DECISION-MAKING UNDER UNCERTAINTY: THE POLITICAL ECONOMY OF SHALE GAS

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A dissertation submitted for the degree of Doctor of Philosophy

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September 2016

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Acronyms and Abbreviations

AAF = Americans Against Fracking

ACI = American Competitiveness Initiative

AEI = American Energy Initiative

AGA = American Gas Association

ALEC = American Legislative Exchange Council

ANGA = America's Natural Gas Alliance

AOTA = All Of The Above Energy Strategy

API = American Petroleum Institute

ASA = Advertising Standards Authority

ASGK = ASGK Strategies, now Kivvit

bcf = billion cubic feet

bcm = billion cubic meters

BEIS = Department for Business, Energy and Industrial Strategy

BERR = Department for Business, Enterprise and Regulatory Reform

BGS = British Geological Society

BP = British Petroleum

BRPM = Benthin Risk Perception Measure

CAQDAS = Computer-Assisted Qualitative Data Analysis

CAT modelling = Catastrophe modelling

CCGT = Combined Cycle Gas Turbines

CEO = Corporate Europe Observatory

CEPR = Centre for Economic Policy Research

CHEC = Centre for Healthy Environment and Communities

CO_2 = Carbon Dioxide

CPE = Comparative Political Economy

CRC = Carbon Reduction Commitment

CRP = Centre for Responsive Politics

DECC = UK Department of Energy and Climate Change

DEFRA = Department for Environment and Rural Affairs

DoE = U.S. Department of Energy

DTI = Department for Trade and Industry

EA = Environmental Agency

EC = European Commission

ECJRC = European Commission Joint Research Centre

EDF = EDF Energy (Électricité de France)

EEF = The Manufacturer's Associations (formerly the Engineering Employer's Federation)

EIA = U.S. Energy Information Administration (part of DoE)

EID = Energy in Depth

EPA = Environmental Protection

EPEA = American Petroleum Exploration Association

ESTNUCE = European Science and Technology Network on Unconventional

Hydrocarbon Extraction

EU = European Union

FoE = Friends of the Earth

Fracking = Hydraulic fracturing

GDP = Gross Domestic Product

GECF = Gas Exporting Countries Forum

GFZ = Deutsches GeoForschungsZentrum (German Research Centre for Geo Sciences)

GIIP = Gas Initially In Place

GIP = Gas In Place

GMO = Genetically Modified Organism

GP = Greenpeace

GW = Giga Watt

HM = Her Majesty's

HSE = Health and Safety Executive

IEA = International Energy Agency

IMF = International Monetary Fund

IPAA = Independent Petroleum Association of America

IPCC = Intergovernmental Panel on Climate Change

IPE = International Political Economy

IR = International Relations

IRGC = International Risk Governance Council

IT = Information Technology

JFK = John F. Kennedy

JRC = Joint Research Council

LME = Liberal Market Economy

LNG = Liquefied Natural Gas

MEP = Member of European Parliament

MIT = Massachusetts Institute for Technology

MP = Member of Parliament

Mtoe = million tonnes oil equivalent

MW/h = Megawatt per hour

NCSL = National Conference of State Legislatures

NGI = Natural Gas Alliance

NGO = Non-Governmental Organisation

NGSA = Natural Gas Supply Association

NRW = Natural Resources Wales

NYMEX = New York Mercantile Exchange

OECD = Organisation of Co-operation and Development

OED = Oxford English Dictionary

Ofgem = Office of Gas and Electricity Markets

OGA = Oil and Gas Authority

OGIP = Original Gas in Place

OGP = Oil and Gas Producer's Association

OPEC = Oil and Petroleum Exporting Countries

PEW = Pew Research Centre

PM = Prime Minister

PPINYS = Public Policy Institute of New York State

ppm = parts per million (a common measure of parts-per notation)

QDA = Qualitative Data Analysis

RSPB = Royal Society for the Protection of Birds

SARF = Social Amplification of Risk Framework

SEPA = Scottish Environment Protection Agency

tcf = trillion cubic feet

tcm = trillion cubic meters

TPES = Total Primary Energy Supply

UK = United Kingdom

UKCS = United Kingdom Continental Shelf

UKERC = United Kingdom Energy Research Council

UKOOG = United Kingdom Onshore Oil and Gas

UN = United Nations

U.S. = United States

USCM = United States Conference of Mayors

WSJ = Wall Street Journal

XTO = XTO, formerly Cross Timbers Oil Company, a subsidiary of Exxon Mobil

Für Volker

Acknowledgements

This thesis would not have been possible without a number of people I was lucky enough to have around me while writing. I first wish to thank, with my deepest gratitude, my supervisors, Ronen Palan and Sara Silvestri. I was not originally supposed to be supervised by Ronen as he only joined the University in the month that I did – I can only be grateful for the coincidence, as working with Ronen these past years has been an invaluable experience. Ronen's seemingly casual comments usually fixed a 'problem', which I had been considering for a week, in the space of an afternoon. Without Sara's encouragement to apply I would have never ended up at City and I am very grateful that she aided me in carrying this project forward, extending her unflinching encouragement in the PhD and all related matters. My gratitude also goes to Graham Allison who kindly supervised me during my time at Harvard, always replied to questions, and overall allowed me to run wild with his original idea of a three-model approach. They add to a list too long to complete of scholars and teachers who enabled me or inspired me to reach this point, including Nora Markard, Stormy-Annika Mildner, Jürgen Schutte, and Alexandra de Hoop-Scheffer. I also wish to express my gratitude to the more recent teachers and scholars who were kind enough to open their doors to my many unsolicited questions, including the extraordinarily patient Stefano Pagliari who has a literature recommendation on every topic under the IPE sun, Amnon Aran, Amin Samman, Anastasia Nesvetailova and Rachel Cohen. Furthermore, I would like to thank my examiners Hayley Stevenson and Iosif Kovras for their insightful commentary and helpful discussion of my work.

I must say thank you to everyone who shared my PhD life in the Pool these past few years, providing exciting discussions, support or comradeship. To my friends, especially Jenny, Juli and Lilli, and the entire Glass-Whiteson family: thank you for the incredible support throughout the years, and I am grateful for all the distractions, too. Thank you to Juli and Hannah G. for comments and thoughts on earlier drafts. And then there is Marius, whom I cannot thank in three lines, but I'm going to give it a go. For the support system, always at the ready waiting for me at home and for taking care of <real life> while I was busy with the PhD, and for all the brilliant comments and insights on my writing, I am grateful. Without him the experience would have been a lot more arduous.

Lastly, I thank my brilliant mother Ulrike who supported me unconditionally and created a second safety net in my home in Berlin. Nobody is more to thank than my parents for getting me here, and by extension my grandparents Peter Petersen and Maria Petersen. The dedication is for my wonderful father, Volker Petersen. He would have been my toughest critic and proudest supporter.

DECLARATION

I declare that the contents of this thesis, except where specifically declared, are my own work, which I carried out at City, University of London.

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Abstract

This thesis explores the factors influencing governmental policy preferences on the uncertain issue of shale gas development. I argue that there is no convincing expected utility of shale gas development, and that, in light of conflicting evidence, governmental decision-makers cannot believe it to be so. The notion of a 'rational actor' government deciding on shale gas based on its utility offers limited explanatory value. I am telling a more comprehensive story of shale gas and by using different clues taken from political economy and behavioural economics theory, develop several narratives about respective dimensions of the decision-making process: a rational expected utility analysis, a perspective on the influence of private interest groups, and a narrative on capture through ideational repertoire and cognitive biases. To this end classical literature of decision-making under risk and uncertainty is reviewed and political economy theory is brought in to widen the debate. The key arguments of this study are that policy decisions on shale gas are irrational from a classical political science perspective; that economic claims made about policy decisions are defying economic logic; that strong interest groups are distorting a market-based energy policy; and that pre-existing ideas about the energy system unduly influence the decision process regardless of their actual applicability. I suggest that fracking is simply so compatible with the current repertoire of ideas, practices and tools around energy policy, that engaging in it becomes a logical conclusion, whereas not to engage in it would require a paradigmatic change. These arguments are taken forward by an in-depth analysis of the decision-making around shale gas made by the United States government and the United Kingdom government since the commercial development of shale gas became possible through technological innovation in the 21st century. The thesis serves to shine light on the story of shale gas policy, but also to explore separate dimensions of policy-making under uncertainty in which cognitive and parochial factors prove more influential than so-called rational calculations.

I Chapter One. Introduction: Shale gas and decision-making under uncertainty

This thesis originates in puzzlement about the popular resurgence of unsustainable energy sources in the form of investment in novel technologies to exploit shale gas reserves. The political decision to develop the unconventional fuel goes beyond any, already contentious, argument to utilise the leftover reserves of conventional fossil fuel sources. After years of arguing for the gradual transformation of energy systems from traditional fuels towards sustainable alternative energy sources, a new argument is made in favour of a different transformation and an increase in the use of unsustainable fuels. Adding to this puzzle is the fact that shale gas development involves a high level of uncertainty in regard to the consequences of its production as well as considerable known risks to the environment and the economy.

To this end in my thesis I consider the favourable decisions made in the United States and the United Kingdom regarding the development of shale gas through hydraulic fracturing ('fracking'). Approaching this policy outcome from an angle of decision-making under risk and uncertainty as well as the notion of irrationality, I discovered a gap in the related literature. Comprehensive theoretical consideration of risk decision-making was trending in the discipline of economics in the middle of the 20th century, then in a small body of literature by behavioural economists in the 1970s and 1980s and again with sociologists in the 1980s and 1990s. In 1971, Graham Allison famously argued that not just individuals but entire governments act irrationally in situations of uncertainty when he researched the policy decisions behind the Cuban Missile Crisis. Yet the topic has only been gaining traction in political science and political economy in recent years of the 21st century, following the global financial crisis and several high profile natural disasters as well as increasing concerns over climate change.

In my thesis, I am using different bodies of literature to develop stories about respective dimensions of the decision-making process that resulted in the support for shale gas. Taking inspiration from Graham Allison's multidimensional approach to decision-making in *Essence of Decision* (Allison 1971), I develop three separate narratives that sensitise me to different aspects of the decision-making process through qualitative, case-oriented research.[1] The three narratives are devised using traditional literature on risk preferences

[1] In regard to Allison's models of research, I follow a similar overall approach in questioning the rational actor model and providing separate distinct narratives to examine the same dependent variable. I do not

as well as political economy theory and consist of a rational expected utility analysis, a private interest power perspective, and an assessment of ideational constraints.

Whether or not it can deliver economic benefits, shale gas is essentially a delay to the introduction of sustainable and clean energy sources which are needed to keep global warming to a minimum and reduce the risks to humanity and the environment brought on by climate change. The energy economy is a key component of any plan for dealing with these risks. Already the political response is slow and inadequate considering the largesse and nearness of the problem, and shale gas appears to be turning the clocks backwards on progress. The development of this thesis gave me an opportunity to shed light on some of the reasons behind the political decision to return and add to unsustainable energy development. Any decision made by the government to support shale gas as part of the national energy mix is a decision made in a situation of clear uncertainty and in acceptance of known risks. Hence the topic allowed me to consider the more abstract theoretical issue of how to deal with uncertainty and risks in policy decision-making which are key features of the energy sector. Due to the impact of 21st century events involving uncertainty and largely unexpected risks such as the Fukushima nuclear incident or the global financial crisis the topic is gaining momentum in political science and my dissertation adds to the debate.

I.1 Problématique

The technology of hydraulic fracturing is used to access and develop previously inaccessible unconventional gas reserves, such as shale gas. Evidence that hydraulic fracturing is responsible for a variety of environmental and health risks, including pollution and seismic activity, is amassing,[2] while strong doubts about the economic benefits of shale gas are also on the increase (Groat and Grimshaw 2012; Helm 2013; Carrington 2013b; Cherry et al. 2014; Stamford and Azapagic 2014; Christopherson 2015; Neate 2015).[3] A factor that both the positive as well as much of the critical output on fracking may underestimate is the degree to which the economic arguments in its favour are unfounded or inaccurate. I address this through a detailed comprehensive analysis of

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use the same models. Qualitative methods make sense for my case study as they are inductive and grounded in empirics which befits a novel topic.

[2] Which ultimately result in adverse economic effects as well.

[3] Of course, depending on definitions of growth and how important one values the environment as an economic asset, the environmental concerns were always also economic in nature. Yet this link is not often made explicit in official or public discussion of the issue. More on this in chapter four and eight.

shale gas and how it fits into the respective U.S. or UK energy sector in chapter four. Yet largely, and that is part of the bigger puzzle which I focus on in this thesis, emerging research that is doubtful about the economic benefits of shale gas has been ignored in political deliberation on the topic. The shale story should be much tougher to promote, at a time when the oil and gas industry is in turmoil and renewable energy is becoming more profitable (Amin 2015; Taylor 2016; Stevens 2016; Ancygier and Hare 2016).

Beyond the aspect of risk and uncertainty it is the impression of unreasonable or baseless decision-making which is most interesting and unnerving about fracking policies. If there is no concrete data available based on which policy makers can make an informed judgement, then why is the lack of such data being ignored? Worse, if there is concrete evidence or at least research strongly suggesting negative outcomes of the policy, these appear to be equally ignored.

The arguments made in support of fracking are based, on the surface, on classic economic assumptions of rationality and efficient cost-benefit analysis in a free market-based system. Fracking is suggested to be compatible with this market and to deliver energy security, revenue and jobs, and increase a country's energy independence. Yet the highly-publicised introduction of generous subsidies such as tax breaks or similar incentives for fracking operations undermines this assertion and ensures that shale gas does not have to compete in a truly free market system. Paradoxically, the supporters of shale gas are arguing for enabling market intervention while they are promoting the resource within frames of standard economic reasoning (Bawden 2013; Gosden 2013c; Macalister and Harvey 2013; Murray 2014; BBC News 2014b). If fracking requires subsidies and support on such a scale, then why do governments and companies appear to genuinely embrace the notion of its economic success?

Conventional public policy discussions, which tend to deal with such puzzles, assume these factors would come into play in the discussion – if they do not, the reasons behind that can be political. In other words, the argument for shale gas is not purely economic but political economic, driven by interested parties. Is shale gas driven by parochial interest, dressed as it were, under the guise of traditional utility arguments? The influence and political power of interest groups, pressure groups and lobbies has become a central theme in modern political science studies, especially in political economy. Research that questions concrete economic rationality in the reasoning behind energy policy often shifts focus on concerns around lobbying (Crooks and McGregor 2012; Buisset, Øye, and Selleslaghs 2012; Cusick 2013; Tansey 2014; Brown 2015). I explore this approach in chapters five and six, after conducting a comprehensive analysis of the costs and benefits of introducing shale gas into the energy mix in chapter four using a classical cost and benefit approach.

From a political economy perspective, it is interesting to investigate why such apparently contradictory factors are being ignored through a third lens. A different approach to distorted decision-making within the discipline focuses on ideational influences. Allison also suggested that in situations where policymakers feel they cannot base their decisions on conclusive data, they may simply ignore those facts that do not fit their vision: this appears possible in the story of shale gas. Literature developed since, mostly in behavioural economics, and (constructivist) approaches in political economy which focus on the power of ideas, are helpful in considering an alternative approach based on cognitive constraints. To this end I add a third narrative to the shale gas story which considers cognitive factors and constraints to objective or rational decision-making. This allows me to consider several so far barely researched aspects of the decision-making process that preceded shale gas support. Through investigating these three separate angles on the decisions in favour of fracking, I add a political economy perspective to a gap in theory concerning the discussion of how decisions are made under uncertainty in political economy, and in particular why such decisions can seem irrational from a cost-benefit analysis point of view.

The story of shale gas raises questions of policy under conditions of uncertainty and risk. It is the unlikely nature of claims and impossible-to-prove promises that so perplex about the shale gas story. Shale gas is marketed as economically sound and environmentally safe and clean (or at least cleaner than coal) before there is evidence for either claim. One cannot help but be reminded of the 1980s nuclear discussion: for example, a month before Chernobyl the *Economist* expressed the prevailing opinion that the technology was "as safe as a chocolate factory" (The Economist 2012a)[4]. The discussion on shale gas is for all appearances incomplete and arguments in its favour are likely irrational.

This discovery leads me to a puzzling oversight in the existing theoretical literature on decision-making under uncertainty. Few researchers concerned with policies or technologies of which such varying accounts exist make reference to uncertainty; most tend to consider risk as a rationally calculable variable (Beck 1998; Cox 2009; Aven and Renn 2009; Nelson and Katzenstein 2010; Mildner and Boeckelmann 2011). Research does exist into risk and uncertainty specifically, and in this field I found considerable affirmation of my thoughts on the variety of preferences yet little answers about their

[4] There is no page number given to this reference as it is an online article on a single page. From here on, direct quotes without page numbers can be assumed to be online articles.

formation. Many case studies for example attest preference and decision divergence between EU and U.S. risk regulation policies, which lead to very different regulation and policy outcomes but also of course cause difficulties in international policy cooperation. Diverging risk preferences by countries and policymakers are assumed and attested for in case studies. However, and this is the second and particularly puzzling oversight, in this research there is a distinctive lack of attention paid to explanatory factors behind different policy decisions on uncertain issues, i.e. behind the formation of such preferences (Shaffer 2004; Christoforou 2004; Kelemen and Vogel 2009; Breggin et al. 2009; Quick 2011; Jasanoff 2011; Stern and Wiener 2011; Gray, Rogers, and Wiener 2011; Eichbrecht and Wilber 2011; Vogel 2012; Wiener et al. 2013).[5] There is no widely accepted comprehensive theory explaining how individuals, groups or elected policymakers form preferences under risk or uncertainty (Mildner and Boeckelmann 2011; Rieger, Wang, and Hens 2013).

I.2 Central research question, theoretical framework and approach

The central research question is derived from the identified gap in current research – the lack of comprehensive analysis of what formed the policy decision to move towards shale gas which poses so much risk and is surrounded by so much uncertainty. My overarching research question is as follows:

Which factors decisively shape the risk preferences of political decision-makers regarding fracking when the decision is made under uncertainty?

To answer it I draw on theory from several disciplines. The study of decision-making in situations of risk or uncertainty has only recently arrived in political research. Yet decisions under risk and/or uncertainty have been an established topic in the discipline of economics since the first half of the 19th century (Knight 1921; Arrow 1951; John Maynard Keynes 1921; Ellsberg 1961) and have been a topic for interdisciplinary economic researchers forming links with psychology or behavioural studies in the 1970s and 1980s (Tversky and Kahneman 1986; Kahneman, Slovic, and Tversky 1982; Bell and Raiffa 1978; Bell, Raiffa, and Tversky 1988; March 1978). The more classical economic works provide rational, calculative accounts of how decisions on risk should be formed. Interdisciplinary works offer accounts mostly of how biases and constraints can override

[5] There is also a large group of scholars who dispute this idea of different risk attitudes in general between the U.S. and the EU, mainly (Wiener 2011; Walsh 2011; Miller 2011; Freestone 2011) and no evidence exists of cultural effects on risk attitudes (i.e. 'pioneering U.S. vs precautionary Europe').

rational decision-making, yet they tend to focus on individual decision-makers only.[6] This work was based on theoretical reconsideration but also empirical studies detailing the contrast between actual decisions and the predictions of these gained by purely rational calculations using expected utility functions (for example Pauker, Pauker, and McNeil 1988; Slovic, Fischhoff, and Lichtenstein 1982; Tversky and Kahneman 1986). Modified versions of these heuristics have been suggested or even proven to be influential in shaping governmental decisions under risk (Allison and Zelikow 1999).

With Ulrich Beck the topic of uncertainty in policy-making briefly became a hot topic in sociology and political sociology (Beck 1986, 1998); his and following work in sociology were often inspired by concerns about climate change as well as new technologies such as nuclear power (Beck 1995; Leiserowitz 2006; Vogel 2012; Kelemen and Vogel 2009; Pidgeon, Kasperson, and Slovic 2003; Horlick-Jones, Sime, and Pidgeon 2003). In most of these works, preferences under risk and uncertainty are considered a given and instead risk perception or specific risk communication is discussed. Unlike traditional studies of calculable risk preferences, these modern approaches focus on uncertainty, and the acknowledgement of risks which cannot be either assessed or expected.

The few examples of more recent literature from the social sciences that consider preferences and decisions under risk and uncertainty outside of economic risk modelling tend to focus on individual risk preferences, or those of the public compared to that of scientific experts (Beck 1986, 1995, Sjöberg 1999, 2000; Lorenzoni and Pidgeon 2006; Leiserowitz 2006). If any are focused on governmental decision-makers, then there is no thorough testing of hypotheses but the studies rather focus on historical comparison, or indeed have a largely normative focus (Kelemen and Vogel 2009; Vogel 2012; Wiener et al. 2013).[7] Lacking from this is a discussion of why decisions are made as they are under uncertainty in politics, and in particular why such decisions can seem irrational from a cost-benefit analysis point of view.

There is a tradition of interest in decision-making under uncertainty and risk which surrounds issues of new technologies such as genetically modified organisms (GMO) and

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[6] The first major strand of literature on preferences or decision-making (judgment) under risk and uncertainty which questioned the calculable nature of economic risk preference theory focused specifically on cognitive constraints to rational cost-benefit calculation. It was pursued by a mixed group of academics from economics, especially behavioural economics, and psychology and began to gain more prominence in the 1970s and 1980s (Tversky and Kahneman 1974; Bell and Raiffa 1978; Tversky and Kahneman 1980, 1981; Kahneman and Tversky 1982; Taylor 1982; Langer 1982; Fischhoff 1982; Einhorn 1982; Slovic, Fischhoff, and Lichtenstein 1982a; Tversky and Kahneman 1986; Bell, Raiffa, and Tversky 1988).

[7] Research tends to focus on singular events such as 9/11 or the Fukushima nuclear accident, yet some of it looks at systemic or long-term risks such as climate change or financial crises (Mildner and Boeckelmann 2011; Mair, Mildner, and Wodni 2012; Wiener et al. 2013).

especially energy technology, such as nuclear, or issues closely related to energy such as climate change (Beck 1995; Anthony Leiserowitz 2006; Vogel 2012; Kelemen and Vogel 2009; Pidgeon, Kasperson, and Slovic 2003; Horlick-Jones, Sime, and Pidgeon 2003). Shale gas is as of yet not researched in much detail and is a fitting opportunity for further work in this direction.

In the following chapters I draw on arguments about factors influencing decision-making using insights from theories of international political economy and comparative political economy. I consider influences on decision-making on the uncertain issue of fracking development from private interests as well as through cognitive constraints. Political economy is a fitting discipline from which to approach this puzzle, as it studies interaction between the state, the society and the market and economy, tracing links between economic and political elements; and it has a history of research through multidisciplinary approaches and inclusion of theory from a variety of social sciences (Hall 1997; Blyth 2009; Encyclopaedia Britannica 2016).[8] Given that the first and most of the work on irrationality in risk preferences came from the field of economics yet much recent work on risk is centred in political science, they need to be considered together theoretically. Political economy, in which insights from both disciplines have been used together, is the discipline most helpful to draw on for this research. My case study also touches upon core issues of international political economy. Concerns have been raised that the shale gas story is a result of private economic interests lobbying policymakers. Moreover, the political decisions being taken are interlaced heavily with ideas of economic reasoning. The thesis begins by establishing why existing approaches to analysing preference formation under risk and uncertainty do not help in explaining the support for shale gas and do not provide the framework needed to investigate decision-making behind current energy policy.

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[8] Following Blyth I consider political economy a "way of doing comparative politics" but also a "distinct way of doing political science in and of itself" (Blyth 2009, 194): importantly, I agree that it has come to "the decay of the boundary that traditionally set … international political economy apart from comparative political economy" (Blyth 2009, 194; MacKenzie 2006; Hobson and Seabrooke 2007). Therefore, I mostly use the term *political economy*, even if my focus is comparative.
Following Blyth and Hall, I prefer to divide between ideas, interests and institutions rather than structure, rationality and culture (Hall 1997; Blyth 2009). For this study I attach the variable rationality, as suggested by Blyth (2009, 216), to the troika, but for reasons explained in this chapter I spend less focus on institutions.

I.3 Research design: Methods and structure of the thesis

To add empirical knowledge to the narrative of shale gas development as well as advance the theoretical discussion on decision making and risk preference formation in this thesis I develop three distinct analytical approaches in response to the above-mentioned questions. Following the impression that reasoning behind the dash for shale gas was both unclear and possibly irrational, the logic behind my thesis' research design was inspired by political scientist Graham Allison's analysis of the governmental decision-making during the Cuban Missile Crisis, *Essence of Decision* (Allison 1971; Allison and Zelikow 1999).

Allison used information about the decision-making process behind the Cuban crisis as a case study into governmental decision-making in situations of risk and uncertainty. His motivation for the book came from his conviction that at the time of writing in the 1970s, the disciplines of political science and international relations were relying heavily on ideas of rational expectations in decision-making which they had taken over from the discipline of economics. He mentions specifically that the saturation of political science with assumptions about rationality and expected utility was based on models such as game theory, for example and challenged this orthodoxy (Allison 1971; Allison and Zelikow 1999). His book title is based on a quote by John F. Kennedy himself that reads: "The essence of ultimate decision remains impenetrable to the observer – often, indeed, to the decider himself" (Allison and Zelikow 1999, xi; Sorenson and Kennedy 2005). Further, he argued, to be 'rational', governmental decision-makers tend to ignore, either intentionally or not, certain data points that do not fit into their modelling of utility (Allison 1971; Allison and Zelikow 1999). Allison introduced several different approaches, or as he calls them, models, of decision-making that may have affected the decisions in Cuba: the classical rational actor model, the organisational behaviour model, and the governmental politics model. He successfully showed that the explanatory value of a rational actor government calculating utility was insufficient in the case study, and his other approaches instead added value to the analysis.

I am using clues taken from political economy theory, economics and behavioural economics to develop three separate narratives about respective dimensions of the decision-making process. Each of the narratives serves as a lens that sensitises me to different aspects of the process which lead to a decision on fracking. It is known that a decision was made, but there is little knowledge about how the decision was made outside of policymakers' declarations that the rationale behind commencing fracking lies in positive economic effects outweighing negative ones, suggesting a cost-benefit analysis.

In this thesis, I want to open the black box of the decision-making processes as far as I can. I am telling the story of shale gas and the reasoning behind it from several different perspectives, to show that the official 'rational economic reasoning' is if anything but one possible explanation, which offers limited explanatory value, and instead I consider other explanations.

To explain the dependent variable of risk or uncertainty preference, which is stated through a country's commitment to hydraulic fracturing for shale gas, in this study I am searching for a common factor most likely responsible for the similar policy decisions made by the U.S. and the UK. I test three separate hypotheses about the influential independent variable with three approaches concerning different dimensions of the decision-making process.

The plan of the thesis is supported by the following claims: 1) That a decision on energy policy involving a new, not thoroughly tested and researched technology is a decision made under considerable uncertainty. 2) That a decision to add fracking for shale gas to a country's energy mix is a decision made under awareness for the potential of consequential risks to the environment (such as pollution and land degradation), to human health (such as water and ground contamination and radioactivity) and to the economy (such as market bubbles, neglect of other important economic assets such as alternative energy, or labour market shifts). 3) That there are viable alternative energy policy paths known to the governmental decision-makers. 4) That a decision to accept the risks brought on by engaging in fracking is expressed through both the governmental decision to commence exploratory and commercial fracking as well as through statements made by official decision-makers and official decision-making bodies and institutions. 5) That an examination of the reasons that factor into a governmental decision on an energy policy which entails risk will enhance our understanding of the reasoning behind the current energy strategy as well as behind decision-making in the face of risk and uncertainty.

Some scholars have criticised this type of approach in which the case selection is based on the dependent variable – i.e. a case selection because of an outcome of a decision-making process and a subsequent analysis of the factors influencing said outcome and their causal relation (Mahoney and Goertz 2006). However, in this particular research project the case selection based on the dependent variable can be justified by the specific puzzle – of which the outcome, i.e. the decision is known, but the path that led there is not – and also by previous successful application of this type of research (King, Keohane, and Verba 1994).

The cases selected to analyse and compare are the United Kingdom and United States of America. A comparative study of the two countries was chosen for the following reasons: First, too few countries have sufficiently developed a shale gas sector to merit an in-depth study. Among those, the U.S. and UK appear most committed to shale gas, and their economic policies are well documented. Second, the U.S. and the UK are distinctive enough to offer a good basis for comparative case studies.

The two countries represent two of the most advanced and best documented economies in the world and hence focus on them is both justified by interest as well as facilitated by previous work. Yet, despite a shared historical or cultural background, the United Kingdom and United States have very diverging economic capabilities and strategies regarding their energy sector, and have very different regulatory and bureaucratic systems governing it (IEA 2002, 2003, 2005; Helm 2008; DECC 2011; DoE 2011; MIT Energy Initiative 2011; IEA 2012b; White House 2012; EIA 2013a; DECC 2014; IEA 2014, 2015b, 2015a, EIA 2015e, 2015c, 2015f).[9] [10] This fact directly causes the disbelief of many experts, especially in the UK, that an approach that, apart from being rather new and uncertain, has been used only within a very specific sector setting in the US, should be emulated in the UK (Stevens 2010; Boersma and Johnson 2012a; Carrington 2013b; BGS 2013a; Anderson 2015). Given the above, I approach my comparative analysis like a most dissimilar systems design (MDSD) aiming to find common factors influencing the decision.

The U.S. and the UK have sufficient data available, while the political process is documented enough as to prove fruitful for investigation. Their engagement with shale gas is closely monitored by other states – China, Argentina, Poland for example – concerned with their energy supply security and interested in joining the shale gas market example (Stevens 2010; Tian et al. 2014). Ergo further analysis of the strategic decision-making around shale gas policy in these cases is needed. Following this line of thought, Canada was deselected for being too similar to the United States in sector history and practices (IEA 2016). Australia and New Zealand are deselected due to legal uncertainties at the beginning of the research about whether or not fracking would be pursued or continue unhindered – moratoria are still discussed (ODT 2012; ABC 2016). In Poland, major companies have quit drilling due to geological differences that meant the hydraulic

[9] I forego the argument over left vs right wing political parties and their influence by including a change of government in each country within my timeframe.

[10] The United Kingdom may after the events of 2016 decide to leave the European Union – however, a) this was not foreseeable before the write up stage of this PhD, and b) there is so far no knowledge on whether the country will truly leave the bloc and if so how closely its energy sector but also overall legal, regulatory, economic and environmental frameworks will still be tied to the EU.

fracturing process was not functioning the way it did in the U.S. (Anderson 2014). South Africa has had its drilling ban lifted but there is hardly any data on the production and policy process available publicly (AFP 2016). China (IEA 2016) is deselected for the same reason.[11]

Considering the small number of cases studies, a very strict or randomised case selection design is neither possible nor appropriate. Yet from early reading and research into the topic what stood out is the discrepancy between the situation of the energy sector in the United Kingdom and the United States (Stevens 2010; Petersen 2013; Chestney 2014; Stevens 2014).

To sum up, the United States and the United Kingdom have been chosen for comparison as they are two countries seriously engaging in policy decisions around shale gas, with their governments officially pro fracking[12]; due to their very different energy sectors they have enough variation on the dependent variable to make for a productive comparative analysis (Keohane, King & Verba 1994). Further, they are chosen as they are both pioneers in the domain of shale gas (the U.S. more so than the UK). The United Kingdom and the United States came to the same conclusion on the risks of fracking and made similar political decisions, but it is very unclear why they should have done so. Their decisions came with a difference in timing, which will be taken into consideration in the study, but which arguably has not altered the key variable of uncertainty. The introduction in chapter two establishes a basic overview of the two countries' energy systems which provide discrepant opportunities and challenges for shale gas exploration, for example in terms of reserves as well as structural and regulatory factors (further analysed as part of the detailed case study in chapter four). I will respect the inherent limitations of a qualitative case study with a small-n sample by refraining from generalising and by acting aware of the fact that there lies uncertainty in my inferences.[13]

Shale gas is a very current issue and a newly relevant method of energy generation, which in the past decade has been increasingly employed in the United States and has been gaining traction in early, not-yet commercial stages in Britain since 2011 (BBC News 2011). Hence the timeframe for this study is 2001/2 – the approximate beginning of commercial fracking on a large scale with the first successful horizontal well in the U.S.

[11] Fracking policy decisions in Argentina commenced too long after this research project did (Gutman 2017).
[12] That is at least until summer 2016, the last included date and dating of submission for this thesis.
[13] To include detailed control cases for my MDSD would not be feasible within the time constraints of this work, and control cases are also limited due to the novelty of the case study; but where possible I reference comparable examples from other countries.

Barnett shale play (Stevens 2010, 14) until 2014/2015, the last available point of time for many of the data sets used.[14]

I devise a more traditional analytical perspective, what Allison would call 'rational actor model', in chapters three and four to consider the merits of a cost-benefit analysis of the shale gas decision made under the impression of rational, *homo economicus* type of decision-making. In the theoretical chapter I consider traditional and critical research on this topic, and in the analysis chapter I use comparative economic, geological and structural data. The sub-hypothesis for this dimension is as follows:

H1: The decision will be made that benefits of fracking outweigh risks if the expected utility of the measure is convincing.

In order to consider the expected revenue from shale gas, in chapter four I examine the resource endowment for both countries and compare this to resource needs and energy consumption patterns. This is to provide a better overview of the energy economic situation and potential impact of shale resources. Further I assess in this chapter structural factors such as the diverse legal framework, gas pricing systems, infrastructure, and population density. Revenue is measured as the estimated potentially recoverable shale gas resources in consideration of costs likely to arise from factors such as the expenses mentioned. All of these affect the expected utility of fracking and political decision-makers can be assumed to be well informed about them. Another factor explored is the need for energy supply security. Information is presented from primary sources such as international data and national statistics, as well as secondary sources on the countries' energy supply and its energy demand compared to production, imports and exports.

Rational choice in political science is a very large theoretical field that has been developing in multiple directions and dominating several key subfields and journals for over fifty years (Green and Shapiro 1994; Friedman 1996). In my thesis, I cannot do justice to the diverse variations of its approaches. Instead I focus on one basic core assumptions that is a) at the heart of all rational choice theory and b) key to risk preference theory, which is that all actors seek to maximise value or utility. This behaviour is considered rational, and political actors are construed as rational beings capable of pursuing it (Green and Shapiro 1994; Friedman 1996). Considering the rational choice options for political decision-makers in my case study, then, I take into account possible goals other than national or public benefit, for example parochial sectoral benefits or short-term goals such as re-election, personal gain and approval. In chapter four, public attitudes towards

[14] Of course, I will consider theory, reports and regulation from outside this time frame that concern or affect actions and decisions within it.

fracking are considered under the assumption that they count for political decision-makers' efforts to gain re-election, to give room to testing a popular, more narrow definition of rational choice and narrower conceptualisation of politicians' interests as that of seeking re-election (Downs 1957). Another interpretation of maximising utility allows for the possibility that politicians act in someone else's but the public's interests: here I also consider in chapters five and six theoretical approaches about lobbying for parochial interests and case evidence on the latter.[15] The possibility of a time lag, that politicians will accept future risks and losses at the risk of short term gains, is less relevant with shale gas, firstly because many risks, such as earthquakes, are experienced almost immediately, and secondly because very negative public perception of shale gas could have an impact in the short term, on the next election.

In this second analytical dimension, I examine private interests in shale gas and the institutional access granted to them first in a theoretical review introducing political economy approaches applicable to the case study (chapter five) and secondly by considering data available on such interests in the U.S. and UK and their respective institutional positions (chapter six). This corresponds to Allison's third model on bureaucratic politics but whereas he focuses on interest from within the government, I am considering private interests.

H2: The decision will be made that benefits of fracking outweigh risks when private (as opposed to public or national) interests align with it and are able to conduct significant lobbying for this policy to go ahead.

To investigate lobbying activity around shale gas I consider the relative strength and history of the gas and oil lobby in either country, then turn specifically towards the top energy firms interested in fracking. In order to establish a comparison, I also spend time on examining the lobbying capacities of the opposition to shale gas. To judge the vital role of institutional access by private interests to policymaking I include a section on the links between companies and the relevant regulatory institutions as well as key policymakers.

In the third dimension of the case study in chapter seven and eight I review the influence of entrenched strategic ideas as well as cognitive biases as to their impact on the shale gas decision, a situation which I call 'cognitive capture'. This framework is based on risk theory and decision-making literature from the field of psychology, decision analysis and

[15] One approach to policymakers' rationality that is not considered in this thesis is the more recent approach of considering politicians' desire to fulfil the interests of investors rather than other market players (Streeck 2013, 2013, 79). It isn't a much discussed or well documented field in the area of the energy market and at the time of commencement of this thesis there were clear issues of data availability. However, later data shows that this story could be promising regarding shale gas and should be researched in future (EIA 2013b; The Economist 2015; Ward 2016; Scott 2017).

organisational behaviour theory as well as IPE literature on ideational and institutional constraints. This corresponds to Allison's second model of organisational process in so far as I consider potentially subliminal constraints to action and change.

H3: The decision will be made that benefits of fracking outweigh risks when they fit within the government's repertoire of strategic ideas and when cognitive biases exist that suggest this course.

In order to analyse the ideas behind current energy policy, strategy documents for both governments' energy policies are assessed and compared. As the focus is on ideas the study will look at primary sources expressing exactly those, ideas and preferences, namely the white papers (UK) and strategic plans (U.S.) by the countries' governmental energy departments (DoE and DTI, BERR, DECC).

The outline of this thesis is as follows: In the following second chapter I introduce the key issues around shale gas and hydraulic fracturing technology, and the related respective policy decisions made. The main part of the thesis from chapter three to eight puts forward the three separate analytical approaches to consider three different aspects of decision-making on shale gas; each approach is subdivided into a first theoretical chapter and second chapter presenting data and subsequent analysis. In chapters three and four I consider the traditional approach of decision-making under risk and uncertainty of cost-benefit analysis and expected utility: the third chapter provides a historical and literature review, criticism and developments, and the fourth chapter presents the related data for the U.S. and UK shale gas case and an ensuing analysis. I then focus on two further dimensions to the story behind shale. The second narrative, also divided into a theoretical chapter six and a data and analysis chapter seven, considers the influence of private interests and their access to governmental institutions as a factor in shale gas policy support. The third dimension in chapter seven and eight focuses on various cognitive constraints, including specific heuristic biases and broader ideational constraints, to rational decision-making. A conclusion follows in chapter nine.

In this thesis, I do not strictly follow a positivist approach but neither do I strictly follow an interpretivist approach. My work is based on the methodology set out by Graham Allison in his book *Essence of Decision.* In the book he explores a decision taken under risk and uncertainty during the Cuban Missile Crisis (Allison 1971; Allison and Zelikow 1999b).

Allison's methods of contrasting diverging explanations for similar situations was aimed to show the degree to which theory can help select certain evidence while deselecting others. Considering that it is impossible to study historical events without theory, the contrasting method he employed leaves it to the reader to adjudicate among diverging explanations. Strictly Allison's approach is not the typical interpretative approach. He treats interpretation as a form of a narrative, or a story telling, and he employs divergent theoretical frameworks to generate such narratives. These narratives are not based, of course, on pure fiction but on evidence. Yet, the fact that three very different narratives are founded on different theoretical frameworks show the power of theory to distort evidence. Allison acknowledges, of course, that the quality of the narrative is partially dependent on the narrator: the skill by which the researcher is able to combine a theoretical framework with empirical evidence to generate convincing historical narrative. But, the skill of the narrator is no guarantee that the story they are telling describes what really matters. In that sense, Allison is not a positivist. He rejects the notion of the possibility of any ultimate truth or approximating truth in historical studies. The best the social scientists can say is that one set of theories or theoretical framework is able to produce a narrative that appears more convincing or comprehensive than another. Allison was able, then, to present his own estimation of the comparative quality of the narratives generated. For instance, he thought that a straightforward rational decision-making approach produced poorer results. His preferred finding was that the insofar not recognised issue of bureaucratic politics seemed most influential. His approach was to present evidence to the reader as openly and transparently as possible and let the reader make up their mind.

Like Allison, I develop three scenarios of decision-making based on three theoretical perspectives. My approach of describing how a decision is made under certain conditions rather than empirically proving one correct hypothesis explaining the causal link in general terms falls in line with methodological nominalism rather than essentialism (Shearmur 2002; Parvin 2013). My aim was to give each the best ammunition possible, so that they each would read as plausible explanations, and as able to partly explain the decision taken. Nonetheless, each has its limitations. Allison disproved the notion that the reasoning behind the decisions taken in Cuba was as straightforward as suggested by the rational actor model. Similarly, by presenting three different scenarios I show that the decision behind supporting shale gas exploration is unlikely a straightforward, rational economic decision.

By using this unconventional approach, like Allison, I am not claiming that I can ultimately prove causality links (i.e., which sets of causes led to a given outcome, in this case, the shale policy). The method used in my thesis helps towards questioning the validity of the official reasoning. I personally, find the least explanatory power in the classic risk preference rational model (chapters three and four), and that a different narrative, the one about cognitive capture presented in chapters seven and eight, has particular internal consistency and apparently more explanatory value.

In constructing such narratives, this thesis deals with several phenomena which are unobservable, for example ideational constraints or the direct impact of lobbying. One can demonstrate, for instance, that certain efforts were expanded by lobbyists in support of certain policy outcomes, and then one can show that the policy options chosen were identical to the ones favoured by certain lobbyists. Yet, even in this, rather rare situation, this does not constitute a causal link between one and another. Political scientists seek additional evidence for causal links between lobbying and policy outcomes by interviewing actors, examining primary literature and or working out whether one narrative or causal link appears more persuasive then another. None of these approaches can establish a line of causality with absolute certainty. My approach relies, therefore, on existing secondary literature on lobbying in the U.S. and the UK and alternative energy, combined with an evaluation of the likelihood of the narrative presented. The same is the case when it comes to ideational constraints, or cognitive capture. Scholars have argued for decades that strong ideas about how the economy should work, such as a subscription of Keynesian or neoliberal beliefs, can have an actual effect on economic policy. This has been researched for example famously by Peter Hall (1993). Looking at the adoption of Keynesian politics he argued that in the absence of proof of other direct causal links or pressures leading to the adoption of specific policies, one could establish whether Keynesian ideas existed and were accepted before the adoption of the related policy. Scholars have argued for years that the way in which an actor perceives the world dictates how they interact with it (Wendt 1994; Blyth 2009; Abdelal, Blyth, and Parsons 2010; Rodrik 2014). Yet again there are no methodological approaches which can establish a causal link with absolute certainty.

Therefore, the decision to include mixed methods and allow for interpretative elements amongst positivist empirical research seems natural and not diminishing to the quality of my results. My decision follows longstanding methodological research refuting the notion that positivist and interpretative research need be separate or mutually exclusive but rather that they can be mutually supportive (Luthans and Davis 1982; Lee 1991). When drawing conclusions, I aim to not present them as 'provable' facts and do not consider them as such but make every effort to outline my analysis and the logic behind my conclusions.

Materials used in this thesis stems from mixed method research. The first research model on rational economic risk preferences includes data from official governmental statistics by the departments entrusted with economic policy, energy policy, environment, budget or statistics, third party data from bodies such as the IEA or OECD, and data from independent scientific research published in recognised journals (e.g. IEA 2002; DTI 2003; IEA 2005; BERR 2008; Owen, Inderwildi, and King 2010; Urbina 2011; IEA 2012; Bolton 2013; International Energy Agency Staff 2013; EIA 2013b, 2015c, 2015a, 2016; IEA 2016).[16] The second model uses a variety of data available on lobbying: the official independent lobbying register from the Centre for Responsive Politics (CRP), Pro Publica, Data from the United States Congress' records and investigative journalism collections as well as data from independent academic research in the United States case study (e.g. Lustgarten 2009; Buisset, Øye, and Selleslaghs 2012; Martin 2014; Horn 2013; Tansey 2014; DeGette 2015; Jones and Rowell 2015; European Commission and European Parliament 2016; CRP 2016). For both countries, data about institutional connections and lobbying was drawn from the business intelligence tool Boardex (BoardEX 2016). Data on lobbying in the UK was less plainly available than in the United States due to a difference in lobbying register. It is based on primary data from parliamentary publications and records and the Lord's Committee of Economic Affairs but also the EU lobbying register, supplanted with data from independent academic research as well as from investigative journalism (Mitchell 2012; DECC 2012; Carrington 2013b; Parliament Publications & Records 2013; Lords' Committee on Economic Affairs 2014; Pratley 2015; Athena 2015). For the third model, the materials considered are all of the respective official energy strategy plans within the timeframe of research: the UK Energy White Papers from 2001 – 2015 and the U.S. Strategic Energy Plans from 2001 – 2015 (DTI 2003, 2007; BERR 2008; DECC 2009, 2011, DoE 2006a, 2011, 2014a; White House 2014). These documents are the blueprints for all energy policy within a country, showcasing the ideas held by official energy policymakers tasked with writing energy related legislation and the ideas that future policy is drawn from. Therefore, to my line of research they have proven more conducive than official statements by elected Congressmen or MPs who are not actually tasked with writing energy legislation or transcripts of parliamentary debates on the issue, as these rarely go into detail. Interviews would have been a helpful addition to the dataset. However, after completing a first round of interviews with parliamentary researchers and researchers at the Department of Energy and Climate Change in the United Kingdom, it became impossible to replicate these interviews in the United States during my research there. Hence interviews do not form

[16] The variety of sources is needed both to fill gaps in data that would otherwise arise, especially when needed for comparison between the two countries keeping different records, but also to increase accuracy and objectivity.

part of my dataset in this chapter, but I acknowledge that they can be a fruitful future addition to the case study.

The study excludes culture and cultural impacts on decision-making. The idea that cultural differences between the U.S., UK and Europe may explain risk preferences and resulting policy towards energy and new technologies has been raised by Wiener et al. (2013). The literature on the subject, however, is highly inconclusive: While the various case studies in Wiener et al. (2013) hint at the possibility that culture may be used to explain otherwise unexplainable phenomena, there is no concurrence or clear strategy. Some studies argue that the U.S. more risk averse than the EU, while others argue the other way around (Vogel 2003; Kelemen and Vogel 2009; Jonathan B. Wiener et al. 2013). Many dispute the notion of cultural divergence and risk appetite between nations (Walsh 2011; Miller 2011; Freestone 2011; Wiener et al. 2013). In my study, I chose not to engage with the variable of culture as I did not see how it might add to the project without sacrificing clarity. Finally, the variable of party identification is sometimes used in the context of culture. However, my research timeframe is such that it covers separate governments from different parties with different party identities in both case study countries. Since in each country parties from either side of the political spectrum chose to engage in shale gas (also counting the coalition government in the United Kingdom), party identification does not appear to have an impact as a variable and will be disregarded.

In my thesis I consider the influence of institutions, often considered one of the three pillars of comparative political economy (Hall 1997; Soskice and Hall 2001; Blyth 2009), not as a separate model but within the other three narratives. Peter Hall defined institutions as "the formal rules, compliance procedures, and standard operating practices that structure the relationship between individuals in various units of the polity and the economy" (Blyth 2009, 197); Douglass North defined them simply as "humanly devised constraints that shape human interaction" (Blyth 2009, 197).[17] Institutions in the sense of structuring possible economic policy are considered in chapters three and four when structural, legal and bureaucratic factors facilitating shale exploration are assessed. Institutions in their role of structural positioning mediating interests (i.e. providing access to policymakers) are considered in chapters five and six on shale gas and interest politics. Institutions in their role of norms and guiding principles are core to the third model I group around ideas in chapters seven and eight.

[17] The notable difference lies between the origin of institutions – in Hall's version they appear to exist prior to the agents who may use them or be constrained by them, whereas North allows for the idea that agents may chose and create institutions to streamline interaction in their favour. (Blyth 2009, 197).

Many reviewers of Allison pointed out the overlapping issues within his second and third model (Smith 1980; Halperin, Clapp, and Kanter 2006; Alden and Aran 2016), further encouraging me to not try and divide up institutions as a specific model. The very nature of institutions as structuring opportunities for other behaviour makes their inclusion into each of the narratives seem natural.

Another issue is the problem of assessing the difference between openly stated and expressed ideas, interests and preferences versus potential hidden but true ideas, interests or preferences. However, this study assesses ideas and interests once they have been publicly expressed and assumes that the latter, hidden kind, cannot have influence on policy process any more after this has happened. Woll states that preferences unfortunately "come with an epistemological problem: the only thing a scientist can observe is an individual's behaviour. One can thus only infer which preference an actor was pursuing with a certain behaviour and only make assumptions about the degree to which such a preference corresponded to the actor's actual interest" (Woll 2008, 31). However, this should not impede nor further concern my research, for two reasons: first, there is no solution to this issue other than impossible telepathy or illegal spying. Second, the preferences taken are those of governments, not the individuals within them, and even when they are, they are made in such an official capacity and, more importantly, with such an impact, that they count for more than an individual's preference, as they lead to policy or at least cannot be taken back as easily since they are public.

I.3.1 Core findings and contribution of the study

The thesis adds to current knowledge and debate on energy sector policy through a new interpretation of empirical data to highlight current challenges regarding shale gas that hinder a transformation of energy sectors to alternative fuels. Breaking such impediments and moving on with climate change action through the support of renewable energy sources is one of the 21st century's key challenges. The thesis also adds to theory and research on decision-making under risk and uncertainty in political science by testing the classical expected utility approach and considering a combined political economy approach.

The empirical investigation of my three narratives provides some important insights about the realities of the shale gas story for the U.S. and UK economies as well as insights about the role of private interests and the impact of cognitive constraints on decision-making. In particular, I find the expected utility and cost-benefit analysis does not recommend shale gas development for either country but especially not for the UK due to the diverging geological and structural factors but difference in timing and new insights about shale gas. This notion both contradicts official statements by policymakers that claim the move towards shale is based on rational economic consideration, but also as a by-product disputes the theoretical arguments that put forward this approach. In reality, shale gas relies heavily on subsidies and support, but governments and companies embrace the ideas about the fossil fuel's economic success. Classical political and economic theories of rational decision-making do not explain these preferences. My research hence adds analytically to the discussion of a broader question at the very forefront of political economy: why are certain economically irrational decisions maintained despite concrete evidence to the contrary? Specifically, why do current policies on energy diverge from the fundamental economic concepts they are based on?

The aims and means of private interests and lobbying are found to strongly positively correlate with the decision on fracking in the United States and to a slightly lesser degree with the United Kingdom, too. Through this narrative the evidence I present lends empirical support to theories of IPE that emphasise the influence of private interests on policymaking, especially to arguments about the effectiveness of lobbying strategies that favour quiet politics and close relations with regulators. A tendency for supporting the status quo over change can also be confirmed to a lesser degree – even if shale gas does not exactly represent the status quo, it fits the theme.

Lastly through my discussion of cognitive capture I discover support for my hypothesis that cognitive capture in the form of biases and key ideas constrain policy options, prohibiting an inclusive debate and change. This provides some confirmation for both IPE theories on the influence of ideas and behavioural economics' theories about the influence of cognitive biases on decision-making under risk and uncertainty. It also helps in explaining the success of shale gas, as the UK and U.S. energy policy strategy appear equally biased in their cognitive treatment of different energy sources.

II Chapter Two. The story of fracking and why it is important

In this chapter I will introduce the energy market phenomenon that is called hydraulic fracturing or 'fracking' and the story of its development until 2016. This serves firstly to familiarise the reader with the resource and the technological innovation that has led to the commercialisation of its development, to clarify terms and concepts used in the following thesis. But beyond that, this clarification is needed in order to understand why shale gas is currently an unusual contender on the energy market, why its development is controversial, and why a policy decision in favour of or against its development is a decision involving uncertainty and serious risks that is worthy of policy analysis.

The chapter is set up as follows: I first explain the currency, technology and history of hydraulic fracturing of shale gas; then I discuss why it is controversial following environmental as well as economic considerations. This is followed by a small section on issues around data reliability. Lastly, I elaborate on the puzzle that is posed by recent policy decisions on shale gas development in the modern energy market which prompted this study.

II.1 Shale gas: A primer

What appear to be substantial unconventional gas resources have recently been located in countries across the globe, predominantly the United States, Canada, Mexico, China, Argentina, South Africa, Poland, Bulgaria and France. They have only become accessible due to recent technological innovation. The discovery is considered as a potentially game-changing resource opportunity for these countries' energy mix by some governments and as a substantial business opportunity by major multinational oil and gas companies (Stevens 2010; The Economist 2012b; EIA 2012b). So far, the United States alone have made significant use of the newly accessible resources: shale gas has increased from accounting for 1% of United States energy production in 2001 to accounting for 20% in 2009 (Stevens 2010; EIA 2012a).

Unlike the production of natural gas, due to shale gas' location in tight shale rock, its production through hydraulic fracturing or 'fracking' involves not only vertical but also horizontal drilling, a process only recently deployed on a large scale (Wright 2012). Hence it belongs within the group of unconventional gas. Whilst horizontal drilling is attractive in that it offers the possibility to drain a larger area with a single drilling platform, stable drilling is much more difficult in horizontal boreholes. These difficulties are only enhanced by the fact that shale drilling normally takes place in much deeper layers of rock formation than conventional gas (Fjaer et al. 2008, 309).

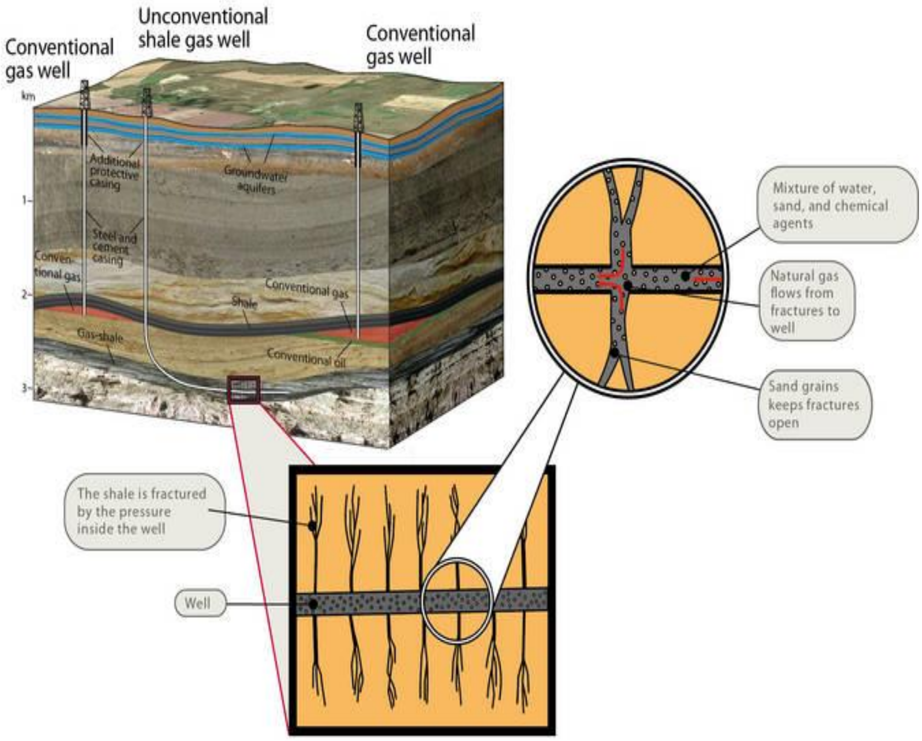

Figure 1: Conventional and Unconventional Gas Well & Fracking (GFZ 2016)

Figure 1 above (GFZ 2016) illustrates the difference between conventional drilling and hydraulic fracturing. Fracking is undertaken by pumping a combination of water, sand (or alternatively tiny ceramic balls), and a mixture of chemicals into the shale rock with very high pressure (Nestler 2012). Hydraulic fracturing "takes place when the fluid pressure within the rock exceeds the smallest principal stress plus the tensile strength of the rock" (Fjaer et al. 2008, 369); the result is a controlled explosion, fracturing the rock. The high water pressure serves to break open the deep formation of rock, the sand or ceramic balls are pumped down to keep open the fractures for the gas to be able to flow out. The small images illustrate the fractures in the shale, artificially created through controlled explosions, which give the procedure its name. Conventional gas does not require such efforts and, under normal circumstances, flows easily once tapped by a well shaft.

At least around 5% of the liquids used in fracking are chemicals that fulfil various tasks – decrease friction, support the transportation of sand or ceramic, and prohibit the formation of bacteria and foul gases (Nestler 2012). But 5% is the minimum – in commonly used fracking fluid concoctions, between 5% and as much as 28% can be acids alone (hydrochloric or acetic acids), used to prepare the shale for fracking; other chemicals include citric acids, guar gum, borate salts, and isopropanol (The Economist 2012b). Some of the chemicals contain gelling polymers often found in food or cosmetics, some contain friction reducers normally used in diapers: overall a mixture of several dozen different chemical ingredients is used (Wright 2012). Not all of these chemicals are dangerous for the environment or if they were to come into contact with humans, but part of them have been proven to be so (Daly 2012). The mixture depends greatly on the specific area and situation of each individual shale basin, and the impact it will have varies. The environmental impact of fracking also differs greatly on how and where the fracking fluid is disposed of once the fracking process is completed (Nestler 2012). Whilst general information about fracking is available and fairly well understood, it varies so greatly from each different basin or layer that it is hard to make overall assumptions about the safety of fracking and fracking fluids (Nestler 2012; GFZ Helmholtz Centre 2013). A problem with estimating the safety of the process lies in the fact that to ensure competition, U.S. companies are not required to disclose the exact chemicals they use during production (Schrope 2013; Terrell, Tinley, and Souther 2014).

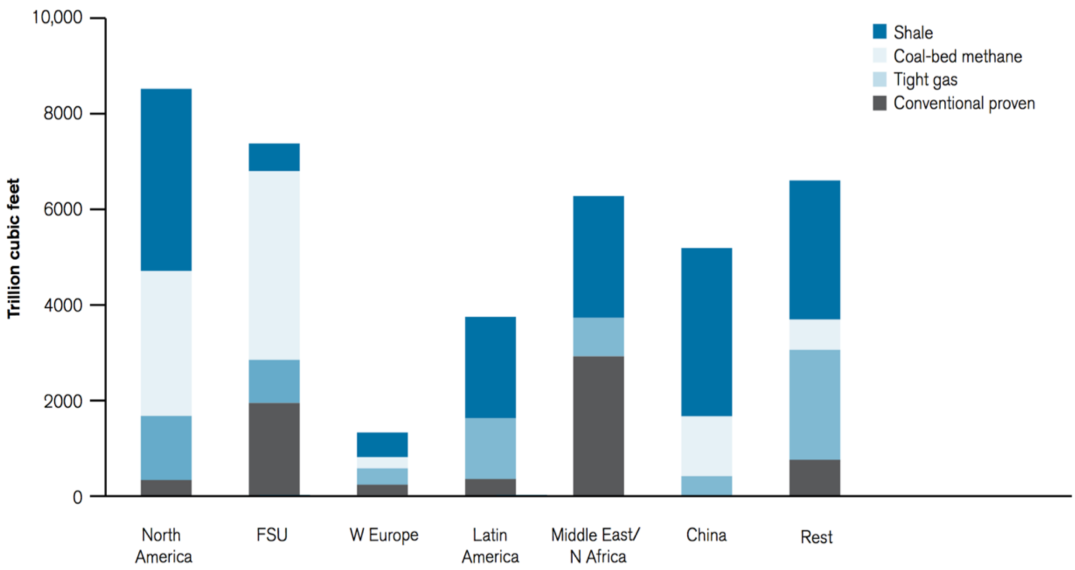

Figure 2: Estimates of Global Gas Reserves 2010 (Stevens 2010)

Figure 2 above (Stevens 2010, 15) sheds light on another factor rendering shale gas so desirable: domestic energy independence. If those estimations were to hold up and the majority of shale layers proven to contain substantial amounts of gas that are viable to recover, then North America, which possesses a comparatively small amount of conventional proven gas resources, is estimated to possess unconventional gas resources potentially greater than the overall gas resources of the Middle East or Russia. The United

States are known to have expressed a strong desire for energy independence in the past, both from the government (White House 2012) but also by the public (PEW 2012). However, the reserve size statistics projected for shale gas resources have previously been revised, are doubted by experts and difficult to judge without insights into the detailed geological situation (DECC 2013b).

The context of the excitement about the so-called shale gas 'revolution' can be accounted for by the interplay of several important factors. First, and quite simply, despite the fact that fracking was first attempted in its current form in the United States in 1947 (Styles 2014), large-scale commercial fracking operations have only become possible and affordable through technological progress in the 2000s (DoE 2015; The Economist 2012b; Wright 2012). Secondly, only the increasing awareness of the limitations of ever declining, slowly depleting conventional fossil fuel resources (Longwell 2002) favours the exploration of less accessible resources such as unconventional gas, and production has accordingly increased manifold in the past decade. Thirdly, the interest can be further explained by the fact that large parts of the expected resources are situated in countries which are traditionally not overly rich in conventional oil and gas resources, such as Argentina, France or Poland (EIA 2012b). This has the potential of changing the global landscape of trade balances.

Global trends support the movement towards new resources in general. World energy demand is expected to grow by 37% by 2040, and with much stronger demand from the Asian markets than previously (especially from India and China), import demand competition is on the rise (IEA 2014). Improvements in energy efficiency have the potential to slow increasing energy demand of course. A further shift affecting the energy market is the approaching retirement of almost half of the current operating nuclear plants before 2040, mostly in the United States, Europe and Russia (IEA 2014, 4). All major regions with the exception of Europe are to see an increase in natural gas output of above 50%. Gas is expected to "draw level with coal as the second largest fuel in the global energy mix, after oil" (IEA 2014, 2). A large share of this prediction concerns unconventional gas reserves.

Both the United States and the United Kingdom are currently in the process of reviewing oft-changing information about the amount of shale gas resources available respectively (Stevens 2012), with both governments considering claims that the new resource could change the energy landscape lastingly and supply a significant amount of the respective country's energy need for the immediate future (MIT 2011; BGS 2013a). Already an established business within the span of only a decade, in the United States hydraulic fracturing of shale gas is the new much-discussed phenomenon said to be transforming the energy market. In the United Kingdom, the government has granted several rounds of increasingly liberal fracking licenses and changed regulation such as specific industry taxes with the shale gas industry in mind. Yet owing to both strong local opposition and several well-publicised mishaps in the early stages, such as earthquakes in Blackpool, fracking has not yet reached a commercial stage in the UK and test drilling has been prevented in several cases. After fracking was briefly suspended in 2011 the UK government once again backed and allowed hydraulic fracturing in Britain in late 2012 (Harrabin 2012). The official U.S. government's stance on shale gas is to support its extraction and that it has provided the economy with positive growth (Pasternak 2001; Lustgarten 2011; Snyder and Klimasinska 2012; White House 2014; Krukowska 2014). In the United Kingdom the Cameron government has decided in favour of supporting its deployment and is actively pushing for shale-friendly legislation (Carrington 2013a; Cameron 2013; BBC News 2014a; Osborne 2015). Top policymakers in both countries have recommended shale gas in the highest tones (Lustgarten 2011; Snyder and Klimasinska 2012; Cameron 2013; Chazan 2013; Vaughan 2013a; Carrington 2013a; Krukowska 2014; BBC News 2014a; Blake 2014; Osborne 2015).

However, "political, environmental and … scientific concerns have risen along with production, as evidence mounts that fracking is responsible for everything from polluting subterranean aquifers to causing regional earthquakes" (Daly 2012).

II.1.1 Controversies around shale gas development: environmental and economic considerations

Shale gas has to compete with the shift towards cleaner and sustainable energy sources. The environmental credentials of shale gas are controversial for two reasons. Shale gas is of course an unsustainable resource, which raises questions about its impact on the economy, the depletion of resources, and its impact on global warming. Its environmental credentials are controversial for two key reasons.

Firstly, the detrimental impacts of shale gas production on the natural environment and the process of global warming are uncertain yet likely considerable. Many supporters consider and promote shale gas as comparatively clean or at least cleaner than coal (Chazan 2013; Leadsom 2015): this claim is unsubstantiated as of 2016. Instead most research points towards greenhouse gas emissions from shale gas being higher than those from natural gas and even higher for the amount of energy produced, or more potent, than those from coal (Howarth, Santoro, and Ingraffea 2011; Boersma and Johnson

2012b; Howarth, Santoro, and Ingraffea 2012; Hirst, Khor, and Buckle 2013). One study projected that the fracking boom may increase global carbon emissions by almost 12% (Bichard 2014). It has also caused pollution near drilling sites (Soraghan 2011; Osborn et al. 2011; Vaughan 2013b).

The breaking up of the shale can be rather noisy due to the heavy machinery at work, yet it will usually take up only around a week. Afterwards, once the gas starts flowing, the landscape can be mostly reclaimed by nature and can return to its original state, apart from – comparatively discreet – pipework and some water storage. This is a key reason as to why shale gas extraction is advertised as a cleaner and greener alternative to coal by the supporters and companies investing into fracking (Wright 2012). Environmental concerns around the practice of shale gas development other than its carbon footprint include the potential for water and ground pollution, large water consumption, seismicity, landscape degradation and radioactivity (Nestler 2012; Daly 2012; Boersma and Johnson 2012b; Groat and Grimshaw 2012; Helm 2013; Stuart 2013; Davis and Fisk 2014; Cherry et al. 2014; Herbert and Jones 2014; Stamford and Azapagic 2014; Vaughan and Mason 2015). Scientists have complained about the limited opportunities and time given to research about these risks, resulting in gaps in knowledge about many aspects of the process, including how to explain and prevent frequent leaks, effects of chemicals on ground and groundwater, or the overall impact on human health (Schrope 2013; Semeniuk 2014; McCarthy and Semeniuk 2014; UKERC 2015). Researchers lament the "current incomplete state of knowledge about shale gas" (UKERC 2015, 5). Some urge that it should result in a ban on fracking until more is known and until conditions necessary for safe exploration that are so far not in place are met (UKERC 2015, 5). Uncertainties remain, about best practices to avoid seismic activity or setting free radioactivity, or indeed how much gas is leaked during the life cycle of a well, combustion chamber and pipelines (Boersma and Johnson 2012b). It is said that "fracking outpaces science" (Schrope 2013) to the point where even risks that could be calculated remain uncertain.

Secondly, shale gas has high potential to draw support and subsidies away from renewables (Stevens 2012) and to continue the trend of favouring fossil fuels with subsidies over renewables (ONS 2004; Athena 2015; Cheon, Lackner, and Urpelainen 2015). The UK specifically was recently reprimanded for this very policy as UN scientist Prof McGlade surmised "what's disappointing is when we see countries such as the United Kingdom that have really been in the lead in terms of getting their renewable energy up and going – we see subsidies being withdrawn and the fossil fuel industry being enhanced" (Harrabin 2015b). While shale gas use has led to a decrease in coal use in the United States, this coal is now used in Europe and other countries – and the inherently global nature of climate change means that this replacement is an entirely pointless measure to combat emissions (Broderick and Anderson 2012; Warrick 2015).

Despite policy output suggesting that fracking for shale gas is meant to, at least to a certain extent, replace conventional gas drilling once the conventional gas reserves are depleted, it has to be taken into account that this requires new, different technology and possibly new infrastructure and hence new investment and structural changes. Any cost-benefit analysis should take into account that even the best of estimations over the amount of shale resources have to concede that it is an unsustainable resource with a limited time span of usability.

Many environmental concerns raised by anti-fracking lobbies in connection with shale gas production have been scientifically and independently confirmed to varying degrees. They include groundwater and freshwater contamination and water use, adding to water scarcity (Osborn et al. 2011; MIT 2011; Horn 2013a; Stuart 2013; Begos 2013). In 2011, a study published by Duke University into fracking safety looked at groundwater probes from wells near the Marcellus and the Utica shale basins and found much higher concentrations of methane in the groundwater than usual. The isotopic signature of the leaked methane gas made it possible to identify it as gas from the fracking wells and allowed researchers to exclude the possibility that it was a previously present concentration of methane, which is otherwise possible and must be considered (Osborn et al. 2011). The study even determined potential explosion hazard near fracking wells in some areas due to the very high concentration of methane. However, they did not find traces of fracking fluid, which led to the conclusion that the methane most likely stemmed from leaky well casings. Similar findings of the increased occurrence of methane near fracking sites were confirmed by another Duke study in 2013 in Pennsylvania (Begos 2013). In this work, it was highlighted that in water wells closer to fracking sites, methane levels were six times as high and ethane levels 23 times as high as average levels. Other proven effects include death of wildlife (MacKenzie and Papoulias 2013), smaller seismic activity as well as record-tying earthquakes (White 2011; Kiger, 02, and 2014 2014; Oklahoma State Gov't 2015; Tagesspiegel 2015; Chokshi and Fountain 2016), land degradation and many more (Helm 2013). Whilst not excluding that other factors can lead to their occurrence, these have been directly causally linked to the practice of hydraulic fracturing (Anderson 2014; Bailey and Preston 2015; Krahmann 2011; Schrope 2013) and many experts predict more adverse environmental effects in the future (Groat and Grimshaw 2012; Rahm et al. 2015; Terrell, Tinley, and Souther 2014). This is mainly owing to the particular process of horizontal drilling in hard rock layers, as explained above, but also with regards to specific regulation and industry practices such as non-disclosure policies (to ensure competition) for chemicals, and exemptions from environmental acts such as the Clean Water Act (Schrope 2013; Terrell, Tinley, and Souther 2014). Findings of a study by the University of Texas covering research into fracking showed that all steps of the fracking process (construction, operation, flow-back, spills and blow-outs) except the actual fluid injection have resulted in some form of environmental contamination (Groat and Grimshaw 2012). Yet when it was released, several press reports stated erroneously that the study had found no evidence at all of such incidents (Munro 2012; Vaughan 2012).[18]

Besides environmental concerns, "hardly anybody seems to have asked the one question which is surely fundamental: does shale development make economic sense?" (Morgan 2014). This line of questioning began much later, and this study aims to add to it in a substantial manner. Evaluating the success of the fracking boom shows up many problems. Potentially the biggest problem facing the shale industry is the disappointing performance of shale wells combined with the hype around the resource: their output declines so quickly that they "will never be profitable" according to one expert (Morgan 2014). Unlike conventional gas drilling, through which regular well rates tend to decline between 7-10% per year, the production rates of fracking wells drop between 60-90% in the first year of use (Murray and King 2012). Overall, the ultimate recovery on a shale gas well is between 8-30%, much lower than the 60-80% for a conventional well (Stevens 2010). Former Amoco geologist Berman illustrated this point with the example of the Eagle Ford shale field in Texas: $10-12 billion would be needed to drill around 1,000 wells each year just to try and counteract the decline in productivity (Stafford 2012). Meanwhile, investors have poured billions of dollars into she shale sector (Morgan 2014). By investing that much one naturally gets very many shale wells off the ground, even if they are much more expensive than regular gas wells – therefore, initial production figures will be impressive (Morgan 2014).

Recently there have been more critical reviews of the economic impact of fracking shale gas. Around 80% of U.S. shale gas production comes from five shale fields, several of which are already in decline with the rest tipped to peak before 2020 (Hughes 2012). The

[18] In general, the University of Texas has extensive links with the oil and gas industry, for example, Royal Dutch Shell is a very big sponsor of the University, but there were also contributions from Halliburton, Exxon Mobil and others (Zaragoza 2012). There are concerns that the findings of the study were toned down or altered and released accordingly in order to please these connections (Henry 2012).

industry appears to struggle (Fowler 2012; Monks, Penty, and Vynck 2013; Crooks 2016). Criticism of reserve sizes is a new development but has been growing stronger in the past few years. A substantial gap (DECC 2013a) usually exists between promising estimations of gas reserves and the amount of gas that is technically recoverable, let alone commercially viable to recover. There has been very little effort to fix said discrepancy – in 2011, the New York Times reported that "energy executives, industry lawyers, state geologists and market analysts" privately questioned whether companies were "intentionally, and even illegally, overstating the amount" of their resources and the productivity of their wells (Urbina 2011c). This concern was only raised internally by the U.S. Energy Information Administration (EIA) at the time (Martin 2010). In 2012, U.S. Energy consultants' findings further consolidated the strong basis for doubt about the reliability and durability of U.S. shale gas reserves (Lowery 2012). Questions are being asked as to whether or not the industry has overstated shale gas reserves (The New York Times 2011; Urbina 2011c; Lowery 2012; DECC 2013b); whether fracking economics pose an incentive for the public at all (Bawden 2013; Inman 2014; Christopherson 2015), and whether the fracking method is cost-efficient or whether it ends up resulting in major losses for the involved industry (Anderson 2014; Crooks 2016).

Arguably, the UK government's interest in shale gas exploration that followed the experience in the United States may be based on a fundamental misunderstanding of the effect of shale gas on the U.S. economy – which several independent experts consider "negligible" (Mathieu, Spencer, and Sartor 2014).

II.1.1 Issues with data presentation

Before assessing the available data on shale gas resources, to facilitate a comparison between expected revenues of the countries in my case study, it is important to note that there is a difference in methodologies for assessing shale gas basins worldwide. Especially a difference between two assessments is often overlooked (DECC 2013b). There are "in-place resource estimates based on a geological model, volumetrics and gas contents" compared to "technically recoverable resource estimates based on well technology, well performance, well density" (BGS 2013b, 10). The first estimate is a top-down approach, gathering information about likely resource size by method of deduction, when there is more knowledge about the shale than the gas it contains. The second is comparable to induction, a bottom-up approach based on actual observations, i.e. information gained by test-drilling in specified basins. The latter has unsurprisingly proven considerably more accurate for predicting actual availability of gas reserves. Simply put, the resource estimate is a – not always verifiable – estimate of the amount of gas present in the shale. This gas may be easily accessible, but it may also be impossible to access, or only partially accessible or too costly to access. The reserve estimate goes beyond this assessment to make a statement about the amount of gas that it may be possible to extract and use, depending on technology, investment and other factors (BGS 2013b, 24). "Gas in-place (GIP), original gas in-place (OGIP) or gas initially in-place (GIIP)" all describe the same very speculative estimate which is made early on, often before the drilling situation has been tested, in order to inform investors or stakeholders (BGS 2013b, 25). The latter method has been discovered to differ strongly from the first on a number of occasions (EIA 2013b; BGS 2013b). For example Norway's shale gas assessment dropped from an initial 83tcf resource estimate in 2011 to a 0tcf reserve estimate in 2013 after disappointing results from several test drill sites – in the parts of the basin considered the least complex (EIA 2011, 2013b). All operations ceased in Norway after the tests, as there was no economic incentive to continue. Similarly, Poland's shale gas estimate for the Lublin Basin was lowered from 44tcf in 2011 to 9tcf in 2013, plus the country's overall reserve estimates were accordingly slashed by a quarter and are awaiting further tests (EIA 2013b; Dittrick 2013). This could still happen in the United Kingdom: as of early summer 2016, no production has taken place in the UK and hence no shale gas direct production data is available. The first approval for drilling was granted in late May 2016 in Yorkshire (BBC Business News 2016). The distinction between the two methods of estimation and especially the distinction between resources and reserves is very rarely made by policymakers, interest group publications or indeed the media (DECC 2013b). For example, the promising numbers announced in certain British news casts (Webster 2013) should have to be at least divided by between 5-10 for the recovery factor: between 8-20% is the average recovery factor for shale gas in the U.S. (POST 2013). Most of those receiving the news will not be aware of this. To address this in the UK briefing papers were recently published by the DECC and the Parliamentary Office of Science and Technology (POST) to point out the distinction and its importance (POST 2013; DECC 2013b).

A third method of measuring and expressing the available amount of gas reserves is through the term of "technically recoverable resources", used by the U.S. Geological Survey to estimate the amount of gas likely to be extracted (Charpentier and Cook 2011).[19] This has proven more helpful and reliable than even the second method of reserve

[19] It would be particularly helpful and less confusing if these were called reserves as they follow after the second method estimate, not resources after the first method.

estimate as it is based on more experience with a play, necessary because "a large variability in shale gas well productivity has been experienced [in North America], where the gas from wells in 'sweet spots' far exceed the average recovery from wells across the play area" (BGS 2013b, 6). This third estimate gives reason for concern about 'sweet spots' and their implications for the future of the U.S. shale industry.

Another distinction needs to be made regarding the terminology. Importantly, the word 'fracking' is used to mean different things. Politicians, media and shale critics use the term loosely to describe the entire process involved in producing the gas, while people from within the industry often use it to describe only one aspect of the production, the injection of chemicals, sand and water to fracture the rock (Soraghan 2011). Of course, supporters as well as critics can and have used the differentiation to help their argument. When fracking supporters say that fracking is entirely safe, they may do so while purposefully omitting serious risks from other parts of the process already known to them, and knowing that their audience will think they mean the entire process. For example, the insistence that fracking does not contaminate water, often repeated publicly, is such a case: most industry members who state it are fully aware that the necessarily connected stages of the drilling process have proven to do so (Soraghan 2011). On the other side, critics are not specific about their complaints either: many for example do not voice their knowledge that exemptions from environmental and safety regulation do not cover every aspect of gas production and therefore that their opponents are not acting entirely unsupervised (Soraghan 2011).

Given that it is the process in its entirety that is responsible for economic and environmental outcomes, and that journals, newspapers and policymakers mean the entirety of the process when they discuss their support for or opposition to fracking, in this thesis 'fracking' will adhere to the common use of the word to describe the entire process of shale gas development.

II.1.2 Uncertainty and puzzles

There are a number of illogical puzzles when it comes to public policy on fracking in the United Kingdom, as well as in the United States, where it was first conducted commercially. The arguments made in support of fracking are all based on classic economic assumptions of rationality and efficient cost-benefit analysis, as well as an assumption of an equal and free market. Fracking is suggested to be compatible with this market and to deliver both product and revenue as well as jobs, and beyond that to increase a country's energy independence. And yet there is both little confirmation of these claims as well as considerable research output which renders doubtful the beneficial aspects of shale gas. In fact, some research suggests that fracking will not only fail to generate any relevant benefit but will also end up harming both the recovering economy as well as the environment. Policy support for fracking tends to be based on core ideas of standard economics such as the assumption of efficiency in a free market. Yet, given incentives and subsidies such as tax breaks, shale gas is unlikely to operate in anything near a free market.

There are clearly plenty of reasons why the hike in shale gas development has not been met with universal approval. Many grave environmental risks have been pointed out to likely be connected, and economic risks such as the rise of a market bubble have been suggested. In a nutshell, outside of official industry presentations on shale gas (Halliburton 2015) there is much doubt in the fact that shale gas development will be profitable or successful for as long as hoped, and doubts about whether it will have as profound or positive an impact on the overall economy. Most astoundingly, it is hailed as a market-efficient solution to gas shortage (see chapter four) despite comparing badly with both conventional gas development as well as modern alternative energy strategies. Although it is being suggested that shale gas is meant to, at least to a certain extent, replace conventional gas drilling once the conventional gas reserves are depleted, it has to be taken into account that the two require entirely different production processes and technology, and therefore a lot of new investment and structural changes. This will affect the UK industry more than that in the U.S. where there are more established drilling operations and because shale fields are often discovered in proximity to those. Furthermore, policymakers today are fully aware of the limitations of the earth's ecosystem (Daly 2012; Ekins 2000; Arrow et al. 1996; Longwell 2002). Therefore, the move to shale is not a plausible turn but only a postponement of the inevitable depletion of the earth's non-renewable energy sources, while potentially speeding up processes of land degradation and global warming which add to the problem. The economic rationality therefore remains questionable in terms of long-term strategy (Nestler 2012; Stevens 2012; Powers 2014; Bailey and Preston 2015).

This section has shown that, given current knowledge of shale gas and its implications, it is a resource and a development process that involve several known, if not perfectly predictable, risks, as well as a considerable amount of uncertainty (unknown risks). Policies towards fracking therefore remain an example of risk preference or indeed decision-making under uncertainty. In light of these issues, arguably, a decision on fracking shale gas is a decision made when the consequences are only incompletely known, thus an expression of risk preference.

III Chapter Three. Decisions under risk and uncertainty: Literature review and history of the traditional 'rational' approach

This thesis is centred around the puzzle posed by the policy decisions made on fracking in the United Kingdom and the United States. The problématique derives from the fact that the reasoning based on economic arguments used in favour of fracking is implausible (outlined in chapter two, in detail in chapter four). On that basis in this chapter I review the theoretical arguments that underlie so-called rational preference formation or rational actor models, as used by traditional economic theory and political science, to explain or predict decision-making.

The arguments made publicly in favour of shale gas by both the UK and the U.S. governments are of an economic nature: that the economic benefits such as growth, jobs and revenue outweigh the costs, and therefore should be pursued (Snyder and Klimasinska 2012; DoE 2014b; Leadsom 2015; DECC 2016b). The costs include investment costs and environmental costs as well as serious economic and environmental risks. However, with shale gas, many experts argue this analysis of the costs and benefits is problematic and flawed (Martin 2010; Urbina 2011c; Boersma and Johnson 2012b; Stevens 2010, 2012; Bawden 2013; Carrington 2013b; Gosden 2013b; Stevens 2014; Fox 2014). Besides, it is indisputable that with a technology as novel as shale gas, many of its costs and benefits remain unknown and uncertain (The New York Times 2011; Schrope 2013; Ahmed 2013; Fox 2014; British Geological Society 2015).[20]

Considering the existence of such risks and uncertainties, I discuss in the first section of this chapter the evolution of thought on rational cost-benefit analysis in situations of decision-making under risk and uncertainty. I begin by examining the core assumptions and theoretical development of the expected utility hypothesis. Through an example I confirm the definition and basic premises of expected utility before moving on to a brief history of its advancement. There has been a multitude of research on and evolution of

[20] As of mid-2016, this ranges from incompletely known environmental costs (Cherry et al. 2014; Semeniuk 2014) as well as incompletely known amount of resources available (Urbina 2011c; Weijermars and McCredie 2012) and little knowledge about impact from shale on structural factors such as jobs (Cusick 2013; Christopherson 2015). In the UK, shale gas was promoted before there was any legal framework that would fully cover shale gas related matters (Stevens 2010, 2012). As of early 2016, there is still no comprehensive or reliable reserve size estimate for the United Kingdom so investments are made on the basis of hope for good results based on initial resource estimates (Schrope 2013; McCarthy and Semeniuk 2014). Estimates however can turn out to be misleading, as in Norway's case (EIA 2011, 2013b, 2015e).

this rational decision-making theory, so I shall focus only on key elements, several historical points and important changes to the original concept.

In section two I discuss existing critiques of rational decision-making through the framework of expected utility in economics and behavioural economics.[21] This section shows that logical flaws were discovered within a decade of the latest and most complete publication of the expected utility hypothesis (von Neumann and Morgenstern 1944; Ellsberg 1954; MacCrimmon and Larsson 1979). Section three concerns a second phase in the critical literature on expected utility, most prominently by behavioural economics and through joint output of economy and psychology scholars. This third section serves to further question the validity of the expected utility theory's 'rational' cost-benefit analysis for decision-making under uncertainty. In it I also introduce a range of common biases and constraints found to be influential on decision-making instead. Then I present prospect theory, the other much used and influential modern variant of expected utility.

Whilst sections two and three are concerned with critique towards the correctness and applicability of expected utility and cost-benefit analysis, in section four I turn towards more recent, critical theory on rational decision-making in political science and political sociology. This body of literature presents further theoretical and empirical evidence disputing the validity of the rational actor model and rational decisions under uncertainty. Furthermore, it includes arguments from a new critical normative case against the hypothesis: scholars question the desirability of making political decisions after a business-like fashion, purely considering an economic cost-benefit analysis.

All of the above leads me to include a final section on the important distinction between uncertainty and risk, on why the distinction is rarely made but why it is vital. This part is firstly significant for the theoretical conception of decision-making under risk: as long as factors are considered calculable that are in fact uncertain or entirely unknown, analysis remains flawed. Secondly, the distinction is also relevant for the case study in this thesis: the development of shale gas entails both known risks as well as a variety of so far incompletely known variables.

[21] At times, it is difficult to put labels on certain authors or articles, as work is interdisciplinary, authors switch academic fields and boundaries between disciplines can change in time.

III.1 Classic cost-benefit analysis for decisions under risk and uncertainty: Expected utility

> "It is no exaggeration to consider expected utility theory the major paradigm in decision making since the Second World War" (Schoemaker 1982, 529).

This section introduces the concept of expected utility for decision-making under risk and uncertainty by providing definitions and examples as well as a résumé of the origins and key changes to the concept. This is crucial because classical expected utility remains the standard concept or benchmark for decision-making under risk and uncertainty, from which other models derive and upon which critical approaches are based (Treier 2010; Rieger, Wang, and Hens 2013; Heal and Millner 2013; Rieger 2014; Strzalecki 2014). I explain the basic concept of expected utility before I turn to the development of the theory.

Expected utility is a term that sums up the utility which a subject or group may expect from a transaction under specific circumstances, by considering the average returns of possible outcomes as well as their likelihood. The term comes from the expected utility hypothesis, which states that "under uncertainty, the weighted average of all possible levels of utility will best represent the utility at any given point in time" (Investopedia 2007). The expected utility of every single possible outcome is weighted both according to its desirability (or pay off) and the likelihood that the transaction will in fact lead to the particular outcome.

The theory's application to real world decisions can be made clearer with an example.[22] Before a person leaves their house for a walk they make a decision on what to wear based on what they expect from the weather. One would rather not carry a heavy jacket on a hot and dry day, but one would prefer to face bad weather with it. There are three possible outcomes for the day: either, one will finish it dry and not bothered by too much clothing; or one will finish it dry but is bothered with the extra clothing; or one will finish walking cold or soaked (as seen in Table 1). There are two possible conditions outside of one's control that are the weather: either good or bad weather. There are two choices of action: bringing the jacket, or not bringing the jacket.

[22] The example is based on an explanation from the Stanford Encyclopaedia of Philosophy (Briggs 2015).

		Condition	
		Bad weather	Good weather
Action	Take jacket	*Bothered but dry*	*Bothered but dry*
	Don't take jacket	*Wet*	*Dry*

Table 1: Expected Utility Choice Problem (own design)

From here on one can assign a specific desirability to each outcome. Several other requisites have to be met (more on these axioms in the following pages), among them that actions and conditions have to be logically independent so that no condition could prevent an act. Also, it is essential that each act, given a state, can lead to only one single outcome.

Moving beyond mathematical probability and focusing on the claim of applicability in real life scenarios, other issues arise – how accurate can information about the weather be? How does one calculate the level of annoyance from carrying an extra jacket before experiencing it? What if the rain turns acid? What if preferences change? Expected utility cannot include these questions.

The above illustration leads me to a simpler but strict definition of expected utility: The expected utility of a transaction taken depends on two things: the value of each possible outcome or consequence, to which real numbers are assigned, and the probability of each consequence of the transaction. The simplest formula for expected utility hence is as follows:

$$EU(A) = \sum_{o \in O} P_A(o)U(o)$$

Here *A* stands for the transaction, *O* is the set of outcomes, *PA*(*o*) is the probability of outcome *o* conditional on *A*, and *U(o)* is the utility of *o*.

What is clear from this example is that expected utility assumes total rationality, and that it assumes extensive and complete, almost omniscient information on the utility of all potential outcomes and the likeliness of their occurrence. (The weather example may make it obvious how trustworthy such information can be at times). It also shows that expected utility in this case is, in effect, the quantification of a simple cost-benefit analysis.[23] As long as a specific number can be assigned to utility and likelihood of occurrence, this formula can calculate a course of action: either to explain it once it happened or to prescribe a course of action. In sections 2-4 of this chapter I analyse the validity of both the mathematical model and its claim to real world application.

