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Germany's Energy and Climate Policy as an Ecology of Games

Volker Schneider

Department of Politics and Public Administration, University of Konstanz, Germany

Correspondence: Volker Schneider (volker.schneider@uni-konstanz.de)

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Abstract

This article analyses a key shift in German energy and climate policy. Following the Fukushima disaster in Japan, the German government decided to shut down eight old nuclear reactors in the short term, and to phase-out the remaining reactors within the next seven years. At the same time, its ambitious climate policy goals relied on energy security through a growing share of renewable energies, an expanded energy grid, improved energy efficiency, and technological innovations, as well as the use of natural gas as a so-called "bridging technology." In this context, this article provides an overview of competing explanations circulating in the political and social science literature for this path-breaking policy shift, and demonstrates how network analysis can be used to offer an alternative explanation—one in which this policy shift was decisively shaped by both the structural context and situational dynamics.

Keywords

climate policy; energy policy; issue competition; social network analysis

1. Introduction

German energy and climate policy, and its intersection with political processes, generate intriguing dynamics. Since the 1990s, Germany has been a pioneer of climate policy, but its leading position had declined by the mid-2010s. A critical turning point was Germany's decision in 2011 to phase out nuclear energy following the Fukushima disaster in Japan. While several countries tightened safety regulations and temporarily suspended nuclear operations, only a few opted for long-term phase-outs. Germany's response to Fukushima was exceptional in its speed, legal finality, and scale, marking a paradigm shift in energy production, governance, and justification, breaking with the pro-nuclear, fossil-based consensus, and sending ripple effects across Europe and global climate debates. The immediate shutdown of eight reactors and the legally binding commitment to exit nuclear energy by 2022 constituted one of the most far-reaching shifts in nuclear policy among industrialized countries. Even Japan, despite the accident occurring on its own soil, eventually resumed nuclear power generation after a temporary suspension (Rinscheid, 2015; Rinscheid et al., 2020).

The *Energiewende* (energy transition), as it is known in Germany, is not merely a retreat from one energy source, but a strategic transformation of the entire energy system. Some have even characterized this shift as an "ecological modernization" to emphasize the scale of this social and industrial transformation (Jänicke & Jörgens, 2023). It was certainly a broad-based policy change that encompassed several policy areas. Following the phase-out decision, a series of new policy packages were adopted: replacing nuclear energy and fossil fuels with renewable energies; expanding the power grid; and promoting energy efficiency through building insulation, electricity savings, and massively promoting research and development (R&D) in the climate and energy sector (the author was involved in one of these projects: Brohmann et al., 2012). An important component of the new policy was the increased use of natural gas as a "bridge technology," with the side effect of a growing dependence on Russian natural gas. Russia then attempted to use this dependence to influence German foreign policy in the wake of its invasion of Ukraine in 2022. In the resulting energy crisis, the German government was forced to make a series of adjustments—such as the use of liquefied natural gas (LNG) and a change of course with regard to the use of carbon capture and storage (CCS) technologies in some economic sectors—that would have been unthinkable just a few years ago.

From a climate policy perspective, it is difficult to understand why a country would completely abandon a carbon-neutral energy source like nuclear power, when it was still heavily dependent on some of the worst climate killers, such as lignite and hard coal. When Germany proclaimed that it would phase out coal in 2019, only eight years after announcing the nuclear phase-out, a *Wall Street Journal* editorial called it "the world's dumbest energy policy" (Editorial Board of The Wall Street Journal, 2019). The nuclear exit presented Germany with a dilemma due to the different orientational logics of the two policy areas: energy policy scores with a comprehensive, secure, and affordable energy supply, while climate policy scores primarily on reducing greenhouse gas (GHG) emissions, although adaptation targets have also been added recently.

The aim of this analysis is to explain Germany's systemic policy turnaround of 2011 in its situational and structural context, using policy network analysis within the "ecology of games" interpretative frame. The study adopts a mixed-methods perspective that integrates qualitative case study analysis with quantitative network analysis and the visual representation of time series (Sale et al., 2002; Teddlie & Tashakkori, 2009). The case study approach provides contextual depth and historical nuance, enabling a detailed understanding of developments within two policy domains as well as broader political dynamics at the macro level. Network analysis complements this by uncovering relational structures and patterns of interaction among actors. To trace changes over time, time series highlight temporal developments and key events. Together, these methods offer a comprehensive analytical framework that bridges interpretive insight and structural explanation.

In the next section, the policy turnaround is first specified in more detail as the central research question. Section 3 presents a variety of competing explanations for this policy shift, providing the background for an explanatory framework in Section 4, which combines some of these approaches and tests them with network data. The final section summarizes the most important findings, discusses some limitations of the analysis, and offers an outlook on the climate and energy policy of the newly elected government.

2. Germany's *Energiewende* as a Policy Puzzle

The 2011–2012 energy transition in Germany presents a compelling puzzle. It marked a paradigmatic shift, as nuclear energy was still Germany's leading electricity source at the time. In 2011, the main sources were nuclear (28%), lignite (25%), and hard coal (18%; IEA, 2024). Just a few years earlier, the government had launched a climate strategy focused on renewables and emissions reduction. The 2011 phase-out commitment reversed decades of nuclear policy, and the *Energiewende* established a new paradigm combining climate protection, renewable expansion, and efficiency. It redefined energy security by favouring decentralization, renewables, and citizen participation over centralized fossil–nuclear systems.

The trigger for the policy turnaround was a natural and technological disaster. On 11 March 2011, one of Japan's worst earthquakes occurred with a magnitude of 9.0. This triggered a tsunami that not only destroyed large parts of the coast but also led to a meltdown at the Fukushima nuclear power plant. This reignited the global debate on the safety of nuclear energy, prompting Germany to dramatically reorient its energy policy amid intense media coverage (Kepplinger & Lemke, 2016). A few months later, the German government decided to phase out nuclear energy completely by 2022. This was not the first such decision. In the late 1990s, a red–green coalition had already agreed on a gradual nuclear exit with reactor lifetime limits. That plan was reversed shortly before Fukushima, when a new governmental coalition between the Christian Democratic Union (CDU) and its Bavarian affiliate (CSU) with the Free Democratic Party (FDP) extended operating times—a move widely seen as an "exit from the exit." The 2011 reversal marked a more radical shift than the original decision and became known as the *Energiewende*, a term that had circulated in environmentalist circles since the 1980s (Renn & Marshall, 2016; Schreurs, 2012).

The policy reversals following the Fukushima disaster were not an isolated response to energy security concerns, but part of a broader paradigm shift that not only linked energy and climate policy but increasingly integrated them. The accelerated phase-out of nuclear energy was in line with the 2010 Energy Concept, which set the course for a low-carbon future by promoting energy efficiency and renewable energies. The strategic shift linked decarbonization and sustainable energy policy, thereby transforming Germany's approach to governing the once separate areas of energy and climate policy into a more integrated framework, which was strongly supported by developments at the EU level (Rogge & Johnstone, 2017; Szulecki et al., 2016; Tews, 2015).

