

**An organisational fields analysis of the governance of
coal: insights into the prospects for the sustainability
of 'new coal'**

Claire Frances Bastin

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The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

The UK has a protracted history with coal production and use. Whilst now in significant decline, until recently coal was a staple in UK energy generation despite concerns about the environmental and social impacts of its use. New 'clean' coal technologies, i.e. where emissions are reduced or abated using technical enhancements such as Carbon-dioxide (CO₂) Capture and Storage (CCS), have been proposed as a means of reducing harmful emissions, whilst maintaining coal use in energy production. Yet, in the UK, targets for coal with CCS projects have not been met (Department for Energy and Climate Change (DECC), 2010).

This research builds on and extends the concept of organisational fields to explore the interesting case study of coal use in the UK from c1960 to the present day. It considers the influence of multi-level, multi-actor (ML/MA) governance arrangements on the prospects for the sustainability of coal. By illuminating organisational fields of governance that emerge over time and at different levels (UK and Yorkshire & Humberside), it adds a significant temporal dimension to ML/MA debates. The research findings, therefore, go beyond a snap-shot or single policy approach to illuminate the agency and motivations of different actors in steering continuous patterns of development. In doing so it reveals previously unknown field dynamics.

The insights developed show that dynamic processes of replication within organisational fields create a 'wicked' (Rittel and Webber, 1973, p.160) problem with disconnects both between and within fields. Specifically, social and environmental fields have become diffuse, heterogeneous and unpredictable. In contrast, economic fields have become more focused and centred with dominant actors exhibiting power beyond the economic organisational fields. This wicked context has potential for conflict and contestation and makes outcomes from ML/MA governance arrangements difficult to predict. Ultimately, this has important implications for the sustainability of future coal use.

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Abbreviations

| | |
|-----------------|---|
| BATT | Best available technologies and techniques |
| BAU | Business as usual |
| BEIS | Department for Business, Energy and Industrial Strategy |
| CC | Climate change |
| CC | Carbon capture |
| CCA | Climate Change Act 2008 |
| CCGT | Combined cycle gas turbine |
| CCS | Carbon dioxide capture & storage |
| CCSA | CCS Association |
| CCUS | Carbon dioxide capture, utilisation & storage |
| CEGB | Central Electricity Generating Board |
| CPF | Carbon price floor |
| CO ₂ | Carbon dioxide |
| CPS | Carbon price support |
| CR | Critical realism |
| CSR | Corporate Social Responsibility |
| DCO | Development Consent Order |
| DECC | Department of Energy & Climate Change |
| Defra | Department of the Environment, Food and Rural Affairs |
| DoE | Department of the Environment |
| EA | Environment Agency |
| EMR | Electricity Market Reform |
| EOR | Enhanced oil recovery |
| ETS | Emissions Trading Scheme |
| EU | European Union |
| FEED | Front End Engineering Design |
| FoE | Friends of the Earth |
| GCCSI | Global CCS Institute |
| GDP | Gross Domestic Product |
| GHG | Greenhouse gas(es) |
| GP | Greenpeace |
| HDR | Human Development Report |

| | |
|---------|---|
| IEA | International Energy Agency |
| IED | Industrial Emissions Directive |
| IGCC | Integrated Gasification Combined Cycle |
| IPCC | Intergovernmental Panel on Climate Change |
| LCPD | Large Combustion Plant Directive 2001 |
| LEP | Leeds City Region Local Enterprise Partnership |
| ML/MA | Multi-level, multi-actor |
| MWe | Megawatt electricity |
| MWh | Megawatt hour |
| NAO | National Audit Office |
| NCB | National Coal Board |
| NGO | Non-governmental organisation |
| NRNR | Non-renewable natural resources |
| NUM | National Union of Mineworkers |
| RDA | Regional Development Agency |
| RSPB | Royal Society for the Protection of Birds |
| SD | Sustainable Development |
| SDC | Sustainable Development Commission |
| SDG | Sustainable Development Goals |
| SEA | Scottish Environment Agency |
| SoS | Secretary of State |
| TUC | Trades Union Congress |
| UKCCSRC | UK Carbon dioxide Capture & Storage Association |
| UN | United Nations |
| UNDP | United Nations Development Programme |
| UNFCCC | United Nations Framework Convention on Climate Change |
| WCA | World Coal Association |
| WCED | World Commission on Environment and Development |
| YF | Yorkshire Forward |

Chapter 1 – Coal use in the UK: Framing a wicked problem

1.1 Introduction

This thesis conceptualises coal use in UK electricity generation as a wicked problem (Rittel and Webber, 1973, p.160); one that is multi-layered, complex and has multiple, competing explanations. It uses both governance and sustainability as organising principles to explore, characterise and understand the changing features of the governance of coal and implications for the prospects and sustainability of coal use in the UK.