Following the above primer in expected utility theory, I wish to explain the beginnings and evolution of this theory in order to better understand its enduring popularity. Early debates around decision-making under risk and uncertainty in literature mostly stem from the disciplines of economics and financial economics and virtually all assume rational behaviour. Most of the early approaches shared ideas and model elements amongst them, hence only a few of them were passed on once broadly accepted and used in the research disciplines (Treier 2010). Of those, the expected utility hypothesis was key to risk and uncertainty modelling since the 20th century (Rieger 2014, 1; Rieger, Wang, and Hens 2013). It is alternatively used "prescriptively", "predictively" and "descriptively" across the various sciences (Schoemaker 1982, 529).[24] [25]

Expected utility theory was originally described by Daniel Bernoulli in an attempt to solve the *St Petersburg paradox* (Quiggin 1993; Treier 2010). This was a lottery: a coin toss in which the price doubled with each further round until the wrong side of the coin appeared, promising infinite payoff and infinite expected value. Contemporary theory could not explain why, presumably, nobody was interested in playing it: the breakthrough was to consider not just the price, or value, but the utility to the specific gambler. Bernoulli introduced the concepts of subjectivity and of constant relative risk aversion – taking into account the subject's position on risk-taking.[26] Subsequently a person's existing assets and potential of losses were considered to play a role in the decision to take a risk. With this step, Bernoulli attempted to make a mathematical model fit a real world economic decision.

[23] Another prominent example of such a choice problem with expected utility is game theory's oft-cited *prisoners' dilemma*, used in economics and political science to analyse a range of issues from trade relations to the nuclear arms race. It is a modified and weakened version of the expected utility concept as it directly states a situation in which information is lacking, namely that of likelihood of occurrence (not knowing what is most likely for the other prisoner to choose), but it nevertheless assigns utility rankings to possible outcomes and prescribes a subsequent course of action. Game theory is based on expected utility. As the prisoners' dilemma shows, these preferences gained with expected utility models often result in outcomes that are not optimal.

[24] Full quote: "It is no exaggeration to consider expected utility theory the major paradigm in decision-making since the Second World War. … It has been used prescriptively in management science (especially decision analysis), predictively in finance and economics, descriptively by psychologists, and has played a central role in theories of measurable utility" (Schoemaker 1982, 529).

[25] Quiggin wrote "for most of the post-war period, the economic theory of choice under uncertainty has been, in essence, the theory of expected utility" (Quiggin 1993, 2).

[26] Subjectivity in this sense does not imply irrational or biased behaviour, but only rationally assumed subjective valuation.

Up until the introduction of expected utility, financial calculations related to risks in insurance or gambling appear to have only considered the potential winnings, yet not losses or related risks.[27] As both financial investment and insurance were becoming significant sectors of the economy, the model of expected utility quickly gained prominence (Strzalecki 2014, 31). In a nutshell, expected utility challenged the appropriateness and applicability of purely considering "profit maximization as a basis for economic decisions under uncertainty" without considering the circumstances, potential losses and subjective attitude towards risk (Quiggin 1993, 7). Another term for expected utility used to be 'moral expectation' rather than 'mathematical expectation' – as it was almost considered what we might call behavioural economics at the time of its conception.[28] Since Bernoulli, economists and scholars of finance have mostly accepted the principle of expected utility as a normative standard model (Treier 2010), assuming rational choice in risk takers.

The core concept of expected utility has been adjusted but not significantly changed since its creation. Additions made to expected utility theory in the 19th century consisted of mainstream classical and neoclassical economic scholars adopting and trialling specific concepts of utility (Quiggin 1993). In the 20th century, John von Neumann and Oskar Morgenstern created the most complete and accepted version of expected utility theory as they worked to make the theory more applicable by adding more axioms (von Neumann and Morgenstern 1944; Arrow 1951). These axioms which are now accepted for expected utility are:

1) Completeness, meaning the person or group making a choice has perfectly stable preferences and will at all times be able to decide between different options.
2) Transitivity, which means that the decision-maker who has such stable preferences and follows the 1) axiom of completeness also decides consistently and does not change preferences.
3) Independence, meaning when different lotteries are mixed, preferences are maintained.[29] This axiom prompted much critique (see following section).

[27] The expected utility function also showed that a utility function per individual (a concave or convex function) could help predict whether the person would invest in risky bets or whether the person was likely to buy insurance.
[28] Bernoulli was also one of the first scholars to suggest there to be advantages in portfolio diversification for an investor or gambler with a risk-averse nature (Wang 2006).
[29] If a player prefers outcome *A* over *B* and they can choose between two lotteries: lottery 1 is a coin toss between *A* and *C,* lottery 2 is a coin toss between *B* and *C.* If the coin coming up either way has anything but a non-zero probability, the player should prefer 1 to 2.

4) Continuity, which means there is no infinite outcome, i.e. no outcome is so bad that one would not chose an otherwise attractive course of action that includes it as a possible result.[30]

Morgenstern and Neumann's aim was to make the theoretical model fit better for real world scenarios. Some issues were in effect resolved through their new axioms, such the independence axiom – but this did not necessarily make the theory more realistic. They continued to assume absolute rationality, to assume that decision-makers had a comprehensive amount of coherent knowledge over consequences of their actions and ready statistical guidance on the likeliness of their occurrence. In combination with this assumption of complete rationality, the subsequent assumption that decision-makers would not only be able to compare all events and develop rational preferences but also do so for a combination of several events is logical yet not realistic.[31] [32] Morgenstern and Neumann at the time responded to criticism by stating that their treatment of utilities as perfectly measurable, numerical quantities was necessary to simplify the judgment of risk preferences and did not radically affect results (Von Neumann and Morgenstern 1953, 16).

For a brief example of how outdated and long-critiqued much of this work is, consider cardinal utility – in brief, it means preferences can be ranked on a cardinal, not ordinal scale. Cardinal utility is a concept modern expected utility theory is based on. The idea of cardinal utility is quite universally considered outdated in research within the disciplines of both mathematics and economics, as there is little evidence for it, but it remains prominent in a select few remaining contexts: decision-making under uncertainty and risk is one of these contexts (Köbberling 2006).[33] Hence, decision-makers faced with risk are expected to make use of approximation models based on tools which are severely criticised for good reason by many disciplines but also that of its own origin.

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[30] Assume that variable *A* stands for going out at night, variable *B* stands for staying in and variable *C* stands for the possibility of death which in this thought experiment is likelier outside the house. Preferences are continuous as *C* cannot be valued at minus infinity, or else there would be no chance of variable *A* and variable *B* combined ever outweighing variable *C* i.e. the house would never be left for fear of a however small possibility of death which is likelier to occur outside.

[31] At the time it was thought that a more detailed theory including subjective probability could be provided, which was suggested by Pfanzagl (1967).

[32] The upgraded expected utility hypothesis used objective probabilities, supposing that all the agents had the same probability distribution, as a convenience.

[33] Cardinal contrasts with the concept of ordinal utility: ordinal utility assumes that it is only relevant to assess preferences on an ordinal scale, i.e. simply which one is better than the other, but not by how much; whether a utility function is concave or convex is economically inconsequential. Cardinal utility on the other hand suggests that differences in preferences are almost equally important; i.e. if *A* is preferred to *B* by a great margin, but *B* to *C* only by a little, this matters. In the context that Neumann and Morgenstern use, only the utility function is cardinal but the expected utility function is ordinal.

III.2 Early critique of expected utility

> "Might future economists find it peculiar that twentieth century economists held firmly to the EU [expected utility theory] in the face of the Allais paradox and other violations?" (Harless and Camerer 1994, 1284).

Arguably the most complete formulation of expected utility was in the 1944 book *Theory of Games and Economic Behaviour,* and based itself on four axioms: completeness, transitivity, independence and continuity (von Neumann and Morgenstern 1944). Adherence to all four of these was considered as rationality; violations of any one of them as irrationality. If a choice was made or planned that showed a deviation from expected utility through noncompliance with any of its stipulations, the person making the choice would be considered to behave irrationally. Such violations however have been abundant, "not only as unsystematic errors, but indeed as systematic biases" (Rieger 2014, 1). These have eventually led some scholars to another adaptation of expected utility, prospect theory, discussed in the following section. The first phase of criticism was fuelled by critical experiments gathering empirical evidence of deviations from choices as expected utility would predict them (Ellsberg 1961; Allais 1945; MacCrimmon and Larsson 1979). The purpose of this section is to assess the first phase of critiques of rationality in decision-making which mostly came from economists.

A critical experiment aiming to disprove the independence axiom was devised in the 1950s by French economist Maurice Allais. He was working on decision theory in uncertain situations in the 1940s independently from his contemporaries Neumann and Morgenstern.[34] Allais devised an example of a choice problem in which a majority of players showed a violation of the predictions gained with expected utility theory. The choice problem consists of two different (independent, not consecutive) experiments where the participant has to choose between two games of luck each. The payoffs of these games are shown in Table 2 below (Allais 1954).

[34] The lack of academic discussion between the scholars, and the fact that Allais published his early work in French suggest that they were.

Experiment 1				**Experiment 2**			
Gamble 1A		Gamble 1B		Gamble 2A		Gamble 2B	
Winnings	Chance	Winnings	Chance	Winnings	Chance	Winnings	Chance
$1 million	100%	$1 million	89%	Nothing	89%	Nothing	90%
		Nothing	1%	$1 million	11%		
		$5 million	10%			$5 million	10%

Table 2: Allais Choice Problem 1 (Allais 1945), own design

The specific incompatibility with expected utility lies as follows: in the first games, most people chose the game *1A* and in the second they chose *2B*. Allais admitted that this was in fact a reasonable choice for each of the games to be played alone (MacCrimmon and Larsson 1979; Oliver 2003). However, since the subjects are asked about both games, it is not. That a player choosing *1A* would at the same time chose *2B* violates the expected utility theory's expectations – which conclude that whoever chooses *1A* will also chose *2A* and likewise with *1B* and *2B*. Simply put, once they choose the certain gain over the higher outcome, their preference should make them do so again. According to expected utility theory, equal outcomes are thought to cancel each other out, they should not have an impact on the relative desirability of each of the games compared to the other. This is illustrated in Table 3 (Allais 1954), where all equal chances are listed together in a row.

Experiment 1				**Experiment 2**			
Gamble 1A		Gamble 1B		Gamble 2A		Gamble 2B	
Winnings	*Chance*	*Winnings*	*Chance*	*Winnings*	*Chance*	*Winnings*	*Chance*
$1 million	89%	$1 million	89%	Nothing	89%	Nothing	89%
$1 million	11%	Nothing	1%	$1 million	11%	Nothing	1%
		$5 million	10%			$5 million	10%

Table 3: Allais Choice Problem 2 (Allais 1954), own design

If the first row of the 89% that are the same were to be cancelled out, the leftover game of luck is exactly the same for game 1 and game 2. Yet respondents do not react accordingly in their choice but overwhelmingly choose option *2B* for the second game. The previously discussed independence axiom states that preferences stay constant between different gambles. Identical outcomes within a choice situation should be disregarded as irrelevant to the decision made in the choice problem overall.

The choice set of *1A* and *2B* was rational to Allais and the most common response he received in his experiments: therefore, Allais considered mainstream expected utility to blame for labelling it an irrational move. Allais asserted at the time what new independent studies consistently and repeatedly prove (Machina 1987; Oliver 2003). The Allais paradox was not contested despite disproving a key axiom of expected utility theory, but it also did not halt or hinder the continued use and popularity of expected utility (Harless and Camerer 1994; Harrison and Rutström 2008; Rieger 2014; Briggs 2015).

In the same line of thinking, economist Daniel Ellsberg designed choice problems to show inconsistencies between the predictions gained with expected utility and real life human decisions (Ellsberg 1961).[35] The better known of two problems that underlie the so-called Ellsberg paradox is the *one urn problem*.

In the *one urn problem*, a player is aware that a single urn contains 30 red balls and 60 balls that are either black or yellow, but the exact number of those black and yellow balls remains unknown (Ellsberg 1961, 563f). The player is then asked to participate in two games of luck.

1) In the first game, one ball is going to be drawn from the urn, and $100 is gained when the player bets on the right colour ball – the player can decide if he wants to bet on red (1A) or on black (1B). Most players choose to bet on red.
2) In the second game, the player is asked to bet on red and yellow (2A) as opposed to betting on black and yellow (2B): either of them drawn will win the player $100. This time the option of 2B is preferred by a majority of respondents (Ellsberg 1961, 654).

The paradox lies in the fact that quite evidently, in the first game the players implicitly assume there to be more red than black balls inside the urn, yet in the second game they assume the opposite.

The Ellsberg paradox is used to criticise the axioms of independence and preference consistency i.e. transitivity which are shown not to be respected. This poses a clear violation of the expected utility hypothesis and an apparent irrationality in the face of

[35] It is noteworthy that whilst Daniel Ellsberg was the person to modify and bring attention to the choice problem or paradox of the same name, Keynes discussed a similar version of it earlier (John Maynard Keynes 1921, 75f).

almost equal gambling options. Expected utility theory is not able to explain this occurrence.

The paradox adds to evidence for a common heuristic or bias people use when making judgments under uncertainty, which is called *ambiguity aversion* or *uncertainty aversion*. This heuristic describes a detected preference in people that means they prefer what they consider to be known risks over unknown elements of risks. It applies to situations where risks are expected but uncertainty remains. When faced with a choice between two games of luck, most people will prefer to choose the game that has less unknown elements in it, even if it has certain risks, and even if the other available game offers better winnings. This heuristic of ambiguity aversion has also been used to explain choices besides lottery games such as election abstentions or volatility in stock markets (Ghirardato and Marinacci 2001). Though the distinction was little discussed at the time, in his paradox Ellsberg had in fact shown that even within the controlled realm of a game example, the issue of uncertainty rather than calculable risk led to behaviour deviating from expected utility predictions.[36] [37]

Empirical testing of the expected utility hypothesis showed early on, therefore, that it was flawed. Controlled tests showed a tendency by decision-makers in situations of uncertainty to make decisions which are considered irrational according to expected utility theory.[38] Accordingly, much effort was made to find a more accurate model in order to determine risk preferences in the field of economics. Difficulties and criticism as described above have led to a variety of alternatives, simplifications and specifications of expected utility theory.[39] Most were designed with the goal in mind to fix expected utility

[36] It is certainly possible to 'calculate' all possible different combinations of black and yellow balls but they would amount to even chances, therefore not providing the player with helpful advice.
[37] There were also more radical critiques of the economic principles around profit maximization: Alchian suggested in 1950 that uncertainty and incomplete information should be included into analysis (Alchian 1950).
[38] This subsequently should at the very least encourage an examination of the preferences under this pretext. There are ample excuses readily available for decision-makers to behave irrationally, as well as ample reason for them to explain lengthy and considerate decisions. Rushing a decision without knowledge of all the facts however when theory tells us one is likely to make a wrong decision is incomprehensible. (Especially for cases in which the decision is not only made to avert a risk and possibly under time pressure, but for cases in which a decision leads to risk once it is made, depending on the outcome.)
[39] For another example, economist Harry Markowitz in 1952 created the Markowitz mean variance model which is still a 'standard model' of risk evaluation today (Markowitz 2013). It is called mean-variance model because its predictions are based on the mean (expected returns) and the variance (standard deviation) of each of the portfolios. By analysing several portfolios of the given securities and ultimately selecting those that are unrelated and would not change in a correlated way, this model is used by investors to try and minimise their risk. An investment portfolio is called *Markowitz efficient* when any added diversification of investment could not lower the portfolio's risk any further and expected returns cannot be increased any further without increasing the portfolio's risk. Markowitz assumes any investor to be rational; further, to be risk-averse, wanting to increase consumption (hence has a concave, increasing expected utility function). The Markowitz model is both trying to minimise risk in portfolio selection in

to the point where it could be seen as consistent with a wider range of choice behaviour and its generalised application would be better justified. Different suggestions were made but the evolved version of expected utility theory which many economists consider most influential since the original theory is *prospect theory*. Its emergence and key characteristics are discussed in the following section.

III.3 The second phase of rethinking expected utility: Rationality biases and prospect theory

> "One of the enduring contributions of behavioural economics is that we now have a rich set of competing models of behaviour in many settings, with expected utility theory and prospect theory as the two front runners for choices under uncertainty." (Harrison and Rutström 2008, 134).

In this section I wish to expand on the second notable wave of readjustments to expected utility theory. This concerns interdisciplinary approaches between economics and psychology, decision analysis and behavioural economics. I present this material for three reasons: to further consolidate the critical case against expected utility; to introduce several identified common biases that can explain choices which contradict expected utility; and to introduce prospect theory. Whereas in section two I discussed work designed to disprove expected utility and show 'irrational' behaviour, in this section I consider works designed to explore mechanisms and reasons behind so-called irrational behaviour.

Theory about imperfect judgment in situations of risk and uncertainty was separately developed based on three rather different strands of research according to Kahneman, Slovic and Tversky, key authorities within the field (Shafer 1984). This research divide began in the late 1950s and 1960s: the comparison of statistical and clinical prediction as begun by Meehl, the study of subjective probability after the Bayesian paradigm, and the

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practice and trying to forego criticism of the independence axiom in theory, by separating all risk choices made. It is important to note that despite criticisms, mainly regarding rationality of investors, systemic risk i.e. the impossibility of separating all related risks, and the normal distribution of returns, and the assumptions that one can keep choices independent, the Markowitz model remains for the most part accepted in modern portfolio theory and therefore implicitly understood as accurate in the judgment of risks.

work of Simon and Bruner into strategies of reasoning and heuristics (Kahneman, Slovic, and Tversky 1982).[40] [41]

A core insight from Kahneman and Tversky's research is that people making choices in situations of uncertainty tend to rely on a limited set of heuristics that reduce the complexity of judging probabilities. This is considered the reason they inadvertently eschew rationality in its narrowest economic definition and rationality as the expected utility theory defines it. Kahneman, Slovic, and Tversky (1982, 3) and the many that followed or updated their work do not consider these heuristic principles problematic in all situations, in fact they find them at times useful. However, there is appreciation that such biases can also lead to systematic and severe errors in judging uncertainty.

Representativeness is one of the biases discussed the most often when looking into biases and constraints of rational decision-making under uncertainty (Kahneman and Tversky 1982; Bar-Hillel 1982; Tversky and Kahneman 1974, 197; Kahneman and Tversky 1979; Kahneman and Tversky 1972). It is defined as "a subjective judgment of the extent to which the event in question is similar in essential properties to its parent population or reflect the salient features of the process by which it is generated" (Bar-Hillel 1982, 69). For example, asked how probable it is that a given young child will grow up to become a scientist, the person asked may consider how similar the image or some characteristic of the child is to a stereotype she or he holds of a scientist (Kahneman and Tversky 1972, 47). This focus will give exceeding influence to variables affecting an event's representativeness, yet not its probability, while it diminishes the influence of such variables that are unrelated to an event's representativeness yet important in determining its probability (Bar-Hillel 1982). Availability – or associate distance – is a second common heuristic when forming preferences in situations dealing with risk or uncertainty. A person employs the availability heuristic when judging probability by estimating "frequency or probability [of an event] by the ease with which instances or associations could be brought to mind" (Kahneman and Tversky 1973, 164). The assumption is that if examples come to the mind very quickly, that must be because they are numerous; that if a connection can be made easily, then the link must be factual (Taylor 1982, 191f).[42] Availability is

[40] Their work on judgment under uncertainty takes into account the at the time recent merger between the study of judgment and the Fritz Heider – pioneered study of causal attribution and lay psychological interpretation.
[41] Kahneman and his colleagues use the words risk and uncertainty separately, however tend not to focus on the difference between the two. Their division of the words lies only in terminology in that they consider a situation of uncertainty as one that bears risks – they do not specify the level of assessment possible for either (Kahneman, Slovic, and Tversky 1982; Shafer 1984).
[42] An original example from Kahneman and Tversky's work is the 'K' study. People were asked to judge for any given English text whether or not the letter K was more likely to appear in first position in words

known to have caused scares, such as increased fear of a crime which occupied the news or even a popular movie. People who saw the movie *The China Syndrome,* which depicts a nuclear disaster, showed increased fear following the actual nuclear accident at Three Mile Island. Equally, people tend to spend more time thinking about extreme events such as lottery wins or aeroplane crashes to the point that extreme events end up appearing more likely than they are, because they are readily available in a person's imagination.

Another specific issue, which limits traditional rationality that is considered common is that of causal reasoning. Several social psychologists argued the fact that thinking is heavily causal, which leads to a variety of related biases (Shafer 1984). Kahneman and Tversky suggest that data or information of a clear causal nature will have a greater impact on decision-makers than other data which may be equally informative. Subsequently, as a causal schema is established, any other information which does not fit this schema will be attributed with less or no significance (Tversky and Kahneman 1980, 118).[43]

Another important consequence of causal judgment is unwillingness to revise existing explanations or models of thinking. Kahneman and Tversky found that subjects in an experiment were strongly inclined to trust presented and suggested existing models of explanation, however unlikely and unfitting they seemed for the case example (Tversky and Kahneman 1980). This heuristic fits together with work by political scientists on the power of ideas in decision-making, which is discussed in detail in chapter seven.[44]

A related observation was that causal judgments cannot be passed on easily – information by experts often fails to convince lay people, no matter how cleverly it is presented. For example, newly gathered and impressive statistical data circulated by the U.S. national

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or in third. It is much easier to think of words where the letter is in the first position, so that is the option test subjects overwhelmingly chose. In fact, a typical text contains usually much more words with K in the third position than in the first, around twice as many.

[43] Kahneman and Tversky's experiments on causal judgments follow the influential cognitive theory by Harold Kelly called attribution theory. It proposes a view of all humans as lay scientists, forever trying their hand at inference, to claim specific causes for observed effects (Nisbett et al. 1976). An example for people's willingness to seek out causal links can be shown with the following problem set. People were asked: "Which of the following events is more probable? (a) That an athlete won the decathlon, if he won the first event in the decathlon (N=21). (b) That an athlete won the first event in the decathlon, if he won the decathlon (N=75)." (Tversky and Kahneman 1980, 120). A third option was that both were equally likely. Both events are equally probable, and yet the majority of respondents said that option b) was the most probable. This suggests a strong underlying causal connection made.

[44] Several authors take the cognitive process around risk preferences further apart: Perceiving risks is only the first step in the process of forming a preference on it, the risk will then be evaluated – most likely by using a range of biases and heuristics – and then judged on, so that a preference is formed. Others combine all of these processes as one and see no distinction worth researching. From all the various case studies reviewed in this field it can be assumed that the preference will not be (entirely) rational (Kahneman and Tversky 1982), at least not by economic standards. However, there is not much judgment of whether or not the lack of rationality postulates adverse effects – the judgment mainly consists in the suggestion that a belief in and reliance on rationality where there is none has negative effects.

health service appears to have had little effect on peoples' decision to undergo cancer detection screening in the mid-1970s. Studies since have found that the public often has very little confidence in experts' estimations (Lorenzoni and Pidgeon 2006). However, public awareness of the mastectomies performed on Ms Rockefeller and Ms Ford led to a huge surge in demand for screenings (Nisbett et al. 1976, 116).[45] These choice models and heuristics are largely devised for the individual, and some are not transferable one to one to a governmental body making decisions (for example a very different level of information availability needs to be assumed).

In the wake of these discoveries, and almost thirty years after Neumann and Morgenstern had fixed the parameters of expected utility theory, Kahneman and Tversky established *prospect theory* (Kahneman and Tversky 1979). Prospect theory is a variant or upgraded version of expected utility that stems from their research in behavioural economics. Next to expected utility, it remains "arguably the most influential theory for behavioural decisions under risk" (Rieger 2014, 1).[46] Unlike expected utility, prospect theory is meant to be only descriptive of real life choices, and not a normative guide to decision-making. The theory states that decisions are made based on separate evaluations of gains and losses, not a final outcome only (Wang 2006). It allows for certain heuristics to influence these evaluations, amongst them the tendency of risk aversion, i.e. to value losses higher than gains. The decision-maker is still assumed to have complete knowledge about all potential outcomes, and the ability to rank them.[47]

Prospect theory was successful in explaining some observed violations of behaviour predicted by expected utility, mainly through its inclusion of risk averse behaviour. The main heuristics considered in it include: that losses are always evaluated higher than gains; a tendency to ambiguity aversion; that people tend to focus on the status quo as reference point for separate gains and loss decisions rather than to look at the final outcome; and finally that they tend to overweigh unlikely, rare extreme events and underestimate the probability of average events (Kahneman and Tversky 1979; Kahneman and Tversky

[45] Scholars further found evidence discrediting the superiority of the economic model argument in that experts are not necessarily always better judges of risks than non-experts or members of the public (Fischhoff et al. 1978; Fischhoff, Slovic, and Lichtenstein 1982). Important is also the finding that experts and the public work with entirely different definitions of risk. A noticeable difference is found in the fact that the public usually focuses on potential consequences whereas experts are more concerned with factual estimations and probabilities than considering outcome possibilities in detail (Sjöberg 1999, 2000).
[46] "When it comes to modelling uncertainty, most economists instinctively reach for the expected utility framework of von Neuman and Morgenstern (1944)" (Heal and Millner 2013, 128).[46]
[47] Over a decade later, Kahneman and Tversky presented a further development or a new variant of their proposed prospect theory: the cumulative prospect theory (Kahneman and Tversky 1992). In this context, I will only give a precis of the main findings of both prospect theory and cumulative prospect theory which could be relevant to the case study.

2000).[48] However, prospect theory does not allow for uncertainty. It also does not take into account major diversions from rationality such as described in the section above on causal judgment. Soon after its publication, articles followed in economic journals pointing out the respective flaws of prospect theory (Harrison and Rutström 2008; Rieger 2014; Nagarajan and Shechter 2014). Its improvement on expected utility theory lies in that it includes heuristics such as ambiguity aversion or the overweighting of losses and therefore a distortion of probabilities.

This section has shown further fault with expected utility, introduced the other most commonly used upgrade of expected utility, namely prospect theory, and discussed several specific biases which are thought to constrain rational decision-making. I will now move on to discussing other theoretical as well as normative criticism of expected utility.

III.4 Modern criticisms of expected utility from the social sciences

> "The view of man as rational is not particular to economics, but is endemic, and even ubiquitous, throughout the social sciences" (H. A. Simon 1978, 64).[49]

Whereas criticism discussed in the previous sections was focused on sharpening the model for cost-benefit analysis to perfection, this section deals with different concerns raised about rationality and cost-benefit analysis. In the following paragraphs, I discuss contributions from the social sciences, mainly political science and sociology, that question whether or not rationality exists, whether or not decision-making based on expected utility exists, and whether the latter *homo economicus* perspective is beneficial.

These works were prompted by theoretical reconsideration but also by empirical studies displaying the contrast between actual decision-making and the predictions gained through purely rational calculations with expected utility functions (for example Pauker, Pauker, and McNeil 1988; Slovic, Fischhoff, and Lichtenstein 1982; Tversky and Kahneman 1986). Political scientist James March argued categorically for bounded

[48] The main development of cumulative prospect theory compared to regular prospect theory is that the weighing of the possible outcomes is applied to the cumulative probability distribution function, as it is in expected utility dependent on ranking, but not applied to the separate individual probabilities of individual outcomes. It is considered a theoretical improvement of prospect theory as it can transform objective cumulative probabilities into subjective probabilities (Kahneman and Tversky 2000) but especially leads to overweighting of extreme yet rare events and does not solve aforementioned issues.
[49] This is in contrast to March who argues that students of politics, organisations and history have been excited to point at flaws in economic models of rational choice (March 1988).

rationality when he proposed that pure models of rational choice were appropriate as guidelines to intelligent action, yet never appropriate for explaining or predicting behaviour (March 1988, 34).[50] His colleague Herbert Simon argued that economic research ignored the actual process behind rational men reaching decisions and that their strategy worked only for "static, relatively simple problem situations" (Simon 1978, 75). To him, this "strategy does not work, however, when [they are] seeking to explain the decision-maker's behaviour in complex, dynamic circumstances that involve a great deal of uncertainty" (Simon 1978, 75).[51]

A prominent name in this field of research is that of Ulrich Beck, who helped popularise the term *risk society* (Beck 1986, 1992, 1995, 1998, 2009). The term risk society aimed to encompass the many facets of modern societies both dealing with but also self-producing risks. The term is usually associated with a number of key writers: Beck (1986, 1998, 2009), Giddens (1998, 1999), Douglas and Wildavsky, and Lagadec who first used the term 'risk civilization' (Lagadec 1981; Douglas and Wildavsky 1992). Their works originally focused mainly on society's response mechanisms to risks and hazards as well as modern society's obsession with risk avoidance despite a large part of the world arguably being a safer place than ever before in the second half of the 20th century. But the focus shifted noticeably towards the implications of consequences brought on by modern technology and scientific advances, which are designed to bring progress but many of which create new risks for humankind or the environment. This was in line with an increase of importance of various kinds of risk analysis used by policymakers, most notably in the areas of health, technology and environment. Social scientist Beck considers the rational model of expected utility not only inadequate but misleading (Beck 1986, 79): "If there is anything that produces unity across the entrenched political divides, then it is the conviction that we are imprisoned by our dependence on rationality" (Beck 1995, 58). In his writing he states his view that political or economic decision-makers tend to make decisions based on statistics and with a focus purely on business, ignoring uncertainty (Beck 1986, 1998). He labels this "economical one-eyedness" and finds issue with the idea of such rationality, whether it can actually exists and whether results from it are desirable (Beck 1986, 80).[52] Beck considers risk preferences not as objective processes but as embedded in the surrounding factors of political, economic and social environment (Beck 1992, 1998). In

[50] His argument did not only entail the stated problems in calculation of rational choice, but also fundamental issues with human behaviour – that preferences and actions may, in fact, be quite separate from one another.

[51] To understand an actor's preferences at any given moment, Simon argues, "one must have a large store of knowledge about the minds of the actors, what they know and believe" (Simon 1995, 60).

[52] Beck defines modern society as one where "gain in power from techno-economic 'progress' is being increasingly overshadowed by the production of risks" (Beck 1992, 13).

his work on nuclear development he argued that there is no reflection of such embeddedness: that it is instead likely that political decision-makers will argue through notions of a purely rational, economic point of view (Beck 1986, 80). In this context, he argued that policymakers will use some form of expected utility theory and thereby judge risks according to the expected revenue when deciding on a new technology entailing a risk the scope of which is as of yet unclear. From this, one can reason that policymakers are either unaware of this paradox, or that they purposefully ignore any uncertainty and the knowledge that their environment shapes them. This may lead them to think or claim that they are rational in situations where they are not and cannot be.

Several political and social scientists have supported Beck's view of 'economic one-eyedness' (Stern and Wiener 2011; Gray, Rogers, and Wiener 2011; Hammitt 2011; Wiener et al. 2013). They consider economic reasoning to be the determining factor for risk preference and according policy preferences, yet not all consider this as problematic like Beck did. Some political science scholars have focused on empirical evidence that diverging risk preferences can cause very different regulatory behaviour in different countries, despite similar economic outset and goals stated, i.e. despite suggested similar expected utility (Christoforou 2004; The Economist 2004; Shaffer 2004; Anthony Leiserowitz 2006; Breggin et al. 2009; Eichbrecht and Wilber 2011; Stern and Wiener 2011; Jasanoff 2011; Quick 2011; Vogel 2012).[53] These scholars forego any transferable conclusions as to why such different attitudes to risk and uncertainty exist – but they do strongly question the existence of or adherence to any generalisable model for rational cost-benefit analysis.

Unlike the previously discussed works on calculable risk preferences, most of the new approaches from the social sciences focus on uncertainty. There is more open acknowledgement of types of risks which cannot be calculated or possibly not even expected – 'unknown unknowns' (Mildner and Boeckelmann 2011).[54] One of these new

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[53] Another group of scholars focuses on disputing the idea of different risk attitudes in general between (mainly) the U.S. and the EU, as no evidence exists of cultural effects on risk attitudes (Christoforou 2004; Kelemen and Vogel 2009; J Wiener 2011; Walsh 2011; Miller 2011; Elliot and Renn 2011; Cantley and Lex 2011; Mildner and Schwarzer 2011; Hammitt 2011; Saterson 2011; Freestone 2011; Mair, Mildner, and Wodni 2012).

[54] In his book *Risk: A Sociological Theory* Niklas Luhmann contributed to the sociological work on risk by crossing it with his theory of autopoietic systems (Luhmann 2008). In his theory, risk is a particular way of dealing with the future, which needs to be decided by factoring in probability. This leads to the insight that the uncertainty of an outcome does not solely stem from reasons of disinformation or incomplete information and complexity of a choice, but also from the very process of preference building or decision-making itself. For example, there often enough is quite a large gap of time between the moment when a decision is made and the moment when its consequences begin to unfold – in the meantime, a whole array of seemingly not directly related factors can affect the course of the consequences. Giddens (1999) defines 'today's risk society' as "a society where we increasingly live on a high technological

concepts is that of systemic risk: these are risks the effects of which may spread across national borders as well as sectors due to interconnectedness, and risks so complex that it becomes hard to distinguish their creators and their victims. For example, aspects of environmental degradation such as pollution and global warming are risks that spread borders and affect anyone, not just those who created them. The effects are global in their impact. Scholars have stated that the regularly used and accepted expected utility framework for risk preferences is likely of limited use when looking at environmental and climate policy issues in part due to this very reason (Kunreuther et al. 2012; Heal and Millner 2013).

This section has shown that criticism of expected utility and rationality in decision-making continued and spread out from economics into different academic disciplines. It has elaborated on the normative beyond the empirical arguments – scholars not only point out that expected utility does not work in most real-world scenarios, they also question why expected value alone should be a model for decision-making. From the discussed critiques, it became clear that many authors find uncertain, not calculable risks, at the heart of much policy failure, and that they take issue with the nonspecific use of the terms 'risk' and 'uncertainty'.

III.5 Risk and uncertainty: An important distinction rarely made

> "Keynes' admonition to open up the field of economic decision-making to the unknown unknowns was entirely neglected in the subsequent development of mainstream economics (including mainstream Keynesian economics)." (Beck 2006, 335)

Throughout the previous parts of this chapter an issue has crystallised to which this section is devoted: a confusion between the terms risk and uncertainty, and a disregard of the latter altogether. In the above reviewed academic literature one often comes across a lack of exact distinction between the two terms. In section one, two, and mostly in section three as well, risk is discussed as a measurable variable and the possibility of uncertainty is ignored – but in section four I mentioned criticism of this oversight and a notion that

frontier which absolutely no one completely understands and which generates a diversity of possible futures" (Giddens 1999: 3).

the terms are different. In this final section I discuss definitions of the two terms and their use in recent literature to decide on a distinction and why it is important.

It has been stated that in the 21st century, risk has become "one of the most used, abused and analysed" (Mudu and Beck 2012, 1217) terms to classify facts, events or the entire social reality. To begin with the basics, the Oxford English Dictionary offers several definitions for the word risk:

> "A situation involving exposure to danger; The possibility that something unpleasant or unwelcome will happen; A person or thing regarded as a threat or likely source of danger; A possibility of harm or damage against which something is insured; A person or thing regarded as likely to turn out well or badly in a particular context or respect; The possibility of financial loss." (Oxford Dictionaries Online 2016a)

All but one of these possible definitions have a clear negative connotation.[55] What these standard definitions do not define is whether or not such a risk would be at all measurable.

The International Risk Governance Council (IRGC) defines risk as

> "an uncertain (generally adverse) consequence of an event or activity with respect to something that human beings value". (IRGC 2012, 4)[56]

Clearly, here, a distinction is made between risk and uncertainty. The definition adds that risks

> "are often taken for opportunities associated with initiating activities or applying technologies" (IRGC 2012, 4).

For the word uncertainty, there are less definitions available:

> "The state of being uncertain; Something that is uncertain or that causes one to feel uncertain" (Oxford Dictionaries Online 2016c).

These definitions are surprisingly inadequate not to mention pleonastic: the word 'uncertain' then is further defined with:

> "Not able to be relied on; not known or definite; (Of a person) not completely confident or sure of something" (Oxford Dictionaries Online 2016b).

which indicates that uncertainty is at least clearly defined as something not measurable. Uncertainty is defined by the IRGC as referring to

> "a lack of clarity or quality of the scientific or technical data. Uncertainty describes the level of confidence that analysts associate with a qualitative or quantitative assessment of a specific risk." (IRGC 2012, 14)

Here a logical sequence is established between risk and uncertainty. Aven and Renn support this, and the idea that uncertainty has little to do with probability or expected

[55] In the English language at least, they commonly all entail the potential for adverse effects.
[56] The IRGC in a previous definition explained risk as the potential appearance of tolerated, or unintentional i.e. accidental consequences of purposeful human activity which damage a good or goods valued by humans (Renn 2005). Whilst this makes room for a differentiation about the certainty of risk appearing, it does not specify whether or not this certainty can be calculated.

values (Aven and Renn 2009, 1, 4, 10). Risk can involve uncertainties; uncertainties can lead to risk. Aven and Renn combine the terms as follows:

> "Risk is a situation or event where something of human value (including humans themselves) is at stake and where the outcome is uncertain" (Aven and Renn 2009, 1).

Similarly, the Gabler Economic Dictionary defines risk as:

> "Designation of the eventuality that with a certain, specified or unknown, probability, a damage or loss may take place, which may also be unknown, following an (economic) decision; or equally that the expected benefit may remain absent." (Kamps 2013)[57]

The last three specific definitions reviewed here show an understanding that there is a clear distinction and possible sequential relationship between uncertainty and risk. The International Organization for Standardization takes the same approach to the separation of the issues and defines risk plainly as the "effect of uncertainty on objectives" (InConsult 2009). Similarly, the Financial Times lexicon defines risk as "the measurable uncertainty that an investment (or the running of a business) will not generate the expected returns (or earnings)" (FT Lexicon 2015). Risk and uncertainty can clearly be divided into two separate categories with one affecting the other. These definitions illustrate the existence of a general understanding of two separate scenarios of calculable and non-calculable potential for (adverse) effects.

In the social sciences, many scholars draw on an original definition by the economists John Maynard Keynes and Frank H. Knight (Keynes 1921; Keynes 1937; Knight 1921) when engaging in discourse on the meaning of uncertainty, risk, and risk preferences.[58] Both Keynes and Knight decided it was necessary to encourage a clear distinction between the concepts of uncertainty and risk. There are different approaches for distinguishing between levels of information and calculability. In his 1921 book *Risk, Uncertainty and Profit* Knight defines the term uncertainty as the overall term for three possible 'probability situations':

- logically deduced probabilities,
- empirically (i.e. statistically) deduced probabilities,
- and estimated probabilities (including all probabilities that are based on both estimations and intuitive judgment) (Knight 1921; Mildner and Boeckelmann 2011).

The first two categories, logical and empirical probabilities, are both considered as risks

[57] Translated from German: "Kennzeichnung der Eventualität, dass mit einer (ggf. niedrigen, ggf. auch unbekannten) Wahrscheinlichkeit ein (ggf. hoher, ggf. in seinem Ausmaß unbekannter) Schaden bei einer (wirtschaftlichen) Entscheidung eintreten oder ein erwarteter Vorteil ausbleiben kann."
[58] A review of many of these can also be found in Mildner and Boeckelmann (2011).

by Knight. Only the third category of estimated probability he considers as true uncertainty, for which there is no available method of objectively measuring the probability of occurrence or impact. As examples he names perfectly unexpected and singular situations such as an unforeseen natural hazard.[59] His belief in the importance of distinguishing outcomes between what is and what is not measurable is obvious. From the field of political science, scholar Elke Krahmann distinguishes between three different types of risk: known risks, unknown risks, and unknown unknown risks. Occurrences can be categorised in this order according to their frequency, their predictability as well as overall existing knowledge of the type of risk (Krahmann 2011). Known risks are thereby risks which have been experienced before and about the causes of which there exists sufficient available and calculable information. Unknown risks to Krahmann are risks the probability and impact of which can be calculated quite accurately but not perfectly so, leaving room for error. Unknown unknowns are almost perfectly impossible to estimate or measure, as we know close to nothing about them and can only speculate as to their future occurrence, or never even expect them at all (Krahmann 2011).[60]

Several other recent studies in the social sciences do not use the differentiated labels of risk and uncertainty but do detect the distinction of the terms. For example, Van Asselt and Renn instead differentiate between *simple risks* and *systemic risks* (van Asselt and Renn 2011). Systemic risks are characterised by uncertainty, complexity and ambiguity (van Asselt and Renn 2011). The IRGC defines systemic risks as

[59] Whilst those are more predictable in the 21st century than at the time of Knight's book, they continue to eschew calculation. In the 21st century the now common or standard practice of catastrophe (CAT) modelling has been found inadequate in situations of extreme events such as the Hurricane Katrina (Westfall 2005) due to unforeseeable attributes.

[60] Several other recent studies (Renn 2005; Daase and Kessler 2007; Nelson and Katzenstein 2010) have come up with similar categories with a clear distinction of terms between risk and uncertainty. Daase and Kessler distinguish between known knowns: about which there is perfectly accurate information available, therefore these count as threats; known unknowns: threats which we know of but which cannot be attributed to a particular actor or cause and are difficult to measure, but are considered risks (Daase and Kessler 2007; Mildner and Boeckelmann 2011). They can be compared to those risks which Knight (1921) considers deducible, however Daase and Kessler point out that there are many different ways to calculate a risk which strongly depend on factors such as context, culture etc. and need not be mathematically logic (Daase and Kessler 2007; Mildner and Boeckelmann 2011). Further, the authors make allowance for political interests to have an influence on the consideration of an issue as a risk (Daase and Kessler 2007). Unknown unknowns are called disasters and their definition is closely aligned with that of Knight's "true uncertainty" (Knight 1921; Daase and Kessler 2007): events which cannot be estimated or measured neither regarding their occurrence probability nor regarding their consequences, including some natural disasters. Daase and Kessler introduce another category of unknown knowns, also called ignorance: this encompasses active decisions of remaining ignorant or having other people remain ignorant about the causal relations surrounding a risk, which thereby becomes an uncertainty.

> "embedded in the larger context of societal, financial and economic consequences and threaten the functionality of a service or a need that is essential for the economy and/or society"; "not confined to national borders"; "cannot be managed through the actions of a single sector"; "require a comprehensive and systemic governance approach, i.e. an approach that acknowledges the interdependencies of the variables and attempts to correct the drivers rather than the symptoms" (IRGC 2012, 4).[61]

Possible examples for systemic risks are climate change or the global financial crisis of 2008.

Whichever way the difference in meaning is labelled – and in this thesis, I chose to distinguish between the terms *risk* and *uncertainty* – the distinction is incredibly important. There is a tendency to ignore the possibility of uncertainty or to classify all uncertainty as risks.[62] For example, Katzenstein and Nelson specifically wrote about the financial crisis in which they consider problems arose or were reinforced through a blatant misunderstanding of and non-distinction between risks and uncertainty (Nelson and Katzenstein 2010). They argued that problems stemmed from the fact that many uncertainties were considered as calculable risks. Nelson and Katzenstein attest that the element of uncertainty is often masked by an overreliance on quantifiable data and complex models which leave little room for an uncertainty factor, specifically in the finance sector, including some studies in investment and insurance (Nelson and Katzenstein 2010). Such risk attitudes are also at the heart of the problématique of this thesis: the next chapters assess whether or not costs of shale gas are considered to a lesser

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[61] If a systemic risk crosses different societal sectors or even just governmental departments, or beyond national borders, a situation of ambiguity arises as there is a further complication of highly different preferences towards said risk and its implication (van Asselt and Renn 2011).

[62] Another terminology which it helps to clarify is the term risk preference. Arrow described risk-benefits analysis, which in turn may inform a risk preference, as a key tool in modern policy analysis (Arrow 1988). One of the earliest mentions of this process is found within Jules Dupuit's paper on cost-benefit analysis (Dupuit 1844), yet it was never practically and consciously applied in arguing for political reasons before the 1950s (Arrow 1988), most prominently with many economist scholars (von Neumann and Morgenstern 1944; Allais 1945; Ellsberg 1961; Quiggin 1982, 1993). A risk preference describes the completion point in decision-making in a situation of risk and under uncertainty. Condensing the Benthin Risk Perception Measure (BRPM) (Benthin, Slovic, and Severson 1993), psychologists Gardner and Steinberg define it most plainly as "whether one believes the benefits inherent in an activity outweigh [its] costs" (Gardner & Steinberg, 2005, p.4). This is how the term will be used in the following: as a preference of whether or not to accept a risk which entails uncertain elements and undergo the activity bearing it (Kahneman and Tversky 1979; Slovic 1987; Wang 2006; Anthony Leiserowitz 2006; Leiserowitz et al. 2007; Treier 2010). The concept of risk preference has been in common use for quite some time as a factor in manifold studies (Slovic, 1987; Bell et al., 1988; Arrow, 1988; Kahneman et al., 1982; Kahneman & Tversky, 2000; Leiserowitz, 2006; Leiserowitz et al., 2007; Slovic & IIED, 2010 - to give but a few examples), amongst others on voting behaviour, financial investment or foreign policy analysis. In studies dating back to before 2000, risk preferences are quite often described by similar terms such as 'risk decision behaviour', 'risk attitudes', 'preferences in risk attitude', 'risk policy preferences' and others. The variety in terminology serves as a further indicator of interest and research into the issue of risk preferences as well as an indication of how disconnected these approaches are; that there has been no effort to collect and combine multidisciplinary insights into the area as of yet.

extent because some are uncertain, not local in their impact and distant – which would go against the notion of ambiguity aversion.

The purpose of this section was to clarify the distinction between risk and uncertainty, to settle on definitions for this thesis, and to point out the danger of confusing uncertainty for a measurable risk, as the above sections have shown risk preference models to do.[63] Having established that there are means of differentiating between risk and uncertainty that are accepted by scholars, this thesis will continue to make the distinction as I deem it specifically important for the case study at hand. In this thesis, the term *risk* will be used whenever it is known that a situation may bring with it adverse effects and when it is possible to calculate their approximate consequences. *Uncertainty* will be used as a term for situations in which potential negative consequences are expected but little is known about their impact or their likelihood and they may not be considered.

III.6 Chapter conclusion

This chapter served the following key purposes: 1) to introduce the reader to the standard approach in risk or uncertainty decision-making analysis, expected utility theory; 2) to show that this approach has been proven to hardly work; 3) to establish prospect theory and introduce common biases in decision-making which become useful later in this case study; and 4) to show concerns about the use of such an approach. A 5)th key purpose of the chapter was to discuss the distinction between risk and uncertainty, which is a distinction rarely made yet very important. Without it rationality in decision-making is not feasible. All of the above conclusions make it very worthwhile to look at other scenarios when aiming to explain a decision taken under uncertainty.

I opened this chapter by introducing the prevalent model for rational decision-making under risk, namely expected utility theory, with its basic propositions and the history of its development and refinement. Throughout several sections I elaborated on consistent criticism of this theory for its inability to either explain or predict real decisions, mostly from the disciplines of economics, psychology, sociology and political science. There is still widespread consensus among current scholars that empirical researchers on behaviour and decision-making under uncertainty should take expected utility, or

[63] There is obviously an aspect of assumption involved (or character judgment of the respective researcher or policymaker) when pointing to uncertainties which were falsely identified as risk. This could have occurred due to lack of knowledge, followed from indolence or a wish to conceal uncertainty.

prospect theory, as a basis for cost-benefit analysis under risk and uncertainty into account as it is the best available model to assess such decisions (Quiggin 1982, 105, 1993; Harless and Camerer 1994; Harrison and Rutström 2008; Treier 2010; Rieger 2014; Briggs 2015). This consensus I spoke of above about the benefits of expected utility however exists mainly between the type of scholars who engage with direct modelling of how to explain or predict risk: most of these engage in positivist research on economic issues, or business and policy recommendation. Expected utility theory, in a nutshell, will assume that a risk is more likely to be taken the higher the potential payoff or revenue is. It takes into account that utility is different for different people, that certainty or losses are valued differently depending on the original circumstances. It always assumes rationality. The economic model of choice that is most popular besides expected utility, prospect theory, divides between gains and losses but doesn't otherwise differ greatly from its parent.

In further sections of this chapter I discussed several types of critique of expected utility, ranging from the kind of critiques based on empirical evidence that aimed to help upgrade and sharpen the formula of expected utility, to the kind that denies it any claim to usefulness and questions its normative foundations.

The chapter showed that from a theoretical perspective, there are many reasons to doubt the official cost-benefit rationale of a policy made. First of all because the very economic concept of cost-benefit analysis under risk, i.e. expected utility, is presumptuous and flawed and has been criticised by its own pupils for decades. There is also more recent evidence that when this kind of rigorous statistical method is applied, it often gets it wrong (Westfall 2005; Clark 2015). I ended the chapter with a discussion of two terms important to this work, risk and uncertainty, and the necessity of distinguishing between their definitions.

The chapter conclusions lead me to assess a rational cost-benefit analysis of shale gas opportunities for the United Kingdom and the United States considering risk and uncertainty involved: Through a concise data and literature review, the next chapter argues that in a situation of such uncertainty, a decision on fracking is not 'rational' in economic terms (chapter four). This entails a weighing of expected revenue and benefits against the expected costs, including investment costs as well as costs such as negative effects on the economy and the environment, and a comparison of alternative options for energy generation. This third chapter, especially where I discussed criticism of expected utility, also leads me to look for other approaches of decision-making analysis in the realm of political economy (chapters five – eight).

IV Chapter Four. Comparison of cost benefit analysis for fracking in the United Kingdom and United States

In chapter three, I discussed the 'rational' theory for decision-making under risk and uncertainty. I also considered both empirical and theoretical criticism of expected utility theory. Despite its critics, expected utility is still considered a key model to analysing, guiding and predicting decisions taken under risk. Hence in this chapter I follow the expected utility theory i.e. cost-benefit approach suggested in the traditional literature for the decision made on shale gas to assess whether it accurately explains policy decisions on shale.[64] The rational actor model is based on the following inference pattern: "if a nation performed a particular action, that nation must have had ends to which the action constituted a maximizing means", with "national interests" as its key goals (Allison 1971, 33). Therefore, I will conduct an analysis into the national interest in shale gas.

As this is a comparative case study, in the opening sections of this chapter I evaluate the empirical data on the energy sectors and specifically shale economics for a purely rational cost-benefit analysis in a first section for the United States and then in a second section for the United Kingdom. I begin the country specific sections by making a wider point on the respective country's energy sector in order to assess how shale gas would fit into the mix: a key criterion of expected utility is after all to assess the utility of a course of action to a specific case, not its general value. Consequently, a mere discussion of shale reserve sizes would be insufficient. Instead it is important to consider each country's specific needs, i.e. overall energy production and consumption play a role, but also structural factors such as gas infrastructure and mining rights to assess if it would be economically viable to introduce shale gas into the energy mix.[65] There are structural particularities to gas as a resource and the gas business which make it a very different economic resource from oil or coal, notably the different modes of transport and pricing. Existing infrastructure should play a major role in determining both the technical ability to access shale gas resources as well as their utility, since this is where investment costs

[64] I will not attempt to evaluate expected utility in a mathematical sense as there would be too many separate choice actions creating a multitude of utility functions. Furthermore, as this chapter will illustrate, many factors that should influence policymaking on shale gas are in fact not measurable to the point where they could be translated into real numbers. What this chapter aims to determine is whether expected utility was considered in the sense of a cost-benefit analysis based on rational assessment of known factors, and whether such as assessment was possible at all given the availability of information on the resource.

[65] I discuss the U.S. shale cost-benefit analysis in more detail than the UK case, as there is more proven data for and experience with the U.S., whereas for the UK mostly plans and the data on which they are based will be discussed.

are likely to occur. The effect that adding shale gas to the energy mix available to a country has also depends on its pricing system. The ownership of below the ground assets is an influential variable when calculating both the lucrativeness of shale assets as well as the viability of their extraction.

In a third section I consider the public opinion on shale gas development in the two countries. The governments of both the United States and the United Kingdom can be expected to, within reason, take their directives from public mandate, if merely to achieve re-election (Downs 1957).

In the final section I establish the existence of alternative energy strategy options for both the United Kingdom and the United States, and argue that there is every reason to assume that the respective governmental policymakers are well aware of them. This section serves to point out the availability of options other than shale gas development, to outline their potential and to make sure that information about such strategies was sufficiently existent. In this chapter I use data from a number of sources: official governmental statistics from the departments entrusted with economic policy, energy policy, environment, budget or statistics, as well as third party data from the International Energy Agency (IEA), the Organisation for Economic Cooperation and Development (OECD), and data from independent scientific research published in recognised journals (i.e. IEA 2002; DTI 2003; IEA 2005; BERR 2008; Owen, Inderwildi, and King 2010; Urbina 2011; IEA 2012; Bolton 2013; International Energy Agency Staff 2013; EIA 2013b, 2015c, 2015a, 2016; IEA 2016).

Before commencing the chapter, it is important to establish how expected utility theory will be used. In literature, it has been used descriptively, predictively or prescriptively. As I am assessing policy decisions that have already taken place, the latter two are not relevant in this context. What I aim to assess is the validity of the underlying principles of expected utility: rationality, and basing a decision on a cost-benefit analysis of known data. I wish to assess whether expected utility to the proclaimed beneficiaries (the national economic sector and the public, and to a lesser degree the industry, the consumers) was derived by taking into account all costs and benefits of the policy proposed, and to which degree this was even possible. Shale gas development is at very different stages in the two selected cases, the United States and the United Kingdom. My strategy to compare them is ultimately based on their similar policy decision-making on shale gas, i.e. the decision to engage in shale gas development (whereas other governments chose not to[66]) and their

[66] For example, the French and German governments have banned fracking (Hansen and Shalal 2016; Felix 2016). There are doubts by green campaigners about true intentions of their governments and

favourable treatment of the sector, both in policy statements (Snyder and Klimasinska 2012; Cameron 2013; Krukowska 2014; Watt 2014) as well as in records of actual legislation (Stevens 2012; BBC 2013; DeGette 2016; Carrington 2016).

I will not, in this chapter, be able to consider the specific environmental costs of shale gas extraction as part of the cost-benefit analysis, something that many scientists in the 21st century consider should be part of the cost calculation. Within the timeframe of this study until the time of writing up in 2016, a variety of environmental disturbances have been linked to shale gas drilling, including water contamination, fish kill, earthquakes, pollution and many more.[67] The evidence speaks for itself that from an environmental standpoint, shale gas is not a recommended energy source, and moreover it is not a sustainable resource. I consider the environmental costs of a resource as essential to calculate its costs and benefits; a recent EU Commission report has shown that if their economic costs included data on health, pollution and environmental effects, gas is already costlier than wind in the United Kingdom (Neslen 2014). But these kinds of costs continue to be kept separate from other economic costs in official energy strategy (see chapter eight) so to gauge the decision strategy of a policymaker I will adhere to this method.

IV.1 Energy and shale gas in the United States

It is necessary to make a wider point about the U.S. energy sector to clarify the role shale gas can play within its energy resource mix, the role it was hoped to play within it at the time of decision-making on shale policy, and what role it played in the first decade of its development.

Coal production in the U.S. was overtaken first by oil production and then by gas production within the 1950s (see Figure 3 (EIA 2016b)). Those three major fossil fuels have dominated the production sector to varying degrees ever since. The development of nuclear energy and renewable energy sources has slowly risen since the 1970s[68] but not reached the same levels as fossil fuel production.

whether or not the bans may not be revoked in future and whether there are exceptions to the ban. However, the official policy decision of both governments was to decide against fracking and therefore differs from the U.S. and the British decision.

[67] (Krahmann 2011; Howarth, Santoro, and Ingraffea 2011, 2012; Nestler 2012; Groat and Grimshaw 2012; T. Helm 2013; Schrope 2013; Terrell, Tinley, and Souther 2014; Anderson 2014; Bailey and Preston 2015; Inman 2016).

[68] The steady amount of renewable energy before 1970 is exclusively hydroelectric and biomass.

Gas production in the U.S. has risen sharply after a rather steady phase between 1990-2005, and crude oil production has been on the rise again after a steady decline since around 2009. A substantial part of this trend can be accredited to shale gas resources. Primary energy production has risen steadily with the exception of coal. Of this, unconventional gas constitutes 60% of production growth – this occurrence is estimated to be brief (as is the United States place at the top of gas producing countries) due to anticipated imminent decline in shale gas (IEA 2014, 2). In short, all types of energy production have risen noticeably since 2000, with the singular exception of coal production, which has declined since 2008 (EIA 2015b, 14).

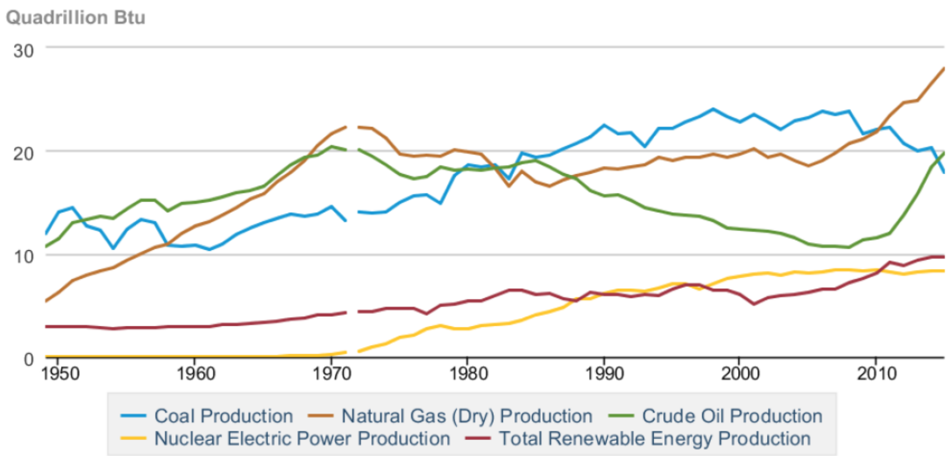

Figure 3: Primary U.S. Energy Production by Source 1949-2015 (EIA 2016b)

Energy consumption has also risen, and has outpaced production, illustrated in Figure 4 (EIA 2016b) below.

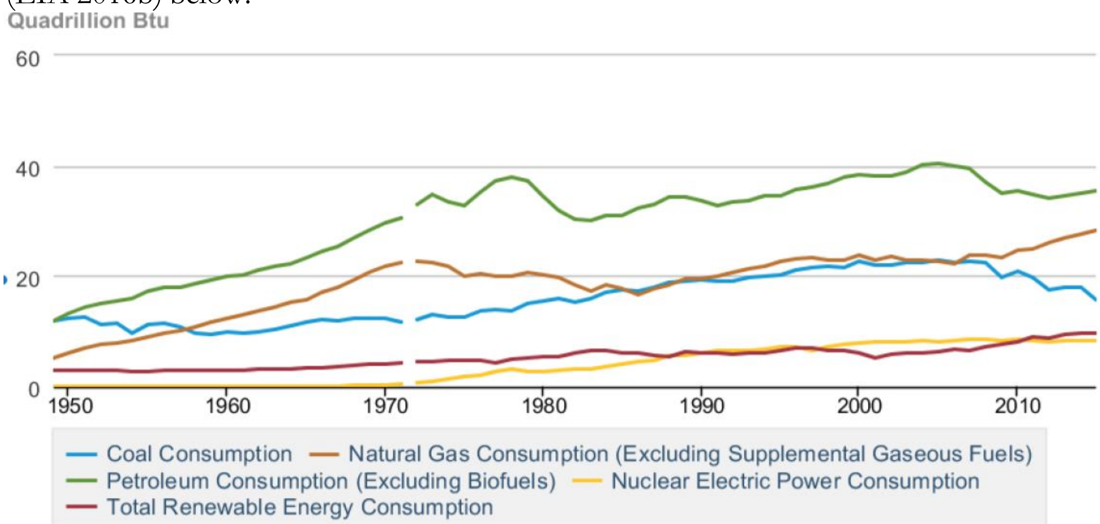

Figure 4: Primary Energy Consumption by Source (EIA 2016b)

Overall consumption of coal has declined over the past decade, and similarly overall consumption of petroleum has declined at the same time, until 2014/15 (EIA 2015b, 16). However, petroleum has remained the most consumed energy source without interruption since 1950, with renewable and nuclear energy consumed the least (EIA

2015b, 2013b). Consumption levels of natural gas were at an all-time high in 2014 and have been continuously rising in the past decade. Yet when compared to previous gas demand peaks in the early 1970s or late 1990s the rise has not been as dramatic as for example the rise between 1950-1970.

The U.S. was still a net importer of energy products in 2015, but the deficit between imports and exports, which peaked around 2008, has been almost halved since then (EIA 2015b, 12). Figure 5 (EIA 2016g, 8) shows that energy is actually opposed to the general trend in the U.S. trade balance, in which the U.S. trade deficit is continuing to grow after a brief respite following the global financial crisis.

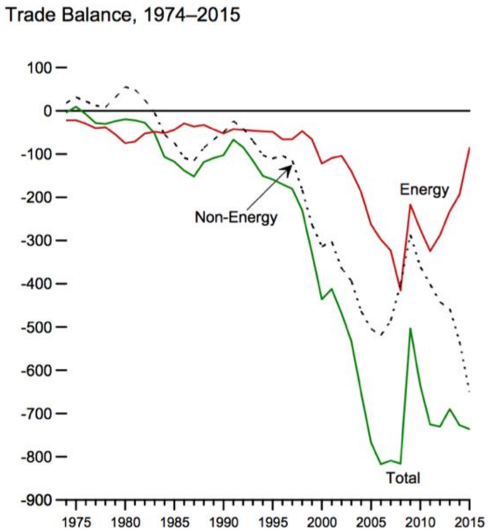

Figure 5: U.S. Trade Balance 1974-2015 (EIA 2016g, 8)

This trend can be explained by rising production levels in unconventional fossil fuels. Imports have decreased considerably since their peak in 2007, but, more remarkably, energy exports have risen significantly since 2009 to their highest ever levels yet, as visible above in Figure 6 (EIA 2016e). While the United States are decreasing their consumption of coal by introducing more shale gas,

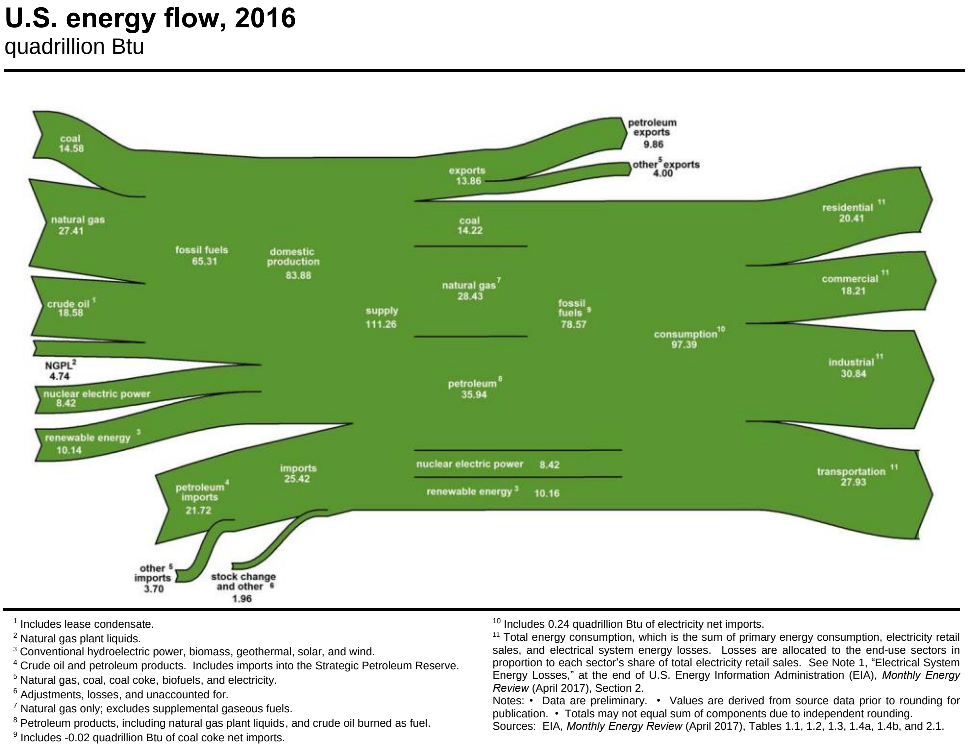

Figure 6: U.S. Net Energy Trade (EIA 2016e)

they are also increasing their coal exports (Broderick and Anderson 2012; Miller 2014). Clearly this renders the ‘clean’ effect of shale gas even more questionable.

Figure 7 below (EIA 2013a) shows a rough division of end use per sector by the different energy sources. This is important because as the overall consumption landscape changes, production will have to adjust. There are few changes until 2015 (EIA 2015a).

Gas is mainly used directly for industrial, residential and commercial purposes or for electricity, and these sectors, unlike transportation, have made great advancements with renewables. Solar power is becoming one of the cheapest sources of energy for private purposes in the United States, while the transport sector is heavily reliant on oil. Natural gas, a major part of which comes from domestic shale gas production, only makes up a small part of the second largest end use sector, transportation, which remains mostly fuelled by petroleum – of which around ten quadrillion Btu remain imports (EIA 2016b). This challenges the argument of shale gas directly generating an increase in energy independence.

Gas plays an important role in the United States energy sector, but it alone cannot change the sector’s reliability on imports. Furthermore, it cannot fix the problem of unsustainability. What will become clearer in the following section is that beyond these

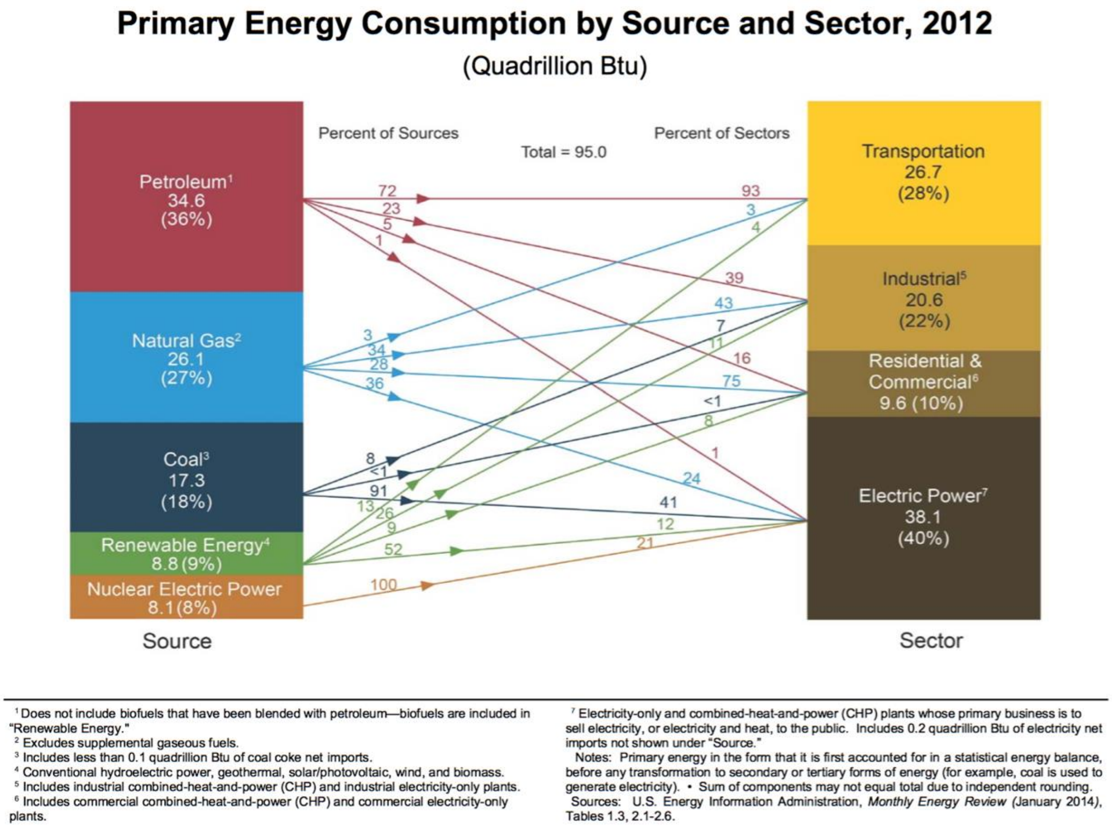

Figure 7: U.S. Primary Energy Consumption by Source and Sector (EIA 2013a)

issues, shale gas cannot simply replace conventional gas as an energy source as if they were equal.

IV.1.1 Shale gas in the United States

The supposedly 'overnight' success of U.S. shale gas has been decades in the making. The first shale well ever drilled in the United States was in Fredonia (NY) in 1821, and the first hydraulic fracturing exploration, albeit not connected to shale, was carried out in Kansas in 1947 (Stevens 2010). Shale gas has been produced on a small scale for over a century in the United States, in the Illinois basin and Appalachian basin (Stevens 2010, 12). Large scale commercial development tentatively began in the 1980s. In 1986 2000ft horizontal shale wells were drilled in the Appalachian basin, and in the 1990s fracking was established in the Barnett shale (TX) (Stevens 2010; Styles 2014). For a long time, the technology was not financially viable for commercial production. In 2015, the Department of Energy concluded that it was technological advances which finally rendered the long known resource profitable in the 21st century and confirmed the department's belief that shale gas "has the potential to significantly increase America's security of energy supply, reduce greenhouse gas emissions, and lower prices for consumers" (DoE 2015). Exact numbers of resource availability vary: the U.S. Energy Information Administration (EIA) originally estimated an original resource amount of 4644tcf of which they considered around 665tcf recoverable (EIA 2013b, 27) - Advanced Resources International considered 1161tcf recoverable (ARI Inc. 2014). But there is much doubt about both figures, which I will discuss later in this chapter. Shale gas currently encompasses 16% of all natural gas production within the United States (DoE 2015).

The following Figure 8 gives an overview of shale gas basins in the continental United States territory. This includes all of the discovered and so far evaluated shale gas basins on the United States mainland (EIA 2015b).

The image illustrates how far shale gas development has already progressed in the United States in little more than a decade – commercialisation began with the use of hydraulic fracturing wells in the Barnett shale basin in 2002 (Stevens 2010). Most of the major discovered plays have been accessed, and several new plays are in planning.

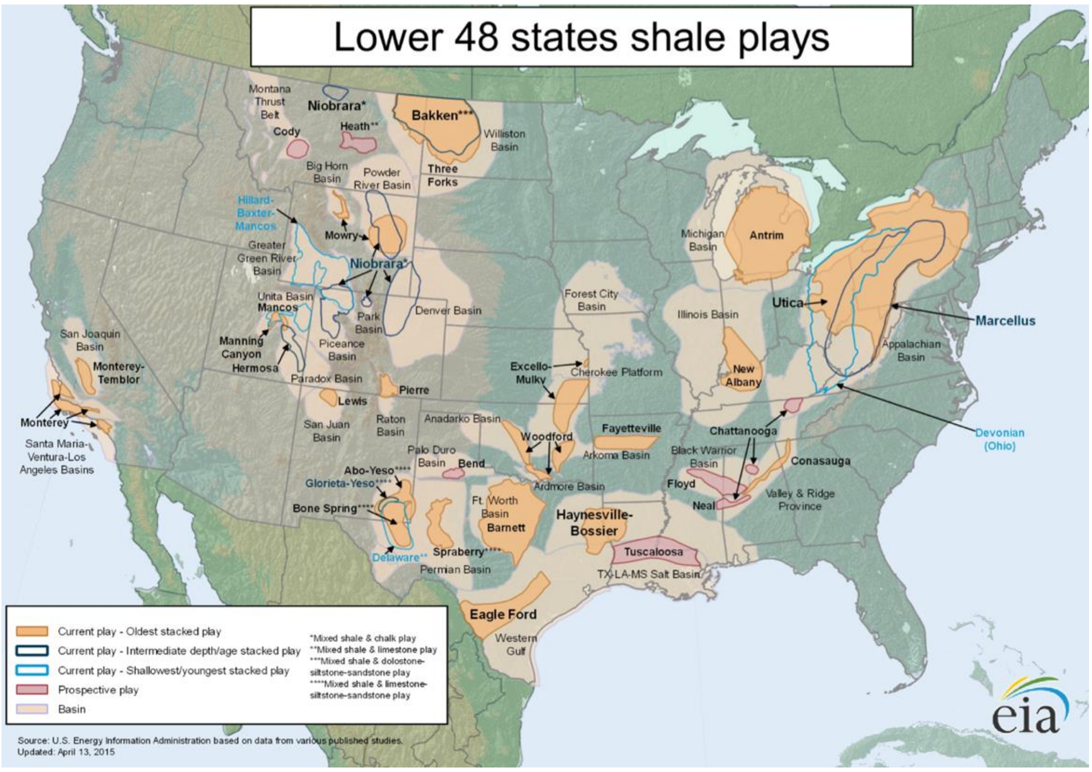

Figure 8: Shale Plays in the U.S. (EIA 2015a)

To further illustrate the development of shale gas in the continental United States, Figure 9 below (EIA 2016h) shows the current production of shale gas in the active plays in billion cubic feet per day. The most productive play by a noticeable margin is the Marcellus play in Pennsylvania. Together with the Haynesville play in Louisiana and Texas, the Eagle Ford play in Texas, the Fayetteville play in Arkansas, and the Barnett play in Texas it makes up the 'big five' U.S. shale basins. These five account for the majority of shale gas produced, each of them many times over the amount of any other shale play. It is important to note that production overall rose mainly due to the tapping of new plays rather than a major increase of production in any of the mentioned shales.

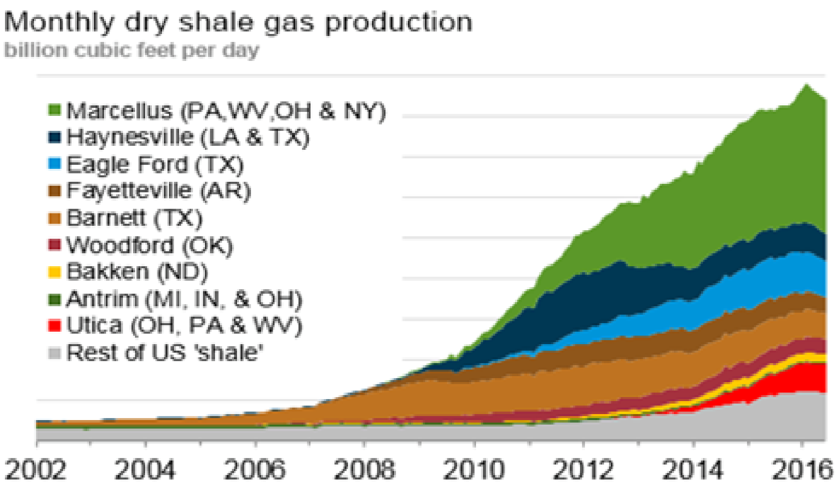

Figure 9: U.S. Dry Shale Gas Production Monthly (EIA 2016h)

In effect, several of the main shale basins, for example Barnett and Haynesville, are already in decline. This raises concerns over sweet spots for drilling, which some members of the shale industry and EPA have warned of (The New York Times 2011).

The following estimations, seen in Figure 10 below (EIA 2016h), may help explain the interest in shale gas and other unconventional gas resources in the United States in particular. According to this 2012 EIA statistical projection, shale gas will make up for half of all gas production.

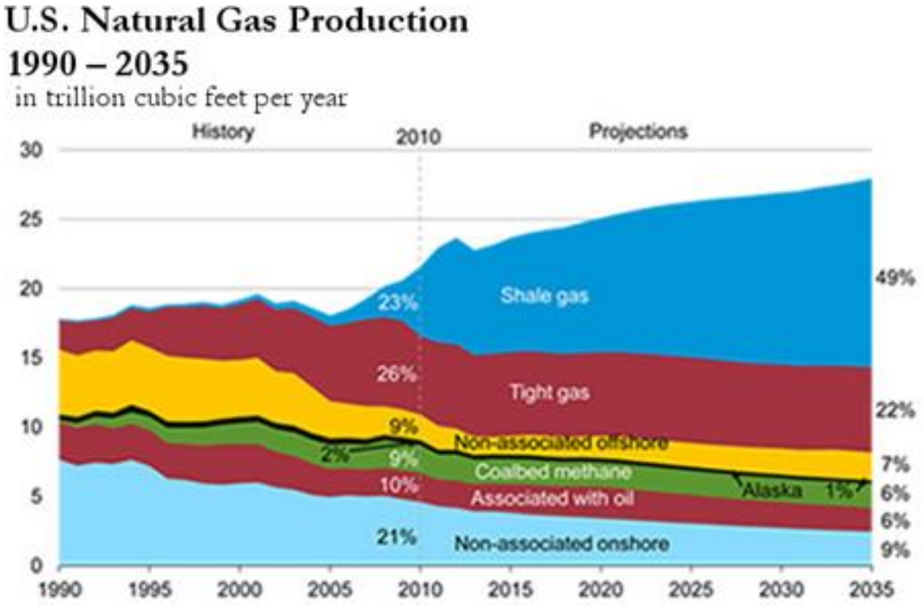

Figure 10: U.S. Natural Gas Production 1990-2035 (EIA 2016h)

Shale gas made up around a fifth of all natural gas production within the United States in 2015 (DoE 2015), and according to the estimation in the above figure by the DoE, there is a strong hope to expand its role in providing natural gas. Its production levels are predicted to continue rising while production of other natural gas sources is due to decline. With this level of importance attached to the success of shale gas, and these kinds of prospects for its continued exceptional performance envisioned by the U.S. Department of Energy, shale gas can be considered to form a vital part of current U.S. energy strategy.[69]

[69] It remains to remark that the shale gas 'revolution' in the United States has had a few interesting consequences in and outside the United States as well. LNG exports originally intended for the U.S. market are since flooding other markets instead (Dohmen and Jung 2012).

IV.1.2 Structural factors

Several structural factors, including pricing, infrastructure and regulatory framework, affect the costs and gains of shale gas development. In the United States, there is a well-developed market system for natural gas, with the physical market (actual price at delivery points) on one side and the futures market (based on NYMEX) on the other. U.S. gas prices are determined by the fundamentals of supply and demand to a stronger degree than in many European countries where they are linked to oil prices (EIA 2016f, 2016c). Weather conditions or economic conditions affect the demand side, and change in production, storage and imports affects the supply side. Competition from other fuel sources can have a real impact on gas prices. With natural gas, minor changes in supply or demand can result in noticeable price changes because short-term alternatives for either consumption or production are limited (EIA 2016f). Therefore, an increase in supply as experienced between 2006 and 2014 due to the expansion of shale gas operations led to very direct changes in gas prices for some. This is also due to the fact that most natural gas consumed in the United States, though not all, comes from domestic production (EIA 2016c).

Natural Gas Prices

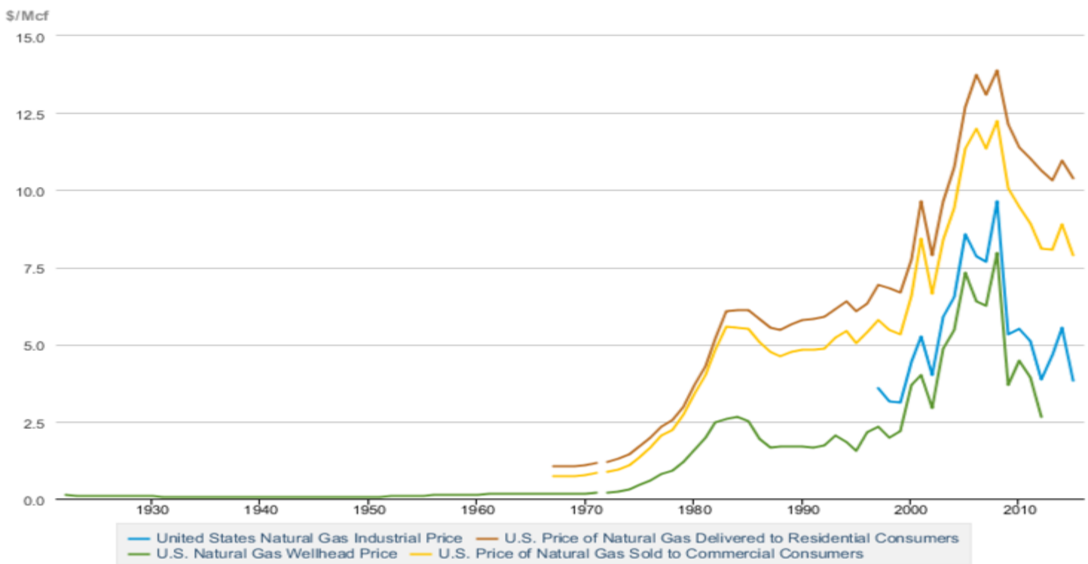

Figure 11: U.S. Natural Gas Prices (EIA 2016d)

Visible in Figure 11 above (EIA 2016d), the United States Henry Hub gas price has decreased considerably correlating with the widespread introduction of shale gas operations in the mid-2000s. Prices fell after an all-time high around 2008 but did not sink as low as pre-2000s prices. However, as supply can affect prices, prices can also affect supply. For some producers, it cannot be economically profitable to drill for gas once the price for it falls under a certain marker. In situations of oversupply of gas and oil, shale gas may lose out: it is easier to interrupt shale operations than other energy operations within the U.S., and many shale wells do not turn profit unless the oil price is around 80-90$ per barrel (Neate 2015).

Gas is not as easily transported as oil, but it either requires pipelines or, where pipelines do not exist, it must be converted to liquefied natural gas (LNG). Therefore, unlike with oil or some other commodities, there is different arbitrage and no fixed global price for gas, and no global gas market. Therefore, gas prices can vary greatly between regions (EIA 2016f). (With increasing amounts of gas trade happening via LNG rather than through pipelines, this may change in the future (Jacobs 2012)). Global pricing across different regional markets is created by the process of physical arbitrage – if that is missing, like in the case of gas trade, the result is that there is no internationally comparable price. Equally, the Gas Exporting Countries Forum (GECF) plays a different, much smaller role than OPEC does. The legal framework for development of gas resources also plays a very important factor when determining their utility: this includes ownership rights of resources i.e. mineral rights.

Shale gas extraction in the United States is facilitated by already existing favourable energy infrastructure. There is a strong gas and oil service industry and easy access to gas pipelines (Stevens 2010). Furthermore, the United States possess 150 years of geological knowledge and drilling experience (Stevens 2010, 13). The United States onshore gas business has also profited from specific geological advantages. Shale gas deposits often lie just above conventional gas and oil reservoirs (Stevens 2010: 10) – so in the United States, where there has already been extensive exploration of the latter, the existing well cores can help estimate shale gas reserves and also facilitate their production. (It also helps with public opinion on shale gas that the land is already in use for drilling in many cases.) According to the U.S. Department of Energy's Energy Information Administration, the pipeline network for natural gas onshore distributions forms a "highly integrated transmission and distribution grid that can transport natural gas to and from nearly any location in the lower 48 States [comprising] 305,000 miles of interstate and intrastate transmission pipelines [and] more than 11,000 delivery points, 5,000 receipt points, and 1,400 interconnection points" (EIA 2016a).

Figure 12 (EIA 2016a) illustrates the presence and interconnectedness of the U.S. gas pipeline network, with particularly dense connections around the Marcellus shale in the Northwest and the Barnett, Eagle Ford and Haynesville Bossier shale plays in the South.

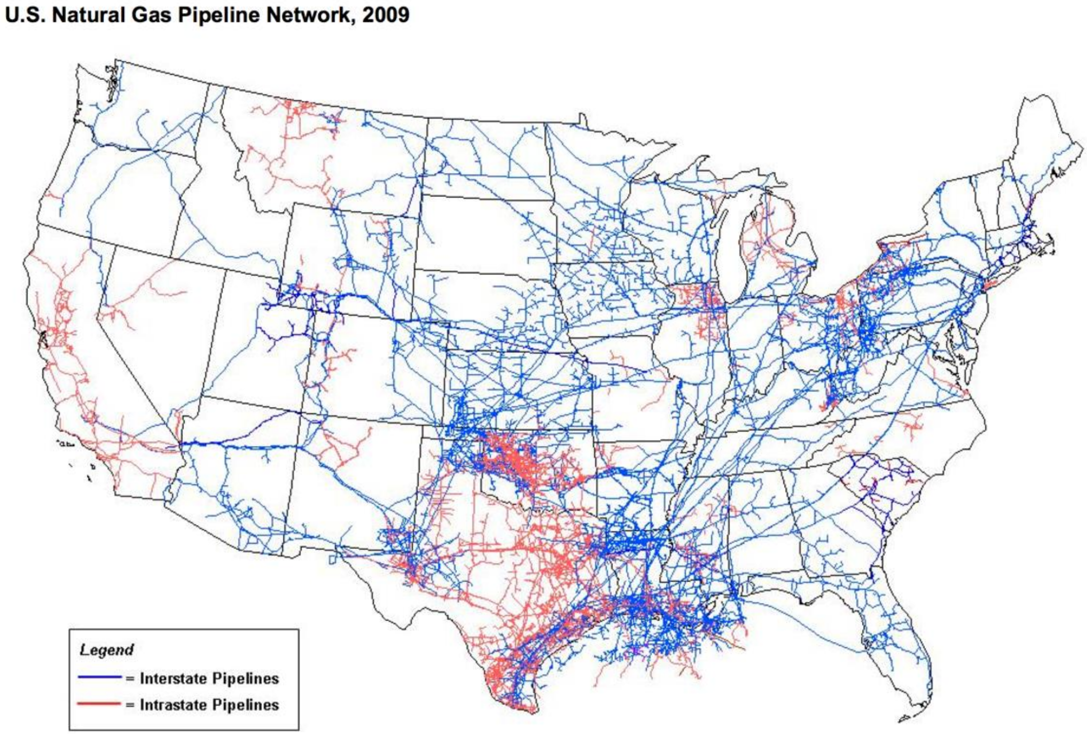

Figure 12: Natural Gas Pipeline Network in the Continental U.S. (EIA 2016a)

The slightly more remote new big shale plays such as Bakken in North Dakota/Montana and Mancos in Utah had also already been well connected with the national interstate gas grid before exploration began. "Rapid development of shale in the United States can also be attributed to the easy and low-cost access to the gas transport network" (Stevens 2010, 12). The United States have a longstanding history with onshore drilling and can now utilise the fact that many shale plays are found in close proximity to original, conventional oil and gas exploration sites (Stevens 2012).

The legal framework is another important factor to consider for the ease with which shale gas could be developed in a country. And in fact, there are very favourable conditions for fracking in the U.S. legislative landscape. An issue likely to prove cost-effective and time consuming would be compliance with strict environmental regulation, especially with regards to groundwater contamination. Currently, hydraulic fracturing is excluded from the Safe Water Drinking Act in the Energy Policy Act of 2005 (Stevens 2012, 13). There is an, as of September 2016 not approved, bill H.R. 1482 awaiting Congressional approval which includes removing this exemption (DeGette 2015; US Government Track 2015). If it was passed, the Environmental Protection Agency would be allowed to regulate all activity of fracking in the United States. The proposal has been attached to three other, previous bills since 2009[70] and has a prognosis of 1% chance of enactment (DeGette 2015; US Government Track 2015). Exxon Mobile has actually included a section in its contract of investment in (or acquisition of) XTO Energy: should Congress pass said bill, thereby rendering "hydraulic fracturing or similar processes […] illegal or commercially impractical" (Kefferputz 2010, 3), Exxon Mobile has reserved the right to reconsider the deal.[71] Shortly after the groundwater exemption in 2007, a presidential memo by the Bush administration "effectively loosen[ed] the limits on air pollution from many natural gas wells" (Groeger 2012). In summary, "natural gas drilling companies have major exemptions from parts of at least 7 of the 15 sweeping federal environmental laws that regulate most other heavy industries and were written to protect air and drinking water from radioactive and hazardous chemicals"(Urbina 2011b). The Crude Oil Windfall Profit Tax Act of 1980 included a non-conventional fuel production tax credit of 53 cents per tcf that ran out in the 21st century (Stevens 2010, 13). The credit was a function of the oil price, and an earlier decline in the oil price was evened out by an increase in the tax credit to discourage the move from unconventional gas back to oil (Stevens 2012, 13). This posed a remarkable incentive for early development of unconventional gas. It was discontinued as profitability of unconventional gas rose regardless because of rising prices and technological optimisation, so development remained attractive.

Another factor that has supported the acceptance of shale gas development is also the legally proscribed division of profits from its development. Before tax levels become an issue, mineral rights have to be considered. The term mineral rights encompasses all of the different possible rights to minerals in the ground, including the right to hold or remove minerals from land or also the right to access the land (Farlex Legal Dictionary 2014).[72] In the United States, mineral rights belong to the private person or body who owns the ground above. Therefore, it will have to be bought or leased of them. This may create a more favourable attitude towards shale operations nearby from the local population, as they would profit directly from gas drilling in their land. There are very few countries in which ownership of all mineral resources was originally granted to the

[70] HR 2766 (111th), H.R. 1084 (112th), H.R. 1921 (113th). Fracturing Responsibility and Awareness Chemicals (FRAC) Act.