In the aftermath of the 2011 decision, the German federal government launched a series of legislative reforms and policy instruments designed to operationalize this integrated approach. These included substantial public programmes as well as voluntary agreements with industry to foster innovation and investment in sustainable energy technologies. The continuity of this policy trajectory was reaffirmed after the 2013 federal election, which resulted in the formation of a new grand coalition between the CDU/CSU, and the Social Democratic Party (SPD). Key measures enacted during this period included: the legally binding phase-out of nuclear power by 2022; an amendment to the EEG to ensure continued support for renewables; the adoption of the National Action Plan for Energy Efficiency; the expansion of renewable electricity generation and the development of reserve power capacities; a ban on hydraulic fracturing ("fracking") for oil extraction; and the designation of natural gas as a bridging technology to facilitate the energy transition. The unwavering commitment to phasing out nuclear power and the actual shutdown in 2022—despite the acute energy crisis triggered by Russia's war against Ukraine—astonished international observers and sparked sharp criticism abroad. A Wall

Street Journal editorial characterized the decision as a deliberate worsening of the crisis, emphasizing the paradox that Germany, in the name of environmentalism, chose to shut down its last nuclear reactors while ramping up coal power production (Editorial Board of The Wall Street Journal, 2022). This move, which defied both economic pressures and energy security arguments, can be understood less as a rational response to short-term supply shocks and more as a reflection of the Green Party's enduring ideological opposition to nuclear energy. Opposition to nuclear power has long served as a foundational element of Green identity, and this ideational commitment—rooted in post-Fukushima political consensus—proved resilient even under extraordinary geopolitical and economic duress.

Together, these developments underscore the extent to which the 2011 policy shift represented not a reactive intervention but a comprehensive reorientation of Germany's energy and climate governance architecture. In summary, the energy transition phased out nuclear power while accelerating renewables, energy efficiency, and innovation.

Figure 1 provides a timeline illustrating the development of German energy and climate policy across six dimensions, also highlighting other important events. The time series on the Climate Policy Performance Index (CPPI) shows that climate policy performance deteriorated significantly between 2012 and 2021. Climate policy only returned to the top of the policy agenda towards the end of the decade when environmental movements raised public awareness of global warming, even prompting the German constitutional court to call on the federal government to do more for climate protection.

The time series in Figure 1 encompasses the entire policy cycle, from the input side of topic salience to the outputs and outcomes in these policy areas:

- *Politbarometer* surveys, conducted for many decades by Forschungsgruppe Wahlen, describe issue salience as the percentage of respondents who consider the topic to be important relative to other issues (for data and methodology, see https://www.gesis.org/wahlen/politbarometer and the Annex available at https://github.com/vsunikon).
- Policy events indicate a fluctuating number of annual measures in Germany (laws, regulations, programmes, etc.) that have been registered by a climate policy database (Nascimento et al., 2022).
- Energy efficiency looks at GHG emissions (mostly CO_2) in relation to economic development (using GDP). Emissions have fallen steadily in recent decades despite GDP growth, indicating rising energy efficiency (AGEB, 2023).
- The share of fossil fuels in primary energy consumption, an important climate policy indicator for reducing GHG emissions, fell continuously for many years and then rose again temporarily around 2010. (AGEB, 2023).
- The CPPI scores Germany's climate policy in comparison to about 60 countries (for data and methodology, see https://www.germanwatch.org/en and the Annex previously mentioned).
- The development of electricity prices shows an important output effect of energy policy—one that made Germany one of the most expensive countries in Europe with respect to end consumer electricity prices (for data and methodology, see: https://ec.europa.eu/eurostat/de).

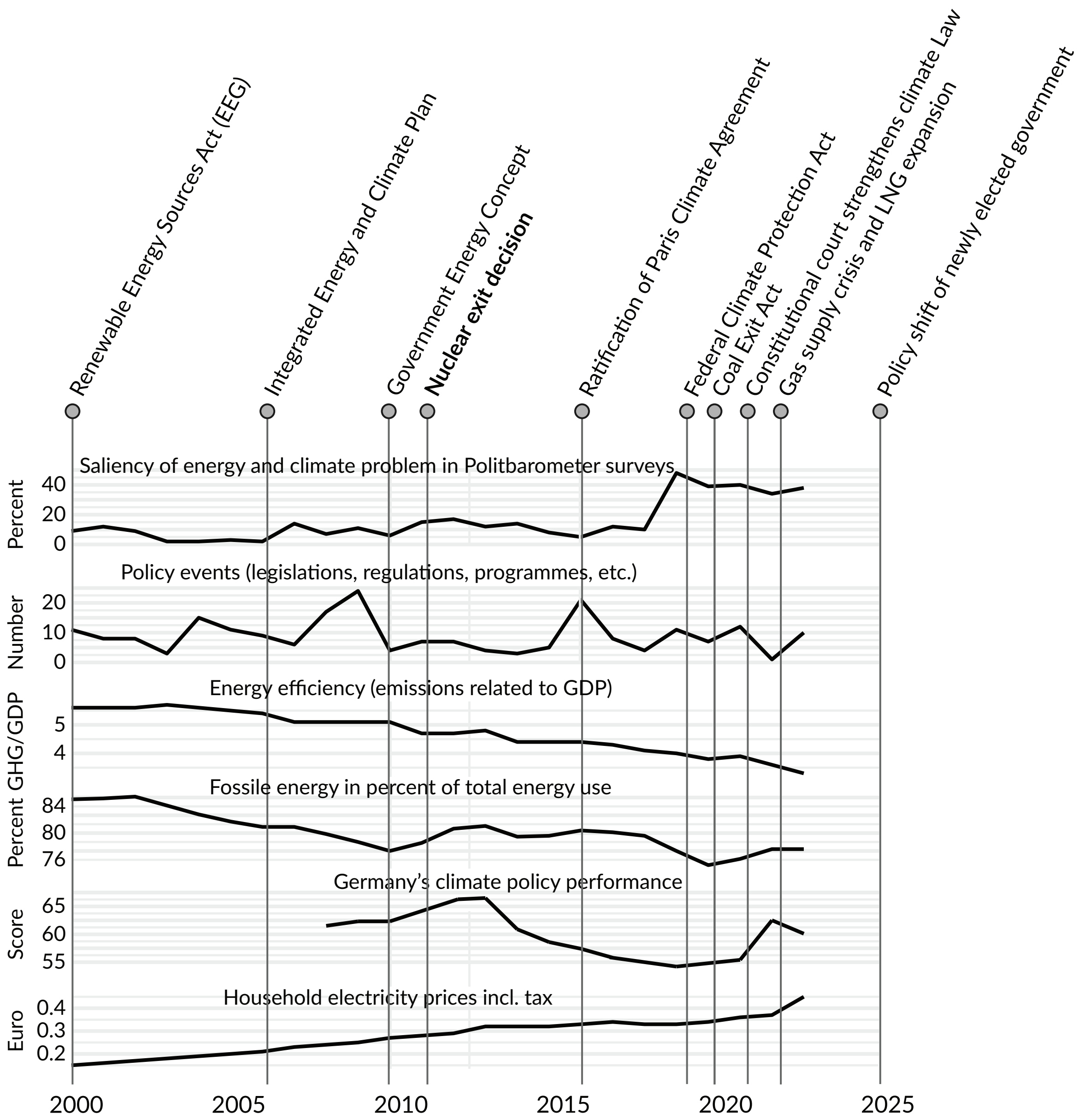

Figure 1. German energy and climate policy events and indicators 2000–2022.

The nuclear phase-out decision and subsequent energy transition policies constituted a Copernican change in energy and climate policy-making. In climate policy, Germany has never been at the top in international comparisons. Its CPPI came close to frontrunners Sweden and Denmark in 2012 and 2013, but then fell back again between 2014 and 2021. The increased proportion of natural gas in the German energy mix and its increasing displacement of lignite improved the emissions balance but led to a growing geo-economic dependence on Russia, which tried to weaponize this relationship after invading Ukraine. The two Nord Stream pipelines played an important role in this. As a result of Russia's full-scale invasion of Ukraine and the sanctions imposed in response, a significant portion of the EU's fuel had to be replaced by coal and more emission-intensive LNG to ensure energy security. Significantly, given this serious situation, the nuclear reactors that were still in operation at the time were shut down.

