

Hydraulic Fracturing Policy in the United Kingdom: Coalition, Cooperation and Opposition in the Face of Uncertainty

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(in [Weible, Heikkila, Ingold and Fischer, 2016](#))

Abstract

The UK government seems to be ‘all out for shale’, but the regulatory process is ongoing, and there remain many hurdles to pass before shale gas can be developed commercially. We try to understand the intermediate policy outcome by identifying advocacy coalitions and explaining how they share information. We identify a large, *tentatively* pro-exploration coalition, and a small anti-exploration coalition. The former argues that, if regulated well, drilling for shale gas is a low risk, potentially high return industry; the latter relies on the ‘precautionary principle’ to identify an issue with unclear risks and potentially catastrophic environmental consequences. The process has produced a UK government policy in favour of hydraulic fracturing, but it is still unclear how devolved and local actors will influence the process.

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Introduction

The UK experience of hydraulic fracturing highlights an interesting puzzle. Its political system has a reputation for centralised power and top-down policymaking, and its government has made strong statements in favour of shale gas. For example, Prime Minister David Cameron declared: ‘we’re going all out for shale. It will mean more jobs and opportunities for people, and economic security for our country’ (Prime Minister’s Office, 2014), while George Osborne, Chancellor of the Exchequer, recently proposed tax breaks and a ‘sovereign wealth fund’ to encourage private investment and public support, and exhorted Cabinet colleagues to push this agenda forward (BBC News, 2014; The Guardian, 2015). However, very little hydraulic fracturing has taken place in the UK.

We explain this intermediate outcome in two main ways. First, we use the advocacy coalition framework (ACF) to identify the main actors, their beliefs, and their information-sharing strategies. We identify advocacy coalitions using survey data and social network analysis tools, and assess coalition beliefs and preferences based on survey responses. This allows us to understand how competing coalitions understand and seek to influence the debate within a hydraulic fracturing policy subsystem. At the heart of this interaction within, and between, coalitions is an attempt by actors to address both uncertainty and ambiguity. There is scientific uncertainty in relation to activities, such as unconventional drilling, with a limited track record. Opponents of hydraulic fracturing try to exploit uncertainty to challenge policy. Yet, policymakers also make key decisions despite their limited abilities to understand scientific reports or articulate risk, in part by deciding to rely on information and evaluation from sources they trust. The generation and exchange of technical information is therefore a key aspect of the policy process.

Ambiguity relates to the different ways in which actors can understand and try to frame hydraulic fracturing as a policy problem: actors in favour of hydraulic fracturing rely on scientific evidence outlining the reliability of the techniques as well as the economic potential of the exploitation of shale gas; opposing actors emphasize environmental concerns and risk issues. This ambiguity combines with uncertainty about who makes key decisions, or how many authorities come together to produce policy. Responsibility for each aspect of the issue may be unclear to people seeking to influence the process, since some aspects are addressed by the European Union (such as water quality), the UK (such as mineral rights, licensing, and taxation), devolved governments (such as planning) and local authorities (the permission to pursue drilling in specific local sites). To address the questions of how to understand the policy problem, determine who is in charge, and what lobbying or framing strategies may be most effective, political information is a key aspect for actors to coordinate actions and influence decision-making more effectively. To understand how actors address ambiguity and uncertainty, we use survey data to assess how coalitions exchange technical and/or political information. We present evidence that: coalition members share political information largely with each other and not with their opponents; engage in debates on science and risk with their competitors; or, perform ‘brokerage’ roles to share information and seek compromises (Sabatier and Jenkins-Smith, 1993; Sabatier, 1998; Weible et al., 2009; Jenkins-Smith et al., 2014).

Second, we combine this framework with documentary analysis to identify three key explanations for the current policy impasse. First, the UK Government is part of a large

coalition of actors which, on average, is *tentatively* pro-exploration, favouring well-regulated shale gas exploration rather than supporting commercial development of shale gas wholeheartedly. Its statements often seem unequivocal, but its policies betray a more cautious approach. Second, it does not live up to its reputation for policy imposition. Instead, it often seeks to use persuasion and incentives rather than impose policy decisions from the centre. Consequently, it is difficult to identify a single, clear government policy. Rather, this is a multi-level and often-fragmented policy process in which many governmental, quasi-governmental and non-governmental organisations interact to produce what we eventually call ‘hydraulic fracturing policy’. Most importantly, local actors play a crucial role as they have, until now, opposed specific projects. Third, hydraulic fracturing is opposed by a smaller but energetic coalition of actors, which promotes the ‘precautionary principle’ to address an issue with unclear risks and potentially catastrophic environmental consequences.

The chapter is structured as follows: First, we outline the institutional, legal, geographical and technological context of hydraulic fracturing in the UK and give a short overview of the Advocacy Coalition Framework (ACF). We then present the main sources of uncertainty in the policy debate on hydraulic fracturing. Third, we identify advocacy coalitions on the national level based on shared beliefs among key actors in UK politics. This empirical data is based on a postal survey, conducted in summer 2014, and documentary analysis. We combine it with documentary analysis to describe the UK government policy and then, subsequently, as policy is made or implemented at other levels of government. Fourth, we investigate technical and political information exchange within, and across, coalitions. Finally, we discuss how the process could unfold in the UK and what the potential is for future policy change. Much depends on the way that devolved and local governments take this agenda forward, and most seem reluctant to emulate the UK Government’s ‘all out’ approach.

Institutional and legal context

In comparative politics, the UK’s reputation relates to the classic ‘Westminster model’, stressing the ‘majoritarian’ nature of policymaking (Lijphart, 1999: 7; Flinders, 2010). In this scenario, power is centralised to central government and policy is made from the ‘top down’ with little room for consensus building with interest groups or sub-central influence. The obvious focus for understanding policy is the centre. However, in policymaking studies, this image is largely rejected (Cairney, 2012; Jordan and Cairney, 2013). UK central government is the home to a large number of ‘policy communities’ composed of civil servants and groups cooperating on a regular basis, and policymaking has become multi-level. The UK now shares responsibility with the European Union, has devolved many responsibilities to devolved governments in Scotland, Wales, and Northern Ireland, and does not impose policies on local government by default.