[71] "The fear of new regulation putting the brakes on hydraulic fracturing, and with it the development of shale gas, has been so acutely felt within the industry that ExxonMobil has even inserted an exit clause in its $30 billion acquisition of XTO Energy – a U.S. gas independent with solid fracking experience – stipulating that Exxon can walk away from the deal should new regulations on fracking damage the commercial potential of shale gas" (Kefferputz 2010, 3).

[72] When land is sold there can be made a distinction between the surface sold or the minerals below it sold – the original owner could retain all his rights to the minerals and access to them whilst giving away the surface and right to build on it to a new owner. Mineral rights can be sold but also leased out under specific terms for a specific amount of time.

individuals or organisations owning the surface they are found under – namely several Canadian provinces, and, most prominently, the United States, for historic reasons. There, the land property owner owns both surface and mineral rights. This complete private ownership is known as "fee simple" estate (King 2014). A legally binding mineral title option is typically the only document that substantiates mineral ownership in the United States of America. In the country's early pioneer days in the 18th and 19th century, when land was originally deeded to individuals, the mineral estate naturally came with the land. As long as it has not been officially severed through a legal act or legal reallocation, the land and minerals remain together and in the hand of whomever the surface belongs to, therefore they are often privately owned. In the United States, the laws which govern the transfer of mineral rights from one owner to another owner, as well as the laws governing the leasing of mineral rights tend to diverge slightly for each individual state. Some states do not have rules for unitisation of oil and gas royalties. Other states have them but only for wells that produce from certain areas or from certain depths. Most states have laws that regulate mining and drilling activity. There are also laws that regulate the sale of surface and mineral property.[73] However, the important point to take away from this is that in the United States, in theory, a landowner would directly profit from leasing out the right to drill for shale gas on their own property to a company. This has been a strong factor aiding the commercialisation and public acceptance of fracking in the United States (Stevens 2014; Anderson 2015).

Population density is another structural factor with potential impact on the success of shale gas operations: in the mature shale areas in the United States, population density is usually very low: Texas has got 37.18 people/km2, Arkansas has 21.8, and North Dakota 3.8. New York State, where fracking is banned, has a population density of 110 (United States Census 2010).[74]

IV.1.3 Assessing the expected utility of the United States shale story so far: Revolution or hype?

In this part I consider any evidence of issues which put in question the success story of the U.S. American shale revolution. This includes data which queries key aspects of the fracking success story so far and suggests misrepresentation of the shale gas 'revolution', as well as data suggesting that the sector is likely to experience problems in the future.

[73] These rules can play a critical role in a leasing or resource development strategy. Manifold stories are in circulation about drilling company scouts saying "Lease to me now or we will drill your neighbour's land and drain your gas without paying you a cent." (King 2014). Such practices are possible in some states due to absence of specific regulation (King 2014).

[74] For better comparison with the UK, square miles were converted to square kilometres.

A first setback for the shale industry is the disappointing performance of shale wells that became apparent with growing experience (Chestney 2014). Overall, the ultimate recovery on a shale gas well is between 8-30%, much lower (Stevens 2010) than the 60-80% for a conventional gas well. All wells are subject to decline rates; but whilst a conventional well declines over years, or decades, the production rate of horizontal fracking wells declines over weeks or months (Richter 2012). As a result, the production rates of fracking wells drop between 60-90% in the first year of use (Murray and King 2012). Their ultimate economic recovery – the gas quantity produced over the life span of a well – is still unknown as the shale business is so young, but it is expected to be very low (Stafford 2012; Inman 2014). Meanwhile, gas prices have to be very high for these wells to be profitable – conversely, prices have been driven down by the shale industry itself. Many shale operations are debt-fuelled, and in order to keep the effect of well decline rates from making their income statements entirely unattractive, shale companies began drilling new wells to make up for the old ones (Richter 2012; Powers 2014; Crooks 2016). Former Amoco geologist Berman illustrates this point with the example of the Eagle Ford shale field in Texas, where US$10-12 billion would be needed for drilling 1,000 wells each year to counteract the decline in productivity and keep up current rates (Stafford 2012).

A second problem for the shale industry, the scale of which cannot yet be estimated correctly, is the issue of 'sweet spots'. It is common that within a shale basin, some spots are technically very easy to recover the gas from, whereas others are much more fragmented, hard to get to and at times no longer economically viable to exploit. The smaller and more scattered they are, the less economically viable to recover they become (BGS 2013b; IEA 2012b; Stafford 2012; EIA 2013b). In a recent production data report it stated that with three of the major shale basins, Barnett, Haynesville and Fayetteville, "less than 20 percent of the area [currently claimed] by companies as productive is emerging as likely to be profitable under current market conditions, according to the data and industry analysts" (Urbina 2011c). Recently researchers have begun to voice doubt over the generous resource estimations: "The government's predictions rely on coarse-grained studies of major shale formations, or plays. Now, researchers are analysing those formations in much greater detail and are issuing more conservative forecasts" (Inman 2014). The five big U.S. shale plays are all currently under production and have been for years, with several of them already in decline (Hughes 2012) and the rest tipped to peak around 2025-2030 (Weijermars and McCredie 2012; Inman 2014; Loder 2016). It is hard to imagine how the situation could not spell future trouble for the shale business (Monks, Penty, and Vynck 2013).

One of the prominent claims of shale gas supporters is the effect that shale gas development has had on gas prices in the United States, and how much this has helped the residential consumers and the industry sector. However, the results for those are mixed as well. For example, industrial gas prices have fallen since 2008, and residential ones, too, though to a much lower degree – yet residential and industrial electricity prices have continued to rise (Mathieu, Spencer, and Sartor 2014). For households, the effects of cheaper gas have been mostly outweighed by the higher electricity prices. The same recent study by the Centre for Economic Policy Research (CEPR) calculated that the impact of lower gas prices on U.S. productivity should be considered negligible, both in income and substitution effects (Mathieu, Spencer, and Sartor 2014).

Another issue with the economic impact of shale gas revolves around jobs. Shale gas is said to create jobs (IHS Markit 2011; Stevens 2012). In fact, one of the key arguments made in favour of shale gas development is the promise of job creation (Snyder and Klimasinska 2012). "Research firm IHS predicts that as many as 3.8 million new jobs will be created in the United States, either directly or indirectly related to the natural gas industry, by 2025" (Schulte 2014). Immediately, IHS introduced caveats to this prognosis: the numbers would not hold if the industry was weakened by novel regulation, for example environmental protection regulation, or a refusal to allow drilling on more federal land in the future (Schulte 2014). Yet according to research there is little evidence for the significance in numbers of jobs created so far. According to employment statistics, the shale industry in the United States has not created many jobs in several key fracking states (FWW 2015; Christopherson 2015). Claims include that the jobs had simply migrated from one part of the sector to another, therefore from one statistical set to another, without actually creating any additional ones (Bawden 2013; Christopherson 2015). Beyond that, countless jobs that may have been related to the fracking industry indirectly, such as catering, were counted as direct fracking jobs in official industry figures (Cusick 2013). The fracking process itself does not require a considerable work force in any case. Creating the site lasts only a few days, and from then on, the wells only have to be manned by very few, single digit numbers of personnel, with highly specialised skillsets. The latter means that these workers tend to be brought in from within the industry, mostly foregoing the chance for local jobs that is often emphasised in connection with fracking (PA 2014). I will illustrate the problem with job forecasts through an example for New York State. In 2011, the Public Policy Institute of New York State (PPINYS) claimed that 62,620 jobs could be created through fracking operations in New York by 2018 (PPINYS 2011, 3, 16). Of these, 15,500 would be 'direct' jobs through spending by fracking companies (not necessarily in the gas sector, but directly created through spending by fracking companies), and another 47,120 jobs would be induced or indirect jobs (PPINYS 2011, 3, 16). However, this PPINYS report is full of both methodological flaws and inaccuracies as well as omissions of information. It is largely based on a report conducted by Penn State University (Considine, Watson, and Blumsack 2011). When NGO Food & Water Watch ran the same study but with corrections for methodological flaws, it could only account for around 6,656 jobs by 2018. The Penn State study had in fact undercounted the number of wells previously drilled by almost 10%, and thus overestimated the number of jobs created per well drilled (FWW 2015). In-state spending that would lead to job-creation was overstated: payments to landowners and tax paid on operations were counted as in-state spending that created direct jobs; subcontracting was found to mask payments as in-state payments that were not. No mention was made that many of the high paid jobs in the gas industry have shown to go to experienced transient workers, therefore they did not create local jobs. PPINYS did not account for economies of scale and gains in productivity and thereby misused results by the Penn State report: these would lower future spending on development, further lowering the count of the fraction of total spending that goes to job creation. The new figure of 6,656 is not significant compared to overall employment figures in New York State, and so far, none of the studies have taken into account the possibility that jobs are lost in other sectors due to shale development, notably in the agriculture or tourism sectors. This possibility has been raised (FWW 2015; Christopherson 2015), but there has been no comprehensive research conducted on this issue and hence no data exists to be compared here. However, considering the amount of environmental degradation that is shown to go alongside large-scale fracking operations, the loss of jobs following substantial damage to farming land or natural beauty spots are a likely possibility that should be followed up consistently in shale employment statistics and shale impact studies more generally.

The pursuit of this example was undertaken to draw attention to the fact that the very promising numbers of jobs created through fracking are highly unlikely to become reality, or have in fact already been proven implausible by experience in more mature shale states such as Pennsylvania. In fact recent setbacks in the oil and gas industry have led to the loss of 86.000 jobs in 2015, which is around 16% of its overall employees, and these are unlikely to be regained (Crooks 2016). Therefore, pushing for fracking operations based on the expectation of a significant growth in employment was inaccurate and has not been rewarded with success.

A key factor spelling trouble for the shale gas 'revolution' is mounting evidence of incorrect reserve size estimations. Predictions for both conventional and unconventional gas and oil resources made by the DoE's Energy Information Administration and private companies have been criticised by independent sources and lowered considerably (Owen, Inderwildi, and King 2010; Stevens 2010; Weijermars and McCredie 2012; Ahmed 2013; WRI 2013). Many of the DoE's official projections show the decline of both onshore and offshore conventional gas reserves in the United States, but point out that they will be replaced by ever increasing shale gas production until 2050 or 2070 (EIA 2012a, 2015b, 2015b). This trend is considered doubtful by independent researchers (Ahmed 2013; IEA 2015a, 2014; Owen, Inderwildi, and King 2010; Powers 2014; Mason 2014) but also by the industry itself (The New York Times 2011; Urbina 2011c).

Here comes into play the fact that in the United States, it is not necessary for companies to have their resource estimates checked or proven by a third, independent party (Ahmed 2013). There are concerns that reserves are heavily exaggerated by the industry in order to gain financial backing (Owen, Inderwildi, and King 2010; Weijermars and McCredie 2012; Richter 2012; Ahmed 2013; Inman 2014). These are based on more knowledge gained about the fields as test drilling takes place as well as simply very generous estimations. For example the recoverable reserve estimates for the Monterey shale – once claimed to be the United States' biggest shale liquids play – was revised down by 96% (Morgan 2014). Changes in reserve reporting to the SEC made in 2009 made it easier to include undeveloped reserves in official figures as long as they can, "with reasonable certainty, be economically produced" in the future (Weijermars and McCredie 2012).

In an interactive 2011 document the New York Times leaked hundreds of internal documents (The New York Times 2011) both from the shale gas industry and lobby, as well as from U.S. DoE, EPA and EIA employees.[75] In these documents, "energy executives, industry lawyers, state geologists and market analysts voice scepticism about lofty forecasts and question whether companies are intentionally, and even illegally, overstating the productivity of their wells and the size of their reserves" (Urbina 2011c, 2011d). Most of these documents, many of which are emails or email attachments, also express a viewpoint that is "in stark contrast to more bullish public comments made by the industry" (Urbina 2011d), bringing to mind similar behaviour seen in insider reports about previous market bubbles, such as the dotcom bubble. "Money is pouring in from investors even though shale gas is inherently unprofitable" is the comment from an analyst with the investment company PNC Wealth Management (Urbina 2011c). In another email a former Enron executive compares the shale gas companies' practice to

[75] The very fact that a leak is necessary in order to find out more about these concerns is problematic.

Enron[76] (The New York Times 2011). A lot of these comments relate to overestimation of reserve sizes, to the problem of above mentioned sweet spots and resources that are not economically or even technically viable to recover, yet are included in the reserve size reports regardless; but the comments also relate to well depletion rates which force companies to play catch-up and invest heavily in order to keep up current investment (Stafford 2012; Urbina 2011c, 2011d).[77]

The amount of leaked documents, the variety of sources they come from, the very senior positions of those who wrote them and the very serious expressions they entail all suggest that doubts about the profitability and longevity of shale economics have existed for a while within the shale gas industry itself.[78] Such doubts however were seldom publicly expressed unlike the concerns by academic researchers or international research institutions and intergovernmental organisations (Ahmed 2013; IEA 2015a; Loder 2016).

Adding to the problems for the shale business are official projections about gas futures unrelated to the shale gas industry in particular, such as the following by the International Energy Agency: "Global natural gas demand remained weak in 2014, growing well below its ten-year average, according to the 2015 report. High prices for gas in the past two years undermined its competitiveness" (IEA 2015a). At the same time, major companies such as Rockefeller or Google have begun to heavily invest in renewable energy instead (Kirkland 2011). This is unlikely to change in light of the continuously low oil prices in late 2015 and early 2016 (Rowell 2016). In fact, U.S. evidence from these years appears to suggest that shale gas development is not economically feasible at oil prices around and below $60 per barrel (Russell and Strachan 2015).

Several analysts now suggest that what we witnessed in the United States was a 'hype', not a 'revolution' of shale gas (Urbina 2011c; Ahmed 2013; Powers 2014; Morgan 2014). Investors have been very excited and pouring hundreds of billions of dollars into the shale business.[79] Given this high level of start-up capital, it is no surprise that great quantities of shale wells were built up quickly, even if they are almost doubly as expensive as normal gas wells, and subsequently it is no surprise that initial production was very high. Another reason for the quick construction of new wells is due to their poor performance and short

[76] Enron was a U.S. energy and services company famous for scandals with their accounting and subsequent bankruptcy.
[77] There are attempts by industry experts to quantify the uncertainty that is part of resource estimates (Lyster 2014).
[78] In many documents the concerned authors mention "market bubbles", "suspicious behaviour", "unlikely resource estimates", "the dotcom bubble", a "Ponzi scheme" or even the phrase "to con Wall Street" (The New York Times 2011).
[79] The possibility that the entirety of the shale 'revolution' was simply about shareholders' and investors' games and not about the real economy is intriguing but does not form part of this PhD.

productivity lifespan. As discussed above, shale well performance is hugely disappointing and short-lived; and shale reserve estimates are lowered constantly, sometimes by as much as 95% of the initial estimates such as in the Monterey shale basin. Given the steep decline rates the reaction so far has been to leave the U.S. landscape covered in abandoned shale wells while drilling new ones in order to keep up production levels as best as possible. This is a problem for investors. The result is that "net cash flow from U.S. shale has been negative year after year" (Morgan 2014), and the shale business has already been abandoned by several of the biggest companies in the energy sector (Eaton 2016). In 2016, there is a possibility that the U.S. shale story is already in decline and that production will diminish rapidly once sweet spots have been depleted. Then the story will have to turn towards the clean-up: salvaging the original environment of drilling sites, re-employment of workers moving about the country in the hope of work for shale gas, and the re-entanglement of local licenses, are among the most pressing issues. There is as of yet no data projecting the potential costs of this, so it is impossible to attempt any estimates at this point. However, research is being conducted into this area (Lu 2014), showcasing both that very little is known but also that some form of clean-up operation is expected as an accepted future (Bullis 2012; Chameides 2013; Herbert and Jones 2014; S. Becker 2015). Whatever the costs for this will be, they are not known and hence do not figure in economic calculations on the return of shale. The above explained notion that many shale gas workers tend to be non-permanent also leads to the conclusion that they will be looking for other work once the operation is finished: whatever the number of jobs created through the shale business is, therefore, is a number of jobs that will have to be relocated once the operation has concluded. The financial system is also likely to experience some form of shock as the shale bubble bursts, albeit probably not a sudden shock, as investors have slowly been wising up.

IV.2 Energy and shale gas in the United Kingdom

Britain's economy depends largely on fossil fuels to make up the country's energy supply (IEA 2012b). The decline of UK domestic oil and gas resources as well as mounting evidence of the likely effects of anthropogenic climate change have prompted much policy debate in the 21st century around the level of reliance on fossil fuels (DTI 2003; BERR 2008; IEA 2012b). Due to declining reserves, the UK production rates in million tonnes oil equivalent have been decreasing and are expected to continue to decrease since their peak between 1996-2000 (IEA 2012b, 20). The introduction of renewables into the country's energy supply mix has been a dominant topic in policy strategy reports (DTI 2003; DECC 2009). Wind, solar and hydro account for less than 4% of energy production in 2016, bioenergy and waste for around 8% (DECC 2016c). Compared to other OECD and IEA member states, the UK produces one of the lowest shares of renewables (IEA 2012b, 21).

The following Figures 13 and 14 (IEA 2012b) illustrate levels of overall production and consumption of primary energy in the United Kingdom.

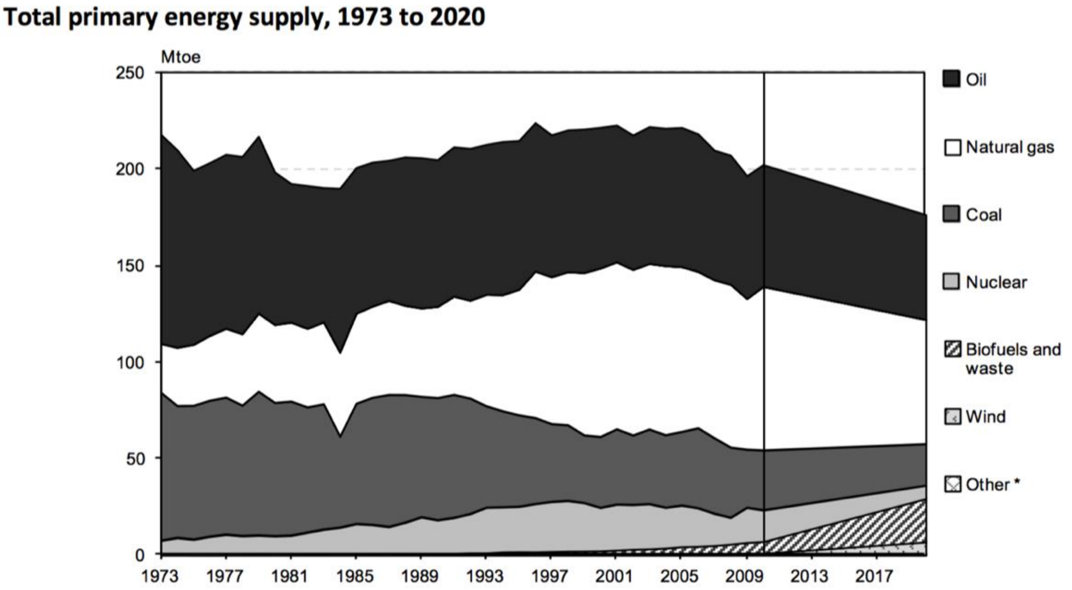

Figure 13: UK Total Energy Supply (IEA 2012b)

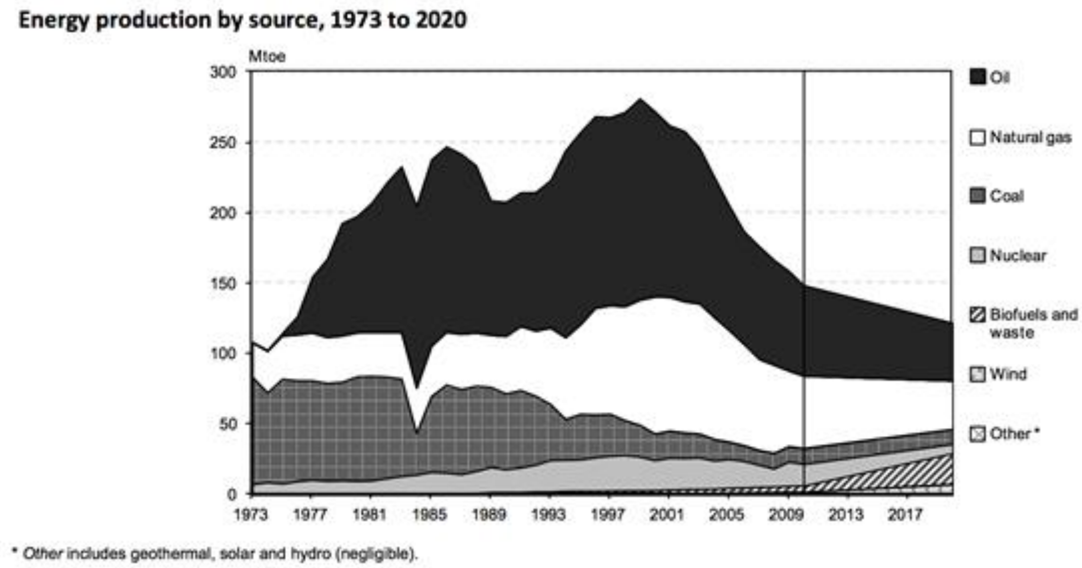

Figure 14: UK Energy Production by Source (IEA 2012b)

Also clear from the above Figure 14 is that all UK production sources are in decline other than wind, biofuels, and "other". Final consumption in million tonnes oil equivalent (mtoe) was 138 in 2010 and is expected to rise (IEA 2012b, 22).

The following tables (4 and 5) present the UK's energy balance overview for the years 2009 and 2011 and illustrate the very recent, strong trend towards more import dependence. The percentage of imports has risen strongly, and it has especially done so for natural gas, which could have a strong effect on energy policymakers and the government's strong interest in a fuel like shale gas thought to increase the UK's energy security.

Import Share of Total UK Energy Consumption

in thousand tonnes of oil equivalent (ktoe) on a net calorific value basis

Supply and Consumption	Coal and Peat	Crude Oil	Oil Products	Natural Gas	Nuclear	Hydro	Geothermal, Solar etc.	Biofuels and Waste	Electricity	Heat	Total
Production	10705	70898	0	53732	18007	453	872	4245	0	0	158912
Imports	23554	56186	22803	35262	0	0	0	1105	568	0	139478
Exports	-594	-46863	-26012	-10607	0	0	0	0	-322	0	-84399
Total Primary Energy Supply	29836	80780	-16882	78098	18007	453	872	5352	246	0	196762
Total Final Consumption	2815	0	56435	41881	0	0	70	1850	27728	1346	132126
% Imports of Total Primary Energy Supply				45,15%							70,89%

Table 4: Import Share of Total UK Energy Consumption 2009 (IEA 2015b), own design

Import Share of Total UK Energy Consumption

in million tonnes of oil equivalent (ktoe) on a net calorific value basis

Supply and Consumption	Coal and Peat	Crude Oil	Oil Products	Natural Gas	Nuclear	Hydro	Geothermal , Solar etc.	Biofuels and Waste	Electricity	Heat	Total
Production	10.87	53.22	-	40.75	17.98	0.49	1.46	4.76	-	-	129.54
Imports	20.35	59.34	23.22	45.21	-	-	-	1.67	0.75	-	150.53
Exports	-0.69	-34.59	-28.16	-14.21	-	-	-	-0.15	-0.21	-	-78.01
Total Primary Energy Supply	30.66	78.6	-18.1	70.18	17.98	0.49	1.46	6.27	0.54	-	188.07
Total Final Consumption	2.54	-	54.14	38.75	-	-	0.11	2.14	27.35	1.27	126.3
% Imports of Total Primary Energy Supply				64.42%							80.04%

Table 5: Import Share of Total UK Energy Consumption 2011 (IEA 2015b), own design

However, as shown in Figure 15 below (Bolton 2013, 6) the United Kingdom has only been a gas net exporter for a very brief period of time between 1995 and 2003. This should factor into the debate around Britain 'losing' its net exporter status.

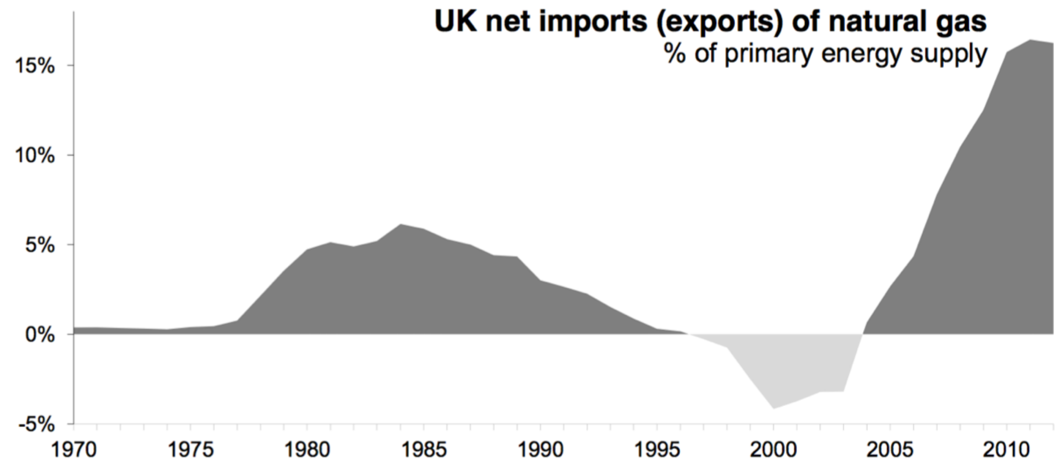

Figure 15: UK Natural Gas Net Exports and Imports (Bolton 2013, 6)

Proven natural gas reserves in the United Kingdom territory have in fact decreased from 1.2tcm to 253bcm (trillion to billion, notice) since 2000; the currently remaining reserves are almost exactly five times as high as current average annual production (IEA 2012b, 68). Imports are "relatively diversified between pipeline imports from Norway, the Netherlands and other European countries and liquefied natural gas (LNG) imports from various sources" (IEA 2012b, 67). A few years ago LNG overtook gas imports through pipelines in supplying the country's main fuel, which may further result in increased flexibility of supply (IEA 2012b, 14). This is important as it leads to the conclusion that there is a less urgent cause to fear import dependency as in a situation where a country is highly dependent on one single importer, such as the gas trade relations between Russia and the Baltic states (Siddi 2016).

With 42% of total primary energy supply (TPES), natural gas accounts for the largest share of the UK energy supply (IEA 2012b, 67). The UK consumes more gas than almost any other European country per year with around 85 million tonnes of oil equivalent (Mtoe) (IEA 2012b, 67). However, the UK government expects gas demand to decrease in the immediate and midterm future (BERR 2008). This could be linked to a number of reasons, for example climate change targets, or alternatively lack of trust in GDP growth: strong energy demand is linked to GDP growth.[80]

[80] Gas demand for power generation, a large part of the UK gas consumption, is sensitive to the relative prices of both coal and gas – for example when gas prices went up in winter 2006, some providers changed to coal (IEA 2012b, 71).

IV.2.1 Shale gas in the United Kingdom

The exploration of UK unconventional shale gas supplies has been promoted by the UK government to help boost the UK's dwindling natural gas reserves (Cameron 2013; BBC News 2014a). Top policymakers were supporting the shale gas agenda strongly in order to follow the U.S. example, with quick decision-making in some cases, such as investment incentives for onshore gas production (BBC 2013) and significant tax rate cuts (62% to 30%) (BEIS 2016). Unlike the United States, the UK has not yet as of 2016 commercially produced and included shale gas into its energy supply mix. However, there has been legislative preparation, research and policy change undertaken in order to introduce and accommodate shale gas into the UK's energy sector.

Shale gas resource amounts in the UK are so far not proven through drilling but through estimates. The United Kingdom's most extensive own shale gas study so far, the British Geological Society's (BGS) report from 2013, presents an estimation of 1,329tcf of gas in place (BGS 2013a). This is a mean estimate: low to high estimates range from 822tcf to 2281tcf (23.3tcm to 64.6tcm). The total estimate draws on production from the upper shale, 264tcf, plus the lower shale, 1065tcf. Much less is known about the lower shale play, and it is harder to drill in (BGS 2013a, 3).[81] Ergo, the very large amount of estimated resources rests to more than 80% on an estimation that is absolute guesswork about an area of the shale dissimilar to known U.S. shales. This number is supposed to inform government and investors but it is not particularly useful, as recovery factors are not known; they lie at around 8-20% in U.S. experience of sweet spots and favourable conditions (POST 2013). Hence these figures represent resource, not reserve estimates. The BGS states that "not enough is yet known to estimate a recovery factor, nor to estimate potential reserves (how much gas may be ultimately produced)" (BGS 2013a, 3) and that "a reliable estimate of recoverable shale gas cannot be made at this time" (BGS 2013a, 46). The BGS report also states that it "must be noted that this Bowland Shale gas in-place (GIP) estimate is very large when compared with the total ultimate recovery of gas (i.e. gas reserves plus cumulative production) from the offshore UK" (BGS 2013a, 47).[82] [83] In comparison, the unproven yet technically recoverable shale gas resources of

[81] "The upper unit is more prospective, primarily due to the better well control which demonstrates its closer resemblance to the prolific North American shale gas plays, in which the productive zones are hundreds of feet thick. The lower unit is largely undrilled, but where it has been penetrated it contains organic-rich shale intervals, whose lateral extent is unknown." (BGS 2013a, 3).

[82] The offshore ultimate recovery of gas is around 92.7tcf-101.4tcf-109.0 tcf, of which 84tcf were developed until the end of 2011 (BGS 2013a, 47).

[83] In their reports on UK shale gas, EIA has already lowered their original 2011 estimations of 97tcf 'risked', of which only 20tcf were considered technically recoverable (EIA 2011, VII-36), to around 26tcf considered in a 'risked' estimation (EIA 2015c, XI-2). (The terms 'risked' and 'unrisked', to the best of my knowledge as they are not explained by EIA, indicate whether or not any assessment has taken place of

the United Kingdom, of 26tcf, are less than 20% of the recoverable resources estimated to be found in France or Poland, and less than 5% of the resources estimated to be in the United States at the same time (at 622tcf) (EIA 2015f). It might be considered as a further indicator of the UK resources' scale of importance that in the 2012 IEA report on global unconventional gas, it is one of the few countries only listed under 'other European countries', whereas for example France and Poland are discussed in several page long detail (EIA 2011, 2013b).

It must be stressed that reserve estimates for the UK do not exist as of yet. The efficiency and production rate remain an unknown up until this point, and there has been little inclusion not just of geological but also of economic, infrastructure and market factors for shale gas development in the UK, which are all bound to have an impact on recovery rates. Horizontal drilling has as of 2016 not been tried on UK soil (IEA 2012b, 73; Gosden 21:10). Following earthquakes induced by well faults in one of the first test drilling sites in Lancashire, a moratorium was placed on fracking which lasted for one and half a year (Paige 2011; IEA 2012b). Test drilling was allowed to resume in December 2012, and is currently considered or pursued by several energy companies, such as Cuadrilla Resources, Ineos, GDF Suez, UK Oil and Gas and Third Energy (Hellier 2015b). The first fracking operations since the Lancashire incident are set to take place in Yorkshire, where Third Energy was given permission for fracking tests in July 2016 (Halliday 2016). In terms of resource awareness but also in terms of their planning the United Kingdom trails far behind the United States.

IV.2.2 Structural factors

Structural factors likely to impact on shale gas development are not looking as promising for the UK as they did for the United States.

The United Kingdom's shale basins are less prone to gas exploration than their U.S. counterparts. According to the International Energy Agency's assessment, British shale basins "generally are not simple continuous structures, such as found in many North

the chances of success of a specific exploration – 'risked' implies that possible impediments to production have been considered. An 'unrisked' estimate of a resource means that the company or analyst that made the estimation is entirely ignoring all risk and assuming that the production will definitely be successful and without complication. The word 'risked' implies that some factors affecting the success of production have been taken into account and considered as to their likelihood of occurrence. I.e. a gas well with a 50% estimated rate of possible success could be worth £100m in an unrisked assessment but only £50m once it is risked. However, the factors considered in the risking process are not always clear to anybody outside the company undertaking the assessment, and certainly not standardised, and none of the institutions which publish on shale provide a complete glossary.)

American shale regions, but rather typically comprise a series of small fault-bounded sub-basins" (IEA 2012b, 76). They are not connected to previous onshore gas sites, and "geologic conditions are much more complex. Faults are numerous, geologic data control is weak, and shale wells are more costly to drill" (IEA 2012b, 73). In 2013 and again in 2015, EIA offered a similar cautioning opinion on UK shale prospects: "Compared with North America, the shale geology of the UK is considerably more complex, while drilling and completion costs for shale wells are substantially higher" (EIA 2013b, 73, 2015c, XI-3). If this holds true it means that to extract gas from the rock would be a much more difficult and widespread operation, not only costlier, but likely less productive. The BGS (BGS 2013a) estimates that the Middle Cambrian Conasauga shale in Alabama is the one that most closely resembles the UK's Cambrian shale deposits, as they are similar in structural complexity and age: but "shale gas development in the Conasauga Shale has not been successful to date" (IEA 2012b, 77). It appears that the United Kingdom is expected to have shale plays as unevenly distributed as those considered the worst basins – those which nobody has yet attempted to exploit – in the United States (IEA 2012a, 77). This is likely to result in higher costs of recovery and development, and less productivity.

A related key factor is infrastructure, and, due to a historically different energy economy from the U.S., with only a "small existing onshore conventional oil and gas industry, the UK has limited domestic service sector capability for shale exploration" (IEA 2012b, 73). Ron Oxburgh, member of the House of Lords Select Committee on Science and Technology and former chairman for Shell, considers Britain not ready for shale gas development: "we need new onshore drilling infrastructure which we don't have now" (Chestney 2014).

As of 2016 it remains unclear who would be funding the necessary creation of an onshore gas infrastructure that would have to be both more sophisticated and very extensive if the shale boom is to have a chance at bringing about the desired revenue. There has been interest and investment from several private companies, but senior industry sources have repeatedly cautioned that the pace of development and exploration would be much slower than the government suggested (Gosden 2014a). Whereas the government suggested 20-40 wells to be drilled within a year or two, industry sources said they would be surprised if it came to any fracking at all in the same time period, and predicted a maximum well count of one or two wells completed (Gosden 2014a). (It should be noted that only after a well has been drilled and shale gas found does the fracking process begin to test the amount of gas actually available.) British energy secretary at the time Chris Huhne stated in summer 2011 that the UK's energy infrastructure and outdated grid was "in such poor state that it would cost scores of billions of pounds to overhaul, even without investment in low-carbon generation" (Harvey 2011). At the same time, government estimations assume the required investment in the gas and also electricity grid to amount to around £200 billion by 2020 (Harvey 2011). In brief: in contrast to the United States "there is no comparable onshore oil and gas service industry to provide drilling rigs and other equipment" in the UK (BBC Business News 2010)[84]. It will have to be built up especially for the shale gas industry. Whilst there is no argument from either side of the shale debate that this would require major amounts of investment, it is so far unclear who would bear the brunt of this. There has not been any attempt to calm the concern that investment would come from public funding, or at least be offloaded on to the public through a rise in gas bills.

Yet another factor which may impact the success of fracking development in the United Kingdom is the likely effect on gas prices. As mentioned above, the gas market is largely regional: The U.S. receives almost 90% of its (small) gas imports from Canada (EIA 2012b); in Europe combined, 45% of gas is imported from inside Europe (i.e. Norway) and about 30% from Russia (Escribano, Marín Quemada, and García-Verdugo 2012, 24). This implicates that the appearance of shale gas has to result in differently large price changes in the U.S. and EU markets. In the United States, as discussed, gas prices are set by the fundamentals of a relatively free, simple market system's supply and demand (EIA 2016f, 2016c). Petroleum prices can also affect gas demand as petroleum can serve as a substitute for gas in heating, power generation and larger consumption. The European gas pricing system in which the UK is tied is different to the U.S. system. Commonly, long-term take or pay contracts guarantee a minimum purchase of gas indexed to oil prices, on the other hand a long-term fixed or at least quite stable price is guaranteed to the consumer (The Economist 2012b). The UK has had a strong domestic (North Sea) production of gas and can apply market strategies of demand and supply up to a point. However, the UK also imports gas, mainly from Norway, and more so since its own North Sea production has declined. Norway, a major gas producer in Europe, continues to peg its gas price to its oil price (Strauss 2008) and therefore it continues to affect British gas prices.

The claim made by Cameron's government that fracking will lower energy bills has been repeatedly denied by experts (Bawden 2013; Carrington 2013b; Gosden 2013b, 2014b;

[84] It is not just Britain that is trailing behind in terms of infrastructure for gas as well as oil production, but all of Europe that is currently discussing shale possibilities.

Elmes 2014). Then chancellor of the Exchequer George Osborne appears to have changed his mind about whether or not fracking would lower bills at least twice (Carrington 2013b; BBC News 2014b; Gosden 2015b). British gas prices, so far without the introduction of shale gas to markets, have been on the rise steadily between 2000 and 2010 – more so for households than the industry.[85] This is visible in Figure 16 below (IEA 2012b, 77).

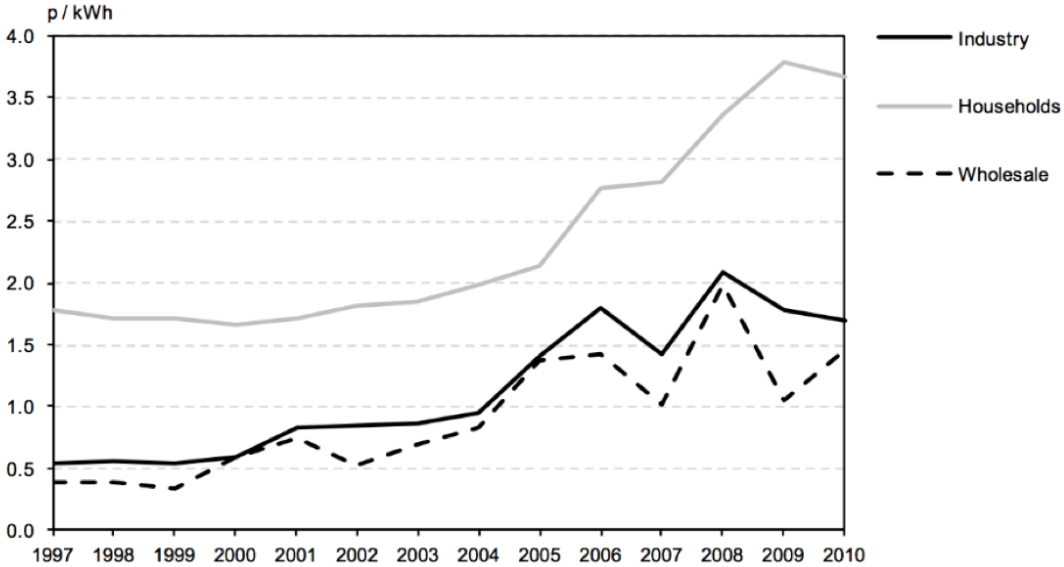

Figure 16: UK Natural Gas Prices 1997–2010 (IEA 2012b, 77)

There are official government claims that these household prices will fall if shale gas resources are tapped but these have so far not been proven or substantiated by any research and are doubted by many (Bawden 2013; Dutton and Bradshaw 2013).

The UK government continues to create a legal framework for productive but also safe extraction of shale gas. The regulations covering gas and oil development in the EU and thus the UK did not even reference unconventional gas and the EU wide accepted definition of 'gas field' did not fit for shale gas when the UK government decided to pursue shale gas development (Stevens 2010, 2012).[86] Experts have accused the government of purposefully providing regulatory loopholes to speed up fracking permissions and exempt it from safety rules (Carrington 2016). In the Infrastructure Act 2015 that came into force in April 2016, whether or not a drilling operation is legally defined as 'fracking' depends on the amount of high-pressured fluid which is used to fracture the shale (HM Government 2015). The amount is set so that less than half of currently operating fracking wells in the United States would be considered fracking wells;

[85] Which prompts a different set of questions that Ofgem has asked several times since 2011 – if it is regulation, not gas supplies, that can fix consumer prices.
[86] Usually this is territorially defined in terms of the gas or water contact. With unconventional fields, such a contact point does not exist and therefore it is not a defined gas field according to current laws.

and the one UK fracking site that caused earthquakes in Lancashire is by that standard not considered a fracking well either. Any requirements and procedures that were put in place to safeguard environment and public health, such as the need for an independent well inspector, will not apply for operations that used less than "1,000 cubic metres of fluid at each stage (or expected stage), or the injection of more than 10,000 cubic metres of fluid in total" (HM Government 2015, 56).

As long as the UK is a member of the EU, fracking could yet be seriously challenged by current EU and UK environmental legislation. The environmental regulation for the entire EU, and particularly at local level, greatly surpasses that of the United States in terms of strictness and specificity (Stevens 2010). Until British regulation in this area becomes untangled from EU law, there will surely be obstacles – and following the earthquakes in the very first fracking attempts near Blackpool, British domestic regulation regarding shale gas has already been made stricter on some issues (IEA 2012b).[87]

Furthermore, the legal situation concerning ownership of below the ground minerals is very different in the United Kingdom than it is in the United States. Throughout Europe, these belong to the state or government, and in the UK, they belong in fact to her Majesty the Queen. "Ownership of oil and gas within the land area of Great Britain was vested in the Crown by the Petroleum (Production) Act 1934. The Continental Shelf Act 1964 applied the provisions of the 1934 Act to the UKCS outside territorial waters" (British Geological Survey 2014, 2016). This takes away a key selling point of the United States shale gas boom – royalties for the landowners that have shale gas discovered below their property.

Lastly, a structural factor likely to be influential on the success of shale development in the United Kingdom is that of population density. The UK has a much higher population density than the U.S. (253 people/km2), especially in areas where fracking is likely to take place such as in in Yorkshire (340 people/km2) (ONS 2004) where fracking operations were first approved in 2016. Anti-fracking protests have been very common and well publicised in the UK between 2011-2016 (Melley 2011; BBC News 2014c; Rhoden-Paul and Howard 2015; BBC Business News 2016). Whilst I cannot claim a direct correlation between population size and mobilisation against fracking, I find it noteworthy that one of the U.S. states with a very high population density, New York State, has also seen large

[87] As this thesis is submitted in summer 2016 as planned since 2012, it will include no commentary and no speculation on a possible British exit from the EU. The process of untangling energy and environmental legislation are likely to be very lengthy as necessary legislation does not exist for the UK outside of EU rules.

scale protests against fracking operations (Reuters 2014b) and has since banned the method (Graves 2016).[88]

IV.2.3 Potential obstacles to fracking in United Kingdom

The United Kingdom has very different economic indicators for shale gas development than the United States at the very outset of exploration. In early IEA and EIA reports, which were among the first and most comprehensive assessments of shale gas resources, the UK is barely mentioned and was not paid a fraction of the attention as many other European countries, not to speak of other global shale players (EIA 2011; IEA 2012b, 2012a, EIA 2012a, 32, 2013b). This does not help to explain the British government's interest in shale gas, considering these reports are the ones which informed most of the news at the time and must have tipped off and commenced them.
The promise of economic growth through shale gas in the UK is very vague. UKERC scientists have suggested that assertions about revenue and lower energy prices are premature (Bawden 2013; Harrabin 2014a; Gosden 2014b). Then energy minister Rudd's claim of 60.000 new, especially local jobs is not backed by the U.S. experience (Christopherson 2015; Pagnamenta 2015). Drilling company Centrica provided the DECC with an estimation of 74,000 potential jobs but the DECC revised it to 16,000-32,000 jobs – nevertheless Cameron and other ministers used the Centrica estimation publicly (Carrington 2014a). There are now more cautioning lessons to be learnt from the difficulties seen experienced by the maturing U.S. shale gas sector. Besides, shale gas in the UK is far from a fait accompli (Morgan 2014). Norway's shale assessment went from unproven technically recoverable 83tcf (2011) to zero tcf (2013) (EIA 2015d). British policy is so far relying entirely on resource estimates, so one might be in for a surprise. Due to reasons of different infrastructure, different pricing systems and different structural factors per se, the UK situation can simply not be compared with the U.S. situation, never mind the fact that the latter is a lot less bright than often claimed.

The United Kingdom is in the unique position of being able to observe prior experience, as the one in the United States, and copy successes whilst learning from mistakes. Yet it seems problems of the U.S. sector that were widely recognised and discussed publicly have not been addressed by the UK government whatsoever. In any case, given the difference between the U.S. and UK energy sector and the difference in their shale gas potential, or what is known of it so far, it is unlikely that they would have come to the

[88] New York State, which includes New York City, likely also has many more flat-owners and tenants in comparison to land owners than other states, which may also affect the public opinion as they do not profit from gas leases.

exact same conclusion based purely on a cost-benefit analysis of the respective energy economic data available. As a preliminary analysis I come to the conclusion that there is no similarity between the U.S. and the UK in the first independent variable that considers the economic costs and benefits of shale gas exploration.

IV.3 Public opinion on shale gas and related sectors

In order to best gauge public interest in and opinions on fracking I provide a meta-analysis of several opinion polls on the issue for the United States and the United Kingdom respectively. Public opinion can be assumed to count towards policymakers' cost-benefit analysis (Downs 1957; Vogel 2012). If nothing else, even if one were to assume that politicians have no interest in the national or public benefit, they tend to have a narrower interest in getting re-elected. For this reason, both the state of the economy as perceived by voters – on which shale is touted to have a positive impact (Urbina 2011c; Ahmed 2013; Powers 2014; Morgan 2014) – and public opinion on shale gas exploration do count towards a rational choice consideration by elected decision-makers. I supplement this with an analysis of surveys on national priorities to see whether the respective public care about and are likely to respond to framing around energy security, environmental protection or job creation, and which related policy areas are most important to them, e.g. jobs, economy, climate.

IV.3.1 Public opinion on shale gas and related sectors in the United States

In Gallup's annual U.S. work and education polls the oil and gas industry has been rated "very negatively" every year from 2001-2014, ranking 23rd out of 24 sectors compared – the only sector regarded even more negatively is the federal government (Gallup 2014; Newport 2014; Jones 2015).[89] Public perceptions of the oil and gas industry overall can be found above all else to be strongly inversely (albeit imperfectly) related to energy and gasoline prices (Jones 2015).

An early study into perceptions of shale gas industry with robust results by Theodori found that the more mature the industry becomes, the more negative public perceptions

[89] Given that hydraulic fracturing for shale gas commenced in the early 2000s in the United States, it is remarkable that the majority of monitoring of public attitudes towards shale gas only commenced around a decade later. (Before 2012, indicators as to the public's interest in shale needed to be assessed through more general polls of the natural gas industry as well as local polls into opinion around shale industry in specific basins.)

of it become in turn (Theodori 2012, 280). Reasons given for this trend include that the gas industry is operating too close to homes, behaves uncaring towards the environment, and becomes too politically powerful – further, those polled near mature shale basins felt strongly pessimistic about the possibility that development of shale gas reserves would benefit locals (Theodori 2012).

In recent years, the traditional national surveys by Gallup and Pew have polled U.S. American opinions on shale gas very regularly (Princeton Survey Research Associates International 2014, 2013a, 2012). As can be seen in Figure 17 below, opinions have changed considerably over the space of two years in 2012 to 2014. Shale gas was initially favoured in the U.S., by a distinct margin, which is in discrepancy with the UK case study. However, the tide appears to have turned since mid-2013.

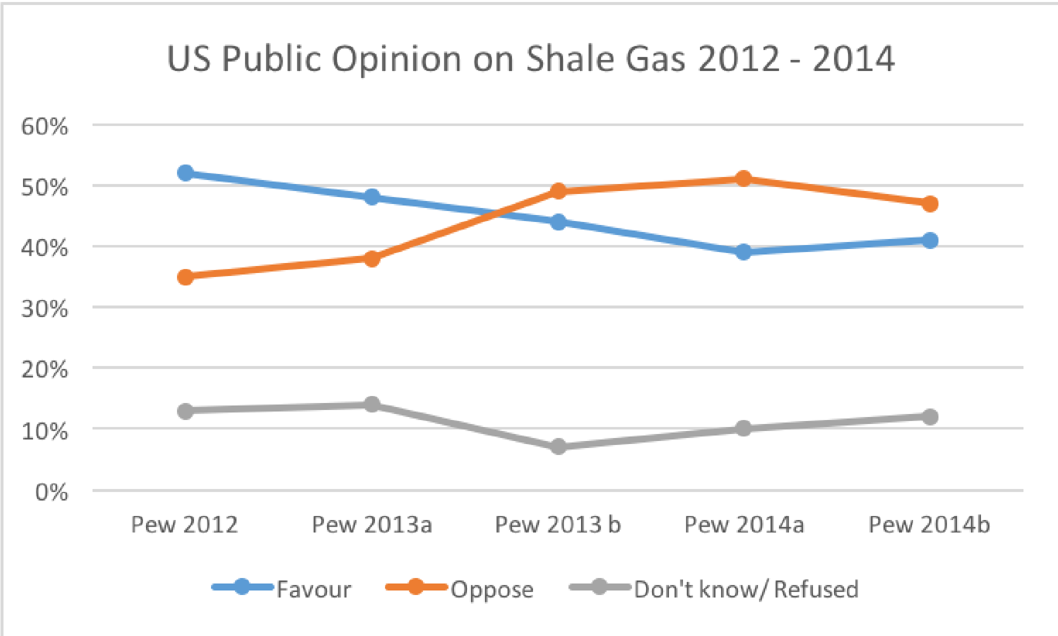

Figure 17: U.S. Public Opinion on Shale Gas (Princeton Survey Research Associates International 2014; Princeton Survey Research Associates International 2013a; Princeton Survey Research Associates International 2012)

A 2013 poll by Gallup (Figure 18) tried to further clarify the issue of preferences by asking Americans directly about their priorities if it were to come to a trade-off between energy and environmental security – and the responses were evenly divided, even over a long period of time (2001-2013) (Princeton Survey Research Associates International 2013b).[90]

[90] Whilst there is a relatively even divide overall, sub groups of those polled have clear preferences. Democrat voters favoured environmental protection over energy production by a 64% over 28% margin, whereas Republican voters responded the opposite way: 71% over 25% prefer the energy sector to take preference. The younger the age group the more significantly favoured is environmental protection (that correlation is perfectly linear); with the age groups above 50 years old most decisively deciding in favour of energy. This is in line with previous Gallup results which see younger people and Democrats in favour of environmental policy over energy or certain economic issues (Princeton Survey Research Associates International 2013b), as well as Independents (Princeton Survey Research Associates International 2015). As a trend, these attitudes have changed little since the early 2000s.

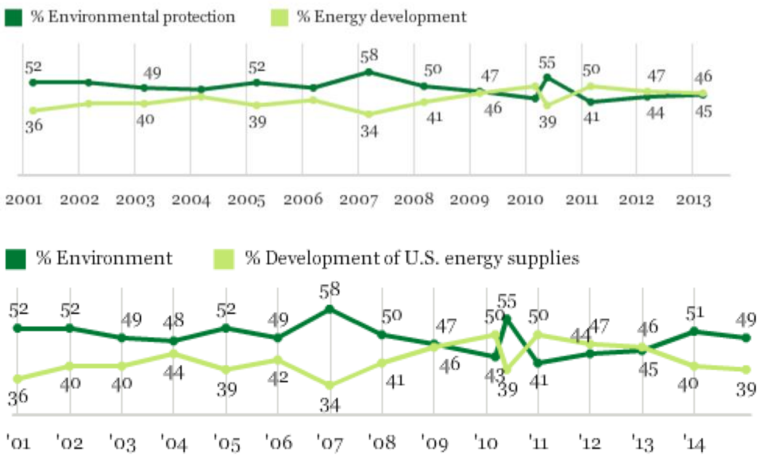

Figure 18: U.S. Priorities in Energy/Environment Trade Off (Princeton Survey Research Associates International 2013b)

Beyond this divide in terms of what should take priority, those polled all tended to agree that if possible, the two should be combined i.e. that energy should be generated by more environmentally friendly methods. A majority of two thirds thinks that the United States should focus on alternative energy sources, specifically wind and solar, over traditional energy sources. A preference for focus on energy conservation over increased energy production could be seen with a double majority of those polled (Princeton Survey Research Associates International 2013b). This has been a consistent poll result for several years leading up to the 2013 survey. Since 2013 attitudes have once again favoured environment over energy as in pre-crisis years (Princeton Survey Research Associates International 2015) – it is a possibility that the return of cheaper gas prices thanks to shale production has also brought with it a return to focus on environmental issues.

It should give a clue towards their attitude regarding shale gas what American citizens consider overall national priorities, given that the debate is often clearly polarised around economic and environmental issues, no matter how misleading this framing may be. In order to gauge these priorities, Pew Research Centre and Princeton University ask for public priorities – what president and Congress should prioritise according to the public (PEW 2012, 2015). Except for the years right after 9/11 as well as 2015 (potentially due to extensive coverage of Daesh exploits), where 'terrorism' takes first place of national priorities of dealing with an issue, 'the economy' is always in the top spot of what citizens think needs political attention most urgently, closely followed by jobs. There seems to be a case in favour of the shale industry here, which is framed as a major stimulation for the domestic economy, less import dependency, and as a job creator. 'Global warming' and 'the environment' do not make it into the top 20 priorities before 2003 and 2007 respectively, as can be seen in Figure 19 below (PEW 2015). The concern with these topics is lower in the aftermath of the financial crisis of 2008. Since it has reached the top

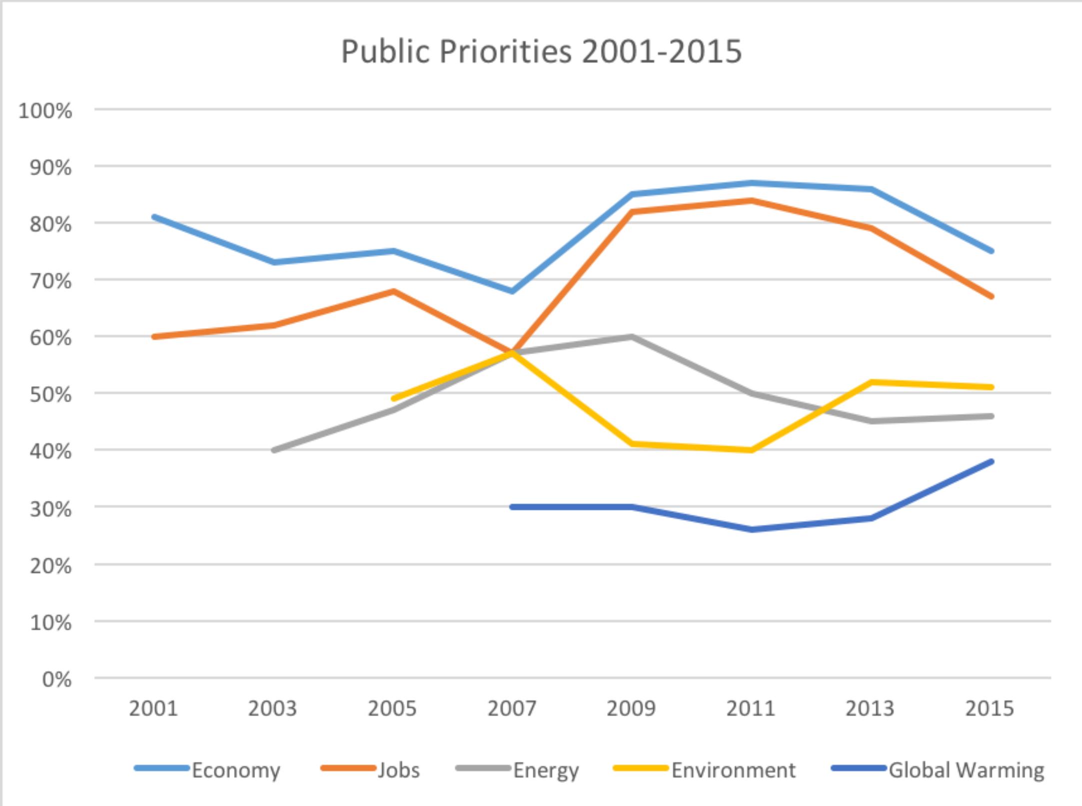

Figure 19: Select U.S. Public Priorities (PEW 2015), own design

20, the environment has overtaken concern with energy (also only reaching the top 20 in 2003) for a brief period before the financial crisis and again since 2013, but fell considerably below it in the post-crisis years.

The U.S. public has very mixed and almost evenly distributed opinions on shale gas, with a trend towards more negative views on fracking the more mature the industry becomes. Their opinion on whether or not the environment or energy are bigger priorities are equally similar, ever changing and inconclusive. A majority of citizens would prefer to combine these goals and achieve energy through cleaner technology. The oil and gas sector are seen very negatively. But the importance of 'the economy' overall and jobs in particular far outweighs the importance accredited to 'the environment', much less to 'global warming'. The real impact shale gas has on job creation and growth are not very promising (Mathieu, Spencer, and Sartor 2014; Christopherson 2015; FWW 2015). I conclude that the public opinion on shale gas in the United States is not primed or particularly receptive to shale gas development, but divided relatively equally with a growing trend towards opposition.

IV.3.2 Public opinion on shale gas and related sectors in the United Kingdom

There have been several successive opinion surveys in the United Kingdom to establish public attitudes towards shale gas (Jaspal and Nerlich 2014; O'Hara 2013; UKERC 2014; Martin 2014; Vaughan 2014; Whitmarsh et al. 2014). Key findings suggest that public attitudes change for the worse both with time and with increasing public salience on shale gas (O'Hara et al. 2015) and that the level of public support has been consistently overestimated or overrepresented by fracking lobbies (Whitmarsh et al. 2014). In a recent survey, the "most strongly disagreed with statement was *'I feel confident that the British Government will adequately regulate shale gas'* [whilst] the most strongly agreed with statement was *'I am concerned about the risks of water contamination from shale gas fracking'*

In terms of a cost-benefit analysis, a quarter of respondents are undecided and around a third of respondents consider that risks outweigh benefits of shale gas; a quarter think the opposite (Whitmarsh et al. 2014). This can be seen in Figure 20 (Whitmarsh et al. 2014, 12).

The risks mainly associated with shale gas include earthquakes (50-70% of respondents between 2012-14) and water contamination (35-45% of respondents between 2012-14). The benefits it was associated with were cheap energy (40-55% of respondents between

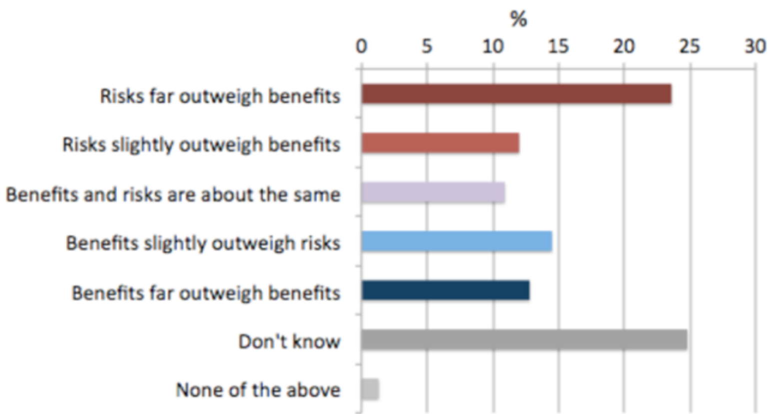

Figure 20: Perceptions of Risks vs. Benefits of Shale Gas in the UK (Whitmarsh et al. 2014)

2012-14) and energy security (50-60% of respondents between 2012-14).[91]

Another strong result from a recent survey is the importance of context: while the public seems to be divided over whether or not fracking should occur and where, when given a choice between different energy production methods they showed a clear and significant

[91] Varying local support does not hold up to scrutiny: while it at first appeared as if respondents in areas likely to experience fracking were more in support of shale fracking, this difference in location result was rendered entirely insignificant and non-existent when tested for demographic and value factors including political affiliation, gender, rurality and environmental attitudes (O'Hara et al. 2015).

preference for renewable technologies. Shale gas in fact was cited as the very least favourite preference in the energy mix, following nuclear (Whitmarsh et al. 2014, 17).

As can be seen in Figure 21 below (O'Hara et al. 2015, 13), shale gas is the recurring least or second least supported energy resource of ten put forward in a questionnaire on what the public thinks should constitute the UK's energy mix, and remains steadily so over the course of several years of surveys, with a trend of decreasing support since surveys began.

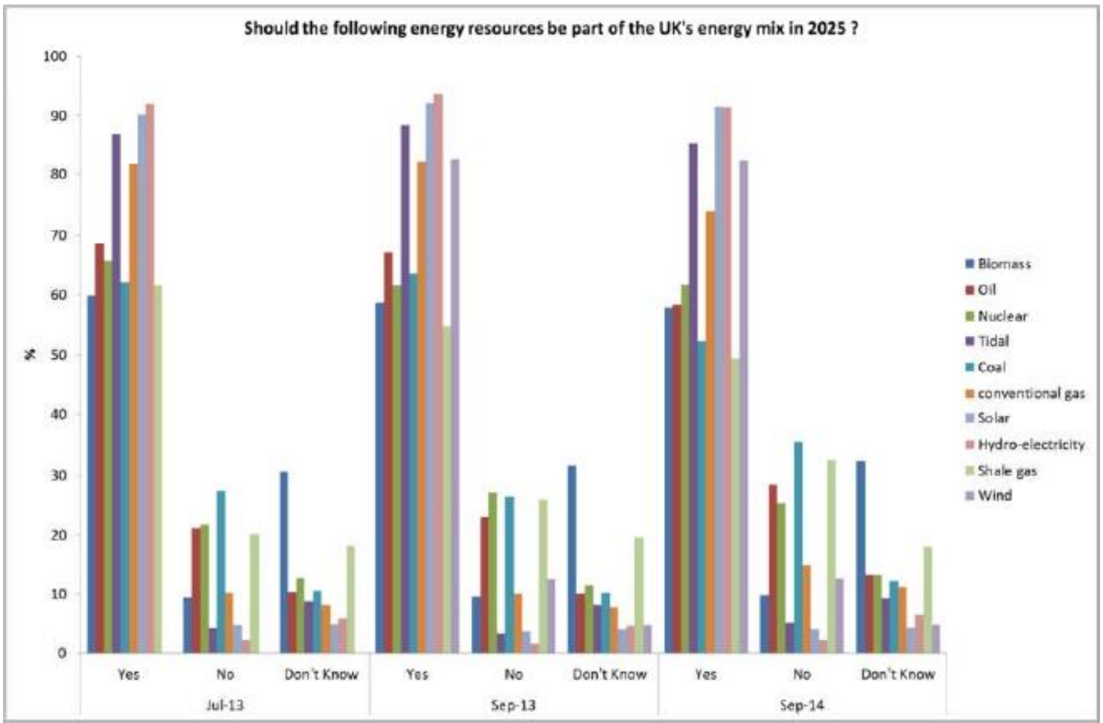

Figure 21: Preferred Resources for UK Energy Mix 2025 (O'Hara et al. 2015, 13)

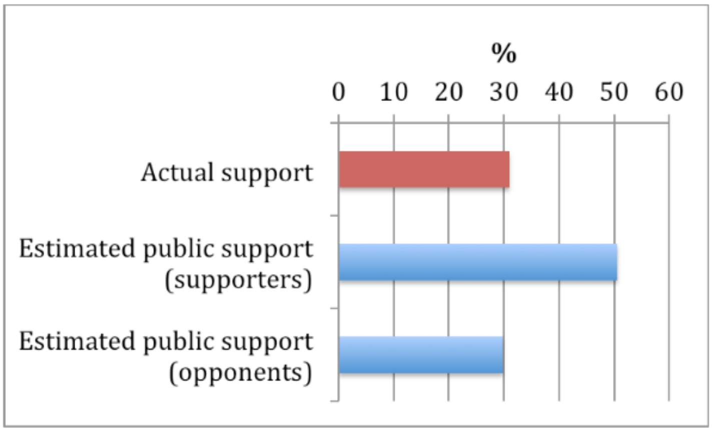

Figure 22: UK Public Support Discrepancy (Jaspal and Nerlich 2014)

There have been problems with misrepresentation of public attitudes in the UK – a recent government study found only 24% of respondents in support of shale gas, whilst a study by UKOOG had previously claimed that 57% of the population were in favour of fracking and only 16% opposed to it (Jaspal and Nerlich 2014). Figure 22 (Jaspal and Nerlich 2014) shows how public support is strongly misunderstood by fracking supporters and judged more correctly by its opponents.

The UK government's attempts to make fracking more appealing to local communities through monetary compensation have not been viewed favourably:

> "most people agree with the view that payments to communities living near shale gas wells are 'bribes'. 57% of those polled said they believed the compensation was 'to get the community's support for fracking in their area' and almost nine in 10 said the payments were not being paid for the benefit of the community" (Vaughan 2014).

In 2016, the latest available survey, only 19% of the UK public support fracking, down from almost 30% in previous years; this is compared to 81% who would prefer renewable energy (Vaughan 2016).

In surveys on important issues facing Britain the economy is consistently considered higher than the environment or pollution between 2001 and 2016, except for a switch in the summer of 2006 (around 10% over 8%) and the early months of 2007 (around 19% over 14%) (Ipsos MORI 2007, 2016). In 2008 worry about the economy jumped from 20% in January to over 60% at the end of the year whilst those considering the environment most important dropped to 6%, most likely in response to the global financial crisis. From then onwards, respondents considering the environment paramount have remained on the single figure percentage whereas concern about the economy stayed very high until late 2014 when it returned to around 30% (Ipsos MORI 2016). In the responses to the Eurobarometer biannual surveys on national priority issues since shale has become a topic in the UK (2011-2015), the top three spots for most important issues in the UK are always taken by 'unemployment', 'immigration', 'economic situation' and 'rising prices/inflation'; while 'the environment' and 'climate change' are continuously at the very bottom or second to last spot of the ten points list, and 'energy supply' when introduced in 2015 outranks them (European Commission 2011, 2013, 2014b, 2015). This trend could have an impact on support for shale gas, which the government has connected to jobs and revenue (Cameron 2013; PA 2014; Watt 2014) – but it seemingly was not enough to convince a majority of UK citizens to support fracking.

In a comparison with 24 other industrialised nations, the UK public's concern about climate change ranks in the bottom third together with China, Poland and Russia for example; they are however the nation that is third most concerned with the issue of energy security (Ipsos MORI 2011). While there is no concrete data to support this, a reasonable assumption based on this information is that UK politicians are likely well-informed of this and hence may use the angle of energy security to promote the shale gas story.

Shale gas support and opposition are relatively equal in the United States but the opposition is growing; in the UK, opposition to shale gas is stronger than support. In both countries, more salience of, or experience with, fracking have led to a worsening of public opinion on the resource. Both in the United Kingdom and the United States awareness and public knowledge of shale gas are on the rise – in earlier surveys, many respondents incorrectly identified either fracking or shale gas or stated that they were unaware of it, but this has rarely been the case after 2013 (O'Hara 2013; PEW 2012; Princeton Survey Research Associates International 2013b; Whitmarsh et al. 2014; Boudet et al. 2014).

Considering public opinion together with the details on the economics surrounding shale gas development, I surmise that there is no evidence of a direct and rational logical conclusion for policymakers to support fracking in the interest of their citizens. In Britain, the public oppose it quite strongly, and in the United States it would prefer low carbon energy generation. Citizens are concerned about the state of the economy, but as discussed, shale gas is unlikely to make a lasting meaningful contribution to either country's economy. However, I am also left with the notion that the respective governmental presentation of shale gas as conducive to lower bills, job creation and economic success are very likely to resonate with the public.

IV.4 Alternative strategies for energy policy

I want to give a brief overview of references to show, firstly, that options other than following the shale gas route are available (otherwise, no decision would take place) and secondly that they are well known to policymakers deciding on shale gas.[92] Clearly, shale gas has a questionable environmental track record that adds to its problems of economic performance: investing in something so obviously unsustainable, and as discussed above, potentially discouraging other investment in renewables, should need to be well-justified in comparison to a different energy strategy including sustainable energy.

From an environmental perspective, for the U.S. and UK government to promote shale gas so strongly in 2010-2016 is at the very least surprising. It seems ill-fitting when the countries, especially the UK, have projected issues with reaching their renewable targets (Harvey 2014b; McGrath 2015) whilst other countries[93] have recently succeeded in serving almost their entire power consumption with renewable energy (Shankleman 2015; Neslen 2016). According to experts, through the use of smart energy and improved grid

[92] In this section I am not attempting to cover in detail the variance of different energy strategy options available to the United States or United Kingdom, as to do so could well require another full thesis of its own.

[93] Portugal and Germany – with the latter rendering the excuse of better weather elsewhere an improbable one.

this would be possible in the UK as well (Taylor 2016; National Infrastructure Commission 2016). The confines of my dissertation make it impossible to include a detailed discussion of alternative energy strategies available: suffice to say, they are available (British Pugwash 2013; Amin 2015; P. Taylor 2016; McGrath 2016), for both the United States of America and for Great Britain, and have experienced a surge across the world in recent years, notably in emerging economies (McGrath 2016). And for the UK as well as the U.S. government it would be almost impossible not to become aware of them.

Before shale gas entered the market and U.S. energy policy plans, there were alternative strategies (IEA 2002, 2003, 2004, 2005). United States energy strategy plans do not extensively mention the need for new unconventional gas resources even now that shale gas is important to the sector (DoE 2006a, 2011, 2014a). Before shale gas became a staple, the United States' national energy policy was quite focused on diversifying energy supply, expanding energy generation from renewable sources as well as planning major investment in nuclear power provision (IEA 2002). The aim of energy security through energy independence has always been predominant in United States energy policy; therefore, a diversification through reliance on trade was not likely a preferred policy option even before shale gas became commercially interesting (IEA 2002). However, previous national energy policy strategy also encouraged the extension of nuclear and renewable energy generation to achieve this.

Shale gas has been lauded as providing the United States energy sector with anything from a bridge to renewables, to a fossil fuel prolonging lifeline, or to the key reason behind newly found increased energy independence. However, I find little evidence of this. New developments such as a low gas price and more experience with well output are not brightening the industry's outlook. Another issue that is confusing investors and feeding into the hands of critics of the current UK energy policy is a perceived bias and selectiveness when considering energy policy options. As an example, following a recent motion to cut subsidies for solar, the then UK governmental minister for energy, Ms Rudd, told the chair of the British Photovoltaic Association that job losses were "not part of the consultation" (Carrington 2015d). Much of the debate around shale gas and protecting the gas industry in general is laced with the argument of providing or saving jobs (Cameron 2013; BBC News 2014a; Carrington 2015d). In one of the most recent energy white papers, the previous government in fact pledged they would support coal to save employment, namely that they had won more flexibility at EU level to "help develop new reserves in existing pits where they are economically viable and help safeguard jobs"

(DTI 2003, 94). It appears that hypocrisy applies when selecting energy sources that are protected or supported in order to create jobs.
For the United Kingdom, the international scientific research and discussion group Pugwash laid out several different pathways for possible future energy strategy that would not rely heavily on fossil fuels, let alone shale gas (British Pugwash 2013). In this project, they decided to focus exclusively on what was achievable with technology which had proven itself and reached commercial maturity, and not to focus on possible yet uncertain future technological advancements. Their results were also tested against the DECC's quantitative computer tool 'pathways to 2050 calculator' (DECC 2016a). In addition, Pugwash draws attention to less quantifiable social, political and environmental outcomes of energy strategy and calls for more effort to assess those. Pugwash introduced three different strategies that would be arguably feasible and would comply with government targets of supply levels and 2050 climate targets: the high nuclear pathway, the high renewables pathway, and the more cautious intermediate pathway. The latter includes more carbon capture provisions, and is the only pathway that relies to a certain extent on future developments not yet guaranteed. Each of the pathways demands a total bill of around £2.8 trillion until 2050, which is not unreasonable considering previous government annual expenditures for the UK energy supply system, for example approximately £95 billion in 2010 (British Pugwash 2013). Of course, all three strategies include challenges and may face obstacles in the future. But so does the plan to develop unconventional gas, and it includes many more uncertainties. The in 2016 relevant and most current United Kingdom Energy white papers that guide national energy strategy also consider future strategies to guarantee national energy supply levels with optimistic recommendations that do not include shale gas (DTI 2003, 2007; BERR 2008; DECC 2009, 2011).

This short section was not intended to elaborate on the details of potential energy strategy plans, but to show that they exist and that the respective United States government and United Kingdom government in question can be reasonably assumed to be fully aware of them.

IV.5 Chapter summary

This chapter leads to two key conclusions. Firstly, shale gas policy is not a strong logical consequence of a 'rational' cost-benefit analysis for either of the two countries, but most especially not for the United Kingdom. With the uncertain future development of shale gas and uncertain consequences of hydraulic fracturing and related processes, there can be no confident result of an expected utility analysis possible that recommends its exploration. Secondly, for a MDSD style research design in which similar independent variables should have the same impact on the similar outcome, the economic cost-benefit analysis of expected utility does not hold true in the case of shale gas as the country studies are too diverging.

Shale gas economics in the United States appear to be a short-term solution, and a hype by and for investors that much overstates its actual utility, rather than a lasting, economically beneficial opportunity for the energy sector. In the case of the United Kingdom, virtually no sound economic reason for the commencement of shale gas policy can be found. Outside of official industry presentations on shale gas there is little doubt left that shale gas will not, in fact, be profitable or successful for as long as some entities, such as EIA, suggest them to be; nor will they have as profound a positive impact on the overall economy. The UK case for shale gas development is very weak, but looking at U.S. data from 2011-2015 makes the U.S. case look much weaker than originally assumed, too. Supporters of fracking connect the resource exploration to classic economic arguments of rationality and market efficiency. And yet my analysis in this chapter further substantiates a growing amount of research that finds little confirmation of these claims and instead throws up doubts about the beneficial economic aspects of shale gas.[94] It is also rendered doubtful that either the U.S. or the UK government actually intends for shale gas to compete in a free market system, given the subsidies and tax incentives it has been granted (Groeger 2012; Macalister and Harvey 2013). This continues a long history of (at times under-reported) subsidies in the fossil fuel sector. Fossil fuels receive a greater share of government subsidies than alternative energy sources but those subsides are rarely discussed (Sills 2011; IMF 2015; International Energy Agency 2016; Global Subsidies Initiative 2016).[95] This goes for global subsidies as well as for government

[94] Importantly it should be noted that many basic practices such as labelling and explaining tables and graphs, that are considered important in academia, are not exactly followed properly in almost all of these datasets given either by research institutes (such as the BGS), the industry, or government-sponsored research. Further, short 'executive summaries' or 'media summaries' can differ starkly from the overall report. For example, with the BGS report, the summary sounds much less cautious and much more positive and promising than the report, once read in its entirety, actually suggests (BGS 2013a). This makes it quite difficult and at the very least enormously time-consuming to compare and check the data given. The rest of the BGS study is not labelled ideally and therefore quite hard for anyone but the authors to decipher and comprehend. Similar problems are found in most of the other reports reviewed above, the main U.S. reports by EIA and DoE especially.

[95] Of course, estimations vary depending on how subsidies are calculated: are subsidies to producers only or those to consumers calculated, are they calculated for domestic producers and consumers or foreign ones as well? But the major international institutions such as the IMF or IEA agree that fossil fuels receive more support than renewables in each case, all things considered.

subsidies spent in the United Kingdom and the United States specifically. For example, according to IMF estimates the UK spent around £26 billion or almost 1.4% of its GDP on fossil fuel subsidies in 2015, around three times more than it spent on renewable energy, and is the only G7 country to drastically increase this amount in the past decade (IMF 2015; Carrington 2015e). Of course, tax breaks for shale gas will feature in this number. In the United States estimations show that renewables have over the first decade of the 21st century received around 40% of the subsidies enjoyed by fossil fuels (Adeyeye et al. 2009). Another issue that has not been raised publicly in connection with shale gas is repeated recent warnings by scientists that no matter how much can be found and or proven in extra fossil fuel reserves, they are finite, and some of them will have to stay in the ground (Shankleman 2015; Clark 2015) if climate targets are to be met. Whilst there are varying estimations of how much can and should still be used, most scientists agree that there is a limit.

The case studies are so different in their capacities that there can be no assumption of similarity in the independent variable leading to a similar policy outcome. The United States' and United Kingdom's energy sectors and energy production capacities (as well as consumption levels) are fundamentally diverse. This goes both for the overall energy economic sectors, as well as specifically for shale gas. There can therefore be no reason to assume that the economic calculation suggested by theory in chapter three is the independent variable which has a realistic effect on the decision-making. Due to reasons of different infrastructure, different pricing systems and different structural factors per se, the UK situation can simply not be compared with the U.S. situation, let alone the fact that the latter is a lot less bright than often claimed. It creates a further clean case for most dissimilar systems design – both countries could hardly be more different with their economic capacity and structural factors regarding shale exploration.

Both findings, that of a lacking economic incentive and that of a discrepancy between the independent variables i.e. the country's fracking potential, further support the finding that the simple cost-benefit analysis suggested by classical theory on decisions under uncertainty is not tenable. In a nutshell, the analysis in this chapter appears to invalidate the possibility that the economic rationale derived from classical literature on decision-making under uncertainty (chapter three) serves to explain the decision-making process in the shale gas policy debate. It is neither economically calculated and logically conclusive, nor is it even calculable. In any case it becomes once again clear that dealing with shale gas is dealing with uncertainty. Specific suggestions by the literature such as a tendency for ambiguity aversion and considering losses stronger than gains can also not be verified within this data chapter, and neither could the modified assumptions of prospect theory. It is not quite possible to fully compare current UK data with the data available in the United States after almost a decade of commercial shale gas exploration; however, comparisons can be drawn between official resource estimates and the respective expected reserve estimates. Given that in the UK, there are as of yet no detailed estimates about recoverability and actual gas reserves, statements about the potential of the gas should be made very cautiously.[96]

Given the avoidance of uncertainty these kinds of calculations tend not to focus on environmental costs or social costs, either. Furthermore, this method of calculation leaves very little space for reflection on potential flaws with the process of decision-making; despite countless studies outlining that it is near impossible to make a perfectly rational decision in this fashion, expected utility is still a commonly deployed model in economic politics. Most problematic about this may be the utter confidence in this kind of decision-making: whereas modelling decision options on a basis of expected utility can be argued for as a helpful tool when lacking other means to sort through alternative decision options, defending it as a fail proof way to end up with correct decisions without allowing for uncertainty and biases to be discussed certainly implies not only imperfect but also inconsiderate decision-making.

[96] Of course, technically recoverable resources or resources economically viable to recover always change (usually for the better) in time according to technological advances (as well as commercial and market factors): the first shale well in the United States was drilled over a century ago and the first hydraulic fracking experiment happened in 1947, but both were not economically plausible at the time on a larger scale. Given the time span between 1947-2005, for example, it is however unlikely, despite increased technology investment and output, that shale drilling will be revolutionised within a year or two, and in either case, it is ill considered planning to invest accordingly just in case when it comes to public finances.

V Chapter Five. The political pursuit of private interests: Theoretical perspectives

The influence and political power by interest groups and lobbies[97] has become an important topic in the social sciences. In this chapter I assess the theoretical approaches that consider the potential for private and industry interests influencing governmental preferences. When economic rationality is not assumed as a key reason for policy decisions, social scientists often revert to concerns around lobbying and interest politics (Gourevitch 1986; Strange 1988; Lichbach and Zuckerman 2009; Baumgartner et al. 2009; Berry et al. 2009; Buisset, Øye, and Selleslaghs 2012; Klüver 2013; Godwin, Ainsworth, and Godwin 2013). The focus on private interests is a traditional approach in comparative and international political economy and in this chapter I survey key theoretical contributions. As the literature shows, one aspect of interest group power is their access to and cooperation with institutions tasked with regulating the sectors relevant to them. This chapter also includes a brief section about the role of institutions in relation to interests. Furthermore, I consider the impact of risk and uncertainty on the ability of organised interests to influence political decision-making. There is no reason to assume that influence by lobbyists does not occur in a policy area involving uncertainties and risk. This might be the case for a situation of the highest level of security risk which remains classified for all but government officials. In any other situation of uncertainty, forms of lobbying that involve the provision of experts or information may in fact be more likely. The role lobbying can play in the formation of risk preferences is accepted, for example around weapon provision or new technologies (Hammitt 2011; Gray, Rogers, and Wiener 2011; Stern and Wiener 2011; Wiener et al. 2013).[98] Outside of the disciplines of political science and political economy, the connection between lobbying and risk or uncertainty has recently inspired research in financial economics (Gregory and Hambusch 2015).[99] Researchers found that lobbying had a special impact on banking during times of risk and

[97] The literature is at times not very exact with a distinction so it has to be taken from the context (Beyers 2008; Beyers, Eising, and Maloney 2008).

[98] The effect of lobbying on risk preferences was also considered through the lens of social amplification of risk. The communication of risk (as occurs through lobbyists) is found highly likely to impact the public but can also affect policymakers (Kasperson et al. 2003; Slovic 2010).

[99] This is a new development: lobbying has not been consistently considered and researched as an influential contributor to banking sector risk and systemic financial sector risk until the 21st century global financial crisis (Blau, Brough, and Thomas 2013; Gregory and Hambusch 2015).

crisis, and that in such moments lobbying could have an entirely different impact than it would have had under normal circumstances (Gregory and Hambusch 2015).[100]

V.1 Private interests in political economy

Organised interests and lobbying are an important topic in political science and the discipline of political economy is especially concerned with it (Hall and Deardorff 2006; Baumgartner et al. 2009; Culpepper 2010; Godwin, Ainsworth, and Godwin 2013; Culpepper 2015; Pagliari and Young 2016). Central to political economy is the analysis into how economic interests shape policy outcomes. This includes how they are shaping and operating within the particular political environment. By the definition of Beyers et al., interest groups classify as such when they have a noticeable political interest, an organisation behind them, and if they can be considered as private, not public (Beyers 2008; Beyers, Eising, and Maloney 2008).[101] A core assumption is that interested parties seek to advance their own interests through the organisation of advocacy groups, seeking special access to policymakers, and seeking a channel for material contributions. From this, one can draw at least two avenues of analysis: either to ask 'qui bono' and assess who stands to benefit from a policy, or to follow the money (and efforts) in the opposite direction and assume that if lobbying takes place then it does so for reasons of self-interest.

The topic of interest power remains one of great currency. In the United States, federal lobbying expenditures rose from $1.45 billion to $3.20 billion per annum between 1999-2015 (Godwin, Ainsworth, and Godwin 2013, CPR 2016). The groups spending these amounts on lobbying "expected to achieve policy goals important to them" and "did not believe they were wasting their money" (Godwin, Ainsworth, and Godwin 2013, 2). Lobbying in the European Union has also increased, as is visible from the rising number of lobbies registered and rising amount of research based on them (Broscheid and Coen 2003; Woll 2006; Gullberg 2008). Simultaneously, public interest in and worry over lobbying has grown. While according to a 1960's survey, around 30% of Americans thought that very few big interest groups more or less ruled their government and all its decisions, a significantly increased proportion of 80% thought so when polled in 2008

[100] Such lobbying is found more likely to happen when the policy issue concerned is not one of high salience, or considered high politics (a concept explained in more detail below).
[101] This is the case even if they claim to represent interests of the national public or humanity in general, such as a cleaner environment or world peace.

(Godwin, Ainsworth, and Godwin 2013, 1). In countries where it is necessary for lobbying entities to register one can witness a steep increase in registered interest groups over time (Klüver 2013). This spells a possible indication of their increasing overall influence on legislators, but certainly is an indication of an increasing potential thereof.

V.1.1 Different models of influencing decisions

> "Political scientists disagree over the extent to which organized interests help or harm the democratic process and the degree to which inequalities in the resources of competing interests bias the policy process" (Godwin, Ainsworth, and Godwin 2013, 25).

Of course, there is not only one single way of approaching the study of interests and lobbying. The influence of interest power on policy outcomes can be researched from a variety of angles. The so-called *exchange model* of lobbying describes a situation in which interests provide resources to policymakers in exchange for favourable treatment in the context of related policy decisions (Godwin, Ainsworth, and Godwin 2013, 15). Some scholars simply call this vote-buying, but the term includes a range of activities, for example providing expertise and information, arranging campaigns such as television ads or letter writing, or arranging meetings with officials (Grossman and Helpman 2002; Godwin, Ainsworth, and Godwin 2013, 3).

In this vein, Potters and van Winden suggest that strategic provision of expertise or private information is one of the key and most effective lobbying strategies (Potters and van Winden 1992).[102] Such expertise can include technical knowledge but also real world knowledge about the impact of policies such as their effect on jobs and consumer behaviour. It could also simply be information about popularity of a policy in a specific interest group's clientele and how the policy may affect their view of the policymaker (Gullberg 2008). On certain issues, lobbyists, especially in-house lobbyists, will be among the most knowledgeable agents. Their inclusion in the role of advisers and experts is seen both as necessary and as highly dangerous, depending on the point of view. Consulting industry experts from a specific group only would allow for a very selective provision of information to policymakers and intentionally exclude other views. There have been cases

[102] Even if lobbyists present not their own but other experts' opinions, there is no reason to assume that governmental risk preferences should not be equally receptive to influence and alteration not only by facts or experts' opinions but also by the presentation, mediation and selection of said facts and opinions. Besides, experts do not need to be independent.

in which lobbyists were directly drafting legislation for policymakers (Schlozman and Tierney 1986; Carrington and Sparrow 2013).

When providing information, lobbying like-minded policymakers rather than undecided or opposed ones is considered rational (Potters and van Winden 1992). Clearly with the use of experts who are lobbyists, there is a dilemma. Policymakers have need of such expertise however they also need to adhere to and demonstrate democratic legitimacy, transparency, inclusion and diversity (Broscheid and Coen 2003). Potters and van Winden assume full awareness of this dilemma by policymakers. Moreover, they assume that policymakers take into account that certain lobbying experts may see it in their interest to provide partial or mis-information (Potters and van Winden 1992).

How exclusive the access of lobbyists to policymakers is, not only depends on whom those policymakers select to advise them but primarily on the level of organisation by those interested in lobbying. Only well-organised groups with reputable expertise and sufficient funding to maintain the lobbying efforts are likely to be considered. Considering the *free rider* problem and the *collective action* problem (Olson 1971; Truman 1981), supporters of the exchange model or elitism theories of lobbying find that interests have an advantage in lobbying if they are strictly organised, rich in resources, and if their pay-out from lobbying is clear. This implies that a top 100 company lobbying for material or structural gains would mostly win out over a part time, single issue civil action group which is lobbying for a cause benefitting many indirectly. Followers of the exchange model of lobbying tend to invoke the collective action issue and inability of less organised groups to equal the efforts of business lobbies; therefore, they consider strong lobbying as harmful to the democratic process.

Unlike in the exchange model, neopluralist theory on lobbing and policy influence suggests that not only resource-rich interests can have significant impact on policymaking. Instead it proposes that so-called issue networks can have a similar impact and have previously successfully lobbied against the aims of powerful industry and business lobbies (Godwin, Ainsworth, and Godwin 2013). Neo-pluralism is based on pluralism theory by Dahl (1961) and Truman (1981), but makes even more allowances for differences in organisation and capability between interest groups. The neopluralist argument is that "most policy issues involve competition among organized interests and that each side has sufficient resources to lobby successfully" (Godwin, Ainsworth, and Godwin 2013, 16). Like pluralism it considers not only the number of people interested in advancing an issue and their level of organisation, but also the perceived importance of the issue they are lobbying as a decisive factor for lobbying success. Importantly, the political arena is considered as very changeable. Depending on who moves into the White House for example, the previously weaker side of a struggle around air pollution standards may suddenly find itself strengthened due to closeness to the new government's agenda. As neopluralist theory holds that almost any interest can influence the policy process, through lobbying but also through parties and elections, they see the practice of interest organisation more positively and lobbies as democratic institutions.

