

What went wrong? Fracking in Eastern Europe

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Abstract

A few years ago, optimistic estimates claimed that Eastern Europe possessed large shale formations that seemed likely to produce great quantities of natural gas. In addition, the countries in the region had strategic incentives to develop a transparent domestic shale industry in order to reduce its reliance on gas from Russia. Nevertheless, political and social factors as well as differences in physical characteristics, prevented the U.S. experience from being replicable in Eastern Europe. In the end, most multinational energy corporations announced that they had abandoned efforts to find and produce natural gas from shale rock in Eastern Europe. The paper discusses the impact of shale gas exploration on the quality of democratic governance by comparing and contrasting fracking regulations adopted in the United States with those of Eastern Europe. The main research question attempts to ask and identify: “what are the factors that influence a democratic and fair governance of public natural resources”.

Keywords Shale gas · Fracking · United States · Eastern Europe · Transparency · Accountability

1 Introduction

In the United States, shale gas has revolutionized the energy industry. Several circumstances made it possible: a fiscal and legal system that encourages production, an advanced oil and gas industry that is able to provide services like hydraulic fracturing quickly and at an affordable cost and, in parts of the country, a land ownership system that rewards owners for production of what lies beneath their holdings. By comparison, in Europe, the shale story is one of much talk and little action. In Britain, drilling efforts have run into the skepticism of local planning departments as well as sporadic protests [1]. France has kept a ban on fracking [2]. Germany has not yet agreed to allow the exploration necessary to confirm whether the country’s geology is promising [3].

A few years ago, Eastern Europe looked like the region with the best opportunity in Europe to put the lessons learned in the United States to work in relation to the exploitation of fracking resources. The most recent developments show however that all major multinational energy corporations (Chevron, Exxon Mobil, Eni of Italy) left the region and abandoned all efforts to find and produce natural gas from shale formations in Eastern Europe [4–6]. So, why didn’t shale gas work in Eastern Europe? This paper studies the relationship between democratic governance, public participation and natural resources, where the hypothesis is that transparency in allocating concessions improves the economic returns from natural resource exploitation, reduces the environmental risk, and generates social and political trust.

The goals of the current research are three-fold: (1) To conduct an intensive survey of literature on hydraulic fracturing; (2) To identify the key factors that shaped the American shale gas experience; (3) To compare and contrast the situation in the US with that in Eastern Europe and to determine what factors made a difference in regards to shale gas regulation.

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The research project evolved in several stages. The first was to review the existing literature and to analyze the significance of shale gas as a strategic resource. The second stage was to determine the key factors that lead to the implementation of fracking in the U. S. The third stage was to determine the applicability of the U.S. experience to the Eastern European context. The fourth stage involved the theoretical and empirical analysis of the findings and attempted to explain why shale gas did not succeed in Eastern Europe. The research strategy involved secondary data analysis and focused on a variety of sources including newspaper articles, media commentary, NGO reports and journal articles. The advantages of this method made it possible to examine trends over time and to make use of nonreactive data [7, 8].

The case-study relies on a small N design that examines similarities and differences in regards to shale gas regulation. The analytical approach adopted in undertaking this research is observation of media reports and literature. The article focuses on countries that considered undertaking shale gas exploration in order to identify the key factors that seem to have led either to the adoption of the practice or to the dismissal of the method. While descriptive, comparative work such as this is valuable as it helps generate important hypotheses for further analysis and informs debates on future actions. The Eastern European countries selected for analysis (Poland, the Czech Republic, Lithuania, Bulgaria, and Romania) embraced different approaches to shale gas regulation and thus, constitute an interesting sample for case comparison through the method of difference. The small N design allows to delve deeper into the patterns revealed by the existing literature and to determine which factors had a significant impact on the story of fracking in Eastern Europe.

2 Context and relevance

Compared to Eastern Europe, the United States has successfully encouraged large-scale investments in fracking while simultaneously defending the public's interest in terms of raising revenue and improving technology transfer [9]. Boersma and Johnson [10] point out, however, that while the US has experienced a shale gas boom, changes in the markets, regulations, and geological insights demonstrate the uncertainty of natural gas exploration. While low prices are great for consumers, they're an obstacle for new investors. Additionally, lower prices for carbon-based electricity will increase overall consumption [10].

2.1 Polarized outcomes

The United States' experience with shale gas revealed polarized outcomes in relation to economic versus environmental concerns. Early stakeholders like Texas, Oklahoma and Pennsylvania highlight economic development and job creation. Global Insight, an economics forecasting organization, projected that by 2035, 1.6 million jobs would be created within the gas industry [11]. Evidence has shown however that fewer than half of the fiscal benefits remain in the hands of local citizens and up to 40% of workers are reported to be non-residents [12]. In a study that examined the impact of gas production within Colorado, Wyoming, and Texas results showed that for every \$1 million profit, gas companies created 2.35 jobs locally [11]. Furthermore, in states like Pennsylvania and Oklahoma, property rights have led to businesses providing monetary compensation to landowners when obtaining the rights to drill on their property [13]. The doubling of oil production in the United States as prompted by the development in fracking has correlated with a technological advancement as well, marking the U.S as an influential actor in the global oil market [14].

On the other hand, states like New Jersey and Vermont went as far as banning fracking over environmental concerns [15]. The environmental drawbacks include air and water pollution, namely high methane concentration near the drilling sites and "accidental blowouts, surface spills from storage facilities, and improper disposal of fracking fluids" [11]. The injected water has been another critical worry, as up to 40% of it is ejected back-up and produces chemical and radioactive material infused water, which often cannot be treated within wastewater plants [16]. In sites where water is injected back underground, minor earthquakes often disrupt locals and while they have not yet been large enough to do any damage, the frequency by which they occur indicates potential risks [16].

