



**Stakeholder perspectives of the Social Licence to Operate:
exploring the governance of shale gas development in England**

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Charlotte Emma Mummery

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In loving memory of my parents, Rita and Mike.

And for my children, Michael and Sophie.

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Abstract

The aim of this research is to investigate the governance of Shale Gas Development (SDG) in England to determine how stakeholders perceive the regulatory regime, regulators and how they understand the associated risks and benefits. The three key research questions are: How do stakeholders of SDG frame their perceptions of risk; which aspects, if any, are important for stakeholders to issue a SLO to the shale gas industry and; to what extent do stakeholders of SGD perceive the regulatory regime in England to be adequate.

Using a case study research design, this research investigates the Social Licence to Operate (SLO) and governance in two key SGD areas of England, Yorkshire and Lancashire. Semi-structured interviews with participants drew on a multitude of factors when forming perceptions of the risks and benefits associated with SGD, pro-SGD participants frame their perceptions based on quantitative risk assessment methodologies, anti-SGD participants use their personal experience of the industry. This research examines which are the important factors regarding the issuance of SLO from a community perspective.

This thesis contributes to knowledge in the following ways; by highlighting the importance of understanding stakeholders' perceptions and framing of risk, by considering how and why communities grant the SLO and to recognise that local communities consider the effectiveness of other aspects of the operation in addition to the activities of the industry. It is therefore helpful to consider the 'granting of' the SLO by the community rather than 'gaining' a SLO by the industry.

Limitations for this research include, despite efforts, no representation from key regulatory agencies such as the HSE and the local authorities in Lancashire or Yorkshire. More demographic data would have been desirable, such as participants employment information and educational attainment in order to ascertain the connection between knowledge and understanding of the issues discussed.

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Chapter 1 Introduction

1.1 Chapter introduction

Energy security, the economic crisis and dwindling North Sea gas supplies are some of the drivers for the development of on-shore gas exploration in England (Cotton et al., 2014; Williams & Sovacool, 2019). Shale Gas Development (SGD) has become a divisive issue in recent times; some claim it will bring revenue, jobs and assert that it will help us to reach CO₂ reduction targets by acting as a bridging fuel as we transition to renewable energy (Williams & Sovacool, 2019). Others are concerned about the potential harm to the environment and to human health (Cotton, 2017; Lampkin, 2019). Government ministers and industry claim the UK has a 'Gold standard' regulatory regime, however these regulations were not designed for this technology and appear fragmented, both in terms of the legislation and the ability of regulators to act (Hawkins, 2015). Some claim the regulations are inadequate, flawed and difficult to enforce (Watterson & Dinan, 2017).

The research in this thesis investigates the governance of SGD in England to determine how stakeholders perceive the regulatory regime, regulators and how they understand the associated risks and benefits. Whilst literature is developing regarding the regulations and governance of SGD in England, it is still poorly understood as a result of the nascence of the industry. Furthermore, as there was a moratorium on SGD put in place for England in 2019, (Sutherland et al, 2020) which may have shifted scholarly focus from SGD. This is potentially problematic as SGD may resume in England, indeed some are convinced it will in some form or another (Brock, 2020). Exploratory drilling and the use of acidification techniques are not part of the moratorium and continue (Brock, 2020). In addition to regulatory concerns, the industry does not appear to have gained a Social Licence to Operate (SLO). The SLO is an implicit contract between the operator and other stakeholders, which may reduce socio-political conflict and challenges to the activities of the SGD company. This research examines which are the important factors regarding the issuance of SLO from a community perspective; this includes perceptions of regulators and governmental organisations. Existing studies examining the SLO concept are looking at the gaining of a SLO from a company perspective; this does not include examining perspectives of other stakeholders such as regulators and government actors. Additionally, the lessons learnt from how regulatory regimes are applied to new a technology can be transferable.

In order to address this problem, using a comparative case study research design, this research investigates the SLO and governance in two key SGD areas of England, Yorkshire and Lancashire. Methods included semi-structured interviews with stakeholders including regulators, operators, Members of Parliament and residents near potential development sites. The next part of this

chapter provides some context by outlining the how SGD came to be in addition to the drivers and issues attributed to SGD. It begins by placing SGD in the context of energy and climate change policy and ends by placing this thesis in the context of the debates in England. The research aims and questions are framed in section 1.5 and this is followed by an overview of the thesis.

1.2 Background and Context

Increasing energy demand, dwindling fossil fuel resources and the realisation of the reality of climate change has made energy a hot topic on the global geopolitical stage. Governments around the world provided incentives for seeking out 'home grown' unconventional resources, especially since the 1970's oil crisis to achieve energy independence and energy security. In the US, this incentivised environment created the right conditions for the development of technologies to extract previously unobtainable fossil fuel resources, such as shale gas (Zoback et al, 2010).

A special combination of proprietary chemicals, sand, water, horizontal drilling techniques and hydraulic fracturing technology was initially used in 1998 and 'Fracking' or 'Shale Gas Development' was developed. This technology was not without its critics; concerns began to emerge regarding environmental degradation and human health. As such, a corresponding interest from the academic community arose, initially in the US. However as other nations sought to emulate the economic successes of the US experience, interest grew amongst scholars and local communities alike. In the UK as Prime Minister David Cameron proclaimed 'we are going all out for shale', indicating a strong desire to pursue UK resources (quoted in the Independent, 14 Jan 2014).

Over the past few years UK scholarly attention has been growing steadily in this field, many papers draw on experiences in the US regarding environmental concerns, wastewater disposal, community impacts, industry practices and the regulatory regime (Schmidt, 2013, Kron, 2014). The process of shale gas extraction was quickly banned or put under a moratorium in 2015 for Scotland and Wales (Cotton, 2020). Despite a short moratorium in 2012, the UK Government continued its support in England until 2019, when, following a series of earthquakes in Lancashire, SGD was once again put under a moratorium (this moratorium also applies to Northern Ireland). Some believe this marks the end for SGD in England others believe it will continue once technological solutions have been sought, regulations relaxed and when the political and social landscape becomes more accepting of the technology (Brock, 2020).

This next section provides an overview of the context of SGD, beginning with a brief exploration into the importance of energy security and energy and climate change policies. This is followed by a description of SGD or 'fracking' and its development over time, finally a brief evaluation of the drivers for SGD in the US and England is presented.

1.2.1 Energy

There are many challenges facing society today, perhaps two of the most significant are in relation to energy: how to ensure a supply of energy that is both affordable and reliable and; how to transform to an efficient, low carbon and environmentally friendly form of energy (Bradshaw, 2014; McCauley et al., 2019). Additionally, to achieve goals for net zero buildings and communities (Bakhtavar et al., 2020). Energy security is defined by the International Energy Agency (IEA) as 'the uninterrupted availability of energy sources at an affordable price' (IEA, 2020; IEA, 2014, p 13). Additionally, lack of energy security is linked with social and economic factors either as a result of physical unavailability or lack of access due to cost (IEA, 2016). Many factors may impact a nation's energy security such as import dependence, energy infrastructure, and the political stability of producing countries. Other factors such as diversity of supply, or the energy mix, are also important in terms of energy resilience (IEA, 2016). When developing policy for energy and climate change, these issues influence the decision-making process.

Given growing issues regarding energy security, many are also concerned about the tensions between energy security and climate change policy (Bradshaw, 2014; Cruz et al., 2018). The publication of landmark reports such as Bruntland's 'Our common future' (Keeble, 1988) and the 1992 World scientists' Warning to Humanity, plus the World Scientists' Warning to Humanity; A second notice (Ripple et al., 2017), as well as the formation of the UN's Intergovernmental Panel on Climate Change (IPCC), projects such as Agenda 21 provide a blueprint for sustainable development and the Kyoto protocol by setting standards and targets for carbon dioxide emissions reduction (Earth Watch, 2016). At least on the surface, specific policy on climate change appears to have become an important factor in shaping policy in a number of other areas, including energy. Furthermore, the 2019 Global Sustainable Development Report entitled 'The Future is Now' warns that difficulties in adopting renewable energy (RE) technologies will imperil the 2030 SDG agenda and that this is in part due to the direct and indirect subsidies to fossil fuels, which exceed those of RE therefore distorting the market (Messerli et al., 2019).

1.2.2 Shale Gas Development

Natural gas is formed over geologic time scales and found in deep underground rock formations. Geologists and engineers have known about gas reserves for a long time; the US has been extracting gas since the early Nineteenth Century and the first encounter of gas in a UK well is reported to be in 1875 (Selley, 2012). While natural gas, along with other fossil fuels has been extractable in some rock formations, other deposits have not been technically or economically recoverable until recently. Hydraulic fracturing or 'fracking' is a process that involves forcing water with chemical additives and proppants (sand) into the fissures of the rock formation under high pressure. The oil and gas industry have used fracking methods since the 1940's (Palliser, 2012; Walter, 2012) in vertical wells (Mooney, 2011). In 1998, whilst experimenting with a combination of fracking, horizontal drilling techniques, pressure, water and chemical additives, a small independent gas producer in Texas named George Mitchell came across a method of extracting gas from tight formations (Merrill, 2013). This process, horizontal hydraulic fracturing (HHF), was observed and emulated by other gas producers (Merrill, 2013).

This new method of HHF has stimulated a boom in the natural gas industry. Proponents cite the benefits of new jobs and increased revenues, moreover making claims of environmental benefit in the form of a 'cleaner' fuel (Douglas et al., 2011). The combustion of natural gas produces significantly lower amounts of carbon dioxide, nitrous oxides and sulphur dioxide than oil and coal (Merrill, 2013; Palliser, 2012). Opponents cite the potential hazards and risks associated with HHF, some of which are not fully understood (Glauser, 2014; Soeder, 2018; Sovacool, 2014). These include: water contamination, adverse effects on human and animal health, disruption to ecosystems, air quality, community impact, health and safety for workers and climate change (Bamberger & Oswald, 2014; Patterson & McLean, 2017; Werner et al., 2015).

'Fracking' or hydraulic fracturing has been receiving substantial attention over the past decade in the media, public discourse and academia. The term 'Fracking' originally referred to a single step in the process of extracting oil and gas: that is the process of injecting liquid at high pressure into subterranean rocks so as to force open existing fissures and extract oil or gas (Oxford Dictionary, 2015). Fracking, for some, has a wider meaning; it often refers to the whole process of shale gas development, from exploration to production, postproduction activities, for example well abandonment and can also include community and environmental impacts (Evensen et al., 2014). 'Fracking' also conveys negative and perhaps even vulgar connotations that may influence public opinion (Climek et al., 2013; Evensen et al., 2014; Roberts et al., 2020): some do not know what fracking is, but nevertheless dislike the sound of it (Bailin, 2013). The interpretation of the word is also responsible for many misunderstandings and disputes.

Industry technical experts are more likely to be referring to the single step in the process, while the general public and media are possibly referring to the whole process. To make matters even more perplexing, terms such as ‘unconventional oil and gas development’, ‘tight gas’, ‘fracking’, ‘shale gas development’ and HHF are also used. In order to avoid any confusion, the term ‘fracking’ will henceforth in this thesis include shale gas development (SGD) when referring to the whole process.

In addition to understanding historical developments of SGD, it is also important to be aware of the ‘drivers’ or reasons why SGD became so ubiquitous in the US. This understanding helps to comprehend the importance of SGD and why governments may pursue this technology, even in the face of adversity. Furthermore, this understanding may assist in ascertaining if governments, such as the UK, may pursue SGD in the future. It is also important to appreciate the environmental and policy implications of implementing SGD. This will help to establish the factors that may, or may not, have an impact on the development and deployment, and continuation of the technology in England. The following will explore the political, environmental and economic drivers since the conception of the industry to date. Each section will explore drivers in the US and England.

1.2.3 Drivers

1.2.3.1 Political drivers

Early on in the life of the technology, the ‘fracking boom’ had been described as the most important economic event since the gold rush (Chen & Randall, 2013). The International Energy Agency (IEA) proclaimed a ‘golden era’ for natural gas (Grose, 2011), others described it as an era of ‘shale revolution’ and ‘energy abundance’ (Inman, 2014). In 2013 The Economist reported that shale gas development could add as much as \$700 billion and 1.7 million jobs to the United States’ economy by 2020 (Anon, 2013). The US was recovering from one of the greatest recessions in its history, and so job creation was a powerful motivational factor in addition to the desire to be energy independent. The oil and gas sector enjoyed ‘startling success’ as the industry made the US the world’s largest producer of oil and gas (Brower, 2020). Indeed, a study looking at the impact of shale gas on the economic growth of the US between 2002 and 2019 found a significant contribution from the sale of shale gas and its capital stock to the US economy, while the SGD labour force was positive, but not significant factor, in economic growth of the US (Solarin et al., 2020). Although job creation was a political driver, it did not contribute significantly to the economy.

This positive picture of the SDG in the early years of the twenty first century is in stark contrast to the state of the industry in 2020. Reports of mass redundancies, lay-offs and idle rigs as the

coronavirus pandemic hit global energy demand in April 2020 and negatively impacted US prices (Brower, 2020). Moreover, according to a report by the Institute for Energy Economics and Financial Analysis (IEEFA), the SGD industry in the US has been performing poorly in financial terms, this pre-dates the pandemic and the report further states that SGD companies 'have reported negative free cash flows every single year during the previous decade, a poor sign of financial health' (Bairstow, 2020, p1)

In 2008 the UK thirteenth licence round for onshore oil and gas took place with little political or public interest (Solman, 2020; Williams et al., 2020), the industry did however take an interest due to the successes witnessed in the US. Moreover, the impact the US shale boom was having on the global market encouraged the British Geological Survey (BGS) to undertake a review of the potential reserves of shale in the UK (Williams et al., 2020). Following the BGS and Cuadrilla's (a SGD company in Lancashire) own estimate for their licensing areas, political interest started to gather pace. The Conservative MP Steve Baker stated in the House of Commons in 2011:

'It seems that we have vast abundant and cheap sources of gas in this country. We should be going through a shale revolution'

(Hansard, 2011 Vol 533 in: Williams et al., 2020)

As political interest and support began to grow, so did the opposition (Zhou & Qin, 2020). This prompted a report by the Royal Academy of Engineering entitled 'The Risks of Hydraulic Fracturing', which concludes that risk associated with SGD, can be managed effectively, providing best practices are used and enforced by effective regulation (Mair et al., 2012). Political interest slowly began to grow driven by the perception of low domestic energy prices and energy security. Moreover, discontent regarding the incentives and support for renewables and the perception that this added to the cost of energy bills, caused many to switch support from 'green energy' to SGD. Indeed, it was reported that David Cameron, Prime Minister at the time, instructed aides to 'cut all the green crap' in relation to green taxes on energy bills (Mason, 2013). The clearest political indicator came from Cameron in 2014 with his comment 'we're going all out for shale' (UK Government, 2014). The following year the (then) energy secretary Amber Rudd cemented this position with statements about growing confidence in their ability to deliver shale, expressing the importance of energy security and 'home grown' supplies of energy, linking this to economic growth and lower carbon emissions, at the same time as taking a tough stance on renewable subsidies (Williams et al., 2020) .

The UK SGD industry finally got underway in April of 2018 with Cuadrilla completing two horizontal shale wells in Lancashire. These operations caused seismicity that exceeded the new

‘Traffic Light System’ (TLS) limits for seismic events, set at 0.5ML (Clarke et al., 2019) which in turn resulted in a cessation of operations for a brief period. Cuadrilla’s chief executive called for a relaxing of the new regulations stating that the industry would be ‘strangled before birth’ if limits were not raised to 2ML (Williams et al., 2020). In November 2019 a report by the Oil and Gas Authority concluded that it was not possible with current technology to predict the probability of earthquakes associated with SGD (OGA, 2019). In response to this report, and possibly also because a general election had just been called, SGD was halted with a moratorium in place.

It should be noted that the moratorium only includes those operations which meet a precise definition in the 2015 Infrastructure Act, specifically operations which inject more than 1000 cubic metres of fluid at each stage of the process, or more than 10,000 cubic metres of fluid in total. Additionally, exploratory drilling and acid stimulation are not included in the moratorium (Brock, 2020). Many are highly dubious about the UK Government’s motives claiming that decisions were more pragmatic than ideological and that this leaves a path back for the industry (Rattle et al., 2020; Smythe, 2020).

1.2.3.2 Environmental drivers

Some environmentalists initially welcomed shale gas as a cleaner fuel as it produces only 45% of CO₂ emissions compared to coal (Spence, 2012). Methane is a Greenhouse gas (GHG) with greater global warming potential than CO₂: it is 21-23 times more potent over 100 years, and has a half-life of 12 years meaning the GHG effect is greater over a short timescale, this means that methane emissions are a concern because of its contribution to climate radiative forcing (de Gouw et al., 2020; Sovacool, 2014). IEA reported reduced US greenhouse gas (GHG) emissions year after year and attributed this to a shift from coal to natural gas as a result of SGD (IEA, 2019). Commenting on 2019 and 2020 figures, the IEA have observed that the largest reductions in global emission have come from the US, however these were in absolute terms rather than percentage terms; the US still has the largest per capita figures, with the average American emitting twice as much as the average Chinese or European, and eight times as much as people from India (Lo, 2020). Furthermore, the reduction in emissions is also partly attributed to milder winters (heating) and cooler summers (air conditioning) (Lo, 2020).

Others argue that SGD may have been, in part, the reason for a reduction in CO₂ emissions in the US, but that methane emissions could be as high as 110 billion cubic meters/year (World Bank). This equates to the total annual natural gas consumption for Germany and France combined (Saheed & Ezalina, 2012; Sovacool, 2014). Emissions have been estimated at twice the amount in the total inventory accounted by the US Environmental Protection Agency (Plant

et al., 2019). Similarly in England a near-field Gaussian plume inversion approach has been used to begin accounting for methane emissions in the UK, initial results show higher methane fluxes on cold venting days at Little Plumton in Lancashire compared with a nearby dairy farm (Shah et al., 2020). Identifying, quantifying and accounting for methane emissions is recommended for regulating SGD in England (Shah et al., 2020).

1.2.3.3 Economic drivers

The economic cost of climate change came to the fore in 2006 with the publication of the Stern report, warning that unabated climate change could cost the global economy the equivalent of 5% of GDP per year and that the benefits of early action would far outweigh the costs later on (Stern, 2006). The cost of reducing emissions was originally estimated at 1% of GDP. Then, due to faster-than-expected rates of climate change, a 2008 review amended it to 2% (Stern, 2008). Two new reports have since been published and in both these estimates have been revised upwards. There have been some critics of the Stern report, and successive reports, for example Byatt et al (2006), Tou and Yohe (2006) claim the report is greatly exaggerated. Others such as Weitzman (2007), Helm (2008) and Baer (2006) support the underlying theory, if not some of the methodology, and claim that the Stern report may have underestimated the cost associated with climate change.

In the academic literature, the economic, mitigation and legal costs of environmental damage from SGD is less prevalent, although as the industry matures so does the scholarly literature relating to monetary cost. Holahan and Arnold (2013) argue that integration contracts and well spacing requirements, used for regulation of conventional oil and gas development (primarily for economic efficiency reasons, but including some environmental considerations) is insufficient for the regulation of unconventional oil and gas. This is because the environmental damage caused is not always a point source pollution problem (Holahan & Arnold, 2013). Examples include the contamination of groundwater, induced seismic activity and air pollution. Conventional gas development is targeted and closely controlled in known geological formations; whereas unconventional gas development requires horizontal boreholes that may extend into unknown geologies (Chalmers et al, 2012 in Holahan & Arnold 2013) and over a much greater spatial scale. Results from a Life Cycle Cost Assessment (LCCA) study of SGD in the US suggest that air and water pollution are the highest, and most expensive, impacting factors (Mehany & Kumar, 2019), the authors further warn against the dependence of shale gas as it is economically and environmentally unsustainable, in part due to the cost of environmental damage and also because it is a finite resource.

Whilst the drivers for the development of SGD in the US are clear, there have been considerable apprehensions regarding the environmental, human health and economic impacts. In addition, concern has been raised regarding the regulatory regime in the US; with this in mind the next section provides an overview of the English regulatory landscape.

1.2.4 English regulatory landscape

The UK government believes its regulatory regime to be superior to many and able to mitigate and/or remediate any environmental harms or damage to human health: a DECC spokesperson stated:

‘The UK has one of the best track records in the world for protecting our environment while developing our industries - these regulations will get this vital industry moving while protecting our environment and people’ (Perraudin, 2015, p 1).

The Government are confident that existing regulations, designed for conventional (on-shore and off-shore) oil and gas extraction, are sufficient to regulate unconventional SGD. However, onshore unconventional SGD is likely to be much larger in scale, utilise different technologies and have a potentially greater impact on local communities and the environment than conventional methods. Amendments to regulations relating to SGD have been made since, such as to the Infrastructure Act (discussed in section 2.6.2), however these amendments are widely viewed as favouring the industry rather than protecting the environment and human health, moreover these amendments have shifted power away from local communities in favour of central government decision making (Cotton, 2017). Furthermore, efforts have been made to redefine SGD as a Nationally Significant Infrastructure Project (NSIP) in order to facilitate the move from local decision making to central government (Brock, 2020).

These issues raise several pressing questions concerning SGD in relation to governance, the regulations and to democracy, which are addressed in this thesis. Insights into stakeholders’ perceptions of regulators, the regime and associated risks of development will help to highlight the positive and negative aspects of the regulatory regime using SGD in Yorkshire and Lancashire as the case study. This will not only be useful if SGD resumes in England, the insights will also be transferable to other new developments which may have community impacts, perceived or otherwise. It is also hoped that this research will contribute to the growing body of literature, which is beginning to introduce new processes to guide decision-making in the context of community engagement/empowerment for a transition to low carbon energy use.

1.3 Problem and significance

The regulatory regime for SGD, despite being hailed as ‘gold standard’ by the UK Government, was not designed for this technology and considered to be inadequate by opponents given the learned experience from the US. The regulatory environment in the US is very different from that in the UK and therefore this aspect of ‘learning from the US’ is not directly transferable. A regulatory regime is defined as a means for achieving regulatory goals and consists of institutional structure with responsibilities assigned for carrying out regulatory actions (May, 2007). The UK regulatory regime for SGD was developed to stimulate investment in the industry; a tax incentive and community benefit package for host communities was unveiled at the same time (Cotton et al, 2014). Understanding stakeholder perceptions of the regulatory regime is therefore important as the SGD regulations were developed for the purpose of stimulating investment rather than protecting the environment and human health.

Before extraction began, there was little scholarly attention to the effectiveness of the UK regulatory regime. Rather, attention began to focus on public attitudes; support for and against SGD. As exploration started, research into communities began to take shape; focus on community engagement, a key aspect of the regulatory regime, began to be investigated (Bradshaw & Waite, 2017b; Cotton, 2013; 2017; Evensen, 2016; 2018; Short & Szolucha, 2017; Whitton et al., 2018). However, this field is still relatively underdeveloped and only really investigated to the extent of the exploration impacts on communities. In the case of SGD, this will likely remain the case in England while a moratorium is in place, however research into the impacts of different stages of development should resume once, or if, SGD resumes.

The research presented in this thesis therefore contributes to the literature on local community perceptions of other stakeholders within the SGD arena (e.g. regulators, governmental actors) in addition to the perceptions of the industry, the latter being more sufficiently covered in the literature. Whilst the concept of SLO has been around for a couple of decades and has received scholarly attention in a range of contexts, there are only a handful of studies applying this concept to SGD, fewer still in the context of SGD in England. During a review of the literature, all studies found relating to SLO looked at the gaining of a SLO for a business company perspective, none found are examining SLO from the point of view of a local community, i.e. which factors are important for a community to issue a SLO. This research fills that gap by examining the SLO from a different perspective, the local community.

The results and insight provided by this thesis will be useful for industry, local communities and help to inform policy formulation and future regarding regulations and regulatory processes. The consequences of not having this information for industry may be costly; in terms of potential

increased operational costs as a result of increased opposition, or the cost of not developing having already committed investments into the project. Industry, regulators and local communities will benefit from a deeper understanding of how different stakeholders perceive risk and therefore the potential consequences of different perspectives. Government organisations will benefit from the contribution to the literature regarding stakeholder perspectives of the regulatory regime, governance in the context of potential conflicting policies and stakeholders' perceptions of powerful actors in government and industry. Furthermore, this thesis seeks to highlight important governance concepts such as due process, good governance, sustainability, intergenerational equity and responsibility, thus further contributing to this literature.

Whilst these issues are being investigated using SGD as the case study, these findings should be transferable to other developments, perhaps especially in rural areas. However, this research aims to highlight processes, from the perspective of local community stakeholders with regards to regulatory processes, regimes and actors involved.

1.4 Responses to problem

In order to address the identified gap in the existing research, a case study methodology was employed using a single case design, multiple units of analysis case study to: describe the current state of SGD and the regulatory framework in England; explore the key issues from each stakeholder perspective; and to compare results between 'units', for example conventional gas development, other countries and experiences or other comparisons made by participants regarding the regulatory regime. This is further discussed in the context of SLO, identifying aspects relating to legitimacy, credibility and trust as illustrated by the 'boundaries' of SLO between a SLO being withheld or withdrawn and a local community having a 'psychological identity' with the industry.

In order to achieve the depth, detail and holistic overview required for this research, descriptive and interpretive answers were essential. Semi structured interviews were undertaken using a range of targeted stakeholders, such as residents near potential development sites, regulators, industry professionals and government actors (MP's).

This research will be transferable to other energy projects in the future; problems identified in this thesis are not just restricted to SGD. Similar problems have been detected in Renewable

Energy projects and other energy infrastructure projects worldwide. The next section explains the research aims, questions and relevance.

1.5 Research aims and questions

1.5.1 Research aims

The overall aim of the research presented in this thesis is to understand how stakeholders perceive the regulatory regime, regulators and the associated risks in order to understand the influences regarding the issuance of a SLO within the context of SGD in England. Additionally, the aim is to develop the SLO concept further by considering the impact of stakeholders' perceptions regarding the regulatory regime and more broadly, the governance of SGD. This is not typically considered when using the SLO framework, rather perceptions of the operating company is the key focus. Considering the SLO in a more encompassing way will benefit stakeholders on all sides of the debate, including developers at the planning stage of a project in addition to policy makers.

1.5.2 Research questions

RQ 1: How do stakeholders of SGD frame their perceptions of risk?

In order to understand stakeholders' perceptions of SGD it is useful to comprehend how they perceive risk. To answer this question this research links the theories of risk outlined in Chapter 2.2 with their perception of risk in relation to SGD. Insights from this research question will also help with understanding risk associated with the governance and the issuance of a SLO in addition to the perception of risk associated with SGD activities. The research question aims to cover the types of risk perceived by opponents, proponents and the overlap between these. Understanding these perceptions provides useful awareness of how risk perception may impact the development of SGD in England in the future and potentially other new technologies looking to develop in rural communities.

RQ 2: Which aspects of SLO, if any, are important for stakeholders to issue a SLO to the shale gas industry?

The aim of this question is to investigate the factors relating to the issuance, or not, of SLO from the perspective of community stakeholders. It further investigates the importance of the

stakeholders' perceptions of non-traditional aspects of SLO, such as perceptions of the regulatory agencies, government actors and attempts to identify other aspects important to the issuance of SLO in addition to the more traditional focus of the perceptions of the industry or operating company.

RQ 3: To what extent do stakeholders of SGD perceive the regulatory regime in England to be adequate?

In order to address this third research question further questions are posited in relation to how stakeholders form their opinions of the regulatory regime. Firstly, how are stakeholders making comparisons with other countries, industries and aspects? As the SGD industry is relatively new and as such little direct experience has been had in England, participants are likely to make comparisons with other countries where SGD has already taken place, for example the US. Comparisons may also be made with other industries, such as conventional onshore gas development or the regulatory landscape and experiences of participants' own industries. Secondly, a question often pondered at the establishment of SGD in England, and indeed elsewhere: should the shale gas industry have a single regulatory regime? Due to the fact that no new bespoke regulatory framework has been devised for SGD, this question is designed to identify if, or where, there are gaps in the regulations. The SGD regulatory framework is 'borrowed' from the offshore regulatory framework, which in itself was copied from the onshore framework some time before. Thirdly, there is a perception that the oil and gas industry (on and off-shore) largely self-regulated in the past. The final sub question is therefore: To what extent should the industry self-regulate? This draws on some theoretical governance concepts such as 'good governance' and is designed to understand the level of (or lack of) trust in the industry; in order for an industry to self-regulate the public should have a level of trust in them (or ignorance of what they are doing).

1.6 Thesis outline

This thesis aims to answer the research questions outlined above. It begins with a review of the literature relating to SGD, risk, governance, the Social Licence to Operate (SLO) in addition to literature relating to technical aspects of SGD relevant to themes in this thesis. The literature review also includes an overview of the UK regulations and relevant EU legislation, which although the UK has left the EU highlights which of the UK regulations have been influenced by EU regulations and policy, and therefore should be monitored. Chapter 3 outlines the methodology. This covers the research strategy and design; which includes the use of case study methodology. Methods employed which were semi-structured interviews with participants

gained by chain referral or 'snowball' sampling. This chapter also examines the researcher positionality and contains a reflexive statement.

Before looking at stakeholders' perceptions of SGD, it is useful to gain some insight into how they perceive risk. Chapter 4 links the theories of risk outlined in the literature review with the risks as perceived by the participants of this study. The themes are identified and categorised as: operational failures, regulatory failures, technical failures and 'other' failures. The latter includes some perceptions of political failures. The categories are labelled as 'failures' as this is driven by the themes raised by residents, who (in this study) are largely anti-SGD. However, this section does cover the types of risk perceived by proponents and opponents in addition to any overlap between the two.

The next chapter (chapter 5) investigates how stakeholders are making comparisons with other countries, industries and aspects in order to explore issues relating to governance and the regulatory regime. Key questions addressed in chapter five include, should there be a single regulatory framework? And to what extent should the industry self-regulate? The former question covers participant arguments for and against a single framework in addition to some alternative regulatory arrangements suggested. Similarly, the latter question covers the pros and cons of self-regulation, it also investigates other factors such as operator reputation, perceptions of deception and non-compliance in the context of self-regulation; this also links to the next chapter on SLO. This chapter also links to the theories of risk outlined in the literature review in addition to the literature and theories relating to governance, notable the concept of 'good governance'.

Chapter 6 investigates the concept of the Social Licence to Operate (SLO) in the contexts of SGD in England. It identifies which aspects are important factors for stakeholders to issue a SLO, the extent to which regulatory agencies are considered in the issuance of the SLO, and finally the extent to which perceptions of government actors are important in the issuance of the SLO. It explores stakeholders' perceptions of not only the industry, which is commonplace in SLO investigations, however also the perceptions of regulatory agencies, the regulatory regime itself, government agencies and actors. Important aspects of SLO are investigated, for example communication. Communication between local residents and industry have mostly taken place at Community Liaison Group (CLG) meetings, and with regulators at 'Meet The Regulator' (MTR) meetings however, although these lines of communication were open, they seemed to reinforce the perception that regulators are complicit with industry. Other key themes relating to SLO include trust, credibility and legitimacy, therefore stakeholders' perceptions are discussed from this perspective.

The final chapter, Chapter 7, is the summary and conclusions. This synthesises the results from the empirical chapters (4, 5 and 6) and finds that participants draw on a multitude of factors when forming perceptions of the risks associated with SGD. They draw on a similar range of experiences when forming perceptions of regulators and government actors. How local residents perceive the regulators and government agencies is an important factor when considering the issuance of a SLO. For example, if stakeholders feel the regulators are complicit with industry or central government, do not trust them or believe they do not have the capacity or expertise to regulate the industry; it is unlikely a SLO will be issued. Of equal importance are the perceptions of industry and government actors regarding local residents. Residents are often characterised as irrational, incapable of understanding the research and science regarding SGD, or as ‘professional activists’ who are simply against development. This study finds local residents to be capable of understanding the risks and benefits, capable of rational debate and furthermore, although the anti-fracking groups are supported by ‘professional protestors’, resident participants are aware of both the benefits and disadvantages of support received from this faction. Other conclusions include the fact that some opinions are not partisan, for example participants’ discussions regarding the idea of a single regulatory framework for SGD. Opinions were not that one side was in favour of a single bespoke regime for SGD and vice versa, rather both sides of the debate came up with pros and cons for this framework, further demonstrating the ability to have a rational debate about SGD. Local residents feel that they have the evidence of industry failing to adhere to existing regulations, gained from conventional gas operations and exploratory SGD, they are therefore unwilling to tolerate an industry self-regulating. This indicates a systemic lack of trust and while this trust is evident, it is difficult to see how the industry can gain a SLO. This research highlights the importance of viewing the SLO from the local community perspective. In order to achieve this, practitioners should include other stakeholders when considering the SLO, while this study considers regulators and government actors, there may be other stakeholders involved such as local businesses, especially when considering transferring this concept to other developments. This Chapter also covers the limitations of this study and difficulties encountered.

Chapter 2 Literature Review

This chapter provides a review of the published research and current debate relating to shale gas development (SGD) and of the chosen methodological and theoretical frameworks supporting this thesis. The primary focus of the SGD literature is on the US as this is currently the only region where SGD could be considered as a mature technology. The body of literature is however growing in the UK and Europe as interest in SGD gathered pace, although the pace has slowed recently. This literature review explores relevant concepts in relation to SGD, such as risk perception, governance and the Social Licence to Operate (SLO), further it provides a review of the literature pertaining to some of the technical aspects regarding SGD. Lastly, it provides an overview of the regulations, including some relevant EU legislation which may be included into UK regulations with the European Union (Withdrawal) Act 2018.

The section on risk (2.2) covers definitions of risk, risk perception and explores three theories relating to risk perception relevant to this thesis. All three theories highlight aspects of risk perception, albeit from slightly different perspectives, which are relevant to SGD governance and SLO. Risk perception in the context of SGD is relatively underdeveloped in the literature; this thesis aims to contribute to this body of work.

Governance in any context is difficult to pin down. Governance of SGD is explored using concepts relating to energy governance, energy justice and environmental justice. Most scholars agree that community engagement is key to achieving a fair, just and democratic outcome. Some even suggest that community engagement should occur during the research and development stage of a new technology; participation and transparency should be the norm in a democracy (Jasanoff, 2019). Policy conflict in the UK is also explored by examining governance, localism and democracy. Finally, the perception of the 'revolving door' between powerful actors in governmental organisations and the oil and gas industry is explored.

The SLO section includes an introduction to the concept and explanation of how it came about, definitions, examples of existing applications and also provides an overview limitations and criticisms relating to SLO. Finally, SLO is explored in the context of SGD in Lancashire and Yorkshire with some of the literature beginning to emerge using SLO in the SGD context.

The final two sections of this literature review cover the technical aspects relevant to SGD and this thesis and provide an overview of the regulatory regime. The technical aspects include fugitive methane and highlight the debate surrounding contamination of groundwater in the US. Well integrity, wastewater disposal and seismicity are also covered as relevant and important technical aspects. The regulations overview identifies key English regulations, relevant EU

directives and legislation and provides an overview of the legislative developments over the past few years.

2.1 Shale Gas Development (SGD)

The literature relating to SGD was at its height in the period between 2010 and 2015 and is still growing, although at a slower pace. A large proportion of it relates to water contamination, air pollution and other environmental concerns, for example Fischetti (2013); Osborn et al. (2011a); Schmidt (2013); Smith (2012) Brantley et al. (2018); Meng (2017); Reible et al. (2016); Ziyank et al. (2019). Methane contamination of groundwater is a contentious issue and discussed in more detail in section 2.6.1 of this review. With the exception of Fischetti (2013) much of the earlier literature (pre-2015) suggests that there is evidence of environmental harm as a result of SGD, however the resource should still be developed in a more sustainable manner and further, concedes that this had not been the case in the US and Europe so far (Smith, 2012). Others pinpoint wastewater disposal as a specific environmental and health concern, claiming that the industry is already producing overwhelming volume of wastewater (Schmidt, 2013). Fischetti (2013) claimed in *Scientific American* that higher levels of methane in drinking water wells within a mile of SGD sites, however this article is no longer available online. Fugitive methane and water contamination is discussed further in section 2.5.1. The more recent literature (post-2015) tends to be more unequivocal about findings, such as Meng (2017) who embraced a 'total environmental study paradigm' in relation to the environmental impacts of SGD, looking at impacts in the anthroposphere, atmosphere, biosphere, hydrosphere, and lithosphere concluding that the environmental impacts of SGD are much 'broader and deeper' than studies to date have indicated. Similarly to Schmidt (2013), Johnston et al. (2016) looked at the environmental degradation associated with wastewater disposal in relation to racial and socio-economic equity and found that disposal sites are disproportionately sited in areas of high poverty. There is a disjunction between official environmental data and the experiences of local communities near SGD sites in the US (Kron, 2014). This has prompted some local communities to engage in their own 'citizen science' style air monitoring projects (Gabrys et al., 2016), which also indicates a mistrust of the authorities in matters such as air quality.

The research regarding regulatory issues and policy implications has significantly gained pace over the last few years. Earlier research identifies the range of regulatory instruments available to governments and recommends more regulatory oversight at SGD sites in the US (Centner & O'Connell, 2014). Others looked at regulatory controls at the state and federal level and

identified more support from anti-SGD activists and environmental policy coalitions for federal level control, conversely the energy industry viewed federal level regulations as restrictive and redundant, favouring local state governance (Davis, 2012; Smith & Ferguson, 2013; Warner & Shapiro, 2013). This preference for state over federal regulation often results in weak regulatory oversight (Warner & Shapiro, 2013). More recent research calls for tighter, transparent and more accessible regulations, in the US and further afield. For example, the regulations of groundwater resource management must include public disclosure, which would allow for independent academic and private sector review (Esterhuysen et al., 2019). Moreover, regulations must be effectively enforced to avoid potentially irreversible contamination of groundwater (Esterhuysen et al., 2019). Some have called for the use of the precautionary principle when considering the issue of groundwater contamination (Yadav et al., 2020).

In the UK governance and regulatory literature is emerging for SGD, especially in the social sciences. Much of this literature reveals the importance of planning and regulation for the future success (or not) of the SGD industry (Evensen, 2018), arriving at conclusions by reviewing and analysing regulation and planning policies (Cotton, 2013; Evensen et al., 2017; Hawkins, 2015; Stokes, 2016). Additionally, some have investigated SGD policy in the context of fairness and ethics, for example Cotton (2013; 2017); Evensen (2017); Whitton et al. (2017); Whitton & Charnley-Parry (2020). In a review of the social science SGD literature, over half (n.26) of the articles reviewed, in relation to the regulations and planning, critiqued the planning process (Evensen, 2018). Critiques include that the planning process is not suitable for SGD and is prejudiced in favour of the industry (Hawkins, 2015), that regulations are insufficient to protect the environment and human health (Hays et al., 2015; Reap, 2015; Smythe, 2020), the regulations are fragmented and not intended for SGD technology (Hawkins, 2015) and further, David Cameron's UK Government was facilitating the development of SGD by using contradictory policy approaches (Stokes, 2016), for example conflicts with climate change policy and localism. Another conflict of policy identified by Patterson & McLean (2017) is the seeming reluctance to apply the precautionary principle¹ to SGD, despite the Government claiming to be a supporter of it (Evensen, 2018). The literature also reveals the lack of community engagement in decision making for local communities near proposed SGD sites (Bradshaw & Waite, 2017b;

¹ The precautionary principle is a guideline enabling decision-makers to adopt precautionary measures when scientific evidence about an environmental or human health hazard is uncertain and when the stakes are potentially high. There are four central components: taking preventive action in the face of uncertainty; shifting the burden of proof to the proponents of an activity; exploring a wide range of alternatives to possibly harmful actions; and increasing public participation in decision making (Kriebel et al, 2001).

Cotton, 2013; 2017; Evensen, 2016; 2018; Short & Szolucha, 2017; Whitton et al., 2018). Community engagement is discussed in more detail in the context of governance (section 2.3.1) and in the context of SLO (section 2.4.3).

Investigations into the public perceptions of SGD in the UK began with studies such as Cotton (2015); Whitmarsh et al. (2015); Williams et al. (2015). All three found fundamental differences in opinions between participant groups regarding SGD. Whitmarsh et al. (2015) and Williams et al. (2015) chose participants from the general public, the former using online surveys and the latter focus groups. Cotton (2015) chose Q-method study of SGD stakeholders. Williams et al. (2015) observed that the participants perceive: that policymakers take a 'salespersons' position on fracking and that this undermines the legitimacy of an unpartisan position; that the benefits of fracking should receive the same level of scrutiny as the risks (participants were very wary of the hype regarding benefits); that the decision making process is essentially un-democratic (Williams et al., 2015). The authors commented that 'engagement should be a dialogue not a monologue' (p 13) and that public engagement is as much about the policy makers learning about public issues as it is about the public learning the facts (Williams et al., 2015). Cotton (2015) identified three viewpoints (or factors) on SGD: do not trust the shale gas industry; shale gas is a useful bridging fuel; and concern over citizen involvement in shale gas governance. He identified statistically significant points, across factors, where there were points of agreement and points of disagreement with the objective of finding areas that were common ground for 'building a shale gas management strategy' (Cotton, 2015; p13). Road traffic ranked low as a concern for stakeholders, in contrast to previous studies (see Theodori, 2009), although the lack of awareness and knowledge of the issue may be the reason for this low ranking (Cotton, 2015). Crucially, lack of knowledge and understanding is an issue echoed in all three studies. Similarly, all three studies highlight the need for government and policy makers to provide transparent, broad and open dialogue with the public and be more responsive to public views, uncertainties and concerns regarding SGD and its place in the UK energy strategy (Cotton, 2015; Whitmarsh et al., 2015; Williams et al., 2015).

The US literature turned its attention to the lessons that may be learned from this technical revolution; especially in areas such as federalism, risk governance and Liquefied Natural Gas (LNG) exports (Golden & Wiseman, 2015). Further, the lessons that may be learned from the negative elements of the technical revolution such as 'more careful regulation of a developing technology' (Golden & Wiseman, 2015).

The final group identified in the literature is those that challenge the findings of others; these are mostly critical of the literature focusing on environmental concerns such as methane

contamination of drinking water at a specific site or within a region or ‘shale play’²(Davies, 2011; Holahan & Arnold, 2013; Molofsky et al., 2013). Some of these issues are explored in section 2.5.

Over the past decade there has been considerable global interest in SGD. Since the hailed success of the US and Canada, other countries considering SGD include the UK, Germany, South Africa, Australia, Argentina and China (Goodman et al., 2016). In the UK context, the Welsh and Scottish Governments issued moratoria on SGD in 2015 and most recently England and Northern Ireland in 2019, with the UK Government stating ‘Fracking will now be paused unless and until further evidence is provided that it can be carried out safely here.’ (BEIS, 2019a, p1). Other countries such as Poland and Bulgaria showed early interest. However, despite being fervent proponents, gas companies withdrew due to unfavourable geological and regulatory conditions (Pigg, 2013). Literature is beginning to emerge from China; the biggest concern here is water use and water stress, with one study estimating the geological conditions in China are such that between 29% and 160% more water will be required for fracking in some areas such as the South West (Ask et al., 2015). This may demonstrate the uncertainty of SGD feasibility in different geological conditions and that the technology is not as easy to transfer as some may think or wish.

Scientists attempting to answer questions about these impacts are also the subjects of public debate regarding transparency; there is profound scepticism about the findings of SGD research, particularly when funding sources are not disclosed, resulting in the emergence of the term ‘frackademic’³ (Kroepsch, 2013). Indeed, research consortiums such as ReFine (Research Fracking in Europe), who are funded by a number of organisations including SGD companies, have had funders withdraw following the publication of research (Davies & Herringshaw, 2016), perhaps findings were not to the industries’ liking. Other issues for scientists and academics include communicating findings in terms of probabilities rather than absolutes; the public often demands a definitive answer to questions about SGD, especially regarding human health and environmental impact (Kroepsch, 2013).

The SGD industry has also been criticised for being less than transparent (Evensen et al., 2014; Konschnik & Boling, 2014), this is well documented in the case of chemical disclosure in the US

² Shale play is defined as ‘A set of discovered, undiscovered or possible natural gas accumulations that exhibit similar geological characteristics. Shale plays are located within basins, which are large-scale geologic depressions, often hundreds of miles across, which also may contain other oil and natural gas resources’ (BEIS, 2019c)

³ “Frackademic” is a term used to describe academics potentially influenced by the flow of money from oil and gas companies to universities (Schneider, 2015).

(Centner & O'Connell, 2014; Davis & Fisk, 2014; Spence, 2012) and in the UK with regards to seismic events (Cotton et al., 2014; Walter, 2012), local impacts in general and with the UK energy market as a whole (Beebeejaun, 2013). Potential UK investors are also concerned about industry transparency because of the potential impact on shareholder value and have stressed the importance of industry managers reducing risks 'by addressing operational hazards and are capturing the genuine, measurable business rewards flowing from environmental management practices that have the potential to lower costs, increase profits and enhance community acceptance' (Jones et al., 2014).

The UK government has also been under scrutiny regarding transparency after the Department for Environment, Food and Rural Affairs (DEFRA) released a heavily redacted report in August 2014 entitled 'Shale Gas: Rural Economy Impacts' (DEFRA, 2014), a move which has been greatly criticised by the media (Mason, 2014) and caused activist groups to protest outside the entrance to DEFRA campaigning against censorship and for public rights to freedom of information (Olofsson, 2014). This report has since been fully published by order of the Information Commissioner following public, media and political pressure. The sections previously redacted highlighted potential health issues such as noise, light and air pollution, economic issues such as reduction in house value, higher rental prices, existing impacts on local industries, for example agriculture, tourism, organic farming, fishing and outdoor recreation. Further, the report recommended that 'regulatory capacity may need to be increased' (Ottery, 2015).

Concerns in the UK are not just limited to transparency of industry and governmental stakeholders. Knowledge, or lack of, of local regulatory agencies is also cited as a major issue (Kinchy & Perry, 2012). Local councils are responsible for issuing planning permission for SGD sites, yet many believe they lack the expertise or knowledge regarding the technology and potential impacts (Beebeejaun, 2013), further, local governments currently lack the capacity to monitor and regulate (Bomberg, 2017). The lack of local knowledge is, in part, due to the fact the technology is relatively new, and partly as a result of the changes and shifts in the political energy strategies experienced over the last 15 years; from renewable energy, nuclear and now towards SGD (Bailoni, 2014).

Both opponents and proponents of SGD across Europe and the UK are looking at the United States to draw on experience and look for evidence to support their arguments (Beebeejaun, 2013). Whilst SGD has proved technologically and financially viable in the US, these experiences may not be transferable to Europe and the UK; the geological, geopolitical and regulatory conditions are quite different. In the UK, the government has suggested that the existing regulatory framework is sufficient for SGD however these regulations were not designed for this

technology, similarly there is no formal EU agreement on how SGD should be regulated. This is potentially a concern for the UK as many suspect a weakening of environmental legislation after the UK leaves the EU. The uncertainties associated with Brexit may also threaten the capacity of the UK to safeguard energy supply, and depending on future negotiations, prevent investments in future energy plans across the whole energy sector (Ifelebuegu et al., 2017). Some are advocating expediting home-grown SGD to maximise benefits to consumers after Brexit, due to potential increase in the cost of energy imports (Acquah-Andoh et al., 2019).

Literature has emerged with regards to the implications of SGD in Europe and the UK, such as Johnson & Boersma (2013); Jones et al. (2014); Kennedy (2014); Thomas et al. (2017a) Bomberg (2017). The focus of these is largely relating to public awareness, the pros and cons, barriers to commercial extraction and the potential impact on property value. There is less literature regarding the governance of SGD, a point raised but not addressed by Raimi (2017) in the context of the US.

2.2 Defining risk

The nature of risk is that it is unknown and in the future. Understanding why and how individuals decide a certain possibility is a risk, or chose to ignore a potential risk, is the subject of much debate and of scientific enquiry. There are disagreements about what things are risky, how risky they are and what should be done about the risks identified (Douglas & Wildavsky, 1983).

The literature suggests the concept of risk is used in a number of ways: expected value, probability, uncertainty and as an event (Aven & Renn, 2009). Some common definitions include:

1. Risk is the combination of probability of an event and its consequences (ISO2002)
2. Risk is defined as a set of scenarios (s_i), each of which has a probability (p_i) and a consequence (c_i) (Kaplan and Garrick 1981; Kaplan 1991)
3. Risk is equal to the two-dimensional combination of events/consequences and associated uncertainties (will the events occur? What will be the consequences?) (Aven 2007)
4. Risk is a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain (Rosa 1998, 2003).

Risk can broadly be broken down into two categories: risk expressed as probabilities and expected values (e.g. definitions 1 and 2) and risk expressed through events, consequences and uncertainties (e.g. definitions 3 and 4). These differences in approach could be described as quantitative approach and qualitative approach respectively.

Much of the risk evaluation literature is concerned with the quantitative approach: objective risk or risk calculated from statistics and probability distributions. Pollard & Rose (2019) call this the quantitative ‘objectivist, technical Interpretation’ where risk is probability multiplied by consequence and further state that this is a successful approach where probabilities and consequences can be easily identified and quantified, for example the chances of engineering failure or transport safety. The quantitative approach is not examined in detail in this literature review. (For a comprehensive overview see Villa et al., 2016; Yang et al., 2018). Criticisms of the objectivist (technical) approach include the tendency for such an approach to cause a unsupportable sense of security and certainty (Pollard & Rose, 2019; Wynne, 1992), the separating of scientific investigation from cultural and social contexts (Jasanoff, 2009), and a lack of engagement with stakeholders and an understanding of political implications (Owens, 2000). Whilst there is a time and place for both quantitative and qualitative analysis of risk, this study will focus on the latter.

Understanding the influences on risk perception and judgments give insights into efficient countermeasures to reduce or mitigate the effects of the risk (Oltedal et al., 2004). The following section begins with a broad overview of the risk perception literature and then explores the SGD risk literature and finally examines the SGD risk literature emerging and pertaining to England. The latter is largely focused on studies conducted using data from the Department for Business, Energy and Industrial Strategy’s (BEIS) wave survey data which is designed to capture public attitudes to energy and climate change issues.

2.2.1 Risk perception theories

Several frameworks exist for understanding risk perception in relation to technical developments. The most widely used all follow a constructivist approach. In other words, these frameworks consider that knowledge and understanding of the world is derived ('constructed') from experiences and reflection on those experiences (Pollard & Rose, 2019). These include the cultural theory of risk (Douglas & Wildavsky, 1983), which asserts that perceptions are based on shared beliefs, values and preferences. Douglas & Wildavsky (1983) highlight four 'rationalities' of risk in line with distinct cultural principles. These are: individualist; hierarchical; egalitarian; and fatalist. Each of these rationalities, or worldviews, have fundamentally different understandings about the world and methods of structuring social relations and furthermore differ significantly regarding the perception of what is risky, how risky it is and how to prevent risk (Baudot et al., 2020). This approach is acknowledged as a useful qualitative analytical tool to be used when attempting to understand the world (Baudot et al., 2020; Malsch et al., 2012).

The psychometric paradigm, Slovic (2000) explains how experts' and non-experts' perceptions of risk differ; experts view risk in terms of quantitative assessments using models and statistics. Non-experts, or the general public's perception of risk is far more complex and involves a variety of psychological and cognitive processes. The psychometric paradigm attempts to create a method of predicting people's reactions to certain types of risk. This suggests that understanding of risk is perceived is achieved by understanding the type of reaction to the perceived hazard; people tend to be intolerant of risks that bear inequitable distribution of risks and benefits, have fatal consequences, have catastrophic potential or are perceived as being uncontrollable and further, distrust the regulation of the hazard (Larock & Baxter, 2013). This involves examining feelings of dread, catastrophe, inequity and risk to future generations into the risk equation (Slovic, 2016). Experts, on the other hand, tend to see risk in relation to probability of harm or expected mortality, and it is therefore unsurprising that when experts attempt to calm fears by use of risk statistics, the public's fears are not necessarily eased (Slovic, 2016). Slovic, in his review of risk perception analysis 1978-2015 warns that although it may be tempting to conclude that studies in this field demonstrate that the general public's perceptions of risk stem from emotion rather than reason, that does not mean that their concerns should not be respected. Rather he argues that emotional processes and reason-based analysis are important to rationality, and further highlights that the human feeling of risk is an essential part of human evolution (Slovic, 2016).

Whilst the psychometric paradigm model has been used extensively for work on risk perception, some argue that models such as this fail to explain all but a fraction of the factors influencing risk perception, and that much remains to be done to better model and explain risk perception

(Sjöberg, 2000). The social amplifications of risk (SARF) framework seeks to answer the ongoing question of why relatively minor risks (as assessed by experts) elicit strong perceptions of risks with the public. The aim is to link the above social and psychological (and sociological) perspectives with the technical aspects of risk assessment, and further to provide a structural description of the social amplifications of risk (Kasperson et al., 1988). Further studies based on this framework seek to include place and culture into the framework (Masuda & Garvin, 2006). It has notably been applied by geographers in fields such as air pollution, municipal landfill, health and the 'distance' between policymakers, the public and scientists (Bickerstaff, 2004; Bickerstaff & Walker, 2001; Cutter, 1993; Garvin, 2001; Wakefield et al., 2001). This research focusses on SARF as a framework for understanding risk perception.