Pluralism and neo-pluralist models of influence remain contested by the exchange model and theories about elite dominance of the policy process (Hunter 1953; Mills 1959; Godwin, Ainsworth, and Godwin 2013). The elitism approach concurs with the exchange model of influence in that it also considers wealth and structural positioning of an interest group as a key indicator of whether or not lobbying can be successful. Besides material factors the theory focuses on 'club behaviour', suggesting that powerful individuals often cluster around the same top universities, companies, clubs, and living areas. But the ultimate conclusion is that membership of these is based on wealth. This theory would find confirmation of their suspicions in the recent U.S. American political contests: almost all the Republican and Democratic candidates in the 21st century were both, multimillionaires and graduates of either Harvard or Yale (Godwin, Ainsworth, and Godwin 2013; Desilver 2014).

In the analysis in chapter six, I draw conclusions about these two opposing models regarding which of the two provides the more applicable context for lobbying in the U.S. and UK energy sector.

V.1.2 Indicators of lobbying success

> "The policy changes that lobbying creates are the best measure of lobbying success" (Godwin, Ainsworth, and Godwin 2013, 99).

The differences in lobbying success have long been a topic of research, often with the suggestion that strong divergences between interest groups may undermine democratic legitimacy (Dahl 1989). But conclusively settling why some are more successful than others is not finished and remains contested. To get an overview, in this section I mostly consider meta-analyses of case studies in lobbying practices (Baumgartner et al. 2009; Godwin, Ainsworth, and Godwin 2013). In 2009, a group of prominent political scientists published a comprehensive study into the determinants of lobbying success (Baumgartner et al. 2009). Through evidence gathered, no unconditional direct link could be confirmed as a rule between the size of material resources and the achieved policy results per se.

Some of the case studies reviewed found weak results when aiming to prove that powerful business interests have increased success with lobbying political struggles (Baumgartner et al. 2009). The study did not suggest that there is no payment for political results, but that it was often very difficult to pin down the exact linkages and transactions. In less comprehensive and more case oriented studies, other scholars have shown correlation between political activity, exchange model type lobbying efforts by firms and their regulatory benefits (Richter, Samphantharak, and Timmons 2009; Gordon and Hafer 2005; Godwin, Ainsworth, and Godwin 2013). Even though overall there is no conclusive evidence of a positive link between resource wealth and lobbying power, many case study results provide evidence of this correlation as long as certain conditions are met.

When analysing the distribution of private rather than public goods there is strong evidence of materially powerful business lobbies achieving success (Godwin, Ainsworth, and Godwin 2013). Whilst introducing a new proposal involving collective goods is seen as difficult, attaching benefits regarding private goods to a proposal or omnibus bill that is on the agenda has proven successful in lobbying private interests (Godwin, Ainsworth, and Godwin 2013, 209).

Another case in which lobbying has proven effective and where advantages to those organised interests with greater resources at their disposal become apparent is that in which regulatory or *quiet politics*, not just *high politics* decisions, are included in case study research (Culpepper 2010; Godwin, Ainsworth, and Godwin 2013). The distinction is made between for example on one hand lobbying for votes in a major election, for passing a bill or referendum, and on the other hand changing smaller details of legislation and making amendments to regulatory drafts before they are voted on as part of an omnibus bill. Therefore it is worth clarifying the distinction between the above-mentioned high politics, which often involve issues of high public salience, and lower or routine policy issues or quiet politics, in order to judge lobbying success (Culpepper 2010; Pagliari and Young 2016). An example of the former would be a decision on going to war with Iraq in 2003, against which millions of informed citizens protested. An example of low or routine politics would be if a country's government, which prides itself on its promotion of human rights, includes an amendment to a small section of a bill that allows the increased sale of arms to the government of a country which it otherwise criticises for its human rights record. This practice is not as highly publicised and incendiary, and has the added benefit that it is also much harder to detect and measure from the outside (Godwin, Ainsworth, and Godwin 2013; Culpepper 2015).

It is often routine or low politics regarding the specificities or regulations where most (and most successful) lobbying takes place (Culpepper 2010; Godwin, Ainsworth, and Godwin 2013). When researching different lobbying strategies for different stages of a policy decision in the European Union, Crombez concludes with a policy recommendation to interest groups that "if given the choice [they should preferably try to] lobby an advocate at the proposal stage" (Crombez 2002, 2971). (This is possible under the EU co-decision procedures.) Rigorous expertise and the upkeep of good relations and priority access to low politics regulation come at a cost. Being able to lobby not just on issues of high politics but also in quiet politics requires more effort, time and resources. In addition, lobbyists need to be constantly monitoring policymakers in order to stay on top of upcoming legislation they may want to influence. Therefore, and in connection to the distinction between high and quiet politics, lobby funds are found to play a vital role. A variation in strength and expense of lobbying per sector is also attested for (Pagliari and Young 2016).

Another strategy that has overall proven very successful in lobbying is that of building and maintaining long-lasting relationships with policymakers (Godwin, Ainsworth, and Godwin 2013). Lobbyists are often found to form close, extended relationships with legislators that agree with their overall cause and are likely to support their work (Bauer, Pool, and Dexter 2007). Therefore, professional lobbying organisations may enjoy a benefit over in-house lobbyists if policymakers are among their participants and they can establish regular contact between lawmakers and lobbyists. These organisations hence often succeed in creating a sense of reciprocity that helps minimise any free rider issues with regulators (Godwin, Ainsworth, and Godwin 2013). In-house lobbyists on the other hand are very useful when they can be drafted in as experts and advisers.

Some scholars argue that little actual changing of policymakers' minds occurs through material lobbying. Instead they suggest that lobbying mainly reinforces politicians' positions, like a legislative subsidy to support already like-minded policymakers, often through providing information (Milbrath 1976; Austen-Smith and Wright 1992; Potters and van Winden 1992; Hall and Deardorff 2006; Bauer, Pool, and Dexter 2007). There is case evidence from both the U.S. Congress and the European Union documenting that in fact lobbying of both like-minded and opposition politicians occurs (Austen-Smith and Wright 1992; Ainsworth 1993; Garrett and Tsebelis 1996; Bouwen 2002; Thomson et al. 2006; Gullberg 2008; Thomson 2011; Klüver 2013). There are also those who disagree with the idea of lobbying already friendly politicians (Austen-Smith and Wright 1992). While there is evidence of lobbying the opposing side, research on this is rarer and some of this work has been criticised in that it often applies only to special situations, not day to day lobbying (Baumgartner and Leech 1996). But the institutionalised access to policymakers and idea of them as 'friends' to certain lobbying issues is worth considering as impacting the success of lobbying.

V.1.3 Institutional relations and lobbying

> "The impact of institutions and the impact of lobbying depend on each other" (Heckelman and Wilson 2013, 362).

The social sciences and especially political economy have seen a rich history of research on the importance of institutional context, and the difference between institutions (Keohane 1988; Laffont and Tirole 1990; DiMaggio and Powell 1991; Hall 1997; Soskice and Hall 2001; Greif 2006; Eising 2007; Culpepper 2008; Blyth 2009).[103] Analysing apparent lack of intervention by powerful interests during periods of economic decline in Britain, Peter Hall put forward that an interested agent's structural (material) position alone was not sufficient to allow him to impact on policy decisions, but that their institutional positioning was similarly decisive on lobbying success (Hall 1986). This corresponds with findings about closeness between lobbyists and legislators in the previous section. There are many theoretical contributions and evidence on how interest groups, specifically business groups, lobby to gain and retain access to institutions, for example to those of the European Union (Bouwen 2002; Beyers 2004; Eising 2007). It is important to consider not only the apparent motive and resource power of an interest group: whether or not they have the necessary access to policymakers to advance their interests is also important (Carpenter and Moss 2014, 16).

An extreme situation of institutionalised lobbying is called *regulatory capture*. 'Captured' means institutions promote the political or commercial interests of those they are tasked to regulate. Carpenter and Moss define regulatory capture as "the result or process by which regulation, in law or application, is consistently or repeatedly directed away from the public interest and toward the interests of the regulated industry, by the intent and

[103] This chapter is not the place to provide an overview of institutional approaches to political economy or the *Varieties of Capitalism* approach. I recognise the importance of institutional structure and framework guiding policy action and lobbying but do not find it necessary to consider them in detail for this part of the thesis. As two liberal market economies, the United States and United Kingdom are close to one another on a spectrum of different institutional typologies (Soskice and Hall 2001); I will consider differences in lobbying access.

action of the industry itself" (Carpenter and Moss 2014, 13).[104] Suspicions around regulatory capture, whether or not explicitly, are often cited in the media. For example, after the *Deepwater Horizon* oil spill, a Wall Street Journal reporter suggested that it was "a striking example of regulatory capture": that agencies which were tasked with promoting public interests had "come to identify with the regulated industry and protect its interests against that of the public" (O'Driscoll 2010). One can distinguish between different forms of capture, more straightforward rent-seeking or 'bribing' types as well as implicit cultural or social ones (Carpenter and Moss 2014).[105] Importantly, the latter version may occur without the legislation being fully aware of it, or the pressure group.

Another newly considered aspect of the institutionalisation of lobbying that is often mentioned in combination with the financial crisis of 2008 is that of *cultural capture* by James Kwak. When cultural capture occurs, it is the closeness between the regulatory agency and the industry they are regulating, rather than actual barriers (regulatory capture) that leads to the regulators favouring the views of the industry in politics (Carpenter and Moss 2014). As Stiglitz puts it, "mind-sets can be shaped by people you associate with, and [Fed regulators] come to think that what's good for Wall Street is good for America" (Becker and Morgenson 2009). An array of scholarly and journalistic articles was motivated by the 2008 financial crisis to consider the informal ties between financial regulators and the financial sector (Seabrooke and Tsingou 2009a; Seabrooke and Tsingou 2009b; Pagliari 2012). *Cultural capture* not only describes a situation in which a regulator's ideas and actions can be influenced by the content of active interest group policy (Kwak 2013). Kwak also suggest suggests there is a subconscious influence simply by the nature of interaction and exchange between them, such as through shared identity, shared networks and social connections. This leads to a bias that the regulators may be unaware of towards those they consider teammates (Kwak 2013, 84). Therefore, biases towards the industry an agency is tasked with regulating may also be unintentional. An example of this would be financial regulators who only ever speak with hedge fund managers but never with small savers and are therefore likely to begin making assumptions about the finance system as a whole based on their very limited perspective on it. The logic behind this proposition is not entirely novel. It recalls elite theory, only that whether or not the connections are made in 'elite' or other groups is not decisive. When Abbott spoke of

[104] This definition depends on the definitions of important terms within it, such as public interest or intent, which are sometimes contested.

[105] The authors further introduce a distinction, which is quite useful in my opinion, of strong and weak capture (Carpenter and Moss 2014): strong capture diverting the outcome so far away from public interest that no regulation would be preferable to the status quo, weak capture however where outcomes may be compromised by pressure groups but overall the public is still served best by this regulation.

‘linked ecologies’ he suggested that within certain networks or peer groups, any discourse over different practices and policy goals will only occur within “intersubjective shared understanding” (Abbott 2005; Seabrooke and Tsingou 2009a, 10) thereby preventing the introduction of novel policy outside of that group thinking. It is reminiscent of what Janis called groupthink (Hart 1991): he also considered the process of excluding outside ideas as less subconscious, however, and blamed the situation on a desire for concurrence among elites.

Studies into lobbying success have furthermore shown that lobbying in support of the status quo has overall proven to be successful more often than lobbying for change (Baumgartner et al. 2009; Leighton and Lopez 2013; Godwin, Ainsworth, and Godwin 2013). It is harder to mobilise people and organise groups to lobby for change than it is to mobilise people to protect what status and benefits they currently enjoy and likely feel entitled to (Godwin, Ainsworth, and Godwin 2013, 208). This can sometimes be seen reflected in the written rules for policy process – vetoing a proposal is often simpler than introducing a new one, which would need approval at every stage of the legislative process. Most established democracies have these rules in place specifically in order to safeguard the democracy from quick and extraordinary changes. In their comprehensive review of lobbying success, Baumgartner et al. (2009) concluded that “the single best predictor of a side's likelihood of winning was whether it was protecting the status quo or trying to change it” (Godwin, Ainsworth, and Godwin 2013, 209).

This is evocative of Graham Allison’s second model of decision-making, which he calls ‘organisational process model’ and in which he insists on the power of *repertoire* in shaping decisions made by government agencies. Allison finds that the presence of a repertoire of procedures and choices to look back to severely constrains options in the future. Therefore, to him as well the best way to discover what an organisation such as the government is likely to do and why at a future time t+1 is to consider what it has been doing at the times t and t-1 (Allison and Zelikow 1999, 175). In combination with Baumgartner’s findings this would entail that government agencies should be heavily biased towards anybody lobbying for the status quo as opposed to those lobbying for change.

V.2 Chapter summary

The above review of key themes makes it plausible that private interests may have influenced policy decisions on shale gas development through lobbying. While it is hard to find evidence for all components of the lobbying process, such as informal meetings or information sharing, there are many case studies providing plausible evidence for the linkage between interest group lobbying and policy outcomes. Like other scholars, I am unlikely to be able to prove the existence and effect of lobbying beyond the shadow of a doubt, but, like them, I can show that opportunity existed and results match certain interests, and thereby assume lobbying through circumstantial evidence.

Preliminary evidence exists of lobbying activities taking place in the energy sector of countries including the U.S. and the UK (Gullberg 2008; Crooks and McGregor 2012, 2012, Mitchell 2012, 2013; Cusick 2013; Richardson 2015), helpful in tracing the lobbying around shale gas. Whether or not the private interests for and against fracking have a decisive impact on decision-making is dependent on the organisation of the pro and anti-campaigns, their resources and their access to policymakers, the status quo and whether or not policymakers are susceptible to lobbying. Specific aspects to consider include whether or not lobbying takes place in high politics or low politics, whether or not exchange of resources such as experts or funding takes place, and whether the institutional access and placement of lobbyists may favour their cause. If the presence of any such conditions can be established, this would implicate that the resource power of interests is also likely influential.

Following previous chapters, my hypothesis for the next chapter is that a policy decision regarding shale gas development is open to influence from a variety of organised interest groups rather than them being disregarded by a government considering public or national expected utility (h0). A core element of international political economy research is the focus on economic interests, and therefore I need to consider the possible explanation that the policy decision on shale gas, despite uncertainty and an inconclusive cost-benefit analysis, is based on powerful interests lobbying this cause. To this end I provide an overview of 'who is who' in the lobbying arena around fracking and consider their motives, capabilities, access to policymakers as well as more general information on lobbying in the sector.

When assessing to what extent lobbying for private interests takes place and has an impact on shale gas policy decisions, I also consider the rationality of such lobbying. Conventional interpretations of political economy assume those interests to be rational and objective (Woll 2008, 32). This type of analysis implicitly presumes a material rationality not unlike that of expected utility, except the utility of a different player in the game. The hypothesis is that interests which have the access and potential to do so will lobby the government into doing something, which according to their own cost-benefit analysis will advance their material interests. I wish to consider, as much as possible, whether or not companies lobbying in favour of shale gas in the U.S. and UK are in fact acting rationally according to their own members' material self-interest. The issue of rationality in lobbying has been raised before. For example, like other scholars, Bauer et al. discuss and found evidence for the trend of lobbying legislators that are already sympathetic or 'friends' to an interest group's cause but they consider this irrational behaviour (Bauer, Pool, and Dexter 2007). Lobbying already like-minded legislators is less complex and expensive. They argue however that failing to focus on undecided legislators means that lobbyists give away opportunities irrationally. Whether or not lobbying is considered rational to them depends on a cost-benefit analysis (Bauer, Pool, and Dexter 2007; Gullberg 2008). Therefore, to conclude my analysis in the following chapter six on groups lobbying for shale gas I will add a brief résumé on the economic rationality of such lobbying.

VI Chapter Six. Evidence on fracking interests

Following the theoretical chapter on the effect that lobbying private interests can have on policy decisions, in this chapter I consider its lessons for the case of shale gas development in the United States and the United Kingdom. By establishing if any of the conditions identified to enable successful lobbying are in place, in my case studies I examine the hypothesis that organised private interests which are influential in the United Kingdom and United States may impact the decision on shale gas development. The conditions most likely to facilitate lobbying success are close connections between lobbyists and policymakers, lobbying quiet politics, the provision of resources including experts and information, and help with preparing legislation through surveys, reports or drafts. If these conditions are met, resource strength of a lobby also impacts their success rate.

In a first step I determine who the top potential beneficiaries of fracking operations in each country are. My list of prospective interested parties to consider includes energy companies that deal in fracking and, in select cases, lobbying groups that represent them. In order to establish a comparison as to their resource power and institutional access, I also briefly present data on the opposition to fracking: mainly environmental campaigners but also, to a lesser degree, the alternative energy companies that can be assumed to be in competition with shale gas. I then review some of the energy sector's history with lobbying, whether the policymakers who are influential on shale gas decisions, and the institutions tasked with the development of shale gas policy and regulations are favourable towards the practice and towards the industry. To judge interest groups' access to these institutions I assess how interwoven the public bureaucracies tasked with shale gas policy are with those lobbying for and against shale gas. To further determine the extent of revolving door practice and possible regulatory capture or cultural capture amongst either country's relevant policymaking organisations I use the business intelligence tool BoardEx. After establishing whether or not certain interest groups have reason, resources and access to decision-making, I also briefly discuss the rationality of such interests.

Data used in this chapter includes all the data available on lobbying from trusted enough resources. In the United States case-research this includes the official independent lobbying register from the Centre for Responsive Politics (CRP), Pro Publica, Data from the United States Congress' records and investigative journalism collections (from the New York Times mostly) as well as data from independent academic research (i.e. Lustgarten 2009; Buisset, Øye, and Selleslaghs 2012; Martin 2014; Horn 2013; Tansey

2014; DeGette 2015; Jones and Rowell 2015; European Commission and European Parliament 2016; CRP 2016). For both countries, data about institutional connections and lobbying was drawn from the business intelligence tool Boardex, which I explain in context. The lobbying data situation in the UK is less rigorous than in the U.S. because of the very limited requirements made by the UK lobbying register, which I discuss within the chapter. The UK case data is based on primary data from parliamentary publications and records and the Lord's Committee of Economic Affairs but also the EU lobbying register; this is supplanted with data from independent academic research as well as from investigative journalism, which has made a strong case about British lobbying for quite some time. Where a newspaper is used that is known to tend towards a certain political identity, such as the Guardian which mostly favours liberal, left-leaning ideas, I try to offset by also using data from newspapers from the other end of the spectrum, for this example the Telegraph, as well as public news considered more neutral, such as the BBC.

This chapter serves to provide a narrative around private interests in shale gas and their impact on policy decisions, widening the analysis after previous chapters three and four failed to establish a plausible national economic benefit from shale gas development. As discussed in the previous chapter, proving the success of lobbying efforts is a difficult thing to do (Baumgartner et al. 2009). I will therefore take care to distinguish between what can be proven, what can be reasonably assumed, and what is simply a possibility.

VI.1 The private interests for shale gas in the United States

To begin this section, I relate what information is accessible on major interest groups likely to lobby on either side of the shale gas issue. I only consider those private groups that are involved enough in the process that they can first of all be expected to have a reasonable interest in lobbying shale, and second of all that their interest can be known.[106] For clarity I curtail this number and only consider the top groups and firms. My focus is on describing potential interest groups, their publicly stated attitudes towards shale gas development, and their lines of access to government policy. In order to provide a

[106] It is worth noting that it has been lamented by journalists and members of the public how difficult it is to receive decent data on shale gas companies, for example answers to questions such as who is drilling, where they are drilling, is there fracking near your area. Specifically for this purpose, the University of Pittsburgh's centre for healthy environment and communities (CHEC), funded by environmental groups, has set up a new website called *FracTracker* providing tools to combine data about shale gas exploration within the United States (Kusnetz 2010).

comparison of the capacities and direction of energy lobbying, I also consider wider trends in this sector's relations with private interests.

In the United States, where shale gas development is at a more advanced, commercial phase compared to the UK, the primary private interest groups in favour of fracking are the companies currently involved in fracking. Unfavourable legislation would hurt their business interests. There are over 14,000 oil and gas companies operating in the United States, many of which hold varyingly large, usually interconnected stakes in the shale gas business: Of these, the top forty producers of gas develop more than half of all domestic U.S. gas resources (Kusnetz 2011). In order to provide reasonable data to discuss in this context, I will limit the discussion to the biggest, top ten oil and gas producing companies that are involved in shale gas development.[107] In my analysis I also consider companies that specifically provide tools or services almost exclusively for oil and gas energy products, such as Halliburton. Naturally, many more firms stand to profit from shale gas development besides oil and gas companies: material providers such as Silica Holdings or General Electric, transportation firms such as Union Pacific, or those managing huge shale gas-specific investment funds such as Goldman Sachs. To keep the discussion manageable, I do not consider all of those. The list of the ten biggest shale gas producing energy firms in the United States is topped by Exxon Mobil[108], which produces almost 50% more than its closest competitor. Exxon is followed by Chesapeake Energy, Anadarko, Devon, BP, Encana, ConocoPhillips, Southwestern, Chevron and Williams (Kusnetz 2011). Each of them has a large share of their gas development in shale basins.[109] They are expected to lobby for the continuation of any policy favouring its development over other policy such as increased environmental safeguards which would hinder the cheap exploration of shale.

The companies named above form part of a strong sector of the U.S. economy. The United States have a long history with domestic oil and gas production, both onshore and offshore. This led to the industry establishing a well organised lobby and longstanding connections to legislature and policymakers in Washington. Amongst the most known

[107] There are different ways to measure the size of energy or any other companies – it could be based on overall reserves, on revenue or market capitalisation – but experts from the industry have stated that production numbers are a good measure because they provide a clear overview (Kusnetz 2011). Also, they are helpful to my work as they clearly separate gas and oil development. Therefore, I am considering the top energy producers from natural gas by production, of which a significant part is based on shale gas specifically.

[108] Note that Exxon Mobil acquired XTO in 2009 (Kusnetz 2011).

[109] The firms' engagement with shale gas development is taken implicitly as their preference in favour of shale gas development. Their actions speak for themselves, but their support for shale gas is also clear from public statements (Williams 2012; Dale 2013; Chevron 2015).

and active interest groups, which the ten firms listed above are members of, are America's Natural Gas Alliance (ANGA), the American Petroleum Institute (API), the Independent Petroleum Association of America (IPAA), the American Gas Association (AGA) and the Natural Gas Supply Association (NGSA) (CRP 2016f). In 2015, 784 direct lobbyists plus 482 revolvers (former federal agents now hired by lobbyists) for the oil and gas sector lobby were registered in Washington (CRP 2016f, 2016g). This compares to 307 and 213 for the alternative energy lobby, or 346 and 128 for the environment lobby reported in the same year (CRP 2016c, 2016a).

Another indicative factor to consider is the amount of direct contributions to political parties and committees made by industry groups. For a different comparison, Figure 23 below shows the total amount of money contributed to political parties and political groups by companies from either the oil and gas sector or the alternative energy and services sector (note the different values on the y-axis).

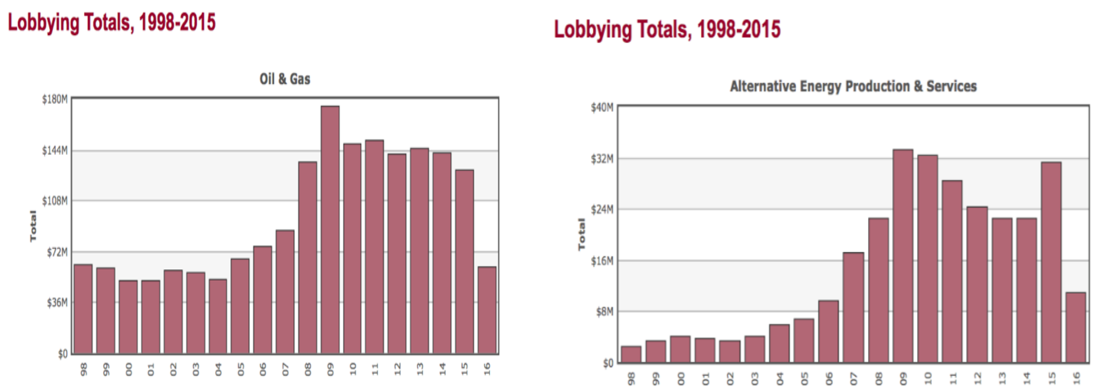

Figure 23: Lobbying Spending Oil Gas vs. Alternative Energy (CRP 2016e, CRP 2016b)

Both sectors have steadily increased their lobbying contributions and both experienced a spike in 2009 (the first year in office of the new administration). Lobbying for renewables decreases slightly after 2009 to spike again in 2015. The difference in funding could indicate both the larger resources disposable to the oil and gas sector, or a perceived stronger need to lobby by them. Given the difference in profiles of the contributors though, such as Koch Industries which has deals in oil, natural gas and shale gas, compared to the Poet LLC, which deals with biofuel, the former is definitely a factor (Forbes 2016; Dolan 2008).

Figure 24 below (CRP 2016e, 2016f) shows the top amounts contributed by oil and gas companies and alternative energy companies in the year 2015-16.

Contributor	Amount
Koch Industries	$8,420,283
Chevron Corp	$4,096,188
Stewart & Stevenson	$3,821,050
Western Refining	$2,607,197
Hunt Companies	$2,604,848
Chief Oil & Gas	$2,477,493
Energy Transfer Equity	$1,920,030
Edison Chouest Offshore	$1,883,662
Ariel Corp	$1,557,100
Devon Energy	$1,536,508
Exxon Mobil	$1,529,051
Otis Eastern	$1,206,088
Occidental Petroleum	$1,105,615
Petrodome Energy	$1,000,000
Kinder Morgan Inc	$958,050
Honeywell International	$906,680
Red Apple Group	$845,775
Freeport-McMoRan	$808,062
Marathon Petroleum	$771,269
Hilcorp Energy	$568,545

Contributions to:
Democrats
Republicans
Liberal Groups
Conservative Groups

Contributor	Amount
Poet LLC	$372,150
American Wind Energy Assn	$186,804
Growth Energy	$139,485
Solar Energy Industries Assn	$91,050
Invenergy LLC	$90,100
Vanguard Energy Partners	$83,100
Iberdrola SA	$81,573
Randlett Renewables	$81,323
Sunpower Corp	$56,904
Abundant Power Group	$48,200
Sunrun Inc	$44,060
NextEra Energy Resources	$36,617
Sunedison Llc	$29,820
National Biodiesel Board	$26,700
Imergy Power Systems	$24,824
Renewable Fuels Assn	$24,641
Cypress Creek Renewables	$24,300
SunEdison	$23,000
AllEarth Renewables	$22,077
EDF Renewable Energy	$21,837

Contributions to:
Democrats
Republicans
Liberal Groups
Conservative Groups

Figure 24: Lobbying Spending by Contributor, Oil & Gas vs Alternative Energy (CRP 2016e, 2016f)

These figures illustrate what appears to be a very strong oil and gas lobby presence based on the aspect of resource transfers. In comparison, the 20th biggest contribution by oil and gas company Hilcorp Energy is still significantly higher than the number one contribution from any alternative energy company (CRP 2016f, 2016c). In terms of sheer numbers in funding and resources, one side of the lobbying issue of gas and shale gas is disproportionately stronger than the other – and if the right conditions are met, this spells lobbying success.

As they present the group most vocally opposed to shale gas exploration, in Figure 25, I include top lobbying contributions by environmental groups (CRP 2016e). They are higher than those for renewable energy. Yet they are several times less in total than those for the oil and gas sector (and remain so even if combined with those for renewable energy). The material strength of the U.S. oil and gas sector and its lobbying arm is crystal clear, even if only top contributors are considered. It is reinforced by the number of private firms lobbying as well as the number of lobbyists registered permanently in Washington. In 2009, the year of recent top lobbying spending for both the oil & gas and the alternative energy sector, spending totals of the former were more than five times that of the latter. In both sectors, the top contributors (Koch Industries and Poet LLC

Figure 25: Lobbying Spending by Contributor, Environmental Protection (CRP 2016e)

respectively) spend more than any other contributors by a strong margin. Koch Industries clearly appears unconcerned by some of the main issues found with shale gas development, as in a joint effort with Exxon Mobile, another key shale supporter, they have been funding research questioning or denying climate change for over a decade (O'Connor 2015). What this data establishes is not as of yet a statement on lobbying success, but a statement about the respective capacity to lobby and the resources spent doing so. Shale gas lobbyists are among America's best equipped.

The discrepancy between lobbying around energy issues is likely influenced by the historical difference in the sector's development. The United States' oil and gas sector was important to the U.S. economy long before the renewables sector became commercially important and before environmental protection became as prominent an issue as it is in the 21st century. While this needs to be taken into consideration, it does not affect the fact that during the time period covered in this thesis, U.S. oil and gas companies together account for considerably more contributions to political parties than the environmental protection or alternative energy sector and lobby do, or in fact the spending of all other energy sectors, coal mining included (CRP 2016d). The oil and gas industry lobby combined is ranked in the overall top ten of lobbying contributors to Congress in the latest 2015-16 cycle; neither renewable energy, nuclear energy or environmental protection lobbying made it into the top fifty (CRP 2016h). Purely considering the material resources available to these lobbies on opposite sides of the energy question, a metaphor around Goliath and David is not unreasonable. According to the theoretical review in chapter five, funding and resources alone do not predict lobbying success, but only in conjunction with other factors such as a focus on quiet politics or good relations with policymakers. I will turn to examining these in the following pages to gain a more complete picture of the type of lobbying expected from the shale gas sector.[110]

Current thinking behind lobbying strategies by industry front groups in favour of continued or increased shale gas development include the notion that any increase of federal or other governmental oversight or regulation in general would lead to significant economic losses (Gardner 2010; Tansey 2014). This is actively lobbied for with senators by companies BP, Shell Oil and ConocoPhilipps, including campaign contributions and supporting votes (Gardner 2010; Kirkland 2010; Mulkern 2011). There is evidence of lobbying through providing information and expertise: lobbying activities reported include the loaning out of experts as well as the funding and drafting of reports trying to reassure the public and officials of the absolute safety of hydraulic fracturing (Gardner 2010). Several of the reports on the environmental and health effects of shale gas provided to regulators by the industry have since been proven to have been misleading or to have included data that was indisputably inaccurate (Lustgarten 2009, 2011).

Shale firms are making strong efforts in order to achieve that shale gas regulation is left up to each individual state, and not coordinated through federal law. The industry members expressively dislike the possible increase in federal oversight (especially from EPA) which it believes would entail stricter regulation (Gardner 2010; Groeger 2012). An active lobby group for shale gas developers is Energy in Depth (EiD), created in 2009, seemingly as a voice to defend the unconventional gas industry from growing criticism. Their website featured especially strong complaints about the movie 'Gasland', a ProPublica investigation, and the New York Times series 'drilling down' (Energy in Depth 2015).[111]

To conclude anything about the relative strength of the pro-fracking lobby in the United States, I briefly consider some of their opposition. Among the most vocal in the U.S. anti-fracking movement are the environmental groups Greenpeace and Friends of the Earth, who are very active with reports and organised protests; but a brunt of the opposition is

[110] In earlier stages there were some reports about the expected lobbying efforts against shale gas by the coal industry, arguably a power player in many countries, or Gazprom in Europe (Behr and Marshall 2009; Buisset, Øye, and Selleslaghs 2012). There has not been much follow up to these reports however.
[111] EiD was lambasted by climate change activists on a news gathering website called 'DeSmogBlog' due to what the activists considered misrepresentation of interests. According to them, EiD only revealed itself as representing small, independent natural gas producers, and not big firms (Energy in Depth 2015) – but a leaked industry memo revealed that in fact it was created as part of a giant lobbying campaign and with funding from some of the industry's biggest names indeed, including BP, Halliburton, Chevron, ExxonMobil and Shell and the above mentioned API and IPAA, who are considered EiD's founders (deMelle 2011). These are now mentioned on the website, but only after the criticism; none of them were acknowledged by the EiD on their website until after the memo leak and ensuing controversy (DeSmogBlog 2015; Energy in Depth 2015).

by smaller, local groups. The website Americans Against Fracking, which is both an active campaigner as well as a national coalition bringing together many smaller groups, counts hundreds of various campaigns (AAF 2014). Amongst them are big national lobbies such as The Other 80%, Environmental Action and Food and Water Watch, but also seemingly unconnected national groups such as Watchdog Progressive, which is more interested in the aspect of lobbying shale gas than concerned with shale gas, or Breast Cancer Action, and Democracy for America (AAF 2014). There are even more state level groups such as Arizonians against Fracking, 350 Silicon Valley, FracDallas or Chefs for the Marcellus (AAF 2014). Considering the story of fracking development in the United States, they have rarely been victorious – there are hardly reports of such victories, in any case. There are several exceptions, one of which is a ban on fracking lobbied for in New York state. Just like their opposition several of the anti-fracking groups have misrepresented concerns over fracking, either through engaging in a debate that is more emotional than political or scientific, or through exaggerating the dangers of fracking (Richardson 2015). Republican and Democratic legislators have had several in-house arguments over the quality and integrity of scientific data on hydraulic fracturing (Richardson 2015). But little change is notable to date. The anti-shale gas lobby has been found successful in their aims at a point where they had the opportunity to provide their own in-house experts: in New York State a state-wide fracking ban was based on a study that was conducted by anti-fracking groups and peer-reviewed by three known fracking opponents (Richardson 2015). The data was contested and decried as 'biased' publicly by the EiD. The EiD in turn itself was found in a report by the Public Accountability Initiative to "distort science to deceive the public and policymakers" (Richardson 2015). This further goes to show that contact with policymakers and provision of experts is very helpful for lobbying, and that such lobbying is common place around the issue of shale gas. The opposition to shale gas just has not done so or has not had the chance to do so as frequently as the supporters of it – if they did, this would likely be public knowledge, as shale gas supporters were quick to point fingers in the New York State case. The provision of biased experts has shown positive for lobbying in the case of shale gas as it has resulted in favourable legislation for both the pro-fracking and anti-fracking lobby. There are just less reports of anti-fracking experts involved in drafting regulation, therefore in most states, shale gas supporters have gotten their way.

My analysis for this part of the chapter finds that there is evidence of favourable conditions for lobbying on the side of shale gas in the United States. The literature review was divided on the influence of resource capabilities on lobbying success, but confirms this to matter when the good lobbied for is private and when the lobbying occurs in quiet, not high politics. As shown, both is the case in the shale gas story. In terms of funding and resources the oil and gas sector is substantially stronger than the renewable energy or environmental sector. The lobbying forces that favour continued, expanded and unhindered shale gas exploration in the United States, both industry and lobbying firms, are amongst the country's strongest and historically most successful interest groups. This suggests an advantage for their lobbying success.

VI.1.1 Lobbying and institutions of the United States energy sector

In the United States, there is a history of doubts concerning the influence of industry pressure groups on energy policy, especially regarding generous regulation around the fossil fuel industry.[112] There are many examples of favourable treatment of the industry within the timeframe covered in this thesis. During the Bush administration the 2005 *Energy Policy Act* was passed which included several regulations favourable to the development of shale gas in particular (United States Congress 2005). The exemption of fracking from the *Safe Water Drinking Act* was expanded in it, for example by excluding from the definition "underground injection" all "underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities" (United States Congress 2005, 119 STAT. 694). This covers the main process of hydraulic fracturing injection, which has raised many concerns about environmental damage and the effects on human health, and basically excludes it from environmental tests. Amongst other things the Act set out that a variety of fracking operations, depending on history or size of the gas field, no longer require an environmental impact of a statement as originally provided by the 1969 National Environmental Policy Act (United States Congress 2005, 119 STAT. 748). It also excluded oil and gas wastes from a list of hazardous wastes. Waste disposal has caused serious concerns about fracking, more so than with conventional gas, and it is allowed to go unchecked for the time being.

G.W. Bush and Cheney in particular received much criticism for what was seen as catering to entrenched fossil fuel interests and their aggressive approach to using domestic fossil fuel resources – especially through the energy task force headed by Cheney (Pasternak 2001). Regarding the 'Halliburton Loophole', which concerns the extended exemption of

[112] There has been a longer history of shale policy and regulation in the United States than in the United Kingdom, hence it is necessary to look at two successive administrations with regards to their shale gas attitudes.

shale gas and fracking from the Safe Water Drinking Act in 2005, one former EPA official who co-wrote the exemption later agreed that it “went too far” (Lustgarten 2011). Evidence emerged that in its draft version, a 2004 study by the United States Environmental Protection Agency (EPA 2004) acknowledged fracking-related threats to drinking water and underground water, yet in its final version these had disappeared (Urbina 2011b). The study concluded that there was little or no threat at all to water supplies, raising concerns about the independence and integrity of its content. The change was later confirmed by an employee of the agency, citing a strong influence by the respective industry and hence political pressure to remove the stronger warnings and hesitation form the report (Urbina 2011b). Beyond that the report focused mainly or almost exclusively on the injection of the fracking fluids but not on the other connected stages of the fracking process, which chapters two and four showed have a considerable, equally or more harmful environmental impact as well. An EPA whistle-blower, Weston Wilson, stated that five of the seven peer-reviewers involved in the EPA study that allowed it were current or recent former employees of the shale gas and gas industry (Urbina 2011b): a good example of lobbying through the provision of personnel and expertise. One cannot accurately establish how many more similar instances have taken place, as it took a whistle-blower to reveal this one. Altering the specificities of a report which then clarifies favourable shale policy as part of a larger bill is also of course part of an action taken in quiet, not high politics: there is little public salience and attention to it. Despite hopes for the Obama administration to tackle the issue, any attempt to close the so-called Halliburton loophole, which also exempts fracking companies from having to disclose the chemicals and other ingredients injected in the process, has been refuted (Cunningham 2013). To remedy this legal exemption would have to grant the EPA greater oversight over hydraulic fracturing. There was little doubt from the very beginning of the Bush presidency that both Bush as well as Cheney and his energy task force, which made said policy decisions, were very close to industry leaders (Pasternak 2001; Doggett 2010). The 2005 Energy Policy Act overall appears not strongly environmentally concerned (United States Congress 2005). Clearly, major lobbying on behalf of private pro-fracking interests can be established to have taken place in the United States.

The Obama administration until early 2016 was also known for comparatively strong support of the natural gas industry, if not decried as overly gas industry friendly the way Bush and Cheney were. Analysts suggested that President Obama meant for natural gas to replace the environmentally even more harmful coal, which it has not, but either way, that his administration was "fully embracing" gas (Cunningham 2013).[113] Obama's administration warned of health and environmental concerns more openly than their predecessor by saying "the technologies aren't as developed as we'd like and so there are some concerns" (Berman 2011). This is quite late, as shale gas development was already in full swing. These concerns are still around and research results are gathering that declare them as valid, yet until 2016 little has been done to mitigate them. In the first months of the Obama presidency there were intentions to tighten regulation for fracking as well, which were taken seriously enough by the industry. This shows in sharp political replies, amongst them the president of the API warning that Obama's minister of the interior, Ken Salazar, would make it "difficult to produce American oil and gas, put more Americans back to work and help restore our nation's economy" (Doggett 2010). Salazar early on in his term announced he would no longer accept the major gas and oil industry as "the kings of the world" they were (to him) under the Bush administration, where they could "walk in and take whatever they wanted" (Doggett 2010). Clearly, from his position he saw evidence of pro-shale lobbying, too. Lobbying in favour of shale persisted during the Obama administration with quiet politics and legislative drafts introducing rules that favoured shale gas. The EPA had planned to call for a moratorium on fracking in 2010 as attested for by one leaked regional briefing and a separate leaked draft by EPA official Philip Sweeney: yet this particular part of a bigger EPA recommendation document was completely removed before being sent to legislators (The New York Times 2011, 442).[114] More recent drafts by the EPA on a national study on fracking were altered several times, until for example some plans of radioactivity tests for drinking water and plans for studying toxic fumes released during drilling were dropped entirely (The New York Times 2011, 260).[115] Small reforms were undertaken, assigning a more active role for the Bureau of Land Management rather than the industries itself in selecting land to drill for example, and holding back or overturning several leases. Yet nothing changed majorly under the new Democratic presidency, as the fracking phenomenon was well underway when Obama took office. Congress put pressure on Salazar to abandon ideas of increased federal oversight over gas production; the House Energy and Commerce Committee also criticised the plans of further regulation, saying that in the current climate it would be too

[113] "Sometimes there are disputes about natural gas, but let me say this: We should strengthen our position as the top natural gas producer because, in the medium term at least, it not only can provide safe, cheap power, but it can also help reduce our carbon emissions" (Obama 2013).
[114] When asked why this happened, an agency scientist replied with the simple statement: "politics" (Urbina 2011b).
[115] In the vast amount of documents from EPA leaked by the New York times in 2011, one can also review several rather direct letters of pressure from political officials to EPA administrators, particularly around the time of the national study planned in 2010, the scope of which they sought to undermine (The New York Times 2011, 407).

difficult to "oppose growth", which they claimed shale gas would deliver (NGI 2011). The above-mentioned criticism and new investigations lead to somewhat of a change of tone in the Obama administration's treatment of fracking as well as to new federal regulation. In March 2015 new regulation was presented, designed to increase drilling safety (Davenport 2015). EPA is the key agency concerned with overseeing environmental issues of fracking: however, the EPA, as mentioned above, has in fact very little jurisdiction over fracking operations. This is both because they are exempt from major environmental protection bills and because their regulation largely remains state business (Urbina 2011b). The difference between federal land and state land is important, not least because a lot of state legislation could be considered quiet politics. On federal land, slightly stricter rules for drilling were introduced by Obama's administration in 2015, but almost none of the shale operations take place on federal land, and state regulations are unaffected by these new rules (Davenport 2015). At the time, officials expressed hope that the new federal regulation, which includes the disclosure of chemicals used as well as inspections of wells, will serve as standard for state legislation but there is no mandate whatsoever to force the issue (Davenport 2015). API has filed a lawsuit against the regulations which it called "a reaction to unsubstantiated concerns" (Davenport 2015). The new rules were in fact struck down by a federal judge in June 2016, stating this was not to do with shale gas but that the interior department had no authority to make such a rule (Jopson 2016).

Lobbying shale gas is not limited to Washington. America's Natural Gas Alliance made generous donations to ASGK Strategies, a consulting firm favouring gas, several Democratic Party as well as Republican Party affiliated PR firms, and Adventures Partners, a company producing education curriculums and classroom materials which promote natural gas use (Fang 2013). ANGA also made several major donations to media outlets, amongst them Bloomberg, the Texas Tribune, the Environmental Media Association and the National Journal (Fang 2013). The web of interconnection between different energy companies, private institutions and not for profit advisory bodies is substantial, and hard to gain an overview of. ANGA is a due-paying member of the American Legislative Exchange Council (ALEC) since 2013. ALEC is another powerful player on the state level, private and corporate funded yet non-profit and tax-exempt (ALEC 2015). "There is no doubt that corporate sponsors are getting what they pay for: the ears of decision-makers whose decisions will have a direct impact on their bottom lines" (Ben-Ishai 2012, 23). ALEC is a particularly effective lobbying group as it mostly targets state level legislators, who are often ignored by the public in favour of federal politics – so much so that in the 2014 by-election an estimated 25% of state legislators ran unopposed for their seats (Mokhiber 2013). But they are certainly not ignored by the shale gas industry as most fracking regulation happens at state level. In fact one in four state legislators is a member of ALEC according to a recent report, and ALEC prepares many drafts for legislation (Oliver 2014; Parti 2015; C. Taylor 2016). One bill targeted was the omnibus Electricity Freedom Act, for which ALEC prepared a statement including the phrase "BE IT THEREFORE ENACTED that the State of [insert state] repeals the renewable energy mandate" (Powell 2014).[116] ALEC is an evident example, but not the only lobby of its kind. In the particular case of fracking, an important role is also played by the National Conference of State Legislatures (NCSL)[117], or the United States Conference of Mayors (USCM)[118] (Ben-Ishai 2012, 34). They all cultivate relations between policymakers and private interests and create a very rarely publicised web of interest access points. This reinforces the role that lobbying resources play in determining lobbying success.

Returning to insights gained from the previous chapter on what constituted lobbying success in other case studies, the information laid out above confirms an image of closeness between the pro-fracking lobbyists and policymakers. The pro shale gas lobby appear to be on good terms with regulators and form part of in-groups which have decided energy policy in the past. They are closely interconnected with successful lobbying groups, especially at state level. Another indicator of a winning lobbying strategy, the focus on quiet politics, is also visible in the efforts of the shale gas lobby. Members of lobbying bodies such as ALEC have proven very successful at influencing regulation at state level, quietly.[119] Lobbying through the provision of experts to help write regulation is also confirmed to have occurred in favour of fracking, specifically to water down environmental legislation. The sector has enjoyed close connections with policymakers in the past, and seconded its own lobbyists to draft legislation. Their opposition does not compare to the power, access and influence of the fossil fuel and gas lobbies in the United States. Taken together, these signs indicate that the gas and shale gas lobby are well situated for very successful lobbying of their goals.

[116] This pre-prepared legislative draft was made famous by a lawmaker in effect forgetting to insert the name of his own state (Powell 2014).

[117] of which ANGA is a "Platinum Sponsor" and AGA is a "Gold Sponsor" (Ben-Ishai 2012, 28ff)

[118] of which ANGA is also a member

[119] ALEC is strongly backed by the shale gas-friendly Koch Industries: one of their latest joint lobbying efforts is to turn revealing the chemicals in shale injections into a criminal offence for doctors, first responders or public health officials (Coleman 2014).

This section confirms that lobbying efforts by fracking supporters have shown results, especially through close relationships with policymakers. Rather than attempting to steer high politics – not that there so far was any substantial threat of a moratorium on fracking – lobbyists have focused on the specifics of regulation. For example, the exceptions to environmental legislation that were gained for the process of hydraulic fracturing in the 2005 Environmental Policy Act can be considered a major success for the industry.[120] Concerns about the fracking process were conveniently taken out of an official EPA report due to pressure from the industry. Through keeping shale regulation on a state rather than national level, the shale gas lobby has further helped along its goal to prevent the details that matter to their clients from turning into a coordinated or high politics issue. Corresponding to the conclusions of the literature review on private interest pursuit, lobbyists for fracking have engaged by providing expertise and personnel. Important regulatory successes for shale gas were achieved through the secondment of current or former gas company employees to draft legislation and close connections with legislators.

Following the select specific examples above of how shale industry members have been spotted to provide expertise to policymakers, the following more comprehensive overview of connections between the industry and its regulators consolidates the impression of closeness. This overview was gained using Boardex, a subscription business intelligence tool designed for networking and possibly lobbying as well as new business development (BoardEx 2016). It has also been used as a source of data for academic research in areas such as boardroom process, corporate governance and corporate connectivity. Boardex contains intelligence such as in-depth profiles of over 700.000 global business leaders as well data on the relationships between these leaders, their companies and staff with one another, all of which is updated frequently (BoardEx 2016).

The Figures 26 and 27 (BoardEX 2016)[121] show the connections one finds when cross checking for first degree and second degree links between government and larger interest groups with BoardEx. First degree connections imply that a person has direct ties to both bodies, for example Centrica and the DECC, because they work for one but sit on the board or expert advisory panel of another, or they used to work for Centrica and now for the DECC or vice versa.

120 To recall, a major advantage of the regulation is turning shale gas waste products into a non-issue. Research has shown that it is often the aftermath of fracking, for example the re-introduction of waste waters into the ground, that are responsible for serious environmental and health hazards. Yet at the moment, any oil and gas wastes escape regulation through a blanket clause excluding them from the definition of hazardous waste and therefore do not have to comply with any standards for ensuring safety or allow independent testing of their (waste disposal) activities.

121 Data is in Appendix.

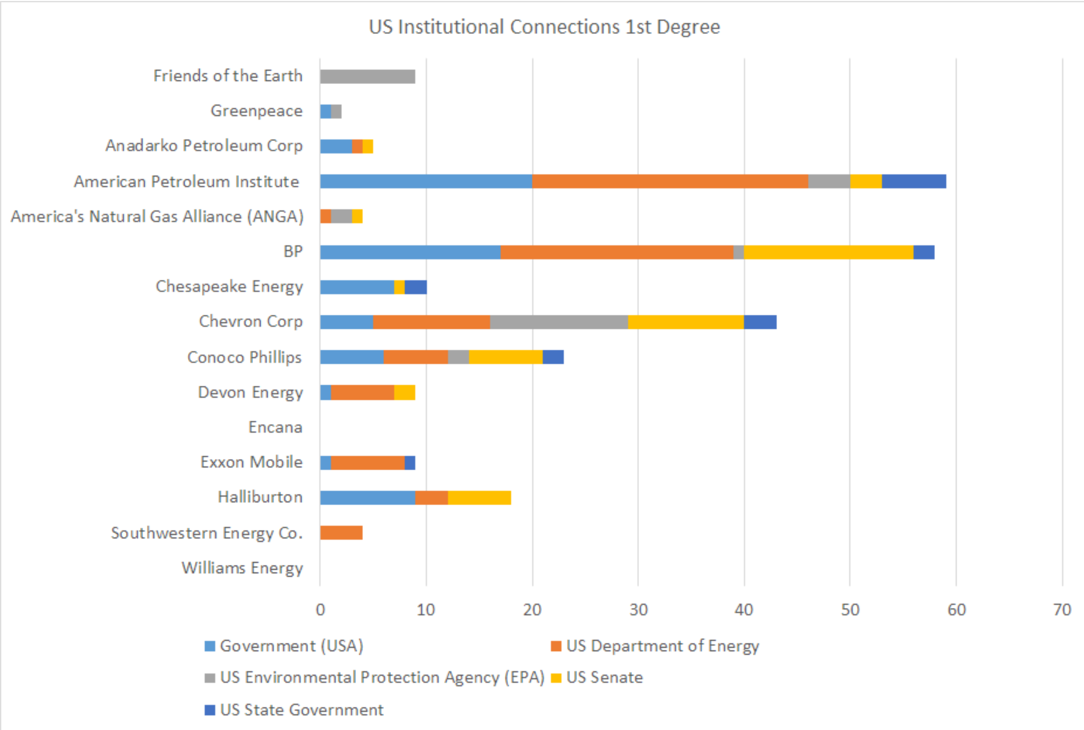

Figure 26: Industry and Policy Institution Connections, 1st Degree U.S. (BoardEx 2016), own design

Looking only at first degree connections, there are notable variations between different energy companies and lobbies. More notable is a difference between the pro-shale interests in comparison to the anti-shale lobbying groups. The gas companies BP, Chevron and Exxon Mobile all have multiple direct contacts in the current regulation, especially within the DoE. So does the lobbying institute API. Most major pro-fracking groups are represented. The connections include current ambassadors to the DoE who were previously executives at BP, or a current advisor to the DoE who is still currently a chairman of Royal Dutch Shell, or a current consultant at the API who is also a consultant for the EPA (BoardEX 2016). The previous director of API is also currently a chairman at the DoE (BoardEX 2016). Greenpeace is almost not represented, and FoE are exclusively represented in the EPA – a body that as discussed has little authority on fracking matters. This reconfirms the above made conclusion that there are close connections between industry and policymakers, which theory shows us has positively affected lobbying results in the past. The first-degree saturation of governmental bureaucracies with members of the oil and gas industry or the industry's lobbying arm suggests that there is much movement of personnel between regulators and those whom they are tasked with regulating. This suggests a revolving door scenario, and a potential for regulatory capture. The more employees of the gas industry work in regulating the gas industry, the more this regulation is likely to favour the gas industry. The level of interaction noted and especially the one-sidedness of the revolving door issue leads me to contemplate the potential for cultural capture as well. If as much exchange occurs between the oil and gas industry and the legislative, it is absolutely possible that policymakers genuinely come to think that whatever benefits the gas sector must be overall beneficial to the national economy. This is a hypothesis I cannot confirm easily but that is suggested by evidence considered; and nothing validates the suspicion that a similar situation of cultural capture exists for contact with the alternative energy and environmental lobbies.

Figure 27 (BoardEX 2016) below shows the second degree connections. A second-degree connection means that members of the government are currently directly working with or have previously directly worked with members of the lobby in question, either in committees or working groups or for previous employers, and are therefore connected. Necessarily this overview is not as significant as the first-hand connections, but sharing relationships through current or previous work connections of course adds to the aspect of closeness and relationships that exist between regulators and those regulated.

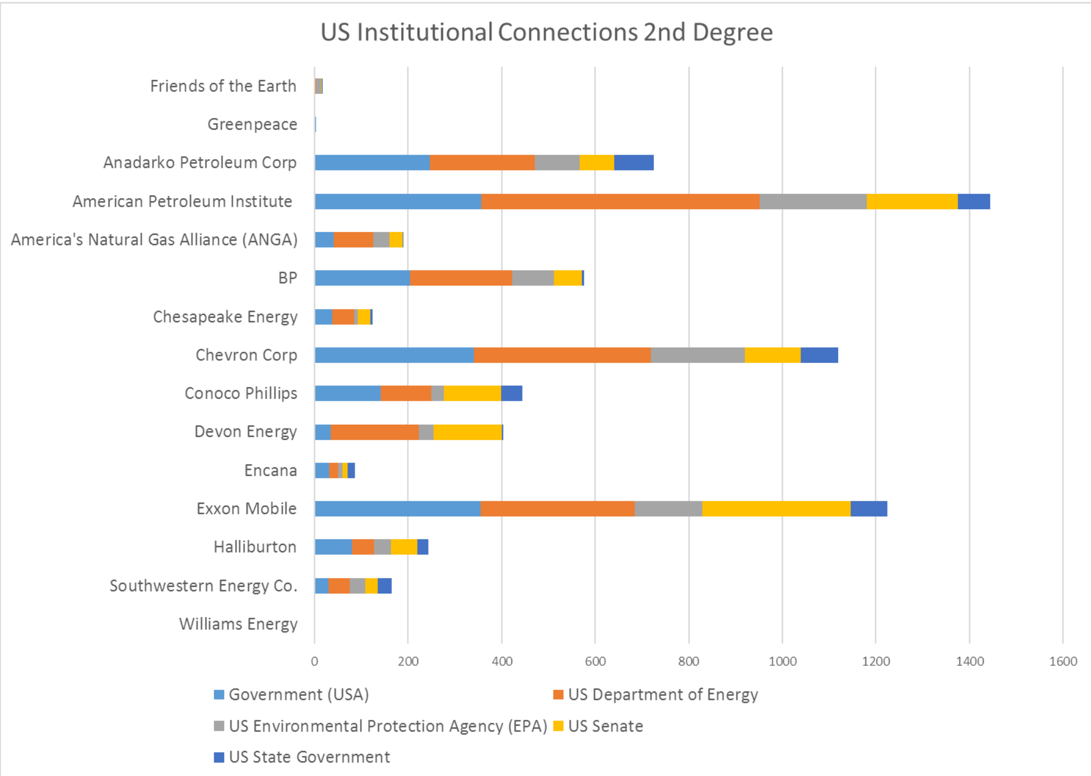

Figure 27: Industry and Policy Institution Connections, 2nd Degree U.S. (BoardEx 2016), own design

This second degree shows the same trend of discrepancy yet with a much larger margin between the number of connections made for the gas lobby as compared to its opposition. The connections are however less significant than first degree connections because they include differently strong connections: if an EPA official works closely together with a Devon Energy chairman in an institute of City Council for almost a decade, this is stronger than a connection through a working group that lasted only a year. Still, Greenpeace and Friends of the Earth, two major opposing parties to fracking development, do not remotely compare in their numbers within the legislative. The two biggest groups lobbying against fracking have connections to policymakers that account for a fraction of the ones enjoyed by their opponents. Numbers overlapping with them include both trustees and employees but also, mostly, simple members of the group, so the number of connections should be higher than those with a company which does not offer such easy membership status.

The results further suggest that my second narrative of private interests is more likely to explain government decisions in favour of fracking in the United States. Having close working relationships and connections with policymakers has helped in lobbying other causes in the past. In the United States, employees of several of the selected biggest gas companies with interests in shale gas as well as other shale gas supporters have used the revolving door between regulation and industry or continue to work for both sides. I argue that a decision in favour of favourable shale gas policy is highly likely to have resulted from the fact that many of the officials tasked with it have interest or work connections with shale gas. The many reports of lobbying activity are to me a much more plausible reason for the expansion of shale gas development than its value to the U.S. economy.

The oil and gas interest groups have a long history of powerful organised lobbying spanning at least four decades (CRP 2016b). Their lobbying personnel is much more numerous and their lobbying spending much higher than that of energy competitors and environmental lobbyists. The analysis shows that they have established long term and regular connections with policymakers, which the theoretical review revealed as a key factor in lobbying success (Baumgartner et al. 2009; Godwin, Ainsworth, and Godwin 2013). Since they apply, resource strength, which is considerable with the pro-fracking lobby, also impacts the success rate. The alternative energy and environmental lobbies are younger, with fewer full time and revolving lobbyists, and to all appearances with less embedded connections with policymakers and regulating agencies. The loaning of experts to draft legislation has proven successful for both the pro and anti-fracking lobby; yet there is so far only one report of state level regulation the latter have won through such methods, whereas shale gas supporters have gained several exceptions from national environmental legislation through this tactic. The revolving door practice is certainly an issue for the energy regulation and the gas industry, strengthening the potential for regulatory and cultural capture. To sum up, the oil and gas industry, a majority of which now is interested in fracking, clearly has a considerable level of access to and support from governmental institutions, more so than their opponents. Grasping all of these developments together, in this chapter I find strong evidence of successful lobbying strategies employed by the U.S. shale gas industry that have led to desired results, a clear disadvantage for the fracking opposition, and a confirmation of indicators for lobbying from the theoretical review. For my thesis, this provides a plausible addition to the shale gas story and appears likely to have significantly impacted pro-fracking policy decisions in the United States, substantiating the theoretical claims of my second narrative.

VI.2 Lobbying fracking in the United Kingdom

After considering pro-fracking interest groups in the United States, in comparison I now identify and assess the private groups that are in favour of commencing or expanding shale gas development in the United Kingdom, according to their own statements or publicly available evidence. The situation of shale and therefore shale lobbying is clearly different to the U.S. case, as there has of yet been no commercial fracking for shale gas in the UK (July 2016) and less concrete data on lobbying is available.[122]

UK energy companies have actively moved to learn from their U.S. counterparts, asking for experience and hiring specialist workforce from successful U.S. shale operations (Hellier 2015a). For the purpose of this thesis I am counting as the primary private interest groups in favour of fracking the top companies that have applied and received licenses for fracking from the UK government and are considered worthy of mentioning by more than one author (Gosden 2015c; Hellier 2015a; Howard and Hellier 2015; Shale Gas Europe 2016). That list includes Ineos, Cuadrilla, IGas, Total, GDF Suez, Hutton, Egdon, Aurora, British Gas and Centrica.[123] In 2016 the only company with consent by the Oil and Gas Authority (OGA) to undertake hydraulic fracturing in the UK is Cuadrilla, which is also likely the most prominent name in the pro-fracking lobby group (Dias 2016). This is mostly due to media coverage of an earthquake caused by Cuadrilla's test drilling for shale gas which prompted a short-lived moratorium on fracking (White 2011). Cuadrilla's

122 One might conclude that lobbyists in favour of fracking have not achieved the same levels of success as their U.S. colleagues, as there still is no commercial fracking in the UK. But that would be too simplistic, as the opportunity of shale gas in the UK only manifested itself later in time than in the U.S., partly inspired by U.S. experience. Furthermore, the UK's and relevant EU regulation around environmental standards for gas operations was more detailed and more difficult to shift to begin with, as the following analysis will show.

123 Until summer 2016, no licenses have been granted in Scotland or Northern Ireland, which have banned fracking (Williamson 2015; Brooks 2016). The situation in Wales is undecided but there have not been any licences rewarded for shale gas yet and a moratorium is still in place (BBC News 2015).

chairman Lord Browne has not been exclusively enthusiastic about shale gas prospects, stating that he wants to commence fracking operations and has been held back by regulatory impediments, but that he could not predict the contribution of shale gas to the UK (Carrington 2013b). He appears to reject most environmental concerns about fracking, and was previously reprimanded for failing to disclose damages to Cuadrilla's Blackpool well that could have negative impacts on the environment (Carrington 2013b). Another key figure in the shale industry much more eager about promoting shale is the chairman of Ineos. He repeatedly claimed that fracking was needed to keep the British economy competitive, and that there would be a shale gas "revolution" in the UK (Hellier 2015a, 2015b).

It is much more difficult to provide an overview of UK lobbying on shale gas than U.S. lobbying because UK regulation on lobbying is very different and there is no acclaimed comprehensive third-party source of statistics about lobbying spending and lobbyist activity. The statutory lobbying register introduced by the Conservative and Liberal Democrat government does not in fact require a disclosure of all lobbying spending, nor does it actually register a majority of lobbying activity (Who's Lobbying 2012; Parliament Publications & Records 2013).

The thought that energy policy in the UK may be influenced by specific powerful interest groups from within the energy industry is not novel (Mitchell 2013). A concern raised about the British energy sector and the DECC in particular is the amount of experts on loan that it draws from major energy companies, mainly because certain companies' secondees far outnumber others (Mitchell 2012; Carrington and Sparrow 2013). This includes secondees from Centrica, Conoco Philipps and Shell; the highest number of employees or experts from any one company involved in advising and drafting policy in the DECC are from Centrica/British Gas, who have a considerable interest in shale gas exploration in England (Mitchell 2012; Carrington and Sparrow 2013). This is a clear example of a lobbying strategy deemed highly successful in the literature on interest power, namely the provision of information and experts. Lobbying practice around the UK energy sector has previously been the topic of criticism, and plenty of recent criticism is specifically generated by anti-fracking campaigns which consider the government and pro-fracking lobbies to be severely entrenched, or captured (Leftly 2013; Carrington and Sparrow 2013; Carrington 2014a; Mason 2014). A problem with allegations of favouritism or regulatory capture in lobbying is always that, if there are no unforeseen leaks, instructions to such expert consultants and the discussions held at meetings remain entirely confidential and unreported.

What can be said in favour of the sceptics is that the lobby register proposed and enacted by the current UK government is least helpful in this situation. This is because only consultant lobbyists, a minority in the industry, need to be disclosed in it, but in-house lobbyists for firms do not, and neither do firms whose main business is not lobbying, even if they engage in it successfully (UK Parliament Publications & Records 2013).[124] It is only a specific image of lobbying that is encompassed by UK legislation: as one unnamed director puts it, "at this time, at least according to the Government's bill, no lobbying has been done. If there is no contact with ministers – even if we've arranged for clients to see ministers unaccompanied – nothing has happened. So 95% of what we do is irrelevant" (Cusick 2013). Amongst the actions not necessary to register are therefore: policymakers having direct contact with industry figures, professional bodies, former ministers with influence, select in-house committee members or advisers; or lobby-steered agenda setting and choreographing, even information providing to Whitehall and to specific ministerial meetings (Cusick 2013). This is the case without documentation or transparency as long as the meetings are not attended by the registered lobbyists. For an example of how this worked in favour of pro-shale lobbying, in late 2011 a round of meetings to discuss fracking with senior ministers in the Department of Energy and Climate Change was put on the agenda and organised by Lord Brown, chairman of drilling company Cuadrilla and formal non-executive advisor to the Cabinet Office (Cusick 2013). Cuadrilla is furthermore understood to have contacted the Treasury, to have drilling company corporate affairs consultants and gas company employees help write legislation (Carrington and Sparrow 2013; Cusick 2013).[125] According to the UK lobbying register discussed above, no lobbying took place and there is no official record of any lobbying efforts regarding these actions by Cuadrilla. This is an excellent example of lobbying through quiet politics and lobbying that stays hidden and elusive to the public or anybody outside a select circle.

Despite the UK's lobbying register aimed at detecting only professional lobbying bodies, regarding shale gas, there is not much information available from the government on their activities either. One has to turn to investigative journalism NGO Spinwatch for that (Jones and Rowell 2015). Lobbying firms Edelman, Burson-Marsteller, Hill & Knowlton, Bell Pottinger and Weber Shandwick were all hired by fracking companies, including

[124] There are attempts by NGOs to decipher who is lobbying the UK government by tracking what these firms are spending on lobbying in the U.S., as there is no comparable data (Who's Lobbying 2012). This of course also renders it impossible to provide a comparison about the lobbying spending by renewable energy firms – yet there is hardly reports about this, suggesting it may not have reached levels that pique public interests.

[125] Cuadrilla is also known to have contacted a select group of academics and journalists for their cause (Cusick 2013).

Cuadrilla, Ineos, or North West to influence the UK government. The practice of the revolving door is at its most visible in the UK shale industry in this context: all of the above mentioned lobbying firms have either employed ex-regulators or some of their former employees now work in government jobs (Jones and Rowell 2015): for an example, this includes the energy adviser to Cameron, Ms Singh, who was previously chief lobby strategist at Centrica – her predecessor left to advise Riverstone Holdings, who own a major share in Cuadrilla.

The lobbying strategies deemed successful throughout the theoretical review of lobbying are all notably in action in this example of fracking lobbying for the UK case study. No such report exists about meetings with the fracking opposition. The lobbying is conducted as subtly as possible, in quiet politics and through the provision of expertise: current UK regulation on lobbying favours this kind of approach. In-house lobbyists are not registered, so one cannot begin to estimate how much lobbying has been conducted through those.

Given that most of the specific regulation of Britain's gas production and environmental legislation is in fact dependent on European law, it is necessary to also consider lobbying for shale gas on the European level. Cuadrilla, Total, IGas, Ineos, GDF Suez (Hellier 2015a) are represented by Shale Gas Europe, Euro-Gas, EEF, Europia and Concawe (Tansey 2014; Warren 2013), which are actively involved in lobbying at the European Union level (Buisset, Øye, and Selleslaghs 2012; European Commission and European Parliament 2016). Business Europe is the main representative organisation for European employers and represents Total, BP, Cuadrilla and other companies with stakes in the shale gas industry (Business Europe 2015). It has lobbied members of the European parliament (MEPs), for example to vote against mandatory environmental impact assessments for shale gas, ahead of several key votes on energy legislation (Business Europe 2013). The group also lobbied to prevent the introduction of obligatory independent reports on environmental impact, insisting that gas developers should be allowed to prepare those reports on their own (Business Europe 2013). Business Europe lobbied to exclude the concern of climate change in environmental impact assessment because of 'legal uncertainties' around climate change as well as ensuing cost and time burdens they did not consider justified (Tansey 2014, 7). Their specific voting recommendations to MEPs in my judgment seem to directly oppose their official commitment to environmental, sustainable goals (Business Europe 2015). Another very active lobby is the International Oil and Gas Producers Association (OGP) which represents, amongst others, firms that frack in the United States and are interested in fracking in the UK: Total, GDF Suez, BP, Chevron, ExxonMobil, ConocoPhillips. The company has produced several fact sheets which include dubitable and unproven statements about shale gas stated as facts, such as that it will not affect support for renewables, or that it will increase GDP and job growth, as well as blatantly false statements, such as the claim that "there has been no case of hydraulic fracturing operations contaminating drinking water resources" (Tansey 2014, 8). It is entirely unlikely that at the point of publication, OGP officials were unaware of all cited cases of water contamination, or had any proof of other claims they made. Shale Gas Europe produces fact sheets which include inaccurate information such as "it can be conclusively demonstrated that none of the claims of environmental harm commonly levelled against hydraulic fracturing stand up to close scrutiny" (Tansey 2014, 9). The manufacturer's association EEF[126] also lobbies for shale gas and in turn is known for its closeness to MEPs and special cultivation of relationships between legislators and lobbyists, providing both funded dinners and lunches as well as briefings for MEPs, and in general giving representatives of the gas industry access to MEPs (Tansey 2014). Also on European Union level there is a new network called the *European Science and Technology Network on Unconventional Hydrocarbon Extraction (ESTNUCE)* which is part of the European Commission's in-house science and research services (EC JRC 2015). Advisory groups which form part of the Joint Research Centre (JRC) have been previously heavily criticised for intransparency and industry links on several occasions, and the European Parliaments chose to freeze the ECJRC's expert group budget twice in four years due to concerns about corporate domination of these groups (Corporate Europe Observatory 2014b; O'Reilly 2014). A problem with this new advisory network on shale gas is that of its 74 members, 60 are not direct members of the Commission but advisors, and more than 40 of these (over 70% of the advisors) are either direct representatives of the shale gas industry or have financial stakes in it (Corporate Europe Observatory 2014a). Shale Gas Europe is one of the groups involved, as are employees of Total, Shell, ExxonMobil, GDF Suez and Cuadrilla, companies which are listed as 'external beneficiaries' of the group (Corporate Europe Observatory 2014a). The academic and research institutions represented in the JRC unconventional gas expert group also have ties with the industry, such as the Oil and Gas Institute Krakow, the University of Mining and Metallurgy Yale, as well as individual academics who have spent part of their academic career working for Chevron or Shale Gas Europe (Corporate Europe Observatory 2014a). Four of the five chairs of the group hold senior positions with conflicts of interest: at Cuadrilla,

[126] They were formerly known as the Engineering Employers' Federation

ConocoPhillips, at the Polish Geological Institute, another strong fracking supporter (Corporate Europe Observatory 2014a), and at the Institute Français du Pétrole et des Energies Nouvelles (IFPEN), which has strong oil and gas industry links and has campaigned to lift the French moratorium on fracking. The fifth chair is from the UK Environment Agency, which has also broadly supported fracking, dismissed or downplayed environmental risks and is headed by a former Cuadrilla advisor (Mason 2014). Clearly, an established network for lobbying policymakers exists to advance the case of shale gas for the UK in the European Union, which sets many of its environmental standards[127]. So far, no commercial fracking has occurred on UK soil, which makes the amount of preparation through lobbying regulation appear as very thorough planning by the industry. The fruitful tactic of lobbying quiet rather than high politics has been employed by firms that wish to frack in the UK. There are no notable reports of active fracking lobbying in terms of vote swaying around the time of the English or Scottish moratorium on fracking. However, there are many reports of lobbyists providing expertise, information and personnel to the bodies that end up deciding on fracking safety regulation. Another condition mentioned by the literature for the success of lobbying, keeping up close relationship with policymakers, is also high on the agenda of the pro fracking lobby and has been mostly achieved on EU level, through funded dinners for example. The evidence is abundant for both, close relations between interest groups and policymakers, and the provision of information and expertise to policymakers by lobbyists. This in turn means that resources play a role – and the shale gas supporting UK gas industry has created a lot of wealth for itself (Maidment 2006; Jones and Rowell 2015).

To provide a comparison, let me consider the main opposition to fracking in the UK. Major opponents of fracking in the UK are the environmental lobbies Greenpeace and Friends of the Earth, the same ones as in the United States, as well as the newly-founded Frack Off lobby which combines many smaller groups. These three were involved in organising the high-profile Balcombe protests. There are also numerous local groups against fracking, such as Ribble Estuary Against Fracking, Frack Free Fernhurst or Residents Action on Fylde Fracking[128] (Melley 2011). Many of these campaigns have emotionalised the protest against fracking considerably, painting the industry as the ultimate evil and claiming there to be scientific consensus on its harmful environmental and economic effects (Mathiesen 2015a). Given the connections some of the pro-fracking lobbyists enjoy it is understandable that many in the public and media observers are

[127] (until now, not considering Brexit).
[128] https://www.facebook.com/RibbleEstuaryAgainstFracking, http://stopfyldefracking.org.uk/, http://www.frackfreefernhurst.com/

resentful or suspicious of them; however, the anti-fracking lobby is also guilty of misrepresenting factual knowledge and claiming to have knowledge they cannot verify (Telegraph 2015). Somewhat more cautious motions against fracking or at least to regulate fracking have garnered the support of the likes of the National Trust and the nature conservation charity RSPB[129], who in 2014 released a joint report about concerns of environmental pollution, including calls for increased regulation (RSPB and the National Trust 2014). Regardless, there are no high-profile reports of covet meetings between the anti-fracking lobby and legislators, neither on UK nor on EU level. If this were the case, it would be reported by the pro-fracking lobby and news media sympathetic to its cause, just as it was reported in the United States and just as the opposite is reported in the United Kingdom and the United States.

In summary, it is clear that there are considerable interest formations beyond governmental policymakers that have a stake, or believe to have a stake, in the decision on shale gas development in the UK. Energy companies interested in fracking have membership of or are represented by very busy lobbying groups at the European Union level that have shown successful in paving the way for shale gas to circumvent environmental regulation. In-house lobbyists, namely members of companies such as Cuadrilla that are interested in fracking, have held meetings with ministers in the UK (that were not registered as lobbying). Strategies suggested as successful by the literature for lobbying have been reported in the UK just as they have in the U.S.: close relationships with policymakers, connections with ministers, and formal advisory roles for regulation. The latter suggests the provision of expertise by lobbies, as former gas company employees now work as advisors to policymakers, which the literature lists as another proven successful lobbying tactic. Furthermore, the picture emerges that these private interest groups have very different levels of resources and different histories of interaction with political parties, with the pro-shale gas industry in a more favourable position. The interest groups who favour shale enjoy the advantage of providing information to the regulating and policymaking bodies.

VI.2.1 Lobbying and institutions of the United Kingdom energy sector

Within the United Kingdom, a variety of actors is involved in the regulation of shale gas policy. On a first level there are the two chambers of parliament who in theory get to vote separately on the matter in general – for a fracking moratorium in 2011, to lift it in late

[129] Formerly the Royal Society for the Protection of Birds only.

2012, and again to affirm the continuation of fracking exploration in January 2015 (Perraudin 2015; Carrington 2015c). The Department of Energy and Climate Change (DECC) lead by the Secretary of State for Energy also needs to grant permission.[130] The British Geological Society plays an important role and has to be consulted for advice on reserve sizes and accessibility of shale layers, as well as groundwater contamination fears (presumably non-binding, as not stated otherwise). Further along the path in UK regulation, the Health and Safety Executive (HSE) has to regulate on engineering issues, approve well design and select an independent well examiner (UKOOG 2015a). Thanks to lobbying efforts, it remains possible for the independent examiner to be an employee of the operating company (The Royal Society and The Royal Academy of Engineering 2012). Beyond that, the operators currently have to comply with 17 separate European Union directives (mostly regarding environmental issues) (UKOOG 2015b).[131] However, the UK shale gas sector is not yet as developed, there has not been fracking on a commercial level: hence, some of the regulators above have not yet been tasked, so specific attention should be directed to policymakers about to decide on this issue, before those that might come in at the implementation stage.[132] As shale gas was not an actively discussed topic in the United Kingdom before 2009, there will be no attention paid to previous governments' interest in shale gas exploration.

So let us consider the official stance on shale gas by key policymakers. Former prime minister Cameron has been a strong and constant supporter of shale gas extraction in Britain, coining the phrase "going all out for shale" (Cairney 2015; Watt 2014).[133] [134] He revealed his belief that it was the United Kingdom's "duty to be more energy-independent" (PA 2014) and has cited energy security as a key reason for his interest in shale (Carrington 2015a). At one point Cameron claimed that shale gas reserves could

[130] Notably, in this very early stage already there is an obligation for all chemicals used for the entirety of the drilling and fracking process to be declared so they can be examined by the Environmental Agency EA (or NRW, SEPA). This is important as it is a step entirely lacking in the United States, where chemicals used do not need to be declared in order to ensure competition and the protection of trade secrets between the companies.

[131] The latest European Commission Impact Assessment considered the current regulation not effective and not addressing environmental risks, not sufficient in providing legal clarity or taking into account public concerns (European Commission 2014a).

[132] The first permission for drilling was granted by a Yorkshire council in May 2016 (BBC Business News 2016). Before that, only one application of this kind had been handled in the UK, by Lancashire County Council which rejected an application by Cuadrilla. Immediately after this rejection ministers voted in a fast track process, taking effect in August 2016. It means that ministers can since override council decisions if the councils take any longer than the projected 16 weeks to come to a decision (Clark and Bounds 2015).

[133] Until 2016, the end of this analysis.

[134] This case study does not cover the time after Mr. Cameron's resignation and will not include the new mid 2016 UK government under Theresa May, nor the fact that the UK has voted to leave the EU which was unforeseeable at time of research or at least impossible to include as a potential future uncertainty.

make Europe "wean itself off reliance on exports from Russia" (PA 2014). The data to support the claim that anyone in Europe who depends on Russian gas imports could replace those with shale gas currently does not exist, and the UK does not rely on Russian gas at all. The former prime minister also promised that lower energy bills would be the outcome of shale gas operations: "fracking has real potential to drive energy bills down", and "if we don't back this technology, we will miss a massive opportunity to help families with their bills and make our country more competitive" (Cameron 2013).[135] [136] Cameron has made inaccurate statements about gas reserves, likely due to confusion over the difference of reserves and resources (BGS 2013a; Cameron 2013). Despite all of the evidence against it Cameron connected hydraulic fracturing with the goal of tackling climate change (Carrington 2015a; Gosden and Dominiczak 2014). He publicly stated that he believed "the U.S. shale gas revolution can be repeated in the UK" (Carrington 2015a). This is ostensibly and under any circumstances a falsehood given the analysis in chapter four of this work.[137] [138] Considering Cameron appeared to base his shale gas enthusiasm on U.S. experience, it is remarkable that he did not seem to find it possible to base shale gas concerns on U.S. experience as well, given the amount of economic and environmental problems it has been accused of causing (Groat and Grimshaw 2012; Ahmed 2013; Helm 2013; Inman 2014). Some of Mr. Cameron's explanations: "it's simple – gas and electric bills can go down when our home-grown energy supply goes up" are extremely simplified, out of context, and inaccurate (Cameron 2013). Lord Stern labelled them "baseless economics" (Bawden 2013).[139] Cameron appeared to ignore any differences between the UK and the U.S. energy system, such as that of the different pricing mechanism, when it did not fit his argument, and to highlight them when it did, as in the case with environmental standards. The former prime minister was correct in

[135] The lowering of prices and energy bills remains an as of yet unsubstantiated claim critiqued by other lawmakers (Bawden 2013; Cairney 2015; Carrington 2013b). The same goes for the promise of more jobs (Cameron 2013) which there is no evidence for and hence no reason to believe in following the U.S. experience so far (Schulte 2014; Christopherson 2015; FWW 2015).

[136] While somewhat possible that Mr. Cameron did indeed not understand the UK and European gas pricing system himself, this is however highly unlikely, given his role and his access to advisers – in which case the above statement would have been made without belief in its accuracy.

[137] Despite that it seems that David Cameron was very aware of a key difference between U.S. and UK shale: the difference in private gains from reserves to be made by land owners. Possibly to mitigate this issue and provide incentives for more support for the controversial technique of hydraulic fracturing which has been raising public concerns, Cameron has announced that councils will be entitled to 100% of business rates raised from fracking sites and further that "revenues generated by shale gas companies could be paid directly in cash to homeowners living nearby" (Watt 2014).

[138] Clearly there is much public concern around fracking and Cameron was well aware of it – recently he blamed "lack of understanding about the process" for some of the opposition and stated that this would be "addressed once people could see functioning shale gas wells in the UK" (PA 2014).

[139] Some analysts suggest that the very low price level is to come to an end in the U.S. due to more market interconnectedness in the future (IEA 2015a), due to short term oversupply, and due to industry losses that will need to be balanced in coming years (Ahmed 2013).

pointing out that UK and European regulation require more environmental safeguarding than has been the case in the United States. Yet he was trying his best to curtail and cut many aspects of this regulation which he clearly saw as impediments (PA 2014). Words have certainly been followed by actions in the case of Cameron's commitment to shale with a range of favourable policies (Cairney 2015; Carrington 2016) such as positive planning guidance (Gov.uk 2014), tax breaks, and local compensation incentives (Macalister and Harvey 2013). Yet, even in the industry, few seem convinced that Britain really has gone all out for shale or indeed that Britain's very own shale revolution lies just around the corner (Cairney 2015; The Economist 2015a). Responsible for all economic and financial matters in the United Kingdom is the Chancellor of the Exchequer and Head of Her Majesty's Treasury, a position occupied by George Osborne since the beginning of shale gas debates in Britain until his departure in June 2016. Osborne was a strong and "enthusiastic" supporter of UK shale gas exploration (Williams 2013b) who promised that he "will make it [shale] happen" and wanted to see "rapid progress" in the matter (Osborne 2013). Specifically, the former chancellor considered shale gas a "low-cost energy source" (Carrington 2013a). In 2013 he stated that he "want[s] Britain to be a leader of the shale gas revolution – because it has the potential to create thousands of jobs and keep energy bills low for millions of people" (Gosden 2013a; Macalister and Harvey 2013). In this spirit he called for a set of actions designed to influence the EU commission on the importance of shale gas for Britain and Europe" (Osborne 2015). Like Cameron, Osborne supported the as of yet unproven claims that unless Britain can "get on with fracking" one would "condemn [it] to higher energy bills and fewer jobs" (Gosden 2015b). To support his ideas, Osborne set out a new tax regime (Murray 2014) of which he said "I want to make the most generous [tax regime] for shale in the world" (Gosden 2013a).[140] [141] In late 2015 a letter was leaked showing that Mr Osborne considered "fast-tracking fracking" a "personal priority" (Carrington 2015b) and specifically urged ministers to make multiple interventions in order to "respond to the asks from [shale gas company] Cuadrilla" (Carrington 2015b). The letter was much condemned by the in-house opposition i.e. the Labour party, which called the government "an unabashed cheerleader for fracking" (Carrington 2015b) as well as by private fracking opposition,

[140] Yet companies interested in gas development and shale gas in Britain apparently did not call for or indeed immediately welcomed this move, at least not publicly. Instead several stated shortly after the new tax incentives that it was not taxes, but "planning permission and public support" which hindered shale gas exploration in the UK and which should therefore become priority issues to resolve (Gosden 2013a).
[141] Osborne definitely has a particular focus on the energy sector: for example, in his last autumn statement before the election, whilst in general supporting green energy, the only specific mentions he made in the energy sector focused entirely on support for gas (Gosden 2013c; Murray 2014).

who took it as confirmation of "collusion with the industry" (Carrington 2015b).[142] [143] [144] [145]

The Lord's Committee on Economic Affairs is another institution with influence on fracking in the UK and prepared a report on fracking in Britain, endorsing it. The Lord's special report *The Economic Impact on UK Energy Policy of Shale Gas and Oil* was released in 2014 and in general recommends that "the UK should seize the opportunity offered by its shale gas resources" (Lords' Committee on Economic Affairs, 2014, 6). This is so shale could bring economic growth and employment, could support energy security and energy independence and "perhaps" cut prices (Lords' Committee on Economic Affairs 2014, 6). The Lords expressed their concern over regulatory uncertainty, which they deem is

[142] Osborne is furthermore criticised by anti-fracking protesters for a reason outside of his concrete policy actions – because his family is connected to the pro-shale lobby. His father-in-law Lord Howell is president of the British Institute of Economics, which is backed by BP and BG group (Leftly 2013), and he sits on the Economic Affairs Committee in the Lords which recommended fracking to parliament.

[143] Since fracking became an issue there have been three Secretaries of Energy: Chris Huhne (LD), Ed Davey (LD) and Amber Rudd (Con). During his time as Energy Secretary, Chris Huhne cautioned against the hype for shale gas. He stated that it was unclear how "economically or environmentally viable" it would be to extract, that "at best, it's years away" – and that it should not direct away plans for a mixed and balanced energy portfolio, and especially not turn focus away from renewables (Huhne 2011). Huhne strongly opposed "short-term, all-or-nothing bets", which he considered the dash for shale to be, but preferred spreading the risk (Huhne 2011). He made explicit reference to the reality of climate change, considered renewable energy targets to be legally binding, and he in particular made reference to uncertainty in his opinion on shale: "Government should not pick winners. A White Paper from 2004 estimated that oil would reach $23 a barrel by 2010; last year, another forecast predicted oil at $80 a barrel. Brent Crude is currently trading at $110. If we were to tie ourselves to one big bet, we would run unacceptable risks with our future" (Huhne 2011). Since leaving his post as Energy Secretary Mr Huhne has offered consistently different opinions on shale gas, as opposed to his government: in 2013 he mentioned that gas prices might be more easily lowered by importing U.S. gas to Europe, which he thinks the UK government should pressure for (Williams 2013a). Beyond that he criticised the relief given to fracking firms (Williams 2013a). In 2014 Mr Huhne branded the shale gas dash as "Cameron's fairy tale" or "nirvana" (Huhne 2014); he seeks to back this up with "marketplace" evidence by stating that shares in Cuadrilla's owner AJ Lucas were down to a quarter of what they were in 2009 (Huhne 2014).

[144] Ed Davey followed Huhne as Energy Secretary and head of the DECC and sent a cautious message about shale in the beginning, calling the shale enthusiasts "impatient" and questioning the possibility of lower consumer bills (Davey 2012; Gosden 2013b). He was accused of "blocking progress" in return and expressed a hope that he would after consideration find it "possible [for me] to give a green light to shale" (Davey 2012; Gosden 2013b). Davies insisted shale was "no quick fix and no silver bullet" but instead wanted to use it "sensibly and safely" (Chazan 2013). Commentators considered Mr Davey as balanced (Chazan 2013; Vaughan 2013a), neither accusing shale of all things evil (Vaughan 2013a) nor wishing to cut regulation. Under Davey's leadership a DECC report was sent out including a direct warning that exploiting shale gas in the UK would cause global emissions to rise without any international climate deal (Vaughan 2013a). Like Huhne, only after leaving his post as Energy Secretary in 2014, Mr Davey has stated that much of the Conservatives' plans around shale were "not backed by any evidence" (Gosden 2015a), questioning the idea of lower prices. He stated that parts of the Conservative Party are "crazy" because they want to "frack every bit of croquet lawn" in Britain (Gosden 2015a).

[145] After the 2015 general election, Conservative Amber Rudd was made the UK Energy Secretary and she was more supportive of shale gas; stating "we need more secure, home grown energy supplies - and shale gas must play a part in that" (Harrabin 2015a). In particular, she agrees with Osborne on the need to fast-track fracking applications, so they would no longer be drawn out. The cohesiveness of their opinions is not entirely surprising given that Ms Rudd was Mr Osborne's private personal secretary previously. Ms Rudd echoes the claims that shale is "good for jobs" and "good for our energy security" (Rudd 2015) - in fact she made a specific promise of "up to 60.000 new jobs" (Murray 2014). In her first interview since being appointed, Ms Rudd "said she would deliver shale now that the impediment of the Liberal Democrats had been removed" (Mathiesen 2015b).

hindering development – and think that a centralised top-down effort is needed (Lords' Committee on Economic Affairs, 2014). They argued that there should be a committee of the cabinet, headed by the Chancellor, "dedicated to ensuring that his commitment to 'go all out for shale' is matched by action" (Lords' Committee on Economic Affairs 2014, 6). The report endorses shale as an "urgent national priority" (Lords' Committee on Economic Affairs 2014, 7). The select Lords appear as committed supporters of shale gas: they "strongly support the Government in their objective to exploit these resources but believe they [the UK government] need to do much more to encourage exploration and get development moving" (Lords' Committee on Economic Affairs 2014, 5). Unlike the EU commission, they consider the UK regulatory framework for gas and oil operations complex and sufficient, yet untested onshore. Public concern about possible environmental or health risks are considered mostly unfounded: they are mentioned in the context of complaining about delays to fracking deployment on UK soil (Lords' Committee on Economic Affairs 2014). Fear is expressed that such delays will drive away investors. This glowing endorsement of shale gas development has since managed to draw a lot of attention and critique, due to its one-sidedness but also due to the committee's members, many of which are in some way or another connected to the industry or corporations interested in developing shale gas in the UK. The following Table 6 shows the members of the committee and their affiliations.

