# PREPRINT

# The Nuclear Alliance vs. the Friends of Renewables: Environmental Conflicts and Nuclear Energy in the European Union

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## 1. Introduction

In 2022, through its proposed green finance taxonomy – a classification system for environmentally sustainable economic activities – the European Commission designated nuclear energy as 'sustainable', in the Taxonomy Complementary Delegated Act, thereby making it eligible for sustainable investment (European Commission, 2022). This decision was advocated for by a group of EU member states informally led by France and known as the Nuclear Alliance (NA). The European Parliament (2022) endorsed this classification, rejecting an attempt to block it by another coalition of states led by Austria and referred to as the Friends of Renewables (FoR). This example illustrates the deep divisions among EU member states regarding strategies for mitigating climate change and the criteria for defining 'sustainability' as a prerequisite for investment eligibility.

The use of nuclear energy to mitigate climate change is strongly opposed by anti-nuclear and environmental justice (EJ) movements, which argue that largescale nuclear energy projects overlook substantial local health and environmental impacts. Such environmental degradation frequently gives rise to conflicts within affected areas and communities (see Cabras *et al.*, 2025). In the literature, these conflicts are generally referred to as 'environmental conflicts' and are often associated with the concept of EJ, understood as a social movement advocating for a fairer and more equitable distribution of environmental benefits and burdens (Martinez-Alier, 2014).

Since the late 1990s, the EU has increasingly depoliticised sustainability, energy, and climate policies by framing political decisions in terms of market rationality rather than through democratic processes that take account of different political positions (Lenz, 2022; Machin, 2020). Nonetheless, member states continue to exercise considerable autonomy in determining their energy mix, with national political parties often advancing divergent views, with the result that complete depoliticisation has not been achieved. Moreover, a mainstream narrative of 'ecological modernisation' has recently emerged, based on the assumption that states and markets can work together to protect the environment (Mol *et al.*, 2013).

In this paper, we investigate the relationship between nuclear energy and the rise of environmental conflicts in the EU. Adopting the lens of EJ, we analyse the risks of environmental conflict associated with policies and initiatives pursued by national governments who are members of the NA and the FoR. Specifically, we investigate multiple issues related to EJ in the nuclear energy sector by analysing 54 local environmental conflicts in EU member states documented in the Global Atlas of Environmental Justice (EJAtlas; www.ejatlas.org). We further consider how the meaning and character of these conflicts shape national discourses on nuclear energy, including the positions adopted by member states in EU policymaking and decision-making processes.

We address the following questions: What are the main causes of environmental conflicts over nuclear energy in Europe? How have competing narratives about nuclear energy emerged and shaped these conflicts within the EU? The remainder of the paper is organised as follows: Section 2 defines environmental conflicts and EJ in the context of nuclear energy; Section 3 outlines the methodology used to develop our analysis; Section 4 examines the results gathered from our case studies; Section 5 analyses the risks of environmental conflict across NA and FoR member states; and Section 6 offers a conclusion.

## 2. Theoretical Background

### 2.1 The connection between environmental conflicts, environmental justice, and nuclear energy

In the literature, environmental conflicts are understood as social conflicts produced by asymmetrical access to, and distributions of, environmental benefits and costs (Cabras *et al.*, 2025). Such conflicts emerge when imbalances within societies are produced through the use or abuse of power, often resulting in inequalities across different segments of the population and among different components of the affected communities. The parties involved in these conflicts typically include communities, companies, investors, and social or environmental movements. Environmental conflicts often occur when companies exploit sites and resources to maximise profits and revenues, or in connection with large infrastructural projects characterised by high environmental costs. At the local level, they may arise within short commodity chains, for instance in relation to soil, sand, or gravel extraction for new infrastructure (Martinez-Alier *et al.*, 2011), as well as over access to natural resources, the burdens of pollution, and

the abuse of ecosystems (Akbulut et *al.,* 2019). These conflicts tend to intensify social inequalities by exacerbating the uneven distribution of wealth within and among communities and countries (Cabras *et al.,* 2025). Beyond resources, they also involve values, cultural identities, and territorial rights, generating significant social, economic, and political tensions within and across affected communities (Temper *et al.,* 2018; Scheidel *et al.,* 2020).

Environmental conflicts are strongly associated with EJ, a concept that draws on the intersectional notions of racism, inequality, gender, class, and environmentalism (Martinez-Alier *et al.,* 2011; Schlosberg and Collins, 2014). EJ is characterised by interdisciplinarity, comprising environmental law, environmental policy, political ecology, development, and sustainability. Whereas in the United States EJ tends to focus on categories such as race, gender, and class (Warlenius *et al.,* 2015), in Europe it is more directly associated with issues concerning environmental quality, social deprivation and equity, and sustainable development (Scheidel *et al.,* 2020).

Since the early 1970s, communities worldwide have mounted increasing resistance to the destructive practices of multinational corporations, governments, and local administrations (Temper *et al.,* 2018). Actors who campaign against these initiatives are predominantly referred to as 'environmental defenders', most often members of vulnerable groups who employ largely non-violent forms of protest in pursuit of EJ. Resistance is frequently organised through EJ organisations (EJOs), composed of activists and local residents campaigning to protect their homelands from resource extraction and its associated forms of pollution, including water, soil, radioactive, and noise pollution (Scheidel *et al.,* 2020; Weber *et al.,* 2024).

EJOs play a vital role in environmental conflicts associated with nuclear energy, for example by organising protests against uranium extraction and nuclear waste storage, connecting local campaigns with transnational advocacy networks, and bringing together cross-border communities facing comparable risks (Cabras *et al.,* 2025; Scheidel *et al.,* 2020; Temper *et al.,* 2018). In recent decades, environmental EJOs such as Friends of the Earth (*Les Amis de la Terre* in France, *Hnutí DUHA* in the Czech Republic, and *Bund für Umwelt und Naturschutz* in Germany) have coordinated multiple campaigns against nuclear energy, targeting not only its environmental risks but also the threats it poses in terms of democracy, sovereignty, and human rights. EJOs often mobilise through the EJAtlas, which documents numerous cases of nuclear-related conflicts, from uranium extraction in Spain, Hungary, and Bulgaria to waste disposal controversies in France, Germany, and the Czech Republic.

Opposition to nuclear energy, advanced by anti-nuclear movements, constitutes one of the most important examples of EJ campaigning worldwide and is frequently linked to peace and pro-democracy movements because of its association with nuclear armaments. Since the 1970s, a series of major nuclear accidents – notably Three Mile Island in 1979, Chernobyl in 1986, and Fukushima in 2011 – has fuelled and consolidated resistance to nuclear power. Today, anti-nuclear movements operate at the local, national, and international level, sharing common tactics, symbols, and narratives that highlight both the ecological risks and the distributional injustices embedded in the nuclear industry's value chain, from uranium mining to long-term waste disposal (Martinez-Alier, 2023b). These injustices disproportionately affect marginalised communities and future generations (Höffken & Ramana, 2024).

EU institutions and national governments tend to prioritise problems with high visibility and for which technical solutions are feasible (Weidner *et al.,* 2020), although recent geopolitical and economic developments have shifted these priorities. Many member states have adopted the narrative of 'ecological modernisation' – which portrays economic growth, environmental protection, and energy security as mutually reinforcing – to justify energy policies and initiatives that diverge from more sustainable paths (Machin, 2020). Within this framework, governments promote nuclear energy as a response to climate change driven by fossil fuels (Martinez-Alier, 2023b, p. 212). Yet this approach neither ensures environmental protection nor challenges the dynamics of the capitalist mode of production, which inevitably lead to environmental degradation (Foster, 2002).

Paradoxically, groups and movements supporting or opposing nuclear energy in the EU all claim that their actions and initiatives aim to protect the environment and to pursue the United Nations Sustainability Goals (SDGs). For instance, those promoting nuclear energy claim to pursue SDG 7 (Affordable and Clean Energy), as nuclear energy can prove a reliable, sustainable and modern source of energy for all (World Nuclear Association, 2025c). In contrast, the anti-nuclear movement claims to pursue SDG 3 (Good Health and Wellbeing), as they campaign to prevent the environmental and health risks associated with nuclear energy (INCITE-DEM; 2025).

### 2.2 Nuclear energy and sustainability in the EU

Nuclear energy is among the most controversial energy sources in the EU. Although it is associated with the birth of the European integration process (e.g. the EURATOM Treaty, 1957), it has never been fully embraced by all EU member states, owing to the high level of investment required, the production of radioactive waste, and concerns about accident risks (Glaser, 2011).

According to the Commission, 'total energy use accounts for approximately 75% of direct greenhouse gas emissions in the Union (…) the energy sector has a crucial role in continuing to reduce greenhouse gas emissions'

(European Commission, 2022, p.1). Proponents of nuclear energy argue that it contributes to the development of sustainable economies and advances the cause of carbon neutrality (Koasidis *et al.*, 2022; Schreiber *et al.*, 2020). Since nuclear facilities do not produce direct emissions from electricity generation, they are seen as contributing to decarbonisation targets in the EU and beyond (Prăvălie and Bandoc, 2018). Several EU member states actively promote nuclear energy as a low-carbon source to decrease their carbon footprint (Capros *et al.,* 2014).

Nuclear power plants (NPPs) are large facilities that require substantial amounts of material for both their construction and their operation, including carbon-intensive resources such as concrete and steel (Pomponi and Hart, 2021). Their decommissioning is similarly time- and labour-intensive, often taking decades, which helps to explain why no large commercial reactor has yet been fully decommissioned anywhere in the world (Hirose and McCauley, 2022). In addition, nuclear fuel production is a highly complex, carbon-intensive process that demands vast amounts of energy and raw materials and poses significant environmental risks (Sovacool, 2008). Proponents of nuclear energy, however, tend to downplay these issues, contributing to ongoing debates about the true carbon intensity of NPPs, nuclear fuel production, and decommissioning (Nian *et al.*, 2014, Scarlat *et al.,* 2022).

In 2018, the European Commission published an *Action Plan: Financing Sustainable Growth (SFAP)*, which called for a classification system that would provide investors with indications and clear guidance on what the EU considers a sustainable investment (European Commission, 2018). The SFAP emphasised the need for a taxonomy to offer 'clarity on which activities can be considered "sustainable"' (p.4). In 2020, to support the EU's decarbonisation objectives, the Commission advanced this agenda by proposing a Taxonomy Regulation for Sustainable Activities (TR2020/852), commonly referred to as the 'green taxonomy' (European Parliament and the Council of the European Union, 2020). TR2020/852 aims to create an EU-wide classification system for sustainable activities, distinguishing between those deemed 'green' (those that contribute to the development of a sustainable economy within the EU) and those that are not. Its purpose, together with the related delegated acts, is to guide investors and private companies towards areas that support the EU's decarbonisation goals, while preventing sunk investments. To this end, it sets out the criteria 'for determining whether an economic activity qualifies as environmentally sustainable for the purposes of establishing the degree to which an investment is environmentally sustainable' (p.25). These rules are intended to steer private investments in the energy sector towards achieving carbon neutrality in the EU by 2050, the overarching objective of the European Green Deal. The taxonomy regulation sets out four overarching conditions that businesses must satisfy in order to qualify as environmentally sustainable. Article 3 of TR2020/852 (p.27) considers an economic activity environmentally sustainable if it: 1) contributes substantially to at least one of the six environmental objectives;[1] 2) does no significant harm (DNSH) to any of the other environmental objectives; 3) complies with minimum safeguards, such as the OECD Guidelines for Multinational Enterprises; and 4) meets with technical screening criteria established by the Commission, which provide detailed thresholds and metrics for assessing substantial contribution and DNSH. The regulation itself, however, does not provide a list of qualifying economic activities or detailed guidance on which sources are to be considered 'green'. To address this issue, the European Parliament and the Council of the EU mandated the European Commission to compile the list of qualifying activities via delegated acts under TR2020/852. This task proved challenging, with some EU member states turning against the inclusion of natural gas and nuclear energy in the taxonomy, arguing that these sources are incompatible with the EU's decarbonisation and sustainability objectives. Critics contended that their inclusion in the taxonomy would entrench natural gas and nuclear energy in EU member states' energy agendas, thereby hindering the genuine transition to a carbon-neutral economy and reinforcing a carbon 'lock-in' (see Unruh, 2000).

