally recognised intermediaries rather than official channels where institutional trust is low.

Consistent with the joint models, a higher trust baseline aligns with greater support. The Urban $\times$ Trust margins indicate that increases in trust yield appreciable gains in local support where scepticism is otherwise more salient (see Fig. 4).

Conflict handling (Q12, Fig. 9). Non-right respondents favour expert-led solutions ($\approx 43\%$ vs. 8%) and neutral mediation ($\approx 28\%$ vs. 5%); AfD-leaning respondents strongly prefer binding, direct mechanisms: a citizen referendum ($\approx 69\%$ vs. 40%) and, secondarily, court proceedings ($\approx 18\%$ vs. 9%). The contrast is between expert-deliberative and direct-binding procedures, not blanket rejection of one mode.

The pattern does not signal blanket rejection of “softer” methods but a preference for mechanisms that produce visible, binding outcomes without relying heavily on interpersonal trust.

Participation formats (Q13, Fig. 10). In-person events are the default for all groups (citizen meetings $\approx 34\%$ in both blocs). Non-right respondents are more open to digitally mediated formats with experts or officials; AfD-leaning respondents rate in-person formats with politicians marginally higher. Within the non-right bloc, urban respondents are somewhat more open to online formats than rural ones ($\approx +6$ – 8 percentage points). Hybrid designs therefore fit heterogeneous preferences better than digital-only campaigns.

The pragmatic implication is to adopt hybrid designs that accommodate heterogeneous preferences: Face-to-face meetings supported by simple, credible visuals, with optional digital deep dives (i.e., on-demand webinars and interactive materials (detailed FAQs, site maps/dashboards, and technical appendices) for those who want more depth).

Taken together, these item-level results refine the hierarchy established by the wind-salient outcomes. Structural markers such as political orientation and education shape how people engage with planning, information, and conflict handling, but it is the proximal levers (clear disclosures, credible intermediaries, visual proof of siting choices, accessible participation and benefit-sharing, and decision procedures that combine deliberation with decisive closure) that constitute mechanisms through which support can be strengthened in practice.

5.3. Information ecosystem and visualization tools

This subsection examines whether communication-channel (Q9) and visualization-tool (Q14) preferences track education and digital access rather than age.

Channels (Q9, Fig. 11). Information events attract broad support but more so among the non-right ($\approx 51\%$ vs. 30%). The separation is sharpest for simulation/visualization formats ($\approx 34\%$ vs. 15%) and operator websites/apps ($\approx 28\%$ vs. 10%); AfD-leaning respondents rate social media marginally higher ($\approx 15\%$ vs. 11%). Site visits are valued across groups. This is consistent with differences in trust and digital orientation rather than place per se.

App use (Q14, Fig. 12). Willingness to use a visualization app is higher among non-right respondents (≈ 3.0 on 1 – 5) than AfD-leaning respondents (≈ 1.9 – 2.2), with urban non-right respondents marginally most willing (3.08). Because openness to digital tools tracks the political-educational cleavage rather than age, app-based visualization and e-participation options should be paired with low-barrier alternatives (printed photomontages, large-screen walk-throughs at events, guided demonstrations) so that visual evidence on siting reaches audiences with different competencies and trust levels (Solman, 2022; Radtke, 2023).

These patterns caution against confounding “digital access” with “effective access”: openness tracks education and trust more than age, so low-barrier, facilitator-guided options must accompany any app-based offer.

Read together, the channel and tooling results reinforce three conclusions: there is no single best medium (in-person formats are endorsed across groups, but only the non-right consistently favour digital and simulation-based communication); visual evidence is pivotal because scenic judgements and local support move together; and messenger and medium interact, so that where institutional trust is low, independent and locally recognised intermediaries in face-to-face settings are essential for translating technical information.

Beyond the core items, the remaining question blocks sharpen three points (see Figures A1-3 in Appendix). First, baseline beliefs about the climate problem display wider group gaps than most process items, showing that value-laden convictions set the backdrop but do not on their own determine local wind support. Second, judgments of municipal climate performance are less polarized, indicating a pragmatic zone where delivery, transparency, and outcomes can build cross-group legitimacy. Third, the perceived importance of expanding renewables follows the same hierarchy documented earlier (political orientation exerts the strongest association with wind-salient attitudes, while education and age contribute only weak gradients and place has no robust direct effect once other markers are included), which aligns with the gradients observed here (see in 5.1). Crucially, the step from general endorsement to local support hinges on proximate perceptions (above all visual fit and trust), underscoring that acceptance rises through concrete process levers rather than abstract agreement alone (see in 5.2). The detailed patterns in channels and participation formats point to hybrid engagement as the default (face-to-face first, complemented by simple visual materials and optional digital deep-dives) and to low-

Table 1
From findings to policy implications.

Finding	Evidence (this study)	Policy implication
Political orientation is the dominant structural correlate of local support	2×2 weighted means + WLS: non-right vs. AfD b ≈ 2.0 (Tab. A3.6/A3.7); Fig. 4	Avoid one-size-fits-all engagement; use credible, non-partisan intermediaries and binding procedures in low-trust settings
Trust and perceived fairness are the proximal levers; they raise support more than distance	TrustIndex strongly associated with support; R^2 rises to ≈ 0.58 with proximal perceptions	Make fairness enforceable: transparent siting criteria, auditable benefit-sharing, independent information
Urban–rural location matters as context, not as a direct divide	Urban coefficient ≈ 0 , n. s. across models (Tab. A3.7; Fig. 4)	Tailor format to constituencies (face-to-face in rural/lower-trust; digital complements where receptive) rather than to geography per se
Preferences for conflict handling and channels differ by cleavage constellation	Q11–Q13 by 2×2 group (Figs. 8–11): AfD-leaning groups favour referenda/binding outcomes; non-right favour expert-led deliberation	Combine deliberation with decisive, visible closure; pair economic returns with procedural guarantees

barrier, facilitator-guided visualization alongside apps, so that evidence about siting trade-offs reaches audiences with different competencies and trust baselines.

6. Discussion

Public views on wind power are broadly positive across many democracies, yet project-level responses remain heterogeneous because attitudes reflect not only judgments about technology and siting but also differences in trust, fairness, and place attachment (Carley et al., 2020; Devine-Wright and Peacock, 2024). In our data, support is stratified along familiar socio-demographic lines: younger, more educated, urban, and non-right respondents are more supportive and more trusting of expert information than other groups. At the same time, the widest gaps concern climate-threat beliefs and source credibility, whereas process-oriented items show more overlap, suggesting that disagreement is sharper over interpretive frames than over actionable governance arrangements.