In short, American regulation and legislation follow process and reward market development, but the outcome differed from state to state. State views regarding how best to approach fracking varied considerably, as can be seen by comparing Texas to New York. In 2015, the Governor of Texas banned cities from prohibiting fracking, citing arguments about private property rights and the economic benefits [17]. In the same year however, concerns over increased water and air pollution and significant uncertainties about health, lead the Governor of New York to announce a statewide ban on the drilling process [18]. Furthermore, a 2014 Pew Research Center survey found that 62% of Republicans favored the increased use of fracking, as compared to only 29% of Democrats [19]. A 2008 study examining trust in information

regarding energy found that Republicans were less likely to believe scientists discussing the risks of drilling, just as Democrats were less likely to believe statements made by the oil industry [19].

2.2 Key drivers of shale gas in the U.S.

All in all, a variety of factors led to the success of unconventional gas drilling in the U.S. From a technical standpoint, the U.S. has had favorable geology, accurate physical information, technological expertise (in regards to fracking development), extensive infrastructure to transport the gas, developed auxiliary services, and water availability [20]. In economic terms, the country had a competitive market structure [made up of many small and mid-sized independent companies] and prices that encourage production [21]. There is also a well-established regulatory framework and the government has supported the boom through incentives and programs [22].

Special attention needs to be paid to the split estate issue in the United States, which is unique in that many mineral owners can benefit from shale development, but significant policy differences can be observed as you move westward. Ryder and Hall present a compelling argument relating to property rights while explaining how split estate ownership has developed over the past two centuries. They argue that eastern states are more likely to abide by the traditional unified estate model, namely the ownership of both the surface and mineral rights, as seen in the court case *Turner v. Reynolds*, 1854 from Pennsylvania [23]. As the United States expanded, the government became increasingly involved in property rights in the newly acquired federal lands in the west. The General Mining Act of 1872 allowed the government to retain and regain control of mineral rights, institutionalizing split estate policy. The Mineral Leasing Act of 1920 gave royalties to state and federal governments when it came to extraction industries and was later amended to extend the federal government's retention of mineral rights on lands purchased after 1947 [23]. Overall, most legislation passed regarding this matter usually allows subsurface rights to supersede surface rights, leading to conflict and spatial inequality.

As new research in the 1960s and 1970s indicated greater energy potential in natural gas, new technology and methods were developed to take advantage of these findings. These developments also brought new legislation regarding surface and subsurface rights. Particularly important in this period are the court decisions (such as *Kinney-Coastal Oil Co. v. Kieffer*, 277 U.S. 488 from 1928) regarding the "accommodation doctrine," in which the owner of the rights of the surface may interfere with the mineral owner's rights under certain circumstances [23, 24]. This came in conjunction with state-level surface damage statutes, which help protect the surface owner's rights in the event of property damage, with 16 states implementing these SOPAs (Surface Owner Protection Acts). The last federal amendment dealing with split estate was signed in 1993, and requires companies to work with the landowner [surface rights owner] to obtain written consent and provide a plan to minimize damages and compensate if necessary [23].

2.3 The paradox of the plenty

Evidence collected from various disciplines over the last 40 years proves that natural resources booms are not followed by economic growth in resource-rich countries [25]. In her book "The Paradox of the Plenty," political scientist Terry Karl examined the negative effects of the oil boom on the development of democratic institutions in developing countries. She notes that economists speak of the "resource curse," a slowdown of economic performance in countries rich in resources due to rent extraction by predatory elites and overvaluation of the nations' currency [26]. In the late 1980s, development economists had noted that resource-rich African states not only had not developed as expected, but were plagued by "corruption, weak governance, rent-seeking, and plunder" while the comparatively resource-poor states of East Asia had seen robust growth [27]. Moreover, by the mid-2000s, about half of the OPEC countries were worse off than in the early 1970s [27].

Research points to an interaction between forms of governance and high value-added resources [28]. Governance can be conceptualized as the group of formal and informal institutions that determine who gets what in a specific country or how public resources are allocated. The goal of good governance was defined by the World Bank as "predictable, open and enlightened policy making; a bureaucracy imbued with a professional ethos; an executive arm of government accountable for its actions; and a strong civil society participating in public affairs; and all behaving under the rule of law" [29]. In weak institutional quality contexts, where the rule of law and the government accountability are poor, the risk thus exists that the resources will be used more for patronage and rent-seeking to consolidate the power and the wealth of the establishment politicians, with little or no positive effects for the rest of society [28].

When a country with a strong governance system, like the United States, discovers a valuable resource, the benefits are largely shared across society at large [30]. By contrast, the resource curse is likely to manifest itself in countries with weak

institutional quality [31]. In environments with weak institutional quality, where the rule of law and the governmental accountability are deficient, the risk thus exists that resources will be used more for patronage and rent-seeking rather than for the benefit of the society [28], thereby generating, little or no benefits for the country.