2.2.1.1 The Social Amplification of Risk framework (SARF)

The SARF is a conceptual framework seeking to link the psychological, sociological and cultural perspectives of risk perception with the technical assessment of risk (Kasperson et al., 1988). The SARF refers to the amplification (or attenuation) of a 'risk event', which is then symbolised, processed and represented by various individual and social 'amplification stations' (Fellenor et al., 2020). This refers to the process of intensifying (or reducing) information from the source, a concept borrowed from communications theory (Kasperson et al., 1988). Examples of the amplification stations are the media (Fellenor et al., 2020), institutions and individuals (Pollard & Rose, 2019), local and 'extra local' systems (i.e. local communities) (Larock & Baxter, 2013). Following this process, ripple effects may lead to impacts on secondary or tertiary parties previously unaffected or involved (Pollard & Rose, 2019), it may also lead to unexpected costs and impacts on the company and industry involved (Slovic, 2016).

An example often cited in the literature to highlight the social amplification and used to demonstrate how a relatively minor incident can create these ripple effects far and wide, is the Three Mile Island (TMI) incident in 1979, where a partial nuclear reactor meltdown led to leaked radiation. The event is considered by the authors as a low level event, where there were no deaths or injuries, yet is nevertheless considered one of the most catastrophic incidents in US history (Kasperson et al., 1988). The ripple effects include loss of reputation and considerable costs to the company that owned the plant, imposition of stricter regulations and reduced operations worldwide, public opposition to nuclear energy increased, scepticism regarding

other technologies grew (such as chemical manufacturing and genetic engineering), the stigmatisation of products, places and technologies (Friedman & Sutton, 2020; Kasperson, 2005; Kasperson et al., 1988; Lower, 2017; Slovic, 2016).

Social amplification of risks is more than just a concept, or a matter of perception. Real world consequences occur for individuals and communities, in addition to the reputational and other impacts on companies and industries expressed above. In the wake of the Deepwater Horizon oil spill incident in 2010, which caused the deaths of 11 people, affected marine ecosystems and coastal communities in the Gulf of Mexico (Neill & Morris, 2012). The perceived contamination of the local seafood resulted in a loss of sales, therefore income, resulting in high levels of mental illness and substance abuse and family breakdown in local coastal communities (Kane, 2015; Lockie & Wong, 2017). Lockie & Wong (2017) also highlight that the social amplification process in incidents, such as TMI, were key drivers in legislative reform and helped to improve financial liability issues through galvanising public support, thereby not viewing the incident as minor, rather as important.

Despite the fact that SARF is a popular framework for analysing risk perception, only a handful of studies have utilised it in the context of SGD (Graham, 2015; Opperhuizen, 2021). Furthermore, only one study highlights the importance of linking risk perception with SLO. Pollard & Rose (2019) adapted SARF to investigate fracking in New Zealand using a multi-scale approach, with attention to 'intra-scalar' interactions shaping risk perception. They identified different scales (international, national, regional and local) of risk events that may impact national policy relating to the oil and gas industry and climate change, this is discussed in further detail in section 2.3.2. Pidgeon (2020) investigated public engagement across sixteen case study areas, including fracking. These studies were conducted mostly in the UK with some case studies requiring comparisons with the US, as indeed was the case with the fracking case study. In his concluding remarks, he notes that for some issues, such as nanotechnologies and consumer products, that risk attenuation is the norm, however for other issues (such as fracking and genetic modification) risk amplification is the norm. This suggests more work needs to be carried out to determine other drivers, such as experienced events or visible accidents, and that it is important to continue to map and understand public perceptions on environmental and technical risks (Pidgeon, 2020). In the US, risk events have been attenuated as a result of the perceived benefits and compensation schemes of SGD (Graham et al., 2015). Amplifying events have caused the prohibition of SGD in some states and localities, however it is yet to reach the

level at which large scale stigmatisation has occurred (Graham et al., 2015). Risk perception of fracking in Ireland was investigated, looking at the amplification effects of local and national media, noting that national media focus more on the economic benefits, whereas the local media focus on the environmental harm (Drehobl, 2014).

In relation to SGD and the extractive industry as a whole, as noted by Pollard & Rose (2019), SGD is relatively new on the world stage and as a result the literature regarding risk perception is underdeveloped. This indicates a need to understand risk perception with a view to explaining, assessing and predicting stakeholder's perception of SGD. The next section explores the work carried out so far in determining the public perceptions, and risk perceptions of SGD in England.

2.2.2 Risk Perception and SGD in England

There is considerable information on public opinion on SGD risks in England. The Department of Energy and Climate Change (now the Department of Business, Energy and Industrial Strategy or BEIS) has conducted a quarterly public attitudes survey named the 'wave' surveys since 2012. These surveys are designed to capture changing public attitude towards key energy and climate change issues and include questions about SGD. Scholarly studies, using these data or building upon them, have emerged at the same time. These studies are investigating perceptions, attitudes, knowledge and support for SGD. With some analysing the relationship between knowledge and support, others comparing attitudes in different countries. Whilst, perhaps unsurprisingly, there is some disagreement regarding conclusions it is never the less encouraging to see the emergence of social science enquiry into the attitudes towards and perceptions of SGD, as this helps to understand why the general public views SGD in the way that they do, rather than just knowing the statistics, i.e. percent in favour, against or unsure.

Studies investigating the relationship between knowledge and support, analysing YouGov survey data, have suggested there is a positive relationship between knowledge and support; those who have knowledge of SGD were twice as likely to support development and that those with the highest prior knowledge of shale gas had the most favourable attitudes towards it (Stedman et al., 2016; Whitmarsh et al., 2015). However as Bradshaw & Waite (2017b) warn, it would be unwise for industry or government to assume that simply providing positive information to the general public who are undecided regarding SGD would result in higher levels of support (Rayner, 2004; Sturgis and Allum, 2004). Furthermore, the same study noted that knowledge does not

seem to be related to support in the US, finding higher levels of knowledge in the UK yet higher levels of support in the US (with lower levels of understanding). Howell (2018) did not agree with the conclusion that greater knowledge equates to greater support, rather she concludes that greater knowledge equates to more polarised views, both in support and opposition. Importantly, in some studies, and as acknowledged by Whitmarsh et al. (2015), level of knowledge was self-assessed rather than using more objective methods of knowledge assessment. The Andersson-Hudson et al. (2016) and Howell (2018) studies did include the same qualifying question¹ designed to assess level of knowledge. Interestingly, another study, using these YouGov survey data, investigated support for SGD in the UK and recommended using SLO as ‘one possible resolution to the problem of contested information and low levels of social acceptance’ (Andersson-Hudson et al., 2016). They further suggest the SLO framework is used to gauge acceptance at the local level, citing success in wind farm projects in Australia (Hall, 2014) and high voltage power line projects in the UK and Norway (Batel et al., 2013).

The scale of influence is also an important consideration, for example if the risks are localised, national or international, such as climate change. A multi scalar study sought to identify the risk events that influence the perception of fracking in New Zealand on different scales; international, national and local/regional (Pollard & Rose, 2019). International risk events identified include the Gasland documentary film⁴ and the Macondo oil spill⁵. The authors concluded that the failure of stakeholders (such as policy makers and industry) to understand the influence of international influencing factors such as these draws attention to the industry and climate change, and further focuses debate on aspects related to these risk events, such as water contamination. Examples include the citing of the Gasland film in more than 95% of interviews and the Macondo event, in terms of shaping national debates, was cited by 36%. A local/regional risk event was identified as the report from the Parliamentary Commissioner for the Environment (PCE), this was favourably received due to its perceived credibility and independence (Pollard & Rose, 2019) and could therefore be described as an attenuating risk event (rather than amplification event). This further highlights the importance of credibility and trust in relation to stakeholders, other than industry, such as regulators and government actors. This study also highlights the importance of considering multi-scalar influences on risk perception for the issuance of a SLO at the local level (Pollard & Rose, 2019).

⁴ Gasland is a 2010 American documentary written and directed by Josh Fox. The documentary focuses on communities in the US where natural gas drilling activity (SGD) was emerging as a concern.

⁵ The Macondo oil spill, also called Deepwater Horizon oil spill, was an industrial disaster that began on 20 April 2010 in the Gulf of Mexico on the BP-operated Macondo Prospect. It is considered to be the largest marine oil spill in the history of the petroleum industry (Griggs, 2011).

Opposition, or 'unease', regarding SGD cannot be reasonably explained by a lack of understanding or knowledge on the part of the study participants. The body of current literature regarding the safety and feasibility of SGD elucidates this position, and further 'orientates strategies for responding to them more effectively' (Williams et al., 2015, p1). Similarly to Howell's findings, discussed above, this may suggest that more knowledge further polarises the debate. The four areas Williams et al. (2015) identified where public perceptions and institutional framings of SGD are themes of concern are: trustworthiness, inclusivity, somnambulism and epistemological pessimism. Concerns about trust and inclusivity were in relation to the involvement of government actors with industry. With regards to inclusivity, this was connected to engagement in the regulatory and decision-making process and democracy. These factors, trust and inclusivity, are closely linked and highly significant to the SLO framework discussed above. In identifying somnambulism as a factor, Williams et al. (2015) are referring to the perception of the approach to health, safety and regulation and suggesting it is 'tantamount to sleepwalking into approving a potentially damaging activity' (Bradshaw & Waite, 2017b, p29). The expression of 'epistemological pessimism' emphasises the tendency of opponents to focus on the worst-case scenario and on areas of greatest uncertainty, such as human health. It has also been suggested that participants feel the SGD debate is too focused on economic benefits at the expense of other areas of importance (Williams et al., 2015).

Similarly to Stedman et al. (2016), other studies have investigated comparisons between the UK and the US in terms of stakeholder perception, for example Partridge et al. (2017), Thomas et al. (2017a) and between the US and Canada Thomas et al. (2017c). These studies agree that most participants focus on the risks and express doubts about benefits and further agree that the main concerns participants express are regarding water contamination, greenhouse gas emissions, and health effects. There is also a debate about whether the perception of risk associated with SGD increases with the intensity of development (Livy et al., 2018), however those living in a region where SGD is more advanced (Lancashire) have been found to be significantly more positive than those living where SGD is not viable (Whitmarsh et al., 2015). Boudet et al. (2014) identified a link between lack of knowledge and familiarity with ambivalence or uncertainty about whether to support SGD. Similar to the lack of agreement regarding the correlation between knowledge and support, there are also disagreements regarding the proponent/opponent demographics, with the notable exception that proponents are more likely to be politically conservative.

Concerns have been identified regarding the compatibility of SGD with participants' visions of the future, particularly in relation to climate change, continued dependence on fossil fuels, development of and investments in alternative energy technologies, the perceived short-term objectives of government and industry, and obligations to act responsibly toward future generations (Partridge et al., 2017). The tendency of industry and government actors to focus on short-term and site-specific concerns has also been highlighted, while identifying the increasing concerns of other stakeholders, which relate to longer-term global issues and the requirement of energy system transformation (Bradshaw & Waite, 2017a).

2.2.3 Summary

This section introduced the two main approaches to risk perception; quantitative and qualitative and focused on the qualitative approach in the literature. The most widely utilised frameworks follow a constructivist approach and include the Social Amplification of Risk framework (SARF). SARF seeks to link the psychological, sociological and cultural frameworks by looking at factors that may amplify or attenuate risk. This implies an examination of the processes involved with the risk rather than examining the perceivers' worldviews or the feelings of the perceivers regarding risk. SARF is further developed by Pollard & Rose (2019) to include a multi-scalar approach; risk amplification (or attenuation) events can be identified at local, regional and international levels to determine the impacts on risk perceptions. Moreover, authors suggest that it is important to map and understand public perceptions of environmental and technical / technological risk (Pidgeon, 2020; Pollard & Rose, 2019).

As SGD is relatively new on the world stage, there is limited literature regarding risk perception and SGD. However, this section examined the work carried out so far, mostly in relation to public perceptions. In England, data for many studies utilise information gathered by BEIS (formerly DECC) to determine, amongst other things, the support for SGD in the UK. There is disagreement about whether knowledge of SGD plays a big part in supporting or opposing development; some claim those with greater knowledge of the technology are more likely to be in support (Stedman et al., 2016), others claim the opposite (Howell, 2018). Similar disagreements exist about support in relation to proximity to a SGD site, some claim living close to a development increases

levels of support (Whitmarsh et al., 2015) while others claim support reduces as intensity of development increases (Livy et al., 2018).

Areas of concern regarding the institutional framing and public perceptions have been identified and include trustworthiness, inclusivity, somnambulism, epistemological pessimism (Williams et al., 2015) and concerns about lack of compatibility regarding visions of the future (Partridge et al., 2017). Most authors agree that the proponents focus on economic factors and opponents tend to focus on environmental and human health risks.

These frameworks, especially SARF, are useful lenses with which to consider risk perceptions of stakeholders in the context of their view of the governance of the SGD industry, in addition to the industry themselves. Many studies consider the risk involved with SGD in relation to the gaining of a SLO, however often from a risk assessment, or quantitative, point of view. Some have considered the risk perception of stakeholders, however only one study has examined this in the context of SLO. These insights, alongside conventional risk assessments and economic evaluations, should be considered as a valuable contribution in terms of understanding stakeholders risk perception and local stakeholders' willingness to issue a SLO. Furthermore, these frameworks are useful to consider in SGD in the wider context of governance; risk perception also plays a part in the perception of how an industry is governed and by whom.

2.3 Governance

'Governance' is a term widely used in the literature with a range of interpretations and meanings addressing different aspects of society (Turke, 2009). Governance differs from 'Government' as government is regarded as an entity and governance as a process or system of interactions. Within the public policy literature, governance may also have a variety of definitions from 'good governance' (corporate) to 'global governance', referring to international agreements and globalisation (Cairney, 2012). In more general terms, it can be described as how society, organisations and networks are steered and governed (Kunchornrat & Phdungsilp, 2012) in order to reach agreements and reconcile differences (Turke, 2009). In another interpretation, from Jan Kooiman, governance is the totality of theoretical concepts on 'governing', where governing is defined as:

‘the totality of interactions, in which public as well as private actors participate, aimed at solving problems or creating societal opportunities; attending to the institutions as contexts for these governing interactions; and establishing a normative foundation for all those activities’ (Kooiman, 2003).

A further perspective is that the term governance refers to new forms of regulation which have departed from the ‘top-down’ hierarchical methods of governing by the state (Kersbergen & Waarden, 2004). Moreover, the term governance also implies some form of self-regulation by the governed and that new types of cooperation between private and public sector are utilised to solve societal problems (Kersbergen & Waarden, 2004).

Understanding the governance of aspects of life is a known challenge. This is due to the myriad of different objects of governance, the fragmented multi-level institutional settings in which governing takes place, and the distribution of power (Cowell et al., 2017). Kooiman (2003) identifies three ‘modes’ of governance: self-governance, co-governance and hierarchical governance. Self-governance is the ability of institutions and individuals to govern themselves with actors collaborating to find collective solutions. Co-governance refers to the collaboration of groups on a ‘horizontal’ basis without any centralised or dominating actor and works through the establishment of public-private regimes. Hierarchical governance is focused on the top-down governance of the state and is described as the most ‘vertical’ and formalised mode of governance, the two concepts of steering and control are used to explain intervention processes (Kooiman, 2003; Stoker, 2004).

Whilst Kooiman’s framework is useful for considering governance, it has been criticised as being overly abstract with little historical or empirical foundations. Moreover, it does not consider whether it is applicable in all countries of the world, rather it seems to only be applicable to the developed world (Stoker, 2004). Indeed, the word ‘governance’ is yet to be translated into many languages (Levi-Faur, 2012).

Governance is rather well summed up in the following five propositions:

1. Governance refers to a set of institutions and actors that are drawn from, but also beyond, government.
2. Governance identifies the blurring of boundaries and responsibilities for tackling social and economic issues.
3. Governance identifies the power dependence involved in the relationships between institutions involved in collective action.

4. Governance is about autonomous self-governing networks of actors.
5. Governance recognises the capacity to get things done which does not rest on the power of government to command or use its authority. It sees government as able to use new tools and techniques to steer and guide.

(Stoker, 1998, p18)

These propositions are to be considered as aspects of governance, rather than true or false statements, furthermore they are complementary to one another rather than in competition (Stoker, 1998). Stoker (1998) also observed some potential dilemmas or ‘critical issues’ associated with these propositions on governance. For example, there is a complex reality associated with real life decision-making, which does not always fit with the normative codes used to validate government’s decisions; there are accountability issues associated with self-governing networks and difficulties in identifying who is responsible which can lead to blame avoidance; unintended consequences occur as a result of power dependence; even when governments are flexible, failure may occur.

The following section explores the literature pertaining to good governance energy governance more broadly followed by energy governance in the context of SGD. It covers policy conflicts such as energy policy, climate change and localism in the UK. Finally, it examines perceptions of the ‘revolving door’ between government and industry and the politics of SGD.

2.3.1 Good Governance

The concept of good governance includes the capacity to plan and create organisations that are required for achieving policy goals (Omri & Mabrouk, 2020; Güney, 2017). It also ensures the participation of the State, non-state actors, private sector, and the civil society in the decision-making process. Promotes transparency, accountability, and the rule of law at all levels. Permits efficient management of resources (economic, natural, human, and financial) for equitable and sustainable development (Omri & Mabrouk, 2020; Hallegatte et al., 2011).

Good governance has been described as ‘the active and productive cooperation between the State and citizens, and the key to its success lies in the powers participating in political administration. Only when citizens have sufficient political power to participate in elections, policy-making, administration and supervision can they prompt the State and join hands with it to build public authority and order’ (Keping, 2018), additionally, democracy is the mechanism by which equal political power can be safeguarded by citizens.



Figure 2.1 Diagram illustrating the characteristics of good governance

The objectives, or hopes, of good governance is to ensure that corruption is minimised, that the views of minorities are considered and that the voices of the most vulnerable in society are heard in the decision-making process. It should also be considering intergenerational equity.

According to the UN, the characteristics of good governance are defined as follows:

- **Participation:** Participation by both men and women is a key cornerstone of good governance. Participation could be either direct or through legitimate intermediate institutions or representatives. It is important to point out that representative democracy does not necessarily mean that the concerns of the most vulnerable in society would be taken into consideration in decision making. Participation needs to be informed and organised. This means freedom of association and expression on the one hand and an organised civil society on the other hand.
- **Transparency:** Transparency means that decisions taken, and their enforcement are done in a manner that follows rules and regulations. It also means that information is freely available and directly accessible to those who will be affected by such decisions and their enforcement. It also means that enough information is provided and that it is provided in easily understandable forms and media.
- **Rule of law:** Good governance requires fair legal frameworks that are enforced impartially. It also requires full protection of human rights, particularly those of minorities. Impartial enforcement of laws requires an independent judiciary and an impartial and incorruptible police force.

- **Responsiveness:** Good governance requires that institutions and processes try to serve all stakeholder within a reasonable timeframe.
- **Equity and inclusiveness:** A society's well-being depends on ensuring that all its members feel that they have a stake in it and do not feel excluded from the mainstream of society. This requires all groups, but particularly the most vulnerable, have opportunities to improve or maintain their well-being.
- **Effectiveness and efficiency:** Good governance means that processes and institutions produce results that meet the needs of society while making the best use of resources at their disposal. The concept of efficiency in the context of good governance also covers the sustainable use of natural resources and the protection of the environment.
- **Accountability:** Accountability is a key requirement of good governance. Not only governmental institutions but also the private sector and civil society organizations must be accountable to the public and to their institutional stakeholders. Who is accountable to whom varies depending on whether decisions or actions taken are internal or external to an organization or institution. In general, an organization or an institution is accountable to those who will be affected by its decisions or actions. Accountability cannot be enforced without transparency and the rule of law.
- **Consensus oriented:** There are several actors and as many view points in a given society. Good governance requires mediation of the different interests in society to reach a broad consensus in society on what is in the best interest of the whole community and how this can be achieved. It also requires a broad and long-term perspective on what is needed for sustainable human development and how to achieve the goals of such development. This can only result from an understanding of the historical, cultural and social contexts of a given society or community.

(Source: UNESCAP, 2014)

2.3.2 Energy Governance

Concern over energy supply and energy independence has become centre stage recently at the same time as concerns regarding the consequences of continuing dependence on fossil fuels and a seemingly business as usual approach to economic growth (Fudge et al., 2011). The energy 'trilema' of affordability, energy security and decarbonisation is of particular concern in the UK in terms of energy governance (Bolton & Foxon, 2013). There are increasing levels of energy consumption in addition to the complex nature of addressing climate change, therefore the need for appropriate policies to address these complex, and perhaps conflicting, policy needs. These issues were first highlighted at the turn of the century with a report from the Royal Commission (2000) which called for an ambitious change in energy and climate change policies and then in 2006 in the Stern review, which highlights the economic cost of inaction (Stern, 2006). The UK Climate Change Act 2008 commits to an 80% reduction in greenhouse gas (GHG) emissions (over 1990 baseline), this further strengthens the message of the need to reduce GHG emissions.

Energy governance has been explored by academics in a number of different ways. Global energy in the context of trade and investment and the global energy markets is explored by Goldthau & Witte (2010). This book highlights the need for transparency in global energy governance, this issue is especially crucial with regards to information on supply and demand, as 'both suboptimal allocation of capital and decreased transparency affect supply, price and volatility' (Goldthau & Witte, 2010, p44). This emphasises how complex energy governance is; the fact that considerations have to be made at different scales, in different geo-political contexts in addition to the energy market operations.

Enquiries have been made into energy infrastructure and energy transitions; in the context of the governance issues surrounding the transition to a low carbon energy infrastructure, for example in the UK (Bolton & Foxon, 2015a) and in Europe (Bouzarovski et al., 2015). Findings include identifying the existence of socio-technical networks which challenge the traditional state decision making powers, and that the distribution networks should be more flexible to enable a transition to low carbon and support sustainable development. The UN Sustainable Development Goals, specifically goal 7 (affordable and clean energy), includes goals to provide universal access to affordable, reliable and modern energy, to increase the share of Renewable Energy (RE), enhance international cooperation to facilitate research and improve infrastructure by 2030 (UN, 2021).

The role of communities and other non-traditional governance networks are emerging as a field of enquiry for researchers. Examples of 'non-traditional' include social networks (and social media networks) and community networks. These include community energy systems, for example Koirala et al. (2016), who note that focus should be on socio-economic, environmental and institutional aspects (in addition to the existing focus on technical aspects) for the continued support of community energy systems. Others also highlight the importance of shifting focus from technical to social aspects, for example Bolton & Foxon (2015b); Centner (2016); Walker & Shove (2007); Whitton et al. (2018).

Over the past few decades the UK has moved from the state controlled model to the market based model of governance, the rationale being that the consumers are protected from inefficiencies and monopoly pricing (Bolton & Foxon, 2013; Kuzemko, 2013). More recently, some have argued that UK energy governance can be characterised by a number of competing policies (Bolton & Foxon, 2015b; Fudge et al., 2011; Kuzemko, 2013), making it confusing and difficult to determine which policies are being influenced, by whom and for what purpose.

There is growing emphasis on governance in the context of SGD. Many studies recognise and highlight the non-state actors involved in the governance of SGD, including civil society,

businesses, local and global anti-fracking networks. Murcott & Webster (2020), using the legal context of litigation in South Africa, examine ways non-state actors create 'learning networks' in order to reach common goals.

Others have examined the governance arrangements associated with SGD and extractive industries and conclude that companies tend to construct the arrangements in a manner that benefits themselves and other profit-orientated actors. Furthermore, they use the process to constrain debates and limit access to some actors in both the debate and the decision making process (Wilson et al., 2018). Wilson et al. (2018) recommend state intervention to ensure that any communicative process initiated by industry is carried out according to the principles of deliberative democracy.

Some studies have examined the rhetoric regarding SGD by looking at certain types of stakeholders, for example policy makers to determine the government's approach.

Williams & Sovacool (2019) conducted elite semi-structured interviews with policy-aligned stakeholders and identified a lack of agreement regarding the framing of SGD from within the political arena, let alone the general public. The 'elite' participants also cited the lack of a coherent approach from the government regarding criticism of its approach to SGD. Nine frames are identified in the storyline for the SGD debate, some pro-shale and some anti-shale (see Williams & Sovacool, 2019, p7), however with regards to governance, or 'bad gas governance' as phrased by the authors, the strapline is termed as 'fast-track fracking and fractured democracy'. The storylines include the sense that there is a betrayal of localism and democracy; a lack of scope for the public to influence debates and decisions, the right to protest has been curtailed (and protesters jailed), public consultations have been ignored and that there is no social licence to operate (Williams & Sovacool, 2019).

Other researchers further highlight issues surrounding social, environmental and distributive justice. Environmental justice concerns include land use change and environmental impacts, social impacts include the sharing of benefits among stakeholders and vulnerable communities (Meng, 2018). Procedural environmental justice considers who participates in the debate and decisions about developments (Clough, 2018). In England, policies have become pro-industry over the past few years; planning legislation has impacted the power of local communities, powers of decision making have moved to central government away from local authorities, environmental risks to communities have increased (Cotton, 2017). Cotton (2017) argues that the scale of SGD governance should be 're-localised' in order to ensure political equity and to

improve current distributive and procedural environmental injustices. This sentiment is echoed by Whitton & Charnley-Parry (2020) who further highlight the lack of transparency in addition to the lack of access to decision making, and agency of, local communities. Collaboration with local communities, to understand their diverse needs, access their experiences and expertise is more likely to result in socially sustainable decisions (Whitton & Charnley-Parry, 2020).

Jasanoff (2019) also calls for different forms of engagement between the public, experts and decision makers with an 'intellectual environment' with which to call on the knowledge and skills of citizens for the resolution of common problems. Whilst Jasanoff (2019) expresses the need for involvement of citizens from an earlier stage, i.e. during the research and development of technology, she advocates moving from 'technologies of hubris' to 'technologies of humility'. Technologies of hubris refer to the development of methods such as risk assessments and cost benefit analysis tools designed to manage, predict and control technologies, even where there is high uncertainty. Technologies of humility acknowledge the need for multiple viewpoints and collective learning in order to consider unforeseen consequences or unintended consequence. Four focal points are put forward to develop technologies of humility: framing, learning distribution and learning (Jasanoff, 2019). In short, Jasanoff argues that participation and transparency should be a 'standard operating procedure of democracy' and that these social technologies would highlight process and deliberation in addition to analysis (Jasanoff, 2019, p243).

The term 'energy justice' is a good way to frame good energy governance and is described by Sovacool & Dworkin (2015) as a framework for decision making which includes decisions about: availability, affordability, due process, good governance, sustainability, intergenerational equity and responsibility.

2.3.3 Governance and Localism

UK planning policies and regimes have significantly changed over the last ten years. The Conservative government (in power since 2010) introduced their policy of localism, designed to give more power to local communities regarding developments in their vicinity. The application of localism does however differ depending on the development (Scudamore, 2015), for example between renewable energy technologies and SGD. On the surface, localism appears to be a policy that empowers local communities, however, as is the case with renewable energy compared to SGD, localism can be used as a political tool to frustrate the development of one technology over another (Scudamore, 2015). Governments can claim to be giving the power to

local communities, as is the case with onshore wind developments, however with regards to SGD, powers have been reverted to the Secretary of State (for example in Lancashire, discussed further in section 5.2.2, shifting the power to the state, when the local communities do not make decisions in line with central government policy (Cotton, 2017; Scudamore, 2015). The localism policy could therefore be viewed as disingenuous; 'dressed in the rhetoric of localism' yet with a purpose of reinforcing a hierarchical planning regime (Cotton, 2017, p10; Johnstone, 2014)

Participants in several studies mention the perceived injustice of this by local communities. Short & Szolucha (2017) investigated the harms caused to local communities during the planning and approval stage of SGD using 'green criminology' insights; they conclude that communities in the context of planning an approval of SGD have experienced a 'collective trauma', several cited 'localism' (or lack of) as a problem. Indeed, 'elite' participants in the Williams & Sovacool (2019) study framed the issue as a betrayal, as discussed above. Hilson (2015) concludes that planning and environmental permitting regimes recognise and legitimise certain types of framing in relation to SGD and not others, and that government frames are prioritised over those of the local community. This may lead to a sense that democracy is impeded, leading to a further sense of lack of legitimacy in central government.

UK Onshore Oil and Gas (UKOOG), a representative body for the onshore oil and gas industry by membership, created a 'Community Engagement Charter'. The aims of which are 'to ensure open and transparent communications between industry, stakeholder groups and the communities in which [they] operate' (UKOOG, nd, p1). The Charter promises to engage with local communities at each stage of development and further, have a point of contact and a plan for active engagement which links to statutory processes. In general, the Charter, as suggested by its title, exhibits language of engagement, transparency and honesty. Critics, however, suggest that the Charter looks more like an information provision framework rather than a framework for community engagement; notably there is a lack of 'participation mechanisms' to facilitate community engagement and furthermore, no opportunity for communities to question the need for SGD in the first instance (Cotton, 2017).

Another key feature of the Charter is the laying out of community benefits; £100,000 per SGD well site and a share of proceeds at production stage (1% of revenues, allocated approximately two thirds to the local community and one third at the county level) (UKOOG, nd), although who exactly would be in receipt of the money, individual households or local councils, is unclear (Cooper et al., 2018). Furthermore, these formal attempts by government and industry to provide community benefit packages are often seen as bribes by local communities who are in

opposition to the development (Howell, 2018; Ogilvie & Rootes, 2016; Thomas et al., 2017b; Walker et al., 2017).

This section highlights issues associated with potentially conflicting policy objectives. In the context of energy, energy policies may directly conflict, such as in the case of RE projects, which support emission reduction and climate change policies, and SGD which do not. In the context of governance, policies such as localism conflict with other objectives, such as the case of the local authority decision being overturned by the secretary of state with regards to SGD planning permission in Lancashire. When the Government is perceived to go back on policies such as localism, many feel a denial of democracy and loss of power. Indeed, community engagement is a policy both key to the planning aspect of regulations and is also written into the Community Engagement Charter, however whilst it speaks of community engagement, it does not offer the mechanisms by which to engage.

2.3.4 Governance and Democracy

According to the Council of Europe, democracy is based on two key principals

1. **Individual autonomy:** The idea that no-one should be subject to rules which have been imposed by others. People should be able to control their own lives (within reason).
2. **Equality:** The idea that everyone should have the same opportunity to influence the decisions that affect people in society.

(CoE, 2017)

Further characteristics are freedom of speech, right to assembly and intergenerational equality (O'Riordan, 2015), this chimes with the concept of energy justice described above and also with procedural justice and political equity frames (Griffiths, 2019).

The concept of democracy and the processes involved, especially in the early stages of SGD are closely linked. Studies have shown that most participants questioned claimed that the processes involved with SGD, especially with regards to planning consent, are undemocratic (Szolucha, 2016). Furthermore, suspicions of corruption exist, especially in relation to the 'revolving door' between industry, regulators and government.

2.3.5 Revolving door

A term first coined in 'The Power Elite' (Mills, 1956) when describing the movement of powerful actors between Congress and the weapons production industry in the US (Bradshaw, 2015), the revolving door has for many years been of great concern for academics as it could, indeed is

often claimed to, induce elected government officials to act in the interest of profit making corporations rather than for social benefit (Vandenbergh et al., 2020). Studies investigating the revolving door phenomenon are across a range of (often highly regulated) sectors, for example banking and finance (Lucca et al., 2014; Young et al., 2017), utilities (Law & Long, 2011), pharmaceuticals (Abraham, 2002; Piller, 2018; Seegert, 2017), genetically engineered crops (Katic & Kim, 2013), energy (Holley et al., 2020) and oil and gas.

Some argue that the revolving door is a force for good, stating that regulations are likely to become more aggressive rather than less as a result of the flow of expertise between regulators, government and industry (Zheng, 2014), and that the revolving door may foster citizen participation in government (Zaring, 2013). Others claim that the cited greater expertise is more likely to be as a result of lobbying and 'regulatory capture' (Hong & Kim, 2017), regulatory capture meaning firms capturing regulators through the promise of future jobs or bribes (De Chiara & Schwarz, 2020). Industry personnel nearing the end of their careers may have gained specialised knowledge which could help regulatory bodies, similarly, former regulators may be able to help companies with regulatory compliance (Meghani & Kuzma, 2011). The legal and political science literatures are beginning to identify some benefits of the revolving door, however the bulk for the literature cites the potential harms (Vandenbergh et al., 2020).

There are sufficient concerns regarding this phenomenon, and associated conflicts of interest, within EU institutions that the Corporate Europe Observatory created a database entitled 'Revolving Door Watch'. This is a database of EU commissioners, MEP's and other officials who have moved from the EU into industry and vice versa (CoE, 2017) . This suggests that the phenomenon is a deeply embedded practice within the political arena, at least in western societies.

The revolving door has become a hot topic of late and has been cited as one of the causes for failures in regulations such as the Deepwater Horizon oil spill (Bratspies, 2011; Neill & Morris, 2012; Zaring, 2013; Zheng, 2014). The oil and gas industry are accused of actively keeping the focus away from environmental, health and safety practices relating to offshore activities. This, combined with the revolving door and lack of regulator funding meant that regulators viewed their tasks through the lenses of industry, rather than from the perspective of public safety and environmental safeguarding (Bratspies, 2011; Neill & Morris, 2012). This does not seem to be solely as a result of industry 'controlling' regulators for their own benefit; regulatory agencies appear to identify more with the industry they are supposed to be regulating rather

than the public they are sworn to protect (Bratspies, 2011).

The revolving door is of particular concern within the oil and gas sector. In this sector it is thought to be fairly common, especially involving men (Szulecki, 2018). Indeed Szulecki (2018) found no cases of women in the revolving door between the energy sector and government in Poland, despite Poland ranking highly on the OECD list of women in managerial positions. This further adds to the evidence that conflicts that arise from revolving door activities should be subject to tighter scrutiny and regulation, an perhaps even a change in political culture (Silva, 2019).

The most well-known case of the revolving door in the context of SGD is the situation regarding of how fracking companies became exempt from the Safe Drinking Water Act (SDWA) in the US. The former CEO of the Texas based global energy company Halliburton, Dick Cheney, became US Vice-President and headed a task force responsible for the amendments to the 2005 Energy Policy Act. This included the exemption for companies engaging in ‘the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities.’ (Morrison, 2015, p100). This is commonly referred to as the ‘Halliburton loophole’. This event clearly highlights how government actors do not just propose and ratify legislation, but also can create rules and regulations that will benefit the industry (Brezis, 2013).

A similar revolving door exists in the UK, although perhaps not with quite so obvious consequences. Lord Browne was the president of the Royal Academy of Engineering (RAE) between 2006 and 2011. As a result, coupled with the fact that the RAE receive funding from the energy industry, some called into question the findings of the RAE 2012 review of hydraulic fracturing report. Furthermore, Lord Browne was the chairman of UK SGD company Cuadrilla, a former BP executive and has had other affiliations with oil and gas industry (Lang, 2014). During his time as a government advisor, he is believed to have influenced policy through appointments to key positions within government, indeed he was tasked with appointing non-executive director to each government department (Leftly, 2013).

In summary, the revolving door between industry, regulators and government poses both ethical and policy challenges involving public trust, democracy and fair representation. For example, the public’ s confidence in the regulatory process and robustness is adversely impacted, especially in relation to new technological processes. The revolving door may result in policy decisions that favour industry interests at the expense of public ones. The revolving door assures industry a voice, yet other stakeholders have no such assurances (Meghani &

Kuzma, 2011). While there may be some benefits to the movement of actors between industry and governmental positions, this should be closely scrutinised and regulated.

2.3.6 Summary

This section explains the different interpretations of governance and highlights the best frame for considering energy and SGD governance. Energy governance includes concerns regarding energy supply and energy independence and the literature emphasises the complexity of global energy governance, especially in the context of competing policies such as those designed to tackle climate change. The role of communities in decision making and ideas of non-traditional governance is an emerging field in the literature; in addition to environmental, social and distributive justice in relation to SGD. These factors have been collectively termed 'energy justice' which includes concepts such as good governance, sustainability, intergenerational equity and responsibility. In the UK there is an additional conflicting policy, localism. Successive governments have sought to devolve power to local communities. However, as seen in the context of SGD in Lancashire, they have shifted the power back to the state if local decisions do not comply with national policy. This results in a sense of loss of democracy in local communities. This sense of a democracy deficit, in addition to feelings the government and industry are attempting to bribe host communities with revenues, serves to further disenfranchise local communities. There are further concerns regarding the integrity of government and regulatory actors, such as a perception that powerful elites are in a revolving door between government and industry for their own personal gain. This further adds to the perception of a lack of transparency, accountability and ultimately to a loss in trust towards government actors and regulators.

2.4 Social Licence to Operate (SLO)

This section introduces the concept of the SLO, one of the theoretical frameworks underpinning this study. An introduction of how the term SLO came into being is provided to contribute to understanding why it is required. SLO is an established term in many sectors, although some consider it to be more useful than others, these criticisms are also addressed. SLO is also discussed in the context of SGD in Yorkshire and Lancashire, although the framework has not been used extensively in the academic context, stakeholders are beginning to mention it while demonstrating their opposition to SGD (Bradshaw & Waite, 2017a).

2.4.1 The Concept of SLO

Cooney coined the term 'social licence' in 1997 whilst discussing global challenges facing the mining industry in terms of community support (Boutilier et al., 2012; Cooney, 2017; Prno, 2013). Cooney predicted that due to accelerating globalisation, and the increasing connectivity of remote communities resulting from communications revolution, would mean that remote communities would gain international allies in support of any objections to mining activities (Cooney, 2017). He realised that companies would not only require a legal licence to operate, such as permits, permissions and adherence to regulations, they would also need approval from the local communities, a 'social licence'. In other words companies could no longer ignore the concerns of local communities and must engage and address concerns. The potential consequences of this could be disruption to activities and lost revenue. Cooney was comparing the importance of a social licence with the regulatory and legal licence; 'It was simply an analogy or metaphor that highlighted the equivalence of the political risk management challenges at the community level with those at a governmental level' (Cooney, 2017, p199). A formal definition of the social licence is 'demands on and expectations for a business enterprise that emerge from neighbourhoods, environmental groups, community members, and other elements of the surrounding civil society' (Gunningham et al., 2004, p308). A further and useful definition is offered by Smith & Richards (2015): 'a tool whereby companies manage socio-political risk by conforming to a set of implicit rules imposed by their stakeholders... [a SLO] derives from communities' perception of a company and its operations, comprised of a company's ongoing acceptance and approval from stakeholders' (Smith & Richards, 2015, p89).

The use of the SLO concept has grown over the past two decades and is considered a prescriptive norm within the mining and extractions industry, further it is becoming a part of the lexicon of a variety of other industries, such as renewable energy, farming and fisheries (Parsons et al., 2014), forestry, agriculture and hazardous waste transport (Bice et al., 2017). A social licence is not a concrete reality, like a legal licence; rather it is a sense of the level of acceptance and approval given by the community to an organisation. As a result of this, the term is ambiguous and has different connotations and definitions from different sectors and perspectives, such as academics, mining companies, lawyers and government representatives. Some see it as a 'continuum of multiple licences achieved across various levels of society', rather than a single licence granted by a community (Dare et al., 2014, p188). As Cooney phrases it 'that is the peril inherent in a metaphor' (Cooney, 2017, p200). Indeed, in the context of SGD, given the dispersed nature of SGD geographically, and the different intensity of industrial activity at different stages

of development, viewing the SLO as continuum of licences, not just across levels of society, over time is a constructive way to view the SLO.

The literature on SLO already encapsulates notions such as expectations and demands, free, prior and informed consent (FPIC), legitimacy, approval and consent, manageability (see Parsons et al., 2014). As Boutilier et al. (2012) point out, in order for SLO to be an effective tool, it must be measurable which involves measuring the socio-political risks and opportunities presented by stakeholders (Boutilier et al., 2012). Building on the theory developed by Joyce & Thomson (2000), Boutilier & Thomson (2011) developed a cumulative hierarchy model (figure 2.2) to illustrate the levels and boundaries of SLO.

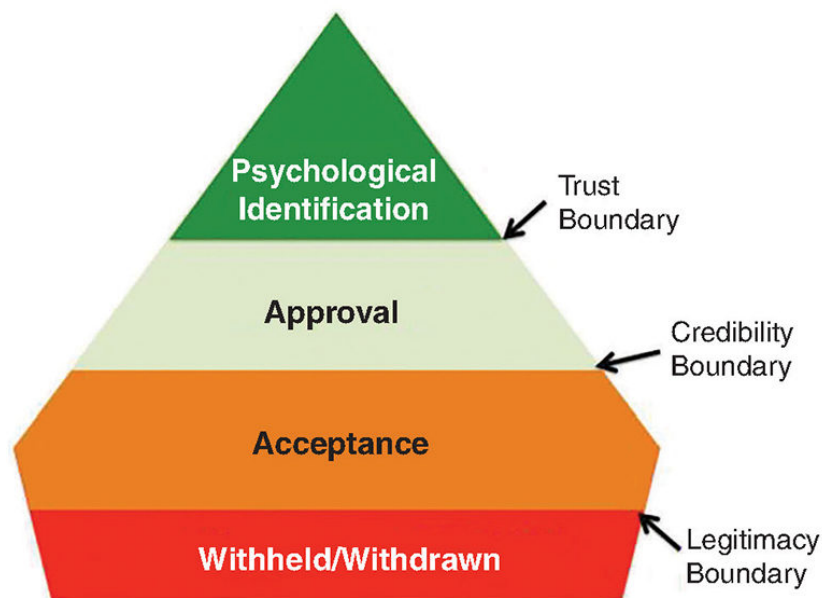


Figure 2.2 Measuring the Social Licence to Operate (Boutilier & Thomson, 2011)

2.4.2 SLO and other related concepts

The SLO is an accepted concept within the fields of corporate social responsibility (CSR), impact assessment studies (Bice et al., 2017; Bice & Moffat, 2014) and sustainable development (Parsons et al., 2014). These concepts of SLO, FPIC and stakeholders have gained traction over the past decades due to the increasing concern from communities, governments and other

stakeholders regarding corporate activities and adverse environmental and social consequences. According to Parsons et al. (2014), the SLO concept has ‘gained the greatest currency’, especially in the mineral and extractions sector, and is increasingly becoming the focus of academic enquiry. A useful place to start is by considering who grants a SLO, and why stakeholders do or do not grant a SLO.

2.4.3 Who grants a SLO and why?

It is generally accepted that a SLO is site specific and that it is granted by the local community, although not by one single group or organisation, rather by a number of stakeholders, for example, local residents, NGO’s, local businesses and local politicians (Parsons & Moffat, 2014). The operator or company is the body seeking to gain a SLO from the local community. The concept of SLO suggests that stakeholders within a community, if they withhold a SLO, may threaten the company’s ability to conduct their business by means of opposition boycotts, protest demonstrations and legal challenges, therefore threatening a company’s legitimacy (see fig 2.2 and the ‘legitimacy boundary’).

Furthermore, a SLO must be maintained, as it is not a written licence or approval granted by an authority or body, and because societal, environmental and economic conditions may change over time. A company must therefore have different strategies at different times. Nevertheless, companies are likely to be dependent on resources controlled by stakeholders, a key motive for maintaining a SLO. Other motives include fear of reputational loss (further discussed in Chapter 6.4.5) and resulting customer loss and regulatory tightening (Boutilier, 2014). Many hold the view, and there is growing evidence to suggest, that the awareness of the SLO induces ‘beyond compliance’ behaviour (Lynch-Wood & Williamson, 2007). However, as Lynch-Wood & Williamson (2007) point out, small and medium enterprises (SME’s) are less responsive to the pressures of the SLO and are therefore less likely to go beyond compliance (Lynch-Wood & Williamson, 2007). An SME is defined as a firm with less than 250 employees and a turnover of less than 50 million Euros (Lynch - Wood & Williamson, 2007) this therefore includes SGD operators in the UK, at least the operators responsible for exploration; development operators may be larger organisations.

A SLO is still an important concept, in the context of SGD and other SMEs for improving environmental behaviour, furthermore an SLO is considered particularly important where organisations have long term objectives, a large and diverse number and range of stakeholders and high exposure to international markets (Dare et al., 2014). Owen & Kemp (2013) investigated the degree to which mining companies seek a SLO (and the difference between

actual and reported SLO) and concluded the motive was more about reducing opposition than long term objectives. However, policy makers may wish to be less reliant on the gaining of a SLO through self-regulation in the case of SMEs. More formal and legal regulations are still required, as discussed Chapter 6.

The European Academies' Science Advisory Council (2014, 11) stated '...even if fully compliant with laws and regulations, activities that are particularly intrusive or perceived to carry significant risks can be vetoed by a hostile public through campaigns, legal actions, demonstrations or other democratic pressures. Such industries must negotiate a 'social licence' with their community to conduct their business' (EASA, 2014, Bradshaw and White, 2017).

In summary, communities grant or withhold a SLO. The stakeholders are not limited to one group, rather a range of stakeholders including local business, NGOs, residents and local politicians. Furthermore, a SLO is dynamic; it is not simply something that is granted and then gained, it must be maintained. Some organisations are likely to be more concerned about gaining an SLO than others, for example SMEs have been found to be less responsive to the pressures. However, the SLO concept is becoming more recognised by industry as an important negotiation with local stakeholders in order to maintain reputation and to conduct their business.

2.4.4 SLO in the context of SGD in Lancashire and Yorkshire

In January 2017, Cuadrilla Resources began preparation for SGD exploration at Preston New Road (PNR) in Lancashire. This was met with resistance from the local community and anti-fracking campaigners who staged demonstrations daily in order to slow down the process. Demonstrations and blockades have recently extended to companies within the supply chain, halting operations by preventing deliveries. The cost and style of policing of protesters is an additional source of contention and many arrests have been made, never the less both sides seem steadfast and resolute. Later in the same year, Third Energy informed local residents it was 'preparing to frack' at Kirby Misperton in North Yorkshire, this was met with equal resistance. However in early 2018, Third Energy began removing equipment from its KM8 well in Kirby Misperton amid senior director resignations and rumours of financial difficulties, in addition to Environment Agency warnings of permit breaches (Hayhurst, 2018c).

Bradshaw & Waite (2017b) provide an insightful commentary of the public inquiry held in 2016 as a result of the Lancashire County Council's (LCC) decision to reject Cuadrilla's planning application. As noted by the authors, these sessions provide useful insights into the state of the SLO in addition to highlighting the feelings towards the operator and the industry. 19 individuals

spoke in support of Cuadrilla, and 127 spoke in opposition to the planning applications. The large number of those who spoke in opposition to the planning application suggests that the industry did not yet possess a SLO in Lancashire (Bradshaw & Waite, 2017b). One individual who discussed the SLO in her opposition presentation cited 'evidence of regulatory breaches and failure to comply with planning conditions means that there are questions over credibility and trust' and concluded by asking 'can a social licence ever be earned and on this basis, how can this business operate?' (Bradshaw & Waite, 2017b, p33). Others in this enquiry, and indeed since, have cited SLO in their opposition to SGD, many link SLO with democracy (or lack of). Bradshaw & Waite (2017b) describe the Lancashire case as 'ground truth' for academic research and opinion polls that wish to investigate support for SGD. It should also be noted that there have been several unsuccessful legal appeals in Lancashire and Yorkshire since the 2016 public inquiry. This is an important consideration for this study, as it demonstrates that the term social licence has entered the lexicon of local stakeholders, such as was demonstrated in the 2016 public enquiry mentioned above. Moreover, a link is established between the stakeholders' perceptions of the regulatory regime and failure to comply with planning conditions, and not just the perceptions of the operator. Additionally, stakeholders are linking SLO with other failures, such as well integrity, fugitive methane and wastewater disposal. This is discussed in more detail in the next section.

2.5 Trust

Trust is a key component of SLO and is considered a requirement to move from approval to psychological identity for a community and operator, see figure 2.1. Trust is also a key component of risk perception and governance. As mentioned in section 2.2.1, reactions to a perceived hazard are dependent on a number of factors including trust, or mistrust, of the regulation of the hazard. In addition, trustworthiness was identified as an area where public perceptions and institutional framings of SGD were themes of concern. (Williams et al., 2015).

Trust has been described as a critical issue and integral to the decision-making process and has a significant impact on individuals' perceptions of risk (Dare et al, 2014). Studies in the field of risk assessment include trust as a key variable, however according to Siegrist (2019) the importance of trust has been often questioned or underestimated. Siegrist posits that the important issue is not so much about if trust is important, rather the form of trust that people rely on in a given situation (Siegrist, 2019). Trust and complexity influence each other and trust

is a mechanism for reducing complexity, thus allowing individuals to function in a complex environment (Luhmann, 1989, Siegrist, 2019).

Many scholars claim that trust is difficult to define, that the definitions are confusing and numerous (McKnight, 2000, Grabner-Kräuter et al, 2006, Kang & Park, 2017). Scholars subsequently began to focus on the definition and conceptualisation of trust with a myriad of different approaches and perspectives, resulting in “a confusing potpourri of definitions applied to a host of units and levels of analysis” (Shapiro, 1987 in Grabner-Kräuter et al, 2006, p235) and has further been described as suffering a ‘definitional paradox’ (Kang & Park, 2017). Empirical research has determined most definitions of trust and therefore individuals have utilised a narrow conceptualisation of trust to suit the requirements of their research (McKnight, 2000, Grabner-Kräuter et al, 2006). McKnight, (2000) argues ‘a more beneficial way would be to recognize the various types of trust that exist and to specify which type of trust is being addressed in the current work’, therefore in this thesis trust will refer to the broader generic concept. A good definition to suit the purposed of this thesis would be ‘the willingness of a party to be vulnerable to the actions of another party based on positive expectations regarding the other party’ s motivation and/or behavior” (Lumineau, 2014, p. 3). Whilst it is recognised that the concept of trust may be more complex from a psychological, sociological and other perspectives, this rather simple definition is applicable to the analytical frameworks used in this research; risk perception, governance and SLO.

2.6 Technical aspects of SGD

In addition to the social concerns regarding SGD, there are also some well-documented technical concerns and debates about SGD within academia. These include fugitive methane and methane contaminated water, well design and integrity, wastewater treatment and disposal and SGD induced seismicity. These are important considerations in the context of this research, these points were identified as themes raised in relation to SLO, industry activities and the regulatory regime.

2.6.1 Methane (fugitive and water contamination)

Perhaps the longest standing and most lively debate is in relation to groundwater contamination related to SGD in the Marcellus and Utica shale formations of north-eastern Pennsylvania which began with the publication of ‘Methane contamination of drinking water accompanying gas-well

drilling and hydraulic fracturing’ by Osborn et al. (2011a) from Duke University. This study identified higher concentrations of thermogenic methane, which matched gas geochemistry of nearby active well sites, in groundwater near SGD compared with groundwater at control sites. In total Osborn et al. (2011a) tested 60 wells. Molofsky et al. (2013) later tested this hypothesis, using a larger dataset (n=1701), and concluded that the higher levels of methane can be attributed to the topography of the landscape rather than the activities of the SGD industry; higher levels of methane in the valleys compared with lower levels in the uplands. It should be noted, however, that these data were Cabot Oil and Gas Corporation’s, and were recognised as such in the acknowledgments.

Others were also involved in this debate, for example Davies (2011); Saba & Orzechowski (2011) and Schon (2011). Davies (2011, p 871) claimed, ‘the evidential basis for implicating this specific process is not sound and needs to be closely scrutinised’ and further recommended that in order to test whether SGD is responsible for methane contamination, baseline monitoring should first take place to determine the natural levels of methane in the groundwater. Jackson et al. (2011, p872), in reply to Davies stated, ‘Any assertion that hydraulic fracturing is unrelated to contamination remains equally unproven’ and further stood by their declaration that more research is needed across Pennsylvania and other regions to determine causal mechanisms for the observed higher methane concentrations. Others claimed that the Duke University study simply did not have enough data to reach these conclusions (Saba & Orzechowski, 2011; Schon, 2011), however in response to these critics, Osborn et al. agreed and requested data from the industry for archived predrilling data, of which they believe are in the thousands, and further, proposed that industry and the Pennsylvania Department for Environmental Protection work with them to ‘make this experiment happen’ (Osborn et al., 2011b).

A more recent study involving Osborn thanked the Colorado Oil and Gas Conservation Commission for providing access to data, indicating that industry did hear this call. This study concluded that wellbore barrier failure, rather than high-volume hydraulic fracturing, was the main cause of thermogenic gas migration (Sherwood et al., 2016). This debate continues to endure, with many claiming no connection between SGD and contamination of groundwater, for example Duncan et al. (2019); Hildenbrand et al. (2020) and Barth-Naftilan et al. (2018). Others claiming a connection, for example and Huang et al. (2020); Lu et al. (2019), the latter two articles propose an improved frameworks for detection of methane contamination. Many more conclude that further research is required, for example Botner et al. (2018); McIntosh et

al. (2018). The debate about groundwater contamination, as expressed by Davies (2011), highlights the imperativeness of baseline monitoring before SGD activities begin.

In the UK, as SGD is still in its infancy, most studies looking at fugitive methane or groundwater contamination have focused on conventional gas sites, for example Boothroyd et al. (2016). Similarly to Sherwood et al. (2016) they conclude that where elevated levels of methane have been detected, this is likely due to an improperly decommissioned site or well integrity failure.

