

## Conceptualizing the above ground factors in shale gas. Toward a research agenda on regulatory governance

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### **Abstract**

Stalling progress in European, Chinese and Latin American shale has been attributed to difficult geological formations and lacking data. Yet, 'above ground' factors matter in the extractive industries as much as geology. It is policies, regulation and institutional settings that determines the success or failure of a contested, risk bound technology such as fracking. This article suggests that a regulatory governance agenda may offer novel insights into shale gas as a policy phenomenon. The article first provides a critical review of the existing literature on shale gas and identifies the key themes of security, social contestations and socio-economic impact. It then turns to assessing the literature on policy regimes, regulatory competition, regulatory path dependence and regulatory agencies which, it is argued, form essential elements of a research agenda for investigating unconventional gas as a regulatory governance problem. Building on these, the paper sketches focal points of investigations going forward.

**Keywords:** shale gas; regulatory governance; technology transfer

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## 1 Introduction

Shale gas, a frequently used term for unconventional natural gas produced from deep-soil shale formations, has been described as a true 'revolution' in global energy (Yergin and Inieson 2009).<sup>1</sup> By the early 2000s, a breakthrough in technology dubbed 'fracking' – a novel combination of horizontal drilling techniques and hydraulic fracturing – enabled companies to tap unconventional gas reserves at economic costs. A decade later, vast additional natural gas reserves have become available in North America. Recently, the United States has surpassed Russia as the largest gas producer in the world (EIA 2012), and is expected to become 'import independent' in natural gas before 2020 (EIA 2014). The bulk of domestically consumed gas in the US is now 'unconventional', giving the term a new meaning.

The fracking technology is expected to spread to promising reserves beyond the U.S. (EIA/ARI 2013; IEA 2012), which would eventually make shale gas 'go global'. In fact, high hopes are placed on 'exporting' the fracking technology to other world regions with the hope of repeating the shale success story elsewhere. Notably Europe, a continent with an estimated unconventional gas base of 883 trillion cubic feet (tcf) (EIA/ARI 2013) – roughly 60 years of cumulative consumption – has come to discuss the chances and pitfalls of exploiting domestic shale reserves, not the least against the backdrop of its strong dependence on Russia as a contested main supplier of European gas (Goldthau 2013; Jong, Auping, and Govers 2014).

Stalling progress in European, Chinese and Latin American shale has been attributed to difficult geological formations and lacking data. Yet, 'above ground' factors matter in the extractive industries as much as geology. More to the point, it is policies, regulation and institutional settings that determines the success or failure of a contested, risk bound technology such as fracking.<sup>2</sup> What is more, shale gas, a proven technology in the U.S. may fail in new regulatory environments even if thriving in its country of origin. In light of this, the present article asks: what does the literature have to say on shale gas as a regulatory problem? Exploring this question enhances our understanding of the role of above ground factors in shaping a new industry, and the opportunities and obstacles surrounding technology transfer from one regulatory context to another.

The main aim of this article is two-fold. One, it provided a review of existing works on shale gas, which so far has been lacking. Second, it does so with a view to identifying gaps in the literature and to justifying a novel approach – one on regulatory governance. Indeed, as this paper suggests, a regulatory governance agenda may offer novel insights into shale gas as a policy phenomenon. More to the point, such an agenda may move the prevalent discussion away from optimization problems ("how to regulate best") and toward investigations that explain the occurrence of regulation at first place. The latter, it will be argued, is important in determining whether shale gas scales up in a country or not, and whether it 'succeeds' or 'fails' elsewhere. In short, this article aims at sketching a research agenda that conceptualizes shale gas

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<sup>1</sup> Though technically incorrect, this article uses the term of shale gas as synonymous with unconventional gas, which reflects its use in broader public debates.

<sup>2</sup> Risks pertaining to fracking stem from, among other, chemicals entailed in fracking fluids that may harm groundwater safety, greenhouse gases related to methane emission, and the processing, and storage or transport of contaminated flowback water (Gordalla, Ewers, and Frimmel 2013; Howarth, Santoro, and Ingraffea 2011; Myers 2012; Vengosh et al. 2014).

regulation as the dependent variable, not the independent one. So far, the literature has not evolved in this direction, and investigations into the regulatory governance of shale gas remain scarce.