2.4 Shale as an unconventional source of natural gas

Among the common advantages cited as a result of shale gas exploration are the increased number of jobs, the reduction of consumer costs of natural gas and electricity, and the progress in achieving energy independence [11, 13, 14]. On the other hand, the disadvantages include significant carbon emissions, the risks of groundwater contamination, gas leakage, and the slowdown of renewable energy [15, 16]. A significant body of research also points to concerns tied to air pollution, impacts on the environment, wildlife, public health and community stress. The hydraulic fracturing processes are correlated with an increase in air pollutants released, such as silica and petroleum hydrocarbons like benzene [32]. Furthermore, methane emissions are released during drilling and well completion and fugitive methane emissions occur along pipelines, valves, and other related infrastructure [32]. Methane is the second most prevalent greenhouse gas and is better at trapping radiation than carbon dioxide [33]. Furthermore, deforestation caused by fracking is linked to negative effects on the air quality and temperature of a region and it can also lead to the destruction and displacement of habitats for animal and plant species [33]. In addition, significant concerns regarding fracking discuss the hydraulic fracturing fluid that could potentially contaminate groundwater and is left behind after the process as wastewater. This is especially significant because there are few protocols regulating the chemical mixture [33]. In addition, the fluid contains “largely undisclosed chemicals, which may be carcinogenic or cause endocrine disruption” [34]. Using ethnographic data collected from communities in northern Colorado, Malin discloses additional effects of fracking on a community, including chronic or increased stress and a decrease in trust of political, community and industry leaders. Two major themes seem prevalent: “uncertainty about localized environmental and public health risks because of barriers to accessing reliable, useful, transparent information” and “perceived powerlessness to participate in decision-making about pace, scale, or outcomes of production” [34].

It took several factors for fracking to become a well-known term. Among them, two aspects had the greatest importance. The first was the development of the engineering innovation that allowed to drill down a great distance and then make a 90° bend and drill horizontally to carry out the complex procedure of hydrologic fracturing [9]. The second was the cost of oil hitting more than \$100 a barrel and making horizontal drilling profitable [21].

In the United States, shale gas has turned around the energy industry. A few conditions made this possible: a financial and legislative system that supports production and issues well-timed permits and an advanced oil and natural gas sector that is able to provide services like drilling and hydraulic fracturing swiftly and inexpensively [20–22].

By comparison, in Europe, the story of shale is one of much talk and little action [4]. In the United Kingdom, fracking efforts have been delayed at first by the distrust of local planning departments as well as sporadic protests [1]. In January 2015, the Scottish government announced an effective ban on fracking, while the Welsh Government issued a “block of the practice” (moratorium) later in the same year [35]. Questions about the role played by the civil society in decision making and concerns about differences in the risks between different regions have prompted disapproval and public resistance [36, 37]. The lens of environmental justice further reveals the different implications of shale gas development: environmental harm, economic redistribution, community engagement in industry management and public participation [38]. A recent study focused on public perceptions of shale gas development in the United Kingdom unveiled that public awareness of shale gas has increased significantly since 2012 and remains high. A 2020 survey indicates that as many as 66% of people now oppose fracking [39].

Due to public pressure, France issued a ban on hydraulic fracturing in 2011. They followed up on this ban in 2017, when the French parliament passed legislation that banned all exploration and production of oil and natural gas within mainland France and all overseas territories until 2040 [2]. Under the new law, France will not allow new licenses or renew existing permits that allow fracking or the extraction of fossil fuels [40]. After a long period of deliberation, Germany followed suit. A series of mining laws issued in 2017 effectively banned unconventional fracking until at least 2021 and called for the Bundestag to reassess its decision in 2021. Additionally, “conventional” fracking will be governed by much tighter rules [41].

3 Comparison of shale gas in the U.S. and Eastern Europe

A few years ago, Eastern Europe appeared to be the region with the best chance to implement the insights gained in the United States. While actual exploration had been limited up until then, the region had significant shale formations that in theory could generate a considerable quantity of natural gas [42]. In addition, the states in the region had strategic reasons to create a competitive local shale industry and diminish their dependence on Russian gas [43]. The most recent developments show however that all major companies left the region and abandoned their attempts to discover and extract natural gas through fracking [4, 6]. So, what went wrong? Among the key factors with significant explanatory value, I will further investigate the role of technology, the impact of energy price, the availability of resources, the importance of transparent public policy-making, and the pressure from civil society in influencing environmental reforms.

3.1 Advancements in expertise and technology

Prior to new technology in drilling, shale formations had been unprofitable globally [21]. Natural gas is considered a low-cost source of energy that can help the economy, improve energy security (if domestic gas replaces imports), and reduce carbon dioxide emissions (if it is replacing coal) [21]. The scale of development, however, exposes more areas to dangers already associated with drilling, such as water pollution. While extraction technology has created a boom in the shale gas sector, it has also highlighted environmental, health, and safety concerns. Several studies raised concerns about the polluting effects of unconventional natural gas and the dangers of chemicals used in high-volume hydraulic fracturing, pointing out the adverse effects that the process has on communities [32, 34, 44, 45]. In order to fully reap the advantages of shale development, the national and regional regulators must promptly and transparently assess and manage risks [21].

The shale gas extraction also carries on risks like contamination from fracking fluid, water supply shortages, and seismic activities [16]. In the United States, while federal law dictates that operators must report spills it is the state that must ensure that the required regulations are in place to prevent them. The Emergency Planning and Community Right-to-Know Act [EPCRA] of 1986, lists hazardous substances based on their acute lethal toxicity. According to the law, spills of these substances activate reporting obligations to state and local authorities [46]. Research also showed that the damage caused by fracking is dependent on the number and location of wells and the safety practices employed by the companies [47]. Furthermore, evidence reveals that towns with more private water wells and higher livestock water usage are more likely to adopt a ban [48]. In Europe, a lot of attention is given to the risks hazardous chemicals pose to health and environment as demonstrated in the “Chemical Strategy for Sustainability: Towards a Toxic-Free Environment” adopted by the European Commission in October 2020 [49]. Among the actions recommended by the new strategy, special consideration is given to banning the most harmful chemicals and to accounting for the cocktail effect of chemicals. The zero tolerance approach to non-compliance is a sign that further shale gas permits will meet significant obstacles [49].

