How historical context shapes the construction of field-level frames: A comparative study of France and Germany's shale gas debates

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Abstract

This study investigates the shale gas debates in France and Germany, providing a comparative lens on how historical context shapes the construction of field-level frames. Leveraging a structural topic modeling approach, our analysis of over 25,000 newspaper articles reveals that France and Germany's field-level frames were influenced by unique historical contexts that reflect longstanding differences in their countries' energy production. While France framed shale gas as inherently in conflict with their energy strategy, Germany framed it as an opportunity aligned with their energy mix. Supplementing the topic modeling results with 78 interviews, we identify three mechanisms through which France and Germany's historical context of energy production influenced the construction of these frames: 1) *historical positioning*, which first situated the concept of shale gas within the country's decades-old understanding of energy; 2) *issue labeling*, which then constrained actors' in how they categorized and even discussed the overall debate; and finally 3) *bounded mobilization*, which, given the positioning and labeling of the issue, limited the actors that could participate in the debates. Taken together, this study offers a rare comparative lens on how field-level frames are influenced by historical contingencies and offers a methodological roadmap for scholars interested in using structural topic modeling to conduct multilingual frame analyses.

Keywords: frames, comparative, field-level, context, topic modeling, fracking.

Introduction

Framing is a powerful communication strategy that enables actors to promote specific interpretations (Entman, 1993; Goffman, 1974) and reorient issues in a way that suits their interests (Cornelissen, Durand, Fiss, Lammers, & Vaara, 2015; Pan, Li, Chen, & Chen, 2020). Successful framing efforts have led to controversial ideas gaining acceptance (Lefsrud & Vaara, 2019; Rhee & Fiss, 2014; Weber, Heinze, & DeSoucey, 2008), social movements gathering momentum (Benford, 1993; Snow, Rochford, Worden, & Benford, 1986), and institutional fields becoming restructured (Feront & Bertels, 2021; Gray, Purdy, & Ansari, 2015; Gurses & Ozcan, 2015). According to this longstanding view, frames are largely the result of agentic and strategic action, whereby actors can select readily accessible frames that best achieve their goals.

Yet where does the content of these frames come from, and why do some frames appear more accessible to actors than others? One plausible explanation is that frames are not simply strategically selected but are "affected by a number of elements of the socio-cultural context in which they are embedded" (Benford & Snow, 2000, p. 628). Building on this idea, a growing body of work has started to show that the beliefs, values, and historical contexts in which contentious issues arise influence how field-level frames are constructed in public discourse (Gamson & Meyer, 1996; Giorgi, Maoret, & Zajac, 2019; Kaplan, 2008). For instance, cultural or political conditions can affect the way frames are expressed in the media (Ansari, Wijen, & Gray, 2013; Mooney & Hunt, 1996), and a country's history can shape how "people locate and find meaning [of issues in] the present" (Schwartz, 2000, p. 301; see also Ocasio, Mauskapf, & Steele, 2016; Wadhwani, Suddaby, Mordhorst, & Popp, 2018).

This work, however, has largely investigated the influences of history on field-level frames within just a single context (e.g., Meyer & Höllerer, 2010). Indeed, it is rare to see a comparative study on how the historical contingencies across *different* contexts shape the

construction of field-level frames in the first place (for reviews, see Benford & Snow, 2000; Cornelissen & Werner, 2014). We argue that a comparative study of this nature could be useful and reveal novel mechanisms by which historical context can influence the construction of field-level frames. At the same time, such an analysis presents several challenges. First, comparing field-level frames across two public discourses requires collecting, processing, and analyzing an enormous volume of text, which the qualitative methods often used in frame analysis studies are ill-suited to handle (Cornelissen & Werner, 2014). Second, contexts with distinct histories, such as diverse countries with different national languages, make direct textual comparisons difficult.

In this study, we gain traction on these issues by deploying a novel Natural Language Processing (NLP) method called Structural Topic Modeling (STM), which enables us to directly compare the shale gas debates in France and Germany's public discourse. Because France and Germany have radically different histories of energy production, this setting offers a unique opportunity to compare how their historical contexts might have influenced how the shale gas issue was framed in public discourse over the same period. To explore this, we collected over 25,000 newspaper articles on shale gas from news outlets in France and Germany between 2006 and 2015. Following prior work (Karell & Freedman, 2019; Lucas, Nielsen, Roberts, Stewart, Storer & Tingley, 2015), we built a monolingual corpus by translating all French and German articles into English. We then used STM to generate topics discussed in both countries (Aranda, Sele, Etchanchu, Guyt, & Vaara, 2021; Hannigan et al., 2019), examined the interrelationships among topics to generate intermediate issue frames (Nelson, 2020), and finally aggregated these issue frames into the field-level frames constructed in each country (DiMaggio, Nag, & Blei, 2013).

Our results reveal a significant difference in how these countries framed the shale gas debate at the field level. In France, a conflicting field-level frame dominated the public

discourse, pitting shale gas against their existing energy strategy. In Germany, an aligning field-level frame instead portrayed shale gas as largely consistent with their energy policy. Digging deeper into this difference with the use of 78 interviews to industrialists, environmentalists, and politicians in both countries, revealed three mechanisms through which historical differences in France and Germany's energy production influenced the construction of these field-level frames: 1) *historical positioning*, which first situated the concept of shale gas within the country's decades-old understanding of energy; 2) *issue labeling*, which then constrained actors' in how they could categorize and even discuss the overall debate; and finally 3) *bounded mobilization*, which, given the positioning and labeling of the issue, limited the actors that could participate in the debates.

This study provides several contributions. First, by leveraging STM as a novel methodological approach, we provide a rare comparative lens that facilitates a more systematic comparison across multiple contexts. While prior work has suggested that history can shape field-level frames (Meyer & Höllerer, 2010), few studies compare the same issue being framed in public discourse simultaneously in two different contexts. By examining the shale gas debates in France and Germany, our findings suggest that a country's unique history can be carried forward into the present day (e.g., Frake & Harmon, 2024; Ocasio et al., 2016), shaping the construction of unique field-level frames in public discourse. Furthermore, by demonstrating that history influences the way field-level frames are constructed in the first place, our findings emphasize the need to study the antecedents of prior work, which has primarily focused on the amplification and eventual outcomes of these framing contests (Benford, 1993; Gray et al., 2015; Bohn & Rogge, 2022).

Second, this study provides a methodological roadmap for using topic modeling for comparative and multilingual frame analysis. In their review of the framing literature, Cornelissen and Werner (2014) suggested that methodological advances in NLP may enhance

framing research by enabling the analysis of larger datasets and the identification of new mechanisms. Our study makes a significant contribution in this direction by demonstrating the usefulness of STM in analyzing over 25,000 newspaper articles. By employing a comparative, multilingual STM, we provide a robust analytical framework that overcomes language barriers and can be applied to explore frames across diverse datasets and linguistic environments. Our paper thus provides a novel example of how "machine translation can be used in conjunction with STM to make comparisons across countries and languages" (Lucas et al., 2015, p. 268). In so doing, our study not only enhances our understanding of the role of history in the construction of field-level frames but also offers a novel methodological approach for the systematic comparison of frames across multiple contexts.

How historical context shapes the construction of field-level frames

Field-level frames, or the shared meanings expressed across multiple actors in public discourse (Furnari, 2018; Lounsbury, Ventresca, & Hirsch, 2003), emerge as orienting devices that enable actors to influence and make sense of contentious issues. These frames are "not merely aggregations of individual attitudes and perceptions but also the outcome of negotiating shared meaning" (Gamson, 1992, p. 111). In this sense, field-level frames are both the outcome of framing activities (Benford & Snow, 2000) and a lens that shapes public debate (Lounsbury et al., 2003). Although prior work has argued that actors can strategically select and shape field-level frames (Gurses & Ozcan, 2015; Lefsrud & Vaara, 2019; Weber et al., 2008), a growing body of work has suggested that such efforts, as well as the construction of the field-level frames themselves, are deeply constrained by the socio-cultural context in which they are embedded.

In particular, social movement scholars have argued that political opportunity structures—or "dimensions of the political environment that provide incentives for people to undertake collective action" (Tarrow, 2022, p. 85)—can influence the construction of field-

level frames (Gamson & Meyer, 1996; Meyer & Minkoff, 2004). For example, McAdam (1982) showed that demographic, migration, and political economy changes created a climate or space in which collective action could be organized. Mooney & Hunt (1996), who studied agrarian efforts in the United States to collectively mobilize, similarly found that the changing political conditions enabled shifts in collective or field-level frames.

In addition to political opportunity structures, scholars have suggested that culture, broadly construed, can also influence the construction of field-level frames (Cornelissen & Werner, 2014). As Benford and Snow (2000) allude: "The cultural material most relevant to…framing processes include the extant stock of meanings, beliefs, ideologies, practices, values, myths, narratives, and the like" (p. 629). Building on this idea, Weber et al. (2008) showed that actors drew upon existing cultural codes (e.g., organic) to frame grass-fed meat and dairy products. Similarly, Giogi and colleagues (2019) found that the prevailing legal environment in which firms operate can change their ability to influence a new law.

One aspect of culture of particular interest to this study is history. While studies have shown that actors can strategically draw upon history to legitimate their ideas (Basque & Langley, 2018), several scholars have theorized that history can also play a subtler role in undergirding a society's collective memory and present-day beliefs (Ocasio et al., 2016). For instance, the prevailing historical context has been shown to affect the unconscious construction of identities (Wadhwani et al., 2018), influence actions or decision-making processes (Marquis & Tilcsik, 2013), and shape how people make sense of the world (Benner & Tripsas, 2012; Meyer & Höllerer, 2010; Schwartz, 2000). As a result, history is one of the most deeply embedded "latent meaning structures that organize social and cultural experience" (Cornelissen & Werner, 2014, p. 207).

Interestingly, although we know *that* past events affect the present in a rather general sense, we have a limited understanding of *how* historical context shapes the construction of

field-level frames. One potential reason for this, we suggest, is that most studies investigate the construction of field-level frames within a single historical context rather than comparing them across contexts. Cornelissen & Werner (2014) note that this focus has produced a deeper understanding of how framing disputes and counter-framing efforts create "active struggles over meaning" within a single context (e.g., Benford, 1993; Gamson, 1992; Gurses & Ozcan, 2015; Kaplan, 2008), but has limited our understanding of how different historical contexts might give rise to the construction of distinct field-level frames in the first place.

In what follows, we offer a comparative study of the shale gas debates in France and Germany and, in doing so, explore how these countries' unique histories with respect to energy production played a role in shaping the construction of the field-level frames that emerged decades later in their public discourse.

Empirical setting

The Shale Gas Debate

The debate surrounding shale gas gained prominence in the late 2000s. Shale gas, a natural gas trapped within shale rock, is accessed through horizontal drilling or hydraulic fracturing (i.e., fracking), which involves injecting a mixture containing water, sand, and chemical additives into the bedrock (Uddameri, Morse, & Tindle, 2015). Though hydraulic fracturing technology has existed since the 1940s, it was the fusion of this technology with horizontal drilling that unlocked shale gas as a significant energy source. Initially viewed as a means to energy independence and economic growth, shale gas extraction raised concerns due to its intensive technique, and the industry soon faced scrutiny for its environmental impact (Speight, 2016). Concerns like groundwater contamination, air pollution, and methane emissions became flashpoints in public and academic discourse. Moreover, reports linking hydraulic fracturing to seismic activity further fueled concerns, making earthquakes another critical aspect of the conversation (Gold, 2014).

Europe's involvement in the shale gas debate has been varied, making it a microcosm of global tensions surrounding the issue (Weible, Heikkila, Ingold, & Fischer, 2016). Some countries, such as the United Kingdom and Poland, initially explored shale gas to bolster energy security and reduce dependency on gas imports (Johnson & Boersma, 2013). However, the United Kingdom quickly put a moratorium on fracking, citing seismic risks (Cotton, Rattle, & Van Alstine, 2014), and Poland's ambitions waned due to less promising geological results. Countries like France and Germany were slower to enact blanket policies, letting a rich public discourse emerge in the news media before they ultimately took action. As such, in France and Germany, the emerging field-level frames captured in the media became powerful orienting devices for environmental, regulatory, and social decisions.

France and Germany's Historical Contexts of Energy Production

France and Germany, both founding members of the European Union (i.e., EU), are not only the largest countries in terms of size and population, but together account for about a third of the total population in the EU and more than 40% of its GDP (Lafrance & Wehrmann, 2023). As the two most influential members of the EU, France and Germany have many economic, political, and regulatory commonalities. As economic powerhouses, they influence EU monetary policy and have highly developed industries. Politically, both operate as representative democracies and have worked in tandem to drive EU initiatives, including defense and climate policies. Regulatory similarities stem from EU membership, mandating adherence to shared standards in competition, consumer protection, and environmental conservation. Thus, both countries are embedded within the same EU macro-regulatory environment and share many important present-day institutional characteristics.