In what follows, the paper first provides for a critical review of the existing literature on shale gas. Here, it identifies the key themes of security, social contestations and socio-economic impact. The article then turns to assessing the literature on policy regimes, regulatory competition, regulatory path dependence and regulatory agencies which, it is argued, form essential elements of a research agenda for investigating unconventional gas as a regulatory governance problem. Building on these, a final section sketches focal points of investigations going forward.

## **2 Reviewing the literature on shale gas**

The literature on shale gas has been advancing rapidly throughout the past 5 years. For this article, we conducted a systematic review of the scholarly work done in the realm of social sciences between 2010 and mid-2015. This review covers more than 200 articles that specifically address shale gas as a social and political phenomenon. The aim of this section is to provide an overview of key trends in research, with a view to developing research agenda in the sections that follow.

Before proceeding, three caveats are in order. First, the present review cannot claim to comprehensively cover works on shale gas, as the literature is still evolving fast. Works as cited therefore remain selective but representative for key aspects covered in the literature. Second, the review does explicitly not cover purely 'technical' treatises, such as the economics of shale or the legalities of unconventional hydrocarbon extraction. Instead, the discussion focuses on works that investigate shale gas as a social phenomenon more generally. Third, there are numerous ways to group research into shale gas, including by country, level of analysis (global, national or local), method, or disciplinary focus (economics, political science etc). For the purpose of this article we decided to delineate the literature according to the focus placed in the empirical investigation. Admittedly, this approach risks blurring units and levels of analysis and lumping together research conducted in separate scholarly fields. Yet, it allows identifying the gaps that exist particularly with a view to understanding shale gas as a regulatory governance phenomenon, and facilitates sketching a research agenda in that field. With this in mind, essentially three strands of research can be identified.

The first strand of existing literature is concerned with the international aspects of shale. Here, key issues covered range from shale gas as a means for projecting US power (Blackwill and O'Sullivan 2014; Dunn and McClelland 2013; Haug 2012; Jong, Auping, and Govers 2014; Malik 2015; Oganessian 2013), the EU-Russia nexus and European energy security concerns (Cwiek-Karpowicz 2012; Jaspal, Nerlich, and Lemańczyk 2014; Johnson and Boersma 2013; Kuhn and Umbach 2011; Umbach 2013) and broader geostrategic implications (Dadwal 2012; Goncalves; Kiernan 2010; Kim and Blank 2014; Riley 2013; Umbach 2013). Broadly situated in the International Relations, this strand of the literature tends to establish a firm link between foreign policy objectives and energy commodities as a geo-economic means thereof. The dominant lens through which shale gas is assessed is realism, which also makes states the primary unit of analysis in this body of works. Other schools of thought in the IR literature feature at the margins at best. Another set of studies examines the effects of shale on international markets and

economies. Here, the focal point of analysis is the relative advantage shale has given the US compared to other global economies (Spencer, Sartor, and Mathieu 2014; Victor, Nichols, and Balash 2014), the economic potential for Europe were they to replicate the US story (Pöyry 2013), and the way global market structures might be affected as a result (Boersma 2015; Rogers 2013).

A second, and rapidly growing literature particularly looks at public attitudes and social contestations. Key themes include public discourse surrounding fracking (Bomberg 2015; Boudet et al. 2014; Cotton, Rattle, and Van Alstine 2014; Goldthau and Sovacool 2016), resident perception and NIMBY effects (Boudet 2011; Brasier et al. 2011; Cotton; Kriesky et al. 2013; Wynveen 2011), which extends into questions of partisanship and worldviews (Brown et al. 2013; Lachapelle, Montpetit, and Gauvin 2014), social representation and the 'license to extract' (Clarke et al. 2012; Evensen, Clarke, and Stedman 2014; LaBelle and Goldthau 2014; North et al. 2014; Smith and Ferguson 2013), as well as framing, notably in the context of the co-evolution of technology and social structure (Hudgins and Poole 2014; Lachapelle, Montpetit, and Gauvin 2014). This strand of the literature seeks to ground shale gas in social context and explores the contested nature of the fracking technology as part of broader phenomena such as technology innovation or participatory governance. A function of data availability, studies remain limited to OECD countries, and particularly the UK and the US.