Several tools can be used by the government to manage these risks. The first is more regulation that encourages transparency at the federal level. The second is tort liability, which would require gas companies to reimburse private parties for exposing them to potential harm. Lastly, there is mandatory liability insurance. This would ensure that only companies that can pay for possible damages are able to engage in drilling. Additionally, in order to be proactive in safeguarding against risks, policy makers should collect and distribute data regularly in order to update regulations [21].

Shale technology developed in the United States has been cost-prohibitive to export to other parts of the world, including Eastern Europe [21, 50]. The American experience shows that any new technological breakthrough requires the development of both “hardware” (equipment) and “software” (personnel). The attempt to export both components came with significant challenges. First, the skills and advanced training of technicians are difficult to replicate outside the U.S. Second, the equipment standardization for mass production has not been achieved yet [50–52]. In brief, shale technology has not matured enough for competitive export. All this explains the American companies’ decisions to suspend fracking in Eastern Europe citing difficulties related to return on investment [4].

3.2 Energy price

On the energy market, everything is decided and controlled by the price of a barrel of oil. During periods when the cost of petroleum remains high, it becomes worthwhile to develop unconventional natural gas resources and to focus on

sustainable and renewable sources of energy such as wind, solar, biomass, and wave energy. The fluctuating nature of oil market prices ends up driving cycles of investment in technological innovations in renewable energy sources as well as non-renewable sources, such as shale gas.

The oil price followed a steady increase in first decade of the twenty-first century, sending the nominal price to an all-time high of \$145 a barrel on July 3, 2008. By 2015, the cost per barrel had dropped significantly and was now between \$40 and \$55 [53]. In 2014, members of OPEC announced that they would maintain their current production levels despite a well-supplied market [14]. The move was seen as an attempt to force US companies to reduce production and exploration of shale gas in a falling market. As a result, there were numerous job losses and a reduction in individual oil wells [14]. The Department of Energy reported that production levels and the amount of oil being held in storage tanks were at the highest levels in decades [9].

Increased oil prices helped the development of shale gas in the US, while low oil prices harmed the same process in Eastern Europe [20]. Additionally, the financial crisis of 2008 also contributed to a significant drop in energy prices that never recovered despite the economic revival that followed [54]. It was around this time that shale was considered as an energy alternative in Eastern Europe. Political uncertainty in the region hindered strategic decision-making with respect to the ability to invest in a new source of energy [28, 52].

In more recent times, the current low energy price demotivates further shale gas exploration. Compared to the all-time high price of \$145 a barrel reached in 2008, current oil prices fluctuated in 2021 between \$48 and \$75 a barrel [55]. Furthermore, the long-term trend of decarbonization of energy is slowly turning mainstream. According to the Office of Energy Efficiency & Renewable Energy, in 2017, “the solar industry achieved the target of \$0.06 per kilowatt-hour for utility-scale photovoltaic (PV) solar power 3 years ahead of schedule, dropping from about \$0.28 to \$0.06 per kilowatt-hour (kWh)” [56]. In 2018, wind energy prices dropped as low as 2 cents per kilowatt hours [57]. The unexpected drop in solar and wind energy prices have made them extremely competitive and persuaded governments to rethink their energy policy to the detriment of shale gas. The combination of all above mentioned factors led to the deprioritization of shale as a strategic energy alternative in Eastern Europe.

3.3 Shale gas reserves

According to the Energy Information Administration, in 2014 the world reserves of natural gas totaled almost 200 trillion cubic meters [58]. Most of this was concentrated in just a few countries: Russia (24%), Iran (17%), Qatar (13%), the United States (5%), and Turkmenistan (4%). It should be noted though, that these numbers were only covering the conventional natural gas reserves, that is the amounts that have been identified in traditional porous sandstone reservoirs. They did not include the unconventional resources of shale gas, obtained from impermeable shale layers through fracking. For the United States, including these unconventional resources would increase its reserves by another 50% [58].

Other areas of the world face more uncertainty in terms of their reserves. Because fracking has not been pursued as much outside of North America (with the exception of China), it is difficult to ascertain how much of the known reserves of other countries would increase if potential shale gas resources were included.

2014 data from the Energy Information Administration, projected Europe’s shale gas reserves at 639 trillion cubic feet [58]. By comparison, the US has an estimated 862 trillion cubic feet. Europe’s geology is however more complex and as a result, shale gas is pricier to explore there. More specifically, the shale formations in America are brittle and easy to fracture, while the European shale is more difficult to fracture and the shale gas reserves are found on average 1.5 times deeper than comparable formations in the U.S [59].

In assessing the energy prospects of Eastern Europe, a key factor is the energy co-dependency between the European Union and Russia. Currently, one third of the EU’s gas imports and one fourth of its total consumption comes from Russia [60]. Due to a lack of liquid natural gas (LNG) terminals, most of Europe depends on existing pipelines controlled by the Russian company Gazprom. Russia is totally reliant on its current gas customers, whose sales help to keep Russian domestic prices down.