Despite these commonalities, a significant difference between France and Germany is their historical approach to energy-related technologies and the means of energy production (Graf, 2018). France strategically decided to invest heavily in nuclear energy following the

oil crises of the 1970s (Hecht, 1998). Decades later, nuclear power dominates France's energy production. As of 2022, nearly 70% of its electricity came from nuclear power, whereas coal contributed less than 1%, offering France a degree of energy independence and relatively low carbon emissions (IEA, 2022a). In contrast, Germany historically has relied on coal investments, which accounted for most of its total electricity production well into the 2000s (Gross, 2023). By 2022, coal still contributed to a third of its electricity production (IEA, 2022b). Unlike France, Germany's longer-term aim to phase out coal involves sidestepping nuclear altogether in favor of more sustainable alternatives, such as wind and solar.

In this context, we aim to answer the following research question: How did the unique historical contexts of France and Germany with respect to energy shape the construction of the field-level frames that emerged decades later to make sense of the shale gas debate?

Methods

Data Collection

To investigate this question, we gathered primary and secondary data. Our primary data source is newspaper articles collected in France (from 2006 to 2015) and Germany (from 2007 to 2015) referenced in Factiva using the keywords 'fracking,' 'shale gas,' 'gaz de schist,' or 'Schiefergas.'[1] The articles were collected in their native language from all available sources within each country (see Table A1 in the Appendix).[2] This resulted in 15,886 French articles and 13,434 German articles. We supplement these media data with 78 interviews conducted by the first author in 2013 and 2014. The interviews, which lasted 45 to 120 minutes, were conducted in German, French, and/or English, recorded, and transcribed (see Table A2 in the Appendix).

[1] The media started covering this topic in 2006 in France, and in 2007 in Germany. By 2015, the debate within both countries was largely settled, and media coverage waned.
[2] Our sample is the full population of newspapers in each country and, thus, includes all articles published in France and Germany during the period of study.

Analytical Strategy

To conduct our comparative study, we devised a two-step analytical strategy. First, we leveraged the news media data and estimated an STM to identify and compare differences in the construction of France and Germany's field-level frames during the shale gas debate. The fact that the shale gas debate simultaneously emerged in France and Germany and generated similar media coverage supports this comparative approach. Second, given that STM's strength lies in detecting thematic structures in large textual data but is less equipped to extract more complex theoretical inferences, we then draw on our rich interview data to identify potential mechanisms that seek to explain *how* France and Germany's unique histories with respect to energy production shaped the construction of different field-level frames. Table 1 provides a general overview of our research design and analytical strategy.

[INSERT TABLE 1]

STM Analysis

To analyze the media articles for potential differences in field-level frames, we use topic modeling, an methodological development in NLP for quantitative text analysis (Mohr & Bogdanov, 2013). Topic modeling facilitates the "analysis of larger corpora than human coders can master, facilitating the discovery of unanticipated frames, and distinguishing between different uses of the same term" (DiMaggio et al., 2013, p. 593). In this study, we leverage STM rather than the basic LDA model widely used in prior work (e.g., Bohn & Gümüsay, 2023; Croidieu & Kim, 2017). STM is more flexible than LDA (Blei, Ng, & Jordan, 2003; Maier et al., 2018), as it not only allows for topics to be correlated but, importantly for our purposes, incorporates metadata in the estimation procedure (Roberts, Stewart, & Tingley, 2016). Metadata can be any relevant variable(s) to explore the relationship between external factors and the content of the texts, in our case, the country in which the article was published (i.e., France or Germany) and the year of publication (i.e.,

calendar year). Including these variables and their interaction term as metadata enables us to identify which topics were prevalent in each country at a given time and facilitates a comparison of the topical content between countries (Reber, 2019).

Given the comparative nature of our study and the fact that our corpus was in both French and German, our first step was to build a monolingual corpus.[3] Naturally, human translation of the documents would have been ideal, but the size of our corpus makes it infeasible. As such, we translated all texts to English using machine translation,[4] which has been found to be a desirable solution for cases like ours since "most approaches to automated text analysis make a bag-of-words assumption, which implies that the ordering of terms [and the distance between them] in a document does not matter. The translation software needs only to correctly translate the significant terms in the original document, as any error in word order will be discarded by the bag-of-words assumption" (Lucas et al., 2015, p. 260). Machine translation is thus particularly well-suited for studies using STM, as the focus is on the frequency of words within the corpus rather than the grammatical structure of the text.

We translated all French and German articles into English to take advantage of the fact that machine translation systems tend to use English as a 'pivot' language.[5] Indeed, these "algorithms are expected to perform best when translating to and from English" (de Vries, Schoonvelde, & Schumacher, 2018, p. 421). Doing so, instead of translating the French

[3] STM (and related methods) convert text into tokens, treating words purely as numerical identifiers based on frequency and co-occurrence patterns rather than their linguistic meaning. This tokenization process renders these models indifferent to the underlying language, as they do not leverage semantic or grammatical nuances. To effectively run a topic model across documents in different languages, the texts must be translated into one language to ensure overlapping tokens that can be leveraged to find common topics across the corpora.

[4] To assess the quality of eTranslation with other translation tools, we drew a random sample of 82 articles and translated them all using DeepL and Google Translation. The original text with the three translated versions was compared, revealing negligible differences between different translation tools. This is in line with prior work concluding that "the choice of translation service plays a minor role, (…) the differences are not of a fundamental nature" (Reber, 2019, p. 114).

[5] The languages included in our study also matter in this decision. On the one hand, "German to English translations are believed to be quite good in comparison to translations between other languages, as they are both Germanic languages and because there is much training data available" (Reber, 2019, p. 119). On the other hand, "machine-translated texts may be of better quality when translated from French to English… as there is more parallel data available for French and English" (de Vries, Schoonvelde, & Schumacher, 2018, p. 419). In turn, translating to and from other languages can present other challenges.

articles to German or *vice versa*, also ensured that all texts were translated, which "at least makes it more plausible that the inevitable error introduced in translation is roughly comparable between the two language groups, resulting in a type of symmetry" (Lucas et al., 2015, p. 269). Moreover, we translated the entire corpus so that "words are always considered within the context that they appear. Context not only improves accuracy in most machine-translation systems but may, in some cases, be necessary for an appropriate translation" (Lucas et al., 2015, p. 269). Hence, using full-text translation preserves the context in which words are used, ensuring their meaning remains unchanged (de Vries et al., 2018; Reber, 2019).

Although translating texts into a third language may alter some of the nuances of the original language, modern machine translation systems are sophisticated enough to capture the core content accurately (de Vries et al., 2018). Importantly, translating all documents to English meant we could estimate a single STM, allowing for direct quantitative comparisons of topic content and prevalence across the two countries. The alternative to this approach would be to estimate two separate STMs in two different languages (as in Bohn & Rogge, 2022), but this would only allow judgment-based comparisons across countries (Amara, Hadj Taieb, & Ben Aouicha, 2021; Heidenreich, Lind, Eberl, & Boomgaarden, 2019).[6]

We then preprocessed the data to prepare the corpus. Following standard practice, we converted all text to lowercase, deleted duplicates, stemmed words, filtered out infrequent words and stop words, as well as removed special characters, punctuation, and numbers (Aranda et al., 2021; Hannigan et al., 2019; Schmiedel, Müller, & vom Brocke, 2018). We also dropped articles with too few (>50) or too many (>2000) words. After this preparation, our final corpus consists of 25,902 articles. Next, we estimated a STM that includes an

[6] As a robustness check, we also run a separate STM for each country (Malaterre & Lareau, 2022). The results are similar to the single-language STM, although some comparative nuances across countries are lost when running a single STM instead of two separate models (Heidenreich, Lind, Eberl, & Boomgaarden, 2019). The results are available from the authors upon request.

interaction between the time and country covariates. We modeled theta using a logistic-normal generalized linear model (Roberts et al., 2016), where country and year are the covariates. This model specification incorporates two key considerations: (1) to allow topics to differ in baseline prevalence between the two countries, and (2) to allow for a different flexible evolution of each topic over time.

The next step was to identify the proper STM solution. There is no right answer to the appropriate number of topics. Still, given the size of our corpus, we followed Lindstedt's (2019, p. 311) guidance: "For shorter, focused corpora (i.e., those ranging from a few hundred to a few thousand documents in size), an initial choice between five and 50 topics is best." We then estimated models ranging from 5 to 50 topics with increments of 5. To select a solution, we plotted the diagnostic values for all solutions and their semantic coherence-exclusivity specification (see Figure 1). As Lindstedt notes, "semantic coherence is a measure of the probability for a set of topic words to co-occur within the same document, [while] exclusivity is a measure of the probability for a word to fall primarily within the top rankings of a single topic" (2019, p. 311).

[INSERT FIGURE 1 HERE]

We used these quantitative indicators and our interviews to qualitatively inspect candidate solutions in detail, aiming to find a solution that allowed us to understand the discussion in each country at a level of granularity that would allow a cross-country comparison. We assessed each of the nine estimated solutions (i.e., 10, 15, 20, … 50.) by labeling all topics in each model. In labeling topics, we followed standard practice, and instead of imposing insights into the meaning of topics, we allowed meaning to emerge from them (Aranda et al., 2021; Hannigan et al., 2019). To do so, we read the top articles within each topic, and then compared the labels derived from different estimated solutions to ensure

accuracy and interpretability.[7] In doing so, we found that the best solution was 30 topics. Labels for the 30 topics solution are listed in Table 2 (see Table A3 in the Appendix for illustrative quotes).

[INSERT TABLE 2 HERE]

Next, leveraging the year and country of the article as metadata in the STM estimation, we plotted the prevalence of each of these 30 topics over time to show the relative dominance of each topic in France versus Germany. Figure 2 plots this comparison for two topics, illustrating statistically significant differences in the prevalence of these topics between France and Germany over the years of study. We replicated this process for all 30 topics, thereby enabling us to determine whether a topic emerged as more dominant (i.e., more prevalent) in France or Germany or was similarly prevalent in both countries. Guided by the country meta-data, this process enabled us to assign most topics to either France or Germany (see Table 2), which formed the basis for exploring similarities and differences between the countries, paving the way for identifying field-level frames.

[INSERT FIGURE 2]

From Topics to Field-level Frames

Our next task was to move from the topics generated by the STM to field-level frames. Using a sequential mixed methods approach (Creswell, 2009), our approach inductively interprets the content of the topics in the context of our interviews to aggregate them into field-level frames (Lounsbury et al., 2003). In doing so, we followed work that has advocated topic modeling as a tool to study framing, whereby "many topics may be viewed as frames

[7] We assigned each article to its most prevalent topic. On average, the value of an article-topic loading that was used to assign it was 0.476 (min: 0.11, max: 0.99, with most theta values between 0.34 (first quartile) and 0.59 (third quartile)). Given our 30-topic solution, a random assignment would equal an expected loading of .03 (1/30). We also inspected these numbers topic-by-topic to ensure that this approach resulted in valid results across all topics. The mean theta for the articles assigned to a specific topic consistently exceeds 0.30 and goes up to 0.76, suggesting an acceptable basis for assigning articles to their respective topics. We also inspected the minimum (0.12 to 0.18) and maximum (0.55 to 0.99).

(semantic contexts that prime particular associations or interpretations of a phenomenon …) and employed accordingly" (DiMaggio et al., 2013, p. 578). In this view, topics represent the words used to frame an issue, highlighting some of its features at the expense of others (Klebanov, Diermeier, & Beigman, 2008). As such, our focus lies in exploring the interrelationships among topics that generate field-level frames (DiMaggio et al., 2013; Mohr & Bogdanov, 2013) while leveraging insights from our interviews to deepen our understanding of each country's historical context. Our process to get from *topics* to *field-level frames* followed prior work (Bohn & Gümüsay, 2023; Nelson, 2020) and comprised two steps.

First, we moved from *topics* to *issue frames* (Glaser & Strauss, 1967). To do so, we read the most representative articles per topic and aggregated topics into inductively derived issue frames.[8] Each issue frame comprises topics that, based on our reading of the top articles and extensive interviews, fit together to address key issues of the shale gas debate. Table 3 lists how our 30 topics aggregate into eight issue frames: 1) energy policy debates (i.e., national and local debates in the context of energy transition and environmental policies), 2) energy security (i.e., environmental dangers vs. climate benefits of using fracking for achieving energy independence), 3) environmental and social governance (i.e., economic, social, and regulatory risks around shale gas development with an emphasis on public engagement), 4) EU policies (e.g., the role of the EU in policymaking), 5) innovation and R&D (i.e., academic debates and scientific research on shale gas), 6) market dynamics (i.e., global economic and geopolitical impact of shale gas), 7) mobilization efforts (i.e., grassroots movements or the mobilization of collective action against shale gas developments), and 8) community and social dynamics (i.e., local and artistic reflections on fracking).

[8] Articles with the highest *theta* per topic which we identified from the *theta* matrix with rows representing the distribution of topics over documents.

