

Green but not nuclear? Environmental policy support and the contested acceptance of nuclear energy in Europe

Levente Kökény

Corvinus University of Budapest

Olivér Hortay

Századvég Foundation

László Kökény

laszlo.kokeny2@uni-corvinus.hu

Corvinus University of Budapest

Research Article

Keywords: nuclear energy, social acceptance, environmental policy support, green-nuclear divide, energy transition, European Union, binary logistic regression

Posted Date: September 8th, 2026

DOI: <https://doi.org/10.21203/rs.3.rs-10703764/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Additional Declarations: No competing interests reported.

Abstract

Background

Europe's low-carbon transition has revived the policy relevance of nuclear energy, but its social legitimacy remains contested. This paper examines public support for nuclear energy in the European Union by focusing on a central puzzle: citizens may support environmental policy measures while remaining reluctant to support nuclear power.

Methods

Drawing on a large-scale CATI survey conducted in 2025 across EU Member States with 27,000 respondents, the study models support for nuclear electricity generation through hierarchical binary logistic regression. The analysis combines socio-demographic factors, settlement characteristics, an environmental policy support index and a country-level indicator capturing whether the respondent lives in a country with an operating nuclear power plant.

Results

The results show a clear green-nuclear divide: the more environmental policy measures respondents support, the less likely they are to support nuclear energy. At the same time, national nuclear experience is the strongest positive predictor of support, with citizens in countries operating nuclear power plants being substantially more favourable toward nuclear energy.

Conclusions

The paper contributes to debates on energy sustainability and social acceptance by showing that nuclear energy acceptance cannot be inferred from environmental concern alone; rather, it emerges from the intersection of environmental policy orientation, socio-demographic cleavages and national energy experience.

1. Background

Nuclear energy has returned to the centre of European energy debates. The combined pressures of decarbonisation, energy security, price volatility and geopolitical vulnerability have made electricity system design a strategic political question rather than a purely technical issue. In 2024, nuclear power plants generated 649,524 GWh of electricity in the European Union and accounted for 23.3% of total EU electricity production, while the Joint Research Centre notes that 12 of the 27 EU Member States operate nuclear power plants and that the EU has more than 100 power reactors in operation (Eurostat, 2026a; European Commission, n.d.). At the same time, the wider energy context remains marked by dependence on imported fuels: in 2024, the EU produced 43% of its own energy and imported 57%, while crude oil and petroleum products, natural gas and solid fossil fuels still dominated its import structure (Eurostat, 2026b). These figures underline why nuclear power has become politically relevant again: it is simultaneously associated with decarbonisation, system reliability and energy sovereignty (Dulian, 2023; International Energy Agency, 2022; Pathak et al., 2022).

The renewed interest in nuclear energy is not merely a reaction to climate targets. The Russian invasion of Ukraine, the subsequent energy price shock and the restructuring of European energy imports have changed how energy technologies are evaluated in policy debates (Arndt, 2023; Kuzemko et al., 2022). The EU economy's greenhouse gas emissions by economic activities and households totalled 3.3 billion tonnes of CO₂ equivalents in 2024, and the energy sector recorded the largest decrease in emissions between 2013 and 2024 (Eurostat, 2026c). In this context, nuclear energy is often framed as a low-carbon, dispatchable source that may complement variable renewable generation. Yet this framing is contested because nuclear technology is also associated with accident risks, radioactive waste, long investment horizons, high capital costs and

unresolved questions of intergenerational responsibility (Gilli et al., 2024; International Energy Agency, 2022; Sovacool and Valentine, 2012).

This tension creates an important problem for the study of sustainable energy transitions. If nuclear energy is framed as a low-carbon technology, one might expect citizens who support environmental policy measures to be more favourable toward nuclear power. However, environmental concern does not necessarily translate into nuclear support. Previous research has shown that climate concern, environmental values and nuclear energy acceptance may coexist in ambivalent or even contradictory ways (Sonnberger et al., 2021; Corner et al., 2011; Pidgeon et al., 2008). For some citizens, nuclear power is not primarily interpreted as a climate solution, but as a high-risk, centralised and institutionally demanding technology. This creates a potential green-nuclear divide: citizens may support environmental regulations while simultaneously rejecting nuclear energy as part of the future energy mix.

The present paper examines this divide in the European Union. It investigates how support for environmental policy measures, socio-demographic characteristics and national nuclear experience shape public support for nuclear energy. The study is based on a large-scale public opinion survey conducted in 2025 across EU Member States. The dependent variable measures whether respondents support electricity generation from nuclear power plants as a means of meeting their country's energy consumption needs. The explanatory framework combines individual-level socio-demographic variables, settlement-related variables, an environmental policy support index and a country-level indicator capturing whether the respondent lives in a country with an operating nuclear power plant.

The paper makes three contributions. First, it provides large-scale European evidence on the social determinants of nuclear energy acceptance in a post-energy-crisis policy environment. Second, it advances the debate on environmental attitudes by showing that support for environmental policy measures does not automatically imply support for nuclear energy. Third, it demonstrates that national nuclear experience is a central contextual factor: citizens living in countries with operating nuclear power plants are substantially more likely to support nuclear energy, although this positive association is weaker among respondents with stronger environmental policy commitments. These contributions are directly relevant to the special issue's broader concern with energy, sustainability and society, because they show that the legitimacy of low-carbon technologies depends not only on their technical contribution to decarbonisation, but also on the social meanings attached to them.

2. Literature review

2.1. Nuclear energy in the European energy transition

The role of nuclear energy in Europe has become increasingly contested and increasingly relevant at the same time. On the one hand, nuclear power is frequently discussed as a low-carbon technology that can contribute to decarbonisation, electricity system stability and reduced dependence on fossil fuels (Dulian, 2023; International Energy Agency, 2022; Pathak et al., 2022). On the other hand, it remains associated with safety concerns, radioactive waste, accident memory and long-term institutional responsibility (Perko, 2014; Renn, 1990; Slovic, 1987). This dual character distinguishes nuclear energy from many other energy technologies: it is not assessed only in terms of emissions, costs or grid performance, but also through broader social and political judgements about acceptable risk, trust and legitimacy.

Recent European energy debates have further strengthened this complexity. The 2022 energy crisis, the Russian-Ukrainian war and concerns about import dependence shifted attention toward energy sovereignty and system resilience (Arndt, 2023; Kuzemko et al., 2022). In this context, nuclear energy has been reframed in some countries as a strategic stabilising technology rather than merely as a low-carbon energy source (Durdovic and Cermak, 2026; Bohdanowicz et al., 2025). However, this reframing has not produced a uniform pro-nuclear turn across Europe. Countries differ substantially in historical experience, existing nuclear infrastructure, energy-mix dependence, party-political narratives and public trust in nuclear institutions (Lindvall et al., 2025; Sonnberger et al., 2021; Wang and Kim, 2018). Therefore, nuclear energy acceptance must be analysed as a context-dependent social attitude rather than a simple technological preference.

2.2. Social acceptance, trust and risk perception

The social acceptance of energy technologies is not equivalent to simple public approval. The seminal framework of Wustenhagen et al. (2007) distinguishes socio-political, community and market acceptance, indicating that the same technology may be supported at one level and contested at another. Later work has emphasised that acceptance is not a static attitude but an evolving social and political process shaped by institutional trust, procedural fairness, distributional justice and local meanings (Batel, 2020; Wolsink, 2018; Devine-Wright et al., 2017). Nuclear energy is particularly sensitive in this respect because it involves long-term infrastructural commitments, high perceived consequences and strong symbolic associations.

Risk perception research shows that public attitudes toward nuclear energy cannot be derived from objective technical risk alone. Citizens' evaluations are shaped by perceived controllability, dread, catastrophic potential, trust in risk-management institutions and moral considerations (Stoutenborough et al., 2013; Whitfield et al., 2009; Slovic, 1987). The nuclear accidents at Chernobyl and Fukushima continue to influence public perceptions because they operate not only as historical events but also as collective reference points through which nuclear risk is interpreted (Kim et al., 2013; Visschers and Siegrist, 2012; Renn, 1990). These events strengthened the association between nuclear energy and low-probability but high-consequence risks, even in countries where nuclear power is regulated through mature institutional systems (Siegrist et al., 2014; Perko, 2014; Siegrist and Visschers, 2013).