Stepping back, the pattern refines core acceptance models rather than overturning them: fairness and trust remain the central correlates of support, but their salience is context-dependent. In particular, rural acceptance appears most responsive when credible intermediaries are visibly involved and when siting and benefit arrangements are not merely promised but enforceable and auditable, which is consistent with work emphasizing process legibility and rule certainty as preconditions of legitimacy (Scherhauser et al., 2018).

A first implication concerns the role of political worldviews. Across our models, non-right respondents express higher acceptance of local wind deployment, stronger trust in scientific and regulatory information, and greater openness to expert-led deliberation, while right-wing respondents place more weight on visible local burdens and binding decision rules. This pattern aligns with research showing that broader identity cleavages structure energy attitudes even when conventional socio-economic controls are included (Holowach and Parkins, 2025; Lindvall et al., 2025; Otteni and Weisskircher, 2022; Kraft and Kraft, 2025).

Importantly, the political cleavage is not a spatial artifact. Political orientation remains the dominant correlate of local support after accounting for trust and perceived landscape fit (roughly half of its

association is transmitted through these proximal perceptions, while the remainder is direct), and it further conditions how strongly trust translates into support, which is more consequential among non-right than among right-leaning respondents. Place, by contrast, carries little direct weight and operates mainly as context. Substantively, this means that building trust pays off less where opposition is politically anchored, so that in such settings binding, transparent procedures (consistent with these respondents' stated preference for referenda and rule-based decisions) matter more than information provision alone. Two recent studies mark the boundaries of this claim. A pre-registered US survey that randomized turbine size and scenic setting finds rural residents opposed regardless of either and attributes their opposition to climate-policy priorities rather than to visual impact, which converges with our result, although in our data perceived landscape fit still transmits part of the political association, so that the two designs locate the same cleavage at slightly different points (Ko et al., 2026). A multilevel analysis of EU survey data, by contrast, attributes close to one fifth of the variation in renewable-energy support to differences between regions and reports an independent negative association with population density, which runs counter to the urban–rural ordering observed here (Rojas-Peña et al., 2026). Read together, these findings caution against treating either the near-zero direct place effect estimated for NRW or a general density gradient as a spatial law: what travels is the political cleavage, not a fixed geography.

A second implication concerns trust and procedural justice. Respondents who express confidence in independent science, planners, and public authorities are more willing to back nearby projects and more open to mediated conflict resolution. In our data, the trust index is among the strongest correlates of local support, reinforcing a large body of evidence that treats trust, informational independence, and transparent process as preconditions for legitimacy rather than add-ons to technical optimization (Leibenath et al., 2016; Hübner et al., 2023). Formal procedural knowledge does not suffice on its own: meaningful participation, perceived fairness, and assessments of the responsibility, accountability, and trustworthiness of the actors behind technological decisions remain central to legitimacy (Miguel et al., 2026; Scheer and Sonnberger, 2026). Two qualifications deserve stating. German survey evidence indicates that institutional trust is not a uniformly positive driver of acceptance but an actor-specific one: trust in government is associated with stronger perceived benefits and weaker perceived disadvantages yet also with stronger negative affect, while trust in corporations shows more positive affect alongside weaker perceived benefits (Stuhm et al., 2026). A composite index such as ours therefore pools components that may partly offset one another, and its coefficient is best read as an average across addressees rather than as evidence about any single actor. Experimental evidence from four European countries adds a second qualification: benefit sharing was the most universally effective trust-building strategy, whereas science communication worked markedly less well among older rural respondents without a university degree, the very segment for which we argue that visibly involved, credible intermediaries are decisive (Yalaz et al., 2025). Demand for credible information and responsiveness to it are evidently not the same thing.

Distributional cues and community benefits also matter, but not as simple “buy-offs.” Our results suggest that regional value creation and revenue-sharing are most effective when they are embedded in credible, co-governed arrangements and legally transparent municipal benefit-sharing rules (Ertel and Wulff, 2024). Citizen investment is shaped not only by expected returns and risks but also by non-monetary value, autonomy, perceived effort, security of supply, and accessible investment conditions, although financial considerations remain dominant (Breitschopf, 2026). This is consistent with German and European evidence showing that participation loses force when it is perceived as symbolic, whereas early cooperation and visible local benefits can raise acceptance if institutional trust is sufficient (Knauf, 2022; Langer et al., 2017; Kalogiannidis et al., 2025). A systematic assessment of 60 active participation and compensation schemes across 19 European countries

and 21 NUTS2 regions, current to October 2025, reports a clear tendency toward fixed-payment compensation, typically monetary transfers to host municipalities and local residents (Bucha et al., 2027). That is the design our results caution against relying on alone: a fixed transfer is legible and auditable, but it does not by itself create the co-governance that our respondents' preference for binding, rule-based procedures implies. The underlying potential is nevertheless considerable, with nationwide German survey evidence indicating that about one third of wind opponents say an option to participate financially could change their position (Ebersbach et al., 2026).

The familiar national-local gap is visible in our data as well: generalized support for wind remains higher than support for nearby projects. This pattern cautions against a simple "NIMBY" reading. Proximity matters, but not as an automatic distance effect: living near (planned) turbines is associated with lower local support primarily because proximity activates concerns about landscape change, the local distribution of burdens and benefits, procedural fairness, and trust in those responsible. Distance alone is often a weak or inconsistent predictor; what matters is how proximate impacts are perceived and governed. Proximity is therefore best understood as a conditional, place-activated effect operating through perceived fairness and trust, rather than as reflexive local self-interest (Dugstad et al., 2020; Kraft and Kraft, 2025). A short-range local effect is nevertheless visible in revealed behavior: turbine deployment reduces support in German product and political markets, but the effect decays rapidly with distance (Germeshausen et al., 2025). Visibility-related declines in pro-renewable voting are concentrated in later election periods and are more pronounced in rural municipalities and in places with organized opposition (Stegmaier and Krause, 2026). Electoral responses are not uniformly negative across settings: in southern Italy, effects vary with the ideological alignment of incumbent coalitions rather than forming a general penalty (Daniele et al., 2026).