2.6.2 Well integrity

Well integrity issues in the oil and gas industry are a known problem and discussed in the energy industry and engineering literature, for example King & Valencia (2016); Mohammed et al. (2020); Yan et al. (2018); Yudhowijoyo et al. (2018); Zhai et al. (2019) and Zhou et al. (2019). This is of special concern to the industry as well integrity failure impacts productivity and gas flow, these issues seem to be of particular concern in SGD and where multiple hydraulic fracturing takes place (Mohammed et al., 2020; Zhou et al., 2019). Also noted are issues such as maintaining well integrity at depth, age of well bore, differing geologies around the world and other chemical, mechanical, and operational factors (Kiran et al., 2017; Mohammed et al., 2020; Zhai et al., 2019). Others are more concerned with the environmental issues associated with well integrity, especially the potential impacts on groundwater (Lefebvre, 2017). Whilst it is generally recognised that most groundwater contamination to date has occurred from surface releases (accidental), it is suspected that the second most likely source of release is failure of the integrity of the wells, well casing and cement failures may lead to methane and fluid flow within and outside the well bore (Lefebvre, 2017). Lefebvre (2017) and others claim that these are easily detected and can also be repaired, however this may be costly and the repairs complex. The rate and frequency at which a well loses integrity is closely linked to the likelihood of contamination, according to Lackey et al. (2017). The main physical barrier preventing fluid flow to 'unintended zones' is cement, this is further dependent on environmental conditions and the chemical composition of the cement, furthermore casing corrosion is another potential issue which, Kiran et al. (2017) claim, is often unavoidable due to acidic environments (Kiran et al., 2017). For a comprehensive account of the causes of well integrity failure, see Kiran et al. (2017). Another issue is the rate at which the technology and methods for extracting gas change, Soeder & Kent (2018) warn that rigorous scientific research should be referred to in order to minimise risk, in the case of well integrity and other aspects of SGD such as chemical composition of the fracturing fluid. Whilst much of the literature relating to well integrity is highly technical, it is

clear that this is an issue which must continue to be investigated in order to minimise and mitigate the risks of negative environmental impacts from oil and gas extraction.

Some work has been carried out to investigate specific operational concerns regarding SGD, these are primarily to do with the integrity of wells. Davies et al. (2014) examined datasets from all over the world in relation to well barrier and well integrity; these data included all stages of development for conventional and unconventional operations. Well casing failure and leakage rates are reportedly very difficult to predict (Lavrov & Torsæter, 2018) and whilst Davies et al. (2014) found a highly variable range of evidence of well or barrier failures, due to the difference in size of the datasets in addition to the range in age and design of wells, it also found that of the 8030 Marcellus shale wells inspected between 2005 and 2013, 6.3% have been reported as having failures. A further study examined found 85 examples of cement and casing failures, four blowouts and two gas venting events in wells inspected between 2008 and 2011 in Pennsylvania (Davies et al., 2014).

Whilst these studies may suggest that well casing failures are not commonplace, they cannot be described as uncommon either; the 2005 to 2013 study mentioned above represents 505 well failures in eight years. It is unlikely that stakeholders would find this an acceptable rate of failure. Indeed, it is claimed that a 'large number of casing failures occur during the volume fracturing operation of shale gas' (Lin et al., 2017, p1). Efforts are being made to find engineering solutions to this often cited problem, one which is frequently documented in industry literature (for example: Cirimello et al., 2017; King & Valencia, 2016; Stone et al., 2016).

2.6.3 Wastewater Disposal

The main body of literature regarding the practicalities and potential environmental issues regarding wastewater treatment and disposal comes from the US. Whilst unconventional wells reportedly produce approximately 35% less wastewater per unit of gas than conventional wells, the fact that the rate of production of unconventional wells are growing has meant a 500% increase in water use in some regions (Lutz et al., 2013; Rodriguez & Soeder, 2015) and therefore the volume of waste water has also increased. This, in conjunction with the fact that almost half of the US SGD sites are located in high water stress areas (Javaid, 2016) has elevated concerns regarding encroachment on drinking water resources and therefore makes water management

an important consideration for future developments (Rodriguez & Soeder, 2015). Other concerns include contamination of groundwater or surface water from accidental spills or leaks, habitat fragmentation and disturbance, and impacts of water transportation both to and from SGD sites (Rodriguez & Soeder, 2015).

Prior to 2011, most of the SGD linked contamination of streams was attributed to permitted release of wastewaters through municipal or industrial wastewater treatment plants (Brantley et al., 2014). Since this practice ceased in 2011 in the US, the reports of contamination (or drinking water 'problems'), as reported by the regulator, have largely come from accidental spills (Brantley et al., 2014). It is however difficult to assess due to lack of transparency and access to data (Brantley et al., 2018). As most contamination issues have occurred from spills rather than at depth (Brantley et al., 2014; Rodriguez & Soeder, 2015) the focus is on how to store wastewater, chemicals and other fluids at SGD sites. Heavy rainfall can cause problems with impoundments (pits and ponds), causing them to overflow, and further leakages through liners are reportedly difficult to detect before contamination occurs. Therefore, the industry began to use storage tanks, which are less susceptible to extreme weather and make it easier to identify leaks. Indeed in many US States, storing wastewater in tanks considered best management practice and treatment through municipal or industrial wastewater treatment plants has reduced in favour of reuse and re-injection practices (Estrada & Bhamidimarri, 2016).

There is increasing interest in the capacity of existing wastewater treatment facilities and infrastructure capacity in the UK. Unlike the US, in the UK wastewater must be treated before discharge; in the US it may be discharged and disposed of in underground formations (see Chapter 2.6). Many authors have concluded that wastewater treatment facilities and infrastructure in the UK, and indeed across Europe, are currently not capable of providing effective treatment for wastewater from SGD (Ferrar et al., 2013; Harkness et al., 2015; O'Donnell et al., 2018; Prpich et al., 2016; Turan et al., 2017). Research regarding how wastewater issues can be managed, and technical solutions are emerging (Caballero et al., 2020; Onishi et al., 2017; Sun et al., 2019; Turan et al., 2017). However, it is anticipated that inadequate wastewater treatment from SGD has the most potential to cause environmental impacts (Annevelink et al., 2016) and is therefore a significant concern with regards to any future developments in the UK. This point is echoed by O'Donnell et al. (2018) who further stress that this issue requires a coordinated coherent strategy between industry, waste water management companies and regulatory bodies and that currently no such strategy exists.

O'Donnell et al. (2018) also calculated the potential cost of wastewater treatment for SGD in the UK and estimates that, for treatment of salinity alone, would be 'between \$2701 (~£2000) and \$1 376093 (~£1 047000) per well, requiring between 2 and 26% of expected revenue' (O'Donnell et al., 2018, p333). Further costs, which would be incurred due to the legal requirements in the UK for disposal of Naturally Occurring Radioactive Material (NORM), are estimated up to £163,450 per well.

An enlightening story was aired in January 2014 by the BBC's Inside Out (North West) programme. It reported that almost two million gallons of radioactive water, wastewater from Cuadrilla's operations, was processed at a water treatment works and then discharged into the Manchester Ship Canal. Cuadrilla was authorised by the Environment Agency to send contaminated water to Daveyhulme treatment facility, as industrial effluent, before discharge into the Manchester Ship Canal. EU regulatory changes in 2011 meant that this practice was no longer possible; this resulted in Cuadrilla withdrawing licence applications for resubmission under the new legislation. Whilst Cuadrilla and the EA were indeed acting lawfully, the incident had taken place before regulatory changes; it nevertheless highlighted the issues associated with treatment of radioactive waste and the potential harm to the environment and human health (BBC, 2014a). Some academic literature also mentions this issue, if only in passing, for example Beebeejaun (2016) who highlights that the practice of discharge to local waterways is contrary to US best practice. Szolucha (2016) mentions that this incident caused alarm and bewilderment to local residents in Lancashire. Tawonezvi (2017) states that this incident demonstrates 'how desperate the industry is in managing wastewater' (Tawonezvi, 2017, p18) and further states that the only protection is from the Mining Waste Directive (2006/21/EC) which was not specifically written with wastewater from SGD in mind.

There are limited updates available in both the academic literature and the wider press regarding the issue of wastewater treatment from SGD operators, other than looking for technical solutions as expressed above. The exception being a mention in a report by the National Audit Office which states that the EA have declared to them that there are currently six sites which hold permits to treat waste water, and further that this meets current requirements (NAO, 2019). It is not clear if this refers to operators with permits or to waste water treatment facilities with permits. If it is the latter then this represents a significant improvement in terms

of capacity to treat SGD wastewater. If it is the former then this may represent no change in capacity.

2.6.4 Seismicity

Concerns have been raised from the beginning of SGD in the UK with regards to seismicity induced by hydraulic fracturing. Natural seismicity is said to be low in the UK by world standards, the UK has lived with seismicity events induced by coal mining and the settlement of coal mines for a long time (Mair et al., 2012). In 2012 The Royal Society and The Royal Academy of Engineering released their report which stated ‘Seismicity induced by hydraulic fracturing is likely to be of even smaller magnitude’ than those experienced as a result of coal mining, or natural events (Mair et al., 2012, p4).

Earthquakes widely attributed to Cuadrilla’s operations caused a cessation of SGD exploration at Preese Hall in Lancashire in 2011. A moratorium was issued while an investigation into the cause took place. A report concluded that the earthquakes were induced by hydraulic fracture treatments at the Preese operated by Cuadrilla, and further concluded that ‘further small earthquakes cannot be ruled out, however the risk from these earthquakes is low, and structural damage is extremely unlikely’ (Green et al., 2012). The moratorium was subsequently lifted and a traffic light system (TLS) (see figure 2.3) put in place to monitor seismicity with a view to halt operations in the event of a tremor exceeding 0.5 Local Magnitude (LM).

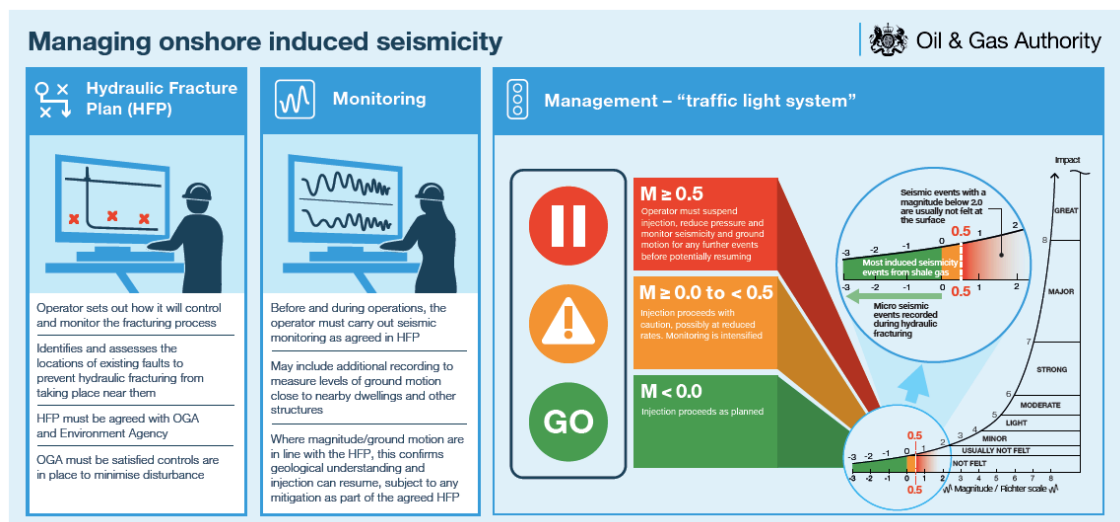


Figure 2.3 Managing onshore induced seismicity. Infographic of the Traffic Light System for seismic activity, Source: OGA

As seen in the figure above, under the heading Hydraulic Fracture Plan (HFF), although the HFF must be agreed with the OGA, the operator determines how to control and monitor the fracturing process. Furthermore, the operator identifies and assesses the existing faults in order to attempt to avoid them. This process is dependent on the operator effectively self-regulating, this is discussed further in Chapter 6. Indeed, a report commissioned by Cuadrilla and the UK Government (Green et al, 2012) stated that potential seismicity could be managed through a self-regulated monitoring system (Aczel & Makuch, 2019).

According report released by the Oil and Gas Authority (OGA), there have been 5 ‘red events’ between the 15th October 2018 and 18th December 2018 causing Cuadrilla to halt operations (Cuadrilla, 2019). Afterwards, the company requested a relaxing of the regulations as they believe that the regime existing at the time was ‘strangling’ the industry. In November 2019 the Government announced a moratorium on fracking, stating that ‘until compelling new evidence is provided which addresses the concerns about the prediction and management of induced seismicity’ the moratorium would be maintained (Prescott, 2019).

A large proportion of the literature regarding seismicity and SGD is unsurprisingly highly technical, for example Ward et al. (2018) which is seeking to improve the quality of real time data in order to further improve the Traffic Light System (TLS). Many studies investigating the social impact of SGD mention seismicity as a key concern of stakeholders, for example Short & Szolucha (2017) Szolucha (2016); Thomas et al. (2017b); Williams & Sovacool (2019). This section on technical issues highlighted a few of the concerns regarding SGD. Fugitive methane, well integrity and wastewater disposal are some of the greatest concerns regarding risk, with evidence from the US and questions are being raised in England, especially with regards to wastewater disposal. Additionally, England has already experienced issues with seismicity, resulting in the cessation of production in Lancashire.

2.7 Regulatory Literature

Beginning with an overview of the UK regulations relating to SGD, this section highlights the main regulatory agencies and legislation in England. The relevant EU recommendations and key regulations and directives are also highlighted, this is an interesting comparison with regards to the EU recommendations verses the UK Government actions, moreover the key EU legislation will be written into UK law with the withdrawal act.

2.7.1 Overview of UK regulations

Between the lifting of the moratorium in 2012 and the moratorium in 2019, the UK Government stated that the development of a UK shale gas industry was an important component of the new UK gas strategy (DECC, 2012) with the expectation that up to 37 GW of new gas capacity would be required by 2030 (Burns et al., 2016). This was in part driven by a desire to emulate the success of the US shale gas industry and also as a result of the reduction in gas production from the UK Continental Shelf (UKCS), which, over the past few decades has supplied the majority of UK gas (Burns et al., 2016). Devolved administrations within the UK have different responsibilities and powers with regards to SGD and have held different positions at different times (Cotton et al, 2020). The Scottish Parliament, Welsh Parliament and UK Government are now in consensus regarding a moratorium however, justification and reasoning differ; the UK Government has justified the moratorium on technical grounds relating to seismicity and the Scottish and Welsh Parliaments have emphasised public opinion and consultation responses (Cotton et al, 2020). Therefore, the regulations considered here will henceforth refer only to England.

The regulations applicable to unconventional SGD in England are the same as for conventional onshore (and offshore) gas development. The Petroleum Act (1998) requires companies to apply for appropriate licenses for exploration and production activities; in the case of onshore exploration and production, this is the PEDL (DECC, 2013). Since 2014, for licenses issued under the 14th round, additional adjustments or ‘model clauses’ have been included for PEDLs for unconventional SGD to address the ‘unique features of shale gas development’ (Burns et al., 2016), specifically the requirement to agree to ‘Retention Areas’ and ‘Development Areas’ with the newly formed OGA.

Until 2015 the responsibility to issue and enforce the PEDL was with the DECC. This is now the responsibility of the OGA; an executive agency within the DECC (OGA, 2015). The establishment of the OGA was in response to the recommendations of the Wood review (Wood, 2015) which highlighted the need for the creation of an independent economic regulator for the Oil and Gas sector for the ‘UK’s energy security and long term economic outlook’ (OGA, 2015; Wood, 2015), the report further highlighted the need to ‘take positive steps to maximise the economic recovery of the UK’s indigenous hydrocarbon resources’ (OGA, 2015).

In England, the EA is responsible for the issuing of environmental consents for SGD under the Environmental Permitting (England and Wales) Regulations 2010 (SI 2010/675), other environmental consents are also required, such as a water abstraction license and notification of an intent to drill a borehole under the Water Resources act 1991 (Environment Agency, 2012). The EA is also responsible for the handling of mining waste and NORMs, surface and groundwater discharge facilities.

The Health and Safety Executive (HSE) is responsible for monitoring well integrity and site safety for shale gas operations and to ensure that safe working practices are adhered to under the Health and Safety Work at Act 1974. The main HSE regulations for SGD are The Borehole Site and Operations Regulations 1995 (BSOR) (SI 1995/2038); The Offshore Installations and Wells (Design and Construction etc.) Regulations 1996; and The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR) (The Health and Safety Executive, 2019). The Minerals Planning Authority (MPA) is responsible for planning permission, planning conditions, public consultation and consider action of factors such as traffic, noise, visual intrusion and nature conservation (DECC, 2014).

In addition to the legislative process, the Oil and Gas industry has recently committed to a package for communities in proposed shale gas development areas: £100,000 in community benefits per well-site where fracking occurs and 1% of revenue from production. Operators have also agreed to publish evidence of how these commitments have been met (DECC, 2016).

In 2013 the DECC published a regulatory roadmap for shale gas companies and other stakeholders in order to clarify the approvals and consents required during the exploration and appraisal phases see figure 2.4.

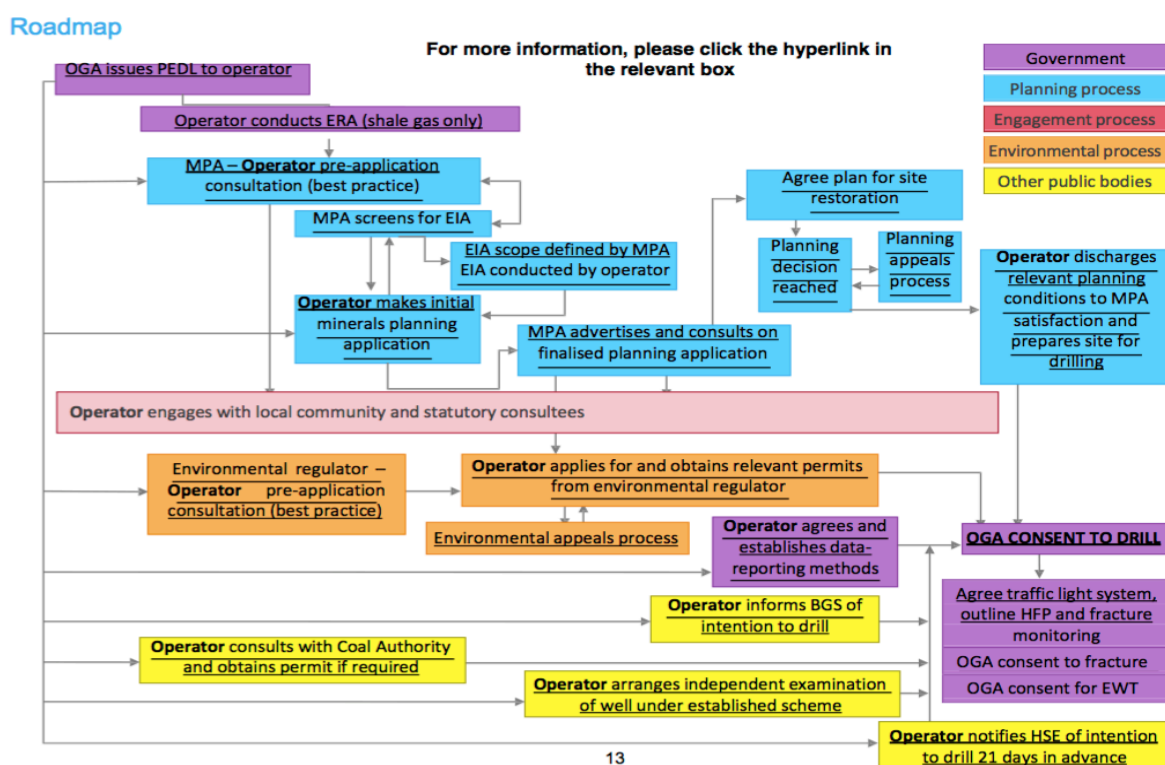


Figure 2.4 DECC regulatory roadmap

Further developments in the regulations for SGD in England include the Infrastructure Act 2015, which removed the right of landowners to refuse permission for drilling beneath their property (Rattle et al., 2020). In November 2015 the government introduced a SGD planning licence condition, which banned any exploration in protected wildlife areas or designated landscapes (DECC, 2015b), however towards the end of the year MPs approved the Onshore Hydraulic Fracturing (Protected Areas) Regulations, allowing SGD under national parks (Perraudin, 2015). The following year a leaked correspondence between Amber Rudd (then energy secretary), Greg Clark (then local government secretary) and Liz Truss (then Environment secretary) revealed plans to remove decisions about SGD from local authorities (Hope, 2016).

‘The Government has always been clear that we will take a precautionary approach and only support shale gas exploration if it can be done in a safe and sustainable way, and that we will be led by the science on whether this is indeed possible. It remains our policy to minimise disturbance to those living and working nearby, and to prevent the risk of any damage’ (Leadsom, 2019).

It was also confirmed that plans to amend the planning process for SGD sites would also be put on hold, unless compelling new evidence is provided, and further that they had no plans to turn the moratorium into a ban (Priestley, 2020).

The Labour Party’s 2019 manifesto committed to ‘immediately and permanently ban fracking’, and they have also proposed a new clause for the Environment Bill 2019-20 which would have the effect of banning SGD in England by preventing ‘the Oil and Gas Authority from being able to provide licences for hydraulic fracturing, exploration or acidification, and would revoke current licences after a brief period to wind down activity’ (Parlament, 5 March 2020). The Public Bill Committee proceedings for the Environment Bill were adjourned in 2020 due to the Coronavirus pandemic with a future date to be provided by the chair (Priestley, 2020).

2.7.2 EU recommendations

In contrast to the US regulatory framework there are no specific European regulations for SGD to date, additionally there are many differing views regarding how existing European regulations may apply, furthermore those which are relevant are applicable on varying governance levels (Fleming, 2015; Goldthau & Sovacool, 2016). The EU also released recommendations on SGD, for example the Commission Recommendation of 22 January 2014 (2014/70/EU), however although these recommendations are not legally binding they are nevertheless significant as they may indicate the ‘current and likely future stance of EU institutions on the regulation of unconventional hydrocarbons’ (Fleming, 2015). These recommendations have been described as ‘a successful balancing act, which leaves member states with considerable leeway for implementing their own regulatory strategies, while providing much-needed assurance for investors that Europe will not be ‘closed for shale business’’ (Fleming, 2015). The following paragraph identifies the main EU regulations and directives that may be applicable. According to Glowacki & Henkel (2013) there are approximately nineteen EU Directives and Regulations potentially relevant to SGD (Glowacki & Henkel, 2013). Some of the areas of interest and general, but related, regulations or directives are identified as follows:

- Environmental Impact assessments
 - Strategic Impact Assessment (SEA), (2001/42/EE)
 - Environmental Impact Assessment (EIA), (85/337/EEC)
- Water
 - The Water Framework Directive (WF), (2000/60/EC)
 - The Groundwater Directive (GW), (2006/60/EC)
 - The Mining Waste Directive (MW), 2006/118/EC)
- Air
 - Integrated Pollution Prevention and Control Directive (IPPC), (2008/1/EC)
 - Industrial Emissions Directive (IE), (2010/75/EU)
 - Air Quality Directive (AQ), (2008/50/EC)
- Land
 - The Environmental Liability directive, (2004/35/EC)
 - Habitats Directive, (92/43/EEC)
 - Birds Directive, (2009/147/EC)
- Chemicals
 - Regulation on Registration, Evaluation, Authorisation and Restriction of Chemical Substances (REACH), (Regulation (EC) no 1907/2006)
- Non-binding documents include:
 - Commission Recommendation of 22 January 2014 on minimum principles for the exploration and production of hydrocarbons (such as shale gas) using high-volume hydraulic fracturing (European Commission., 2014a)
 - Communication on the exploration and production of hydrocarbons (such as shale gas) using high volume hydraulic fracturing in the EU' (European Commission., 2014b).

As a result of the 2011 mandate from the European Council, the European Commission authorised the first of many independent studies on SGD, the initial study focused on the legal framework and concluded that the current EU regulatory framework 'may not be sufficient for commercial scale exploration of shale gas in western Europe' (Glowacki & Henkel, 2013). The Commission, in response to these findings, set up the Work Program on unconventional hydrocarbon extraction which has two main objectives: to ensure all of the environmental risks linked to SGD are identified and managed appropriately; and to establish a common approach across the EU by providing legislative 'clarity, coherence and stability to market operators who wish to invest in unconventional hydrocarbon developments' (Glowacki & Henkel, 2013).

2.8 Summary

This literature review began with an overview of the SGD literature to date, by providing a summary of the areas gaining most scholarly attention: environmental concerns, regulatory and policy implications in the US and the UK, public perceptions and scientific uncertainty. A sizable proportion of the literature is critical of the UK approach to the governance of SGD, with the lack of community engagement a key finding. Community engagement is an important aspect of the SLO as communication and consultations with stakeholders is key to gaining trust and legitimacy.

The literature review presented in this chapter continued by identifying crucial theoretical and methodological frameworks to support this thesis in the context of risk perception, governance and the SLO. The Risk perception section concentrated on qualitative approaches to risk analysis focusing on the Social Amplification of Risk Framework (SARF). SARF is a conceptual framework which seeks to incorporate the psychological, sociological and cultural aspects of risk perception with the technical assessment of risk and highlights risk events as amplification or attenuation factors.

Studies have looked at risk perception in the context of SGD using the UK Government's 'wave' surveys as primary data. Some disagreement is apparent regarding findings, perhaps spurring the recent interest from qualitative social scientists in public perceptions and support with regards to SGD.

Wider understandings of governance was explored followed by a focus on energy governance, energy justice and governance in the context of competing policies such as localism. As the democratic process is a key concern in the UK regarding SGD, this was explored using the Council of Europe key principals of democracy. Finally, the revolving door perception is discussed as many believe there is a movement of powerful elites between government, industry and regulators. Indeed, this has been observed in the context of the EU and in the oil and gas sector in the US, UK and Poland.

The SLO has become a prescriptive norm in many industries, especially the extractive industries. It refers to a non-actuary licence, or form of acceptance, by communities to an industry developing in the local vicinity. It is considered by some as important as any legal actuary licences as the consequences of not having a SLO could be costly or damaging to the development. SLO is closely connected to other concepts such as Corporate Social Responsibility (SCR) and Free, Prior and Informed Consent (FPIC), although SLO is considered to have gained

the greatest currency (Parsons & Moffat, 2014). In the context of the UK and SGD, the industry does not seem to have gained a SLO. Using Lancashire as a case study, one study (Bradshaw & Waite, 2017a) provided a commentary on the public enquiry into the rejection, and subsequent overruling, of the planning consent application made by Caudrilla at Preston New Road. This provides evidence that local residents are aware of the social licence, having cited it in their rebuttals. Moreover, local residents link the SLO with their sense of lack of democracy in the planning process, and wider regulations concerning SGD.

Some relevant technical literature was reviewed, specifically fugitive methane, methane contamination of ground water, well integrity, wastewater disposal and seismicity. These are well-documented concerns causing debates amongst scholars and perhaps the main reason for the controversy in the first place. The literature reveals an on-going debate about groundwater contamination in the US literature, however in the absence of baseline data, this is unlikely to be resolved anytime soon. Well integrity is a known problem within the industry. It is also cited in the industry literature, as there are economic incentives for industry to resolve this problem. Well integrity is considered the second most likely cause of fugitive methane and surface water contamination, after accidental spills. Although there is no commercial scale SGD in the UK at the current time, wastewater is being examined as a potential problem. Indeed, wastewater is considered a problem at the exploration stage of development as wastewater infrastructure in the UK is considered inadequate. Further concerns include the environmental and human health impacts of inadequately treated, or disposed, wastewater. It has also been estimated, that if the industry was to conform to current standards of wastewater treatment (including treatment of NORM) it would make SGD prohibitively expensive to extract. Seismicity is perhaps the most relevant issue relating to SGD, as it is the reported reason for the 2019 moratorium in England. This review outlines the occurrence of seismic events in the England, mainly in Lancashire. Much of the literature relating to seismicity is highly technical, however some social impact studies are beginning to emerge, these indicate that seismicity is cited as a concern to a range of stakeholders.

Finally, this review provided an outline of the UK regulations and the relevant EU recommendations for member states wishing to pursue SGD. It outlines the key relevant regulator actors and institutions in addition to the 'DECC regulatory roadmap' (fig 2.4) published in 2015. The regulations of onshore oil and gas development are the same as those for offshore and conventional developments. However, there have been a few amendments to incorporate SGD over the past few years by successive governments, which were analysed.

The review of the literature of the regulatory framework for England provides a grounding for the key concepts of this thesis; risk perception, governance and SLO (see figure 2.5).

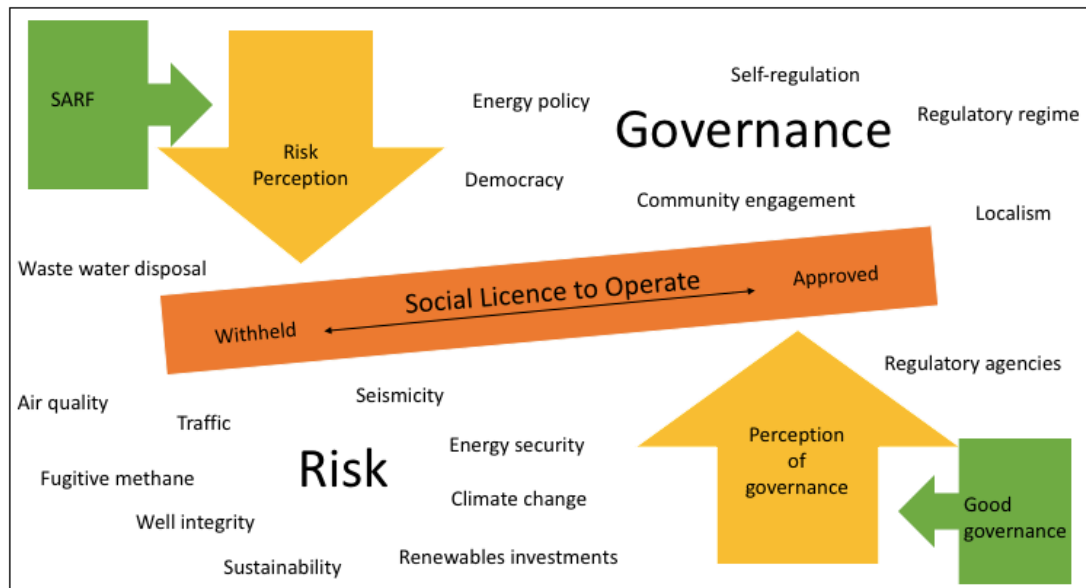


Figure 2.5 Diagram illustrating key concepts, themes and analytical frameworks for this thesis

The above diagram is an illustration of the key concepts, themes and analytical frames investigated in this thesis. The focal points are risk perception (yellow arrow down), SLO (orange rectangle) and the perception of governance (yellow arrow up), i.e. industry, regulatory regime, agencies, local and national government. The analytical frames (green boxes) are used to investigate the impact of the perception of risk and governance on the SLO. Themes are identified from the literature in relation to risk and governance, for example energy security, seismicity and community engagement.

Although scholarly attention is growing in relation to the public perception of SGD in England, this is mostly quantitative enquiry based on the UK Government's wave surveys. There is therefore a good understanding of the level of support and opposition, some limited understanding regarding the factors related to support and opposition, for example environmental concerns and concerns regarding energy security. Additionally, the emergence of literature regarding the procedural and distributive justice concerns and scholarly critiques of the regulations, especially the planning guidance aspect of the regulation has made good progress. However, a knowledge gap exists in relation to how risk perception influences support or opposition to SGD, how and why stakeholders made decisions about what is risky and what is not, enquiry relating to the positionality of stakeholders and their perceptions of risk of SGD. An additional knowledge gap relates to the confidence stakeholders have in the system of

governance surrounding SGD, including local and national government and regulatory agencies and how this relates to support for SGD.

The gaps in the literature are broadly in relation to how and why stakeholders perceive SGD in a positive or negative light, which requires a qualitative understanding. Whilst there is some enquiry in relation to SLO and SGD worldwide, there is a gap in its application in the UK; some studies mention SLO in passing (Bradsahaw & Waite, 2017), others suggesting using SLO as an analytical frame to investigate the low levels of social acceptance of SGD in the UK (Andersson-Hudson et al, 2016). There is no research looking at the SLO in Yorkshire and Lancashire.

Research in the US has identified trust as an important factor in relation to stakeholder's propensity to believe various different institutional actors' rhetoric and discourse relating to SGD. Moreover, regional variations are identified in the level of trust different regions afford different actors, for example Texas stakeholders have greater trust in industry than elsewhere (Evensen, 2018). There is a lack of similar research in the UK, suggesting value in obtaining and evaluating data on trust in relevant stakeholders exchanging information on SGD and how this relates to support.

This thesis seeks to address these gaps in addition to investigating the concept of a single regulatory regime for SGD and the perception of self-regulation by the industry. Additional gaps in the literature include the impact of media, political commentary, industry rhetoric, anti-SGD group and environmental networks affect public perceptions about risk and SGD activities.

The next chapter explains the research design, theoretical frameworks and methods for data collection and analysis in order to address some of the research gaps identified in Chapter 2.

Chapter 3 Methodology

3.1 Introduction

This chapter outlines the theoretical approaches, the research strategy, the design and methods of data collection for this thesis. A description of the research participant demographics is given to provide some insight into the positionality of participants in terms of their view, regarding Shale Gas Development (SGD). Finally, the ethical considerations and data protection are discussed.

3.2 Theoretical frameworks

The theoretical frameworks supporting this thesis include the use of the Social Licence to Operate (SLO), risk perception theories and governance theories as outlined in chapter 2.4. These will be briefly outlined here by way of justification for the qualitative approach taken to the research.

The SLO is a concept which has gained some traction over the last 20 years and used in a number of sectors, most notably the extractive sector (Mercer-Mapstone et al., 2017). SLO is a useful framework for thinking about how mining and similar developments impact host communities and other stakeholders. SLO is a measure of the legitimacy and acceptability of a project and further, the level of trust communities and other stakeholders hold for the operating company (Boutilier & Thomson, 2011). Whilst these aspects are difficult to measure, indeed this is an often-cited critique of SLO, it was found in this research to be a useful framework for considering the perceptions of stakeholders, not only towards the industry, but also their perceptions of other key aspects considered to be important for the granting of a SLO; namely the regulatory regime.

In order to understand participants' perceptions, it was also necessary to recognise theories relating to risk perception. How and why people consider a development to be inherently risky, or not, is an important consideration. Distinguishing between how 'experts' and lay people view or measure risk was especially important, (see psychometric paradigm, in section 2.2.1.2). Quantitative risk perceptions tend to be expressed in terms of expected values and probabilities whereas qualitative risk perceptions are expressed through consequences, uncertainty and through the expression of examples (events) (Aven & Renn, 2009). Some theories describe risk

perception as a function of culture, a result of individuals' shared beliefs, values and preferences (Douglas & Wildavsky, 1983). The Social Amplification of Risk Framework (SARF) aims to link perspectives of other theories and highlights the 'risk event' which may amplify or attenuate the perception of a risk (Kasperson, 2005; Kasperson et al., 1988). Research in this area has taken a qualitative approach to gain insight into people's beliefs and motivations.

Governance is a widely used term and can mean different things in different contexts. It was therefore necessary to define governance as used in this thesis (chapter 2.3). Of course, there are a wide range of aspects subject to governance and therefore the most appropriate theory related to SGD governance was considered to be in the field of energy governance. Energy governance focuses on the 'energy trilemma' of affordability, security and decarbonisation (Bolton & Foxon, 2013). Moreover, it incorporates concepts such as 'energy justice' and is increasingly being used as a way to assess and investigate new energy systems to determine aspects such as availability and affordability, intergenerational equity and sustainable (energy) development (Sovacool & Dworkin, 2015). These considerations are themes identified in this research, in addition to concerns regarding democracy, localism and the perception of a 'revolving door' between government and industry, in the context of SGD.

3.3 Research design

Given the types of insight required to address the theoretical frameworks chosen, it was decided to adopt a qualitative methodology and apply a case study approach in order to incorporate an in-depth view of the regions of England where SDG has been proposed. This is explained in the details of the case study design reviewed in the following sections.

3.3.1 Case study

The purpose of this research was to investigate and evaluate the perceptions of stakeholders with regards to the SGD industry and the regulatory regime governing it. The most appropriate way to achieve this is to use a case study approach. This comprises a single case design, multiple units of analysis case study (Mills, 2010) to: describe the current state of SGD and the regulatory framework in England; explore the key issues from each stakeholder perspective; and to compare results between 'units', the comparison will be between different potential SGD sites in England and between conventional and unconventional gas development (primary objective) and also with other developing technologies such as described by participants (secondary objective).

Case studies facilitate the researcher to investigate and explore a phenomenon within its context; additionally the 'hallmark' of case study research methodology is the use of multiple sources of data (Baxter & Jack, 2008; Patton, 1990; Yin, 2009).

Arguably the most authoritative, often cited and seminal scholars regarding case studies and case study methodology are Yin (2009) and Stake (1990). Both approach case studies with the objective of ensuring that the phenomenon in question is well explored and that the 'essence of the phenomenon is revealed' (Baxter & Jack, 2008). Yin defines a case study as an 'Empirical inquiry that investigates a contemporary phenomenon in depth and within its real life context, especially when the boundaries between the phenomenon and the context are not clearly evident' (Yin, 2009, p18). Stake avoids a definitive definition of case study, as he believes it is not possible to provide a definition that would satisfy all disciplines, rather he provides focus on the definition of 'case' as a 'bounded system' and should be viewed as an 'object rather than a process' (Yazan, 2015). Denscombe (2010) expands upon this to clarify the objective which is to provide 'in-depth accounts of experiences, events or relationships within a defined situation' (p52).

The philosophical underpinnings of Yin and Stake also differ; Yin, although not explicitly stated in his text, seems to draw from positivist traditions such as a strong focus on objectivity, validity and generalisability (Yazan, 2015). For example, when considering design quality, Yin states that researchers should 'maximise four conditions': construct validity; internal validity; external validity; and reliability (Yin, 2009). Furthermore, Yin believes in a 'strong and essential common ground' between qualitative and quantitative enquiry; this is evident in the design, methods and processes he suggests. Stake however explicitly states his epistemology for case study methodology as constructivist; he believes 'how case study researchers should contribute to readers experience depends on their notions of knowledge and reality' (Stake 1995, p100). Stake considers the role of case study researchers to be that of 'interpreters and gatherers of interpretations which require them to gather their rendition or construction of the constructed reality or knowledge that they gather through their investigation' (Stake 1995, p45).

There is somewhat less consensus regarding the purpose and implementation of the case study. Some have stated that there is no requirement for a case study to generalise from one case to others and that this is not the purpose, the purpose is however to understand the case for itself (Thomas, 2009). Gerring and McDermott state that the case study is 'a form of analysis where one or a few units are studied intensively with an aim to elucidate features of a broader class of—presumably similar but not identical—units' (Gerring & McDermott, 2007), in other words, it is possible to make wider generalisations from relatively small cases. Others, such as

Abercrombie, Hill and Turner state that the information derived from a case study is not sufficient to make broader assumptions and furthermore that a case study is best utilised in the preliminary stages of an investigation for the purpose of formulating hypotheses and should be 'tested systematically' with a larger number of cases (Abercrombie, Hill, & Turner, 1984, p. 34 in Flyvbjerg (2006). Whilst a case study may indeed be a good starting point for some studies, many are in support of, and strongly advocate case studies as a primary or sole methodology where a holistic, in-depth and descriptive study of a phenomenon is required (Flyvbjerg, 2006; Gerring, 2006; Hancock & Algozzine, 2006; Merriam & Tisdell, 2015; Silverman, 2011; Yin, 2009).

A case study framework was ultimately chosen because the objective of this research is an in-depth investigation into relationships and processes rather than an analysis of the outcome, using data gathered from a range of stakeholders with differing perspectives. In summary, a holistic view of the situation is required rather than an analysis of isolated factors. Case study methodology has been widely applied to investigations with these criteria (Tellis, 1997).

Between Yin (1993) and Stake (1995) six types of case study have been identified:

- Exploratory: usually considered as a prelude to research
- Explanatory: used for identification of casual relationships and should also contain explanatory theories
- Descriptive: require descriptive theory to be developed before investigation begins
- Intrinsic: when the researcher has a personal or professional interest in the case
- Instrumental: when the case is used to understand 'more than what is obvious to the observer'
- Collective: when a group of cases is studied

(Yin 1993)

(Stake, 1995)

The above types of case studies may all be single-case or multiple-case applications (Tellis, 1997) further a case study may be more than one of the above.

Thomas (2009) presents a slightly different way of looking at the case study methodology and suggests that case studies are either single or multiple. Single studies may be: retrospective; snapshot; or diachronic. Multiple studies present the opportunity for comparison and may therefore be either a 'simple comparative study' or the comparison of elements within one case study; these elements are described as nested. Using this framework, this research is intended

to be Single, snapshot and nested. Single, as the 'case' is the governance of SGD in England, nested as two potential SGD sites were investigated, snapshot as views over time are not being investigated. Parallel rather than sequential as the cases are being studied at the same time rather than one after the other. Figure 3.1 illustrates the case study, participants' locations.

Following Yin (2009) this study used a four-stage process: design the case study, conduct the case study, analyse the case study evidence, and develop the conclusions, recommendations and implications.

3.3.2 Case study design

The research questions, see section 1.5, are 'how' and 'what' questions, which are considered ideal style questions for case study research (Yin, 2009). The questions were developed from an identification of a gap in research during the literature review and where suggestions were made for areas of research. Attention was also paid to similar studies in other fields of new technology such as nanotechnology, for example Dorbeck-Jung (2007) and Bernstein et al. (2014) (Lee, 2008).

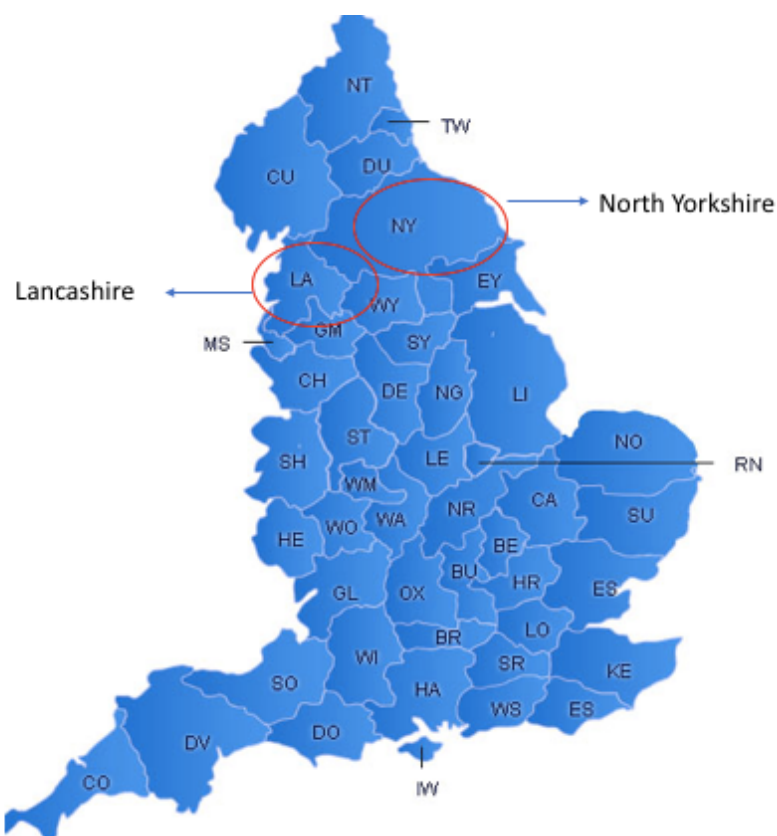


Figure 3.1 Map of England showing location of case studies, North Yorkshire and Lancashire
Source: AFP interactive maps

The fieldwork for this research was carried out in 2016 and 2017 which was a turbulent time for the UK, both societally and politically, as at this time the referendum vote to leave the EU was held. The referendum revealed deep societal divides between those voted to remain in the EU and those who voted to leave. Politically, David Cameron resigned as Prime Minister the day after the referendum vote and was replaced by Theresa May. In June 2017, a general election was held resulting in a hung parliament and a minority Conservative Government was formed. Boris Johnson replaced Theresa May following her resignation in June 2019 and a further election was held in November 2019, this resulted in a landslide 80 seat majority for the Conservative Party. In relation to Shale Gas in England, the Conservative party moved from being fervent supporters of SGD (between 2014-2018) to issuing a moratorium in November 2019, following seismic activities in Lancashire and just a few weeks before the general election. Therefore, the context of the interviews for this research is that they were held at the beginning of a tumultuous time for England and the UK as a whole.

3.3.3 Interviews

The main method of data collection for this research is semi-structured interviews. The research participants were from a wide range of backgrounds with considerably different ontological positions and experiences regarding SGD. Semi-structured interviews allowed for guidance through the issues, related to the research aims, (section 1.5), with the freedom to ask questions in a manner suitable to the participant and for the participant to respond in his or her own way. Further, the participant was able to lead the structure of the interview; perhaps with the most important personal issues first, with the interviewer using the interview schedule to ensure all topics are covered. In contrast to questionnaires and other forms of interviews, semi-structured interviews take a more fluid and conversational form and will therefore vary according to the participants' interests, views and experiences (Flowerdew & Martin, 2005). Eyles (1998) described an interview as 'a conversation with a purpose' (Eyles 1998 in Flowerdew & Martin, 2005 p111).

Some of the participant stakeholders could be described as 'elite', defined by Gillham (2000) as 'someone who is in a privileged position as far as knowledge is concerned these are often people in positions of authority, with considerable personal power' (Gillham, 2005, pg 81). Furthermore, in addition to being important connections for research, there may be beneficial connections between elites and elite groups (Gubrium & Holstein, 2002). Whilst people in these positions can be remarkably beneficial participants, they are 'not naïve subjects so will not

submit tamely to a series of prepared questions' (Gillham, 2005, pg 54). It is therefore recommended to loosely structure the interview (Gillham, 2005). Gaining access to elites may also prove challenging, there may be many demands on their time. Some may feel that the research project should be interesting and worthwhile to them (Gillham, 2005), their work or cause. Elites are also more likely to have 'gatekeepers', described by Burges (1984) as 'those individuals in an organisation that have the power to grant or withhold access to people or situations for the purpose of research' (Burges, 1984 in Flowerdew & Martin, 2005 p116). It is important therefore to identify and contact potential gatekeepers when and where appropriate in order to gain access for interview. Given the contentious nature of the SGD debate, some may be concerned about giving their personal views, being miss-quoted or of unintended consequences as a result of statements made. These issues were overcome by offering anonymity, the opportunity to review interview transcripts and the opportunity to review of any quotations they have made pre-publication (Gillham, 2005).

Whilst there is a considerable amount of literature and suggested strategies available for interviewing elites, and indeed children, men, women, older people, ill people, different races or sexuality and also for people with pets (Gubrium & Holstein, 2002; Ryan & Ziebland, 2015), there is a paucity of literature regarding interview techniques and strategies for interest groups or communities under stress.

Interviewing as a technique for gathering data has some disadvantages; face-to-face interviews are time consuming and costly. In terms of time, developing, piloting, traveling to and setting up the interview often all take more time than anticipated (Gillham, 2005). Further, post interview; transcription and analysis are also time consuming. For this research, transcription time varied between 2 and 10 hours per interview for interviews varying from 45 minutes to over 2 hours in duration. That transcription time is in keeping with estimates from Gillham (2005) of up to ten hours transcription for a one hour interview (Gillham, 2005). Keeping the interview open at the end to allow follow up conversations for clarification or more in-depth explanations was also done to allow for more descriptive and clear data. Permission was sought for follow up questions or clarification of answers by phone or email.

Interviewees were recruited by word of mouth and by email invitation for potential participants considered key, such as the local authorities in Lancashire and Yorkshire, the Environment Agency, Health and Safety Executive, industry and MP's. Residents were referred by each other and a 'snowball' technique used this began with the journalist, industry participants were also recruited this way from the initial industry interview. Interviewees ceased to be recruited once

referrals had stopped and email invited either accepted or rejected. This 'interview recruitment saturation' point was reached at 23 interviews.

3.3.4 Interview strategy and question objectives

The interview strategy was based on the following objectives that are designed to seek opinions and level of knowledge from the research participants in order to answer the research questions. These objectives were developed using Konschnik & Boling (2014) framework for evaluating and shaping shale gas governance strategies; Characterisation of risk; Optimisation of mitigation strategies; Regulation; and Enforcement (CO/RE) (Konschnik & Boling, 2014). This framework is designed to assist in the assessment of the interviewees' perceptions of the governance of SGD, understanding of risk and help determine if regulations keep pace with the development of the technology.

Interview objectives:

1. Establish baseline understanding / perception of SGD regulations, risks, operational procedures. Perceptions of opportunities and threats. Identify if participant is a proponent, opponent or undecided.
2. Specific topics for steering the interview
 - a. Characterisation of risk, understanding the risks and the causes of risk are important aspects of good governance for shale gas development, furthermore knowledge, collaboration and available information will help to reduce the gap between perceived risk and actual risk.
 - b. Optimisation of mitigation strategies, such as new pollutant reduction technologies, improved industry operational standards, shared expertise, collaboration within the industry and regulatory agencies. Tax credits, tax breaks, grants and other incentives. Provision of incentives to drive private-sector innovation.
 - c. Regulation & Enforcement, may be in the form of 'command and control' rules, softer performance standards or target setting. Enforcement provides credibility and helps to build trust between stakeholders, furthermore it helps

to provide data to identify risk patterns, causation and correlations which in turn will help identify non-linear and accumulative cause and effect.

(Konschnik & Boling, 2014)

3. Ideas of how regulations and processes (i.e. best practice) should be improved and information shared. (Example question prompts: more regulations? Less regulation? Homogenous EU regulations or/and operational standards or/and risk assessments?).

The interview questions or prompts can be found in the appendices and are organised according to the above objectives. For example, questions relating to regulations are marked as objective 2c and 3 according to interview objective above.

Whilst most of the questions were the same for each type of participant, there were some differences. For example, industry participants were asked about the UK Onshore Oil and Gas Charter of community engagement (UKOOG, nd) and asked to evaluate their performance against two of the minimum standards: engagement with individuals and organisations in the local communities from an early stage and, monitoring and evaluating the engagement process regularly. It was not considered appropriate to ask local residents this question. Instead residents were asked about their perceptions of the Environment Agencies' level of involvement in the planning process. The interview prompts are in appendices 1 (residents), 2 (NGOs), 3 (industry), 4 (agencies), 5 (MP's), 6 (journalist),

3.4 Interviewee demographics

In total twenty-three semi-structured interviews were conducted. The focus of the case study is Yorkshire and Lancashire, most of the participants are from these areas (17), however although the remainder reside outside these regions they have an interest or specific knowledge about the case study regions. The participants have been categorised as proponents, opponents or neutral regarding SGD; 60% of the interviewees identified as opponents. Of the three identifying as neutral only one demonstrated true neutrality in responses and have therefore been categorised as between positions; neutral leaning towards proponent or opponent (see table 3.1). Participants are further categorised by type, for example: resident, MP, Industry representative, academic, regulator, journalist, and NGO of which there were four

representatives from one organisation however from both Lancashire and Yorkshire. Many attempts were made to engage other NGOs however, as with the regulators, they seemed reluctant to participate. The local authorities in Yorkshire and Lancashire were also invited to participate; North Yorkshire County Council declined and Lancashire County Council failed to respond.

Table 3.1 Participant details and position on SGD

Number	Area	Type	Code	Pro/anti/neutral
1	Yorkshire	MP	01YM	Proponent
2	Neither	MP	02NM	Proponent
3	Yorkshire	MP	03YM	Opponent
4	Yorkshire	NGO	04YN	Opponent
5	Lancashire	NGO	05LN	Opponent
6	Lancashire	NGO	06LN	Opponent
7	Yorkshire	NGO	07YN	Opponent
8	Neither	Academic Professor	08NP	Neutral
9	Neither	Regulatory Agency	09NA	Neutral / Proponent
10	Neither	Industry	10NI	Proponent
11	Yorkshire	Industry	11YI	Proponent
12	Neither	Industry	12NI	Proponent
13	Yorkshire	Resident	13YR	Proponent
14	Yorkshire	Resident	14YR	Opponent
15	Lancashire	Resident	15LR	Opponent
16	Lancashire	Resident	16LR	Opponent
17	Yorkshire	Resident	17YR	Opponent
18	Yorkshire	Resident	18YR	Opponent
19	Yorkshire	Resident	19YR	Opponent
20	Yorkshire	Resident	20YR	Opponent
21	Yorkshire	Resident	21YR	Opponent
22	Yorkshire	Resident	22YR	Opponent
23	Neither	Journalist	23NJ	Neutral / Opponent

The resident participants were selected (and self-selected) as living near to potential shale gas development sites or existing conventional oil and gas sites. Although most are involved to varying degrees in action groups, for example Roseacre Awareness Group (RAG), part of the

Frack Free Lancashire alliance and Frack Free Ryedale (FFR), they were primarily selected as residents rather than activists. This is important as many criticisms aimed towards the anti-fracking community imply that they are not residents but 'professional activists'. Four of the residents have been to anti-fracking rallies or demonstrations and two, a married couple (19 and 20 YR), have been arrested and further identify as 'Geriactivists', a term used to describe a retired or older activist.

3.5 Data analysis

Interviews were audio recorded and transcribed and inputted to NVivo. NVivo is a qualitative data management software product used to organise, analyse and gain insights into qualitative data such as interview data (QSR, 2021). Transcripts were anonymised and assigned codes according to table 3.1. Coding was developed by interview objectives and by themes identified by participants. For example, initial codes were assigned according to SLO themes such as trust and legitimacy and governance themes such as accountability and transparency. Word clouds and word trees were utilised to identify key themes identified by participants; these include themes such as self-regulation, democracy and localism.

3.6 Ethics and data protection

The primary objective for ethical consideration is participant wellbeing and minimising harm (Israel & Hay, 2006; Kara & Pickering, 2017). The literature cites issues such as anonymity, confidentiality and informed consent. Other considerations include recruitment of participants, gatekeeping and institutional requirements (Kara & Pickering, 2017).