A third, and related and sometimes even overlapping set of works centers on the socio-economic impact of shale gas on sub-state, that is county level or municipal, communities. Objects of analysis include effects on employment, income or the property market but also social dynamics (Christopherson and Rightor 2012; Considine, Watson, and Blumsack 2010; Cruz, Smith, and Stanley 2014; Gopalakrishnan and Klaiber 2013; Graham et al. 2014; Jaspal, Turner, and Nerlich 2014; Krupnick, Wang, and Wang 2013; Paredes, Komarek, and Loveridge 2015; Perry 2012; Weber 2012), local risks, risk perception and risk governance (Israel et al. 2015; Jacquet 2014; Lipscomb, Wang, and Kilpatrick 2012; Schafft, Borlu, and Glenna 2013; Small et al. 2014) or questions of energy justice (Garvie and Shaw 2015; Melo-Martín, Hays, and Finkel 2014).<sup>3</sup> With regard to discipline, studies in these areas are biased toward sociological approaches and ethnography but also law. Again, the geographical focus is on Western democracies, for the obvious reason that community concerns resonate best in a political environment that is receptive to them, but also related to data availability and access.

In addition to these three broad sets of literature, some interesting works have started to use shale gas as an opportunity to theorize about pertinent issues in institutional theory (Holahan and Arnold 2013), to conduct socio-economic cost-benefit analyses (Sovacool 2014).

As the above review demonstrates, the existing literature acknowledges important security related aspects of shale gas, the socio-economic nexus of shale gas as a novel technology and a source of significant economic activity, and the role of public attitudes and perceptions, also with regard to policy choices. Clearly, as the review shows, there exists an empirical bias toward OECD countries, and the bulk of studies has been carried out in the US. Within Europe, select Western European countries feature

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<sup>3</sup> Though clearly relevant for local communities, we leave aside a large body of important work done on health impacts and environmental degradation. These studies typically lie in the realm of natural sciences and hence do not form part of the present investigation and review.

prominently, including the UK, whilst sub–state level dynamics are particularly underrepresented in works on Eastern Europe.

Moreover, and possibly more significantly, the existing literature by and large has a blank spot when it comes to investigating the regulatory dynamics surrounding fracking. More to the point, while a broad set of literature exists on the environmental or fiscal regulation of hydrocarbon extraction, including shale gas, that literature tends to be very technical and is primarily concerned with optimization problems such as minimizing methane leakage, setting the right incentives for energy investment, or taxing rents (e.g. Alvarez et al. 2012; Avram, Stoica, and Cristescu 2014; Jones, Comfort, and Hillier 2014; Kaiser 2012; Weijermars 2013; Weijermars 2015). Yet, the rapid scaling up of a technological innovation and its spread across U.S. states does not happen in a vacuum, nor is it a mere function of the 'right' regulatory choices. Instead, it is contingent on the complex interplay between private actors, public agencies and regulatory institutions. In short, it is regulatory governance that matters (Levi-Faur 2011).

From a regulatory governance perspective, regulation is the dependent variable, not the independent one. The success (or failure) of shale gas and the fracking technology remains the outcome of regulatory choices. Yet the latter become the focal point of analysis, with a view to understanding the politics of regulation and the political economy behind it. This aspect has so far been by and large neglected by the literature, and investigations into the regulatory governance of shale gas remain scarce. A notable exception is McGowan (2014), who points to the interplay between regulation and the dynamics of technology innovation, and how the latter are mediated in different policy contexts. The present piece takes this as a motivation to develop a research agenda for investigations into shale gas as a regulatory governance phenomenon. For this, the following sections elaborate on four specific sets of literature: policy regimes and regulation; regulatory competition and experimentation; the governance of regulatory agencies; and regulatory path dependence.

### **3 Policy regimes and regulation**

Policy regimes matter in that they are decisive in determining policy design and outcome in a given sector or field. This is because policy regimes define which social, state and market players are included in the policy process, and how this interaction is structured (Eisner 2000). Energy policy is no exception to this rule. In fact, divergence in national regulatory choices in energy can be directly attributed to the scope of the regime in place (i.e. who is included in decision making processes and who is not), and the processes that govern that regime.