[INSERT TABLE 3]

Second, we moved from *issue frames* to *field-level frames*. To do so, we once again leveraged our deep reading of the top articles and our extensive interview data to evaluate how each issue frame (and underlying clusters of topics from our STM output) portrayed the concept of shale gas in relation to a country's historical energy strategy. This was an iterative process, where we revisited Figure 2 to closely examine the peaks and troughs of topic prevalence in each country over time, while referring back to the top articles to contextualize these trends and to the interviews to validate our interpretations. Through this process, we identified how issue frames were interconnected within each country and how they differed between countries. Guided by the interviews, we were able to further understand how issue frames relate to each country's historical energy policy and uncover the underlying foundations shaping the debate within each country. This comprehensive analysis allowed us to group issue frames into the overarching field-level frames within each country (see Table 3).[9]

Our aggregation process—from *topics* to *field-level frames*, as summarized above and depicted in Table 3—can also be seen in Figure 3, which plots the correlations between topics from our STM output. Topics discussed primarily in Germany are shown in blue nodes, whereas topics discussed primarily in France are shown in beige nodes. Topics discussed in both countries are shown in white nodes. Issue frames that cluster these topics are also overlaid on this plot with their respective labels (blue for Germany and red for France).[10] Validating our analytical strategy and aggregation process, the graph highlights two separate clusters (left vs. right), thereby reflecting two distinct field-level frames.

[9] During this process, we noted that some issue frames contained what seemed to be *both* elements of conflict and alignment (rather than just one). However, because the focus of this study is on *differences* between France and Germany's field-level frames, as opposed to their similarities, we bracketed this combined frame in our findings section.

[10] For the sake of parsimony, the graph excludes issue frames that load into *both* field-level frames.

[INSERT FIGURE 3]

Findings

Our STM analysis and analytical framework reveal distinct field-level frames in France and Germany. Given their historical focus on nuclear energy and longstanding efforts to shift away from fossil fuels, the public discourse in France portrayed shale gas as fundamentally inconsistent with the country's historical energy mix and a direction that would jeopardize its transition towards a more sustainable future. We define this as a *conflicting* field-level frame. In contrast, because of their historical reliance on coal, the public discourse in Germany viewed shale as a comparatively cleaner fossil fuel and portrayed fracking as a practical extraction technology to cheaply obtain a transitional energy source. We refer to this as an *aligning* field-level frame.

In what follows, we first detail the content of these two field-level frames captured by our STM analysis of the news media. We then leverage our rich interview data to identify potential mechanisms that elaborate upon *how* France and Germany's unique historical context shaped the construction of these field-level frames.

France: A Conflicting Field-Level Frame

France's conflicting field-level frame consists of the following issue frames: energy policy debates (topics 2, 3, 5, 8, 12, 13, and 19), mobilization efforts (topics 20 and 28), and innovation and R&D (topic 27) (see Figure 3).

France's conflicting field-level frame first emerged in the media with the issue of energy policy debates. Such debates captured an abstract inquiry into the nature of renewable energies and the future of the environment. Instead of exploring the more specific idea of shale gas extraction and its related technologies, French actors maintained the debate at the ideological level. As a French environmentalist stated:

> This is a societal debate. We are really at the heart of the energy transition question: Should we continue to explore the possibilities of fossil fuels to a maximum or shift to a mode of energy transition where we distance ourselves as fast as possible from fossil fuels? (French Environmentalist-1)

The discourse remained ideologically-laden even when the discussion addressed the more specific topic of extractive fossil fuel technologies. It emphasized how these technologies pose a fundamental risk to the climate and overall environment. The following article demonstrates this point:

> "[The Federation of Regional Natural Parks of France] mobilized to express their fears about the social, economic, and environmental consequences, especially on water reserves. Indeed, the water resource is highly threatened due to an important need in the technique of hydraulic fracturing. Part of this water containing many chemical components is not recovered and resides in the basement. (…) Moreover, the exploitation of a fossil resource, releasing methane, runs counter to a policy of struggle combating climate change or promoting energy savings and energy development renewables" (330).

Similarly, when the topics of R&D efforts and innovative technologies emerged in the media, they were met with skepticism and an overall resistance to the idea of exploring ways to make shale gas extraction safer. As one article noted, even the idea of "conducting research on the techniques of exploitation of shale gas, [is] very controversial" (17406). Given the presumption that shale gas extraction was damaging to the environment, little research was sought in France to even explore the degree to which shale gas extraction was truly as problematic as most assumed.

Interestingly, the conflicting field-level frame was shared between shale gas opponents and proponents alike. For example, opponents (e.g., environmentalists and opposition politicians) called for a shale gas ban. They engaged in protests and demonstrations, creating community awareness and rapidly raising widespread opposition to

shale gas. Protesters "mobilized in Paris as part of the World Day Against Hydraulic Fracturing" (22279), arguing that the focus should be on developing renewable energy infrastructure "for a more sustainable development" (196). Similarly, proponent politicians who were open to shale gas admitted that the critical question was really about the paradigm society wanted for alternative energies. A supportive French politician noted that "the question of shale gas is but one small part in an overall coherent policy frame on the energy transition" (French Politician-5), and another proponent politician concluded that: "Even if the fracking technique was without risks, we will not exploit shale gas since it is still a fossil fuel" (French Politician-4).

Taken together, the debate in France remained entrenched in abstract ideological concerns about renewable energy and their historical energy mix, thereby ignoring the more concrete issues of extraction technologies and their potential. Even though "nearly one in two French people thinks it is necessary to stop nuclear energy" (1060), the conflicting field-level frame that emerged in France's public discourse made it clear that shale gas was not a replacement. As one environmentalist said: "Even if they fracked with tomato juice, I would still be against it" (French Environmentalist-3).

Germany: An Aligning Field-Level Frame

Germany's aligning field-level frame was built around the following issues frames: environmental and social governance (topics 7, 10, 16, 18, 29, and 30) and energy security (topics 6, 14, and 23) (see Figure 3).

Germany's aligning field-level frame first emerged in the media with the governance issue. Instead of dismissing fracking at an abstract level, as the French did, when German stakeholders talked about regulation, they were focused on figuring out how to best regulate the specific technology and the best extraction modes. One article notes that the Federal Environment Agency:

> "recommends a comprehensive risk assessment of all fracking projects for gas and oil production" (7476) and "urges rapid legal regulation for the risk technology fracking. 'Close guardrails are needed to protect the environment and health,' said President Maria Krautzberger" (8142).

Similarly, the Association of Municipal Enterprises and the Alliance of Public Water Management, representing public utilities and municipal enterprises, called for comprehensive regulation to protect drinking water from the dangers of fracking, encouraging the involvement of water authorities and municipalities:

> The Alliance of Public Water Management, as a representative of the public water utilities and wastewater companies and the "Soil and Water" Associations, calls on the Bundestag to prioritize the protection of nature, water resources, and drinking water supply when dealing with the topic of fracking. (11027)

The idea that fracking technology would "be possible in Germany only under strict conditions" (7506) made clear the assumption that shale gas was presumed to be already aligned with their existing energy mix, and that they could move on to consider its extraction techniques. This practical, as opposed to ideological, approach also emerged in the media surrounding the energy security issue. Indeed, there were calls for more research to understand the risks better:

> ""The technology is not yet sufficiently researched," said Environment Minister Lucia Puttrich (CDU)" (8363). "Although health protection is a priority, we do not want to close ourselves for all times for purely ideological reasons against new techniques or funding methods" (7206). And Norbert Brackmann wants further research on the technology to be carried out: "I find it irresponsible to ban research." (8672)

This more concrete focus on extractive technologies also led to examining the technical differences between conventional fracking (i.e., vertical drilling) and unconventional fracking (i.e., horizontal drilling). While this distinction was initially introduced by proponents of domestic gas extraction, it was embraced and reused by opponents as well. For instance, a German environmentalist remarked, "There is fracking, and there is fracking..." (Environmentalist 2-Germany), by which they meant that some extraction techniques are better and potentially safer than others. German politicians also supported this by arguing that "the fracking fluids that are used to crack the rocks are an orange juice cocktail compared to what comes up with the flow back…If we treated the flow back, I think then we would get a higher acceptance by the people who are reasonably open to energy and technology" (Politician 3-Germany). By distinguishing different extractive technologies, German actors portrayed fracking as potentially contributing to the country's energy security:

> In principle, Germany should no longer resist the production of shale gas and explore its shale gas resources on a 'scientific basis'. (8944) We are, therefore, very in favor of approaching shale gas on a scientifically sound basis rather than just saying, no, that's dangerous; we don't want that. (9795)

This more concrete focus also led proponents and opponents alike to a narrower set of what they viewed as the primary risks of fracking: earthquakes and water contamination. The discussion on earthquakes focused on communicating research findings linking fracking to seismic activity, arguing that "since many such disruptions are unknown, authorities, industry, and academia must work closely together when fracking expands into new regions" (8013). The discussion on water protection mobilized various proponents and opponents calling for fracking regulations. For example, Maria Krautzberger, President of the German Federal Environment Agency, advocated for strict rules and safeguards for water protection,

including a ban, but only when fracking happened in certain sensitive areas. Breweries and mineral water companies similarly orchestrated a strong mobilization in favor of water protection:

> Fracking is a danger to water and, therefore, to the beer — at least in the opinion of the brewing industry, which opposes the gas production method. For the Berg Brewery, it's all about basics: 'Water is a basis for life and survival that cannot be dispositioned,' says a statement in which brewery chief Ulrich Zimmermann argues against the controversial fracking. (4838)

Taken together, the overall debate in Germany focused more narrowly on the practical ways to use and regulate the safest fracking technologies available. By portraying fracking as being already aligned with their existing energy mix, proponents and opponents sidestepped the discussion of more intractable issues—such as the broader implications of fracking for climate change, as we saw in France—from entering the debate. Indeed, a German political advisor noted: "Gas is more environmentally friendly than other energy sources. It's better than brown coal. It's better than stone coal. Hence, gas is a safe bridge fuel before we can practically rely 100% on renewables" (Politician 3-Germany).

How Historical Context Shapes the Construction of Field-Level Frames

The above findings show that the shale gas debate was framed very differently in France compared to Germany. However, while these differences seem to reflect the unique historical contexts of France and Germany's energy policies, our STM results cannot explain *how* historical context might shaped the construction of these field-level frames. This section aims to draw this connection by leveraging our rich interview data. In doing so, we identify three sequential mechanisms—historical positioning, issue labeling, and bounded mobilization—through which France and Germany's histories appear to have constrained the construction of their field-level frames that emerged decades later.

Historical positioning. The first and most important mechanism explaining how France and Germany's historical context influenced their field-level frames is *historical positioning.* This mechanism embedded the concept of shale gas within each country's historical understanding of energy production, leading the concept of shale gas to take on entirely different meanings in these two countries.

In particular, because France has historically emphasized nuclear, the concept of shale gas was positioned as just another fossil fuel and was, by definition, a non-starter. "France has no oil, no gas, no coal. We have nuclear," GDF Suez boss Gérard Mestrallet noted (978). Given this longstanding history, stakeholders were focused not on the way shale gas could be extracted in novel and inexpensive ways (as in Germany) but instead on the fact that shale gas could not be considered in the first place. One environmentalist noted: "Today we fight against the use of fossil fuels. Full stop. Whether it is shale gas, oil, or uranium" (French environmentalist-7). This is further illustrated in the following quote:

> The Minister of Ecology Nathalie Kosciusko-Morizet reiterated Tuesday that it was "out of the question" to use "extracting processes that would have a disastrous ecological impact" to exploit shale gas. It is out of the question to have recourse in France to the means of extraction processes that would have a disastrous environmental impact," Kosciusko-Morizet said in a debate in the Assembly National on shale gas. "It would be a step backward from everything we did and wanted together," she continued. (1164)

In contrast, because Germany has historically relied heavily on fossil fuels (i.e., coal), shale gas was positioned as an improvement upon their existing fossil fuel energy mix. Given that "coal, oil, and natural gas are at the top of German consumption" (466), the fracking technique was positioned as a pragmatic alternative to help the country transition away from even dirtier fossil fuels. Indeed, when comparing the differences between the electricity

produced from fracking and that generated from other fossil fuels, fracking was positioned as helping the country's energy transition within, and eventually out of, the fossil fuel space: "The use of domestic shale gas could make the energy transition affordable" (6311). Even the German Green Party, while opposed to fracking, prioritized it as cleaner than coal:

> "Gas is a cleaner energy source than stone coal until we can cater to our needs completely with renewables. This will probably take some more time and thus we need to make sure that our power plants run as cleanly as possible, also with regards to CO^2 emissions". (German Politician-1)

The unique historical contexts of France and Germany led to the issue of shale gas being positioned, and therefore understood, entirely differently. In France, discussions emphasized the fundamental incompatibility of shale gas as a fossil fuel, whereas the debates in Germany focused on the fracking technologies and how shale gas extraction is preferable to coal mining. Taken together, as one article aptly notes: "the choice of such energy [shale gas] or technology [fracking] is complex and remains linked to a country's history, development, resources or culture" (2292).