Since appearing on the policy agenda in the last decade, SGD has become a contentious issue with stakeholders holding very strong views. Given the contentious nature of this subject it was essential to conduct the research with impartiality in order to represent the views accurately of all stakeholders across the spectrum of those for and those against SGD.

When interviewing policy makers and other 'elite' professionals, potential issues can sometimes be related to power differentials as interviewees may have an agenda or wish to steer the meeting to meet their requirements. Elites may be difficult to access, and it is possible that there

will be no alternative or substitute for them, further they may wish to rush the interview due to time constraints. Indeed, this was the case with one of the MP participants, however they became invested in the interview and afforded more time as a result.

While interviewing anti-fracking organisations and local communities, feelings of anxiety, fear and anger can be very strong in these groups. It was therefore necessary to consider this at all stages; sensitively designing the question guide, conducting the interviews and also data analysis in order to represent fairly and accurately.

Consent from interviewees was obtained and participants were provided with a clear overview of the research objectives and aims and an example of the types of questions they were going to be asked, when requested. Permission was obtained for audio recording the interview. Participants will also have access to the research findings once published. Furthermore, the right to refuse to answer the questions or to withdraw at any stage of the interview or research was highlighted at the beginning of the interview.

Whilst only two participants requested anonymity, all participant responses were treated as confidential and with anonymity, this precaution was taken in order to ensure participants are not easily identified. Within some groups of participants, for example the single regulatory agency participant, the number of interviews were relatively small and therefore without due care it could be possible to unintentionally expose the identity and point of view of a participant. In the case of the agency participant, they did not request anonymity.

Data were stored securely in Dropbox and password protected. Dropbox use Advanced Encryption Standard (AES) of 128-bit or higher, AES is considered the best available technology for data security (Zhang et al., 2013) in addition a 'secure tunnel' is used for file transfer and storage (Dropbox, 2016). Furthermore Dropbox assures its users that files are backed up several times and that a copy is backed up again for safety and stored across several data centers (Walker, 2016), data is therefore further protected against loss or damage.

This research was carried out according to the principles laid out by the UK Research Integrity Office (UKRIO); this promotes good research practice and aims to prevent misconduct. Furthermore, the UKRIO's code of practice is described as a 'living document' as it is updated to reflect any changes in legislation and ethics guidance (UKRIO, 2021).

Formal ethical approval was granted by the University of Hull on 25th November 2016.

3.7 Study limitations

3.7.1 Methodological limitations

Case study justification and critiques was illustrated in section 3.3.1. In relation to this research, the case study design was chosen before data collection, as described in 3.3. However, as the research participants were recruited using a referral system and by recommendation, some of the participants did not fall into the pre-defined criteria. For example, some participants (n6) were located outside the geographically defined area, Yorkshire and Lancashire. The boundaries of the case were therefore redefined as the research refers to SGD sites in Yorkshire and Lancashire, and not necessarily where the participants were located. The case study approach was therefore limited in terms of comparative aspects between cases. Additionally, although some demographic data were obtained, this was not used and considered not enough to draw any meaningful conclusions from (see appendices 1-6). Additional demographic data should be obtained in any future research, for example proximity to SGD site, age and educational achievement.

3.7.2 Positionality

Expressing positionality in social research is recognised as important because individuals ontological and epistemological beliefs influence the research process (Holmes, 2020). Researcher positionality shapes the research, influences interpretations and understanding of not only their own research but existing research and therefore their understanding of the wider topic.

Positionality is defined as the researcher's world view, the position adopted regarding research 'tasks' and the social and political context in which the research is taking place (Rowe, 2014, Holmes, 2020). The researcher's ontological and epistemological beliefs are influenced by values and principles that are shaped by political allegiance, religious faith, gender, sexuality, historical and geographical location, ethnicity, race, social class, and status, (dis)abilities amongst others (Holmes, 2020; Marsh, et al. 2018).

With these influencing factors in mind, the following will reveal this researcher's positionality, followed by a reflexive statement detailing where these factors may have impacted on this research.

As a white British middle-class female with no disabilities, I consider myself to be fortunate and have had opportunities afforded to me others have not. Although I was brought up with religion as a key feature of my life, I am an atheist. However, I do remain interested in religion from a sociological perspective. I was fortunate to have grown up living in many different countries, with an anchor in the UK, some of which were developing countries and I therefore witnessed real poverty, injustice and inequity at an early age. I grew up in a mixed-political household; with parents holding differing political values. I would describe myself as politically left with a concern for social equality and egalitarianism. Additionally, I am concerned about environmental issues and have a background in environmental economics and renewable energy.

3.7.3 Reflexive statement

Reflexivity has had a long history in social science and is considered important as social scientists are always in some position or other in relation to what is being researched (May, 2004). Moreover, the 'implication of our social situatedness is that we experience and interpret the world from a particular perspective and we can never fully escape this subjectivity' (Shaw, 2010. p235). This has been called the 'observer effect'; a recognition that the process of observing and measuring phenomena changes those very phenomena (Hamby, 2018).

The researcher's objectives for writing a reflexive statement are three-fold. Firstly, to highlight areas of potential bias, positive and negative. Secondly, to be transparent about positionality regarding influencing factors described above. Thirdly, to recognise that, although attempts were made to be as 'objective and impartial as possible' at the outset of this research, that there is no such thing as objective and impartial social research.

Before conducting the research, the topic of SGD was well read by the researcher and attempts made to read and understand the opinions of different sides of the debate. Additionally, it was considered important to recognise the different socio-political, cultural, and ideological issues surrounding the issue. For example, one aspect considered was political affiliation.

Surveys investigating support for SGD have identified greater support for SGD from individuals, particularly men, who are politically to the right (see chapter 2). As a politically left female, it is possible that such prior knowledge may have influenced the approach to interviews and the manner in which interview questions were posed. This potential issue was identified by the

researcher before the interviews commenced and care taken not to seem politically partisan, particularly as most of the resident interviews took place in rural villages in Yorkshire and Lancashire; both areas considered to be 'safe seats' for the Conservative party. Political affiliation was not asked of participants, for future research this, and future voting intention, may be a useful additional question in order to determine support for SGD with other factors such as proximity to potential SGD sites.

With regards to influencing factors such as socio-economic and class status, the researcher is of the same or similar status as all of the participants. This was therefore not considered as a barrier, at least in terms of access, communication or being accepted. In terms of quality of research, as there may be many shared values between researcher and participant, some issues may not have been explored. Socio-economic equality issues were discussed in the context of nimbyism and SGD site locations however, there were no discussions regarding race, ethnicity, sexuality or gender. Whilst it is difficult to envision how these factors may arise in the context of SGD, a researcher of a different ethnicity or sexuality may identify issues this researcher has not.

Perhaps the most important point of reflection is the researchers position on environmental issues, particularly regarding their background in renewable energy. SGD is not a renewable source of energy. Arguments regarding SGD as a bridging fuel and other environmental benefits, such as the displacement of coal arguments, were carefully considered. Whilst there is some agreement about gas as a bridging fuel while the transition to renewable energy is made, this researcher does not agree with developing a new resource using a new technology, such as SGD for this purpose. This is because of the potential accumulative environmental impacts associated with this development, in addition to this the long-term issues associated with well integrity. The displacement of coal argument is not considered strong by this researcher, as evidence has shown that coal extraction has not reduced, the produced coal is simply exported and combusted elsewhere, thus with no environmental benefit to the planet. The researcher came to these conclusions during the course of her research, however tried to maintain a sense of neutrality with participants; this is hopefully reflected in the range of questions asked in the interviews (see appendices 1-6). However, this position potentially influenced this research during data analysis and when interpreting and discussing the data.

3.8 Summary

This chapter began by rationalising the use of the theoretical frameworks introduced in chapter 2. The main concept underpinning this thesis is the use of the SLO framework. Additionally, the use of governance and risk perception theories was also explained. The research design, the case study, was justified for its use in this research. An explanation of other methods considered was also briefly elucidated. The case study design, and the thinking behind it, in addition to the development of the interview questions was also discussed. The chosen method of data collection, semi-structured interviews, was explained and included a discussion about conducting interviews with 'elites', because a few of the participants for this research could be describe as elite, for example the MP's and industry professionals. The location of the participants is given in figure 3,1 and table 3.1 illustrating the type of participant, where they are from, where they live and their position regarding SGD (proponent, opponent or neutral). Table 3.1 also provides the codes assigned to each participant, these codes are used throughout this thesis when quoting or referring to viewpoints. A description of the data analysis was then provided, which was done using interview transcripts imported to NVivo and coded according to themes. Finally, a discussion of the ethical considerations and data protection was discussed and detailed essential conduct for the research such as gaining consent, anonymity and the right to withdraw or to decline to answer a question. This chapter also highlighted how data were securely stored.

Finally, study limitations were identified and discussed. Methodological limitations were acknowledged, including the necessity to redefine the boundaries of the case study after data collection. Additionally, more demographic data should be gathered in any future research, such as proximity to potential SGD sites, political affiliation and future voting intentions. The researcher's positionality was identified and explored for any potential bias. Political affiliation was acknowledged as most likely at odds with interview participants, however it is not believed to have influenced data gathering. Support for renewable energy technologies may have been a stronger influencing factor when discussing issues relating to SGD in this research.

Chapter 4 Risk Perception

4.1 Introduction

In order to understand how stakeholders perceive SGD, including perceptions of risks and benefits, it is important to explore how stakeholders frame their perception of risk. This chapter addresses the first research question; how do stakeholders of SGD frame their perceptions of risk? Theoretical aspects of risk are explained in Chapter 2, in addition to a review of the work carried out so far in relation to the risk perceptions of SGD.

This chapter will begin with investigating how the research participants perceive the risks and benefits; explores the framing of risk by participants and further looks at the perception of risks by considering perceptions of failures in both the nascent SGD industry in the UK and conventional onshore gas development. It looks at risk from a holistic view, rather than from simply looking at the risk according to aspects of the operation. The sections of this chapter are divided into perceptions of operational failures, regulatory failures, and industry practice failures and finally look at other ways participants characterise failures and therefore risk. Understanding how stakeholders characterise risk will be useful for investigating how they perceive the regulations and governance (examined in Chapter 5) and for determining how industry may go about gaining a Social Licence to Operate (SLO) (the focus of Chapter 6) and further how they seek to influence change.

4.2 Perceptions of SGD risk and benefits

This section seeks to identify the areas of concern or opportunity that stakeholders have with respect to SGD in order to determine the reasons they are for or against SGD and how this may influence the granting, refusal or withdrawal of a SLO. It also seeks to provide the groundwork for understanding how aspects of regulation and governance are perceived. Besides identifying the perceptions of the risks and benefits, the section considers anecdotal evidence relating to industry failures and examine how stakeholders expressed their fears by comparing to other industries, either by their own experiences or perceptions of events.

Similarly to other studies, residents, NGO representatives and MPs opposed to SGD cite more risks than benefits. Participants recited a similar list of risks to one another, as did some of the proponents, however each honed in on specific examples; some citing their own experiences and others used examples from the US and Australia. The risks are expressed in terms of potential impact on health, water, soil and air, risk of increased seismic activity and 'the fact that the faults could transmit fluids, that are left in the ground into eventually aquifers or other water sources' (15LR, 12/2016).

Other localised risks mentioned by interviewees include noise and light pollution, increased traffic causing traffic congestion and likelihood of more road traffic accidents, disruption to local flora, fauna and biodiversity. Climate change is also a concern; this is expressed in terms of a continuing dependence of fossil fuels as an energy source and as a rebuttal against the notion that shale gas is a bridging fuel that may help achieve CO₂ reduction targets while we transition to renewable energy.

4.2.1 Framing risk

As explained in chapter 2, many stakeholders frame risk in different ways, for example by world view (Douglas & Wildavsky, 1983), whilst thinking about the different ways (and why) people are likely to frame risk, this section looks at the ways the participants in this research expressed risk specifically in terms of SGD in England. It includes concern on a spatial and temporal scale.

Some expressed more general concern in terms of far reaching impacts over time and space, for example one MP cited the potential for fugitive gases over the lifetime of the well, and perhaps beyond (post well abandonment). They framed this as a long-term risk and then provided an example of this being a problem for the water companies, they further expressed concern that the risks will be experienced by, not only the local communities, but farther afield and by future generations. This demonstrates that they believe the risk to be great on both a temporal and spatial scale. They proceeded to point out that then there is an issue of the industry scaling-up, which adds further magnitude to their perceptions of the risks involved with SGD. The spatial scale is indeed a factor to be considered, it will not only be the SGD site that will be impacted by developments, other sites, for example sand / silica mining sites and wastewater disposal and treatment sites, will also be impacted and perhaps the local communities at these sites are unaware of the potential future impacts.

These spatial impacts are known; the industry know that sand will be required, produced waste water will need treatment and further that SGD will result in increased vehicle movements. In other words, these potential risks can be quantified and mitigated, projections can be made regarding scale of production and the impact this may have on sand/silica demand or wastewater treatment. The temporal aspects raised by a participant could be described as unknown, in other words this is not something that can be estimated, mitigated or even predicted or inevitable, rather it is perceived to be the case.

The risk in terms of the potential scale of the industry is often cited, in terms of both the expansion of the industry and the greater risks of impacts arising from a greater scale of production. Most participants are aware that the economies of scale dictate that one, or a handful of wells, will not meet the energy demands anticipated from SGD. Some draw on images of the extensive natural-gas operations at Jonah Field in Wyoming, USA (see Figure 4.1), an often-used image of how mature gas fields may look in the UK. At the time of the interviews, UKOOG had not yet published the visualisation video (see UKOOG, 2017), many residents, and MP' s at APPG (All-Party Parliamentary Group) meetings, requested information about the visualisation of an unconventional gas field from industry representatives, such as this resident 'I tried for months to get something out of them on visuals, what it would look like and they just hedged and fudged and I never got any suitable answers back' (15LR, 12/2016). Others residents interviewed claimed that industry is using images of conventional gas sites to claim that SGD sites will look the same (for example 15LR and 16LR).



Figure 4.1 Jonah Field demonstrating aerial view of a SGD site in Wyoming and the impact on the landscape.

(RSC PUBLISHING, 2017)

This development in Wyoming covers around 70 square miles, over 2500 wells with each well pad requiring approximately 4 acres (Allison & Mandler, 2018). If the industry is not satisfactorily answering questions such as 'what will it look like', stakeholders are more likely to draw on images such as fig 5.1, even if this is an inaccurate image of what a UK SGD site may look like. Failure to provide such information adds to the mistrust stakeholders (including some proponents, see Chapter 5) feel towards the industry. Moreover, the perception that industry is attempting to create the image that a SGD site will look the same as a conventional gas development site further compounds the feeling of mistrust.

Many of the concerns of residents and NGOs relate to the capacity of the regulatory agencies to conduct adequate monitoring and enforcement of the regulations; this was also expressed as a longer-term risk as this resident articulates:

'Let's take well-design as an example, there's the HSE who will sign off well design, but farther down the line, in 5-10 sites time, is it going to be the same well design? or is it a different well design? Who will sign it off? Who will make sure that they will drill the well and that the well is fitted to that design? ... We know already that they've had well casing [failure at Preese Hall] ... annular failings, where the wells have been damaged. ... we struggled with that, at Preese Hall, trying to find out information out of them' (15LR 12/2016).

In this example the concern has been framed as a risk which may happen at any time in the future; the potential for well casing failures, on-going monitoring of the well integrity and concern is further expressed that operators will adhere to agreed well design in the first instance. Furthermore, the difficulty in obtaining information regarding well casing issues at Preese Hall lead this resident to question future operations and to raise current and future compliance concerns.

Well integrity and fugitive methane is a highly disputed issue within the academic arena and was discussed further in Chapter 2. Well integrity was cited by many participants in this study and many seem aware of the literature on this issue, at least of its existence, if not the detail. Experiences such as expressed above, finding it difficult to get information from operators regarding well integrity following seismic events, coupled with knowledge of the volume of

literature about well casing failure make it unlikely that stakeholders will trust operators, and the technology they are using, enough to issue a SLO. Furthermore, the perception that well integrity failure is 'high risk' seems rational given the discussion above. With regards to the concern relating to the agencies capacity to enforce and monitor the regulatory regime, this is discussed further in section 5.3.1.

The regulatory agency's written response to the interview question regarding key risks, recognised that risks exist, such as to human health and to the environment. However, the EA suggests that these risks, such as potential water, soil and air pollution, are similar to other sectors with the notable exception of potential risks at depth: 'The new aspects [for SGD] are depth pollution. For us [the EA] the risks are associated with the deep well. EA are used to regulating air quality, emissions from a variety of sites, groundwater from a variety of sites but they don't have very deep wells' (09NA 7/2017). This suggests a confidence in the capacity to regulate in areas where the agency has prior experience, such as water and air pollution, however less confidence regarding regulating 'depth pollution' and perhaps even the suggestion that pollution at depth is beyond the remit of the EA, or difficult to monitor.

Similarly, one industry representative stated that compared to the fracking operation, drilling is far more challenging 'if you understand the fundamentals of it - a) it's very deep; b) it's very tight rock - and it's already cased off, it's cased off, that means we've made it safe. Drilling is something we do all the time, no one is really complaining about the drilling but it is technically far more challenging because you are actually going through Mother Nature' (11YI, 7/2017).

In both of these responses there seems to be recognition of the potential risks at depth, from the EA's perspective of regulating, and from the operator's perspective of drilling. The operator is minimising the risk by stating that 'it's cased off' perhaps suggesting that this is the most risky aspect of the operation. They make the point that it is more risky than the frack, however the risky aspect has been mitigated. This may also be explained by the expert verses non-expert theory of risk perception identified in the literature (section 2.2.1); if the industry participant is viewed as an expert, they are viewing the risk in quantitative or risk assessment terms. In other words, a risk identified and mitigated by means of well casing. Other non-expert participants may not necessarily view this mitigation measure as acceptable enough to disregard the risk,

indeed as discussed below, well casings do fail and there are risks associated with well casing failures.

Well casing failure is not only a concern to opponents of SGD but also a known problem within the wider oil and gas industry (see Cirimello et al., 2017; Kiran et al., 2017; Li et al., 2017; Mohammed et al., 2019; Mohammed et al., 2020). This therefore may be seen as an acceptable risk (with mitigation measures in place) for industry, however the perception of the other stakeholders, including it seems the EA, is that this is an unacceptable and large risk. Note that Cirimello et al. (2017) warn that the type of casing used in 'deep shale plays' are not designed for this purpose as they are not designed for sustaining large numbers of drilling cycles.

In response to the question regarding the 'dispersed nature of the industry' the same regulator had a similar response; comparing SGD to other industries 'there are other industries where they are geographically spread, for example farming. Are there issues about having different sites? Yes - it's a different issue, because we are called the EA people think everything to do with the environment is the EA but this is not the case' (09NA 7/2017). The inference here is that the EA feel that they have the transferable skills to manage a dispersed industry such as SGD, there are issues, not expressed in the written response, however they feel that they have the capacity to regulate. Interestingly, an industry participant also compared SGD with agricultural activities in terms of emissions and environmental degradation, this is discussed further in Chapter 6.

The dispersed nature of the SGD industry is one of the concerns of residents; both in terms of the dispersal of potential pollutants and also some feel this hinders the ability of the regulators to effectively regulate. As discussed in the introduction to this chapter, the capacity of and trust in the regulatory agencies is an important factor in the issuance of a SLO; if stakeholders feel the agencies are unable to effectively regulate (or do not trust them to) it is unlikely they will issue a SLO.

Industry participants minimised the risks expressed by opponents and the media, such as expressed above, citing the experience and safety track record of the oil and gas industry as a

whole, across the globe and since the 1970s: ‘we’ve been drilling all over the world, there’s 2000 wells in the UK for example, no one seems to have complained about them. Many of them have been abandoned, people don’t even know where they were.’ (11YI, 7/2017). This suggests that this industry representative believes that if people were unaware of the existence of a gas well then there was not an issue. The statement further implies that they view the industry as one, in other words that SGD is not a new industry, rather a part, or continuance of conventional gas extraction.

The risks and challenges faced are framed in terms of risks if the industry is not permitted to develop, if the recoverable gas is lower than expected and ‘how you grow it across an area of England that isn’t the same as vast areas of Texas or Pennsylvania’ (11YI, 7/2017). Many may challenge the claim of ‘an excellent safety record’, indeed as discussed in chapter 6, in the wake of high-profile incidents such as Piper Alpha and Macondo, many do not see the oil and gas industry as having an excellent safety record, rather they see it as inherently dangerous. With regards to the reference to ‘2000 wells’ across the UK comment, in fact 2000 wells have been drilled to date and 120 sites (250 wells) are currently in operation, most of these conventional gas resources in England are in Yorkshire and Lancashire (UKOOG, 2020). This research discusses complaints about such sites, and further other studies cite arguably more serious accidents such as the Hatfield blow-out near Doncaster in 1981 (Davies et al., 2014; Ward et al., 2003).

Other proponents, namely MPs, take a wider policy view of potential risks, citing the risk of depleting North Sea gas and therefore to energy security and loss of opportunity in local communities of new jobs and to the economy. At the national level, the fact that at the time of interviews, there was minority government could mean that SGD was ‘considered or perceived to be controversial [and] is [therefore] unlikely to be tackled head-on’ (02NM, 10/2017). Further, the UK government, from 2016 to the present time have made little progress on a range of policy issues, not just energy policy, as a result of Brexit negotiations and resulting problems in Parliament, and more so since March 2020 and the outbreak of Covid-19.

The other framing of risk by this MP is that opponents of SGD are so focused on issues such as low birth weight babies and cancer that they are not concerning themselves with the real issues such as on-site health and safety, lorry movements and planning applications. It seems this participant is skeptical that cancer and low birth weight babies are real risks related to SGD, as opposed to them not being serious enough. In fact, as discussed in Chapter 2, there are several studies suggesting that these risks are credible, for example for low birth weight babies see Apergis et al. (2019); Currie et al. (2017); Hill (2012); McKenzie et al. (2014); Stacy et al. (2015);

Walker Whitworth et al. (2018). Similarly, credible studies investigate cancer risk, these are discussed in Chapter 2. The issue being, as with many epidemiological and human health studies, they often take decades to be verifiable and replicable. Moreover, opponent participants cited on-site health and safety, lorry movements and planning applications in addition to cancer concerns and reports of low birth weight babies born near SGD sites in the US, compared with control areas and births prior to SGD activities taking place.

The above is a description of some of the perceived risks and benefits associated with SGD. Opponents' frame 'spatial risks' in terms of the potential size of the industry, the dispersed nature of the industry and highlight the wider impact in the supply chain, such as waste water treatment and sand mining. The temporal concerns are largely due to the potential cumulative impact of fugitive methane over time, during production and post abandonment. Proponents frame risk in terms of lost economic benefits, and further minimise risk of operational failures citing an excellent track record globally. Others cite a potential problem of pollution at depth, both in terms of difficulty in monitoring and detection.

The next section will look at examples and stories residents have expressed regarding actual failures at well sites, these are perceived as evidence of failure or non-compliance to residents and provide further insight into how participants framed their perceptions of risk. These examples include a conventional well site at West Newton, East Yorkshire operated by Rathlin Energy, Preese Hall in Lancashire operated by Cuadrilla and the conventional operations of Third Energy in East Yorkshire.

4.2.2 Experiences: Perceived operational failures

Building on the perceptions of risks and benefits, this section is divided into anecdotal evidence and actual evidence of perceived operational failures, regulatory failures and industry practice failures. Some of the participants have evidence to back up claims of failures, for example, Freedom of Information requests (FOI). The recounting of these events supports Thomas et al. (2017a) theory that stakeholders draw on place based experiences when considering the risks associated with SGD. At the time of the interviews no SGD production had taken place, only SGD exploration, evidence is primarily drawn from conventional gas activities (see sections 5.2.1 and 5.2.2).

The most frequently cited incidents in this research regarding operational failures are the failures of operations at a conventional drilling site in West Newton, east Yorkshire operated by Rathlin Energy; cited by three residents, living in East Yorkshire, and the journalist who

conducted an investigative piece on the case. Many breaches of the environmental permit were reported as a result of a leak from a flare, this resulted in the issue attracting national media coverage and subsequently other breaches were revealed as a result:

‘Had it not been for that, the other issues of non-compliance would never have been revealed... for example we didn't have an up-to-date emergency plan, in paper on the site and there was no mobile connection on site so they couldn't actually download it onto their laptops, their list of top hazardous chemicals wasn't up-to-date. I mean it was mostly paperwork issues and was the lowest level of non-compliance but they were breaching the environmental permit’ (23NJ, 1/2017).

Local residents noticed a ‘foul smell’ and ‘just nagged and nagged and nagged, just kept ringing the environment agency helpline, to complain about it’ (23NJ, 1/2017). The other issues at this site included light pollution, noise pollution, health and safety breaches and a situation where ‘all the little rodents, mice and shrews and stuff, were all disorientated [and] running about’ (19YR, 3/2017). Further, one resident recounted ‘not only that but there was a tanker left leaking out of its pipe ... we couldn't see any notices on the lorry to tell you what’ s inside the tank. I can't believe they're allowed to do that, but what was it? Was it dangerous? Was it radioactive? It’ s incredible!’ (17YR, 2/2017). These issues, coupled with the difficulty they encountered getting answers from the company and the agencies motivated one local resident interviewed (19YR) to compose a report detailing regulatory non-compliance, possible environmental effects and potential solutions.

Any perceived operational failures such as these, regardless of the severity, in existing operations, including conventional gas operations, seems to have an impact on the way that future SGD operations are perceived. Furthermore, as resident participants’ view SGD as far more aggressive and dangerous than oil and gas conventional development, then their perceptions are likely to be that the impacts of similar breaches discussed above, and below, are possibly going to have even more serious consequences. This view is similar to that of Williams & Sovacool (2019) who state that SGD is more intensive due to higher depletion rates, and thus the need for more drilling, and higher levels of liquid waste, and therefore greater truck movements.

Operational failures such as these also have an impact on the operators’ credibility and trust, one resident remembers:

‘in fact we know that in one case when they shut down West Newton A for two weeks, it was actually the Environment Agency that came back with the best method by which Rathlin could overcome the problems, and Rathlin couldn't find the solution to the

particular problem that was raised. It was to do with cold venting ... we know from emails, again we got them released from there [FOI request]' (19YR, 3/2017)

This resident demonstrates incredulity to the fact that Rathlin did not seem to come up with the solution to the problem by themselves; further demonstrating a lack of trust and credibility (discussed further in section 6.4.7).

Research participants also expressed concerns for the safety of the staff in addition to the wider community, in light of these incidents and the aftermath. Whilst it is important to reiterate again that this is an experience from a conventional well site. Many participants view the energy extraction industry as one, although they recognise that the gas targets and methods of extraction are different, further they suspect that conventional gas companies such as Rathlin will be applying for SGD licences in the future.

Another operational failure of great concern to the residents at West Newton is in relation to the prevention ditch around the site. Rathlin have applied to the planning authority for permission to drain the ditch into the Lambwath stream, which eventually runs into the Humber Estuary. Residents are extremely concerned as 'some fluids - believed to be oil based have leaked into the ditch, and that it killed many hundreds of frogs and the things that had obviously started to populate that ditch' (19YR, 3/2017).

At the time of interview this planning permission had not been granted, however the resident claims that 'We're watching that very carefully, we know at the moment it's being tankered off but we're aware that any time they could begin pumping that into a local waterway, which again makes us somewhat unhappy, we've had a sub group, which has already taken some samples from the Lambwath stream and stored it.' (19YR, 3/2017). Again, this demonstrates a lack of trust in both the company and the local authority with regards to communicating any changes to the planning permission with the local community, with their sense of environmental stewardship and regard for the local environment and further that the local community are prepared to take matters into their own hands and take baseline samples of the stream themselves. The fact that residents have taken stream water samples indicates an understanding for the need for baseline data. Whether they know how to store or analyse these sample was not investigated.

To date (March 2020) Rathlin Energy have not been granted planning permission to drain the ditch into the Lambeth stream. Recent news updated from the company indicates that the 'West Newton project represents a significant oil and gas discovery rather than a pure gas discovery as originally thought' and they have therefore temporarily suspended operations in order to reassess (Rathlin Energy, 2019). There is no mention however if this resource will be described as 'unconventional' .

4.2.3 Experiences: Regulatory failures

Further relying on the West Newton case, interviewed local residents cited examples of regulatory failures and a more general lack of trust that the regulatory agencies are doing their job effectively. This perceived lack of effective regulation is also important in terms of risk perception; stakeholders are intolerant of risk they perceive to be inappropriately regulated (Larock & Baxter, 2013; Slovic, 2016). The perception is that the agencies are 'purely responsive bodies' (19YR, 3/2017). For example, attending site only when a number of complaints had been received regarding odour and water contamination events, failing to identify the fact that Rathlin Energy's on-site contractors had copied each others Health and Safety Risk assessment and method statements, failing to identify the wrong type of rig in operation, giving notice for inspections rather than conducting unannounced inspections.

The odour and water contamination event was the subject of an investigative piece by the journalist participant in this study entitled 'What went wrong at West Newton?' During the course of this investigation it was discovered that 'the site and its operator, Rathlin Energy breached environmental permit conditions eight times in three months' (Hayhurst, 2015a). With regards to the odour, the article states, 'people living nearby complained about a bad smell. The first complaint to the Environment Agency, on 9th September 2014, described a 'huge release of gas' and a 'strong household gas smell in the area' (Hayhurst, 2015a) and that the following day the EA recorded Compliance Assessment Reports (CAR's) including one for a 'distinct odour' 50m from the site and 'extremely strong hydrocarbon type odour present on site immediately downwind of flare stack'. The report concluded: 'The activities are giving rise to pollution outside the site due to odour' (Hayhurst, 2015a).

The article also describes emails between the EA and Rathlin Energy (or possibly a contracting company), obtained under a FOI request, which suggest that Rathlin Energy were making claims that the odour was originating elsewhere and requests were made to the EA to investigate the validity of the complaints. When Rathlin Energy finally issued a statement, they described 'the odour as 'slight', 'very localised' and 'intermittent' (Hayhurst, 2015a). It could be argued that

the EA, as described above and further in the article, carried out their duties proactively rather than reactively.

Whilst the initial incidents were indeed reported by local residents, the response seems to have been fairly swift, i.e. the next day, CARs were issued and other environmental permit breaches were identified, for example as described in Rathlin Energy's own response to the journalists article, issues relating to 'documented management systems and operating procedures' (Hayhurst, 2015b). These breaches were also picked up by the national press, for example *The Guardian* (Vidal, 2014). In terms of local communities issuing a SLO, incidents such as these do not bode well; the sense that as Rathlin is 'only' exploiting conventional gas at the site, the inference is that any SGD is likely to lead to more regulatory violations, if such activities eventually take place.

The perception that Rathlin attempted to deflect the problem away from their own activities, before accepting that they had caused 'slight, localised and intermittent odour' coupled with the requests to the EA to investigate the validity of the complaints, suggesting that they believed the local residents to be perhaps untruthful. These issues do not help local residents to trust the operator, which is likely to result in withholding the SLO. Furthermore, when issues such as these are reported in the national press, support is galvanised, at least in the short term, for local residents resisting the industry as a whole. Nationwide reporting of risk events such as this is likely to act as an amplifying event causing ripple effects, perhaps fostering further investigation into the company or industry. Moreover, as suggested by SARF, this is likely to lead to unexpected costs and impacts on the company, in addition to further cementing the perception that SGD is risky.

Many participants cited the traffic management plan (TMP) at West Newton as problematic. In terms of a regulatory failure, the TMP was not in itself an issue; rather that it was not adhered to:

'Vehicles were supposed to be separated coming through here and they [have a] holding area just off the road down by Coniston. If there was going to be a group of vehicles to go to the site, they were supposed to go to the lay-by and be despatched at certain intervals and come through individually, leave the site go back off they were not supposed to be closer together than 2 minutes. One day we had 160 odd vehicles through, nose to tail, half came through nose to tail, then there was a short gap then the other half of them came through nose to tail' (19YR, 3/2017).

This issue was raised with Rathlin, who failed to take responsibility and blamed the police. The subsequent lack of action from East Riding Council, left residents frustrated with regulators at all levels. The feelings from residents are; why have a condition in the planning application if it

is not adhered to? What are the consequences of this? These questions lead to a lack of trust and credibility, not just for the operator, for regulators, in this case the local authority. Residents can monitor traffic easily enough as it is highly visible, and therefore determine if the TMP is followed, however they feel that other aspects of the operation may be more difficult for them to monitor, such as drilling operations underground and other on-site activities, behind walls or security fences. The inference is that if operators are failing to adhere to the TMP then it is possible that they are failing to adhere to other regulations.

Trust, faith and credibility with regards to regulators is a key theme in this research, and a theme running through both chapters 5 and 6. Many of the point raised refer to how participants expect agencies, industry and authorities to behave in the future. This section examined perceptions of actual non-compliance at an existing conventional site and the implications in the community. Evidence of operational failures, perceived or otherwise, provide insights into how research participants view SGD, moreover it supports Thomas et al.'s (2017b) place based theory highlighting local experiences in the perception of risk. Experiences such as discussed in this section, even though many were from conventional gas sites, demonstrate the lack of trust local residents have in industry. This was expressed both in terms of incidents cited, such as those at West Newton, and also in terms of the perceived inability of the company to come up with its own solution to a problem, thus affecting the credibility of both the company and wider industry, this also impacts the credibility of regulators, as it was the EA who came up with the solution, discussed further in 4.3. It should also be noted that the investigative report cited above also highlighted Health and Safety breaches by Rathlin Energy and these were investigated by the HSE, this is discussed further in section 5.4.1.

4.2.4 Experiences: Industry practice failures

Industry practice failures, in this context, relate to issues associated with the industry in terms of industry processes and requirements. This may be in connection to communication and transparency, or to do with internal planning, for example waste management. A good example here comes from the Lancashire site at Preese Hall, the first well to be hydraulically fracked in England. Following exploratory drilling, one resident claims that:

‘they had flow back water sitting in containers for a long long time, because they couldn’t find anywhere to dispose of it, and I think it was the Environment Agency that gave them a permit to dispose of it in the Manchester Ship Canal. If that sets the bar, if you got a problem, we will find a way around it for you, that’s not the way to proceed’ (16LR 12/2016).

Post production waste water disposal is a concern raised by many participants, as discussed in section 6.2.1, and indeed a lack of facilities in the UK to deal with SGD at the production stage is a known problem (Cooper et al., 2018). The case of Cuadrilla ‘dumping wastewater in the canal’ was reported by the national press, including The Guardian, The Independent, BBC news and was also the subject of the BBC Inside Out programme. The press articles and the TV programme do support this resident’s perception that this route of disposal was permitted under EA licence, however the media reports stated that this ceased in September 2011 when the EA changed the terms of the licence. It was reported that prior to this date radioactive water from Cuadrilla’s SGD operations was handled at United Utilities treatment works in Davyhulme and, after treatment, released into the Manchester Ship Canal. Beebeejaun (2016) and Rodriguez & Soeder (2015) further state that this practice is contrary to US industry best practice.

If the UK and EA are not adhering to US industry best practice, then this could be perceived to be making rather a mockery of the much hailed ‘gold standard regulations’, and further erode trust in the wider community in addition to local residents. As expressed by Truong et al. (2019), trust in a given institution is an important factor in any industrial activity, and further that higher levels of trust towards authorities and regulators leads to lower involvement, concern and interest in resource development. The Manchester Ship Canal story was reported by a greater number of newspapers than the Rathlin odour story outlined in section 4.2.2. Perhaps because the release of radioactive waste water into a public canal has wider reaching consequences, for more people, than at the site of SGD operations. Comments from Cuadrilla could not be found, other than a statement on their website, which could be described as rather vague:

‘The Environment Agency is charged with regulating Cuadrilla’s water usage and disposal, and with setting any conditions it considers appropriate to protect the environment and people. The permit application sets out the measures that Cuadrilla proposes to take to ensure the safe disposal of returned waters. The Environment Agency will carefully review this application, including an appropriate period of public consultation.’ (Cuadrilla, 2012)

More recently the EA have changed the permit to allow on-site treatment and disposal of wastewater by pipeline to Carr Bridge Brook (Environment Agency, 2018), this has reportedly caused disappointment to local communities who believe that Cuadrilla appears to be able to move the regulatory goalposts at will. The implication being that rather than change the company practice to adhere the regulations, the company are able to influence the regulators to change the regulations to fit industry practice: *‘The situation seems to change on a weekly basis as they salami-slice their conditions for their own benefit’* (Hayhurst, 2018b). The Manchester Ship Canal issue is discussed further in Chapter 6, here it is used to highlight perceived industry practice failures.

Wastewater management and disposal is indeed a concern among stakeholders across the board. It has been noted that wastewater disposal, including capture, storage and transport, poses the greatest threat to the environment during the production phase (Prpich et al., 2016; Rozell & Reaven, 2012). As discussed further in Chapter 2 and Chapter 5 (section 5.2.1) treatment of produced water is a known challenge to the UK SGD infrastructure and studies have shown that UK treatment facilities are not fit for purpose and further may be incapable of providing effective treatment at the production phase of development in the future (Ferrar et al., 2013; Harkness et al., 2015; Prpich et al., 2016). Prpich et al. (2016) further highlight the concern that different wastes from different geological formations may require different operational, technological and regulatory responses therefore, it may not be appropriate to emulate the wastewater management processes utilised in the US and elsewhere. It should be noted however that the preferred strategy for produced water disposal in most states in the US is deep well injection (Estrada & Bhamidimarri, 2016). This is currently not permitted in the UK and in terms of the future, there are concerns regarding the suitability of underground disposal for the UK, as a result of observed increases in induced and triggered seismicity across the US. (O'Donnell et al., 2018).

4.2.5 Other failures

Other failures include a range of issues from arguably minor issues such as typographical mistakes in documents relating to SGD to more serious complaints in relation to trusting local representatives. These are highlighted below because these issues reflect how the local residents feel about those in authority and with the responsibility for making decisions about developments in their area. This was also observed by Marlin-Tackie et al. (2020) in their study comparing two communities whose local governments differently managed the public meetings in the US.

There is a strong feeling amongst local resident research participants (n=8) in Yorkshire regarding the capacity of local planning authorities, at the county council level and at the parish council level, to represent their interests effectively and fairly. One resident strongly implies that a parish council was placated with the gift of a barbeque. Another recounts a local planning meeting, where the reports designed to educate the parish councillors '*was a cut and paste job*' (19YR, 3/2017), full of typographical mistakes and clauses which referred to other reports. As a result, the report claimed that the lighting management plan would help prevent dust. These kinds of errors, in addition to the failures to spot the errors, does not instil confidence in the local communities regarding the capacity of local representatives to grasp the 'problem' as they see it, or to make informed decisions.

Others highlight local councillors' ineptitude when speaking about SGD publicly '*we had another one who when interviewed on 5Live, [name of councillor], couldn't answer any of the questions, he had no idea what fracking was really all about, and yet he was a member of the panel*' (21YR, 1/2017). This incident, and others, means that local communities do not feel represented by their local councillors, furthermore, they are not trusted to act in their best interest. These feelings are mostly held by resident participants in Yorkshire; Lancashire residents interviewed (n=2) generally demonstrated more trust and respect for their local representatives.

4.3 Summary

The perception of SGD risks and benefits is framed by experiences with the process so far (at the time of interviews) with the SGD company in Lancashire and similar operations such as conventional onshore development. The research participants recounted stories of operational, regulatory and procedural failures in addition to failures of other actors within the regulatory system, such as during the planning application stage. These failures, actual or perceived, result in a lack of credibility of operators and therefore residents do not trust them or believe they have a legitimate place in their community. The recounting of events where the agencies have assisted operators with finding solutions to operational and environmental problems also has an impact on the regulatory agencies in terms of trust and credibility from residents. This is discussed further in Chapter 5.

The differences in the framing of risks between opponents and proponents of SGD by participants in this study support the expert versus non-expert theory identified in the risk perception literature, which illustrates how experts and non-experts differ in terms of how they frame risk (see section 2.2.1). The proponents in this study, and examined in this section, are either industry professionals or work for a regulatory agency and could therefore be described as experts. Proponents describe risk as already mitigated, therefore no longer of concern. For example, highlighting that the well is cased off, meaning it has been made safe. The opponents, or non-experts, are reacting to the perceived hazard and framing these as having catastrophic potential, and further they demonstrate lack of trust in regulators to adequately regulate the perceived risk.

This section also highlighted several areas, or risk events, that may amplify, or intensify the perceptions of risk (and the communication of that risk) in the context of the SAR Framework. These are amplified in terms of the events becoming national news, and thus galvanising support for the opposition movement. This amplification may also serve to keep the events in memory,

should development proceed in the future, these events will be remembered, and the stories re-told.

The evidence from this chapter also supports Howell (2018) that greater knowledge, either through experience or education, does not equal greater support for SGD, and further supports the recommendation by Andersson-Hudson et al. (2016) and Pollard & Rose (2019) to use the SLO framework to further assess acceptance at the local level, and further to gain insights into the risk perceptions of stakeholders.

Chapter 5 Social Licence to Operate (SLO)

5.1 Introduction

This chapter aims to identify important aspects of SLO, such as legitimacy, credibility and trust, with regards to the stakeholders' perceptions of various aspects of the regulations and actors involved. It begins with identifying more general perceptions of risks and benefits, to attempt to understand the way stakeholders frame the risks and benefits. More specific aspects of the regulatory regime and regulators will then be discussed and, finally, aspects of Shale Gas Development (SGD) governance in England will be investigated.

As stated in Chapter 2, the SLO can be viewed as a continuum of licences, both spatially (geographically), across different sectors of society and temporally. A SLO must therefore be granted and re-issued time and time again. This is particularly true of the SGD industry, as the intensity of the activities is not the same over the life time of a well, for example high intensity activities in the site preparation stage; drilling and fracking. Less intensive activity during the production stage. Similarly, with regard to the dispersed nature of SGD; it is geographically dispersed compared to other industrial activities. Additionally, a SLO may need to be given over a wider area impacting more than one community. It is therefore suggested that a new term of 'continual and dispersed SLO' be introduced for SDG and similar activities. This adapted concept will therefore recognise the challenges of building, and perhaps re building, relationships across a scattered and diverse geography and over time. This concept will be further discussed throughout this chapter.

Most studies exploring the concept of SLO, as discussed in Chapter 2, examine SGD from the industry's perspective; how does an industry/company/sector gain a SLO? These studies look at the factors in gaining a SLO by the company as opposed to the factors leading to the issuance, or not, of a SLO by the community and other stakeholders (for example Owen & Kemp, 2013). Key to this is examining the context; findings from previous studies reveal that diverse social, environmental and economic contexts in different communities and development projects have an impact on SLO outcome (Prno, 2013). In other words, there is no 'one size fits all' approach, each community is unique and each project is unique (Prno, 2013).

In addition to influencing the issues most important to a community and how these issues are expressed (i.e. protests), the context will also influence which strategies may be useful in terms of the potential solution (Prno, 2013). Therefore, an important aspect of the context is examining the communities' perception of the risks posed by the industry. This in turn will help inform industry and policy makers of the expectations of communities in SGD areas.

This research proposes that another aspect of SLO is how stakeholders perceive the regulatory agencies and their capacity to regulate. Whilst the agencies are not seeking to gain a SLO for themselves, how they are perceived may have an impact on whether or not a particular SGD company is successful in gaining one. Community stakeholders may see regulators as complicit and 'on the same side' as the operator, especially if stakeholders are not confident in the regulators' capacity to regulate. A more traditional component of SLO is community engagement; the quality of engagement and dialogue between a company and stakeholders is often cited in the literature as imperative for gaining and maintaining a SLO. Parsons & Moffat (2014) suggest companies begin by assuming that they do not have a SLO, then begin dialog to understand the communities' perceptions, aspirations and expectations. Others have suggested SLO as a useful tool for enhancing engagement with communities, with a view to understanding risk, impact and negotiate acceptance of the project (Hall, 2014). This research further suggests that the engagement and dialogue between the regulators and stakeholders is of key importance in the development of trust. This chapter will examine and evaluate stakeholders' perceptions of: risks and benefits; capacity of agencies; and community engagement and discuss why these are important. However, firstly it is necessary to gain an understanding of how the research participants in this study perceive SLO.

Whilst the formal definitions of SLO are discussed in Chapter 2 it is important to understand how the participants interviewed perceive and define SLO. It should be noted that whilst most of the questions for all participants were the same, some industry, NGO and MP participants were asked about SLO explicitly whereas the resident participants were not, see section 3.3.2 for explanation and questionnaires in appendices 1 to 6. Some resident participants did mention a 'social licence', usually to state that the industry did not have one (e.g. 15LR and 19YR), however no explanation regarding definition of SLO was given by the participants. The following interview extracts represent an industry participant and an MP participant, both proponents of SGD, however have different views of whether an SLO is in place in England, these statements also give some insight into how different research participants define SLO:

'I have been to many CLG meetings and other community and consultation events. I do believe that we have established a SLO. A Social Licence is not something where we need everybody to be supportive, most people are OK with what we are doing, we need acceptance not advocacy. It all depends on how you define Social Licence. Broadly speaking it is accepted by most people. 7-8 miles from a site people don't even know we are there. If you distinguish between the national and global appetite, I'd have to say there's a national appetite and local acceptance, that covers both forms of Social Licence - in other words what we are doing is fairly well supported nationally and locally it is broadly accepted' . (12NI, 7/2017)

This industry participant clearly believes that a SLO has been gained and has focused on the scale of which it is required, in other words he believes that nationwide there is an appetite for SGD and further that locally it is accepted. This does not reflect the findings of this research, and indeed others (Andersson-Hudson et al., 2016; Richert et al., 2015). Moreover, the Government Wave Surveys, discussed in Chapter 2, do not suggest that there is a national appetite for SGD, rather the opposite. This view further supports the need for a new concept reflecting the dispersed nature of SGD. If, as suggested, there are different 'forms' of SLO, then these must be clearly defined and investigated.

Other proponents believe that the SGD industry does not currently have a SLO and that it will only be possible to gain a SLO once the industry has commenced operations and is in production, thereby proving that all of the opponents' concerns have not come to light:

'So, have they got a social license? I would say that not at the moment, we haven't got a social license. I think people are very concerned, but I do think the only way to get that is to push ahead with shale gas, make sure this independent monitoring is in place and demonstrate to the public that the air quality is ok and the water quality is ok. I think that's how we get the social license, combined with independent monitoring ongoing, so third party, no relationship with the producer and proper planning policies so people can see that this isn't going to mean that North Yorkshire is like a gas field' (01YM, 8/2017)

Even between proponents there is a difference in perception as to whether a SLO has been gained. However, the industry participant cited above (12NI) is an oil and gas professional but does not work in either of the case study sites for this research. The MP (01YM) represents a constituency in Yorkshire, which is a host for SGD and is one of the case studies for this research. This may explain the difference in the scale used for conceptualising whether a SLO is in place. In other words, the interviewee 01YM is thinking only of Yorkshire, and 12NI is thinking on a national scale. Thinking about a continual and dispersed SLO would also be a useful concept in the context of this MP's opinion regarding when a SLO is required. The inference here is that it

is gained by 'pushing ahead' and demonstrating to the local community that it is safe. It is unlikely that other stakeholders will agree that this is an effective way to gain a SLO, moreover the important point is that a SLO must be gained at the outset and then maintained or reissued.

5.2 Perceptions of the regulatory agencies and regime

This section focuses on the regulatory agencies and the regulatory regime, an overview of which can be found in section 2.6.2. When asked about the regulatory regime of SGD, participants responded in two ways, firstly with their perceptions of the regulators themselves and secondly in relation to the regulations, in other words responses were in terms of perceptions of the EA, HSE and local authority or/and their perceptions of the processes and legalities of the regulatory regime.

This section will look at firstly the regulators and secondly the regime. It will then examine: how stakeholders use their perception of the regulators in decisions relating to SLO; if the regulatory regime is an important factor for communities granting the SLO; and whether government policy is a factor considered in granting SLO at the local level.

Chapter 2 details both governance of the regulators and good regulatory practice, more generally and in the context of SGD and further discusses the OECD Governance of regulators, EU recommendations and the UKOOG Charter for Community Engagement. This section will examine perceptions of the regulators with this in mind, in addition to the concepts of SLO.

5.2.1 Agencies

The most likely communications the local communities have with regulators regarding SGD will be at Meet the Regulator meetings (MTR). MTR events are hosted by the EA, HSE and the local planning authority and are intended to be informal public awareness opportunities to explain to the general public and local stakeholders the regulations and regulatory processes relating to SGD. However, there seems to be some confusion among some local residents regarding the

difference between the regulators' MTR meetings and the industries community liaison group meetings (CLG). One Lancashire resident described an MTR meeting as sectioned off into *'little groups so you can go off and ask questions to different people'* (15LR, 12/2016) and that this resulted in different agencies giving different answers to the same question. In response to this problem the resident *'wrote to Egan about this to say they weren't very well managed, there should have been done in a better way'* (15LR, 12/2016). Francis Egan is the chief executive of Cuadrilla, and therefore perhaps not the appropriate person to suggest changes regarding a MTR meeting.

Another example in Yorkshire illustrates that MTR and CLG meetings are equivalent in this resident's mind, at least after the event and while recalling events:

'Yes I have [been to a MTR meeting], I went along to the one in Drifffield, that being shortly after the time that the West Newton A site was closed. Prior to that I've been to the Rathlin open day, which was held at Aldbrough. I went along to the regulators and talked to them about one or two of the things' (22YR, 2/2017).

The interview question was posed as such: have you been to any of the 'meet the regulator meetings' hosted by the Environment Agency and Health and Safety Executive? (see appendix 1) and therefore explicitly about the MTR meetings. Whilst confusing MTR and CLG meetings in response to interview questions is interesting, this alone does not confirm that residents were not aware of which meeting they were attending at the time, or that they do not understand the fundamental difference between the types of meetings or indeed the meeting hosts, *i.e.* regulators or industry, however it may indicate that for some stakeholders their perception is that the regulators are complicit with, or indistinguishable from, the SGD industry.

If the residents do indeed consider the regulators complicit with industry, this may have an impact on their willingness to grant a SLO to industry. One of the key questions a community may ask whilst considering SLO is *'does what they say make sense or is it confusing or strange?'*, (as explained in Chapter 2 – questions at the legitimacy boundary). Confusion in recalling which meeting they attended may be an indicator of *'confusing and strange'*. Given the level of confusion regarding the MTR meetings, and the possibility that this creates a perception that the regulators are complicit with industry, this might suggest that the meetings are more likely to cause the local residents to withhold the SLO, perhaps a different method of communication with residents, such as a hotline, website information or hold meetings which do not resemble CLG meetings in terms of structure and style, might be more effective.

Whilst some residents are confusing the types of meetings, other residents are unaware that MTR meetings have taken place: *'It would've been nice five years ago if the EA and HSE or whoever got a genuine dialogue going, rather than having to be patronised by the industry speak, but that's gone I think, that opportunity has gone, we are where we are'* (16LR, 12/2016). This could indicate that the input from, and communication with regulators is valued, at least in theory, however as the residents are connected through groups such as Roseacre Awareness group (RAG), in the case of 16LR, and Frack Free Ryedale (FFR), this might suggest that the meetings (or information from meetings) are not considered valuable enough to share the information, at their own meetings or on social media for example. It may also indicate that as the regulators did not support their anti-fracking position, the information from meetings is not 'share-worthy'. The perception that the regulators did not engage also poses an issue for industry gaining a SLO as this adds weight to the notion that the industry will not be appropriately regulated.

One industry representative confirms that the industry does not attend MTR meetings *'we don't go to those meetings, because we don't want to give the impression that we were in cahoots with them. We would have loved to have turned up, but on the advice of the EA, OGA and HSE, BGS its best if we keep a low profile'* (11YI, 7/2017). It is possible that this is an indication that the regulatory agencies are aware that the residents view them as complicit with industry and therefore advised the industry not to attend MTR meetings. Cuadrilla declined an interview request to participate in the research for this thesis so it was not possible to determine if Cuadrilla has been advised similarly however there is no evidence to suggest that joint meetings with regulators and industry have taken place in Lancashire, for example published minutes or statements on Cuadrilla's web page. MTR meetings are not the only contact the residents have with agencies. Stakeholders also formed their perceptions based on experiences at West Newton, Preese Hall and during the consultation process at Preston New Road, Roseacre Wood and Kirby Misperton.

The results of this research support the idea that both proponents and opponents of SGD expect the regulators to be in support of their views. Many residents have described the agencies, the

EA in particular, as *'arms of the government'* and *'puppets'* (16LR, 12/2016), *'under duress from government and industry'*, *'under instruction'* and *'scared of their own shadows'* (21YR, 1/2017) suggesting that they believe that the regulatory agencies are afraid to act against the government and industry. Similarly, proponents of SGD expect the agencies to placate the local community and assure them that the process is safe.

One local MP, a proponent, described the intention of the meetings with industry regulators as an opportunity to educate a cross-section of the community. However, in reality the only people who show up are opponents and that the regulators *'being regulators, they don't tend to be unequivocal, they don't tend to say 'don't worry it'll be safe' they talk in scientific terms and it probably doesn't always come across as reassuring the public'* (01YM, 8/2017). The residents do however express faith in science and the regulators' use of scientific terms and further, contrary to the belief of some proponents, are perfectly capable of understanding the scientific discourse associated with SGD, for example at least one local resident interviewed (21Y) has a science related background. Watterson & Dinan (2016) also noted this in their study examining regulation and Health Impact Assessments (HIA) and further stated that the assumptions that non-industry stakeholders are *'all biased, ill-informed, or victims of scaremongering in their resistance'* (Watterson & Dinan, 2016, p20) is quite incorrect, indeed some of these stakeholders are scientists, lawyers and other professionals perfectly capable of understanding the scientific, technical and legal discourse.