3. Germany's Copernican Policy Change and Its Explanations

As emphasized at the outset, Germany's energy transition is exceptional among industrialized nations. It is the only major economy to have undergone such a radical policy shift (Jahn & Korolczuk, 2012). It is important to note that the risk of nuclear accidents and the general risk of natural disasters such as earthquakes or tsunamis is relatively low in Germany compared to other OECD countries. Rinscheid et al. (2020) analyse nuclear risk along two dimensions: (a) technical risk (using nuclear energy use per capita) and (b) natural disaster risk (earthquakes, tsunamis, etc., measured using an indicator from the UNDDR). Despite Germany's low risk in both categories, its reaction to Fukushima was the most extreme. The mystery behind this policy change has led to a veritable academic industry analysing this policy change. Many books (Haas, 2017; Radtke & Kersting, 2018; Von Hirschhausen et al., 2018), articles (review articles include Schiffer & Trüby, 2018; Yang, 2022), and even handbooks (Ekardt, 2014; Holstenkamp & Radtke, 2017) cover this policy process. The various explanations for this policy change can be categorized at different levels and across multiple areas, as summarized in Table 1.

Table 1. Explanations of Germany's energy transition 2011.

Levels	Situational explanation	Structural explanation
Political	Coalition-building, political realignment, and Fukushima as a window of opportunity	Historical role of the Green Party and Germany's environmental movements
Ideational	Belief shifts among political elites after intensive media coverage of Fukushima	Long-standing anti-nuclear sentiment and risk perception
Economic	Fukushima-empowered renewable energy lobbies, weakened nuclear interests	Growth of the renewables sector since the 1990s, shifting corporate power
Technical	Fukushima challenged the belief in nuclear safety	Technological evolution and niche innovations promoting green energy

Fukushima transformed nuclear energy into a central election issue, forcing the governing coalition to shift its stance. Some scholars interpret the shift as a case of electoral realignment (Jahn & Korolczuk, 2012; Wittneben, 2012; Zohlnhöfer & Engler, 2014). An in-depth analysis of the decision-making process convincingly shows that eliminating nuclear energy as a political issue from the German policy agenda was an important goal (Tratzmiller, 2018).

Another situational explanation applies the multiple streams approach, arguing that Fukushima created new opportunity structures for long-standing anti-nuclear advocates. The Baden-Württemberg state election, held shortly afterward, served as a critical moment in linking nuclear policy debates to the broader political agenda (Fischer, 2017).

Structurally focused approaches indicate that Fukushima's impact was amplified by long-term shifts in Germany's party system. Since the 1980s, the Green Party and environmental civil society have gained political influence, forming a strong anti-nuclear coalition that shaped the response (Rinscheid et al., 2020; Stefes, 2016).

Explanations also emphasize ideational factors, with some using the Advocacy Coalition Framework (ACF), which highlights belief changes following external shocks (Sabatier, 1988). After Fukushima, the German pro-nuclear coalition collapsed as key political actors changed their stance overnight (Rinscheid, 2015; Rinscheid et al., 2020). Media discourse further amplified the shift, with Fukushima receiving far more media coverage in Germany than elsewhere (Kepplinger & Lemke, 2016).

Some ideational explanations combine situational and structural components. Studies using the critical threshold approach suggest a broad anti-nuclear coalition that has existed for decades (Stefes, 2016; Weber & Cabras, 2017). In addition, some perspectives emphasize historically influenced cultural peculiarities in risk perception that give rise to the typically German *angst* around technological risks (Biess, 2020).

Some explanations point to economic changes. Fukushima created new lobbying opportunities for renewable energy companies and weakened nuclear and fossil fuel interests (Gründinger, 2017; Strunz, 2014). Notably, even the insurance sector turned against nuclear power, as the disaster reshaped risk assessments (Von Hirschhausen et al., 2018).

Economic transformations are accompanied by sectoral changes, with businesses (in this case) also promoting innovations in renewable energies, creating new interest groups that reinforce these trends through lobbying strategies. A similar explanation draws on neo-Marxist and Gramscian perspectives, stating that the energy transition represents a new hegemonic green–capitalist project (Haas, 2017; Rest, 2011). One study even uncovers a network of transnational corporations promoting global climate capitalism (Sapinski, 2016).

Finally, there are approaches highlighting the technological dimension, from both situational and structural perspectives. Chancellor Merkel framed Fukushima as proof that even an advanced nation like Japan could not fully control nuclear risks (for a repetition and nuanced contextualization of the statement made at that time, see Merkel & Krahmann-Baumann, 2024). This aligns with Perrow's "normal accidents" thesis, which argues that nuclear energy is inherently uncontrollable (Perrow, 1984). In Germany, both Chernobyl and Fukushima solidified public distrust in nuclear power (Beck, 1992; Hoffman & Durlak, 2018).

In addition to this situation-related technological perspective, there is a structural perspective in which energy transition is a long-term trend in socio-technical evolution, where radical niche innovations are important drivers of an overall transformation of the energy system (Geels et al., 2016; Li et al., 2015).

The sketch above shows that the energy transition of 2011 can plausibly be explained and interpreted from many perspectives. While some explanations compete with one another, others complement each other and can therefore be combined. This is the aim of the next section, in which situational and structural explanatory factors are combined into a complex relational explanation supported by network analysis.

4. Connecting Dots and Levels: Networks, Politics, and Nested Policy Games

One of the most popular political approaches is the advocacy coalition model, which offers a rather parsimonious explanation of political change and depicts the political process—somewhat exaggeratedly—as a kind of religious war in which groups of actors with different shared beliefs communicate with each other and form coalitions in favour of (or against) certain political measures, which they then implement once they win (Ingold, 2011; Sabatier, 1988; Satoh, Gronow, et al., 2023). The task of the researcher is then to ascertain which coalition was victorious, along with its relative strength. However, such an explanation remains superficial if the underlying forces and conditions of coalition-building are not revealed. In our case, two questions arise: First, why was such a large and powerful coalition able to form in Germany in the first place? And, second, why could this policy change be implemented so quickly and radically, overcoming all political and social hurdles? Contrary to the consensus view of the *Energiewende* policy shift, numerous conflicts continued to exist in various areas and at various levels of Germany's complex political system (Chemnitz, 2018). On the other hand, the energy transition of 2011 triggered a radical change that completely contradicts the traditional image of consensus-oriented German politics, with its many veto players and decision-making blockades (Czada & Radtke, 2018; Saalfeld, 2003).

A comprehensive model must thus consider both the situational and structural factors shaping the coalition that implemented the policy switch. Situational factors include actors' issue positions and relational discourse dynamics, while structural factors encompass long-term trends shaping the composition of the actor set and its network relations.

4.1. Policy Networks in an "Ecology of Games" Framework

In the following discussion, the context for this paradigmatic policy shift is conceptualized as a political network where relevant policy actors interact through multiple network ties to jointly address political problems (Kenis & Schneider, 1991; Schneider, 2024). The network nodes are policy actors with significant roles and positions in both energy and climate policy areas. The relations among actors can be direct, such as cooperation or exchange of information, or indirect, such as shared interests, beliefs, or institutional affiliations to policy bodies or social subsystems.

Furthermore, we pursue an ecosystem-inspired perspective in which the network of actors is not subject to a single homogeneous rationality, but rather consists of network segments comprising different "political species" that play distinct roles based on their different interests and institutional positions (Ronit, 2024). A policy network thus integrates facets that are emphasized in complexity theories: a multitude of heterogeneous actors, networked by a variety of relationships that include both conflict and cooperation, whose joint action is structured by complex sets of rules, and who are involved in political problem-solving and decision-making processes (Schneider, 2010, 2012).