Peer	Party	Conflict of Interest
Lord MacGregor of Pulham Market (Chair)	Conservative	Chairman, British Energy Pension Fund Trustees Chairman, Eggborough Power Ltd Pension Fund Trustees - Both now part of EDF Energy
Baroness Blackstone	Labour	n/a
Lord Griffiths of Fforestfach	Conservative	"Board Member of Goldman Sachs International, a wholly owned subsidiary of the Goldman Sachs Group which advises companies in the field of oil and gas exploration."(Lords' Committee on Economic Affairs 2014, 95)
Lord Hollick	Labour	Samson Resources
Lord Lawson of Blaby	Conservative	Central Europe Trust Company Ltd - Chairman (retired Dec 2012) Also Chairman of the Global Warming Policy Foundation
Lord Lipsey	Labour	Chairman Impower plc 2001-03
Lord McFall of Alcluith	Labour	FTI Consulting shares, fracking industry advisers
Lord May of Oxford	Crossbench	Member of the Committee on Climate Change
Baroness Noakes	Conservative	Shareholdings in energy companies including BP plc, Centrica, BG Group plc, Royal Dutch Shell plc, also shareholdings in BHP, Xtrata and Rio Tinto plc (mining) and Serco Group plc (support services)
Lord Rowe-Beddoe	Crossbench	n/a
Lord Shipley Lord Skidelsky	Liberal Democrat Crossbench	n/a Janus Capital Group - holds stakes in oil and gas firms
Lord Smith of Clifton	Liberal Democrat	n/a

Table 6: Lord's Committe on Economic Affairs Connections with or Stakes in the Shale Gas Industry (Leftly 2013; Lords' Committee on Economic Affairs 2014; Parliament UK 2016), own design

It is worrying that at least eight out of thirteen peers involved in the report on shale gas have financial or employment ties to corporations in favour of fracking in the UK and therefore likely stand to personally gain from shale development on UK soil. Their interests are mostly declared in the Lords' register. Regardless, it is clearly difficult to maintain that this committee was independent.

Beyond the independence of the official committee advising the government on shale gas, a key concern of lobbying watchdogs in the UK is the institution of non-executives or 'Neds'. The 'Neds' are over sixty advisors "largely drawn from Britain's most impressive corporate talent" and spread out across different government departments in Whitehall to "help ministries run in a more business-like manner" (Leftly 2013). The current chair of Cuadrilla, Lord Browne, is the overall leader of this non-executive group of parliamentary advisers and therefore has a seat in the Cabinet Office itself. There is also Mr Laidlaw who is the non-executive in the Department for Transport and also chief executive of Centrica, which owns a large share of Cuadrilla's Lancashire license. Another prominent Ned is Baroness Hogg who is both in the Treasury and a non-executive of the BG Group. Key private supporters of fracking are embedded in the UK government.

Apart from these non-executives there are many industry secondees in senior positions at the DECC who are employees of gas companies with stakes in shale gas (Carrington and Sparrow 2013). There is no suggestion of malpractice with any of these advisers. However, it is a fact that they are in very influential positions and that they have clear motives to support pro-fracking policies in the UK. There are no comparable reports emerging about relations between the government and fracking opponents, which gives the impression of an imbalanced distribution of access. This impression is further supported by the fact that reportedly during a one-year assessment period (2010-2011) there were 195 recorded meetings between traditional fossil fuel energy companies or their lobby groups with DECC ministers compared to 17 meetings between DECC ministers and environmental campaign groups (Carrington and Sparrow 2013). This is a clear sign for the amount of a specific resource, namely time with policymakers, which the traditional fossil fuel industry currently enjoys in the UK. It also suggests higher levels of closeness and cooperation between them and the DECC.

Anti-fracking campaigners but also other energy industry insiders are concerned by the fact that major energy-sector figures have secondary roles with access to Whitehall. Among the concerned parties are not only environmental campaigners but for example also an EDF Energy executive, who worries that "the Government's new-found commitment to shale has ended up hurting the French group's negotiations over building a nuclear power plant at Hinkley Point" (Leftly 2013). There are also reports of donations to the Conservative party by key stakeholders in UK shale gas development (Doward and Helm 2012). It has emerged that industry and current government officials have shared pre-prepared PR statements on shale gas during a row of high-level dinner and drinks functions, specifically on how to deal with its opposition, while industry members shared lists of stakeholders necessary to target (Carrington 2014a). This is a very high degree of cooperation between policymakers and private interest groups. It may even suggest a situation of cultural capture – this level of joint preparation makes it appear as if government officials and gas industry members genuinely follow the same goals.

Clearly there is a point to make here about the close lobbying relationship between the pro-fracking industry and lobby and policymakers in the UK. This ranges from personal connections through top governmental decision-makers including chancellor Osborne, or members of the committee providing judgment on shale gas such as Lord McGregor or Baroness Noakes, to in-house lobbyists such as the Chairman of Cuadrilla in the Cabinet Office and a member of BG Group in the Treasury. The literature and historical case studies strongly suggest that close relationships between private interest groups and legislators are very indicative of lobbying success, and in the United Kingdom, the picture bodes very well for the pro-fracking lobby.

Beyond good relations with policymakers, it is important to note that all of the above discussed instances of lobbying have occurred in a framework of quiet politics. The lobbying tactics are comparatively covert and they seem to have targeted the specifics of regulation before the moratorium on fracking and again with renewed vigour since the moratorium was lifted. A clear example of how successes of the pro-fracking lobby are taking place through quiet politics rather than high politics is a minor change in defining the process of fracking that occurred in early 2016. Geologists reported that the UK government had changed the definition of what constitutes hydraulic fracturing to the point that a majority of fracking operations would no longer be defined as fracking at all (Carrington 2016). The new regulation which came into force on 6 April 2016 in fact excludes the UK's only well so far, in Blackpool, from the definition, as well as almost 50% of fracking wells currently active in the United States. Safety regulation such as independent inspection and waste management does not come into effect without meeting these definitions (Carrington 2016). This may be the strongest example yet of the success lobbying for shale gas in the UK has found through quiet politics – regulation for safety is promised publicly, but the rules for when they apply are changed without much notice. Of course, as is often the case when researching lobbying success, it is not possible to prove who specifically pressed for this change in definition. It is, however, entirely clear who benefits from the change in definition, and from the above analysis it is clear that those beneficiaries had very good access and opportunity for lobbying. So circumstantial evidence would suggest this regulatory detail is a major lobbying success for the pro-fracking industry. The episode also compares to U.S. fracking lobbying strategies: a definition that excludes many drilling sites from fracking regulation is likely just as useful to the industry as a general clause excluding all waste from gas operations in the U.S. from environmental checks. Given the evidence of the provision of secondees and industry experts to the DECC rather than evidence of lobbyists influencing final votes on fracking, quiet politics and close connections seem to be the preferred option of lobbying for shale gas in the UK. There is a real similarity between the two country case studies on these issues.

To follow up on this thought, the Figures 28 and 29 (BoardEX 2016) show the evidence one finds when cross checking for first degree and second degree connections between government regulators and interest groups with BoardEx. There is divergence in the amount of connections between energy companies, and also between those that are pro fracking and those that are against it. The graph of first degree current or revolving

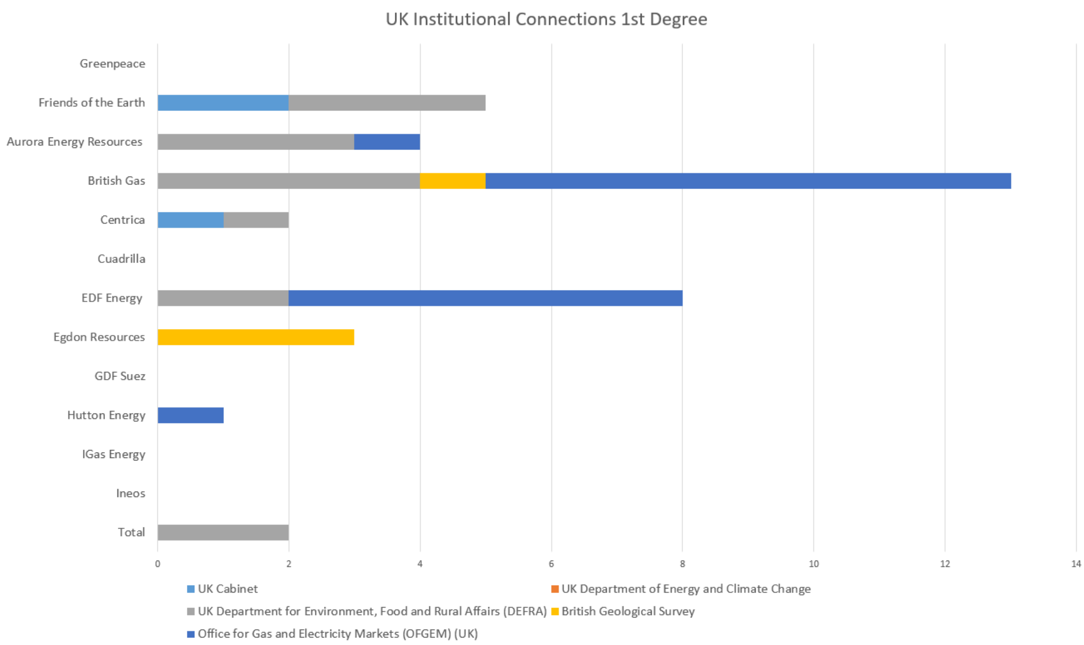

Figure 28: Industry and Policy Institution Connections, 1st degree UK (BoardEx 2016), own design

connections between regulators and those regulated reveals less connections than in the U.S. case.[146] As can be seen, not all Neds are included by BoardEx, and neither are the Lord's Committee members, hence several clearly influential individuals are missing from

[146] The UK cabinet and U.S. government do not have the same number of members of course, and neither do the institutions. The comparison between different connections remains valid.

this overview. There nevertheless remain strong cases of connection and revolving door: An employee of the Office of Gas and Electricity Markets (Ofgem) began working as a non-executive director for Aurora Energy after half a decade with Ofgem yet kept his position with the regulator, a strategic director at British gas moved from there to become a Director General at the Department for Environment and Rural Affairs (DEFRA); and a director at Centrica became a chairman at the DECC.

Already, the picture is different not only in numbers but also in comparison with the opposition: Friends of the Earth (FoE) members are well represented amongst UK policymakers. However, all of those counted are not formerly employed by or lobbying for, but are simply members of Greenpeace or FoE. Clearly, there is a difference – one cannot be a member or supporter of BP or Cuadrilla the way one can with Greenpeace or Friends of the Earth, and working together with somebody who is next to their other job also a member of FoE is not as significant as working together with a Cuadrilla board member. EDF, which has high stakes in developing nuclear energy in the UK and previously criticised the strong support for shale gas by the government (see above) is also well represented in DEFRA and Ofgem. The BoardEx analysis suggests the conclusion that based on available information, the practice of the revolving door is less frequent, and less exclusive, between the gas industry and groups interested in fracking with their regulators than is the case in the United States. The issue of revolving door movement has been raised and is likely in the UK energy sector, but the comprehensive analysis of connections suggests less closeness between regulators and industry than in the U.S. case. For example, the amount of people revolving between British Gas and DEFRA is likely not substantial enough to impact on regulation. However, BoardEx does

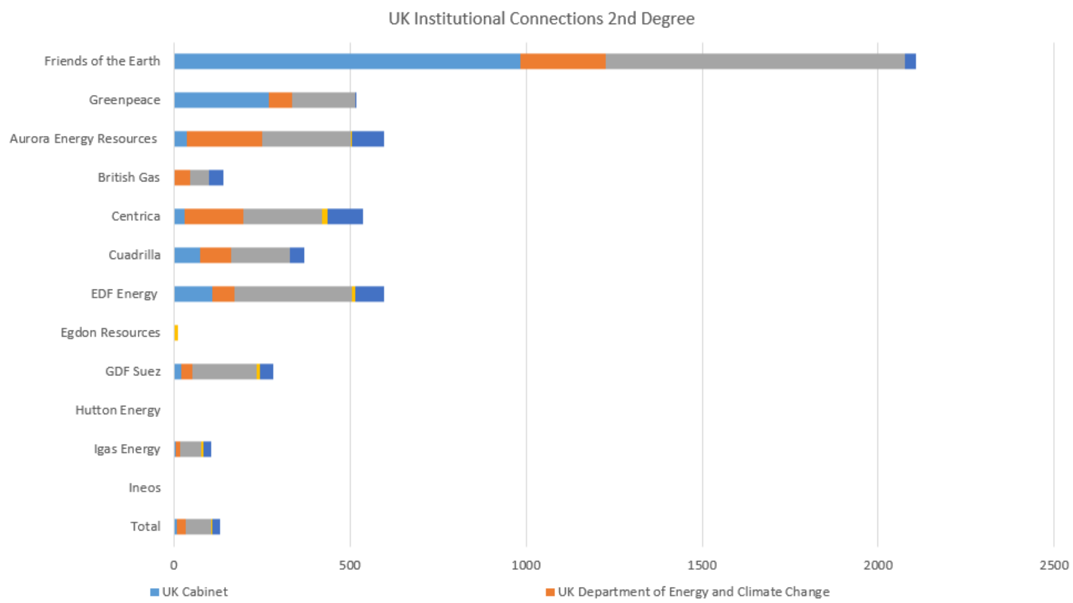

Figure 29: Industry and Policy Institution Connections, 2nd degree UK (BoardEx 2016), own design

not count Neds such as Lord Browne or secondees such as the Centrica employees in the DECC, so the picture may be misleading. Moreover, single very influential individuals may be more effective in influencing policy than a great number of less high ranking in-house lobbyists, and we know that these connections exist.

Considering second degree connections, Greenpeace and Friends of the Earth, the two most outspoken anti-fracking lobbyists, appear to be very well represented in the UK government. Again, the connections with such an organisation may be weaker than those created through former employment or board membership of a firm. Regardless, the situation is clearly different to the U.S. scenario. This data does not validate a conclusion about regulatory and cultural capture similar to the U.S. case. There appears to be less of a case of interconnectedness between the UK gas industry with fracking interests and their future regulators. Based on this I cannot therefore conclude with confidence that the practice of the revolving door has affected UK shale gas policy. Supporters of shale gas outnumber its opponents in a strategic position to oversee its regulation. Yet through membership the environmental lobby against fracking has much better connections with the UK cabinet, energy and environment departments than their counterparts in the United States do. Consequently, it stands to reason that the U.S. and UK revolving door issues are distinctly different.

Other aspects of lobbying activity remain noteworthy with regards to their likely impact on fracking policy decisions. In smaller numbers yet through significant positions, private interests concerned with the issue of shale gas development do have good access to governmental institutions in the UK, as evident from case examples discussed above. In this, the U.S. and UK cases bear similarity. Longstanding and regular relationships between lobbyists and industry persist (and remain unchecked for in-house lobbyists, facilitating their staying under the radar or public scrutiny). Many of these include the provision of expertise and information by industry members to policymakers. Lobbying efforts have also clearly occurred in situations of quiet politics.

The UK case does not compare well with the situation in the US, but neither does the data availability.

VI.3 Chapter summary

In chapters three and four I could not establish a convincing rationale for each of the national governments in question to engage in fracking policy for reasons of national economic gains such as GDP growth, job creation or expected tax revenue. Especially for the case study of the United Kingdom, this data was unconvincing, preventing me to conclude a similar independent variable of promising expected utility influencing the decision on shale gas. Therefore, I proceeded to consider whether there was another group benefitting from these policy decisions on shale development and whether it was not in the public but in private interest to create pro-fracking policy. To provide a second and different narrative for the reasoning behind governmental preferences on shale gas in the U.S. and the UK, in this chapter and the previous chapter I made the case for the pursuit of private interests into fracking through lobbying and its potential effect on policy decisions. This is a traditionally considered approach of analysis within the social sciences and in political economy especially.

Following the preceding theoretical chapter, my hypothesis for this chapter was that a final policy decision on shale gas development is open to influence from private interests that expect to benefit from fracking, rather than them being disregarded by a government considering only national or public expected utility. To assess the potential for industry interests influencing governmental preferences on shale gas development I identified key players interested in promoting or preventing shale gas development in the United States and United Kingdom, their resources and their access to policymakers, and also considered overall lobbying potential in the sector. As these were considered indicators for successful lobbying, I looked for evidence of lobbying through the provision of information and expertise, for lobbying through close relationships and cultivating connections between lobbyists and policymakers, and for lobbying activity in quiet politics. Both in the UK case and the U.S. case, evidence can be found for all of the above in favour of the oil and gas sector and the shale gas industry, over that of alternative energy or environmental lobbies.

Close relationships between the pro-fracking lobby and policymakers and regulators are common place and abundant both in the U.S. and the UK. There is evidence of gas industry and gas lobby employees working on drafting legislation alongside policymakers in both countries, especially in the U.S., to such a degree that cultural capture could be expected to occur. For both countries, an analysis with the business intelligence tool BoardEx showed the amount of revolving door connections between governmental departments involved in fracking legislation and the industry they are supposed to regulate. The number is more substantial in the United States. Particularly the U.S. Department of Energy is very interconnected with former and also current employees of the private oil and gas sector and their lobbies, notably API, BP, Exxon Mobile and Halliburton. In the UK, the anti-fracking lobby is represented in high numbers and better connected with Whitehall than their counterparts are in Washington. There are confirmed reports of lobby and industry experts specifically drafted or seconded to help write regulation on shale gas in both the UK and U.S. respective energy departments. This provision of expertise and introduction of experts was shown as a very useful lobbying tactic in the theoretical review.

Evidence of lobbying regulatory and quiet politics rather than high salience votes can also be found in both countries. In the U.S., the fracking business is exempt from a considerable amount of environmental and safety legislation since the 2005 Energy Policy Act (partially because they helped writing it). In the United Kingdom commercial fracking has not yet begun, and the industry is younger, however lobbying meetings are taking place and already a coup has been realised by introducing a definition of fracking into the environmental assessment regulation which in fact excludes many fracking operations from the term and thereby prevents connected safety testing and procedures. Clearly, these outcomes suggest that lobbying is taking place and that it is successful enough to continue. There are differences. In comparison to the variety of agencies needed to approve a fracking license in the UK, amongst them BGS, HSE and European regulators, in the United States almost all regulation of onshore oil and gas production is left to the individual states, and there are great differences in between states' legislation. As discussed, much of the regulatory process falls away as fracking in the U.S. is exempted from several environmental acts entirely, meaning that no disclosure of any chemicals used needs to be made; any chemicals, including toxic and carcinogenic, are allowed, and no public health or environmental safety assessments regarding these are required as part of regulation. Considering this is where much of the UK regulatory bodies are involved, it becomes clear that fracking permits in the United States are much more quickly obtained. More generally, I found evidence for a discrepancy in access, funding, and resources between the shale gas lobby and its opposition. This was less clear in the UK case where less information about lobbying spending is publicly available, but the general financial means remain substantially different. The fact that energy and gas licenses can be considered a private good the way they are treated in the U.S. and UK further adds to the possibility of lobbying success. Arguably UK and U.S. energy policy in the 21st century suggests that energy is a marketable private good. Energy resources that can be exploited and sold by private companies in a market based system certainly fit the description. This is opposed to energy trade in other countries, for example in Venezuela, where Chavez decided to re-nationalise the nation's petroleum resources (Simon 2007). Lobbying for private rather than public goods was found to be an indicator of greater lobbying potential in the theoretical review and it seems confirmed in the case of shale gas. The theoretical review has found differences in funding and resources to be especially influential in lobbying through the cultivation of relations with policymakers, attempting to address quiet politics, and for private goods. Considering the above analysis, both in the UK and in the U.S. the fracking lobby are likely to be very influential, especially in comparison with their direct opposition, which are environmental groups and alternative energy lobbies. Considering that lobbying for shale gas by major business groups appears successful whereas anti-fracking campaigners Greenpeace, FoE and civil actions groups have so far registered fewer results, I find more evidence of the exchange model of lobbying than of neopluralist theory applicable in the case study.

My conclusion is that lobbying has an effect on energy policy in both countries. There is evidence of historical and recent situations in which lobbyists have affected energy policy regulation, and there is also evidence of revolving doors and increased access of lobbyists to governmental institutions tasked with energy policy decisions. The situation however is not equal in the United States and the United Kingdom. In the U.S., the situations is strongly skewed in favour of the pro-shale gas lobby. In the UK, environmental lobbyists have better access to government institutions and many current legislators have ties to environmental protection agencies. Yet the UK energy sector is still favourable towards the traditional oil and gas industry: "The incumbents and institutions overseeing the current energy system have too many interests in maintaining it, and the government has done nothing to change this" (Mitchell 2013).[147] This would reinforce the theory that it is easier to lobby for the status quo.[148] In this sense, renewable energy has less prospect of

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[147] The centralised nature of the English political system plays a role in this – the state by state differences in regulation of fracking in the U.S. make it much harder for federal legislators to regulate coherently, and much harder to gain an overview of lobbying tactics across the country.

[148] As discussed in detail in this thesis, an important aspect of any policy decision on fracking is the scientific and empirical uncertainty surrounding the process in the long-term. Pro- and anti- fracking campaigners alike are certainly guilty of pretending to have answers beyond those which they can actually support with evidence, scientific testing or other knowledge. Both the pro-fracking lobby and industry as well as the anti-fracking lobby and campaigners have been strongly criticised for misrepresenting scientific data and knowledge about hydraulic fracturing in order to get their points across: "the old saw about statistics — that, given enough spin, they can be used to support anything — is being increasingly applied to science, especially, critics say, when it comes to the fight over hydraulic fracturing" (Richardson 2015). For example, it is correct to say that industry claims and promises of lower gas bills are unsubstantiated and uncertain and considered untruthful by many experts; yet it is incorrect to state that experts agree on the opposite. For this reason a recent Greenpeace ad was banned by the Advertising Standard's Authority ASA (Telegraph 2015; Mathiesen 2015a). Given that the 'expert' ASA cited to be in non-agreement was non-scientist, non-economist David Cameron, Greenpeace and other supporters were furious with the

success in the United Kingdom and the United States who both have a longstanding history with the fossil fuel sector. However, shale gas could also not be lobbied as easily in the UK as in the U.S. since it requires a certain amount of change and does not fit into the sector as neatly as it did in the U.S. where existing drilling fields infrastructure made the transition smoother.

I find that in this chapter there is sufficient evidence of interest and opportunity in lobbying to assume that interests have an influence on governmental policy decision. I cannot conclusively prove this, yet all the signs and circumstantial evidence point in this direction. I find differences between the U.S. and UK case study, especially with regards to the revolving door saturation of policymaking institutions. However, the private interests pursuing fracking in both countries are more likely to have significantly impacted any governmental decision to allow fracking than a rational cost-benefit analysis of the public benefits through shale gas. Their efforts to enable fracking through watering down legislation, preventing environmental assessment but also simply their efforts to closely connect with policymakers are well-documented. The same cannot be said for the fracking-opposition. It is important to note that the situation in the U.S. and the UK is not mirrored and therefore the independent variable influencing fracking policy in this narrative is not perfectly similar.

By following the logic of 'qui bono', in this chapter I arrived at the conclusion that there are very strong private groups who stand to benefit from favourable fracking policy or at least believe that they do so, and that these groups have been very active in lobbying shale gas. I find the explanatory power of the influence of fracking and gas industry on government decisions outweighs that of the national benefits from fracking. Arguably, when I accept the above evidence and circumstantial evidence as proof of much more successful lobbying on behalf of the pro-fracking interest groups, then the second narrative has proven more helpful in explaining fracking policy decision-making than the first in this thesis.[149]

VI.3.1 Rationality of the pro shale gas lobbies

In the literature review in chapter five I found suggestions that lobbying can occur irrationally and against a firm's material interests. Since the analysis of the shale gas sector

decision and further convinced of foul play and conflict of interest. The current chair of ASA, Chris Smith, is also head of a fracking-industry-funded shale gas task force (Mathiesen, 2015).

[149] Albeit in both scenarios, there was more significant reason for the U.S. than the UK to engage in fracking.

in chapters two and four raised doubts about its potential and profitability, I want to briefly return to this issue now that I have discussed the influence of private interests.

There are previous examples of lobbying in which stated and lobbied for goals appear to diverge from the lobbying firms' material interests (Woll 2008). This may yet be the case with fracking after all. Case studies in which interest groups lobby to prevent change of which they ultimately benefit have been documented by other scholars (Fernandez and Rodrik 1991; Leighton and Lopez 2013; Rodrik 2014; Godwin et al. 2013). Fernandez and Rodrik in particular show in various case studies that "uncertainty regarding the identities of gainers and losers can prevent an efficiency-enhancing reform from being adopted, even in cases in which reform would prove quite popular after the fact" (Fernandez and Rodrik 1991, 1154). For a specific example one may consider the lobbying that went before the introduction of free trade liberalisation in Turkey in the 1980s: the policy changed was pushed through by the authoritarian government despite strong opposition by the business community. Yet the latter emerged to profit from it almost immediately and has since been its strongest defender (Fernandez and Rodrik 1991, 1147).

Evidence shows that in the shale gas story, fundamental economic incentives are not always clear. Some companies drilling are allegedly not profiting from shale gas operations (Fowler 2012; Ahmed 2013; Inman 2014). Reserves have been overstated, and disappointing well data and the correcting down of reserve estimations in the U.S. shale gas story have led to comparisons with the dotcom bubble and have left many private companies with losses (Urbina 2011c; The New York Times 2011; W. Richter 2012; Anderson 2014; Lipton 2014; Neate 2015). Since 2012, Chesapeake Energy, Exxon Mobil, and BG have all had to accept substantial losses, and write down or sell shale assets (Ahmed 2013). That has not stopped firms from lobbying on the behalf of shale gas however. In some cases, it appears firms are actively lobbying something that has hurt their own material interests. 80% of U.S. shale gas production comes from five shale fields, several of which have been in decline since 2012 (Hughes 2012). In a meeting at the Council on Foreign Relations 2012 the then CEO of Exxon Mobile stated: "We are all losing our shirts today. We're making no money. It's all in the red" (Fowler 2012). Dozens of gas and oil companies went bankrupt in the United States in 2015, the top 60 U.S. independent gas and oil firms have a combined net debt of $206bn (more than doubled since 2006) (Crooks 2016). Many shale gas companies have debts multiple times higher than their pre-tax earnings, and a third of U.S. oil and gas companies are rated low enough by S&P that they're considered at high risk of default (Crooks 2016). Yet lobbying continues (Davenport 2015). The notion that "fracking lacks economic viability" (Reuters

2014a) has been raised by many experts. Insiders within the industry have repeatedly warned against shale gas (The New York Times 2011; Urbina 2011c; Bawden 2013; Reuters 2014a). Fracking has been called “inherently unprofitable”, a Ponzi Scheme or it has simply been stated that the economics of fracking “do not work” (Reuters 2014a). Especially in the United Kingdom, firms should be aware of this due to a difference in timing regarding the exploration, knowledge of the negative sides of U.S. experience, and knowledge about the difference between the U.S. and UK energy economies. In early 2015, more oil and gas rigs in the United States were deactivated than any since 1987, and the trend is expected to have a severe negative impact on the U.S. economy (Neate 2015).[150] The low gas price they themselves helped create is very harmful to U.S. shale gas companies, as is the low global oil price since late 2014. The latter should be particularly cautioning to British interests, where the gas prices are linked to oil as in Europe.

In the United Kingdom, Ofgem itself commissioned a report into shale gas which concluded that it was not likely a game changer for the country; Ofgem’s chief executive stated that shale gas would furthermore not have a significant impact on UK energy prices (Harvey 2013).[151]

Whereas industry behaviour and industry logic behind decision-making is not part of my thesis, governmental decision-making is, and governments can be expected to be amongst the best-informed agencies about an economic situation such as the one described for shale gas above. Therefore, the incentive to provide for requests by the industry becomes less clear. Short of assuming that the U.S. and UK national government are willing to yield to industry requests in spite of severe doubts about the economics for fracking, I am left with an even stronger impression that something besides strong lobbying may affect governmental decision-making.[152]

In the following two chapters I will consider a third different scenario with potential to impact decision-making on shale gas. My aim is to assess whether or not there is a strong impact of underlying ideas and cognitive factors recognisable in strategic policy papers which are biased in favour of supporting shale gas over alternative energy production.

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150 I am not here considering the distinction between real economy and investor economy due to lack of space and research time.

151 Former UK energy minister Huhne mentioned the valid notion of the interconnection of the European gas market, saying that even if “our brave frackers triumph over all these adversities and succeed in producing such vast volumes [we] have so many pipelines connecting us to the continent that if the price were lower here, some gas trader would buy in Britain and export it. Soon the prices would be virtually the same. For exactly this reason, energy prices were no lower than Germany's even when we were self-sufficient” (Huhne 2011).

152 See fn 150.

VII Chapter Seven. Cognitive capture: Theoretical review

Following narratives on expected utility and on the influence of private interests, in this and the next chapter I will consider policy decisions that favour fracking through a third lens. This narrative is about the power of ideas and specific cognitive biases in policymaking. The hypothesis I consider in this chapter is that current strategy on energy policy reflects cognitive factors: ideas and biases that favour the policy path to the decision of shale gas development. The previous chapters have dealt with the purely calculative cost-benefit analysis for shale gas development by each respective government in the economic interest of their country, as well as with the notion that this process may be twisted towards private interests through lobbying power. In this and the following chapter I will engage with a third narrative of decision-making that includes two different approaches to cognitive factors which influence decision-making and preclude objectivity in the strictest sense. I am not arguing that these cognitive processes ultimately must lead to wrong decisions: I am arguing that they (are so powerful that they) distort the decision-making process. To this end I review separate strands of literature concerned with cognitive and ideational influences on decision-making. The theoretical review is divided into these two sections: a political economy approach on the influence of ideas on strategy and decision-making, and a behavioural economics approach that focuses on the influence of cognitive biases on decision-making (which I touched upon in chapter three).

VII.1 Ideas as cognitive constraints

> "Most important from the perspective of policy analysis, ideas determine the strategies that political actors believe they can pursue. … Expand the range of feasible strategies and you radically change behaviour and outcomes" (Rodrik 2013, 1).

In this part of the chapter I discuss research in political economy around the question of when and why ideas matter for political outcomes. The argument put forward is that actors' ideas about how the economy works substantially shape policy outcomes. This goes for both 'big' ideas such as a belief in the preponderance of Keynesianism or Neoliberalism, but also for smaller ones such as seeing an automatic connection between unemployment and inflation in the Philipp's Curve that must then influence future policy decisions. The impact of ideas fits well in my thesis, both due to their importance in political economy and because ideas are thought to matter especially in situations of risk and uncertainty. Writing on constructivist IPE theory, André Broome confirms the prevalence of ideas as "constructions of how the world works" (Broome 2013, 195). This is the case specifically in situations of uncertainty as described by Knight, in which outcomes of actions are not perfectly calculable (Broome 2013; see also Knight 1921; Blyth 2002; Seabrooke 2006; Abdelal, Blyth, and Parsons 2010; Palan 2013).[153] If actors cannot fully estimate their potential returns due to uncertainty, they may not know what their interests are. They will then rely on key ideas as guides more than in situations where they could calculate returns, i.e. uncertainty affects a decision-maker's perception of their own interest (Blyth 2002, 2009). Blyth argues that in situations of uncertainty, the prerequisite for effective action is a shared idea between agents for interpreting the uncertainty (Blyth 2002, 47ff).

A distinction can be made between ideas which are used instrumentally and ideas which are influencing decisions less consciously (Blyth 2009). To give examples, the former is considered prominently in research into how developmental ideas are used to influence economic policy in South America (Sikkink 1991); in thoughts by more rationalist scholars on ideas as roadmaps during uncertainty and hence focal points for coordination (Goldstein and Keohane 1993); and in work on ideas shaping the EU's monetary policy (McNamara 1999). The other role of ideas distinguished by Hall sees them used not instrumentally but as conventions (Hall 1989; 1993; Blyth 2009). This means that ideas acquire a life of their own once introduced and thus retain the power to bias future decisions through their mere presence and circulation (Blyth 2002; Berman 2006; Jabko 2006).[154] Because I am researching cognitive constraints, the second role of ideas is more interesting. Yet I am not making a point about the creation and introduction of ideas in order to influence policy: in this thesis, I consider the effect that ideas have on policy output. Hence the distinction does not affect my argument. I am examining the input side, namely key ideas which are apparent in strategy papers, but regardless of their origins, their effect on policy output remains the same. Who put the ideas into the policy papers and whether or not they did it purposefully is not the focus of research, but what they are

[153] Broome sees uncertainty as a general factor furthering the currency of ideas as a topic in IPE research, stating that the "concept of Knightian uncertainty has had a major impact on the development of constructivist understandings in IPE of the interplay between actors' interests and intersubjective ideas, while helping to boost the argument that ideas can trump interests as explanatory variables" (Broome 2013, 195).

[154] Berman's focus on the use of ideas by elites to refocus interests is not unlike Gramsci's ideas of hegemonic stability in its focus on the active creation of a specific, limited space for interests to reside in, albeit with entirely different frames of reference (Berman 2006).

capable of doing once they are embedded and accepted. Therefore, I do not attempt to sort one from the other but rather to prove the existence of either or both.

Amongst the first major scholars to combine interest and institutional approaches of IPE with an ideational approach were Hall and Katzenstein. Researching the behaviour of smaller states in the global economy Katzenstein discovered evidence for the impact of ideas that transcend interest struggle and institutional path design (Katzenstein 1985). He argues that ideas which were conceived around a perception of vulnerability that may no longer exist can influence policy in spite of powerful interests. Peter Hall's research on the reception of Keynesian ideas in different countries focused on the active utilisation of ideas as resources to push for institutional change (Hall 1989; 1993; Baeck and Hall 1990). His argument is that exogenous shocks such as those occurring in the 1930s do not smoothly lead to a change in policy preferences unless they are mediated and interpreted by ideas. Whether such mediation and interpretation is successful depends on how well the ideas fit within the structure of a country's prevailing political discourse (Hall 1989, 383; Blyth 2009, 211).[155] In further work about interests, institutions and ideas in political economy, Hall concludes that ideas are in fact the key component of policy preference change (Baeck and Hall 1990; Hall 1993). In 1993 Hall argued "that policy change is typically highly constrained because the ideas that support the status quo remain extremely powerful" (Baumgartner 2013, 240). However, though most change is incremental, there is potential for dramatic change through paradigmatic shift. When change occurs, it must not necessarily alter the power relations between different interest groups: "reform often happens not when vested interests are defeated, but when different strategies are used to pursue those interests, or when interests themselves are redefined" (Rodrik 2014, 206). Policy change is likely to occur in situations where the status quo has been discredited sufficiently. Jones and Baumgartner argued in a similar fashion but with different methodology at the same time as Hall that "an important element of the likelihood of policy change is the staying power of the status quo" (Baumgartner 2013, 255). Simon also lays great importance on the need for alternatives to prove themselves much more rather than pointing out inadequacies of the status quo. He argues that "once a theory is well entrenched, it will survive many assaults of empirical evidence that purport to refute it unless an alternative theory, consistent with the evidence, stands ready to replace it" (Simon 1979, 509).

[155] Hall insists that focusing on ideas does not preclude a researcher from considering political agency: "The most important step we can take, however, is to note that it is not necessary to deny that politics involves a struggle for power and advantage in order to recognize that the movement of ideas plays a role, with some impact of its own, in the process of policymaking." (Hall 1993, 289; 292)

The role of ideas in determining or altering preferences is not a new topic to the field of economic policy research but more novel than the approaches around interests and institutions (Blyth 1997; Rodrik 2014). There has been prominent research into ideologies having a strong influence on partisan politics for example, notably by Alesina and Rosenthal (1995), and more recently work on the formation of preferences through experience, societal influences or the media (DellaVigna and Kaplan 2007; Yanagizawa-Drott 2014; Rodrik 2014). For a broader context, one may recall the distinction between soft power and hard power made by Joseph Nye, in which soft power is the power to attract and convince rather than to command and coerce (Nye 2008). The power of ideas is a soft power, albeit there need not be a direct perpetrator executing that power. If an industry lobby or NGO gives out information to the government which informs on and enhances their view on shale gas, it is a direct use of soft power. But other ideas whose origin may be less clear, or even unintentional, nonetheless can wield the same kind of effective soft power.

Government officials and those involved in policy legislation are proposing policies within a framework of certain ideas and assumptions about how different policies are supposed to work, about how the system functions. Economic policy research is often concerned with sharpening models, with adjusting ideas to finding the right model[156] (Rodrik 2014, 193). And yet, many agents discussed in economic research already "believe that they know how the world works, if not precisely, at least probabilistically" (Rodrik 2014, 193). Their ideas and assumptions shape their expectations and their estimation of the consequences of their actions, in the political and the economic realm. Establishing policy preferences "involves complex ideational processes whereby policymakers assemble and assess information and construct pictures of reality" (Bell 2012, 671). These ideas can range from big ideas, such as a belief in the overwhelming benefits of a free market system over the merits of state intervention, to smaller, more specific ideas about how welfare should be distributed. Should for example de-commodified benefits depend on specific need, on previous contributions, or simply be equal for all (Esping-Andersen 1990; van der Veen and van der Brug 2013)? An answer to this question implies not only normative preferences but a very specific assumption about how the economy works. These kind of expectations influence policy behaviour; and evidence which is inconsistent with the trusted models and expectations tends to be downplayed or ignored (Rodrik 2014, 193).[157] Financial deregulation and lack of oversight are now blamed by most

[156] A model that can be empirically proven to work in the real world without raising normative problems.
[157] The simple broad decision whether to focus on demand side or supply side economic policies, possibly due to a perceived need to shift due to globalisation, can have a major impact on the availability of energy

policymakers for contributing to the manner in which the 2008 financial crisis unfolded. This leads to the conclusion that ideas about the financial sector are also to blame then: banks could not have argued for their own interests, for example less oversight, as efficiently had there not been an overall belief in deregulation, in less oversight and red tape. Large financial corporations could not have found as much support for their own partisan interests had they represented them as such. The accepted argument instead was that deregulation and the laissez-faire policies they were enjoying were in the interest of the entire economy, and this was outlined in ideas powerful enough to stick (Thompson 2009; Nelson and Katzenstein 2010; Kwak 2013).[158] This is important for my third narrative of analysis on the influence of ideas as a similar situation could be the case with shale gas. If governmental decision-makers are convinced about the benefits to the economy of a new fossil fuel source and unconventional gas, regardless of the accuracy of such benefits, it further serves to explain why private interests are successful in lobbying for shale gas.[159] In this case cognitive capture leads to a decision favouring the advancement of shale gas policy notwithstanding information that may discredit the merits of fracking.[160]

The power of ideas to influence policy is considered significant in political economy. In contemporary political economy research, approaches that focus on ideas are often connected to the theory of constructivism in social sciences but they do not have to be (Blyth 2002). Ideas are seen as necessary to interpret reality before decisions are made and action is taken, therefore they influence decision-making. Blyth suggests that "practicing social science without viewing ideas as fundamental to both the nature of human action and causation in social systems produces seriously misleading explanations" (Béland and Cox 2010, 83). Especially in situations of uncertainty about outcomes, ideas come into force. Accepted ideas are also considered to function as agents of the status quo, aiding it to prevail and slowing down change. Research in IPE that focuses on ideas is concerned with challenging the notion of a direct, automatic link between interests or goals and

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economic options. Will the focus lie on digging for more, discovering new sources, supplying different energy? Or will it lie on consumer behaviour, on preserving more energy?

[158] Of course, it is entirely possible in this scenario that ideas were also disseminated through close contact between the financial and political sphere, as suggested in the cultural capture argument by Kwak.

[159] This notion may come about through shared understanding and cultural capture such as considered in chapter five – to verify this would be a very interesting possible future topic, and would require a detailed examination of not just the political decision-makers' ideas but those of the closely connected industry and lobbying figures and then an assessment to see if key ideas match.

[160] The term cognitive capture is one that to the best of my knowledge, I alone have devised to specify this particular state of affairs. However, in the meantime it has been used once with a different connotation: Adair Turner in his role as the chair of the Financial Services Authority used the term *cognitive capture* in relation to what Kwak calls *cultural capture*, "to describe the tendency of financial regulators to engage in <problem solving with the [regulated] institution> rather than enforcing existing rules" (Kwak 2013, 78).

outcomes rather than dismissing the importance of interests in political outcomes (Baeck and Hall 1990; Hall 1997; Woll 2008; Blyth 2009; Abdelal, Blyth, and Parsons 2010; Leighton and Lopez 2013; Mitchell 2013; Rodrik 2014).[161] Rodrik calls it a "mapping" between interests and policy outcomes, which he argues is not given but "depends on many unstated assumptions about the ideas that political agents have" (Rodrik 2014, 190). These ideas might range from very general ideas such as preconceptions about how the economy works to more specific ideas such as what policy tools one can make use of to push interests, and of course ideas about what those interests actually are. Questioning the link between interests and policy outcomes through introducing ideas as a factor does not undermine the focus on agency, political game or lobbying in this thesis. If interests are influenced by ideas, ideas can of course be challenged, manipulated or changed.

VII.2 Common heuristics in decision-making under uncertainty

> "The deviations of actual behaviour from the normative model are too widespread to be ignored, too systematic to be dismissed as random error, and too fundamental to be accommodated by relaxing the normative system"
> (Bell, Raiffa, and Tversky 1988, 167)

In order to explore another avenue of cognitive bias, in the following paragraphs I discuss in more detail the constraints to rational decision-making first discovered by Tversky, Kahneman and like-minded scholars of decision analysis which I introduced in chapter three. Many important judgments that are made in situations of uncertainty concern questions such as: how likely is it that outcome *B* is a result of an event from process *A*? What is the likelihood that process *A* can result in outcome *B* (Kahneman, Slovic, and Tversky 1982)? In answering these questions, people use a variety of heuristics and biases, such as how similar are *A* and *B*, or what is the causal relation between them. This section was prompted by suggestions that often enough, decision-making is influenced strongly by factors other than given information and material data as assumed by expected utility. There is evidence that information which is viewed as highly relevant and convincing by scientists concerned with the matter is "habitually ignored" by non-scientists, whilst

[161] A strong point of ideas in political economy is that it can turn around the focus on interests – not exclusively considering the causal effect of interests on policy outcomes, but to presciently explain the interest formation. Naturally a weakness is the linking between ideas and outcomes – establishing the presence of ideas in actors is often possible, yet making the case for causality is very difficult. However, given that many praised books on interests and lobbying fall short of actually proving the connection – listing meetings between policymakers and interest groups, listing similar goals, yet being unable to prove lobbying in the strictest sense took place – this should no less preclude ideas from becoming the focus of research.

certain logically weak items of information "trigger strong inferences and action tendencies" in them (Nisbett et al. 1976, 116). The non-scientists in this statement also include other experts, politicians and governmental decision-makers (Fischhoff, Slovic, and Lichtenstein 1980; Sjöberg 1999; Allison and Zelikow 1999).[162] For example, the effect of human activity on climate change and global warming is a scientifically proven phenomenon accepted by the entire scientific community except for a negligibly low number of scholars, many of which have links to the fossil fuel industry, and yet after almost thirty years of knowledge and research, this does not convince a majority of U.S. senators (Goldenberg 2015).

Rather than providing a full list of all the heuristics discussed by Kahneman et al. I focus on major heuristics and those that have potential to impact on decision-making in my case study. That means that for example issues with information gathering will be excluded as they may affect an individual but certainly should not affect a governmental decision-maker with access to abundant amounts of data, teams of researchers and experts.[163] The common bias *representativeness* is defined as 1) the level of essential similarity between an event and its parent population, and 2) the level of reflection of prominent features of the process which causes it (Bar-Hillel 1982, 69). The underlying assumption is that 'like goes with like', so causes and outcomes should be connected through similarity. It leads to overestimating events that seem more representative as being more likely. It is one of few widely recognised heuristics for decision-making under uncertainty (Kahneman and Tversky 1982; Bar-Hillel 1982; Tversky and Kahneman 1974, 197; Kahneman and Tversky 1979; Kahneman and Tversky 1972). To give an example I consider the case of guessing a student's major, which was the task of an experiment Kahneman and Tversky conducted (Kahneman, Slovic, and Tversky 1982, 126ff). Test participants were given a description of a graduate student's personality, called Tom, which they are told was written by a clinical psychologist when he was still in school (Kahneman, Slovic, and Tversky 1982).[164] Tom's character description includes information stating that he is very moral, yet self-centred, highly intelligent yet uncreative

[162] Again, Allison and Zelikow's reworked *Essence of Decision* also shows well-documented misjudgements of risk and use of heuristics in case of uncertainty by governmental decision-makers as well as government organisations. As for experts: the misjudgement of risks is not only proven to have taken place in countless case studies with subjects such as university students, lay people or random sample groups, but in regards to scientific experts' endeavours (Fischhoff, Slovic, and Lichtenstein 1980; Kahneman and Tversky 1982; Beck 1986, 1998; Wiener et al. 2013). A common heuristic is the dangerous overconfidence in current scientific knowledge and control.

[163] Other biases include for example adjustment and anchoring but they are not easy to translate from the individual to a government and are otherwise unlikely to apply to my case study (Kahneman, Slovic, and Tversky 1982).

[164] This example is taken from (altered, but based on) Kahneman, Slovic, and Tversky (1982, 126ff).

apart from imagination around sci-fi, that he is orderly and dull, and that he was unsympathetic to others and shied interaction. The test subjects are first asked to predict in which academic field Tom was likely to be graduating. There was very strong agreement that Tom was least likely to major in humanities, social work or education, and equally strong agreement that he most likely majored in engineering or IT. The test takers were then in a second task asked to explain whether or not they believed projective personality tests were a good source of information for predicting future professional choices: most of them said that they did not. After completing these two tasks, respondents were told that Tom was in fact a graduate in the department for education and taking part in a special training program to work with disabled children. This did not prompt many test participants to reconsider their position; I will elaborate on their reaction later on in this chapter.

The experiment is an example of representativeness, amongst other heuristics, for a variety of reasons. First of all, base rate information is entirely ignored. There are many more students of humanities and education than there are in IT (at the time of the experiment) yet this was entirely ignored by respondents in favour of guessing at similarity. Representativeness is the heuristic used when saying a child is likely to become a surgeon because it strongly resembles a famous one that is often seen on TV, or likes to wear a white coat, but without considering the child's grades in science classes or the number of surgeons in the country. This kind of judgment can make a quick response easier – but often results in serious errors of judgment. Several factors that really should influence judgment, such as the base rate of information, have no influence on representativeness, or similarity between two events. In the case of Tom, the graduate student, reliability of the character witness and the degree to which such a description actually allows a prediction – which many respondents admitted they doubted – were equally ignored. That degree, also called predictability, is a very important factor however. If predictability of an outcome from several events equals zero, then the exact same predictions should be made for all of them. Nothing circumstantial should influence a decision. This is almost never the case in reality though; intuitive predictions often discount predictability (Kahneman, Slovic, and Tversky 1982).

Usually when given information fits well with a predicted outcome people are very confident in a connection between them. Kahneman and Tversky call this the 'illusion of validity', and in multiple further experiments show that it exists even when people are fully aware that there are factors which limit the predictability of an outcome or the accuracy of such a prediction (Tversky and Kahneman 1982b).

I chose to include representativeness in this discussion because it seemed a possibility that it would have an effect on the issue of shale gas development. A focus on the assumed similarity between gas and shale gas, or a comparison with the experience of shale gas development in the United States to judge what will occur in the UK, disregarding the discrepancy between the different resources and different country situations, would indicate the use of the representativeness heuristic.

Another common heuristic is that of *availability*, which is related to representativeness but with a different process focus. Representativeness has more to do with misjudging the probability of a specific outcome, whereas availability is more about misjudging the specific probability. The availability bias is used when one "estimates frequency or probability [of an event] by the ease with which instances or associations could be brought to mind" (Kahneman and Tversky 1973, 164). To put it another way: "[o]ne assumes that if examples are brought to mind quickly, then there must be a lot of them, or that if an association is easily made, then it must be accurate" (Taylor 1982, 191f). For example, when considering the risks of cancer, a person is likely to consider the number of cancer cases witnessed among their family and acquaintances. This is an instance in which familiarity affects the judgment of probability or frequency of occurrence. Such judgment can also be affected by other aspects of the information input, such as salience, or prominence of an issue. Kahneman and Tversky conducted an experiment in which they read out lists of famous people's names to an audience and afterwards asked if the list had included more men than women or more women than men. Salience impacted the bias: If the male names on the list were more famous, the majority responded by saying the list had included more men even if this was untrue, and vice versa if the women's names were more famous (Tversky and Kahneman 1982a). So the presentation and prominence of an issue also affects availability. As for prominence, for many seeing photographic evidence of a wounded toddler in Aleppo has more impact on the subjective judgment of such occurrences than reading a statistic about how many children die there. Moreover, timing affects availability: the more recent an event is the more likely it is available in somebody's mind. Saying that a random child is likely to become a brain surgeon because it looks like a famous one is an example of representativeness. Agreeing when asked specifically if a random child will become a brain surgeon because one knows very many of them and therefore thinks it is likely even though they make up a tiny percentage of the work force is an example of availability.[165]

[165] Naturally for this purpose I am excluding the unrelated issue that knowing somebody who knows very many brain surgeons might aid in becoming one, through connections and role models – hence the child in the example is not related, but random.

Availability can be a useful heuristic and it can lead to correct assumptions – frequently occurring events are often easier to recall than rare events, so the use of availability can lead to correct judgments. However, extreme but rare events, such as aeroplane crashes, are also easily recalled, but to assume they are frequent or likely because they are easily brought to mind is false. Availability depends on factors besides probability or frequency of event occurrence, and basing judgments on availability can therefore lead to errors in judgment and biases in decision-making. I chose the availability bias as it can also have an impact on shale gas development – earthquakes have been caused by fracking operations, and albeit minor or rare, this phenomenon may become strongly and predominantly attached to the resource. Similarly, as of 2016 only one country (with very specific structural predispositions) has experienced a well-documented so-called 'revolution' with shale gas, with most countries possessing minor shale gas reserves yet nothing of a size worth noting. Naturally, the latter come less readily to mind when discussing shale gas options.

Other oft-discussed heuristics in decision-making which fit the third narrative on cognitive capture in my thesis include the issue of *causality and attribution*, or *causal judgment*. Attribution theory is a topic in psychology which in its broadest sense comprises any efforts by lay people to "understand the causes and implications of the events they witness" (Ross and Anderson 1982, 129). It revolves around the understanding that people base their explanation and expectations on assumptions and data. Assumptions can be flawed, and their data can be inaccurate, biased or based on insufficient or unrepresentative information such as specific experiences. Beyond gathering the data, there must also be techniques for using and interpreting the data – rules and conceptual models that permit deductions. Attribution theory mainly deals with two cognitive tasks: causal judgment, and social inference. Causal judgment, once fixed on a certain conceptual model, is a heuristic that strongly affects judgment and decision-making and can do so erroneously if based on flawed assumptions. The bias exists because thinking is heavily causal, and thus any potential causal links or causal arguments are weighted more heavily than circumstantial evidence or evidence of a more abstract nature (Shafer 1984). Data or information of an assumed to be causal nature, even if wrong, will likely have a greater impact on decision-makers than other data which may be equally informative. As a causal schema is established, other information which does not fit this schema will be attributed with less or no significance (Tversky and Kahneman 1980, 118). Making matter worse, Kahneman and Tversky found a "prevalent tendency to treat the [case example] as if it were perfectly valid, in spite of severe doubts" (Tversky and Kahneman 1980, 128). Subjects in experiments were strongly inclined to trust suggested existing models of explanation, however unlikely and unfitting they seemed for the case example, with only very few people suggesting the causal link or model might be invalid (Tversky and Kahneman 1980). This corresponds to the tendency of staying power of a status quo if it remains supported by powerful ideas discussed in the first part of this chapter. The refusal to reconsider assumptions about how things work is where serious issues may arise: once a connection is made, however wrong, it is difficult to challenge.

To elaborate on this, I return to the example of Tom, the allegedly self-centred graduate student in education (Kahneman, Slovic, and Tversky 1982). Test participants had guessed his career choice as IT or engineering, based on a character description of him in high school. In a separate unrelated question, most respondents had expressed doubts about the reliability of predicting career choices through projective personality tests. Respondents were then told that Tom was in fact a graduate in the department for education and taking part in a special training program to work with disabled children. Immediately after the revelation they were asked to complete a new task: to explain the relation between his personality and his choice of profession, in the full knowledge that most of them had guessed it wrongly. This is where causal judgment plays a role. The majority of respondents decided to either focus on aspects of Tom's personality description that they felt fit the picture after all – for example his moral sense – or to reinterpret his career choice to make it fit his personality test, suggesting it was taken up due to a need for dominance or order. This happened despite the fact that most respondents had said they were sceptic of the predictive power of personality tests. But once received, it was trusted. Their explanations were based on a verified fact (Tom's career choice) and on a more detailed but potentially questionable description of his character from years before. Yet only around a fifth of the respondents mentioned the possibility that the personality description might have been inaccurate guesswork or that Tom's character changed significantly since high school (Tversky and Kahneman 1980). Few respondents had the idea to reverse the direction and diagnose his character in light of his career choices. The conviction with which participants predict a career choice based on a personality description is evidence that people believe in a correlation between character and professional choices. This should imply that the other way around, professional choice is strongly diagnostic with regards to character. Given the example of Tom, in which his character and career choice do not seem to fit, diagnostic inference should result in questioning or revising the character description, or in questioning the link between character and career choice. But few test participants consider this. Tversky and Kahneman conclude that this shows the tendency of once-accepted causal connections and models of thinking to prevail against all odds (Kahneman, Slovic, and

Tversky 1982, 126ff). To return focus to cognitive capture, the lens of analysis created in this chapter, let us consider the impact this type of cognitive constraint can likely have on decisions even by official policymakers. It relates closely to lessons from the first half of this chapter which show the difficulty in discrediting a status quo as long as it is backed by accepted, prevalent ideas. Kahneman and Tversky suggest that predicting consequences from causes comes more naturally to human thinking than the reverse. Even if a model shows flaws, sticking to a causal connection that leads from action to consequence is easier than focusing on the outcome and reversing the logic. In other words, deduction is more trusted or generally found easier to apply than inference. To show the difference between causal and diagnostic reasoning, Kahneman and Tversky came up with the following problem set:

> "Problem 9: Which of the following two probabilities is higher?
>
> A) The probability that there will be rationing of fuel for individual consumers in the U.S. during the 1990s, if you assume that a marked increase in the use of solar energy for home heating will occur during the 1980s.
>
> B) The probability that there will be rationing of fuel for individual consumers in the U.S. during the 1990s, if you assume that no marked increase in the use of solar energy for home heating will occur during the 1980s." (Tversky and Kahneman 1980, 124)

According to Tversky and Kahneman, one can choose between only two logical directions: to either assume that all "other things being equal, a marked increase in the use of solar energy can only alleviate a fuel crisis in later years" (Tversky and Kahneman 1980, 124), because it adds to supply levels. The other option is to assume that "a marked increase in the use of solar energy during the '80s also provides a strong indication of an impending energy crisis" (Tversky and Kahneman 1980, 124). Their reasoning is that the increase in the use of solar energy could only be economical if otherwise "fuel prices in the '80s are sufficiently high" (Tversky and Kahneman 1980, 124). But this would suggest a shortage of fuel supply, which might lead to rationing. The causal judgment comes up with decreased probability for rationing, but the diagnostic judgment does the opposite. Therefore, an unreflective adherence to causal judgment constrains the cognitive process and affects ideas and subsequent decision-making.

This section delivers more evidence on the resilience of the status quo. In the case of graduate Tom and other experiments, the case studies found that respondents were reluctant to reconsider an accepted causal model, no matter how unreliable or uncertain its ability to predict outcomes is seen. There further is evidence of a tendency for fluent adaptation of an old model to new facts.[166] Causality thus can lead to exclusion of novel,

[166] The overwhelming failure of test subjects in this experiment to reconsider the presented character description could be due to the nature and wording of the task at hand. This occurred to the authors,

different or ill-fitting data from decision-making. There is ample evidence of "the tendency to explain without revising, even when the model that is used in the explanation is highly uncertain" (Tversky and Kahneman 1980, 128). Explaining or predicting things based on an existing model of thought is a different type of causal reasoning than revising a theory or a model based on new information. To explain an observation, one needs to link it to fitting features of the existing model. To predict an outcome, one needs to guess which consequence most fits the model elements. But when new observation leads to a revision, the original theory or model of thought is questioned and changes are made based on new evidence. The bias of trusting in causality rather than new diagnoses makes this last action less likely.[167] This heuristic fits together with work by political scientists on the power of ideas in decision-making discussed in the first half of this chapter on ideas and policy change, especially with findings about the dominance of the status quo.

The above discussed heuristics have been accepted as influential on decision-making and as potential factors to distort rationality both by critics as well as by supporters and reformers of expected utility theory (Kahneman and Tversky 1979; Kahneman, Slovic, and Tversky 1982). Decision-making is rarely based on a rational cost-benefit analysis, and even the proponents of modern expected utility theory and prospect theory agree on this. There are always biases. Constraints and biases have been suggested or even proven to be influential in shaping governmental decisions under risk (Allison and Zelikow 1999).[168] With the level of access to information and advisory councils only they have, governments should be better placed than most to take decisions under uncertainty. However, if policymakers are unaware of their own cognitive constraints, their ability to take well-considered decisions can be severely diminished just as it would be from surrounding themselves with experts and advisors drawn from only one particular advocacy group.

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however they reason they are convinced the wording was less influential in this than the causality bias (Kahneman, Slovic, and Tversky 1982, 126ff).

[167] Many inferences in regular decisions by both lay people and governmental decision-makers are based on theory and assumptions which are known to be incomplete or imprecise, and sometimes prove to be incorrect at a later point in time. People are aware of this and often are ready to admit that their theories might be flawed (Kahneman, Slovic, and Tversky 1982, 126). In broader terms, this can be illustrated by shifts in economic policy goals and models over time. Keynesianism was once widely accepted as a good prescription of how to adjust economic policy to achieve growth, until it was replaced by the ideas of Milton Friedman's Chicago school and Williamson's Washington consensus.

[168] The following quote by Fischhoff et al. nicely summarises what this realisation might lead to in political circles: "For experts and policy makers, these findings pose what may be a more difficult challenge: to recognize and admit one's own cognitive limitations, to attempt to educate without propagandizing, to acknowledge the legitimacy of public concerns, and somehow to develop ways in which these concerns can find expression in societal decisions" (Paul Slovic, Fischhoff, and Lichtenstein 1982a, 489). Naturally this should not suggest that governmental statements from now on include a blanket phrase stating 'we're probably biased, and likely wrong about this'. It is unclear what would be to gain from wilfully diminishing public confidence in such a way. But awareness is necessary to improve policy deliberation.

VII.3 Chapter summary

To achieve a clearer understanding of non-material factors influencing decision-making in this chapter I considered the possibility of cognitive capture. Ideas guide strategy in that they provide a framework of what is possible and which options and interests are available to choose from. Besides or as part of guiding key ideas, cognitive biases including causal judgment, availability and representativeness can impact the thinking of decision-makers. This way, systematic cognitive capture can present a situation in which certain ideas are entertained and others are not considered regardless of their value.

Key ideas about how a system or a policy is supposed to work have been found to be influential on decision-making. My theoretical review finds that this application of ideas is if anything more pronounced in a situation of uncertainty, when there is no clarity about the outcome or particular winners and losers of an action. Often enough ideas are quite normative or complex and not easily proven as right or wrong. Yet there is nothing to suggest that ideas are less influential when they are scientifically inaccurate – false ideas can be just as powerful as correct ones. In this chapter I also reviewed specific cognitive heuristics, namely representativeness, availability and causality, which have been found to bias information and decision-making even in the face of accurate information. The approach by behavioural economics, economics and psychology confirmed arguments from the political economic theory about the power of ideas and judgments, especially the difficulty to draw into question the validity of the status quo.

Despite their origins in quite different strands of literature, the two theoretical concepts can be combined around a similar focus of reasoning. Both approaches are concerned with the influence of certain reasoning on decision-making. For Béland and Cox, "ideas are causal beliefs … products of cognition … [ideas] are connected to the material world only via our interpretations of our surroundings [and] posit connections between things" (Béland and Cox 2010, 3). I find this view of ideas most helpful in combining the two bodies of literature considered in this chapter. Both are concerned with the influence on decision-making caused by ideational reasoning or indeed causal judgment and interpretation of material world issues and interests.

In the next chapter I will consider evidence from U.S. and UK energy strategy to confirm if they appear to influence policy on shale gas. This task cannot be fulfilled by simply surveying energy policy papers, but through the interpretation of strategy as to their assumptions, key ideas and logical associations about the energy sector. The third part of the above theoretical review suggests that underlying ideas and understandings of the world, the system or the economy are likely highly influential in situations of decision-making, especially in situations of uncertainty. Shale gas development brings with it uncertainty about many of its consequences, and therefore I address the role of existing ideas about how the energy system works that likely influence policy.

There is a possibility that a preferable solution to energy issues may lay outside of policymakers' regular remit, that they simply do not have enough or the right ideas on their radar, or are constrained by cognitive biases. As Mitchell (2013) notes, a focal point of the debate around energy generation and energy security in the 21st century should be innovation and change in energy technology. Technological advancement changed the economics of communication in the past decades, and it is changing the regulatory as well as economic playing field for the media in the most recent years. This is widely accepted. As for the energy sector, there are many indications that systemic change is possible as well as desirable.[169] The important point is the move to entirely different platforms. News and entertainment organisations are scrambling to improve their new media and especially their online content offers. Regardless, despite evidence that "given the opportunity, customers and citizens jump to invest in this latter future [renewable energy technology]" (Mitchell 2013), many policymakers and traditional energy providers are not leaping in a similar direction. When renewable zero marginal cost brings energy prices tumbling as it has in some instances in Germany for example, large energy companies will see falling profit whether they engage in it or not (Mitchell 2013). The success stories of countries and private interests that invest in renewables are convincing enough to prompt rethinking of energy policy (Usborne 2014; Parr 2015; Russell and Strachan 2015; Neslen 2016). The issue with ideas being missing or wrong is not whether miscalculations or false facts can make their way into legislation (McQue and Macalister 2014). The issue is whether current strategies on energy policy are potentially biased towards the option of shale exploration. If, for example shale gas is seen as a continuation of the status quo and traditional methods of energy generation whereas renewable energies are seen as change, this may have a strong impact on policymaking.

This chapter gives reason to consider every and all possible cognitive biases that may affect decision-making in energy policy, and to look for key ideas within the official governmental blueprint statements on energy. Such ideas may be based on specific causal judgments and biases, or consist of them. Arguments from the two different strands of

[169] Some countries are already experiencing rapid change and economic growth due to innovation in the energy system (Lipp 2007; Neslen 2016; Taylor 2016; Shankleman 2016b). Certain private interests are also experiencing economic success with renewables investment (Usborne 2014; The Times of India 2016; Shankleman 2016a). If the economic costs of fossil fuels included calculating health, pollution, clean-up and other environmental effects, then according to a report for the EU commission wind is already much cheaper than gas in the UK (Neslen 2014).

theory reviewed above have a different focus and basis, but they both form part of a larger argument about cognitive capture. Both can have the same effect, namely to influence and divert decision-making.

To confirm my third narrative of the fracking story and review evidence of this in the case study of shale gas at hand, the institutions' guiding strategy papers will be assessed as indicators of the framework of ideas surrounding energy decisions to examine ideas and heuristics which may affect decision-making.

VIII Chapter Eight. Cognitive capture: Evidence from the strategy plans

In this chapter I follow insights from chapter seven and examine official energy policy strategy papers to establish the existence of cognitive capture in the form of underlying ideas and biases, which the theoretical review suggests can alter and constrain decision-making. My hypothesis for the chapter is that evidence of cognitive capture, through the presence of specific key ideas and cognitive biases, such as causal judgments, favours shale gas over other new resources for the energy sector. The 0-hypothesis to this is that strategy documents either include strong ideas that suggest a policy path other than the one including shale gas, or that they contain a multitude of ideas and no noticeable pattern of pro-shale gas related ideas. To this purpose I examine evidence gathered from strategy documents based on indicators drawn from the theoretical review. These indicators concern the prevalence of key ideas, and of the biases causal judgment, representativeness and availability. I review several key documents that are officially claimed to be the strategic guiding papers on energy policy in the United States and the United Kingdom which represent as well as inform ideas on energy policy strategy.

It is impossible for me to conclusively prove that there is a direct effect of such ideas on ensuing policy outcomes. However, it is possible to review whether or not such ideas exist in the first place, and whether they fit with the policy decision of supporting shale gas development, thereby establishing probable cause. The practice of tracing ideas and their fit with policy decisions to demonstrate their significance for policy outcomes is established in political economy (Hall 1989). Difficulty arises as there is no clear cut path of methods to follow on how to establish the existence of an idea in a written document, and "the extent to which outcomes are directly attributable to these ideas is still difficult to ascertain" (Blyth 2009, 215). In fact, most of the research in this area is more concerned with the effects on policy outcomes by ideas the existence of which is already well-known and specifically articulated, such as a neoliberal belief in the benefits of trade liberalisation.[170] There is no guidebook on how to prove the existence of an idea in a text. I am looking for more specific ideas and judgments made about the energy sector and select energy production sources. Béland and Cox suggest that a "way to make the case for ideational scholarship is [taking] an outcome of interests and show[ing] that ideas

[170] In their ground-breaking work on the influence of ideas on policy, Peter Hall and his colleagues simply assume the existence of Keynesian ideas in the governmental sphere – they do not look for evidence of them in official statements.

matter in explaining it" (Béland and Cox 2010, 83). This is my approach, to see if I can explain the policy outcome of support for shale gas development by establishing that it matches the ideational repertoire of the countries. If this is the case and cognitive constraints can be proven as well, I have established what I label cognitive capture. In the first half of this chapter I analyse the strategy documents manually and summarise their core focus points briefly, as well as key ideas that can be found in them. This is to provide context which is important to text analysis to avoid misrepresenting its subjects of analysis. I further address this concern by introducing each document considering the time and circumstances of its creation where possible and or necessary. During the manual analysis I also establish key ideas as codes of association for causal judgment which I use in the second half of the chapter for further comprehensive statistical discourse analysis with the Provalis Research QDA Miner statistical tool. QDA Miner is a data analysis software package by Provalis specifically intended to be used in mixed methods research, for "coding, annotating, retrieving and analysing small and large collections of documents" (Provalis Research 2016).

The second half of the chapter captures wider ideational and causal trends of the documents and also shows if underlying ideas clash with those promoted more prominently in the strategy blueprints. This is where I look for very specific causal judgments between energy sources and policy results.

The focus for this chapter therefore lies on the input, i.e. the information side. On the output side, the depending variable, we know a decision has been made by both countries' governments to approve and support shale gas development. Hence in order to trace specific ideas I am considering information produced by and informing the governments discussing key strategies and concerns before the state of policy implementation. Which information was presented to the decision-makers, do the strategy blueprint documents correlate or clash with their final political decision on shale gas? I work from the assumption that key policymakers are both involved in composing the strategy papers and then take their strategic cues from them. I consider the strategy documents under the theoretical lens of the literature previously reviewed and with the aim to find answers to the following questions: Which are the key ideas connected with the different energy sources? What is the tone of the connection between certain concepts such as environmental health or energy security and different energy sources, i.e. positive, negative, causal, or neutral? Is there a similarity or difference in core ideas and causal judgments between U.S. and UK energy strategy plans? Do the key ideas and themes change drastically between different documents? Is any evidence of the biases found in the theoretical review noticeable in the strategy papers? Given the fact that I am not conducting controlled behavioural tests with policymakers but basing my conclusions on indicators of ideas expressed in strategy papers, detecting biases is a more complicated and different task relying on interpretation. It is difficult to establish concrete evidence of representativeness or availability outside of a controlled test situation, but this is possible through interpretation. Evidence of causal judgments has the best potential for content analysis in documents and a connected trend in favour of the status quo can also be detected in this form of data.

The data considered in this chapter consists of the respective official energy strategy plans: in the United Kingdom these are the Energy White Papers from 2001 – 2015 and in the United States these are the Strategic Energy Plans commissioned between 2001 – 2015 (DTI 2003, 2007; BERR 2008; DECC 2009, 2011, DoE 2006a, 2011, 2014a; White House 2014). These documents are the blueprints for all energy policy within a country: they showcase the ideas held by official energy policymakers as well as the ideas that future policy is drawn from. Hence, they give a unique insight into the ideas and mind-set of those who end up drafting actual energy policy legislation within the specific departments dealing with this task, and how they may or may not change across time. To this line of research this is more conducive than official statements by elected Congressmen and -women or MPs who are not actually tasked with writing energy legislation – hence I chose to consider the energy strategy papers over transcripts of parliamentary debates on the issue, after finding that the latter rarely go into detail and are mostly held by people not actually tasked with writing energy legislation. That is not to say that these public debates have no influence on the final energy policy, but that they do not substantially add to the review of strategy plans.[171]

Through the analysis in this chapter I gain insights on strong underlying ideas about energy policy and specific biases such as causal judgments about different energy sources and policy outcomes. The results add to my analysis of factors that influence policy decision on shale gas development by preventing objective consideration due to cognitive biases.

[171] Interviews would have been a helpful addition to the dataset. However, after completing a first round of interviews with parliamentary researchers and researchers at the Department of Energy and Climate Change in the United Kingdom, it became impossible to replicate these interviews in the United States during my research there. Hence interviews do not form part of my dataset in this chapter, but I acknowledge that they can be a fruitful future addition to the case study.

VIII.1 First evidence of cognitive capture in United States energy strategy: Context and key ideas

In this section, I consider several documents officially designed to outline and guide U.S. American governmental energy strategy and policy decisions within the energy sector. The chosen documents, limited in number through the timeframe selected, are the following: Each of the U.S. Government's commissioned Strategic Energy Plans, researched and written by the Department of Energy (DoE) between 2001-June 2016. That includes the DoE 2006 Energy Strategy Plan, the DoE 2011 Energy Strategy Plan, the DoE 2014-2018 (March 2014) Energy Strategy Plan and the All-of-the-Above Energy Plan 2014 (AOTA) (May 2014).

VIII.1.1 The 2006 Department of Energy strategic plan

In the 2006 Energy Strategic Plan the U.S. Department of Energy states that "over its history, DoE has shifted its emphasis and focus as the energy and security needs of the nation have changed" and it nowadays focuses on "energy, scientific, environmental, and national security goals" (DoE 2006, 6). The combination of goals shows the importance accredited to the energy sector and its relevance for security, but also appears to suggest the sector to be very adaptive to change in time. The key topics of the plan are – in that order – energy security, nuclear security, scientific discovery and innovation, environmental responsibility, and management excellence (DoE 2006, 7). The DoE Strategic Plan further outlines the DoE's key ideas and aims for the development of new energy technologies, the improvement of energy independence, the protection of United States nuclear weaponry stockpile, and a renewed increase in U.S. American competitiveness in the global energy market. To help achieve these goals, President Bush launched two key research initiatives which the plan discusses: The American Competitiveness Initiative (ACI) to increase "investment in research and development, … and encourage(s) entrepreneurship and technology discovery" and the Advanced Energy Initiative (AEI) which promotes energy efficiency to lessen imports and increase energy independence (DoE 2006a, 6). AEI is also mainly responsible for the allocation of funds to advance renewables technology research, i.e. wind or solar, but also carbon capture and clean coal technology. Clearly this is kept separate from other investment in technology research. In the three years following the strategy plan with Bush still as president, the ACI was funded between 30-50% more than the AEI (DoE 2006b, 2007, 2008), further suggesting different priority attributed to the goals. This idea of the importance of research and scientific innovation in the future to mitigate current as well as future problems and challenges is repeated throughout the document (DoE 2006a). This focus suggests a heavy reliance on science and future scientific discoveries to do away with problems. It appears to be reserved for specific causes: the need for research is not nearly as strongly promoted for example when there is need for thorough scientific research to mitigate risks in the pursuit of shale gas development, as experts have criticised (Schrope 2013; Semeniuk 2014; McCarthy and Semeniuk 2014; Goodchild van Hilten 2015). The DoE considers that its "principal tool for advancing technology is investing in high-risk, high-payoff energy research, development [which] the private sector would not or could not develop alone in our market-based economy" (DoE 2006a, 8). Willingness to invest appears to exist, but it is selective. While the trust in scientific innovation is strong, this brief outright dismissal of market-based options as insufficient seems unusual in a U.S. government publication. It does not engage with other sections of the same document which treat the efficient market-economy as a given and desirable, nor is it repeated in later U.S. strategy documents.

The strategy plan repeatedly stresses the importance of keeping America strong economically and as a global leader, an end to which "reliable, clean and affordable energy" is a necessary means (DoE 2006a, 8). Nuclear energy is considered alongside renewables. The transport sector is pointed out as a very inefficient sector, and heavily reliant on foreign imports of petroleum and therefore weak in terms of energy security. (Shale gas cannot simply fix this issue.) Said dependence is the main criticism of fossil fuels in the document, and it is related more to oil than gas. A strong recommendation for renewables is a result from the finding that there is a connection between diversification of the "energy portfolio and increase [in] energy security" (DoE 2006a, 9). However, the plan is also filled with a notion of no urgency, and almost unlimited time in order to fix current or future issues in the future: The plan explicitly counts the aim of energy efficiency and less energy intensity as positive for the economy and conducive to enabling energy independence in one paragraph (DoE 2006a, 8). The rest of the sections on environmental protection and legacy are full of references to current and future technological advances that will solve current and future problems.

Reviewing the strategy plan of 2006 almost a decade after its publication, I find that several items on its agenda showcase the inability to make detailed and accurate long-term economic predictions. As an example, in 2006 due to an increase in global and regional energy demand as well as production constraints, attested largely to the decline of resources and resource availability, gas and oil prices were rising rapidly and expected to continue rising without an end in sight (DoE 2006a; Romero 2004). In 2016, we know better. In 2004 the U.S. imported 65% of domestically used crude oil (DoE 2006a), and the U.S. EIA forecasted that this would increase continuously (EIA 2005). The picture has changed dramatically since then: the U.S. market is flush with cheap domestic gas, and global oil prices fell lower than they had been in a very long time (IEA 2014). Said resource availability issues and rising prices were cited as key reasons to diversify the energy portfolio and invest, for example, in renewables – "energy diversity is essential for America's energy security and economic prosperity" (DoE 2006a, 9). The necessity was expected to increase and diversify the U.S. energy mix and lessen dependence on imports of oil, "thereby reducing vulnerability to disruption and increasing the flexibility of the market to meet U.S. needs" (DoE 2006a, 9ff). The attitude I can detect towards renewable development appears to paint it mainly as a necessary step to take when the preferred sources of energy become troublesome to acquire. The document makes mention of "energy disruptions" and the high risk possibilities that natural disasters such as droughts, water shortages, earthquakes and others could have a potentially major impact on the energy supply and energy security of the United States. There is little effort made however to elaborate on the fact that it is the effects of the use of fossil fuels that cause these risks. It is worth noting that several of these risks have since been demonstrably linked to shale gas operations.

A strong causal judgment is hinted at midway through the strategy plan: "Fuel prices will affect the rate at which many new energy-related technologies penetrate target markets. When fuel prices are high, typically large-scale market penetration occurs sooner than when fuel prices are low" (DoE 2006a, 12). In 2016 this has proven not to be so – the oil price had been very low for over a year and renewable technology flourished throughout this time and is set to be one of the cheapest energy sources in the U.S. in 2016 (Johnson, Yeh, and Hope 2013; Watson 2016). Yet when discussing the environment, the DoE warns that its ability to achieve the environmental responsibility goals might be hindered by changes in regulation – that requirements to comply with further environmental regulation might make it harder for them (DoE 2006a, 22). This seems like a prophylactic warning and as if the DoE does not desire any further environmental regulation. Concern about costliness are further expressed by the following reminder that a "factor that most of the energy technologies being researched by the Department have in common is that they are more costly than conventional technologies in today's marketplace" (DoE 2006a, 12).[172] This is also the case for unconventional shale gas of course, as chapter two and four have shown, but this fact is not as publicised.

Key ideas in this report include that renewable energy technologies are considered ultimately inferior to traditional fossil fuels in their potential contribution to the economy but necessary as a second-best plan to help with energy independence and reduce emissions. Causal judgment is found about renewable energy as environmentally beneficial but costly. Environmental concerns are considered prominently but are not granted similar levels of urgency as energy independence. The U.S. energy sector was in a declining phase in 2006, with rising imports and high prices, and the 2006 energy strategy plan reflects this through a notion of some urgency and an attitude of future problem-solving. Remedies to the problems of energy dependence, declining resources, and environmental hazards are suggested to lie in diversification and renewables amongst others, but there is no cheerleading for this option. There is a strong recurring idea notable around the importance of energy for national security through energy independence.

VIII.1.2 The 2011 Department of Energy strategic plan

The 2011 DoE Energy Strategic Plan was "intended to serve as a blueprint for the Department of Energy to help address the nation's energy, environmental, and nuclear challenges through transformative science and technology solutions" (Schueler 2011). In its mission statement one reads that the way to ensure both American security and American prosperity lies in "addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions" (DoE 2011, 5). This is not wildly different to the previous energy strategy paper. There is however more focus on the environment, at least in the summary pages, though this remains quite vague.

The key plans outlined in this strategy document and found throughout are: to aid the transformation of the national energy system, to ensure U.S. leadership in clean energy innovation and technology, to invest in science, assure nuclear security and to create a new framework for energy policy (DoE 2011). The free market system as the ideal approach to a functioning energy market is considered as a given.

The plan focuses heavily on U.S. leadership in all energy-related areas. Its authors ascertain an increasing challenge to U.S. leadership in many areas, such as IT,

[172] Furthermore, there are multiple references to the DoE's role and responsibility in safeguarding the nation from nuclear proliferation elsewhere and safeguarding the nation's own nuclear power plants and nuclear weapons' stockpile.

biotechnology, aerospace and many other technological industries. "American leadership in the clean energy revolution is essential to future economic competitiveness" (DoE 2011, 3). However, they admit that "the United States has lost its lead in many of the energy technologies that [they] developed" (DoE 2011, 3). In fact, the United States has been a net importer of high technology products since 2011 (DoE 2011; The World Bank 2015). Renewable energy is considered more earnestly in this context of leadership, as if a key reason for engaging with them is the desire to not miss out on being a leader in another sector of the modern economy.

As in 2006, a strong focus lies on innovation and supporting new technologies and constant invention, readily accepting the prospect of some of the investments failing. This appears to suggest that certain costs are tolerated. There is strong trust in increasing capacities of technology and that future problems can be fixed. Establishing leadership in energy innovation in general is seen as a way to ensure future economic revenues for the United States, but there is at this point little explicit connection made between renewable development and positive economic impact, other than the potential for leadership. The document is heavily focused on economic aspects related to energy, for example pleading the imperative to reverse the trend of decreasing manufacturing jobs within the United States.[173]

The document stresses that the United States' "excessive dependence on oil is taking [them] down an increasingly costly, insecure, and environmentally dangerous path" (DoE 2011, 12). The dangers of energy dependence and climate change are deemed worthy of drastic measures for prevention: "The transition to a secure, low-carbon energy future requires nothing less than a new industrial revolution." (DoE, 2011, p. 13). The risk of climate change is discussed with reference to emissions: "As part of prudent risk management, our responsibility to future generations is to eliminate most of our carbon emissions and transition to a sustainable energy future." (DoE 2011, 12). Shale gas is of course not sustainable. The effect of climate change is accepted as a given, which is not necessarily the case for all American policymakers and bureaucrats. The comment is a most important statement in that it shows that in their strategy outline, the formulation of their goals and ideas 2011, the United States government clearly considers carbon emissions a risk. This not only further confirms the suitability of the focus on decisions under risk and uncertainty in this study for researching decision-making in energy policy,

173 In this spirit, the document praises the U.S. as being the place of the greatest research institutions in the world, a situation for which the department takes partial credit (DoE 2011, 12) but emphasises repeatedly that it considers this position of leadership at risk.

it also confirms that the government in their expression of ideas considers them to be so. The latter inarguably clashes with the decision to support and invest in further unconventional fossil fuel production as has been the case with the commitment to shale gas exploration, making it an unusual policy choice at first glance. There is surprising vigour in the statements that "there is compelling evidence that carbon-dioxide emissions from human activities are adversely affecting the climate" and that "the conventional use of fossil fuels is a major source of these emissions" (DoE 2011, 12). These are strong statements for the government of a country in which climate change sceptics, albeit below 1% of the scientific community, are represented almost equally in the media (Boykoff 2007). But these insights are not used in the document to effectively employ rhetoric against increasing development of fossil fuel resources. Emissions also remain the only environmental hazard discussed in any detail. Considering the document relates a strong trust in the future effectiveness of carbon capture, this may not necessarily imply a need to turn to renewable energy.

The 2011 strategy plan's focus on the panacea that is new technology is a strong idea influencing the document in that it seeks to dispel the notion of limitations. Instead of focusing on the finite nature of the planet's ecosystem, in this plan the idea is pushed that future inventions can change everything and fix problems of the current system, therefore investment in technological innovation almost absolves the government of certain hard decisions. But it also increasingly focuses on environmental issues, which is a change in trend since the 2006 document. The new Obama administration is of course responsible partially for a change in administration at the DoE in between 2006 and 2011 which may have to do with changes in style. Renewable energy sources however are not considered in any detail and the discussion of climate change remains much less specific than for example discussions of the energy sector's overall impact on the U.S. economy. This appears as an example of availability: there is less experience with renewable sources, therefore they are not considered in as much detail and length. Key ideas promoted in this report include the importance of U.S. leadership and the importance of decreasing import dependence which is a theme carried onwards from the 2006 plan. The perceived vulnerability is carried on despite an actual improvement and change in the situation in the meantime. That energy independence leads to security and safety is a strong causal judgment that is not questioned: this non-consideration of details, and the priority attributed to this goal, facilitate the introduction of a short-term fix such as shale gas.

VIII.1.3 The 2014–2018 United States strategic planner and the 2014 all-of-the-above energy strategy as a path to sustainable economic growth

With the 2014-2018 strategic plan the Department of Energy aims to address "energy, security, economic and environmental challenges facing the United States in the 21st century" – and declares itself ready to deliver solutions (DoE 2014a, 3). While all of the discussed energy strategy papers tend to mention climate change prominently, this is the first U.S. plan that begins by naming climate change as a primary challenge and priority in the energy sector in its opening message from the energy secretary (DoE 2014a). Major concerns of the plan are mitigating climate change and working towards U.S. energy independence. This focus is only a nominal change from the more general 'energy security', as it usually is understood as equivalent to energy independence in the U.S. strategy plans.

Looking back from 2016, it appears as though there was an increase in the discussion of climate change at the same time that shale gas development flourished and first troubles of the industry became known. Alike previous strategic documents the DoE 2014-2018 puts strong emphasis on the importance of scientific innovation and supporting research, and shows a strong belief in the power of future ideas to solve current problems.[174] A third of the report is concerned with nuclear energy and nuclear weapons, dedicated to discussing the safety of the U.S. nuclear deterrent and working at the global level to reduce threats of nuclear weapons.

The strategic plan that opened with a statement on climate change does deliver in the sense that commitment to renewables and environmental clean-up are discussed in much detail and with abundant examples of different programs that the department is supporting. It is very specific about different renewable initiatives and in fact all its policy recommendations, and makes several big concessions to the capacity of renewable energy to contribute to the U.S. economy. The focus on economic competitiveness and job creation is also very strong. There is further a strong focus on supporting scientific and technological innovation and for this purpose to support education in science, technology and engineering. Part of the strategy for departmental management is dedicated to the clean-up of chemical and nuclear waste. It is, however, clear that waste from other energy technologies is not considered worthy of discussion in this context. There is strong emphasis on both the moral and legal imperative of dealing with nuclear waste products

[174] Further focus lies once again on nuclear weapons' technology, non-proliferation and U.S. leadership in global energy transition. In terms of substance it adds little outlandish or different material to the analysis that would diverge from previously pledged ideas and preferences. Also, it is very repetitive with its key themes.

to protect environment and health. This is not as of yet reflected in emphasis of dealing with environmental damage, risks to human health and the effect of waste from shale gas operations.

None of the U.S. strategic plans regarding energy reviewed so far have mentioned the phenomenon of shale, shale gas or shale oil with a single sentence. There is talk of 'unconventional gas', which includes shale as well as tight gas, in the context of future research and sharing of best practices. This is despite shale gas and oil becoming major factors within the U.S. energy sector by then.

In the 2014-2018 plan the market is still considered the best and only system for the allocation of energy resources, there are simply fewer words spent on reaffirming this. In this document, the idea that the energy sector is vital to the job market is underlined, and further job creation and action to increase sector competitiveness are encouraged. The key idea of salvation through technological discovery and scientific research is carried on from the previous document, but here the policy plans connected are more concrete. The report also pays ample attention to national security defence and continues the trend towards an increasingly environmental framing of energy policy strategy. Alternative energy generation is considered more seriously than in the previous documents (this was expected with the switch from a Republican to a Democratic administration but did not manifest as strongly in 2011). Whereas the economic prowess of conventional fuels is still highlighted, the notion that renewables can yield economic results is promoted more than in the 2011 plan.

The latest strategic planner for energy policy in consideration for this study is the "all-of-the-above energy strategy" plan (AOTA from here on) "as a path to sustainable economic growth" (White House 2014). It entailed a new $27.9 billion Fiscal Year Budget request for the DoE (2.6% increase) from president Obama and was lauded to emphasise continued commitment to both national energy goals, "global leadership" in energy, energy security as well as low carbon goals (Moniz 2014). During the 2015 State of the Union address, President Obama said that "one of the biggest factors in bringing more jobs back is our commitment to American energy. The all-of-the-above energy strategy … is working, and today, America is closer to energy independence than we've been in decades" (Moniz 2015). Clearly the focus on U.S. energy independence is as strong as ever. The DoE explicitly considers energy dependence a risk: "Although international oil supply shocks and oil price volatility will always present risks, empirical evidence presented in this report suggests that further reductions in net petroleum imports will reduce those risks" (White House 2014, 6). Petroleum imports are again singled out as an issue of dependence. The AOTA blueprint opens prominently with a reminder that the U.S. energy sector is in the middle of a phase of great "historic" change and transformation, and that it is experiencing considerable growth in almost all the sectors' resource groups, including renewables as well as traditional fossil fuels (White House 2014, 2).[175]

The document can be roughly divided into three strategies which are described as key features of the blueprint: the support of economic growth and creation of new jobs in the energy sector, the advancement of energy security and energy independence, and a focus on cleaner, low carbon energy. Shale gas can only, in the best-case scenario, deliver the second out of those three objectives to the U.S., and only for a very limited time. There seems to be a clear hierarchy of ideas and of the three main stated goals in the strategy paper; the important progress of making the U.S. a leader in energy policy, for example, is discussed in length and only after continued support is explicitly pledged to this goal, the final sentence of the paragraph reads that "(AOTA) will strengthen this progress" of energy independence and being the world leader in oil and gas supply "while deploying low-carbon technologies and laying the foundation for a clean energy future" (White House 2014, 3, 6). This appears as a purposeful ranking of goals in order of importance. The necessity of achieving (or, depending on the sector, preserving) U.S. leadership is highlighted as vitally important throughout the document, just as energy independence is.

The fact that natural gas consumption has risen by 18% in the past decade is considered a success in the same spirit that an increase of energy in solar, wind and geothermal sources in the past half a decade is (White House 2014, 8–9). This is partly due to the fact that the increase in gas consumption goes hand-in-hand with the decrease in petroleum consumption and hence import. Secondly, this success is seen due to a slight decrease in CO_2 emissions, as gas is widely considered cleaner than oil. The second point should be accepted with caution; both because shale gas has not replaced coal but often led to it being exported and burnt elsewhere, therefore not lowering overall emissions; and because emissions from shale gas are quite possibly much more potent than from conventional gas or coal (Hirst, Khor, and Buckle 2013; Harvey 2014a). The authors of the AOTA strategy paper readily admit that both of those changes as well as many other developments in the energy sector were previously unpredicted by the department (or other official sources known to them). They go on to make a new prediction that dependency on imports will decline in the future whilst the role of gas in the U.S. market

175 In its opening statement, the AOTA plan self-describes its strategy as "aggressive" (White House 2014, 2). The executive summary and key chapters are full of references to climate change and the need for a low carbon transition.

will strengthen and continue. The irony goes unnoticed, yet it is evidence of the survival of a key idea that has guided U.S. energy strategy for decades: namely a strong belief in the power of the oil and gas sector, despite growing knowledge of declining resources and fossil fuels' connection to global warming. This is a clear impact of causal judgment: the result of import dependency is not used to then engage in diagnostic inference and establish that the oil and gas sector has not delivered on this goal lately. Instead the judgment that the sector always delivers is trusted and therefore, only the direct neighbourhood of this issue is considered: more oil and gas is needed, rather than diagnosing that the association no longer works and finding an alternative that will lead to energy security and independence. This connection also confirms a status quo bias: the positive perception of fossil fuels' effect on the economy has not been discredited enough.

