Towards Nuclear Fusion? Political feasibility and policy constraints[1]

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Abstract

Europe's search for resilient and geopolitically secure energy sources has renewed interest in nuclear technologies, including fusion. This paper examines the political conditions under which nuclear investments can remain socially and institutionally sustainable. Drawing on experimental survey evidence from six European countries, we identify the institutional and economic features that most strongly shape public acceptance. Political feasibility depends less on technology choice per se than on governance, energy sovereignty, and consumer costs. Fusion benefits from a modest legitimacy advantage and represents the least politically constrained pathway to sustain European nuclear capabilities. However, durable support requires embedding nuclear development within credible public and European oversight frameworks, reducing external supply dependencies, and ensuring visible benefits for consumers, particularly through electricity affordability. Careful siting and realistic communication are also essential. Nuclear policy should therefore be designed as an institutional and distributive strategy, aligning technological development with credible governance.

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Introduction and context

Price volatility, fragile supply chains, and geopolitical crises are reshaping European energy policy, especially since reduction of Russian gas supplies after 2022 exposed the strategic fragility of Europe's energy system. Policymakers increasingly look at long-term energy projects in terms of resilience, i.e., their capacity to withstand political strain, external shocks and sustained uncertainty over time (Burgoon et al., 2022; Nicoli et al., 2023). Market efficiency, while important, is made increasingly secondary by geopolitical tensions. It is therefore not a surprise that nuclear energy has returned to the policy agenda, thanks to its capacity of providing stable, continuous output at relatively low operational costs, especially if one considers plant development as a sunk cost (Rosslowe & Petrovich, 2025). Reflecting a growing awareness that the energy transition toward sustainable energy systems must account for geopolitical factors that were previously underestimated, nuclear power is no longer discussed solely as a climate tool or a legacy technology, but it is increasingly viewed as a strategic asset. Yet its feasibility crucially depends on how it is embedded in society and, ultimately, on its public acceptance. Existing fission energy plants would be able to produce a large share of Europe's energy needs at contained *consumer* costs.[2] However, many existing plants are old generations and need refurbishment; new plants face frontloaded investment costs of enormous proportions, often measured in billions or tens of billions of Euros, and decades in construction times; a very high bill even at times of geopolitical upheaval, especially considering the elongated timelines before new plants can come online. Moreover, current fission technology does not solve the issue of security of supply, as they need fissile fuel (primarily uranium) which is not natively available on the European continent. This shifts, but does not solve, the problem of dependency from malicious actors like Russia.[3]

These issues raise serious concerns over the viability of nuclear fission as a long-term, assured energy source. At the same time, novel nuclear technologies are advancing fast. In 2023, the US-based National Ignition Facility passed, for the first time, the threshold of net energy gain in an inertial confinement fusion experiment; since then, they have repeated the feat with increasing efficiency, while competing fusion technologies are also advancing fast. Private investment has now surpassed 10 billions dollars, and the International Atomic Energy Agency has estimated that, by the end of the century, fusion energy is likely to represent between 10% and 50% of global electricity generation, even in the most conservative scenarios (IAEA, 2025).[4]

Four debates are therefore unfolding simultaneously: whether or not investment in nuclear energy is worthwhile, compared to renewable energies; whether to focus on new generations of fission power plants, or whether to pursue fusion energy; which fusion technology pathway to pursue (tokamaks and stellarators for magnetic confinement, or laser arrays for inertial confinement); and

[2] for reference, France's and Spain -the EU's two leading nuclear powers – have had consumer electricity which over the last 18 months were respectively 30% and 50% lower than Germany's; moreover, Germany's electricity costs have increased by 70% since the pre-war period, while Spain costs have in fact decreased (own calculations based on Eurostat, 2025).
[3] for instance, Niger long represented an importance source of Uranium for France, until a Russian-sponsored coup d'etat in 2023 led to a nationalization of the mines.
[4] Formally, also fusion reactions require 'fuel', but current and proposed fusion reactors all primarily make use of Deuterium, which is readily available as an isotope of hydrogen. Most also use Tritium, which is extremely rare, but can be manufactured inside the reactor itself if needed. Inertial confinement adds a manufacturing step, as it uses "fuel" pellets that need extremely high precision manufacturing. However, there are no fundamental barriers in terms of natural resources dependency from third countries, even when importing the fuel pellets might be economically more efficient.