This complex situation can be understood as overlapping games in which actors operate across different decision-making contexts and must choose appropriate strategies. Rather than isolated arenas, policy games are nested, interwoven, and mutually permeable. The metaphor of an "ecology of games" aptly captures this complexity (Long, 1958). Emerging from eco-perspectives in the social sciences—such as human, population, and organizational ecology—Norton Long argued that local politics should be seen as a network of intertwined policy processes. He rejected views of centrally controlled politics (e.g., power elite models) and game theory's assumption of unified rationality, instead promoting a heterogeneous perspective. Games are role-typical action contexts oriented toward specific goals, like scoring in football or shooting baskets in basketball. Long (1958) identified multiple local games, such as banking, media, and civic organization games, each with distinct objectives and rules. This perspective has since been applied in various forms, using both qualitative and quantitative methods, to analyse the interdependence of political processes across domains (Cornwell et al., 2003; Dutton et al., 2012; Kimmich et al., 2023; Lubell, 2013).

In his seminal book *Crisis and Choice*, Scharpf (1991) offers a strikingly similar perspective. Analysing West Germany's policy response to the economic crisis of the 1970s, Scharpf conceptualizes economic policymaking as an interplay of games involving fiscal and monetary policy, industrial relations, and electoral competition. Decisions in one domain influence the constraints and opportunities in others. By highlighting how strategic interactions across these institutional arenas shape policy outcomes, Scharpf applies core ideas of the ecology of games approach, where overlapping policy processes evolve in dynamic tension.

Applied to Germany's energy transition, at least three interlinked games can be identified: a climate policy game focused on emissions reduction; an energy policy game ensuring supply security and affordability; and an electoral game in which both are embedded, with parties competing for issue ownership. Policy decisions imply power struggles; even committed policymakers must seek electoral support, often prioritizing power retention over problem-solving. These dynamics are shaped by institutional structures that influence party and interest group behaviour, and by temporal contexts—such as clustered elections in Germany's federalist system—that intensify competition.

By 2011, Germany had evolved into a multiparty system with a strong Green Party and a more pluralistic interest group landscape (Schneider, 2015). Civil society had also gained expertise through independent think tanks and research institutes (Satoh, Nagel et al., 2023). A key driver of the energy transition was the historical strength of the anti-nuclear movement, which the Greens represented in parliament during key decision phases and earlier sustainability reforms (Weidner & Eberlein, 2010; Weidner & Mez, 2008). Institutional features like proportional representation, federalism, and bicameralism also enabled diverse societal interests to shape public policy. Germany's system thus favours inclusive policy networks linking state and civil society actors (Schneider, 2015).

Policy domains can also be viewed as differentiated subsystems involving a division of labour and distinct problem-solving orientations (Mayntz, 1988). Climate and energy policy each follow unique logics, shaped by different histories and institutional settings. Traditional energy policy, handled by the Ministry of Economic Affairs, emphasized security and affordability, especially during the oil crises of the 1970s and 1980s. Climate policy emerged later. Rooted in environmental policy and focused on emission reductions, it gained prominence after Chernobyl with the creation of the Ministry of the Environment in 1986.

Initially centred on coal and oil, German energy policy later embraced nuclear power to enhance security. But anti-nuclear protests of the 1980s and the rise of the Greens led to convergence with environmental concerns. Global environmental awareness and Germany's support for initiatives such as feed-in tariffs and the Kyoto Protocol gave climate policy increasing weight from the late 1980s onward. Under the red–green coalition of the late 1990s, climate and energy policies became more integrated. This period saw the introduction of the Renewable Energy Sources Act and the first nuclear phase-out. A shift occurred under the CDU/FDP coalition in 2009, which extended nuclear plant lifespans, only to reverse course after Fukushima in 2011. This marked a turning point: the launch of the *Energiewende*, which phased out nuclear energy, expanded renewables, and increased dependence on Russian natural gas.

Despite major advances, tensions between the two policy areas persist. The energy policy focus on affordability and security often clashes with climate policy's emission reduction goals. The following political network analysis (Schneider, 2024) reconstructs the interaction of 2011–2012, when these dynamics overlapped in a multi-level ecology of games.

4.2. Germany's Climate and Energy Policy Network and the Energy Transition

As part of an international comparative study (Broadbent, 2016; Ylä-Anttila et al., 2018), we conducted quantitative policy network analysis to identify actor constellations and associated influence structures in German climate policy during this turbulent period. We surveyed the most important actors in this policy field just a few months after the watershed event in Fukushima (from August 2011 to October 2012). Although originally framed from a climate policy perspective, the 2011–2012 actor survey also included key energy policy issues. Despite some thematic bias, the dataset enables an integrated analysis of climate and energy policy by identifying overlapping actor constellations and their positions in the broader issue space.

Following the classic approach of quantitative policy network research (Knoke et al., 1996; Laumann & Knoke, 1987), we surveyed all relevant organizations involved in German climate and energy policy (for details, see the Annex previously mentioned). For boundary specification, we used discourse network analysis based on print media (Schneider & Ollmann, 2013). Of the national actors identified in this process, only 50 were interviewed, and only 48 organizational datasets could be used for this analysis. The full network includes 92 actors, including 42 international organizations. Data was collected on relationships such as influence reputation, collaboration, and information exchange, and on issue perceptions and policy positions, but also on actors' attributes and affiliations with societal sectors.

The network analysis enables both a situational view of issue orientations and a structural view of cooperation and information exchange. Figures 2 and 3 present the results: Figure 2 displays dissimilarities

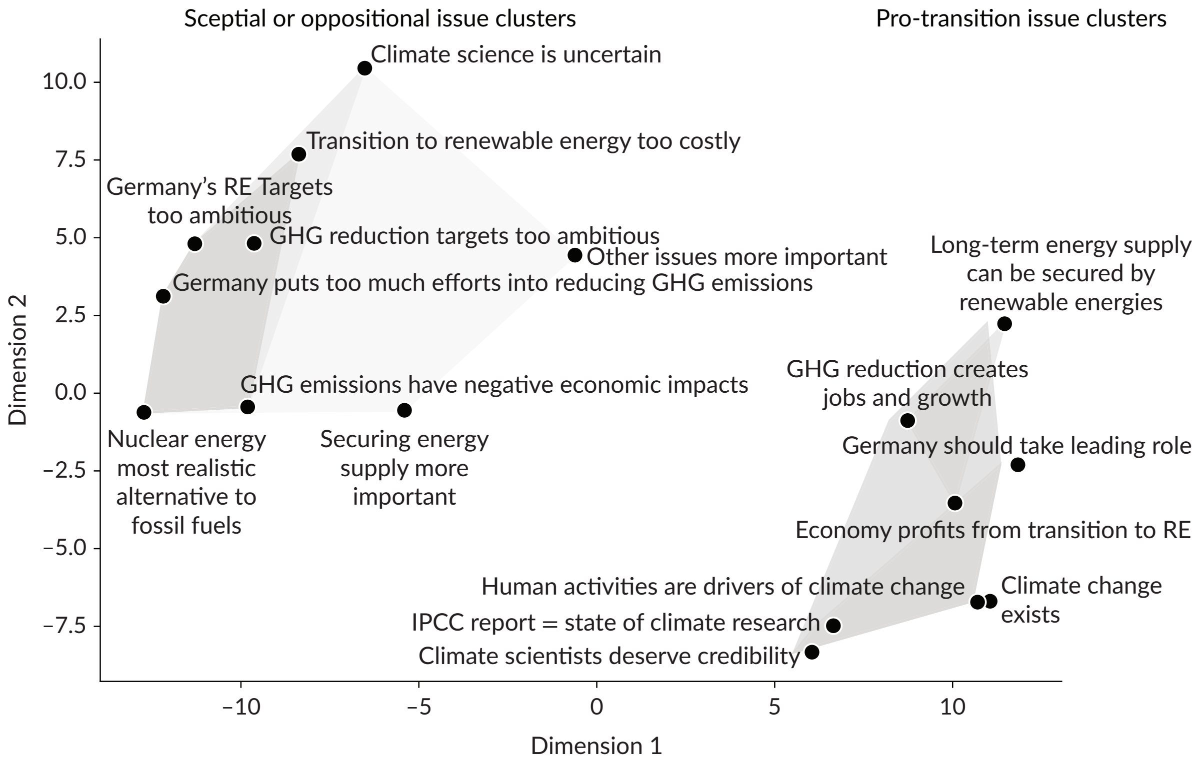

Figure 2. Nested clustering of beliefs and preferences in the energy and climate issue space. Notes: RE = Renewable energy; IPCC = Intergovernmental panel on climate change; methods used: metric multidimensional scaling and clustering based on Ward's minimum variance method.