A further set of results speaks to the generality of this ranking. The German Longitudinal Environmental Study (GLEN), a nationally representative probability panel fielded in 2024, carries a closely comparable item on support for more wind turbines, including near the respondent's own home (23,940 valid responses), and reproduces the pattern reported here on an unrestricted national sample (GLEN, 2026). Mean support differs by 1.87 scale points between Green and AfD supporters (4.07 against 2.20; 78.9% and 17.5% in favour respectively). Place produces a gradient of its own, but a much flatter one: support declines steadily from metropolitan urban regions (3.23; 45.8% in favour) through regiopolitan urban regions (3.15) and rural regions close to an urban region (3.03) to peripheral rural regions (2.93; 35.2%), a total spread of 0.30 points. With the urban-rural distinction drawn as in our survey, a joint model of party alignment, place, education, age and gender (16,559 cases) yields an AfD coefficient of -1.125 against a rural coefficient of -0.141 , a ratio of about 8 to one; the place coefficient is thus small, though at this sample size it is distinguishable from zero. The factorial breakdown shows where it comes from. Among respondents without an AfD vote intention, support is 0.19 points lower in rural than in urban regions (3.19 against 3.38), whereas among AfD supporters the two barely differ (2.18 against 2.21); the party gap is correspondingly somewhat narrower in rural regions (1.02 against 1.17 points; interaction term $+0.138$, $p = 0.044$). Consistent with our data, the urban-rural contrast within each political bloc is small: place conditions the political cleavage rather than producing it. Adding climate concern and satisfaction with democracy reduces the party coefficient to -0.470 , that is by 58%, closely matching the decomposition reported above, while the rural coefficient changes much less (-0.117). The same panel also shows that the individuals behind these aggregates move: asked again one year later, 46.5% of 12,576 respondents gave a different answer, somewhat more often in rural than in urban regions (48.8% against 45.1%), while the share in favour shifted by less than one percentage point (see Appendix A3.6). The cleavage structure identified here therefore generalizes beyond NRW, but the individual positions composing it are not

fixed.

Nationwide evidence gathered in spring 2026 suggests the gap is narrower than a NIMBY reading assumes: in a survey of 6,566 respondents, 78% endorsed a higher share of renewables in electricity generation and local wind expansion was likewise supported by a majority, while opposition remained more than twice as common in the east as in the west, at 14% against 6% (Ebersbach et al., 2026). That east-west difference is itself a reminder that the geography which matters here is institutional and biographical rather than metric.

NRW's specific governance and deployment context sharpens these implications. Because settlement density is high in the Rhine-Ruhr corridor and many remaining potential sites are socially and ecologically contested, the state has long faced a pronounced 'how' problem: conflicts concentrate less on whether renewables should expand than on which siting rules, buffers, and decision procedures can command legitimacy (Radtke et al., 2021). In this context, the survey's strong demand for detailed, credible, and experience-near information (especially on noise, nature impacts, and exact turbine locations) should be read as a response to spatial constraint and cumulative exposure rather than as generalized climate scepticism. Recent permitting and commissioning dynamics further raise the stakes for transition acceleration (Sovacool et al., 2025). As NRW has moved into a leading position in new permits and additions while revising restrictive siting rules (Fachagentur Wind und Solar, 2025; Clean Energy Wire, 2023), acceptance problems are likely to cluster where accelerated deployment pressure meets low institutional trust (i.e., abolishing a formal spatial barrier such as the 1000-m minimum-distance rule lowers planning difficulties but might spark increased social resistance). For NRW policy, the implication is straightforward: broad support for climate protection or presumed urban majorities are not enough. What matters is procedurally robust governance—credible intermediaries, transparent siting criteria, and enforceable local benefit-sharing—that can travel across metropolitan, post-industrial, and peripheral districts alike.

Media and cueing environments likely reinforce these differences. Comparative research shows that partisan media consumption shapes energy preferences independently of socio-demographics, while polarizing frames gain traction where institutional trust is brittle (Schneider and O'Neill, 2025; Holowach and Parkins, 2025). Our own results mirror this: the largest gaps concern items tied to elite credibility, whereas differences are smaller for process-design items centered on concrete information and face-to-face dialogue.

Partisan cues should not be treated as sufficient explanations on their own. Political orientation is the strongest structural correlate of wind-salient attitudes in our results, but its practical importance varies with trust, perceived fairness, and local context (Andrews et al., 2025). These patterns bear directly on the study's central question and on the design of engagement instruments. Our multivariate tests converge on a consistent ranking: political orientation is by far the strongest structural correlate of wind-salient outcomes; education and age contribute only weak gradients that are not consistently distinguishable from zero, and the direct urban effect is small and statistically indistinguishable from zero once the other factors are held constant. The practical implication is to invest early in independent, evidence-based information, visible fairness safeguards, and participation formats that match heterogeneous preferences.

Read through a policy lens, these findings translate into four governance priorities—enforceable fairness, credible information, context-matched participation, and procedurally embedded local benefits—summarized in Table 1 and developed as concrete recommendations in Section 7.

Taken together, the evidence indicates that progress on wind acceptance will depend less on multiplying messages than on aligning socio-technical design with different place-politics constellations. The central task is to stabilize support where trust is already comparatively high while building credible, locally grounded pathways in settings where scepticism is tied to low institutional trust, distributive concerns,

and landscape change.

7. Conclusions and Policy Implications

This study set out to identify which socio-demographic cleavages structure local onshore wind attitudes in North Rhine-Westphalia, and whether place conditions these relationships. Three findings stand out. First, political orientation is the dominant structural correlate of local support, whereas the direct urban–rural effect is small once politics, education, and trust are accounted for. Second, place operates as context rather than cause: its influence runs through trust and perceived fairness, which are the strongest proximal correlates of support. Third, the levers that shift the large undecided middle (credible information, visible procedural fairness, and participation formats matched to local preferences) are precisely those that planning can influence. Methodologically, the paper contributes by separating place of residence from right-wing versus non-right-wing party alignment in a 2×2 design.

Conclusions and Policy Implications. Four evidence-based recommendations follow. (1) Make fairness enforceable through transparent siting rules and traceable benefit-sharing, since trust and perceived fairness, not distance, most strongly track support. (2) Route information through credible, non-partisan intermediaries and show the chain of evidence, as source credibility is where group differences are largest. (3) Use hybrid, context-matched participation: face-to-face formats with simple visuals where rural or lower-trust publics dominate, with digital and expert-led complements where urban and higher-educated audiences are receptive. (4) Treat local economic returns as necessary but not sufficient, pairing them with procedural guarantees so benefits are not read as compensation for weak voice. Because political orientation is the strongest structural divide but acts largely through trust and fairness, engagement should be differentiated by place–politics constituency rather than delivered uniformly (Radtke, 2025b; Radtke, 2026; Webler and Tuler, 2025; Webler and Tuler, 2020; Devine-Wright and Peacock, 2024; Devine-Wright and Howes, 2010; Devine-Wright, 2013).

The broader implication is that accelerating wind deployment cannot be understood as a merely technical or administrative task. It also depends on administrative capacity, local governance, public legitimacy, and the ability to handle distributional and procedural conflicts in ways that affected communities regard as credible. In this sense, social acceptance is part of the implementation capacity of the energy transition itself rather than an external constraint on it (Bogumil et al., 2025; Plaga et al., 2024; Hübner et al., 2023; Bogumil, 2025).