### 2.3 The Nuclear Alliance and the Friends of Renewables

Over time, two blocs of EU member states have emerged in relation to nuclear energy. One bloc, frequently represented by Austria and Germany, strongly opposes nuclear power, citing technological and safety challenges that remain difficult to resolve (Lofstedt, 2008; Renn and Marshall, 2016). The other, informally led by France, strongly supports nuclear energy, emphasising its contribution to EU energy security and climate objectives (Osička and Černoch, 2017; Pan, 2023). Although these blocs are recognisable, their memberships vary and fluctuate depending on nuclear policies, preferences, and historical nuclear legacies. Members of both the NA and the FoR regularly argue about the role of nuclear energy as a low-carbon energy source in the green transition and in broader initiatives that address energy and climate legislation. Debates are likely to persist as new legislative proposals emerge, with disputes over nuclear energy intensifying in the wake of Russia's invasion of Ukraine (Dulian, 2023).

Since 2022, a sharp decline in energy supply and a rapid rise in energy prices have prompted some previously hesitant countries to turn towards nuclear energy. France capitalised on the conflict to promote nuclear energy across the EU, positioning itself as a leader of the NA coalition and framing nuclear energy as a means of securing energy

[1] The six objectives are: (i) climate change mitigation, (ii) climate change adaptation, (iii) the protection of water/marine resources, (iv) the transition to a circular economy, (v) pollution prevention, and (vi) the protection of ecosystems.

sovereignty, advancing decarbonisation, and boosting the economy. Two NA meetings held in February and March 2023 culminated in a joint statement signed in May 2023 by Belgium, Bulgaria, Croatia, the Czech Republic, Finland, France, Hungary, the Netherlands, Poland, Romania, Slovakia, Slovenia, and Sweden (Dulian, 2023).[2] In parallel, the FoR, led by Austria, emerged with a collective commitment to accelerate the expansion of renewable energy across Europe. This coalition seeks to coordinate the positions of like-minded countries in order to exert greater collective influence (Bundesministerium für Wirtschaft und Klimaschutz, 2024). The FoR held its first meeting during the EU Energy Council in March 2023 and continued to convene in June and July 2023 (Dulian, 2023).

The memberships of the NA and the FoR have shifted slightly over the years. Currently, the NA comprises 12 countries: Bulgaria, Croatia, the Czech Republic, Finland, France, Hungary, the Netherlands, Poland, Romania, Slovakia, Slovenia, and Sweden (Nuclear Alliance 2024).[3] The FoR also includes 12 countries: Austria, Cyprus, Denmark, Germany, Greece, Ireland, Italy, Luxembourg, Malta, the Netherlands, Portugal, and Spain. The Netherlands participates in both groups, while Belgium, Estonia, Lithuania, and Latvia belong to neither.[4] France's willingness to be involved in the FoR generated tensions, with Paris ultimately being excluded from FoR ministerial meetings (Taylor, 2023).

The NA and the FoR often have opposing views on the role that nuclear energy ought to play in the green transition. The NA calls on the EU and international partners 'to take into account the contribution of all affordable, reliable, fossil-free and safe energy sources to achieve climate neutrality by 2050' (Nuclear Alliance 2023, p. 1), lobbying for the recognition of low-carbon sources such as nuclear energy, hydrogen, and carbon capture technologies. A major success for the NA was the inclusion of nuclear energy and natural gas in the Complementary Climate Delegated Act amending TR2020/852, which seeks to increase the level of environmental protection by diverting capital from environmentally damaging investments to greener alternatives (Kardaś, 2024). This achievement also serves as a blueprint for the nuclear lobby's broader ambitions, which include generating extensive political debate under the banner of 'technology neutrality' and a 'level playing field', while forming alliances with fossil fuel advocates (notably natural gas) to temper ambition for more sustainable solutions (CAN Europe, 2024).

Similar dynamics emerged during the revision of the Renewable Energy Directive (RED III; Dulian, 2023). In 2023, France and other NA countries advocated a low-carbon 'weighting' to support the higher EU 2030 renewable energy target of 45%, proposing that so-called low-carbon energy sources be counted towards national renewable energy targets. Although unsuccessful in this effort, the NA secured a concession on renewable hydrogen, obtaining provisions that facilitate nuclear-produced hydrogen and further undermining the renewables-based technology pathway (CAN Europe, 2024).

The FoR, by contrast, rejected the idea of placing nuclear energy on an equal footing with renewables, insisting that 'renewable means renewable' (Dulian, 2023). In March 2023, the European Commission launched its proposal for the Net Zero Industry Act (NZIA) in response to the United States' Inflation Reduction Act (IRA). While nuclear energy was included among the technologies deemed to contribute to decarbonisation, Commission President Ursula von der Leyen declined to classify it as a 'strategic technology' eligible for additional EU funding. The FoR lobbied for the 'strategic technologies' list to be limited to technologies that represented shared EU priorities, excluding nuclear energy on the grounds that it was backed only by a minority of member states. The initial list thus included solar, wind, energy storage, heat pumps, and grid technologies (CAN Europe, 2024). However, in December 2023, following NA lobbying, the Council of the European Union expanded the NZIA list to include nuclear energy, adopting an amendment from the European Parliament (Kardaś, 2024). The inclusion of 'nuclear fission energy technologies' broadened the list so extensively that it effectively diluted its strategic focus (CAN Europe, 2024).

Clashes between the NA and the FoR are likely to recur in debates on forthcoming climate and energy legislation. In a joint statement, the NA urged the Commission 'to adequately reflect the role of nuclear energy in all future communications and proposals', while the FoR argued that future energy legislation should prioritise the rapid roll-out of renewables (Dulian, 2023, p. 9). The NA's ambitions extend beyond the EU: at COP28 in December 2023, an alliance of 22 countries (including all NA members)[5] announced their willingness to triple global nuclear energy capacity by 2050 in view of achieving net-zero targets (US Department of Energy 2023; Kardaś, 2024).

## 3. Methodology

[2] Among the signatories are also the United Kingdom (as a guest) and Italy (as an observer). Details of the meetings reported by Dulian (2023) in the European Parliamentary Research Service (EPRS)

[3] Belgium (now an observer) and Estonia were initially members of the 'pro nuclear alliance', while the United Kingdom participated as an invitee and Italy held observer status (Dulian, 2023; Nuclear Alliance 2024).

[4] Estonia and Latvia have participated in meetings of the FoR (Dulian, 2023).

[5] Other countries include Armenia, Canada, Ghana, Jamaica, Republic of Korea, Moldova, Mongolia, Morocco, Ukraine, the United Arab Emirates, and the United Kingdom.

### 3.1 Data

To address our research questions, we adopted a methodological approach comprising political ecology and case studies (e.g. Martinez-Alier et al., 2016). Our analysis draws on data extracted from the EJAtlas database, a global inventory of 4,300 cases[6] documenting the activities of EJOs worldwide. The EJAtlas serves as a platform for identifying the actors involved in specific conflicts, their actions, and their networks. This rich dataset has been widely employed in academic research; previous studies have used it to examine the origins and emergence of the EJ movement (Martinez-Alier, 2021) and its development (Del Bene and Ávila, 2023), among other issues. The literature that draws on the atlas is substantial, including entire special issues (for example Temper *et al.,* 2018), with Martinez-Alier (2023a) offering a comprehensive overview.

The information extracted from the EJAtlas database was used to explore and investigate EJ issues related to nuclear energy, with particular attention to how actors shape EU sustainability and nuclear discourses, policies, and laws. Covering a 60-year period from 1965 to 2025, we identified 160 conflicts worldwide associated with projects in the nuclear energy sector and its supply chain, comprising NPPs, nuclear waste management processing sites (NWMs), nuclear fuel reprocessing plants (NRPs), and nuclear research centres (NRCs). From these, we selected 54 conflicts within the EU, 27 of which are located in France, the Czech Republic, Germany, and Spain. The choice of these four countries is consistent with the juxtaposition between the NA and the FoR: France and the Czech Republic have been key players in the NA, and both countries are planning new nuclear power plants, while Germany and Spain are the largest EU members of the FoR (without also being members/observers of the NA) and have been progressively withdrawing from nuclear energy. Our analysis of France, the Czech Republic, Germany, and Spain explores how EU narratives, initiatives, and policies have shaped national and regional struggles over nuclear energy. We also investigate differences in mobilisation strategies, success outcomes, and state repression.

We employed a multiple case study approach, which is well suited to analysing and interpreting complex human phenomena such as government authority and control (Yin, 2009), as the aim of this study is to investigate socially meaningful actions through detailed observation in natural settings. The richness of the data afforded by multiple case studies allows for the examination of the micro-dynamics of these phenomena (Yin, 2009) at both the national and the subnational level. This approach is particularly appropriate to our research, given the complexity of the economic and social impacts of nuclear power and the diverse direct management strategies adopted by national and subnational governments, ministries, energy companies, and non-governmental organisations (NGOs).

Yin (1993) emphasises that multiple case studies should be guided by a replication logic (whether literal or theoretical) rather than by statistical sampling. In this regard, the EJAtlas serves as a valuable tool for identifying and analysing grassroots environmental conflicts, offering geographically diverse and systematically documented case studies that enrich academic inquiry into patterns of resistance, environmental harm, and justice claims. The EJAtlas provides detailed case descriptions, including information on location, actors, conflict history, outcomes, multimedia evidence (e.g. maps, protest images, legal documents), and process tracing (e.g., how a movement escalated from petitions to lawsuits; Temper *et al.,* 2015).

The EJAtlas supports this approach by providing a large and diverse dataset from which cases can be selected to enable cross-case comparisons. Eisenhardt (1989) argues that case study research is particularly suitable for inductive theory development and that selecting four to ten cases, including polar types, is appropriate for maximising variation. The EJAtlas aligns well with this approach as it offers a broad dataset with contrasting cases and emergent themes – for example, the inclusion of nuclear power within green industrial strategies as a low-carbon energy source. In addition, the EJAtlas facilitates cross-referencing across multiple reports, incorporating both activist and academic perspectives, thereby reducing single-source bias by using multiple sources to validate findings (Yin, 1993).

### 3.2 Environmental conflicts and nuclear energy projects in the EU

Figure 1 presents the 54 environmental conflicts associated with nuclear energy in the EU, disaggregated by project type (NPP, NWM, NRP, NRC, uranium mining, or other) and by the share of nuclear energy in electricity production in 2020. The map identifies significant variation across member states, with all individual conflicts listed in the Appendix.