In terms of SLO, this suggests that the state of the debate and progress towards gaining a SLO is very far from the psychological identity and trust required for gaining and maintaining SLO. Residents may suspect that those in authority, such as MPs, local authorities and regulators, do not think they have the capacity to understand the scientific discourse and may therefore feel that they are not respected or valued and feel like a nuisance, indeed some have articulated that they feel they are treated like terrorists or *'drum banging, pot smoking hippies'* (16YR, 12/2016).

Another MP explained how she believes the *'protesters'* view the agencies

'I think with the regulators its really unfair they try their very best but these are civil servants, they're not decision makers - they're certainly not responsible for the industry but they get protesters coming in and shouting at them and no matter how much they say 'we're not the industry', it's all fracking to them' (02NM, 10/2017).

The fact that neither proponents or opponents of SGD perceive the regulatory agencies as on their side indicates that the agencies are effective in being bipartisan and not promoting one view over the other. Whilst objectivity of the agencies is desirable in the regulatory process, the perception of their position on SGD is the important factor when considering the SLO. It is important to highlight however that the regulatory agencies do not make decisions about SGD or make the regulations. Regulatory agencies have a suite of applicable regulations to enforce and furthermore they do not choose which regulations to uphold and which to ignore. Not everyone agrees with this conclusion, Smythe (2020) claims that the regulators overlook inadequacies in industry's geological understanding and 'mendacious geological interpretations' by SGD companies (p43).

Other stakeholders have conceded that the agencies are at least trying and in a difficult environment; *'I think the Environment Agency is really trying quite hard at the moment ...and doing it in a, probably a very sensible way, I mean I've been to town hall meetings that have descended into complete and utter chaos'* (23NJ, 1/2017), however this is a minority position expressed by a journalist, who is possibly looking at the situation a little more neutrally.

This evidence illustrates how the agencies are in a difficult position, with high and conflicting expectations from different stakeholders. The evidence also suggests that – regardless of whether we might expect them to – the agencies are not placating either side of the debate. The issue therefore is that perceptions of the regulators has an impact on both the industry's prospects of gaining, and the community's willingness to grant, a SLO. This is a difficult situation to manage, and is possibly something the industry is also aware of and the agencies may therefore be under pressure to convey a pro-SGD message to the other stakeholders. Similarly, the agencies are under pressure to protect the public and the environment. This situation of being 'caught in the middle' could make agencies rather shy of communicating issues that they are ideally placed to highlight, for example gaps in the regulations or potential environmental damage from, for example a choice by industry in a certain technology. Additionally, agencies such as the EA have experienced funding cuts due to austerity measures, this is highly likely to impact their capacity to regulate effectively (BBC, 2014b). However, it is difficult to predict, if the agencies were more vocal regarding potential issues, if this would have a negative or positive impact of the issuance of a SLO. Indeed, as highlighted in sections 5.2.1

and 5.2.3, where agencies have found solutions to regulatory issues on behalf of operators, residents view them negatively.

The agency perspective of MTR meetings is that face-to-face meetings are preferable for the residents. However, the one interview from the regulatory agency also points out that there is a cost involved:

'My impression is that they go reasonably well and the people are grateful that we have made the effort, also having real people available is better than faceless people the end of the telephone. My personal opinion is that it's a good thing to do, we should do as much as we can, but don't forget there is a cost involved: 'tax dollars' as the Americans would say, a cost factor to the tax payer. This is different for the OGA for example, there are far fewer people, the practicality of having one of them go to one of the meet the regulator meetings is difficult, they are spread too thinly.' (09NA, 7/2017, notes).

Given that residents do not always differentiate between CLG and MTR meetings, and considering the cost involved, perhaps single fully represented meetings would be preferable to the disjointed separate meeting. The main concern would be, as expressed by the journalist (23NJ), that meetings descend into chaos.

The industry perspective is interestingly mixed and framed in terms of experience, demonstrating more faith in the HSE than in the EA *'I think all the regulators are good at their jobs, some have more experience than others, like the HSE. The EA are still learning but they are all trying to do their very best, they know that they are under scrutiny as well and we feel that scrutiny.'* (11YI, 7/2017). This may be because the company have had more favourable dealings with the HSE, associated with conventional operations and during the application process, or because the HSE have less diverse responsibilities than the EA. The HSE's responsibility is limited to the site, for example well design and operational procedures. The EA's responsibilities are more dispersed (air quality, water quality etc.), diverse and the impacts less well understood. Further, many of the risks of SGD articulated by residents are expressed in terms of factors regulated by the EA rather than the HSE, for example water contamination.

The statement *'we feel that scrutiny'*, expressed by the industry representative about the regulatory agencies, suggests that the EA are indeed being cautious, thorough and scrutinising

SGD applications effectively. Residents have less contact with the HSE compared with the EA, perhaps explaining why more of the negative comments regarding agencies are directed at the EA, yet have more faith (or less complaints) about the HSE. This position of stakeholders is perhaps unjust as the cause of issues relating to SGD are more likely to be to do with factors connected to aspects of the operation regulated by the HSE, for example well integrity, operational process and worker safety while the effects of these (potential) failures are more likely to have an impact on aspects regulated by the EA. In other words, taking well integrity as an example, if the well integrity is compromised (HSE responsibility) the consequences are groundwater contamination and fugitive methane (EA responsibility). This set of circumstances illustrates how the perceptions of the regulatory agencies are not necessarily just or accurate and further that this adds complications when considering these factors with the SLO.

Further evidence that a similar perception of the agencies is held by opponents and proponents is illustrated by this pro-SGD resident: *'I think they get a bit confused sometimes about who's overseeing what, and what their role is and they need to know their roles and stick to their bit, and then everyone knows what they're doing and they need to coordinate actually'* (13YR, 8/2017). This statement is remarkably similar to this comment made by an anti-SGD resident from the, also from Yorkshire:

'When they've been brought together as a group on a platform, and the serious questions start to be asked, they look at each other because they don't know who's doing what. Yes, I think they're pretty near to hopeless, I really think this is a travesty of effective regulation' (21YR, 1/2017).

This indicates that the residents, whether they are pro SGD or anti SGD, believe that the agencies are disjointed, unaware of their role and not communicating with one another. This may mean that some aspects of their roles maybe overlapping or that there are gaps in the regulatory responsibilities. The EA responded to this issue in a written response to the question 'do you think there is a good flow of information between your agency and other regulatory agencies?'.

'We have a working together agreement with the Health and Safety Executive committing to a joined up approach, appropriate monitoring and joint inspection of operations. We already work with the HSE to regulate conventional oil and gas sites and more complex regimes such as COMAH (Control Of Major Accident Hazards) and we are confident we will continue to work well together into the future..... We have built on these existing networks and will continue to work closely with our regulatory partners to ensure the emerging shale gas industry can be regulated effectively to protect people

and the environment. (09NA, 7/2017).

The EA and HSE also jointly published 'Working together to regulate unconventional oil and gas developments' in 2012 and reviewed every year (WTA, 2018). This document highlights coordinated regulation between the HSE and EA, each agency's roles and responsibilities, along with a statement about collaborative working which states that they have worked together over the past sixteen years in the 'mutual delivery of major packages of regulation in England and Wales' (WTA, 2018, p1).

5.2.2 Regulatory Regime

When asked about the regulatory regime participants talked about local governance and about trust in the political system as much as they spoke about the regime in terms of regulatory processes (gaining PEDL licences, obtaining environmental permits etc) and legal processes. This next section will examine the stakeholders' perceptions of the regime, including local and national governance and policy decisions. It begins with a discussion regarding planning meetings, one of the first steps in the regulatory process by which an operator must gain planning permission to explore within the PEDL area for shale gas. This is an important aspect in terms of SLO because how the local authority deals with planning permissions, i.e. whether they are granted or denied, seems to have an impact on the perception of legitimacy of the regulatory process.

As will be discussed, in Lancashire where planning consent was denied, the residents have faith in the local authorities. Conversely, in North Yorkshire where planning consent was granted at Kirby Misperton, there is very little faith from residents in the local authority and the planning aspect of the regulatory regime. Consequently, this indicates that stakeholders have faith in the aspects of the regulatory processes that work for them; similar to the perceptions of the agencies themselves. However, as illustrated by this Yorkshire resident, local government have a 'dual mandate' and is responsible for the local economy and economic development, as well as representing residents.

'The local authorities have to take some responsibility here, because they are charged first of all with planning permissions and they have to cooperate with the agencies, but they are also the democratic representatives of us, of the people who live in the area. So

they have a dual [responsibility] a political democratic mandate, and then they have these planning responsibilities (21YR, 1/2017).'

The dual political democratic mandate of the local authorities is also a point raised by others, in this research, in the literature (for example Cotton et al., 2014) and in the wider press. Local Authorities will receive a monetary incentive if they allow SDG in their regions; the Conservative government promised 100% of the business rates for SGD will stay with the Local Authority. As some Local Authorities have had their budgets reduced considerably over the last decade, this revenue may prove irresistible as means to replace some of the lost income. Furthermore, this is likely to erode any trust local communities may have had in their Local Authority to make the right decision on their behalf.

Once again resident perceptions of the regulatory regime are informed by experiences of planning permissions, local regulatory enforcements, such as traffic, and other local issues. Additionally, from experiences with conventional gas wells owned and operated by Rathlin Energy in East Yorkshire. These include the belief that the local councillors are incompetent, do not understand the process or are pushing a political agenda.

This resident is describing what she sees as ignorance and incompetence at the local governance level (see also section 5.2.4), she feels that the councillors at the planning meeting were unaware of the activities of Rathlin Energy. The local residents do not believe that Rathlin only intend to continue conventional gas extraction activities, rather that they plan unconventional SGD, this resident explains how she achieved a 'no fracking clause' in a planning meeting for West Newton B as she believes that the local council do not know the difference.

Whilst Rathlin Energy have not declared an intention to frack for shale gas at West Newton B, this resident was clearly dubious of the claim and seized the opportunity to have a 'no fracking clause' in the planning permission, just in case. This meeting was described in great detail by 19YR as she was presenting on behalf of local residents. She describes the situation as a joke as she believes that the local councillors did not understand the process well enough to object to her request for a no fracking clause, resulting in her description '*some of the Tories nearly exploded*' and further highlights '*they all said they had a phone call from the company the night before*'. She does not explain why the Conservative representatives had a phone call the night

before, however the implication is collusion between industry and local government. This indicates a lack of trust, not only in the company, but also with the local planning authority and councillors and their ability to carry out their duties. The reciting of this story illustrates not only the lack of trust in the regulatory process but also the lack of credibility in local governance. This is likely to impact SLO, as credibility is a key component of gaining acceptance for industry. Credibility is not only about the company itself but also of the regulatory processes governing it. This story also illustrates that – whether or not Rathlin Energy is taken at its word that it has no intention of fracking for shale gas – the credibility, trust and legitimacy of industries similar to SGD (i.e. conventional gas) may influence whether a SGD company gains a SLO.

Another Yorkshire resident expressed further distrust of local government councillors, this example is regarding the accountability of money transfers. This statement further demonstrates mistrust and suggests that he believes the local council guilty of corruption, the perceived lack of transparency in the process is a cause for concern and, other than going through the lengthy FOI process, she believes there is no way of knowing.:

‘there are no machinery [mechanisms] in place at East Riding Council, ... but then when you’ve got, I’m sorry I don’t mean to be partisan, but when you got a Tory council carrying out a national Tory policy ... it should be open and it should be accountable. How can you do that without checking through Freedom of Information, I mean we could well suspect that Rathlin have paid East Riding Council a backhanders somehow, ... but it’s there in the regulation that it should go to the community’ (18YR, 2/2017).

The incident cited as an example is when Rathlin provided the local parish with a BBQ. This was interpreted as bribery, insufficient compensation for the industry’s activities and further at the local parish council level, no paper trail could be found for this gift. In terms of SLO, the mistrust and the belief that local government is corrupt, poses perhaps one of the biggest barriers to gaining a licence. Perhaps even an insurmountable one. Others also expressed concerns of corruption in local governance. However, there is a key difference between the impact of the lack of trust in local parish and local government representatives and the lack of trust in agencies as constituents can vote individuals and parties, in local government, out. As discussed in section 5.4.2, there have indeed been opportunities to do this at local and general elections which have taken place since the interviews were conducted, however this has not yet happened.

The sense that the SGD industry and government representatives are working together is not just at the local level; there is a perception that there is a 'revolving door' between government ministers and industry at the national level. The 'revolving door' is a term used to describe movement of influential people between government positions and industry positions where they can carry out lobbying activities to influence policy (as elaborated in section 2.3.4).

This movement of influential people between industry and government is also cited in the academic literature in the context of SGD (De Rijke, 2013), and in the wider context of oil and gas development (Bradshaw, 2015; Neill & Morris, 2012). The Washington Post claimed in 2010 that three out of four oil and gas lobbyists has worked for the federal government (Eggen & Kindy, 2010) in the USA. An insightful study by Adamidis et al. (2019) is investigating UK firms' actions to influence policy as a means to obtain or maintain an economic advantage through political and social leverage, this study's initial findings include: 'during the period of 2010-2015, gas firms used lobbying firms more frequently than wind and nuclear segments combined' (Adamidis et al., 2019, p8) and similarly that gas firms 'met most times with ministers to discuss energy policy,' almost twice as many times as Wind firms (Adamidis et al., 2019, p9).

Many participants in this study referenced the relationship between Lord Browne, the Government and the oil and gas industry to illustrate this issue. Lord Browne is a former chief executive of BP, past president of the Royal Academy of Engineering and was also a partner of Riverstone, a co-owner of Cuadrilla Resources. He is currently a crossbench member of the House of Lords. One resident explains:

'Well the industry has the whip hand because it's been given the whip hand by government. But then the industry was taken into government with Lord Browne from...he's involved with Cuadrilla and all sorts of things, BP beforehand. He's then taken in as a government advisor, and there he is making policy and then he nips out to be chief executive of this then he moves on... the regulatory regime has no chance against the sort of collusion between industry and government' (21YR, 1/2017).

The perception of a revolving door between government and industry, and even a suggestion that motives of government ministers are personally financial, feeds into the mistrust of the regulatory system as a whole and suggests that the people in authority are not recognising or respecting the local community, a key question a community will ask when considering granting the SLO. Furthermore, responses to the question 'does what they say make sense or is it

confusing and strange?’ (See section 5.3.1 and Chapter 2) may be linked to the granting of an SLO, as the question relates to trust and credibility. Other evidence from interviewed local residents to support the revolving door perception includes:

‘I think we’re dealing with a very dangerous situation where we have a government which has clearly entered in to commitments based on its ‘dash for gas’, it clearly has high level arrangements with the industry to do as much as they can to facilitate the industry success in this country’ (19YR, 3/2017).

Both of these research participants believe that not only is there a close relationship between government ministers and industry, but that the government have already concluded that the country will proceed with SGD regardless of any opposition from local communities. This perception is likely to create considerable opposition, and indeed has, in terms of both the industry and the perceived lack of democracy. In other words, they feel that they are not being listened to.

Another concern raised regarding democracy and representativeness illustrates the fact that in Yorkshire the decision is made at the county council level rather than the district council level, which means that potentially the decisions are made by representatives who are not elected by the local community and therefore there is no political consequence for the county councillors if they make unpopular decisions. The county council in Yorkshire is based in Northallerton, some distance from Kirby Misperton for example. This Yorkshire resident, a former councillor himself articulates:

‘one of the interesting issues on planning is that once the planning committee has made a decision, unlike all other subcommittees of the council, that decision is not open for challenge at the full council meeting. So a group of councillors can make a decision without the full council agreeing with it. That was relevant in North Yorkshire where there wasn’t a single councillor from the area affected by the decision on the committee that made the decision. North Yorkshire is unusual because it’s a huge old-fashioned county, based in Northallerton. So ... there’s a lot of people who have got no knowledge of the area, politically they don’t need to worry about the area.’ (19YR, 3/2017).

He then continues and compares the Yorkshire situation with Lancashire, where the administrative centre for Lancashire County Council is Preston (more central and closer to the SGD sites than North Yorkshire County Council in Northallerton is to Kirby Misperton) and the County Council refused planning permission to Cuadrilla at Preston New Road and Roseacre Wood: *‘but then to have the Lancashire process where it goes to appeal, all the processes exhausted and the answer is still no, and then a minister overrules it, so in terms of justice [it is not just]’ (19YR, 3/2017).* This suggests a frustration with the planning consent aspect of the

regulatory regime, that even when the processes are observed, and the local planning authority deny planning permission that the secretary of state can overrule the decision. The frustration for local residents then remains, why go through local planning consent procedures when the decision is ultimately made in Westminster.

This view is supported by one of the Yorkshire MPs interviewed who claims:

'Well if you look at what happened in North Yorkshire, over 99% of the populace did not want to see any fracking within their community, they made that absolutely clear to North Yorkshire Council who did not follow through what the local will of the people was. So they were completely ignored, when you had such a strong opposition to fracking there, and I believe that they are taking every effort to work against the local community' (03YM, 9/2017).

There were further beliefs that the Government were planning to include SGD in the Nationally Significant Infrastructure Project (NSIP) regime, thus taking the decision to permit SGD activities away from local authorities. A Government consultation, between July 2018 and concluded November 2019, did indeed consider inclusion of SGD projects in the NSIP regime, however as a result of the recent moratorium the consultation 'identified a lack of support for the inclusion of shale gas production ... There was no consensus on what including shale gas production in the NSIP regime would look like in practice, or under what circumstances it would be appropriate ... on the basis of the current scientific evidence, and in the absence of compelling new evidence, it has taken a presumption against issuing any further hydraulic fracturing consents' (BEIS, 2019b). This may change if the current moratorium is lifted, as the current Government is a majority.

The sentiments expressed above are echoed in Lancashire, a resident from Roseacre explains how she and the local community went 'through the whole of the regulatory process and planning process' and raised a range of issues including traffic *'we followed a process and it's cost us much in time, effort, money, whatever because we have faith in the process and it's just being completely overridden.'* (15LR, 12/2016) and further concludes:

'they're not listening ... that destroys all faith that I have in democracy. The government railroad this for their own reasons and they don't care what the local authority says - [they] don't care what the local residents say, you don't tell me you're giving us a voice, the ordinary people, because you're not, you were going to railroad this for your own reasons whether we like it or not and that's why I am angry; for our loss of democracy, we have no voice' (15LR, 12/2016).

This statement clearly shows the frustration felt by this, and other residents regarding the secretary of state overruling of the decision at Preston New Road. This resident however is mainly concerned with Roseacre Wood, yet feels that the decision is likely to go the same way as Preston New Road and therefore perhaps expressing frustration in anticipation of that outcome. Although, it is important to point out that the Government did uphold the decision by Lancashire County Council and the Roseacre development did not go ahead (Williams et al., 2020). This suggests that the story of Preston New Road and the overruling of the decision made by Lancashire County Council undermines the credibility of independent processes such as this, as this neutral (neither pro or anti) research participant states *'why should you go through the whole process if in the end the government knows the answer and wants a particular answer and is going to make sure that that happens'* (08NP, 7/2017). This point of view is further articulated by this NGO participant:

'at the mineral planning level, certainly at local plans they take into consideration the responses of the local people, but at government level, at least in theory, but then the Lancashire county council said no but the secretary of state said yes. Again, people don't have much confidence in democracy now because it's been overturned at most occasions' (05LN, 3/2017).

Arguments supporting the decision for SGD at the local level extend beyond the issues relating to democracy and representativeness alone to the management of the local economy and the balancing of the requirements of new and potential industries with existing industries. A Yorkshire resident points out that in East Riding Council the councillor in charge of economic development is also in charge of planning:

'What's interesting is the way that East Riding Council have changed, one of the efficiencies of East Riding Council is that the director responsible for planning is also responsible for economic development, so on the one hand he is meant to be making sure that industry well-regulated and that the environment is protected. The same director has got a whole lot of publicity that you can pick up in tourist information about the nature triangle, the wonderful environment etcetera etcetera. 'come to East Riding because of the wonderful environment'' (19YR, 3/2017)

Essentially these issues are about *where* the decision to develop shale gas should be made, locally or on a national basis. Interestingly other, non-resident, stakeholders agree that the

decisions should be made locally, at least for the initial exploration process. This industry professional expresses this view:

'I think for exploration I believe it's really down to the local decision-making process, but when it comes to production, if you're talking about multiple pads, you're talking about the infrastructure in support of that ...we always say we need local involvement, local community groups need to be involved, community liaison - all this kind of stuff is core, and decision making at exploration is probably best at local level. But at some point, you have to make that step change otherwise I think that you just get stuck in the local issues.' (10NI, 6/2017).

The 'local issues' point is also raised by a Yorkshire NGO representative interviewed who identifies that *'It's a difficult one because if you put a huge amount of weight on local people's opinions then you would never be able to build or do anything next to where there is wealthy enclaves - which means that less organised communities can become more and more disturbed and lose all of their wildlife'* (04YN, 1/2017). This point is particularly poignant as in both the Yorkshire and Lancashire cases, the proposed SGDs are in areas that are wealthy and have a high percentage of retirees in the population and therefore financially capable of legal representation and potentially have more time to spend on resisting developments. Additionally, both areas are rural, not used to industrial activity and therefore the contrast of SGD activities, compared with traditional activities (farming, tourism etc.) is more stark. The question then is about the fair-mindedness of moving activities to less wealthy areas and those more used to industrialisation. Assuming that SGD is accessible in these areas. Another study, assessing public perceptions of fracking using focus groups, commented that a group of ex-miners were initially optimistic about the prospect of fracking, posing questions about feasibility, timelines for development and employment opportunities (Williams et al., 2015). This may support the argument that stakeholders more used to industrial developments on their doorsteps are less resistant to proposed SGD, especially if there are employment opportunities. The authors note that the ex-miners' enthusiasm waned somewhat once their questions were answered (Williams et al., 2015).

Another slightly different aspect to the regulatory regime that may have a significant impact on SLO is the news in 2017 regarding the high court injunction taken out by Ineos against any future protests at their sites (High Court Claim No: HC-2017-002125). This is seen by many as an obstruction of the right to a peaceful protest. This MP, while speaking about the injunction said, 'I certainly do not believe we have equality in the law to enable people to stand up for their

environment, environmental protections are currently weak and will get weaker in the future as well as we withdraw from Europe, I have no doubt' (03YM, 9/2017). Whilst this injunction is not part of the regulatory regime governing the SGD process, by using the high court in this manner, Ineos has made this a part of the regulatory landscape for SGD.

5.2.3 Moving the regulatory goalposts

The perception of resident and NGO stakeholders regarding the evolving regulations, particularly with regard to the UK Infrastructure Act (2015), is that the government is attempting to reduce the levels of regulation or make the process easier for SGD companies. One example is the change in the definition of High-Volume Hydraulic Fracturing (HVHF) by the UK government. The new defining threshold for HVHF is such that any well using less than 10,000 m³ (or 1,000 m³ per frac stage) is not considered fracking, regardless of the technology used. If this definition had applied in the US, 43% of the HVHF wells would not have been defined as fracking (Smythe & Haszeldine, 2017), and therefore subject to fewer regulations, permits and environmental permissions. As this Lancashire resident illustrates:

'the government have basically done everything it can to make it easy for fracking in every possible public consultation its gone against the public opinion and made it easier for fracking to continue. To the extent of changing the definition of fracking so most of what is being proposed won't be defined as fracking and in fact, most of what's happened in America wouldn't be defined [as fracking] by the new definition of fracking' (05LN, 3/2017).

Residents view this change in definition as 'moving the goalpost' in order to provide an opportunity for SGD companies to declare lower water use and continue without required consents. As stated by this NGO representative *'it is very difficult for local people to see how they can stop something they think is really bad when the goal posts are moved and made it really difficult.'* (04YN, 1/2017). A Yorkshire resident expresses how we need *'genuinely comprehensive [regulations] and without get-out clauses, like the famous one now - if they use less than 10,000 m³ then its not a frack'* (19YR, 3/2017). Furthermore, to add to this confusion, one Yorkshire resident claims the local council (East Rydale Council) stated *'that there are different definitions of what a hydraulic frack is, and because they weren't injecting sand, it wasn't a hydraulic frack.'*

(20YR, 3/2017). Both East Rydale Council and North Yorkshire County Council declined to be interviewed, it is therefore not possible to confirm their perception of the definition of HVHF. However, it was reported that in the North Yorkshire County Council's draft plan to the planning inspector a further definition was used which states 'hydraulic fracturing includes the fracturing of rock under high pressure regardless of the volume of fracture fluid used' (Hayhurst, 2018a). Different definitions of the same process by different actors is likely to be seen as confusing or obfuscating, further impeding the likelihood of the issuance of a SLO.

The concern from residents and NGOs, as also expressed by Smythe & Haszeldine (2017), is that SGD using HVHF may 'creep under the radar' as some sites may be classed as conventional operations and therefore less regulation would be applicable. For example, a hydraulic fracturing plan may not be required, operations may go ahead under permitted development without the requirement of a public consultation or to go through the full planning system process at local council level. This in turn may negate necessity to consult statutory consultees such as the EA, HSE (at the planning stage) and NGOs prior to exploration. This has become a particular concern since the moratorium was issued in November 2019; many suspect that operations may continue under a different definition of operations.

Similarly, the residents' perception of operators claiming the size of the operation as being 'just under' 1 hectare, in order to avoid Environmental Impact assessment (EIA) regulations. Under the EIA Regulations, a development is deemed an EIA development when it meets Schedule 2 criteria; an EIA is required if the area of works exceed 1 hectare. This resident believes that operators are claiming their site is smaller in order to avoid regulation:

'you know what the rule is, if its less than [1 ha]we had the high court hearing and that showed it to be much bigger than a hectare..... we [also] measured the site and found it to be bigger than a hectare. No there wasn't an EIA, but [also] the basic biodiversity assessment was inadequate' (19YR, 3/2017).

He further believes that he and the high court 'caught out' the operator in this case and therefore does not trust the industry to make accurate declarations in relation to size of works in the future. Trust is a major component for a company to gain SLO, if the residents and other stakeholders believe the industry is misleading regulators to avoid conducting an EIA for environmental protection, they are unlikely to grant the industry a SLO.

Participants also raised this ‘sidestepping of the regulations’ in a study conducted by Cotton et al. (2014) and one participant described this practice as ‘Incredibly unwise because I think it made the industry look like they had something to hide’ (Cotton et al., 2014, pg1). Avoiding aspects of the regulation, such as declaring the site to be 0.99ha to avoid conducting an EIA, does not bode well for gaining a SLO; gaining an SLO is not just about adhering to the regulations, it is about going further to gain trust. In the example given above, the resident participant also claims to have measured the site himself and discovered it to be over one hectare. It is unclear how this participant measured the site, however it is possible to either measure using technology, for example Google Earth or by drone, or to measure on the ground with a measuring wheel. Whichever method they used, it is a fairly simple fact to check for local residents, and therefore could be described as rather foolish of the operator to attempt to declare the site as smaller than it is in order to avoid completing an EIA; especially when the cost is likely to be further erosion of trust and therefore making it less likely to gain the SLO.

These two issues – fracturing fluid volumes and works area – demonstrate the importance of having clearly defined terms in relation to SGD. With regards to the fluid volumes and definition of fracking, it would be wise to define the process in relation to the technology and not based on one single aspect of the operation, and further one which varies from site to site because of geology, not environmental impact. In terms of works size, in relation to environmental impact, the size of an operation is not, or should not be, the indicator of potential environmental harm, rather likely impacts of the activities, regardless of size. In other words, impacts will be determined by the EIA and therefore operations should not be exempt by virtue of size or volume. These issues also make the regulatory process seem less than transparent and further, limit accountability, this is discussed in more depth in section 6.3.

The issues discussed above were brought to the attention of ministers at the APPG meetings, by resident representatives attending the meeting. Andrea Leadsom (then Energy Minister) responded by stating:

‘That absolutely would not be in anyone’s interest to play games like that. That would be an appalling thing to do. I would absolutely not permit that sort of game-playing to happen. There will be a very clear definition it won’t be the case that you can simply flout the rules by having a litre or two less water, that will not be the case I can assure you of that’

However, this is precisely what happened according to resident participants, as discussed above. The assurances of a government minister are unlikely to satisfy stakeholders, especially if they are shown to have been misleading. There must also be trust in the government and ‘law makers’ in order for a SLO to be granted. The next section (5.4) examines the perceptions of the political aspects of SGD governance.

In summary, most residents had access to regulatory agencies at MTR meetings and, although these meetings are a good idea, many residents confused these with CLG meetings or were unaware that they existed, indicating that perhaps some clarity was missing in these meetings. Both proponents and opponents of SGD expect the agencies to be supportive of their viewpoint and none of the research participants interviewed for this study viewed the regulatory agencies as ‘on their side’ which indicates that the agencies are succeeding in impartiality. In terms of granting a SLO, if residents view the agencies as complicit with industry, this may cause further barriers to the operator gaining the SLO as agencies must also be trusted, credible and considered legitimate by residents. With regards to the regulatory regime, stakeholders frame their perceptions using examples of issues with the planning regime; as a result of the differing council responses between Yorkshire and Lancashire, Yorkshire residents expressed dissatisfaction and mistrust of the local planning authority, Lancashire residents did not. The responsibilities and capabilities of local councillors is also questioned by the Yorkshire residents interviewed as they believe they are not trustworthy and even some implication that they are corrupt. Residents in both areas also believe there is collusion between industry and government actors with a ‘revolving door’ of jobs between government ministers and industry professionals for the purpose of carrying out lobbying activities to influence policy. Further claims of moving the regulatory goalposts by, for example, changing definitions of fracking in order to allow development, were also expressed. Ultimately these perceptions damage the sense of having core democratic rights, such as representativeness and accountability and leave residents who live close to SGD sites feeling disenfranchised. Disenfranchised residents are unlikely to issue a SLO to extractive industries.

5.3 Trust in government

Discourse and perceptions of SGD in England are not only about the technology and regulations. Discussions include perceptions and opinions relating to democracy; 'in popular political imaginary, unconventional fuel extraction has become strongly intertwined with the crisis of liberal representative democracy' (Szolucha, 2016, p77). This may be in part because anti-fracking groups identify with, and align themselves closely with, the mobilisation of pro-democratic movements such as Occupy and Indignados. This provides the context for how residents perceive and trust (or not) the government. In this study, 100% of residents against SGD were involved at some level with an anti-fracking organisation and actively engaged in campaigning and the planning process.

5.3.1 Central government verses localism

This research identifies several themes connecting SLO and perceptions of national government, the themes identified may be one of the most important aspects concerning a local community's willingness to grant a SLO. This is an important factor, especially in the early stages of exploration, as this is when stakeholders have the opportunity to object during the planning stage. Indeed, residents expressed dissatisfaction regarding local and national political representatives and institutions; this was expressed in terms of mistrust, loss of faith in 'the system' and as likely to change the way the individual research participant votes. This section will examine the main themes regarding politicians, local and national, beginning with actual experiences of individuals at events such as APPG meetings.

In 2013 Lord Howell, a former Conservative Secretary of State for Energy, famously commented during questions in the House of Lords that fracking should take place in the 'desolate North East' (HL Debate, 30th July 2013). These comments were widely reported and perhaps set the scene for stakeholders' perceptions of how the Government viewed fracking, and indeed the North of England. Many participants in this research have experience of, and have represented their areas, in meetings such as the APPG on unconventional oil and gas. Many reported that they felt the politicians were dismissive of their views, condescending and left them feeling that government 'had an agenda' and are determined to proceed regardless of the views of local residents and other stakeholders. One resident who took part in the research for this thesis and attended the APPG meetings made several references to the attitude of politicians throughout

the interview, the first one is regarding the Advertising Standards Agency (ASA) ruling against Cuadrilla's 2013 brochure regarding the safety of Hydraulic Fracturing:

'Nigel Lawson just dismissed the ASA thing as no more than just a bit of sales patter, that's all that is its just sales patter!' (16LR, 12/2016).

'They were elevated, maybe 15 of them, you know and we were sitting down here [indicating low down], and to say patronising isn't strong enough, some of them were quite reasonable, some asked reasonable questions and in a reasonable manner, but some of them were patronising [and] sneering' (16LR, 12/2016)

'One of their lordships, when he could be bothered to open his eyes, said to us very coldly, 'what would it take to get you to shut up and go away?' Well almost, he phrased it slightly differently but that was the essence of it - it was that crude – what do we need to do to make you shut up and go away' (16LR, 12/2016)

'I think that attitude that [this] is going to happen – 'look you just [keep] getting in the way - you're just being a nuisance''. (16LR, 12/2016)

This experience of the APPG meeting and the subsequent perception that the politicians were 'patronising and sneering', and further, almost irritated by the presence of the local residents and with the nature of their objections, suggests that residents feel disconnected with the decision-making process. If they are made to feel like an irritant, they are unlikely to feel respected. The feeling of being recognised and respected by those in authority is a key factor in relation to the SLO. As expressed by Boutilier & Thomson (2011), this means a project (or policy) is unlikely to be granted a SLO and further, that resources are likely to be withheld or restricted.

Another Lancashire resident expressed similar concerns regarding written correspondence in relation to objections:

'We'll just [keep] pushing in whatever way we can, but they're not going to listen to our little community.... in fact, they have said as much, I mean Andrea Leadsom, in their letters, I get so angry when I read their letters you know basically these people, [we] don't count that's what they're saying, the bottom line is 'we know better'. It really gets you angry' (15LR, 12/2016)

Similar expressions of frustrations were expressed in Yorkshire. One resident, although unable to attend the APPG meetings, has read the transcripts of the meetings and expresses concern that even the pro-fracking MPs did not receive satisfactory answers to their questions:

'Hollinrake and the guy [Mark Menzies] ... these guys where asking the industry representatives 'what exactly does this mean, when, how much?' They came to the end of that without any satisfactory answers, they were batted away. And they then went on to talk about how many wells? How extensive? What's the landscape going to be?

and it ended up with Hollinrake and Menzies getting quite irate, as I hear it, as you read it in the transcript, and Menzies actually said to them 'unless you start coming clean about this, you're stuffed, you're stuffed, it won't happen' ...Even people like Hollinrake who've sold out, trying to ask the industry serious questions and being told 'go away sonny - we'll sort that out'. It's characteristic I think of the sort of governments we've had, that we have at the moment, very condescending and abusive and anti-democratic' (21YR, 1/2017).

The implication is, if Conservative MPs are being 'batted away' then there is little hope that other stakeholders, such as residents or opposition party MPs, will have their questions answered satisfactorily. This leads to a sense that politicians who are in favour of SGD are obfuscating issues and hiding things they do not want the residents to know, such as scale and aesthetics. Others further expressed that they felt belittled by government ministers, another comment made by this Yorkshire resident, regarding the same APPG meeting as referred to by the Lancashire resident above, corroborates the feelings of the attendees:

'One of my colleagues in the group heard Angela Leadsom say at the APPG at Westminster, 'I've got to go to Prime Minister's Questions now, but I don't know why you're all sitting here, this is going to happen, you might as well go away' That was when they were asking fundamental questions of the industry, about how they were going to do this, how they were going to do that. (21YR, 1/2017)

The experiences expressed above, and the relaying of another's, whilst clearly in some sense leave residents feeling disengaged and belittled, it also empowers and unites them, this was also noted by Szolucha (2016). Many participants expressed, and as stated above by 15LR, that they will keep 'pushing' and continue to resist through regulatory means, such as planning objections, and even implied that other methods, perhaps illegal, will be used:

'I have this burning sense of injustice, we've done it absolutely the right way. The expense we've gone to, I don't know how we have managed it, it's been tens and tens and tens of thousands of pounds.... inexorably it's moving to something really really [pauses]- because the government and industry are intransigent, for all the wrong reasons, they are fixated on this, if we can't do it this way will have to do it another way I'm afraid' (16LR, 12/2016)

Whilst the Localism Act (2011) sought to devolve power and decisions to local governments, subsequent acts, such as the Infrastructure Act (2015) have, in effect, reversed that power and ability to make decisions at the local level for certain energy projects, including SGD. The final decision regarding developments reverts to the Secretary of State for Energy. As expressed by Cotton (2017) and Johnstone (2010), there is the rhetoric of localism however the system serves to reinforce a hierarchical top-down planning system (Cotton, 2017; Johnstone, 2010). This creates a feeling of loss of subsidiarity with local communities and further a sense of injustice, as expressed by 16LR, factors that are likely to create barriers to the SGD industry

gaining a SLO. Furthermore, there is an implication from residents that as they have tried to object 'the right way', i.e. legally, that they will resort to more drastic and perhaps illegal methods to prevent the industry developing. The fact that decisions have been removed from local government, and therefore away from local communities, coupled with the impression local participants have of ministers expressed above, this gives a sense of hopelessness and creates 'problems of participative and consent-related injustice' (Cotton, 2017, p14).

5.3.2 Political implications

Many local residents who participated in this research identified as traditional Tory voters. The Conservative party was the only pro-fracking party at the time of the interviews, however on 2nd November 2019 the Conservative party announced a moratorium on fracking, stating that 'until compelling new evidence is provided which addresses the concerns about the prediction and management of induced seismicity' the moratorium would be maintained (Prescott, 2019). It should be noted that this announcement was made shortly after the announcement of the general election; because SGD is viewed as unpopular some have suggested that this was a vote winning election ploy. Further observations include that 'new evidence' is a vague term and should be further defined and further that given the government have redefined fracking, as discussed in section 5.3.3 (and Chapter 2), opponents should remain vigilant. Indeed, a report by iNews, on 11th November 2019, claims that the Government 'quietly issued a document which contradicts that promise'. The article claims that civil servants have stated 'future applications will be considered on their own merits' and further that there was 'considerable merit' in loosening planning laws so local councils would no longer be able to block firms from drilling for shale gas (Gye, 2019). In June 2020, the Energy Minister Kwasi Kwarteng stated in an interview that the Government had 'moved on' from fracking and further stated 'We've always said we'd be evidence-backed so if there was a time when the science evidence changed our minds we would be open to that. But for now, fracking is over.' (Hayhurst, 2020, p1).

At the time of the interview conducted for the research reported in this thesis, despite identifying as traditional Tories, participants suggested that they felt strongly enough to consider voting for another party. The expressed change in voting intentions was evident in both Lancashire and Yorkshire, similar findings were also present in the Szolucha (2016) study on the Human Dimension of SGD in Lancashire. One example is the statement by this Lancashire resident: *'I was a Tory voter who suddenly got fracking on their doorstep, one of the first communities, how many more thousands of people are going to be like me out there, who feel*

the same, we don't want it at any cost' (15LR, 12/2016). In Szolucha's study, participants used words such as 'disabused', 'autocracy' and 'disorientated' in relation to the Conservatives and further, expressed a lack of trust in the party (Szolucha, 2016, pg 80). The results of the general election in 2016 however did not reflect these feelings in either Yorkshire or Lancashire; rather in both areas the Conservatives increased their majorities. Similarly, during the local elections in Lancashire of 2015, arguably at the height of the conflicts between local residents and Cuadrilla, and despite the fact that the Liberal Democrats and the Green party were running on anti-fracking platforms, the Conservatives increased their majority there too (Szolucha, 2016). Many constituencies in rural Yorkshire and Lancashire are considered safe Tory seats; perhaps these areas are so safe that politically the Conservative government does not need to be concerned about losing these seats. However, another resident predicted: *'Shale Gas Fracking, is going to be Teresa May's Poll tax, I can see some unpleasant confrontational situations ahead'* (16LR, 12/2016). Although, given the subsequent election results, this seems unlikely.

More general comments regarding the government were made by local residents in relation to trust and include:

'I've got this lack of faith in central government to act in our best interest, in fact I don't think they're acting in the national interest either, (16LR, 12/2016).

'So ultimately if you can't look to the politicians to do the right thing, then it's going to be down to grass roots movement' (16LR, 12/2016).

'contrast that with ours [UK regulations] which was 'can we paper over these cracks please in the next 3 months' ... 'you tell us what you think and then we'll tell you what you think' and we'll go ahead''. (21YR, 1/2017)

'Well it would be nice, if Hollinrake had bothered, but we all know how he's where he is. The council might have been on our side; however, they are cut from the same cloth as him, and therefore it's just left to the people on the ground.' (14YR, 12/2016)

Comments such as these suggest that whilst there may not be a protest at the ballot box, there is continued resistance at the grass roots level; it is also worth noting that since 2016 most political discourse nationwide has been in relation to Brexit and since early 2020 the Covid-19 pandemic. However, whilst it is difficult to see how much of an impact this will have politically, it is likely to have an impact on the SLO for the local SGD companies. This perhaps highlights the disconnection between whom stakeholders blame for the policy of SGD (central government) and who suffers the consequences (the SGD companies and the local residents).

Other concerns from residents relate to what will happen in the future post Brexit; this resident, in response to a question about what may happen to regulations if we leave the EU, clearly does not have much faith in the Government maintaining high regulatory standards:

'The EU thing is simple isn't it, they've said they're going to make sure that all the regulations are as good if not better ... and then they've also said that if they don't get a good deal they're going to turn Britain into an offshore Singapore style country that is a magnet for developers etc. well that's not consistent with a high regulation culture. So, there's a miss-match there, which is worrying (19YR, 3/2017)

Other studies have similarly identified a lack of trust in government, for example Bomberg (2017), Bradshaw & Waite (2017b), Beebeejaun (2016), Cotton et al. (2014), Cotton (2013; 2017) and Williams et al. (2015). These studies are discussed further in Chapter 2, however they highlight that attitudes towards SGD can be predicted by political affiliation and attitudes toward climate change, as discussed below in section 5.4.3, and further express doubts regarding the ability of government to effectively regulate the industry, their trustworthiness and conflicting discourses.

Many local residents and NGO's feel that the Government's position on SGD is inconsistent, not transparent and at odds with other policies and international commitments, such as climate change policies and emissions targets. Many likened it to other industries in terms of lobbying and as evidence that government agendas in the past have not always been in the best interest of people, rather in the best interest of corporations and economic development:

'Fracking which is going to be far more invasive on communities and people and [it's] also going to be far more damning on climate change. Why is it we don't have a choice on that? the reason we don't have a choice is that it's all about bloody money for the Government and of course the oil and gas industry lobbying and spinning and they've spent millions doing so, to make sure that that's what the Government want and it reminds me of the tobacco industry and of the asbestos and the chemicals. We are being driven by business and it's all about growing the economy and it's not about people's health and wellbeing it's not about what's good for normal people and it's not about quality of life, (15LR, 12/2016)

This comment from a local resident (15LR) sums up this section, trust in government, and highlights the perception that government motives are economic, the sense that local communities lack any influence and that the industry has powerful lobbyists at its disposal.

5.3.3 Policy conflict

The most often cited conflict by interviewees regarding policy is to do with climate change, fossil fuel dependence and emission reduction targets. This supports finding from other studies, such as Williams et al. (2015) in the UK context and Thomas et al. (2017c) in the US and Canada. Further criticism is regarding the short term thinking of the current Government, and governments in general, in relation to energy policies and the continued dependence on fossil fuels. In addition to these longer-term global concerns, concern and frustration was expressed regarding the short term and localised impacts of SGD, such as traffic congestion and longer-term potential impacts such as groundwater contamination (as discussed above in section 5.2).

Friends of the Earth, at the Lancashire appeal public enquiry, stated that the applications at Preston New Road contravened the National Planning Policy Framework (NPPF) and the Joint Lancashire Site Allocation and Development Management Policy in terms of sustainable development and emission reduction targets, and further that it failed to take into account impact on climate change. These sentiments were echoed at the public enquiry by residents, who stated that there are 'enough green energy solutions without having to go down this dirty road' (Sanderson, 2016) and that the: 'applications are in the wrong place and in the wrong century' (Mitchell, 2016). These feelings and beliefs are echoed in this research, put into context by this resident:

'the whole debate about climate change has developed rapidly over the last 5 years - I don't think there are any respectable arguments against anthropogenic climate change' (21YR, 1/2017)

In relation to the competing policies and renewable energy, this resident articulates:

'Well I just think it's atrocious that the people I was talking to 12 months ago about solar farms planning applications, it's no longer about jobs. Green energy companies have folded, and [continue to] daily, so there's nothing rational about this, so there's no cohesive, long-term thought through about this energy program or any energy security program for the country' (16LR, 12/2016).

Whilst the Government argues that we are transitioning to the use of renewable energy using shale gas as a 'bridging fuel' to reduce CO₂ emissions, others argue that shale gas is undermining commitments made to climate change targets and CO₂ reduction targets. The Climate Change Act (2008) charges the Secretary of State with ensuring a 80% reduction by 2050 over the 1990 baseline figures for net carbon, which as Cotton (2017) points out is likely to be the motivating factor behind the Government's SGD policy as these targets are legally binding and will incur fines if not upheld. Furthermore, renewable energy alternatives for electricity generation do not readily fit with energy markets and investments designed for energy based on fossil fuels (Cotton, 2017).

Participants in this study highlight the displacement of renewable energy technologies in terms of investments and incentives. Indeed, incentives designed to encourage investment in renewable energy have been reduced significantly, for example the Feed in Tariff (FiT) for renewable electricity, arguably making the investments less attractive. As further highlighted by 16LR above, there is also the opportunity cost of jobs in the renewable energy sector to consider, arguably these would be greater in number, more sustainable and could be fulfilled by local people than the jobs created by the SGD industry. A further comparison is made with the nuclear industry, claiming that the subsidies for nuclear and SGD are promoting less clean sources of energy whilst hindering the development of renewable energy:

'How you can promote nuclear and subsidise Hinckley to the degree that they're proposing to subsidise it and the shale gas industry, whilst you're pulling the plug on the safe, clean, viable, job creating, climate saving renewable sector. It's completely unreasonable' (16LR, 12/2016).

In 2014 a group of NGOs, including the Wildlife Trusts and the RSPB, published policy recommendations in a document entitled 'Are we fit to frack?'. This publication warns that decisions made now will have a significant impact on wildlife, the countryside and climate for years to come. They further warn that given that the carbon footprint of shale gas is 16 times higher than that of wind, exploiting shale gas would be contrary to warnings from the International Energy Agency (IEA) in 2012. As discussed in section 1.2.1, the IEA warned that without Carbon Capture and Storage (CCS) no more than half of the world's fossil fuel resources should be consumed, this rules out most of the world's shale resources.

The NGOs highlight that in the UK, and given the UK's historic emissions, it is the responsibility of the UK to lead a low carbon transition. This report gives ten policy recommendations regarding the regulation of any future SGD operations in the UK (Anon, 2014a). UKOOG responded to these policy recommendations by stating that many were already in place. Further, in response to the issues raised regarding carbon footprint, stated, 'the economic and environmental imperative to use the UK's indigenous resources of gas is clear' (Anon, 2014b, p1) and continued to highlight that in the USA, SGD helped reduce CO₂ emissions and energy prices and at the same time the USA invested in low carbon technology. Others disagree with this position, including the Union of Concerned Scientists, whilst they agree that gas burns more cleanly than coal and makes the transition easier and quicker, they warn that 'investing in natural gas brings its own economic and safety risks, and won't bring the emissions reductions we need' (UCSUSA, 2019, p1).

The Union of Concerned Scientists further warns that in the USA renewables face major obstacles - some are inherent with all new technologies; others are the result of a skewed regulatory framework and marketplace (UCSUSA, 2017). King & Gulledge (2014) in their analysis of climate change and energy security policy research also cite regulatory uncertainty, however claim that in the USA this uncertainty has caused power companies to delay capital investment that would lower carbon emissions and diversify fuel mix. This in turn make the economics of renewables (and nuclear investments) 'hazy' (King & Gulledge, 2014). However, a report released in December 2020 reported that solar installations in the USA increased by 43% in 2020 over 2019, defying predictions (Ellis, 2020). This might suggest that the obstacles faced by new technologies have been overcome and that the regulatory framework and marketplace have not hindered the growth of the industry as expected.

5.3.4 Gold standard regulations

Many local residents who participated in this research mentioned the UK Governments' repeated statements about 'gold standard regulations', usually in a sarcastic tone, to iterate the fact that they did not believe that the UK's regulations were any more stringent than those in the US or elsewhere, as suggested by David Cameron (then Prime Minister) in his 'all out for shale' speech. Indeed, the support for SGD is largely founded and supported by the beliefs and

assumptions that there is a strong regulatory regime already in place to deal with any impacts. Participants in this study disagree, claiming that there is simply no proof that the UK's regulations are 'Gold Standard':

'The Government ... said our regulations are going to be the best in the world, they could have said this is what they did in America, this is what we're going to do so that people could actually compare the two, and say 'oh well that's actually a vast improvement'' (18YR, 2/2017)

'Have you heard of the precautionary principle? You know that's what we should be applying here, we should be taking time out to, firstly look at all the health things that are coming about from America. Looking at all these reports about regulations and they keep saying 'we'll regulate it better here, the regulations here are gold standard' well what does that mean? what does gold standard regulations mean? nobody knows and we've asked them, 'what do you mean by that?' nobody proved to me that they're gold standard, nor are they likely to' (15LR, 12/2016).

Many scholars have also recommended the precautionary approach to any future SGD, these include Hawkins (2015), McGowan (2014), Watterson & Dinan (2016). Others have noted that the UK does not seem to be using a precautionary approach, for example Prpich et al. (2016), Patterson & McLean (2017). The precautionary principle is often discussed in the literature, especially in relation to the regulatory regime, and despite the UK subscribing to the concept of the precautionary principle in theory and in line with the EU, it certainly does not seem to be taking the precautionary approach in the SGD case, rather a risk-based approach, as discussed further in section 2.1.

'it's about the precautionary principle, if we are raising all these things you should be applying that. And the Public Health England should be proving if they can that there aren't any risks, which I think there are, and that's why they're not doing it' (15LR, 12/2016).

The precautionary principle in the context of SGD and new technology is discussed more generally and in more detail in Chapter 2, however with regards to the participants perceptions in this study, and in relation to 'Gold Standard Regulations', participants opposing SGD are stating that true gold standard regulations should be applying the precautionary principle, rather than in opposition to it. Indeed the scholars examining the precautionary principle warn that the use of this principle is in decline all over the world, even in the EU where it is most prevalent, and that this is a threat to sustainable development (Read & O'Riordan, 2017).

A further warning to the UK is that Brexit also poses a particular threat to the use of the precautionary principle, although in the short term The European Union (Withdrawal) Act 2018 will bring EU law into UK law, in the longer term the precautionary principle could be amended or even removed by a parliamentary majority and replaced by less stringent or less precautionary forms of regulation (Read & O'Riordan, 2017). Concerns could now be, even if not at the time of interview, that future trade deals with countries outside the EU, such as with the USA, may result in a lowering of regulatory standards.

A further concern is the rival 'innovation principle' which, although currently not written into any laws, is gaining momentum and increasingly appearing in EU policy documents (Garnett et al., 2018). The European Risk Forum has defined the innovation principle as 'Whenever policy or regulatory decisions are under consideration the impact on innovation as a driver for jobs and growth should be assessed and addressed' (ERF, 2013). This could be viewed as departing from the precautionary approach to unknown risks and scientific uncertainty in favour of a more 'gung-ho' approach, especially in the context of economic recession and increasing unemployment.

5.4 Summary

The aim of this chapter was to investigate the factors relating to the issuance, or not, of a SLO from the perspective of the community stakeholders and in particular how they perceive risk. Findings include that stakeholders frame risk using their own experiences in addition to information they have read or heard about SGD in other countries, such as the USA and Australia. The list of risks cited tend to be the same for all opponents and include concerns regarding fugitive methane, water contamination, pollution, increased traffic congestion and human health concerns. Proponents tend to express their concerns regarding risk as the loss of the opportunities or benefits, i.e. jobs, energy security, and other economic benefits. Some opponents framed the risk in terms of temporal risk, for example the potential for fugitive methane to escape over a long period of time, even after the site has been restored. Spatial risk includes the space required by the industry in a full-scale production scenario. Proponents,

particularly industry proponents, rebut this concern by comparing SGD to other activities such as farming.

Some of the resident participants live near a conventional gas site in Yorkshire and thus used their experiences of incidents to express concerns regarding the operators and the regulators. Others live near Preese Hall in Lancashire and used another high-profile incident relating to the disposal of produced water following fracking operations in 2011. The recounting of these incidents demonstrates that the residents have very little faith in both the operators and the regulators. The residents' perception of the operators is that they do not comply with regulations, and their perception of the regulators is that they take a long time to respond and are complicit with industry as they (the EA) find solutions to industry problems, such as cold venting, rather than the industry finding the solutions themselves. Upon investigation of the reports written at the time of the incidents in Yorkshire, it seems that the EA did indeed respond quickly, the next day, and issued CAR's in response to the incident, demonstrating efficiency. Furthermore, the EA finding the solution to the problems faced by Rathlin could be described as demonstrating competency. However, this does help to give the perception of being complicit, as does the incident in Lancashire where residents are concerned that the EA came up with the solution of disposing of the produced water in the Manchester Ship Canal. This further creates the impression to residents and opponents that the EA is complicit with industry, rather than protecting the environment. As discussed in the introduction, the perception of the regulators is possibly as important as that of the SGD industry in terms of the issuance of a SLO. Furthermore, the vigilance demonstrated by local residents living near SGD and conventional gas sites, highlights the requirement for a continual dispersed concept of SLO.

An important factor for SLO is communication. The MTR meetings are the main platform by which the local residents can meet with and engage in dialogue with the local regulators. Residents have confused MTR and CLG meetings which may suggest that they see regulators and industry on the same side. Furthermore, some stakeholders seem unaware of the fact that MTR meetings have taken place. This suggests that the meetings were not well advertised, or at least not advertised in an effective place. Opponents and proponents of SGD also seem to differ in their understanding of the purpose of the meetings; with the latter believing that they are to educate the public of the benefits and relieve them of their concerns. This situation is a long way away from the psychological identity and trust required for gaining and maintaining a SLO. However, in terms of the reality of the position of the agencies, particularly the EA, the fact that

both sides see the agencies as 'on the other side' suggest that they are indeed neutral. The industry perception of the agencies is mixed; they view the HSE as more knowledgeable and efficient than the EA. This is perhaps because the HSE have a more 'hands off' role in the regulation of SGD.