This matters because wind expansion now carries significance well beyond climate mitigation. In the post-2022 European context, faster renewable deployment has become central to reducing fossil import dependence, limiting exposure to gas-price volatility, and strengthening energy-system resilience. Achieving these goals requires decisive acceleration of clean-energy deployment within a strategy of resilience, diversification, and strategic autonomy in an interconnected European energy system (Ah-Voun et al., 2024; Navia Simon and Diaz Anadon, 2025; Navia Simon and Diaz Anadon, 2025; LaBelle, 2024; Wetzel et al., 2026; Wetzel et al., 2023).

Against this background, North Rhine-Westphalia is not just another federal state in which local conflicts over wind energy happen to occur. NRW is a particularly consequential arena because it condenses, within a single region, the core tensions of the present transition: renewable expansion under spatial scarcity, industrial decarbonization under competitive pressure, and democratic legitimation under conditions of social heterogeneity. As Germany's most populous and economically most significant federal state, with a strong industrial base and substantial mitigation pressure, NRW is a decisive setting for whether renewable expansion can be aligned with industrial transformation and

social acceptance at the same time. This is especially relevant because the decarbonization of basic industries in NRW is closely tied to new energy infrastructures, including hydrogen, and therefore depends on public support across multiple layers of transformation rather than in the electricity sector alone (Altstadt et al., 2026).

NRW is also an analytically informative — rather than statistically representative — case for structural change in Europe and beyond. The Ruhr area is described in the literature as one of the most prominent former old industrial regions in Western Europe, indeed as the largest former old industrial region in Western Europe, while also constituting Germany's largest conurbation and one of the world's largest industrial agglomerations. That combination makes the region especially relevant for comparative research and policy transfer. The Ruhr's long-term transformation from coal and steel dependency toward a more diversified economic structure has repeatedly been discussed as a source of lessons for other regions facing industrial restructuring, including explicit comparisons with other European transition territories such as Northern Greece. For that reason, success or failure in NRW resonates beyond the German case: if accelerated decarbonization can be made socially legitimate in such a dense, industrialized, and politically complex region, the case carries considerable relevance for other coal, steel, manufacturing, and port regions across Europe and internationally (Hassink and Kiese, 2021; Belke et al., 2019; Altstadt et al., 2026).

The practical implication is therefore not that conflict can be designed away, but that it must be governed more credibly. Transparent siting criteria, early and intelligible communication, trusted intermediaries, visible procedural fairness, and well-governed local benefit-sharing should be treated as core infrastructure of acceleration rather than secondary instruments of conflict management (Hübner et al., 2023).

More broadly, the study underlines that the future of wind energy expansion in Germany depends on aligning four governance dimensions: credible information, meaningful participation, fair benefit allocation, and strategic resilience. Wind energy is no longer only a climate-policy issue; it has become part of a wider project of democratic self-government under conditions of decarbonization, geopolitical uncertainty, and industrial transformation. In that broader perspective, NRW functions not merely as a regional case but as an analytically informative, most-relevant case for whether accelerated renewable deployment can simultaneously strengthen democratic legitimacy, reduce external vulnerability, and support the reorganization of former industrial heartlands in a socially durable way.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix

Table A1
Survey Facts

Sample size	6284
Survey region	North Rhine-Westphalia (Germany)
Survey period	September 17, 2021 – September 29, 2021
Age	18 - 29 30 - 39 40 - 49 50 - 64 65 +
Occupational status	Worker Employee Senior Employee/Executive Civil Servant
Vocational education	Vocational training University degree or higher Still in training No degree
Employment	Employees Self-employed Unemployed/Non-working persons Retirees Students
Marital status	Single Married/Widowed Divorced
Children in the household	Children in the household No children in the household
Counties	Bielefeld Bochum Bonn Borken Bottrop Coesfeld Dortmund Duisburg Düren Düsseldorf (Stadt) Ennepe-Ruhr-Kreis Essen Euskirchen Gelsenkirchen Gütersloh Hagen Hamm Heinsberg Herford Herne Hochsauerlandkreis Höxter Kleve Krefeld Köln (Stadt) Leverkusen Lippe Mettmann Minden-Lübbecke Märkischer Kreis Mönchengladbach Mülheim an der Ruhr Münster (Stadt) Oberbergischer Kreis Oberhausen Olpe Paderborn Recklinghausen Remscheid Rhein-Erft-Kreis Rhein-Kreis Neuss Rhein-Sieg-Kreis

(continued on next page)

Table A1 (continued)

	Rheinisch-Bergischer Kreis Siegen-Wittgenstein Soest Solingen Steinfurt Städteregion Aachen Unna Viersen Warendorf Wesel Wuppertal
Administrative district	Düsseldorf Köln Münster Detmold Arnsberg
Religion	Catholic Protestant Another Non-denominational
School education	High School Diploma (Abitur) Secondary School Diploma (Mittlere Reife) Lower Secondary School/No Degree (Hauptschule/kein Abschluss)
Political voting intention (federal election)	CDU/CSU (Conservative Party) SPD (Social Democratic Party) Grüne (Green Party) FDP (Liberal Party) Linke (Left-wing Party) AfD (Right-wing Party) Other

Table A2
Questionnaire

No.	Questions	Response categories	Responses in total (percentage)
1	Do you think that climate change is a threat, that needs to be handled?	Yes, definitely Rather yes Rather no No, by no means Undecided	18.1 54 11 9.6 7.3
2	Do you think that there are enough climate protection activities in your county?	Yes, on any case Rather yes Rather no No, not at all Undecided	14.6 17 23.9 19 25.5
3	How important do you think is the expansion of renewable energy systems?	Very important Rather important Rather unimportant Totally unimportant Undecided	55.3 21.3 8 9.2 6.2
4	Do you support the expansion of wind energy in your county?	Yes, on any case Rather yes Rather no No, not at all Undecided	41 19.6 8.6 21.5 9.3
5	Which of the following statements about wind energy do you agree with? (multiple answers allowed)	Contributes to climate protection Protects natural livelihoods Contributes to the <i>Energiewende</i> Means independence from energy imports Puts health at risk Endangers animals and plants Contributes to regional value creation Burden for residents None of the above	56.4 19 60.9 44.1 17.4 40.3 28 43.4 4.2

(continued on next page)

Table A2 (continued)