In 2012, the European Commission brought formal charges against Gazprom [Judgment of the Court of 13 May 2015, *Gazprom*, C-536/13, ECLI:EU:C:2015:316] for breaching EU competition laws [61]. In 2014, the president of the European Council proposed an Energy Union to jointly negotiate energy contracts and pool its own supply capacities. The Commission has been largely supportive of this endeavor. In 2015, the Commission issued a Statement of Objection to Gazprom related to the upstream gas supplies in Central and Eastern Europe which presented the formal charges [62, 63]. The EU appeared to have the upper hand in the negotiations. Shale prospects in the US and the growth of LNG trading has

reduced energy prices and as a result, the EU has begun to use reverse gas flow in order to redirect Russian imports. While the political and economic implications of the Energy Union would be complicated, they would nevertheless help to restore the balance between energy dependence and the strength of local economies [60].

3.4 National regulation of shale gas development

In the United States, decentralization played an important role in promoting shale development as local and state governments are at the forefront of energy regulation. At the local level, several places (Niagara Falls, Albany, New York City) have discussed bans and moratoriums on shale gas [64–66]. In Colorado, a few cities have passed bans on fracking within city limits [23]. Shortly after the decision, the state government and the gas companies have initiated legal actions against these cities on the basis that the main regulatory authority should be the state, not the city [67, 68]. One landmark lawsuit was brought by the Colorado Oil and Gas Association that sued the city of Longmont in December 2012 after the citizens of Longmont voted in favor of a moratorium on hydraulic fracturing [69]. Another one was brought by the same company against the city of Fort Collins that established a 5-year moratorium on fracking and the storage of its wastes within the city [70]. In both decisions the Colorado Supreme Court upheld trial court decisions striking down citizen-initiated ballot measures adopted to regulate fracking and rejecting Fort Collins' moratorium and Longmont's ban on hydraulic fracturing [69, 70]. The legal battles between state and local governments caught most local governments unprepared and the states attempted to preempt ordinances passed at the local level [71]. "In many cases, communities are encountering large-scale industrial fossil fuel production for the first time, and as remote natural gas resources are exhausted, fracking continues to push closer to residential areas" [72]. Several sources tackle the regulatory battle between states and local governments emphasizing the tension between state and local control, the impact of local drilling zoning limitations and the options available to municipalities to control the effects of drilling on their local environment and economies [73–75].

At the federal level, fracking falls under the jurisdiction of the Bureau of Land Management (BLM), a branch of the Department of the Interior [DOI], and the Environmental Protection Agency (EPA). In 2015, the BLM proposed a set of federal regulations on fracking which included major updates on safety and transparency on federal owned land. The changes sought to establish more environmentally friendly drilling by increasing the number of requirements on chemical disclosure, well-construction, and water management rules [76]. The rules were scheduled to be made effective in June of 2015. However, the Western Energy Alliance (WEA) and the Independent Petroleum Association of America (IPAA) filed a lawsuit claiming that the regulations were based on unsubstantiated concerns [77]. In the end, the regulation was never in effect, due to the pending litigation after the challenges from IPAA and WEA. The Trump administration decided to fully rescind the Hydraulic Fracturing Rule in 2017 [77].

In Eastern Europe, decentralization did not play a major role in fracking regulation as countries in the region are unitary states where most of the competences lie with the central government and only minor issues are within the authority of regions or cities. Natural resources are public property, but the use of proceeds and a lack of transparency when allocating concessions have plagued several projects (such as the Roșia Montană mining development in Romania) and resulted in high levels of public distrust [78]. The lack of trust in the government's decisions with natural resource exploitation is due to a chronic lack of public consultation, with most legislation shortcutting or ignoring existing consultation regulations [79]. No mechanism of public consultation is put in place to assess the costs and benefits (economic, environmental, social) of energy production. Several sources discuss the poor implementation of the Aarhus Convention and legal breaches of EU provisions on environmental impacts [80, 81]. They claim that Romania is only mimicking environmental transparency: "Citizens' demand for transparency and openness in government is weak, as they lack trust in state institutions, including courts, and harbor the belief that they cannot change the course of governmental affairs. Courts, in their turn, aggravate this situation by means of lengthy court proceedings and lack of a proper remedy system" [80].

In the U.S., the mineral rights of a property are generally granted to the land owner. As previously discussed however, the traditional "unified estate," or the ownership of both the surface and mineral rights is only prevalent in the Eastern states. In the American West, the surface and mineral estates are often severed and owned by different entities, causing conflicts [23].

The situation is different in Eastern Europe where land possession does not come with ownership of any underground minerals, such as oil, gas and all other minerals. These are all owned by the state. This land ownership model restricts the array of options for private individuals to take advantage of shale gas exploration. It also negatively impacts the level of public support for the exploration process.

Studies focusing on fracking policies in Eastern Europe emphasize the region's dependency on foreign energy imports [60, 82, 83]. Poland, the Czech Republic, Lithuania, Bulgaria, and Romania are typical case studies because of their dependency on Russia as energy supplier, despite their promising domestic shale gas capabilities. The five countries also share a common history of strong state regulation and are all subject to European Union environmental policy [84]. They embraced however different approaches to shale gas regulation and thus, constitute an interesting sample for case comparison through the method of difference.

3.4.1 Poland

While Poland was an initial frontrunner for unconventional gas drilling in Europe, actual prospects for fracking have dwindled after a series of failed test drills and major companies ultimately backing out as a result [85]. Shale gas was initially presented as a great economic opportunity that could generate new jobs, increase state revenue, and improve market competition [84]. Energy professionals emphasized the prospect of producing cheaper natural gas, while state-owned companies saw the opportunity to further develop their expertise and technology.