Policy regimes have been generally framed as "governing arrangements for addressing policy problems" (May and Jochim 2013), 429). They are defined as a "set of ideas, interests, and institutions that structures governmental activity in a particular issue area" (McGuinn 2006), 206). Interests typically refer to stakeholders in the society, economy but also the political domain, whereas institutions denominate processes and structures. Ideas refer to a normative element, which may either guide policy or serve as a narrative for explaining it. In the literature on policy regimes, the focus of investigation lies on a broad set of issues, including institutional patterns and processes (Eisner 1994), their impact on administrative structures (Harris and Milkis 1996), and the role of regimes in explaining regulatory divergence (Hood,

Rothstein, and Baldwin 2001) or national policy change (Jordana, Levi-Faur, and Puig 2006). The level of analysis typically is national or sub-national, though in the context of EU studies the supranational level plays an important role too. It is important to note that regimes and regime dynamics may differ considerably depending on the sector or policy domain (Baumgartner and Jones 1991; Jenkins-Smith, St. Clair, and Woods 1991; McCool 1998). In other words, policy regimes in the energy sector are necessarily different from, say, the ones 'governing' telecommunications.

That said, it is important to acknowledge that policy regimes are used in very different ways in scholarly inquiry, and for a large variety of objects of analysis. This includes changing constitutional relationships in the United States (Orren and Skowronek 1998), the process of policy instrument choices and policy design (Howlett 2009), and mechanisms of policy change (McGuinn 2006). Some observers have suggested that strong policy regimes may be conducive to enhance the cohesion of the policy process (May, Jochim, and Sapotichne 2011). This is because strong regimes are able to align crucial societal interests by way of tying them into a comprehensive institutional structure and uniting them behind a joint policy narratives.

A policy regime lens offers important insights for academic inquiry into the regulatory governance of shale gas. One, from a policy regime viewpoint, the US shale gas 'revolution' points to the existence of a strong policy regime, which helped establish a shared vision among key socio-economic stakeholders on the federal and sub-state levels while the institutional setup supported the implementation of pro-shale regulation. Key stakeholders would include risk-prone entrepreneurs such as the legendary John Mitchell, state-level regulators such as the Texas Railroad Commission, landowners holding subsoil mineral rights, and federal-level agencies such as the Department of Energy. Institutional elements might, among other, comprise the establishment of wide discretion for putting in place (state-level) regulatory frameworks for shale (a key example here is the federal Energy Act of 2005), or administrative support for a nascent fracking industry (for instance through R&D). The transfer of the fracking technology to new destinations, in turn, would then be contingent on a policy regime in the 'recipient' country in Europe or elsewhere that features similar characteristics. The mere existence of pro-shale regulation, by contrast, would not be sufficient, as it might not meet the support of key stakeholders and may, therefore, eventually fail. In short, a policy regime perspective stresses the intertwined nature of stakeholders, institutions and regulation, and the importance of a regulatory regime being aligned with the broader socio-economic context.

#### **4 Regulatory competition and experimentation**

A second strand of literature to inform shale gas research in the context of regulatory governance can be captured by the term of regulatory competition and experimentation. The main body of works in this realm has been done in the context of U.S. federalism research. The starting point is that "[i]n the American federalist system, states are often seen as the best places to experiment with policy" (Warner and Shapiro 2013), 475). This generates competition both among the federal level and state governments, and between states (see also Dye (1990)). In theory, it allows generating policies meeting the preferences of citizens and responding to the needs businesses. States, in a nutshell, resume the important function of "laboratories of democracy" (Karch 2007).

An impressive body of literature has investigated the traction of this 'bottom up' argument for climate change governance in North America (Adler 2012; Rabe 2002; Selin and VanDeveer 2009) or environmental regulation (Adler 2008; Mazmanian and Kraft 2009; Revesz 2001).<sup>4</sup> The main finding is that state-level measures have become instrumental in addressing key environmental concerns in the absence of more aggregate-level policies and have proven innovative additions to the regulatory toolbox.

Spence (2013) makes explicit reference to the US type of “cooperative federalism” in the context of shale gas regulation (for a critique see (Burger 2013)). In this system, general standards are set on the federal level but implementation is left to state level authorities. State agencies are left with large discretion with regards to the regulatory tools they choose to comply with national level standards, the way they issue permits and the environmental requirements they set in addition to national level ones. This extends even to sub-state entities, which have resumed important authority over parts of the energy industry, notably on local and municipal level (Davis 2014).