In Germany, five major environmental conflicts around nuclear energy have been documented, in relation to the Brokdorf NPP, the Kalkar NPP, the Wyhl NPP, the Gorleben NWM, and the Wackersdorf NRP. Most of these conflicts resulted in victories for anti-nuclear and EJ movements, with several facilities cancelled or prevented from operating fully. The Kalkar (case 44) and Wyhl (case 46) NPPs, along with the Wackersdorf NRP (case 45), were cancelled. Both the Wyhl NPP and the Wackersdorf NRP were sites of major anti-nuclear protests in Germany during the 1970s and 1980s, leading to the suspension of construction in Wyhl and Wackersdorf in 1975 and 1989, respectively. The

[6] As of September 2025.

Kalkar NPP, though completed in 1985, never entered into operation. These projects were ultimately halted due to a combination of safety concerns, political opposition, economic constraints, and top-down political decisions.

In France, the map identifies 19 major environmental conflicts, 13 of which were associated with NPPs: Blaye (case 11), Bugey (2), Cattenom (6), Chinon (17), Chooz (5), Creys-Malville (1), Erdeven (4), Fessenheim (7), Flamanville (10), Golfech (12), Le Carnet (14), Penly (18), and Plogoff (3). Some of these conflicts are related to cost overruns and delays. The Flamanville 3 ERP reactor exemplifies the economic drivers of conflict, with costs significantly increasing from €3.3 billion to over €23.7 billion and a 12-year delay (Pécout, 2025). Such systematic cost overruns undermine public trust and generate opposition to new projects, including the planned €67.4 billion investment in six new EPR2 reactors (Wajsbrot, 2024). Additional environmental conflicts concern the NWMs at Bure (8) and Narbonne (13); the NRP in La Hague (9); the International Thermonuclear E Reactor NRC (ITER) in Cadarache (16), and two 'other' cases: the Chasteuil hydro-nuclear dam (15) and nuclear tests in French Polynesia at Mururoa and Fangataufa atolls (19). The complexity of nuclear technology and its associated risks, including waste management challenges at facilities like Bure and La Hague, remain ongoing sources of environmental conflict that extend beyond individual plant locations.

In Spain, the map pinpoints eight major conflicts, seven of which are associated with NPPs: Lemoiz (21), Garoña (22), Tudela (23), Retortillo (24), Almaraz (25), Valdecaballeros (26), and Cofrents (27), with one case – Villar de Cañas (28) – involving an NWM facility. Three NPP projects – Lemoiz (21), Retortillo (24), and Valdecaballeros (26) – were cancelled due to a combination of political, social, and economic factors, during a period of intense anti-nuclear activism, shifts in government policy, and structural changes to Spain's energy planning. Two further projects, Tudela (23) and the NWM Villar de Cañas (28), were announced but never realised, owing to sustained opposition from EJOs and anti-nuclear movements. The Garoña NPP (22) was decommissioned as part of the Spanish nuclear phase-out, while Almaraz (25) and Cofrents (27) are scheduled to cease operations in 2028 and 2030, respectively.

In the Czech Republic, the map identifies only two major environmental conflicts: one concerning an NWM facility in the Klatovy region (20), which remains ongoing, another connected to the Temelín NPP in the South Bohemian Region (45), which dissipated once the plant was completed.

**[FIGURE 1 HERE]**

**Figure 1** Environmental conflicts related to nuclear energy by project type and number, and total nuclear electricity production in terawatt-hours (TWh), 2020

## 4. Case studies

The overview presented in the previous section identified a varied distribution of nuclear energy projects and related environmental conflicts in the EU. Figure 2 illustrates these conflicts by facility status, classified as *withdrawn*, *cancelled*, *operating*, *under construction*, or *announced*. Most of the projects are concentrated in France and Spain, representing NA and FoR members, respectively. The four case studies presented in this section detail the development of environmental conflicts associated with nuclear energy projects at different stages of advancement, providing a broad overview of such conflicts across NA and FoR member states.

**[FIGURE 2 HERE]**

**Figure 2** Environmental conflicts related to nuclear energy (and their number) in Nuclear Alliance and Friends of Renewables member countries

### *France*

In France, nuclear energy accounts for around 70% of national electricity production (World Nuclear Association, 2025a). The roots of environmental conflicts over nuclear energy in the country can be traced to several interconnected factors that reflect broader European patterns, including centralised state decision-making processes, democratic deficits, cost overruns and delays in facility construction, environmental and safety concerns, and technological risks. The French anti-nuclear movement emerged in response to the high degree of centralisation and technocratic trends that have long characterised modern French society (Chafer, 1985). A notable example is the government's top-down implementation of the Messmer Plan following the 1973 oil crisis, which expanded nuclear energy without any public consultation. This established a pattern of technocratic governance that continues to generate resistance among the wider public. The lack of participatory decision-making in nuclear planning has created enduring tensions between the national government, local authorities, and local communities. This democratic deficit is exemplified by the recent abandonment of electoral commitments, such as François Hollande's

2012 pledge to reduce nuclear energy's share to 50% by 2025, a target first postponed to 2035 and then abandoned entirely in 2023 (Pécout, 2023).

The map in figure 2 identifies five cancelled nuclear projects (Creys-Malville [1], Erdeven [4], Le Carnet [14], Plogoff [3], and Hydro-Nuclear Dam Chasteuil [15]), two retired nuclear sites (French Polynesia [19] and Fessenheim [7]), three conflicts over announced new reactors (Chinon [17], Penly [18], and Bugey [2]), two under construction (Flamanville [10] and ITER Cadarache [16]), and seven conflicts over operating projects (Blaye [11], Cattenom [6], Chooz [5], Golfech [12], Le Carnet [14], La Hague [9], and Narbonne [13]). The French government promotes nuclear energy by presenting it as a technologically advanced solution to climate change and a pillar of sustainable economic growth. This narrative itself functions as a form of 'governmentality', wherein the state governs not through coercion but by shaping the conduct of individuals, industries, and institutions via rationalities of climate responsibility and energy efficiency (Foucault, 1991). Through its leadership in the NA, France exports this narrative beyond national borders, positioning nuclear power as essential to the EU's identity as a 'global leader in the green transition', promoting nuclear energy 'alongside renewable energy' as the 'backbone of industrial decarbonization' (NA, 2024, p. 1).

Despite the mobilisation of nearly 175,000 people across ten demonstrations in the late 1970s, the French anti-nuclear movement has achieved only modest successes, as demonstrated by the small number of cancelled projects in the country (Kitschelt, 1986). While the French government continues to promote nuclear power as climate-friendly technology, critics argue that it is 'too slow and too risky' compared to renewable alternatives, highlighting competing visions of sustainable energy futures within European climate policy. The relatively small number of cancelled projects in France compared to countries like Germany indicates that the anti-nuclear movement has been less successful, though some have questioned whether the closure of Fessenheim was a genuine EJ success (Martinez-Alier, 2023b, p. 213).

Opposition to nuclear energy in France has been strongly regionally based. Three well known major cancelled NPPs (Plogoff, Erdeven, Le Carnet) were located in historic Brittany, underscoring the importance of regional and local leadership in environmental conflicts and suggesting that place-based identities and governance structures significantly influence conflict outcomes (Cabras *et al.,* 2025). The anti-nuclear network was particularly active in Plogoff (NPP) and Creys-Malville (NPP) organising large demonstrations against these facilities in the 1970s. The French anti-nuclear movement was highly confrontational, employing disruptive strategies to challenge the planning and siting of NPPs. Political elites largely opposed the use of holding referendums on nuclear power. The French Socialist Party advocated the idea of a referendum, while in opposition, but quickly abandoned the idea, while in office (Kitschelt, 1986). Following the government's decision to construct the Superphénix breeder reactor in Creys-Malville without any debate in the National Assembly, massive demonstrations were held in 1977. These culminated in violent clashes, during which the environmental activist Vital Michalon was killed by an offensive grenade, probably deployed by the police. The Creys-Malville Superphénix reactor was commissioned in 1986 and permanently closed following a government decision in 1997 due to poor performance, high costs, political opposition (especially from the Greens), and broader shifts in public and governmental attitudes toward nuclear power. The protests at Creys-Malville were related to other anti-nuclear mobilisations in Europe, such as the demonstrations against the Lemoiz NPP (21) in Spain, the Brokdorf NPP (43) in Germany, and the Gorleben NWM (42) in Germany. These protests were part of a transnational wave of environmental activism and are often regarded as foundational moments in the European anti-nuclear and Green political movement.

EJOs including Greenpeace, *Sortir du Nucléaire, Réseau Action Climat*, and the *Association pour le Contrôle de la Radioactivité dans l'Ouest* (ACRO) have played a central role in mobilising resistance, drawing attention to the risks associated with France's extensive nuclear infrastructure. Much of this infrastructure is concentrated in a handful of areas, often rural or economically weaker regions that are exposed to long-term hazards while receiving little local economic return beyond initial employment boosts. These 'sacrifice zones' highlight the unequal distribution of environmental risks. The Cotentin peninsula in Normandy is one of the most nuclearised regions on the planet. It hosts the Flamanville NPP (10), the Orano NRP in La Hague (9), the La Manche NWM, and other military installations. At La Hague (Normandy, 9), high-level radioactive waste storage and reprocessing have led to discharges into the sea, contributing to marine pollution and radiation risks. In addition to the accumulation of radioactive waste, the facility is authorised to release vast amounts of gaseous and liquid radioactive substances, with emissions several orders of magnitude greater than those from the Flamanville nuclear reactor (Schneider et al., 2001; Schneider and Frogatt, 2004). Although France promotes the reprocessing of spent fuel as a form of recycling, the actual recycling rate of reloaded fuel remains below 1%, with most plutonium and reprocessed uranium stored indefinitely due to limited reuse (Haut Comité pour la Transparence et l'Information sur la Sécurité Nucléaire - HCTISN, 2018). Local EJOs in Normandy have repeatedly raised concerns about marine pollution and public health risks associated with nuclear activities, calling for a national nuclear phase-out plan (ACRO, 2017; Greenpeace France, 2019). At Bure (Grand Este, 8), the environmental conflict centres on the planned deep geological repository

and the long-term storage of high-level radioactive waste, with activists protesting against groundwater contamination and democratic deficits.

***The Czech Republic***

The Czech nuclear programme began in the late 1960s, when the country was still part of Czechoslovakia. The first reactor (Jaslovské Bohunice A1) was built in the Slovak part of the republic in 1972, followed more than a decade later by four reactors constructed at the Dukovany NPP, in the Czech part (1985–1987). In the 1980s, the Czech energy company ČEZ delivered another two reactors at the Temelín NPP. All of these facilities were based on Soviet technology, a common feature of many other NPPs across Eastern Europe. Following the fall of the Communist regime, the Czech nuclear programme was suspended in the 1990s amid economic and political transformation, but construction of the new reactors at Temelín resumed between 2000 and 2003 (Maltby and Mišík, 2024). During this period, several Czech reactors underwent design upgrades, although some key components, such as Soviet-manufactured pressure vessels, could not be replaced.