No.	Questions	Response categories	Responses in total (percentage)
6	Do you think that wind parks influence the appearance of the landscape positively or negatively?	Clear positively Rather positively Partly Rather negatively Clear negatively Do not know	8.8 9.8 30.9 14.9 33.7 1.9
7	What should be taken into account when constructing a wind farm near your home? (multiple answers allowed)	Comprehensive information for the public Active involvement of the public Special consideration of citizens' interests Locations far from residential areas Revenue should benefit the region Financial participation for the public Operation by municipal energy providers Use for affordable electricity for the municipality None of the above	41.5 36.7 30.3 37.5 41.6 29.5 29.3 44.1 9.2
8	What information would you like to receive before a wind farm is built near your home? (multiple answers allowed)	Information about the location Technical information about the wind turbines Visualization of wind turbines and the landscape Possible noise generated by the wind turbines Planned measures for the protection of animals Impact on the surrounding nature Economic viability Quantified contribution to climate protection None of the above	57.7 27.9 33.2 63.2 50.2 59 33.6 34.3 7.6
9	If a wind farm were planned near your home, how would you like to be informed about it? (multiple answers allowed)	Information events Information brochures Information website/app by the wind farm operator Site visit or visit to a similar wind farm Radio report (Online) newspaper Social media such as Facebook, blogs, YouTube Simulation/visualization of the wind farm None of the above	49.4 28.9 27.1 34.7 9.4 24.1 12.1 32.3 16.9
10	Which of the following factors would motivate you to invest financially in a wind farm near your home? (multiple answers allowed)	Contribution to climate protection Contribution to the <i>Energiewende</i> Financial gain Low entry amount of money Discounted electricity tariff Regional value creation/strengthening the local economy Having a say in decisions (e.g., location) Friends or acquaintances are also participating None of the above	33.1 31.2 40.7 18.2 37.5 17.7 17.6 1.4 31.4
11	If a wind farm were planned near your home, which source of information on wind energy would you consider credible in this situation? (multiple answers allowed)	Local politicians State or federal politicians Scientists Press reports Nature and environmental protection organizations Citizen initiatives Wind power companies and associations Involved planning offices and authorities None of the above	11.3 6.9 58.6 13.6 38.7 17.6 11 17.9 20.2
12	In your opinion, how should conflicts during the planning of a new wind farm be handled? (multiple answers allowed)	Finding solutions through experts Negotiation in the municipal or city council Vote in a citizen or public referendum Town hall meetings/citizen dialogues Conflict parties should resolve it among themselves Public pro/con debate Mediation process with a neutral mediator Legal proceedings in court None of the above	39.7 18.1 43.1 40.2 6.7 31.2 25.2 9.5 7.8

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Table A2 (continued)

No.	Questions	Response categories	Responses in total (percentage)
13	If a wind farm were planned near your home, how would you like to discuss it? (multiple answers allowed)	Face-to-face events with other citizens Online events with other citizens Face-to-face events with those responsible Online events with those responsible Face-to-face events with politicians Online events with politicians Face-to-face events with associations/ experts Online events with associations/experts None of the above	35 12.6 41.5 14.4 27.1 9.5 36.6 16.7 25.4
14	If a wind farm were planned near your home, would you use an app that allows you to see the wind farm in the real environment?	Yes, on any case Rather yes Rather no No, not at all Undecided	24.4 18.6 18.3 26.8 11.9

A3: Appendix für Methods

A3.1 Study design, population, and weighting

We have analyzed a cross-sectional, representative survey of residents of North Rhine-Westphalia (NRW), fielded in September 2021. The consolidated research file contains $N = 6284$ unique respondents and the survey provider's post-stratification weight (weight), used in all descriptive and model-based analyses to restore population margins. Because not all questions were asked of all respondents and some items exhibit item nonresponse, analytic sample sizes vary by outcome and model; we report the per-model N in every table and figure. Unless otherwise noted, we apply model-specific listwise deletion: for each analysis, observations missing any variable used in that model are omitted. Age was surveyed in ordered categories, and we keep it categorical to reflect the instrument and to avoid imposing linearity that the measurement does not support.

The empirical strategy proceeds in three steps that mirror the structure of the results. First, for descriptive purposes, we present survey-weighted item distributions and contrasts across the four factorial groups, and all hypothesis tests rely on the factorial 2×2 decomposition of urban–rural residence and political orientation. Second, we estimate joint, survey-weighted least-squares (WLS) models for each primary outcome in which the four socio-demographic markers enter simultaneously. When theoretically appropriate, we include proximal covariates, such as the TrustIndex in both outcomes and, for Q4, the landscape evaluation (Q6) to test whether perceived visual fit is directly linked to local support. Third, we probe context dependence via a small, pre-specified set of interactions (Urban $\times$ Trust, Urban $\times$ Fairness if a fairness scale attains $\alpha \geq .60$, and Urban $\times$ Political orientation). Interactions are summarized with marginal-effects plots so that both direction and magnitude are directly interpretable.

All analyses apply the survey's post-stratification weights. Because unequal variances are plausible with attitudinal outcomes, we compute HC-robust standard errors (HC2/HC3) and emphasize effect sizes and confidence intervals over dichotomous significance thresholds. Although outcomes are ordinal (1–5), we prioritize OLS-type models for transparency and for the straightforward interpretation of interactions, and we verify that conclusions are robust to ordered-response specifications. Variance-inflation factors are inspected and remain below conventional thresholds. Missing data are handled by listwise deletion within each model; variation in N across specifications reflects split batteries and item nonresponse.

A3.2 Outcomes and predictors

Our analyses focus on wind-salient outcomes rather than broad climate views:

- Local wind support: 5-point item capturing support for onshore wind expansion in one's county (Dausbalk, coded 1–5; higher = more supportive).
- Perceived landscape impact: 5-point evaluation of how positively the landscape is perceived in the context of wind energy (Flandbild, 1–5).
- Trust in information and institutions: composite index (TrustIndex, 0–1) computed as the mean of available trust items in the “K-items” battery (items standardized to a common 0–1 direction where necessary).
- Participation and conflict-handling preferences: where internal consistency allowed, we summarize preferences for deliberative/mediation formats and for adversarial/direct formats; if reliability was too low, we analyze items singly (reported transparently in the Appendix).

Key socio-demographic predictors are modeled jointly in every multivariate specification:

- Place (Urban vs. Rural): indicator of residence in a densified/urban area (1 = urban, 0 = rural). Place is treated as a context variable and, where relevant, a moderator, not as a proxy for a broader identity grouping.
- Political orientation: binary indicator for right-populist vote intention or preference (e.g., not AfD/right-populist, where 1 = not AfD/right-populist, 0 = AfD/right-populist). In robustness checks, we test alternative codings (e.g., left/center/right dummies) when available.
- Education: categorical highest school qualification (dummy-coded).
- Age: categorical as surveyed (dummy-coded).

Gender and household income are not central to the theoretical focus of this study; where available, we include them only in robustness to demonstrate that our main inferences about place, education, age, and political orientation are not sensitive to their omission.