Issue labeling. The historical positioning of shale gas within France and Germany's understanding of energy, in turn, constrained stakeholders in terms of how they could label the overall debate. Thus, *issue labeling* builds on the prior mechanism, recasting the way the concept of shale gas was embedded within France and Germany's historical context as a label that defined the focus of the overall debate.

In France, the country's positioning of shale gas—being just one of many fossil fuels—was a non-starter that led stakeholders to see this debate in an abstract and ideological manner, prompting actors to label it as the "shale gas issue." Indeed, being historically unwilling to consider fossil fuels as a step forward, shale gas naturally became a non-negotiable and "red line" even when better technology became available. This historical view

of fossil fuels in general, and shale gas in particular, is captured when a French Politician commented: “I consider that shale gas exploitation can only slow down the (energy) transition. It can only be a brake” (French Politician-4).

In contrast, in Germany, the country’s positioning of shale gas as an improvement upon existing extraction techniques of other fossil fuels led stakeholders to see this debate in a more concrete and pragmatic manner, consistently labeling it as the “fracking issue.” As a German politician noted: “Our main enemy is coal. As long as fracking allows us to decrease our coal consumption and replace it with gas, I’m happy with it” (German Politician-6). Labeling the debate as the “fracking issue” also led German actors to focus on more specific technological risks associated with fracking, such as groundwater contamination, and the technological opportunities to manage those risks. “If industry treated the toxic fracking fluids that flow back to the surface, then I think this would add to the acceptance of the people who are generally open to energy and technology.” (German Politician-1).

Thus, once the concept of shale gas was positioned within France and Germany’s unique historical contexts, the overall debate emerged as either an abstract and ideological fight against fossil fuels or a concrete and pragmatic exploration of technological improvements to existing extraction techniques.

Bounded mobilization. The final mechanism reflects how—given the way shale gas was historically positioned within France and Germany’s contexts, which in turn constrained how stakeholders labeled the issue—only certain actors were drawn in to participate. Indeed, abstract and ideological debates attract and require the mobilization of different stakeholders compared to debates that emphasize the more technical outcomes of fracking.

France’s ideological debate surrounding the abstract “shale gas issue” immediately incensed environmental opponents, who protested “to express their fears about the social, economic, and environmental consequences” (330). Governmental leaders, who had little to

no appetite to return to dirtier and non-renewal fossil fuel energy options, picked up on these protests and intervened with the passage of Jacob's Law, which banned fracking. Moreover, given the ideological and closed nature of this debate, there was no need to involve a broad range of stakeholders in debating the risks and benefits of fracking technologies, as such considerations were simply out of scope.

In contrast, Germany's more technically driven debate surrounding the "fracking issue" called for a more diverse range of stakeholders. Industrial proponents and environmental opponents alike explicitly asked for scientific experts to participate and evaluate the risks of fracking: "We want citizens to learn about this method and its implications and want to mobilize the public" (1043). The collective objective was to understand whether fracking constituted a relative improvement over coal and if these improvements were worth the new risks. Such a debate required more voices and "people to be engaged" (4243) to come to a resolution.

The historical positioning and labeling of the issue within France and Germany thus led to very different actors participating in the public discussion. France's ideological positioning and abstract labeling produced a relatively closed-off debate, where technical questions about fracking were largely ignored, and protesters and government officials led the charge to shut down the issue. In contrast, Germany's more practical positioning and concrete labeling produced a far more open debate that required the mobilization of various voices to identify the technical issues and potential benefits of these extraction technologies.

Discussion

This study investigated the debates on shale gas in France and Germany. By leveraging a novel methodological approach to analyze over 25,000 newspaper articles and 78 in-depth interviews, we revealed how France and Germany's field-level frames regarding energy production were shaped by their unique historical contexts. We offer a rare comparative lens

that sheds new light on the role of history in the construction of field-level frames as well as provides a novel methodological approach to conducting systematic and comparative multilingual frame analyses using STM.

How Historical Context Shapes the Construction of Field-Level Frames

Framing scholarship has long argued that field-level frames are the result of agentic and strategic action, whereby actors can select readily accessible frames that best achieve their goals (Benford & Snow, 2000; Cornelissen & Werner, 2014). However, studies over the last few decades have started to emphasize the role of context—from political opportunity structures (Gamson & Meyer, 1996; Mooney & Hunt, 1996) to cultural discourses (Giorgi et al., 2019; Weber et al., 2008)—and its influence in shaping field-level frames and framing activities. Our study extends this conversation in several ways.

First, we offer a rare comparative lens that examines the same contentious issue simultaneously emerging in two countries' public discourse, thereby allowing for a direct comparison of field-level frames. Prior work primarily investigates frames and framing activities that have emerged within a single context rather than a comparison across contexts. Cornelissen & Werner (2014) suggest that this has led to research questions focusing primarily on "active struggles over meaning" within a single setting (p. 208). While exploring framing disputes, counter-framing efforts, and frame change within a single context is important (e.g., Benford, 1993; Gamson, 1992; Gurses & Ozcan, 2015; Kaplan, 2008), our study's comparative approach to the content of two countries' field-level frames shows that two countries can construct entirely different interpretations of the same contentious issue over the same period of time.

Second, these results also offer new insights into *how* historical context shapes the construction of field-level frames. Although organization theorists have recognized that the past plays a vital role in shaping the present (e.g., Hannan & Freeman, 1984; Zucker, 1977;

Ocasio et al., 2016), framing scholars have focused more on how political opportunity structures and culture codes influence field-level frames (for a review, see Cornelissen & Werner, 2014; Giorgi et al., 2019; Weber et al., 2008), and less on the historical contingencies embedded within a given context. One recent exception is a paper by Bohn and Rogge (2022), who examined the media debate on electric vehicles in Germany and the United Kingdom, revealing essential differences in the field-level frames that emerged in each country's public discourse. While these findings are an important first step, key questions arise that require investigation. For example, *what aspects* of a country's historical context could have driven these differences, and *how* exactly does it shape the construction of its field-level frames?

We shed light on these questions. In particular, our findings identify France's historical investment in nuclear and Germany's historical investment in coal, both mainly dating back to the 1970s, as the critical difference in their country's historical contexts that shaped the construction of their field-level frames surrounding shale gas. Indeed, these longstanding historical differences established the historical context—or the material practices, beliefs, and values that operate as "latent meaning structures that organize social and cultural experience" (Cornelissen & Werner, 2014, p. 207)—within which actors in both countries sought to interpret and make sense of the concept of shale gas when it emerged as a topic for discussion in the mid-2000s. Moreover, starting with these longstanding historical differences in how France and Germany invested in energy production, our findings also identified a set of three sequential mechanisms through which these countries' historical contexts shaped the construction of their subsequent field-level frames.

The first mechanism was *historical positioning*, which depicted how the concept of shale gas became embedded within France and Germany's historical energy context. France's historical investment in nuclear led them to position shale gas as an outdated fossil fuel. In

contrast, Germany's historical investment in coal led them to position shale gas as an improvement to their existing energy infrastructure. This initial positioning, in turn, then constrained stakeholders in terms of their ability to *label the issue*. While France defined it as an ideological debate that assumed "shale gas" to be a non-starter, Germany saw this "fracking issue" as an opportunity to improve existing extraction techniques. Finally, the historical positioning and the labeling of the issue defined the terms and scope of the debate in each country, as well as defined a *bounded mobilization* by specifying which actors could mobilize. Indeed, France's ideological approach encouraged the involvement of primarily environmental protesters and government officials, who led the charge to quickly shut down the shale gas issue, whereas Germany's more pragmatic approach required a wider array of voices to identify the trade-offs of fracking.

We believe that these three sequential mechanisms, which help explain *how* a country's historical context shapes the construction of field-level frames that emerge in public discourse, extend existing research on framing in at least two valuable ways. First, these mechanisms move beyond prior work that has sought to explain how framing disputes become more intense or amplified (Benford, 1993; Gray et al., 2015) and, instead, emphasize how the content of such field-level frames is constructed in the first place. More specifically, before considering how field-level frames get amplified or more intense within a single context, this study seeks to investigate where the content of these field-level frames comes from in the first place. In this regard, our findings offer initial support for Cornelissen and Werner's suggestion that historical practices, beliefs, and values operate as "latent meaning structures that organize social and cultural experience" (2014, p. 207), serving as the cultural tools actors use to generate field-level frames when contentious issues arise.

Second, the sequential nature of these three mechanisms offers new insight into the temporal nature of how the prevailing context shapes the construction of field-level frames.

Prior work on frame amplification, for example (Benford, 1993; Gray et al., 2015), tends to focus on specific mechanisms and how they operate alongside one another and less on how they relate to one another or how they might even be contingent upon one another. Our findings suggest that the mechanisms through which historical context shapes the construction of field-level frames unfold sequentially, constraining the meaning construction, labeling of the issue, and participation in the debate. Indeed, our findings suggest that who participates in a debate (i.e., *bounded mobilization*) is contingent on what specifically is at issue (i.e., *issue labeling*), which, in turn, is contingent upon how the issue is understood in the first place (i.e., *historical positioning*). While we cannot demonstrate the universality of these mechanisms, it seems plausible that the construction of field-level frames necessarily depends upon these three unfolding mechanisms. Indeed, who participates in a debate is defined by what issue is at stake, and the issue at stake emerges from how the topic is interpreted within the extant meaning system. This possibility calls for more investigation into the temporal process by which context shapes the construction of field-level frames.

Methodological Contributions

This study also provides a methodological contribution by developing a roadmap for using STM to conduct systematic and comparative multilingual frame analyses to understand *how* historical context shapes the construction of field-level frames. While prior work often examined frames using qualitative methods like thematic content analysis to identify "the occurrence and co-occurrence of certain keywords or expressions in discourse produced by actors" (Cornelissen & Werner, 2014, p. 218), we respond to Cornelissen and Werner's (2014, p. 220) call for the scholarly conversation to build on "recent methodological advances" to identify latent themes in large datasets. Our study provides one of the first examples of how to systematically conduct comparative, multi-lingual research to study field-level frames using STM. Specifically, our methodology highlights the value of incorporating

metadata into the STM, enabling researchers to make systematic comparisons across multiple contexts and gain a deeper understanding of the historical context in which field-level frames are constructed, thereby filling a critical gap in the current framing literature.

Our methodology also addresses two key challenges in framing studies: managing large volumes of data and overcoming language barriers. First, large textual data in different languages presents significant challenges for researchers aiming to draw systematic field-level frame comparisons. Despite the advantages of using recent advances in NLP for the "inductive discovery of systematic patterns in large quantities of textual data, to date, topic modeling is primarily used to understand text corpora written and published in one language only – most commonly in English" (Lind et al., 2022, p. 96). Our study advances this work by translating French and German articles into English to illustrate how researchers can use STM to study multilingual, non-Anglo-Saxon contexts. In doing so, our work also illustrates how to leverage the abundance of textual data in different languages, further enhancing our ability to systematically tackle comparative framing research questions.

Second, our findings illustrate how STM enables researchers to extract topics from multilingual texts and aggregate them into broader field-level frames, providing a roadmap for scholars interested in systematic comparisons across multiple contexts. Several promising avenues exist for researchers working with multilingual textual data. First, bilingual (Boyd-Graber & Blei, 2009) or multilingual LDA models (Boyd-Graber & Resnik, 2010) laid the foundation for multilingual topic modeling by introducing methods to draw inferences across texts in different languages. Second, multilingual topic models (MLTM) are designed "for datasets where more than one language is represented (this means that one article can be in, say German, and another article in French, but not cases where a single article exhibits more than one language). The topics that one would get from an MLTM are similar to an LDA topic except that each topic has a separate representation in the different languages that are

found in the dataset" (Zosa & Granroth-Wilding, 2019). The advantage of using multilingual LDA topic models is that they align topics across languages (Ni, Sun, Hu, & Chen, 2009). An extended version of the MLTM, the multilingual dynamic topic model (ML-DTM), captures the cross-lingual evolution of topics over time (Zosa & Granroth-Wilding, 2019). Third, polylingual topic models (pLDA) are a useful tool for "leveraging correspondences between semantically comparable documents in multiple different languages (…) to increase cross-cultural understanding" (Mimno, Wallach, Naradowsky, Smith, & Mccallum, 2009, p. 2). Finally, recent topic modeling techniques based on transformer-based embeddings (i.e., BERTopic and Top2Vec) have been developed to support multilingual data and facilitate cross-language analyses without requiring translation (Angelov, 2020; Grootendorst, 2022). Future work can thus benefit from the various tools that topic models provide for effectively handling multilingual textual data.