In this institutional context, ‘hydraulic fracturing policy’ is a *collection* of decisions made at multiple levels. Unlike other countries outlined in this book, ‘the Crown’ owns the mineral rights in the UK according to the Petroleum Act of 1988. The central government then attributes extraction licences and administers the compensation (Beebeejaun, 2013). The government holds overall responsibility for energy policy and decides about the use and provision of mineral and gas resources. However, it has delegated aspects of the policy to:

devolved governments, responsible for developing national planning guidelines (The *Scotland Act 2015* will also devolve licensing); local authorities charged with granting planning permission for individual drilling sites; and public bodies responsible for ensuring environmental protection and health and safety. It also shares responsibility for environmental policy with the European Union. Further, public bodies responsible for environmental regulation draw on rules devised by at least two levels of government.

The preliminary aim of UK central government has been to develop a broad strategic framework and to estimate the commercial potential of unconventional gas development. Unconventional gas includes shale gas extraction from tight sands, shale and coal (DECC, 2014g). In the UK, shale gas reserves are estimated to reach 600 trillion cubic feet (tcf) in the northern (carboniferous shale), and 25 tcf in the southern parts (lias shale). Technically recoverable reserves however only reach 25 tcf and 1 tcf respectively (Chyong and Reiner, 2015). In this context, responsibility of the UK central government includes strategic issues, related to energy security and the mix of energy use (an issue which transcends several subsystems, including nuclear and renewable energy), the generation of evidence, the tax and incentives regime, and the UK-wide system granting energy companies the right to operate to extract minerals, but not the decision to approve drill sites in local areas. The UK central level often seems to be most important, but its pro-fracturing policy has not translated yet into concrete policy outcomes, partly because it is not the sole decision maker.

The theoretical framework

Advocacy Coalition Framework

A key way to research policy processes is to identify ‘advocacy coalitions’ which contain, ‘people from a variety of positions (elected and agency officials, interest group leaders, researchers) who share a particular belief system’ and ‘who show a non-trivial degree of coordinated activity over time’ (Sabatier, 1988: 139). Political actors involved in policymaking form coalitions to join resources, coordinate their influence strategies, and translate their goals into policy (Mahoney, 1997; Sabatier and Weible, 2007). We expect actors to form coalitions if they have similar policy beliefs – although we recognise that, given the early stage of hydraulic fracturing policymaking in the UK, it is not easy to say if early cooperation represents short term ‘coalitions of convenience’ rather than advocacy coalitions that remain stable for many years.

Beliefs can range from ‘core’ that are difficult to change to ‘policy core’ that are still deep-seated, but more specific and related to one specific policy subsystem or field. Finally, more instrumental beliefs (‘secondary aspects’) link to specific policy development such as the manner in which regulations should be made or what kind of policy measure to be used. From the first (core) to the last (secondary) category, the propensity of change in the respective belief system increases. Deep ideologies are thus said to be the most resistant to change. Still, it takes considerable research to determine what kinds of beliefs bring, and keep, actors together in coalitions (Sabatier and Jenkins-Smith, 1993).

Bounded rationality and scientific uncertainty: risk, reward and persuasion

When we study the exchange of technical and political information, we seek to understand how coalitions cooperate with each other, and compete with others, under

conditions of uncertainty and ambiguity. Policymakers are boundedly rational and, by necessity, have to make decisions in the face of uncertainty regarding the risks and rewards of action (Newig et al., 2005; Sigel et al., 2010). For example, policymakers decide who, and what information, to trust, to help them develop a sense of risk associated with any decision. They then decide what level of risk is acceptable, given the potential reward. Since this is a political process: many actors debate acceptable risk in relation to potential reward; and, policymakers weigh up the risks of their actions in terms of the policy problem and the effect of their decision on, for example, their popularity, or in relation to their other aims. In other words, ‘evidence based policy making’ (EBPM) is a political process like any other, involving competition to decide what counts as evidence, how it should be evaluated, and what policymakers should do with it. Science plays a major part, but the link between scientific information and policy is not linear or unproblematic (Cairney, 2014). Consequently, when we describe the exchange of ‘technical’ information, we do not suggest – by separating it from ‘political’ information – that it is objective or value free.

Rather, ‘political’ information refers to discussions of strategies, in relation to how to frame issues and influence policy in multiple venues. Policymakers make decisions in the face of ambiguity, which regards the ways in which policy problems can be defined or ‘framed’. People can use a large number of ways to understand or think about an issue. Consequently, a large part of the agenda setting process regards the use of persuasion to encourage people to think about issues primarily in terms of their positive or negative aspects; or, the potential for events, media, and powerful actors to shift attention to one at the expense of the others, to determine how governments *primarily* understand and seek to solve the problem at a particular time (Kingdon, 1984: 3–4; Baumgartner and Jones, 1993: 11-2; Dearing and Rogers, 1996: 1; Cairney, 2012: 183).

In the case of hydraulic fracturing, this process of persuasion and framing plays out in relation to a fundamental debate, fuelled by uncertainty, regarding potential risks and rewards. The rewards relate primarily to the importance of ‘energy security’, when a state is able to reduce its reliance on energy imported from other countries (a key feature in the US), and economic gains related to: tax revenue from mineral extraction; an improved balance of payments when fuel is exported or less is imported; capital investment and employment; regeneration in areas with low economic activity; and, lower energy bills. There is also a potential environmental (greenhouse gas emissions) gain if the main effect of local shale gas extraction is to rely less on imported fossil fuels (Bradshaw, 2014; Tosun and Lang, 2016).

The risk relates primarily to environmental problems, and the uncertain effects of hydraulic fracturing activities, including the: contribution of methane gas (leaked during production) to climate change; groundwater pollution, when the chemicals used to fracture shale enter the water supply; greater risk of earthquakes/ tremors from fracturing; and, air and noise pollution to local areas (Friends of the Earth, 2013; Jones et al, 2013: 387; Bradshaw, 2014; White et al, 2014: 13-6). These factors may also affect the quality of life and house value of local populations (Jones et al., 2014a: 512).

Such trade-offs between risk and reward are compounded by the need to make choices that influence these images, such as: (a) the opportunity costs involved in the encouragement of hydraulic fracturing- including the alternative uses for water and waste treatment resources, the money lost to tax breaks to shale gas companies, and consequent reductions in

comparable investment in renewable energy; (b) uncertainty about the likely effectiveness of the regulatory regime (Bradshaw, 2014); and, (c) ethical questions about which areas to drill – in the UK this issue relates primarily to a potential North / South divide if it is cheaper to frack in the north of England (which is less densely populated and less economically active).