Following Stoker (1998) and Rhodes (1996) this research views governance as an 'imprecise' term (ibid., p.652), but one that is often used to describe conditions by which actors beyond state governments have roles in shaping society. However, whilst imprecise, using governance as an organising principle allows for a rich and 'thick understanding' (Geertz, 1973, p.14) of the processes and outcomes of governance (Adger and Jordan, 2009). In this thesis, these are viewed as inextricably linked with the processes and outcomes of sustainability (Farrell et al, 2005, pp. 129-130; Lemos and Agrawal, 2006).

The thesis explores the case of coal use in electricity generation in the UK between the 1960s and the present day. It considers the implications of new governance mechanisms on the changing market for coal and for the sustainability of 'new' or 'clean' coal, i.e. where emissions from coal are reduced or abated using technical enhancements such as Carbon-dioxide (CO₂) Capture and Storage (CCS). To do this, an analysis of the discourse (Dryzek, 2005) relating to the governance of coal has identified distinct organisational fields (DiMaggio and Powell, 1983). Going beyond traditional uses of organisational fields as collections of organisations that, together, create an institutional setting, this thesis generates new 'organisational fields of governance'. These show that more than the *formal*, nominally 'new' governance arrangements for coal exist. Instead in reality, multiple, overlapping and distinct organisational fields that illuminate previously unknown agency and motivations become evident. This complex institutional setting creates pressures and dynamics both between and within fields which have been identified and are presented here.

The research characterises the organisational fields in to distinct eras of governance. These demonstrate that, over time and at different levels of analysis, economically, socially and culturally driven disconnects, both between and within organisational fields of governance, have emerged. This characterisation contributes a novel temporal dimension to the discourse on multi-level, multi-actor (ML/MA) arrangements intrinsic to new governance in wicked contexts. This deep and rich understanding of both the temporal dimension and the dynamics between and within organisational fields of governance at different levels has important implications for the future of coal in the UK.

Following this brief preamble, this chapter further conceptualises and problematises the wicked problem of coal use in UK electricity generation in section 1.2. Together sections 1.1 and 1.2 provide context for the research aims and objectives set out in section 1.3. Section 1.4 then signals the novel contribution this research makes. Finally, section 1.5 details the logic and structure of this thesis.

1.2 UK coal use, a wicked problem

Coal use is increasing globally (Shearer, 2018), but is in significant decline in the UK, (Department for Business Energy and Industrial Strategy (BEIS), 2018a, ET4.2; Carbon Brief, 2016, 2017; Appendix A), and the UK Government has announced its intentions to further reduce unabated coal by 2025 (BEIS, 2016). However, during the early part of the 21st century, and despite government and industry targets to reduce its use (Smith, 2010, p.100; Department for Energy and Climate Change (DECC), 2012a), coal accounted for over one third of the electricity generated in the UK (Digest of UK Energy Statistics (DUKES), 2015, ET2.1). Coal is the most carboniferous fossil fuel (US Energy Information Administration, 2016) and issues relating to the sustainability of its combustion - climate change, public health factors, resource depletion, water use, land use, risk - are well documented. Yet during these peaks in coal use, and currently, electricity from coal is generated from unabated¹ coal fired power stations characterised throughout this thesis as 'old coal'. In addition, as discussed in chapter eight, energy transitions away from

¹ That is coal fired power stations without emissions abatement technologies such as CCS.

coal, to alternative lower carbon sources of energy have been slower than predicted (Commission on Climate Change (The CCC), 2018a; Carbon Brief, 2017), and the UK stands at a critical juncture in energy policy if it is to be able to meet its targets for CO₂ emissions reductions (The CCC, 2018b)

Technological solutions to this paradox are being sought by industry and government actors as a means of balancing competing demands. The timely introduction of so called 'new' or 'clean' or 'sustainable'² coal technologies (BEIS, 2017a; DECC, 2010a, 2012; World Coal Association (WCA), 2012, 2015), have been discussed as a means of reducing CO₂ emissions whilst maintaining business as usual (BAU) governance arrangements, operations and infrastructure.