Trust and knowledge are also repeatedly identified as central predictors of nuclear acceptance. Studies show that public knowledge, perceived benefits and public engagement may increase acceptance, whereas perceived risk suppresses it (Wang et al., 2019; Stoutenborough et al., 2013). Nevertheless, the literature also warns against reducing public scepticism to a deficit of information. Trust in government, experts and industry actors, as well as the perceived fairness of decision-making, often matters as much as factual knowledge (Batel, 2020; Wolsink, 2018; Sovacool and Dworkin, 2015). This is especially important in the nuclear field, where citizens are asked to accept decisions whose consequences may extend over decades or generations.

2.3. Environmental policy support and the green-nuclear divide

A central question in the present study is whether environmental policy support increases or decreases support for nuclear energy. The answer is theoretically ambiguous. From a climate-policy perspective, nuclear energy may be interpreted as a useful low-carbon technology; from an environmental-risk perspective, it may be perceived as incompatible with environmental protection because of radioactive waste, accident risk, centralised infrastructure and distrust in long-term governance (Corner et al., 2011; Bickerstaff et al., 2008; Pidgeon et al., 2008). The literature therefore suggests that environmental concern and nuclear support may have a conditional or ambivalent relationship rather than a simple positive association (Arndt, 2023; Sonnberger et al., 2021; Spence et al., 2010).

The idea of a green-nuclear divide builds on this ambiguity. Environmental policy support does not necessarily represent a coherent endorsement of every low-carbon technology. Citizens may support certain environmental regulations, such as carbon-related consumer measures, restrictions on fossil heating systems or the phase-out of internal combustion vehicles, while rejecting nuclear energy because they associate it with different kinds of technological, environmental and political risk. Sonnberger et al. (2021) showed that climate concern can coexist with nuclear disapproval in several European contexts, while Bohdanowicz et al. (2025) found that the post-2022 pro-nuclear shift in Europe is not socially uniform. Recent experimental evidence further indicates that public support is technology-specific even within the nuclear domain, differing between next-generation fission and fusion options (Biten Butorac et al., 2026). These findings point to the need to distinguish environmental policy support from nuclear technology acceptance.

This distinction is particularly relevant because the environmental policy measures used in the present study represent different dimensions of the low-carbon transition. Willingness to pay more for carbon-compensated products captures a consumer-oriented form of environmental responsibility, and previous research shows that willingness to pay for low-carbon

or sustainable products depends on credibility, perceived effectiveness, income and other product attributes (Denver et al., 2023; Li and Kallas, 2021; Feucht and Zander, 2018; Jou and Chen, 2015; Shuai et al., 2014). Support for restrictions on fossil heating systems reflects acceptance of household-level decarbonisation, where affordability, everyday routines and fairness are crucial (Smith et al., 2025; Hoyne et al., 2024; Becker et al., 2023), and where phase-out regulations for fossil fuel boilers and gas heating have become an increasingly common national policy instrument (Koster et al., 2022; Braungardt et al., 2021; Kerr and Winskel, 2021). Support for the phase-out of conventional fuel vehicles captures attitudes toward transport decarbonisation, where infrastructure, costs and distributional effects influence policy legitimacy (European Public Health Alliance, 2025; Spandagos et al., 2022; Transport and Environment, 2022).

2.4. Socio-demographic cleavages in nuclear energy acceptance

Previous research indicates that nuclear energy attitudes are structured by socio-demographic differences. Gender is one of the most consistent predictors: men are often more supportive of nuclear energy than women, while women tend to report higher levels of perceived risk (Sundstrom and McCright, 2016; Solomon et al., 1989). This difference is usually interpreted not as a simple information gap but as a broader difference in perceived safety, social responsibility and trust in risk-management institutions. Recent evidence on the polarisation of energy preferences also indicates that gendered and political cleavages may interact with broader ideological divisions over energy technologies (Lindvall et al., 2025).

Age is also relevant. Older respondents may attach greater importance to energy security, system stability and state-led infrastructure, whereas younger groups may be more strongly oriented toward environmental risk, renewable energy and post-material values (Arndt, 2023; Wang and Kim, 2018; Corner et al., 2011). This does not mean that younger citizens uniformly reject nuclear energy or that older citizens support it unconditionally. Rather, generational experience can structure how citizens balance climate mitigation, technological risk and energy security (Bohdanowicz et al., 2025; Sonnberger et al., 2021).

Income, education and labour market position may also shape nuclear attitudes. Higher socio-economic status can be associated with greater trust in technological systems, better access to information and greater confidence in institutional problem-solving (Wang et al., 2019; Stoutenborough et al., 2013). Financial security may reduce sensitivity to perceived transition costs and increase confidence in large-scale energy strategies, whereas households facing affordability constraints tend to evaluate energy policy primarily through immediate costs and subsistence concerns (Jaber and Szep, 2024). Care responsibilities may add a further layer, since respondents whose daily routines are organised around unpaid household and caring work assess household-level risks and burdens differently (Patrick et al., 2022). However, these effects are not deterministic: education and income may increase support in some contexts while also strengthening critical reflection in others (Wang and Kim, 2018; Bertsch et al., 2016). For this reason, socio-demographic variables should be interpreted as structuring conditions rather than as direct causes of nuclear support.

2.5. National nuclear experience and contextual acceptance

Beyond individual characteristics, nuclear energy acceptance is likely to depend on national energy context. Countries with operating nuclear power plants differ from non-nuclear countries not only in infrastructure, but also in public familiarity, institutional capacity, policy narratives and perceived benefits. In nuclear countries, the technology is part of the existing energy mix and may be associated with energy sovereignty, domestic expertise, electricity system stability and skilled employment. In non-nuclear countries, nuclear power may remain more abstract and may be evaluated mainly through accident memory, waste concerns, high investment costs or political controversy (Gilli et al., 2024; Dulan, 2023).

Local and national experience can normalise contested energy infrastructure. Research on local communities near nuclear facilities suggests that proximity and everyday experience may reduce abstraction and support positive attitudes, particularly when communities perceive economic benefits, employment opportunities and procedural fairness (Frantal and Maly, 2017; Parkhill et al., 2010; Venables et al., 2009). At the same time, siting research cautions against a simplistic NIMBY interpretation: place attachment, local identity, perceived fairness and political voice are central to whether infrastructure is accepted or resisted (Wolsink, 2018; Devine-Wright, 2009; Van der Horst, 2007).

At the cross-national level, national nuclear experience may be one of the strongest contextual predictors of support. Wang and Kim (2018) demonstrated the importance of country-level context in a multilevel analysis of public attitudes toward nuclear power across 27 European countries. More recent studies suggest that the post-2022 energy crisis has reinforced nuclear support in some countries, but not uniformly across Europe (Durdovic and Cermak, 2026; Bohdanowicz et al., 2025). This implies that existing nuclear infrastructure may increase support, but the effect is likely to be conditioned by environmental orientation and broader energy-policy narratives. Those with stronger environmental policy commitments may be less influenced by the normalising effect of national nuclear experience if they continue to interpret nuclear energy primarily through an environmental-risk frame.

3. Research aims and hypotheses

The general aim of this study is to examine how environmental policy support, socio-demographic characteristics and national nuclear experience shape public acceptance of nuclear energy in the European Union. The study is not limited to identifying who supports nuclear energy; rather, it investigates whether support for concrete environmental policy measures aligns with or diverges from support for nuclear power. This focus is particularly important because sustainable energy transitions require not only technically feasible energy pathways, but also socially legitimate policy coalitions.

More specifically, the study has four objectives. First, it analyses whether support for environmental policy measures is associated with support for nuclear energy. Second, it examines whether stronger environmental policy support, measured as the number of supported environmental measures, corresponds to a higher or lower likelihood of nuclear acceptance. Third, it assesses how gender, age, education, income position, labour market status and settlement context structure support for nuclear energy. Fourth, it investigates whether living in a country with an operating nuclear power plant increases support for nuclear energy and whether this contextual effect is moderated by environmental policy support.

H₁ Environmental policy support is negatively associated with support for nuclear energy.