Overall, coalitions trade technical information which can help clarify the risks and rewards of hydraulic fracturing, but also political information which can influence how people *understand* the issue and, therefore, how they *weigh up* these risks and rewards. Put simply, one coalition may seek to frame the issue as a major economic opportunity, in which the rewards outweigh the risks; the other may seek to accentuate the potential for environmental disaster which heavily outweighs the reward.

Coalitions, their beliefs and positions, and their patterns of information exchange

Data and method

To identify advocacy coalitions and to shed light on framing strategies by political actors, we rely on empirical data gathered in summer 2014 with a survey among key actors involved in the regulation process on unconventional gas development in the UK. An in-depth study of the policy process on unconventional gas regulation in the UK between 2007 (13th onshore licensing round) and 2014 (key report on shale gas exploration externalities published by the Department of Energy and Climate Change) allowed us to identify the most important collective actors involved in decision-making on hydraulic fracturing on the national level (see Knoke, 1993). 34 organizations were identified (see the list of actors in appendix 1) and received a survey containing questions on their process participation, venue shopping, policy core beliefs and secondary aspects, (dis)agreement, and information exchange relations (see survey questions appendix 2). From the 10 scientific actors, 5 environmental non-governmental organizations (NGOs), 9 industry representatives and 10 political actors in a narrow sense (i.e. political parties or government administration), 53% (18 actors) answered our survey. We acknowledge that 18 actors are few. However, for some questions, we are still able to use information about all 34 actors. Based on the network questions on actors' agreement and disagreement as well as their information exchange ("provide with" and "receive"), we are able to deduce so-called "passive data": actors who did not answer our survey could still be mentioned by other actors with respect to agreement, disagreement or information sharing. Obviously, this data only corresponds to perceptions of the actors who answered the survey.

First, for the identification of 'advocacy coalitions', we rely on survey data (see appendix 3). We asked actors to indicate with which organization, from a list containing all key actors identified before, they agreed or disagreed about policy measures to be taken for the regulation of unconventional gas development in the UK. This information serves as a proxy for the similarity of actors' policy beliefs (Ingold, 2011). Based on this data, we create a network of agreement and disagreement relations between actors, with values of -1 representing disagreement between two actors, and 1 representing agreement.

To identify advocacy coalitions, we then identify clusters of actors with similar beliefs. To do so, we rely on the 'balance' procedure in Pajek (Batagelj and Mrvar, 1996), which rearranges the data matrix by randomly switching two actors and then comparing whether the new matrix comes closer to a pre-defined ideal structure (Nooy et al., 2005). This procedure

is continued until reaching an arrangement that is closest to the ideal structure. In accordance with the theoretical idea of advocacy coalitions, the ideal structure corresponds to a data matrix partitioned in groups, with only positive within-group-ties and negative between-group-ties. Deviations from this ideal arrangement are indicated with an error term (Doreian and Mrvar, 2009), and the solution with the lowest error term is chosen for interpretation (see Fischer, 2014; 2015).

Second, to identify substantive areas of agreement and disagreement between actor coalitions and on the level of policy core beliefs, we asked actors to evaluate state intervention versus individual and market freedom on a 4-point Likert scale (from 1= strongly disagree to 4= strongly agree) (question 10, appendix 3). In the same way, we evaluated secondary aspects as their general attitude towards hydraulic fracturing, their perception of the seriousness of problems related to the issue, and their policy preferences regarding regulation (questions 2, 8 and 9 respectively in appendix 3).

Third, we evaluate the patterns of information exchange among coalitions. Our survey distinguishes between political and technical information. *Political information exchange* is defined as information related to political affairs, i.e. “information that allows your organization to organize during the policy process; as well as information on the preferences of other actors or on the agenda for the next meeting with coalition partners to discuss the influence strategy on the policy process”. *Technical information exchange* is defined as information on the technical aspects of unconventional gas development, as well as scientific information on potential implications for the environment and neighboring population. Examples are given in the survey such as “information on the requirements for the well construction to access unconventional gas or on the estimation on fugitive methane emissions generated by unconventional gas operations”. We then provided survey partners with the same list of actors mentioned above and asked them to indicate a) from which organizations they regularly obtain information related to hydraulic fracturing, and b) which organizations they regularly provide with the respective information.

Advocacy coalitions: current membership and levels of agreement

Our analysis of actors’ agreement and disagreement data from the survey results in three groups of actors. First, we identify a coalition composed of 25 administrative entities, governmental actors, business and research organizations. This coalition is not simply in favor of hydraulic fracturing, since the average position is one that favors the careful or moderate development of shale gas exploration:

- UK government bodies: Cabinet, Department of Energy and Climate Change DECC, Office of Unconventional Gas and Oil (OUGO).
- Government agencies focused on one aspect, without an expectation of supporting/opposing drills: Environment Agency, Health and Safety Executive. State agencies typically belong to the government coalition: even though some might be rather sceptical or neutral, they perform a role set out for them.
- The three main UK political parties: Conservative Party, Labour Party, Liberal Democrats.

- The Energy and Climate Change Committee of the House of Commons, currently with a government majority.
- Private energy companies (Cuadrilla, IGas Energy, Centrica, Total, Shell, National Grid) and industry groups (United Kingdom Onshore Operators Group, Oil & Gas UK, Chemical Industries Association (industry),
- The NGO, No Hot Air
- Groups generating and sharing research: Royal Academy of Engineering, Royal Society, British Geological Survey, CNG Services, Geological Society, Policy Exchange.

The second group represents a smaller coalition which can be described meaningfully as ‘anti-exploration’. It consists of six actors of: the Green Party, which has only 1 of 650 MPs in the House of Commons; four NGOs, Campaign to Protect Rural England, Frack off, Friends of the Earth, and WWF UK; and, a research actor, Tyndall Centre Manchester. A third group of actors contains two research institutes – UK Energy Research Center, Chatham House. We do not tabulate the results for this third group because we received only one response (therefore, it is difficult to describe them as a separate coalition).

Although there are two separate coalitions, based primarily on shared beliefs, this does not mean that all within coalitions agree with each other completely. Table 4.1 identifies the average perceived agreement (0 to 1) and disagreement (0 to -1) between and within the coalitions. Not surprisingly, agreement among actors dominates within coalitions (values on the diagonal), whereas there is mostly disagreement between coalitions. Whereas the disagreement between the pro-exploration coalition and the anti-exploration coalition is perceived as about equally strong from both sides (-0.25 and -0.29, respectively), the internal agreement is stronger in the anti- than in the pro-exploration coalition.