Shale was also discussed through the lens of national security. Representatives of the Polish business community expressed concern over Russia's past use of energy as a foreign policy tool. Poland produces one-third of its natural gas domestically, while the rest is exclusively imported from Russia [86]. Shale gas was considered to be an essential tool in their attempt to attain energy independence. Predictably, environmental organizations have been less enthusiastic, warning about the side effects of hydraulic fracturing [86]. In time, the civil society grew to be especially critical of drilling, citing groundwater contamination and damage to natural habitats as undesirable consequences [87].

Furthermore, the country's energy market is heavily limited by its lack of pipelines. Many gas transportation networks run through urban areas and are far from regions where shale gas would be produced. The country has plans to expand infrastructure through the Baltic Pipe between Poland and Denmark, but the progress has been very slow [88]. In May 2020, Gaz-System [the Polish gas transmission system operator] obtained the final permit for the Baltic Pipe project as Sweden's government approved its construction in the Swedish exclusive economic zone. The Polish and Danish authorities have already approved construction of all the Baltic Pipe project components in its onshore and offshore parts [89].

To date, no shale gas has been produced in Poland, although geologists believe there are at least four basins that could be exploited [90, 91]. The Polish government seemed supportive of the process and passed regulations encouraging unconventional drilling. However, the production costs remained very high and the major Northern American companies were forced to eventually abandon their shale gas efforts [92]. At a 2011 conference in Warsaw, Peter Richter, Global Unconventional Technology and Marketing Manager at Schlumberger declared that "the cost of drilling a 2000-m (6562-foot) horizontal well in the U.S. averages \$3.9 million, compared with \$11 million in Poland" [93].

3.4.2 The Czech Republic

By contrast with Poland, where government decisions remain favorable to unconventional natural gas production, the Czech Republic has introduced in 2012 a moratorium on shale gas exploration. Like other countries in the region, the Czech Republic also relies on significant imports of Russian natural gas and faces pressure to diversify its energy production. Furthermore, several major international companies showed great interest in the country's potential shale gas basins [94]. Despite this, the Czech government prioritized environmental concerns over economic gains. The Ministry of Environment explained the decision by citing "high consumption of water per well, risk of groundwater pollution under conditions of technological lack of restraint, and landscape degradation as well as deterioration of air quality" [94].

The moratorium marks a significant shift in energy policy. During the communist rule, all energy utilities, from production to distribution, were owned by the same state-owned company. At the end of 1980s their energy production shifted to a more competitive market. After the accession to the European Union, the country's largest utility company (CEZ Group) faced major scrutiny. The main criticism against the 70% state-owned company was that small independent producers entering the energy market would have no means to deliver their products to consumers without the distribution networks owned by the state. Ultimately, the company would complete a series of internal reforms aimed at fulfilling EU's aspiration for competitive energy markets [95]. After the 2012 moratorium, nothing has been done in the Czech Republic on this front. The inactivity is a sign that additional actions are improbable.

3.4.3 Lithuania

Lithuania was the first Soviet republic to declare independence in 1990 but remains reliant on Moscow for energy [96]. In 2008, Lithuania tried to veto EU's negotiations to renew the Partnership and Cooperation Agreement (PCA) with Russia. The country announced in July 2011 that it will pursue the development of shale gas [97].

In the 2010s the Baltic states, particularly Lithuania, voiced concerns that Russia discriminated against them in terms of gas pricing, imposing politically rather than commercially derived prices. Following a complaint by Lithuania, in September 2012 the European Commission's Directorate General for Competition launched a formal antitrust investigation against Gazprom's practices in Central and Eastern Europe, which include imposing unfair oil-based pricing, hindering the free flow of gas from one country to another and preventing diversification [98].

Until 2014, Gazprom owned 37% of Lithuania's national gas company, univocally decided gas prices and even threatened to cut off supplies during winter's coldest days [96]. "The result, according to Lithuanian officials, was one of the highest gas bills in Europe. In the first half of 2013, industrial buyers paid an average of 44 euro cents, or \$0.47, per kilowatt-hour for Gazprom gas. Businesses in the U.K., which has its own gas reserves, paid 35 euro cents, EU data show" [96]. While a partial agreement that unbundling will proceed was reached between Lithuania and Gazprom in May 2012, Gazprom reserved its arbitration rights.

In June 2012, the Seimas (Lithuania's unicameral parliament) passed the new National Energy Independence Strategy with the overarching goal of achieving energy efficiency and independence. Prior to this initiative, Lithuania imported over 60% of its energy. In order to move away from the dependence on Russia, shale gas was presented as a primary alternative energy source. It was estimated that 100 billion cubic meters of natural gas was recoverable through the shale gas reserves [99]. Moreover, article 84 of the strategy gave Lithuania the ability to encourage exploration of these reserves while upholding protections of the environment [99]. Also known as the "Energy Independence Strategy", the bill focuses on regional nuclear (Visaginas NPP project), LNG (Klaipėda terminal), shale gas, construction of regional and EU interconnections for electricity and gas, and implementation of the 3rd EU Energy Package [97]. The document lists support for shale gas exploration as one of the five strategic initiatives in the gas sector. According to the strategy, Lithuania will endorse "economically feasible and environmentally balanced shale gas extraction." The strategy also says that "If shale gas is discovered in Lithuania by 2020, the country will thoroughly assess options of commercial shale gas extraction" [97].