Citizens who support a greater number of environmental policy measures are expected to be less likely to support nuclear energy. This hypothesis reflects the assumption that environmental policy support may be linked more strongly to anti-nuclear risk perceptions, renewable-energy preferences and concerns over long-term governance than to a technology-neutral low-carbon logic (Sonnberger et al., 2021; Corner et al., 2011; Pidgeon et al., 2008).

H₂ National nuclear experience is positively associated with support for nuclear energy.

Respondents living in countries with operating nuclear power plants are expected to be more likely to support nuclear energy than respondents living in countries without operating nuclear power plants. This reflects the expected normalising effect of existing nuclear infrastructure, institutional familiarity and national experience with the technology (Durdovic and Cermak, 2026; Wang and Kim, 2018; Frantal and Maly, 2017).

H₃ Environmental policy support weakens the positive association between national nuclear experience and support for nuclear energy.

The positive effect of living in a country with an operating nuclear power plant is expected to be weaker among respondents who support more environmental policy measures. This hypothesis reflects the expectation that strong environmental policy orientation may reduce the reassuring or normalising effect of national nuclear experience if nuclear power continues to be interpreted through a risk-based environmental frame (Bohdanowicz et al., 2025; Arndt, 2023; Sonnberger et al., 2021).

H₄ Men are more likely than women to support nuclear energy.

Based on previous research on gender differences in nuclear risk perception, male respondents are expected to show higher support for nuclear energy than female respondents (Sundstrom and McCright, 2016; Solomon et al., 1989).

H₅ Older respondents are more likely than younger respondents to support nuclear energy.

Older age groups are expected to show higher support for nuclear energy, reflecting the greater salience of energy security, system stability and conventional infrastructure among older citizens (Arndt, 2023; Wang and Kim, 2018; Corner et al., 2011).

H₆ Financially more secure respondents are more likely to support nuclear energy.

Respondents who report a more comfortable household income situation are expected to be more supportive of nuclear energy than financially vulnerable respondents. This reflects the assumption that socio-economic security may be associated with higher trust in large-scale technological systems and lower perceived vulnerability to energy transition risks (Wang et al., 2019; Stoutenborough et al., 2013).

H₇ Settlement-related factors have a weaker and less consistent association with nuclear energy support than attitudinal and national-contextual factors.

Settlement type and settlement size are expected to play a secondary role compared with environmental policy support and national nuclear experience. This hypothesis reflects the assumption that broad national energy context and environmental orientation are more consequential than general settlement structure in explaining nuclear energy acceptance (Wolsink, 2018; Devine-Wright, 2009; Van der Horst, 2007).

4. Research methodology

4.1. Data and sampling method

The empirical analysis is based on a large-scale public opinion survey conducted by Századvég between 18 February and 17 April 2025. The survey covered the 27 member states of the European Union, as well as the United Kingdom, Norway and Switzerland. In total, 30,000 randomly selected adult respondents were interviewed using the CATI method, that is, Computer-Assisted Telephone Interviewing. The data collection forms part of the Project Europe survey programme, which the Századvég Foundation has conducted annually since 2020 on behalf of the Hungarian government, and which continues the earlier Project28 series launched in 2016; the programme applies an identical questionnaire and an identical country-level sampling design across all participating countries, which makes cross-country comparison possible.

In each country, 1,000 adult respondents were included through random sampling. Although the original survey covered 30 European countries, the present study focuses exclusively on the 27 member states of the European Union. This restriction allows the analysis to concentrate on the social and political context of nuclear energy within the EU, where energy security, decarbonisation targets and national differences in energy policy make the acceptance of nuclear power a particularly relevant research question.

Within each country the target population was the adult population aged 18 years and over, and respondents were selected through random telephone sampling covering both landline and mobile numbers. The gross country sample of 1,000 interviews yields a maximum margin of error of approximately ± 3.1 percentage points at the 95% confidence level for country-level estimates.

Restricting the analysis to the 27 EU Member States yields a gross sample of 27,000 respondents. The regression models were estimated on 18,232 cases, since respondents with missing values on the dependent variable or on any explanatory variable were excluded by listwise deletion. The reduction is due mainly to item non-response on household income status and on the environmental policy items. The analytic sample retains the country-balanced structure of the original design, but it should be borne in mind that respondents who declined to answer the income question are somewhat under-represented.

4.2. Variables

The aim of the present study is to examine the social, economic, demographic, settlement-related and contextual factors that shape public attitudes towards nuclear energy in Europe.

The dependent variable in the hierarchical binary logistic regression models measures whether respondents support the use of nuclear energy in their country’s energy mix. Since the response was recoded into a dichotomous outcome, the dependent variable has two possible values:

- **0**: does not support the use of nuclear energy in the country’s energy mix;
- **1**: supports the use of nuclear energy in the country’s energy mix.

The independent variables were introduced into the models in a hierarchical structure. The first block included socio-demographic variables, namely gender, age, educational background based on ISCED categories, household income status and labour market status. The second block added settlement-related variables, including settlement type and the number of residents in the respondent’s settlement. The third block introduced the environmental policy index, which captures the number of environmental policy measures supported by the respondent. This index was treated as a categorical variable ranging from 0 to 3, where higher values indicate support for a larger number of environmental policies.

The fourth block added a contextual country-level variable indicating whether there is an operating nuclear power plant in the respondent’s country. This variable was coded as follows:

- **0**: there is no operating nuclear power plant in the country;
- **1**: there is an operating nuclear power plant in the country.

Finally, the fifth model included interaction terms between the environmental policy index and selected explanatory variables. These interaction variables were used to examine whether environmental policy support modifies the effect of socio-demographic, settlement-related and national nuclear context variables on support for nuclear energy. The full set of variables included in the regression model is presented in Table 1.

Table 1
Variables included in the binary logistic regression model

Sociodemographic variables	Settlement-structure variables	Environmental policy index	Nuclear power plant	Interaction variables
gender (female / male), age (18–29, 30–39, 40–49, 50–59, 60–69, over 70 years) educational background (ISCED 0–8) household income status (four subsistence categories) labour market status (full-time, part-time, unemployed, student, retired, etc.)	settlement type (capital city, suburb of a large city, smaller town, village, farmstead) (by size category)	support for environmental policies Categorical variable (0–3): the number of the three environmental measures examined that the respondent supported.	operating nuclear power plant in the respondent's country (0 = there is no operating nuclear power plant in the country, 1 = there is)	Interaction among explanatory variables included in the model.
Source: own editing				

4.3. Statistical analysis

The analysis used hierarchical binary logistic regression because the dependent variable is dichotomous (LaValley, 2008; Menard, 2001). The models estimate the likelihood that a respondent supports nuclear energy in the country's energy mix while controlling for socio-demographic, settlement-related, attitudinal and contextual predictors. Results are reported as odds ratios (Field, 2017), with values above one indicating higher odds of support and values below one indicating lower odds of support. Data processing and model estimation were carried out in IBM SPSS Statistics 30.0.

4.4. Hierarchical model building and the interaction variables

The hierarchical structure of the models (Wilson and Lorenz, 2015; Tranmer and Elliot, 2008) makes it possible to assess how the explanatory power changes when attitudinal and contextual variables are added to individual background characteristics.

Given the nonlinear nature of logistic regression (Ai and Norton, 2003), these terms are interpreted as conditional associations and are discussed substantively rather than treated as simple additive effects.

Model fit was assessed using overall model significance, pseudo- R^2 indicators, the Hosmer-Lemeshow test (Hosmer et al., 2013) and classification accuracy. The effects of explanatory factors were interpreted while controlling for the remaining variables in the model.

5. Findings

5.1. Explanatory power grows as attitudes and context enter the model

All five models were statistically significant ($p < 0.001$), and each additional block improved the description of support for nuclear energy. The first model, resting on sociodemographic characteristics alone, explained only a small share of the variation, with a Nagelkerke R^2 of 0.047 and a Cox and Snell R^2 of 0.035, while correctly classifying 62.8% of respondents. The settlement block added in the second model changed little, raising the Nagelkerke R^2 only to 0.050 and the classification rate to 63.1%. The third model marked the first substantial advance, since the entry of the environmental policy index almost trebled the explained variation to a Nagelkerke R^2 of 0.121 and lifted correct classification to 66.7%. The fourth model, which added the presence of an operating nuclear power plant in the respondent's country, produced the second large gain, reaching a Nagelkerke R^2 of 0.158 and a classification rate of 69.0%. The fifth model, which introduced the interaction variables, raised the explained variation only marginally, to 0.163. The pattern of these increments is itself informative, since it shows that attitudinal and contextual factors, rather than individual background alone, carry most of the explanatory weight. The Hosmer and Lemeshow test supported the fit of the first three models, yet it turned significant in the fourth and fifth, which indicates that the richer specifications describe the broad direction of support reliably while reproducing the extreme probability ranges less closely.