More concretely, the agreement among anti-exploration coalition members on policy measures, to take for the regulation of unconventional gas development, is stronger than among their opponents. This, again, should not come as a surprise, as it is arguably easier to agree on policy positions in a group of 6 actors than in a group of 25 (see also results about core beliefs and secondary aspects below). Yet, it also shows that the goals and policy beliefs of actors in the smaller coalition might be more narrow (oppose hydraulic fracturing) than those of the different types of actors belonging to the larger coalition (support hydraulic fracturing or identify its potential, attract investors, involve local population, regulate it through different types of instruments, provide scientific evidence, etc.).

Table 1 Average Agreement Within and Disagreement Between Coalitions

| | Pro-exploration | Anti-exploration |
|-------------------------------|------------------------|-------------------------|
| Pro-exploration (N=25) | 0.19 | -0.25 |
| Anti-exploration (N=6) | -0.29 | 0.28 |

Numbers represent average values of agreement (1) and disagreement (-1) between actors within the respective groups. The average among all 34 actors is 0.04. Values in the table are not symmetric because the

reported level of (dis)agreement from the anti- towards the pro-coalition does not have to be identical to the reported level of (dis)agreement from the pro- towards the anti-coalition.

Beliefs and areas of (dis)agreement

Table 4.2 outlines the average beliefs of both coalitions: numbers close to 1 indicate complete disagreement, numbers close to 4 complete agreement on policy solutions and problem perceptions (columns 2, 3, 4), as well as with core beliefs (last column). Analyzing these substantive positions allows us to interpret the disagreements between coalitions and to understand how coalitions frame the issue of hydraulic fracturing. Interestingly, both coalitions are not very different with respect to their core beliefs¹ (column 5) as well as their preferences for pro-environmental regulation of the issue² (column 4). The fact that there are no strong differences with respect to core beliefs, concerning the degree of state intervention, indicates that conflict might not be deeply rooted, and that coalition boundaries are not entrenched yet. Further, the fact that both coalitions favor a pro-environmental regulation supports our interpretation that the tentative pro-exploration coalition is not entirely in favor of hydraulic fracturing, i.e. is not going ‘all out for shale’. The smaller anti-exploration coalition is slightly more favorable to state intervention in general and pro-environmental regulation in particular, but differences are small.

The main disagreement between the two coalitions is due to divergences on whether exploration projects in the UK should be stopped or not,³ and on whether problems related to hydraulic fracturing are serious or of no concern.⁴ On average, actors in the pro-exploration coalition are slightly against stopping ongoing projects and favor a moderate development of shale gas exploitation (2.22). The relatively favorable position of this coalition is sustained by the fact that they do not identify serious problems arising from the development of shale gas (2.08). On the contrary, the anti-exploration coalition wishes to stop the respective projects completely (4.0) and tends to see serious risks and problems related to hydraulic fracturing activities (2.86).⁵ Both coalitions thus have a different perception of problems, with the pro-exploration coalition seeing no major concerns and the anti-exploration coalition perceiving rather serious problems.

Table 4.2 Beliefs of Coalitions

| Coalitions | Stop hydraulic fracturing | Problems related to hydr. fracturing | Pro- environ. regulation | Core beliefs |
|----------------------------------|----------------------------------|---|---------------------------------|--------------------------------------|
| | <i>1= absolutely not</i> | <i>1= no concern</i> | <i>1= not necessary</i> | <i>1= individual/ market freedom</i> |
| | <i>4= stop completely</i> | <i>4= serious problems identified</i> | <i>4= absolutely necessary</i> | <i>4= state intervention</i> |
| Pro-exploration coalition | 2.22 (n=9) | 2.08 (n=8) | 3.35 (n=8) | 2.72 (n=7) |
| Anti-exploration | 4.0 (n=4) | 2.86 (n=4) | 3.6 (n=2) | 2.88 (n=2) |

coalition

Note: One actor (GFRAC) does not have any clear group membership (balance-procedure) and is therefore not included. Response rate to the belief questions were even lower than on the whole survey (18). Number of respondents per category (n) are indicated in brackets

The UK Government as a representative of the tentatively pro-exploration coalition

One of the key actors within the pro-exploration coalition is the UK government. Besides the cabinet, several important administrative departments and agencies are part of the large coalition which favours exploration of shale gas resources under strict conditions.

For the UK government, hydraulic fracturing is associated with three positive frames: ‘energy security, decarbonisation and economic growth’ (DECC, 2014a: 4). It has produced a series of decisions which, combined, give the impression of a *tentative* pro-exploration policy. This includes an overall statement on DECC’s website which frames hydraulic fracturing positively:

“The government believes that shale gas has the potential to provide the UK with greater energy security, growth and jobs. We are encouraging safe and environmentally sound exploration to determine this potential” (DECC, 2012).

We say ‘tentative’ partly because DECC (2014a: 3) has not made a firm decision about the economic viability of hydraulic fracturing (the likelihood that shale gas will represent an economic ‘game changer’ is much lower than in the US - White et al., 2014: 5, see also Heikkila and Weible, 2016). Instead, its strategy is to provide the conditions for private companies to decide how viable their operations will be, when subject to government taxation, and planning and environmental regulations (DECC, 2014a: 3).

There are some indications of the potential for shale gas extraction to be commercially viable, but the government’s assumption is that it will not have enough knowledge until it gathers information from test drilling sites (White et al., 2014: 4-6). To this end, it reduced regulations and obstacles to drilling, including legislation (the *Infrastructure Act 2015*) to: remove the need for energy companies to gain landowner permission to extract minerals from under their property, when they operate at least 300m below the ground; support the energy industry’s voluntary scheme to compensate landowners primarily via a £20,000 payment towards community projects; and, beyond the usual requirements of local planning, hold companies only to a voluntary agreement on notifying local communities of drills (Scotland was largely exempted from these plans in anticipation of further devolution) (DECC, 2014a: 26-8).⁶

In part, these proposals are in response to high profile attempts by landowners to oppose drills (Press Association, 2013), and/or to clarify the law on planning, land ownership and access (Jones et al., 2014a: 512; 2014b: 356). The government has persevered despite quite high levels of activist-led opposition in particular areas, significant public opposition to its legislative plans (expressed through consultation responses, following an organised campaign), and some suggestions that consultations on the issue are being rushed (Beebejaun, 2013; Jones et al., 2013: 389; Gosden, 2014). In its post-consultation report, it reiterated its support for ‘indigenous energy sources’ to help ‘improve energy security, create jobs and meet carbon targets, and to reduce the costs of exploration (DECC, 2014b: 6). These

moves are reinforced by robust rejections, by senior ministers, of critics to hydraulic fracturing (Wintour, 2014), and measures to encourage preliminary development, including six major elements:

- a) Tax breaks to encourage capital investment.
- b) The promise of industry and the government to compensate local areas (DECC, 2013b), including a ‘sovereign wealth fund’ to make sure that shale revenue is ‘invested in the long-term economic health of the north to create jobs and investment’ (HM Treasury, 2013; BBC News, 2014).
- c) The formation of the Office of Unconventional Gas and Oil (OUGO) unit, within DECC, responsible for ‘encouraging and overseeing energy development in the UK, including licensing oil and gas exploration and production’ (DECC, 2014c).
- d) Planning guidance (for England) favouring development (Jones et al, 2014b: 357).
- e) A ‘sound science’ approach, based on the evidence of low risk when operators meet or exceed regulatory expectations, in DECC’s: explanatory documents (DECC, 2014d); engagement strategy built on generating feedback in local areas likely to host test drilling sites (Sciencewise, 2013); and, adoption of the Royal Society and Royal Academy of Engineering’s (2012) best practice guidance.
- f) Miscellaneous supporting policies, including tracking data on public attitudes to energy (DECC, 2014f).⁷

We also call the outcome ‘intermediate’ and the pro-exploration coalition ‘tentative’ because there is, as yet, no commercial development of shale gas in the UK (Beebejaun, 2013). The UK Government has not gone ‘all out’ for shale in the sense of imposing a pro-fracturing policy on local areas with large reserves, or prioritising methane gas above other sources of energy (it also held a brief moratorium on drilling in 2011 following two small earthquakes in England – Harrabin, 2012). Instead, the UK Government largely accepts its part of a multi-level policy process and an often-complicated ‘roadmap’ of regulation.⁸

Strategic actions: political and technical information exchange

To assess how actors coordinate and deal with uncertainty and ambiguity, we identify the extent to which coalition members exchange technical and political information with their peers or with their opponents. We rely on the percentage of exchange relations within and across coalitions which actually exist, over all relations that could exist between the actors in the respective groups (Tables 4.3 and 4.4).

First, looking at the networks of political and technical information exchange, without taking into account the coalitions, we can see that actors tend to engage more in technical than in political information exchange. On average, actors exchange technical information with 18% of the other actors involved in policymaking on hydraulic fracturing in the UK. Political information is exchanged only with 8% of other actors. This is an additional indicator for the early stage of policy making on this issue, and for the large amount of uncertainty in relation to hydraulic fracturing techniques and unconventional gas exploitation. Actors thus spend more time searching for technical and scientific information than exchanging information about political strategies and venue shopping.

Table 4.3 Average Political Information Exchange

| | Pro- exploration | Anti- exploration |
|-----------------------------------|-----------------------------|------------------------------|
| Pro-exploration (N=25) | 12% | 6% |
| Anti-exploration (N=6) | 2% | 11% |

Numbers represent the percentage of relations between actors within the respective groups which actually exist, over all relations that could exist. The average among all 34 actors is 18%. Values in the table are not symmetric because the reported level of information exchange from the anti- towards the pro-coalition does not have to be identical to the reported level of information exchange from the pro- towards the anti-coalition.

Not surprisingly, political information exchange (Table 4.3) is above average within both the pro- and anti-exploration coalitions (12%, 11%, diagonal values), while it is below average or even almost inexistent across coalitions (2%, 6%). This is also in line with a basic theoretical assumption on advocacy coalitions: actors with similar beliefs engage in a non-trivial degree of coordination within their coalitions (Schlager 1995; Sabatier, 1998).

The pro-exploration coalition is the most active group, and it also exchanges some political information with members of the anti-exploration coalition (6%). This pattern can tentatively be interpreted as the willingness of the pro-exploration coalition to integrate the anti-exploration coalition into the process of finding a viable policy solution to the issue in the UK. Given that most members of the anti-exploration coalition take some part in actions against local projects (Beebeejaun, 2013; Jones et al., 2013: 389), providing these actors with political information on potential compromises and levels of government on which to implement them looks like a strategy of the pro-exploration coalition to reduce further protest.

Table 4.4 Average Technical Information Exchange

| | Pro- exploration | Anti- exploration |
|-----------------------------------|-----------------------------|------------------------------|
| Pro-exploration (N=25) | 24% | 15% |
| Anti-exploration (N=6) | 9% | 19% |

Numbers represent the percentages of relations between actors within the respective groups which actually exist, over all relations that could exist. The average among all 34 actors is 8%. Values in the table are not symmetric because the reported level of information exchange from the anti- towards the pro-coalition does not have to be identical to the reported level of information exchange from the pro- towards the anti-coalition.

As with political information, technical information exchange about shale gas extraction and hydraulic fracturing techniques is stronger within (24%, 19%) than across coalitions (9%, 15%). This pattern corresponds to the assumption, discussed above, with respect to political information: actors within a coalition need to coordinate, and do so in a non-trivial way. While this assumption is most straightforward with respect to political information used for strategic coordination within coalitions, also technical information

exchange follows a similar pattern. Technical information exchange is above-average within the pro-exploration coalition, whereas it is at an average value within the anti-exploration coalition. Besides consulting their fellows with respect to coalition strategies to implement, actors within a coalition also exchange technical information in order to increase their understanding of the technology they are supposed to deal with. The importance of technical information is most probably related to the high uncertainty in the policy sector of hydraulic fracturing.⁹

Also between coalitions, the exchange of technical information is clearly more intense than the exchange of political information. This corresponds both to the idea that technical information is more ‘politically neutral’ than political information, but also that technical information is important for actors to deal with scientific uncertainty in this domain. The pro-exploration coalition is rather active in providing the other coalition with technical information (15%). This probably stems from the fact that leading administrative actors such as the DECC and the OUGO belong to this coalition.