From a federalism research viewpoint, the degree to which the unconventional gas industry managed to scale up is therefore a function of the frameworks individual states decided to set up for fracking. This process assumably generated solutions that both 'fit' peoples' preferences and catered the needs of the industry in the specific local context. Particularly given the broad 'regulatory gaps' (Tabak 2014) in federal level jurisdiction on fracking, states should find ample room for experimentation. Importantly, for the case of fracking it is not pre-determined which way regulation would go – toward higher standards or toward a 'race to the bottom'. The often-cited 'California effect' would suggest that states tend to push environmental standards upwards, both because their economic leverage allows them to and because this may give domestic companies a competitive edge (Vogel 1995). The 'Delaware effect', by contrast, points to the possibility of a downward spiral in (fiscal) regulation, to attract companies and investment (Cary 1974). Since fracking is exempted from several national level environmental provisions, the vector may therefore go either way (see also (Genschel and Plumper 1997)). A federalist approach – seen as resulting in a state level competition on the optimal solution – would therefore also necessitate investigating the degree to which states have used environmental regulation to foster or prevent unconventional gas production from scaling up.

The literature also suggests that the competitive process unfolding among U.S. states is not only likely to produce policy solutions fitting specific local environments. They may also make policy innovation spread to other jurisdictions in case they prove effective (Karch 2007). Some states may even end up setting standards for entire sectors or policy areas. Examples of such 'horizontal' policy diffusion, as a result of interjurisdictional competition, include vehicle emissions standards but also education testing (Aulsi et al. 2007). Part of the U.S. 'policy lab' experience is also 'vertical' diffusion, with CAFE standards being a prominent case of federal level frameworks adopting successful state level policy frameworks (Posner 2010).

Note that cooperative federalism does not suggest that policy diffusion will inevitably happen. Because of state-level specificities such as geography or path dependent institutional design (see below), policies may

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<sup>4</sup> For a federalist account of fiscal policy and economic development see (Kincaid and Kenyon 1991)

evolve differently across jurisdictions, and so will their regulatory answer to a given problem. Still, it can be assumed that 'early adopters' of the fracking technology (such as Texas) serve as important sites for regulatory experimentation and as "Guinea pigs" 'laggards' can profit from.<sup>5</sup> Latecomers, in turn, may profit from a process of policy learning, either adopting best practice or going a different pathway in order to avoid failures the first movers had encountered. Finally, a federalist stance on fracking would pose that regulatory competition among U.S. states would eventually generate a set of regulatory patterns that are widely regarded as superior to others and hence diffused both horizontally and vertically across the country.

Some pertinent works have been carried out with a specifically federalist research agenda. As available evidence suggests, there indeed exists a strong heterogeneity in the approach individual states have taken regarding fracking (Gradijan 2012; Rahm 2011). That said, while this policy outcome would be expected from a federalist point of view, fracking regulation so far seems to fail to produce significant horizontal or vertical policy diffusion across states (Rabe 2014). To the contrary, strong regulatory heterogeneity created a 'hodgepodge' (Warner and Shapiro 2013), 385) of regulatory frameworks in shale on the state level ((Richardson et al. 2013) cited in (Rabe 2014)). So while regulatory competition may on the one hand lead to tailored results for a specific state-level environment (possibly also contingent on other factors such as state capacity (Arnold and Holahan 2014) or the ability to compromise (Fry 2013), it on the other hand has not generated opportunity for best practice and policy learning. More empirical investigation therefore is warranted, notably beyond the US context, and with a deliberately comparative approach (an exception is (Lin 2014)).

## **5 The role of regulators and regulatory agencies**

A third strand of literature relevant in the context of regulatory governance puts emphasis on the role and function of state level regulators. The main motivation for this is that regulatory agencies fulfill an important role in policy implementation and sector oversight, a key feature related to the rise of the 'regulatory state' (Majone 1997). Establishing and empowering agencies may come on the back of a number of motives, including public interest, depoliticizing the policy process, enhancing its efficiency or avoiding inconsistencies (Pollitt 2004). Regulatory agencies enjoy a long history in the US context and have resumed an important function in increasing public ownership in the policy process (Eisner 1994). More generally, the 'regulatory state' model has spread across the OECD world and now constitutes the rich world's specific mode of governance (Jayasuriya 2001; Lodge 2008; McGowan and Wallace 1996). Europe now epitomizes the regulatory state, also in the EU's politically contested energy sector governance. As some observers argue, the EU has even come to use a regulatory state approach in dealing with more geopolitical energy challenges such as Russian gas (Andersen, Goldthau, and Sitter 2015; Goldthau and Sitter 2014; Goldthau and Sitter 2015).