5.2. Men and older respondents are more likely to support nuclear energy

Gender produced one of the most consistent associations in the analysis. Men were more likely than women to support nuclear electricity generation in every model, and the effect remained highly significant throughout, moving from an $\text{Exp}(B)$ of 1.529 in the first model to 1.513 in the fourth ($p < 0.001$). Age displayed a graded pattern in which support rose with seniority. In the model based on background characteristics alone, the likelihood of support increased steadily from the youngest band to the oldest, reaching an $\text{Exp}(B)$ of 1.801 among respondents aged 60 to 69 and 1.887 among those aged 70 years or older. Once the environmental policy index entered the model this age gradient weakened appreciably, since older respondents tend to endorse fewer environmental measures, yet it stayed clearly significant in the fourth model, where the two oldest bands still recorded values of 1.384 and 1.391 odds ratio ($p < 0.001$). The youngest contrast, between respondents aged 30 to 39 and the reference band of 18 to 29, lost significance once attitudes were controlled, which places the meaningful age divide among the middle aged and older groups rather than among the younger adults.

5.3. Master level education and financial comfort raise support while homemakers remain reluctant

Educational attainment exerted a comparatively modest and uneven influence. With primary education (ISCED 1) serving as the reference, most categories did not differ significantly from it in any model. The clearest exception was the master level (ISCED 7), whose holders were consistently more supportive, with an Exp(B) that rose from 1.367 in the first model to 1.431 in the fourth ($p < 0.01$) and to 1.619 in the fifth. Upper secondary education (ISCED 3) showed a weaker positive association that reached significance only in the first two models before fading. Subjective financial position mattered mainly at its favourable end. Respondents who reported living comfortably on their current income were distinctly more supportive than those in the hardest pressed category, with an Exp(B) of 1.338 in the third model and 1.395 in the fourth ($p < 0.001$), while those who reported managing on their income showed a smaller positive effect of 1.196 ($p < 0.01$). The hardest pressed and the merely struggling did not differ from one another. Labour market position yielded a single robust result, namely the markedly lower support among homemakers and respondents on parental leave, whose Exp(B) stayed close to the range from 0.66 to 0.69 and remained significant in every model ($p < 0.001$). The unemployed, pensioners, students and those living on benefits did not differ significantly from the actively employed.

5.4. Place of residence plays almost no independent role

Settlement type produced no significant contrast in any model, so that residents of villages, towns, farmsteads and suburbs did not differ meaningfully from those in large cities. The size of the settlement gave only scattered and unstable signals. Respondents in settlements of 250,000 to 499,999 inhabitants appeared more supportive in the second and third models, with an Exp(B) of 1.280 and 1.232 respectively ($p < 0.01$ or below), but this advantage vanished once the nuclear context entered the fourth model. A weak negative signal for medium sized settlements of 50,000 to 249,999 inhabitants surfaced in the fourth model with an Exp(B) of 0.889 ($p < 0.05$), yet the absence of any coherent gradient indicates that settlement size is not a substantively important determinant of support.

5.5. Environmental policy support

The environmental policy index produced the most important and most clearly patterned result of the study. The more environmental measures a respondent endorsed, the less likely that respondent was to support nuclear energy, and the relationship took the form of a steep and orderly gradient. Compared with respondents who supported no environmental measure, those who supported one recorded an Exp(B) of 0.553, those who supported two an Exp(B) of 0.301, and those who supported three an Exp(B) of 0.254, every value being significant at $p < 0.001$ in the fourth model, with almost identical figures in the third. In substantive terms, respondents at the top of the environmental scale were close to four times less likely to favour nuclear energy than those at the bottom. The strictly monotonic shape of this decline is the central empirical finding, since it shows that environmental commitment and acceptance of nuclear power diverge in a continuous and dose like fashion rather than through a single sharp break.

5.6. National nuclear experience is the strongest driver of support

Whether the respondent's country already operates a nuclear power plant emerged as the single strongest positive predictor of support (Supplementary Tables S1–S3). In the fourth model the presence of an operating plant more than doubled the likelihood of support, with an Exp(B) of 2.165 ($p < 0.001$), and in the fifth model, where the interaction terms are present, the corresponding value rose to 3.502. The descriptive distribution makes the gap tangible, since 48.9% of respondents in countries with an operating plant expressed support against only 29.2% in countries without one. The country figures sharpen the contrast further, ranging from very low support in states without nuclear capacity, such as Austria at 13.0% and Portugal at 20.6%, to clear majorities in long established nuclear states, such as the Czech Republic at 61.3% and Hungary at 69.1%.

5.7. Environmental commitment weakens the other drivers of support

The interaction terms entered in the fifth model qualified the main effects without reversing them, and they confirm that environmental orientation conditions the influence of several other factors. The interaction between the environmental policy

index and gender was significant, with an $\text{Exp}(B)$ of 0.875 ($p < 0.001$), which means that the greater readiness of men to support nuclear energy narrows as environmental commitment rises. The interaction between the environmental policy index and the presence of a nuclear plant pointed the same way, with an $\text{Exp}(B)$ of 0.816 ($p < 0.001$), showing that the reassuring effect of national nuclear experience is weaker among the most environmentally committed respondents. Smaller but significant interactions appeared for age, with an $\text{Exp}(B)$ of 0.974 ($p < 0.05$), and for subjective income, with an $\text{Exp}(B)$ of 1.047 ($p < 0.01$). The interactions involving education, labour market status, settlement type and settlement size were not significant. The direct contrasts for the environmental index lost significance in the fifth model, because its influence is there carried partly by the continuous interaction terms, so the gradient described above is best read from the third and fourth models.

The full hierarchical regression results are presented in Table 2. Additional descriptive results are provided in Supplementary Tables S1–S3.

Table 2

Results of the hierarchical binary logistic regression analysis on support for nuclear energy in the EU-27, 2025

Results of the hierarchical binary logistic regression analysis on support for nuclear energy in the EU 27, 2023						
Independent variables		(1)	(2)	(3)	(4)	(5)
Exp (B) odds ratio (95% confidence interval)						
SOCIODEMOGRAPHIC VARIABLES	Educational background (reference category: ISCED 1)					
	ISCED 0	N.A.	N.A.	N.A.	N.A.	N.A.
	ISCED 2	1.003 (0.805–1.25)	0.997 (0.8-1.243)	0.971 (0.774–1.219)	0.958 (0.761–1.206)	0.974 (0.77–1.232)
	ISCED 3	1.244* (1.017–1.522)	1.229* (1.004–1.504)	1.212 (0.984–1.492)	1.213 (0.983–1.498)	1.257* (1.003–1.574)
	ISCED 4	1.132 (0.913–1.405)	1.118 (0.901–1.388)	1.155 (0.925–1.443)	1.237 (0.987–1.549)	1.323* (1.026–1.705)
	ISCED 5	0.958 (0.762–1.203)	0.946 (0.753–1.189)	1.006 (0.795–1.273)	1.049 (0.827–1.332)	1.141 (0.857–1.52)
	ISCED 6	1.102 (0.899–1.350)	1.082 (0.883–1.327)	1.098 (0.89–1.355)	1.132 (0.915–1.401)	1.254 (0.937–1.677)
	ISCED 7	1.367** (1.112–1.681)	1.333** (1.083–1.641)	1.355** (1.094–1.678)	1.431** (1.152–1.778)	1.619** (1.172–2.236)
	ISCED 8	1.006 (0.766–1.321)	0.988 (0.751–1.298)	1.117 (0.843–1.48)	1.179 (0.887–1.568)	1.367 (0.907–2.059)
	Gender (reference category: female)					
	Male	1.529*** (1.437–1.627)	1.528*** (1.436–1.626)	1.503*** (1.41–1.603)	1.513*** (1.418–1.615)	2.079*** (1.771–2.441)
	Household income status (reference category: we have a very hard time making ends meet on our current income)					
	We struggle to make ends meet on our current income.	0.991 (0.881–1.114)	0.992 (0.882–1.115)	1.055 (0.934–1.191)	1.047 (0.926–1.184)	0.95 (0.823–1.097)

Note: Dependent variable: "Do you support electricity generation from nuclear power plants as a means of meeting your country's energy consumption needs?" (0 = does not support; 1 = yes, supports). ISCED 0: pre-primary education; ISCED 1: primary education; ISCED 2: lower secondary education; ISCED 3: upper secondary education; ISCED 4: post-secondary non-tertiary education; ISCED 5: short duration tertiary education; ISCED 6: Bachelor (BA/BSc) or equivalent; ISCED 7: Master (MA/MSc) or equivalent; ISCED 8: Doctorate or equivalent; B: Coefficient of logistic regression; Sq. p-value; Exp(B): odds ratio, the likelihood ratio of the outcome.