A3.3 Scale construction and reliability

To address concerns about “arbitrary single items,” we construct indices when conceptually warranted and when internal consistency is acceptable. Specifically, we compute Cronbach's α for each candidate scale using the survey weight. Our pre-registered decision rule for reporting in the main text is $\alpha \geq .60$.

- TrustIndex meets this threshold ($\alpha \approx .68$) and is used in the main models.
- The deliberative/mediation bundle exhibited modest reliability ($\alpha \approx .42$), and the adversarial/direct bundle was very low (near 0). We therefore refrain from presenting these as scales in the main text; instead we (i) keep the most theoretically central items as single predictors in robustness models and (ii) report full item-level descriptives and reliability diagnostics in the Appendix, as recommended good practice.

All index items are oriented so that higher values consistently indicate more of the construct (e.g., more trust).

A3.4 Statistical analyses

Weighted descriptive comparisons (Urban vs. Rural). For each wind-salient outcome, we report weighted means (and standard errors) by place. Rather than relying on “by-eye” differences, we test mean differences by estimating a weighted bivariate linear model of the form

$$Y_i = \beta_0 + \beta_1 \text{Urban}_i + \varepsilon_i,$$

with survey analytic weights (weight). Equivalently, this corresponds to a weighted two-sample comparison of Urban vs. Rural. We report $\hat{\beta}_1$, its 95% confidence interval, and the p-value. This approach avoids pitfalls from unequal group sizes and accommodates the weights used later in multivariate models.

Multivariate models for wind-salient outcomes. To assess the unique association of each socio-demographic factor with wind attitudes, we estimate weighted least squares (WLS) regressions for each outcome Y on the full predictor set:

$$Y_i = \beta_0 + \beta_1 \text{Urban}_i + \beta_2 \text{Education}_i + \beta_3 \text{Political}_i + \beta_4 \text{AgeCats}_i + X_i^\top \gamma + \varepsilon_i,$$

where X_i contains construct-proximate covariates when relevant (e.g., TrustIndex, Perceived landscape), and all models are estimated with the survey analytic weight. Given reviewer concerns about duplication, we never include a composite “group dummy” alongside its component (e.g., not an identity grouping and Urban simultaneously); we use Urban directly.

Moderation tests (context-conditioned effects). To test whether place conditions the influence of theoretically central predictors, we add interaction terms to the baseline model:

- Urban $\times$ Trust (does trust matter differently in urban vs. rural contexts?)
- Urban $\times$ Perceived fairness (if a fairness index meets $\alpha \geq .60$; otherwise, the most central fairness item in robustness)
- Urban $\times$ Political orientation

The canonical specification is:

$$Y_i = \dots + \beta_5 \text{Urban}_i \times \text{TrustIndex}_i + \beta_6 \text{Urban}_i \times \text{Political}_i + \dots$$

We graph marginal effects of the moderator at meaningful values (e.g., TrustIndex across [0,1] for Urban = 0/1) to aid interpretation. Interactions are retained if the joint F-test of added terms rejects at conventional levels or if the interaction materially alters the magnitude and uncertainty of the focal main effect.

Estimation details, diagnostics, and robustness. All models use analytic weights. We report coefficients, standard errors, 95% CIs, p-values, and R^2 (or pseudo- R^2 , where applicable), along with the analytic N. Because heteroskedasticity is plausible with attitudinal outcomes and unequal weights, we compute HC-robust standard errors in a sensitivity analysis (HC2/HC3) and confirm that our substantive conclusions are unchanged; the robustness tables appear in the Appendix. We also check variance inflation factors (VIFs); VIFs below conventional thresholds indicate that including both Urban and age/education/political indicators does not induce problematic multicollinearity.

A3.5 Statistical results

Table A3.1
Urban Means.

Measure	Urban	N	Weighted mean
Local wind support (1–5)	0	1412	3.494
Local wind support (1–5)	1	1089	3.565
Landscape perception (positive; 1–5)	0	1384	2.374
Landscape perception (positive; 1–5)	1	1094	2.513
Trust index (0–1)	0	1406	0.217
Trust index (0–1)	1	1096	0.224
Preference: deliberative/mediation (0–1)	0	1384	0.337

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Table A3.1 (continued)

Measure	Urban	N	Weighted mean
Preference: deliberative/mediation (0–1)	1	1120	0.35
Preference: direct/confrontational (0–1)	0	1384	0.214
Preference: direct/confrontational (0–1)	1	1120	0.174

Table A3.2

Main Model.

Unnamed: 0	coef	se	t	p
const	2.414409	0.229613	10.51512	7.36E-25
Urban	0.074122	0.071755	1.03299	0.301804
TrustIndex	0.655625	0.208614	3.142766	0.001712
Flandbild	0.420752	0.030713	13.69933	5.87E-40
nichtafd	0.053494	0.152021	0.351889	0.72498
schulbil_2.0	0.00857	0.129396	0.066234	0.947202
schulbil_3.0	−0.08655	0.117966	−0.73366	0.463289
alter_2	0.395548	0.176025	2.247106	0.024803
alter_3	−0.40986	0.164647	−2.48935	0.012924
alter_4	−0.15956	0.151319	−1.05445	0.291875
alter_5	−0.08638	0.150754	−0.57299	0.56675

Table A3.3

Moderations.

Unnamed: 0	coef	se	t	p	model
TrustIndex	1.459766	0.271332	5.379999	8.61E-08	M1: Support ~ Trust × Urban + Ctrl
Urban	−0.02018	0.111289	−0.18136	0.856107	M1: Support ~ Trust × Urban + Ctrl
Trust_x_Urban	0.313803	0.368951	0.850527	0.395166	M1: Support ~ Trust × Urban + Ctrl
Flandbild	0.409046	0.032578	12.55586	1.3E-34	M2: Support ~ Landschaft × Urban + Ctrl
Urban	−0.18649	0.132528	−1.40716	0.159566	M2: Support ~ Landschaft × Urban + Ctrl
Fland_x_Urban	0.071896	0.049328	1.457509	0.145165	M2: Support ~ Landschaft × Urban + Ctrl
nichtafd	0.578604	0.142623	4.056874	5.14E-05	M3: Support ~ nichtAfd × Urban + Ctrl
Urban	−0.10955	0.221161	−0.49535	0.620401	M3: Support ~ nichtAfd × Urban + Ctrl
Urban_x_nichtafd	0.151021	0.229381	0.658387	0.510354	M3: Support ~ nichtAfd × Urban + Ctrl