whether or not fusion powerplants are politically sustainable. Nuclear energy, overall, still suffers from a political stigma associated with the Chernobyl and Fukushima disasters, which led several countries to abandon nuclear energy generation altogether (for instance Italy and of late Germany). On the other hand, fusion is often perceived as forward-looking innovation, largely removed from the past controversies associated with nuclear power (Fischer et al., 2018; Carayannis et al., 2024), whereas fission remains closely tied to earlier accidents and long-standing concerns about safety and radioactive waste, as well as doubts about institutional competence and technical assessment (Bird et al., 2014; Guo and Ren, 2017; Pampel, 2011; Sonnberger et al., 2021; Uji et al., 2021). National approaches reflect this tension, as illustrated by the countries included in our survey (Butorac et al. 2026). France and Spain maintain a strong nuclear sector, even though France treats it as a cornerstone of its energy system while Spain is considering a phase-out. Germany has completed its phase-out and remains politically constrained, despite ongoing research activities (Wierz et al. 2023). Italy retains formal prohibitions, though rising energy prices have reopened discussion. Poland is pursuing nuclear power as part of its transition away from coal. The United Kingdom combines existing fission capacity with a long-standing commitment to fusion research, reinforced by its past role in hosting of the Joint European Torus, the largest European experimental facility of its kind (Shaw, 1990).

Fusion occupies a different political space from fission, as it remains tied to long-term prospect and for now object of international technoscientific cooperation. This gives fusion a degree of political flexibility that fission lacks. At the same time, it generates expectations that are difficult to reconcile with long development timelines (Giacometti et al., 2025; Jones et al. 2019, 2021; Oltra et al., 2019, 2025). Nonetheless, and beyond their different levels of technical maturity, the two most promising fusion technologies may carry different public and political expectations, not because people fundamentally care about the technology per se, but because these come with different footprints, with magnetic confinement likely requiring much larger, costlier but also more efficient powerplants than inertial confinement.

These different perceptions have important consequences since public acceptance affects regulatory stability, financing conditions, and the likelihood that projects survive electoral cycles. In Butorac et al. (2026) we provided extensive experimental survey data on the relative importance of these factors for the public opinion in six European countries: France, Germany, Italy, Spain, Poland, and the United Kingdom. In this policy contribution, we first propose a synthetic version of these results, and then we elaborate on the policy implications that our results hold.

Survey results

The survey examined how citizens respond to nuclear energy projects when confronted with concrete trade-offs. Respondents were presented with two hypothetical development plans at a time and asked which they preferred and whether they would support it. Each proposal combined multiple attributes. This structure allowed respondents to make comparisons similar to those implied by real policy decisions.

To begin with, participants were randomly assigned to assess either fusion projects or next-generation fission projects. Aside from this initial framing, the projects varied along identical dimensions. These included plant size (which is a correlate of the technology used),[5] proximity to residential areas, oversight and governance arrangements, fuel sourcing, construction costs, expected electricity prices, Co2 emissions, and employment effects (see Butorac et al. 2026 for

[5] For instance, respondents assigned to a design including a proposed magnetic confinement plant would get a text saying “the plant uses magnets, and it is therefore larger in size”; conversely, a respondent getting a laser confinement technology would get a text saying “the plant uses lasers, and it is therefore smaller in size”.

the full list of attributes). The design makes it possible to isolate how these individual features affect support and to compare responses across the two technologies.

In all six countries, outright opposition to nuclear projects was limited. Most respondents expressed either support or neutrality, while only a small minority rejected all proposals. This distribution points to a degree of flexibility in public attitudes. Many European citizens seem to be open to nuclear energy under certain conditions, depending on how the projects are designed. A substantial number of people remain neutral and are therefore swayable during referendum campaigns or other highly politicized decision-making nodes.