Agencies often emerge as actors of their own right in the governance of industries. This is a function of key parts of the regulatory process – monitoring, audit, enforcement or even rule-making itself – being farmed out to specialized units. As scholars have noted, the neoliberalist turn has fostered that trend, as

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<sup>5</sup> Terms adopted from (Boersma and Johnson 2012)

has globalization. Several waves of deregulation coupled with international competitive pressure on industry to specialize created the need to govern highly complex private sector industries which had traditionally been subject to an integrated bureaucratic administration (Jordana and Levi-Faur 2004; Majone 1997). This, in turn, called for specialized knowledge among the agencies to which oversight was delegated.

The rise of specialized agencies in sector governance points to several issues that warrant investigation in the context of shale gas. On the one hand, principal agent problems may emerge (Jensen and Meckling 1976; Mitnick 1980; Mitnick 1975). The essential point here is that self-interested independent regulatory bodies may use their specialized knowledge to empower themselves with a view to influencing the legislator's decisions or actions (Thatcher 2002). This gives agencies considerable discretion (Calvert, McCubbins, and Weingast 1989). In extreme case, the hierarchical relationship between the principal (elected officials) and the agent (the regulator) would be turned on its head.

At the same time, it is important to recall that agencies' missions and processes are defined by politicians. In fact, independent regulators may fulfill important purposes for politicians in the policy process, particularly in instances when legislative powers are limited. In this context, Spence (2013), referring to the works done by McCubbins, Noll and Weingast, points to the fact that legislators may purposefully design administrative structures and processes so that agencies generate the desired policy outcomes. In this case, regulatory bodies have to be seen as politically controlled and emerge as instruments for state policy, rather than as agents of their own (McCubbins, Noll, and Weingast 1989). This includes assigning the delegated body authority to regulate certain areas but not others, and in doing so giving a distinct mission to an agency. As a result, decisions the agency takes are in line with the preferences of the legislator that puts them in place (McCubbins, Noll, and Weingast 1987).

Arguably, the energy sector is a prime case for specialized knowledge calling for specialized bodies. In the U.S., states typically delegate primary regulatory jurisdiction either to individual oil and gas commissions or to environmental agencies (Spence 2013; Warner and Shapiro 2013). In Europe, national energy regulators have been set up that both oversee domestic market governance and coordinate on an EU level, in the shape of ACER. Obviously, national or state level regulators differ with regard to mandate and mission. This becomes most obvious in the case of oil and gas regulators such as the Texas Railroad Commission (TRC), which arguably sees its mission in the dual task of regulating the oil and gas industry by at the same time promotion the industry's growth (Rahm 2011). By contrast, environmental agencies can be assumed to serve the purpose of protecting nature and habitat.

The specialized nature of certain industries may also be an entry point for vested interests to shape sector governance. As studies have shown, the growing complexity of certain sectors, including finance but also energy, have led to a situation in which only the industry possesses the knowledge required for effective regulation. This opens the door for vested interests to effectively lobby for pro-business policies (Noll 1985; Noll 1989; Stigler 1971), or outright regulatory capture (Laffont 1999; Laffont and Tirole 1991). In this context, it is important to highlight the importance of intra-agency modes of governance. The design of the agency leadership (single or multi-member), their mode of appointment and level of accountability,

or of their tenure (staggered or simultaneous) may not only influence the degree to which agencies may fall prey to capture, or empower themselves over their principal (Shapiro 2005).

The questions that emerge in the context of shale gas center on whether and to what extent energy agencies developed a life of their own in fostering (or preventing) shale gas development; whether their mission and the processes that were hardwired into the institutional design of those agencies made a difference; whether regulators were instrumental in fostering (sometimes unpopular) policies on behalf of elected officials; whether they might have come too close to industry interests and organized lobbying, and if not, to what extent agency governance may have made a difference; and to what extent novel approaches such as (EU level) networked governance (Maggetti 2014) may impact on the way agencies handle an emerging unconventional gas industry. While there exists a growing body of literature that investigates US state level regulation in this regard (Davis 2012; Rabe and Borick 2013; Rabe and Hampton 2015; Rinfret, Cook, and Pautz 2014; Warner and Shapiro 2013), little work has been done for contexts outside the United States, notably Europe.

Finally, an important element in how regulatory agencies govern the shale gas sector may lie in historical precedent: states with a long history in oil and gas extraction have established powerful industry regulators while newcomers were by default left with their respective environmental agencies (Kulander 2013), 1103). This brings us to the next strand of literature – regulatory path dependence.