With this said, our methodological approach has limitations. First, in line with prior work (Aranda, Vaara, Etchanchu, & Guyt, 2024), our STM analysis predominantly relies on media representations that may only partially capture the spectrum of public opinion or the complexities of policy discussions. Future studies could benefit from incorporating a wider array of data sources, such as social media, public forums, and official policy documents, to gain a more holistic view of these processes. Another opportunity might be to incorporate more source-specific metadata, which STM allows, to explore how a newspaper's political positioning (left/center/right) influences its discourse and framing. Second, we acknowledge that the mechanisms that link France and Germany's history to present-day field-level frames are theorized primarily based on interview data. Future empirical work might consider finding ways to empirically test these mechanisms. Third, we excluded topics that contain elements of both frames from our analysis. However, future research examining the relative importance of these mixed-frame topics, compared to those loading on a single frame, may

provide additional insights into to how a given historical context affects the construction of field-level frames years or even decades later.

Finally, when considering the generalizability of this study, we acknowledge that a country's approach to energy may be particularly prone to long-lasting path dependencies due to institutional, technological, and infrastructural "lock-ins" (Fouquet, 2016). Indeed, prior studies have referred to the interlocking of these forces as "carbon lock-ins" (Goldstein, Neimark, Garvey, & Phelps, 2013), which can create resistance when transitioning to cleaner energy sources and lead to a persistence of fossil fuel dependence. In this regard, scholars might consider studying other industries to further explore the mechanisms by which a country's unique history might influence how contentious issues are interpreted and understood when they arise decades later in public discourse.

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Table 1: Research Design and Analytical Strategy.[11]

No.	Step	Description
1	*Data collection*	29,320 newspaper articles from Factiva. 78 interviews.
2	*Build a monolingual corpus*	Translation of newspaper articles to English. Data preprocessing.
3	*Select an STM solution*	Estimate STM model including selected meta-data. Examine diagnostic values (Figure 1). Qualitatively inspect candidate solutions.
4	*Label topics*	Interpret topical content in selected solution thorough reading of top articles.
5	*Assign topics to dominant country*	Explore significant temporal evolution of topics and variations in prevalence across countries (Figure 2).
6	*Aggregate topics into issue frames*	Group topics together based on extensive reading of top articles. Derive issue frames from qualitative interpretation of groups of topics.
7	*Aggregate issue frames into field-level frames*	Compare issue frames across dominant countries. Aggregate issue frames into field-level frames guided by thorough reading of top articles as well as interview data (Figure 3).
8	*Identify mechanisms*	Leverage interviews to uncover the mechanisms.

[11] Note that the analysis was iterative, involving repeated back-and-forth refinement between the STM results, interview data, and qualitative interpretations. As such, this table offers a summary of the iterative steps taken, in the general order in which they were engaged.

Table 2: Topics

Number	Label	Top Words	Dominant country
1	Global oil market dynamics	oil, price, barrel, market, countri, increas, world, produc, fall, state, declin, opec, demand, saudi, expect, energi, current, crude, global, million	
2	Industrial policy, economic competitiveness, and government incentives	tax, french, competit, govern, industri, social, compani, employ, job, increas, state, presid, report, billion, cost, holland, public, measur, shale, financ	France
3	Electoral politics and campaign dynamics	parti, left, candid, vote, campaign, presid, polit, obama, elect, first, right, front, major, social, presidenti, nation, state, democrat, green, support	France
4	Energy independence and geopolitical dynamics	gas, shale, billion, compani, energi, natur, russia, ukrain, project, poland, gazprom, countri, pipelin, lng, europ, total, shell, invest, group, suppli	
5	Policy debates on energy transition	energi, debat, transit, nuclear, environment, ecolog, confer, develop, environ, gas, nation, shale, govern, renew, presid, french, power, end, issu, reduc	France
6	Fracking technology and environmental risks	frack, gas, water, natur, germani, rock, environment, feder, environ, technolog, chemic, extract, shale, ban, controversi, method, drill, deposit, area, layer	Germany
7	Federal and regional government meetings	berlin, meet, feder, german, hamburg, topic, minist, germani, presid, report, open, munich, confer, number, servic, offic, associ, lectur, frankfurt, present	Germany
8	Legislative action on shale gas and hydraulic fracturing	shale, gas, hydraul, fractur, explor, exploit, permit, oil, techniqu, prohibit, law, hydrocarbon, govern, minist, research, ban, report, compani, french, environment	France
9	Financial markets and economic indicators	bank, market, rate, stock, euro, growth, increas, debt, investor, exchang, expect, point, financi, invest, index, price, fund, bond, crisi, valu	
10	Political debates on fracking legislation	minist, feder, spd, green, cdu, govern, frack, environ, bundestag, law, fdp, coalit, state, altmaier, union, berlin, protect, gabriel, ban, group	Germany
11	International relations and security concerns	presid, countri, protest, minist, state, afp, govern, russia, polic, former, war, militari, accord, peopl, secur, foreign, polit, unit, attack, intern	
12	Municipal law and local development projects	council, public, municip, law, constitut, work, plan, project, decis, court, mine, develop, administr, state, propos, general, oper, committe, eur, order	France
13	Environmental policy debates	minist, govern, ecolog, holland, jean, montebourg, presid, shale, gas, arnaud, nicola, sarkozi, former, socialist, ump, green, batho, prime, ayrault, eelv	France
14	Energy production and climate impact	energi, power, electr, gas, plant, coal, nuclear, climat, renew, wind, emiss, increas, price, transit, solar, countri, global, consumpt, carbon, cost	Germany

Number	Label	Top Words	Dominant country
15	Industrial energy project investments	group, unit, billion, million, invest, state, market, industri, total, eur, sector, compani, project, oper, activ, american, increas, gas, europ, profit	
16	Local community engagement in fracking discussions	frack, district, citizen, member, topic, meet, discuss, citi, group, local, associ, inform, school, work, spd, green, chairman, region, invit, peopl	Germany
17	Energy-intensive industries and energy markets	gas, industri, energi, germani, percent, compani, chemic, german, europ, price, import, increas, materi, shale, market, raw, usa, cost, howev, high	Germany
18	Societal perspectives and long-term concerns	even, time, now, mani, much, polit, still, know, just, good, dont, countri, come, long, problem, question, get, see, becom, look	Germany
19	Shale gas extraction and environmental concerns	gas, shale, exploit, unit, state, energi, extract, resourc, fractur, drill, reserv, hydraul, well, countri, explor, hydrocarbon, studi, oil, techniqu, unconvent	France
20	Local activism and shale gas projects	shale, gas, collect, permit, region, project, mayor, mobilis, peopl, meet, concern, depart, exploit, territori, municip, organis, local, saint, citizen, inform	France
21	Corporate investments and fracking	compani, billion, busi, million, group, sale, percent, eur, profit, ceo, siemen, euro, expect, share, increas, etr, industri, announc, quarter, board	Germany
22	Demographic trends and social history	old, year, peopl, live, time, man, life, children, first, famili, world, young, citi, just, last, work, car, littl, sinc, come	
23	Technical aspects of gas extraction and its consequences	drill, oil, gas, compani, frack, rock, natur, well, sand, meter, hole, deposit, state, field, deep, earthquak, area, time, high, year	Germany
24	EU trade policies	europ, trade, state, agreement, commiss, negoti, union, countri, polici, brussel, free, commission, oetting, summit, member, unit, protect, energi, germani, market	
25	Regional conflicts	paper, transmi, video, general, gmt, syria, conflict, map, format, usa, locat, africa, countri, violenc, attack, world, syrian, present, presid, archiv	France
26	Film industry and environmental themes	film, land, documentari, cinema, promis, festiv, screen, director, gasland, damon, van, matt, show, sant, gus, fox, berlinal, josh, gas, compani	
27	R&D and technological innovation	research, develop, technolog, innov, scienc, engin, car, manag, industri, univers, world, scientif, futur, compani, model, work, vehicl, system, public, exampl	France
28	Community events and educational gatherings	shale, meet, gas, place, organis, hall, associ, saint, eur, jean, school, free, room, take, open, present, debat, citi, april, march	France
29	Fracking operations and regional planning	frack, gas, natur, compani, district, drill, area, state, mine, citizen, plan, energi, search, permit, explor, extract, field, municip, method, accord	Germany
30	Water management and environmental protection efforts	water, drink, protect, associ, wast, pollut, area, environment, natur, groundwat, manag, contamin, well, suppli, qualiti, risk, treatment, dispos, chemic, toxic	Germany

Table 3: Topics, Issue Frames, and Field-level Frames

Number	Topic	Issue Frame	Field Frame
1	Global oil market dynamics	Market Dynamics	Both
2	Industrial policy, economic competitiveness, and government incentives	Energy Policy Debates	Conflicting
3	Electoral politics and campaign dynamics	Energy Policy Debates	Conflicting
4	Energy independence and geopolitical dynamics	Market Dynamics	Both
5	Policy debates on energy transition	Energy Policy Debates	Conflicting
6	Fracking technology and environmental risks	Energy Security	Aligning
7	Federal and regional government meetings	Environmental and Social Governance	Aligning
8	Legislative action on shale gas and hydraulic fracturing	Energy Policy Debates	Conflicting
9	Financial markets and economic indicators	Market Dynamics	Both
10	Political debates on fracking legislation	Environmental and Social Governance	Aligning
11	International relations and security concerns	EU Policies	Both
12	Municipal law and local development projects	Energy Policy Debates	Conflicting
13	Environmental policy debates	Energy Policy Debates	Conflicting
14	Energy production and climate impact	Energy Security	Aligning
15	Industrial energy project investments	Market Dynamics	Both
16	Local community engagement in fracking discussions	Environmental and Social Governance	Aligning
17	Energy-intensive industries and energy markets	Market Dynamics	Both
18	Societal perspectives and long-term concerns	Environmental and Social Governance	Aligning
19	Shale gas extraction and environmental concerns	Energy Policy Debates	Conflicting
20	Local activism and shale gas projects	Mobilization Efforts	Conflicting
21	Corporate investments and fracking	Market Dynamics	Both
22	Demographic trends and social history	Community and Social Dynamics	Both
23	Technical aspects of gas extraction and its consequences	Energy Security	Aligning
24	EU trade policies	EU policies	Both
25	Regional conflicts	EU policies	Both
26	Film industry and environmental themes	Community and Social Dynamics	Both
27	R&D and technological innovation	Innovation and R&D	Conflicting
28	Community events and educational gatherings	Mobilization Efforts	Conflicting
29	Fracking operations and regional planning	Environmental and Social Governance	Aligning
30	Water management and environmental protection efforts	Environmental and Social Governance	Aligning