Figure 1a. support for nuclear development projects (all types)

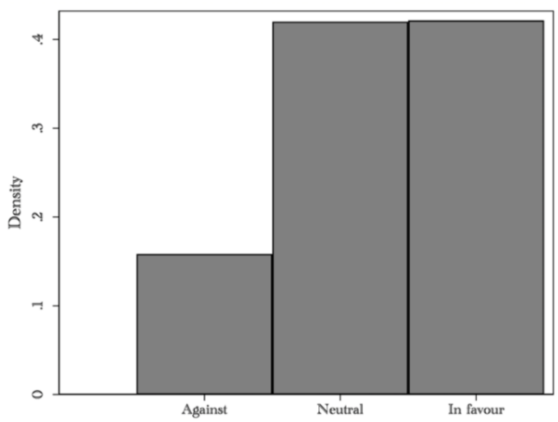
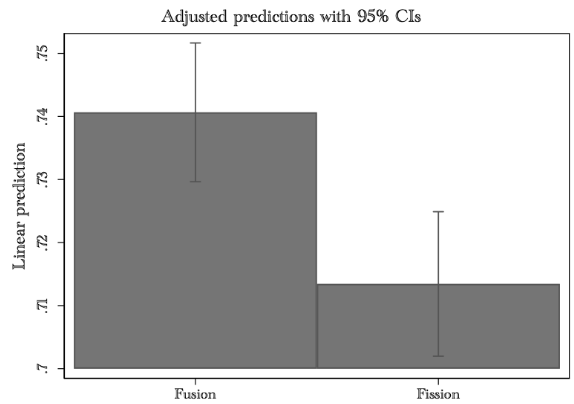


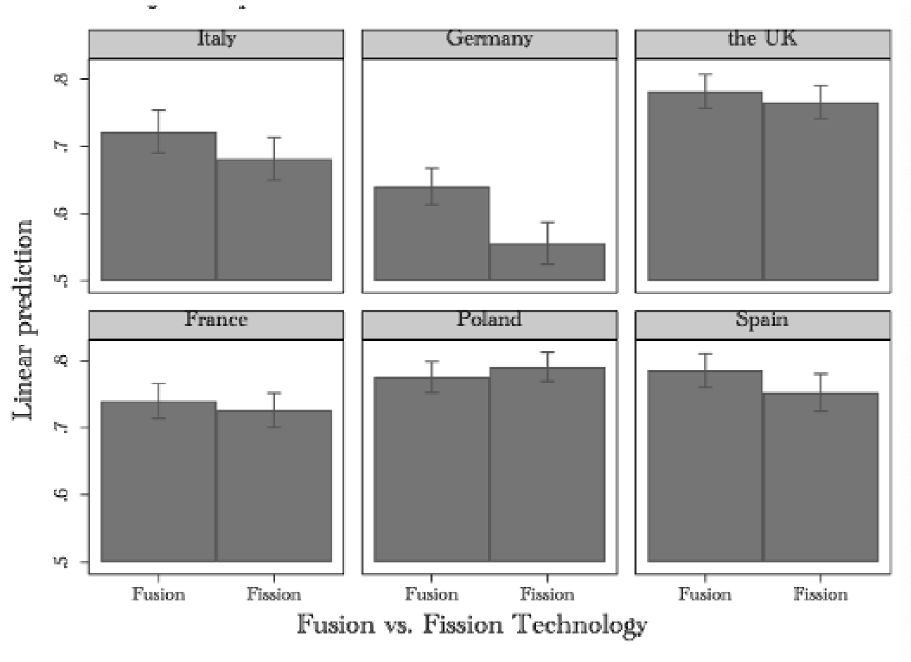
Figure 1b. support for fusion vs fission projects



Across the full sample, fusion is causally associated with a marginal, albeit fully statistically significant, higher support for nuclear development projects (figure 1b). The difference was not large, but it appeared consistently and it did not depend on any single project feature.

The gap widened among respondents who reported a clearer understanding of the distinction between fusion and fission. The size of this gap also varied by country. It was most pronounced in Germany and Italy, where historical opposition to nuclear power remains influential. In France, Poland, and the United Kingdom, levels of support for the two technologies were more similar, with Spain occupying an intermediate position.

Figure 2. Average support for fusion and fission development plans, by country.