One such technology, CCS with coal, was widely discussed as a means of reducing carbon emissions in the atmosphere. In 2009 the UK Government³ announced that no new coal fired power stations would be built in the UK without CCS technology (Carrington, 2009). For some, however, new coal technologies have been viewed as a temporary fix at best and, at worst, a risk laden endeavour which will neither mitigate against the causes of climate change (Tickell, 2015), nor help societies develop sustainable energy solutions. In this latter view, a technical solution to *capture* rather than reduce or prevent CO₂ emissions, may be preferable to unabated coal, but cannot be viewed as environmentally, socially or economically sustainable.

From the 1980s onwards, successive UK governments have offered differing views on the desirability of continued use of coal in the energy mix with implications for the future of this key resource. From the miners' strikes of the 1980s to commitments to reduce NO_x and SO₂ in the 1990s and latterly CO₂ emissions,⁴ 'coal' use in and of itself, may be considered a political issue with economic, environmental and social consequences. This is especially (but not

² Hereafter 'new coal'. The term new coal rather than clean coal is adopted here to avoid conflation of the concept and the technologies. However, unless identified in quotations the terms are used synonymously.

³ Then Labour under Gordon Brown

⁴ Largely through legislative and regulatory processes e.g. the planned closure of coal fired power stations under the EU Large Combustion Plant Directive (LCPD), EU Industrial Emissions Directive (IED), Climate Change Act 2008. See chapter 8 for full discussion.

uniquely⁵) the case in the UK, particularly in former coal mining regions that remain hosts to the electricity generation infrastructure now often located close to coal mines (Pearce and Evans, 2015, no pagination).

As with all matters relating to sustainable development (World Conference on Environment and Development (WCED), 1987, p.43), features of the debate on continued coal use spread wider than the environmental arena. The legacy of a coal mining industry in the UK, now reduced but once significant, continues to have local (Beatty, Fothergill and Powell, 2007) and national, economic, social and environmental relevance; in particular for those regions that still host coal fired power stations. In these coalfield regions, such as Yorkshire, North Nottinghamshire and Wales, associated physical infrastructure (transport links, workers' housing, power stations) and social institutions (generations of mining families, trades unions, mining communities) were built around coal. Typically, whilst low carbon developments are being planned (for example see the Teesside Collective), such former coalfield regions are now poor and underdeveloped with high levels of unemployment, (Foden, Fothergill and Gore, 2014; Strangleman, 2001), poor health, and worsening environmental outcomes (Royal Society for the Protection of Birds, 2013, 2016).

To add a further layer of complexity, in order to avoid the worst impacts of climate change, it is crucial that a *timely* alternative to unabated coal is established in line with international targets for greenhouse gas (GHG) reduction (DECC, 2012a; International Energy Agency (IEA), 2016); even though coal use has decreased, this remains a priority. In this view, if CCS is not deployed, the UK will find it at best difficult and, for many observers impossible, to make the required deep cuts to CO₂ emissions (The CCC, 2018b; National Audit Office (NAO), 2017a; Haszeldine, 2015; IEA, 2017; 2015; International Panel on Climate Change (IPCC) 2014; DECC, 2012a) required under the Climate Change Act of 2008. However, projects to test CCS have faltered in the UK. In April 2012, the Coalition Government launched a CCS Roadmap and competition to demonstrate commercial scale CCS (DECC, 2012a) on fossil fuel power plants. The Roadmap included

⁵ Consider, for example, attempts by US President Donald Trump to bolster the US coal sector in order to garner votes and the resultant increases in coal production (<https://www.eia.gov/todayinenergy/detail.php?id=34992>).