## **6 Regulatory path dependence**

A fourth strand of literature of relevance in a regulatory governance research agenda relates to the path dependency argument. Here, the focus of analysis rests on historical events and the lasting effect they exert on future. The main argument as made in the literature is that past decisions on the institutional and regulatory design of a given economic sector are important to understand institutional and regulatory choices taken today. The reason lies in the well-documented role of transaction costs, which make it increasingly unlikely that a once established pathway is left again (Mahoney 2000; Pierson 2000; Thelen 1999). In this context, particular attention is placed on 'critical junctures', which determine the evolution of a sector and the institutional design surrounding it. In short, regulation is embedded in historical contexts, which requires understanding factors such as state traditions and isomorphic institutional structures (Thatcher 2002). This is a pattern that is well illustrated by studies on the U.S. electricity industry (Granovetter and McGuire 1998) or the nuclear industry (Cowan 1990).

In the context of shale gas, a path dependency perspective would suggest that the scaling up of an unconventional energy sector and the deployment of the fracking technology is not a deliberate choice. Instead, it is fate, albeit one that has its roots in the past. If a given state has seen a long period of hydrocarbon extraction, a sizeable extractive industry will have developed with it. This will have brought about regional or state level institutions to deal with key aspects of the industry, such as environmental oversight, tax collection or work safety issues, hardwiring regulatory pattern into the state's energy regime. The result is regulatory and policy lock-in.

Moreover, states with a long-standing history in oil and gas extraction will likely build on their well-established regulatory apparatus for dealing with shale gas. This would on the one hand suggest that the novel technology will be dealt with in the way the incumbent regulatory regimes has historically been set up. On the other hand the path dependence theorem also suggests that this very pre-existing regulatory apparatus will only foster shale gas extraction to the extent that it can deal with the new industry in a seamless way. This 'fit' is not necessarily a given, as fracking comes with certain characteristics that leave the confines of the conventional energy industry.

Further, the path dependency argument would also point to the likely emergence of state- or country specific ecosystems, that is 'techno-institutional complexes' (Unruh 2000) comprising industry representatives, elected officials, and members of regulatory agencies. These complexes would not only auto-reproduce and perpetuate a given regulatory trajectory but also determine whether there is regulatory 'fit' for a novel technology. Finally, past regulatory choices related to property rights and land tenure arguably exert lasting effects on the developments of natural resources such as shale. Not only do economic incentives differ fundamentally depending on the ownership structure of subsoil resource rights; given the significant economic rents they promise, it is also hard to revert those ownership structures.

Indeed, existing evidence on the U.S. suggests that there are strong elements of regulatory path dependency. The prominently discussed case of Texas features a long standing regulatory history in promoting the energy sector with the goal to "enhance [...] development and economic vitality" (Railroad Commission of Texas, 2011, cited in (Rahm 2011)), a reason why it managed to scale up the unconventional gas sector quickly.<sup>6</sup> Pennsylvania, another prominent 'shale state' also used existing rules on permit and inspection requirements for conventional drilling to deal with unconventional gas (Rabe and Borick 2013). In the state of New York, by contrast, a long history of resource extraction had led to a regulatory path trying to balance resource extraction with environmental conservation, arguably a driver of a more cautious stance (and in fact a moratorium) on fracking (Siler 2012; Tabak 2014). Similarly, in Michigan, a legal passage stemming from 1939 – whilst aiming at 'maximum production' – essentially hardwired the goal of conservation into the state's Natural Resources and Environmental Protection Act (NREPA) governing oil and gas extraction. Arguably, this passage still exerts impact when it comes to environmental regulation and landowner protection (Gosman, Robinson, and Shutts 2013; Richardson et al. 2013).

Further, evidence from Eastern Europe suggest that a strong post-communist legacy, essentially fostering the public utility model in the energy sector, prevented shale gas extraction from scaling up (Goldthau and LaBelle 2015). The UK, by contrast, might emerge as Europe's next 'frontier' in shale gas, not necessarily because of the population embracing it but thanks to a sophisticated and long standing regulatory apparatus governing the country's conventional gas sector.

Finally, subsoil resource ownership sitting with the land owner has given US landlords a significant financial incentive to allow exploratory drilling and eventual extraction of shale gas. Mineral ownership in

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<sup>6</sup> Spence (2013), 458) makes the same argument.