In the early 2000s, the Czech government began exploring the construction of a permanent NWM facility. Nine potential sites were initially identified, with four shortlisted following extensive geological investigations in December 2020 (SÚRAO, 2024). A final decision on the location is expected by 2028, with construction scheduled for completion by 2050, at an estimated total cost of €4 billion (ČTK, 2024a). The Březový potok site in the Klatovy district, considered the most suitable of the four, has already seen 20 organised protests staged in its proximity. This conflict represents one of the two major environmental disputes over nuclear energy in the Czech Republic. The other centres on the Temelín and Dukovany NPPs, which provoked strong opposition not within the Czech Republic itself but in the neighbouring Austria. These facilities attracted significant environmental criticism from abroad, even as domestic support for nuclear power remained comparatively strong. Historically, nuclear power has enjoyed broad public backing in the Czech Republic (Osička and Černoch, 2017), with national media generally portraying it in a positive light (Kratochvíl and Mišík, 2020).

The Temelín NPP provoked only limited protests in the Czech Republic, mainly during the early 1990s, and these did not alter the country's nuclear trajectory. Far stronger opposition to the Czech NPPs came from Austria, with large protests and border blockades held during the late 1990s and early 2000s. The main concerns centred on the safety issues of the Temelín NPP, whose Soviet-era design was regarded as falling short of Western nuclear safety standards, despite a series of upgrades. The Austrian government also became directly involved, seeking to bring the issue before the European Commission during the Czech Republic's EU accession negotiations. The Commission declined to intervene, however, framing the matter as a bilateral dispute. Unlike in several other accession countries in 2004, the Czech Republic was not required by the Commission to shut down any of its reactors on safety grounds (Maltby and Mišík, 2024).

Unlike the development of NPPs, the identification and planning of an NWM has generated far stronger domestic resistance. The Czech NGO *Jaderný odpad – děkujeme, nechceme!* ('Nuclear waste – thanks, but no thanks' - JODN) has been central to mobilisation, staging multiple protests in 2024, often in coalition with local municipalities and residents. Protests have also drawn support from neighbouring Bavaria (Germany), highlighting their cross-border dimension. In the Klatovy region, protests have been taking place since the late 2000s, targeting the development of an NWM on the grounds of the risk to groundwater and soil, negative effects on property values, and broader public health concerns. Local municipalities have backed the protests, criticising the Czech government for excluding them from the decision-making process regarding site selection. Although the government pledged to amend the law to include municipalities in the decision-making process, this commitment has yet to be implemented (ČTK, 2024b).

The Czech Republic remains a keen supporter of nuclear energy, which is considered a low-carbon energy source that contributes to decarbonisation and, by extension, to the energy transition process targeting climate change. Although the country has made progress in developing renewable energy, nuclear power remains a high priority for the government. Plans for nuclear expansion, however, have faced repeated delays and legal challenges (Kratochvíl & Mišík, 2020). Public opposition remains relatively limited, but local EJOs have played an important role in outlining the risks and opposing the decision-making process related to nuclear infrastructures and investments. For example, Calla – Association for Preservation of the Environment and the South Bohemian Mothers (Jihočeské matky, JODN) campaigned to link local protests against nuclear waste storage to broader debates on environmental justice and democratic participation. Similarly, Austrian EJOs such as *Global2000* collaborated across borders, raising safety concerns about Temelín and pressing EU institutions to intervene. While Czech public opinion remains broadly favourable towards nuclear energy, conflicts over waste management and plant safety underscore the role of EJOs in exposing risks, mobilising communities, and framing nuclear infrastructure as a matter of EJ and democratic accountability. These struggles demonstrate how local protests, even in a pro-nuclear society, can shape the pace and governance of energy transitions. The Czech case shows how cross-border solidarity (e.g. Austria–Czech

mobilisation) and local EJOs have kept nuclear issues on the political agenda, even in the face of strong governmental and industry support. Although protests at the border did not alter Czech nuclear policy, they contributed to the slower expansion of the nuclear programme. In 2024, a key decision was made to expand the Dukovany NPP, although the procurement procedure had not been finalised at the time of writing owing to procedural matters and a pending court decision.

***Germany***

Environmental conflicts over nuclear energy in Germany stem mainly from the complex relationship between fossil fuel phase-out policies and the country's climate commitments. Nuclear power played an important part in Germany's energy production in the 1960s until its complete withdrawal in April 2023. Yet while it successfully eliminated nuclear power, Germany increased fossil fuel usage by 7% between 2002 and 2022 (particularly natural gas), undermining its stated climate goals (Emblemsvåg, 2024; Weber and Cabras, 2017). Germany was the second country, after Italy in 1990, to phase out formerly functioning nuclear plants, but it remains among the slowest countries in the EU to phase out coal, with a target deadline set for 2038. Only Bulgaria (2040) and Poland (2049) have set less ambitious deadlines for coal phase-out within the EU.

The transition from an industrial to a risk society has fundamentally altered public perceptions of nuclear technology (Beck, 1992). In Germany, society's confrontation with the inherent risks of nuclear power has been a central catalyst for conflict, particularly in the wake of major nuclear accidents such as Three Mile Island in 1979 and Chernobyl in 1986, which heightened public awareness of its potential catastrophic consequences. These environmental conflicts were further intensified by democratic deficits and top-down decision-making processes that excluded local communities from nuclear facility planning, creating legitimacy crises and fuelling grassroots resistance movements.

In Germany, the main actors involved in environmental conflicts over nuclear energy include, on one side, anti-nuclear movements aligned with broader social movements, energy cooperatives, and EJOs, and on the other side, the German government together with federal and local administrations, industry and regulatory bodies, and even far-right political groups. During the 1990s, anti-nuclear movements successfully framed nuclear energy as fundamentally incompatible with sustainability by employing 'sub-politics' strategies. These involved cooperation with local activists across the country to plan and deliver direct action protests, lobbying efforts, and court challenges (Dryzek *et al.,* 2020). Their narrative emphasised – and continues to emphasise – the impossibility of achieving truly 'clean' nuclear energy, given the unresolved problems of waste disposal and storage, as well as the risk of accidents. EJOs such as *Ausgestrahlt*, *Robin Wood*, and German branches of *Friends of the Earth* (BUND) played a pivotal role in supporting local campaigns, amplifying the voices of affected communities, and connecting grassroots resistance with broader national and European debates. These organisations were crucial in terms of mobilising protests, providing expertise to activists and campaigners, and ensuring that opposition to nuclear energy was framed in terms of justice, democracy, and intergenerational responsibility.

Since the 2000s, Germany's nuclear phase-out has been driven largely by political strategies promoted by social movements and energy cooperatives, which in the aftermath of the Fukushima disaster 2011 succeeded in broadening anti-nuclear sentiment among the public. Their campaigns also targeted the transition to sustainable energy, promoting solidarity-based economic models such as energy cooperatives and the remunicipalisation of energy production as more democratic and sustainable alternatives (Selje, 2022). Many of these campaigns coalesced in the *Energiewende*, Germany's ambitious programme to transition from fossil fuels and nuclear energy to a renewable energy-based economy, aimed at drastically reducing greenhouse gas emissions (Weber, 2012). Traditional German actors have promoted the *Energiewende* as a national strategy for transitioning to a renewable-dominated energy system while phasing out nuclear power, with government estimates placing the total costs at up to €1 trillion. Major energy companies such as EON, RWE, EnBW, and Vattenfall received nearly €2.4 billion in compensation for the premature closure of their nuclear reactors and have consistently dismissed calls to restart decommissioned nuclear plants, declaring such initiatives economically unviable (Amelang, 2024).

However, the German far right (and notably the Alternative for Germany party, or the AfD) has positioned nuclear power at the centre of its nationalist energy policy agenda (Moreaou, 2024). This reflects a reactionary sustainability narrative that prioritises economic nationalism over environmental concerns, a position echoed by several conservative opposition leaders who have called for Germany's return to nuclear energy (Wehrmann, 2023).

In February 2025, the newly elected Chancellor Merz criticised his predecessor, Chancellor Scholz, for closing Germany's last three NPPs at a time when the country was grappling with soaring energy prices. Although stopping short of promising new NPPs, Chancellor Merz vowed to invest in new technologies, including small modular reactors and nuclear fusion, which unlike fission, does not generate long-lived radioactive waste. In parallel, the German government abandoned its formal opposition to nuclear energy in an attempt to embrace France's nuclear shield as a

deterrent to future Russian aggression, leaving Austria as the sole EU member state to maintain strict anti-nuclear opposition and thereby assume the leadership of the FoR (Chassany and Hancock, 2025).

In the case of NWMs, the lack of permanent storage solutions has fuelled persistent conflicts. The Gorleben NWM site (42), designated as a temporary facility, became a focal point of resistance due to uncertainty over final repositories, with local communities rejecting the prospect of indefinitely hosting hazardous materials. The Brokdorf NPP (43), in operation from 1986 to 2021, was shut down on 31 December 2021 as part of the nuclear phase-out announced in 2011. Its closure increased Germany's reliance on coal and natural gas, much of it imported from Russia. Following the Russian invasion of Ukraine and the subsequent embargo on Russian fossil fuels, Germany sought to diversify its energy sources by increasing coal imports from countries such as Colombia. While this strategy addressed short-term energy security concerns, it raised critical issues of global environmental and climate justice. Coal extraction in the Global South has been linked to significant social and ecological harm in local communities, highlighting the disconnect between Germany's domestic sustainability objectives and the transnational consequences of its energy policies (Weber and Cabras, 2021; Weber *et al.,* 2024).

***Spain***

The Spanish civil nuclear programme was launched in 1964 under the dictatorship of General Franco. The regime justified its development on security grounds: first, it sought to secure an autonomous energy supply, including through the exploitation of domestic uranium mines; and second, it sought to establish a potential nuclear deterrent that could enhance the international standing of an otherwise isolated regime within an incipiently integrating Western Europe. The programme was closely tied to aspirations for a future nuclear weapons capacity. The first generation of NPPs were constructed at Zorita in 1968, Garoña in 1971, and Vandellós I in 1973, shortly before Franco's death in 1975 (Martínez, 2004).

Following the transition to democracy, successive governments remained committed to expanding the nuclear programme, motivated by both energy security considerations and military ambitions. In 1975, the government launched the Plan Energético Nacional, promising the construction of four second-generation NPPs at Almaraz, Ascó, Lemóniz, and Cofrentes (Martínez, 2004). In 1977, the constitution of the Coordinadora Antinuclear Estatal brought together several anti-nuclear regional movements in the country (Camacho Palencia, 2018). Numerous protests against nuclear facilities were organised during this period. In 1978 and 1979, ETA (*Euskadi Ta Askatasuna*), a Basque separatist terrorist organisation, carried out attacks on the Lemóniz NPP construction site (21) as part of its resistance campaign, likely intensified by concerns over plans to develop nuclear infrastructures in the Basque Country, where no plants had yet been established. Likewise, local residents began to organise widespread resistance to proposed nuclear projects in the late 1970s, in a context marked by strong political repression and restricted civil rights.

The Spanish anti-nuclear movement is deeply rooted in democratic resistance to the Franco regime, and the national nuclear debate on nuclear energy has since remained influenced by the programme's origins under dictatorship. Nuclear accidents abroad and at home have also served as critical turning points in the history of anti-nuclear resistance in Spain. The Three Mile Island accident in March 1979 coincided with the democratic transition from dictatorship and gave further impetus to an already robust anti-nuclear movement. The Chernobyl disaster in April 1986 was closely preceded by a national moratorium on new NPPs (Martínez, 2004). In 1989, a technical failure at the Vandellós I NPP created the conditions for a potential reactor meltdown just 100 km from Barcelona, in what is considered the most serious nuclear accident in Spain's history, significantly heightening public awareness of the risks of nuclear energy. Finally, the Fukushima accident in 2011 influenced the national debate over extending the lifespan of the Garoña NPP, which had been in operation since the late 1970s and used the same reactor and containment design as Fukushima (22).