We manage on our current income.	1.092 (0.977–1.219)	1.097 (0.982–1.225)	1.198** (1.068–1.344)	1.196** (1.065–1.344)	0.973 (0.803–1.179)
We live comfortably on current income.	1.14* (1.01–1.287)	1.146* (1.015–1.294)	1.338*** (1.18–1.517)	1.395*** (1.228–1.585)	1.01 (0.768–1.328)
Labour market status (reference category: actively employed)					
Unemployed	0.887 (0.747–1.052)	0.895 (0.754–1.062)	0.867 (0.727–1.034)	0.854 (0.714–1.021)	0.868 (0.628–1.201)
Lives on benefits	0.788 (0.596–1.04)	0.786 (0.595–1.039)	0.85 (0.639–1.132)	0.774 (0.58–1.034)	0.791 (0.545–1.148)
Retired	1.052 (0.915–1.21)	1.053 (0.915–1.21)	1.069 (0.926–1.235)	1.068 (0.923–1.237)	1.083 (0.873–1.345)
Homemaker / on parental leave	0.619*** (0.52–0.737)	0.629*** (0.528–0.749)	0.66*** (0.552–0.789)	0.678*** (0.566–0.812)	0.692*** (0.558–0.858)
Student	0.888 (0.739–1.068)	0.892 (0.742–1.073)	0.915 (0.758–1.105)	0.889 (0.735–1.076)	0.891 (0.73–1.087)
Age (reference category: 18–29 years)					
30–39 years	1.165* (1.037–1.309)	1.166** (1.038–1.31)	1.055 (0.936–1.189)	1.052 (0.932–1.187)	1.138 (0.992–1.305)
40–49 years	1.353*** (1.205–1.519)	1.349*** (1.201–1.515)	1.154* (1.024–1.3)	1.139* (1.009–1.285)	1.322** (1.113–1.569)
50–59 years	1.584*** (1.411–1.778)	1.589*** (1.416–1.784)	1.261*** (1.119–1.421)	1.264*** (1.12–1.427)	1.557*** (1.262–1.922)
60–69 years	1.801*** (1.572–2.063)	1.799*** (1.57–2.061)	1.368*** (1.189–1.575)	1.384*** (1.199–1.596)	1.795*** (1.382–2.332)
70 years or older	1.887*** (1.582–2.252)	1.895*** (1.588–2.262)	1.401*** (1.167–1.683)	1.391*** (1.155–1.675)	1.906*** (1.377–2.638)

Note: Dependent variable: "Do you support electricity generation from nuclear power plants as a means of meeting your country's energy consumption needs?" (0 = does not support; 1 = yes, supports). ISCED 0: pre-primary education; ISCED 1: primary education; ISCED 2: lower secondary education; ISCED 3: upper secondary education; ISCED 4: post-secondary non-tertiary education; ISCED 5: short duration tertiary education; ISCED 6: Bachelor (BA/BSc) or equivalent; ISCED 7: Master (MA/MSc) or equivalent; ISCED 8: Doctorate or equivalent; B: Coefficient of logistic regression; Sq. p-value; Exp(B): odds ratio, the likelihood ratio of the outcome.

SETTLEMENT-TYPE VARIABLES	Settlement type (reference category: large city)					
	Homestead/Farmstead	1.166 (0.879– 1.548)	1.054 (0.789– 1.41)	1.14 (0.85– 1.53)	1.452 (0.877– 2.402)	
	Village or commune	1.14 (0.966– 1.346)	1.075 (0.906– 1.275)	1.058 (0.889– 1.259)	1.263 (0.879– 1.814)	
	Town or small town	1.109 (0.993– 1.238)	1.069 (0.954– 1.198)	1.053 (0.937– 1.182)	1.187 (0.93– 1.516)	
	Suburb of a large city	0.912 (0.816– 1.021)	0.927 (0.826– 1.041)	0.94 (0.836– 1.057)	1.000 (0.851– 1.175)	
	Number of residents in the settlement (reference category: more than 500,000 residents)					
	Up to 9.999 residents	0.856 (0.723– 1.013)	0.86 (0.723– 1.024)	0.891 (0.746– 1.063)	0.873 (0.576– 1.322)	
	10.000-49.999 residents	0.869* (0.756– 0.999)	0.89 (0.771– 1.027)	0.878 (0.759– 1.016)	0.863 (0.626– 1.189)	
	50.000-249.999 residents	0.952 (0.852– 1.065)	0.961 (0.857– 1.078)	0.889* (0.792– 0.999)	0.882 (0.705– 1.104)	
	250.000-499.999 residents	1.28*** (1.116– 1.468)	1.232** (1.07– 1.419)	1.09 (0.944– 1.258)	1.093 (0.92– 1.299)	
	ENVIRONMENTAL VARIABLE	Environmental policy index (reference category: supports 0 policies)				
		Supports 1 policy		0.555*** (0.51– 0.603)	0.553*** (0.509– 0.602)	0.836 (0.605– 1.154)
		Supports 2 policies		0.304*** (0.277– 0.334)	0.301*** (0.274– 0.331)	0.671 (0.359– 1.254)
		Supports 3 policies		0.255*** (0.231– 0.281)	0.254*** (0.23– 0.28)	0.82 (0.323– 2.086)
NUCLEAR COUNTRY	There is nuclear power plant in the country (reference category: there is not)					

Note: Dependent variable: "Do you support electricity generation from nuclear power plants as a means of meeting your country's energy consumption needs?" (0 = does not support; 1 = yes, supports). ISCED 0: pre-primary education; ISCED 1: primary education; ISCED 2: lower secondary education; ISCED 3: upper secondary education; ISCED 4: post-secondary non-tertiary education; ISCED 5: short duration tertiary education; ISCED 6: Bachelor (BA/BSc) or equivalent; ISCED 7: Master (MA/MSc) or equivalent; ISCED 8: Doctorate or equivalent; B: Coefficient of logistic regression; Sq. p-value; Exp(B): odds ratio, the likelihood ratio of the outcome.

	There is nuclear power plant				2.165*** (2.028–2.31)	3.502*** (2.982–4.113)
INTERACTION VARIABLES	Interactions					
	Environmental policy index × Gender					0.875*** (0.823–0.931)
	Environmental policy index × Educational background					0.991 (0.974–1.008)
	Environmental policy index × Age					0.974* (0.953–0.995)
	Environmental policy index × Household income status					1.047** (1.011–1.085)
	Environmental policy index × Labour market status					1.001 (0.978–1.025)
	Environmental policy index × Number of residents in the settlement					1.001 (0.962–1.04)
	Environmental policy index × Settlement type					0.977 (0.935–1.022)
	Environmental policy index × Nuclear country					0.816*** (0.767–0.868)
CRITERIA	Criteria					
	Constant value (B)	-1.293	-1.259	-0.417	-0.754	-0.92
	Nagelkerke R ²	0.047	0.050	0.121	0.158	0.163
	Cox-Snell R ²	0.035	0.037	0.089	0.116	0.120
	Log-likelihood	23,551.340	23,509.678	22,494.980	21,945.439	21,869.540
	χ ²	645.237	686.899	1701.597	2251.138	2327.037
	Degrees of freedom	21	29	32	33	41
	P-value (model)	0.000	0.000	0.000	0.000	0.000

Note: Dependent variable: "Do you support electricity generation from nuclear power plants as a means of meeting your country's energy consumption needs?" (0 = does not support; 1 = yes, supports). ISCED 0: pre-primary education; ISCED 1: primary education; ISCED 2: lower secondary education; ISCED 3: upper secondary education; ISCED 4: post-secondary non-tertiary education; ISCED 5: short duration tertiary education; ISCED 6: Bachelor (BA/BSc) or equivalent; ISCED 7: Master (MA/MSc) or equivalent; ISCED 8: Doctorate or equivalent; B: Coefficient of logistic regression; Sq. p-value; Exp(B): odds ratio, the likelihood ratio of the outcome.