According to AOTA, it was partly the energy sector that helped along the U.S. recovery from the recent economic and financial crisis: "Rising domestic energy production has made a significant contribution to GDP growth and job creation." (White House 2014, 3). Much of this rising production can be attributed to shale gas, therefore a positive connection is made clear. A lessening of U.S. trade deficit since 2009 is also partially due to a decrease in oil imports – according to AOTA, this accounts for more than a fifth of the narrowing margin.[176] Reasons for this include both the stark increase in domestic production of gas and oil as well as the greater use of biofuels and some advancement in energy efficiency, such as more efficient vehicles. Yet other reasons include the economic downturn and subsequent reduced energy demand (Mathieu, Spencer, and Sartor 2014). AOTA claims a rather unspecified growth in jobs around the energy industry largely to do with the expansion of the shale business – "employment in these sectors [oil and gas] increased by 133,000 between 2010 and 2013" (White House 2014, 15).[177] This number is difficult to verify or back up. Natural gas is embraced and distinguished explicitly as a 'transitional fuel': cleaner than many other traditional sources of energy, it is meant to aid the path towards a renewable energy future. In the same sections "some environmental

[176] The DoE sees problems in the reliance the energy sector, especially the transportation sector, on heavy liquid fossil fuels, both for reasons of energy independence as well as in terms of environmental damage (White House 2014). "The convenience of high-energy content liquid fuels means that their role in the transportation sector could persist for decades"(White House 2014, 38f). It states that the DoE means to discourage this trend, however said convenience may serve as an explanation why the ideas and preferences have scarcely advanced in the decade spanned by the here-analysed strategy blueprints.

[177] This claim is unspecific (i.e. it does not say what jobs and in which sectors, because not just the industry directly is considered) and very contested by researchers (Cusick 2013; Christopherson 2015; FWW 2015).

concerns" in connection to natural gas are seemingly belittled and not discussed further (White House 2014, 40).[178]

The document is at times less exact than desirable and does not shy away from exaggerated claims it later mitigates: for example it suggests that "The United States has emerged as the world's leading producer of petroleum and natural gas" (White House 2014, 13), only to concede at a different point in the document that in fact it is not that yet, because it only "leads in natural gas and is predicted by the International Energy Agency 'to lead in oil as well within a few years' " (White House 2014, 3). This may be an editorial oversight but may also be purposeful; the reader who only skims headlines and executive summary would likely not notice. The report further claims that the U.S. has reduced its total carbon pollution since 2005 more than any other nation on the planet has reduced their respective ones, however there are no exact numbers or formulas referenced that would elucidate how it got to this result. It is not easily verifiable through brief research, only repeated on the White House website. World Bank data compilations do not, in fact, corroborate this claim (World Bank 2011). It is evident of a key idea or theme in the U.S. strategy paper: the notion of U.S. leadership and exceptionalism, which is very strong. The conservation of this perceived leadership is worth a lot to the authors of all of the U.S. strategy plans reviewed here.

The half-sentence reminding the reader that in his last two State of the Union Addresses President Obama called on Congress to pass legislation to the effect that there would be a market incentive or market-based mechanism for reducing carbon emissions makes it clear that currently this is still in absentia (White House 2014, 36).[179] It is also very unspecific. Along the document are mentioned many expenses taken by the government to support renewables, clean coal technology, renewables on public land, and private investors in renewables, to compensate for a lack of incentives in the free market, which they plainly say works better for fossil fuels. The impression one gets when reading is that renewable energies are considered to have special needs, and while the DoE wants everyone to know how much they have already and will further support them, they also insist on reminding the reader of their inferiority to conventional fuels.

[178] There are remarks on the utility of gas as backup power for wind and solar plants. This is a new narrative for supporting gas and potentially shale gas, but a cost-benefit analysis of producing new shale gas only for this purpose is not attempted and unlikely to be convincing.

[179] "In the absence of market-based mechanisms to internalize the externality, it is appropriate to provide support through tax incentives and other measures commensurate with the value of the GHG reductions provided by those zero-emissions energy sources" (White House 2014, 36), for example the renewable energy production tax credit.

For the first time in 2014, nonconventional shale gas is explicitly mentioned in a governmental energy strategic paper (White House 2014). It is once used to label a figure and again in the context that research to "inform prudent local environmental regulation of hydraulic fracturing is actively under way" (White House 2014, 35). This seems rather late if not remiss, considering that at this point hydraulic fracturing on a major commercial scale had been an active part of the energy economy for around a decade.

The AOTA focuses less on technical innovation than previous strategy plans; it still is full of references to national security, and strongly recommends free market solutions but it sees more limitations in these policy goals than the previous but not the first two reports. The market is in this case also used with reference to protecting the environment: that renewables may not be strong market competitors yet, but the market can fix this, adapt, and further their inclusion by providing incentives for low carbon energy generation. Overall the focus on environmental factors has increased, but they are implicitly given a lower importance in a ranking of priorities. The economic focus on the other hand is increasing both in frequency and priority. Key ideas promoted in this last available U.S. energy strategy blueprint include the connection of the gas sector to growth and jobs and economic recovery, as well as to increased U.S. energy independence and security. This is very clearly a fruitful base for the support and extension of favourable shale gas policy. Considering the results of chapter four, intentionally or unintentionally presenting the support of shale gas as based on job creation, 'the economy' and security concerns (while maintaining it is a cleaner fuel than others) also targets key public priorities.

VIII.1.4 Preliminary analysis

The U.S. energy strategy papers reviewed, in as far as they can be compared amongst themselves, have shown the existence of several noticeable key ideas that are informing their energy policy. Although there are different highlights in each strategic plan, one could not establish a major change or specific trend in between them. The 2006 energy plan stands out for a sense of urgency and looming doom, especially with regards to increasing import dependence, which leads it to partially condemn oil. The energy sector at the time was considered in decline, and the plan was, of course, also published by a different, Republican administration than the other three. The 2014 strategic plan is unique in that it is very specific in terms of detailed policy plans and statistical information about renewable technology developments for example, whereas large parts of the other plans focus only on broader themes and strategy for alternative energy.

Guiding ideas are discernible throughout all of the four U.S. energy blueprints. They concern the energy department's priorities as well as judgments of energy sources and are indicative of cognitive capture in shaping and constraining the room for energy policy decisions. The need to achieve energy security and energy independence is very strong in these strategy plans. The terms are often used interchangeably: energy security is not deemed possible while dependent on imports. Because of this, oil and petroleum is at times portrayed unfavourably, but energy independence is not really negatively connected with the gas sector. The energy sector overall, but especially the gas sector, is often connected with the creation of jobs, and in later strategy papers specifically with helping the American economy on its way to recovery. These ideas, however flawed, can have a strong impact on policymaking regarding shale gas which is considered to decrease levels of import dependence in the short run.

Environmental concerns are prominent, and clearly considered more seriously in the documents published under the Obama administration than in the 2006 plan. Yet renewable energy sources are discussed less frequently and less specifically than traditional fossil fuels (with the exception of the 2014-2018 strategy plan), despite a recurring focus on climate change and a slightly less discussed very general need for low carbon energy production. This could be an effect of availability: there is less experience with and knowledge of them. Furthermore, in terms of their capacity for growth and revenue, renewables are several times compared and considered inferior to fossil fuels, especially when competing in a market system, which indicates a strong causal judgment. If they really are considered gospel, these cognitive connections may have impacted policy planning around gas, shale gas and renewables. Renewables are unlikely to thrive in the market system if there is no belief in their ability to do so and subsequent policy action; just as there were few plans developed prior to 2008 into how to regulate the banking system more strictly because trending ideas did not suggest this course of action.

Another idea is a strong trust that research and innovation, and constant technological improvement, will fix current issues in the future. The repetition of phrases in this spirit suggests that future generations and future administrations will come up with solutions to problems that are currently experienced but are not prioritised to be dealt with, such as perfecting carbon capture or belatedly attaching environmental regulation to drilling procedures. This is a problem, and could be indicative of the introduction of shale gas. Where it causes problems to the environment they are not prioritised and recognised sufficiently, or else put off to be dealt with in the future. This betrays an idea of ultimate control over the future of the energy sector that cannot be assumed: uncertainty may alter the framework in which decisions are made to the point that plans made in 2014 may no longer be feasible in 2020.

Another discernible idea is the need for U.S. American leadership in diverse areas, such as energy production (gas), technology and innovation, or simply with the country's economy. This can affect the policy decisions around shale gas: arguably, this is an area where the United States can take up the mantle as pioneers again.

The older policy blueprints show evidence of incorrectly and somewhat presumptuously predicting future developments yet setting out firm policy responses to imagined trends regardless. This fits in with a general trend of ignoring uncertainty in policymaking and is a major point in my criticism of shale gas policy. If uncertainty as well as warnings continue to be ignored, by the time shale gas reserves are depleted in the foreseeable future they will have diverted funds, efforts and resources from the renewable sector and worsened the environmental and possibly also the economic situation, generating new costs. The latest reviewed U.S. document, 2014-2018, still insists on the same transformations needed as its predecessors – systematic change was not made. This is quite possibly also in part a result of the introduction of shale gas into the energy mix which slowed the perception of a trend of resource depletion, altered the trade balance, and lowered gas prices for certain sectors, although not necessarily overall or for the regular consumer (see Chapter 4).

The preliminary evidence from the U.S. strategy reports fits with my hypothesis in the sense that I do not find ideas or policy goals that would oppose the introduction of shale gas. Quite the opposite, the newly expanded U.S. gas sector is considered an asset to the economy that is creating jobs and is considered environmentally comparatively desirable. This is a guiding idea in all the of strategy papers: the gas sector is seen vital to the U.S. economy and even in particular to its recovery after 2008, and it is not seen as very environmentally harmful, even though a large share of it was constituted by shale gas at the time of writing of these strategy plans. The issues of global leadership and energy independence, both of which gas and also shale gas is believed to provide, are very strongly promoted in the documents. Clearly, while at times the documents look unfavourably on petroleum, mostly due to import dependence but also due to its environmental record, gas is seen as a separate entity. It is promoted as a powerful and necessary part of the U.S. economy: and clearly it has not been discredited in the ideas about energy policy. Instead it is connected to powerful ideas about economic success and U.S. leadership, so it is supported by very strong ideas. This is a status quo that is well protected in policymakers' key ideas and will complicate any attempt at radical policy change. As Rodrik (2014) put it, agents tend to believe they know how the world works and have a cognitive map of how to reach their goals: if they believe that only the free market works for an economic system and that only fossil fuels can work within a market system, then they will focus their efforts on how to fix glitches in this system. They will not then diagnose an inconsistency from the current economic situation and infer that as times have changed, fossil fuels can no longer deliver and reconsider their options more radically, promoting change and creating different causal connections. This sequence of events seems not to have been hindered at the outset by the fact that shale gas is not a typical fossil fuel.

So far it appears that the U.S. strategy documents confirm the notion of my third narrative, namely the existence of cognitive capture in the form of ideational factors with potential influence on shale gas policy decisions. As the literature proposes that it might, in the United States energy sector the status quo has a strong effect on current policymakers and its guiding core ideas appear not to have been discredited enough. I will now turn to consider the UK energy strategy plans before following this summary of energy policy ideas with a statistical discourse analysis to consider whether there are specific causal associations made: i.e., especially whether certain energy sources are cognitively linked to energy policy goals such as leadership, security or jobs.

VIII.2 First evidence of cognitive capture in United Kingdom energy strategy: Context and key ideas

In this section I analyse the documents officially designed to outline and guide overall UK governmental energy strategy as well as concrete policy decisions in the energy sector. The selected documents are the following: All of the UK Government's Energy Strategy Papers that fall in the selected timeframe, i.e. the UK Energy white papers 2003, 2008, 2009 and 2011, asserting the "National Strategy for Climate and Energy" (HM Government 2009: I).

VIII.2.1 The 2003 white paper: Our Energy Future

The first UK energy strategy paper I review, the 2003 white paper 'Our Energy Future – creating a Low Carbon Economy' was in fact the first time in twenty years that a formal overall energy policy was established in the UK (DTI 2003; Helm 2008; Coriolis Energy

2014). The strategy document proclaims itself based on four key ideas: protection of the environment, reliable energy supply, affordability of energy and a belief in competitive markets. Already this is different to key goals in U.S. strategy papers. From the very beginning, the 2003 UK Energy white paper strikes a distinctive tone of dramatic inevitability: Climate change will happen, and its consequences will be costly and dangerous, the UK will become a net importer, renewables will become a dominant energy source.[180] Of course, so far, they are not. The energy grid is outdated and not functional for modern energy supply and there will be no choice but to change and renew it (DTI 2003). The tone is unusual but environmental protection is not considered above and beyond all other issues and challenges; and part of the reason for the fatalistic language is informed strongly by the decline of resources and worries about energy supply security, not only by worries about global warming. While these issues are discussed in more detail the authors seem constantly to suggest that there is in fact no other option than to accept all of these premises and move on to dealing with them. Clearly this has not happened, but the tone of the 2003 white paper is remarkable.

The document begins with a discussion of the loss of net exporter status, the expected further decline of the UK's indigenous fossil fuel supplies, coal, gas and oil. This has of course since happened: the UK became a net importer of coal in 1984, of natural gas in 2004, of natural gas liquids and crude oil in 2005, and of petroleum products in 2013 (EIA 2014). The issue is approached differently in this white paper than in any other U.S. or UK strategy paper: the diminishing of these resources is not immediately handled as a significant problem. The 2003 white paper expresses its unconcern at becoming a net importer at various times, i.e. "being an energy importer does not necessarily make it harder to achieve energy reliability" or citing the fact that few of the world's leading economies are energy net exporters (DTI 2003, 9). It is even suggested that there is no issue of dependency because there will be interdependency – "their energy being as important to us as their income from us is to them" (DTI 2003, 10). This logic has not been raised in any of the United States strategy plans and latter UK ones, where dependency is seen in varying degrees of negativity but never as such a non-issue. Instead, the 2003 white paper concludes that the best way to ensure energy security and reliability is to create diversity in every aspect, diversity of energy sources, suppliers and trade routes (DTI 2003, 9, 16f). Diversity above all is considered the best way to ensure against threats such as sudden price rises or even terrorism resulting in supply route disruption. This is

[180] The last notion is especially surprising; it is for once formulated as if that was a simple policy measure that can be enforced.

mentioned in the 2006 and other U.S. strategy plans but never with such emphasis or in such a positive tone.

The authors of the 2003 white paper make sure to strongly underline their idea that the new challenges facing the energy system, namely resource decline, climate change, outdated grid etc., provide in fact many new opportunities. They see opportunities for growth and revenue, opportunities to become experts and world leaders in new technologies (DTI 2003). Amongst those they see a distinctive chance to shift the UK economy to a more productive low carbon economy resulting in higher living standards. This is an unusual statement – usually the notion of a less energy intensive future involves the use of less energy and cutbacks in certain comforts. The idea to export cutting edge technology and create new jobs is lauded, however not specifically connected to any particular energy source. This is supported by the accepted idea that "bringing forward technological changes [is a natural or necessary step] to keep down costs to the UK and to avoid compromising our competitiveness" (DTI 2003, 57) The white paper states that the government will continuously encourage UK industry and UK businesses to make the most of said opportunities presented by moving towards a low carbon economy (DTI 2003, 15).

In the 2003 white paper the DTI presents very specific calculations confirming previous IPCC review results which suggest that actions currently planned to curb emissions and stabilise CO_2 levels in the atmosphere[181] would lead to an average of GDP loss of around 1% or less in developed countries by 2050 (DTI 2003, 15). This, according to the white paper, would be offset and justified by the decrease in risks associated with climate change thus achieved. This is very specific, and the only time this claim is made as such. Yet even in this document it remains a small note compared to the oppressing amount of connections between costs associated with the deployment of renewables, as the analysis later on in this chapter shows.

Insistent focus on market-led solutions is noticeable throughout the document as well as expectation of rationality from consumers (i.e. it is considered rational that homes and business will make investments into energy saving measures to cut costs in the future). The absolute capability of a market-based system to face all these challenges is however questioned: "Where the market alone cannot create the right signals (for example on the environment) we will take steps that encourage business to innovate and develop new

[181] At a maximum of 550ppm.

opportunities to deliver the outcomes we are seeking" (DTI 2003, 11).[182] This notion of using market strategy only wherever possible corresponds to similar claims in the 2006 U.S. energy strategy plan, as does the apparent paradox of juxtaposing this proposition with insistence on the success of the free, liberal energy market system. Again, the market system as such is not questioned: markets are desired but considered not adapted to certain current challenges, even if they are labelled as opportunities, and need to be fixed to work perfectly again. This is a distant indication of causal judgment: there is no inference leading to seriously reconsider whether the market works for the current energy landscape, or whether a (free) market situation exists. The fact that a market exists and that a market-based system is ideal for the energy sector is a causal judgment that is not altered – instead it is adapted to new realities by allowing for small fixes in the immediate neighbourhood of a problem found.

The 2003 strategy plan contains a direct placement of blame: "climate change – largely caused by burning fossil fuels" (DTI 2003, 3). The document refers actively to reports by the Intergovernmental Panel on Climate Change (IPCC) as well as UN climate change related documents, with very specific data, whereas follow-up strategy papers tend to be much less specific, rather depicting climate change as a remote, non-specific threat in comparison. In this white paper, the problem is explained in detail as a very specific threat – i.e. outlining weather-related economic losses to communities and businesses in the UK in the past decades as well as predicting a considerable increase in flooding and extreme weather in the UK. This is a very explicit statement of linking threats and costs to fossil fuel, and does not leave room for the vagueness often connected with climate change. Rallying and securing international commitment to mitigating climate change is outlined as a key component of future UK foreign policy. Investment in climate change research and environmental technologies is equally suggested as a crucial base of future energy policies (DTI 2003, 46).[183] The white paper's overall focus is more on an analysis of issues and challenges facing the UK energy system and suggesting the necessity of a low-carbon economy than in actually outlining detailed policy responses. There is, in fact, very little concrete detail in terms of policies to be adopted, although there is of course some, as discussed above. The more specific (if not detailed in their implementation plans) policy

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182 "Until the 1990s the energy system in the UK - as in most other countries - was largely owned and controlled by Government. Today the UK has one of the most open energy markets in the world. Open and competitive markets will remain vital to delivering the energy we need. But it is the Government's responsibility to set the overall goals for UK energy policy and to ensure that our energy markets and other policies deliver those goals" (DTI 2003, 6).

183 In 2003, the authors of the white paper conclude that "leaving action until the last minute is not a serious option. If we do not begin now, more dramatic, more disruptive, and more expensive change will be needed later on" (DTI 2003, 8).

goals set out by the 2003 white paper include the ambition for developed countries' economies to cut their greenhouse gas emissions by around 60% until the year 2050. This appears to show the government's acceptance of the recommendation by the Royal Commission on Environmental Pollution to make this an achievable, enforceable policy goal and to become a world leader in emissions reduction (DTI 2003, 25). This goal will not be feasible if shale gas is developed on a major scale. Regarding renewables, the white paper authors profess support for large tidal and offshore wind farms, as well as smaller onshore wind farms; support for biomass, support for building new homes that are more energy efficient, and support for hydrogen as fuel. They also acknowledge the fact that "the cheapest, cleanest and safest way of addressing all our goals is to use less energy" (DTI 2003, 32) – an issue less clear or prominent in later UK energy policy strategy papers or in U.S. documents, except for the AEI initiative. It is considered economically and technologically viable to run a virtually zero carbon economy in the future (DTI 2003, 104f).

The authors acknowledge a need for large investments in order to update and replace the current energy infrastructure system of the UK (DTI 2003, 10, 14, 49). Part of this requires a change in the electricity distribution network as it is designed for a few, large central power stations and not smaller or decentralised power generation (DTI 2003, 104f).[184] Both the introduction of more renewable energy as well as the introduction of more onshore (shale) gas drilling into the energy mix would require major investment in the future. Therefore, any argument for shale gas and against renewables by pointing to the latter's infrastructure costs is not immediately convincing.

To summarise, a clearly and notably recurrent theme throughout the 2003 white paper is a call for cleaner energy. Climate change is accepted as a threat to be mitigated, while resource depletion is discussed but not considered as a major threat to the economy albeit a key issue requiring strong action. The document includes very strong ideas about which energy sources are good and which are bad for the environment, positing conventional fuels and alternative energy sources on opposite sides of the issue. A key idea notable in the white paper is the need for market-based solutions to current problems and belief in the free market, despite criticism of its shortcomings. In this document, the creation of a low carbon economy is still associated with revenue and growth. In fact tidal power and offshore wind are specifically mentioned as connected to business opportunities, but only after they have been adequately funded and researched (DTI 2003). Clearly renewables

[184] Finally, it should be mentioned that the UK Energy White Paper 2003 called for and led to the creation of the UK Energy Research Council (UKERC) in 2004 (UKERC 2014).

are considered to be lagging behind conventional fuels, but this is seen as less of a problem. The notion of required funding is carried onwards, but this idea of major business opportunities connected to wind or other renewables is not as emphasised in future strategy plans. The idea of a need for energy independence so notable in U.S. documents is not strong in this white paper, but ideas about the importance of technological innovation and technological leadership are comparable. Of course they are not quite as strong, and not in the spirit of exceptionalism as hinted at in U.S. government statements. The 2003 UK energy strategy paper stands out from others, as will become clear in the next pages: it directly links climate change to fossil fuel production, and focuses on diversity in energy and on opportunities through a change to renewables, though it remains quite vague on these. It does not appear to justify the current government's shale gas policy as clearly as I saw a justification for shale gas deployment in the reviewed U.S. documents.

VIII.2.2 The 2008 white paper: Meeting the Energy Challenge: A White Paper on Nuclear Power

The 2008 Energy white paper of the United Kingdom, entitled "Meeting the Energy Challenge: A White Paper on Nuclear Power" was composed by the Department for Business Enterprise and Regulatory Reform (BERR) and officially launched on May 23rd, 2008. It is a follow-up to the 2006 energy review and largely draws on the conclusions gained in the aforementioned to discuss its consideration of widening the extent of nuclear power generation as an energy policy option for the United Kingdom.[185] Unofficially as well as in retrospect it has often been suggested that the 2008 strategy paper was intended to prepare for a move towards nuclear power as a dominant part of the energy strategy, which had not been prominent in the 2003 white paper (Helm 2008). The key goals the document aims to address "are the challenges the UK faces in addressing climate change and ensuring security of energy supplies" (BERR 2008, 8). Climate change is considered "quite simply the biggest challenge facing humanity" as proposed in his foreword by the prime minister (BERR 2008, 4). Specifically the role of nuclear in securing clean and affordable energy supplies is highlighted in consideration of recent declines of the UK's North Sea oil and gas production (BERR 2008, 16). Energy security as well as climate change mitigation are to be reached with four policy goals in mind: cutting carbon emissions significantly; ensuring reliable energy supply; promoting sustainable economic growth; and improving productivity through competitive markets

[185] This is why the 2006 review is not considered – they are extremely similar with large part identical.

(BERR 2008, 10ff).[186] Again these goals differ from key priorities of the U.S. energy strategy at a first glance.

Another key component of energy strategy discussed in the white paper is the establishment of more international energy cooperation and international energy framework to combat the effects of energy production on climate change, especially on EU level. There is a plan to set up legally binding targets within the UK economy to reduce emissions and supporting further transparency and competition in the international energy market and further liberalisation of the European one. The document shows the government's willingness, even pledge to support low carbon technologies as much as possible, encouraging increasing international-domestic as well as public-private collaboration in this area both in terms of research and deployment (BERR 2008, 70, 72, 110, 164, 170). In this category falls the launch of the Energy Technologies Institute and the Environmental Transformation Fund. Shale gas is unlikely to have been considered for this, as it was not a dominant issue for the UK yet or as widely reported from the U.S. case. In the 2008 white paper it prominently states – unlike in others reviewed – that renewables are not considered at a level yet where they can guarantee energy supply on their own, most certainly not in the UK (BERR 2008, 16).[187] [188] In terms of energy supply, the 2008 white paper on nuclear strategy confirms the UK's commitment to bring up the shares in electricity generation generated by renewable energy to 10% in 2010 and 20% in 2020 – this target is unlikely to be met (Harvey 2014b).[189] The white paper supports the continued recovery of remainders of the currently explored gas and oil fields in the North Sea, in a rather small and unspecified section of the overall document. It appears as so this is either not a main concern but room is left for future policy in this area, or as if this

[186] According to the 2006 white paper, around 30-35 GW of electricity generation capacity will need to be added within the two decades following 2008 in order to fill the gap between energy supply and demand (BERR 2008, 13).

[187] Those regarding the business sector include the Carbon Reduction Commitment for businesses (by now relabeled as the CRC Energy Efficiency Scheme) – which has since been criticised as trade offs to push the 6000 MWh of electricity limit further are quite possible (Kahya 2011) –, the introduction of new certificates regarding energy performances for businesses as well as public sector organisations, and a promise to extend the practice of smart metering to as many business premises as possible by 2012 (BERR 2008). Proposals regarding the transport sector are less detailed – they include the introduction of a Low Transport Innovation Strategy and the government's pledge to support the inclusion of aviation into the European Union Emissions Trading Scheme (BERR 2008). (This legislation has been in the process of introduction since 2012, however it has already seen many national airlines such as the U.S.' declare legal exemption from it before even implemented.)

[188] The document speaks repeatedly of introducing a mix of both incentives as well as rules and regulation alongside each other; in regards to energy efficient behaviour of households individuals, but also in regards to investment in cleaner energy by the industry (BERR 2008, 11, 31–33, 82, 107, 121 etc.). The authors insist strongly on independent regulation of markets as absolutely necessary, meaning independent from government, not from the market system (BERR 2008, i.e. 127).

[189] A focus on carbon capture and storage technology, the expansion of biomass operations as a source of energy production, and a commitment to increase the amount of biofuel used as transport fuel are supposed to deliver results.

strategy was purposefully not advertised. There is certainly discussion of the need for carbon capture, but it is not introduced as an overall panacea.

The 2008 energy white paper's focus lies mainly on making the case for building new nuclear power plants and increasing the role of nuclear in the UK's energy mix. The report appears overconfident in politicians' and scientists' ability to control this process. The authors consider current regulation of nuclear energy safety in terms of health and environmental concerns both at home and abroad (where uranium will be mined) as absolutely sufficient (BERR 2008, 28, 77). Whilst the case for nuclear power is made, renewables investment is justified as a by-product. All the reasons the white paper authors name to divest and support nuclear could be used as support for renewables as well. Apart from a small section on finishing already tapped fields, further oil or gas development is not supported. Nuclear power is seen as clean, reliable and a promising energy source in itself, but also as an important bridge between the current energy system and an unspecified future system that relies on renewables which cannot yet be relied upon as they are not advanced enough though ultimately desired (BERR 2008).

On the surface, the 2008 white paper shows a clear negative attitude towards oil and gas and traditional fossil fuels – notably oil receives more negative connotation than gas – and a seemingly complete acceptance of the necessity to mitigate climate change and secure clean energy supply for the future. The idea of connecting fossil fuels and environmental degradation is uncommonly prominent in this document, as is the threat of climate change to specific public and private goods. Conventional fuel is mentioned both as bad for the environment, and, which is more out of the ordinary, a few times as bad for energy security and potentially as adversely affecting the economy. Indicators suggesting grounds for the promotion of shale gas are not abundant in this white paper.

VIII.2.3 The 2009 white paper: National Strategy for Climate and Energy

The 2009 white paper "National Strategy for Climate and Energy" begins with a strong emphasis on "protecting the public from immediate risk" (DECC 2009, 2). The focus lies on risk as well as on uncertainty avoidance, as can be deduced from the loose explanation of risks that the public will need protection from. The risks discussed include climate change effects in general as well as water related issues, clean water protection but also specifically flooding. These are risks also associated with hydraulic fracturing. The transition is considered a logical move based on the costs and benefits: "In Britain, as our own reserves in the North Sea decline, we have a choice: replace them with ever-increasing imports, be subject to price fluctuations and disturbances in the world market and stick with high carbon" (DECC 2009, V) or "make the necessary transition to low carbon, right for climate change, energy security and jobs. … There will be costs to the transition. But they are far outweighed by the costs if we didn't act" (DECC 2009, V). This statement however does not outweigh the amount of associations made between high costs and renewable energy and environmental legislation in the rest of the document. Even in this context, the choice is triggered not by climate change but by declining resources; the problems with the other option are import reliance and market risks, not environmental concerns. Considering the importance the 2003 white paper had already placed on a transition to low carbon, the 2009 strategy paper is somewhat surprising in its repetition of many of the original plan points (DTI 2003) as though they were novel. This appears as an admission to the fact that the topic had not progressed immensely in the years in-between.

The white paper begins with an overall five-point plan: protecting the public from risk, namely climate change consequences such as flooding; mitigating no longer avoidable consequences of climate change; pursuing a new international climate change agreement in order to further mitigate climate change globally; turning Britain into a low carbon country; and supporting both the industry and individuals in preparing for and mitigating climate change (HM Government 2009: II).[190] The white paper also supports the introduction of new nuclear facilities alongside alternative energy sources in order to boost energy supply while lowering emissions. In considering amounts of energy generated from each source, there is very little admission to the fact that problems might also be mitigated by using less energy, or that said option may no longer be open for debate within the context of declining resources. This is in contrast to the 2003 energy white paper, which considers less energy use as the theoretically most efficient way of dealing with all the challenges facing the UK energy system at once. Nothing is done to change perception on how much energy should be used, suggesting that the authors themselves do not perceive this as a possibility or solution. Therefore, a decrease in resources may be awarded more importance.

The main body of the white paper focuses on the transformation of different sectors and how they were best to adopt to the transition; the energy sector first of all, then private homes and communities, workplaces and work opportunities, transport and finally land and farming. The currently discussed 2009 white paper credits itself with setting out "the

[190] The strong focus on all things climate change and complete acceptance of its existence and its negative consequences is remarkable in light of future events, such as the imminent appointment of climate change sceptic Mr Owen Patterson as head of DECC (Carrington 2014b, 2012).

UK's first ever comprehensive low carbon transition plan" (DECC 2009, 4). The white paper is set to deliver 18% emission cuts compared to the most recent (2008) levels by the year 2020 and over 30% compared to levels measured in the 1990s (DECC 2009).[191]

Almost 20% of the white paper is focusing on homes, households and communities – though at the time only 13% of emissions came from private heating (DECC 2009, 82) – and how to include them in the move towards greener energy. The white paper includes a large section on aiding cost-vulnerable customers so that low income is not in the way of energy efficiency and encouraging communities to compete for green innovation. Around £3.2 billion were scheduled to be made available for these household-centred emission-cutting targets (HM Government 2009: 83). In comparison to this funding, or in comparison to the £4 billion the European Investment bank is making available for business-led energy projects in the UK (DECC 2009, 13), "£120 million investment in offshore wind, and investment of up to additional £60 million to cement the UK's position as global leader in marine energy" appear minor sums (DECC 2009, 113). This is an example of how concrete policy ideas clash with broader stated priorities.

A section of the white paper is directly aimed at Ofgem, specifying their duty in protecting consumers by helping mitigate climate change and ensuring energy security (HM Government 2009, 4). Accepting climate change and preparing to deal with it is considered part of consumer protection. Throughout the document (HM Government 2009, 11, 53, 55), Ofgem is repeatedly reminded that its key responsibility lies with "ensuring effective competition" as well as with "enforcing regulation in the energy market" (HM Government 2009, 55). Building several new nuclear power stations or at least for the government to facilitate that option to energy suppliers is also part of the white paper strategy.[192]

In this white paper, climate change is treated as a very abstract problem, one that needs accommodation and handling, certainly, but without any concrete explanations as to why and how. It seems a step back from the previous white papers, especially the 2003 energy

[191] It has more recently been reported by governmental advisors on climate change that the UK was quite "on track to miss its carbon targets in the 2020s" (Harvey 2013). Further targets set for the year 2020 include electricity generation: 30% is intended to be generated from renewable energy sources by then, and 40% from low carbon energy sources in general. This target is also likely to be missed at this stage (Harvey 2014b) with renewables at around 5% and low carbon sources overall at 10% (DECC 2014).

[192] The White Paper was met with mainly positive if hesitant responses (Jha 2009, UKERC 2009) – at the time executive director of Greenpeace Sauven considered it a good plan, stating that apparently Ed Milliband, then Secretary of State, was "winning important battles in Whitehall", and the Energy Savings Trust issued an equally supportive statement (Jha 2009). However, Sauven immediately cautioned that it was of utmost importance to now follow through on the outlined plans and equally important that the Treasury took it seriously (Jha 2009) enough to invest properly – showing he had doubts he shared with many about the transition from idea to policy. Many agreed that it was ambitious (Black 2009).

strategy paper. This is a possible result of the bias of availability: climate change effects are not obvious. Increased bouts of extreme weather in the UK, including flooding as well as heat waves, have certainly been noted. However, while climate change is mentioned, the connection of these exact risks with climate change or rather yet with factors that promote global warming, such as the burning of fossil fuels and CO_2 emissions, are not made plain as consequences. The causality seems distant at best, which differs from 2003. And climate change is less available than other energy related issues such as energy shortages in winter, or fuel poverty. But there has been much research and evidence into the effects, and the white paper does not reflect these.[193] The notion of energy security as energy independence becomes more relevant in this white paper than it had been in previous ones; renewables are considered not for their convincing economic performance or environmental safety, but because they provide relief from import dependence. Shale gas support seems more possible based on core ideas in this white paper than the previous two. The timing may have had an effect: this white paper was published after the global financial crisis hit in full swing, which likely led to an increased focus on economic issues and economic security: shale gas is often presented as conducive to both.

VIII.2.4 The 2011 white paper: Planning our electric future: A White Paper for secure, affordable and low-carbon electricity

The in 2016 latest available, 2011 white paper on energy for the United Kingdom focuses on electricity as a common denominator for all of its proposed efforts to ensure energy security as well as cheaper and cleaner energy supply for Britons. Three primary challenges are considered broadly within the overall energy security challenge: 1) diversification of supply, which lists both a diversification of sources as well as a diversification of imports to decrease dependence, 2) operational security to ensure that demand and supply even out, considering unpredictable changes to both, and 3) resource adequacy, meaning enough capacity to cover peak demand whenever necessary (DECC 2011, 10).[194]

A concern about import dependency has risen on the list of priorities and this is visible throughout the document; in this sense, the 2011 white paper relates more closely to the

[193] As a fitting illustration, the word combination “greenhouse gas” features more often in this document than the word “gas” in terms of natural gas – however the former is mainly name-dropped, again and again, whereas the latter appears in connection with rather specific plans and data.
[194] As the white paper is specifically concerned with electricity generation this spells a slightly different angle than for example with the plan focused on the future of nuclear energy – however, key ideas expressed in the papers remain the same and comparable despite a different core focus.

U.S. strategy plans. Energy security is discussed as a key priority here, and energy independence is also evidently considered as a part of ensuring energy security. This strongly differs from conclusions in the 2003 white paper and has the potential to affect support for shale gas as it is a domestic resource. Albeit most certainly a political hot topic by mid-2011, the entire 2011 DECC white paper on energy does not reference the phenomenon of shale gas once.

The strategy paper's authors point to recent failures of the electricity market, and its inability to meet future challenges in its current form or raise enough investment to even begin doing so. Readers are reassured in the same paragraph that ever since "the market was privatised in the 1980s the system has worked" (DECC 2011, 3). This is followed by judgment that general "market failures" are preventing energy sector investment (DECC 2011, 59). The statement is unclear but intentionally so: criticism of the market system in general is not discussed, but specific failures to work for future needs are conceded, to give the impression that they simply need to be fixed. Unsurprisingly, reference then is also made to the inability of renewables to survive in the market system, leaving it rather unclear who is to blame for this. (Of course, it is also not true, considering conventional fuels also receive support.)

In 2011's white paper, the DECC insists that it is traditional energy, i.e. fossil fuels, that leave the UK energy market vulnerable to import dependence, to volatile price changes. They are also blamed for carbon emissions, which are accepted as harmful to environment and human health.[195] Key aim is the diversification of supply and the discontinuation of import dependence. This resonates with the 2003 white paper, but the criticism of energy dependence is different.

Low-carbon energy generators are seen as "at a natural disadvantage" (DoE 2011, 3) in the UK energy market; key aims of the DECC are therefore to make the market fairer and more open, to the low carbon technologies as well as to any smaller firms or new market entrants who currently have to compete strongly with the traditional 'big six' (DECC 2011, 89). The overall strategy proposed by the DECC to achieve this transformation is to convince investors of the low risk and high returns of investing in new energy methods. Sustainable energy is seen as desirable yet incapable of flourishing and delivering without major governmental support. Again, this is a simplified view and does not have to be the case in 2011. Further they wish overall to establish the kind of

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[195] "Instead [of traditional fossil fuels], we need huge investment in renewables; a new generation of nuclear stations; and, in time, gas and coal plants" but only if they "can capture harmful emissions."(DECC 2011, 3).

system in which renewables and other low-carbon technologies are capable of competing with traditional fuels as well as with each other within the free market to achieve best innovation and results (DECC 2011).[196] This is utterly incongruent with the introduction of favourable policy towards shale gas.

To briefly summarise, the 2011 UK white paper continues to focus on climate change, supply security and other established topics from 2003-2009. An increased focus on energy independence as part of energy security is very notable. The 2011 white paper also voices the UK government's desire for the UK to be "continuing to play an active role internationally" (DECC 2011, 60). While it does not compare in terms of frequency, this is noteworthy to the reader who just witnessed similar documents from the United States in which U.S. leadership in all parts of the sector is encouraged frequently and with emphasis. This could provide a reason for pursuing shale gas – the UK would be a leader of the technology in Europe, a status it has already given away with regards to renewables.

The white paper shows stronger aspects of national security defenders framing than previous documents, and also increased signs of free market libertarianism, with the assumption that market failures to adapt can be corrected. Key ideas notable throughout the white paper are the notion that renewable energy does not work in a market system yet, and a stronger desire for UK leadership and independence than in previous strategy plans. Overall, this white paper appears much more relatable to the support of shale gas and fracking policy than the first three UK energy plans: there appears to be a trend of key ideas developing in this direction.

VIII.2.5 Preliminary summary and analysis

In the above summary and review of UK energy strategy plans I established the existence of several key ideas that inform future energy policy as well as the existence of causal judgment constraining objective decision-making. I find that unlike their U.S.

[196] And yet, already in its opening statements the white paper warns that investment in new energy generation alone cannot fix the UK problem with energy supply security – energy efficiency and lowering demand for energy are considered equally important. Here the "government recognizes that reducing demand is likely to be more cost-effective than building additional capacity" (DECC 2011, 11) yet also thinks that energy efficiency can reduce the consumer bills my more than six to eight percent (DECC 2011, 12).
Further there is recognition that "the current market price for electricity is driven by fossil plants, such as unabated gas-fired Combined Cycle Gas Turbine (CCGT), with much lower fixed costs relative to their operational costs in contrast to, for example, nuclear or offshore wind. Investors in non-gas fired generation are also disadvantaged by being exposed to more volatile and uncertain returns when compared to gas" etc. (DECC 2011, 6, 28). However, there is a section in recognition that "the social cost of carbon is not fully reflected in the market price as this does not take into account all of the damage caused by climate change" (DECC 2011, 7).

counterparts, the UK strategy papers on energy are quite different from one another in their insistence on key goals. All of them focus very strongly on climate change, which is an accepted reality and considered a risk and a challenge. The mitigation of climate change is promoted in all of the documents, and the UK plans sound more engaged with the specifics of environmental protection than the U.S. documents and consider it a priority. Yet if one looks closely, causal judgment on how costly renewables are and how incapable they are to function in a market system are plentiful. This is a key idea strongly present in the strategy repertoire. The belief in the market system is a key idea notable in all of the UK strategy papers just as in the U.S. ones, although there is more criticism of flaws in it such as problems with adapting to the new reality of changing energy sources. And renewable energy is strongly considered as being less or not at all capable of functioning in the market system. Again, it is an unverified assumption that renewable energy cannot compete in a free market with fossil fuels, which have not had to compete in a free market either in the UK (or the U.S.) thanks to subsidies and other governmental financial support (Macalister and Harvey 2013; Athena 2015; Carrington 2015d; International Energy Agency 2016; Global Subsidies Initiative 2016). However false, this casual judgment has the potential to seriously constrain policy options. If the goal is to achieve increased energy supply, increasing revenue and job availability and overall sector growth, and these goals are considered only achievable with fossil fuels and in a market system in which only fossil fuels can compete, the room for change in policy is severely limited. If we can assume such a map to exist in policymakers' minds about how to achieve their goals, and know that shale gas (even if incorrectly) fits within the boundaries of such a map and renewables do not, then the policy decision to support it is a logical consequence.

Comparing the UK plans with each other, there is a clear trend from a very specific language of why to transition to a cleaner energy sector to a more abstract and general language on the need for transformation between 2003 and 2011. This does fit with the trajectory of the shale story, because the UK came to the table later than the U.S. did. Unlike in the U.S. documents, climate change is a key priority in all of the UK energy strategy plants. Especially the 2003 energy white paper stands out in this sense, and might even be considered an outlier. It considers climate change effects and depleting fossil fuel resources not only as a risk and challenge but sees the need for new energy sources as an opportunity to reinvent, improve and strengthen a modern sector of the UK economy. It connects renewable technology less obviously with increased costs and investments than the other strategy papers do, and it very directly blames fossil fuels for climate change and climate change effects. The 2008 paper also makes this link directly while supporting nuclear power, but the association is less clear in the 2009 and 2011 papers. The earlier two white papers (2003 and 2008) are very specific in their labelling of climate change prevention and mitigation as a priority, linking fossil fuels to environmental degradation and including detailed calculations for climate change effects and the costs to mitigate them. The 2009 and 2011 white paper equally warn of the doom of climate change, yet treat it in a much more abstract fashion. It appears that the availability heuristic associated with climate change which was less present in 2003 and 2008 energy strategy has returned to later documents (which suggests that when the issue is pushed purposefully, it is somewhat possible to move past its abstract nature).

The importance of the UK energy sector to the country's economy is emphasised similarly to how it is treated in U.S. documents, yet the energy trade deficit and net importer status are treated differently in the successive plans. While the U.S. papers all consider it a key priority, the 2003 energy white paper considers it almost as a non-issue, claiming that if the UK should depend on energy imports then their trade partner would equally depend on UK payments, seeing no danger of dependency. In comparison, the 2008, 2009, and 2011 strategy papers are all more focused on energy security. It must be said that unlike in U.S. strategy plans, energy security often simply means security of supply in the UK context and not automatically independence of energy supply. The UK 2011 white paper is unique in that it lays stronger focus on energy security in combination with energy independence, but this does not compare to the U.S. emphasis on it. Again, this idea that energy independence is increasingly important could favour shale gas, which is perceived and presented as conducive to this goal. It could, of course, also favour investment into domestic sustainable energy sources, but due to causal judgment connections they are not considered fitting with other goals such as a market system or proven historical economic benefits such as those connected with oil and gas. All of the UK energy white papers lay importance on international cooperation to combat climate change and energy supply challenges, but the 2011 white paper places more emphasis on the UK as a strong international energy player.

The 2003 and 2008 UK strategy papers adhere to environmental ideals and a negative discussion of fossil fuels and their decline to a point, but the goal of preserving the environment is not considered superior to others such as energy security. The idea that the market is the best system to allocate energy resources is notable in the UK papers just as in the U.S. documents, even if several of the documents contain strong criticism of market failures that need to be solved. But again, there is no diagnostic inference that then the free market system may not be ideal to trade a good as important to the economy as energy. Instead the causal judgment that the market system has always worked and is best for an efficient energy sector is upheld and despite small failures not discredited. Hence, whether or not an energy source is perceived to be market compatible decides on the support is receives.

It is impossible to fully verify this claim, but from the different focus on key ideas it appears that UK strategy papers have changed in time to the point that the governmental excitement about shale gas is reconcilable with overall plans of the 2009 or especially the 2011 documents. Ergo one can locate some first evidence of influential factors into shale gas support for the UK case study in this third dimension on cognitive constraints. The development towards fracking support could not have been explained in light of the 2003 energy white paper. In later white papers, an increasing focus on energy security and the causal judgment that is made about economic inferiority of renewables may lead to the assumption that there are plausible arguments to introduce more home-grown fossil fuels such as shale gas. Overall, in this first part of the analysis of the UK case I find evidence of ideational capture that would predict a focus on shale gas, but mostly in the later documents.

The U.S. and the UK energy strategy appear very similar in ideas about the energy market system and its superiority in managing the energy sector despite acknowledgment of recent issues with it. There is also concurrence in the level of control they assume as climate change is shrouded in availability issues and as they trust in the future technological innovation that can fix current problems. The ideas found to be promoted in the first half of my evidence for the third narrative appear to be similar between the countries and also to fit the policy outcome. Therefore, they are likely influential on decisions about shale gas policy. It is not possible to identify all the persons involved in writing the strategy papers as usually the institution alone is given as author – but it is worth recalling findings from the second narrative to consider the possibility that industry employees were likely partially involved in drafting part of the strategy documents. Although this is not the key focus of this analysis, it does give one reason to think that certain ideas may have been introduced to the plans purposefully as well as through an element of cultural capture.

In the next and final section, I am using Provalis Research QDA Miner's statistical analysis tool to give a more detailed and more comprehensive analysis of specific ideas around the different energy resources. Specifically, I am looking for causal judgment as to the effect of these energy sources on key goals such as economic strength, leadership aspirations, energy security, or environmental health. To do this, all documents are uploaded into the QDA Miner repository and then used with QDA Miner WordStat which gives statistical insights about textual information, for example about phrase clusters, frequency, word connections and such. I found the tool to be very helpful in managing the textual data, and to keep an overview while creating manual codes. However, once I had come up with my causal connections and coded them into groups, I found the tool to be not sufficiently succinct which is why every single connection and cluster identified was once again followed by manual analysis.

VIII.3 A second discussion of ideas: frequency, causal judgment and association

In this section I discuss findings of a statistical discourse analysis which I created and conducted by using the relevant documents in a QDA Miner database project, allowing me to perform a computer-assisted qualitative data analysis (CAQDAS). The section expands upon results and impressions of the above qualitative content data analysis of key energy strategy documents by providing more comprehensive data on causal associations. This helps in considering underlying ideas and oft repeated and trusted causal associations rather than the ideas which are self-promoted as 'key' in the strategy papers.

My research approach follows traditional social science methods of text-based content analysis, only aided by QDA in terms of organisation and data volume management and in order to quantify the usage of themes accurately.[197] I began by analysing the documents in a conventional manual content analysis to elicit key terms or codes. This included the above context review to look for key ideas, as well as preliminary manual coding of any and all things relevant to key themes such as costs and security. I then conducted several QDA-assisted queries around the general categories of 'fossil fuels' and 'renewable/alternative energy' as well as around each of the energy sources specifically. I considered subject frequency and category frequency and manually analysed each of the close to 2400 correlations to find and confirm causal associations and evidence of causal judgments. My results are summarised in the ensuing pages.

A key element of the respective strategy plans of both the United States and the United Kingdom is the discussion of energy security. There are some claims that energy security

[197] The distinction needs to be made between thematic and semantic qualitative analysis of textual contents; the following analysis will be focused on thematic analysis. If I reference particularly intriguing semantic or formational aspects of the documents, I will clearly point this out and separate it from regular thematic analysis. When referring to themes in a document I refer to not the general "subject matter of a document" but themes as content that reappears through "recurrent patterns that run through a text much as musical themes are melodic subjects embedded in musical compositions" (Roberts 1997, 36).

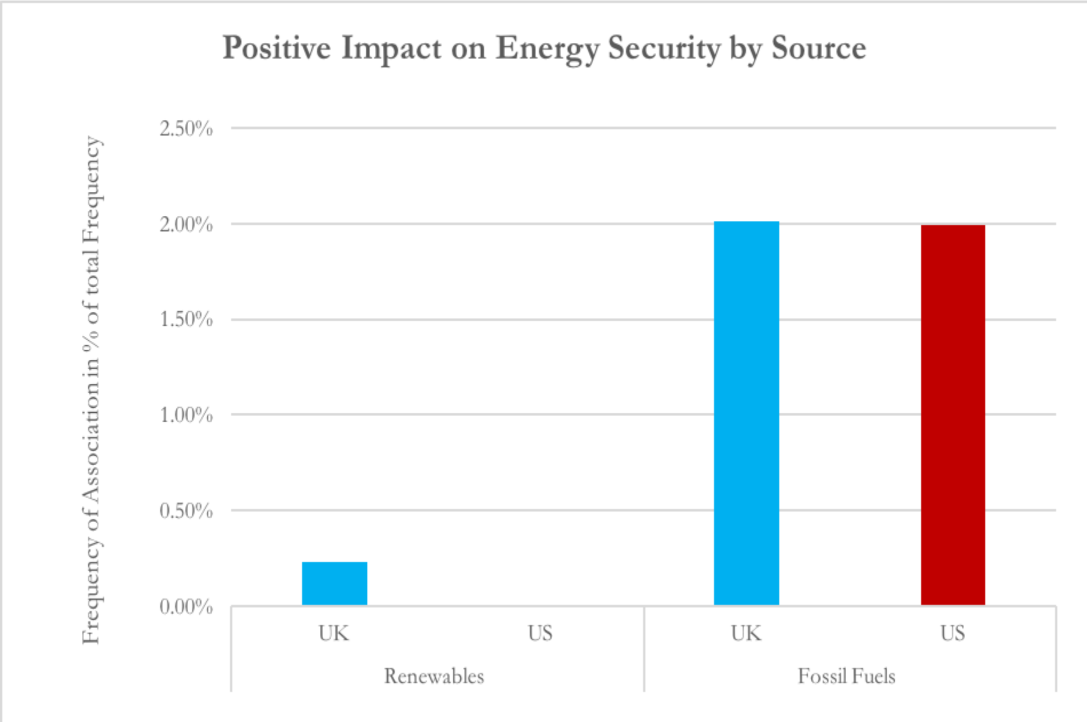

Figure 30: Positive Impact on Energy Security (Based on Strategy Papers DoE 2006-2014 and DTI, BERR, DECC 2003-2011), own design

is a much contested concept and, according to a recent article, that there are no less than twenty different dimensions of energy security (Cherp 2012). For the purpose of this thesis their most common denominator, expressed in the definition by the International Energy Agency, will be used: "energy security as the uninterrupted availability of energy sources at an affordable price" (International Energy Agency 2014). This includes ensuring long-term energy security, which might require long-term investments and adaptation to a changing system, as well as the capability to react promptly to short time changes in the energy system i.e. market-induced or political. The above Figure 30 and below Figure 31 give an overview of how the term energy security is causally related to the different discussed energy sources in both U.S. and UK documents (the percentage is of total mentions of the energy type).

Data in Figure 30 above shows that energy security as a concept is more strongly linked to fossil fuels and hence traditional methods of energy generation than it is to renewable energy of all kinds, despite the fact that some of the reviewed documents spend considerably more words on the topic of renewables. This reads as evidence of causal judgment.

Both positive and negative impacts by fossil fuels on energy security outweigh the effect renewables are considered to have on them. As long as this causal connection is not discredited and changed, then shale gas, which is often placed in the same context as conventional natural gas, would be a plausible answer to the question of security.

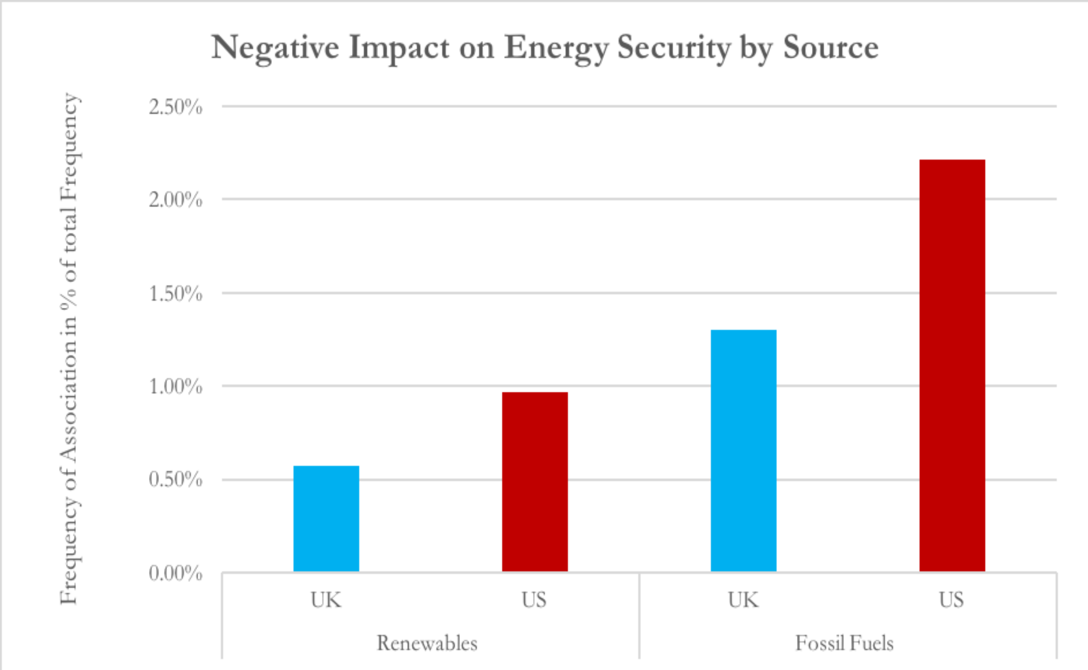

Figure 31: Negative Impact on Energy Security (Based on Strategy Papers DoE 2006-2014 and DTI, BERR, DECC 2003-2011), own design

Figure 31 above shows that especially in the United States, fossil fuels are also seen as negatively connected to energy security, slightly more so than their positive connection with energy security. But looking more closely at the context, I found this is not due to major belief in the positive aspect of the supply strength of renewables. It is almost exclusively due to a fear of dependence on foreign imports of fossil fuels. It is most strongly connected to the first U.S. strategy document (2006) when around two thirds of petroleum were imported into the United States and the mood was urgent (DoE 2006a). The effect is almost dissolved when one divides sources between oil and gas: oil imports are seen as negative for energy security as there are only negative ideas associated with import dependence in U.S. plans. This causal judgment does not negatively affect gas however: gas is seen as quite positive (DoE 2006a, 2011; White House 2014).

The positive role of fossil fuels for energy security is quite consistent in U.S. strategy documents after 2006 and in all of them for gas, just not for oil imports. This causal connection is also visible in the latter two UK strategy papers. Whilst it is possible that in the UK this was written with the knowledge of the American shale gas experience as an afterthought, it is in no way acknowledged; shale gas does not really feature in any of the strategy papers. There is a possible hidden agenda in some of the UK energy strategy papers: the criticism of fossil fuels and the positive impact on energy security from renewables is often found in the plan sections concerned with nuclear power (BERR 2008; DECC 2009). When arguing in favour of more nuclear capacity, the latter tends to be presented as a support and bridge before renewables overtake the energy system.

Hence in the white paper sections that suggest increasing investment into nuclear energy as the best choice for the UK, there are allowances made to renewables as well, and their role in ensuring energy security is increasingly considered and constituted. The sections supporting nuclear overlap with those that actively label fossil fuels as outdated or harmful, or strongly contend the idea that reliance on fossil fuels may actually endanger the goal of energy security for the UK.

Overall throughout the white papers, the UK seems much calmer and content in its security situation within the European network, especially its trade connection with Norway. This is maybe surprising in light of recent policy statements about the need for shale gas to boost UK energy supply security (Cameron 2013; Osborne 2015; Harvey 2015).

A second strong result of the comprehensive analysis is the evidence that the concepts of economic profitability and financial burdens are very clearly distributed between the different energy sources. When looking for evidence that an energy source was linked to economic profitability, several paths of reasoning were considered during the codebook node collecting process. Any mention of it aiding economic growth, the creation of jobs, and the promise of revenue, and in general mentioning it as a positive opportunity for industry and business, were included. The resulting evidence of causal judgment is displayed in the following Figure 32 (in total mentions rather than percentage).

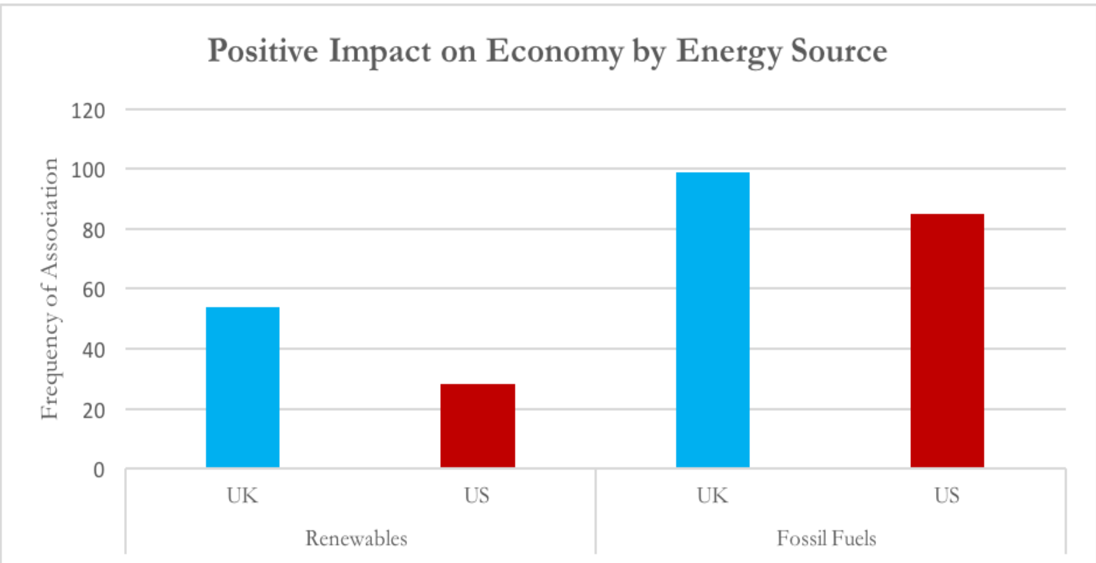

Figure 32: Positive Impact on Economy (Based on Strategy Papers DoE 2006-2014 and DTI, BERR, DECC 2003-2011), own design

Both in the U.S. and the UK strategy papers, fossil fuel energy sources are more strongly associated with revenue and economic profitability than renewables are. This is evidence of causal judgment and the mapping of ideas: the path to prosperity is linked to fossil fuels. To give an example of the type of causal connection found, consider the following:

"fuels that are the current lifeline of America's economy—petroleum, natural gas, coal" (DoE 2006a, 8). Another important connection is that of jobs: "growth in oil and gas production has both directly and indirectly created jobs" (White House 2014, 15). "In addition to direct employment in resource extraction, jobs have been created in the companies that provide goods and services to those industries" as well as "local jobs" specifically (White House 2014, 15). Other connections are less telling and forceful, for example simply listing the high percentage of energy successfully generated by conventional fuels or the abundance of coal reserves, or stating how they meet the energy needs of the nation. In the United Kingdom energy white papers, fossil fuels are almost twice as likely to be causally linked to positive economic impacts as renewables. In the United States strategy plans the number is even higher, with more than double as many references to the economic benefits such as growth and jobs connected to fossil fuels than to renewables. While there is some variance between the years, there is no clear trend when taking into account the different lengths of some documents. I am not considering environmental health and growth as a positive economic effect in this context because this is clearly not considered in any of the documents; economic and environmental prosperity are kept quite separate. This is a further bias that constrains the support of renewable energy: counting environmental costs and benefits would fit them into the market based scheme of expected utility much more successfully.

Adding to this picture in which conventional fuels work for the economic good and renewable energy does not, Figure 33 below shows the other side of the coin, the amount of future costs and challenges associated with the different energy sources.

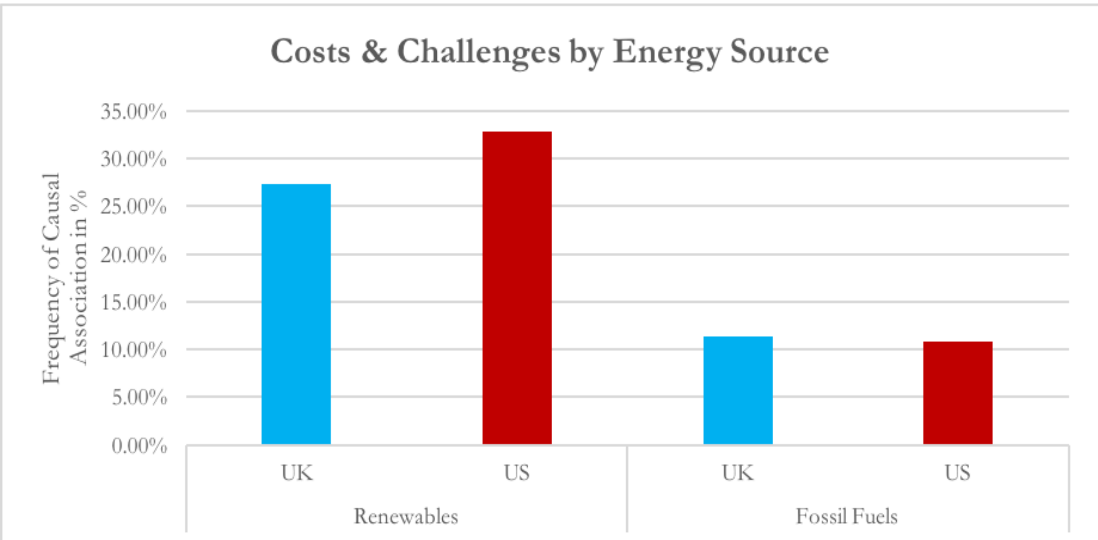

Figure 33: Costs and Challenges (Based on Strategy Papers DoE 2006-2014 and DTI, BERR, DECC 2003-2011), own design

This figure shows clear evidence of causal judgment in the exact opposite direction than the bias visualised through the previous figure. Both in the U.S. strategy papers and their

UK counterparts, renewables tend to be considered as very costly, in need of vast amounts of investments and unable to sustain themselves, much less appeal to the private sector by themselves. There is an abundance of points such as "generating electricity using renewables still costs more than fossil fuel generation and deployment is hampered by a range of barriers" (DECC 2009, 59), "the increase in energy bills is caused by the use of renewable generating technologies" (DECC 2009, 96f), or focus on the problem of how "low unsubsidised returns for renewable energy compare to traditional sources" (DoE 2011, 13). Many associations are much less drastic and simply a neutral consideration of policy options, yet combining renewables with the idea of costs such as: "help bring down the cost of renewables in the future" (DECC 2009, 60), "support research and development efforts to reduce the costs of renewable energy technologies" (DoE 2006a, 10) or simply a discussion of the average costs of solar energy. All of these small notices however add to the impression of causal judgment about renewables. Even if the discussion is positive and lauding a drop in costs for photovoltaic panels, the judgment is very clear: costs are always considered in connection with alternative energy sources, and rarely with conventional fuels. These stem from various suggestions of spending, including proposed investments, extra training and research, monetary incentives to be given, extraordinary costs of regulation and profits missed out on through obligations to renewables. The association is short-sighted given the success both countries as well as private firms and investors enjoy with renewable technology (Amin 2015; Lovins 2015). It also does not concur with several prominent statements in the documents such as the one about the costs of not transitioning being higher than the apparent high costs of reform (DECC 2009, V). This was put forward in some of the reports yet drowned in the amount of less prominent causal judgments declaring the opposite and focusing on the costs of renewables. Many of the associations of expenses with fossil fuels are only related to import dependence (more so in the U.S. than UK plans). Evidently, renewable energy sources are much more easily causally judged to create cost and expenses and loss of revenue than fossil fuels. In the UK case the latest strategy paper was printed before tax incentives were given to shale gas but regardless, for other conventional fuels they existed before, and all such incentives to fossil fuel production overall remain largely not emphasised. In the United States where the unconventional gas industry had already been enjoying favourable legislation and tax incentives for decades before the publication of the DoE's latest energy strategy planner, this omission is also notable (Stevens 2010).

Especially when it comes to association with market-based solutions and the free market, fossil fuels win out over renewables. Fossil fuels (despite incentives and tax breaks) are consistently discussed in context that makes use of market style vocabulary and it is completely accepted that their performance in the market is successful. With regards to renewables however there are frequent reminders that they are not yet market compatible and need support to get to that stage. This is visualised in Figure 34 below.

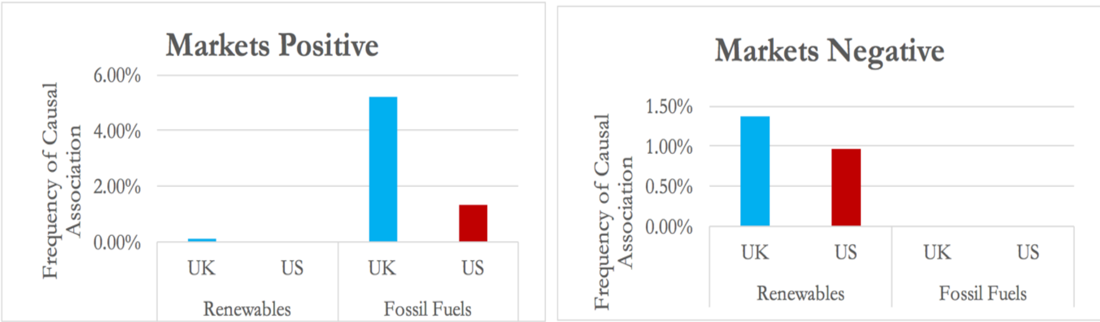

Figure 34: Market Effects by Energy Source (Based on Strategy Papers DoE 2006-2014 and DTI, BERR, DECC 2003-2011), own design

The number of occurrences are too low to be statistically significant to a quantitative analysis (65 causal associations are made). However, the direction of the causal judgment made is almost unanimous, which is noteworthy. Fossil fuels are considered to work in the market based system, which is strongly believed to be the best system to manage the energy sector in both countries - and renewable energy is not. This is entirely in dismissal of singled out phrases protesting 'market failure' which can be found in the strategy plans to place some of the blame on the market system rather than renewables, making them seem out of context. The finding albeit statistically weak is very indicative of the problem with instigating policy change against oil and gas and in favour of renewables. Trust in the power and efficiency of the market based system is a key idea for all of the energy policy blueprints, and renewable energy is not seen as compatible with it yet, whilst fossil fuels – somewhat falsely - are. There is no diagnostic inference of the fact that if the market place does not appear to work for renewables, maybe the market place is not as free and competitive as it is heralded to be, or maybe even that it is not as efficient for the energy sector as it is for other sectors. Another diagnostic inference that is avoided is the consideration of tax credits, incentives and favourable regulation granted to the oil and gas industry: this could lead one to infer that the strength of unconventional fuels on the market is not a given. However, this causal judgment is not altered: shale will simply be added to the model through small changes, but the model is not reconsidered.

Finally, several other findings deliver relatively consistent results. One of them is the idea of positive or adverse effects which an energy source is assumed to have on the environment and climate change – both topics are much mentioned in all of the documents. Figure 35 below illustrates consistency in the ideas of connection between environmental issues and the energy sources. Overall, fossil fuel is seen to have a more negative impact on the environment than renewable sources do. This leads to the conclusion that the environment and climate change are simply not priorities, despite the documents stating this.

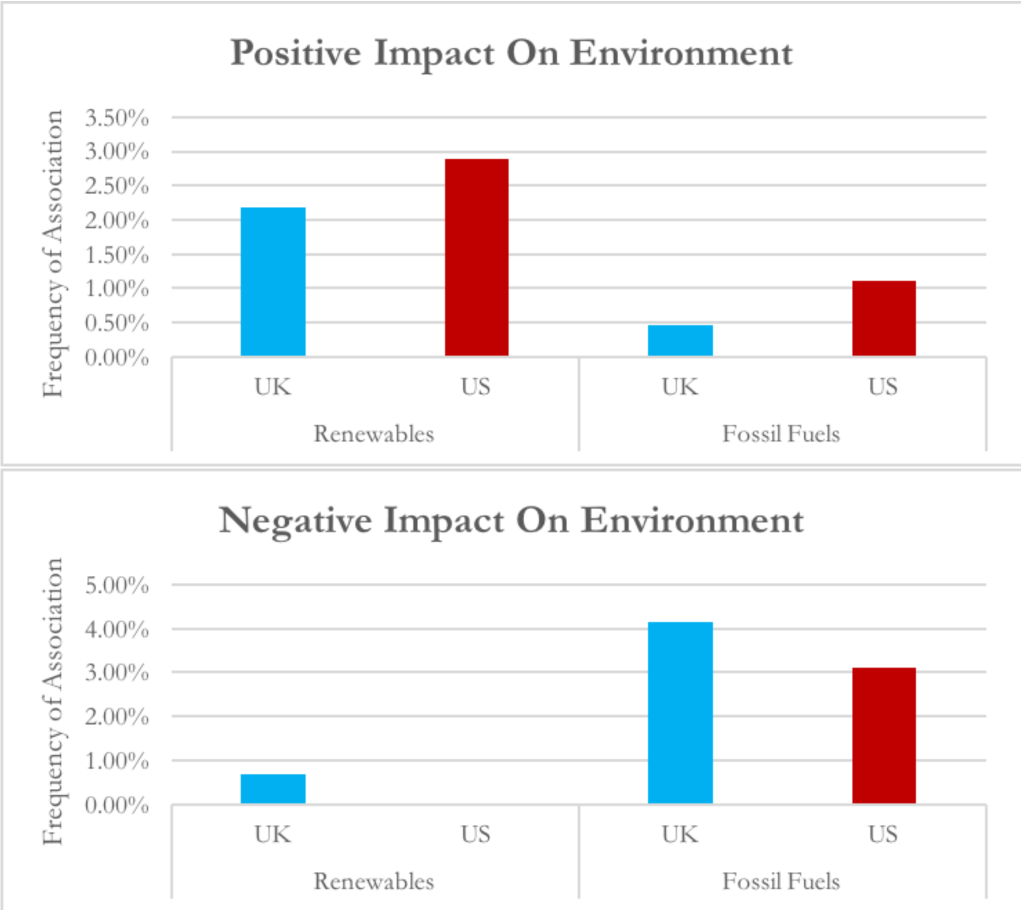

Figure 35: Impact on the Environment (Based on Strategy Papers DoE 2006-2014 and DTI, BERR, DECC 2003-2011), own design

When renewables are seen as negatively impacting the environment this is largely to do with the impact on landscapes by wind turbines and similar apparatus, which is an issue raised by focus groups that were consulted (BERR 2008; DECC 2009). When fossil fuels are considered to have a positive impact on the environment, then the statements are about natural gas and therefore about shale gas which formed a large part of the U.S. gas revival in question. There are not many negative environmental connections involving gas: these either concern 'fossil fuels' in general or oil and petroleum in particular. The fact that gas is less harmful to the environment than oil or coal is mentioned in several U.S. and UK strategy plans. This should be read with caution for shale gas however, since fracking emissions are higher than regular gas emissions (Hirst, Khor, and Buckle 2013). Either way it is quite clear that research has not caught up yet with the effects of onshore unconventional gas drilling (Schrope 2013) but that most scientists see serious possibilities as well as first evidence of grave environmental damage (Ahmed 2014, Owen 2014, Lorde 2013). Regardless, if the connection between gas and more environmental health is trusted and the differentiation between gas and shale gas is also not made, this could be very indicative of a reason to support shale gas development. Furthermore, as the costs and benefits to the environment are judged separately from other economic costs and benefits, and subsidies to fossil fuels remain high yet unacknowledged, renewables cannot enter the cost-benefit analysis on their strongest terms.

What is remarkable is that costs arising from environmental hazards are discussed yet kept entirely separate from other costs, such as investment, in these strategy papers. Without going so far as to consider different definitions of growth that include environmental factors (Ekins 2000), costs through environmental issues such as flooding should be considered together with other economic costs. Yet the issues remain overwhelmingly separate, except for the 2003 UK document and a few unspecific statements about the danger of climate change in the 2008 UK document which supported nuclear energy.

VIII.4 Chapter Summary

This chapter follows the prior case studies establishing the context that economic rationale alone is an unconvincing reason for shale gas policy decisions, but that private interests were likely influential, though not similar in the two case studies. In chapter seven I demonstrated through a literature review on the power of ideas and cognitive biases that these had potential to further influence the decision. To follow up on this hypothesis I conducted an explorative discourse analysis of the existing ideas around energy policy. My analysis into the official strategy papers that form a blue print for U.S. and UK energy policy shows that ideas and biases as derived from the previous theoretical chapter play a role in the outlining of strategy on energy. There is variation between the strategy papers, but not between the key ideas and biases.

When perusing the examples of currently in use strategy papers it becomes evident that despite a different focus in the plans the policy tool repertoire has not changed drastically between 2003-2011 (UK) and 2006-2014 (U.S.) respectively. Evidence of particular ideas is found in the strategy documents: strong belief in the efficiency of the market-system is apparent, even if it is considered in need of tweaking. Environmental preservation is a much-discussed topic and key priority of the later U.S. and all of the UK strategy blueprints. It is not, however, considered an issue so paramount that it should be dealt with above other challenges. It further appears that the idea that renewable technology could lead to great economical advantage as well, an idea which appears to already be considered in other countries (Germany, Norway, Portugal) has not quite arrived in U.S. and UK politics yet. The notion of energy playing a strong role in not just energy security but overall national security is very apparent in the U.S. strategy papers but not so in the UK documents, though there are mild references to it in the UK's last, 2011, white paper. There is also a clear case to be made for existing causal judgments about the effect of different energy sources on environment, growth or security. Yet there is less clear evidence for the biases of availability and representativeness.

I find evidence of divergent underlying ideas about the varying energy sources; they are connected to economic and environmental aspects with different causal assumptions, even if they are not heralded in the article headlines. Renewables are considered less compatible with the free market and as very costly, with less positive economic benefits. Causal judgment, or causal beliefs (which is a definition of ideas – see chapter seven), exist that strongly associates fossil fuels with jobs, growth and revenue, much less with investment costs. However, renewables are considered as better for the environment than fossil fuels (mostly excluding gas), which leads to the inference that this is less of a priority. Costs of climate change are not considered in these calculations (Amin 2015; Taylor 2016). This is probable evidence of cognitive capture, specifically casual judgment. The policy support for shale gas fits very well with this narrative: it is a form of gas, which is judged positive for economic growth and jobs, and these are considered a priority over environmental issues.

Despite some of the more prominent ideas leading in different directions, in pure frequency causal judgment on the capacities of different energy sources seem very unfavourable towards renewables and form a plausible ground for shale gas development to be considered. Several of the energy blueprints sound engaged with environmental concerns in first the manual content analysis, yet this is not reflected in the policy decision on shale gas and neither does it correspond to the underlying ideas and causal associations found. The white paper authors may flaunt their interest in the opportunities of change, but an analysis of causal judgment tells a different story that fits better to the support of shale. Overall in the strategy documents, fossil fuels are discussed more frequently than renewable sources. Gas seems to be much more of a topic than oil, or fossil fuels in general and beyond that, fossil fuels are constantly mentioned in the connection with carbon capture technology (except for the UK plan on nuclear power). At times the latter appears like an easily-achievable panacea for all potentially arising issues surrounding fossil fuel powered energy generation. This focus on gas bodes well for the introduction of shale gas into the mix in the belief that it is both more economically capable than renewables and a much cleaner energy source than oil or coal. Causal judgments appear unaltered and trusted: there is little evidence of diagnostic inference which considers the new reality of the energy sector in the 21st century and come to the conclusion that methods and approaches need to be changed. New energy methods are neatly fit into the old models of thinking and causal judgment which determine policy strategy: since shale gas fits this model better than alternative energy sources do, a decision in its favour is logical based on this narrative.

Much of the discussion around renewables remains abstract and intangible. Of course, they are the newer energy sources and we have less experience with them than we do with coal or gas. Regardless, there is much more knowledge and experience about renewable energy in circulation than is let on in most of the UK and U.S. strategy papers. In comparison, the sections concerned with fossil fuel related energy generation tend to be much more concrete in terms of policy goals and statistical data. This might be interpreted as a distant effect of the availability heuristic. There is less experience with renewables, hence they do not come to mind and are not considered as seriously as fossil fuels. Renewables are also often linked to climate change, in that they are needed to mitigate and curb it: the term climate change however suffers prominently from the bias of availability. Experiences with climate change are not as concrete – often enough, the association is not made. (Not everyone affected by Hurricane Katrina sees a direct connection between fossil fuels, carbon emissions, climate change and more extreme weather.) I found that climate change overall is a topic with which problems of availability exist: it remains less available in that it is not easily directly associated with a risk, unlike with other energy related issues such as energy shortages in winter or power plays around energy shortages or rising fuel prices. But there has been much research and evidence into the effects, for example by recent IPCC reports, and the energy strategy papers do not reflect those soundly except for the 2003 UK strategy paper. Causality and attribution of the effects of climate change remain vague, when mentioned. Climate change causing floods is considered, fossil fuels causing climate change is considered; that developing fossil fuels causes floods and thereby costs to the economy is a step not taken except in the 2008 UK paper on nuclear energy. There is previous research connecting climate change to availability (Sunstein 2005): the costs that it brings with it and that are to our current knowledge best prevented and mitigated through divestment and large scale introduction of clean renewable energy are factually but not cognitively available to governmental decision-makers even if they are privy to cutting edge research on the topic. They will not become cognitively available until the time has passed where these costs can be avoided. Until those costs however are clear, the benefits from perceived to be high investment to mitigate them are also not cognitively available to policymakers. Only if on one hand, strongly salient effects of climate change such as hurricanes are linked to it while on the other hand it is connected with its causes, such as the use of fossil fuels, a strong response to climate change and ensuing change in the upkeep of the status quo are likely (Sunstein 2005, 8).

The clear and similar findings from the U.S. and UK strategy papers to me suggest that there is very likely a situation of cognitive capture impacting decision-making in the energy sector in both countries. Key ideas exist about which energy source will strengthen the economy and which will cost it, with regards to which energy sources function well in a market-based system which is unanimously desired even though it is occasionally considered flawed in adapting to future challenges. And whilst the causal judgments about which energy sources impact the environment more severely also exist (more so in the UK than the U.S. case), these are not considered as much of a priority as economic growth. This kind of thinking suggests continued and renewed exploration of fossil fuel and specifically natural gas resources, even if they are unconventional, rather than a switch to renewables. This is ignoring evidence from other countries which have achieved economic successes with renewable energy rather than increased gas production, and especially the perceived incapability of renewable energy to compete in a real free market system is ignoring the fact that fossil fuels have been so well subsidised and supported that they mostly have not had to, either.[198]

This concludes the third dimension of my analysis into factors influential on policy decisions favouring shale gas development. In the content analysis, I established several key differences as well as similarities between ideas on energy strategy in the UK and the U.S., however in the statistical discourse analysis I found much more correlation. Key ideas in both country's official energy policy strategies concur in their judgment of energy sources' abilities to a point at which the introduction of shale gas into the energy mix is rendered plausible. The status quo does not appear sufficiently discredited to validate radical policy change, but is supported by strong ideas about the economic superiority of

[198] There is also a point to be made about the larger institutional similarity between the United States and the United Kingdom following the lesson of the institutional political economy approach that is Varieties of Capitalism. Both countries are classified as liberal market economies (LME), which focus more on short term capital information such as the stock market and therefore more on short term growth opportunities (Soskice and Hall 2001). LME's are also characterised by a more competitive relationship between private firms, and niche production is less supported (Soskice and Hall 2001), therefore market advantage is likely to win out over joint efforts to cut unhealthy production habits: only a market incentive that works for everyone to give up on pollution is likely to come through. This was visible in the above reviewed strategy documents about the ideas on market competition. Yet in LMEs innovation and sector change is believed to be more radical (Soskice and Hall 2001) – this does not apply to the energy sector according to the ideas considered in the above discussion.

fossil fuel resources, of which gas forms a part, and ideational preference for a market-based system in which only fossil fuels, not renewables, are considered able to sustain themselves. These ideas give the impression of being resilient throughout the documents analysed and over the time span of a decade in both the United States and the United Kingdom. The ideas appear entrenched or institutionalised. As Vivien Schmidt finds in a lesson from historical institutionalism: "once ideas are institutionalised, they represent powerful forces for continuity", creating a "'path dependence' of existing ideas" and "constraints on alternatives" (Schmidt 2013, 37; Pierson 2004). I argue that such a path dependence exists in the energy sector of both the U.S. and the UK in favour of conventional over alternative energy sources, constraining policy change and thereby enabling what is seen as a continuation of the status quo through shale gas. Shale gas is not, in fact, a continuation of business as usual in the gas sector but instead requires large amounts of investment and in the United Kingdom an overhaul of the entire grid system. Whilst these are considered as impediments in connection with renewables in the above reviewed strategy plans, chapters two and four have shown that in the case of shale gas, similar costs exist but are largely ignored. While there is no evidence in the strategy papers for it, as shale gas is barely mentioned in them, this notion leads me to another tentative conclusion: Representativeness likely affects the shale gas issue in the UK. This representativeness is not directly reflected in the strategy papers but an interpretation that seems likely, yet which I cannot conclusively prove. The judgment process is as follows: that since previous gas (in Texas, or the North Sea) made the economy strong, so can shale gas. Again, the impediments to shale gas make this assumption inaccurate but do not stop it from being made. As Tversky and Kahneman suggest, a tendency exists to fluently adopt old models to newer facts if they appear at all related, and an illusion of validity is created when new information appears on the surface to fit with predicted outcomes: shale gas appears to be like gas, gas and fossil fuels are often connected to economic prosperity, so shale gas is promoted in the spirit of the same ideas. Wolf would call this the "confirmation bias – the tendency to interpret new information as support for pre-existing beliefs" (Wolf 2014).

The interplay of ideational and heuristic constraints constitutes what I call cognitive capture, preventing outside ideas from gaining prominence and inducing policy change. I conclude that this narrative on cognitive capture is much more likely to be influential on the policy decisions to allow hydraulic fracturing of shale gas than an expected utility assessment of national benefits from the practice. This does not have to take away agency from interests i.e. explanatory value from the second narrative on lobbying influence (Hall 1993, 289; 292). In fact, they likely corroborate each other: interest groups can serve to support this cognitive capture – the powerful lobbyists of the oil and gas industry are also working to preserve the status quo, and have no reason to actively attempt and change governmental ideas about energy sources' capacities, if they are aware of them.

The uncertainty surrounding shale gas development makes my conclusion about the influence of cognitive biases no less likely: the energy strategy documents reviewed in this chapter provided several historical examples of energy policy decisions based on predictions made despite uncertainty which turned out faulty in less than a decade. For example, the suggestion that renewables could only flourish if conventional fuel prices were particularly high turned out not to be true as we know from experience in 2016, yet this is predicted by the 2006 DoE strategy paper: only a price rise for fossil fuels could further their development. Incidentally, in one of their logical examples to prove cognitive biases which I discussed in chapter seven (see page 172), Kahneman and Tversky, who explain causal judgment with this example, make the exact same causal judgment. Given that they made it several decades earlier it is less ill-considered than the DoE's prediction, yet ultimately the relation was proven wrong.

The previous points of analysis further seem to suggest that the status quo – a heavy reliance on traditional fossil fuels – is in effect not discredited enough for it to be given up for something that is considered in much more uncertain terms, i.e. alternative energy, due to lack of experience but also due to disregard of existing information and lack of research efforts. Hence my study contributes to the literature by finding further evidence of the resilience of powerful ideas supporting a status quo, and contributes to the story of shale gas by indicating that this false assumption of shale gas to fit into the status quo has gained it the support it enjoys.

A further problem with cognitive capture and uncertainty is how selectively it affects decisions. The relative uncertainty over the specific effects of natural hazards and global warming leads to two very different outcomes. On the one hand, the problem of availability affecting climate change leads to a lack in efforts to combat it – not perfectly knowing what will happen means little is done to mitigate it. On the other hand, despite this uncertainty and availability problem policymakers appear to work with the idea that they have and will have total control over the situation. From the above reviewed documents, one gains the impression that there is an assumption that there will always be time for alternative energy in the future, when it is really necessary to implement it - until then, the perceived economic benefits of fossil fuels and shale gas can be enjoyed. This is despite evidence that incidents happen unexpectedly which can worsen the original condition on the basis of which policy is made. Recent incidents include the Fukushima nuclear accident, increasing weather catastrophes or a sudden sinkhole turning a state's aquifer and potentially other resources radioactive (Harrabin 2014b; Redfern 2014; Brown 2015; BBC 2016; Wingfield-Hayes 2016). Theoretical evidence of such thinking is found by Nisbett et al. (1976) who note that whilst people tend to always see their own behaviour as changing and adapting, they tend to view the behaviour of other people as stable (Kahneman and Tversky 1973, 176).[199] This heuristic cannot simply be translated from an individual (the example is often a bad chess player) to a highly capable government organisation: but the metaphor is not far off. These strategy blueprints are full of an optimism that humans can yet change their behaviour in time, become better, have better technology, and the eco-system can then be fixed.[200] What is missing is the realisation that the planet, too, can and does change. Once a certain amount of change has occurred, there simply is no guarantee that humans or their governments will be able to adapt fast enough to mitigate the consequences without serious harm to millions. The assumption of control is entirely illogical.

My third narrative concludes my framework of analysis for the decision-making on shale gas policy and contributes to the debate by confirming strong, and similar results between the two countries on cognitive capture.

[199] False assumptions and predictions about new technology and future changes are not exclusive to lay people. Experts continue to err, even in their own specialised areas of work. Scientist were wrong when they described x-rays as harmless. Nobel prize winner Robert Millikan called the possibility of power through nuclear energy a "myth" less than ten years before it was confirmed, yet did not lose his reputation (González 2005, 64–65). When the United States government discovered it was working with entirely different numbers of magnitude for the risk assessment of the Three Mile Island nuclear plant they still did not close it until the accident happened.

[200] Or indeed they betray a complete lack of caring about such future consequences.

IX Chapter Nine. Conclusion

The popular resurgence and hype around the so-called shale gas 'revolution' has become the topic of heated debate between supporters who see a welcome blessing in this newly accessible resource and critics who see another dirty fuel to accelerate climate change and to delay much needed change in the energy sector. The rationality of the decisions by the U.S. and UK governments to support shale gas development has been drawn into question. I therefore challenge the official, rational explanation based on economic opportunities behind the decision through a concise cost-benefit analysis and offer two different narratives helpful in explaining the support for shale gas.

While the issue is still[201] current and final outcomes of the dash for shale are uncertain, several years have passed since policy decisions to allow fracking were made and it is now possible to consider the circumstances of these preferences and retrace their formation. In this dissertation, I analysed factors that led to political support for hydraulic fracturing in the United States and the United Kingdom in the 21st century. In doing so, I gathered insights on obstacles to the transformation towards sustainable energy. I also added empirical substantiation to existing theoretical concepts about decision-making under uncertainty.