With regards to the regulatory regime, the focus tends to be on the aspect of the regime that perhaps they have had more experience with, the planning process. Because the local planning authority initially rejected the planning application for SGD in Lancashire, stakeholders in Lancashire demonstrated more trust in this aspect of the regulatory regime than the Yorkshire research participants, where North Yorkshire County Council granted planning permission for SGD. In Yorkshire, a large county, concern is also expressed regarding the locality of the district council in relation to the operations; the council is situated a long distance from potential SGD and existing conventional gas operations. Many participants also expressed concern regarding how trustworthy local councillors are, with some insinuating corruption. This was also expressed with respect to national level of politics in terms of the 'revolving door' between politicians and industry at a high level.

Stakeholders have also noticed that the definitions of SGD, fracking and HVHF have changed with the development of the regulatory framework. Many believe that this is moving the goalposts or sidestepping the regulations and further than this may mean that operations could go ahead without regulatory scrutiny due to factors such as depth, volume of fluid required or size of the well pad. This further erodes trust in the regulatory regime in addition to the erosion of trust in the regulators and industry.

The potential SGD sites which are the case studies in this thesis lie in the North of England are both situated in Conservative-voting areas. Some participants expressed dissatisfaction with the Conservative party as a result of SGD policy and suggested that in the next election (2016) that they would not vote for the Conservative Party. This was not the case; in both areas the Conservatives increased their majorities in 2016. More recently, and in the context of another general election in December 2019, the Conservative Party have U-turned on their SGD policy by issuing a moratorium. This may have secured the Conservative vote in these areas. A recent

review of social media however suggests that many remain vigilant regarding the moratorium and believe that this could be merely an election tactic to win votes.

The continuing use of fossil fuels in the context of climate change concerns is cited as a policy conflict. Although the Climate Change Act (2008) is possibly also a motivating factor for the Government SGD policy in light of the consequences of not meeting CO₂ reduction targets, as SGD will displace some of the coal currently used. Others argue that the investments in SGD are displacing the investments in RE and preventing the growth of the RE industry.

Many residents commented on the Governments' phrase 'Gold Standard Regulations' suggesting that gold standards should be more in line with principles such as the precautionary principle. The industry track record in terms of regulation and safety is discussed further in the next chapter, Regulations and Governance, Chapter 6. It is clear that the local residents who participated in this research do not believe that England has gold standard regulations, and question the legitimacy of this claim.

Finally, trust is established in the literature as the key to SLO. This chapter has demonstrated that trust is lacking on all sides of the SGD debate; from residents trusting operators, regulators and policy makers to the industry and policy makers trusting other stakeholders to understand the benefits and processes involved in SGD. These factors suggest that achieving a situation where a SLO is granted seems unlikely in the short to medium term.

Chapter 6 Regulation and Governance

6.1 Introduction

This chapter addresses the question: to what extent do stakeholders of SGD perceive the regulatory regime in England to be adequate?

This chapter's first three sections cover the main themes from the analysis of the transcribed interviews regarding stakeholders' perceptions of regulation of SGD in England, namely:

- Comparisons with regulation in other countries, industries and aspects.
- Regulatory framework for the SGD industry.
- Self-regulation for the SGD industry.

The following figure (6.1) illustrates the relationship between modes of governance, as detailed by Kooiman (2003) and discussed in section 2.3, stakeholder perspectives, which describes the way in which interview participants evaluate the governance of SGD in England and the emerging themes, as identified by interview participants.

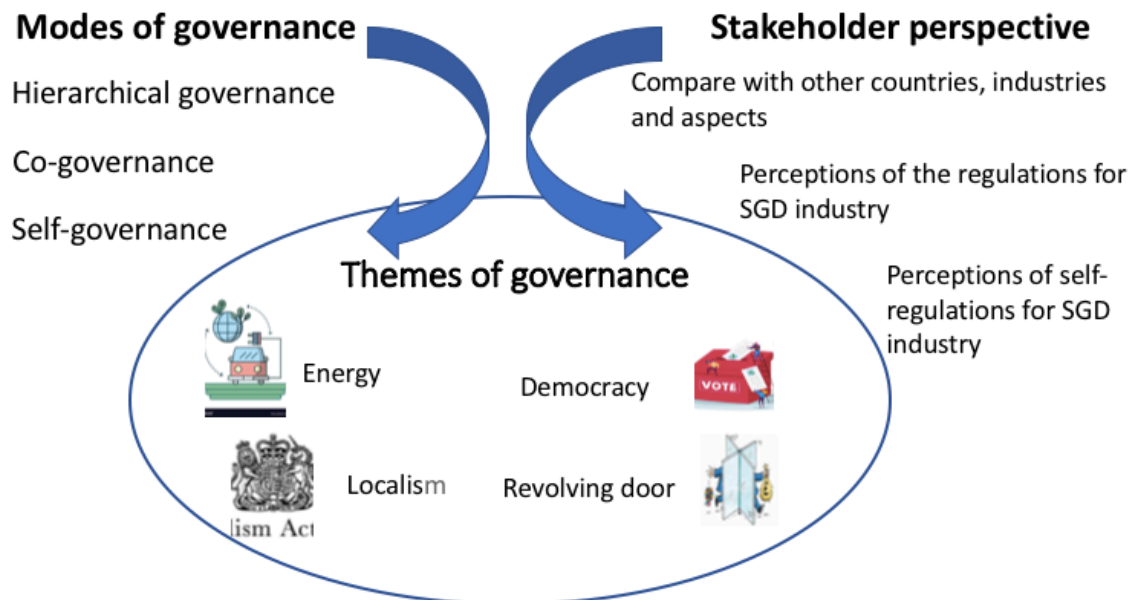


Figure 6.1 Illustration of the relationship between modes of governance, stakeholder perspectives and emerging themes based on Kooiman (2003).

The final section of this chapter pulls together the responses to these themes to address the research question.

6.2 Comparisons with other countries, industries and aspects of SGD

Interview participants expressed their views regarding the regulations and regulatory framework by using a variety of different contexts. They include making comparisons with other industries, activities, times, policy contexts and countries, especially the US. This next section will explore these comparators to provide some context to the participants' perceptions of the regulations in relation to SGD in England.

6.2.1 Other countries

Given that fracking is new to the UK, participants commonly drew on what they had heard or read about experiences of SGD in other countries. Many participants highlight that they believe that the UK regulations are, or will be, superior to those in the US, however, as discussed in Chapter 2, the regulatory landscape in the US is very different from England and further varies between States. One MP who participated in this research stated that it is in *'everyone's best interest to do this in the right way'* (01YM, 08/2017) and that the regulators and industry working closely together would likely achieve this. He further claims that some of the *'problems'* in the US such as *'seismicity and stuff over there and [in] terms of some of the undoubted pollution incidents happened there, mainly from surface spills'* claiming that *'if what happened in the US happened here I think we wouldn't be fracking'* (01YM, 08/2017). Seemingly he blames the lack of, or quality of, regulations for incidents such as surface spills and seismicity from re-injection of produced water in the US. Similarly, another interview participant, from the EA, claims that *'ours [regulations] are way better'* and expresses his surprise at *'some of the large omissions from federal and state regulations in the US'*, citing the abstraction licences for the water supply and methods for dealing with waste as examples. Indeed, the industry is exempt under the Resource Conservation and Recovery Act of 1976, among other regulations, causing concern regarding water abstraction and contamination (Centner & O'Connell, 2014). There is, however, very little literature on the individual states' water abstraction regulatory frameworks and it was therefore difficult to analyse these processes in relation to the US for the purposes of this study. Ziogiannis et al. (2016) in their evaluation of the heterogeneity of state SGD regulations concluded regulatory elements with the *'highest compliance difficulty'* are those that relate to water use and water withdrawal suggesting that the issues in the US regarding water use relate to enforcement of the regulations rather than the regulatory framework. Compliance difficulty was ranked by *'experts'* to determine the most important elements with regards to public

health and the environment and further to assess the level of difficulty operators may face when complying with regulations (Zirotiannis et al. 2016).

With regards to methods for dealing with waste, there are many claims that there are insufficient waste treatment facilities in the US (Davis, 2017) and indeed in the UK (as well as Europe) to deal with the waste water from shale gas operations (Watterson & Dinan, 2017). These questions were raised at an SGD Regulations meeting attended (by this author) in London in April 2016 and unsatisfactory answers were given relating to facilities by industry, in other words no facilities at that time had the capacity or expertise. These concerns are also expressed by one of the local residents interviewed (21YR), *'Water contamination is the main long-term risk, and that would include the long-term problem, rather like Nuclear waste, of the waste product from fracking, nobody has a solution to that yet.'* (21YR, 01/2017). Watterson & Dinan (2017) further cite an industry funded report which casts doubt on the capacity of the agencies to work together to ensure effective regulation and that this problem is illustrated by the lack of clarity on waste disposal in agency documentation.

Both the Agency and MP participants frame these US examples as issues that would not occur in England due to the regulatory constraints. A further example is expressed:

'Preese Hall is a classic example, isn't it? In 2011, I remember it was on the news, fracking in Preese Hall and nobody said a word really, then there was induced seismicity and we stopped for six years. They wouldn't have stopped for six minutes in the US; they'd have not told anybody and cracked on. So, I do think that here we'll take a different approach' (01YM, 08/2017).

This statement 'they'd have not told anybody and cracked on' implies that he believes the industry, at least in the US, is not very trustworthy. It seems he believe that the shale gas operators in England will be more accountable and transparent, or possibly that the regulations will prevent this type of industry behaviour or that there will be closer supervision. An industry participant provided a similar account to illustrate a different point:

'I went to an operation in Pennsylvania - they had done 69 fracks in 21 days. We've not done one in 5 years. We might call them, I hate to use this term, cowboys, and gung-ho but they know how to get things done. But then again it's probably within the regulations'

and within the government, or the powers that be, they understand the industry because it's been there for a while' (11YI, 07/2017)

These two statements, both from proponents, highlight how they believe the industry in the US is perhaps less responsible than the operators in England, and that the regulations in the US allow a certain amount of 'gung-ho' behaviour from industry, the inference is that England imposed a moratorium for six years illustrates the superiority of the English regulations. Indeed, Goldthau (2016b) concluded that the SGD boom is unlikely to be replicated in Europe due to reasons 'related to regulation [and] industry structure' (Goldthau, 2016b, p5). This does not, however, account for the fact that as SGD had begun in the US some time before the planned operations in the UK and that the stories, and indeed films, had already begun to emerge from the US highlighting the potential environmental and human health concerns relating to fracking. Thus, residents living near potential fracking sites in the UK had knowledge of the process, whereas in the beginning for the US resident it was most likely that they were unaware of the process and of the potential harms. It is also possible that US residents benefited financially due to owning the subsurface mineral rights and therefore were less likely to object than in the UK context as landowners do not own subsurface mineral rights. The significance of the residents' level of knowledge prior to commencement of operations is that UK residents had the opportunity to object to planning applications and galvanise support against SGD which in turn put pressure on local authorities and national government to impose a moratorium once a problem occurred. The question is, was the delay in getting started and the imposition of the moratorium as a result of stringent English regulations, or a result of pressure from local residents and anti-fracking groups? Or indeed, as suggested by Murcott & Webster (2020), as a result of learning networks between non-state actors (anti-fracking groups) to achieve the common goal of halting the industry.

Opponents of SGD certainly like to claim that their activism is the primary reason for the decision to impose a moratorium in England; similarly, proponents like to claim that this is evidence of effective regulation and that the moratorium was imposed as a result of the industry failing to adhere to the regulations. The answer is probably a combination of the two; the moratorium of 2019 was announced shortly before a general election and the more cynical stakeholders may say that this was an election ploy; SGD sites are situated in predominantly Conservative voting areas (see section 5.3.2) and the government's wave surveys (see Chapter 2) have suggested a steadily rising opposition to SGD and coupled with well-publicised anti-fracking protests, this may have seemed too risky a policy to continue supporting. Indeed, in 2019, following a long Freedom of Information (FOI) campaign, a confidential report was released indicating that the

Government believed public opposition was the cause of slow progress for SGD in England (Brock, 2020). On the other hand, Cuadrilla's activities in the months prior to the issuance of the moratorium were causing significant earthquakes which required several cessations of activities due to the Traffic Light System (TLS) regulations. These regulations had been implemented as a result of similar problems in 2012 and the TLS was introduced as a means of mitigating the risks of seismicity (Williams et al., 2020). Although some have suggested the focus of imposing stringent regulations on seismicity has been to the detriment of other environmental concerns (Smythe, 2020).

Some resident participants have a different view of US regulations: *'The more you learn about America, the more you start thinking ... in fact, until Trump gets going, that they've actually got some really tight regulations'* (20YR, 03/2017). As discussed above, it is difficult to critique 'American regulations' as a whole when the industry is predominantly State regulated in the US. It is worth noting that local residents expressed a higher regard for US regulations than the MP and industry interview participants, perhaps indicating an understanding of the difference between federal and state regulation, as some states are more effectively regulated than others (Graham et al., 2015). Some participants also mentioned attending a talk from an American activist who claimed that the regulations, at least on paper were adequate in her state (15LR and 16LR). Pro-SGD representatives would however have to take the stance of denying the issues the industry have had in the US or to take the stance, which they seem to be doing, 'that won't happen here' because the UK regulations are superior, in other words the UK regulations will prevent any of the accidents and/or industry behaviours witnessed in the US. Resident participants seem to be stating that the regulations in the US are adequate, yet they still had problems, indicating that they do not believe reported incidents are as a result of regulatory failure, rather an inevitability.

The comment regarding 'large omissions' in regulations in the US, as observed by the Agency participant, is interesting as one may expect a regulator to defend the regulatory framework concerning the industry, even one from a different country. Conversely, the English regulator may benefit from claiming the English regulators are superior to the American regulators, thus alleviating concerns regarding regulators' capacity to regulate. However, these omissions may only become apparent in the wake of an incident, for example a spill or seismic event, such as at Preese Hall in Lancashire. More is discussed regarding regulations and seismic events at Preese Hall in section 5.2 of Chapter 5. In response to a question about industry's willingness

and / or capacity to handle increased/ tighter regulations, the industry representative pointed out when interviewed for this study *'first of all you need a reason, normally an accident like Piper Alpha you then find mistakes and you tighten regulations'* (11YI, 07/2017). He further claims that in England, this is hard to justify as *'we've not had a mistake'* (11YI, 07/2017). This participant works for an operator currently extracting conventional gas with planning applications underway for exploratory SGD, therefore one assumes he is alluding to conventional gas extraction, as at the time of the interview no SGD had yet taken place. However, the industry and other proponents do not see SGD anything other than an improved technology when compared with conventional gas extraction. The residents, as discussed in chapter 5, do not agree about the 'no mistake' claim of Third Energy in Yorkshire, citing documented 'sour gas' leaks, problems associated with flooding, staff accidents, and 'clashes with the HSE regarding well-casing design' (Hayhurst, 2015a; Hayhurst, 2018c). With regards to the Piper Alpha⁶ tragedy in 1988, it was widely hoped that the offshore oil and gas industry had 'overcome its dubious and dangerous past - a past that had on occasion seen it accused of having the worst accident record of any industry' (Paterson, 2017, p2). However the Piper Alpha replacement, hailed by the industry as 'state of the art' with regards to safety suffered several explosions and 'unresolved safety problems', yet some claim that, despite the disaster, the industry is continuing to resist prescriptive regulation to achieve improved health and safety standards and is opting to peruse greater reliance on self-regulation (Paterson, 2017). The evidence therefore from historical events is that disasters do not always result in more stringent and effective regulations, they do however seem to result in a change in regulations.

Other resident who participated in interviews for this study, drawing on examples from the US and Australia, pointed out that not all problems emerge immediately, and claimed that *'generality of problems didn't emerge in the first year or two or three; they've emerged between five and fifteen years and in Australia, in Queensland'*, and further warned that *'the evidence is there in America and Australia that should make us very cautious, and yes we should adopt a strenuous regime, if we are going to have fracking'* (21YR, 01/2017). The problems referred to relate to health, such as *'reproductive health and respiratory related conditions'* (21YR, 01/2017).

⁶ Piper Alpha was an oil platform in the North Sea, north-east of Aberdeen and operated by Occidental Petroleum (Caledonia) Limited. The platform exploded and sank on the 6th of July 1988. 165 men were killed on board and a further 2 rescue workers. 61 workers escaped and survived. At the time of the disaster, the platform accounted for approximately ten percent of North Sea oil and gas production. The accident is the worst offshore oil disaster in terms of lives lost and industry impact (Saadawi, 2018).

Indeed health issues do take longer to become apparent and epidemiological studies take longer still. However, as highlighted in section 2.1, evidence is beginning to emerge relating to human health issues and SGD in the US, which does support this residents' perceptions of events. This highlights that research participants are aware that some issues are unknown and therefore unregulated and that there may be potential problems created by this technology of which we are currently unaware. The most likely of these being problems that relate to human health, as these issues (such as cancer) may take decades to be realised and that caution should be employed as evidence is beginning to emerge from other countries.

Other regulatory comparisons made between the US and UK interviewees include pointing out that the geology is very different and therefore different regulations at depth should apply (10NI, 06/2017). Indeed, the shale basins in England are different in depth and scale from those in the US, with the basins in the US being shallower and spread over a larger area at the surface. This suggests that the English sites for shale gas would have fewer wells at the surface, but more horizontal laterals below the surface, which may require additional or different regulatory considerations. Additionally, the history of the landscape may also be a factor to consider regarding the regulations. In England, there may be undocumented and very old wells or mine shafts in play, this is less likely in the US due to the age of the nation and the fact that the landscape sizes differ; in the US, the landscape is vast and therefore less likely to encounter such a problem.

6.2.2 Other industries

In terms of comparisons with other industries, participants in this research used examples to explain differences or similarities between how they perceived the regulations for SGD and the example industries in the following five key regulatory areas: the planning application process; the scale in which the industry is (or should be) regulated, risk management and waste management regulations and operational standards. Participants, including proponents and opponents, drew upon knowledge of their own industries and of stories they have knowledge of outside their own field of work.

6.2.2.1 Other industries and the planning process

One of the key questions, and highlighted as a comparison between industries, is the appropriateness of using the planning permission process for the SGD industry. Many viewed it as a special case; potentially more damaging to the environment and human health than other planning concerns, such as building a home extension to one's home or building a supermarket. Statutory consultees are encouraged to treat SGD applications 'like any other planning case' (07YN, 10/2017). Others point out that the regulations, including planning regulations, are not designed for this technology. The Town and Country Planning Act (1948), however, clearly defines 'development' as 'any building, engineering or mining operation' and is therefore designed exactly for this type of process, although the precise process of SGD is unlikely to have been imagined in 1948. It could be further argued that the statutory consultation process allows stakeholders to object within parameters (on certain factors) to the development and is therefore the correct mechanism by which to allow or reject a planning application. However, as discussed in chapter 5.2.2 and 6.3, when the decision is 'taken out of the hands of local Authorities' and therefore effectively from the hands of the local community, or this process is seen to be bypassed, such as the Secretary of State overruling a local planning decision, then there is a perceived lack of democracy.

In terms of the context for participants' perceptions of the planning regulations, one MP when interviewed compared the process with the building of a supermarket and claimed that the building of a new supermarket, although also subject to planning regulations, involved no community consultation and further that they retrospectively applied for planning consent. This claim, while made in support of the industry, highlights a lack of consistency and effectiveness of the planning regulations. If, as claimed, the large supermarket chain built a store in her constituency and retrospectively applied for planning permission, then this further highlights the ineffectiveness of the application of The Town and Country Planning Act (1948). In other words, it is not the regulations per se which are lacking, rather it is the effective application of them. This behaviour may be partly the industry culture, as in the case of supermarkets (because they are seen as job creators), or as a result of the lack of expertise in local government. As discussed in section 2.1, capacity and expertise of the regulators, including the Local Authority, to enforce the regulations is a key concern. No evidence was found that supermarkets in the UK carry out the practice of building then retrospectively applying for planning permission. However, there are accusations of supermarkets 'throwing money at the planning process until they get their way' (Dawson, 2010, p1) and of using their substantial financial power to

overcome local planning restriction. Indeed, there is even a protest group named 'Tescopoly' who have formed to combat the expansion and perceived power of the 'big four' supermarkets. Further investigation regarding this is beyond the scope of this research, however the perception of this MP that a large supermarket chain was able to behave in this manner speaks to the power she believes they have in comparison to the SGD operators. A further concern in this scenario is that powerful organisations such as large supermarket chains do have the ability to influence regulations. This relates to trust in industry and is discussed further in Chapter 5.

Other interviewees highlight the juxtaposition of Renewable Energy (RE) and SGD projects, both in terms of the planning process and of the UK energy policy in general. One participant regularly mentioned the difficulties regarding gaining planning permission for Solar farms and wind energy projects in comparison to SGD, claiming that more RE projects are rejected at the planning stage as a result of objections during the consultation process. He further states that many *'green energy companies have folded'* (16LR, 12/2016) and that *'no cohesive, long-term thought through about this energy program or any energy security program for the country'* and further that *'you're pulling the plug on the safe, clean, viable, job creating, climate saving renewable sector'* (16LR, 12/2016). A further discussion regarding Energy policy and renewable energy is discussed below. These perceptions are also reflected in the literature, Strachan et al. (2015) conducted research into the impacts of devolution in the UK on the likelihood of community owned RE projects and concluded that irrespective of whether a region was devolved, planning arrangements *'systematically favour major projects and large corporations'* and keep community RE projects to the margins (Strachan et al., 2015, p96).

Planning guidelines were changed and aimed at local authorities for SGD projects and seemed to be to ensure that these projects were fast-tracked by pulling the decision-making powers back to central government and away from local authorities. This does seem rather at odds with the former Conservative policy of Localism and the Localism Act 2011. Conversely, with regards to the planning process for RE, this has been changed in order to give local communities more of a say and more opportunities to object (Cotton, 2016). Larger wind farm projects have been removed from the NSIP process and given back to local communities (Persaud, 2016), potentially making RE projects less likely to be approved. In addition to this, incentives such as the Feed-In Tariff for electricity generation from smaller PV and wind projects has been prematurely withdrawn making investments in RE projects less financially viable. Similarly, the renewable heat incentive (RHI) rates have been reduced making these types of projects also less financially viable for investors. This, in combination with the scrapping of the zero carbon for new homes scheme has indeed caused many RE companies to cease trading (Oldfield, 2015) and suggests

that the government are not committed to meeting RE targets or to reducing CO₂ emission in line with CO₂ reduction targets. Furthermore, it has been noted by several scholars that objection in the local planning process for SGD projects focusing on climate change and reducing dependence on fossil fuels are not considered a legitimate objection and therefore often excluded (Beebeejaun, 2019; Hilson, 2015).

An ongoing dilemma for the UK regards where we get our energy from as a nation, should this decision be made locally, or is it indeed a NSIP as suggested by the UK Government and therefore a decision to be made centrally (BEIS, 2018). Further, local authorities are charged with responsibilities relating to local economic growth in addition to other responsibilities, including representing their constituents as discussed in section 4.2.5. When balancing energy projects, including RE and SGD, Local Authorities are in a better position to weigh up these developments with other economic concerns such as agriculture and tourism; potentially competing developments in terms of land use. In environmental terms, disallowing local authorities and communities, effectively undermining them, may have an impact on the realisation of local environmental evidence to emerge and therefore cannot inform the wider scientific community (Beebeejaun, 2019). In other words, local residents have a better understanding of their local environment both in economic and environmental terms.

6.2.3 Other aspects of regulations

A few participants, mostly those who are possibly more aware of the 'cradle to grave' processes for SGD compared the regulatory requirements at different stages of development and highlighted that different stages are likely to require different regulations, and on different scales. In other words, the regulatory requirement for exploration is very different from the requirement at the production stage and different again during well abandonment and site restoration. This point is clearly made by an industry participant:

'I think for exploration I believe it's really down to the local decision-making process, but when it comes to production, if you're talking about multiple pads, you're talking about the infrastructure in support of that, you're talking about that trade work, then that might be across a whole range of council areas for a whole range of reasons. So, in fact it might be more appropriate for that to go into a national planning system, so they can look at that in a national context and come up with the strategic level solutions to address it. If there five, six or seven authorities trying to find a solution, commonality across that group would be very difficult if not impossible. So, I think things like HS2, these big infrastructure projects that would cover a whole range of areas and are regional, I think we need a different mechanism, we always say we need local involvement, local community groups need to be involved, community liaison, all this

kind of stuff is core, and decision making at exploration is probably best at local level. But at some point, you have to make that step change otherwise I think that you just get stuck in the local issues.' (10NI, 06/2017)

This viewpoint seems logical. Once a project is of national significance and decisions must be made uniformly across Local Authority boundaries, then it makes sense for decisions to be made centrally. However, if the decision regarding exploration is made locally and, as is the case in all areas of England with potential SG developments, if there is local opposition, which challenges and prevents exploration, there may never be a production phase to manage centrally. All the areas of England with potential SGD have local opposition, which challenges and prevents exploration. Even an NGO participant interviewed for this research conceded that if all decisions are made locally 'then no-one would ever be able to do anything' (04, YN 01/2017). This is further discussed in relation to the planning regulatory framework in section 6.1.1 below. Further, whilst there are numerous scholarly investigations into aspects such as environmental damage, human health issues and technical studies into gas flows at various stages of development, there are no studies looking at the regulatory requirements at different stages of development, not only for SGD but for oil and gas production more generally, which seems like a logical next step for future research.

One industry participant, when asked about regulating the potential 'dispersed' nature of the pollutants, compared SGD to the annual local ploughing contest, claiming ploughing is more dangerous than SGD. The comparison with ploughing is interesting; he claims that the pollution from such an event, and agriculture more generally, is more polluting than SGD. He justifies this in two ways: by the time the 'frack' takes, i.e. two hours for the frack and 'several' hours' for ploughing contest; and the regulation required for this, compared with a ploughing contest which is greater. It is further implied that the ploughing contest is accepted without question by the local community yet is more polluting and requires less planning and preparation. According to Edwards (2018), ploughing contests, along with other community activities, are aimed at training young farmers for their wider role in agricultural communities and is therefore accepted, even considered necessary, by local communities in rural areas (Edwards, 2018). In addition to this comparison, the industry participant is also minimising the SGD operation by talking only of 'the two hour frack job', in doing so he is framing fracking as something less harmful in terms of pollution than an annual event, probably fully accepted by the local community. This links to section 1.2 and 5.2.3, which discuss how different stakeholders, define fracking / SGD more generally.

6.2.4 Time and Space

The research participants, especially those in opposition to SGD, expressed concern regarding the scale and future scaling up of the industry. This is discussed in section 5.2 with regards to the risks and impacts of SGD, however it was also expressed in terms of the regulations and the capacity to regulate a ‘dispersed’ industry, and the potentially dispersed nature of the resulting pollutants, for example emissions. As expressed here by a Lancashire resident: *‘Some would argue it’s like any other industry, but I actually don’t think it is like any other industry. This is going to be a widespread industry dotted all over the countryside … how are the Environment Agency going to manage that?’* (15LR, 12/2016).

Many expressed concerns regarding how the regulators would monitor the SGD industry, as it is not ‘all in one place’: *‘it’s bound to be more difficult isn’t it, if you have everything in one great big building, you could regulate it a lot more easily’* (01YM, 08/2017). This was expressed by an MP, who is a proponent of SGD, and who further stated that this could be mitigated by having *‘best practice’, for example using ‘a barrier beneath the surface of the site’* (01YM, 08/2017). Using advanced technology is indeed a good mitigating measure for some aspects of SGD and further it is likely to be utilised where new technology is commercially viable, for example Green Completions⁷ to capture fugitive methane; this would reduce the loss of product (gas). New technology may not always be cost effective or beneficial for operators to invest in. Using the regulatory framework would be a good method of encouraging operators to adopt new technology where they otherwise may not. A recent example is the criticism, and subsequent High Court Hearing (November 2018), of Cuadrilla and its perceived failure to use Best Available Technology (BAT) with onsite treatment and reuse of produced water at its site in PNR, Lancashire. Further criticism was made by FOE of the EA claiming that the EA had failed in its duty in relation to the Mining Waste Directive (2006) to ensure that Cuadrilla is using BAT. There was some discussion about whether the proposed BAT, in this case electrocoagulation (which was proposed by the EC in its BREF document as a potential, but emerging, BAT), is indeed the best technology available for treating produced water on site. Therefore, what becomes defined as BAT may sometimes be contested and potentially quickly surpassed by other technologies. It is unclear if making these decisions is within the role of, and indeed expertise of, regulatory

⁷ Green Completions are a zero-flaring product. Hydrocarbons produced during well test operations are ‘cleaned’ and then routed to processing facilities for export rather than being flared. The product has been utilised for over 10 years (Al Harrasi et al, 2021).

agencies. Further, as discussed above, given the dispersed nature of the SGD industry, it is possible that the same BAT may not be appropriate at every site considering different geological, environmental and social conditions.

A further point is made by 11YI regarding pollution and regulations: *'the way we are going to design our wells and the standards we adopt. Unless someone screws up, if we follow it, the regulations and the standards and we do it properly, there will be no contamination.'* (11YI, 07/2017). He finishes his point by stating 'unless someone screws up' and if they 'do it properly' then there will be no contamination. This is true of any activity, other participants have made comparisons such as 'I could crash my car and spill petrochemicals all over the place', 'if I cross the road properly I won't get run over!', 'if regulations had been adhered to then the Macondo (Deepwater Horizon) and Piper Alpha incidents would not have happened'. In other words, claiming that if regulations are followed, then nothing could happen. This is perhaps best highlighted by the comments made by this resident participant from Yorkshire describing another interesting comparison, processes in the NHS:

'For example, in hospitals there are things called 'never events'; these are things that should just never happen, and is [about] all of the checks and balances [that] are put in place and [therefore ensuring that if] everybody does their job properly, they will not happen. It should be the same in industry. Yes humans are fallible [but] there should be enough controls in place so that, for example, if I draw up the wrong medication I'm going to check it, you're going to check it, it's going to be checked again at the bedside so it should never be given. Just have enough checks and balances and controls' (14YR, 12/2016)

In both the SGD and NHS examples given here, it is highly unlikely that just following the regulations will ensure that 'nothing untoward' will happen. There are numerous cases of incidents happening in both the NHS and in the oil and gas industry, are these all down to non-adherence to, or lack of regulations? Or is this more about what is considered acceptable by communities and society? Indeed, Beaussier et al. (2016) examined why the risk-based regulations, enthusiastically adopted by successive governments, have failed to improve the quality of healthcare regulation, citing several preconditions which should be met for a successful outcome. These include clear goals for regulators, an availability of a range of enforcement tools, and that there should be political and societal tolerance in the case of unfavourable outcomes. They further state that risk based reforms 'are unlikely to succeed when goals are ambiguous or contested, failures hard to spot in advance, and political tolerance of adverse outcomes uncertain' (Beaussier et al., 2016, p219). This assessment of a risk-based approach to regulating healthcare seems to be considered as inappropriate, this view is echoed by Bevan (2008) and Black & Baldwin (2012). The latter further claims that regulators tend to

pay too much attention to low-risk aspects of healthcare and not enough focus on high-risk aspects. There seems to be some parallels these scholars conclusions regarding risk based assessments and the perceptions of resident participants, rather than, as 14YR (An NHS nurse) claims, the governance of the NHS being superior to that of SGD.

Summing up, stakeholders are making comparisons with other countries, industries and activities in the context of timescales, spatial issues and further, expressed concerns regarding the scale of the SGD industry. Comparisons were made regarding the quality of the regulations, comparing them with US regulations. Some, generally proponents, perceived English regulations to be superior to the US regulations, whereas opponents did not perceive the US regulations to be problematic; rather they viewed the industry itself to be inherently risky. Other industries, such as supermarkets, the RE industry and the NHS were compared in the context of either specific issues, such as the planning regime, or a more general approach to regulating using a risk-based approach. Perceptions regarding the planning process centered on inconsistencies across sectors, for example the perception that planning regulations favours supermarket chains over shale gas operations, and a contrasting view that planning regulations favour SGD over RE projects. The NHS was hailed as an example of good governance of risk, however the literature reveals that scholars are highly critical of the risk-based approach, the same approach used in the governance of SGD. The requirement for bespoke regulations at different stages of development was also discussed, however there was little supporting literature, both in the area of oil and gas and other related industries.

In addition to the issue of scale and regulations, direction and style of and governance is also cited as a concern. Several of the interview questions (Appendices 1-6) are designed to understand how participants perceive that the SGD industry should be regulated; top down by central government, or bottom up by local authorities and further, if participants felt that a single regulator regime would be more effective than the current multi agency approach. The latter is discussed in more detail in the next section.

6.3 Should there be one single regulatory agency?

The interview participants were asked their opinions regarding how the SGD industry should be regulated in England, the question was posed in two ways: Do you think there should be one regulatory agency rather than the current multi-agency approach? If so how should this be funded; and do you think the industry should be regulated locally by the Local Authority or centrally by Central government? This was to stimulate discussion regarding the advantages and

disadvantages relating to participants' knowledge of the current system, and further to obtain any thoughts, or parallels with other industries regarding ideas about how it should be done. Intriguingly, the answers to this question did not yield partisan answers, in other words the proponents of SGD did not all agree with one another and neither did the opponents. Table 6.1 indicates the position of each participant regarding SGD, followed by table, 6.2, indicating the position of participants regarding the issue of a single regulator.

Table 6.1 Table showing Position of research participants regarding SGD

Opponents	Proponents	Neutral
03YM	01YM	08NP
04YN	02NM	09NA
05LN	10NI	23NJ
06LN	11YI	
07YN	12NI	
14YR	13YR	
15LR		
16LR		
17YR		
18YR		
19YR		
20YR		
21YR		
22YR		

Table 6.2 Summary of the participants' views regarding the need for a single regulator.

Position	Comment	Participant (s)
In favour of a single regulator	More Authoritative	23, 20
	Should be independent	23, 07, 03
	Provides a more holistic view of industry / consistent approach	01, 07, 15, 20, 22, 05
	Expertise and knowledge (e.g. ecologists, petroleum engineers, planning, regulations)	07, 11, 14
	One 'body' accountable to all stakeholders	01

Against a single regulator	Agencies already have the expertise	01
	One agency too easy for Government and Industry to 'lean' on	05, 07, 01 08
	There will be as little trust in one agency as there is currently (pointless exercise)	12, 22
	Merging regulators would cause a loss of expertise and then divisions within single regulator mirroring the EA and HSE (i.e. no change)	01, 05, 22
Other solutions	One central group with local representation	15, 01, 20
	Single regulator only appropriate for production phase	10
	Need the regulators to enforce current regulations rather than create new expensive system	22, 03

One factor that was consistent across the board of both proponents and opponents is that they would like to see an independent regulator (s); where they believe the current multi agency approach is preferable they would like to see more independence from these regulators, and where they believe a single regulatory agency would be preferable they cited that independence is the most important factor. Most seemed to define 'independence' as independent of either 'pressure' or instruction from the Government and also from industry and further with no conflicts of interest, the notion of independence is discussed further in this section. This section will also examine the thoughts and ideas of participants with regards to the single regulatory approach idea. This was a policy idea detailed in the Conservative Party Manifesto 2017, however subsequently abandoned and did not appear in the Queen's speech, therefore did not become a legislative priority.

It should also be noted that some participants explored both sides of the argument and whilst some settled on one answer, others reiterated the fact that it is a complex question, with benefits and disadvantages of both systems, the following two quotes sum up the general feeling of many of the participants:

'I think it would command more respect and more trust and I think it would solve the issue of who's responsible for what However, a single agency is not going to be locally based, or locally accountable and I think the idea that you elect your local councillors who then make decisions on your behalf is a sort of real basic thing isn't it; that we've kind of grown up with So I think it's really difficult one actually, it's maintaining its democratic credentials and its local connection but having something that doesn't pass the buck from one organisation to another, and I think that's the real concern that people have, that if something goes wrong who's going to pick up the pieces? who's going to be responsible for it? who's going to pay?' (23NJ, 01/2017).

These sentiments were echoed by this NGO representative, in addition to others:

'It's really difficult that one, it's difficult because there should be a body that regulates it

that ... is completely independent from everyone, so there shouldn't be anyone with a conflict of interest. But then if you take a decision out of the local communities' hands then they don't have a say on what should happen in their area, and they are the experts, it makes it very difficult, I think overall, they do need to be a body that regulates fracking for the whole country and then perhaps you have more local stakeholders that would then input into those decisions - but it's very difficult, it's very hard' (07YN, 10/2017).

The two interview extracts above clearly illustrate how the question of a single regulator is not straightforward. The question about the single regulator being local or national demonstrates concerns about accountability and representativeness and ultimately about democracy; 'the idea that you elect your local councillors' and that they represent local communities and their interests is a fundamental aspect of our society in England; to have a single regulator based centrally making decisions regarding local communities is likely to be seen as undemocratic and non-representative. It may, however, prove beneficial to the perceived issue of accountability, certainly compared to the multi-agency approach, as at least there would be one body to hold to account. In order to explore this complex issue further, the views of participants supporting the idea of a single regulator will be discussed followed by those against the concept.

Firstly, to examine stakeholders who are generally in favour of a single regulator, and their reasoning. Participant codes are detailed in Chapter 3, this includes an explanation of the codes. Many cite, similarly to the journalist (23NJ) and NGO member (07YN) above, that a single regulator would have more credibility and authority than the current system: '*obviously the authority, the independence is absolutely crucial*' (03YM, 09/2017). Others, such as this NGO participant, claim '*sometimes decisions can be made for the national good and so sometimes the national good is an environmental national good. If everything is done at Local Authority level then you may have a race to the bottom in terms of laissez-faire with their [county] neighbours*' (05LN, 03/2017). These comments, although in response to slightly different questions, highlight that stakeholders are aware of the benefits of a single independent regulator and suggest that this should be a national regulator rather than a local one, to avoid local issues, i.e. 'the race to the bottom' with neighbouring counties. Further that the national regulator is more likely to be '*dispassionate in terms of pressure*' (05LN, 03/2017). The 'pressure' in this example is from local communities. This highlights that stakeholders see 'pressure' directed towards a regulator as undesirable whether it is from government, Industry or the local communities, although for different reasons. There is therefore possibly a conflict between the democratic rights of the local community and the 'national good', as discussed above and discussed in Chapter 5. The three points to discuss from these NGO representative comments are: 'national good' does not always equal 'environmental good', arguably especially not in the context of energy; the potential 'race to the bottom' on a county by county basis and; the issue of a single regulator being more resistant to 'pressure'. These points are discussed below.

If we assume that the NGO participant is defining a 'national good' as that which benefits the UK society as a whole then he seems to be saying that by making decisions and managing regulations centrally, that this may also become beneficial to the environment. However, as most 'benefits to society' tend to be measured in economic or monetary terms it seems less likely that any economic good could equal an environmental good since, as environmental economics theories suggest (see Harris & Roach, 2017), environmental externalities are often poorly assessed and accounted for and as a result should be at the core of regulatory design. Further, if UK government policy did indeed have environmental considerations at the core of policy and regulatory design, then the assumptions made by the NGO participant would be more likely to be true. In the case of energy, as discussed in the introduction to this thesis, the concerns about demand, the desire to be self-sufficient, issues regarding security of supply and economic growth are arguably likely to overshadow the environmental issues associated with production.

With regards to the 'race to the bottom' comment, the concern seems to be that if the decision to host and regulate SGD is made / carried out at the local level and if decisions are made based on economic interests then counties may compete with each other in order to 'win the business'. One of the 'tradables' to achieve this may be a lowering of standards and regulations which may in turn have a negative impact on local environmental quality. Given that the laws and regulations governing the SGD industry are in fact national, it is unlikely that this would be possible, further the extent of the shale basin and the availability of commercially viable access points are more likely to be the drivers of where an operator chooses to extract rather than the local regulatory landscape. In other words, there may be little choice regarding the location of SGD sites due to geo-technical and economic constraints.

The final point regarding a single regulator being 'more resistant to pressure' is quite intriguing as he is one of the few opponents of SGD participating in this research who conceded that pressure on regulators may also come from local communities; others interviewed tend to assume pressure is from government or industry. Viewing pressure from local communities as undesirable ties in with this participant's belief (or hope) that national goods can equal environmental goods as discussed above. Others did point out that pressure from central government or from industry is possibly easier if there is only one regulator, implying one regulator is more corruptible or easier to 'lean on' in terms of relaxing regulation, gaining permits etc. for example comments made by 05LN and 01YM discussed later in this section. The wider topic of regulator independence is discussed next.

The ‘independence’ of the regulator, in this research, seems not to be so much about the lack of trust in the integrity of the agencies, indeed participants accepted that the agencies are doing the best job they can with current resources and therefore ‘independence’ is possibly as much to do with capacity as it is trust. There is a concern that the Government may ‘lean’ on agencies, for example to issue an environmental permit (EA), or approve a well design (HSE), however there is no documented evidence of this, except perhaps with regards to the Local Authority and planning permits see section 5.3.3. Hanretty & Koop (2012) point out the fact that agencies should be ‘independent’ from a range of actors, for example the regulated industry, civil society groups and the general public. However, they highlight the importance of ‘political independence’ which is defined as ‘the degree to which the day-to-day decisions of regulatory agencies are formed without the interference of politicians and/or consideration of politicians’ preferences’ (Hanretty & Koop, 2012, p199). There is no way of knowing if agencies are considering the preferences of politicians or political parties, at least at the level at which these interviews were conducted, with only the one regulatory agency (EA) willing to be interviewed for this study. However, it is possible that other agencies declined to be interviewed because of the fear of potential political ramifications. Hanretty & Koop (2012) also further introduce the concept of ‘formal independence’ which is defined as ‘the degree of independence from politics inherent in those legal instruments which constitute and govern the agency’ (Hanretty & Koop, 2012, p199). With regards to this study, political independence seems to be the largest concern, with some participants also concerned with independence from industry too.

Would the current concerns and questions with regards to multiple regulators simply be transferred onto a new single regulator? As this Lancashire NGO interviewee points out *‘There is also the risk that it makes it easier for government to lean on that single agency because it is a single agency I would feel more comfortable with not all the eggs being in one basket’* (05LN, 03/2017). Similarly, it could be argued that a single regulator would be easier for industry to lobby and influence, as this Yorkshire MP mentions *‘you don’t have one regulator that ends up being close to an industry’* (01YM, 08/2017). There is clearly a concern from all sides of the debate with regards to how the agencies are being influenced by ‘other’ stakeholders, however as mentioned in Chapter 5, there are perceptions from opponents that the agencies are ‘on the side’ of the proponents and vice versa. It is therefore possible, if not likely, that the agencies (at least the EA and HSE) are independent of influence from stakeholders, including government, at least on a case-by-case basis. The activities of the regulatory agencies are also legal responsibilities, for example as illustrated in section 2.5.1, the Environment Agency is responsible for issuing environmental permits as defined under the Environmental Permitting

(England and Wales) Regulation 2010 (EPR) and therefore instructed by the legal framework rather than any individual or group.

To summarise, with regards to the ‘independence’ of the regulatory agencies, even if the structure is changed to a single regulator, it is unlikely to alleviate these stakeholder concerns regarding the independence of regulators and may even exacerbate them. The real issue is more likely to be to do with funding, expertise and staffing levels of each agency. This opinion is echoed by Cooper et al. (2018) in their social sustainability study of shale gas in the UK, they warn that ‘If or when the shale gas industry takes off in the UK, the inspection ratio will increase significantly and, therefore, it is imperative that staffing numbers increase to keep up with demand’ (Cooper et al., 2018, pg 15), and further that training initiatives for agency inspectors and staff should be independent of industry, unlike in the US where schemes were funded by ExxonMobil and General Electric, otherwise this will cause concern to local communities and the wider general public.

A further prediction by some research participants is that if a single regulator were to be formed, this would in the first instance be very costly and a waste of resources, and secondly that in the long term, the single regulator would end up divided into the very departments they came from, for example a planning section, an environment section and a health and safety section:

‘I think yes if you were to combine, say health and safety and the Environment Agency into one bigger agency, what would happen then? You’d have an Environment Agency division and you’d have a health and safety division, it would be the same as it is now but probably add a lot of cost, in having a top tier management structure in there.’ (22YR, 02/2017)

Many of the resident participants believe that ‘the EA and HSE are basically good agencies that do a good job’ (22YR, 02/2017) providing that they receive sufficient information and access to sites for onsite inspections, which means in turn that they have sufficient resources. Few participants in this study are convinced that the agencies have good communication between themselves (between agencies), this creates the perception that issues may ‘fall through the cracks’, and that this could leave aspects of the operation unregulated: *‘The other [issue] is there is no identified inspectorate responsible for the holistic safe operation of the site; it’s fragmented and the day to day operation isn’t inspected’* (20YR, 03/2017). Many others expressed this desire for a ‘holistic’ or ‘consistent’ approach; comments were made by both proponents and opponents of the single regulator idea, and across all types of stakeholders, including MPs NGOs, residents and industry. Calls for a holistic and consistent approach to SGD governance is also being made by scholars, for example Lozano-Maya (2016) and Konschnik & Boling (2014).

The industry response was quite interesting in that each industry participant had a different view of a single-regulator framework. Participant 10NI claimed that to create a single regulator for exploration is like *'using a sledgehammer to crack a nut'* (10NI, 06/2017), however they did suggest that during production and in the scenario of a more commercialised shale industry that:

'it makes sense to put some of this regulation in the same place so the commercial side of it, the licensing, the compliance of the environment the compliance of Health and Safety, some of that could be put into one place. So exploration is not an issue but production, economies of scale, may be beneficial for everybody' (10NI, 06/2017).

This comment may indicate that this interviewee from industry envisages the SGD industry becoming quite large, the scaling up of SGD will require a scaling up of regulators however relating the single regulator idea to economies of scale may suggest that his perception is that the production will be greater than the current regulatory framework can manage. It should be noted that this was not expressed by any other industry participant, and indeed not directly expressed by this one (10NI).

Another industry participant believes that a single regulator, one which includes petroleum engineers, would improve efficiencies for the industry and further that *'initially it would definitely help to bring them all under because there is so much lack of education across the regulators and we're having to provide the information all of the time'* (11YI, 07/2017). He further points out that although the HSE have some technical expertise, *'the drillers are only a small part of the jigsaw puzzle'*, this suggests that he believes expertise is missing here and with regards to the EA *'I said to the EA if they had some petroleum engineers in their organisation we wouldn't be having this conversation'* (11YI, 07/2017) expressing frustration at the lack of knowledge within the EA. The same industry participant does, however, rate the Local Authority planning department and The North York Moors National Park authority, citing that because the conventional gas industry has been operating in Yorkshire for over twenty years, the planners in the region have the experiences dealing with the industry, he further suggests that bringing these expertise together will enable the regulator to *'handle all the ones that come through in a more efficient way, as opposed to somebody having to go back to square one to say what is a well'* (11YI, 07/2017). As this industry participant is from Yorkshire, it is possible that he views the planning authority to be efficient due to the fact that NYCC approved his company's application for SGD, it is possible that Cuadrilla in Lancashire may not agree as their planning application was initially rejected by LCC, as discussed in Chapter 2 (section 2.4.4). However, as Cuadrilla declined to be interviewed it is not possible to confirm this. Another issue, raised by one participant, an MP, in response to the question regarding a single regulatory approach to

the industry (see appendix 5): *'I can see that, that's not to say you wouldn't have the local authority involved at some level, in terms of being a statutory consultee for example'* (01YM). This suggests that should there be a single regulator, the consultation process may be avoided as this is part of the planning application process. This would mean that local communities would not have an opportunity to object.

From one perspective, having petroleum engineers and technical experts within the regulatory network does seem to be a solution to one aspect of a 'gap in knowledge of the regulators' as pointed out by some of the interviewees. Currently regulators tend to be civil engineers or environmental specialists and hold a broad range of skill sets, in the case of the EA usually related to flood or water management. As expressed by 11YI, the North Yorkshire County Council planning department already has experience of onshore gas production and therefore does not have to acquire this knowledge from scratch, another local authority, with less experience, may have to train existing staff or employ consultants. Similarly, with the EA, as stated by 11YI, there is an expertise gap due to a lack of experience with the industry, which requires further training and resources. Having these skills in situ within these agencies may suit the industry and the agencies, however it would not satisfy those desiring a more holistic approach, as mentioned above, one of the advantages of having the EA as a regulator is that they do have a holistic view of the area, which includes the local environment and are therefore better suited to determine any environmental impacts of SGD, or any other industrial activity. In other words, the holistic view is one of the expertise of the EA.

The third industry representative interviewed does not believe a single regulator is appropriate in any stage of production:

'Personally, I don't think you should merge regulators, for instance Health and Safety used to be part of the Department for Energy and they separated those for good reason. Different agencies have different expertise and that's the way it should be. It might be easier to have a single regulator but that's not what is important here, different regulators have expertise in different areas. If we merged them into one department for extraction industries, they would split away from the other responsibilities, if they focus on one thing then the right questions may not be raised' (12NI, 07/2017)

The last point raises the question about whether it is preferable for a regulator to be specialised on different aspects of their remit, for example the environment. One resident worries about the lack of expertise in the EA by stating that regulators *'are just having a spell on fracking today and then hopping off to look at a forest the next day'* (14YR, 12/2016). However, this could also be viewed as the holistic regulation of the environment; a regulator with an understanding of forests, floods, ecology and SGD. If the 'environment arm' of a single regulator only focuses on

SGD, then their knowledge of other aspects of the environment may become diminished. Similarly, with the HSE, a holistic perspective of health and safety at work, well design from the offshore and other industries, and perhaps other duties may be of benefit rather than a negative. It is perhaps not possible to have both holistic and specialist regulators.

In response to a question regarding at which level the industry should be regulated, one MP (01YM) points out the work involved by the MPA regarding mitigations in North Yorkshire, although he does not explicitly state which mitigations he is referring to, it is possible he is referring to minimum set back distances for well pads, number of well pads and traffic management plans.

'I think the mitigations North Yorkshire put in in terms of the mineral and planning policies need to be absolutely recognised if we're going to take away from the local area because this is going to be ruled out at scale, so you're getting hundreds of applications on a monthly basis, how are you going to cope with that? I just don't understand. But I wouldn't let that happen if the protections we've already put in place weren't put into national policy. So for me you would need to say 'ok we'll have that as long as national policy says only ten well pads per 100 square kilometers' for example and access to A roads and this kind of stuff so at least there is a correlation and a cooperation between Northallerton and Whitehall. If it could be determined locally great, if they had the capacity or developed policies around that to do it from Northallerton then I just think it would be too onerous' (01YM, 08/2017).

This links to the comments made by 10NI (pg12-13) regarding economies of scale, suggesting that possibly this MP also believes that the industry will grow to an extent that will not be practical for local authorities, or possibly other agencies, to manage on a local level, and that at such a time a single central regulator will be required.

Other points raised by a variety of stakeholders with regards to the question of a single regulatory agency for SGD include the question of scale. As touched upon above by the Yorkshire MP, the point was further made that if the industry is going to develop into a large scale one, i.e. hundreds of applications in a given area, then a single *'independent regulatory authority for fracking'* (03YM, 09/2017) is appropriate. She also points out that independence is crucial (for any regulator) and highlights the importance of the 'level' at which the regulation is implemented, for example locally or nationally. The other point, and perhaps even more important that who regulates at which level, is the requirement of having 'experts' regulating, as expressed by this NGO participant: *'yes maybe if it has the right staff because ...I think if you had an ecologist who ... knew as best as an expert that you could advise on them all [aspects of ecology] and ensure a consistent approach across them all, then that would be a big advantage from an ecology side definitely'* (07YN, 10/2017).

In addition to highlighting the need for experts in any single regulatory agency, this participant also highlights the need for a 'consistent approach', as she has been involved in the planning applications of SGD sites as a statutory consultee, this may suggest that she feels the approach is not currently consistent, however there is no evidence of this, perhaps due to the low number of applications to date. A consistent approach to the enforcement of regulations is of course an important factor, however there is no evidence, or indeed suggestion by the stakeholders interviewed in the course of this research that the EA or HSE are not consistent. There is however suggestion that the applications of the planning aspects of the regulations are not consistent, based both on experiences with other planning applications not related to SGD and related to SGD. So two very important points are raised here: competent staff, experts in their field and consistency of approach. The former could be true and implemented in either framework of regulations, i.e. in a single regulatory or multi agency regulator, however the second point is more achievable and perhaps likely in a single regulatory regime model.

An intriguing point is raised by one of the industry participants with regards to the single model. From his perspective he feels like there is a lot of repetition in what the SGD companies have to provide to each agency, and further that because the regulatory agencies do not want to seem ignorant of aspects of the SGD operation, that they ask questions outside their remit:

'I now see the need for the next few years, to bring it under one body because the regulators are under so much pressure and scrutiny that they not only concentrate on their own remit but want to know what's going on outside, so you might get the environment agency wanting to know about how the seismometers are managed which is something more the OGA might be interested in, I'm just giving example.....but they just don't want to be asked a question they don't know the answer to. All of those questions take a lot of our time, providing answers to them, and some of the time we don't know where they're coming from because it doesn't seem to be within their remit. For fracking, the remit of the environment agency is rather small, it is make sure the frack hasn't gone beyond the permit boundary. That's a very small remit but they are interested in everything we do' (11YI, 07/2017)

As highlighted in section 5.3.1, some stakeholders do perceive the regulatory agencies as unfamiliar with aspects of the operation of SGD, and indeed it is reasonable to expect the agencies to want to understand the whole operation in order to determine potential risks and hazards. The last part of this interview extract is rather curious though as the EA do not have a 'very small remit' with regards to SGD, rather they probably have the largest 'remit' of all the agencies, both spatially and in terms of the number of aspects they are required to regulate (air, soil, water, biodiversity etc). It is possible that as discussed in section 6.2.3 that this Industry participant is specifically referring to the frack aspect only and not SGD as a whole. In which case

the EA's responsibility during the frack (2-3 hours) would indeed be to track the frack, although it is difficult to see how they could 'make sure the frack hasn't gone beyond the permit boundary'.