As suggested by these figures, negotiations across coalitions about an issue under uncertainty can be technical in nature and discussed primarily by experts, or it can be highly political and subject to charged debate by many groups. In the case of hydraulic fracturing, many actors seek to downplay or amplify scientific uncertainty (about the effect of commercial fracturing) to support or oppose policy. For example, the UK Government has sought information from its trusted sources - professional scientific bodies and businesses - to try to reduce the appearance of uncertainty and help frame issues in positive (economic, security and environmental) terms (see timeline, appendix 1). First, the government was looking for an estimate of the *potential for shale gas extraction*. The UK Government’s Department of Energy and Climate Change (DECC) has commissioned reports from bodies such as the British Geological Society (BGS, 2014), including the Bowland Shale Gas Study (Andrews, 2013: 3) which estimates a range between 23.3-64.6 trillion cubic meters (tcm) of gas in place (GIP), which differs markedly from the amount of commercially recoverable gas for which there is no official estimate (Postbox, 2013). Postbox (2013) provides an estimate of 1,800-13,000 billion cubic metres (bcm) based on an ability to recover the gas at a rate found in comparable US sites. It compares this amount to the UK’s conventional gas resources (1466 bcm) and annual consumption of gas (77 bcm).

Second, estimation of *the economic potential* was needed. Individual companies, including Cuadrilla and IGAS, have begun to use (or recommend) test drills in particular areas to assess their economic potential. The Institute of Directors raised the prospect of £3.7bn investment per year and up to 74000 jobs, but DECC Secretary of State, Ed Davey, has been more cautious (White et al., 2014: 6-7). Rapidly falling oil and gas prices also undermine the economic attractiveness of drilling for shale in the short term.

Third, given the opposition from environmental actors, there was a need to assess *the likely environmental impact and the need for regulation*. The Royal Society and The Royal Academy of Engineering’s (2012: 4) review argues that hydraulic fracturing is ‘an established technology that has been used in the oil and gas industries for many decades’, and that the ‘health, safety and environmental risks ... can be managed effectively in the UK as long as operational best practices are implemented and enforced through regulation’. It suggests that problems relate to poor practice and regulation, with the risk of: ‘fractures

propagating from shale formations’ minimised if the drilling takes place at an appropriate depth; pollution minimised with ‘well integrity’ and the use of ‘non-hazardous’ chemicals; and, ‘seismicity induced by hydraulic fracturing’ going above natural levels (or those induced by coal mining) ‘reduced by traffic light monitoring systems’.

However, the authors of these reports do not seek to make the case for commercial shale gas development. Indeed, the latter argues that, ‘This remains the responsibility of the Government’ (The Royal Society and The Royal Academy of Engineering, 2012: 5). Expertise may be used to help reduce uncertainty but not settle the matter.

Discussion and conclusion

We find evidence for two main advocacy coalitions in contemporary UK hydraulic fracturing politics. There is a larger pro-exploration coalition including governmental actors, the industry, some research groups, and NGOs. This coalition is not simply in favor of hydraulic fracturing, since there is a mix of actors who: advocate shale gas development relatively strongly (including DECC and the Conservative Party); seek to profit from hydraulic fracturing (private companies); provide government services to help regulate one aspect (government agencies); or, provide supportive information on the risks without making policy recommendations (including the research societies). It is thus more accurate to describe this coalition as *tentatively* pro-exploration when compared with the smaller coalition which is clearly against hydraulic fracturing. The latter, composed primarily of the Green party and NGOs, is unequivocally against the technique and test drilling sites.

Despite the apparent imbalance in coalition composition, and existence of clear minority opposition, there is also some evidence of agreement between both coalitions. While they do not agree on whether to allow hydraulic fracturing or not, both coalitions agree that regulation for the protection of the environment is crucial, and that full commercial exploitation should not go ahead without more assurances on safety (and, in many cases, commercial viability). The current roadmap includes a large number of permissions required to start exploration. These may represent new ‘venues’ for opponents to influence the respective process, or, at least, a chance to slow it down - a point used by the House of Lords Economic Affairs Committee (2014: 6-7) to criticise the UK Government’s hesitancy and recommend gas exploration to be an ‘urgent national priority’.

Besides identifying advocacy coalitions and their beliefs, this chapter studied how coalitions deal with uncertainty and exchange both political and technical information. In general, and in line with the expectations of the ACF, coalition members tend to share information among each other and less so with their competitors. However, there is also some interesting exchange across coalitions: the exchange of political information from the pro-exploration coalition to other actors (perhaps to encourage the development of common ground, or seek to influence or convince other actors); and the subsystem-wide exchange of technical information, to reflect widespread sharing of information in relation to relatively high scientific and regulatory uncertainty. Thus, with respect to empirically studying policy processes with the ACF, this chapter suggests that within-coalition coordination (Sabatier and Jenkins-Smith, 1993; Schlager, 1995) is crucial for understanding the functioning of advocacy coalitions, but also that across-coalition patterns of information exchange are a key feature for understanding the policy process. Further, the distinction of technical and political

information exchange is important to understand which type of information underlies coalitions' coordination and lobbying activities. This is true especially if the policy process involves important technical and political uncertainties, as is the case with the politics of hydraulic fracturing in the UK.

Given that the large pro-exploration coalition exists mainly on the national level, and that things look differently at the regional and local level, the coalition imbalance in favor of shale gas development has not led to the types of shale gas extraction that we associate with countries such as the US (see Heikkila and Weible, 2016). Instead, UK policy seems to be more tentative (which might be reinforced if energy prices remain so low), and the policymaking system seems more able to slow or halt development. What we see, so far, is an imbalance between coalitions *at the UK central level only*. We need more data on the multi-level dimension of the UK policy on hydraulic fracturing, as it progresses from this tentative pro-exploration stage at the center, towards new developments at local levels. This requires more information of the beliefs, preferences, and strategies of actors in devolved and local areas.

With respect to potential further evolution of this policy sector and future policy change, the multi-level nature of hydraulic fracturing politics in the UK is key. A pro-exploration position at the UK central level is complicated by developments at devolved and local levels and, in some cases, environmental and industrial requirements maintained by the EU (note that these planning and environment powers existed before hydraulic fracturing arose as a new issue; the UK did not devolve powers recently – rather, it chose not to centralise). Indeed, devolved or local authorities often oppose specific sites. To date, each devolved government has been less positive about hydraulic fracturing. The Scottish Government (2013; 2014a) seeks to juggle its focus on environmental protection and community consultation to a commitment to exploring the potential for shale, and introduced a 'moratorium' in January 2015 to put off the matter until after key elections (Cairney, 2015a). The Welsh Government has considered a 'moratorium' on hydraulic fracturing (Dean, 2014), albeit without having unambiguous powers to 'call in' planning applications, and the Northern Ireland Government has refused to fast-track exploratory drills (Minister of the Environment, 2013). Based on the debate so far, we would also expect more reluctance at local levels, with local authorities conscious of the environmental impact and subject to the most specific and concentrated opposition (BBC News, 2015).