To examine different aspects of the decision-making process, I approached the policy result to add shale gas to the energy mix through three separate narratives based on mixed theoretical approaches: a cost-benefit analysis for the expected utility of shale gas to each respective country's energy mix, a review of the influence of private interest groups in favour of fracking, and an analysis of cognitive constraints which give advantage to shale gas over alternative energy sources. I found little confirmation of the benefits of fracking in the cost-benefit analysis, especially in the United Kingdom, where less promising geological features dampen the prospect for fracking and structural factors preclude the relatively fast integration of shale gas into the energy mix. The economic reasoning behind the U.S. shale story is also less convincing than many, including the U.S. and UK governments, proclaim it to be. My research found no support for the idea that shale gas could be used as a cleaner, transitional fuel: instead it is likely to have severely detrimental environmental effects. Furthermore, the use of shale gas presents a serious additional risk of accelerating global warming, both due to its ability to replace renewable energy on the agenda and due to its high greenhouse gas emissions. I found stronger support of the

[201] In summer 2016.

shale gas story when researching private interests in this cause. The oil and gas sector in the United States has a history of high lobbying spending, and is very well interconnected with policymakers and regulators, with evidence of the revolving door practice. In the United Kingdom, there was less evidence of this and I found that the results were less conclusive due to different lobbying regulation and the fact that many instances of lobbying activity are able to go unreported. There was no evidence of a degree of revolving door practice between industry and regulators that matched the U.S. scenario. Yet I found that several instances of successful lobbying have taken place. Conclusively, private interests in both countries engaged in the type of lobbying deemed most successful by IPE literature. My third narrative of cognitive capture, in which I focused on key ideas purported within energy strategy documents as well as cognitive biases, best matched with and explained the policy result and showed promise as a key influence on shale gas decision preferences. Key ideas were discernible to comparable amounts in the strategy documents of both countries, for example about the importance of the sector and the panacea of technological innovation, or the superiority of a market-based system. Especially causal judgments about the costs and benefits of different fuel sources were evenly matched between the U.S. and UK plan, and strategy documents with few exceptions showed evidence of the availability heuristic impacting strategy regarding climate change and renewable energy.

This enabled the finding that key ideas and cognitive biases exist in both countries' strategic repertoires for the energy sector which benefit the introduction of a new fossil fuel resource, falsely believed to be quite clean, over change towards alternative energies. The empirical analysis adds to theoretical work on the influence of ideas in political economy, which is a more novel approach compared to the other two taken in this work. My study adds to this by substantiating claims about the power of ideas empirically as well as by furthering the theoretical concept through combining it with insights on cognitive heuristics from behavioural economics. It also adds to our understanding of reasons as to why some countries appear slow in their transition towards alternative energy generation.

The research enabled reflection on the different theoretical approaches that underpin my different narratives of the shale gas story. In particular, it confirmed criticism of expected utility and the assumption of cost-benefit rationality in decision-making under risk. Assuming the respective national government to be amongst the most well-informed decision-makers possible, the cost-benefit analysis of shale gas assets should have led to a more cautious response in the United States than it did and should not have led to support for fracking in the United Kingdom at all. If environmental costs were considered consistently as part of economic costs, shale gas should not have received the support it did in either country. The approach to explaining events and policy decisions by recounting the calculations of governments is the trademark of a rational actor approach common in public policy, the merit of which Allison and Zelikow (1999) and others have previously discredited. Instead, in my work I found confirmation of theoretical findings on the power of private interest groups (Gourevitch 1986; Baumgartner et al. 2009; Culpepper 2010), in particular on the constitution of lobbying success through the use of quiet politics and close connections with policymakers as well as expertise provision. The argument of a lobbying advantage for those lobbying for the status quo is confirmed by the difference in U.S. and UK private interest pursuit. Given my brief comparison between the oil and gas sector's lobbying power and the relative lobbying capacity of environmental groups, in view of political results for the fracking industry, I could not agree with findings of neopluralism or pluralism that suggest alike influence for different groups in society. Instead the gas lobby appears to be in a very privileged position compared to opponents of fracking, for example due to close connections with policymakers. Finally, the empirical results showed a commonality in the cognitive capture of U.S. and UK policymakers: core ideas and cognitive biases about the energy sector resemble each other strongly in the respective energy strategy blueprints, despite having diverging overt focus points across the documents. This last narrative especially helps shed light on reasoning behind the strong backing of hydraulic fracturing for shale gas by the U.S. and UK governments.

This chapter concludes my thesis by giving a résumé of its main findings: the story of shale gas support in the United States and United Kingdom; the contributions to theory; and the response to the problématique and research question raised in the opening of this study.

IX.1 Results: The story behind support for shale gas

In my thesis, I considered the policy outcome of allowing hydraulic fracturing through the lenses of three different narratives. The first focused on a rational cost-benefit analysis as befitting the decision-making by *homo economicus* and the official explanations of national and public benefits given for the renewed interest in the unsustainable energy source that is shale gas. My second narrative considered the impact of private interest pursuit on decision-making in the energy sector regarding fracking regulation. In the third dimension of this thesis I focused not on interest but on the process of decision-making, by examining cognitive capture through the influence of ideational constraints and heuristics on the decision to allow fracking.

Following a background on the characteristics of shale gas and hydraulic fracturing in chapter two, chapter three and four analysed the story of fracking from a rational actor, or *homo economics*, point of view. The third chapter introduced the reader to expected utility, a concept of cost-benefit analysis that is considered a standard approach for decision-making under uncertainty and risk, as well as to theoretical and empirical criticism of this approach. The basic conclusion of expected utility is that utility is different to different agents and that ultimately the size of the expected pay-out or revenue from engaging in an activity that carries risk will decide if it is undertaken. The second most popular variant of expected utility, called prospect theory, builds on this with a distinction between costs and losses and an insight that losses may well be counted differently and higher than gains. In this chapter I also elaborated on the distinction between risk and uncertainty and the fact that this distinction is hardly ever applied correctly despite its significance for decision-making. Besides a lack of empirical evidence for the applicability of expected utility, there is a lack of articulation of normative arguments about the appropriateness of public policy decisions on the basis of expected utility. My empirical analysis of the shale gas story under the lens of expected utility led me to argue that supporting fracking is not a profound and necessary conclusion for either the United States or the United Kingdom based on assessing potential costs and benefits of the practice. I found some evidence that facilitated this kind of reasoning in the United States, for example favourable structural factors, such as a very well adapted existing energy grid and the incentive for private landowners to allow fracking due to their ownership of mineral resources and hence share in revenue. In some states, a number of jobs were created and incomes raised – yet the overall picture is less impressive than official accounts let on. It does not create an overwhelming argument in favour of allowing fracking in a manner as supportive and laxly regulated as the past two U.S. governments have allowed. The unsustainable nature of the resource was always obvious to decision-makers as were its environmental costs. There have also been many concerns regarding the economic performance of shale gas over the years, which the government must be aware of – its overall effect on the U.S. economy is considered negligible in comprehensive analyses (Mathieu, Spencer, and Sartor 2014). While more recently evidence emerged that shale could potentially harm the energy sector and economic recovery due to the increasing debt and difficulties of many companies fracking, it stands to reason that if they looked closely enough the successive U.S. governments in the timeframe must have known that shale gas was always unlikely to create lasting economic benefits for the nation. In the United Kingdom on the other hand, almost no argument about the utility of fracking to the economy stands up to scrutiny: there is too little known about the reserves as of 2016, they are evidently unsustainable, and structural factors in the UK are not conducive to shale operations. Very high initial investment costs are required to bring shale gas into the UK energy mix, and to this end generous tax breaks were allocated to fracking alongside other favourable policies. As these supportive measures are the very aspects that are in general complained about and objected to in connection with renewable energy, their non-issue status in relation to shale gas appears illogical through a pure cost-benefit focus. The support of fracking is expressed in terms of standard economic arguments as to their economic benefit and success in the market-based system. There are direct comparisons drawn by the UK government elaborating that shale gas is an economically strong option compared to the amount of support and investment renewable energy needs (Leadsom 2015). I cannot confirm this position but can only question it given the evidence of the support that shale gas has enjoyed, ensuring it did not have to compete in a free market in the United States and will not have to do so in the United Kingdom either. My analysis suggests instead that there is no free, efficient market operating in the energy sector in either country, but rather that the market is heavily tilted by subsidies and preferential treatment of certain groups. Lastly, though neither is overwhelmingly promising in the long run, the prospects of shale gas in the United States and the United Kingdom have, in my analysis, shown to be so fundamentally different that there can be no reasoning of a common independent variable in this narrative. The U.S. has seen positive economic balances and short-term figures, which may be used to support short term policy narratives.

Further notable results from this part of the analysis included the apparent exclusion of environmental costs from overall economic cost calculations, as well as the lack of consideration for uncertainty. Risks connected to shale gas are discussed albeit in a way that diminishes and almost belittles them, but there is no evidence that the concept of complete uncertainty or unknown unknowns has entered the decision-making process.

Since expected utility or a 'national interest' supporting the expansion of shale gas exploration could not be established convincingly for either country, chapter five and six of my thesis were committed to exploring the potential impact of private interests on governmental decision-making regarding the energy sector. Lobbying is a notoriously difficult process to establish conclusively as theoretical works assume the strongest advances of lobbying to lie in non-transparent quiet politics and closed meetings between policymakers and private interests. Nevertheless, by combining available reports of lobbying occurrences and general lobbying statistics regarding the energy sector, I developed a case which confirms evidence of what the theory considers indicators for successful private interest pursuit in the case of fracking. In chapter five I drew on international and comparative political economy lessons about lobbying private interests, focusing strongly on meta analyses of theoretical works and empirical case studies such as the ones by (Baumgartner et al. 2009; Godwin, Ainsworth, and Godwin 2013). While I found disagreement in the literature about whether or not business interests play a preferential role compared to other private interests, there was consistency in the notion that certain specific factors have proven to aid in lobbying success and especially aid lobbying success of businesses and resource-rich interests in a disproportionately strong way. One of these factors was the differentiation between lobbying for public and private good, and as energy is considered a mostly private good that is managed and allocated in competitive markets in both the U.S. and the UK, already a condition for lobbying was fulfilled. The level of complexity and uncertainty surrounding shale gas if anything helped the lobbying efforts, as industry expertise was arguably more in demand. In chapter six I examined more evidence to establish whether there are private interest groups with considerable interest in furthering shale gas production in either country, and whether or not they had been engaging in lobbying according to the premises of the preceding theoretical review in chapter five.

Judging the effect of private interest pursuit on policy outcomes is a core topic of political economy and a topic often raised in combination with the energy sector. However, there has as of yet been no comprehensive comparative analysis of the situation regarding shale gas in the U.S. and the UK, only singular issue reports. My sixth chapter provides such an analysis as I compare the relative capacities of energy lobbies and their connections with policymakers, especially their institutional access through in-house and revolving lobbyists and the revolving door scenario. Using business analysis tool Boardex I found a plenitude of past and current connections between industry and regulating bodies in the United States, providing evidence for the common practice of the revolving door and indicating a strong potential for cultural capture as well. I could not establish a similar situation of private interests embedded in government institutions within the United Kingdom. (Again, this result may be connected to a difference in reporting lobbying in the two countries.) While there was less of a case to be made for the revolving door in UK departments, there was still plenty of evidence of close connections and frequent contact between lobbying and policymakers in both countries, a key suggestion of the literature of successful lobbying. I found reports of gas industry employees and even senior level industry figures working as advisers or co-authoring legislation within the governmental departments on energy and environment just as in the United States.

Consolidating my argument that the pro shale gas lobby has the potential for strong influence on policy output is the fact that in both countries, the anti-fracking lobby is disproportionately less engaged with policymakers, and where data is available the opposition is also shown to have fewer resources at their disposal. In the United Kingdom, there was a considerably higher number of connections between the key anti-fracking lobbies Greenpeace and Friends of the Earth with policymakers than in the United States, although mostly through membership and not employment. Clearly the situation of lobbying through the revolving door practice is not similar in the two case studies. A different proposition of the literature, the success attributed to lobbying quiet politics rather than high salience issues, can also be confirmed in the case of shale gas lobbying. There is not much reporting around lobbying to influence the UK moratorium on fracking, for example, or open lobbying on the acceptance of the U.S. Energy Policy Act: but plenty of reports exist about changes in definitions of the fracking process, quiet exemptions from environmental legislations or private meetings between lobbyists and policymakers. Few of these measures will have reached public awareness or headline status, but for the industry they are considerable gains that make a significant difference. Lastly, in this narrative I find confirmation of the advantage of lobbying for the status quo over change since those interests lobbying for shale gas are often established private interests in the conventional gas sector, even if shale gas does not entirely fit the description. This would offer another reason why the analysis established higher lobbying success in the United States than the United Kingdom. The onshore gas industry is much larger and better established in the U.S. than the UK, and fewer structural changes are required for the introduction of shale gas: i.e. there is more of a status quo situation to be defended with shale gas.

Accordingly, my analysis in chapter five and six led me to conclude that lobbying has certainly had an impact on policy decisions that support fracking but that the situations were not perfectly similar. This insight may not come as a surprise to some but by substantiating the claims with a thorough analysis of evidence and indicators I have contributed new evidence and content to the debate. As almost always in research on lobbying, I cannot conclusively prove that the non-reported meetings between industry and policymakers or the lobbying spending for example had the direct desired effect in policy outcomes. However, by asking 'qui bono' and providing credible motive as well as opportunity, I can make a convincing case that this is what happened with the story of shale gas.

For the dissertation, overall this results in assigning more explanatory value to the second narrative of private interests than the first of expected utility considerations. Regardless, there are reservations and limits of its explanatory power to be considered: first of all, the case for lobbying could not be made as clearly and comprehensively in the UK as in the U.S., especially regarding the revolving door practice. The case is also less strong in the UK than the U.S. owing to less available information on lobbying statistics due to the insufficiency of the UK lobbying register, which does not require reports on several activities of lobbying.

Secondly, the rationality of some of the business interests lobbying for the expansion of shale gas development in either country is questionable given the troubles faced by the industry in the U.S., which should serve as caution and discourage further industry engagement and investment. In any case, while I find more evidence of influence in the second narrative than the first, the situations in the UK and U.S. are too dissimilar to strictly agree on a common independent variable.

In my third and final narrative in chapter seven and eight I considered the theoretical basis and empirical evidence for cognitive capture, a term I use to describe different forms of cognitive constraints precluding objective decision-making. This premise is based on behavioural economics literature about specific cognitive biases and heuristics as well as on more recent literature in political economy considering the impact of ideas on policymaking that is not only but especially pertinent in situations of uncertainty and risk. I elaborated on this literature in chapter seven and found that besides the overall influence of ideas guiding and constraining policy formulation, there is evidence of specific biases such as causal judgment, availability, and representativeness which can affect decision-making profoundly and are applicable in the case study on shale gas. Scholars from more recent IPE theory, some of which classifies itself as constructivist, agree that a decision situation under uncertainty either creates or amplifies the need for reliance on ideas, a notion that dates back to Knight (Knight 1921; Blyth 2002; Abdelal, Blyth, and Parsons 2010; Broome 2013). I used the insights from behavioural economics to consider the influence of non-objective or erroneous ideas and found evidence that irrational biases influence and constrain thinking. A notable effect based on the study of ideas was their lasting power once accepted or what is called the resilience of the status quo – ways of thinking have to be thoroughly discredited and replaced with strong new ideas for there to be change.

In chapter eight I reviewed key ideas that are current in the U.S. and UK energy policy strategy documents and therefore can be taken to represent as well as inform ideas on further energy policy. This was done to gather clues about general ideas guiding energy policy to see if they provided for the inclusion of shale gas into the energy mix over and above alternative sources. Despite its currency, shale gas did not actually feature in any of the documents but one. My analysis showed that both the U.S. and the UK energy policy strategy promoted key ideas that, in combination, did not encourage the use of alternative energy sources over conventional fuels. All documents showed strong belief in the market system as the best method of allocation in the energy sector, even though some admitted it needed to be fixed of glitches, without acknowledging less than free market conditions within the sector. There was little to no belief in the ability of renewable energy to thrive or even survive in a market system; renewable energy sources were instead strongly associated with costs of a varied nature, but not strongly with economic benefits. Neither country's successive administrations appear to adhere to the idea that transforming the energy sector can bring with it a multitude of benefits and opportunities not just to the environment, this point is clearer, but to the economy. The UK 2003 energy white paper is a bit of an outlier in this sense, as it does make allowance for economic opportunities of transforming the energy system – but overall alternative energy is still causally judged as costly. A key idea of the energy papers together is the notion that technology and innovation can solve problems in the future and a heavy reliance on uncertain technological advances. This corresponds with concerns about too much trust in science and technology by sociologists (Giddens 1998; Beck 1986; Beck 1995) and hinders action designed to mitigate such problems, i.e. action to combat global warming through the introduction of renewable and sustainable energy. The trust in uncertain future technology to fix problems is incongruent with the disregard for negative uncertainty. There is ample evidence of unexpected risks severely impacting energy and environmental planning (Conley et al. 2016; BBC 2016) to assume they will continue to do so, but this does not affect decision-making, likely due to the availability heuristic.[202] Climate change and to a lesser degree environmental preservation feature prominently in the energy strategy plans; yet neither is truly considered a priority above all others, despite opening quotes that describe it as a great or greatest challenge, notions which are not followed through with. Instead other ideas receive greater priority: in the U.S. documents, the need for energy security and especially energy independence is paramount, and the idea of U.S. American leadership is similarly influential. This is less notable in the UK, where energy

[202] This echoes the challenger shuttle disaster story: Nasa was fully aware of the possibility of problems in cold weather with a small seal but ignored it – the seal failed during launch (BBC Magazine 2016).

security does not immediately imply energy independence; the latter as a notion is rejected in the 2003 white paper yet increases over time and becomes more important in 2009 and 2011. Energy sources are causally judged to contribute to energy security in varying degrees: fossil fuels are strongly positively associated with energy security and independence, as well as negatively, but this is only the case for oil and petroleum, not gas. Renewable energy sources are not judged to have a great effect on energy security, and this idea is very likely to influence policy decisions. Besides the assumption about the relation between specific energy sources and security, causal judgment also exists that strongly links fossil fuels, and gas especially, to economic benefits including growth, revenue and job creation. Casual judgments do not appear to change over time but stay relatively constant in the energy strategy plans, suggesting a repertoire of ideas used to inform policy decisions.

The bias of availability has been linked to climate change in previous research and in the strategy documents therefore links to renewable energy, causally associated with a positive effect on the environment and climate change. A problem the effects of which cannot be felt directly at the present time suffers from availability, compared to other problems with effects immediately noticeable, such as fuel shortages or energy prices, a key concern for U.S. and UK citizens (Sunstein 2005; Dahlgreen 2014). For example, in a 1990s survey, more than sixty percent of poll takers in the U.S. supported the Kyoto Treaty and agreed that "protecting the environment is so important that requirements and standards cannot be too high and continuing environmental improvements must be made regardless of cost" (Sunstein 2005, 10). However, when asked if they would still support the Kyoto Treaty to protect the environment if this would cost the average U.S. household around $100 more per month, only 11% stated they would, the others were clearly not supportive regardless of costs. This suggests that in theory climate change and environmental protection is valued, but as long as it does not affect humans' everyday lives in their own countries, they are not, in fact, willing to accept costs to mitigate it. As long as climate change remains a distant concept, and beset by the availability heuristic, and governments stick to key ideas and false assumptions such as that renewable energy must be less beneficial and more expensive than fossil fuels, progress is unlikely.

Shale gas enters this discussion through the heuristic of representativeness that assumes, simply put, that 'like goes with like'. Shale gas is demonstrably not like natural gas, its production is much costlier due to more complicated drilling well techniques and spread out resources, and its emissions are also much higher.[203] Yet this is largely ignored in the

[203] (Stevens 2010; Howarth, Santoro, and Ingraffea 2011; Inman 2014)

way in which unconventional and conventional gas are considered similar, and does not in any manner impede the erroneous conclusion that if gas benefits the economy, so must shale gas. Uncertainty around fracking does not hinder its implementation the way availability affects climate change – it is associated with its parent population natural gas, and treated accordingly. Following the concept of causal judgment bias I can hence confirm that new realities appear to be assimilated into old models of thinking without revision of the model in the case of shale gas. There is potential for diagnostic inference that links new facts about the 21st century energy and environmental situation to conclude that trusted ideas about energy sources are not valid any longer, but this is not inferred. This omission is in disregard of scientific consensus about climate change and the risks it bears for humans and the economy, and in disregard of facts such as the allocation of subsidies and government investment towards energy sources, which show that fossil fuels receive more than renewable energy sources to this day (Sills 2011; IMF 2015; International Energy Agency 2016; Global Subsidies Initiative 2016).

The evidence from the third narrative confirms, in my view, the effect that cognitive capture has on energy policy decisions, especially given the uncertainty of future outcomes. Guiding ideas, affected by causal judgments and other biases, suggest very specific policy responses and constrain others, and the decision to allow hydraulic fracturing for shale gas can be explained most convincingly by this dimension of the decision-making process. The status quo of ideas about fossil fuels is not questioned sufficiently despite them being judged negatively on their environmental record, which does not rank high enough on a list of priorities to discredit them. The impression of cognitive capture in U.S. and UK strategic ideas regarding energy policy is concurring and quite similar, and it represents the one narrative that shows most similarity on the independent variable. Having said that, clearly there are certain limitations to the claims one can make based on the research and results of this dissertation.[204]

[204] Through my most dissimilar research design I have shown up the independent variables that share traits and therefore are likely the influential ones, but I cannot conclusively prove the internal decision-processes of each of the involved policymakers and establish the validity of my conclusions beyond doubt.

IX.2 Theoretical implications

The empirical analysis has facilitated reflection on several theoretical propositions regarding decision-making under uncertainty and risk specifically as well as core assumptions on decision-making from political economy theory.

My analysis of the expected utility of shale gas development in the United States and the United Kingdom adds to empirical critique of the theory of expected utility on the rational expectations for decision-making under uncertainty. The evidence does not support the conclusion that a rational cost-benefit analysis of all available information on shale gas as well as a consideration of not available information was taken into account during decision-making. This clashes both with official policy statements which promote shale gas as cost-effective as well as with the notion of expected utility as a standard tool for the analysis of decision processes. I could also not confirm newer propositions made by prospect theory about the notion that losses are generally calculated higher than gains. Therefore, my dissertation adds theoretical criticism to the literature on expected utility.

My second narrative of shale gas which considers private interests delivers more promising results in that considerable strength of the pro-shale lobby can be attested for in the United States in particular, while there is also some evidence, of a less comprehensive nature, about lobbying success for shale gas in the United Kingdom. In particular, my research confirms theoretical assumptions in political economy about key aspects of lobbying, namely the focus on quiet politics, the use of expertise and experts in furthering causes with policymakers, and that closeness between lobbyists and policymakers is considered conducive and worthy of effort. Especially in the United States, the oil and gas industry and the departments in charge of regulating them have been shown to be intertwined to a degree that brings to mind a scenario of the revolving door. Hence my findings add value to theoretical assumptions about both the methods and the effects of lobbying private interests with policymakers. Specifically, the finding of divergence between U.S. and UK lobbying strongly supports the theoretical finding that lobbying for a status quo is advantageous.

But the narrative in which I found the most common ground between the U.S. and UK shale story, and the one which can add the most and more novel theoretical insights, was the third in which I consider cognitive capture. My statistical discourse analysis corroborated suggestions of cognitive biases present in strategic ideas that inform policy responses. I found confirmation for both political economy theories that purport the influence of ideas on policy output and the influence of cognitive biases. The frame of uncertainty that is present in shale gas adds to considerations that ideas are particularly decisive in circumstances of uncertainty where returns cannot be calculated (bearing unknown risks). The findings on ideas correspond with the findings by Vivien Schmidt (2013) of institutionalised ideas creating a situation of path dependence that constrain alternative action and progress despite obvious fault lines. My findings in chapter eight highlight and reaffirm theoretical conclusions about the impact of cognitive biases on decision-making. This is specifically the case for the bias of causal judgment and association, which leads to an unwillingness to change assumptions and hence to attempts to match new information with old models of thinking, sustaining an illusion of validity until the last possible moment. These insights from behavioural economics and (constructivist) political economy on ideas and associations have previously not been considered in combination and here my work added a new possible avenue for theoretical refinement.

The seventh and eighth chapter continued to bring up the notion that status quo is difficult to defeat, a notion that also featured in the previous chapters about the influence of private interests. This is an issue that is often brought up in connection with large organisations or bureaucracies, such as and especially government bodies.[205] Again, my approach to this thesis was partially inspired by Graham Allison's book *Essence of Decision* (Allison 1971; Allison and Zelikow 1999).[206] [207] As Allison puts it, "blueprints for action provide one set of opportunities and constraints" (Allison and Zelikow 1999, 179). My comparative analysis of government policy on shale gas in the energy sector corresponds with Allison's original theoretical propositions of the status quo's power and resilience, or path dependence:

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[205] Governments and government departments are very large organisations and have been considered theoretically as such in successful research (Allison 1971; March and Simon 1993).

[206] At the time that criticism of expected utility theory in economics was mounting, March and Simon also discussed the cognitive limits of rationality in situations of decision-making for organisations (March, Simon, and Guetzkow 1958; March 1978; Simon 1979). They focus on the element of uncertainty in their case studies and point out uncertainty as the main limiting factor of rationality. These authors do not go as far as questioning the possibility of rational decision-making altogether. However, they consider rationality in preference formation impossible in uncertain conditions as they say rational decision-making requires full information: all alternative options, all alternatives to a perceived problem or risk must be known to the decision-maker (March, Simon, and Guetzkow 1958). Further the decision-maker must have some kind of criteria available and known to them that allow them to evaluate and rate or rank these options by desirability, which they must all be able to perceive. Already these requirements for a rational decision seem close to impossible in a situation of uncertainty or indeed in many situations, and violates requirements of expected utility. The authors conclude that such a scenario is highly unlikely in organisational life, i.e. that rationality is always limited by constraints in such an environment (March, Simon, and Guetzkow 1958). Hence, a "search for satisfactory rather than optimal options is the true criterion of most decision-making" (Selznick 1959, 912). *Satisficing* is the general rule – whenever a solution to a current issue is found, the search ends; not the best, but the first available solution counts (Allison and Zelikow 1999, 152; March and Simon 1993, 160–62).

[207] See also: North (1990), Pratt & Zeckhauser (1986), Moe (1984), Williamson (1985), Nelson & Winter (1982).

> "Existing organisations and their existing programs and routines constrain behaviour in the next case: namely, they address it already oriented toward doing whatever they do." (Allison and Zelikow 1999, 145).

Such repertoire, however, leads to the exclusion of further, new options, innovation and change; anything outside of the routine program becomes less likely to be considered.[208] This corresponds to Hall's notion that previous experience strongly impacts on preference and interest formation (C. Woll 2008, 23). Writing extensively on the role of organisations in particular, Finnemore and Barnett confirmed their capacities for irrational and 'pathological' behaviour (Barnett and Finnemore 1999, 2004).[209] [210] [211] Government organisations are thought to engage in satisficing rather than optimisation. Allison notes that this satisficing is strongly dependent on previous knowledge and experience and therefore unlikely to allow for change. "Societies and their organisations may become so dependent on a particular path towards prosperity … that, having chosen their instruments in the circumstances of the past, they are confined by them as they encounter new circumstances in the future" (Allison and Zelikow 1999, 148f).[212] This also resonates with Beck's statement that the surrounding environment shapes policy preferences more than rational calculation. The case study evidence confirms such theory on path dependence: The U.S. and UK energy sectors are set up to process fossil fuel policy, not alternative courses of action.

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208 An example of how organisational processes can destroy efficiency is described by the journalist and author Tom Wolfe in *The Right Stuff*. He details how the Mercury astronauts were configured and constrained by the common professional standards and rules applying to military test pilots in the United States which made little to no sense when applied to space exploration (Wolfe 2005). The example illustrates how efficiency as well as innovation often enough get bested and lose out to routine and repertoire.

209 Besides a loss of control due to lack of expertise, standardization can mean that a mechanism to distribute and importantly to upgrade shared beliefs about what is right is lost. "Not norms and values, but taken-for-granted scripts, rules and classifications are the stuff of which [government organisations] are made of" (DiMaggio and Powell 1991, 15).

210 A loss of control combined with a shift in norms contributes to what Douglass North labelled "institutions that are the underlying rules of the game" (North 1990, 5).

211 The notion of institutions as processes influencing decisions corresponds with British political scientist Jim Bulpitt's work about the effect of any support system on decision-making when discussing the effect of international on domestic politics (Bulpitt and John 2008; Bradbury 2010). The systems are created to ensure smooth operationality, however, they come with a string of contingencies and automatisation. When these systems are fully in place their maintenance "is fraught with danger precisely because it risks becoming an end in itself that distracts the politicians at the centre from their fundamental … purposes" (Thompson 2010, 388). This loss of overview is viewed as a handing over of the reigns and authority: "the risk for politicians in constructing an external support system as part of their domestic statecraft is that it distorts their political judgement" (Thompson 2010, 388).

212 Allison considers the U.S. Army's dramatic failure in the Vietnam war as one of the rare instances which led an organisation to reconsider their strategy. Except for these extreme situations, Allison states that "if a nation performs an action of a certain type today, its organisational components must yesterday have been performing (or have had established routines for performing) an action only marginally different from today's action" (Allison and Zelikow 1999, 175).

Susan Strange, sometimes considered the founding mother of modern IPE, once suggested that humans tend to lean towards recreating or attempting to recreate history rather than imagining a new future (Strange 1998, 187). She was talking about the financial sector but the lesson applies to the energy sector as well. This statement is reiterated in a different vein by Wigan and Gammon who, also in work on the financial sector, consider the Freudian *principle of constancy* and find evidence for a "drive towards stasis" (Gammon and Wigan 2013, 205). They suggest that rather than gaining maximisation or pleasure, a desire for constancy often determines human agency: commitment to a status quo and investment into the ideas that support it can be strong enough to prevent change. My analysis of the guiding ideas underlying energy sector policy supports these theoretical assumptions.

The research investigating this puzzle adds to a broader question at the very forefront of modern political economy: why are certain economically irrational decisions maintained despite concrete evidence to the contrary? "Why do such failed policies persist over long periods, even when they are known to be … wasteful and even when better policies exist?" (Leighton and Lopez 2013, 112). My findings suggest that at least in the case study on shale gas, close interaction between governments and industry but more than that cognitive constraints of guiding key ideas and causal judgment distort the decision-making process and lead to a situation of inertia in which repertoire policy is made and opportunities for change are constrained. Regarding research on decisions under risk and uncertainty in particular, my thesis also contributes the finding that ideas and cognitive capture are likely highly influential in the formation of risk preferences and should be considered a priority.

IX.3 Epilogue and outlook

This study has made a contribution to knowledge about the decision-making around shale gas policy as well as further contributions to the literature. Firstly, it provided an in-depth analysis of political reasoning and decision-making around the introduction of shale gas into the energy strategy in the United States and the United Kingdom. Secondly, it provided a new case study through which to explore expected utility, cognitive biases and political economy theory on interests and ideas. Thirdly, I identified a common factor behind U.S. and UK shale gas policy and added the narrative of cognitive capture by combining insights from political economy literature on ideas and behavioural economics on cognitive biases. In delivering these contributions this dissertation has provided an answer to my overarching research question: *Which factors shape the risk preferences of political decision-makers regarding fracking when the decision is made under uncertainty?* I argued that the calculable economic factors surrounding shale gas exploration have not played a key role in the decision to allow fracking either in the U.S. or in the UK. Instead, the thesis showed that private interests had a significant impact on fracking policy but that the real similarity between my cases lies in the shared repertoire of ideas guiding energy policy and a similar level of cognitive capture.

The theoretical implications of the study and especially of the third narrative on cognitive capture are worthy of further exploration and confirmation. In order to verify and assess results, more countries should be considered for future case studies, and a broader analysis on energy policy without the focus on shale gas specifically should be carried out. A comparison with energy strategy in Germany promises particularly interesting results and should follow this work to support the MDS-design, as the country has so far rejected shale gas development and has been comparatively successful in including renewable energy into its national energy supply. The key ideas and cognitive biases guiding and constraining private interests, whose influence on energy policy this case study confirmed, should be considered and compared to the ideas held by governmental decision-makers to establish a situation of shared cognitive capture which would combine it with cultural capture as intended by Kwak (2013). Another future step could be to look into the origins and creation of such networks of ideas, potentially linked to the new theory on knowledge regimes (Campbell and Pedersen 2014, 2015).

The transformation of our energy system is a key political and economic challenge of global impact that needs utmost attention and effort if the risks and costs of global warming and environmental degradation, both of which are expedited by the use of fossil fuels, are to be mitigated. The issue has always been beset by the bias of availability: the associated problems do not come to mind easily and therefore are not a priority to resolve. When at school I was taught rhetoric with the example of Severn Suzuki's speech at the UN Rio summit in which she berates global leaders acting "as if we have all the time we want and all the solutions" (Cullis-Suzuki 1992). I find that two decades later, major ideas about the energy sector still maintain this attitude and lack of urgency, even if the importance of climate change mitigation has registered since. My dissertation makes an addition to one aspect of our understanding as to why risks of such a magnitude are not being confronted with more drastic measures in the 21st century, as it begins to explain the puzzle that is the revival of unsustainable energy use through fracking. A change in ideas is necessary to stop "taking ever-bigger gambles with the climate" (Wolf 2015) and to bring about significant change in the form of a transition to sustainable and cleaner energy systems.

Bibliography

AAF, Americans Against Fracking. 2014. 'Coalition Members | Americans Against Fracking'. Organization. http://www.americansagainstfracking.org/about-the-coalition/members/.

Abbott, Andrew. 2005. 'Linked Ecologies: States and Universities as Environments for Professions'. *Sociological Theory* 23 (3): 245–74.

ABC, ABC News Online. 2016. 'Victoria Moves to Ban Coal Seam Gas, Fracking'. *ABC News*. August 30. http://www.abc.net.au/news/2016-08-30/victoria-to-ban-csg-fracking-and-unconventional-gas-exploration/7796944.

Abdelal, Rawi, Blyth, Mark and Parsons, Craig 2010. *Constructing the International Economy*. 1st ed. Ithaca NY: Cornell University Press.

Adeyeye, Adenike, James Barrett, Jordan Diamond, John Pendergrass, and Daniel Schramm. 2009. 'Estimating U.S. Government Subsidies to Energy Sources: 2002-2008'. Washington D.C.: Environmental Law Institute. http://www.eli.org/research-report/estimating-us-government-subsidies-energy-sources-2002-2008.

Ahmed, Nafeez Mosaddeq. 2013. 'The Great Oil Swindle'. *Le Monde Diplomatique*. http://mondediplo.com/2013/03/09gaz.

Ainsworth, Scott. 1993. 'Regulating Lobbyists and Interest Group Influence'. *The Journal of Politics* 55 (1): 41–56.

Alchian, Armen A. 1950. 'Uncertainty, Evolution, and Economic Theory'. *The Journal of Political Economy* 58 (3): 211–21.

ALEC, American Legislative Exchange Council. 2015. 'American Legislative Exchange Council - Limited Government · Free Markets · Federalism'. *ALEC - American Legislative Exchange Council*. http://www.alec.org/.

Alesina, Alberto, and Howard Rosenthal. 1995. *Partisan Politics, Divided Government, and the Economy*. Cambridge; New York: Cambridge University Press.

Allais, Maurice. 1945. *Économie Pure et Rendement Social*. Paris: Sirey.

———. 1954. 'Puissance et Dangers de l'Utilisation de l'Outil Mathematique En Economique'. *Econometrica* 22 (1): 58–71.

Allison, Graham T. 1971. *Essence of Decision: Explaining the Cuban Missile Crisis*. Boston: Little, Brown.

Allison, Graham T., and Zelikow, Philip. 1999. *Essence of Decision: Explaining the Cuban Missile Crisis*. New York: Longman.

Amin, Adnan Z. 2015. 'Renewables Are Changing the Climate Narrative from Sacrifice to Opportunity'. *The Guardian*. Online Edition, November 19. http://www.theguardian.com/environment/2015/nov/19/renewables-are-changing-the-climate-narrative-from-sacrifice-to-opportunity.

Ancygier, Andrzej, and Bill Hare. 2016. 'Three Reasons to Be Cheerful about Limiting Global Warming to 1.5 Degrees'. *The Conversation*. July 12. http://theconversation.com/three-reasons-to-be-cheerful-about-limiting-global-warming-to-1-5-degrees-62125.

Anderson, Richard. 2014. 'Shale Industry Faces Global Reality Check'. *BBC News*, April 7, sec. Business. http://www.bbc.co.uk/news/business-26735000

———. 2015. '"No Shale Gas Revolution in Europe"'. *BBC News*. http://www.bbc.co.uk/news/business-32993104.

ARI Inc. Advanced Resources International, 2014. 'Unconventional Resources: Unconventional Gas, Coalbed Methane'. http://www.adv-res.com/.

Arrow, Kenneth, Bert Bolin, Robert Costanza, Partha Dasgupta, Carl Folke, C. S. Holling, Bengt-Owe Jansson, Simon Levin, Karl-Goran Maler, and Charles Perrings. 1996. 'Economic Growth, Carrying Capacity, and the Environment'. *Ecological Applications* 6 (1): 13–15.

Arrow, Kenneth J. 1951. 'Alternative Approaches to the Theory of Choice in Risk-Taking Situations'. *Econometrica* 19 (4): 404–37.

———. 1988. 'Behavior under Uncertainty and Its Implications for Policy'. In *Decision Making*. Cambridge: Cambridge University Press.

Athena, Athena Information Solutions Pvt. Ltd. 2015. 'IMF Stats Show UK Fossil Fuels Still Get Billions in Subsidies, While Renewables Slashed'. *India Energy News*, August 4. http://0-search.proquest.com.wam.city.ac.uk/docview/1701521108/abstract.

Austen-Smith, David, and Wright, John R.. 1992. 'Competitive Lobbying for a Legislator's Vote'. *Social Choice and Welfare* 9 (3): 229–257.

Aven, Terje, and Ortwin Renn. 2009. 'On Risk Defined as an Event Where the Outcome Is Uncertain'. *Journal of Risk Research* 12 (1): 1–11.

Baeck, Louis, and Hall, Peter. 1990. 'The Political Power of Economic Ideas: Keynesianism Across Nations.' *The Economic Journal* 100 (402): 985-987.

Bailey, Rob, and Felix Preston. 2015. 'Stuck in Transition: Managing the Political Economy of Low-Carbon Development'. *Chatham House*. Accessed July 21. http://www.chathamhouse.org//node/6824.

Bar-Hillel, Maya. 1982. 'Studies of Representativeness'. In *Judgement under Uncertainty: Heuristics and Biases*, Kahneman, Slovic, Tversky, 69–84. Cambridge: Cambridge University Press.

Barnett, Michael N., and Finnemore, Martha. 1999. 'The Politics, Power, and Pathologies of International Organizations'. *International Organization* 53 (4): 699–732.

———. 2004. *Rules for the World: International Organizations in Global Politics*. Ithaca, N.Y: Cornell University Press.

Bauer, Raymond A., Ithiel De Sola Pool, and Lewis Anthony Dexter. 2007. *American Business and Public Policy: The Politics of Foreign Trade*. 2nd edition. Chicago: AldineTransaction.

Baumgartner, Frank R. 2013. 'Ideas and Policy Change: Ideas and Policy Change'. *Governance* 26 (2): 239–58.

Baumgartner, Frank R., Berry, J.M., Hojnacki, Marie, Kimball, David C. and Leech, Beth L. 2009. *Lobbying and Policy Change: Who Wins, Who Loses, and Why*. Chicago; London: University of Chicago Press.

Baumgartner, Frank R., and Leech, Beth L. 1996. 'The Multiple Ambiguities of "Counteractive Lobbying"'. *American Journal of Political Science* 40 (2): 521–42.

Bawden, Tom. 2013. '"Baseless Economics": Lord Stern on David Cameron's Claims That a UK Fracking Boom Can Bring down Price of Gas'. *The Independent*, Online Edition, September 3. http://www.independent.co.uk/news/uk/politics/baseless-economics-lord-stern-on-david-camerons-claims-that-a-uk-fracking-boom-can-bring-down-price-of-gas-8796758.html.

———. 2016. 'Fracking Decision in North Yorkshire Reignites Intense Debate'. *BBC News*. May 24. http://www.bbc.co.uk/news/business-36366302.

BBC News. 2010. 'Q&A: Will Shale Revolutionise Gas?' *BBC*, September 23, Online edition, sec. Business. http://www.bbc.co.uk/news/mobile/business-11399950.

———. 2011. 'Blackpool Shale Gas Drilling Begins'. *BBC News*, March 28, sec. Lancashire. http://www.bbc.co.uk/news/uk-england-lancashire-12886987.

———. '"Generous" Tax Breaks for Shale Gas Industry Outlined'. *BBC News*. July 19, http://www.bbc.co.uk/news/business-23368505.

———. 2014a. 'Cameron Urges Fracking Opponents to "Get on Board"'. *BBC News*. January 13. http://www.bbc.co.uk/news/uk-politics-25705550.

———. 2014b. 'Osborne: Fracking May Not Slash Household Energy Bills'. News. *BBC News*. February 4. http://www.bbc.co.uk/news/uk-politics-26030204.

———. 2014c. 'How Summer Fracking Protest Unfolded in Sussex Village'. *BBC News*. April 17. http://www.bbc.co.uk/news/uk-england-sussex-26765926.
———. 2015. 'Fracking Still Opposed in Wales, Ministers Tell Councils'. *BBC News*, August 14, sec. Wales politics. http://www.bbc.co.uk/news/uk-wales-politics-33935224.
———. 2016. 'Viewpoint: Challenger and the Misunderstanding of Risk'. *BBC News*, February 1, sec. Magazine.
———. 2016. 'Florida Sinkhole Causes Huge Waste Water Leak into Aquifer'. *BBC News*, September 17, sec. US & Canada. http://www.bbc.co.uk/news/world-us-canada-37390562.
Beck, Ulrich. 1986. *Risikogesellschaft: auf dem Weg in eine andere Moderne (Risck Society: Towards a New Modernity)*. Frankfurt am Main: Suhrkamp.
———. 1992. *Risk Society: Towards a New Modernity*. London: SAGE.
———. 1995. *Ecological Politics in an Age of Risk*. Polity Press.
———. 1998. 'Politics of Risk Society'. Edited by J. Franklin. *The Politics of Risk Society*, 9–22.
———. 2006. 'Living in the World Risk Society'. *Economy and Society* 35 (3): 329Á–345.
———. 2009. *World at Risk*. English ed. Cambridge: Polity Press.
Becker, Jo, and Morgenson, Gretchen. 2009. 'Geithner, Member and Overseer of Finance Club'. *The New York Times*, Online Edition, April 26. http://www.nytimes.com/2009/04/27/business/27geithner.html.
Begos, Kevin. 2013. 'Excite News - Studies Find Methane in Pa. Drinking Water' *Excite News*, June 24. http://apnews.excite.com/article/20130624/DA74B74O2.html.
Behr, Peter, and Christa Marshall. 2009. 'Is Shale Gas the Climate Bill's New Bargaining Chip?' *The New York Times*, Online Edition, August 5, sec. Business / Energy & Environment. http://www.nytimes.com/cwire/2009/08/05/05climatewire-is-shale-gas-the-climate-bills-new-bargaining-2382.html.
BEIS, Department for Business. Energy & Industrial Strategy. 2016. 'Guidance on Fracking: Developing Shale Oil and Gas in the UK'. Government. *Guidance on Fracking: Developing Shale Oil and Gas in the UK*. https://www.gov.uk/government/publications/about-shale-gas-and-hydraulic-fracturing-fracking/developing-shale-oil-and-gas-in-the-uk.
Béland, Daniel, and Robert Henry Cox. 2010. *Ideas and Politics in Social Science Research*. Oxford: Oxford University Press.
Bell, David E, Raiffa, Howard. 1978. 'Risky Choice Revisited' in *Decision Making: Descriptive, Normative, and Prescriptive Interactions,* edited by Bell, David E., Raiffa, Howard, 99-112. Cambridge: Cambridge university Press.
Bell, David E, Raiffa, Howard and Tversky, Amos, eds. 1988. *Decision Making: Descriptive, Normative, and Prescriptive Interactions*. Cambridge; New York: Cambridge University Press.
Bell, David E, Raiffa, Howard and Tversky, Amos. 1988. *Decision Making: Descriptive, Normative, and Prescriptive Interactions*. Cambridge; New York: Cambridge University Press.
Bell, Stephen. 2012. 'The Power of Ideas: The Ideational Shaping of the Structural Power of Business'. *International Studies Quarterly* 56 (4): 661–73.
Ben-Ishai, Elizabeth. 2012. 'Access for Sale - A Report on Corporate Funding of Associations of State and Local Government Officials'. Citizen.org. www.citizen.org/documents/Corporate-Funding-Associations-Government-Officials.pdf.
Benthin, Alida, Slovic, Paul and Severson, Herbert. 1993. 'A Psychometric Study of Adolescent Risk Perception'. *Journal of Adolescence* 16 (2): 153–68.

Berman, Dan. 2011. 'Obama Acknowledges Fracking Concerns'. *POLITICO*. http://www.politico.com/story/2011/04/obama-acknowledges-fracking-concerns-053423.

Berman, Sheri. 2006. *The Primacy of Politics: Social Democracy and the Making of Europe's Twentieth Century*. Cambridge: Cambridge University Press.

BERR, Department for Business Enterprise and Regulatory Reform. 2008. 'Meeting the Energy Challenge: A White Paper on Nuclear Power'. The Stationery Office.

Berry, Jeffrey M., Baumgartner, Frank R., Kimball, David C., Leech, Beth L. and Hojnacki, Marie. 2009. *Lobbying and Policy Change*. Chicago: University of Chicago Press.

Beyers, Jan. 2004. 'Voice and Access: Political Practices of European Interest Associations'. *European Union Politics* 5 (2): 211–40.

———. 2008. 'Policy Issues, Organisational Format and the Political Strategies of Interest Organisations'. *West European Politics* 31 (6): 1188–1211.

Beyers, Jan, Eising, Rainer and Maloney, William. 2008. 'Researching Interest Group Politics in Europe and Elsewhere: Much We Study, Little We Know?' *West European Politics* 31 (6): 1103–28.

BGS. 2013a. 'The Carboniferous Bowland Shale Gas Study: Geology and Resource Estimation'. *British Geological Survey for the Department of Energy and Climate Change*, 1–65.

———. 2013b. 'The Carboniferous Bowland Shale Gas Study: Geology and Resource Estimation' *British Geological Survey for the Department of Energy and Climate Change: Full Report.*

Bichard, Erik. 2014. 'Fracking Boom Could Mean up to 12% More Carbon Emissions'. *The Conversation*. October 15. http://theconversation.com/fracking-boom-could-mean-up-to-12-more-carbon-emissions-33050.

Blake, Mariah. 2014. 'How Hillary Clinton's State Department Sold Fracking to the World'. *Mother Jones*. http://www.motherjones.com/environment/2014/09/hillary-clinton-fracking-shale-state-department-chevron.

Blau, Benjamin M., Brough, Tyler J. and Thomas, Diana W.. 2013. 'Corporate Lobbying, Political Connections, and the Bailout of Banks'. *Journal of Banking & Finance* 37 (8): 3007–3017.

Blyth, Mark. 1997. '"Any More Bright Ideas?" The Ideational Turn of Comparative Political Economy'. Edited by Judith Goldstein, Robert Keohane, and Kathryn Sikkink. *Comparative Politics* 29 (2): 229–50.

———. 2002. *Great Transformations: Economic Ideas and Institutional Change in the Twentieth Century*. Cambridge: Cambridge University Press.

———. 2009. 'An Approach to Comparative Analysis or a Subfield within a Subfield?' In *Comparative Politics*, Second edition. Cambridge Studies in Comparative Politics. Cambridge University Press.

BoardEX. 2016. 'BoardEx > Home'. Data. *BoardEx Business Development*. https://www.boardex.com/.

Boersma, Tim, and Johnson, Corey. 2012. 'Risks and Potentials of the Shale Gas Revolution'. *SWP Comments* 39 (December): 1–8.

Bolton, Paul. 2013. 'Energy Imports and Exports'. House of Commons. *Briefing Paper* August 30, http://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN04046.

Boudet, Hilary, Clarke, Christopher, Bugden, Dylan, Maibach, Edward, Roser-Renouf, Connie and Leiserowitz, Anthony. 2014. '"Fracking" Controversy and Communication: Using National Survey Data to Understand Public Perceptions of Hydraulic Fracturing'. *Energy Policy* 65 (February): 57–67.

Bouwen, Pieter. 2002. 'Corporate Lobbying in the European Union: The Logic of Access'. *Journal of European Public Policy* 9 (3): 365–90.

Boykoff, Maxwell T. 2007. 'From Convergence to Contention: United States Mass Media Representations of Anthropogenic Climate Change Science'. *Transactions of the Institute of British Geographers* 32 (4): 477–89.

Bradbury, Jonathan. 2010. 'Jim Bulpitt's Territory and Power in the United Kingdom and Interpreting Political Development: Bringing the State and Temporal Analysis Back In'. *Government and Opposition* 45 (3): 318–44.

Breggin, Linda, Falkner, Robert, Jaspers, Nico, Pendergrass, John and Porter, Read. 2009. *Securing the Promise of Nanotechnologies towards Transatlantic Regulatory Cooperation*. London, England: Chatham House. http://www.elistore.org/Data/products/d19_09.pdf.

Briggs, Rachael. 2015. 'Normative Theories of Rational Choice: Expected Utility'. In *The Stanford Encyclopedia of Philosophy*, edited by Edward N. Zalta, Winter 2015. http://plato.stanford.edu/archives/win2015/entries/rationality-normative-utility/.

British Geological Society. 2015. 'Shale Gas | Energy | Our Research | British Geological Survey (BGS)'. http://www.bgs.ac.uk/shalegas/.

British Geological Survey. 2014. 'Legislation & Policy: Mineral Ownership |Planning | MineralsUK'. *Minerals UK - Centre for Sustainable Development*. https://www.bgs.ac.uk/mineralsuk/planning/legislation/mineralOwnership.html.

———. 2016. 'Legislation & Policy: Mineral Ownership | Planning | MineralsUK'. https://www.bgs.ac.uk/mineralsuk/planning/legislation/mineralOwnership.html.

British Pugwash. 2013. 'Pathways to 2050: Three Possible UK Energy Strategies'. London: Pugwash. http://britishpugwash.org/pathways-to-2050-three-possible-uk-energy-strategies/.

Broderick, John, and Anderson, Kevin. 2012. 'US Shale Gas Drives up Coal Exports'. Manchester: University of Manchester. http://www.manchester.ac.uk/discover/news/article/?id=8946.

Brooks, Libby. 2016. 'Scottish Parliament Votes Narrowly in Favour of Ban on Fracking'. *The Guardian*, Online Edition, June 1, sec. Politics. http://www.theguardian.com/politics/2016/jun/01/scottish-parliament-votes-narrowly-in-favour-of-ban-on-fracking-snp.

Broome, André. 2013. 'Libidinal Political Economy: A Psycho-Social Analysis of Financial Violence'. In *Global Political Economy: Contemporary Theories*, edited by Ronen Palan, 2nd ed, 193–204. London: Routledge.

Broscheid, Andreas, and Coen, David. 2003. 'Insider and Outsider Lobbying of the European Commission: An Informational Model of Forum Politics'. *European Union Politics* 4 (2): 165–89.

Brown, Alleen. 2015. 'I Can't Believe It's Not Lobbying: The National Petroleum Council'. *The Intercept*. May 1. https://theintercept.com/2015/05/01/cant-believe-lobbying-national-petroleum-council/.

Brown, Taylor Kate. 2015. 'Five US States Where Climate Change Could Be Disastrous'. *BBC News*, November 23, sec. US & Canada. http://www.bbc.co.uk/news/world-us-canada-34872956.

Buisset, S., Øye, O., and Selleslaghs, J.. 2012. 'Lobbying Shale Gas in Europe'. PACT European Affairs, Report. Brussels. http://www.scribd.com/doc/135847720/Lobbying-Shale-Gas-in-Europe.

Bulpitt, Jim, and John, Peter. 2008. *Territory and Power in the United Kingdom: An Interpretation*. Colchester, UK: ECPR Press.

Business Europe. 2013. 'Voting Recommendations for the Environmental Impact Assessment Directive (2012/0297(COD))'. https://www.businesseurope.eu/ sites/buseur/files/media/imported/2013-00706-E.pdf

———. 2015. 'BUSINESSEUROPE - 40 Members in 34 Countries'. Company Website. *Business Europe*. http://www.businesseurope.eu/Content/Default.asp?pageid=600.

Cairney, Paul. 2015. 'Shale Fail: David Cameron Has Not Gone "All Out" for Fracking'. *The Conversation*. http://theconversation.com/shale-fail-david-cameron-has-not-gone-all-out-for-fracking-36810.

Cameron, David. 2013. 'We Cannot Afford to Miss out on Shale Gas'. *The Telegraph*, Online Edition, August 11. http://www.telegraph.co.uk/news/politics/ 10236664/We-cannot-afford-to-miss-out-on-shale-gas.html.

Campbell, John L., and Pedersen, Ove K.. 2014. *The National Origins of Policy Ideas: Knowledge Regimes in the United States, France, Germany, and Denmark*. Princeton: Princeton University Press.

———. 2015. 'Policy Ideas, Knowledge Regimes and Comparative Political Economy'. *Socio-Economic Review* 13(2): 1-23.

Cantley, M., and Lex, M.. 2011. 'Genetically Modified Foods and Crops'. In *The Reality of Precaution. Comparing Risk Regulation in the United States and Europe*, edited by Wiener et al., 39–64. New York NY: RFF Press.

Carpenter, Daniel P., and Moss, David A.. 2014. *Preventing Regulatory Capture: Special Interest Influence and How to Limit It*. New York, NY: Cambridge University Press.

Carrington, Damian. 2012. 'Owen Paterson's Climate Change Problem: Cock-up or Conspiracy?' *The Guardian*, Online Edition, September 7, sec. Environment. http://www.theguardian.com/environment/damian-carrington-blog/2012/sep/07/owen-paterson-climate-change-sceptic.

———. 2013a. 'Budget 2013: George Osborne Commits to UK Shale Gas Boom'. *The Guardian*, Online Edition, March 20, sec. Environment. http://www.theguardian.com/environment/2013/mar/20/budget-2013-george-osborne-shale-gas-boom.

———. 2013b. 'Lord Browne: Fracking Will Not Reduce UK Gas Prices'. *The Guardian*, Online Edition, November 29, sec. Environment. http://www.theguardian.com/environment/2013/nov/29/browne-fracking-not-reduce-uk-gas-prices-shale-energy-bills.

———. 2014a. 'Emails Reveal UK Helped Shale Gas Industry Manage Fracking Opposition'. *The Guardian*, Online Edition, January 17, sec. Environment. http://www.theguardian.com/environment/2014/jan/17/emails-uk-shale-gas-fracking-opposition.

———. 2014b. 'Paterson's "Green Blob" Tirade Reveals the Right's Problem with Climate Change'. *The Guardian*, Online Edition, July 21, sec. Environment. http://www.theguardian.com/environment/damian-carrington-blog/2014/jul/21/paterson-green-blog-right-climate-change.

———. 2015a. 'David Cameron Rejects Call for Fracking Ban'. *The Guardian*, Online Edition, January 26, sec. Environment. http://www.theguardian.com/environment/2015/jan/26/david-cameron-rejects-fracking-ban-shale-gas.

———. 2015b. 'George Osborne Urges Ministers to Fast-Track Fracking Measures in Leaked Letter'. *The Guardian*, Online Edition, January 26, sec. Environment. http://www.theguardian.com/environment/2015/jan/26/george-osborne-ministers-fast-track-fracking.

———. 2015c. 'Tories Forced into U-Turn on Fast-Track Fracking after Accepting Labour Plans'. *The Guardian*, Online Edition, January 26, sec. Environment. https://www.theguardian.com/environment/2015/jan/26/conservatives-u-turn-fracking-labour-cuadrilla-drilling-ban.

———. 2015d. 'Government Plan on Solar Subsidy Cuts "Ignored Job Losses"'. *The Guardian*, Online Edition, September 4, sec. Environment. https://www.theguardian.com/environment/2015/sep/04/government-plan-on-solar-subsidy-cuts-ignored-job-losses.

———. 2015e. 'UK Becomes Only G7 Country to Increase Fossil Fuel Subsidies'. *The Guardian*, Online Edition, November 12, sec. Environment. https://www.theguardian.com/environment/2015/nov/12/uk-breaks-pledge-to-become-only-g7-country-increase-fossil-fuel-subsidies.

———. 2016. 'UK Government's Fracking Definition "Could Allow Drilling without Safeguards"'. *The Guardian*, Online Edition, April 13, sec. Environment. https://www.theguardian.com/environment/2016/apr/13/uk-governments-fracking-definition-could-allow-drilling-without-safeguards.

Carrington, Damian, and Sparrow, Andrew. 2013. 'Gas Industry Employee Seconded to Draft UK's Energy Policy'. *The Guardian*, Online Edition, November 10, sec. Environment. http://www.theguardian.com/environment/2013/nov/10/gas-industry-employee-energy-policy.

Charpentier, Ronald R., and Cook Troy A.. 2011. 'USGS Methodology for Assessing Continuous Petroleum Resources'. 2011–1167. Reston, Virginia: U.S. Geological Survey.

Chazan, Guy. 2013. 'Ed Davey Makes Environmental Case for Shale Gas Exploration'. *Financial Times*, September 9. http://www.ft.com/cms/s/0/6090d082-1954-11e3-83b9-00144feab7de.html.

Cheon, Andrew, Lackner, Maureen and Urpelainen, Johannes. 2015. 'Instruments of Political Control National Oil Companies, Oil Prices, and Petroleum Subsidies'. *Comparative Political Studies* 48 (3): 370–402.

Cherp, Aleh. 2012. 'Defining Energy Security Takes More than Asking around'. *Energy Policy* 48 (9): 841–42.

Cherry, John, Ben-Eli, Michael, Bharadwaj, Lalita, Chalaturnyk, Richard, Dusseault, Maurice B., Goldstein, Bernard, Lacoursiere, Jean-Paul, et al. 2014. 'Environmental Impacts of Shale Gas Extraction in Canada'. Assessment. Toronto: Council of Canadian Academies. http://www.scienceadvice.ca/uploads/eng/assessments%20and%20publications%20and%20news%20releases/shale%20gas/shalegas_fullreporten.pdf

Chestney, Nina. 2014. 'Britain far from Primed for Shale Gas Exploration, Experts Say'. News. *Reuters UK*. March 5. http://uk.reuters.com/article/uk-shale-britain-idUKBREA240LE20140305.

Chevron. 2015. 'Natural Gas from Shale'. Company Website. *Chevron.com*. https://www.chevron.com/operations/shale.

Chokshi, Niraj, and Fountain, Henry. 2016. 'Oklahoma Orders Shutdown of Wells After Record-Tying Earthquake'. *The New York Times*, Online Edition, September 3. http://www.nytimes.com/2016/09/04/us/earthquake-ties-record-for-strongest-in-oklahoma-history.html.

Christoforou, T. 2004. 'The Precautionary Principle, Risk, Assessment, and the Comparative Role of Science in the European Community and the U.S. Legal Systems'. In *Green Giants: Environmental Policies of the United States and European Union*, edited by Vig, N.J. and Faure, M.G, 17–51. Cambridge: Massachusetts Institute of Technology (MIT) Press.

Christopherson, Susan. 2015. 'The False Promise of Fracking and Local Jobs'. Academic. *The Conversation*. http://theconversation.com/the-false-promise-of-fracking-and-local-jobs-36459.

Clark, Duncan. 2015. 'How Much of the World's Fossil Fuel Can We Burn?' *The Guardian*, Online Edition, March 25, Online edition, sec. Environment. https://www.theguardian.com/environment/keep-it-in-the-ground-blog/2015/mar/25/what-numbers-tell-about-how-much-fossil-fuel-reserves-cant-burn.

Clark, Pilita. 2015. 'Catastrophe Models Give Insurers Insight into Disasters'. *Financial Times/ Special Report: Risk Management*. https://next.ft.com/content/76438596-0432-11e3-8aab-00144feab7de.

Clark, Pilita, and Bounds, Andrew. 2015. 'Ministers Freed to Intervene in Fast-Track Fracking Drive'. *Financial Times*, August 13. http://www.ft.com/cms/s/0/a346b038-4114-11e5-b98b-87c7270955cf.html.

Coleman, Jesse. 2014. 'Fracking Rules in North Carolina Tied to Koch, Halliburton, and ALEC | Huffington Post'. News. *The Huffington Post*. May 19. http://www.huffingtonpost.com/jesse-coleman/fracking-rules-in-north-c_b_5352907.html.

Conley, S., Franco, G., Faloona, I., Blake, D. R., Peischl, J. and Ryerson, T. B.. 2016. 'Methane Emissions from the 2015 Aliso Canyon Blowout in Los Angeles, CA'. *Science* 351 (6279): 1317–21.

Considine, Timothy J., Watson, Robert and Blumsack, Seth. 2011. 'The Pennsylvania Marcellus Natural Gas Industry: Status, Economic Impacts and Future Potential', Report, Penn State Department of Energy and Mineral Engineering, http://marcelluscoalition.org/wp-content/uploads/2011/07/Final-2011-PA-Marcellus-Economic-Impacts.pdf.

Coriolis Energy. 2014. 'UK Energy Policy and UK Climate Change Policy'. *Coliolis Energy/ Wind Energy/ Policy UK*. http://www.coriolis-energy.com/wind_energy/policy_uk.html.

Corporate Europe Observatory. 2014a. 'Carte Blanche for Fracking'. Brussels: Corporate Europe Observatory. http://corporateeurope.org/climate-and-energy/2015/04/carte-blanche-fracking.

———. 2014b. 'Parliament Freezes Problematic Expert Groups Budget for Second Time in Four Years'. *Corporate Europe Observatory*. October 22. http://corporateeurope.org/expert-groups/2014/10/parliament-freezes-problematic-expert-groups-budget-second-time-four-years.

Cox, Jr., Louis Anthony (Tony). 2009. 'Game Theory and Risk Analysis'. *Risk Analysis* 29 (8): 1062–68.

CPR, Center for Responsive Politics. 2016. 'Lobbying | OpenSecrets'. Research Institute. *Lobbying Database*. July 19. http://www.opensecrets.org/lobby/.

Crombez, C. 2002. 'Information, Lobbying and the Legislative Process in the European Union'. *European Union Politics* 3 (1): 7–32.

Crooks, Ed. 2016. 'Oil: US Shale's Big Squeeze'. *Financial Times*, January 22. http://www.ft.com/cms/s/0/2db96dae-c0eb-11e5-9fdb-87b8d15baec2.html.

Crooks, Ed, and Richard McGregor. 2012. 'US Energy Lobby Hits Campaign Trail'. *Financial Times*, June 5. https://www.ft.com/content/876e2614-af29-11e1-a8a7-00144feabdc0 CRP, Center for Responsive Politics. 2016a. 'Alternative Energy Production & Services: Lobbying'. Data. *Alternative Energy Production & Services:* https://www.opensecrets.org/industries/lobbying.php?cycle=2016&ind=E1500.

———. 2016b. 'Background for Oil & Gas Lobbying'. Data. *Open Secrets*. http://www.opensecrets.org/lobby/background.php?id=E01&year=2015.

———. 2016c. 'Lobbying Spending Database Alternative Energy Production & Services'. Data. *Open Secrets*. https://www.opensecrets.org/industries/indus.php?ind=E1500.

———. 2016d. 'Lobbying Spending Database Coal Mining'. NGO. *Influence & Lobbying*. https://www.opensecrets.org/industries/indus.php?ind=E1210.

———. 2016e. 'Lobbying Spending Database Environment'. Data. *Environment*. https://www.opensecrets.org/industries/indus.php?ind=Q11.

———. 2016f. 'Lobbying Spending Database Oil & Gas'. News. *Opensecrets.org*. http://www.opensecrets.org/lobby/indusclient.php?id=E01&year=2010.

———. 2016g. 'Oil and Gas Lobby Industry Profile'. *Influence & Lobbying for Oil & Gas*. http://www.opensecrets.org/lobby/indusclient.php?id=E01&year=2015.

———. 2016h. 'Top Interest Groups Giving to Members of Congress, 2016 Cycle'. Data. *Open Secrets*. https://www.opensecrets.org/industries/mems.php.

Cullis-Suzuki, Severn. 1992. 'Online Speech Bank: Severn Suzuki - Speech at 1992 UN Conference on the Environment'. *American Rhetoric: Online Speech Bank*. http://www.americanrhetoric.com/speeches/severnsuzukiunearthsummit.htm.

Culpepper, Pepper D. 2008. 'The Politics of Common Knowledge: Ideas and Institutional Change in Wage Bargaining'. *International Organization* 62 (1): 1–33.

———. 2010. *Quiet Politics and Business Power: Corporate Control in Europe and Japan*. Cambridge: Cambridge University Press. http://ebooks.cambridge.org/ref/id/CBO9780511760716.

———. 2015. 'Structural Power and Political Science in the Post-Crisis Era'. *Business and Politics* 17 (3): 391–409.

Cunningham, Nick. 2013. 'Federal Government Is Longtime Supporter of Fracking - DC BureauDC Bureau'. *DC Bureau*. http://www.dcbureau.org/201309058959/bulldog-blog/federal-government-is-longtime-supporter-of-fracking.html.

Cusick, James. 2013. 'How Lobbying Works – and Why This Bill Won't Change a Fracking Thing'. *The Independent*, Online Edition, August 18, http://www.independent.co.uk/news/uk/politics/how-lobbying-works--and-why-this-bill-wont-change-a-fracking-thing-8773474.html.

Cusick, Marie. 2013. 'Where Do Pennsylvania's Gas Industry Jobs Numbers Come From?' News. *StateImpact Pennsylvania*. October 29. https://stateimpact.npr.org/pennsylvania/2013/10/29/where-do-pennsylvanias-gas-industry-jobs-numbers-come-from/.

Daase, Christopher, and Kessler, Oliver. 2007. 'Knowns and Unknowns in the `War on Terror': Uncertainty and the Political Construction of Danger'. *Security Dialogue* 38 (4): 411–34.

Dahl, Robert Alan. 1961. *Who Governs? Democracy and Power in an American City*. Yale Studies in Political Science 4. New Haven; London: Yale University Press.

———. 1989. *Democracy and Its Critics / Robert A. Dahl*. London: Yale University Press,.

Dahlgreen, Will. 2014. 'Energy Bills Still the Biggest Household Worry'. Polling. *YouGov: What the World Thinks*. https://yougov.co.uk/news/2015/01/14/energy-biggest-household-concern/.

Dale, Spencer. 2013. 'The Shale Revolution Continues'. Company Website. *BP Energy Outlook*. http://www.bp.com/en/global/corporate/energy-economics/energy-outlook-2035/shale-projections.html.

Daly, John. 2012. 'Poland Gives Green Light to Massive Fracking Efforts'. *Oilprice*. January 26. http://oilprice.com/Energy/Natural-Gas/Poland-Gives-Green-Light-to-Massive-Fracking-Efforts.html.

Davenport, Coral. 2015. 'New Federal Rules Are Set for Fracking'. *The New York Times*, Online Edition, March 20.

http://www.nytimes.com/2015/03/21/us/politics/obama-administration-unveils-federal-fracking-regulations.html.

Davey, Ed. 2012. 'Speech by Edward Davey to Gastech Conference - Speeches - GOV.UK'. presented at the GasTech Conference 2012, London, England. https://www.gov.uk/government/speeches/speech-by-edward-davey-to-gastech-conference.

Davis, Charles, and Fisk, Jonathan M. 2014. 'Energy Abundance or Environmental Worries? Analyzing Public Support for Fracking in the United States'. *Review of Policy Research* 31 (1): 1–16.

DECC. 2013a. 'About Shale Gas and Hydraulic Fracturing'. https://www.gov.uk/government/publications/about-shale-gas-and-hydraulic-fracturing-fracking/about-shale-gas-and-hydraulic-fracturing-fracking.

DECC, Department of Energy and Climate Change. 2009. 'Energy White Paper 2009: The UK Low Carbon Transition Plan- National Strategy for Climate and Energy'. Stationery Office.

———. 2011. 'Planning Our Electric Future: A White Paper for Secure, Affordable and Low-Carbon Energy - Publications - GOV.UK'. https://www.gov.uk/government/publications/planning-our-electric-future-a-white-paper-for-secure-affordable-and-low-carbon-energy.

———. 2013b. 'Note on Resources vs Reserves'. *Briefing Paper*, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/256358/Publication_Resources_vs_Reserves_June13.pdf

———. 2014. 'Annual Energy Statement 2014'. HM Stationery Office. https://www.gov.uk/government/publications/annual-energy-statement-2014.

———. 2016a. 'DECC 2050 Calculator'. Government. *Pathway Calculator*. http://2050-calculator-tool.decc.gov.uk/#/calculator.

———. 2016b. 'Guidance on Fracking: Developing Shale Oil and Gas in the UK'. Government. *Gov.uk/Government/Publications*. April 11. https://www.gov.uk/government/publications/about-shale-gas-and-hydraulic-fracturing-fracking/developing-shale-oil-and-gas-in-the-uk.

———. 2016c. 'National Statistics: Energy Trends'. Total Energy Statistics. London: Department of Energy and Climate Change. https://www.gov.uk/government/statistics/total-energy-section-1-energy-trends.

DeGette, Diana. 2015. 'Text - H.R.1482 - 114th Congress (2015-2016): Fracturing Responsibility and Awareness of Chemicals Act of 2015'. Government. *Congress.gov*. March 20. https://www.congress.gov/bill/114th-congress/house-bill/1482/text.

———. 2016. 'Fracturing Responsibility and Awareness of Chemicals Act of 2015 (H.R. 1482)'. Government. *GovTrack.us*. https://www.govtrack.us/congress/bills/114/hr1482.

DellaVigna, Stefano, and Kaplan, Ethan. 2007. 'The Fox News Effect: Media Bias and Voting'. *The Quarterly Journal of Economics* 122 (3): 1187–1234.

deMelle, Brendan. 2011. '"Energy In Depth" Was Created By Major Oil and Gas Companies According to Industry Memo'. *DeSmogBlog*. http://www.desmogblog.com/%E2%80%98energy-depth%E2%80%99-was-created-major-oil-and-gas-companies-according-industry-memo.

Desilver, Drew. 2014. 'Fancy Degree? Most Americans Say It's Not Required to Be President'. Polling. *Pew Research Center*. May 22. http://www.pewresearch.org/fact-tank/2014/05/22/degree-from-harvard-or-yale-most-americans-say-it-doesnt-matter-for-their-president/.

DeSmogBlog. 2015. 'Fracking the Future - Gas Industry Lobbying Muscle'. Blog. *Desmogblog.com*. http://desmogblog.com/fracking-the-future/lobbying.html.

Dias, V. 2016. 'A Response to Your Enquiry to BEIS - Ref: TO2016/08320', August 23.

DiMaggio, Paul J., and Powell, Walter W.. 1991. *Introduction to New Institutionalism*. Chicago: University of Chicago Press.

Dittrick, Paula. 2013. 'EIA-ARI Issues Update of World Assessment of Shale Oil, Shale Gas'. Magazine. *Oil&Gas Journal*. July 1. http://www.ogj.com/articles/print/volume-111/issue-7/general-interest/eia-ari-issues-update-of-world-assessment.html.

DoE, U.S. Department of Energy. 2006a. '2006 Department of Energy Strategic Plan - Linking Strategic Goals to Annual Performance Goals'. http://energy.gov/downloads/2006-department-energy-strategic-plan-linking-strategic-goals-annual-performance-goals.

———. 2006b. 'Department of Energy Requests $23.6 Billion for FY 2007'. *Energy.gov*. http://energy.gov/articles/department-energy-requests-236-billion-fy-2007.

———. 2007. 'Department of Energy Requests $24.3 Billion for FY 2008 Budget'. *Energy.gov*. http://energy.gov/articles/department-energy-requests-243-billion-fy-2008-budget.

———. 2008. 'President Bush Requests $25 Billion for U.S. Department of Energy's FY 2009 Budget'. Government. *Energy.gov*. http://energy.gov/articles/president-bush-requests-25-billion-us-department-energys-fy-2009-budget.

———. 2011. '2011 Strategic Plan | Department of Energy'. http://energy.gov/downloads/2011-strategic-plan.

———. 2014a. '2014 - 2018 Strategic Plan | Department of Energy'. http://energy.gov/downloads/2014-2018-strategic-plan.

———. 2014b. 'Why Is Shale Gas Important?' Natural Gas from Shale: Questions and Answers. Department of Energy. http://energy.gov/fe/downloads/why-shale-gas-important.

———. 2015. 'Shale Gas R&D | Department of Energy'. *Shale Gas R&D*. http://energy.gov/fe/science-innovation/oil-gas-research/shale-gas-rd.

Doggett, Tom. 2010. 'U.S. Overhauls Oil, Natural Gas Drilling Policy'. *Reuters*, January 6. http://www.reuters.com/article/2010/01/06/us-usa-oil-drlling-idUSTRE6054SI20100106.

Dohmen, Frank, and Jung, Alexander. 2012. 'Europe's Failed Natural Gas Strategy: Gazprom Hopes to Build Second Baltic Sea Pipeline'. *Spiegel Online*, May 18, sec. International. http://www.spiegel.de/international/business/gazprom-eyeing-second-pipeline-as-nabucco-faces-failure-a-833501-2.html.

Dolan, Kerry A. 2008. 'Mr. Ethanol Fights Back'. *Forbes*. November 6. http://www.forbes.com/forbes/2008/1124/052.html.

Douglas, Mary, and Wildavsky, Aaron. 1992. *Risk and Culture: An Essay on the Selection of Technological and Environmental Dangers*. Reprint edition. University of California Press.

Doward, Jamie, and Helm, Toby. 2012. 'Fears Grow over Conservatives' Links to Fossil Fuel Lobbyists'. *The Guardian*, Online Edition, October 21, sec. Environment. https://www.theguardian.com/environment/2012/oct/21/conservatives-links-fossil-fuel-lobbyists.

Downs, Anthony. 1957. 'An Economic Theory of Political Action in a Democracy'. *Journal of Political Economy* 65 (2): 135–50.

DTI, Department for Trade and Industry. 2003. 'Energy White Paper 2003: Our Energy Future - Creating a Low Carbon Economy'. The Stationary Office.

———. 2007. 'Meeting the Energy Challenge: A White Paper on Energy - Publications - GOV.UK'. https://www.gov.uk/government/publications/meeting-the-energy-challenge-a-white-paper-on-energy.

Dupuit, Jules. 1844. 'De La Mesure de L'utilité Des Travaux Publics'. *Annales de Ponts Des Chaussées*, 2ième Série, 8, 2 (8).

Dutton, Joseph, and Bradshaw, Michael. 2013. 'The Battle Lines Are Drawn on the UK's Shale Gas Debate'. *New Humanist*. https://newhumanist.org.uk/articles/4430/the-battle-lines-are-drawn-on-the-uks-shale-gas-debate.

Eaton, Collin. 2016. 'Exxon Mobil Chief Not Inclined to Buy Ailing Shale Companies'. News. *Houston Chronicle*. March 2. http://www.houstonchronicle.com/business/energy/article/Exxon-Mobil-chief-not-inclined-to-buy-ailing-6866669.php.

ECJRC, European Commission Joint Research Centre. 2015. 'Launch of the European Science and Technology Network on Unconventional Hydrocarbon Extraction - JRC Science Hub - European Commission'. *JRC Science Hub*. https://ec.europa.eu/jrc/en/news/launch-european-science-and-technology-network-unconventional-hydrocarbon-extraction.

EIA, U.S. Energy Information Administration. 2015b. 'Monthly Energy Review - Energy Information Administration'. http://www.eia.gov/totalenergy/data/monthly/.

———. 2005. 'Annual Energy Outlook 2005'. http://www.eia.gov/forecasts/aeo/archive.cfm

———. 2011. 'World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States'. 1. Washington D.C.: Department of Energy. https://www.eia.gov/analysis/studies/worldshalegas/.

———. 2012a. 'Annual Energy Outlook 2012 - Early Release Overview'. U.S. Energy Information Administration. http://www.eia.gov/forecasts/aeo/er/pdf/0383er%282012%29.pdf.

———. 2012b. 'U.S. Natural Gas Imports by Country'. *U.S. Natural Gas Imports by Country*. http://www.eia.gov/dnav/ng/ng_move_impc_s1_a.htm.

———. 2013a. 'Annual Energy Review'. Government. *EIA Total Energy Data*. http://www.eia.gov/totalenergy/data/annual/#consumption.

———. 2013b. 'Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States'. http://www.eia.gov/analysis/studies/worldshalegas/.

———. 2014. 'UK Became a Net Importer of Petroleum Products in 2013 - Today in Energy - U.S. Energy Information Administration (EIA)'. *Today in Energy*. July 3. http://www.eia.gov/todayinenergy/detail.cfm?id=16971.

———. 2015a. 'Monthly Energy Review'. Government. *Total Energy/ Beta/ Data*. http://www.eia.gov/totalenergy/data/monthly/.

———. 2015b. 'Natural Gas'. *EIA Natural Gas Maps: Exploration, Resources, Reserves, and Production*. http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/maps/maps.htm.

———. 2015c. 'Technically Recoverable Shale Oil and Shale Gas Resources: United Kingdom'. Washington, DC: Department of Energy. https://www.eia.gov/analysis/studies/worldshalegas/.

———. 2015d. 'U.S. Energy Information Administration (EIA)'. Data. *World Shale Resource Assessments*. http://www.eia.gov/analysis/studies/worldshalegas/.

———. 2015e. 'World Shale Resource Assessments'. 3. Washington D.C.: Department of Energy. https://www.eia.gov/analysis/studies/worldshalegas/.

———. 2015f. 'World Shale Resource Assessments'. Government. *EIA/ Analysis/ Studies/ World Shale Gas*. September 24. http://www.eia.gov/analysis/studies/worldshalegas/.

———. 2016a. 'About U.S. Natural Gas Pipelines'. Government. *Natural Gas*. http://www.eia.gov/pub/oil_gas/natural_gas/analysis_publications/ngpipeline/index.html.

———. 2016b. 'EIA Total Energy Data (Beta)'. Government. *Total Energy/ Beta/ Data*. http://www.eia.gov/beta/MER/index.cfm?tbl=T01.02#/?f=A&start=1949&end=2015&charted=1-2-3-6-13.
———. 2016c. 'Factors Affecting Natural Gas Prices - Energy Explained, Your Guide To Understanding Energy - Energy Information Administration'. Government. *U.S. Energy Information Administration/ Energy Explained*. https://www.eia.gov/energyexplained/index.cfm?page=natural_gas_factors_affecting_prices.
———. 2016d. 'U.S. Natural Gas Prices'. Government. *Natural Gas Prices*. http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_a.htm.
———. 2016e. 'U.S. Total Energy Flow, 2015'. Government. *U.S. Energy Flow 2015*. https://www.eia.gov/totalenergy/data/monthly/pdf/flow/total_energy.pdf
———. 2016f. 'What Are the Major Factors Affecting Natural Gas Prices?' Government. *U.S. Energy Information Administration/ Tools/ FAQs*. https://www.eia.gov/tools/faqs/faq.cfm?id=43&t=8.
———. 2016g. 'Monthly Energy Review July 2016'. Monthly Energy Review. Washington D.C.: Department of Energy. http://www.eia.gov/totalenergy/data/monthly/index.cfm.
———. 2016h. 'U.S. Energy Information Administration (EIA)'. Government. *Natural Gas Weekly Update*. July 28. http://www.eia.gov/naturalgas/weekly/#tabs-supply-1.
Eichbrecht, Paul T., and Wilber, Vann H.. 2011. 'Transatlantic Trade, the Automotive Sector: The Role of Regulation in a Global Industry, Where We Have Been and Where We Need to Go, How Far Can EU—US Cooperation Go Toward Achieving Regulatory Harmonization?' In *Systemic Implications of Transatlantic Regulatory Cooperation and Competition (World Scientific Studies in International Economics: 15)*, edited by Simon J Evenett and Robert M Stern,165–95, Singapore: World Scientific Co. Pte. Ltd.
Einhorn, Hillel J. 1982. 'Learning from Experience and Suboptimal Rules in Decision Making', in *Judgment under Uncertainty*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 268-284. Cambridge: Cambridge University Press.
Eising, Rainer. 2007. 'The Access of Business Interests to EU Institutions: Towards Élite Pluralism?' *Journal of European Public Policy* 14 (3): 384–403.
Ekins, Paul. 2000. *Economic Growth and Environmental Sustainability: The Prospects for Green Growth*. Routledge.
Elliot, D.E., and Renn, Ortwin. 2011. 'Chemicals'. In *The Reality of Precaution. Comparing Risk Regulation in the United States and Europe*, edited by Wiener. et al. (ed.), 223–56.
Ellsberg, Daniel. 1954. 'Classic and Current Notions of "Measurable Utility"'. *Economic Journal* 64 (255): 528–56.
———. 1961. 'Risk, Ambiguity, and the Savage Axioms'. *The Quarterly Journal of Economics* 75 (4): 643–69.
Elmes, David. 2014. 'Why Fracking for Shale Gas Won't Bring Britons Cheap Energy Bills'. News. *The Conversation*. January 22. http://theconversation.com/why-fracking-for-shale-gas-wont-bring-britons-cheap-energy-bills-22283.
Encyclopaedia Britannica. 2016. 'Political Economy | Britannica.com'. Reference. *Encyclopaedia Britannica*. https://www.britannica.com/topic/political-economy.
Energy in Depth. 2015. 'Energy In Depth —'. Company Website. *Energy in Depth*. http://energyindepth.org/.
EPA. 2004. 'Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs; National Study'.
Escribano, Gonzalo, Marín Quemada, José María, and García-Verdugo, Javier. 2012. *Energy Security for the EU in the 21st Century: Markets, Geopolitics and Corridors*. London; New York: Routledge.

Esping-Andersen, Goșta. 1990. *The Three Worlds of Welfare Capitalism*. Cambridge: Polity.
European Commission. 2011. 'Standard Eurobarometer'. 76. http://ec.europa.eu/COMMFrontOffice/PublicOpinion/index.cfm/Survey/index#p=1&instruments=STANDARD.
———. 2013. 'Standard Eurobarometer'. 80. http://ec.europa.eu/COMMFrontOffice/PublicOpinion/index.cfm/Survey/index#p=1&instruments=STANDARD.
———. 2014a. 'European Commission Impact Assessment'. Brussels: European Commission. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52014SC0022.
———. 2014b. 'Standard Eurobarometer'. 82. http://ec.europa.eu/COMMFrontOffice/PublicOpinion/index.cfm/Survey/index#p=1&instruments=STANDARD.
———. 2015. 'Standard Eurobarometer'. 84. ttp://ec.europa.eu/COMMFrontOffice/PublicOpinion/index.cfm/Survey/index#p=1&instruments=STANDARD.
Fang, Lee. 2013. 'The Fracking Industry's Dishonest Response to "Gasland"'. *The Nation*. http://www.thenation.com/article/fracking-industrys-dishonest-response-gasland/.
Farlex Legal Dictionary. 2014. 'Farlex Legal Disctionary'. *TheFreeDictionary.com*. http://legal-dictionary.thefreedictionary.com/Mineral+Right.
Felix, Bate. 2016. 'France Studying Possible Ban on Import of U.S. Shale Gas - Minister'. *Reuters*, May 10. http://www.reuters.com/article/france-usa-shalegas-idUSL5N1875VT.
Fernandez, Raquel, and Rodrik, Dani. 1991. 'Resistance to Reform: Status Quo Bias in the Presence of Individual-Specific Uncertainty'. *The American Economic Review* 81 (5): 1146–55.
Fischhoff, Baruch. 1982. 'For Those Condemned to Study the Past: Heuristics and Biases in Hindsight', in *Judgment under Uncertainty*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 335-352. Cambridge: Cambridge University Press.
Fischhoff, Baruch, Slovic, Paul and Lichtenstein, Sarah. 1980. 'Lay Foibles and Expert Fables in Judgments about Risk'. *The American Statistician* 36 (3b): 240–55.
———. 1982. 'Lay Foibles and Expert Fables in Judgments about Risk'. *The American Statistician* 36 (3): 240–55.
Fischhoff, Baruch, Slovic, Paul, Lichtenstein, Sarah, Read, Stephen and Combs, Barbara. 1978. 'How Safe Is Safe Enough? A Psychometric Study of Attitudes towards Technological Risks and Benefits'. *Policy Sciences* 9 (2): 127–52.
Fjaer, Erling, Holt, R.M., Horsrud, P., Raaen, A.M. and Risnes, R.. 2008. *Petroleum Related Rock Mechanics*. Amsterdam; Boston: Elsevier.
Forbes. 2016. 'Koch Industries on the Forbes America's Largest Private Companies List'. *Forbes*. http://www.forbes.com/companies/koch-industries/.
Fowler, Tom and DiColo, Jerry A.. 2012. 'Exxon: "Losing Our Shirts" on Natural Gas'. *Wall Street Journal*, June 27, sec. Business. http://www.wsj.com/articles/SB10001424052702303561504577492501026260464.
Fox, Tim. 2014. 'UK Energy Shale Gas: Evidence and Technical Literacy Needed'. *Institution of Mechanical Engineers*. http://www.imeche.org/news/institution/uk-energy-shale-gas-evidence-and-technical-literacy-needed.
Freestone, D. 2011. 'The Marine Environment'. In *The Reality of Precaution. Comparing Risk Regulation in the United States and Europe*, Wiener et al., 177–200.
FT Lexicon, Financial Times Lexicon. 2015. 'Definition of Risk'. *Ft.com/Lexicon*. The Financial Times. http://lexicon.ft.com/Term?term=risk.

FWW, Food & Water Watch. 2015. 'Exposing the Oil and Gas Industry's False Jobs Promise for Shale Gas Development'. NGO. *Food & Water Watch*. September 14. http://www.foodandwaterwatch.org/insight/exposing-oil-and-gas-industrys-false-jobs-promise-shale-gas-development.

Gallup. 2014. 'Business and Industry Sector Images Continue to Improve'. Polling. *Gallup.com*. September 3. http://www.gallup.com/poll/175616/business-industry-sector-images-continue-improve.aspx.

Gammon, Earl, and Wigan, Duncan. 2013. 'Libidinal Political Economy: A Psycho-Social Analysis of Financial Violence'. In *Global Political Economy: Contemporary Theories*, edited by Ronen Palan, 2nd ed, 205–16. London: Routledge.

Gardner, Margo, and Steinberg, Laurence. 2005. 'Peer Influence on Risk Taking, Risk Preference, and Risky Decision Making in Adolescence and Adulthood: An Experimental Study'. *Developmental Psychology* 41 (4): 625–35.

Gardner, Timothy. 2010. 'Big Oil Seeks Shale Gas Deal in U.S. Climate Bill'. *Reuters*, March 25. http://www.reuters.com/article/2010/03/25/energy-climate-fracking-idUSN2523659520100325.

Garrett, Geoffrey, and Tsebelis, George. 1996. 'An Institutional Critique of Intergovernmentalism'. *International Organization* 50 (2): 269–99.

GFZ, Deutsches GeoForschungszentrum. 2016. 'What Is Shale Gas?' Research Institute. *Shale Gas Information Platform*. http://www.shale-gas-information-platform.org/what-is-shale-gas.html.

GFZ, Deutsches GeoForschungszentrum. 2013. 'About us: SHIP - Shale Gas Information Plattform'. *SHIP - Shale Gas Information Platform*. http://www.shale-gas-information-platform.org/about-us.html.

Ghirardato, Paolo, and Marinacci, Massimo. 2001. 'Risk, Ambiguity, and the Separation of Utility and Beliefs'. *Mathematics of Operations Research* 26 (4): 864–90.

Giddens, Anthony. 1998. *The Third Way: The Renewal of Social Democracy*. Reprint edition. Malden, Mass: Polity.

———. 1999. 'Giddens - Risk - Lecture Hong Kong'. *BBC*, January 1, sec. Reith99. http://news.bbc.co.uk/hi/english/static/events/reith_99/week2/week2.htm.

Global Subsidies Initiative. 2016. 'Placing a Spotlight on Subsidies'. Research Institute. http://www.iisd.org/gsi/.

Godwin, Ken, Ainsworth, Scott and Godwin, Erik. 2013. *Lobbying and Policymaking: The Public Pursuit of Private Interests*. 2300 N Street, NW, Suite 800, Washington DC 20037 United States: CQ Press. http://sk.sagepub.com/cqpress/lobbying-and-policymaking.

Godwin, Ken, Ainsworth, Scott H., Godwin, Erik and SAGE Knowledge EBA. 2013. *Lobbying and Policymaking: The Public Pursuit of Private Interests*. Los Angeles: CQ Press. http://0-knowledge.sagepub.com.wam.city.ac.uk/view/lobbying-and-policymaking/SAGE.xml.