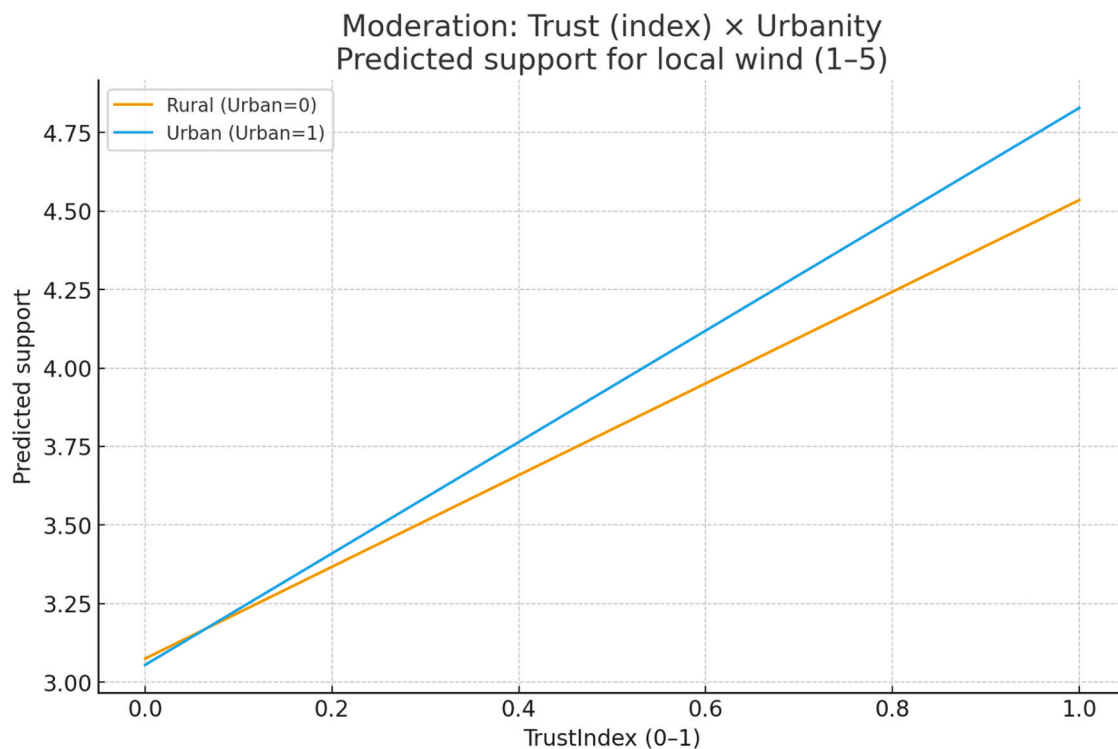
**Fig. A3.** Moderation: Trust (index) × Urbanity.

Table A3.4
Reliability.

Scale	Items	Cronbach_alpha
Trust index (K-items)	8	0,442
L_delib (experts, assemblies, mediation, debate)	4	0,425
L_advers (referendum, court, parties-only)	3	−0,008

A3.6 Limitations

Several design features of this study constrain inference. The analyses are cross-sectional, political orientation is self-reported, age is measured categorically, and the panel modality is online; these choices are appropriate for population coverage and cost but limit claims about dynamics and may interact with digital literacy. Fieldwork timing (2021) and the absence of objective exposure measures (e.g., turbine distance/sound) further bound generalizability beyond the study region. Future work should track cohorts longitudinally, embed experiments that manipulate fairness and trust framings (and intermediary identity) in real planning processes, and integrate acceptance constraints with spatial and power-system models to stress-test policy packages under realistic social and grid conditions.

The panel evidence referred to in Section 6 bears directly on this limitation and is worth stating in full. In the German Longitudinal Environmental Study, an item on building more wind turbines, including near the respondent's own home, was put to the same 12,576 adults one year apart (GLEN, 2026). The aggregate barely moved: the share in favour went from 45.9% to 45.0% and the mean from 3.22 to 3.19. Individuals moved a great deal, however: 46.5% gave a different answer, 8.6% shifted by two categories or more, and mean absolute change exceeded net change by a factor of 19. Movement was somewhat more frequent in rural than in urban regions (48.8% against 45.1%), that is, where acceptance is lower and where projects are actually built. The distributions reported here should therefore be read as a snapshot of a population whose individual positions circulate even where the aggregate appears settled. This does not weaken the present study's emphasis on procedural design but sharpens it, since arrangements that must hold across a project life cycle cannot rest on a cross-sectional majority.

A3.7: Additional survey questions

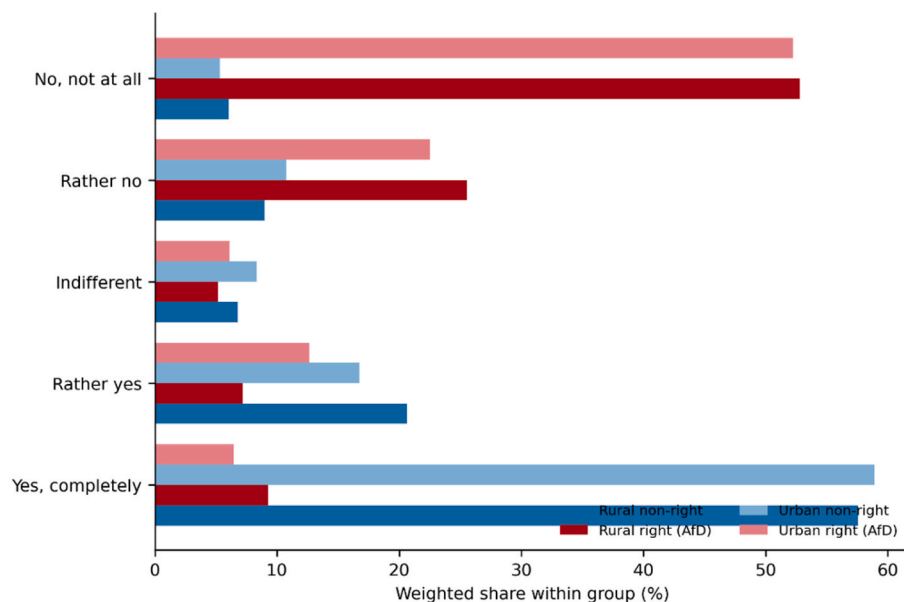


Figure A4. Do you perceive climate change as a threat? (Question 1) by 2 × 2 group, weighted % within group. (Source: Gesamtdatensatz2; urban = verdichtet.)

Fig. A4. Do you perceive climate change as a threat? (Question 1) by 2 × 2 group, weighted % within group. (Source: Gesamtdatensatz2; urban = verdichtet.)