Hosmer-Lemeshow test p-value	0.730	0.209	0.076	0.000	0.007
Correct classification rate (%)	62.8	63.1	66.7	69.0	69.0
N (number of respondents)	18232	18232	18232	18232	18232

Note: Dependent variable: "Do you support electricity generation from nuclear power plants as a means of meeting your country's energy consumption needs?" (0 = does not support; 1 = yes, supports). ISCED 0: pre-primary education; ISCED 1: primary education; ISCED 2: lower secondary education; ISCED 3: upper secondary education; ISCED 4: post-secondary non-tertiary education; ISCED 5: short duration tertiary education; ISCED 6: Bachelor (BA/BSc) or equivalent; ISCED 7: Master (MA/MSc) or equivalent; ISCED 8: Doctorate or equivalent; B: Coefficient of logistic regression; Sq. p-value; Exp(B): odds ratio, the likelihood ratio of the outcome.

*** $p < 0,001$, ** $p < 0,01$, * $p < 0,05$.

Source: own editing.

6. Discussion

6.1. Summary of empirical findings

The findings provide a consistent answer to the central puzzle of the paper. Nuclear energy support in Europe is not simply a function of whether citizens are generally favourable towards environmental policy. The environmental policy index is the clearest empirical expression of this divide. Compared with respondents who supported none of the three environmental measures, those supporting one, two or all three measures were progressively less likely to support nuclear electricity generation. The pattern is monotonic rather than episodic, which means that the divide is not produced by a single environmental item or by a weak binary distinction between green and non-green respondents.

The second central result is the strength of national nuclear experience. Living in a country with an operating nuclear power plant substantially increases the likelihood of supporting nuclear energy. This effect is stronger than most individual socio-demographic variables. The descriptive gap between nuclear and non-nuclear countries confirms that nuclear energy is evaluated differently when it is part of the existing national energy system rather than an abstract policy option. This finding supports the idea that familiarity, institutional capacity and national energy narratives matter for public acceptance.

The interaction results further show that environmental policy support conditions otherwise stable predictors of nuclear acceptance. The male advantage in nuclear support narrows as environmental policy commitment increases. Similarly, the positive effect of living in a nuclear country becomes weaker among environmentally committed respondents. These effects do not reverse the main associations, but they show that environmental orientation acts as a cross-cutting attitudinal frame through which citizens interpret demographic position and national nuclear context.

6.2. Theoretical contribution

The first theoretical contribution is to refine the concept of social acceptance in the context of contested low-carbon technologies. Energy technology acceptance is not only a reaction to technical performance, but a social judgement shaped by risk perception, trust, legitimacy and contextual experience (Batel, 2020; Devine-Wright et al., 2017; Wustenhagen et al., 2007). This study extends that argument by showing that acceptance also depends on how citizens classify a technology within the moral and political field of environmental transition. Nuclear energy may be low-carbon, but it is not necessarily perceived as environmentally legitimate by citizens who support environmental regulation.

The second contribution is the identification of a continuous green-nuclear divide. Earlier studies have shown that climate concern and nuclear acceptance can be weakly or negatively related, because nuclear power is often interpreted through a risk frame rather than a decarbonisation frame (Arndt, 2023; Sonnberger et al., 2021; Corner et al., 2011; Pidgeon et al., 2008).

The present study adds to this literature by operationalising environmental policy support as an index and showing that each additional supported environmental measure is associated with lower odds of nuclear support.

The third contribution concerns national nuclear experience. The results indicate that nuclear acceptance is strongly embedded in country-level energy context, supporting research that links energy attitudes to historical, institutional and infrastructural experience rather than to individual attributes alone (Bohdanowicz et al., 2025; Wang and Kim, 2018; Sovacool and Valentine, 2012). Existing nuclear infrastructure can normalise nuclear energy at the public-opinion level, although this normalisation is weaker among respondents with stronger environmental policy commitments.

6.3. Practical and policy implications

The findings have important implications for energy policy and public communication. Policymakers should not assume that citizens who support environmental regulation will automatically support nuclear energy. A generic low-carbon argument is unlikely to be sufficient for building legitimacy around nuclear power. For environmentally committed citizens, nuclear energy may remain associated with risk, waste, centralised control and distrust in long-term governance. If nuclear power is included in transition strategies, these concerns need to be addressed directly rather than treated as a communication deficit.

The strong effect of national nuclear experience suggests that acceptance is partly built through familiarity and institutional credibility. Countries with operating nuclear power plants may benefit from established regulatory institutions, workforce experience and national narratives of energy security. In non-nuclear countries, where nuclear energy is more abstract, communication may need to address basic knowledge, perceived risks and institutional safeguards before technical or economic arguments can be persuasive.

The green-nuclear divide also implies that communication strategies should differentiate between types of environmental policy support. Support for carbon-compensated products, fossil-heating restrictions or the phase-out of conventional vehicles can reflect different motivations. These motivations cannot be collapsed into a single pro-environmental segment. Energy policy communication should therefore distinguish between consumer-oriented, household-level and mobility-related decarbonisation attitudes, because their relationship with nuclear energy may differ.

More broadly, the results caution against technocratic decision-making in nuclear policy. Nuclear energy involves long time horizons, high perceived risk and high institutional responsibility. Public acceptance cannot be secured only through expert claims about relative emissions or comparative environmental harm. Policymakers must also explain how risks are governed, how waste is managed, how decisions are made and how benefits and burdens are distributed. Sustainable energy transitions depend not only on technological performance, but also on social legitimacy.

6.4. Limitations and future research

The study has limitations. It is based on cross-sectional survey data, so the results should be interpreted as associations rather than causal effects. The survey measures support for nuclear electricity generation, but it does not directly measure detailed nuclear knowledge, trust in specific institutions or perceived comparative environmental harm. Future research should include explicit indicators of nuclear knowledge, trust in regulators, accident risk, waste concerns and perceived climate benefits. Because the relevant attitudes were captured through single-item measures in a telephone interview, question order and framing may additionally introduce anchoring effects (Wendt and Tyson, 2018).

The country-level indicator captures whether an operating nuclear power plant exists in the respondent's country, but not the full complexity of national nuclear contexts. Future studies could add the share of nuclear energy in electricity generation, phase-out or expansion policies, import dependence and proximity to nuclear facilities. Predicted probability plots and multilevel models could also further clarify how the green-nuclear divide varies across national contexts and social groups.

7. Conclusion

This study examined public support for nuclear energy in the European Union by focusing on a central tension in contemporary energy-transition politics: the relationship between environmental policy support and nuclear energy acceptance. Using large-scale survey evidence from 2025, the analysis showed that nuclear energy support is shaped by attitudinal, socio-demographic and national-contextual factors. The strongest finding is the existence of a green-nuclear divide. Respondents who supported more environmental policy measures were less likely to support nuclear electricity generation, and this negative relationship followed a clear monotonic gradient.

The results challenge the assumption that public support for environmental policy can be translated directly into support for all low-carbon technologies. Nuclear energy occupies an ambiguous position in public opinion. It may be relevant for decarbonisation and energy security, but it is also associated with risk, waste, accident memory and institutional responsibility. For this reason, nuclear energy is not judged only through an emissions lens. It is evaluated through a wider legitimacy frame that includes trust, fairness, perceived control and national experience.