in issue positions, while Figure 3 links these positions to the information and cooperation network. Figure 2 visualizes the issue space—reflecting beliefs and preferences—using multidimensional scaling (MDS) combined with hierarchical clustering. Multiple cluster levels are shown as nested convex hulls in increasingly darker grayscale, creating a Venn-style diagram that reveals overlaps and groupings. Euclidean distances between topic profiles determine the placement of issue nodes, with proximity indicating similar issue orientations.

Figure 3 maps 48 actors within the same issue space using MDS, based on their thematic positions from Figure 2. Geometric distances reflect the dissimilarity of their issue positions. Lines between actors represent confirmed information exchange, defined as mutual acknowledgement of sending and receiving information. These relationships were identified through matrix transposition and multiplication. Node shapes denote actor categories and node size reflects influence reputation. The constellation of actors and their positions in the issue space, as depicted in both diagrams, reflect the situation between August 2011 and October 2012—the period following intense political and social debates on the nuclear phase-out and the subsequent launch of the energy transition, which was accompanied by a series of further policy choices in the years that followed.

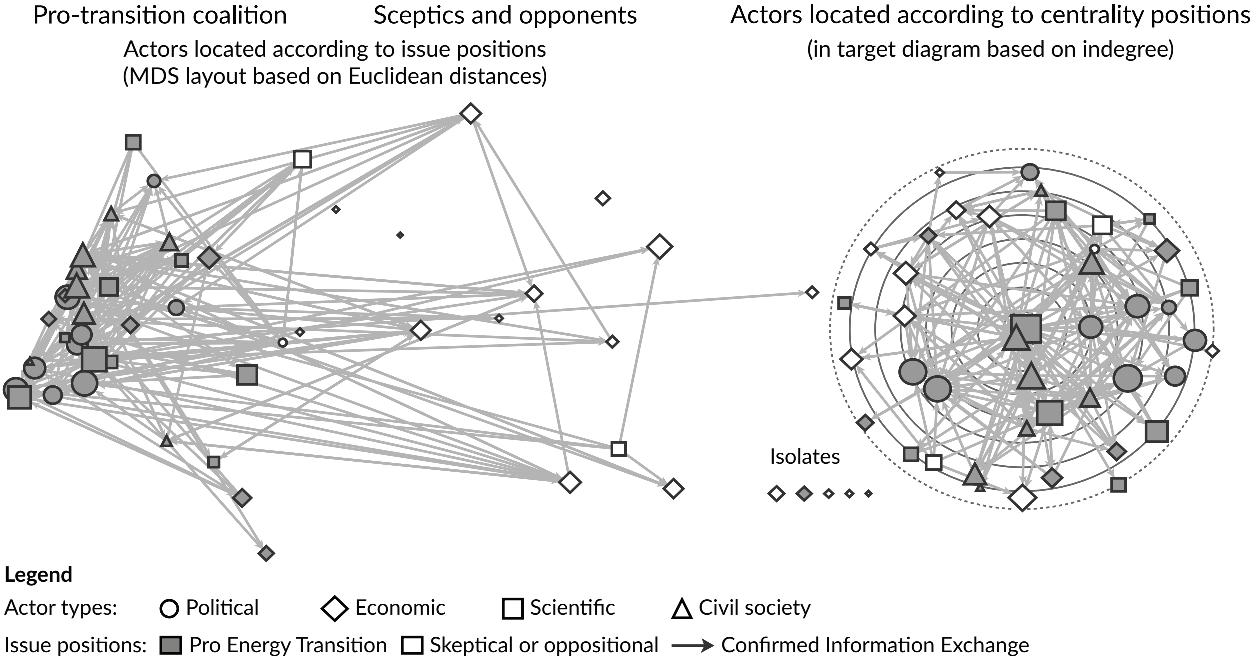

Figure 3. Germany's climate and energy policy: Issue positions and information exchange. Notes: Size of symbols corresponds to eigenvector centrality based on influence reputation; visualized with the help of *visone* (Brandes & Wagner, 2004).

The actors and their influence are shaped not only by the immediate aftermath of Fukushima but also by broader political, economic, and scientific developments over recent decades. These shifts have transformed Germany's energy mix and consumption patterns, while also reshaping science, civil society, politics, and the economy. Ecological modernization and related R&D programmes have fostered new economic sectors and scientific fields with growing political influence. The expansion of the renewable energy sector has created new interests and centres of power. Notably, the environmental movement and the Green Party have become major political actors at both the federal and state levels. Many organizations from these spheres now play key roles in the policy network. The impact of these long-term structural dynamics becomes particularly evident when comparing policy networks across countries (Rinscheid et al., 2020; Satoh, Nagel, et al., 2023).

Figure 3 (left side) divides the issue space into two halves, with the pro-energy transition coalition comprising 36 actors on the left. These account for more than three-quarters of the weighted influence reputation based on eigenvector centrality (Bonacich, 1982). This metric assigns higher scores to those endorsed by other influential actors, recursively weighting centrality. While most actors opposed nuclear energy, some dispersed business actors remained sceptical or even oppositional. All political parties supported the phase-out and focus on renewables, though the FDP did not participate in the survey. Industrial and business actors were split between pro and contra positions. Notably, sceptics on the right were less connected than the cohesive pro-transition alliance on the left. The right-hand diagram in Figure 3 shows that nearly all actors are part of the information exchange network, except for five economic actors, all are embedded in a dense web of information exchange. Political and civil society actors occupy central positions, while economic actors—such as trade associations and large firms—tend to be more peripheral.

Both analyses show that not all actors in the policy network supported the new energy transition strategy, but an overwhelming majority did, including almost all parliamentary parties and governmental institutions. Furthermore, many civil society organizations and scientific actors influenced agenda-setting and policy formulation in the new direction (Satoh, Nagel, et al., 2023).

To understand the positional and ideational orientation of this network at this time, it is important to consider the dynamics of political discourse in spring 2011. Based on German press coverage, Haunss et al. (2013), Rinscheid (2015), and Rinscheid et al. (2020) analysed the energy discourse before and after the Fukushima accident using “discourse network analysis” (Leifeld, 2020). This involves examining a two-mode network of political actors and their debated positions, which statements (interpreted either as claims or beliefs) the various actors support or reject. Indirectly, this creates a network of shared statements that can be interpreted as discourse coalitions. Both research teams found a complete reconfiguration of German discourse coalitions after the nuclear disaster. Beforehand, the debate had been polarized, with the CDU/CSU and FDP in favour, the opposition parties, and many civil society organizations opposed to nuclear energy. After Fukushima, almost all actors in government and civil society took an anti-nuclear stance. According to Haunss et al. (2013), the demand for a phase-out became dominant in the discourse because (a) its advocates held central positions in the discourse network, (b) they quickly formulated a coherent and broadly connectable set of claims, and (c) pro-extension actors failed to secure central positions or develop similarly integrative demands. Rinscheid (2015) concludes from his analysis that political mediators also helped to bridge the divide, leading to broad support for the phase-out of nuclear energy by June 2011.