Given the current and early state of play, the potential appearance of "coalitions of convenience" rather than advocacy groups, and the relative hesitancy of devolved and local governments, we would expect one of three things. First, the anti-exploration coalition may swell, to reflect a growth in opposition or the decision of local authorities to reject planning applications. This is particularly likely if incidents such as tremors or earthquakes should happen again close to test drilling sites. Second, the pro-exploration coalition may swell, but change further, to reflect an important degree of *hesitant* and *prudent* pro-exploration attitudes that are not sufficient to produce policy change. Or, third, the pro-exploration coalition becomes more in favor of hydraulic fracturing, perhaps following the development of test drills and the gathering of evidence that suggests that regulations are sufficient and the commercial potential of shale gas is more certain. In any case, the election of a new

Conservative UK Government in 2015 has ensured that the UK Government remains committed to shale gas exploration.

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Appendix 1: UK timeline 2007-15 (Cairney, 2015c)

| | |
|-----------|---|
| Nov 2007 | UK Government invites applications for onshore oil and gas licenses (13 th round) |
| Jan 2008 | Cuadrilla Resources Ltd established. |
| Apr 2010 | West Sussex County Council grants planning permission at Balcombe (West Sussex) |
| Aug 2010 | Cuadrilla begins drilling at Preese Hall (Lancashire) |
| Apr 2011 | First tremor Preese Hall - 2.3 on Richter scale |
| May 2011 | Second tremor Preese Hall - 1.5 on Richter scale. Drilling suspended while DECC commissions report to examine link to hydraulic fracturing activities (ITV news). |
| Dec 2011 | Cuadrilla has DECC license and planning permission for exploration in Balcombe |
| Apr 2012 | DECC report : hydraulic fracturing (direct fluid injection) caused the Preese Hall earthquakes |
| Jun 2012 | Royal Society and Royal Academy of Engineering report published |
| Oct 2012 | DECC policy statement restates the economic potential for shale |
| Dec 2012 | UK Government lifts the temporary ban on hydraulic fracturing across the UK |
| Mar 2013 | George Osborne offers tax breaks for shale in 2013 budget |
| May 2013 | IOD highlights the need for the industry to secure a ‘social license to frack’ |
| July 2013 | Lord Howell advocates hydraulic fracturing in the ‘desolate’ North of England |
| July 2013 | Northern Ireland minister rules out fast-track process for hydraulic fracturing applications |
| July 2013 | British Geological Society report on Bowland reserves |
| Aug 2013 | 2000 people march to protest Balcombe projects; part of summer-long protests. |
| Aug 2013 | Protests interrupt Cuadrilla operation. Balcombe not viable for commercial exploitation. |
| Aug 2013 | David Cameron advocates hydraulic fracturing to help bring energy bills down |
| Sep 2013 | Cuadrilla announces that it has found hydrocarbons at Balcombe |
| Sep 2013 | Green Alliance criticises UK Government position on hydraulic fracturing |
| Oct 2013 | Cuadrilla does not pursue project site at Westby in Lancashire |
| Oct 2013 | O’Hara et al suggest that Balcombe has reduced UK public support for hydraulic fracturing |
| Oct 2013 | European Parliament votes for Environmental Impact Assessments at all sites |
| Oct 2013 | Greenpeace launches legal challenge to hydraulic fracturing in England |
| Dec 2013 | Cuadrilla closes site at Preese Hall in Lancashire. |
| Dec 2013 | HM Revenue and Customs outlines new tax breaks for onshore oil and gas |
| Dec 2013 | DECC announces new ‘regulatory roadmap’ |
| Jan 2014 | David Cameron states that he is ‘all out for shale’ |
| Feb 2014 | West Sussex landowners launch legal block to hydraulic fracturing at Balcombe |
| Feb 2014 | Cuadrilla proposes two new sites near Blackpool (Bowland, Lancashire) |
| Mar 2014 | Cuadrilla : there could be 330 trillion cubic feet (tcf) of gas in its Lancashire sites |
| Apr 2014 | House of Lords Economic Affairs Committee criticises lack of progress |
| May 2014 | Celtique announces that it will not pursue South Downs site |
| Nov 2014 | George Osborne proposes north of England shale fund |
| Dec 2014 | Announcement that Welsh Government sought legal advice on moratorium |
| Jan 2015 | Leaked letter from George Osborne asking colleagues to push progress on hydraulic fracturing. |
| Jan 2015 | Westminster vote on Infrastructure Bill produces greater regulation but no moratorium (27 th). The bill will reduce planning obstacles to drill sites. |
| Jan 2015 | Scottish Government announces moratorium on hydraulic fracturing (28 th) |

Appendix 2: Actors' list

| Actor Acronym | Full actor name | Category 1= Political; 2= Industry; 3= NGO; 4= Research |
|----------------------|---|--|
| BGS | British Geological Survey | 4 |
| <i>CABINET</i> | <i>Cabinet</i> | 1 |
| CAMPAIGNRE | Campaign to protect Rural England | 3 |
| <i>CENTRICA</i> | <i>Centrica</i> | 2 |
| <i>CHATHAM</i> | <i>Chatham House</i> | 4 |
| <i>CIA</i> | <i>Chemical Industries Association (CIA)</i> | 2 |
| CNG | CNG Services Ltd. | 4 |
| CONSERV | Conservative party | 1 |
| CUADRILLA | Cuadrilla Resources Holding Ltd | 2 |
| DECC | Department of Energy and Climate Change (DECC) Energy and Climate Change Committee of House of | 1 |
| ECCCOMMITTEE | Commons | 1 |
| <i>ENVAGENCY</i> | <i>Environment Agency</i> | 1 |
| <i>FRACKOFF</i> | <i>Frack off</i> | 3 |
| FRIENDS | Friends of the Earth | 3 |
| <i>GEOLSOCIETY</i> | <i>Geological Society</i> | 4 |
| <i>GFRAC</i> | <i>Gfrac technologies</i> | 4 |
| GREEN | Green party | 1 |
| <i>HSE</i> | <i>Health and Safety Executive</i> | 1 |
| IGAS | IGas Energy | 2 |
| <i>LABOUR</i> | <i>Labour party</i> | 1 |
| <i>LIBERAL</i> | <i>Liberal Democrats</i> | 1 |
| NATIONAL | National Grid | 2 |
| NO HOT AIR | No Hot Air | 3 |
| OUGO | Office of Unconventional Gas and Oil (OUGO) | 1 |
| <i>OILGASUK</i> | <i>Oil & Gas UK</i> | 2 |
| POLICY | Policy Exchange | 4 |
| SHELL | Shell international Ltd. | 2 |
| <i>ROYALACADEMY</i> | <i>The Royal Academy of Engineering</i> | 4 |
| <i>ROYAL SOCIETY</i> | <i>The Royal Society</i> | 4 |
| <i>TOTAL</i> | <i>TOTAL</i> | 2 |
| TYNDALL | Tyndall Centre Manchester | 4 |
| UKERC | UK Energy Research Centre (UKERC) | 4 |
| <i>UKOOG</i> | <i>United Kingdom Onshore Operators Group (UKOOG)</i> | 2 |
| WWF | WWF UK | 3 |

Note: actors in italic did not respond to the survey.