Europe, by contrast, remains with the state (as it does in most other countries) not the individual. This difference in land regimes has become one of the most-often cited reasons for a lagging European shale gas industry (McGowan 2014; Stevens 2010). It essentially points to the fact that historical juncture points – the US decision to extend private ownership to subsoil resources – directly translate into today's incentives for shale development.

In all, this suggests that regulatory path dependencies indeed matter, and that they represent an important factor not only in determining the pace of shale gas development, but also whether development happens at first place.

## **7 Toward a research agenda on regulatory governance in shale**

Shale gas has become subject to a rapidly growing body of research in the social sciences. This article has attempted to suggest several key elements for a research agenda that focuses on the regulatory governance dimension of shale gas. More specifically, it has argued that such an agenda may foster our understanding of shale gas as a case of technology transfer and regulatory diffusion, particularly with a view to shale gas developments beyond the U.S..

To pointedly sketch this agenda for investigations going forward, research will, first, need to focus on the incumbent environment in which shale gas 'happens'. This environment comprises actors and institutions, and the policy narratives surrounding shale. The crucial point here is that the incumbent policy regime may constitute an important factor for explaining why shale-related policies are implemented, either in favor or against the technology. The transfer of the fracking technology to new destinations, in turn, requires an understanding of the policy regime in the receiving country. The analytical added value of focusing on policy regimes consists in highlighting the dynamic interplay between societal actors, regulation and policy outcomes, and the important role they play in facilitating the scaling up of a novel technology or in preventing this from happening.

Second, and following from the policy regime argument, energy technology never travels alone but typically necessitates the establishment of certain set of regulatory patterns similar to those where the technology scaled up. Energy technology transfer may therefore require a certain degree of policy transfer in order to succeed. Although even the U.S. case suggests low levels of horizontal policy learning and diffusion, the U.S. regulatory environment is still relatively homogenous compared to, say, the EU, which features 28 different legislative systems, each coming with their legal and regulatory history. From a regulatory governance perspective it will therefore be interesting to study the degree to which national European regimes adapt in the face of the 'arrival' of fracking. This includes the policies pertaining to the energy sector, the institutions affected and/ or in charge, the sector organization and the role of incumbent companies. Due to the larger default variation in regulatory systems between the U.S. and Europe (compared to variation within the U.S.) we should be able to observe the corollary effects of technology transfer on policy learning.

Third, empirical emphasis needs to be placed on regulatory agencies. Regulatory path dependencies, 'sticky' regulatory patterns and regulatory bias may be important factors in preventing successful

technology transfer. In turn, jurisdictions which so far have little experience in conventional or unconventional fossil fuel extraction may prove important cases for testing whether regulatory frameworks established from scratch 'do better'. Particularly in countries beyond the U.S. current developments in shale gas offer great opportunity to study the effects of path dependency and the choice of the regulatory body on sector regulation – close to real time. Particularly the large variety of empirical contexts found in Europe, notably Eastern Europe promises to offer interesting insights into the validity of the historical argument and the importance of the regulator's mission. Moreover, the EU has emerged an important locus of experimentalist governance, in the energy sector and beyond (Eberlein 2010; Sabel and Zeitlin 2010). Since the regulatory environment on the supranational EU level can be held constant, EU member states become the much debated 'laboratories' for policies surrounding technology transfer in shale.

Finally, and moving slightly beyond a regulatory governance agenda, for reasons related to the difficulty of clearly attributing costs and benefits (Sovacool and Vivoda 2014), fracking is and remains a contested energy technology, both in the U.S. and beyond. It therefore offers important lessons to what extent public opinion and attitudes translate into regulatory patterns and policies, and how. Here, the design of the policy process and – again – the incumbent regulatory regime are important focal points of analysis. Europe offers an interesting sample in this regard, including strongly centralized countries, highly federalist ones, and political systems with extensive opportunity for direct democracy and only indirect voter representation. Given a comparably high population density, European case studies should also offer ample opportunity to study the role of NIMBY effects on voter preferences, ideological cleavages and respective regulatory patterns in shale gas regulation.

To be sure, a plethora of alternative approaches may be considered in a research agenda on the regulatory governance of shale, and the proposed approaches may offer nothing more than a first point of departure. We trust, however, that it is a one that will lead to exciting research and intriguing insights into one of the most pertinent phenomena in today's world of energy.

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