In a recent reanalysis, Haunss and Hollway (2023) provide a formally elegant account of discourse coalition transformation, highlighting micro-mechanisms such as actor prominence, cross-party support, and cluster formation. It concludes that the nuclear phase-out “cannot be explained by factors such as political economy, party politics, or power shifts, but was largely the result of an intense and controversial debate.” Yet this interpretation may overreach what microanalysis can truly explain. A key limitation lies in treating political claims as discrete, observable links between actors and positions, without accounting for why these links change over time. While the model shows when actors support or drop demands, it overlooks the causal mechanisms behind these shifts. Attributing change solely to discourse risks idealizing communicative interaction à la Habermas. Without considering actors' cognitive, ideological, or strategic reasoning, the model remains descriptively rich but explanatorily thin.

In contrast, Rinscheid et al. (2020) explain the policy shift through changes in beliefs, offering a more robust theoretical account that incorporates political feedback and ideational learning. The German government's repositioning is attributed to belief changes among key actors, notably Chancellor Angela Merkel, Markus Söder (then Bavarian Environment Minister, now CSU Chairman), Christian Lindner (FDP Chairman), Stephan Mappus (then Baden-Württemberg Minister-President), and Norbert Röttgen (then Federal Environment Minister).

In an in-depth analysis based on interviews with high-ranking experts (Tratzmiller, 2018), Markus Söder is also cited as one of the leading voices calling for an immediate moratorium, and one is tempted to interpret this as policy learning. In retrospect, however, the diagnosis of Söder's change of heart seems implausible, as the "master of political U-turns" changed his convictions several times in the years that followed. These switches always took place before important elections, depending on the opinion polls (Westenberger & Schneider, 2022). Without direct access to the thinking of key politicians, it remains unclear whether their repositioning reflected genuine policy learning or electoral strategy amid a changing media landscape. Given the general strategic orientations of these figures—as discussed in German political science over the past decade—the interest-driven "issue competition" thesis appears more plausible than idea-based learning. Tratzmiller's analysis supports this view and concludes that the decision to phase out nuclear energy was due to the fact that the Greens had made nuclear energy a central campaign issue and the government had to respond in this situation of issue competition.

From the perspective of issue competition theory, nuclear energy has long been the core issue for the German Greens. After Chernobyl, rising public concern over nuclear risks helped them gain entry to the Bundestag. Fukushima brought the issue back to the forefront of political debate. The coalition for phasing out nuclear power was thus not only a situational response but also the outcome of a long-standing process in which the Greens held "issue ownership"—a key factor in Germany's increasingly fragmented party system, and its federal structure with frequent state elections (Spoon et al., 2014; Westenberger & Schneider, 2022).

Green issues came to the fore during these years, not only in the conflict over nuclear energy, but also in a local conflict over the large railway station project Stuttgart 21, which had important environmental and national implications (Nagel & Satoh, 2019). On 27 March, around two weeks after the Fukushima disaster, state elections were held in Baden-Württemberg in which the combination of Stuttgart 21 and the new nuclear policy of the CDU/FDP coalition at the federal level led to a landslide defeat for the incumbents. After 58 years of governing in this federal state, the CDU became the opposition to a new government led by the Greens and the SPD (Keil & Gabriel, 2012).

Campaign and issue competition motives were also examined by Haunss et al. (2013), who queried whether the nuclear phase-out aimed to save the CDU in Baden-Württemberg's state election. This was dismissed, arguing that state elections were secondary for federal strategy. However, Angela Merkel's autobiography offers a more nuanced view (Merkel & Krahmann-Baumann, 2024). She explicitly mentions the upcoming state elections and the symbolic 45-kilometre human chain between Stuttgart and the Neckarwestheim nuclear plant. Describing a climate in which "we can't just carry on as before" (Merkel & Krahmann-Baumann, 2024, p. 577), she highlights the urgency of responding to growing public concern—this suggests that also electoral dynamics did play a role.

Particularly revealing is her reference to the report by the Ethics Commission for a Safe Energy Supply, which she had appointed. The report, entitled *Germany's Energy Transition—A Collective Project for the Future*, emphasizes that nuclear risk assessments should not be limited to technical dangers but must also consider the consequences for the social climate: "One subject of ethical judgment must also be the consequences that result from a poisonous social climate, which has a justifiable place in nuclear energy discussions in Germany" (cited in Merkel & Krahmann-Baumann, 2024, p. 580).

Merkel's decision thus appears not only as a response to reactor safety but also as a communicative strategy to restore political legitimacy and social cohesion. In this light, it is difficult to maintain that electoral strategy played no role. Merkel's account suggests that nuclear energy had become electorally toxic. Given high issue salience and partisan competition, neutralizing the Greens' central issue became essential for future electoral viability. This approach was later described as "asymmetrical demobilization" (Decker & Adorf, 2018, p.10)—a strategy to weaken or remove issues that energize political opponents (Faas, 2015; Jung, 2019).

In summary, the structural description of issue positions in the policy network presented here does not contradict Haunss et al.'s (2013) description, nor that presented by Rinscheid (2015) or Rinscheid et al.'s (2020) research group. Most stakeholders supported the 2011 nuclear phase-out, with only a few dissenting voices. The positions in Figure 3 reflect the political and societal majority during that period (August 2011–October 2012), which only began to shift a decade later. While these positions may reflect the Copernican policy shift, the overall constellation is not merely situational. The composition of the policy topic's actor set, their influence reputation, and patterns of cooperation and information exchange are more structural and enduring aspects of the policy network. They illustrate how, in Germany's intertwined energy and climate policy systems, a broad array of public and private actors is engaged in problem-solving. Civil society and scientific organizations occupy central positions, while many economic actors appear more peripheral.

4.3. Information Exchange as the Backbone of the German Policy Complex

From this perspective, our network analysis offers insights into Germany's "policy-making engine room," identifies the relevant actors, and highlights information exchange as the backbone of this complex system of political interaction. By relating actors' positions on the issues to the exchange of information, we can check whether information exchange is more likely to occur between actors with similar beliefs or policy positions than between opposing coalitions or groups. This is ultimately the central hypothesis of the ACF, according to which information exchange facilitates coalition-building (Satoh, Gronow, et al., 2023). This allows us to check whether the exchange of information was a result of the specific situation after Fukushima, or whether it was independent of the actors' issue positions and thus a more permanent infrastructure of political interaction. A look at Figure 3 shows that the AFC hypothesis is not supported by the data. Although the analysis is restricted to confirmed information exchange, both visualizations indicate that almost all actors participate in information exchange, even those who hold opposing positions. This is also largely consistent with observations made in other analyses of German policy networks, in which information exchange relationships are strongly explained by the institutionally supported opportunity structures of the consensus-democratic political system (Leifeld & Schneider, 2012; Schneider, 2015). Interestingly, the later decision to phase out coal in Germany was also the result of a highly inclusive deliberative process. A specially convened commission brought together representatives from politics, industry, trade unions, environmental organizations, and academia to develop a broadly supported roadmap for the coal exit (Reitz, 2024).

Since the similarity of issue positions does not appear to be a decisive factor for information exchange, it is interesting to estimate the probabilities of information exchange and its determinants more systematically. To identify the factors influencing the probability of information exchange between network actors, we applied Exponential Random Graph Models (ERGM), a special regression method for network data (Cranmer et al., 2020; Leifeld & Schneider, 2012) implemented in the *statnet* package in *R* (Hunter et al., 2008). This method takes autocorrelation and multicollinearity in network data into account while integrating node attributes and relational structures into the modelling under control of endogenous network dependencies. Inspired by random graph simulation, ERGMs capture common structural patterns such as preferred connectivity, homophily, transitivity, clustering, and reciprocity. These models estimate the probability of tie formation—analogous to logistic regression—based on node characteristics, edge covariates, and network structures, and provide interpretable coefficients as log odds ratios (see https://github.com/vsunikon for further details).