This industry participant has clearly given this issue much thought, he has over time changed his mind regarding a single regulator: *'If you'd asked me six months earlier I'd have said no it's fine the way it is,'* (11YI, 07/2017). He has since reached the conclusion that as the industry scales up that some efficiencies could be made, he defines 'efficiencies' as:

'When you move from one region to another you're having to re-train the planning people, you're having to retrain the permitting people, you're having to retrain everybody, 'oh I'm scared I don't understand this', well we can't give twenty degrees overnight to one individual. The width of knowledge across our industry is colossal, geology, geophysics , petro physics, production engineering, drilling, well engineering, completions, power generation. That's a massive width of skills and experience, you can't throw that into one person quickly to approve planning application' (11YI, 07/2017).

What is most interesting about this statement is that all of the skills cited are clearly industry-focused skills rather than the skills one would expect other stakeholders would rather the planners and regulators have, such as environmental scientists, air and water quality specialists, or biodiversity experts etc. rather he highlights the lack of, for example geophysicists and petro physicists, and other skills required for the production of oil and gas rather than the skills required for protecting the environment, human and animal health or even local economies. In other words, his view is very industry centric. That is not to say that other stakeholders do not have their own centric view of the skills required for a regulator, they do, for example local wildlife NGOs are unsurprisingly wildlife-centric. This does highlight the need for a wide and holistic sense of the operation of SGD rather than any one perspective. This is difficult to achieve as to be all things to everyone might seem a somewhat impossible task. This industry participant does seem to understand this, at least from the planning authority point of view, perhaps because the operator has the most to do with the planning authority than any other regulator at the early stages of development, he states that: *'the industry, who might be good at drilling wells and producing gas, they don't understand what the poor planner has got to contend with...its a science in itself, there's so many planning conditions and regulations'* (11YI, 07/2017).

He concludes by wondering if the best solution is to have a single regulator during the initial exploratory phase and during the production phase bring it back to the multi regulator system. This is in stark contrast to other stakeholder views, even other industry views. Again, this is something he realises, that there are differing views regarding a single regulator amongst his colleagues and the industry, *'Now I'm in that place, and many of my friends and colleagues aren't in that place but they probably it comes back to the power of the assessor. I think I'm the only*

person who has been through the whole process, from beginning to almost the end' (11YI, 07/2017). At the time of the interview, only Third Energy and Cuadrilla had been through the whole process of environmental assessments and planning applications, Third Energy's application had been approved at the county council level and Cuadrilla's had not, therefore he is suggesting that he, and Third Energy, are the only ones with this whole experience. Cuadrilla declined to be interviewed, it was therefore not possible to ascertain their views regarding this or the regulatory regime as a whole. It might be expected that they would be less keen on the multi-agency approach, or at least the local planning application part of the process as they were rejected at this stage and were required to appeal, successfully as it turns out, this is discussed further in section 5.4.2.

Other participants in the research had a range of different views regarding a single regulator: *'The obvious answer to me would be, yes, one agency will be better, provided they had ethics behind them and the right resources'* (15LR, 12/2016) and she further suggests that the EA would be the obvious agency as they are the *'major player'*. Interestingly she does not seem to be advocating a new single agency, rather one of the agencies taking the responsibility for regulating SGD, she further clarifies that *'the decision for fracking should be local they cannot be made by a national agency or body because there are not aware of what the impacts will be at a local level'* (15LR, 12/2016). She therefore seems to be suggesting that if the decision to develop shale gas is made by local government, then the regulatory responsibility should then be passed to a single national regulator such as the EA. She does however, also point out that although a central 'essential framework' is necessary for monitoring and permitting, that it is equally important to take into account local variances such as water levels, air quality and background noise levels which will vary from site to site, essentially these are baselines.

Some other participants also agreed that the EA was, or should be, the 'major player' including the MP proponent of SGD, although he is not in agreement regarding having a single regulator, *'I think the Environment Agency are naturally the lead agency and I think it makes sense to have a forum or some kind of body that allows those agencies to come together and talk about some of those issues they have'* (01YM, 08/2017). He further describes this as 'cross-agency working' which he believes is preferable to creating a new agency and putting them in a 'fancy new building in Whitehall' which would not only be expensive but perhaps unnecessary as *'we don't even know if this stuff is going to come out of the ground yet'* (01YM, 08/2017). These points are all valid, the EA and HSE already claim that they are working cross agency with regards to SGD, and perhaps all that is needed, certainly at this stage, is a forum for communication between the HSE, EA, OGA and planning authorities. With regards to the final point, there is no sense in creating a new agency if it is not certain that SGD is going to be technically and/or

commercially viable.

Another perspective is that expecting a new single regulatory agency to be some sort of 'gold standard' agency that would do much better than the existing ones, and further that they would suddenly have the respect and trust of all of the stakeholders involved is probably quite unlikely. A new agency would need time to gain trust, and as trust is one of the biggest themes running through this study, a new agency is more likely to take a step backwards with regards to regulatory effectiveness and trust. The staffing of this new agency is likely to come from the existing agencies, and as pointed out by (01YM) above, a bespoke SGD agency focusing on this industry alone means that the agency would lose the bigger picture holistic view of the process, for example the wider environmental concerns. Further, if, as some have suggested, the monitoring is mostly a paper exercise with industry sending weekly reports to the regulators, then there would be no noticeable change with regards to regulation between a single regulator or a multi-agency one, except for perhaps one report per week rather than multiple.

Finally, one industry participant looked at this from a commercial perspective with regards to the opportunities a single regulator may afford to the industry as a whole:

'We just basically can't be complacent and in fact maybe a one regulator model as we move forward into something of a larger scale would make a lot of sense because then you could look at the broader benefits of doing certain types of, apply certain types of rules across the regulatory piece, rather than piecemeal fraction, so I think we have all the tools, we just need to keep that active and alive, [that] is the challenge' (10NI, 06/2017).

He further states that implementing new regulations and adopting new technologies could be 'quite environmentally beneficial' (10NI, 06/2017). This does make sense because if there were one regulatory body advising the industry as a whole, then the message would likely to be consistent, whereas in the multi-agency approach there may well be conflicting messages and potentially even counterproductive messages and advice being given to industry. Furthermore, if, for example, the regulator requires an adoption of a new technology then this would be across the industry, therefore all operators in England will have the same cost burden. However, the problem with this is that they are not just competing with other companies under the same regulatory framework, they are competing with companies globally, some of which have low regulatory standards by comparison. Whilst Vogel (1997) found no evidence of either regulatory laxity or regulatory subsidy when looking into competitiveness and regulatory burden in the telecommunications and finance sectors (in Britain and Japan). Vogel further predicted that in the future 'national authorities will continue to have difficulty in shifting regulation to the international level' (Vogel, 1997, pg 169) however over the last 20 years since this study,

globalisation and industry complexity has undoubtedly increased. Goldthau (2016a) further warns that due to the growing complexity of some industries, and uses both finance and energy as examples, this leads to the worrying situation that only the industry themselves know how to regulate themselves effectively and that 'this opens the door for vested interests to effectively lobby for pro-business policies or outright regulatory capture' (Goldthau, 2016a). This leads to the question of the level of self-regulation within the SGD industry.

In summary, the stakeholder perspectives on a single regulatory agency are not partisan. Both anti and pro SGD participants raised many advantages and disadvantages, indeed this was possibly the interview question for which most participants attempted to be as objective as possible in their response and explored the different options including pros and cons of each option. The strongest arguments in favour of a single regulator include that some participants believe a single regulator would be more authoritative and provide a more holistic view of the whole SGD operation including the impacts on the environment and human health. The arguments put forward against a single regulator include in the fact that creating a new agency would simply divert the expertise away from existing regulators, and further that in time this agency would likely divide into the same groups as already exist, i.e. an HSE section and an EA section, thus making it a pointless, and expensive, exercise. Interestingly research participants viewed the 'independence' of single agency in different ways; some viewed a single agency as easier to manipulate by Government, other viewed it as more likely to be independent and less likely to be influenced.

6.4 Stakeholder views on the potential for the shale gas industry to be self-regulating

Opinions regarding 'self-regulation' vary from no self-regulation should occur to feelings that there should be a balance of self-regulation and external third-party regulation. A number of participants reflected in the interviews on the current regulatory regime, many of whom believe is currently very reliant on self-regulation by industry and not enough scrutinisation by the regulators.

As highlighted in section 2.5.4, the implementation of Traffic Light System (TLS) for monitoring seismic activity is seen as an example of self-regulation of the SGD industry, including in a report

commissioned by Cuadrilla and the UK Government (Green et al, 2012). However, the ‘red’ events between October and December 2018 caused by Cuadrilla to cease operations. This could be viewed by some as effective self-regulation, as ‘red’ events were identified, and operations closed down. The company subsequently requested a relaxing of the regulations. The response was for the UK Government to issue a moratorium on the industry signaling a mistrust of the industry to manage operations within the permitted guidelines for seismicity. Although, as stated in section 6.2.1, there may have been other motives for the moratorium as a general election was about to be announced.

This section will examine these different viewpoints, explore the reasoning and beliefs behind them and further investigate the level of which these beliefs are mere perceptions or reality. This issue of self-governance is discussed in Chapter 2 (section 2.3), and addressed by Stoker (1998), and who states that while self-regulation can be good, however there are critical issues including issues with accountability and identifying who is responsible, which in turn can lead to blame avoidance.

This section will begin with those opposed to self-regulation, then move on to the ‘mid ground’ followed by the industry (plus one pro fracking resident) perspective. Further, this section will also look at some of the reasons cited and evidence put forward to support the different views. The response from the agency participant for questions relating to self-regulation were not answered directly, rather an explanation of the existing process was offered, this will also be examined.

6.4.1 Perspectives opposed to Self-Regulation

Those who believe that no self-regulation should occur included NGO participants and an anti-fracking MP. Views are mostly related to lack of trust and faith in the shale gas industry to accurately and fairly regulate themselves: *‘I have no faith in self-regulation because that’s about protectionism so it should be through a proper statutory process, there should be regulation’* (03YM, 09/2017). A similar comment was made by this NGO participant *‘you can’t just rely on them to regulate themselves because it’s also in their own interest to hide things if things go wrong’* (05LN, 03/2017) suggesting that the industry is not trustworthy enough to accurately report any issue, as also echoed by another NGO representative *‘it’s opening the doors to things not being recorded correctly’* (06LN, 03/2017). These three comments seem to also signpost a lack of trust in industry in terms of a belief that they will ‘hide’ things which may go wrong or obfuscate issues. Other stakeholders directly cited corruption and conflicts of interest in

response to the question about self-regulation:

'any type of development that would regulate it- would be quite prone to corruption almost, it needs to be external and independent and not linked to specific [industry]. Whilst you want local people, experts in the area, to feed into what might look like a check list, I think it needs to be higher than that to be the regulator so then you [avoid] conflicting interests in, government led almost, Environment Agency or Natural England that kind of level I think' (07YN, 10/2017)

This NGO participant clearly advocates for regulatory bodies overseeing operations rather than a reliance on self-regulation. However, as discussed in section 5.3, many other stakeholders do not trust the regulators either. In terms of regulating the industry, it is possible that some stakeholders simply do not support the industry or the regulators, as they are seen as an extension of the industry themselves. As expressed by the journalist participant *'The way the industry has been set up it is to self-regulate, and I don't think people trust it, whether they do a good job or not is not the point its whether it's acceptable to the population'* (23NJ, 01/2017). This suggests that unless every aspect of every operation is monitored by a regulator deemed acceptable, then the industry will simply not be accepted. She further points out *'People like Mark Menzies [Lancashire MP] have talked about wanting men in yellow jackets on the grounds all the time, well somebody is going to have to pay for that, these people don't come cheap, and they're not going to do it for nothing'* (23NJ, 01/2017). This solution is clearly not practical; indeed, no industry is regulated to this extent, finding the correct balance of external regulation to self-regulation is the key.

Whilst some industry participants in this research point out that other industries manage to self-regulate perfectly well, such as the nuclear industry and the conventional oil and gas industry. Others have pointed to those industries as an example of self-regulation failures, although neither of these industries wholly self-regulate, the perception from some stakeholders is clearly that they do. The next paragraph looks at how participants have framed these examples as illustrations of self-regulatory failures.

Some have stated that as self-regulation is not 'allowed' in industries such as building and construction and therefore *'why should something that's potentially far more dangerous to human beings and the environment be allowed to regulate itself?'* (17YR, 02/2017). Many local residents who participated in this research, such as this individual, draw upon experience in their own industries. This interviewed participant works alongside construction as an electrical engineer. It is true that the construction industry does not wholly self-regulate, there are internal compliance 'officers' to ensure that they are complying with the regulations, at least in larger organisations, however, when for example a builder is building a house or an estate, it is

visible to other stakeholders such as local residents, they will know if there are any breaches of regulation more easily than a less visible operation occurring underground, such as gas extraction. Further, as these breaches in regulation will incur a financial cost there is the incentive to do it within regulations in the first place, further any problems with builds which are discovered in the future may result in litigation which will also be costly for the builder. In other words, there is a financial incentive for the construction industry to get things right the first time and within regulatory guidelines to avoid additional costs. Using the example of building a home, a person or people will be living in that home at some point and short cuts or things not done properly will become apparent. This is not the case for a SGD site, stakeholders other than industry and agencies are not likely to be present on site to witness any results of any breaches of regulations, and this is clearly the case with the part of the SGD operation which occurs underground.

Other interviewees used existing onshore conventional gas development as an example of self-regulations failing and gave examples such as an incident where the Environment Agency discovered that *'they [Rathlin Energy] didn't have water monitoring equipment, or air monitoring equipment which is part of the regulations that should be in place or adhered to'* (18YR, 02/2017). A further example by the same participant regarding the same company relates to the incident of the wrong rig being used and expresses that if self-regulation was working as it should, the company would not have been using the wrong type of rig in the first place. She further points out that if the HSE had checked this beforehand, the incorrect rig would never have been in use. This supports views that the industry should have greater scrutiny and monitoring from regulators at the start of any operation, to ensure the adherence to the regulations from the start. If this example is correct, then this did not happen in this case. This incident was likely to have been costly for Rathlin Energy, in terms of organising resale or disposal of the workover rig and purchase of a new one. Perhaps this costly mistake is a way of insuring that this kind of incident does not occur again, potentially highlighting the need for better self-regulation and internal checks. The consequences of using the wrong rig for this activity would most likely be in terms of worker safety so in one respect the company is extremely fortunate that this issue was reported to the HSE by this participant, otherwise could have resulted in a work-related accident or death.

Participants also draw on examples outside the oil and gas industry to point out that self-regulation is ineffective in a whole host of sectors, examples include the BSE crisis, regular health scares and child welfare issues: 'how is that we can't actually trust the guardians in almost any sphere, and it's really very sad that it should be like that, but the record on self-regulation across the board in this country is pretty poor, we've been let down dozens of times, seriously let down

so many times' (21YR, 01/2017). This is perhaps condemning the regulators across the board in addition to the self-regulation; perhaps this is more of an argument for stronger self-regulation, self-learning and stronger external regulation. This range of examples may also serve to highlight that something is wrong with the foundations of how we regulate, in most of these cases regulations are based on risk assessments. As discussed in Chapter 2, assessing risk is highly subjective, a potential event may be considered by one individual as high risk and another low, or in terms of likelihood; one may consider it likely and another not. Another aspect of this is usually a cost benefit analysis, certainly when forming policy and then further regulation. How much of the risk is lowered because of the cost? Furthermore, who is qualified to ascertain the level of risk? Are they the right people, generally it is the industry themselves, they do not consider the frack, for example, to be risky at all, whereas other stakeholders consider it to be very risky indeed.

Another resident, a proponent of self-regulation, articulates that *'there is no doubt industries should as far as possible be self-regulating however they should be subject to close scrutiny, some of that can come from within, but some of it must come from without'* (22YR, 01/2017) and further points out that where hazards are involved, in any industry, that they should be subject to very close scrutiny. Similarly to above, this feeds into different perceptions of hazards, and where clearly defined hazards are present then there is a strong consensus that both self-regulation and external scrutiny should be occurring. This leads on to the next category of comment regarding self-regulation, that there should be a little self-regulation.

One MP who questioned BEIS about the level of self-regulation in the oil and gas industry and reported that *'the answer you get back from the departmental officials at BEIS (used to be DECC) is that we've always done it that way and this is how oil and gas exploration happens in the UK is that there's a lot of self-regulation, it's what happens in the North Sea.'* (01YM, 08/2017). As explained in section 2.6.1, the offshore regulations in the UK were actually originally copied and adjusted from the onshore regulations and therefore not sufficient justification for the acceptability of them, further given the incidents which have occurred on offshore developments (discussed in section 6.2.1) this should be an argument against, not for, self-regulation. Furthermore, just because something 'has always been done this way' is certainly not justification for continuing anything. This MP does state that a little self-regulation should be occurring but that given that:

'there's certainly been enough evidence to show that things can be done badly.... I think we should be regulating them and charging them for the privilege. And I think we've got the capacity to do that, I don't think we've got the framework to do that, we've just got

to add the capacity which equals cost. Some of that money has been paid already, just it needs to go into a different sequence for me' (01YM, 08/2017).

The issue of cost is addressed further below. The issue of framework is further discussed above in section 6.3 and below in the comment about risk-based regulations.

Returning to the issue of trust, clearly some MP's trust the SGD industry enough to self-report any issues experienced *'I know the industry self-regulates to a point, and that has to happen, you want to encourage them to self-regulate and to report if things are going wrong which they do but the public still had to have trust, faith, spot checks and that it's not just left to the industry to do it. I don't think that would be very good'* (02NM, 10/2017). However, this MP states that the process is not just left to the industry alone. Whilst this MP also points out that the industry should regulate themselves for their own benefit and that *'self-regulation for the industry makes financial sense'* (02NM, 10/2017), the issue is not just about the extent to which the industry monitors, or 'spot checks', the issue is about who generates these data. For example, the well integrity data is produced by the operator and emailed to the HSE on a weekly basis and this fulfills the requirement of the regulations for monitoring the well integrity on site. The HSE may never visit the site to check these data are accurate. One industry representative stated that it would be very difficult for them to forge, or manipulate these data, however because of the lack of trust the local residents have in industry this is viewed as a potential weak link. Similarly, with environmental monitoring, many believe that because data are produced by the industry, and indeed some of the monitoring is also conducted by industry, that this leaves the potential for manipulation and obfuscation. Another industry representative points out that self-regulation is important for the operator to monitor potential issues which may have cost implications, including environmental remediation costs, however in terms of gaining trust from other stakeholders, external monitoring would possibly go a long way to reassure those who do not believe the industry is trustworthy. Whilst this MP believes *'the four main companies involved in shale gas exploration at the moment are highly responsible ... that doesn't mean you can't have operators like you have in America, and there are some very bad examples from America'* (02NM, 10/2017). She then goes on to state that we can 'learn' from the mistakes made in the US and that we have a regulatory regime that we can 'celebrate'. There is little evidence that lessons have been learnt from the US experience, other than regulators stating that many of these issues could not have, or will not, occur here. This evidence is still the information that the residents draw on and discourse such as this is unlikely to appease them or make them feel safer and free from risk.

6.4.2. Perspectives favouring a balance between regulation and self-regulation

The next section will examine the views of those who have expressed that a balance of external and self-regulation is optimal, as considered by Stoker (1998) in his observation of governance dilemmas and critical issues. As expressed by this industry participant, there is a balance between self-regulation and a full inspection regime:

‘There’s always that fine balance between self-regulation and regulators inspecting everything that’s going on all the time, so... the idea is really with our regulatory structure is that we are risk based, we identify the risk and we manage those out and then we’re left with the mitigating components and the industry then has to deliver against the permits and the consent block and follow the rules. The industry has a role to play and then the regulators are checking for compliance’ (10NI, 06/2017)

Clearly, as discussed, expecting the regulators to monitor ‘everything that’s going on all the time’ is not practical or cost effective, the question is rather regarding the balance and whether it has been appropriately achieved. A further explanation of the process articulated by one of the regulators in a written response:

‘It is the operator’s responsibility to comply with the conditions of their permits, including any monitoring conditions. Operators must undertake any environmental monitoring outlined in the permit, which we then examine to ensure that they are abiding by their permit conditions. In some cases, depending on the risks presented by a site, we may undertake extra monitoring ourselves.

The environmental permit sets out the pre-operational and operational monitoring requirements we expect of them. Baseline monitoring of groundwater will be made a pre-operational condition of the environmental permit which the operator must comply with. Operators are required to submit baseline monitoring data to us prior to shale gas exploration taking place. We will review this data and if we are satisfied with it, we will allow activities to commence.

Operational monitoring may include, but not be limited to: conditions on groundwater, surface water, emissions, safe storage of waste, noise and air pollution caused by site operations’ (09NA, 07/2017)

All of these interview extracts clearly put much emphasis on the ‘risk-based approach’ and one industry representative (10NI) states that ‘we identify the risk and we manage those out’. As discussed in chapter 2 (2.3.1) other frameworks are preferable for making decisions regarding risk which include decisions about due process, good governance, sustainability and responsibility (Sovacool & Dworkin, 2015).

The concern of many stakeholders with regards to environmental monitoring is that the industry would be doing this monitoring of this themselves; this is confirmed by the regulatory agency

(09NA) above in the statement ‘Operators must undertake any environmental monitoring’. It seems therefore as if the EA are responsible for identifying the monitoring requirement, from the operators’ own risk assessment, and then requiring the operator to also carry out the monitoring. There are potential issues with this, firstly if the operator does not identify the risk in the first place the requirement to monitor may never end up in the permit and therefore be missed entirely. The operator may identify the risk but, not consider it to be high, this may also result in the issue not being monitored. Secondly, there may be an incentive, and this is certainly the perception of some of the research participants who are opposed to SGD, that the industry will not monitor these risks effectively even if identified.

A further issue regarding this approach, once the risks are ‘managed out’ and the operator is left with the ‘mitigating components’, is how (and who) to decide the best way to mitigate, and ask if these mitigations are acceptable to all stakeholders and whether there any consultations of these mitigating aspects. Jasanoff (2019) suggests wider public engagement at an earlier point in order to reduce unintended or unforeseen consequences, or at least with wider engagement these are more likely to be recognised. See discussion on moving from ‘technologies of hubris’ to ‘technologies of humility’ in Chapter 2 (2.3.1). Wider public engagement at an earlier point is also termed ‘upstream engagement’, although, as Corner et al (2012) warn upstream engagement ‘should not be undertaken as part of an attempt to: ‘sell’ new technologies; to ‘legitimize technological choices’; or to ‘close down’ public contestation about new technologies (p 456). There are many benefits to carrying out upstream engagement, especially for new technologies, as it provides a critical and unique window of opportunity for eliciting the concerns and perspectives of wider society.

What constitutes a ‘good balance’ is possibly defined slightly differently by different stakeholders. A good balance for some is one regulator being more ‘hands off’ and one more ‘hands on’ as suggested by one industry participant:

‘The HSE are fairly hands off, they’re not a hands-on regulator and we have one of the best safety records in the world, across all of our sectors. Whereas the Environment Agency are more hands on and we have that kind of interesting balance, and both are equally effective, which is quite intriguing, so the industry does have a role to play’ (10NI, 06/2017).

Stakeholders are possibly likely to be defining a good balance between self-regulation and agency regulations as across the board, as opposed to by agency. For example, regardless of which agency is regulating there is (or should be) a balance between inspections and self-

reporting, or external monitoring and industry monitoring. In other words, one agency's under regulation does not balance out the other agency's over regulations of an operation. Local resident participants would perhaps rather see a balance in both agencies. Interestingly the industry participant (10NI) states that 'both are equally effective', this is possibly because of the nature of the responsibilities of each agency, for example environmental monitoring perhaps requires more active participation from the Environment Agency than well integrity monitoring required by the HSE. However, from the public perception perspective 'hands off' regulation by the agency is not considered appropriate or effective. Given the level of mistrust of both the SGD Industry and the regulatory agencies (as discussed in Chapter 5, sections 5.3 and 5.4) perhaps a solution is to employ more 'independent regulators', however these would need to be wholly independent of both the industry and the agencies to gain trust. Furthermore, the issue of funding, and by whom is always going to be an issue. One industry representative mentions in their interview that there have been '*lots of conversations about the role of an independent well examiner in the past and how that role functions*' (10NI, 06/2017) suggesting that they are aware of the lack of trust and that an independent regulator may be a solution. This participant goes on to explain that the HSE 'stick by the rules' and that therefore additional independent regulation/inspection is not necessary and further that provided there are '*responsible operators and supply chain and competent regulators*' (10NI, 06/2017) that there should be no requirement for independent regulators. This of course is true, in an ideal world all involved would be competent, trustworthy and capable, therefore no regulation would be required at all. In the real world, this is simply not the perception of other stakeholders, as one resident participant from Lancashire, a proponent of a 'good balance' states:

'Obviously they [Cuadrilla] should play the biggest part, Cuadrilla will have the best intentions, they'll produce reports and stuff like that but there'll be short cuts for expediency, they've already tried to do it, it's not very good for us when we've seen what Cuadrilla have tried to do here, they've tried to increase the noise levels, to something that's suitable to them, what they've actually said is we'll have to spend another seven million on noise attenuation. So you bloody well should! Seven million pounds is nothing to you, you're going to make billions out of this but to us as residents ... it should be very much the industry, they should have bonds so if anything goes wrong, they're covered with whatever' (15LR, 12/2016).

Using the example of the regulation of noise level, a contentious issue in Roseacre at the time, the interviewee talks about how Cuadrilla initially offered to put up sound barriers to mitigate the noise levels at the proposed SGD site in Roseacre, but later withdrew the offer due to cost and a hostile reception from the local community. Then in response rather than pursue the noise mitigation strategy they attempted to get the regulations changed regarding permitted levels of noise. This story provides an example of how the residents see the actions of industry, they will try and 'move the goalposts' or change the regulations rather than abide by the regulations. This

is also evident in Cuadrilla's efforts to change the regulations regarding the earthquake traffic light system, once activities commenced and it was realised that these regulations are rather constricting and requires a regular halt in operations.

Some participants of the research, mainly proponents of SGD, have proposed that the operator should provide data and that the regulator should check these data, as expressed by 12NI. As explained in section 2.5, the operator sends weekly reports to the HSE, the HSE check these reports and would only intervene if they identified a problem. Most of the industry participants regarded this as a preferable way of operating, preferring the 'hands off' approach afforded by the HSE compared with the EA. The most obvious issue here is the perception of this to other stakeholders such as residents. Many residents, as discussed before do not trust the SGD industry to provide accurate data to the agencies, even though in practice this would actually be very difficult to fabricate, according to the industry participants. Importantly, the most vulnerable data in terms of potential for fabrication is the baseline data; it is important that these data are accurate, because otherwise it is difficult to prove any changes in the environment, for example air or water quality. Another participant, a proponent resident, thinks that initially the monitoring by the regulators would be more intense than as the regulators become content that operators know what they are doing then they would not require as much intervention or supervision.

In summary, the balance of the different perceptions from the participants of this study are that more participants favour a regime with less reliance on self-regulation, the notable exception to this is the interviewees from the SGD industry, who favour more self-regulation. Stakeholders at different ends of the spectrum do not have a wildly different view of the extent to which the SGD industry should be self-regulating. The industry and proponents believe a little less oversight is required than is currently proposed, certainly by the EA. The local residents and opponents of the SGD, while ideally desiring a 24/7 approach where regulators are watching and monitoring every move, nonetheless understand that this is not practical. They do not wish for the industry to be entirely self-regulating and perceive that if the operator is currently monitoring themselves, 'marking their own homework', providing the data to the regulators and producing the baseline data and that this is a step too far. Many participants are satisfied that operators will self-monitor on an ongoing basis and provide this information to the regulators, but feel this should not be the only data checked or the only monitoring that is done. Baseline data should be done by the regulators and not the industry, perhaps even by an organisation independent of both.

6.4.4 Best Available Technology (BAT)

Similarly to other industries, SGD operators believe that using BAT will negate or mitigate the need for regulation. For example, this operator uses the example of technology detecting fugitive hydrogen sulphide:

‘Obviously fugitive emissions - hydrogen sulphide, if it’s not combusted properly in the flare, all those kind of things could be pollutants and every site might have a range of issues that would have to be addressed but though applying the BAT and monitoring the performance of that and through reporting any issues [that] should they arise then having the right method statements for addressing it, you should effectively address that, this is not just about the regulator looking at everything and making sure its running, it’s about the operator also delivering what their permits say. So it’s that web isn’t it?’ (10NI, 06/2017)

The use of BAT, which is mandatory, or other new technologies depending on the type and cost is of course a sensible way forward; another example is Green Completions (Litovitz et al, 2013). Methane is the product in the case of SGD, however not all operations adopt technology such as Green Completions because of the cost involved, even though it helps reduce the loss of the product the company is producing and selling. This could of course indicate that the losses of methane are not great, or at least not great enough to justify the purchase of Green Completion technology. As with any new technology, initially the costs are greater to cover the R&D costs and as the adoption increases the price reduces, however it may be prudent to regulate or legislate the use of Green Completions from the outset to reduce the methane emissions, this is a legal requirement in some states in the US. Mandatory measures such as these may also help to placate the local residents, at least on the issue of fugitive methane and other potential fugitive gases.

Most of the interviewees of this research, when asked if there was any technology or practices that would make them less opposed to shale gas said that there was not, and usually then moved on to talk about issues such as the use of fossil fuels generally and climate change.

6.4.5 Operator Reputation

In the context of self-regulation one industry participant pointed out that the reputation of the company is paramount and that without that reputation they would not be able to exist as they would not be offered PEDL licences (explained in chapter 2), the point he is making is that it would not be worth their while to falsify data or not adhere to the regulations. This ties in with SLO and is discussed in section 5.2.

'It's up to us to follow our own company standards as well as the industry standards as well as the UK regulations. We can't go below that. We just can't, people don't appreciate how much reputation means, with a poor reputation you don't get your licenses, you don't get your planning permissions, you get throttled so why would we lie? Do anything to hurt our staff? Why would we do anything to hurt the public or the environment? And yet we take an awful lot of unfair abuse' (11YI, 07/2017)

Company reputation is indeed of great importance, however it could be argued that this may provide even more of an incentive to falsify records if, for example there was an accidental spill, as has been evidenced in the United States where not only was the accident not reported but industry encouraged or provided financial compensation to individuals or groups under non-disclosure agreements (NDAs). This kind of story, both actual and perceived, have not done the industry wider reputation any good at all. Even if the regulations in the UK were tighter, as suggested by some (Chapter 2), the damage to the industry as a whole has already been done by the pioneers in the US. The industry in the UK would need time to prove themselves, which is not being afforded by the anti-fracking communities due to lack of trust as a result of the poor reputation, so this could be described as a catch twenty-two situation. There are of course other similar industries for views to be garnered from, other than the US experience, such as conventional onshore and offshore oil and gas. However, these experiences have also not improved the industry's reputation, in part because when accidents do happen, even if they are rare, they tend to be catastrophic, i.e. Piper Alpha.

The journalist who participated in this research reiterates this point regarding the US experience and also expresses that she suspects that the industry is placating other stakeholders, and to some extent the regulators are too, and that they don't have much of an idea what they are doing and lack experience:

'I think this is very difficult because it's impossible to really trust what the industry is saying now because I think it's firefighting and they're saying what it thinks will make people feel better about it, and I don't think they have much more of an idea than we do, or if they do they're not saying, and that's a pretty dishonest approach.' (23NJ, 01/2017)

6.4.6 Deception and non-compliance

One of the questions posed to all participants was in relation to how the regulator would detect non-compliance of the regulation. Most opponents believed that the regulators would not be able to detect non-compliance and, in some cases, stated that this was because the industry was not trustworthy and would cover up any non-compliance. Some residents from Lancashire provided the following example, perhaps best expressed by this Lancashire resident:

'How are they going to detect non-compliance? It's all about self-regulation, we know for a fact they're dependent on...Cuadrilla will send reports in weekly, monthly or whatever, but let me give you an example at Preese Hall...It was six months after the earthquake where the well casing had been damaged that Cuadrilla admitted to it, so I'm not convinced, because they're [regulators] not going to be on site, and depending on what the oil and gas industry provide, the reports, that they'll always be aware' (15LR, 12/2016).

Other residents have also claimed that Cuadrilla did not admit there had been a well case failure as a result of the earthquake, potentially resulting in fugitive methane to the air and to water. Another resident makes a similar claim and links it to the reporting structure currently in place with the HSE:

'If it comes to it I would want inspectors on site I wouldn't want them to be reliant upon Cuadrilla sending a fax off on Friday saying everything fine, because that's what happened when we had the earthquakes at Preese Hall, they were just making reassuring noises and didn't declare the fact that they had a problem for a long time, so it would have to be really hands-on' (16LR, 12/2016)

It could also be argued, in terms of the industry reputation that the earthquakes, and resulting damage and further conduct by Cuadrilla (discussed in section 5.3.3), means that the harm to the industry's reputation in England has already been done. Even though not a lot of SGD has occurred in England to date, and none at the time of interview, that which has occurred has been problematic thus, further eroding, or preventing any trust in industry.

6.4.7 Broken Regulatory Framework

Other stakeholders have cited the current system as not working and have used a variety of examples, the most often cited in Yorkshire is the claim that when there was a regulatory failure in West Newton, it was not the company themselves (Rathlin) but the residents and anti-fracking protestors at the nearby camp who notified the EA of the problems, suggesting that self-regulation by Rathlin is either not occurring or not working as it should with the regulators.

'None of that would have happened had not residents and the camp people alerted the Environment Agency and the HSE to the problems. So Rathlin isn't regulating itself, the EA and the HSE are not proactive which they should be, for goodness sake, if it was anybody else building a block of flats, the building inspector would be down there if there was anything wrong, but it makes the whole business of the regulatory process look ridiculous' (17YR, 02/2017).

Another resident described the industry as a whole as *'utterly devious'* (21YR, 01/2017) and does not see a reason to believe that they will behave in any other fashion than they did in the US, using the evidence of their conduct so far and how the operators *'doorstepped farmers ...with*

the double-glazing salesman approach' (21YR, 01/2017). Other residents also used this example of evidence of the industry not being trustworthy and further claimed that the negotiating tactics were unfair. Indeed there is evidence of this in literature from the US, for example (Matz, 2013).

One Yorkshire resident, whose background is in engineering, makes this point about baseline monitoring, indicating that residents are very aware of the issues, requirements and regulations, be it from their own experience in their own fields or because they have familiarised themselves with the regulations regarding SGD and oil and gas:

'They [the EA] aren't collecting that data themselves, they don't have it, and they haven't got the staff to go out and do it, so industry will be required to that. It is one of the tests Third Energy are supposed to be completing now at Kirby Misperton, I don't know whether they are doing it or not. That's the first thing, you can only measure the things if you have a baseline to measure from.' (21YR, 01/2017).

Once again, this quotation illustrates a lack of trust in the SGD industry and further a recognition that the regulatory agencies are underfunded and do not have the capacity to carry out the necessary baseline monitoring. As this resident points out, a baseline is needed to monitor from in order to identify any changes to, for example the air quality or water quality. A further valid query made by the same local resident when interviewed regards potential incidents such as 'spillage from the wastewater'. He asks who will be responsible for carrying out the chemical analysis from the spillage, who will have the responsibility of publicising the information? He suspects that this will fall under the area of self-regulation and suspects that the industry will conceal any findings. He underlines this point by stating that no information regarding the chemical analysis of the wastewater from the initial drills at Kirby Missperton have been publicised.

As pointed out by the Journalist who participated in this reaserch, who has herself interviewed many residents and other stakeholders, one of the biggest concerns people have regarding this industry is that they believe there is far too much emphasis on 'self-governing' and self-regulation and that worryingly the only contact some of the operators may have with the regulators is that 'the system is dependent on them sending in information by email', which is not satisfactory to some stakeholders.

While self-regulation may be a prudent way for the operator themselves to conduct their activities, as stated above to reduce the loss of product and minimise revenue losses. It is not considered a satisfactory method of regulating an industry with the reputation, history and

mistrust that the SGD industry has. At least in the short term the preferred option would be for regulators to conduct the baseline tests, monitor themselves and inspect operations on an ongoing basis and that these checks should include unscheduled, unannounced visits by the regulators. Perhaps as time goes by, and once the operators individually have proved themselves (not the industry as a whole) then they could move to more self-regulation, however this could only occur once the other stakeholders, especially the local residents had developed more trust in the company (see Chapter 2, figure 2.1 and Chapter 5).

Many have expressed a desire to have external monitoring and/or baseline tests performed by a third party, not involved with either the industry or the regulator. A few problems with this include the likelihood that this 'third party' is likely to be a profit-making organisation, for example ARUP, further who will pay them? When asked this question in the interviews, almost all the research participants (with a few exceptions) stated that the industry should pay. If they pay a contractor directly then the likelihood that the external contractor would want to satisfy the needs of the paymaster is high. Therefore, even if funds should be raised from the industry (by membership to an association, or by taxes, or fines) the 'paymaster' should not be the industry directly. A system of raising funds from industry, such as membership of an association, should be implemented and the external third-party specialist should be contracted by the regulator. An example of this is the requirement for an independent well examiner, the well examiner is contracted by the industry and paid for by the industry and there is potentially little incentive for the well examiner to be critical about well design, as the company may not contract them again. The HSE do check that the operator has 'these arrangements in place' and that these remain in place for the life cycle of the operation, from design to final plugging (The Health and Safety Executive, 2019).

By far the most popular idea from participants in this study is to have a 'properly funded' body of agencies with the capacity and capability to provide on-site monitoring, both announced and unannounced and that these agencies are involved from the beginning with regards to baseline and subsequent monitoring. No one objects to the idea of self-regulation for the companies' sake and suggest it is a sensible way to conduct themselves, however that this is not an appropriate way of governing the industry in this case, given the potential consequences.

In conclusion, similarly to Chapter 5 (with respect to SLO), this chapter on regulation and governance of SGD highlights the importance of trust. This is something the industry simply does not have at this current time in England. Perhaps they should have focused on gaining this trust before commencement of shale gas operations, however it is possibly too late already. Perhaps

it may never be an option because of the stories, evidence and perceptions of what happened in the US. Perhaps if there was more trust in the regulators then there would be an opportunity for the industry to proceed and begin to gain this trust, as the agencies have a much better chance of gaining trust from resident and other stakeholders than the industry do. However, if this is to happen then stories such as the workover rig at West Newton must not occur, therefore more monitoring should be taking place by both the HSE and the EA.

The point about the industry having always operated this way is an interesting one, as stated above, just because something has always been done a certain way does not justify its continuance. It does highlight however the difference in perception about risk and danger. The industry themselves are under the impression that they are very safe and have an excellent safety record. Other stakeholders are under the impression that this is a very risky and dangerous industry with a catastrophic track record. This is discussed further in Chapter 4 on risk perception of the SGD industry.

6.5 Summary

This chapter began by exploring the comparisons participants made between the English regulatory framework for SGD with that of other countries, notably the US, similar regulations in other industries and other aspects of the regulations. As much has been made of the 'gold standard' UK regulations by Government representatives in the media, unsurprisingly direct comparisons with SGD in the UK and the US were made by many participants, including the MPs and the EA. Some cited the rather cowboy approach to development experienced in the US in the early days of SGD and claimed that that could not happen in England as a result of more stringent regulations. Others interviewed as stakeholders cited the many exemptions from federal regulations enjoyed by the oil and gas industry in the US, with a particular focus on water use and disposal. Indeed, these comparisons highlighted the problem England faces regarding water disposal infrastructure, although water disposal is handled differently in the US than is anticipated in England; reinjection is not permitted under current UK regulations.

The stringency of the regulations was discussed in terms of the moratoria on SGD put in place in 2012 and 2019 in England; and the question asked was this as a result of effective regulation or of effective activism? It was concluded that both were probably a factor, in addition to the fact that the general public were already aware of the SGD industry due to activities in the US. This is an advantage that UK residents had over US residents who had no idea of what was involved with SGD before it started. Additionally, US residents were more likely to receive an income if they owned the mineral rights, a situation not possible in the UK as those rights are owned by

the Crown. Opponents of SGD did not view the US regulations as necessarily insufficient and therefore did not blame issues reported from the US as the result of bad regulation, rather of bad practice.

One operator highlighted the method by which the industry had been regulated in the past; when an incident occurs, the regulation improves. This suggests a 'trial by error' approach to regulating the SGD industry. This was stated in the belief that the industry had not encountered problems (at the time of interview), a claim which other stakeholder may dispute, including residents near conventional oil and gas sites in Yorkshire who cite many problems caused by the industry. Moreover, the literature reveals many incidents and indeed tragedies involving the industry, especially offshore, and that although these incidents result in a change of regulation, this does not always mean more effective or more stringent regulations (Paterson, 2017).

When making comparisons with other industries, participants became more focused on specific regulations. For example, The Town and Country Planning Act (1948) is considered by opponents an inadequate regulation for dealing with SGD. However, this act does define development as 'any building, engineering or mining operation' and furthermore does allow for a consultation process. It is however unlikely that in 1948 SGD was envisaged. Some proponents also cited problems with The Town and Country Planning Act (1948) and claimed inconsistencies in its application as the issue. For example, it was claimed that supermarkets flouted the regulations by retrospectively applying for planning permission. If true, this simply supports the inadequacy of the act rather than the suitability for it to be used as part of the regulatory suite for SGD. A worrying issue did arise in this discussion, the potential for large powerful organisations to influence regulations. This links with Chapter 5 and is also discussed in sections 2.3.4.

Comparisons were also made with the experiences of RE projects compared with SGD. Additionally the conflict between climate change policies and support for SGD over RE projects at the planning application stage. Claims were made that it is much more difficult to get a RE project through the planning application stage compared with SGD and that is in conflict with objectives set to reduce emissions. These claims are supported in the academic literature where it is reported that the planning process supports large corporations and industries over smaller scale RE projects (Strachan et al., 2015). Moreover, changes to the planning process seem to be favouring the SGD industry over other projects.

New planning guidelines aimed at local authorities for SGD projects are ensuring that these projects are fast-tracked by changing the decision-making powers from local authorities to central government. Yet, with regard to the planning process for RE projects, the reverse seems to be happening; local communities are given more of a say and more opportunities to object

to such projects (Cotton, 2017). It has further been noted in the literature that objection to SGD projects relating to the continued use of fossil fuels is not a valid objection (Beebeejaun, 2019; Hilson, 2015). Other policies also seem at odds with climate change objectives, such as the scrapping of the zero carbon for new homes scheme, the Feed in Tariff scheme (FiT) for renewable electricity and the Renewable Heat Incentive (RHI) for renewable heating.

Chapter 7 Conclusion

7.1 Introduction

This final chapter consists of four sections: an overview of research findings (7.2); implications of this research (7.3); research limitations (7.4); recommendations and suggestions for future research (7.5).

The research represented in this thesis has investigated the governance of Shale Gas Development (SGD) in England to determine how stakeholders perceive the regulatory regime, regulators and the associated risks. The purpose was to understand how perceptions of actors, other than industry, impact on the willingness to issue a SLO. The research design, as set out in Chapter 3, was designed to yield information from a range of stakeholders including proponents and opponents of SGD.

The main research questions addressed in this thesis were as follows:

- RQ 1: How do stakeholders of SGD frame their perceptions of risk?
- RQ 2: Which aspects of SLO, if any, are important for stakeholders to issue a SLO to the shale gas industry?
- RQ 3: To what extent do the stakeholders perceive the regulatory regime to be adequate?

7.2 Summary of thesis findings

Information was sought during the interview process in order to answer the research questions posed above. Questions were categorised according to the interview objectives detailed in section 3.3.4. The interview strategy was designed to ascertain the level of knowledge and understanding of SGD. Moreover, to understand how research participants characterised risk, considered possible mitigation strategies and viewed the regulatory framework and enforcement of regulation. This strategy was inspired by Konschnik & Boling (2014) CO/RE framework. This section will summarise findings from this research while identifying how each research question was answered.

7.2.1 How do stakeholders of SGD frame their perceptions of risk?

To address this research question, direct and indirect questions (appendices 1-6) were asked in line with the interview objectives relating to the characterisation, understanding and causes of risk. For example, a direct question was asked “what do you believe are the key risks, if any, associated with SGD?”. This question encouraged participants to express key concerns which

provided the context for future answers concerning individual participants perceptions of the risks associated with SGD. Other less direct questions were asked to ascertain a more nuanced perceptions of risk, such as how participants believed the regulatory agencies deal with or would enforce regulations. This encouraged more specific answers relating to the regulatory regime, the agencies and to some extent the governance of SGD. Participants were also asked if there should be a uniformed risk assessment methodology, such as recommended by the EU, or should risk be assessed on a case by case basis. This was discussed in chapter 4 and confirms the finding of other studies regarding the main concerns; impact on human and animal health, water, air and soil quality, increased seismic activity. This research further revealed that participants have concerns that faults, caused by the SGD process or naturally occurring, could transmit fracking fluids to the ground and eventually into the aquifer over time. Similarly, research participants were concerned about risks to future generations.

Stakeholders frame risk using their own experiences in addition to information they have read or heard about concerning SGD in other countries, such as the United States (US) and Australia. Opponents of SGDs' lists of risks cited tend to be similar and include concerns regarding fugitive methane, water contamination, pollution, increased traffic congestion and human health concerns. Proponents who favour SGD tend to express their concerns regarding risk as the loss of the opportunities or benefits, i.e. jobs, energy security, and other economic benefits. Some interviewees who oppose SGD framed the risk in terms of temporal risk, for example the potential for fugitive methane to escape over a long period of time, even after an extraction site has been restored. Spatial risk includes the land and space required by the industry in a full-scale production scenario. Proponents, particularly industry proponents, rebut this concern by comparing SGD to other activities such as farming. Perceptions are also framed by experiences with the process so far with the SGD operations in Lancashire and conventional oil and gas operations in Yorkshire. Opponents view the industry as one, in other words the oil and gas sector is one industry, not 'conventional' or 'unconventional' industries. Some industry professionals also view the industry as one, especially when citing 'an excellent track record'.

Stakeholders frame their perception of risk by recounting stories of operational, regulatory and procedural failures in addition to failures of other actors within the regulatory system, for example during the planning application stage. These stories result in a lack of credibility of SGD operators and therefore local residents as stakeholders do not trust them or believe they have the right to be in their community. The recounting of events where the regulatory agencies have assisted operators with finding solutions to operational and environmental problems also has an impact on the regulatory agencies in terms of trust and credibility from local residents.

The findings of this research support the experts versus non-experts' theory of risk perception which illustrates how their expertise influences how people frame risk. The proponent participants in this study are either industry professionals or work for a regulatory agency and are therefore described as 'experts'. Proponents describe risk as already mitigated, therefore no longer of concern. The non-experts, largely the opponents to SGD in this research, are reacting to the perceived hazards and consider these as having catastrophic potential; they also demonstrate lack of trust in regulators to regulate the perceived risk.

In addition to supporting the finding of other research regarding some of the specific arguments made by proponents and opponents regarding risk perception, this study has revealed that opponents are citing spatial risks such as wider impacts on the supply chain, for example waste water treatment and sand mining. In other words, the concerns reach geographically farther than simply their own communities. Proponents seem well versed regarding the risks and benefits of SGD from their perspective, however this research reveals concern, or at least an acknowledgment, that there are potential risks at depth.

This research also highlights several areas, or risk events, that may amplify, or intensify the perceptions of risk (and the communication of that risk) in the context of the Social Amplification of Risk Framework. Events are amplified by becoming national news, and thus galvanising support for the opposition movement, for example failures at West Newton. These events are identified by local residents, reported to the press or investigative journalists, such as the journalist interviewed for this research, and the events are occasionally picked up by national press. This amplification may also serve to keep the events in memory, should development proceed in the future, these events will be remembered, and the stories re-told.

The findings from this research supports Howell (2018) that greater knowledge, either through experience or education, does not equal greater support for SGD, and further supports the recommendation by Andersson-Hudson et al. (2016) and Pollard & Rose (2019) to use the SLO framework to further assess acceptance at the local level, and further to gain insights into the risk perceptions of stakeholders.

7.2.2 Which aspects of SLO, if any, are important for stakeholders to issue a SLO to the shale gas industry?

Stakeholders' perceptions of the regulatory agencies are shown by this research to be as important as their perceptions of the industry; if regulators are not trusted, the industry will fail

to gain a SLO. This is an important development in the theory of SLO, as the traditional focus of acquiring an SLO is that the focus is on the company or industry and not the regulatory regime or agencies. A key factor is communication, which to date has been unsuccessful, as far as industry and regulators' objectives are concerned. Meet the Regulator (MTR) and Community Liaison Group (CLG) events have done little to mollify the fears of local residents, rather they have helped to support the narrative of regulatory agencies being on the side of the industry rather than neutral. In SLO terms, this is a long way from the psychological identity and trust required for gaining and maintaining a SLO. Industry stakeholders view the EA as inexperienced regarding SGD and favour the HSE; this is perhaps because the HSE has more of a 'hands off' regulatory role and is more likely to have experience with the oil and gas industry.

The planning application process is the part of the regulatory regimes which stakeholders on all sides have the most experience of, and therefore refer to most. This in addition to the event where Lancashire County Council's (LCC) rejection of planning permission to Cuadrilla was overturned by the Secretary of State. This leaves residents feeling a democracy void. Even though the ruling was overturned, residents in Lancashire have more faith in local councillors compared with Yorkshire, where no objections were made to Third Energy's application. There is a distinct lack of trust in local governments representatives in Yorkshire, this could be in part due to the proximity of the county council to the (proposed) shale gas operation; far away in Yorkshire and closer in Lancashire. However, neither case study area changed voting habits in the subsequent election, both are Conservative strongholds and remain so.

Resident and NGO stakeholders also highlight the fact that the definition of SGD, fracking and High-Volume Hydraulic Fracturing (HVHF) has changed with the development of the regulatory framework. Many believe that this is moving the goalposts or sidestepping the regulations and are concerned that this may mean that shale gas operations could go ahead without regulatory scrutiny of factors such as depth, volume of fluid required or size of the well pad. Indeed, since the moratorium on SGD imposed in 2019, this has been suggested in the media (Gye, 2020). This further erodes trust in the regulatory regime in addition to the erosion of trust in the regulators and industry.

Climate change concerns and continuing dependence of fossil fuels are cited as a policy conflict by participants of this research. Moreover, investments in SGD are displacing investments in renewable energy (RE) technologies and preventing the growth of the RE industry. Conflicts such as these from policy makers do not help the SGD industry to gain trust. In SLO terms, one of the key questions relating to trust and legitimacy is ‘does what they say make sense or is it confusing or strange?’, ‘they’ referring to the industry (see Chapters 2 and 5) conflicting policies do not make sense and can seem very confusing. This research therefore posits that stakeholders’ perceptions of policy makers and government actors are also important considerations in deciding whether a SLO is issued to the industry.

Trust is the key to SLO. This research demonstrates that trust is lacking on all sides of the SGD debate; from residents’ lack of trust in operators, regulators and policy makers to the industry and policy makers having limited trust in other stakeholders to understand the benefits and processes involved in SGD. These factors suggest that achieving a situation where a SLO is granted seems unlikely in the short to medium term.

A further key finding of this research, and in support of the findings of Watterson & Dinan (2016), is that local residents as stakeholders in SGD are capable of understanding, and engaging with, the scientific discourse in relation to SGD. Some industry professionals and policy makers seem to be under the impression that they are not, and further that they have been misguided or misled by anti-fracking discourses. Many of the residents have professional backgrounds, including in law, business and academia.

An important extension to the theory of SLO from this research, is the conclusion that a SLO may need to be given over a wider area impacting more than one community. It is therefore suggested that a new term of ‘continual and dispersed SLO’ be introduced for SDG and similar activities.

7.2.3 To what extent do the stakeholders perceive the regulatory regime to be adequate?

Three key questions were asked during the interviews in order to determine the participants' perceptions of the regulatory regime relating to SGD in England. These questions were designed to determine how stakeholders make comparisons with other countries, industries and to explore their views on whether the SGD industry should have a single regulatory framework. A further question was to determine the extent to which they perceive the industry to be self-regulatory and how much self-regulation should occur.

A key theme was in relation to the moratorium on fracking in England put in place in 2012. Proponents of SGD claim this is evidence of effective regulation, opponents claim this is a result of effective activism. This study concludes that it is a combination of the two. Proponents, particularly MPs, having posited that the regulations are 'gold standard' have of course claimed the moratorium as evidence of this. Similarly, opponents, having expressed that the amount of time and money spent in fighting SGD in their local communities, with considerable cost to their physical and mental health, equally want to claim the moratorium as their success in an attempt to validate their efforts, in other words, they feel that their sacrifices were worth it in the end.

The industry safety track record was also a contested issue. Industry participants believe that the industry has an excellent track record and state that regulations are only changed or improved in the wake of an incident. Other stakeholders do not agree that the industry has a good safety record citing incidents ranging from a local to global scale. Indeed some of the literature also highlights the industry's lack of a good safety record, for example Paterson (2017).