Figure 1: Diagnostic Values

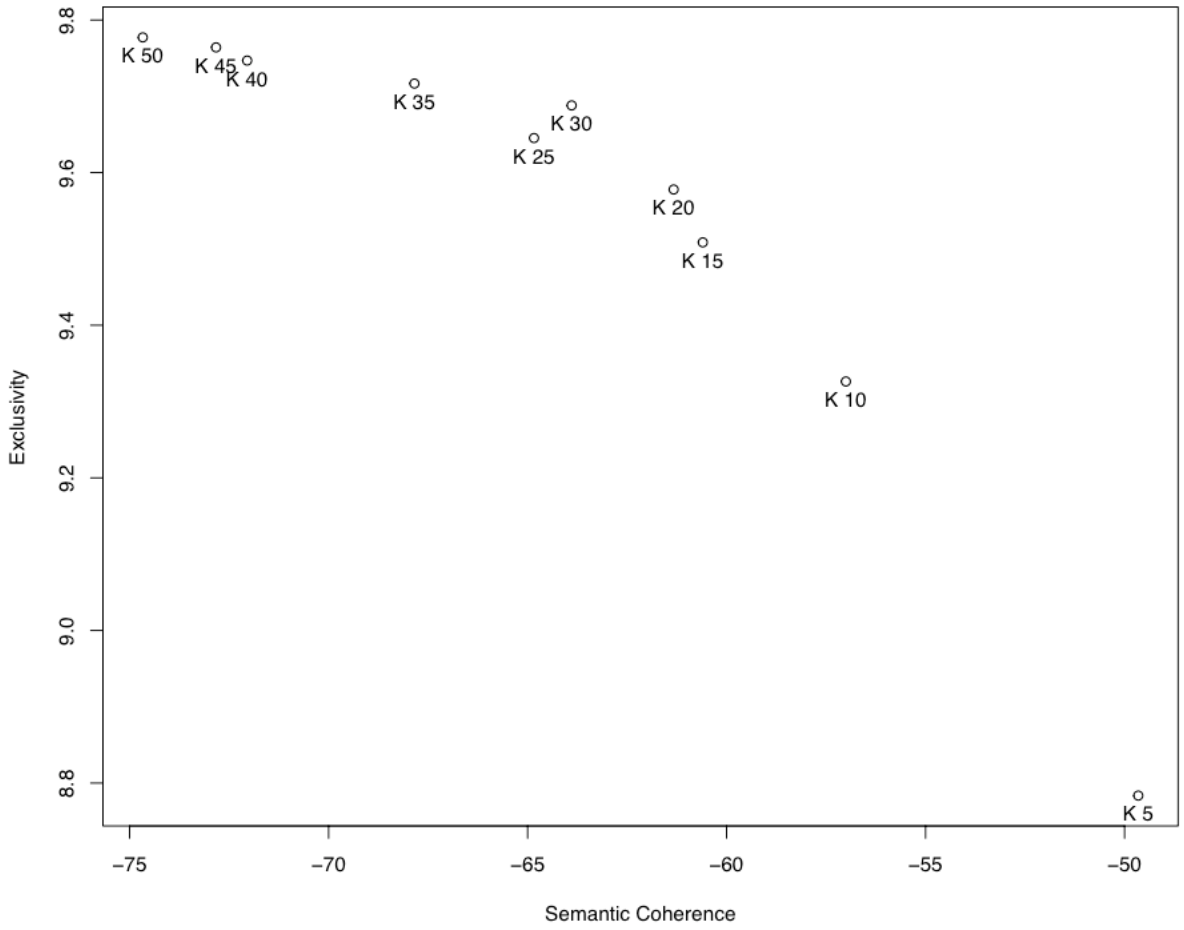
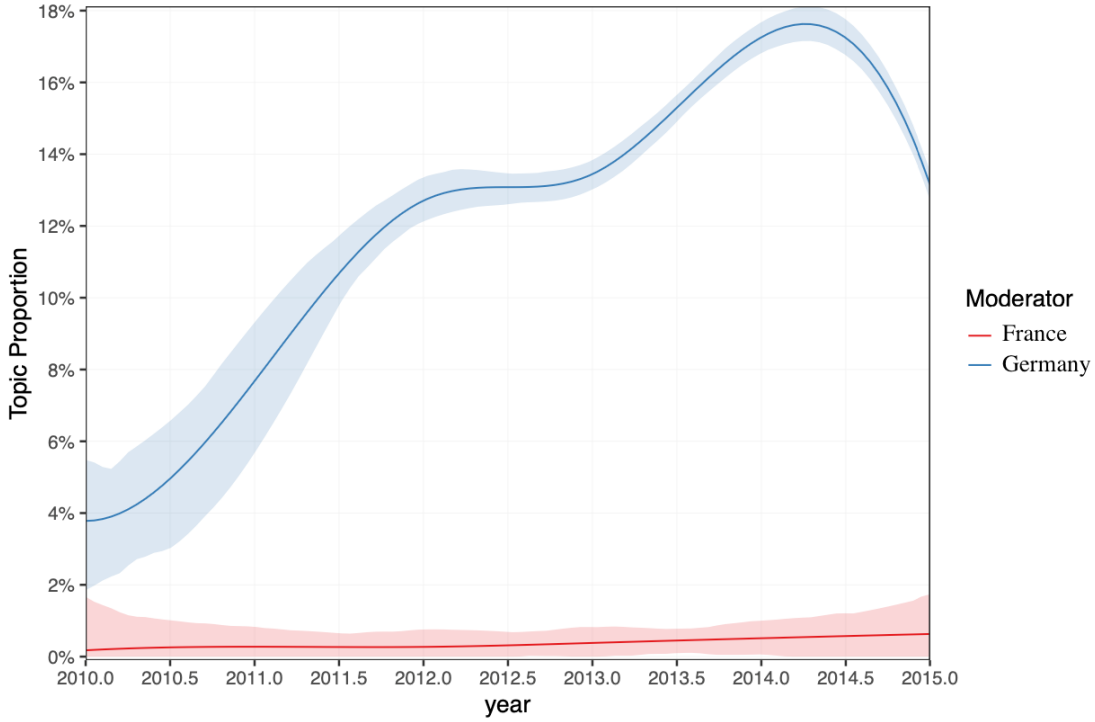


Figure 2: Examples of Topics Plotted Over Time in France versus Germany

Topic 6: Fracking technology and water usage



Topic 8: Legislative action and bans on hydraulic fracturing

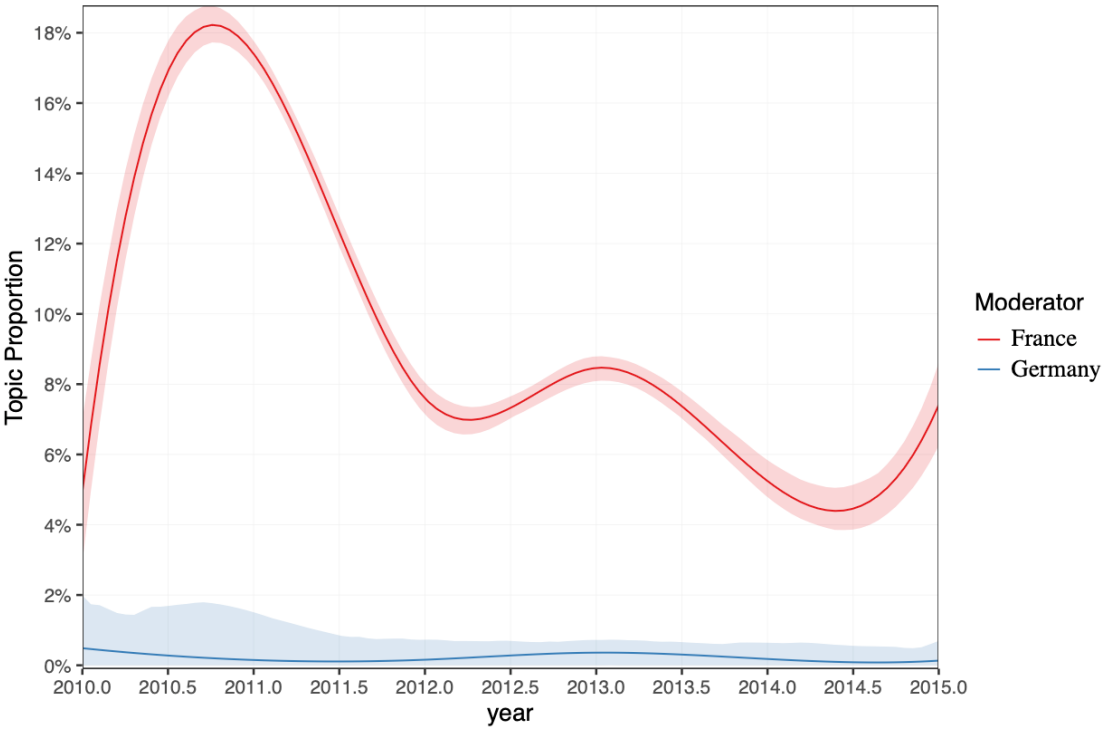
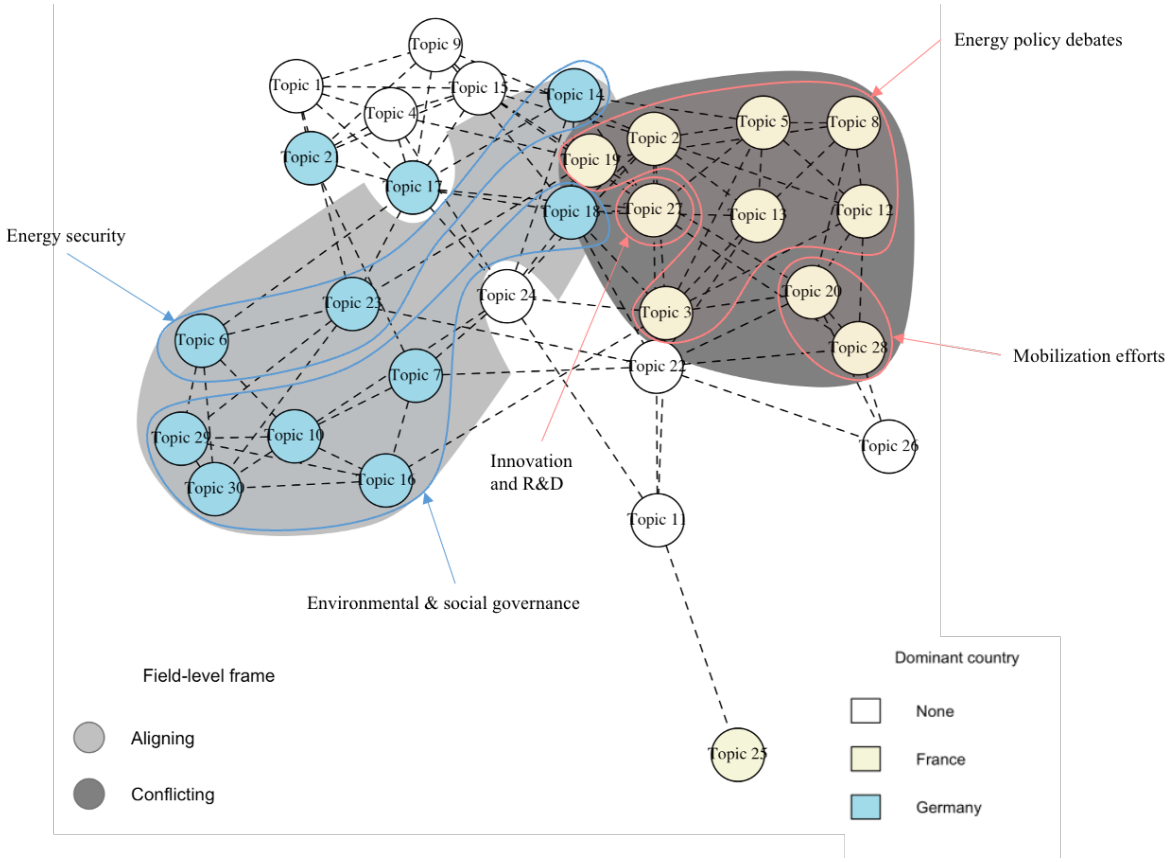


Figure 3: Topic Correlations[12]



[12] The issue frames in the graph are overlaid with blue (Germany) and red (France) colored contours.
Topic 1: Global oil market dynamics. **Topic 2**: Industrial policy, economic competitiveness, and government incentives. **Topic 3:** Electoral politics and campaign dynamics**. Topic 4:** Energy independence and geopolitical dynamics. **Topic 5:** Policy debates on energy transition. **Topic 6:** Fracking technology and environmental risks. **Topic 7:** Federal and regional government meetings. **Topic 8:** Legislative action on shale gas and hydraulic fracturing. **Topic 9:** Financial markets and economic indicators. **Topic 10:** Political debates on fracking legislation. **Topic 11:** International relations and security concerns. **Topic 12:** Municipal law and local development projects. **Topic 13:** Environmental policy debates. **Topic 14:** Energy production and climate impact. **Topic 15:** Industrial energy project investments. **Topic 16:** Local community engagement in fracking discussions. **Topic 17:** Energy-intensive industries and energy markets**. Topic 18:** Societal perspectives and long-term concerns. **Topic 19:** Shale gas extraction and environmental concerns. **Topic 20:** Local activism and shale gas projects. **Topic 21:** Corporate investments and fracking. **Topic 22:** Demographic trends and social history. **Topic 23:** Technical aspects of gas extraction and its consequences. **Topic 24:** EU trade policies. **Topic 25:** Regional conflicts. **Topic 26:** Film industry and environmental themes. **Topic 27:** R&D and technological innovation. **Topic 28:** Community events and educational gatherings. **Topic 29:** Fracking operations and regional planning. **Topic 30:** Water management and environmental protection efforts.