The relationships were examined using three models: a basic, full, and reduced model. All models use the same binary dependent variable—mutually confirmed information exchange between actors in the climate–energy policy network. The basic model includes only the edges term to control for network density. The full model adds endogenous structural effects—mutuality, indegree popularity, and triadic closure—as well as edge covariates capturing external relational structures: issue similarity, collaboration, and advice ties. The reduced model excludes statistically insignificant covariates from the full model for greater parsimony. Each model reports coefficient estimates with standard errors, alongside diagnostics such as Markov Chain Monte Carlo (MCMC) convergence and goodness-of-fit (GoF) statistics to assess model fit. While the GoF statistics in the Annex (previously mentioned) indicate that the models reproduce key structural features of the observed network reasonably well, some deviations remain. Despite some limitations in model fit, as is common in complex network structures, the dataset has already supported robust findings in prior publications in respected journals (Karimo et al., 2022; Satoh, Nagel et al., 2023; Wagner et al., 2023).

Figure 4 uses the *R* package *texreg* (Leifeld, 2013) to visualize the three models that identify factors influencing actors' likelihood of exchanging information in the German climate and energy policy process. The three models show that the quality of the model (Akaike Information Criterion [AIC] and Bayesian Information Criterion [BIC]) can be improved by including a broad spectrum of influencing factors, but that the more parsimonious third model demonstrates even higher quality. The first model appears to confirm the ACF hypothesis to a small degree. However, when the influence of similarity of beliefs is controlled for typical endogenous network processes such as reciprocity (mutual relationships), local clustering (joint partnerships), and popularity (indegree), and when other parallel relationships such as influence reputation attribution, advice, and cooperation are additionally integrated into the model, the effect of the variable *similar beliefs* approaches zero and loses statistical significance. In the reduced third model, the endogenous variables reciprocity and clustering, as well as the relationship variables influence reputation and cooperation, have a highly significant influence. Notably, actors' affiliation with the economy reduces the probability.

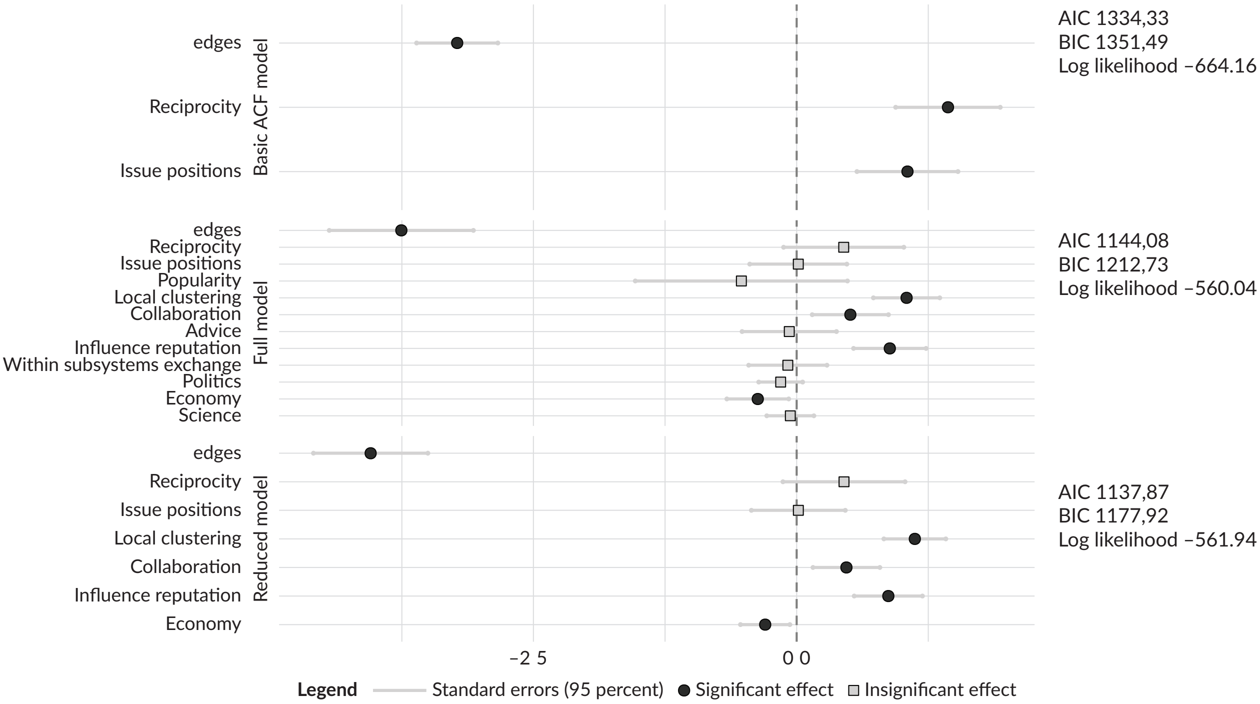

Figure 4. Exponential random graph models: Estimating effects on the likelihood of information sharing.

Actors are therefore more likely to exchange information with those they perceive as influential, and with those who are in collaborative relationships. While collaboration may partly reflect belief homophily, its inclusion also points to the importance of empirically observed relational structures that go beyond shared issue positions (Gronow et al., 2020; Kammerer et al., 2021). The node effect belonging to the business community is moderately significant, but it has a negative effect and tends to reduce the probability of exchanging information. This can also be observed in Figure 3, where economic actors on the right display relatively few connections among themselves.

The general message of Figures 3 and 4 thus is that the German policy network for climate and energy policy was very inclusive, but that a pro-transition coalition dominated completely, despite some sceptical opponents in the business community. It is very interesting to note, however, that many of the driving forces behind the nuclear phase-out at the time, such as Markus Söder, now hold the opposite view. This suggests that the decision to phase out nuclear power in 2011 was not based on policy learning, but on strategic electoral considerations.

Figure 5 strongly supports such an interpretation by showing the context of the issue competition game. Angela Merkel and the CDU ultimately improved their position in the issue space in the period between Baden-Württemberg's shock election and the federal election in the autumn of 2013, with climate and energy policy again taking a back seat. Tracking the polls from 2011 to 2013, the figure highlights the salience of energy and climate compared to unemployment—the most salient issue—and the positions of the various parties. Ten elections were held at the state level between 2011 and 2013, seven of them in the so-called "super election year" of 2011 (Jesse & Strum, 2012). Despite the continued salience of the climate and energy issues, which showed the highest upward swing during the Bundestag discussions in 2012, the Greens were less and less able to keep up in this competition. Another key issue, namely the euro crisis, dominated the political agenda during this period. In any case, the result was that in 2013, the CDU/CSU achieved their best electoral result since 1990 under the leadership of Angela Merkel, with the Left Party overtaking the Greens and the FDP losing their seats in the Bundestag, failing to reach the 5% threshold. This election resulted in a change of government to a coalition of CDU/CSU and SPD.