Comparisons were also made in this thesis with regards to specific regulations, for example The Town and Country Planning Act (1990) which is considered by some, especially opponents, as an inadequate way of dealing with SGD. The raising of this issue highlighted the multitude of applications for this legislation and further that it may be applied inconsistently across different industries. For example, claims were made by interviewees that supermarkets are able to bypass certain aspects of the regulations. Similarly, the application of this legislation was compared to RE projects, where it was perceived to be more difficult to obtain planning consent for RE projects compared with SGD projects. Furthermore, local communities seem to have more of a voice and more opportunities to object when considering RE projects (Cotton, 2017).

With regards to the idea of a single regulator for the SGD industry, views were not partisan; views were mixed amongst opponents and proponents. The idea was discussed with advantages and disadvantages raised by the range of stakeholders. The perceived advantages of a single regulator are that a single regulator would be more authoritative and provide a more holistic view of the whole operation and that this is better placed to consider the risks and impacts on the environment and human health. The perceived negative aspects of a single regulator were in relation to the fact that creating a new agency would be costly, possibly at the expense of existing agencies. Moreover, that a single agency would be easier to manipulate than multi agencies, negating the perceived advantage of a more 'independent' regulator. The issue of self-regulation came down to a perception of trust and risk. This links to discussions in chapters 4 and 5 of this thesis. Whilst many participants believed that the industry should be self-regulating, for its own benefit, there should also be regulatory scrutiny. Incidents were cited as examples of why the SGD industry should not be trusted to self-regulate, for example regulatory failures at West Newton in Yorkshire.

Key findings from Chapter 6 are that some participants do not consider The Town and Country Planning Act (1990) to be an inappropriate method of regulation. This legislation seems to be poorly and inconsistently implemented and moreover, concessions have been made in order to make it easier for some industries to navigate through this stage of the regulatory process. This should be a critical time for stakeholders to engage with the regulatory process as local residents are statutory consultees during the initial planning application stage. The sense that they are not listened to leaves local residents feeling disillusioned with the process and their sense of lack of effective democracy more generally.

7.3 Implications of research

Considering stakeholders' risk perceptions and how they frame risk is an important aspect to consider when contemplating a local development of any sort but particularly in the case of a new mining industry. Understanding these perceptions may help shale gas developers to consider mitigation strategies before any form of resistance gathers pace. If local residents feel that the oil and gas industry understand their concerns, rather than simply dismissing them, they are more likely to trust the industry and ultimately to issue an SLO. Steps should be taken much

earlier to engage proactively with local communities than has been seen in the process of attempting to develop SG in England over the last decade. As suggested by Jasanoff (2019) should be approached at the stage of conception. Moreover, considerations should be made regarding lessons learned from other parts of the world, and indeed similar industries. The world has become more globalised in recent decades and as a result more connected, therefore networks are more easily formed to resist development. Indeed, this is how the notion of SLO first evolved; the recognition of the fact that local (previously remote) communities can garner support from other communities all over the world. Therefore, permission and acceptance must be gained from the impacted community, in other words a SLO.

Another important implication is to consider the development project from the point of view of the impacted local community. The local community are not just considering the activities of the industry, they are looking at the whole process and context in a more holistic way. This includes consideration of the regulations, the regulatory agencies, their capacity to regulate and their funding. Local residents are also likely to consider the project in the context of wider political and environmental concerns. An example from this research is the consideration of SGD in relation to climate change, continuing dependence of fossil fuels and furthermore, how SGD is in conflict with other policies. A further example is how the local residents who participated in this research view much wider implications of policy conflicts, such as the Conservative's localism policy being in conflict with Government decisions to overturn local authority decisions, this has a far-reaching impact on feelings of loss of democracy.

A final implication for consideration is the view of industry and policy makers towards other stakeholders, such as local communities. As expressed above (7.2) local communities have the capability and capacity to understand the scientific evidence in relation to new technologies and developments. Additionally, with more academic research becoming freely available through open access and this information is being used and shared within stakeholder networks it is unwise to assume that local communities are ignorant of facts and information.

The methodology and theoretical frameworks in this research are transferable to other areas of research, such as any new development looking to commence in a particular area. Of particular use is to consider the SLO framework at the conceptual stage of a project.

7.4 Limitations of research

Whilst a good cross section of stakeholders as interview participants was achieved for this research, there was no representation from key regulators such as the HSE or the local authority (this was not for lack of asking). Furthermore, greater representation from the SGD industry would have been preferable. A good number of local residents were willing to be interviewed, however in some regions of Lancashire residents were reluctant to be interviewed. This was partly to do with 'interview fatigue'; some have given many interviews to researchers in the past. Some were also wary of the interviewer's motives; this is likely to be the case with the reluctance of some potential regulators and industry participants. Additionally, as discussed in section 3.7, the case study boundaries were changed after data collection, this was as a result of using the referral method for recruiting participants. Some participants did not 'fit' into the original choice of boundary, which was geographical i.e. either from Yorkshire or Lancashire.

As with many research projects, the number of interviews could have been greater. More interviews might have allowed a clearer picture of the biggest themes and the ability to connect the themes to stakeholders' positions on SGD. However, the themes and links between them and stakeholder type are clear and where they have not been, this was discussed. Additionally, demographic data such as type of employment (or past employment) and educational attainment would have enabled a better connection of knowledge and understanding to the issues discussed. As discussed in section 3.7, political affiliation and voting intention demographics would also have been useful data. This information coupled with proximity to SGD sites and views on regulatory frameworks and risk perception may have given further insight to participants world views. Some of this information was gleaned from discussions with participants prior or after interview, rather than posed as a formal question.

A suggestion for future research would be to introduce a focus group at the beginning of the research. This may help dispel some uncertainties with regards to researcher motives. Moreover, a focus group could help to identify themes prior to the creation of the interview questionnaire.

7.5 Recommendations and future research

Firstly, if SGD is to be resurrected or continued in England and new regulations drawn up specifically for the industry, the regulatory agencies should have a key role in the development, this includes the EA and the HSE. Secondly, rhetoric such as ‘Gold Standard Regulations’ should be avoided as there is no evidence of this. This, in addition to the issues discussed such as ‘moving goalposts’ and changing definitions only exacerbate the mistrust stakeholders feel towards Government, industry and regulators. Thirdly, regulators should prepare by conducting baseline surveys rather than relying on industries to do this themselves, they should also be clear that these have been carried out independently and these data should be transparent and accessible.

Finally, as discussed in chapter 6, the requirement for bespoke regulations at different stages of development is highlighted as an area lacking in attention from scholars. This was identified in the oil and gas industry in addition to other closely related industries. It is therefore recommended further research be conducted given the different technological processes and the different scales of operation between exploration, production, well abandonment and site restoration.

7.6 Postscript

At the time the data collection for this thesis concluded, SGD in England was subject to a moratorium (announced in November 2019). It seemed possible that SGD was consigned to history without it ever being commercially developed. However, in practice the story has continued to unfold. The objective of this postscript is to outline some events since 2019.

The DEFRA wave survey referred to in this thesis was last carried out in Autumn of 2021 and reports increased opposition to fracking. Only 17% of respondents said they supported shale gas extraction, including just 4% of expressing strong support. This is a reduction from 24% in support in the 2020 wave survey. 45% opposed SGD compared with 36% in 2020, including 22% of respondents who strongly opposed it. However, levels of indecision were high, with 30% saying they neither supported nor opposed SGD. The increased opposition is likely due to the negative press regarding fracking induced earthquakes in Lancashire in the autumn of 2019

(DEFRA, 2022). This demonstrates that even during a period of time when SGD is not high on the news agenda, support is still waning.

Changes in Industry include the fracking firm Third Energy, interviewed for this research, was taken over by green energy company Wolfland Group who stated that they have 'absolutely no interest in fossil gas', it has since been awarded a government grant to assess feasibility of using geothermal energy from its former gas wells in Ryedale (King, 2022). Cuadrilla announced that they will permanently abandon their Preston New Road site in Lancashire, with the government ordering a shut down and removal of the well head following extended suspension of operations.

In February 2022, Conservative MPs and peers signed 'Net Zero Scrutiny Group' letter to the Prime Minister stating the moratorium on fracking is 'unconservative' and further that shale gas production would allow Britain to avoid an energy crisis. In March 2022 Russia invaded Ukraine, further driving up wholesale gas prices and further threatening security of supply to major European countries (King, 2022). In March 2022 the Oil and Gas Authority are reported to have written to Cuadrilla to offer an extension to the deadline for sealing up well heads at the Preston New Road site. The letter follows suggestions from ministers that decommissioning the wells would be imprudent in light of ongoing challenges to energy security including the war in Ukraine (Wells, 2022). Following a second letter in March, Downing Street confirmed that Boris Johnson is reviewing the shale gas moratorium, three days after business secretary Kwasi Kwarteng argued that it would not solve either supply or price problems (Riley-Smith, 2022). This indicates the Government are perhaps beginning to review the policy on shale gas, however some remain opposed in the Conservative party.

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Appendix 1: Interview prompts, residents

Overview

The purpose of this interview is to find out your views regarding various aspects of SGD in England, specifically aspects relating to the regulatory regime, possible mitigation strategies and what if any risks you feel SGD poses.

My objective is to get your perspective as a stakeholder and to answer my research questions (detailed in introductory letter)

Objective

My research is concerned with your perception of the regulatory regime in England, the steps (if any) you, and other stakeholders are taking to influence the current process and to what extent you think the regulations have been influenced by the EU and EU policy.

Who is involved in the study

I am interviewing people a variety of different people for this research including regulators, industry and people living near potential development sites. This will include proponents, opponents and people who have not yet decided.

Requirements

If you consent, I will be recording this interview; this is important so I can ensure accuracy and objectivity. You are of course free to terminate the interview at any time. The interview will take approximately 1 hour. This interview is in confidence and you will not be named in my research (unless you consent to) and furthermore it will not be possible to identify you from your answers. All information from the interview will be stored securely.

Review

You will have the option, if required, to review the transcripts from this interview.

Are you happy to continue?

Terminology

SGD/ fracking, regulatory agencies, stakeholders, industry etc.

Any questions?

Introduction questions and demographics

Job Title or proximity to proposed site:

Years lived at this house |__|__|yrs|__|__|mths

Are you originally from this area ? ☐ Yes ☐ No

Do you have any connections to the Shale gas industry? ☐ Yes ☐ No

Do you have any affiliations with any other groups? ☐ Yes ☐ No

If Yes, which organisation?

How would you describe your level of involvement?

Have you been to any meet the regulator meetings? (*hosted by the Environment Agency, Health and Safety Executive, Oil and Gas Authority and Public Health England*) ☐ Yes ☐ No

Now moving on to more specific questions about Shale gas/Fracking.

Objective	Question or probe
Understanding / position (1)	What do you think are the key benefits, if any, of shale gas development? What do you know about the regulatory process?
Understanding / position (1, 2a)	a) What do you believe are the key risks, if any, associated with SGD? (Environmental, Economic, Energy security, local community) b) Who do you think should bare the burden of responsibilities for mitigating or preventing this/these? (depending on answer from a) c) Who should pay? (<i>for mitigation, monitoring, increased regulation</i>)

Understanding / position/perceptions (1,2b, 2c)	<p>Do you think there is a good flow of information between regulatory agencies?</p> <p>Environment agency, HSE, local authority, OGA, Dept. of Business, Energy and industrial strategy (formerly DECC)</p> <p><i>(if demonstrates good knowledge of regulatory process)</i></p>
Risk perception / Information gathering (1, 2a, 2c)	<p>How effective do you think the agencies are regarding:</p> <p>Identifying risk factors?</p> <p>Detecting non-compliance?</p> <p>Issuing penalties?</p> <p>Communicating with other stakeholders?</p>
Regulation (2c)	<p>To what extent should the EA be consulted in the planning process?</p> <p>- Do you think that the EA have an appropriate level of input in the planning process?</p> <p>- Should EA 'permission' be part of the planning process?</p> <p>- Do you think the balance of responsibility is appropriate between regulatory agencies?</p>
Risk perception / Information gathering (1, 2a,)	<p>Do you foresee any problems with the dispersed nature of the potential pollutants in relation to the capacity of agencies to regulate this?</p>
Information gathering (1, 2a,)	<p>Should there be a uniformed risk assessment methodology (such as proposed by the EU) or should assessment be on a case-by-case basis? Thinking about:</p> <p>Geological differences</p> <p>Social acceptability</p>

	Local environmental factors
Information gathering (1, 2a,)	How do you think grants, tax credits and/or other incentives should be managed, if at all?
Mitigation strategies (2b)	<p>Would you recommend any particular operational standards, management strategies or new technologies for the purpose of measuring and reducing pollution? (industry & agencies)</p> <p>Or</p> <p>Are there any standards or technologies that would make you happier for SGD to move forward?</p>
Mitigation strategies (2b)	<p>Some information regarding SGD in the US suggest that over 70% of the operation is performed by sub contractors. Who is (should be) responsible for mitigation and remediation, specifically with regards to:</p> <p>Accidents</p> <p>Pollution</p> <p>Financial loss</p>
Regulation (2c, 3)	<p>Have you identified any regulatory gaps? If so, what are they?</p> <p><i>(try and get a sense of scale, on what level are the gaps? Is there any compensation between levels)</i></p>
Regulation (2c)	What role should industry (including trade associations) play in regulating the industry?

Regulation, mitigation, information (1, 2c, 3)	<p>How will SGD companies manage absorbing additional regulations? (are factors such as size an issue?</p> <p>Or</p> <p>What do you think the impact on industry will be if the regulations are enhanced? (explain enhanced)</p>
Regulation, mitigation, information (1, 2c, 3)	<p>During the public consultation process, how do you think public issues are dealt with?</p> <p>How should they be dealt with?</p> <p>Who should address these issues and why?</p> <p>How do you feel about your access to justice? (<i>scale; EU, national, local</i>)</p>

Regulations and enforcement (2c, 3)	How are you (or have you) seeking to influence the development of SGD or the regulations associated with SGD? Examples?
Regulations and enforcement (2c, 3)	<p>How will agencies detect non-compliance of the regulations?</p> <p>Any knowledge of existing situation (conventional gas)</p> <p>Unconventional gas, for all stages of development from spudding to abandonment and includes sub contractors and service companies</p>
Regulations and enforcement (2c, 3)	Unconventional SGD is much larger and more intense than conventional gas but the proposed regulations are the same, do you think the existing regulatory regime is suitable for the regulation of SGD?
Regulations and enforcement (2c, 3)	Many of the regulations have come from the EU (especially the environmental regulations), what do you think the impact of Brexit will be on these regulations?

	Will this have a positive or negative effect on the industry?
Knowledge, regulations (2c, 3)	How much do you know of the relevant UK, EU as US regulations for SGD? How do you feel the UK laws and regulations for SGD compare to those in the US?
Knowledge, regulations (2c, 3)	Who should regulate the industry? The LA or National Government?
Knowledge, regulations (2c, 3)	The shale gas industry is a dynamic and changing one; do you believe that the proposed regulations and regulatory agencies will be able to keep pace with potential technological advancements?
Knowledge, position, regulations, ideas (1, 2c, 3)	What do you believe are the main difficulties facing the regulators for this industry?
Knowledge, position, regulations, ideas (1, 2c, 3)	Do you think that one single regulatory approach would be more effective than the current multi-agency approach? If so, which regulatory agency would be the best fit? How would this agency be funded? Examples from other industries, countries or other technologies?

Any other comments, questions or ideas?

Are you happy to be contacted again should any changes happen or if new information comes to light?

Appendix 2: Interview prompts, NGO

Overview

The purpose of this interview is to find out your views regarding various aspects of SGD in England, specifically aspects relating to the regulatory regime, possible mitigation strategies and what if any risks you feel SGD poses.

My objective is to get your perspective as a stakeholder and to answer my research questions (detailed in introductory letter)

My research is concerned with your perception of the regulatory regime in England, the steps (if any) you, and other stakeholders are taking to influence the current process and to what extent you think the regulations have been influenced by the EU and EU policy.

Who is involved in the study

I am interviewing people a variety of different people for this research including regulators, industry and people living near potential development sites. This will include proponents, opponents and people who have not yet decided.

Requirements

If you consent, I will be recording this interview; this is important so I can ensure accuracy and objectivity. You are of course free to terminate the interview at any time. The interview will take approximately 1 hour. This interview is in confidence and you will not be named in my research (unless you consent to) and furthermore it will not be possible to identify you from your answers. All information from the interview will be stored securely.

Review

You will have the option, if required, to review the transcripts from this interview.

Are you happy to continue?

Terminology

SGD/ fracking, regulatory agencies, stakeholders, industry etc.

Any questions?

Introduction questions and demographics

Job Title or proximity to proposed site:

Years lived worked for |__|__|yrs|__|__|mths

Always worked this area ? ☐ Yes ☐ No

Do you have any connections to the Shale gas industry? ☐ Yes ☐ No

Do you have any affiliations with any other groups? ☐ Yes ☐ No

If Yes, which organisation?

How would you describe your level of involvement?

Have you been to any meet the regulator meetings? (*hosted by the Environment Agency, Health and Safety Executive, Oil and Gas Authority and Public Health England*) ☐ Yes ☐ No

Now moving on to more specific questions about Shale gas/Fracking.

Objective	Question or probe
Understanding / position (1)	What do you think are the key benefits, if any, of shale gas development? What do you know about the regulatory process?
Understanding / position (1, 2a)	a) What do you believe are the key risks, if any, associated with SGD? (Environmental, Economic, Energy security, local community) b) Who do you think should bare the burden of responsibilities for mitigating or preventing this/these? (depending on answer from a) c) Who should pay? (<i>for mitigation, monitoring, increased regulation</i>)

Understanding / position/perceptions (1,2b, 2c)	<p>Do you think there is a good flow of information between regulatory agencies?</p> <p>Environment agency, HSE, local authority, OGA, Dept. of Business, Energy and industrial strategy (formerly DECC)</p> <p><i>(if demonstrates good knowledge of regulatory process)</i></p>
Risk perception / Information gathering (1, 2a, 2c)	<p>How effective do you think the agencies are regarding:</p> <p>Identifying risk factors?</p> <p>Detecting non-compliance?</p> <p>Issuing penalties?</p> <p>Communicating with other stakeholders?</p>
Regulation (2c)	<p>To what extent should the EA be consulted in the planning process?</p> <p>Do you think the balance of responsibility is appropriate between regulatory agencies?</p> <p>Do you think the balance is right between H&S and Env safeguards and industry requirements?</p>
Risk perception / Information gathering (1, 2a,)	<p>Do you foresee any problems with the dispersed nature of the potential pollutants in relation to the capacity of agencies to regulate this?</p>
Information gathering (1, 2a,)	<p>Should there be a uniformed risk assessment methodology (such as proposed by the EU) or should assessment be on a case-by-case basis? Thinking about:</p> <p>Geological differences</p> <p>Social acceptability</p> <p>Local environmental factors</p>

Information gathering (1, 2a,)	To what extent should the industry regulate itself?
Mitigation strategies (2b)	<p>Do you feel that <i>(the agency EA/HSE/LA)</i> has:</p> <p>The appropriate staffing levels and expertise to enforce the regulation?</p> <p>Sufficient authority to take enforcement action where necessary</p>
Mitigation strategies (2b)	<p>Some information regarding SGD in the US suggest that over 70% of the operation is performed by sub contractors. Who is (should be) responsible for mitigation and remediation, specifically with regards to:</p> <p>Accidents</p> <p>Pollution</p> <p>Financial loss</p>
Regulation (2c, 3)	<p>Have you identified any regulatory gaps? If so, what are they?</p> <p><i>(try and get a sense of scale, on what level are the gaps? Is there any compensation between levels)</i></p>
Regulation (2c)	Do you think the industry has gained a SLO?
Regulation, mitigation,	In the UK Onshore Oil and Gas - Charter of community engagement – two of the minimum standards are :

information (1, 2c, 3)	<p>To engage with individuals and organisations in the local communities from an early stage and,</p> <p>Monitor and evaluate the engagement process regularly</p> <p>How would you evaluate industries progress so far?</p>
Regulation, mitigation, information (1, 2c, 3)	<p>During the public consultation process, how do you think public issues are dealt with?</p> <p>How should they be dealt with?</p> <p>Who should address these issues and why?</p> <p>How do you feel about your access to justice? (<i>scale; EU, national, local</i>)</p>

Regulations and enforcement (2c, 3)	How are you (or have you) seeking to influence the development of SGD or the regulations associated with SGD? Examples?
Regulations and enforcement (2c, 3)	<p>How will agencies detect non-compliance of the regulations?</p> <p>Any knowledge of existing situation (conventional gas)</p> <p>Unconventional gas, for all stages of development from spudding to abandonment and includes sub contractors and service companies</p>
Regulations and enforcement (2c, 3)	Unconventional SGD is much larger and more intense than conventional gas but the proposed regulations are the same, do you think the existing regulatory regime is suitable for the regulation of SGD?
Regulations and enforcement (2c, 3)	Many of the regulations have come from the EU (especially the environmental regulations), what do you think the impact of Brexit will be on these regulations?

	Will this have a positive or negative effect on the industry?
Knowledge, regulations (2c, 3)	How much do you know of the relevant UK, EU as US regulations for SGD? How do you feel the UK laws and regulations for SGD compare to those in the US?
Knowledge, regulations (2c, 3)	Who should regulate the industry? The LA or National Government?
Knowledge, regulations (2c, 3)	The shale gas industry is a dynamic and changing one; do you believe that the proposed regulations and regulatory agencies will be able to keep pace with potential technological advancements?
Knowledge, position, regulations, ideas (1, 2c, 3)	What do you believe are the main difficulties facing the regulators for this industry?
Knowledge, position, regulations, ideas (1, 2c, 3)	Do you think that one single regulatory approach would be more effective than the current multi-agency approach? If so, which regulatory agency would be the best fit? How would this agency be funded? Examples from other industries, countries or other technologies?
	How do you think grants, tax credits and/or other incentives should be managed, if at all?

Any other comments, questions or ideas?

Are you happy to be contacted again should any changes happen or if new information comes to light?

Appendix 3: Interview prompts, Industry

Overview

The purpose of this interview is to find out your views regarding various aspects of SGD in England, specifically aspects relating to the regulatory regime, possible mitigation strategies and what if any risks you feel SGD poses.

My objective is to get your perspective as a stakeholder and to answer my research questions (detailed in introductory letter)

Objective

My research is concerned with your perception of the regulatory regime in England, the steps (if any) you, and other stakeholders are taking to influence the current process and to what extent you think the regulations have been influenced by the EU and EU policy.

Who is involved in the study

I am interviewing people a variety of different people for this research including regulators, industry and people living near potential development sites. This will include proponents, opponents and people who have not yet decided.

Requirements

If you consent, I will be recording this interview; this is important so I can ensure accuracy and objectivity. You are of course free to terminate the interview at any time. The interview will take approximately 1 hour. This interview is in confidence and you will not be named in my research (unless you consent to) and furthermore it will not be possible to identify you from your answers. All information from the interview will be stored securely.

Review

You will have the option, if required, to review the transcripts from this interview.

Are you happy to continue?

Terminology

SGD/ fracking, regulatory agencies, stakeholders, industry etc.

Any questions?

Introduction questions and demographics

Job Title or proximity to proposed site:

Years working in this organisation |__|__|yrs|__|__|mths

Years working in this industry |__|__|yrs|__|__|mths

Do you have any affiliations with any other groups? *i.e.* trade associations ☐ Yes ☐ No

If Yes, which organisation?

Now moving on to more specific questions about Shale gas/Fracking.

Objective	Question or probe
Position (1)	What are the key challenges facing the SG Industry?
Position (1, 2a)	<div>a) What do you believe are the key risks, if any, associated with SGD? (Environmental, Economic, Energy security, local community)</div> <div>b) Who do you think should bare the burden of responsibilities for mitigating or preventing this/these? (depending on answer from a)</div> <div>c) Who should pay? (<i>for mitigation, monitoring, increased regulation</i>)</div>

Understanding / position/perceptions (1,2b, 2c)	For your experience of the community liaison meetings so far, do you feel that the industry has gained a Social License to operate in (Yorks or Lancs)?
Risk perception / Information gathering (1, 2a, 2c)	How effective do you think the regulatory agencies are / will be regarding: Identifying risk factors? Detecting non-compliance? Issuing penalties? Communicating with other stakeholders?
Regulation (2c)	To what extent should the EA be consulted in the planning process? - Do you think that the EA have an appropriate level of input in the planning process? - Should EA 'permission' be part of the planning process? - Do you think the balance of responsibility is appropriate between regulatory agencies?
Risk perception / Information gathering (1, 2a,)	Do you foresee any problems with the dispersed nature of the potential pollutants in relation to the capacity of agencies to regulate this? And for the industry to prevent or mitigate this?
Information gathering (1, 2a,)	Should there be a uniformed risk assessment methodology (such as proposed by the EU) or should assessment be on a case-by-case basis? Thinking about: Geological differences Social acceptability Local environmental factors

Information gathering (1, 2a,)	How do you think grants, tax credits and/or other incentives should be managed, if at all?
Mitigation strategies (2b)	<p>Would you recommend any particular operational standards, management strategies or new technologies for the purpose of measuring and reducing pollution?</p> <p>Give examples</p>
Mitigation strategies (2b)	<p>Some information regarding SGD in the US suggests that over 70% of the operation is performed by sub-contractors. And accountability is a big concern for some stakeholders - Who is (should be) responsible for mitigation and remediation, specifically with regards to:</p> <p>Accidents</p> <p>Pollution</p> <p>Financial loss</p>
Regulation (2c, 3)	With regards to the regulatory framework, do you think the balance between environmental and H&S safeguards and industry requirements is appropriate? <i>(can the industry develop and grow with these regulations in place - as are)</i>
Regulation (2c)	<p>What role should you play in regulating yourselves?</p> <p>Examples</p>
Regulation, mitigation, information (1, 2c, 3)	How will you/your company manage to absorb any potential additional regulations? <i>(Are factors such as size of the organisation an issue? - what are the possible impacts on your industry if regulations are enhanced)</i>

Regulation, mitigation, information (1, 2c, 3)	<p>In the UK Onshore Oil and Gas - Charter of community engagement – two of the minimum standards are :</p> <p>To engage with individuals and organisations in the local communities from an early stage and,</p> <p>Monitor and evaluate the engagement process regularly</p> <p>How would you evaluate your progress so far?</p> <p><i>(For UKOOG itself – how would you evaluate the progress of operators regarding the charter of community engagement?)</i></p>
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Regulations and enforcement (2c, 3)	<p>Is the company engaged in the development of the onshore SG regulations? If at all?</p> <p>Examples (this might come out wrong and sound like an accusation – trying to find out about lobbying)</p>
Regulations and enforcement (2c, 3)	<p>How do/will agencies detect non-compliance of the regulations?</p> <p>Any knowledge of existing situation (conventional gas)</p> <p>Unconventional gas, for all stages of development from spudding to abandonment and includes sub contractors and service companies</p>
Regulations and enforcement (2c, 3)	<p>Unconventional SGD is potentially much larger and more intense than conventional gas but the proposed regulations are (more or less) the same, do you think the existing regulatory regime is suitable for the regulation of onshore SGD?</p>
Regulations and enforcement (2c, 3)	<p>Many of the regulations have come from the EU (especially the environmental regulations), what do you think the impact of Brexit will be on these regulations?</p> <p>Will this have a positive or negative effect on the industry?</p>

Knowledge, regulations (2c, 3)	How do you feel the UK laws and regulations for SGD compare to those in the US?
Knowledge, regulations (2c, 3)	Who should regulate the industry? The LA or National Government?
Knowledge, regulations (2c, 3)	The shale gas industry is a dynamic and changing one; do you believe that the proposed regulations and regulatory agencies will be able to keep pace with potential technological advancements? (Considering that some technologies may actually help reduce emissions for example, some may not)
Knowledge, position, regulations, ideas (1, 2c, 3)	What do you believe are the main difficulties facing the regulators for this industry?
Knowledge, position, regulations, ideas (1, 2c, 3)	Do you think that one single regulatory approach would be more effective than the current multi-agency approach? If so, which regulatory agency would be the best fit? How would this agency be funded? Examples from other industries, countries or other technologies?

Any other comments, questions or ideas?

Are you happy to be contacted again should any changes happen or if new information comes to light?

Appendix 4: Interview prompt, Agency

Overview

The purpose of this interview is to find out your views regarding various aspects of SGD in England, specifically aspects relating to the regulatory regime, possible mitigation strategies and what if any risks you feel SGD poses.

My objective is to get your perspective as a stakeholder and to answer my research questions (detailed in introductory letter)

Objective

My research is concerned with your perception of the regulatory regime in England, the steps (if any) you, and other stakeholders are taking to influence the current process and to what extent you think the regulations have been influenced by the EU and EU policy.

Who is involved in the study

I am interviewing people a variety of different people for this research including regulators, industry and people living near potential development sites. This will include proponents, opponents and people who have not yet decided.

Requirements

If you consent, I will be recording this interview; this is important so I can ensure accuracy and objectivity. You are of course free to terminate the interview at any time. The interview will take approximately 1 hour. This interview is in confidence and you will not be named in my research (unless you consent to) and furthermore it will not be possible to identify you from your answers. All information from the interview will be stored securely.

Review

You will have the option, if required, to review the transcripts from this interview.

Are you happy to continue?

Terminology

SGD/ fracking, regulatory agencies, stakeholders, industry etc.

Any questions?

Introduction questions and demographics

Job Title or proximity to proposed site:

Years working in this organisation |__|__|yrs|__|__|mths

Years working in this industry |__|__|yrs|__|__|mths

Do you have any affiliations with any other groups? *i.e.* trade associations ☐ Yes ☐ No

If Yes, which organisation?

Now moving on to more specific questions about Shale gas/Fracking.

Objective	Question or probe
Position (1)	What are the key challenges facing the SG Industry?
Position (1, 2a)	<div>a) What do you believe are the key risks, if any, associated with SGD? (Environmental, Economic, Energy security, local community)</div> <div>b) Who do you think should bare the burden of responsibilities for mitigating or preventing this/these? (depending on answer from a)</div> <div>c) Who should pay? (<i>for mitigation, monitoring, increased regulation</i>)</div>

Understanding / position/perceptions (1,2b, 2c)	For your experience of the community liaison meetings so far, do you feel that the industry has gained a Social License to operate in (Yorks or Lancs)?
Risk perception / Information gathering (1, 2a, 2c)	How effective do you think the regulatory agencies are / will be regarding: Identifying risk factors? Detecting non-compliance? Issuing penalties? Communicating with other stakeholders?
Regulation (2c)	To what extent should the EA be consulted in the planning process? - Do you think that the EA have an appropriate level of input in the planning process? - Should EA 'permission' be part of the planning process? - Do you think the balance of responsibility is appropriate between regulatory agencies?
Risk perception / Information gathering (1, 2a,)	Do you foresee any problems with the dispersed nature of the potential pollutants in relation to the capacity of agencies to regulate this? And for the industry to prevent or mitigate this?
Information gathering (1, 2a,)	Should there be a uniformed risk assessment methodology (such as proposed by the EU) or should assessment be on a case-by-case basis? Thinking about: Geological differences

	<p>Social acceptability</p> <p>Local environmental factors</p>
Information gathering (1, 2a,)	How do you think grants, tax credits and/or other incentives should be managed, if at all?
Mitigation strategies (2b)	<p>Would you recommend any particular operational standards, management strategies or new technologies for the purpose of measuring and reducing pollution?</p> <p>Give examples</p>
Mitigation strategies (2b)	<p>Some information regarding SGD in the US suggests that over 70% of the operation is performed by sub-contractors. And accountability is a big concern for some stakeholders - Who is (should be) responsible for mitigation and remediation, specifically with regards to:</p> <p>Accidents</p> <p>Pollution</p> <p>Financial loss</p>
Regulation (2c, 3)	With regards to the regulatory framework, do you think the balance between environmental and H&S safeguards and industry requirements is appropriate? <i>(can the industry develop and grow with these regulations in place - as are)</i>
Regulation (2c)	<p>What role should you play in regulating yourselves?</p> <p>Examples</p>

Regulation, mitigation, information (1, 2c, 3)	How will you/your company manage to absorb any potential additional regulations? <i>(Are factors such as size of the organisation an issue? - what are the possible impacts on your industry if regulations are enhanced)</i>
Regulation, mitigation, information (1, 2c, 3)	<p>In the UK Onshore Oil and Gas - Charter of community engagement – two of the minimum standards are :</p> <p>To engage with individuals and organisations in the local communities from an early stage and,</p> <p>Monitor and evaluate the engagement process regularly</p> <p>How would you evaluate your progress so far?</p> <p><i>(For UKOOG itself – how would you evaluate the progress of operators regarding the charter of community engagement?)</i></p>

Regulations and enforcement (2c, 3)	<p>Is the company engaged in the development of the onshore SG regulations? If at all?</p> <p>Examples (this might come out wrong and sound like an accusation – trying to find out about lobbying)</p>
Regulations and enforcement (2c, 3)	<p>How do/will agencies detect non-compliance of the regulations?</p> <p>Any knowledge of existing situation (conventional gas)</p> <p>Unconventional gas, for all stages of development from spudding to abandonment and includes sub contractors and service companies</p>

Regulations and enforcement (2c, 3)	Unconventional SGD is potentially much larger and more intense than conventional gas but the proposed regulations are (more or less) the same, do you think the existing regulatory regime is suitable for the regulation of onshore SGD?
Regulations and enforcement (2c, 3)	Many of the regulations have come from the EU (especially the environmental regulations), what do you think the impact of Brexit will be on these regulations? Will this have a positive or negative effect on the industry?
Knowledge, regulations (2c, 3)	How do you feel the UK laws and regulations for SGD compare to those in the US?
Knowledge, regulations (2c, 3)	Who should regulate the industry? The LA or National Government?
Knowledge, regulations (2c, 3)	The shale gas industry is a dynamic and changing one; do you believe that the proposed regulations and regulatory agencies will be able to keep pace with potential technological advancements? (Considering that some technologies may actually help reduce emissions for example, some may not)
Knowledge, position, regulations, ideas (1, 2c, 3)	What do you believe are the main difficulties facing the regulators for this industry?
Knowledge, position, regulations, ideas (1, 2c, 3)	Do you think that one single regulatory approach would be more effective than the current multi-agency approach? If so, which regulatory agency would be the best fit? How would this agency be funded? Examples from other industries, countries or other technologies?

Any other comments, questions or ideas?

Are you happy to be contacted again should any changes happen or if new information comes to light?

Appendix 5: Interview prompt, Members of Parliament

Overview

The purpose of this interview is to find out your views regarding various aspects of SGD in England, specifically aspects relating to the regulatory regime, possible mitigation strategies and what if any risks you feel SGD poses.

My objective is to get your perspective as a stakeholder and to answer my research questions (detailed in introductory letter)

Objective

My research is concerned with your perception of the regulatory regime in England, the steps (if any) you, and other stakeholders are taking to influence the current process and to what extent you think the regulations have been influenced by the EU and EU policy.

Who is involved in the study

I am interviewing people a variety of different people for this research including regulators, industry and people living near potential development sites. This will include proponents, opponents and people who have not yet decided.

Requirements

If you consent, I will be recording this interview; this is important so I can ensure accuracy and objectivity. You are of course free to terminate the interview at any time. The interview will take approximately 1 hour. This interview is in confidence and you will not be named in my research (unless you consent to) and furthermore it will not be possible to identify you from your answers. All information from the interview will be stored securely.

Review

You will have the option, if required, to review the transcripts from this interview.

Are you happy to continue?

Terminology

SGD/ fracking, regulatory agencies, stakeholders, industry etc.

Any questions?

Introduction questions and demographics

Job Title:

Years worked at organisation |__|__|yrs|__|__|mths

How long have you worked in this sector? |__|__|yrs|__|__|mths

Do you have any affiliations with any other groups? ☐ Yes ☐ No

If Yes, which organisation?

How would you describe your level of involvement?

Now moving on to more specific questions about Shale gas/Fracking.

Objective	Question or probe
Position (1)	What do you think are the key challenges facing the SG industry?
Position (1, 2a)	a) What do you believe are the key risks, if any, associated with SGD? (Environmental, Economic, Energy security, local community) b) Who do you think should bare the burden of responsibilities for mitigating or preventing this/these? (Depending on answer from a) c) Who should pay? (<i>For mitigation, monitoring, increased regulation</i>)
Position/perceptions (1,2b, 2c) <i>Efficacy</i>	In your opinion, and from your knowledge of the community liaison & MTR meetings have the industry gained a SLO?
Risk perception / Information gathering (1, 2a, 2c) <i>Efficacy</i>	How effective do you think your agency is regarding: <ul style="list-style-type: none">• Identifying risk factors?• Detecting non-compliance?• Issuing penalties?• Communicating with other stakeholders?

Regulation (2c) <i>Structure</i>	<p>The EA are a key agency regarding the planning process and also during the operational stage -</p> <p>- Do you think that the EA have an appropriate level of input in the planning process?</p> <p>- Do you think the balance of responsibility is appropriate between the EA, HSE MPA etc</p>
Risk perception / Information gathering (1, 2a,) <i>Efficacy</i>	<p>Do you foresee any problems with the dispersed nature of the potential pollutants (or emissions) in relation to the capacity of agencies to regulate this, and for the industry to prevent or mitigate this??</p> <p><i>(for example emissions to air, water etc. may travel & distribution of wells & consider dispersal over time)</i></p>
Information gathering (1, 2a,) <i>Structure</i>	<p>Should there be a uniformed risk assessment methodology (such as proposed by the EU) or should assessment be on a case-by-case basis? Thinking about:</p> <ul style="list-style-type: none"> • Geological differences • Social acceptability • Local environmental factors
Information gathering (1, 2a,) <i>Structure</i>	<p>Do you feel that <i>(the agency EA/HSE/LA)</i> has:</p> <ol style="list-style-type: none"> a) The appropriate staffing levels and expertise to enforce the regulation? b) Sufficient authority to take enforcement action where necessary
Information gathering (1, 2a)	How do you think grants, tax credits and other incentives should be managed if at all?
Mitigation strategies (2b) <i>Transparency</i>	<p>Some information regarding SGD in the US suggests that over 70% of the operation is performed by sub contractors. (And accountability is a big concern for some stakeholders) Who is (should be) responsible for mitigation and remediation, specifically with regards to:</p> <ul style="list-style-type: none"> • Accidents • Pollution • Financial loss
Regulation (2c, 3) <i>Structure,</i> <i>Transparency</i>	With regards to the regulatory framework, do you think the balance between environmental and H&S safeguards and industry requirements is appropriate? <i>(can the industry develop and grow with these regulations in place - as are)</i>
Regulation (2c) <i>Structure</i>	To what extent should the industry self-regulate?

Regulation, mitigation, information (1, 2c, 3) <i>Transparency</i>	In the UK Onshore Oil and Gas - Charter of community engagement – two of the minimum standards are : <ul style="list-style-type: none"> • To engage with individuals and organisations in the local communities from an early stage and, • Monitor and evaluate the engagement process regularly How would you evaluate the industries progress so far?
Regulation, mitigation, information (1, 2c, 3) <i>Efficacy</i>	During the public consultation process, how do you think public issues are dealt with? <ul style="list-style-type: none"> • How should they be dealt with? • Who should address these issues and why?

Regulations and enforcement (2c, 3) <i>Structure, Efficacy</i>	With regards to the inspection regime: <ul style="list-style-type: none"> a) How often do you think wells should be inspected? (at different stages of development) b) Do you think the agencies should conduct un-announced inspections?
Regulations and enforcement (2c, 3) <i>Structure, Efficacy</i>	How will (<i>the agency EA, HSE, LA</i>) detect non-compliance of the regulations? What are the consequences of non-compliance?
Regulations and enforcement (2c, 3) <i>Structure</i>	Unconventional SGD is much larger and more intense than conventional gas but the proposed regulations are the same, do you think the existing regulatory regime is suitable for the regulation of SGD?
Regulations and enforcement (2c, 3) <i>Structure, T&S</i>	Many of the regulations have come from the EU (especially the environmental regulations), what do you think the impact of Brexit will be on these regulations? Will this have a positive or negative effect on the industry?
Knowledge, regulations (2c, 3)	How do you feel the UK laws and regulations for SGD compare to those in the US?

<i>Structure, T&S</i>	
Knowledge, regulations (2c, 3) <i>Structure, T&S</i>	Who should regulate the industry? The Local Authority or National Government?
Knowledge, regulations (2c, 3) <i>Structure, Efficacy</i>	The shale gas industry is a dynamic and changing one; do you believe that the proposed regulations and regulatory agencies will be able to keep pace with potential technological advancements?
Knowledge, position, regulations, ideas (1, 2c, 3) <i>Efficacy</i>	What do you believe are the main difficulties facing the regulators for this industry?
Knowledge, position, regulations, ideas (1, 2c, 3) <i>Structure</i>	<p>Do you think that one single regulatory approach would be more effective than the current multi-agency approach? (for e.g. in the Conservative manifesto, a single regulator was proposed)</p> <ul style="list-style-type: none"> • If so, which regulatory agency would be the best fit? (or totally new) • How would this agency be funded? • Examples from other industries, countries or other technologies?

Any other comments, questions or ideas?

Are you happy to be contacted again should any changes happen or if new information comes to light?

Appendix 6: Interview prompt, Journalist & Academic

Overview

The purpose of this interview is to find out your views regarding various aspects of SGD in England, specifically aspects relating to the regulatory regime, possible mitigation strategies and what if any risks you feel SGD poses.

My objective is to get your perspective as a stakeholder and to answer my research questions (detailed in introductory letter)

Objective

My research is concerned with your perception of the regulatory regime in England, the steps (if any) you, and other stakeholders are taking to influence the current process and to what extent you think the regulations have been influenced by the EU and EU policy.

Who is involved in the study

I am interviewing people a variety of different people for this research including regulators, industry and people living near potential development sites. This will include proponents, opponents and people who have not yet decided.

Requirements

If you consent, I will be recording this interview; this is important so I can ensure accuracy and objectivity. You are of course free to terminate the interview at any time. The interview will take approximately 1 hour. This interview is in confidence and you will not be named in my research (unless you consent to) and furthermore it will not be possible to identify you from your answers. All information from the interview will be stored securely.

Review

You will have the option, if required, to review the transcripts from this interview.

Are you happy to continue?

Terminology

SGD/ fracking, regulatory agencies, stakeholders, industry etc.

Any questions?

Introduction questions and demographics

Job Title or proximity to proposed site:

Years lived at this house |__|__|yrs|__|__|mths

Are you originally from this area ? ☐ Yes ☐ No

Do you have any connections to the Shale gas industry? ☐ Yes ☐ No

Do you have any affiliations with any other groups? ☐ Yes ☐ No

If Yes, which organisation?

How would you describe your level of involvement?

Have you been to any meet the regulator meetings? (hosted by the Environment Agency, Health and Safety Executive, Oil and Gas Authority and Public Health England) ☐ Yes ☐ No

Now moving on to more specific questions about Shale gas/Fracking.

Objective	Question or probe
Understanding / position (1)	<p>What do you think are the key benefits, if any, of shale gas development?</p> <p>What do you know about the regulatory process?</p>
Understanding / position (1, 2a)	<p>a) What do you believe are the key risks, if any, associated with SGD? (Environmental, Economic, Energy security, local community)</p> <p>b) Who do you think should bare the burden of responsibilities for mitigating or preventing this/these? (depending on answer from a)</p> <p>c) Who should pay? (<i>for mitigation, monitoring, increased regulation</i>)</p>

Understanding / position/perceptions (1,2b, 2c)	Do you think there is a good flow of information between regulatory agencies? Environment agency, HSE, local authority, OGA, Dept. of Business, Energy and industrial strategy (formerly DECC) <i>(if demonstrates good knowledge of regulatory process)</i>
Risk perception / Information gathering (1, 2a, 2c)	How effective do you think the agencies are regarding: <ul style="list-style-type: none"> • Identifying risk factors? • Detecting non-compliance? • Issuing penalties? • Communicating with other stakeholders?
Regulation (2c)	To what extent should the EA be consulted in the planning process? - Do you think that the EA have an appropriate level of input in the planning process? - Should EA 'permission' be part of the planning process? - Do you think the balance of responsibility is appropriate between regulatory agencies?
Risk perception / Information gathering (1, 2a,)	Do you foresee any problems with the dispersed nature of the potential pollutants in relation to the capacity of agencies to regulate this?
Information gathering (1, 2a,)	Should there be a uniformed risk assessment methodology (such as proposed by the EU) or should assessment be on a case-by-case basis? Thinking about: <ul style="list-style-type: none"> • Geological differences • Social acceptability • Local environmental factors
Information gathering (1, 2a,)	How do you think grants, tax credits and/or other incentives should be managed, if at all?
Mitigation strategies (2b)	Would you recommend any particular operational standards, management strategies or new technologies for the purpose of measuring and reducing pollution? (industry & agencies) Or Are there any standards or technologies that would make you happier for SGD to move forward?
Mitigation strategies (2b)	Some information regarding SGD in the US suggest that over 70% of the operation is performed by sub contractors. Who is (should be) responsible for mitigation and remediation, specifically with regards to: <ul style="list-style-type: none"> • Accidents • Pollution

	<ul style="list-style-type: none"> Financial loss
Regulation (2c, 3)	<p>Have you identified any regulatory gaps? If so, what are they?</p> <p><i>(try and get a sense of scale, on what level are the gaps? Is there any compensation between levels)</i></p>
Regulation (2c)	<p>What role should industry (including trade associations) play in regulating the industry?</p>
Regulation, mitigation, information (1, 2c, 3)	<p>How will SGD companies manage absorbing additional regulations? (are factors such as size an issue?</p> <p>Or</p> <p>What do you think the impact on industry will be if the regulations are enhanced? (explain enhanced)</p>
Regulation, mitigation, information (1, 2c, 3)	<p>During the public consultation process, how do you think public issues are dealt with?</p> <ul style="list-style-type: none"> How should they be dealt with? Who should address these issues and why? How do you feel about your access to justice? <i>(scale; EU, national, local)</i>

Regulations and enforcement (2c, 3)	<p>How are you (or have you) seeking to influence the development of SGD or the regulations associated with SGD? Examples?</p>
Regulations and enforcement (2c, 3)	<p>How will agencies detect non-compliance of the regulations?</p> <ul style="list-style-type: none"> Any knowledge of existing situation (conventional gas) <p>Unconventional gas, for all stages of development from spudding to abandonment and includes sub contractors and service companies</p>
Regulations and enforcement (2c, 3)	<p>Unconventional SGD is much larger and more intense than conventional gas but the proposed regulations are the same, do you think the existing regulatory regime is suitable for the regulation of SGD?</p>

Regulations and enforcement (2c, 3)	<p>Many of the regulations have come from the EU (especially the environmental regulations), what do you think the impact of Brexit will be on these regulations?</p> <p>Will this have a positive or negative effect on the industry?</p>
Knowledge, regulations (2c, 3)	<p>How much do you know of the relevant UK, EU as US regulations for SGD?</p> <p>How do you feel the UK laws and regulations for SGD compare to those in the US?</p>
Knowledge, regulations (2c, 3)	Who should regulate the industry? The LA or National Government?
Knowledge, regulations (2c, 3)	The shale gas industry is a dynamic and changing one; do you believe that the proposed regulations and regulatory agencies will be able to keep pace with potential technological advancements?
Knowledge, position, regulations, ideas (1, 2c, 3)	What do you believe are the main difficulties facing the regulators for this industry?
Knowledge, position, regulations, ideas (1, 2c, 3)	<p>Do you think that one single regulatory approach would be more effective than the current multi-agency approach?</p> <ul style="list-style-type: none"> • If so, which regulatory agency would be the best fit? • How would this agency be funded? • Examples from other industries, countries or other technologies?

Any other comments, questions or ideas?

Are you happy to be contacted again should any changes happen or if new information comes to light?

Appendix 7 – List of organisations

Cuadrilla Resources – Oil and gas exploration and production company operating in Lancashire.

<https://cuadrillaresources.uk/>

Department for Business, Energy and Industrial Strategy (BEIS). The Department for Energy and Climate Change and the remaining functions of the Department for Business, Innovation and Skills were merged to form BEIS. Responsibility for business, industrial strategy, science and innovation, energy and climate change.

Department for Environment, Food and Rural Affairs (DEFRA). A ministerial department responsible for improving and protecting the environment. DEFRA aim to grow a green economy, sustain thriving rural communities, support food, farming and fishing industries.

Department of Energy and Climate Change (DECC). DECC became part of Department for Business, Energy & Industrial Strategy (BEIS) in July 2016.

Environment Agency – EA. EA is an executive non-departmental public body, sponsored by the Department for Environment, Food & Rural Affairs (DEFRA). <https://www.gov.uk/government/organisations/environment-agency>

Friends of the Earth – A global network of environmental campaigners concerned with the wellbeing and protection the natural world. Friends of the Earth also campaign for safe energy and support renewable energy technologies.
<https://friendsoftheearth.uk>

Health and Safety Executive – (HSE). The HSE is a UK government agency responsible for the encouragement, regulation and enforcement of workplace health, safety and welfare, and for research into occupational risks.
<https://www.hse.gov.uk/>

INEOS - A global chemicals and energy company, it is organised into 20 different companies producing chemical substances, petrochemicals and plastics. INEOS Oil and Gas (UK) is a fully integrated exploration and production company.
<https://www.ineos.com/businesses/ineos-oil-and-gas/>

International Energy Agency - IEA. The **International Energy Agency** provides data, analysis, and solutions on all fuels and technologies. <https://www.iea.org/>

Lancashire County Council – LCC. <https://www.lancashire.gov.uk/>

Oil and Gas Authority – OGA. Government agency that regulates, influences and promotes the UK oil and gas industry.
<https://www.ogauthority.co.uk/>

Rathlin Energy (UK) Ltd – Exploration and development of oil and gas reserves in Great Britain and Northern Ireland. Rathlin Energy is owned by Connaught Oil & Gas and Reabold. Rathlin hold the PEDL licences for West Newton A and West Newton B in the East Riding of Yorkshire. <https://www.rathlin-energy.co.uk>

ReFINE (Research Fracking in Europe). An international research consortium on fracking. Based in the UK and led jointly by Newcastle and Durham Universities, ReFINE works closely with a global network of leading scientists and institutions to research the potential environmental and social impacts of shale gas exploitation. <https://research.ncl.ac.uk/refine/>

Third Energy – Privately-owned group of power generation and onshore gas exploration companies based in North Yorkshire.

United Kingdom Onshore Oil and Gas (UKOOG). Represents the onshore oil and gas industry and wider supply chain. <https://www.ukoog.org.uk/>

Yorkshire County Council – YCC. <https://www.northyorks.gov.uk/>

Appendix 8 – Consent form individuals

DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF HULL

CONSENT FORM: INTERVIEW

I, _____ of _____

Hereby agree to participate in this study to be undertaken by Charlotte Mummery

and I understand that the purpose of the research is to explore the governance and regulatory conditions of hydraulic fracturing in England. This research will seek to understand how people involved or affected by hydraulic fracturing technologies perceive the effectiveness of the regulations; additionally, a study of the EU, UK and local regulations will be undertaken.

I understand that

1. Information from the interview will be coded and my name and address kept separately from _____ it.
2. Any information that I provide will not be made public in any form that could reveal my identity to an outside party. i.e. I will remain fully anonymous.
3. Aggregated results will be used for research purposes and may be reported in scientific and academic journals.
4. Individual results **will not** be released to an person except at my request and on my authorisation.
5. That I am free to withdraw my consent at any time during the study, in which event my participation in the research study will immediately cease and any information obtained from me will not be used.

Signature:

Date:

The contact details of the researcher are:

Charlotte Mummery PhD student in Human Geography

Department of Geography, Environment and Earth Sciences (GEES)

Tel: 01482 465385 (x6332)

Fax: 01482 466340

Email: c.mummery@2014.hull.ac.uk

The contact details of the Geography Ethics Officer are:

Department of Geography, University of Hull, Cottingham Road, Hull, HU6 7RX, tel. 01482-465320.

Appendix 9 – Consent form institutions/organisations

DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF HULL

CONSENT FORM – For Institutions/Organisations

I, of

Hereby give permission for

to be involved in a research study being undertaken by Charlotte Mummery and I understand that the purpose of the research is is to explore the governance and regulatory conditions of hydraulic fracturing in England. This research will seek to understand how people involved or affected by hydraulic fracturing technologies perceive the effectiveness of the regulations; additionally a study of the EU, UK and local regulations will be undertaken and that involvement for the institution means the following:-

I understand that

- 1. The aims, methods, and anticipated benefits, and possible risks/hazards of the research study, have been explained to me.
- 2. I voluntarily and freely give my consent for the institution/organisation to participate in the above research study.

5. I am free to withdraw my consent at any time during the study, in which event participation in the research study will immediately cease and any information obtained through this institution/organisation will not be used if I so request.
3. I understand that aggregated results will be used for research purposes and may be reported in scientific and academic journals.

I agree that

4. The institution/organisation MAY / MAY NOT be named in research publications or other publicity without prior agreement.
5. ***I / We DO / DO NOT require an opportunity to check the factual accuracy of the research findings related to the institution/organisation.***
6. ***I / We EXPECT / DO NOT EXPECT to receive a copy of the research findings or publications.***

Signature:

Date:

The contact details of the researcher are:

Charlotte Mummary PhD student in Human Geography

Department of Geography, Environment and Earth Sciences (GEES)

Tel: 01482 465385 (x6332)

Email: c.mummary@2014.hull.ac.uk

The contact details of Geography Ethics Officer are: Department of Geography, University of Hull, Cottingham Road, Hull, HU6 7RX, tel. 01482-465320.