The American-based company Chevron submitted a bid for the rights to explore Lithuania's shale gas reserves, particularly the Silute and Taurage areas [6]. Chevron started the exploration in March 2012 [99], but the company later announced its withdrawal from the country due to restrictive laws and regulations [6]. During the timeframe in which the rights were awarded to Chevron, Lithuanians took part in numerous protests against fracking. On February 26, 2013, hundreds of individuals took to the streets of capital, Vilnius, to send a strong message to the government. The anti-fracking protests emphasized the environmental risks to the country, particularly in the areas close to the Baltic Sea [100]. Following Chevron's departure, there have been no other developments of Lithuania's shale gas prospects. Due to the growing public pressure, the government postponed discussions about opening another tender for shale gas exploration [101].

3.4.4 Bulgaria

Similar to other countries in the region, Bulgaria heavily depends on Russia for gas imports. Likewise, the prospect of gaining energy independence constituted a major incentive in the consideration of shale gas development. Nonetheless, the announcement that Chevron would start shale gas exploration triggered large-scale anti-fracking protests in early January 2011. Concerns regarding the state of the environment, which included the possibility of groundwater contamination and minor earthquakes, eventually led the government to retract the permit given to Chevron. Furthermore, new legislation has also set fines of 43 to 66 million dollars in response to any ban infringements [102].

The Bulgarian government started the shale gas discussion as a matter of national security and economic opportunity. At the time when shale gas first emerged as a possibility, the region faced worries over the 2009 Gazprom gas pricing dispute between Russia and Ukraine as well as high energy costs [103, 104]. Nevertheless, Bulgaria banned fracking in 2012 and, to date, no shale gas companies remain in the country [105].

According to Goldthau and Sovacool [84], three key arguments against fracking have shaped the national debate on unconventional gas drilling. The first was the idea of "economic sellout" that became popular with a wide array of actors,

from green parties to businesses and academics. The concern was that the exploitation of public resources will primarily result in private gain. Furthermore, the benefits gained from the short-term low-skilled jobs created were regarded as insufficient. Another major argument against shale gas exploration was linked to the lack of public consultation and the massive distrust of the government. In support of this view came the fact that communication between the public and private companies interested in exploration was based only on formal announcements, not open dialogue. Lastly, the biggest concerns were connected to environmental damage such as groundwater contamination, food safety, and destruction of natural habitats [84].

Energy policy in Bulgaria remains highly centralized. Both key regulatory agencies (the State Energy and Water Regulatory Commission and the Ministries of Energy, Transport, and Environment) are operating at the national level [82]. Regional and local actors have no official oversight. The country's energy sector is likewise monopolized at the national level as Bulgaria's Energy Holdings is a state-owned company [106]. While the official narrative framed shale development as being essential in obtaining energy security, public opinion was focused exclusively on the risks of fracking and its previous economic and environmental failures [84].

The major vulnerabilities of Bulgaria's attempt to explore unconventional gas were the failure to decentralize policies and the lack of coordination and communication between government actors. Concessions have been granted without any sort of national debate or public consultation, and as a result, public support plummeted [82]. After the 2012 ban, nothing significant happened in Bulgaria in regards to fracking. The stagnation indicates that further actions are unlikely.

3.4.5 Romania

Romania brings a unique perspective as an outlier. The country ranks second in the European Union, after the Netherlands, in terms of natural gas production [107]. Most of the natural gas consumed domestically is produced locally, so the country has less pressure and more leeway in adopting shale gas on their own time table. Romania has been attractive to foreign shale investors, but public opposition has limited actual development.

When shale was introduced to the region, government officials presented it as a unique economic opportunity and as an alternative to dwindling domestic energy resources [108]. Like in Bulgaria, the opponents of the plan looked towards the inherent risks to agriculture, especially their water supplies. The economic issues became a priority at the local level, while environmental issues came to the forefront of the national debate [83, 108].

At present, Romania's extractive industry is of a moderate size. In the oil and gas sector, which reached their peak level in the mid-1970s, production has steadily decreased. According to official data, the yearly petroleum production in Romania is decreasing by 2–5% for gas and 2–4% for oil [109]. Unless the trend is reversed or adjusted, Romania will soon have gas reserves roughly equivalent to 6–7 years' consumption. To mitigate the depletion of mature fields, investments should be made in the discovery of new fields, as well as a more intensive exploitation of existing ones made possible by new technology.

As the only EU member country with a legacy of conflict and violence related to the mining sector (thousands of coal miners invaded Bucharest repeatedly in early 1990s) [110], Romania found itself in a similar predicament in 2013. According to its Constitution, Romania's natural resources are public property. Yet, a lack of transparency when allocating concessions and the use of proceeds have plagued several projects (such as Rosia Montana gold mining) and generated a high level of public mistrust. For several years, Romania remained the most corrupt new member of the EU, according to the Transparency International Corruption Perceptions Index [111]. A country-specific report by the same organization, notes that "the institution most affected by corruption, but also the least independent pillar, is the public sector" [112]. The report also finds that public expenditures as frequently wasteful, based on favoritism and corruption. The lack of trust in the government's decisions regarding natural resource exploitation is also due to a chronic lack of public consultation [113].

The prospect of starting shale gas exploration and the attempts from the mid-1990s by several different governments to push forward the Rosia Montana gold mining project without an environmental license led to an increase in community protests. This triggered unprecedented confrontations between community protesters and riot police, which in turn caused the rejection of a new mining law in the fall of 2013 [114].