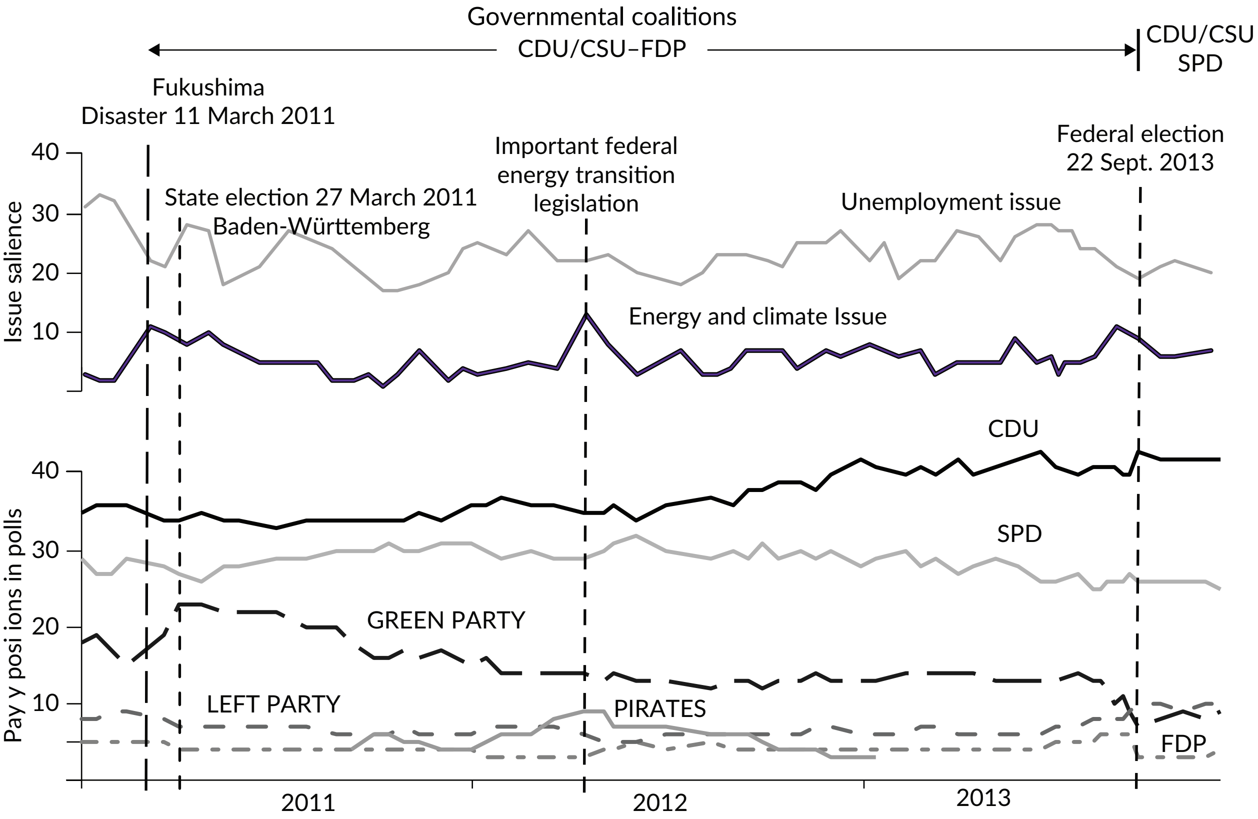

Figure 5. Issue salience and party positions 2011–2013.

The decision to phase out nuclear energy in 2011 is therefore less a result of political learning and belief change, at least as far as the most important players are concerned, and more a product of the competition for environmental issue ownership in the German party system. The analysis therefore supports the interpretation of authors who suspected a realignment of electoral politics (Fischer, 2012; Luhmann, 2012; Skea et al., 2013; Tratzmiller, 2018; Wittneben, 2012; Zohlnhöfer & Engler, 2014). The case shows that party political actors pursue thematic strategies to claim, defend, or neutralize specific issues in media discourse to secure or improve their position in the electoral vote market. From the perspective of the ecology of games, policymaking in energy and climate policy games is thus "overdetermined" by macropolitical electoral competition for control of issue ownership.

5. Conclusions, Limitations, and Outlook

Against the backdrop of Germany's energy and climate policy, this article explains the extraordinary 2011 decision to phase out nuclear energy and launch the long-term *Energiewende* to shift towards renewables.

Germany aimed not only to eliminate nuclear risks but also to tackle climate change. Despite the Fukushima-triggered phase-out, the government upheld its climate goals, initiating a comprehensive transition strategy and committing to a coal phase-out by the late 2030s. In recent years, however, achieving these goals has become more difficult, especially amid the war in Ukraine and shifting geo-economic conditions.

The explanation combines long-term structural dynamics and the short-term shock of Fukushima. Structurally, the policy shift is seen as emerging from an "ecology of games," in which interactions across the climate, energy, and political arenas created a window of opportunity in 2011. Since Chernobyl, Germany had developed a powerful anti-nuclear and environmental movement that, by the 2000s, had begun to see climate change as a central issue. Through the Green Party, this issue gained electoral success and eventually governmental power. In alliance with scientific institutes and think tanks, this issue coalition built a strong interest base for climate protection. The Fukushima disaster then acted as a catalyst, prompting a response unmatched in its radicalism by any other country.

The above analysis has shown that this was not an exaggerated panic reaction, but a decision made within the context of strategic election campaigning, which was, however, conditioned by long-term power constellations. Over time, almost all parties had incorporated environmental issues into their election programmes in the context of a historically strong environmental and anti-nuclear movement. To some extent, one could speak of a "greening" of the German political system. In addition, a rapidly growing "green economy" had developed in Germany since the 1990s, in which innovation policy and research policy played a major role. Ultimately, this had an impact not only on the German economy but also on the German science system. Many new scientific organizations and fields of research emerged, which exerted a growing influence on agenda-setting and decision-making. This complex system of actors was analysed as a policy network in which organizations with mutual interests in the relevant policy areas exchange information and collaborate to formulate and implement public policies. Within this policy network, we identified a broad alliance that strongly supported the energy transition decision.

The analysis has some limitations, two of which are particularly noteworthy. First, there is a slight climate policy bias, as the network was defined and surveyed within the scope of an international climate policy study. This bias would likely not exist if energy and climate policy had been equally prioritized from the outset. However, the analysis shows that both areas now overlap significantly and are treated in an integrated way, including in the present issue space. Second, the study faced a moderate and uneven response rate across actor categories. While higher rates are generally preferred in network analyses, this is a common challenge in survey-based research. The particularly low response rate among ministries can be attributed to the high politicization of both policy areas during the study period. This sensitivity required full anonymity for respondents, which is why individual organizations are not named.

Germany's energy transition, once driven by a strong normative commitment to phasing out nuclear energy and advancing renewables, is facing increasing challenges. Internationally, Germany appears increasingly isolated in its anti-nuclear stance, as many countries reconsider nuclear power as a low-carbon option. Domestically, the continued reliance on coal as a bridging technology and doubts about the feasibility of the coal phase-out raise questions about the policy's internal coherence. Under the new Federal Minister for Economic Affairs and Energy, Katherina Reiche, the focus has shifted toward energy security and price stability, with expanded gas-fired capacity, targeted renewable subsidies, and revised electricity demand projections. The inclusion of CCS signals a more pragmatic turn. While the original *Energiewende* reflected a voluntaristic ethos, recent geopolitical shocks—especially the war in Ukraine and gas dependency—have prompted adaptive responses. This raises the question of whether the energy transition is undergoing a strategic recalibration, or even a partial reversal.

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Conflict of Interests

The author declares no conflict of interests.

Data Availability

Annex and data on issue network relations are available at https://github.com/vsunikon

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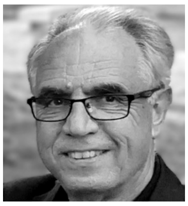
About the Author



Volker Schneider obtained his PhD from the European University Institute in Florence and his habilitation from the University of Mannheim. Between 1986 and 1997, he was a research fellow at the Max-Planck-Institute for the Study of Societies in Cologne. Since 1997, he has been a professor at the University of Konstanz, since 2020 emeritus.