Appendix 3: Survey questions

Question 2: Current position on unconventional gas development

Please indicate what comes closest to your current position in relation to unconventional gas development that uses fracking technology in the UK. It should be: 1 expanded extensively, 2 expanded moderately, 3 limited, 4 stopped completely.

Question 5: Agreement and disagreement with other actors

We are now interested with whom your organisation agreed or disagreed about policy measures during the policy process of unconventional gas development in the UK between 2007 and 2013. The following table (*list of actors, see appendix 2*) shows exactly the same list of actors as before. Please check all actors with whom your organisation mainly agreed upon policy measures to be taken to regulate unconventional gas development in the UK (second column). In a next step, please indicate all actors with whom your organisation mainly disagreed about policy measures to be taken to regulate unconventional gas development in the UK (third column). If there are actors missing, please add them to the bottom of the list and indicate if your organisation agreed / disagreed with them.

6A. Technical information

The following table shows exactly the same list of actors as before. Please check all actors from which your organisation regularly obtained technical information during the policy process on unconventional gas development in the UK (2007 – 2013). Please check all actors which your organisation regularly provided with technical information during the policy process on unconventional gas development in the UK (2007 – 2013). If there are actors missing, please add them to the bottom of the list and indicate if you obtain technical information from them, or if you provide technical information to them.

Question 6B: Political information.

The following table shows exactly the same list of actors as before. Please check all actors from which your organisation regularly obtained political information during the policy process on unconventional gas development in the UK (2007 – 2013). Please check all actors which your organisation regularly provided with political information during the policy process on unconventional gas development in the UK (2007 – 2013). If there are actors missing, please add them to the bottom of the list and indicate if you obtain political information from them, or provide them with political information.

Question 8: Current problems related to unconventional gas development

Following the opinion of your organisation, please indicate the extent to which the following issues are current problems related to unconventional gas development: 1 not a problem, 2 minor problem, 3 moderate problem, 4 serious problem.

Issues to be selected:

- Contamination of ground and surface water
- Competition of water supplies
- Air pollution and air quality degradation
- Landscape degradation
- Nuisance to general public related to site development
- Destruction of public lands

- Patchwork of regulations across different institutional levels
- Unclear competence distribution

Question 9: Policy instruments

Below is a list of policy instruments which may be introduced for the regulation of unconventional gas development in the UK. Please indicate your organisation's level of agreement with adopting each of the following policy instruments independently of what has been done in the UK thus far: 1 strongly disagree, 2 moderately disagree, 3 moderately agree, 4 strongly agree.

- Monitoring of water quality
- Monitoring of air emissions
- Disclosure of chemicals in fracking fluids
- Setbacks of wells from occupied buildings or natural features
- Quality control of designing and constructing wells
- Disposing or treating produced water
- Quality control of constructing well pads
- Mitigating risks from induced seismic activity
- Mitigating risks and nuisances to the general public caused by truck traffic, noise, and light from well site operations
- Funding scientific research relating to environmental impacts of unconventional gas operations

Question 10: General attitudes

The following statements reflect general attitudes, not related to unconventional gas development. Please indicate whether your organisation agrees or disagrees with each statement: 1 strongly disagree, 2 moderately disagree, 3 moderately agree, 4 strongly agree

- Government should put limits on the choices individuals can make so they do not get in the way of what is good for society.
- The government should do more to advance society's goals, even if that means limiting the freedom and choices of individuals.
- Sometimes government needs to make laws that keep people from hurting themselves.
- It is not government's business to try to protect people from themselves.
- Government should stop telling people how to live their lives.
- Government interferes far too much in our everyday lives.

Endnotes

¹ Question 10 (appendix 3) includes 6 items evaluating the degree of state and government intervention in society, market and individual decision-making.

² In question 9 (appendix 3) survey participants were asked to evaluate 10 pro-environmental regulations of hydraulic fracturing including the control of air and water quality, chemical disclosure, management of infrastructure, risk and nuisance monitoring.

³ Original question Q 2, appendix 3.

⁴ Question 8, appendix 3.

⁵ Interestingly, the two research institutes (UKERC and Chatham House) evaluate problems arising from hydraulic fracturing as being even more serious (3.27) than the anti-exploration coalition. They thus favor more rigorous state intervention with respect to environmental standards related to hydraulic fracturing (3.67), but are against stopping the respective projects (2.0). More specifically, one of the two research institutes, the UK Energy Research Centre, states being in favor of a moderate development of hydraulic fracturing in the UK.

⁶ Although note that some regulations were tightened following the passing of amendments to the bill proposed by the Labour Party (Macalister, 2014).

⁷ There appears to be a ‘permissive consensus’ for further exploration *in principle* across the UK but evidence of higher opposition in local areas (Cairney, 2015b).

⁸ The arrangements for the devolved territories are similar, but: Northern Ireland’s Department of Enterprise, Trade and Investment provides its own petroleum licenses, PON process, and oversees systems management, data reporting and monitoring; Northern Ireland, Scotland and Wales have their own environment agencies and oversight over local authorities; and, Northern Ireland and Scotland have produced primary legislation on environmental regulation. Further, the licensing of onshore oil and gas extraction will be devolved further to Scotland, in the *Scotland Act 2015*. The legislation will also devolve some income tax, which gives some incentive to boost shale-related employment, but not the power to tax the extracted fuel.

⁹ Compare, for example, with German chemistry policy (technical: 7%, political: 39%, Leifeld and Schneider, 2012) or with hydraulic fracturing politics in Switzerland (technical: 11-20%, political: 13-16%, Ingold and Fischer, 2016).