Online Appendices

Table A1: Media Data Sources

	France	Germany
Representative newspapers	Midi Libre Agence France Presse Les Echos Sud Ouest Le Figaro Usinenouvelle.com Reuters Le Parisien Ouest France La Dépêche du Midi Les Echos.fr Centre Presse La Croix L'Indépendant Le Progrès L'Humanité Journal de l'environnement La Tribune.fr Libération Lejdd.fr La Correspondance Economique La Voix du Nord DJ Bourse Boursier.com La Montagne	Rheinische Post Deutsche Presse Agentur Dow Jones German News Wire Bremer Nachrichten Süddeutsche Zeitung News aktuell OTS Thüringer Allgemeine Reuters Dow Jones News Wires German Bergedorfer Zeitung Hamburger Abendblatt Die Tageszeitung Energie & Management/Powernews.org Aachener Nachrichten Agence France Presse Thüringische Landeszeitung WELT online Handelsblatt Die Welt The Wall Street Journal Deutschland Weser Kurier DAPD Landesdienste Frankfurter Rundschau Nordwest-Zeitung Hamburger Abendblatt Online

Table A2: Interviews

Interview Data	Environmentalists	Business Executives	Trade Unionist	Politician	Other
France	6 • Representatives of collectives • Member of Attac France • Lawyers • France Nature Environment members	21 • Schneider Electric, sustainability director • ENGIE E&P, CEO • Vermilion Energy (various positions) • Total (various positions) • Hess Oil France, Head of communication and public affairs • Halliburton, Vice-president • Shell (various positions) • HSE director • ENGIE, responsible for communication on shale gas • Schlumberger, president board of administration	2 • Ufip (General director, and Director for Exploration & Production)	13 • PS (various positions) • DVG, mayor of Saint-Étienne-de-Boulogne • EE-LV, Mayor of Lagorce • Senate counselor • National Assembly, president of sustainability commission • Deputy of Gard department • Honored deputy of Manche • Prime minister's energy advisor • Finance minister's energy advisor • Mayor of Parentis • Assistant director of ministry for economic regeneration	2 • Academy of Technologies, President of the Energy and climate change commission • Evershed, Partner

Interview Data	Environmentalists	Business Executives	Trade Unionist	Politician	Other
Germany	5 • Head of German local collectives against fracking • Coordinator of the anti-fracking-movement in North-Hesse • Mining engineer • Free journalist, member of citizen collective • BUND, fracking expert • Lawyers	5 • ENGIE, chemical engineer • Wintershall (various positions) • ENGIE, PR manager • ExxonMobil, PR manager	3 • WEG (various positions) • BDI, Energy and climate politics	7 • Ex member of European parliament • Lower Saxony Environmental ministry • Piratenpartei Regional assembly North Hesse • CDU (various positions) • Die Grünen (spokepersons on energy)	3 • GFZ, German geological research institute • UBA (Federal Environmental Agency), fracking studies coordinator
EU	2 • Friends of the Earth Europe • Food and Water Watch Europe	2 • European Union Affairs for ExxonMobil and OGP • ConocoPhillips, OGP	3 • Shale Gas Europe, communications consultants • OGP (Oil and Gas Producers)	3 • European Commission: DG Energy, DG Climate, and DG Environment	1 • Professor for energy and social impact
Total	*13*	*28*	*8*	*23*	*6*

Table A3: Media Quotes*

Topic number	Quotes from the media (Top words in **bold**)
1	Through the fracking method, more and more **crude oil** is being produced in the United States. (7936, DPAFX, 2014) One of the main reasons for the downturn in **oil** prices is that, thanks to the fracking production method, the US is less dependent on oil imports from the **world** market. This slows down **demand** on the **global** market. (8324, DPAFX, 2014) The continued rise in the US production of **crude oil** through the fracking method ensures a growing supply. (7825, DPAFX, 2014) Coal, oil and gas would dominate the **global energy** mix beyond 2030 — because demand and production would continue to **increase**. Fracking, especially in the United States, has nurtured hopes for long-lasting prosperity through fossil energies. (4021, HNDBLT, 2013)
2	Another proposal, the resumption of **shale** gas research in France, has already been rejected by the **government**. (17523, VOINOR, 2012) To improve **French competitiveness**, Mr Gallois suggested some 20 other **measures**, including a resumption of research on **shale** gas. But this proposal was rejected as early as Monday by the **government**. (17493, AFPFR, 2012) Mr Ayrault immediately rejected another proposal by Mr Gallois: resumption of searches on exploitation **shale** gas that clashes with the categorical opposition of ecologists, members of the coalition **government**. (17474, CNPRES, 2012) At a time when electricity prices are rising in Europe and growing **industrialists** leave our continent, France benefits from abundant and affordable electricity. This asset, we must defend and preserve it, while rebalancing our energy mix according to the commitment of the **President** of the Republic. This strategy is complementary to our energy transition project, to install renewable energy at a high level, while reducing the share of nuclear. On **shale** gas, the Prime Minister recalled that there is environmental damage that is not acceptable. Current hydraulic fracturing technologies in some cases cause irreversible pollution that we cannot tolerate (…). As long as we do not have a clean technique, there is no question of getting into **shale** gas. (5226, BREMNA, 2013)
3	Europe Ecology is progressing through opposition to planned shale gas exploration. (12450, HUMAN, 2011) “We could not make an alliance with a **party** that defends nuclear power and the exploitation of shale gas,” explains Marine Tondelier, elected EELV to the mayor of Henin-Beaumont. (12450, HUMAN, 2011) The shale gas case (...) led to an emotional **vote** in favor of Europe Ecology. (12451, CNPRES, 2011)
4	In May 2012, Royal Dutch **Shell** and Chevron secured the concession to develop Ukrainian **shale gas** fields...These fields are expected to provide Ukraine with the opportunity to cover up to 10 percent of total domestic **natural gas** consumption in 2020. (5698, PRNWDE, 2013) “We see **gas** as a reliable and efficient component in the future **energy** mix and as an important addition to building renewable **energy**” [said Tony Cocker, CEO of E.ON **Energy** Trading]. (48, VWDUNT, 2010)
5	**President** François Hollande affirmed] “If it is necessary to rebalance the place of the atom in the **energy** mix”, he considers “unrealistic to want to **reduce nuclear** and oil while finding money to finance (**energy**) **renewables**”. And François Hollande condemned the exploitation by hydraulic fracturing of **shale gas** in a speech at the **environmental** conference that was well received by **environmentalists**. (…) “If research evolves on this technique, it will be time to talk about it again” he added. (5681, BGDZEI, 2013) François Hollande, under pressure from NGOs seeking guarantees on **nuclear**, **shale gas**, biodiversity or 'green' taxation, opens Friday the **ecological** chapter of its five-year term with the **environmental** conference promised during the **presidential** election. Of the five thematic round tables (**energy**, biodiversity, health, taxation, governance), the one on **energy** promises to be electric. With particularly sensitive topics on the menu such as **nuclear**, **shale gas** or drilling offshore oil tankers. This round table, (...) must mainly serve to frame the much-anticipated **national debate** on the “**energy transition**,” (...) industrialists as NGOs will obviously be very attentive to the “signals” sent by the **government** on the atom or **shale gas**. (5457, SDDZ, 2013) François Hollande opened yesterday the **environmental** conference by announcing the closure of the Fessenheim **nuclear power** plant at the **end** of 2016 and the release of **shale gas** exploration permits. (16763, CHARLI, 2012)

Topic number	Quotes from the media (Top words in **bold**)
6	**Fracking** seems to be the way out of the energy mix. While the energy companies are cheering, however, critics are violently alarming. They warn of high risks to the country and point to the United States. There for years **gas** spearing faucets and poisoned ground **water** have been stirring fear. (4604, FDG, 2013) The **extraction** of **gas** from underground **shale gas layers** in Europe will not lead to as low energy prices as in the US, said Cefic President Kurt Bock in Munich on Friday. (…) At present, there is not a single **drill** permit in **Germany**. There must be progress here. "It would be stupid to ignore the chances of **shale gas**," he warned. "**Shale gas** should be seen as part of a broad **energy** mix", Bock demanded. In **Germany**, the **technology** is highly **controversial**. During **fracking**, **water** and **chemicals** are pressed under high pressure into low-lying **rock layers** to release the **gas deposits** therein. Critics fear that the use of **fracking** leads to unacceptable and uncontrollable risks to the **environment**. Before the election, the **German** government from CDU and FDP could no longer agree on a draft law regulating **gas extraction** from deep **rock layers**. On the other hand, the **technology** is now widely used in the US and ensures low energy prices, which benefit both industry and private consumers. (6331, RHEPO, 2014)
7	A Canadian company wants to investigate northern Hesse for possible natural gas deposits and extraction by means of so-called "fracking". The method of conveying is controversial because the groundwater could be polluted. The Environment Committee of the Landtag discusses the application of the Canadian company on Thursday. The feature explains the opportunities and risks of "fracking". (762, DDPLD, 2012) Lower Saxony groundwater **lecture** "fracking and possible effects on groundwater". (2969, DDPLD, 2013)
8	In France, **shale gas** is subject to controversy. **Environmental** activists and local elected officials point to **environmental** risks of extraction processes, in particular for water pollution. (1959, BREMNA, 2013) A parliamentary committee passed a bill to **ban** in France **exploration** and **exploitation** of unconventional **hydrocarbons**, **shale gases** and **oils**. (17773, AFPFR, 2012) Total wants to continue searching for **shale gas** in southeastern France, as part of an exclusive **permit** obtained in 2010, but without the use of **hydraulic fracturing technique**, now **banned**. (14242, BERREP, 2011) **Government** to repeal three **shale gas exploration permits** in southern France granted in March 2010, indicated Le Figaro on its website. (14278, CNPRES, 2011)
9	Exxon Mobil and Chevron are under pressure from their **investors**, who have been more than 30% demanding greater transparency regarding the environmental impact of the exploitation of oil and shale gas. (13600, REUTFR, 2011) Osborne: a 'sovereign **fund**' will be established for northern England, financed by shale gas taxes. (25257, RTDJFR, 2014)
10	Countries argue over nuclear bearings. Meanwhile, **government** factions agreed on a bill on controversial **fracking**. Accordingly, drilling for shale gas in **German** soil is permitted under strict conditions. (8363, OTS, 2014) As long as essential risks of this technology are not yet predicted and controlled, there should be no **fracking** in **Germany** for the extraction of shale gas. (795, WESKU, 2012) The Grand **Coalition** is planning legal regulations for controversial gas **fracking** before the summer break. (8392, KOLDUM, 2014)
11	The discovery of shale gas, which has triggered a boom especially in the U.S., could, according to experts, push prices. For Gazprom and the **Russian state** budget, whose revenues come mainly from the energy sector, this could have drastic consequences. (3964, WELTAK, 2013) With the exception of Poland, Europe refuses to exploit the potential of shale gas for ecological reasons. The whole world is relying on gas, and we have not foreseen this new development. The result: The **United States** is expanding its competitive advantage. (4900, SPGL, 2013) **Russia** sees the shale gas revolution as a threat to its own prosperity, **President** Vladimir Putin made clear last year: The shale gas boom will seriously change the global energy market. (…) Moscow wants to ensure Europe's continued dependence on **Russian** gas. (7759, RHEPO, 2014)

Topic number	Quotes from the media (Top words in **bold**)
12	The Junas City **Council** was held on Wednesday to address **public** concerns over shale gas and its potential environmental hazards. (12801, MIDLIB, 2011) **Council** calls for moratorium on shale gas exploration and implementation of a **public** debate necessary for any **decision** concerning the prospecting and exploitation of shale gas. (13880, MIDLIB, 2011) The elected representatives of Chamborigaud have positioned themselves against exploitation and exploration of shale gas by highly polluting methods and asked the **government** to withdraw permits granted on French territory. (13630, MIDLIB, 2011)
13	Senator Europe **Ecologie-Les Verts**, **Jean**-Vincent Placé, criticized on Friday the replacement of Nicole Bricq at the Ministry of **Ecology** by Delphine **Batho**, believing that it was 'an eviction' and 'a funny message' sent to environmentalists. He argued that the **former** PS Senator, appointed Thursday night, defended 'the environmentalists' positions on **shale gas** in particular. (20537, AFPFR, 2013) Some economic powers did not accept the level of ambition I set for the energy transition,' particularly on the question of **shale gas** and the reduction of the share of nuclear power in France, she [Delphine **Batho**] said. (20523, AFPFR, 2013) There are 'double standards,' when we talk about **ecology**. (20538, AFPFR, 2013)
14	"We have voted for a healthy **energy** mix that relies on both **renewable energies** and much-needed conventional **energy** sources such as **gas**. **Nuclear energy** or shale **gas** cannot be excluded," said Herbert Reul, after the plenary vote on the EU **energy** roadmap on Thursday. (3886, BGDZEI, 2013) On the other hand, in the United States, which remains one of the most polluters, 200 million tons of CO2 have been emitted less, following the replacement of **coal** with shale **gas** in **power plants**. (20597, AFPFR, 2013) But **price** for this **energy** transition [towards **renewables**] is gigantic — while the impact on **global** warming is hardly measurable. (...) As surprising as it sounds: The United States' efforts to combat **climate** change are much more effective and imitable. The reason lies in an unprecedented shift towards natural **gas energy** production, the combustion of which releases 45 percent less CO2 than the combustion of hard **coal**. The rapid **transition** from **coal** to natural **gas** is the fruit of three decades of technological innovation, which enabled the development of significant deposits of previously inaccessible shale **gas** by fracking. Despite legitimate security concerns, the overwhelming benefits for **climate** protection can hardly be surpassed. And fracking has caused US **gas prices** to fall by 75 percent. (2441, DWELT, 2013)
15	Faced with structurally deficit, **Total** will take action. Two of its five sites will be affected. One, in La Mède, will be converted to biofuel production. The other, in Donges, will be modernized...French refining continues to face heavy deficits, linked to **European** overcapacity as well as the grip between the **United States** with shale **gas** and giant Asian refineries. (21527, AFPFR, 2013) The announced restructuring of **Total**'s petrochemical platform in Carling (Moselle) illustrates the difficulties of the **sector** in **Europe**, with declining demand, eroded competitiveness and **increased** international competition. A major competitive disadvantage vis-à-vis US petrochemists who now use shale **gas** ethane, which costs three times less, and compared to the giga-chemical complexes of emerging countries and the Gulf, at lower production costs as fueled by local natural **gas** fields. (15217, BURSIE, 2012) Solvay announced on Monday the acquisition of the unlisted **U.S. company** Chemlogics worth $1.3 **billion** (**EUR** 1 **billion**) to strengthen its presence in the chemical **market** for oil and **gas** extraction. (22550, ECHOFR, 2013)