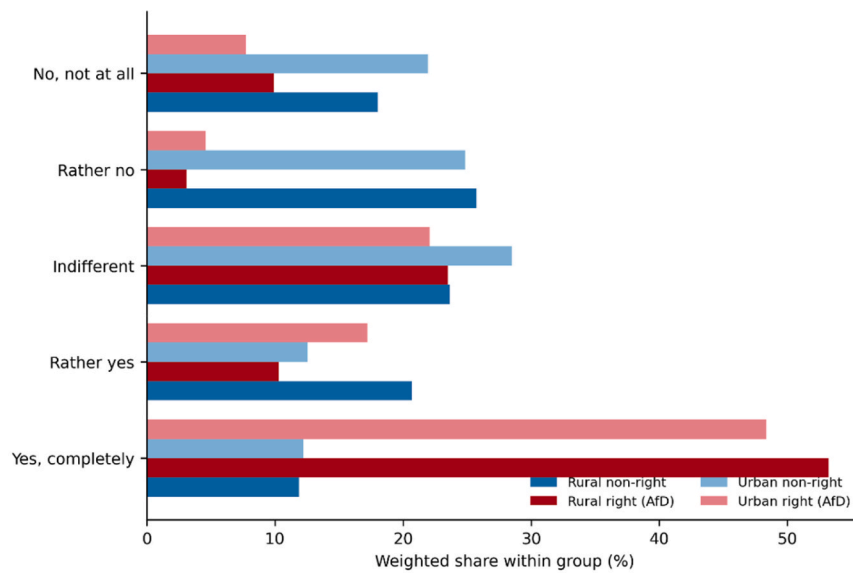


Figure A5. Is enough done in your district to protect the climate? (Question 2) by 2×2 group, weighted % within group. (Source: Gesamtdatensatz2; urban = verdichtet.)

Fig. A5. Is enough done in your district to protect the climate? (Question 2) by 2 × 2 group, weighted % within group. (Source: Gesamtdatensatz2; urban verdichtet.)

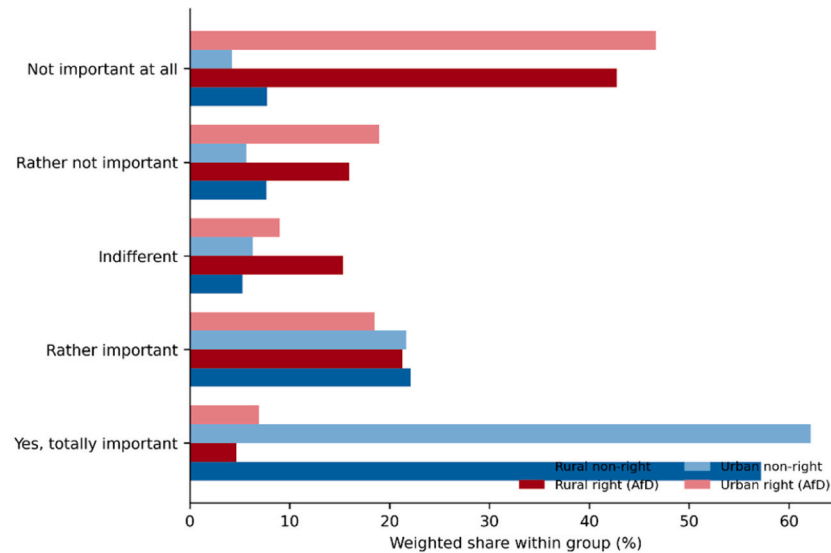


Figure A6. How important do you think is the expansion of renewable energy systems? (Question 3) by 2×2 group, weighted % within group. (Source: Gesamtdatensatz2; urban = verdichtet.)

Fig. A6. How important do you think is the expansion of renewable energy systems? (Question 3) by 2 × 2 group, weighted % within group. (Source: Gesamtdatensatz2; urban = verdichtet.)

A3.8: Additional Appendix Tables (2 × 2 design)

These appendix tables document the reviewer-motivated shift from a heuristic cosmopolitan contrast to a factorial 2 × 2 design. They report cell sizes, weighted means, and weighted linear and logistic models for the four analytically distinct groups (urban non-right, urban right, rural non-right, rural right), ensuring that inferential comparisons do not rely on a heterogeneous residual category.

Table A3.5

Cell sizes for the 2 × 2 design (urban–rural × right-wing orientation)

Residence	Political orientation	Unweighted N	Weighted N
Urban	Non-right-wing	2420	2553.8
Urban	Right-wing (AfD)	354	247.3
Rural	Non-right-wing	3014	3554.0
Rural	Right-wing (AfD)	496	320.8

Table A3.6

Weighted means (1–5) of key outcomes by 2 × 2 group (higher values indicate stronger agreement/importance)

Outcome –	Rural – Non-right	Rural – Right (AfD)	Urban – Non-right	Urban – Right (AfD)
Would use visualization app (Q14)	2.98	2.18	3.08	1.87
Climate change seen as threat (Q1)	4.15	1.95	4.13	1.99
Landscape evaluation in wind context (Q6/Q5)	2.45	1.43	2.64	1.32
Support wind expansion in district (Q4)	3.62	1.57	3.66	1.50

Table A3.7

Survey-weighted linear models (WLS, HC3 robust SEs): effects of residence, political orientation, and their interaction

Dependent variable	Term	b	SE (robust)	p	R ²
support	urban	−0.070	0.173	0.687	0.115
support	nonright	2.052	0.141	<0.001	0.115
support	urban:nonright	0.105	0.216	0.626	0.115
landscape	urban	−0.106	0.122	0.385	0.068
landscape	nonright	1.026	0.106	2.99e-22	0.068
landscape	urban:nonright	0.294	0.165	0.0745	0.068
climate_threat	urban	0.041	0.254	0.873	0.186
climate_threat	nonright	2.201	0.150	5.66e-49	0.186
climate_threat	urban:nonright	−0.056	0.278	0.84	0.186
app_use	urban	−0.317	0.240	0.187	0.030
app_use	nonright	0.794	0.182	1.22e-05	0.030
app_use	urban:nonright	0.420	0.269	0.119	0.030

Table A3.8

Survey-weighted logistic models (GLM binomial, HC3 robust SEs): trust in science and preference for citizen decision in conflicts

Dependent variable	Term	log-odds b	SE (robust)	p	Odds ratio
trust_science	urban	−0.207	0.354	0.559	0.81
trust_science	nonright	1.428	0.234	1.13e-09	4.17
trust_science	urban:nonright	0.421	0.365	0.249	1.52
prefer_citizen_decision	urban	−0.040	0.315	0.9	0.96
prefer_citizen_decision	nonright	−0.991	0.228	1.36e-05	0.37
prefer_citizen_decision	urban:nonright	−0.490	0.327	0.134	0.61

Data availability

The data that has been used is confidential.

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