More recently, anti-nuclear movements have targeted the Garoña NPP. The social-democratic government led by Zapatero decided to extend the lifespan of the NPP until 2013. The debate acquired a high political profile and rekindled anti-nuclear movements, which coalesced into the *Movimiento Iberico Antinuclear* in November 2015 (Ecologistas en Accion, 2015). In 2017, the conservative government let by Rajoy decided to deny extension, citing economic reasons, widespread resistance to nuclear energy, and a lack of political support (Apezteguia, 2017). This decision marked the ultimate distancing of the country's energy policy from nuclear energy. Today, the ruling coalition between PSOE, Sumar, and regional parties maintains a policy against extending the lifespans of nuclear power plants. EJOs such as Greenpeace Spain, *Ecologistas en Acción*, and *Movimiento Ibérico Antinuclear* have been at the centre of these protests, providing technical expertise, mobilising activists, linking local initiatives to broader national and international campaigns, and framing nuclear debates in Spain in terms of EJ and long-term sustainability.

Following the nationwide blackout in Spain on 28 April 2025, right-wing opposition parties in Spain criticised the Spanish government's nuclear phase-out and reliance on renewables, claiming it left the country vulnerable to outages. However, the Spanish government attributed the blackout to overvoltage and inadequate voltage control capacity, finding no causal link with renewable energy policy and the transition to renewables (France24, 2025). Today, the debate on nuclear energy in Spain remains deeply entwined with Spain's climate change policy and renewable energy transition. In 2024, 56% of the electricity generated in Spain came from renewable sources, as part of the plan to phase out both coal and nuclear power in alignment with EU climate goals. However, the April 2025 blackout exposed critical vulnerabilities associated with the national transition strategy. The disruption originated at a small substation grid in Granada, cascaded across the Iberian Peninsula, and ultimately extended into southern France before grid operators managed to isolate the affected systems (European Network of Transmission System Operators, 2025). The blackout sparked what has been described as 'a blackout blame game over green energy', with conservative groups questioning whether Spain's longstanding anti-nuclear stance – shaped by decades of democratic resistance – now conflicts with climate imperatives. Prime Minister Pedro Sánchez reaffirmed the government's commitment to its energy goals, aiming for 81% renewable electricity by 2030 (France 24, 2025). In response to the blackout, in June 2025, the EU approved a €1.6 billion loan aimed at strengthening the Spain–France electricity link. This investment is intended to end Spain's status as an energy island by expanding cross-border capacity and building a more resilient, renewables-based European grid (European Investment Bank, 2025).

**5. Mapping the risk of environmental conflicts associated with nuclear energy in the EU**

The evidence from France, Spain, Germany, and the Czech Republic can be used to model and account for the risk of environmental conflicts associated with nuclear energy projects and facilities. Combining this with information from the EJAtlas, and differentiating experiences across NA and FoR member states, two factors appear to play an important role in predicting the likelihood of conflict within the nuclear energy domain: the degree of governmental support for nuclear energy in a given country; and the 'nuclear legacy' of past policies and investments pursued by several EU governments since the latter half of the twentieth century.

Figure 3 illustrates a four-quadrant framework in which EU members are divided into NA and FoR members, with circle sizes directly proportional to the number of conflicts recorded in a given country (Belgium, Estonia, Lithuania, and Latvia are not currently members of either group). France and Spain have the largest circles, reflecting the high number of environmental conflicts in both countries, each shaped by a strong nuclear legacy, though their current government positions on nuclear energy are diametrically opposed.

As the leader of the NA, France actively promotes nuclear power as central to energy independence and climate goals, seeking to steer EU energy policy away from a renewables-dominated pathway. The French approach to nuclear energy has exacerbated tensions among EU member states over technological pathways to decarbonisation: while the EU has generally emphasised renewable energy expansion, France's nuclear stance advances competing policy solutions, extending from domestic policy to reactor and fuel product export strategies, and situating nuclear energy at the core of its wider economic model.

Nuclear energy policy in France can be understood as a form of governmentality, with the French government working to shape the conduct of individuals, industries, and institutions via rationalities of climate responsibility and energy efficiency (Foucault, 1991). France actively promotes a nuclear discourse beyond its borders, promoting nuclear energy as essential to the EU in its role as a 'global leader in the green transition' (NA, 2024, p. 1) and presenting it as the 'backbone of industrial decarbonization', alongside renewable sources (NA, 2024, p. 1). In doing so, the French government presents nuclear energy as both a technologically sophisticated response to climate change and a pillar of sustainable economic growth.

In contrast, Spain has positioned itself at the forefront of the EU's green transition, assuming a leading role within the FoR group, though nuclear energy remains politically divisive in the country. Since the early 2000s, Spanish conservative parties have regarded nuclear energy as an important means of achieving energy security, whereas the current left-wing coalition government opposes extending the lifespan of NPPs. Public opinion remains shaped by the historical legacy of Franco's dictatorship, with nuclear power still widely associated with authoritarianism, military ambitions, and close ties to the private electricity industry. The anti-nuclear movement that emerged during the democratic transition of the 1980s represented a form of resistance to the Francoist legacy, and anti-nuclear activists actively targeted utility companies that received compensation for the revenues lost under the 1984 moratorium on nuclear energy (Lehtonen *et al.,* 2022). Together, these factors have defined Spain's distinct energy trajectory, positioning the country as an increasingly influential actor in shaping EU sustainability policies.

In our proposed framework, the Czech Republic is clustered with other Eastern European countries such as Hungary, Poland, and Bulgaria. These states have traditionally maintained a supportive stance towards nuclear

energy, though the relatively small number of NPPs and NWM sites has limited the likelihood of environmental conflicts. During the 1990s, government interest in environmental issues waned, but from the 2000s onwards it was revitalised by a technocratic approach to environmental problems. In this sense, the main NA narrative promoted by France – grounded in technocratic decision-making and market-oriented solutions – has increasingly been adopted by Eastern EU member states (Babička, 2024). At the same time, more radical, grassroots movements critical of the state's technocratic approach to environmental problems have emerged, alongside efforts to establish a green political party. While this has generated some opposition to nuclear energy in the Czech Republic, it has not been strong enough to affect the country's nuclear trajectory. This explains the leading role played by the Czech government in the NA bloc and its narrative of nuclear energy as a driver of sustainable growth, job creation, climate leadership, and electromobility:

> The nuclear energy is an opportunity for Europeans to continue to develop high value-added industries, create thousands of jobs, strengthen their leadership in the climate protection and secure enough energy for Europe at a time when electricity needs for electromobility will be growing while emission sources will be dampening. It is essential that, together with France, we have succeeded in mobilizing other pro-nuclear member states to support the nuclear energy in the EU. (Czech Ministry of Industry and Trade, 2021 p. 1)

Germany is positioned at the intersection of the four quadrants. Although a FoR leader from the outset, the country carries a substantial nuclear legacy, and recent geopolitical and economic developments have re-opened the nuclear debate, heightening the risk of further environmental conflicts. The nuclear debate in Germany reflects deeper questions about post-growth economics. The German experience suggests that countries that are heavily dependent on fossil fuel-based industries (for instance, the automotive sector) face particular challenges in achieving sustainable transitions without deeper economic transformation. Germany has become an involuntary post-growth economy (Haas, 2021) that relies on coal as a nuclear substitute, supplied at very competitive prices by developing countries such as Colombia.[7] The environmental conflicts in the country have generated alternative approaches to energy provision, including energy cooperatives and remunicipalised production, suggesting that sustainable transitions may require fundamental changes to economic organisation rather than simple technological substitution.

Other NA and FoR countries appear in the framework clustered into two distinct groups: Sweden and Finland on the one hand, and Slovenia and Croatia on the other. In all four cases, government support for nuclear energy is strong, and the nuclear legacy substantial, though important differences remain. In Sweden and Finland, nuclear energy policy reflects a complex interplay of historical, economic, and environmental factors, posturing the two countries as key players in the broader conversation about energy security and sustainability in Europe. Nuclear energy is an important component of their national energy strategies: Finland currently operates five reactors and Sweden three, generating around 40% and 33% of their respective electricity supplies (World Nuclear Association, 2025b). The Swedish parliament has recently approved a government proposal to offer state support for investments in nuclear energy, while Finland has also approved plans to increase its nuclear production with new reactors. Public opinion remains divided, however, with a significant portion of the population favouring nuclear energy alongside ongoing exploration of alternative energy sources. This situation has generated localised conflicts in areas close to NPPs and NWMs, and the risk of further disputes is likely to grow as planned expansion programmes move forward.

Slovenia is the smallest nuclear state in the world, operating a single NPP at Krško, which has been jointly owned with Croatia since 1981. The Slovenian government is currently considering the addition of a second unit at the site, though the country lacks a regulated repository for any type of nuclear waste. A nationwide referendum originally scheduled for November 2024 to decide on the proposed expansion was called off and may instead be held later in the project cycle, possibly in 2028. This delay has introduced uncertainty and heightened the risk of environmental conflicts. The situation also directly affects Croatia, which has no independent nuclear capacity but remains co-owner of the Krško NPP close to its border. In the past, the Croatian government considered joining Slovenia in building a proposed new reactor at Krško as an alternative to establishing a domestic nuclear capacity of its own. Recently, a newly established Working Group for Nuclear Energy has been tasked with preparing studies on potential locations for the development of nuclear energy facilities within Croatia (World Nuclear News, 2025).

Among the remaining countries in the framework, the three FoR members – Italy, Portugal, and Austria – have a very low risk of environmental conflicts associated with nuclear energy. Austria, the leader of the FoR, does not operate any NPPs, although one NPP was completed in 1978 at Zwentendorf, 60 km north of Vienna, although it never entered service after a national referendum rejected its operation. This outcome led to a constitutional ban on nuclear energy, which remains in place today. Similarly, in Italy, a referendum called in 1987 following the Chernobyl disaster the year before resulted in the closure of the country's existing NPPs. Since the late 2000s, successive

[7] While Germany's *Energiewende* has been widely praised internationally, its *Verkehrswende* (mobility transition) has proven far more challenging, underscoring the sectoral complexity of comprehensive sustainability transitions.

Italian governments have attempted to revive the Italian nuclear energy programme, but these efforts were decisively blocked by another referendum in 2011. Portugal has no nuclear facilities; its only reactor was activated in the late 1970s for research purposes but was decommissioned in 2019.[8] In 2021, the Portuguese government reinforced this stance by signing a declaration to exclude nuclear energy from eligibility for European funding.

**[FIGURE 3 HERE]**
**Figure 3** Nuclear energy and environmental conflicts across NA and FoR members.

## 6 Conclusion

The analysis presented in the previous sections demonstrates the extent to which debates over nuclear energy and environmental conflicts are intrinsically connected to broader debates related to the energy transition process and climate change, which are currently shaping EU environmental policies. These debates often cause friction between national and local authorities on the one hand and anti-nuclear groups and EJOs on the other. Our findings indicate that, where nuclear energy is concerned, national governments in both NA and FoR states justify their strategies through narratives aimed at promoting energy transition and mitigating the effects of climate change, often neglecting the environmental and social impacts of the wider nuclear supply chain. This resonates with broader EU-level dynamics since the late 1990s, when energy, sustainability, and climate policies were partly de-politicised by framing decisions in terms of market rationality rather than democratic processes that incorporate diverse political perspectives (Lenz, 2022; Machin, 2020). Within this context, and consistent with our findings, a mainstream narrative of ecological modernisation has emerged, grounded in the assumption that states and markets can work together to safeguard the environment (Mol *et al*., 2013).