Topic number	Quotes from the media (Top words in **bold**)
16	The **topic** 'Fracking in the Four Lands' is currently on everyone's lips in the country. (3373, BGDZEI, 2013) The **information** evening with Dr. Sabine Jordan from Kleve on the **topic** 'Fracking — Gas at Any Cost?'. (7688, RHEPO, 2014) The extended board **meeting** starts with a statement from Dyck on the 'environmentally appropriate disposal of deposit water during **fracking**'. (6135, BREMNA, 2014)
17	In view of rising **energy prices**, **Europe** should not miss the opportunity to promote cheap **shale gas**, otherwise the creeping process of shifting **energy**-intensive **industries** such as **chemicals**, steel and paper from **Europe** to North America will continue. (1218, VWDUNT, 2012) The bill, for example, for ethylene, one of the essential **raw materials** of petrochemicals, looks unambiguous for the expert Bürger-Kley. In the production of naphtha, as it predominates in **Europe**, the **raw material** is about 60 **percent** more expensive than if American **shale gas** is used as a **raw material**. (7607, RTDJGE, 2014) The **shale gas** boom in the **US** will have far-reaching consequences for **European chemical companies** over the next three decades. (6931, HNDBLT, 2014) "Fracking is an opportunity for the economy." For the necessary infrastructure, many **companies** such as **chemical** and building **materials companies** are needed. "This creates jobs." **Energy** is an important topic for the future of **Europe's industrial** location, but it hardly has resources. **Europe** should not lose this opportunity, otherwise the community would fall even further behind in global competition. (5492, BGDZEI, 2013)
18	Shale gas: It's an incredible financial bubble. Next to it, the subprime crisis was nothing. (24766, JOUCEN, 2014) In terms of fracking, the *presumption* of guilt must apply. (10293, WISKU, 2015) Promoting renewable energies, but recognising their limits; Continue nuclear energy explore new technologies and expand networks — these are Vahrenholt's answers to the **question**: "What **comes** after the oil?" (228, FTD, 2011)
19	As the debate on **shale gas** and **oil** is in full swing in France, the Government **Energy** Agency revised its estimates of **reserves**. (20116, TBNWEB, 2013) This **technique** [fracking] is banned in France and considered polluting by its critics but is widely used in the **United States**, where it has enabled the development of a major **exploitation** of **shale gas**. (18151, AFPFR, 2012)
20	Opponents and elected officials were side by side to say all the evil they thought about the exploration and **exploitation** of **shale gas** and oil, and protesters took the opportunity to distribute a leaflet summarizing all the dangers and harmful consequences of this practice. (24769, MIDLIB, 2014) A human chain, between the bridge of the Treille and the Pont du Prieuré, will protest against operating **permits** in the area. (15533, SOUEST, 2012) Faced with the general outcry, the government had decreed a pause, suspending temporarily the planned explorations on French **territory**. (...) In South Aveyron, the residents remain vigilant and opponents' voices continue to speak out against the relevance of prospect **permits** for **shale gas**. Friday night was only to be a public debate organized by the **local** coordination, [but] two hundred **people** crammed into the multi-purpose hall in the small village to demand the repeal of exploration requests and greater transparency. (12997, CNPRES, 2011)
21	**Industry** demands diffusiveness of fracking law. (10695, DPAFX, 2015) Fracking bill stands—high environmental hurdles for gas extraction. (8313, DPAFX, 2014) Compromise on controversial gas fracking. (8186, DPAFX, 2014) BASF welcomes agreement on fracking law. (3133, DPAFX, 2013) Merkel: No environmental risks in gas fracturing. (4621, DPAFX, 2013)

Topic number	Quotes from the media (Top words in **bold**)
22	Fracking. Formerly called the well poisoning. (…) We should still call fracking well poisoning. (3677, DIEZEI, 2013) Preparing for a revolution energy, polar bears will soon sink with the **last** ice rafts. (18516, LBRT, 2013) The gas-producing method "fracking" with which the "groundwater of our **children** is contaminated". (4901, AACHZ, 2013)
23	How man causes earthquakes. When water is pumped into the earth, for example, to extract **oil** or use geothermal heat, earthquakes can be triggered. Warning signs help prevent damage. (10941, DGAPFI, 2015) Contrary to what is often assumed, the risk of noticeable earthquakes caused by **fracking** is small. The amount of water used there is comparatively low, so it usually remains with the desired microquakes. But there are exceptions. (...) In Germany, where the **fracking** process has been used since the 1960s, no noticeable vibrations have been detected on the surface, says Christian Bönnemann of the Federal Institute for Geosciences and Raw Materials (BGR). (8095, LABFAC, 2014) Among the concerns triggered by the controversial **drilling** technique **fracking** is the fear of earthquakes. (...) The real problem here is not the **fracking** itself, in which the **drilling** troops blow up the **rock** at depth so that **natural gas** caught in it can flow to the production tower. More dangerous is the pressing of the resulting dirt water that pushes the **companies** into other **drill** holes. The volume of the wastewater changes the pressure conditions underground, and the liquid acts like a lubricant on edged **rock** layers. (5387, SDDZ, 2013)
24	More renewable **energy** sounds good at **EU** level. In the implementation, the many differences slow down a common **energy** transition of the 27 **states**. In **energy policy**, the **EU** regularly stumbles on its contradictions. On the one hand, the 27 **states** have set common objectives: An increase in the share of renewable **energies** to 20 percent by 2020, for example, or the joint presence with large **energy** suppliers. On the other hand, each **state** decides on its own **energy** mix — and sometimes quite suddenly. (664, RHEPO, 2012) The question of the **energy** mix remains delicate. Whether they use coal, gas, nuclear power, wind or sun to produce **energy** remains left to the **Member States**. (11058, TAGON, 2015) The **Energy Union** is a major strategy, ranging from concrete legislative proposals to abstract objectives. One focus is on networking so that **energy** can flow more freely, for example through "super grids" called high-voltage transmission lines. However, one principle should not be shaken: Each **country** may decide on its own "**energy** mix" and decide whether it uses, for example, nuclear power and shale **gas**. (11096, DPAFX, 2015) In order to defuse the **EU**'s dependence on imports, the **Commission** is tasked with investigating possibilities for **EU countries** to promote the controversial shale **gas**. (4465, AFPDE, 2013) However, the so-called fracking is controversial. (4481, WELTAK, 2013) For the controversial issue of shale **gas** use, so-called fracking, the **EU Commission** intends to present proposals for common rules only at the end of the year. (4475, FDG, 2013) In order to defuse the **EU**'s opposition to promoting shale **gas**, the declaration suggests that the **Commission** should consider the possibilities for each **Member State**. (16267, AFPFR, 2012)
25	N/A

Topic number	Quotes from the media (Top words in **bold**)
26	**Gus Van Sant**'s drama '**Promised Land**' around the highly topical topic of fracking, the controversial method of natural **gas** extraction, was premiered yesterday in **Berlin**. (2769, BERMP, 2013) **Matt Damon** acts as a single fighter with a **gas company** that wants to use unconventional methods — so-called fracking — to open up new natural **gas** sources. (2602, BERLKU, 2013) The **film**: '**Promised Land**' describes the environmental hazards caused by drilling for natural **gas** extraction with highly toxic additives. (2738, BZDE, 2013)
27	This book is a veritable encyclopedia of current ecological issues. (…) Several articles are devoted to the polemic issues of geo**engineering**, shale **gas** or waste storage. Others focus on internal debates in the **world** of sustainable **development**. (23795, OUESTF, 2014) In the same vein, Franz Ulm and Roland Pellenq set up the X-shale hub in 2011 in partnership with the oil **industry** (Shell and Schlumberger) on shale **gas** Poromechanics. The X-shale hub now has a dozen **researchers** and offers the first multi-scale **model** of methaniferous shale. The UMI CNRS-MIT is at the center of a strategic device covering both **research** and training in partnership with **industry**. (22716, HUMAN, 2013)
28	Today lecture 'The mirage of **shale gas**' by Thomas Porcher. (24845, MIDLIB, 2014) **Shale Gas** The collective for **shale gas** is organizing a **meeting** tonight (...). We will have to reflect on the future actions to be **taken**. (17100, MIDLIB, 2012) Today **Meetings** of the Périgord Campus. Conference on "The challenges of **shale gas**", with Claude Bacchiana and **Jean**-Paul Passeron, oil geologists. (19821, SOUEST, 2013) **Meeting** on **shale gas**, (...) organized by the mayor, with excerpts from the film Gasland and the intervention of the collective 'Stop **shale gas**'. (11762, MIDLIB, 2011)
29	Despite local resistance, the **State** Office for Mining, **Energy** and Geology (LBEG) has allowed a German and a US **company** in northeastern Lower Saxony to **search** for oil and **natural gas**. (2126, HARANNA, 2012) The PRD **Energy company** has responded to the criticism of **citizens'** initiatives and **municipalities** about the well-known oil production **plans** for the Bramstedt **permit field**. **According** to PRD **Energy** project leader Wigbert Freund, the controversial **fracking** technology will definitely not be used, contrary to the expectations of **municipalities**, **citizens** and professionals. (7596, HABEND, 2014)
30	In view of today's state and **association** hearing on the fracking legislation, the **Association** of Municipal Enterprises (VKU) calls for clear legal rules for fracking. From the point of view of the VKU, whose members supply approximately 80 percent of all Germans with **drinking water**, the planned regulations must comprehensively **protect drinking water** and its resources from the **risks** of fracking. (9690, OTS, 2015) The **Association** of Municipal Enterprises (VKU) sees the extraction of unconventional natural **gas** like shale **gas** critical. "It cannot be ruled out that by obtaining unconventional natural **gas** poses a threat to basic and **drinking water** resources," explains VKU Managing Director Hans-Joachim Reck. (336, OTS, 2011) The Federal Cabinet today adopted the legislative package for fracking. Hans-Joachim Reck, Managing Director of the **Association** of Municipal Enterprises (VKU), welcomes the fact that the first hurdle has now been taken to a law: Fracturing involves significant **risks** to the **environment** and **water** bodies. Clear legal requirements, which have the highest goal of **drinking water protection**, are therefore urgently needed. (10173, OTS, 2015) On the occasion of World **Water Day**, the Wirtschaftsvereinigung Alcohol-Free Drinks (WAFG) once again strongly advocates for comprehensive **protection** of **water** resources in Germany at a high level against potential **risks** of fracking. (10090, OTS, 2015)

* The parentheses indicate the ID number, source abbreviation, and year for each quote, respectively.
Below is the list of sources along with their corresponding abbreviations:

- AACHZ: Aachener Zeitung (German)
- AFPFR: Agence France-Presse (French)
- BGDZEI: Badische Zeitung (German)
- BERLKU: Berliner Kurier (German)
- BERMP: Berliner Morgenpost (German)
- BERREP: Berliner Report (German)
- BREMNA: Bremer Nachrichten (German)
- BURSIE: Boursier.com (French)
- BZDE: Berliner Zeitung (German)
- CHARLI: Charlie Hebdo (French)
- CNPRES: Le Canard Enchaîné (French)
- DDPLD: Deutscher Depeschendienst Landesdienst (German)
- DIEZEI: Die Zeit (German)
- DGAPFI: DGAP Finanznachrichten (German)
- DPAFX: Deutsche Presse-Agentur (German)
- DWELT: Die Welt (German)
- ECHOFR: Les Échos (French)
- FDG: Frankfurter Allgemeine Zeitung (German)
- FTD: Financial Times Deutschland (German)
- HABEND: Hamburger Abendblatt (German)
- HARANNA: Hannoversche Allgemeine Zeitung (German)
- HNDBLT: Handelsblatt (German)
- HUMAN: L'Humanité (French)
- JOUCEN: Journal du Centre (French)
- KOLDUM: Kölner Stadt-Anzeiger (German)
- LABFAC: La Banque Postale (French)
- LBRT: Libération (French)
- MIDLIB: Midi Libre (French)
- OTS: Originaltext-Service (German)
- PRNWDE: PR Newswire German (German)
- REUTFR: Reuters France (French)
- RHEPO: Rheinische Post (German)
- RTDJFR: Reuters/Dow Jones France (French)
- RTDJGE: Reuters/Dow Jones German (German)
- SDDZ: Süddeutsche Zeitung (German)
- SOUEST: Sud Ouest (French)
- SPGL: Der Spiegel (German)
- TBNWEB: Tribune Online (French)
- TAGON: Der Tagesspiegel (German)
- VOINOR: La Voix du Nord (French)
- VWDUNT: Vereinigte Wirtschaftsdienste (German)
- WELTAK: Welt am Sonntag (German)
- WESKU/WISKU: Weser-Kurier (German)

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