Goldenberg, Suzanne. 2015. 'US Senate Refuses to Accept Humanity's Role in Global Climate Change, Again'. *The Guardian*, Online Edition, January 22, sec. Environment. https://www.theguardian.com/environment/2015/jan/22/us-senate-man-climate-change-global-warming-hoax.

Goldstein, Judith, and Keohane, Robert O. 1993. *Ideas and Foreign Policy: Beliefs, Institutions and Political Change*. Cornell Studies in Political Economy. Ithaca, N.Y: Cornell University Press.

González, Wenceslao J. 2005. *Science, Technology and Society: A Philosophical Perspective*. Netbiblo.

Goodchild van Hilten, Lucy. 2015. 'Fracking: Science Needs to Catch up with Public Awareness, Researchers Say'. *Elsevier Connect*. April 8. https://www.elsevier.com/connect/fracking-science-needs-to-catch-up-with-public-awareness.

Gordon, Sanford C., and Hafer, Catherine. 2005. 'Flexing Muscle: Corporate Political Expenditures as Signals to the Bureaucracy'. *American Political Science Review* 99 (2): 245–61.

Gosden, Emily. 21:10. 'Fracking Gets Go-Ahead in UK for First Time since 2011 as North Yorkshire Council Approves Plans'. *The Telegraph*, Online Edition, http://www.telegraph.co.uk/news/2016/05/23/north-yorkshire-council-approves-fracking-plans/.

———. 2013a. 'George Osborne Pledges Most Generous Tax Regime for Shale Gas'. *The Telegraph*, Online Edition, July 19. http://www.telegraph.co.uk/finance/newsbysector/energy/10189932/George-Osborne-pledges-most-generous-tax-regime-for-shale-gas.html.

———. 2013b. 'Fracking Won't Lower Energy Bills, Says Davey'. *The Telegraph*, Online Edition, September 9. http://www.telegraph.co.uk/news/earth/energy/fracking/10296274/Fracking-wont-lower-energy-bills-says-Davey.html.

———. 2013c. 'Autumn Statement: Shale Gas Tax Breaks to Attract "Billions of Pounds of Investment"'. *The Telegraph*, Online Edition, December 5. http://www.telegraph.co.uk/finance/budget/10498330/Autumn-Statement-Shale-gas-tax-breaks-to-attract-billions-of-pounds-of-investment.html.

———. 2014a. 'Shale Gas "Boom" Is a Long Way Off, Claim Experts'. *The Telegraph*, Online Edition, January 20. http://www.telegraph.co.uk/news/earth/energy/10585296/Shale-gas-boom-is-a-long-way-off-claim-experts.html.

———. 2014b. 'Fracking Won't Cut Bills and Ministers "Oversold" Shale Gas Benefits, Experts Say'. *The Telegraph*, Online Edition, November 12. http://www.telegraph.co.uk/news/earth/energy/fracking/11224097/Fracking-wont-cut-bills-and-ministers-oversold-shale-gas-benefits-experts-say.html.

———. 2015a. 'Ed Davey: "Crazy" Conservatives Would "Frack Every Bit of Croquet Lawn"'. *The Telegraph*, Online Edition, March 6. http://www.telegraph.co.uk/news/earth/energy/fracking/11453359/Ed-Davey-Crazy-Conservatives-would-frack-every-bit-of-croquet-lawn.html.

———. 2015b. 'George Osborne: Get Fracking or Condemn Britain to Higher Energy Bills'. *The Telegraph*, Online Edition, June 17. http://www.telegraph.co.uk/news/earth/energy/fracking/11681830/George-Osborne-get-fracking-or-condemn-Britain-to-higher-energy-bills.html.

———. 2015c. 'Fracking: Plans to Drill 68 New Shale Gas Wells Unveiled'. *The Telegraph*, Online Edition, December 17. http://www.telegraph.co.uk/news/earth/energy/fracking/12056209/Fracking-plans-to-drill-for-shale-gas-at-68-new-sites-unveiled.html.

Gosden, Emily, and Dominiczak, Peter. 2014. 'Shale Gas Part of Solution to Climate Change, David Cameron Says'. *The Telegraph*, Online Edition, September 23. http://www.telegraph.co.uk/news/earth/environment/climatechange/11114583/Shale-gas-part-of-solution-to-climate-change-David-Cameron-says.html.

Gourevitch, Peter Alexis. 1986. *Politics in Hard Times: Comparative Responses to International Economic Crises*. Cornell Studies in Political Economy. Ithaca: Cornell University Press.

Gov.uk. 2014. 'Planning Practice Guidance'. *Planning Portal UK*. http://planningguidance.planningportal.gov.uk/.

Graves, Lucia. 2016. 'On the Faultline: New York Fracking Ban Leaves State Divided as Primary Looms'. *The Guardian*, Online Edition, April 16, sec. Environment. https://www.theguardian.com/environment/2016/apr/16/fracking-new-york-primary-bernie-sanders-hillary-clinton-donald-trump.

Gray, G., Rogers, M.D. and Wiener, Jonathan B. 2011. 'Beef, Hormones and Mad Cows'. In *The Reality of Precaution: Comparing Risk Regulation in the United States and Europe*, edited by Wiener. et al., 65–90. Washington DC/ London: Resources for the Future Press (RFF).

Gregory, Katina, and Hambusch, Gerhard. 2015. 'Factors Driving Risk in the US Banking Industry: The Role of Capital, Franchise Value and Lobbying'. *International Journal of Managerial Finance* 11 (3): 388–410.

Greif, Avner. 2006. *Institutions and the Path to the Modern Economy: Lessons from Medieval Trade*. Political Economy of Institutions and Decisions. Cambridge: Cambridge University Press.

Groat, Charles G., and Grimshaw, Thomas W.. 2012. 'Fact-Based Regulation for Environmental Protection in Shale Gas Development'. Energy Institue - The University of Texas at Austin. http://barnettprogress.com/media/ei_shale_gas_regulation120215.pdf.

Groeger, Lena. 2012. 'From Gung-Ho to Uh-Oh: Charting the Government's Moves on Fracking'. *ProPublica*. February 7. https://www.propublica.org/special/from-gung-ho-to-uh-oh-charting-the-governments-moves-on-fracking.

Grossman, Gene M., and Helpman, Elhanan. 2002. *Special Interest Politics*. Paperback edition. Cambridge, Mass: MIT Press.

Gullberg, Anne Therese. 2008. 'Lobbying Friends and Foes in Climate Policy: The Case of Business and Environmental Interest Groups in the European Union'. *Energy Policy* 36 (8): 2964–72.

Hall, Peter. 1997. 'The Role of Interests, Institutions, and Ideas in the Comparative Political Economy of the Industrialized Nations'. In *Comparative Politics: Rationality, Culture, Structure*, eds. Mark Irving Lichbach and Alan S. Zuckerman. Cambridge: Cambridge University Press.

———.1986. *Governing the Economy: The Politics of State Intervention in Britain and France*. Europe and the International Order. Oxford: Oxford University Press.

———. ed. 1989. *The Political Power of Economic Ideas: Keynsianism Across Nations*. Princeton, N.J: Princeton University Press.

———. 1993. 'Policy Paradigms, Social Learning, and the State: The Case of Economic Policymaking in Britain'. *Comparative Politics* 25 (3): 275.

Hall, Richard L., and Deardorff, Alan V. 2006. 'Lobbying as Legislative Subsidy'. *American Political Science Review* 100 (1): 69–84.

Halliburton. 2015. 'Shale - Halliburton'. http://www.halliburton.com/en-US/ps/solutions/unconventional-resources/shale.page?node-id=hgjyd46w.

Halliday, Josh. 2016. 'North Yorkshire Council Backs First UK Fracking Tests for Five Years'. *The Guardian*, Online Edition, May 23, sec. Environment. https://www.theguardian.com/environment/2016/may/23/north-yorkshire-council-backs-first-uk-fracking-tests-for-five-years.

Hammitt, J.K. 2011. 'Stratospheric Ozone Depletion and Global Climate Change'. In *The Reality of Precaution. Comparing Risk Regulation in the United States and Europe*, edited by Wiener et al., 159–76, New York NY: RFF Press.

Hansen, Holger, and Shalal, Andrea. 2016. 'German Government Agrees to Ban Fracking Indefinitely'. *Reuters*, June 21. http://www.reuters.com/article/us-germany-fracking-idUSKCN0Z71YY.

Harless, David W., and Camerer, Colin F.. 1994. 'The Predictive Utility of Generalized Expected Utility Theories'. *Econometrica* 62 (6): 1251–89.

Harrabin, Roger. 2012. 'Gas Fracking: Ministers Approve Shale Gas Extraction'. *BBC News*, December 13, sec. Science & Environment. http://www.bbc.co.uk/news/uk-20707574.

———. 2014a. 'Ministers' Shale Gas "Hype" Attacked'. *BBC News*. November 12, http://www.bbc.co.uk/news/uk-politics-30013668.

———. 2014b. 'Risk from Extreme Weather Set to Rise'. *BBC News*, November 27, sec. Science & Environment. http://www.bbc.co.uk/news/science-environment-30215782.

———. 2015a. 'Fracking Bids to Be Fast-Tracked'. *BBC News*. http://www.bbc.co.uk/news/science-environment-33894307.

———. 2015b. 'UN Scientist Jacquie McGlade Raps UK over Renewables'. *BBC News*, October 19, Online edition, sec. Science & Environment. http://www.bbc.co.uk/news/science-environment-34555821.

Harrison, Glenn W. and Rutström, E. Elisabet. 2008. 'Expected Utility Theory and Prospect Theory: One Wedding and a Decent Funeral'. *Experimental Economics* 12 (2): 133–58.

Hart, Paul't. 1991. 'Irving L. Janis' Victims of Groupthink'. *Political Psychology* 12 (2): 247–78.

Harvey, Fiona. 2011. 'Chris Huhne: UK Must Invest in Energy Infrastructure to Keep the Lights on'. *The Guardian*, Online Edition, July 12, sec. Environment. https://www.theguardian.com/environment/2011/jul/12/chris-huhne-energy-market-invest.

———. 2013. 'Ofgem Predicts Higher Energy Bills'. *The Guardian*, Online Edition, February 19, sec. Money. https://www.theguardian.com/money/2013/feb/19/ofgem-higher-household-energy-bills.

———. 2014a. 'Is Shale Gas Greener?' *The Guardian*, Online Edition, January 24, Online edition, sec. Environment. https://www.theguardian.com/environment/reality-check/2014/jan/24/reality-check-shale-gas-greener.

———. 2014b. 'UK on Track to Miss Carbon Targets, Climate Change Advisers Warn'. *The Guardian*, Online Edition, July 15, sec. Environment. http://www.theguardian.com/environment/2014/jul/15/uk-miss-carbon-targets-climate-change-advisers.

———. 2015. 'Too Early to Say If Fracking Is Good for the UK, Says Taskforce'. *The Guardian*, Online Edition, July 15, sec. Environment. https://www.theguardian.com/environment/2015/jul/15/fracking-gets-cautious-approval-from-taskforce.

Heal, Geoffrey, and Millner, Antony. 2013. 'Uncertainty and Decision in Climate Change Economics'. Working Paper 18929. National Bureau of Economic Research. http://0-www.nber.org.wam.city.ac.uk/papers/w18929.

Heckelman, Jac C., and Wilson, Bonnie. 2013. 'Institutions, Lobbying, and Economic Performance'. *Economics & Politics* 25 (3): 360–86.

Hellier, David. 2015a. 'Fracking: Who's Who in the Race to Strike It Rich in the UK'. *The Guardian*, Online Edition, August 22, sec. Business. http://www.theguardian.com/business/2015/aug/22/fracking-uk-whos-who-in-race-to-strike-it-rich.

———. 2015b. 'UK Government Hands out New Fracking Licences'. *The Guardian*, Online Edition, December 17, sec. Environment. https://www.theguardian.com/environment/2015/dec/17/fracking-uk-government-hands-out-new-licences.

Helm, D. 2008. *Energy, the State and the Market: British Energy Policy since 1979*. Oxford: Oxford University Press.

Helm, Toby. 2013. 'Liberal Democrats Blast Environmental Damage Caused by Fracking'. *The Guardian*, Online Edition, August 24. http://www.theguardian.com/environment/2013/aug/24/lib-dems-damage-fracking-shale-gas-revolution.

Henry, Terrence. 2012. 'Texas Professor On the Defensive Over Fracking Money'. *StateImpact Texas*. http://stateimpact.npr.org/texas/2012/07/24/texas-professor-on-the-defensive-over-fracking-money/.

Herbert, Alan, and Jones, Trevor. 2014. 'Technology Isn't Ready to Clean up Fracking's Radioactive Legacy'. *The Conversation*. March 4. http://theconversation.com/technology-isnt-ready-to-clean-up-frackings-radioactive-legacy-23116.

Hirst, Neil, Khor, Cheng Seon and Buckle, Simon. 2013. 'Shale Gas and Climate Change'. Briefing Paper 10. London: Imperial College London: Grantham Institute for Climate Change. https://www.imperial.ac.uk/grantham/publications/briefing-papers/shale-gas-and-climate-change---grantham-briefing-paper-10.php.

HM Government. 2015. 'Infrastructure Act 2015'. HM Stationery Office. http://www.legislation.gov.uk/ukpga/2015/7/section/50/enacted.

Hobson, John M., and Seabrooke, Leonard, eds. 2007. *Everyday Politics of the World Economy*. Cambridge: Cambridge University Press. http://ebooks.cambridge.org/ref/id/CBO9780511491375.

Horlick-Jones, Tom, Sime, Jonathan and Pidgeon, Nick. 2003. 'The Social Dynamics of Environmental Risk Perception: Implications for Risk Communication Research and Practice'. In *The Social Amplification of Risk*, edited by R. E. Kasperson, N. Pidgeon, and P. Slovic, 262–85. Cambridge: Cambridge University Press.

Horn, Steve. 2013. 'Exclusive: Censored EPA PA Fracking Water Contamination Presentation Published for First Time'. *DeSmogBlog*. http://desmogblog.com/2013/08/05/censored-epa-pennsylvania-fracking-water-contamination-presentation-published-first-time.

Howard, Emma, and Hellier, David. 2015. '1,000 Sq Miles of England to Be Opened up for Fracking'. *The Guardian*, Online Edition, August 18, sec. Environment. https://www.theguardian.com/environment/2015/aug/18/1000-sq-miles-england-opened-up-fracking-new-round-licences.

Howarth, Robert W., Santoro, Renee and Ingraffea, Anthony. 2011. 'Methane and the Greenhouse-Gas Footprint of Natural Gas from Shale Formations: A Letter'. *Climatic Change* 106 (4): 679–90.

———. 2012. 'Venting and Leaking of Methane from Shale Gas Development: Response to Cathles et Al.' *Climatic Change* 113 (2): 537–49.

Hughes, J. David. 2012. 'Shale Gas Supply to the Greater Toronto Area'. Council of Canadians. http://canadians.org/sites/default/files/Exhibit-L-EGD.pdf.

Huhne, Chris. 2011. 'Britain Can't Afford to Bet Its Future on Shale Gas - Wind Turbines Are Here to Stay'. *The Telegraph*, Online Edition, November 8. http://www.telegraph.co.uk/news/earth/energy/8877214/Britain-cant-afford-to-bet-its-future-on-shale-gas-wind-turbines-are-here-to-stay.html.

———. 2014. 'The Truth about David Cameron's Fracking Fairytale'. *The Guardian*, Online Edition, January 26, sec. Comment is free. http://www.theguardian.com/commentisfree/2014/jan/26/truth-david-cameron-fracking-fairytale-shale-gas.

Hunter, Floyd. 1953. *Community Power Structure: A Study of Decision Makers*. Chapel Hill, N.C: University of North Carolina Press.

IEA, International Energy Agency. 2002. *Energy Policies of IEA Countries: United States 2002*. Energy Policies of IEA Countries. Paris: OECD Publishing. http://www.oecd-

ilibrary.org/energy/energy-policies-of-iea-countries-united-states-2002_9789264191976-en.
———. 2003. *Energy Policies of IEA Countries: 2003 Review*. Energy Policies of IEA Countries: Review. Paris: OECD Publishing. http://www.oecd-ilibrary.org/energy/energy-policies-of-iea-countries-2003-review_energy_iea-2003-en.
———. 2004. *Renewable Energy*. Paris: OECD Publishing. http://www.oecd-ilibrary.org/energy/renewable-energy_9789264107922-en.
———. 2005. *Energy Policies of IEA Countries: 2005 Review*. Energy Policies of IEA Countries: Review. Paris: OECD Publishing. http://www.oecd-ilibrary.org/energy/energy-policies-of-iea-countries-2005-review_energy_iea-2005-en.
———. 2012a. 'World Energy Outlook 2012'. http://www.worldenergyoutlook.org/publications/weo-2012/.
———. 2012b. 'Energy Policies of IEA Countries - The United Kingdom'. Energy Policy of IEA Countries. Paris: International Energy Agency. http://www.iea.org/publications/freepublications/publication/energy-policies-of-iea-countries---the-united-kingdom-2012-review.html.
———. 2014. 'World Energy Outlook 2014 Fact Sheet'. http://www.worldenergyoutlook.org/publications/weo-2014/.
———. 2015a. 'Medium-Term Reports'. http://www.iea.org/publications/medium-termreports/#d.en.27705.
———. 2015b. 'United Kingdom: Balances'. Data. *IEA Statistics*. http://www.iea.org/statistics/statisticssearch/report/?country=UK=&product=balances&year=Select.
———. 2016. 'Unconventional Gas Database'. Data. *Unconventional Gas Forum*. http://www.iea.org/ugforum/ugd/.
IHS Markit. 2011. 'Shale Gas Supports More Than 600,000 American Jobs Today; by 2015, Shale Gas Predicted to Support Nearly 870,000 Jobs and Contribute $118.2 Billion to GDP, IHS Study Finds'. Information Services. *IHS Markit Newsroom*. December 6. http://press.ihs.com/press-release/energy-power/shale-gas-supports-more-600000-american-jobs-today-2015-shale-gas-predict.
IMF, International Monetary Fund. 2015. 'IMF Survey: Counting the Cost of Energy Subsidies'. Washington D.C.: IMF. http://www.imf.org/external/pubs/ft/survey/so/2015/new070215a.htm.
InConsult. 2009. 'Risk Managment Update: ISO 21000 Overview'. International Organization for Standardization.
Inman, Mason. 2014. 'Natural Gas: The Fracking Fallacy'. *Nature* 516 (7529): 28–30.
———. 2016. 'Can Fracking Power Europe?' *Nature* 531 (7592): 22–24.
International Energy Agency. 2014. 'IEA - Energy Security'. *International Energy Agency - Energy Security*. http://www.iea.org/topics/energysecurity/.
———. 2016. 'Energy Subsidies'. Research Institute. *World Energy Outlook*. http://www.worldenergyoutlook.org/resources/energysubsidies/.
Investopedia, Terms and Definitions. 2007. 'Expected Utility Definition'. *Investopedia*. June 5. http://www.investopedia.com/terms/e/expectedutility.asp.
Ipsos MORI. 2007. 'Issues Index: 1997 - 2007'. London: Ipsos Mori. https://www.ipsos-mori.com/researchpublications/researcharchive/poll.aspx?oItemId=56&view=wide.
———. 2011. 'Energy Security Is a Top Concern for Brits'. London: Ipsos Mori. https://www.ipsos-mori.com/researchpublications/researcharchive/2771/Energy-security-is-a-top-concern-for-Brits.aspx.

———. 2016. 'Issues Index: 2007 Onwards'. London: Ipsos Mori. https://www.ipsos-mori.com/researchpublications/researcharchive/2905/Issues-Index-2012-onwards.aspx?view=wide#2009.

IRGC, International Risk Governance Council. 2012. 'An Introduction to the IRGC Risk Governance Framework'. *International Risk Governance Council*. https://www.irgc.org/risk-governance/irgc-risk-governance-framework/

Jabko, Nicolas. 2006. *Playing the Market: A Political Strategy for Uniting Europe, 1985-2005*. Cornell Studies in Political Economy. Ithaca, N.Y: Cornell University Press.

Jackson, Gregory, and Deeg, Richard. 2006. 'How Many Varieties of Capitalism? Comparing the Comparative Institutional Analyses of Capitalist Diversity'. SSRN Scholarly Paper ID 896384. Rochester, NY: Social Science Research Network. http://papers.ssrn.com/abstract=896384.

Jacobs, Justin. 2012. 'Global Gas Market Decades Away Say Industry Leaders'. Research Institute. *Petroleum Economist*. October 11. http://www.petroleum-economist.com/articles/markets/outlook/2012/global-gas-market-decades-away-say-industry-leaders.

Jasanoff, Sheila. 2011. *Designs on Nature: Science and Democracy in Europe and the United States*. Princeton: Princeton University Press.

Jaspal, Rusi, and Nerlich, Brigitte. 2014. 'Fracking in the UK Press: Threat Dynamics in an Unfolding Debate'. *Public Understanding of Science* 23 (3): 348–63.

Johnson, Laurie T., Yeh, Starla and Hope, Chris. 2013. 'The Social Cost of Carbon: Implications for Modernizing Our Electricity System'. *Journal of Environmental Studies and Sciences* 3 (4): 369–75.

Jones, Jeffrey M. 2015. 'Americans' Views of Oil and Gas Industry Improving'. *Gallup.com*. August 24. http://www.gallup.com/poll/184784/americans-views-oil-gas-industry-improving.aspx.

Jones, Melissa, and Rowell, Andy. 2015. 'Access All Areas: Westminster's (Vast) Fracking Lobby Exposed'. *Spinwatch Public Interest Investigations*. April 29. http://www.spinwatch.org/index.php/issues/climate/item/5765-access-all-areas-frackers-lobbyists-and-the-revolving-door.

Jopson, Barney. 2016. 'Judge Strikes down Obama Attempt to Tighten Fracking Rules'. *Financial Times*, Online edition. https://www.ft.com/content/893c67ce-3893-11e6-a780-b48ed7b6126f.

Kahneman, Daniel, Slovic, Paul and Tversky, Amos, eds. 1982. *Judgement under Uncertainty: Heuristics and Biases*. Cambridge; Cambridge University Press.

Kahneman, Daniel, and Tversky, Amos. 1972. 'Subjective Probability: A Judgment of Representativeness'. *Cognitive Psychology* 3 (8): 25-48.

———. 1973. 'On the Psychology of Prediction'. *Psychological Review* 80 (4): 237–51.

———. 1979. 'Prospect Theory: An Analysis of Decision under Risk'. *Econometrica* 47 (2): 263–91.

———. 1982. 'Subjective Probability: A Judgment of Representativeness', in *Judgment under Uncertainty*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 32-47. Cambridge: Cambridge University Press.

———. 2000. *Choices, Values, and Frames*. New York; Cambridge (UK): Russell Sage Foundation; Cambridge University Press.

Kahya, Damian. 2011. 'Carbon Tax "May Not Reduce CO2"'. *BBC*, March 7, sec. Business. http://www.bbc.co.uk/news/business-12649143.

Kamps, Udo. 2013. 'Gabler Economic Dictionary'. Definition 'Risiko' Gabler Wirtschaftslexikon. http://wirtschaftslexikon.gabler.de/Definition/risiko.html.

Kasperson, Jeanne X., Kasperson, Roger E., Pidgeon, Nick and Slovic, Paul. 2003. 'The Social Amplification of Risk: Assessing Fifteen Years of Research and Theory'. In *The Social Amplification of Risk*, edited by Paul Slovic, R. E. Kasperson, and Nick Pidgeon, 13–46. London: Cambridge University Press.

Katzenstein, Peter J. 1985. *Small States in World Markets: Industrial Policy in Europe*. Cornell Studies in Political Economy. Ithaca, N.Y.; London: Cornell University Press.

Kefferputz, Roderick. 2010. 'Shale Fever: Replicating the US Gas Revolution in the EU? CEPS Policy Brief No. 210, 17 June 2010'. Policy Paper. June. http://aei.pitt.edu/14544/.

Kelemen, R. D., and Vogel, D.. 2009. 'Trading Places: The Role of the United States and the European Union in International Environmental Politics'. *Comparative Political Studies* 43 (4): 427–56.

Keohane, Robert O. 1988. 'International Institutions: Two Approaches'. *International Studies Quarterly* 32 (4): 379.

Keynes, J. M. 1937. 'The General Theory of Employment'. *The Quarterly Journal of Economics* 51 (2): 209–23.

Keynes, John Maynard. 1921. *A Treatise on Probability*. Mineola, N.Y.: Dover Publications.

Kiger, Patrick J., for National Geographic PUBLISHED May 02, and 2014. 2014. 'Scientists Warn of Quake Risk From Fracking Operations'. *National Geographic News*.
http://news.nationalgeographic.com/news/energy/2014/05/140502-scientists-warn-of-quake-risk-from-fracking-operations.

King, Gary, Keohane, Robert O. and Verba, Sidney. 1994. *Designing Social Inquiry: Scientific Inference in Qualitative Research*. Illustrated edition. Princeton, N.J: Princeton University Press.

King, Hobart. 2014. 'Mineral Rights | Oil & Gas Lease and Royalty Information'. *Geology.com*. http://geology.com/articles/mineral-rights.shtml.

Kirkland, Joel. 2010. 'Big Money Drives Up the Betting on the Marcellus Shale'. *The New York Times*, Online Edition, July 8, sec. Business / Energy & Environment. http://www.nytimes.com/cwire/2010/07/08/08climatewire-big-money-drives-up-the-betting-on-the-marce-22075.html.

———. 2011. 'Cash-Rich Companies Begin to Make Renewable Energy Investments'. *The New York Times*, Online Edition, August 18, sec. Business Day / Energy & Environment.
http://www.nytimes.com/cwire/2011/08/18/18climatewire-cash-rich-companies-begin-to-make-renewable-e-3023.html.

Klüver, Heike. 2013. *Lobbying in the European Union: Interest Groups, Lobbying Coalitions, and Policy Change*. Oxford: Oxford University Press.

Knight, Frank Hyneman. 1921. *Risk, Uncertainty and Profit*. Ulan Press.

Köbberling, Veronika. 2006. 'Strength of Preference and Cardinal Utility'. *Economic Theory* 27 (2): 375–91.

Krahmann, Elke. 2011. 'Beck and beyond: Selling Security in the World Risk Society'. *Review of International Studies* 37 (1): 349–72.

Krukowska, Ewa. 2014. 'Obama Pitches Shale Gas to Europe Seeking to Cut Imports'. *Bloomberg.com*. http://www.bloomberg.com/news/articles/2014-03-26/obama-pitches-shale-gas-to-europe-seeking-to-cut-imports.

Kunreuther, Howard, Heal, Geoffrey, Allen, Myles, Edenhofer, Ottmar, Field, Christopher B. and Yohe, Gary. 2012. 'Risk Management and Climate Change'. Cambridge, United States: National Bureau of Economic Research, Inc.

Kusnetz, Nicholas. 2010. 'For Gas-Drilling Data, There's a New Place to Dig'. *ProPublica*. July 12. http://www.propublica.org/article/for-gas-drilling-data-theres-a-new-place-to-dig.

———. 2011. 'Who Are America's Top 10 Gas Drillers?' *ProPublica*. September 1. http://www.propublica.org/article/who-are-americas-top-10-gas-drillers.

Kwak, James. 2013. 'Cultural Capture and the Financial Crisis'. In *Preventing Regulatory Capture*, edited by Carpenter, D.P. and Moss, D.A. 71–98. Cambridge: Cambridge University Press.

Laffont, Jean-Jacques, and Tirole, Jean. 1990. 'The Politics of Government Decision Making: Regulatory Institutions'. *Journal of Law, Economics, & Organization* 6 (1): 1–31.

Lagadec, Patrick. 1981. *La civilisation du risque: Catastrophes technologiques et responsabilité sociale*. Paris: Éditions du Seuil.

Langer, Ellen J. 1982. 'The Illusion of Control', in *Judgment under Uncertainty*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 231-238. Cambridge: Cambridge University Press.

Leadsom, Andrea. 2015. 'Shale Gas – an Inconvenient Truth for the Anti-Fracking Lobby - Department of Energy and Climate Change Blog'. Government. *Department of Energy and Climate Change Blog*. September 23. https://decc.blog.gov.uk/2015/09/23/shale-gas-an-inconvenient-truth-for-the-anti-fracking-lobby/.

Leftly, Mark. 2013. 'Revealed: Fracking Industry Bosses at Heart of Coalition'. *The Independent*, Online Edition, July 13. http://www.independent.co.uk/news/uk/politics/revealed-fracking-industry-bosses-at-heart-of-coalition-8707589.html.

Leighton, Wayne A., and Lopez, Edward J.. 2013. *Madmen, Intellectuals, and Academic Scribblers: The Economic Engine of Political Change*, Stanford, CA: Stanford university Press.

Leiserowitz, A., Weber, E., Orlove, B., Krantz, D., Marx, S., Roncoli, C., and Phillips, J..2007. 'Communication and Mental Processes: Experiential and Analytic Processing of Uncertain Climate Information'. *Global Environmental Change* 17 (1): 47–58.

Leiserowitz, Anthony. 2006. 'Climate Change Risk Perception and Policy Preferences: The Role of Affect, Imagery, and Values'. *Climatic Change* 77 (1–2): 45–72.

Lichbach, Mark Irving, and Zuckerman, Alan S. eds. 2009. *Comparative Politics: Rationality, Culture, and Structure*. 2nd ed. Cambridge: Cambridge University Press.

Linke, Sebastian, Gilek, Michael, Karlsson, Mikael and Udovyk, Oksana. 2014. 'Unravelling Science-Policy Interactions in Environmental Risk Governance of the Baltic Sea: Comparing Fisheries and Eutrophication'. *Journal of Risk Research* 17 (4): 505–23.

Lipp, Judith. 2007. 'Lessons for Effective Renewable Electricity Policy from Denmark, Germany and the United Kingdom'. *Energy Policy* 35 (11): 5481–95.

Lipton, Eric. 2014. 'Richard Berman Energy Industry Talk Secretly Taped'. *The New York Times*, Online Edition, October 30. http://www.nytimes.com/2014/10/31/us/politics/pr-executives-western-energy-alliance-speech-taped.html.

Loder, Asjylyn. 2016. 'Why Billions in Proven Shale Oil Reserves Suddenly Became Unproven'. News. *Bloomberg.com*. June 15. http://www.bloomberg.com/news/articles/2016-06-15/shale-drillers-paper-wells-draw-sec-scrutiny-before-vanishing.

Longwell, Harry J. 2002. 'The Future of the Oil and Gas Industry: Past Approaches, New Challenges'. *World Energy* 5 (3): 100–105.

Lords' Committee on Economic Affairs. 2014. 'The Economic Impact on UK Energy Policy of Shale Gas and Oil'. The Stationary Office.

Lorenzoni, Irene, and Pidgeon, Nick F.. 2006. 'Public Views on Climate Change: European and USA Perspectives'. *Climatic Change* 77 (1–2): 73–95.

Lovins, Hunter. 2015. 'The Climate Denier's Guide to Getting Rich from Fossil Fuel Divestment'. *The Guardian*, Online Edition, April 14. http://www.theguardian.com/environment/2015/apr/14/the-climate-deniers-guide-to-getting-rich-from-fossil-fuel-divestment.

Lowery, William. 2012. 'Perspective - between a Rock and a Hard Place'. *Petroleum Review* Magazine. https://www.energyinst.org/information-centre/ei-publications/petroleum-review/petroleum-review-january-2012.

Luhmann, Niklas. 2008. *Risk: A Sociological Theory*. Translated by Rhodes Barrett. Berlin, New York: Walter de Gruyter.

Lustgarten, Abrahm. 2009. 'Energy Industry Sways Congress With Misleading Data'. *ProPublica*. http://www.propublica.org/article/energy-industry-sways-congress-with-misleading-data-708.

———. 2011. 'Former Bush EPA Official Says Fracking Exemption Went Too Far; Congress Should Revisit'. *ProPublica*. http://www.propublica.org/article/former-bush-epa-official-says-fracking-exemption-went-too-far.

Lyster, Steve. 2014. 'Quantification of Uncertainty in Shale Gas Resource Estimates'. Energy Resources Conversation Board. http://www.searchanddiscovery.com/pdfz/documents/2014/80361lyster/ndx_lyster.pdf.html.

Macalister, Terry, and Harvey, Fiona. 2013. 'George Osborne Unveils "Most Generous Tax Breaks in World" for Fracking'. *The Guardian*, Online Edition, July 19, sec. Environment. http://www.theguardian.com/politics/2013/jul/19/george-osborne-tax-break-fracking-shale-environment.

MacCrimmon, K., and Larsson, S.. 1979. 'Utility Theory: Axioms versus "paradoxes"'. In *Expected Utility Hypotheses and the Allais Paradox*. Reidel, Dordrecht, NL: Allais M, Hagen O (eds.).

Machina, Mark J. 1987. 'Choice Under Uncertainty: Problems Solved and Unsolved'. *Journal of Economic Perspectives* 1 (1): 121–54.

MacKenzie, Donald. 2006. *An Engine, Not a Camera*. Cambridge: Cambridge University Press.

MacKenzie, Tom, and Papoulias, Diana. 2013. 'Hydraulic Fracturing Fluids Likely Harmed Threatened Kentucky Fish Species'. *U.S. Geological Survey Newsroom*. http://www.usgs.gov/newsroom/article.asp?ID=3677&from=rss_home#.UiT63LxnhE0.

Mahoney, James, and Goertz, Gary. 2006. 'A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research'. *Political Analysis* 14 (3): 227–49.

Maidment, Paul. 2006. 'The U.K.'s 40 Largest Companies'. *Forbes*. December 5. http://www.forbes.com/2006/12/02/forbes40-hsbc-hbos-biz-cx_pm_1205uk40_intro.html.

Mair, Sabine, Mildner, Stormy-Annika and Wodni, Wiebke. 2012. 'Risikofreudiges Amerika, risikoaverses Europa?' *SWP Zeitschriftenschau*, May.

March, James G. 1978. 'Bounded Rationality, Ambiguity, and the Engineering of Choice'. *The Bell Journal of Economics* 9 (2): 587-608.

———. 1988. 'Bounded Rationality, Ambiguity, and the Engineering of Choice'. In *Decision Making*. Cambridge University Press.

March, James G., Simon, H. A. and Guetzkow, H.. 1958. *Organizations*. Wiley.

March, James G., and Simon, Herbert A.. 1993. *Organizations*. Wiley.

Markowitz, Harry M. 2013. 'How to Represent Mark-to-Market Possibilities with the General Portfolio Selection Model'. *Journal of Portfolio Management* 39 (4): 1–3.

Martin, Phyllis. 2010. 'Documents: Federal Officials Quietly Question Shale Gas'. http://www.nytimes.com/interactive/us/natural-gas-drilling-down-documents-5.html#document/p9/a21602.

Martin, Sean. 2014. 'Government Figures Rubbish Shale Gas Lobby's Claims That Most of UK Supports Fracking'. *International Business Times UK*, sec. Regulation. http://www.ibtimes.co.uk/government-figures-rubbish-shale-gas-lobbys-claims-that-most-uk-supports-fracking-1460833.

Mason, Rowena. 2014. 'New Environment Agency Chairman Has Fracking Links'. *The Guardian*, Online Edition, July 22, sec. Environment. http://www.theguardian.com/environment/2014/jul/22/environment-agency-chairman-fracking-links.

Mathiesen, Karl. 2015a. 'ASA Rules Greenpeace Anti-Fracking Ad Is Misleading, Citing Cameron Claims'. *The Guardian*, Online Edition, May 6, sec. Environment. http://www.theguardian.com/environment/2015/may/06/asa-rules-greenpeace-anti-fracking-ad-is-misleading-citing-cameron-claims.

———. 2015b. 'Fracking Support Falls as Tory Government Promises to "Deliver Shale"'. *The Guardian*, Online Edition, May 19, sec. Environment. http://www.theguardian.com/environment/2015/may/19/public-opposition-to-fracking-rises-in-face-of-tory-push-for-shale-gas.

Mathieu, Mathilde, Spencer, Thomas and Sartor, Oliver. 2014. 'Economic Analysis of the US Unconventional Oil and Gas Revolution'. *CEPR Policy Portal*, March 22, VOX Online edition, sec. Vox/ Columns. http://www.voxeu.org/article/limited-economic-impact-us-shale-gas-boom.

McCarthy, Shawn, and Semeniuk, Ivan. 2014. 'Go Slow on Fracking, Scientists Warn'. *The Globe and Mail*, April 30, Online edition, sec. News/National. http://www.theglobeandmail.com/news/national/go-slow-on-fracking-scientists-warn/article18355999/.

McGrath, Matt. 2015. 'Emissions "Far Above" 2C Target'. News. *BBC News*. http://www.bbc.co.uk/news/science-environment-34135202.

———. 2016. 'Renewable Energy Surges to Record Levels around the World'. *BBC News*. June 1. http://www.bbc.co.uk/news/science-environment-36420750.

McNamara, Kathleen R. 1999. *The Currency of Ideas: Monetary Politics in the European Union*. Ithaca, N.Y: Cornell University Press.

McQue, Katie, and Macalister, Terry. 2014. 'Department of Energy Admits Arithmetic Gaffe in Legislation Draft'. *The Guardian*, Online Edition, June 25, sec. Environment. http://www.theguardian.com/environment/2014/jun/25/solar-power-legislation-gaffe-department-energy.

Melley, James. 2011. 'New Groups Protest at Shale Gas'. *BBC News*. September 28. http://www.bbc.co.uk/news/science-environment-15021328.

Milbrath, Lester W. 1976. *The Washington Lobbyists*. Westport, Conn: Greenwood Press.

Mildner, Stormy-Annika, and Boeckelmann, L. 2011. 'Unsicherheit, Ungewissheit, Risiko'. *SWP-Zeitschriftenschau*, 1–8.

Mildner, Stormy-Annika, and Schwarzer, Daniela. 2011. 'Taming the Financial Beast: A Status Report of Financial Regulatory Reform in the United States and the European Union'. 47. AICGS Policy Report. John Hopkins University. http://www.swp-berlin.org/fileadmin/contents/products/fachpublikationen/mdn_swd_taming_the_financial_beast_ks.pdf.

Miller, F.H. 2011. 'Medical Errors, New Drug Approval, and Patient Safety". In *The Reality of Precaution. Comparing Risk Regulation in the United States and Europe*, edited by Wiener et al., 257–85. New York NY: RFF Press.

Miller, John W. 2014. 'Dirty U.S. Coal Finds a Home in Europe'. *Wall Street Journal*, May 5, sec. Business. http://www.wsj.com/articles/SB10001424052702303417104579543814192542586.

Mills, C. Wright. 1959. *The Power Elite*. New York: Oxford University Press.

MIT, Massachusetts Institute of Technology. 2011. 'The Future of Natural Gas - an Interdisciplinary MIT Study'. *MIT Energy Initiative*. MIT Press. http://mitei.mit.edu/system/files/NaturalGas_Report.pdf.

Mitchell, Catherine. 2012. 'Who Is in Charge of Britain's Energy Policy?' *The Guardian*, Online Edition, February 28, sec. Environment. https://www.theguardian.com/environment/2012/feb/28/britain-energy-politics.

———. 2013. 'Britain Needs an Overhaul in the Way It Implements and Makes Decisions about Energy Policy'. 20 Nov 2013. *British Politics and Policy at LSE*. http://blogs.lse.ac.uk/politicsandpolicy/britain-needs-an-overhaul-in-the-way-it-makes-decisions-about-energy-policy-and-then-how-it-implements-it/.

Mokhiber, Russell. 2013. 'Alaska's Lesson for the Left'. *The Nation*. https://www.thenation.com/article/alaskas-lesson-left/.

Moniz, Ernest. 2014. 'President's 2015 Budget Proposal Makes Critical Investments in All-of-the-Above Energy Strategy and National Security'. *Energy.gov*. http://energy.gov/articles/president-s-2015-budget-proposal-makes-critical-investments-all-above-energy-strategy-and.

———. 2015. 'All-of-the-Above Is Making a Difference Across America'. *Energy.gov*. http://energy.gov/articles/all-above-making-difference-across-america.

Monks, Matthew, Penty, Rebecca and de Vynck, Gerrit. 2013. 'Shale Grab in U.S. Stalls as Falling Values Repel Buyers'. *Bloomberg*. http://www.bloomberg.com/news/2013-08-18/shale-grab-in-u-s-stalls-as-falling-values-repel-buyers.html.

Morgan, Tim. 2014. 'Shale Gas: "The Dotcom Bubble of Our Times"'. *The Telegraph*, Online Edition, August 4. http://www.telegraph.co.uk/finance/personalfinance/investing/11006723/fracking-for-Shale-gas-the-dotcom-bubble-of-our-times.html.

Mudu, Pierpaolo, and Beck, Elise. 2012. 'Navigating Scientific Routes to Risk Assessment: A Tortuous Path'. *Journal of Risk Research* 15 (10): 1217–22.

Mulkern, Anne C. 2011. 'Natural Gas Companies Send Workers to Hill to Make Case for Fracking'. *The New York Times*, Online Edition, March 8, sec. Energy & Environment. http://www.nytimes.com/gwire/2011/03/08/08greenwire-natural-gas-companies-send-workers-to-hill-to-83229.html.

Munro, Margaret. 2012. 'Fracking Does Not Contaminate Groundwater: Study Released in Vancouver'. *Www.vancouversun.com*. February 17. http://www.vancouversun.com/news/Fracking+does+contaminate+groundwater+study+released+Vancouver/6165532/story.html.

Murray, James. 2014. 'Autumn Statement 2014: Fossil Fuel Tax Breaks to the Fore as Osborne Rejects Green Growth Opportunities'. Article. *Business Green*. http://www.businessgreen.com/bg/news/2384858/autumn-statement-2014-fossil-fuel-tax-breaks-to-the-fore-as-osborne-rejects-green-growth-opportunities.

Murray, James, and King, David. 2012. 'Climate Policy: Oil's Tipping Point Has Passed'. *Nature* 481 (7382): 433–435.

Nagarajan, Mahesh, and Shechter, Steven. 2014. 'Prospect Theory and the Newsvendor Problem'. *Management Science* 60 (4): 1057–62.

National Infrastructure Commission. 2016. 'Smart Power: A National Infrastructure Commission Report - Publications - GOV.UK'. https://www.gov.uk/government/publications/smart-power-a-national-infrastructure-commission-report.

Neate, Rupert. 2015. 'Fears for US Economy as Shale Industry Goes into Hibernation'. *The Guardian*, Online Edition, February 7, sec. Business.

https://www.theguardian.com/business/2015/feb/07/shale-industry-hibernation-us-economy-fears.

Nelson, Stephen, and Katzenstein, Peter J.. 2010. 'Uncertainty, Risk, and the Financial Crisis of 2008'. *International Organization* 68 (2): 361-392.

Neslen, Arthur. 2014. 'Wind Power Is Cheapest Energy, EU Analysis Finds'. *The Guardian*, Online Edition, October 13, sec. Environment. https://www.theguardian.com/environment/2014/oct/13/wind-power-is-cheapest-energy-unpublished-eu-analysis-finds.

———. 2016. 'Portugal Runs for Four Days Straight on Renewable Energy Alone'. *The Guardian*, Online Edition, May 18. http://www.theguardian.com/environment/2016/may/18/portugal-runs-for-four-days-straight-on-renewable-energy-alone.

Nestler, Ralf. 2012. 'Fracking: Schiefergas Könnte Das Energiethema 2013 Werden'. *Die Zeit*, December 21, sec. Umwelt. http://www.zeit.de/politik/2012-12/deutschland-streitet-ueber-ga.

Newport, Frank. 2014. 'Business and Industry Sector Images Continue to Improve'. Polling. *Gallup.com*. http://www.gallup.com/poll/175616/business-industry-sector-images-continue-improve.aspx.

NGI, Natural Gas Intelligence. 2011. 'House Caucus Calls on Interior to Back Off from Hydrofracking Rules'. Magazine. *Natural Gas Intelligence*. January 6. http://www.naturalgasintel.com/articles/1048-house-caucus-calls-on-interior-to-back-off-from-hydrofracking-rules.

Nisbett, Richard E., Borgida, Eugene, Crandall, Rick and Reed, Harvey. 1976. 'Popular Induction: Information Is Not Necessarily Informative'. in *Judgment under Uncertainty*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 101-116. Cambridge: Cambridge University Press. North, Douglass C. 1990. *Institutions, Institutional Change and Economic Performance*. Cambridge: Cambridge University Press.

Nye, Joseph S. 2008. 'Public Diplomacy and Soft Power'. *Annals of the American Academy of Political and Social Science* 616: 94–109.

Obama, Barack. 2013. '"We Need to Act": Transcript of Obama's Climate Change Speech'. News. *Bloomberg.com*. June 25. http://www.bloomberg.com/news/articles/2013-06-25/-we-need-to-act-transcript-of-obama-s-climate-change-speech.

O'Connor, Lydia. 2015. 'How Exxon Mobil And Koch Brothers Created A Culture Of Climate Doubt'. News. *The Huffington Post*. November 24. http://www.huffingtonpost.com/entry/exxon-mobil-climate-doubt_us_5654d16de4b0d4093a599530.

O'Driscoll, Gerald P. 2010. 'The Gulf Spill, the Financial Crisis and Government Failure'. *Wall Street Journal*, June 12, sec. Opinion. http://www.wsj.com/articles/SB10001424052748704575304575296873167457684.

ODT, Otago Daily Times. 2012. 'Fracking Found to Cause Quakes'. *Otago Daily Times Online News*. April 17. https://www.odt.co.nz/news/national/fracking-found-cause-quakes.

O'Hara, Sarah. 2013. 'Public Perception of Shale Gas Extraction in the UK: The Impact of the Balcombe Protests in July'. Nottingham: University of Nottingham. http://nottspolitics.org/wp-content/uploads/2013/10/public-perceptions-of-shale-gas-in-the-UK-september-2013-1-2.pdf

O'Hara, Sarah, Humphrey, Matthew, Andersson-Hudson, Jessica, and Knight, Wil. 2015. 'Public Perceptions of Shale Gas in the UK- September 2015'. 11th. Nottingham:

University of Nottingham. https://www.scribd.com/doc/131787519/public-perceptions-of-shale-gas-in-the-UK-September-2015-pdf.

Oklahoma State Gov't. 2015. 'News | Earthquakes in Oklahoma'. *News*. http://earthquakes.ok.gov/news/.

Oliver, Adam. 2003. 'A Quantitative and Qualitative Test of the Allais Paradox Using Health Outcomes'. *Journal of Economic Psychology* 24 (1): 35–48.

Oliver, John. 2014. *Last Week Tonight with John Oliver: State Legislatures and ALEC (HBO)*. https://www.youtube.com/watch?v=aIMgfBZrrZ8.

Olson, Mancur. 1971. *The Logic of Collective Action: Public Goods and the Theory of Groups*. Harvard Economic Studies. Cambridge, Mass: Harvard University Press.

ONS, Office of National Statistics UK. 2004. 'Regional Profiles: Key Statistics'. *Hart's Global Refining and Fuels Report*, June 23, Online edition. http://global.factiva.com/redir/default.aspx?P=sa&an=EFN0000020040624e06n0000b&cat=a&ep=ASE.

O'Reilly, Emily. 2014. 'Letter to the European Commission Requesting an Opinion in the European Ombudsman's Own-Initiative Inquiry OI/6/2014/NF Concerning the Composition of Commission Expert Groups »European Ombudsman', May 12. http://www.ombudsman.europa.eu/en/cases/correspondence.faces/en/58861/html.bookmark.

Osborn, Stephen G., Vengosh, Avner, Warner, Nathaniel R. and Jackson, Robert B. 2011. 'Methane Contamination of Drinking Water Accompanying Gas-Well Drilling and Hydraulic Fracturing'. *Proceedings of the National Academy of Sciences*, May.

Osborne, George. 2013. 'Budget 2013: Chancellor's Statement - Oral Statements to Parliament - GOV.UK'. Government. *Gov.uk/Government/Speeches/Budget-2013*. https://www.gov.uk/government/speeches/budget-2013-chancellors-statement.

———. 2015. 'George Osborne Demands Rapid Progress on Fracking – Full Letter', January 26. http://www.theguardian.com/environment/interactive/2015/jan/26/george-osborne-fracking-letter.

Owen, Nick A., Inderwildi, Oliver R. and King, David A. 2010. 'The Status of Conventional World Oil reserves—Hype or Cause for Concern?' *Energy Policy* 38 (8): 4743–49.

Oxford Dictionaries Online. 2016a. 'Risk - Definition of Risk in English'. Dictionary. *Oxford Dictionaries | English*. https://en.oxforddictionaries.com/definition/risk.

———. 2016b. 'Uncertain - Definition of Uncertain in English'. Dictionary. *Oxford Dictionaries | English*. https://en.oxforddictionaries.com/definition/uncertain.

———. 2016c. 'Uncertainty - Definition of Uncertainty in English'. Dictionary. *Oxford Dictionaries | English*. https://en.oxforddictionaries.com/definition/uncertainty.

PA, Press Association. 2014. 'Fracking "Good for the UK", Says David Cameron'. *The Guardian*, Online Edition, March 26, sec. Environment. http://www.theguardian.com/environment/2014/mar/26/fracking-good-for-uk-cameron.

Pagliari, Stefano. 2012. *Making Good Financial Regulation: Towards a Policy Response to Regulatory Capture*. Guildford, Surrey: Grosvenor House Publishing Limited.

Pagliari, Stefano, and Young, Kevin. 2016. 'The Interest Ecology of Financial Regulation: Interest Group Plurality in the Design of Financial Regulatory Policies'. *Socio-Economic Review* 14 (2): 209-337.

Pagnamenta, Robin. 2015. 'Planning Rules Eased to Clear Way for Fracking'. *The Times (London)*, August 10, sec. Business.

http://www.thetimes.co.uk/tto/business/industries/naturalresources/article4522385.ece.

Paige, Jonathan. 2011. 'Blackpool Earthquake Tremors May Have Been Caused by Gas Drilling'. *The Guardian*, Online Edition, June 1, sec. Environment. https://www.theguardian.com/uk/2011/jun/01/blackpool-earthquake-tremors-gas-drilling.

Palan, Ronen. 2013. *Global Political Economy: Contemporary Theories*. Second Edition. London: Routledge, Taylor & Francis Group.

Parliament Publications & Records. 2013. 'House of Commons - Political and Constitutional Reform Committee: Written Evidence Submitted by Who's Lobbying—whoslobbying.com (GLB 19)'. Government. *Parliamentary Business: Political and Constitutional Reform*. September 18. http://www.publications.parliament.uk/pa/cm201314/cmselect/cmpolcon/601/601vw20.htm.

Parliament UK. 2016. 'Register of Lords' Interests'. Government. *UK Parliament Register of Lords' Interests*. http://www.parliament.uk/mps-lords-and-offices/standards-and-interests/register-of-lords-interests/.

Parr, Mike. 2015. 'Danish Offshore Wind: Getting Better All the Time'. News Blog. *EnergyPost.eu*. June 16. http://www.energypost.eu/danish-offshore-wind-getting-better-time/.

Parti, Tarini. 2015. '"Dark Money": ALEC Wants Image Makeover'. News. *Politico*. July 30. http://www.politico.com/story/2015/07/alec-koch-brothers-dark-money-anonymous-donation-120784.html.

Pasternak, Judy. 2001. 'Bush's Energy Plan Bares Industry Clout'. *Los Angeles Times*, August 26. http://articles.latimes.com/2001/aug/26/news/mn-38530.

Pauker, Stephen G., Pauker, Susan P. and McNeil, Barbara J.. 1988. 'The effect of private attitudes on public policy: prenatal screening for neural tube defects as a prototype'. In *Decision Making*. Cambridge University Press.

Perraudin, Frances. 2015. 'Fracking under National Parks Approved by MPs amid Acrimony'. *The Guardian*, Online Edition, December 16, sec. Environment. https://www.theguardian.com/environment/2015/dec/16/fracking-under-national-parks-approved-by-mps-amid-acrimony.

Petersen, Hannah. 2013. 'As US Shale Industry Falters, a UK Fracking Boom Is Unlikely'. *The Conversation*. https://theconversation.com/as-us-shale-industry-falters-a-uk-fracking-boom-is-unlikely-17791.

PEW. 2012. 'Public Priorities: Deficit Rising, Terrorism Slipping'. *Pew Research Center for the People and the Press*. http://www.people-press.org/2012/01/23/public-priorities-deficit-rising-terrorism-slipping/.

———. 2015. 'Public Priorities for 2015'. *Pew Research Center for the People and the Press*. http://www.people-press.org/2015/01/15/publics-policy-priorities-reflect-changing-conditions-at-home-and-abroad/1-15-2015-priorities_01/.

Pfanzagl, J. 1967. 'Subjective Probability Derived from the Morgenstern-von Neumann Utility Theory'. In *Essays in Mathematical Economics In Honor of Oskar Morgenstern*, Martin Shubik (ed.), 237–51. Princeton University Press.

Pidgeon, Nick, Kasperson, Roger E. and Slovic, Paul. 2003. *The Social Amplification of Risk*. Cambridge: Cambridge University Press.

Pierson, Paul. 2004. *Politics in Time: History, Institutions, and Social Analysis by Pierson, Paul (2004) Paperback*. Princeton, N.J: Princeton University Press.

POST, Parliamentary Office of Science and Technology. 2013. 'UK Shale Gas Potential'. House of Parliament. POSTbox *Briefing Paper*. https://www.parliament.uk/documents/post/ShaleGas_POSTbox.pdf.

Potters, Jan, and van Winden, Frans. 1992. 'Lobbying and Asymmetric Information'. *Public Choice* 74 (3): 269–92.

Powell, Brian. 2014. 'The ALEC Problem Is Even Worse Than John Oliver Thinks'. Watchdog. *Media Matters for America*. November 3. http://mediamatters.org/blog/2014/11/03/the-alec-problem-is-even-worse-than-john-oliver/201424.

Powers, Bill. 2014. 'The Popping of the Shale Gas Bubble'. *Forbes*. http://www.forbes.com/sites/billpowers/2014/09/03/the-popping-of-the-shale-gas-bubble/.

PPINYS, The Public Policy Institute for New York State. 2011. 'Drilling for Jobs'. New York, NY: The Public Policy Institute for New York State. http://www.ppinys.org/reports/2011/Drilling-for-jobs-what-marcellus-shale-could-mean-for-NY.pdf.

Princeton Survey Research Associates International. 2012. 'Q.16 - Fracking Awareness'. Pew Research Center for the People and the Press PEW 4. University of Connecticut: PEW. http://www.ropercenter.uconn.edu/psearch/question_view.cfm?qid=1856001&pid=50&ccid=50#top.

———. 2013a. 'Q.77A - Favour or Oppose Fracking'. Pew Research Center for the People and the Press PEW 3. University of Connecticut: PEW. http://www.ropercenter.uconn.edu/psearch/question_view.cfm?qid=1856001&pid=50&ccid=50#top.

———. 2013b. 'Americans Still Divided on Energy-Environment Trade-Off'. Polling. *Gallup.com*. April 10. http://www.gallup.com/poll/161729/americans-divided-energy-environment-trade-off.aspx.

———. 2014. 'Q.69A - Favour or Oppose Fracking'. Pew Research Center for the People and the Press PEW 7. University of Connecticut: PEW. http://www.ropercenter.uconn.edu/psearch/question_view.cfm?qid=1856001&pid=50&ccid=50#top.

———. 2015. 'Americans Choose the Environment Over Energy Development'. *Gallup.com*. April 13. http://www.gallup.com/poll/182402/americans-choose-environment-energy-development.aspx.

Provalis Research. 2016. 'Qualitative Data Analysis Software for Mixed Methods Research'. Company Website. *Provalis Research*. https://provalisresearch.com/products/qualitative-data-analysis-software/.

Quick, Reinhard. 2011. 'Transatlantic Regulatory Cooperation on Chemicals — An Idealist's Dream?' In *Systemic Implications of Transatlantic Regulatory Cooperation and Competition*, *(World Scientific Studies in International Economics: 15)*, edited by Simon J Evenett and Robert M Stern, 241-285, Singapore: World Scientific Co. Pte. Ltd. Quiggin, John. 1982. 'A Theory of Anticipated Utility'. *Journal of Economic Behavior & Organization* 3 (4): 323–43.

———. 1993. *Generalized Expected Utility Theory the Rank-Dependent Model*. Dordrecht: Springer. http://site.ebrary.com/id/10657289.

Rahm, Brian G., Vedachalam, Sridhar, Bertoia, Lara R., Mehta, Dhaval, Vanka, Veeravenkata Sandeep and Riha, Susan J. 2015. 'Shale Gas Operator Violations in the Marcellus and What They Tell Us about Water Resource Risks'. *Energy Policy* 82 (July): 1–11.

Redfern, Simon. 2014. 'Warming Boosts UK Flooding Risk'. *BBC News*, April 30, sec. Science & Environment. http://www.bbc.co.uk/news/science-environment-27228408.

Renn, Ortwin. 2005. 'Risk Governance - Towards an Integrative Approach'. *International Risk Governance Council Series, Vol 1:* 3-73 Geneva: International Risk Governance

Council. http://www.ortwinrenn.de/sites/default/files/PDF/RecentPublications/IRGC%20WP%20No%201_Risk%20Governance.pdf.

Reuters. 2014a. 'N. Ireland Fracking: Minister Rejects Global Energy Firm's Drilling Proposal'. *RT International*. https://www.rt.com/uk/179784-fracking-proposal-rejected-protest/.

———. 2014b. 'Anti-Fracking Protest Rocks NY Governor's State of the State Address'. News. *RT International*. January 9. https://www.rt.com/usa/fracking-protest-new-york-348/.

Rhoden-Paul, André, and Howard, Emma. 2015. 'Hundreds Protest against Proposed Fracking Site in Lancashire'. *The Guardian*, Online Edition, June 23, sec. Environment. https://www.theguardian.com/environment/2015/jun/23/hundreds-protest-against-proposed-fracking-site-lancashire-cuadrilla.

Richardson, Valerie. 2015. 'Fracking Politics Trump Science as Oil Industry, Environmental Lobby Push Biased Views'. *The Washingtion Times*, April 28, Online edition, sec. News. http://www.washingtontimes.com/news/2015/apr/28/fracking-politics-trump-science-as-oil-industry-en/.

Richter, Brian K. Samphantharak, Krislert and Timmons, Jeffrey F. 2009. 'Lobbying and Taxes'. *American Journal of Political Science* 53 (4): 893–909.

Richter, Wolf. 2012. 'Dirt Cheap Natural Gas Is Tearing Up The Very Industry That's Producing It'. News. *Business Insider*. June 5. http://www.businessinsider.com/capital-destruction-in-natural-gas-2012-6.

Rieger, Marc Oliver. 2014. 'Evolutionary Stability of Prospect Theory Preferences'. *Journal of Mathematical Economics* 50 (1): 1–11.

Rieger, Marc Oliver, Wang, Mei and Hens, Torsten. 2013. 'Risk Preferences around the World' Management Science 61 (3): 637 - 648.

Roberts, Carl W. 1997. *Text Analysis for the Social Sciences*. Mahwah (NJ): Lawrence Erlbaum Associates, Inc.

Rodrik, Dani. 2013. 'Ideas Shape Interests'. *The Nation*, October 2. http://nation.com.pk/columns/10-Feb-2013/ideas-shape-interests.

———. 2014. 'When Ideas Trump Interests: Preferences, Worldviews, and Policy Innovations'. *Journal of Economic Perspectives* 28 (1): 189–208.

Romero, Simon. 2004. 'With Oil Near $50 a Barrel, Gas Prices Start to Inch Up'. *The New York Times*, Online Edition, September 29, sec. Business. http://www.nytimes.com/2004/09/29/business/29gasoline.html.

Ross, Lee, and Anderson, Craig A.. 1982. 'Shortcomings in the Attribution Process: On the Origins and Maintenance of Erroneous Social Assessments'. In *Judgment under Uncertainty*. Cambridge University Press.

Rowell, Andy. 2016. 'Half of U.S. Fracking Industry Could Go Bankrupt as Oil Prices Continue to Fall'. *EcoWatch*. January 18. http://ecowatch.com/2016/01/18/fracking-industry-bankrupt/.

RSPB and the National Trust. 2014. 'Are We Fit to Frack?' *The RSPB*. http://www.rspb.org.uk/forprofessionals/policy/climatechange/action/ukenergy/fit-to-frack.aspx.

Rudd, Amber. 2015. 'Our Country Needs Shale Gas, so Let's Go Get It'. *The Sunday Times*, August 9, sec. Guest Column. http://www.thesundaytimes.co.uk/sto/comment/regulars/guestcolumn/article1591147.ece.

Russell, Alex, and Strachan, Peter. 2015. 'Tories Are Backing the Wrong Horses When It Comes to Energy'. *The Conversation*. June 23. http://theconversation.com/tories-are-backing-the-wrong-horses-when-it-comes-to-energy-43746.

Saterson, K.A. 2011. 'Biodiversity Conservation'. In *The Reality of Precaution. Comparing Risk Regulation in the United States and Europe*, edited by Wiener et al., 201–23, New York NY: RFF Press.

Schlozman, Kay Lehman, and Tierney, John T.. 1986. *Organized Interests and American Democracy*. New York: Longman Higher Education.

Schmidt, Vivien A. 2013. *Resilient Liberalism in Europe's Political Economy*. Cambridge University Press.

Schoemaker, Paul J. H. 1982. 'The Expected Utility Model: Its Variants, Purposes, Evidence and Limitations'. *Journal of Economic Literature* 20 (2): 529–63.

Schrope, Mark. 2013. 'Fracking Outpaces Science on Its Impact'. EnvY : The Journal of the Yale School of Foresty and Environmental Studies. *EnvY : The Journal of the Yale School of Foresty and Environmental Studies*. http://environment.yale.edu/envy/stories/fracking-outpaces-science-on-its-impact.

Schueler, John. 2011. 'Secretary Chu Unveils the 2011 Strategic Plan'. *Energy.gov*. http://energy.gov/articles/secretary-chu-unveils-2011-strategic-plan.

Schulte, Bret. 2014. 'Can Natural Gas Bring Back U.S. Factory Jobs?' Magazine. *National Geographic News*. February 1. http://news.nationalgeographic.com/news/energy/2014/01/140131-natural-gas-manufacturing-jobs/.

Seabrooke, Leonard. 2006. *The Social Sources of Financial Power: Domestic Legitimacy and International Financial Orders*. Cornell Studies in Political Economy. Ithaca, N.Y.; London: Cornell University Press.

Seabrooke, Leonard, and Tsingou, Eleni. 2009a. 'Revolving Doors and Linked Ecologies in the World Economy:Policy Locations and the Practice of International Financial Reform'. In. Vol. 260/09. CSGRWorking Paper.

———. 2009b. 'Power Elites and Everyday Politics in International Financial Reform'. *International Political Sociology* 3 (4): 457–61.

Selznick, Philip. 1959. Review of *Review of Organizations*, by James G. March, Herbert A. Simon, and Harold Guetzkow. *American Sociological Review* 24 (6): 911–13.

Semeniuk, Ivan. 2014. 'What Experts Say We Don't Know about Shale Gas'. *The Globe and Mail*, April 30, Online edition, sec. News/National. http://www.theglobeandmail.com/news/national/what-experts-say-we-dont-know-about-shale-gas/article18356509/.

Shafer, Glenn R. 1984. 'Review: Judgment Under Uncertainty'. *Journal of the American Statistical Association*, 220–24.

Shaffer, Gregory C. 2004. 'Reconciling (or Failing to Reconcile) Regulatory Differences: The Ongoing Transatlantic Dispute over the Reculation of Biotechnology'. *Workshop on The New Transatlantic Agenda and the Future of Transatlantic Economic Governance*. http://works.bepress.com/gregory_shaffer/12.

Shale Gas Europe. 2016. 'Shale Gas and The Economy'. Industry. *Shale Gas*. http://shalegas-europe.eu/shale-gas-explained/shale-gas-and-economics/.

Shankleman, Jessica. 2015. 'Labour Manifesto 2015: Green Policies at a Glance'. http://www.businessgreen.com/bg/analysis/2403721/labour-manifesto-2015-green-policies-at-a-glance.

———. 2016a. 'Rockefeller Fund Takes First Green Stake in Pivot From Oil'. News. *Bloomberg.com*. http://www.bloomberg.com/news/articles/2016-07-27/rockefeller-fund-divesting-from-oil-takes-first-renewables-stake.

———. 2016b. 'Germany Just Got Almost All of Its Power from Renewable Energy'. *The Independent*, Online Edition, May 19. http://www.independent.co.uk/environment/germany-just-got-almost-all-of-its-power-from-renewable-energy-a7037851.html.

Siddi, Marco. 2016. 'The EU's Gas Relationship with Russia: Solving Current Disputes and Strengthening Energy Security'. *Asia Europe Journal* 14 (2), 1–11.

Sikkink, Kathryn. 1991. *Ideas and Institutions: Developmentalism in Brazil and Argentina*. Ithaca, N.Y: Cornell University Press.

Sills, Ben. 2011. 'Fossil Fuel Subsidies Six Times More Than Renewable Energy'. *Bloomberg.com*, November 9. http://www.bloomberg.com/news/articles/2011-11-09/fossil-fuels-got-more-aid-than-clean-energy-iea.

Simon, Christopher. 2007. 'Is Energy a Public Good?' *Renewable Energy World Magazine*. http://www.renewableenergyworld.com/articles/2007/07/is-energy-a-public-good-49201.html.

Simon, Herbert A. 1978. 'Rationality as Process and as Product of Thought'. *The American Economic Review* 68 (2): 1–16.

———. 1979. 'Rational Decision Making in Business Organizations'. *The American Economic Review* 69 (4): 493–513.

———. 1995. 'Rationality in Political Behavior'. *Political Psychology* 16 (1): 45–61.

Sjöberg, Lennart. 1999. 'Risk Perception by the Public and by Experts: A Dilemma in Risk Management'. *Human Ecology Review* 6 (2): 1–9.

———. 2000. 'Factors in Risk Perception'. *Risk Analysis* 20 (1): 1–11.

Slovic, Paul. 1987. 'Perception of Risk'. *Science* 236 (4799): 280–85.

———. 2010. 'The Psychology of Risk'. *Psicologia Do Risco.* 19 (4): 731–47.

Slovic, Paul, Fischhoff, Baruch and Lichtenstein, Sarah. 1982a. 'Facts versus Fears: Understanding Perceived Risk', in *Judgment under Uncertainty*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 463–490. Cambridge: Cambridge University Press.

———. 1982b. 'Response Mode, Framing, and Information-Processing Effects in Risk Assessment'. In *New Directions for Methodology of Social and Behavioral Science: Question Framing and Response Consistency*, edited by R. Hogarth, 21–36. San Francisco: Jossey-Bass.

Slovic, Paul, and IIED. 2010. *The Feeling of Risk: New Perspectives on Risk Perception*. London; Washington, DC: Earthscan: In association with the International Institute for Environment and Development.

Snyder, Jim, and Klimasinska, Katarzyna. 2012. 'Obama Pushes Natural-Gas Fracking to Create 600,000 Jobs'. News. *Bloomberg.com*. January 25. http://www.bloomberg.com/news/articles/2012-01-25/obama-backs-fracking-to-create-600-000-jobs-vows-safe-drilling.

Soraghan, Mike. 2011. 'Baffled About Fracking? You're Not Alone'. *The New York Times*, Online Edition, May 13, sec. Business Day / Energy & Environment. http://www.nytimes.com/gwire/2011/05/13/13greenwire-baffled-about-fracking-youre-not-alone-44383.html.

Sorenson, Theodore C., and Kennedy, John F.. 2005. *Decision-Making in the White House: The Olive Branch or the Arrows*. New York: Columbia University Press.

Soskice, David W., and Hall, Peter eds. 2001. *Varieties of Capitalism: The Institutional Foundations of Comparative Advantage.* Oxford: Oxford University Press.

Sovacool, Benjamin K., and Brown, Marilyn A. 2015. 'Deconstructing Facts and Frames in Energy Research: Maxims for Evaluating Contentious Problems'. *Energy Policy* 86 (November): 36–42.

Stafford, James. 2012. 'Shale Gas Will Be the Next Bubble to Pop - An Interview with Arthur Berman'. *Oilprice*. http://oilprice.com/Interviews/Shale-Gas-Will-be-the-Next-Bubble-to-Pop-An-Interview-with-Arthur-Berman.html.

Stamford, Laurence, and Azapagic, Adisa. 2014. 'Life Cycle Environmental Impacts of UK Shale Gas'. *Applied Energy* 134 (December): 506–18.

Stern, J., and Wiener, J.B. 2011. 'Terrorism and Weapons of Mass Destruction'. In *The Reality of Precaution. Comparing Risk Regulation in the United States and Europe*, Wiener et al., 285–320, New York NY: RFF Press.

Stevens, Paul. 2010. *The 'Shale Gas Revolution': Hype and Reality*. London: Chatham House and Royal Institute of International Affairs.

———. 2012. 'The "shale Gas Revolution": Developments and Changes'. *Chatham House Briefing Paper*. https://www.chathamhouse.org/publications/papers/view/185311.

———. 2014. 'Why Shale Gas Won't Conquer Britain'. *The New York Times*, Online Edition, January 14. http://www.nytimes.com/2014/01/15/opinion/why-shale-gas-wont-conquer-britain.html.

———. 2016. 'International Oil Companies: The Death of the Old Business Model'. Research Institute. *Chatham House* https://www.chathamhouse.org//node/22108.

Strange, Susan. 1988. *States and Markets*. London: Pinter.

———. 1998. *Mad Money: When Markets Outgrow Governments*. Manchester: Manchester University Press.

Strauss, Michael J. 2008. 'Natural Gas Price Links to Oil Market Frustrate Regulators' Efforts to Develop Competition'. *The New York Times*, Online Edition, October 29. http://www.nytimes.com/2008/10/29/business/worldbusiness/29iht-rengas.17346943.html.

Strzalecki, Tomasz. 2014. 'Decision Theory Lecture Notes'. Lecture Notes, Harvard University, Cambridge (MA).

Stuart, Marianne. 2013. 'Water Supplies May Struggle to Cope with Fracking Demands'. *The Conversation*. August 21. http://theconversation.com/water-supplies-may-struggle-to-cope-with-fracking-demands-17296.

Styles, Peter. 2014. 'Shale Gas: How Does It Form, Where Is It Found, Do We Need It and How Might We Access the Energy from It Safely?' *Shalegas-Europe.eu*. http://shalegas-europe.eu/shale-gas-form-found-need-might-access-energy-safely/.

Sunstein, Cass R. 2005. 'The Availability Heuristic, Intuitive Cost-Benefit Analysis, and Climate Change' (John M. Olin Program in Law and Economics Working Paper No. 263, 2005). Coase-Sandor Institute for Law and Economics.

Tagesspiegel. 2015. 'Fracking Soll Erdbeben Ausgelöst Haben', August 28, Online edition, sec. World. http://www.tagesspiegel.de/weltspiegel/kanada-fracking-soll-erdbeben-ausgeloest-haben/12247048.html.

Tansey, Rachel. 2014. 'Fracking Brussels - a Who's Who of the EU Shale Gas Lobby'. Report. Friends of the Earth Europe.

Taylor, Chris. 2016. 'ALEC's Dark Money Game | Huffington Post'. News. *The Huffington Post*. August 10. http://www.huffingtonpost.com/rep-chris-taylor/alecs-dark-money-game_b_11432948.html.

Taylor, Phil. 2016. 'Here's How Smart Power Could Help the UK Reach 100% Renewable Energy'. Academic/ News. *The Conversation*. May 23. http://theconversation.com/heres-how-smart-power-could-help-the-uk-reach-100-renewable-energy-59344.

Taylor, Shelley E. 1982. 'The Availability Bias in Social Perception and Interaction', in *Judgment under Uncertainty*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 190-200, Cambridge: Cambridge University Press. Telegraph, Agency.

2015. 'Greenpeace Anti-Fracking Advert Banned'. *The Telegraph*, Online Edition, May 5. http://www.telegraph.co.uk/news/earth/energy/fracking/11584861/Greenpeace-anti-fracking-advert-banned.html.

Terrell, Kimberley, Tinley, Morgan and Souther, Sara. 2014. 'Without Full Disclosure of Accidents and Chemicals Used, Fracking Risks Remain Unknown'. *The Conversation*. http://theconversation.com/without-full-disclosure-of-accidents-and-chemicals-used-fracking-risks-remain-unknown-30065.

The Economist. 2004. 'The Price of Prudence'. *The Economist*, January 22. http://www.economist.com/node/2347855.

———. 2012a. 'The Dream That Failed'. *The Economist*, March 10. http://www.economist.com/node/21549936.

———. 2012b. 'Focus: Natural Gas Reserves'. *The Economist*. May 6. http://www.economist.com/blogs/graphicdetail/2012/06/focus.

———. 2015. 'Time to Get Fracking'. *The Economist*, June 20. http://www.economist.com/news/britain/21654399-britain-inches-towards-getting-shale-gas-slow-start.

The New York Times. 2011. 'Documents: Leaked Industry E-Mails and Reports'. Online Data Portal. http://www.nytimes.com/interactive/us/natural-gas-drilling-down-documents-4.html?_r=0.

The Royal Society, and The Royal Academy of Engineering. 2012. 'Final Report - Shale Gas Extraction in the UK: A Review of Hydraulic Fracturing'. London: The Royal Society. https://royalsociety.org/policy/projects/shale-gas-extraction/.

The Times of India. 2016. 'Siemens Boosts Profit Forecast as Renewables Demand Rise'. News. *The Times of India*. http://timesofindia.indiatimes.com/business/international-business/Siemens-boosts-profit-forecast-as-renewables-demand-rise/articleshow/53538825.cms.

The World Bank. 2015. 'High-Technology Exports (Current US$):Data'. http://data.worldbank.org/indicator/TX.VAL.TECH.CD.

Theodori, G. L. 2012. 'Public Perception of the Natural Gas Industry: Data from the Barnett Shale'. *Energy Sources, Part B: Economics, Planning, and Policy* 7 (3): 275–81.

Thompson, Helen. 2009. 'The Political Origins of the Financial Crisis: The Domestic and International Politics of Fannie Mae and Freddie Mac'. *The Political Quarterly* 80 (1): 17–24.

———. 2010. 'The External Realm and Domestic Politics in Territory and Power in the United Kingdom'. *Government and Opposition* 45 (Special Issue 03): 386–405.

Thomson, Robert. 2011. *Resolving Controversy in the European Union: Legislative Decision-Making before and after Enlargement*. Cambridge: Cambridge University Press.

Thomson, Robert, Stokman, Frans N., Achen, Christopher H., Kœnig, Thomas eds. 2006. *The European Union Decides*. Cambridge: Cambridge University Press.

Tian, Lei, Zhongmin Wang, Krupnick, Alan and Liu, Xiaoli. 2014. 'Stimulating Shale Gas Development in China: A Comparison with the US Experience'. *Energy Policy* 75 (December): 109–16.

Treier, Christoph. 2010. 'A Survey on International Differences in Risk- and Ambiguity Aversion and Implications to Global Financial Services'. Swiss Banking Institute Zürich.

Truman, David Bicknell. 1981. *The Governmental Process: Political Interests and Public Opinion*. Westport, Conn: Greenwood Press.

Tversky, Amos, and Kahneman, Daniel. 1974. 'Judgment under Uncertainty: Heuristics and Biases'. *Science* 185 (4157): 1124–31.

———. 1980. 'Causal Schemas in Judgments under Uncertainty'. In *Judgment under Uncertainty*. Cambridge: Cambridge University Press.

———. 1981. 'The Framing of Decisions and the Psychology of Choice'. *Science*, New Series, 211 (4481): 453–58.

———. 1982a. 'Availability: A Heuristic for Judging Frequency and Probability', in *Judgment under Uncertainty*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 163-178, Cambridge: Cambridge University Press.

———. 1982b. 'Belief in the Law of Small Numbers', in *Judgment under Uncertainty*, edited by Daniel Kahneman, Paul Slovic, and Amos Tversky, 23-31, Cambridge: Cambridge University Press. ———. 1986. 'Rational Choice and the Framing of Decisions'. *The Journal of Business*, Part 2: The Behavioral Foundations of Economic Theory, 59 (4): S251–78.

UK Parliament Publications & Records. 2013. 'House of Commons - Political and Constitutional Reform Committee: Written Evidence Submitted by the National Council for Voluntary Organisations (GLB 22)'. Government. *Parliament Publications & Records*. http://www.publications.parliament.uk/pa/cm201314/cmselect/cmpolcon/601/601vw23.htm.

UKERC, UK Energy Research Council. 2014. 'History: UK Energy Research Centre'. http://www.ukerc.ac.uk/support/tiki-index.php?page=History&structure=Home.

———. 2015. 'Conditions for Environmentally-Sound UK Shale Gas Development'. London: UKERC. http://www.ukerc.ac.uk/asset/8EF4541F-648E-46C4-A7805C4E65B90DE7/.

UKOOG, United Kingdom Onshore Oil and Gas. 2015a. 'Regulation - What Is the Process?' *UKOOG - Regulation*. http://www.ukoog.org.uk/knowledge-base/regulation/what-is-the-process.

———. 2015b. 'UKOOG | Press Releases'. *UKOOG - Press Releases*. http://www.ukoog.org.uk/about-ukoog/press-releases/121-ukoog-fit-to-frack-response UKOOG response to the 'Are we fit to frack?' paper.

United States Census. 2010. 'Resident Population Data - 2010 Census'. Government. *Census.gov*. http://www.census.gov/2010census/data/apportionment-dens-text.php.

United States Congress. 2005. *Energy Policy Act of 2005. 42 USC §13201 et Seq. (2005).* https://www.epa.gov/laws-regulations/summary-energy-policy-act.

Urbina, Ian. 2011a. 'Pressure Limits Efforts to Police Drilling for Gas'. *The New York Times*, Online Edition, March 3, sec. U.S. http://www.nytimes.com/2011/03/04/us/04gas.html.

———. 2011b. 'Insiders Sound an Alarm Amid a Natural Gas Rush'. *The New York Times*, Online Edition, June 25, sec. U.S. http://www.nytimes.com/2011/06/26/us/26gas.html.

———. 2011c. 'Behind Veneer, Doubt on Future of Natural Gas'. *The New York Times*, Online Edition, June 26. http://www.nytimes.com/2011/06/27/us/27gas.html.

US Government Track. 2015. 'Fracturing Responsibility and Awareness of Chemicals Act of 2015 (H.R. 1482)'. *GovTrack.us*. https://www.govtrack.us/congress/bills/114/hr1482.

Usborne, David. 2014. 'Rockefellers Go Green: Rockefeller Foundation Divests Funds in Fossil'. News. *The Independent*, Online Edition, September 22. http://www.independent.co.uk/environment/climate-change/rockefellers-go-green-rockefeller-foundation-divests-funds-in-fossil-fuel-industries-9749767.html.

van Asselt, Marjolein B.A., and Renn, Ortwin. 2011. 'Risk Governance'. *Journal of Risk Research* 14 (4): 431–49.

van der Veen, Robert Jan, and van der Brug, Wouter. 2013. 'Three Worlds of Social Insurance: On the Validity of Esping-Andersen's Welfare Regime Dimensions'. *British Journal of Political Science* 43 (2): 323–43.

Vaughan, Adam. 2013a. 'Fracking Won't Endanger UK's Climate Targets, Says Ed Davey'. *The Guardian*, Online Edition, September 9, sec. Environment. http://www.theguardian.com/environment/2013/sep/09/fracking-shale-gas-ed-davey-climate-change.

———. 2013b. 'Taxpayers to Pay for Fracking Pollution If Companies Go Bust'. *The Guardian*, Online Edition, December 11, sec. Environment. http://www.theguardian.com/environment/2013/dec/11/taxpayers-fracking-pollution-companies.

———. 2014. 'Public Support for Fracking in Britain Falls for a Second Time'. *The Guardian*, Online Edition, January 28, sec. Environment. http://www.theguardian.com/environment/2014/jan/28/fracking-protest-david-cameron-public-support-poll.

———. 2016. 'UK Support for Fracking Hits New Low'. *The Guardian*, Online Edition, April 28, sec. Environment. https://www.theguardian.com/environment/2016/apr/28/uk-support-for-fracking-hits-new-low.

Vaughan, Adam, and Mason, Rowena. 2015. 'Fracking Could Hurt House Prices, Health and Environment, Official Report Says'. *The Guardian*, Online Edition, July 1, sec. Environment. http://www.theguardian.com/environment/2015/jul/01/fracking-could-hurt-house-prices-health-and-environment-official-report-says.

Vaughan, Vicki. 2012. 'Fracturing "Has No Direct" Link to Water Pollution, UT Study Finds'. *Fuel Fix*. February 16. http://fuelfix.com/blog/2012/02/16/ut-study-fracturing-itself-not-connected-to-water-pollution/.

Vogel, David. 2012. *The Politics of Precaution: Regulating Health, Safety, and Environmental Risks in Europe and the United States*. Princeton University Press.

von Neumann, John, and Morgenstern, Oskar. 1944. *Theory of Games and Economic Behavior*. Princeton University Press.

von Neumann, John, and Morgenstern, Oskar. 1953. *Theory of Games and Economic Behavior*. 3rd edition. Princeton UP.

Walsh, M.P. 2011. 'Automobile Emissions'. In *The Reality of Precaution. Comparing Risk Regulation in the United States and Europe*, edited by Wiener et al., 142–58, New York NY: RFF Press.

Wang, M. 2006. 'Prospect-Theorie in Behavioural Finance'. ISB Zürich.

Warren, Bill. 2013. 'Chevron Fracks Europe: Transatlantic Trade & Investment Agreement Favors Big Energy Companies and Threatens the Environment'. *Friends of the Earth*. http://www.foe.org/news/archives/2013-05-chevron-fracks-europe-transatlantic-trade--investmen.

Warrick, Joby. 2015. 'U.S. Exports Its Greenhouse-Gas Emissions — as Coal. Profitable Coal.' News. *Washington Post*. October 15. https://www.washingtonpost.com/world/us-exports-its-greenhouse-gas-emissions--as-coal-profitable-coal/2015/10/08/05711c92-65fc-11e5-bdb6-6861f4521205_story.html.

Watson, Bruce. 2016. 'Have We Reached the Tipping Point for Investing in Renewable Energy?' *The Guardian*, Online Edition, February 13. http://www.theguardian.com/sustainable-business/2016/feb/13/renewable-energy-investment-fossil-fuel-divestment-investor-summit-climate-change.

Watt, Nicholas. 2014. 'Fracking in the UK: "We're Going All out for Shale,' Admits Cameron'. *The Guardian*, Online Edition, January 13, sec. Environment.

http://www.theguardian.com/environment/2014/jan/13/shale-gas-fracking-cameron-all-out.

Webster, Robin. 2013. 'UK Shale Gas Resources May Be Ten Times Less than Peter Lilley Claims | Carbon Brief'. http://www.carbonbrief.org/blog/2013/04/shale-gas-resources-versus-reserves/.

Weijermars, Ruud, and McCredie, Crispian. 2012. 'Inflating US Shale Reserves'. *Petroleum Review*, no. January 2012. https://www.energyinst.org/information-centre/ei-publications/petroleum-review/petroleum-review-january-2012.

Westfall, Christopher. 2005. 'How Did Catastrophe Models Weather Katrina?' *Insurance Journal West*. http://www.insurancejournal.com/magazines/features/2005/10/03/61170.htm.

White, Garry. 2011. 'Cuadrilla Admits Drilling Caused Blackpool Earthquakes'. *The Telegraph*, Online Edition, November 2. http://www.telegraph.co.uk/finance/newsbysector/energy/8864669/Cuadrilla-admits-drilling-caused-Blackpool-earthquakes.html.

White House. 2012. 'Securing American Energy'. *The White House*. White House/ Energy https://www.whitehouse.gov/sites/default/files/docs/aota_energy_strategy_as_a_path_to_sustainable_economic_growth.pdf.

Whitmarsh, Lorraine, Nash, Nick, Lloyd, Alyson and Upham, Paul. 2014. 'UK Public Perceptions of Shale Gas, Carbon Capture & Storage and Other Energy Sources & Technologies: Summary Findings of a Deliberative Interview Study and Experimental Survey'. Cardif University Working Paper.

Who's Lobbying. 2012. 'They Spent $3.5 Billion Lobbying in the USA - What's Their Activity in the UK?' Watchdog. *Who's Lobbying Blog*. February 29. http://blog.whoslobbying.com/post/18488136446/4billion-lobbying-spend.

Wiener, Jonathan B., Hammit, James, Rogers, Michael and Sand, Peter. 2013. *The Reality of Precaution: Comparing Risk Regulation in the United States and Europe*. London: Routledge; New York NY: RFF Press.

Wiener, Jonathan B. 2011. *The Reality of Precaution: Comparing Risk Regulation in the United States and Europe*. London; New York: RFF Press.

Williams, Jack. 2012. '"Shale Gas: An American Success Story," a Speech by Jack Williams'. Company Website. *ExxonMobil*. September 20. http://corporate.exxonmobil.com/en/company/news-and-updates/speeches/shale-gas-american-success-story.

Williams, Rhiannon. 2013a. 'Chris Huhne: UK May Have to Export Fracking Gas to Rest of Europe'. *The Telegraph*, Online Edition, September 30. http://www.telegraph.co.uk/news/earth/energy/fracking/10343489/Chris-Huhne-UK-may-have-to-export-fracking-gas-to-rest-of-Europe.html.

———. 2013b. 'Osborne: "I Would Love Fracking to Get Going in UK"'. *The Telegraph*, Online Edition, October 22. http://www.telegraph.co.uk/news/earth/energy/fracking/10396672/Osborne-I-would-love-fracking-to-get-going-in-UK.html.

Williamson, Claire. 2015. 'Fracking Banned in Northern Ireland for the First Time'. News. *The Belfast Telegraph*, Online Edition, September 28. http://www.belfasttelegraph.co.uk/news/northern-ireland/fracking-banned-in-northern-ireland-for-the-first-time-31564424.html.

Wingfield-Hayes, Rupert. 2016. 'Is Fukushima's Exclusion Zone Doing More Harm than Radiation?' *BBC News*, March 10, sec. Asia. http://www.bbc.co.uk/news/world-asia-35761136.

Wolf, Martin. 2014. 'Make Policy for Real, Not Ideal, Humans'. News. *Financial Times*. December 16. https://www.ft.com/content/8d3b623e-8099-11e4-872b-0144feabdc0.

———. 2015. 'The Riches and Perils of the Fossil-Fuel Age'. News. *Financial Times*. March 3. https://www.ft.com/content/fdcf2e1e-c0ee-11e4-876d-00144feab7de.

Wolfe, Tom. 2005. *The Right Stuff*. London: Vintage.

Woll, Cornelia. 2008. *Firm Interests: How Governments Shape Business Lobbying on Global Trade*. London: Cornell University Press.

———. 2006. 'Lobbying in the European Union: From Sui Generis to a Comparative Perspective'. *Journal of European Public Policy* 13 (3): 456–69.

World Bank. 2011. 'CO2 Emissions (Metric Tons per Capita) | Data'. Data. *CO2 Emissions*. http://data.worldbank.org/indicator/EN.ATM.CO2E.PC?page=1&year_high_desc=false.

WRI. 2013. 'Shale Gas | World Resources Institute'. *WRI Project Shale Gas*. http://www.wri.org/project/shale-gas.

Wright, Simon. 2012. 'An Unconventional Bonanza'. *The Economist*, July 14. http://www.economist.com/node/21558432.

Yanagizawa-Drott, David. 2014. 'Propaganda and Conflict: Theory and Evidence from the Rwandan Genocide'. *The Quarterly Journal of Economics 129 (4): 1947-1994*.

Zaragoza, Sandra. 2012. 'University of Texas Gets $3.9M Donation from Shell Oil - Houston Business Journal'. http://www.bizjournals.com/houston/news/2012/02/15/shell-oil-invests-39m-in-ut.html.

Appendix

Supplementary documents are provided in electronic form due to their length.