Ecological modernisation has become a powerful political narrative in the EU, with alternative and contesting visions of sustainable futures increasingly marginalised (Machin, 2020). NA governments often invoke ecological modernisation to promote their energy transition strategies, building on the use of nuclear energy and renewables. At a local level, however, their actions clash with anti-nuclear movements, local activities, and EJOs, which advocate for greater investment in renewable energy sources and better local energy solutions. Such tensions frequently give rise to environmental conflicts centred on nuclear projects.

Our findings highlight two main factors that contribute to increasing the risk of environmental conflicts associated with nuclear energy in the EU: first, the degree of support provided by national governments for nuclear policies; and second, the legacy left by previous nuclear policies and investments in nuclear facilities. Levels of government support vary across NA and FoR members: NA states, led by France, are keener to invest in nuclear energy, while some FoR members display more ambivalent positions, with Germany, for instance, re-evaluating its nuclear energy policies due to the challenges presented by the current economic and political situation. Equally, a country's 'nuclear past' amplifies the likelihood of conflict, as it provides fertile ground for the rise of anti-nuclear movements and EJOs, increasing awareness of the risks associated with nuclear energy among the wider public – as illustrated by Spain. These considerations apply to EU countries across the spectrum, regardless of their NA and FoR membership or whether nuclear facilities are operative within their administrative borders. Moreover, taken together, government support for nuclear energy and the weight of the nuclear legacy expose fundamental contradictions in the energy transition strategies pursued by EU member states. These contradictions are mirrored in the number and intensity of environmental conflicts documented in the EJAtlas and highlighted in our framework.

The transition to more sustainable energy sources is a complex process that requires cooperation among stakeholders with varying degrees of power and interest. In the EU, this complexity is heightened by the large number of stakeholders involved, including EU institutions, member states and their respective governments, the nuclear industry, local authorities and communities, and groups supporting or opposing nuclear energy. Interactions among these stakeholders are relevant to the transition, and reaching consensus among these categories is extremely challenging. Decisions and interventions by EU and national policymakers should aim at securing a smooth energy transition while pursuing economic growth and ensuring social equality in terms of access to energy. As highlighted in our analysis, however, the inclusion of nuclear energy in TR2020/852 has increased the risk of environmental conflicts. A more effective multistakeholder approach to decision-making in the nuclear sector would require raising awareness among the various stakeholders. Given that the policy and regulatory framework in this area is constantly evolving, future policymaking should place greater emphasis on social and environmental considerations, which are too often overshadowed by economic and political imperatives. Strengthening these aspects of policy- and decision-making would provide stakeholders with opportunities to develop shared objectives and strategies, thereby reducing the risk of conflict in the nuclear energy sector.

[8] The Portuguese Research Reactor (RPI) operated for more than 40 years but was decommissioned in 2006 and dismantled in 2019.

While our study addresses an original topic, offering new insights into the relationship between nuclear energy and environmental conflicts, several limitations must be acknowledged. First, as environmental conflicts are constantly evolving, the information provided by the EJAtlas is highly fluid: while we have focused on the nuclear energy sector, our analysis encompasses a wide range of conflicts across an extended timespan, thereby introducing considerable variation in terms of the characteristics and outcomes of the cases examined. Second, we restricted our analysis to the EU, even though the EJAtlas offers opportunities to examine environmental conflicts worldwide. Third, while the four case studies included in this paper allow us to examine multiple aspects and issues affecting NA and FoR members, their specificity inevitably limits the degree to which our findings can be generalised. The case studies provide a broad but limited overview of the themes addressed in our investigation. Finally, time and financial constraints prevented us from acquiring and adding more qualitative information (for instance via interviews with local administrators and campaign leaders), which would have enriched the empirical depth and analytic scope of our findings.

In conclusion, our results provide new insights into the relationship between nuclear energy and environmental conflicts in the EU. Given the paucity of studies on the effects of such conflicts on local communities – both within the EU and elsewhere – this paper provides an original, timely contribution to the literature. It also opens a path for future research aimed at better understanding the drivers of environmental conflict and developing strategies to prevent and mitigate them.

**Acknowledgements**

The authors gratefully acknowledge the support of the Slovak Research and Development Agency under Grant No. APVV-23-0032.

**References**


ACRO (2017). "Pollution du Ru des Landes près de l'usine de retraitement d'Areva à La Hague : de nouveaux résultats d'analyse confirment la présence de strontium et de plutonium". Press release, 2 March. Available at: https://www.acro.eu.org/wp-content/uploads/2017/03/CP-RDL_020317-1.pdf (accessed 29 August 2025).

Akbulut, B., Demaria, F., Gerber, J. F., & Martínez-Alier, J. (2019). Who promotes sustainability? Five theses on the relationships between the degrowth and the environmental justice movements. Ecological Economics, 165, 106418.

Amelang, S. (2024), "Germany agrees to pay energy companies over 2 billion euros in nuclear exit compensation. Clean Energy Wire", https://www.cleanenergywire.org/news/germany-agrees-pay-energy-companies-over-2-billion-euros-nuclear-exit-compensation (accessed 25. December 2025)

Apezteguia, F. (2017), "Satisfacción en Euskadi por el cierre definitivo de la central nuclear de Garoña". *El Correo,* 1. August, available at https://www.elcorreo.com/sociedad/garona-20170801120858-nt.html (accessed 21 December 2024).

Babička, M. (2024), "Discourses of Moral and Ecological Crisis in the Czech Post-Socialist Transformation", In Trencsényi, B.; Balikić, L.; Blagojević, U. Grubački, I. (Eds), *East Central European Crisis Discourses in the Twentieth Century*, Routledge, London, pp. 368-391.

Beck, U. (1992), *Risk Society: Towards a New Modernity*, Sage Publications, London.

Bundesministerium für Wirtschaft und Klimaschutz, (2024). Joint message from the Friends of Renewable Energies on the Climate Communication. https://www.bundeswirtschaftsministerium.de/Redaktion/EN/Downloads/J/240304-joint-message-friends-of-renewable-energies-on-climate-communication.pdf

Cabras, I., Llavero-Pasquina, M., Picaud-Bello, K., and Weber, G. (2025), "Place-based leadership and environmental conflicts in the European Union". Regional Studies, 2486644.

CAN Europe (2024), Position Paper: The nuclear hurdle to a renewable future and fossil fuel phase–out. https://caneurope.org/press-release-nuclear-is-a-dangerous-distraction/ (accessed 25 December 2025)

Capros, P., Paroussos, L., Fragkos, P., Tsani, S., Boitier, B., Wagner, F., Busch, S., Resch, G., Blesl, M., Bollen, J., (2014). "Description of models and scenarios used to assess European decarbonisation pathways", Energy Strategy Reviews, Vol. 2, pp. 220–230.

Camacho Palencia, A. (2018), "El movimiento antinuclear en España 1977-1990", *Ecologistas en Acció*n, 11 May, available at: https://www.ecologistasenaccion.org/16239/el-movimiento-antinuclear-en-espana-1977-1990/; (accessed 15. December 2024)

Chafer, T. (1985), "Politics and the perception of risk: A study of the anti-nuclear movements in Britain and France", West European Politics, Vol. 8, No 1, pp. 5-23.

Chassany, A.-S., Hancock, A. (2025), "Germany drops opposition to nuclear power in rapprochement with France", *Financial Times* 19 May 2025, available at: https://www.ft.com/content/e99efa2b-338a-4065-89c6-0683d5759ed7; (accessed 26 June 2025).

ČTK (2024a), "Na Klatovsku bude další protest proti plánovanému úložišti jaderného odpadu", Ekolist.cz, 22 May, available at: https://www.novinky.cz/clanek/domaci-na-klatovsku-protestovaly-stovky-lidi-proti-jadernemu-ulozisti-40330299; (accessed 29 June 2025).

ČTK (2024b), "Na Klatovsku protestovaly stovky lidí proti jadernému úložišti", Ekolist.cz, 25 October, available at: https://www.novinky.cz/clanek/domaci-na-klatovsku-protestovaly-stovky-lidi-proti-jadernemu-ulozisti-40330299; (accessed 15 December 2024).

Czech Ministry of Industry and Trade (2021), "Czech Republic and France has been preparing a nuclear alliance of European Union member states", press release, 12 October, available at: https://www.mpo.gov.cz/en/guidepost/for-the-media/press-releases/czech-republic-and-france-has-been-preparing-a-nuclear-alliance-of-european-union-member-states--263929/#:~:text=The%20joint%20action%2C%20which%20is,the%20European%20Union%20(EU); (accessed 12 December 2024).

Del Bene, D., & Ávila, S. (2023), "Critical Mapping for Researching and Acting Upon Environmental Conflicts – The Case of the EJAtlas", Villamayor-Tomas, S.; and Muradian, R. (Eds), *The Barcelona School of Ecological Economics and Political Ecology*, Springer VS, pp. 195-210

Dryzek, J. S., Downes, D., Hunold, C., Schlosberg, D., & Hernes, H. K. (2020), "Ecological modernization, risk society, and the green state", Dryzek, John S., and others, *Green States and Social Movements: Environmentalism in the United States, United Kingdom, Germany, and Norway,* Routledge, London, pp. 164-191.

Dulian, M. (2023, September 6). "Nuclear energy in the European Union", European Parliamentary Research