From a policy perspective, the future of nuclear energy in Europe will depend not only on technical feasibility, cost or emissions performance, but also on whether policymakers can build credible social legitimacy around the technology. Communication strategies need to move beyond the simple claim that nuclear energy is low-carbon. They must engage with concerns about safety, waste, governance, transparency and the distribution of benefits and risks, especially among environmentally committed citizens.

Overall, the study contributes to the literature on sustainable energy transitions by showing that the public legitimacy of nuclear energy is produced at the intersection of environmental attitudes and national energy experience. Citizens may support climate and environmental policies while rejecting nuclear energy as a legitimate pathway. Recognising this divide is essential for designing energy policies that are not only technically coherent, but also socially viable.

Declarations

Declaration of Conflicting Interests:

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.

Ethics approval and consent to participate

Not applicable. The study used anonymised survey data, and no personally identifiable information was analysed.

Consent for publication

Not applicable.

Availability of data and materials

The data that support the findings of this study are not publicly available due to institutional restrictions, but may be available from the corresponding author upon reasonable request and with permission of the data owner.

Competing interests

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.

Funding

No specific external funding was received for the preparation of this manuscript.

Authors' contributions

L.K. (Levente Kökény) and L.K. (László Kökény) contributed to the conceptualisation, methodology, data analysis, interpretation of results, and writing of the manuscript. O.H. contributed to the conceptualisation, literature review, and manuscript writing. All authors reviewed and approved the final manuscript.

Acknowledgements

Not applicable.

References

1. Ai C, Norton EC (2003) Interaction terms in logit and probit models. *Econ Lett* 80(1):123–129. [https://doi.org/10.1016/S0165-1765\(03\)00032-6](https://doi.org/10.1016/S0165-1765(03)00032-6)
2. Arndt C (2023) Climate change vs energy security? The conditional support for energy sources among Western Europeans. *Energy Policy* 174:113471. <https://doi.org/10.1016/j.enpol.2023.113471>
3. Batel S (2020) Research on the social acceptance of renewable energy technologies: Past, present and future. *Energy Res Social Sci* 68:101544. <https://doi.org/10.1016/j.erss.2020.101544>
4. Becker S, Demski C, Smith W, Pidgeon N (2023) Public perceptions of heat decarbonization in Great Britain. *Wiley Interdisciplinary Reviews: Energy Environ* 12(6):e492. <https://doi.org/10.1002/wene.492>
5. Bertsch V, Hall M, Weinhardt C, Fichtner W (2016) Public acceptance and preferences related to renewable energy and grid expansion policy: Empirical insights for Germany. *Energy* 114:465–477. <https://doi.org/10.1016/j.energy.2016.08.022>
6. Bickerstaff K, Lorenzoni I, Pidgeon NF, Poortinga W, Simmons P (2008) Reframing nuclear power in the UK energy debate: Nuclear power, climate change mitigation and radioactive waste. *Public Underst Sci* 17(2):145–169. <https://doi.org/10.1177/0963662506066719>
7. Biten Butorac M, Nicoli F, Lalli R (2026) Unpacking public support for nuclear energy: A twin conjoint experiment on innovative nuclear fusion and next-generation fission technologies. *Energy Policy* 210:115007. <https://doi.org/10.1016/j.enpol.2025.115007>
8. Bohdanowicz Z, Lopaciuk-Gonczaryk B, Kowalski J (2025) Europe becomes pro-nuclear? Drivers of public support for nuclear energy in six EU countries after the energy crisis of 2022. *Energy Policy* 200:114528. <https://doi.org/10.1016/j.enpol.2025.114528>
9. Braungardt S, Keimeyer F, Buerger V, Tezak B, Klinski S (2021) Phase-out regulations for fossil fuel boilers at EU and national level. *Oeko-Institut*
10. Corner A, Venables D, Spence A, Poortinga W, Demski C, Pidgeon N (2011) Nuclear power, climate change and energy security: Exploring British public attitudes. *Energy Policy* 39(9):4823–4833. <https://doi.org/10.1016/j.enpol.2011.06.037>
11. Denver S, Christensen T, Lund TB, Olsen JV, Sandoe P (2023) Willingness-to-pay for reduced carbon footprint and other sustainability concerns relating to pork production: A comparison of consumers in China, Denmark, Germany and the UK. *Livest Sci* 276:105337. <https://doi.org/10.1016/j.livsci.2023.105337>
12. Devine-Wright P (2009) Rethinking NIMBYism: The role of place attachment and place identity in explaining place-protective action. *J Community Appl Social Psychol* 19(6):426–441. <https://doi.org/10.1002/casp.1004>
13. Devine-Wright P, Batel S, Aas O, Sovacool B, Labelle MC, Ruud A (2017) A conceptual framework for understanding the social acceptance of energy infrastructure: Insights from energy storage. *Energy Policy* 107:27–31. <https://doi.org/10.1016/j.enpol.2017.04.020>
14. Dulian M (2023) Nuclear energy in the European Union. *European Parliamentary Research Service*. PE 751.456.
15. Durdovic M, Cermak D (2026) Reinforced by the energy crisis: Nuclear revival and public opinion in the Czech Republic. *Utilities Policy* 99:102147. <https://doi.org/10.1016/j.jup.2026.102147>

16. European Commission (n.d.). Nuclear energy. Joint Research Centre. https://joint-research-centre.ec.europa.eu/projects-and-activities/nuclear-energy_en
17. European Public Health Alliance (2025) Open letter urging EU countries to uphold the 2035 phaseout of internal combustion engines
18. Eurostat (2026a) Nuclear power production increased by 4.8% in 2024. <https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20260129-2>
19. Eurostat (2026b) Energy in Europe – 2026 edition. <https://ec.europa.eu/eurostat/web/interactive-publications/energy-2026>
20. Eurostat (2026c) 2024 EU greenhouse gas emissions: -20% since 2013. <https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20260123-1>
21. Feucht Y, Zander K (2018) Consumers' preferences for carbon labels and the underlying reasoning: A mixed methods approach in six European countries. *J Clean Prod* 178:740–748. <https://doi.org/10.1016/j.jclepro.2017.12.236>
22. Field A (2017) *Discovering statistics using IBM SPSS statistics*, 5th edn. Sage
23. Frantal B, Maly J (2017) Close or renew? Factors affecting local community support for rebuilding nuclear power plants in the Czech Republic. *Energy Policy* 104:134–143. <https://doi.org/10.1016/j.enpol.2017.01.048>
24. Gilli L, Bull A, Obbard E, Colombo E, Shendrikova D, Kerr O (2024) The perception of science, risk and nuclear energy: An international survey. OECD Nuclear Energy Agency Working Paper
25. Hosmer DW, Lemeshow S, Sturdivant RX (2013) *Applied logistic regression*, 3rd edn. Wiley
26. Hoyne S, Breen M, Campbell A, Miraglia E, Hurley J (2024) Decarbonisation of residential heating and cooling: The heat pump challenge. Publications Office of the European Union. <https://doi.org/10.2806/1095646>
27. International Energy Agency (2022) Nuclear power and secure energy transitions: From today's challenges to tomorrow's clean energy systems. IEA
28. Jaber MM, Szep T (2024) Subjective indicators of fuel poverty in Zarqa Governorate. *Jordan Energy Effi* 17:21. <https://doi.org/10.1007/s12053-024-10197-x>
29. Jou RC, Chen TY (2015) Willingness to pay of air passengers for carbon-offset. *Sustainability* 7(3):3071–3085. <https://doi.org/10.3390/su7033071>
30. Kerr N, Winskel M (2021) A review of heat decarbonisation policies in Europe. *ClimateXChange*
31. Kim Y, Kim M, Kim W (2013) Effect of the Fukushima nuclear disaster on global public acceptance of nuclear energy. *Energy Policy* 61:822–828. <https://doi.org/10.1016/j.enpol.2013.06.107>
32. Koster E, Kruit K, Teng M, Hesselink F (2022) The natural gas phase-out in the Netherlands. CE Delft
33. Kuzemko C, Blondeel M, Dupont C, Brisbois MC (2022) Russia's war on Ukraine, European energy policy responses and implications for sustainable transformations. *Energy Res Social Sci* 93:102842. <https://doi.org/10.1016/j.erss.2022.102842>
34. LaValley MP (2008) Logistic regression. *Circulation* 117(18):2395–2399. <https://doi.org/10.1161/CIRCULATIONAHA.106.682658>
35. Li S, Kallas Z (2021) Meta-analysis of consumers' willingness to pay for sustainable food products. *Appetite* 163:105239. <https://doi.org/10.1016/j.appet.2021.105239>
36. Lindvall D, Sorqvist P, Lindeberg S, Barthel S (2025) The polarization of energy preferences: A study on social acceptance of wind and nuclear power in Sweden. *Energy Policy* 198:114492. <https://doi.org/10.1016/j.enpol.2024.114492>
37. Menard S (2001) *Applied logistic regression analysis*, 2nd edn. Sage
38. Parkhill KA, Pidgeon NF, Henwood KL, Simmons P, Venables D (2010) From the familiar to the extraordinary: Local residents' perceptions of risk when living with nuclear power in the UK. *Trans Inst Br Geogr* 35(1):39–58. <https://doi.org/10.1111/j.1475-5661.2009.00364.x>