Beyond framing effects, several project attributes consistently shaped support:

- The NIMBY effect is clearly visible: distance from residential areas had a strong effect, as projects located farther away were evaluated more favorably.
- Plant size (which was presented as a consequence of the technological choices made) also influences responses, although its effect was far less pronounced than proximity.
- Projects highlighting scientific and engineering employment attract slightly more support than those focused on routine operational jobs. This held true regardless of the educational profile of the respondents, suggesting that - rather than hopes for personal employment or benefits - respondents reasoned following the type of local economic development they would like to see.
- Private safety oversight is viewed negatively, while public monitoring attracted higher support, even more so when provided by supranational institutions such as the European Union.
- As for fuel sourcing, projects relying on domestic or EU-based fuel production are substantially preferred to those dependent on non-European sources.
- EU-level involvement in research and development increases support for fission projects, while making little difference for fusion. In combination with preferences over oversight, this suggests that fission - perceived as a riskier technology - benefits from having neutral, super-partes technocratic institutions involved.
- The strongest effects emerged in relation to electricity prices for consumers, which dominated all other attributes. Lower prices substantially increased support across technologies and countries. Construction costs and emissions also influenced evaluations, but their effects were substantially smaller, the latter suggesting that people tend to see infrastructure development costs as sunk costs and less relevant insofar they are not reflected in the final electricity prices.

Policy implications

On the ground of these results, we advance the following policy recommendations pertaining the political feasibility of nuclear renewal.

1. Prioritize fusion research as a politically efficient investment

Public support for nuclear energy is conditional and project-specific, rather than ideologically fixed. Within this constrained space, fusion research enjoys a modest but consistent legitimacy advantage over fission. This advantage is especially pronounced in countries where historical opposition to nuclear energy remains politically salient. As a result, directing public resources toward fusion research entails lower or no immediate political costs. Fusion investment is therefore a less politically constrained pathway to sustain European nuclear technological capabilities, even though it cannot substitute for fission in the short term.

2. Anchor nuclear investments in credible institutional oversight

Governance arrangements significantly affect political feasibility. Projects subject to public oversight attract substantially greater support than those relying on private monitoring, with supranational oversight—particularly at the European level—generating the highest levels of trust. Embedding nuclear development within European governance frameworks can therefore strengthen legitimacy and improve political resilience. This applies both to regulatory supervision and to research coordination.

3. Minimize external dependencies and emphasize energy sovereignty

Fuel sourcing is a major determinant of public support. Reducing external dependency is not only a strategic objective but also a political prerequisite for sustained public support: projects relying on European or domestic fuel supply chains are consistently preferred to those dependent on external providers. Nuclear policy should therefore be integrated with broader strategies aimed at strengthening European control over nuclear supply chains. Notably, this is much easier to do in the case of fusion technology rather than fission technology.

4. Link nuclear development to tangible economic benefits, especially electricity prices

Electricity prices dominate all other project attributes in shaping public acceptance. Projects associated with lower consumer prices receive substantially greater support, even when other features remain constant. This implies that nuclear development strategies must be explicitly connected to affordability outcomes. Projects perceived as increasing consumer costs are unlikely to remain politically sustainable, regardless of their strategic or environmental benefits. Conversely, credible commitments to price stability or reduction can offset other sources of resistance.

5. Manage local opposition through siting choices, employment effects and distributive compensation

Local proximity generates consistent opposition across countries and technologies. This reflects durable perceptions of risk and disruption that cannot be eliminated through communication alone. Careful site selection remains essential. At the same time, local resistance is not absolute. When projects are associated with clear economic benefits our results show that citizens become more willing to accept local costs. Nuclear policy should therefore combine spatial planning with visible distributive benefits, ensuring that local burdens are matched by credible economic gains.

6. Maintain realistic and restrained communication strategies

Fusion's political advantage is contingent on expectations. Support declines when citizens lack basic understanding of the technology or associate it with military applications. Overstating technological readiness or near-term benefits risks undermining credibility and eroding support. Communication strategies should therefore emphasize realistic timelines, institutional safeguards, and concrete benefits, since credibility of the technology appears to be crucial.

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