Service, EPRS
No. 2023/751456, available at: https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/751456/EPRS_BRI(2023)751456_EN.pdf (accessed 15. July 2025)
Ecologistas en Accion (2015), El movimiento antinuclear se organiza para pedir el cierre de las nucleares, https://www.ecologistasenaccion.org/31091/el-movimiento-antinuclear-se-organiza-para-pedir-el-cierre-de-las-nucleares/ (accessed 25. December 2025)
Eisenhardt, K. M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14, No. 4, pp. 532-550.
Emblemsvåg, J. (2024), "What if Germany had invested in nuclear power? A comparison between the German energy policy the last 20 years and an alternative policy of investing in nuclear power", *International Journal of Sustainable Energy*, Vol. 43, No. 1, 2355642.
European Commission. (2022). *Commission Delegated Regulation (EU) 2022/1214 of 9 March 2022 amending Delegated Regulation (EU) 2021/2139 as regards economic activities in certain energy sectors and Delegated Regulation (EU) 2021/2178 as regards specific public disclosures for those economic activities*. Official Journal of the European Union, L 188/1. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32022R1214
European Commission (2018) Action Plan: Financing Sustainable Growth COM(2018)97 final https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52018DC0097 (accessed 25. December 2025).
European Parliament (2022), "Taxonomy: MEPs do not object to inclusion of gas and nuclear activities", Press releases, 6 July, available at: https://www.europarl.europa.eu/news/en/press-room/20220701IPR34365/taxonomy-meps-do-not-object-to-inclusion-of-gas-and-nuclear-activities (accessed 18. December 2024).
European Parliament and the Council of the European Union (2020), "Regulation (EU) 2020/852 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088". Official Journal of the European Union, L. 198, 22 June, pp. 13–43, available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32020R0852; (accessed on 07. June 2025).
European Network of Transmission System Operators (2025), "ENTSO-E Expert Panel initiates the investigation into the causes of Iberian blackout", press release, 9 May, available at: https://www.entsoe.eu/news/2025/05/09/entso-e-expert-panel-initiates-the-investigation-into-the-causes-of-iberian-blackout/ (accessed 20 June 2025)
European Investment Bank (2025), "EIB supports with €1.6 bn the strategic Bay of Biscay electricity interconnection between Spain and France" https://www.eib.org/en/press/all/2025-241-eib-supports-with-eur1-6-bn-the-strategic-bay-of-biscay-electricity-interconnection-between-spain-and-france (accessed 25 December 2025)
Foucault, M. (1991), "Governmentality", In Burchell, G., Gordon, C., Miller, P. (eds.) *The Foucault Effect. Studies in Governmentality*. The University of Chicago Press.
Foster, J. B. (2002), "Environmental sociology and the environmental revolution: A 25th anniversary assessment". *Organization & Environment*, Vol. 15, No. 1, pp. 55-58.
France24 (2025), "Spain says 'overvoltage' caused major April power outage", press release, 17 June, available at: https://www.france24.com/en/live-news/20250617-spain-says-overvoltage-caused-huge-april-blackout; (accessed 19 June 2025).
Glaser, A. (2011), "After Fukushima: Preparing for a More Uncertain Future of Nuclear Power", *Electricity Journal*, Vol. 24, pp. 27–35.
Greenpeace France, (2019), "The Global Crisis of Nuclear Waste", press release, 20 January, available at: https://cdn.greenpeace.fr/site/uploads/2019/01/REPORT_NUCLEAR_WASTE_CRISIS_ENG_BD-2.pdf (accessed 30. August 2025)
Haas, T. (2021), "From green energy to the green car state? The political economy of ecological modernisation in Germany", *New Political Economy*, Vol. 26, No. 4, pp. 660-673.
HCTISN (2018). "Présentation du cycle du combustible français en 2018", press release, 27 July, available at : https://www.hctisn.fr/IMG/pdf/2018-_rapport_cycle_maj.pdf (accessed 12 August 2025)
Hirose, R. and McCauley, D. (2022), "The risks and impacts of nuclear decommissioning: Stakeholder reflections on the UK nuclear industry", *Energy Policy*, Vol. 164, 112862.
Höffken, J. and Ramana, M. V. (2024), "Nuclear power and environmental injustice", *WIREs Energy and Environment*, 13(1), e498.
INCITE-DEM (2025), "Italy's anti-nuclear movement: A grassroots victory in Viadana", press release, 13 September, available at: https://incite-dem.eu/viadana/ (accessed 22 September 2025)
Kardaś, S. (2024), "Striking a balance: assessing the role of nuclear energy in the European Union's energy

transition“, *The Oxford Institute for Energy Studies Forum*, Issue 139, pp. 53-56.
Koasidis, K., Nikas, A., Van de Ven, D.J., Xexakis, G., Forouli, A., Mittal, S., Gambhir, A., Koutsellis, T. and Doukas, H. (2022), “Towards a green recovery in the EU: Aligning further emissions reductions with short- and long-term energy-sector employment gains“, *Energy Policy,* Vol. 171, 113301.
Kitschelt, H. P. (1986). “Political opportunity structures and political protest: Anti-nuclear movements in four democracies”. British Journal of Political Science, 16(1), 57-85.
Kratochvíl, P. and Mišík, M. (2020), “Bad external actors and good nuclear energy: Media discourse on energy supplies in the Czech Republic and Slovakia“, *Energy Policy*, Vol. 136, 111058.
Lehtonen, M., Prades, A., Espluga, J. and Konrad, W. (2022), “The emergence of mistrustful civic vigilance in Finnish, French, German and Spanish nuclear policies: ideological trust and (de) politicization“. *Journal of Risk Research*, Vol. 25, No. 5, pp. 613-631.
Lenz, S. (2022), “The digital spirit of green capitalism. How the European Union tries to save ecological modernisation“, *Culture, Practice & Europeanization*, Vol. 7, No. 2, pp. 166-191.
Lofstedt, R. (2008), “Are renewables an alternative to nuclear power? An analysis of the Austria/Slovakia discussions“ *Energy Policy*, Vol. 36, pp. 2226–2233.
Machin, A. (2020), “Changing the story? The discourse of ecological modernisation in the European Union“, Environmental Politics, Vol 28, no.2, pp. 208-227.
Martinez, L. (2004), El movimiento ecologista. La lucha antinuclear y contra el modelo energético en España. Mientras tanto, (91/92), 83-105. https://cdn.vientosur.info/archivos_spip/pdf/mov-ecologista.pdf (accessed 25. December 2025)
Martinez-Alier, J. (2014), “The Environmentalism of the Poor”, *Geoforum*, Vol.54, 239-241
Martinez-Alier, J. (2021), “Mapping ecological distribution conflicts: The EJAtlas”, *The Extractive Industries and Society*, Vol. 8, No. 4, 100883.
Martinez-Alier, J. (2023a), “Environmental conflicts and the making of world movements for environmental justice”, *Economia Politica,* Vol. 40, pp. 765–779.
Martinez-Alier, J. (2023b), *Land, Water, Air and Freedom*, Edward Elgar Publishing, London
Martinez-Alier, J., Healy, H., Temper, L., Walter, M., Rodriguez-Labajos, B., Gerber, J. F., & Conde, M. (2011). Between science and activism: learning and teaching ecological economics with environmental justice organisations. Local Environment, 16(1), 17-36.
Martinez-Alier, J., Temper, L., Del Bene, D. and Scheidel, A. (2016). “Is there a global environmental justice movement?”, *The Journal of Peasant Studies*, Vol. 43, No. 3, pp. 731-755.
Maltby, T. and Mišík, M. (2024), *Energy Transitions in Central and Eastern Europe: The Political Economy of Climate and Energy Policy*, Cambridge University Press, Cambridge.
Moreau, P. (2024), L'AFD: l'extrême droite allemande dans l'impasse. Fondation pour l'innovation politique. https://www.fondapol.org/app/uploads/2024/10/244_afd_moreau_fr_2024-10-16_w.pdf (accessed 25 December 2025)
Mol, A.P.J, G Spaargaren and Sonnenfeld, D.A. (2013), “Ecological Modernization Theory: Taking Stock, Moving Forward”, Lockie, S.; Sonnenfeld, D.; Fisher, D. (Eds) Routledge International Handbook of Social and Environmental Change, Routledge, London, pp. 31–46.
Nian, V., Chou, S.K., Su, B. and Bauly, J. (2014), “Life cycle analysis on carbon emissions from power generation – The nuclear energy example“, Applied Energy, Vol. 118, 68–82.
Nuclear Alliance (2023), “Nuclear Alliance meeting Paris – Draft Statement“, press release, 16 May, available at https://www.ecologie.gouv.fr/sites/default/files/documents/nuclear%20alliance%20statement_VEN.pdf; (accessed 12 December 2024)
Nuclear Alliance (2024), “European Nuclear Alliance Leader’s declaration“, press release, 21 March, available at: https://www.elysee.fr/en/emmanuel-macron/2024/03/21/european-nuclear-alliance-leaders-declaration; (accessed 12 December 2024)
Pan, Y. (2023), “Managing the atomic divorce: The challenges of East Central Europe’s nuclear energy decoupling from Russia“, *Electricity Journal*, Vol. 36, 107241.
Pécout, A. (2023), “France's elusive promise: Cutting nuclear power to 50% of electricity production“, *Le Monde*, 24 January, available at: https://www.lemonde.fr/en/economy/article/2023/01/24/france-s-elusive-promise-cutting-nuclear-power-to-50-of-electricity-production_6012818_19.html; (accessed 20 December 2024).
Pécout, A. (2025), “EPR de Flamanville : la Cour des comptes estime le coût total à 23,7 milliards d’euros et prévoit « une rentabilité médiocre“, *Le Monde*, 14 January, available at: https://www.lemonde.fr/economie/article/2025/01/14/epr-de-flamanville-la-cour-des-comptes-estime-le-cout-total-a-23-7-milliards-d-euros_6497010_3234.html; (accessed 20 December 2024).

Pomponi, F. and Hart, J. (2021), "The greenhouse gas emissions of nuclear energy – Life cycle assessment of a European pressurised reactor", *Applied Energy,* Vol. 290, 116743.
Prăvălie, R. and Bandoc, G. (2018), "Nuclear energy: Between global electricity demand, worldwide decarbonisation imperativeness, and planetary environmental implications", *Journal of Environmental Management*, Vol. 209, pp. 81–92.
Renn, O., and Marshall, J.P. (2016), "Coal, nuclear and renewable energy policies in Germany: From the 1950s to the "Energiewende", *Energy Policy* Vol. 99, pp. 224–232.
Selje, T. (2022), "Comparing the German exit of nuclear and coal: assessing historical pathways and energy phase-out dimensions", *Energy Research & Social Science*, Vol. 94, 102883.
Scarlat, N., Prussi, M., and Padella, M. (2022), "Quantification of the carbon intensity of electricity produced and used in Europe", *Applied Energy* Vol. 305, 117901.
Scheidel, A., Temper, L., Demaria, F. and Martinez-Alier, J. (2020), "Ecological distribution conflicts as forces for sustainability: An overview and conceptual framework", *Sustainability Science*, Vol. 15, 543–562.
Schreiber, P., Pinson, L., Can Ileri, E. and Jeandon, J., (2020), "Behind the curtains: When the gas and nuclear lobbies reshape the EU sustainable taxonomy ", https://reclaimfinance.org/site/wp-content/uploads/2020/08/Reclaim-Finance-Media-Briefing-EU-Sustainable-Taxonomy-1.pdf (accessed 24 December 2025).
Schlosberg, D., & Collins, L. B. (2014), "From environmental to climate justice: climate change and the discourse of environmental justice", Wiley Interdisciplinary Reviews: Climate Change, 5(3), 359-374.
Schneider, M., Coeytaux, X., Faid, Y. B., Marignac, Y., Rouy, E., Thompson, G., ... & Sumner, D. (2001), Possible toxic effects from the nuclear reprocessing at Sellafield (UK) and Cap de la Hague (France). https://www.europarl.europa.eu/RegData/etudes/etudes/join/2001/303110/DG-4-JOIN_ET(2001)303110_EN.pdf (accessed 25. December 2025)
Schneider, M. and Froggatt, A. (2004), "The World Nuclear Industry Status Report 2004". (Brussels, December 2004). https://www.worldnuclearreport.org/IMG/pdf/2004MSC-WorldNuclearReport-EN.pdf (accessed 25. December 2025).
Sovacool, B. K. (2008), "Valuing the greenhouse gas emissions from nuclear power: A critical survey", *Energy Policy*, Vol. 36, No. 8, pp. 2950-2963.
SÚRAO, (2024), "Recommended sites", Radioactive Waste Repository Authority, available at: https://www.surao.cz/en/recommended-sites/; (accessed 10 July 2025).
Temper, L., Del Bene, D., and Martinez-Alier, J. (2015), "Mapping the frontiers and front lines of global environmental justice: the EJAtlas", *Journal of Political Ecology*, Vol. 22, No. 1, pp. 255-278.
Temper, L., Demaria, F., Scheidel, A., Del Bene, D. and Martinez-Alier, J. (2018). The global environmental justice atlas (EJAtlas): Ecological distribution conflicts as forces for sustainability. *Sustainability Science*, Vol. 13, no.3, pp. 573–584.
Taylor, K. (2023), "France barred from 'Friends of Renewables' EU ministerial meeting", *Euroactiv*, 19 January, available at: https://www.euractiv.com/section/energy-environment/news/france-barred-from-friends-of-renewables-eu-ministerial-meeting/ (accessed 1 July 2025).
Unruh, G.C. (2000), "Understanding carbon lock-in", *Energy Policy*, Vol. 28, pp. 817–830.
US Department of Energy (2023), "At COP28, Countries Launch Declaration to Triple Nuclear Energy Capacity by 2050, Recognizing the Key Role of Nuclear Energy in Reaching Net Zero", press release. 1 December, available at https://www.energy.gov/articles/cop28-countries-launch-declaration-triple-nuclear-energy-capacity-2050-recognizing-key; (accessed 1 July 2025).
Warlenius, R., Pierce, G., and Ramasar, V. (2015), "Reversing the arrow of arrears: The concept of "ecological debt" and its value for environmental justice". Global Environmental Change, 30, 21-30.
Weidner, H., Mez, L., & Okamura, L. (2020), "Introduction and research approach". In L. Mez, L. Okamura, & H. Weidner (Eds.), The ecological modernization capacity of Japan and Germany, Springer, Wiesbaden, pp: 1-18
Wajsbrot, S. (2024), "EXCLUSIF - Nucléaire : la facture prévisionnelle des futurs EPR grimpe de 30 %." Les Echos 24, 4 March, available at: https://www.lesechos.fr/industrie-services/energie-environnement/exclusif-nucleaire-la-facture-previsionnelle-des-futurs-epr-grimpe-de-30-2080380; (accessed 1 July 2025).
Weber, G. (2012), "La ecología política de la «Energiewende»(transición energética) en Alemania". Ecología Política, (44), 61-68.
Weber, G. and Cabras, I. (2017), "The transition of Germany's energy production, green economy, low-carbon economy, socio-environmental conflicts, and equitable society", *Journal of Cleaner Production*, Vol. 167, pp.