While Chevron obtained in 2013 the rights to extract shale gas from an area of 2 million acres in eastern Romania, the company decided to suspend all its activities after mass protests extended from the villages impacted by the exploration to the capital and the largest cities [5].

3.5 Public opinion

Across the United States, conflicts and resistance have occurred in many towns and cities where the process of hydraulic drilling has created a new era of gas development. Grassroots protests have also intensified in response to the documentary *Gasland* and to the progress of global anti-fossil fuel movement [115]. In “Under the Surface: Fracking, Fortunes, and the Fate of the Marcellus Shale”, Tom Wilber examines the complexities of shale gas development by explaining the economic and environmental motivations of anti-fracking actors. He also uncovers a detailed representation of the type of citizens that formed the anti-fracking coalition in the U.S.: from community leaders, to landowners, artists, academics and environmentalist activists [15].

The scale and intensity of protests in Eastern Europe have been however much higher. The largest obstacle to unconventional gas development in Eastern Europe remains local hostility. Many of these countries are experiencing a growth of green movements that manifest themselves in a wide array of concrete actions. In countries like Poland, Bulgaria and Romania, the anti-fracking protests created a wide coalition of grassroots movements targeting the extractive industry. The demonstrations transitioned from nonviolent marches to forceful confrontations between activists and law enforcement [5, 116].

In 2012 and 2013, Polish farmers and Chevron repeatedly faced off over shale gas [86, 88]. The farmers succeeded in temporarily stopping gas exploration, and soon after Chevron and the local community held a forum. While Chevron expressed the desire to cooperate, local representatives allegedly left the room and refused to negotiate. When residents questioned the construction of a fence around the exploitation area, Chevron responded that they own all legal rights to work in the area. Following the incident, the American company partnered with the state-controlled gas network to improve its operations, but eventually ceased activities within the country [85].

In early January 2011, the Bulgarian people began large scale protests over the prospect of Chevron’s exploration of large shale gas reserves in the country. Concerns focused on the environmental impacts that fracking could have on the region. A petition garnered 15,000 signatures within a few days and as a result, several local officials shifted their stance and began opposing the development of shale gas. By mid-January, the campaign spread from Dobrudja to Veliki Peslaz, and soon reached the capital Sofia and other cities across the country [117]. The protests continued in an effort to sway the government to stop the drilling and to revoke the permit obtained by Chevron to begin drilling in the northeast part of the country. At the end of the month, Bulgaria’s government took a firm stance by banning fracking and thus becoming the second European country (after France) to do so. The concerns regarding the state of the environment, including the possibility of groundwater contamination and resulting earthquakes, led Bulgaria to retract the permit given to Chevron [118].

In Romania, protests that started in the village of Pungești and the town of Bârlad spread rapidly to the capital, Bucharest and other large cities. Three small villages in eastern Romania [Silistea, Puiesti and Pungesti] were the epicenter of national protests between 2012 and 2014. The movement began with peaceful demonstrations, but rapidly grew into violent clashes between law enforcement and protestors, resulting in injuries [119]. Interviews with protesters revealed the widespread human rights violations committed by law enforcement during the protests. The Romanian gendarmerie [a military police force tasked with high-risk and specialized law enforcement duties] deployed a significant number of troops to the villages of Silistea and Pungesti. They occupied the streets and blocked all access points with police vans. The shale gas debate became a complex problem centered on access to primary resources and widespread human rights abuses [120].

Opponents of fracking were not easily swayed by a cost–benefit analysis and cited extreme environmental and health risks. The government did little to create any financial incentives for local communities or to allow opportunities for local authorities to become more involved in the licensing process [121].

4 Implications for policy and future research

In 2015, Chevron ended all attempts to produce natural gas using hydraulic fracturing in Eastern Europe and claimed that “the opportunities here no longer compete favorably with other opportunities in Chevron’s global portfolio” [4]. The move represented the most significant setback to hopeful attempts to start a new European shale gas industry. Chevron made the most serious commitment to shale efforts outside the United States, focusing on Eastern Europe. The company previously started several exploratory wells in Poland and Romania and signed agreements to start drilling in Ukraine

and Lithuania. Since Chevron's exit, Eni of Italy, Exxon Mobil and some smaller companies have also followed suit and ceased operations in the region.

In the end, aside from the differences in physical characteristics, political and social factors prevented the American experience from being replicable in Eastern Europe. In the near future, the prospects of shale gas exploration in Eastern Europe are slim. However, three unlikely scenarios could pivot countries to reconsider their position: a dramatic increase in energy prices, natural gas being reconsidered as a viable source of hydrogen and an escalation of hostility with Russia.

The present study compares and contrasts the experience of shale development in the United States and several countries in Eastern Europe. It points out that the U.S. experience has been largely effective due to market dynamics, a promising geology, a strong governance structure and mechanisms to minimize risks. It argues that several of these features were absent in many Eastern European countries, leading to overwhelming public distrust of fracking, despite compelling national incentives to increase domestic supplies of natural gas. Each of the factors discussed in this article explain why the American shale gas experience could not be replicated in Eastern Europe. Initial exploration attempts have been hampered by the difficulty to export fracking know-how, the fluctuation of energy prices, the difficult geology, the need for transparent regulatory reforms and the public hostility. In brief, there are more forces opposing than championing the cause of shale in the region. Policy makers were jolted by the unexpected and sustained public opposition to shale exploration. Given the general sense of political uncertainty in Europe, it is unlikely that governments will risk going against mainstream public opinion. Future energy debates will continue to address the renewed concern and policy dilemma of how to reduce the region's dependency on gas imports from Russia.

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