39. Pathak M, Slade R, Shukla PR, Skea J, Pichs-Madruga R, Urge-Vorsatz D (2022) Technical summary. In P. R. Shukla (Eds.), *Climate Change 2022: Mitigation of Climate Change*. Cambridge University Press.
<https://doi.org/10.1017/9781009157926.002>
40. Patrick JH, Bernstein L, Spaulding A, Dominguez BE, Pullen C (2022) Grandchildren as caregivers: Adding a new layer to the sandwich generation. *Int J Aging Hum Dev* 96(1):106–116. <https://doi.org/10.1177/00914150221106726>
41. Perko T (2014) Radiation risk perception: A discrepancy between the experts and the general population. *J Environ Radioact* 133:86–91. <https://doi.org/10.1016/j.jenvrad.2013.04.005>
42. Pidgeon NF, Lorenzoni I, Poortinga W (2008) Climate change or nuclear power - No thanks! A quantitative study of public perceptions and risk framing in Britain. *Glob Environ Change* 18(1):69–85.
<https://doi.org/10.1016/j.gloenvcha.2007.09.005>
43. Renn O (1990) Public responses to the Chernobyl accident. *J Environ Psychol* 10(2):151–167.
[https://doi.org/10.1016/S0272-4944\(05\)80125-2](https://doi.org/10.1016/S0272-4944(05)80125-2)
44. Shuai CM, Ding LP, Zhang YK, Guo Q, Shuai J (2014) How consumers are willing to pay for low-carbon products? Results from a carbon-labeling scenario experiment in China. *J Clean Prod* 83:366–373.
<https://doi.org/10.1016/j.jclepro.2014.07.008>
45. Siegrist M, Visschers VHM (2013) Acceptance of nuclear power: The Fukushima effect. *Energy Policy* 59:112–119.
<https://doi.org/10.1016/j.enpol.2012.07.051>
46. Siegrist M, Sutterlin B, Keller C (2014) Why have some people changed their attitudes toward nuclear power after the accident in Fukushima? *Energy Policy* 69:356–363. <https://doi.org/10.1016/j.enpol.2014.02.026>
47. Slovic P (1987) Perception of risk. *Science* 236(4799):280–285. <https://doi.org/10.1126/science.3563507>
48. Smith W, Demski C, Pidgeon N (2025) Public perceptions of heat decarbonisation in Great Britain: Awareness, values and the social circle effect. *Energy Res Social Sci* 119:103844. <https://doi.org/10.1016/j.erss.2024.103844>
49. Solomon LS, Tomaskovic-Devey D, Risman BJ (1989) The gender gap and nuclear power: Attitudes in a politicized environment. *Sex Roles* 21:401–414. <https://doi.org/10.1007/BF00289599>
50. Sonnberger M, Ruddat M, Arnold A, Scheer D, Poortinga W, Bohm G, Bertoldo R, Mays C, Pidgeon N, Poumadere M, Steentjes K, Tvinnereim E (2021) Climate concerned but anti-nuclear: Exploring (dis)approval of nuclear energy in four European countries. *Energy Res Social Sci* 75:102008. <https://doi.org/10.1016/j.erss.2021.102008>
51. Sovacool BK, Dworkin MH (2015) Energy justice: Conceptual insights and practical applications. *Appl Energy* 142:435–444. <https://doi.org/10.1016/j.apenergy.2015.01.002>
52. Sovacool BK, Valentine SV (2012) The socio-political economy of nuclear energy in China and India. *Energy* 38(1):66–74.
<https://doi.org/10.1016/j.energy.2011.12.001>
53. Spandagos C, Tovar Reanos MA, Lynch MA (2022) Public acceptance of sustainable energy innovations in the European Union: A multidimensional comparative framework for national policy. *J Clean Prod* 340:130721.
<https://doi.org/10.1016/j.jclepro.2022.130721>
54. Spence A, Poortinga W, Pidgeon N, Lorenzoni I (2010) Public perceptions of energy choices: The influence of beliefs about climate change and the environment. *Energy Environ* 21(5):385–407. <https://doi.org/10.1260/0958-305X.21.5.385>
55. Stoutenborough JW, Sturgess SG, Vedlitz A (2013) Knowledge, risk, and policy support: Public perceptions of nuclear power. *Energy Policy* 62:176–184. <https://doi.org/10.1016/j.enpol.2013.06.098>
56. Sundstrom A, McCright AM (2016) Women and nuclear energy: Examining the gender divide in opposition to nuclear power among Swedish citizens and politicians. *Energy Res Social Sci* 11:29–39.
<https://doi.org/10.1016/j.erss.2015.08.008>
57. Tranmer M, Elliot M (2008) Binary logistic regression. Cathie Marsh Centre for Census and Survey Research
58. Transport and Environment (2022) Believe us, it wasn't easy: How the combustion engine phase-out was won in Europe's capitals

59. Van der Horst D (2007) NIMBY or not? Exploring the relevance of location and the politics of voiced opinions in renewable energy siting controversies. *Energy Policy* 35(5):2705–2714. <https://doi.org/10.1016/j.enpol.2006.12.012>
60. Venables D, Pidgeon NF, Simmons P, Henwood K, Parkhill K (2009) Living with nuclear power: A Q-method study of local community perceptions. *Risk Anal* 29(8):1089–1104. <https://doi.org/10.1111/j.1539-6924.2009.01259.x>
61. Visschers VHM, Siegrist M (2012) How a nuclear power plant accident influences acceptance of nuclear power: Results of a longitudinal study before and after the Fukushima disaster. *Risk Anal* 33(2):333–347. <https://doi.org/10.1111/j.1539-6924.2012.01861.x>
62. Wang J, Kim S (2018) Comparative analysis of public attitudes toward nuclear power energy across 27 European countries by applying the multilevel model. *Sustainability* 10(5):1518. <https://doi.org/10.3390/su10051518>
63. Wang S, Wang J, Lin S, Li J (2019) Public perceptions and acceptance of nuclear energy in China: The role of public knowledge, perceived benefit, perceived risk and public engagement. *Energy Policy* 126:352–360. <https://doi.org/10.1016/j.enpol.2018.11.040>
64. Wendt D, Tyson G (2018) Diagnostic accuracy in Australian psychologists: Impact of experience and endorsement on the anchoring effect. *Australian Psychol* 53(3):236–242. <https://doi.org/10.1111/ap.12311>
65. Whitfield SC, Rosa EA, Dan A, Dietz T (2009) The future of nuclear power: Value orientations and risk perception. *Risk Anal* 29(3):425–437. <https://doi.org/10.1111/j.1539-6924.2008.01155.x>
66. Wilson JR, Lorenz KA (2015) Hierarchical logistic regression models. *Modeling binary correlated responses using SAS, SPSS and R*. Springer, pp 201–224
67. Wolsink M (2018) Social acceptance revisited: Gaps, questionable trends, and an auspicious perspective. *Energy Res Social Sci* 46:287–295. <https://doi.org/10.1016/j.erss.2018.07.034>
68. Wustenhagen R, Wolsink M, Burer MJ (2007) Social acceptance of renewable energy innovation: An introduction to the concept. *Energy Policy* 35(5):2683–2691. <https://doi.org/10.1016/j.enpol.2006.12.001>

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryMaterial1808.docx](#)