1222-1231.
Weber, G. and Cabras, I. (2021), “Environmental justice and just transition in the EU’s sustainability policies in third countries: the case of Colombia”, *The International Spectator*, Vol. 56 No 2, pp. 119-137.
Weber, G., Ardila, L., and Cabras, I. (2024), “Just transition and the European Green Deal: The case of coal mining in Colombia. In Making the European Green Deal Work” (pp. 177-192). Routledge.
Wehrmann, B. (2023), Leading conservative opposition figures call for Germany's return to nuclear energy (Frankfurter Allgemeine Zeitung, 4 Dezember 2023, https://www.cleanenergywire.org/news/leading-conservative-opposition-figures-call-germanys-return-nuclear-energy (accessed 25 December 2025).
Wittner, L. S. (2009), “Nuclear disarmament activism in Asia and the Pacific, 1971-1996”, *The Asia-Pacific Journal,* Vol. 25, no.5, 3179
World Nuclear Association (2025a) "Nuclear Power in France", press release, 23 October, available at: https://world-nuclear.org/information-library/country-profiles/countries-a-f/france (accessed 26 October 2025)
World Nuclear Association (2025b) "Nuclear Power in Finland", press release, 6 December, available at: https://world-nuclear.org/information-library/country-profiles/countries-a-f/finland (accessed 25 September 2025)
World Nuclear Association (2025c). “SDG7: Affordable and Clean Energy”, press release, 9 October, available at: https://world-nuclear.org/net-zero-nuclear/sdgs/sdg7-affordable-and-clean-energy (accessed 12 November 2025)
World Nuclear News (2025) "Croatia to study potential locations for new nuclear capacity", press release, 17 February, available at: https://www.world-nuclear-news.org/articles/croatia-to-study-potential-locations-for-new-nuclear-capacity (accessed 22 August 2025)
Yin, R. K. (1993), *Applications of case study research*, Sage Publishing, London.
Yin, R. K. (2009), *Case study research: Design and methods (Volume. 3)*, Sage Publishing, London.

## APPENDIX: Environmental conflicts in the EU associated with nuclear energy [May 2025]

| ID | Country | Code | Location | Region | Type of facility | Length of conflict | Project Status | Campaign success |
|---|---|---|---|---|---|---|---|---|
| 1 | France | FR | Creys - Malville | AURA | NPP | 1974-1997 | Cancelled | Anti-nuclear |
| 2 | France | FR | Bugey | AURA | NPP | 2016-2022 | Operating | Pro-nuclear |
| 3 | France | FR | Plogoff | Brittany | NPP | 1975-1981 | Cancelled | Anti-nuclear |
| 4 | France | FR | Erdeven | Brittany | NPP | 1974-1975 | Cancelled | Anti-nuclear |
| 5 | France | FR | Chooz | Grand Est | NPP | 1980-1984 | Operating | Pro-nuclear |
| 6 | France | FR | Cattenom | Grand Est | NPP | 1979-1986 | Operating | Pro-nuclear |
| 7 | France | FR | Fessenheim | Grand Est | NWM | 1977-2017 | Retired | Anti-nuclear |
| 8 | France | FR | Bure | Grand Est | NFC | 1991- 2013 | Announced | Pro-nuclear |
| 9 | France | FR | La Hague | Normandy | NPP | 1978-1979 | Operating | Pro-nuclear |
| 10 | France | FR | Flamanville | Normandy | NPP | 2005-2006 | Under construction | Pro-nuclear |
| 11 | France | FR | Blaye | Nouvelle-Aquitaine | NPP | 1998-2022 | Operating | Pro-nuclear |
| 12 | France | FR | Golfech | Occitanie | NPP | 1975-1990 | Operating | Pro-nuclear |
| 13 | France | FR | Narbonne | Occitanie | NWM | 2009-2020 | Operating | - |
| 14 | France | FR | Le Carnet | Pays de la Loire | NPP | 1976-1997 | Cancelled | Anti-nuclear |
| 15 | France | FR | Chasteuil | PACA | Other | 1979-1981 | Cancelled | Anti-nuclear |
| 16 | France | FR | Cadarache | PACA | NRC | 1988-ongoing | Under construction | Pro-nuclear |
| 17 | France | FR | Chinon | Centre-Val de Loire | NPP | 2023-ongoing | Proposed | Pro-nuclear |
| 18 | France | FR | Penly | Normandy | NPP | 2020-ongoing | Proposed | Pro-nuclear |
| 19 | France | FR | Mururoa Fangataufa | French Polynesia | Other | 1966-1996 | Cancelled | Anti-nuclear |
| 20 | Czech Republic | CZ | Klatovy | Pilsen | NWM | 2020-ongoing | Proposed | Anti-nuclear |
| 21 | Spain | SP | Lemoiz | Pais Vasco | NPP | 1972-1984 | Cancelled | Anti-nuclear |
| 22 | Spain | SP | Garoña | Castilla y León | NPP | 1970-2016 | Retired | Anti-nuclear |
| 23 | Spain | SP | Tudela | Navarra | NPP | 1979-ongoing | Proposed | Anti-nuclear |
| 24 | Spain | SP | Retortillo | Castilla y León | NPP | 2008-ongoing | Cancelled | Anti-nuclear |
| 25 | Spain | SP | Almaraz | Extremadura | NPP | 2016-ongoing | Operating | Pro-nuclear |
| 26 | Spain | SP | Valdecaballeros | Extremadura | NPP | 1976-1984 | Cancelled | Anti-nuclear |
| 27 | Spain | SP | Cofrents | Valencia | NPP | 1977-2011 | Operating | Pro-nuclear |
| 28 | Spain | SP | Villar de Cañas | Castilla La Mancha | NWM | 2004-ongoing | Proposed | - |
| 29 | Portugal | PT | Freixo de Espada a Cinta | Norte | NWM | 1987-2017 | Cancelled | Anti-nuclear |
| 30 | Portugal | PT | Peniche | Oeste | NPP | 1976-1977 | Cancelled | Anti-nuclear |
| 31 | Italy | IT | Montalto di Castro | Lazio | NPP | 1971-1986 | Cancelled | Anti-nuclear |
| 32 | Croatia | HR | Trgovska gora | Croatia proper | NWM | 1999-ongoing | Cancelled | Pro-nuclear |
| 33 | Slovenia | SLO | Krsko | Lower Sava Region | NPP | 1975-ongoing | Operating | Pro-nuclear |
| 34 | Slovenia | SLO | Vrbina | Lower Sava Region | NWM | 2009-ongoing | Operating | Pro-nuclear |
| 35 | Hungary | HU | Paks | Tolna | NPP | 2009-ongoing | Operating | Pro-nuclear |
| 36 | Hungary | HU | Pecs | Baranya County | Uranium mining | 2006-ongoing | Proposed | Anti-nuclear |
| 37 | Bulgaria | BG | Novi Han | Sofia Province | NWM | 1964-ongoing | Operating | - |
| 38 | Bulgaria | BG | Buhovo | Sofia Capital District | Uranium mining | 1938-1992 | Cancelled | Anti-nuclear |
| 39 | Lithuania | LT | Ignalia | Utena County | NPP | 1980-2012 | Cancelled | Anti-nuclear |
| 40 | Poland | PL | Żarnowiec | Pomeranian Voivodeship | NPP | 1972-1990 | Cancelled | Anti-nuclear |
| 41 | Poland | PL | Międzyrzecz | Lubusz Voivodeship | NWM | 1980-1989 | Cancelled | Anti-nuclear |
| 42 | Austria | A | Zwentendorf | Lower Austria | NPP | 1972-1978 | Cancelled | Anti-nuclear |
| 43 | Belgium | BE | Tihange | Wallonia | NPP | 2012-2023 | Operating | Pro-nuclear |
| 44 | Belgium | BE | Doel | East Flanders | NPP | 2012-2022 | Operating | Pro-nuclear |
| 45 | Czech Republic | CZ | Temelin | South Bohemian Region | NPP | 1996-2014 | Delivered | Pro-nuclear |
| 46 | Czech Republic | CZ | Dukovany | Vysočina Region | NPP | 2000-ongoing | Delivered | Pro-nuclear |
| 47 | Germany | DE | Gorleben | Lower Saxony | NWM | 1977-2020 | Cancelled | Anti-nuclear |
| 48 | Germany | DE | Brokdorf | Schleswig-Holstein | NPP | 1976-1986 | Withdrawn | Anti-nuclear |
| 49 | Germany | DE | Kalkar | North Rhine-Westphalia | NPP | 1973-1985 | Cancelled | Anti-nuclear |
| 50 | Germany | DE | Wackersdorf | Bavaria | NFC | 1986-1989 | Cancelled | Anti-nuclear |
| 51 | Germany | DE | Wyhl | Baden-Württemberg | NPP | 1974-1977 | Cancelled | Anti-nuclear |
| 52 | Finland | FI | Olkiluoto, Eurajoki | Satakunta | NPP | 2002-2023 | Operating | Pro-nuclear |
| 53 | Finland | FI | Hanhikivi, Pyhäjoki | North Ostrobothnia | NPP | 2013-2022 | Cancelled | Anti-nuclear |
| 54 | Sweden | S | Kynnefjäll in Bohuslän | Götaland | NWM | 1985-1990 | Cancelled | Anti-nuclear |

*Source: Authors' elaboration from data gathered from the EJAtlas, 2025*
*NPP= Nuclear Power Plant; NRC = Nuclear Research Centre; NWM=Nuclear Waste Management Site; NFC=Nuclear Fuel Centre*