£1 billion in funding to support development of full-scale CCS by 2020 (ibid., 4). However, in December 2015, the then Conservative Government removed its support for the programme. There are now no commercial scale CCS projects in the UK and targets, originally established in 2012, for four plants being operational by 2018 (DECC, 2012b) will not now be met with potentially harmful consequences (Global CCS Institute (GCCSI), 2016).

As discussed further in chapter two, since the 1980s with the intentional '*rolling back of the state*' (Scott, 2013, p.65; Pierre and Peters 2000), and its planned replacement with multi-level/multi-actor approaches to governance (Gillard et al, 2016), the mechanisms and institutions, processes and outcomes of governance have changed. This is perhaps especially significant for coal production and use with private ownership of formerly state-run industries, and complex and contradictory planning, taxation and subsidy policies governing coal use.

An additional feature of the wider debate relevant for the wicked problem of continued coal use, is that the stated level at which governance activity occurs also fluctuates between national, international and sub-national (Drake, 2009). This period of fluctuation coincided with recognition of borderless intergenerational, environmental problems; biodiversity loss, ozone depletion, climate change. As a result, state actors, as well as civic and corporate actors at different levels of governance become, at least nominally, part of ML/MA, market friendly forms of governance (Baker & Eckerberg, 2010; Adger and Jordan, 2009; Gouldson and Murphy, 1998).

Finally, as discussed in chapters five and seven, continued coal use is essentially resource depleting, CCS is an end of pipe technology therefore difficult to consider as a sustainable energy solution. What becomes interesting in this thesis is the extent to which new coal, whilst characterised as a new clean technology, remains inextricably, structurally, institutionally, culturally linked with 'old coal'. Similarly, the extent to which new governance is inextricably, structurally, institutionally, culturally linked with old governance in wicked contexts – in ways that are perhaps uncharted or not fully understood elsewhere – is illuminated here.

Sustainability can in and of itself be considered a complex issue (WCED, 2008; Kasemir et al, 2003) and within it issues of complexity, i.e. those that legitimately have many descriptions and potential outcomes (Casti, 1986) require innovative approaches to research. From an ontological perspective, this research begins by examining changes in governance arrangements, actors and entities over the period 1970 to 2014. Using an analytical framework developed from Dryzek (2005) for discourse analysis, it examines changes in organisational fields over time, in terms of structure, agency at both UK and local level. It finds the discourse on coal use has changed from one dominated by the view that 'coal is king' (and accepted as an environmental bad because of its economic and public goods), to coal seen as either a win-win low carbon, or a contested, energy option resulting from institutional carbon lock-in (Unruh, 2000) in this period. The research then goes on to explore the changes in the market for coal and CCS between 2014 and 2018 following the UK Government's withdrawal from CCS development programmes.

The problem of continued coal use for electricity generation in the UK, either unabated in existing coal fired power stations or using new coal technologies yet to be developed, has been characterised here as wicked. Rittel and Webber (1973) have framed such problems as those that are difficult or impossible to solve. Conklin (2006) also describes wicked problems as those that are difficult to resolve and where incomplete, contradictory or changing features of the problem overlap and are difficult to recognise. In this case, coal use and plans for its decline are considered as problems with multiple levels of complexity which may be framed in different ways depending on different actors' views and understandings of the problem. To gain a sufficiently rich understanding of coal use in the UK and, specifically, why a technology once heralded as the UK's best chance of mitigating against climate change⁶ has faltered, it is necessary to look beyond individual policies or pathways.

The issue is complex and contested. Within the discourse on coal use, key environmental and distributional questions arise. These questions link to debates on the processes and outcomes (Adger and Jordan, 2009) of

⁶ I.e. CCS with coal

sustainability and governance which are intertwined with debates on power (Lukes, 1974, 2005; Clegg, 1989) and justice at multiple levels of society (Jessops, 2004). Given the complexity of the problem with economic, social and environmental dimensions, and that the UK has what will be shown in this thesis to be a protracted history with coal, the historical social science approach adopted is appropriate for this research. Discourse analysis of interview, observation and bureaucratic data from 1960 to June 2018 is used to discover key governance metaphors and rhetorical devices (Dryzek, 2005) evident throughout the period of study (c1960 to c2014). As a result, the actors, relationships and entities embedded within metaphors are discovered and explored in ways that illuminate the complexities embedded within the wicked problem of coal use.

This brief introduction to core features of the discourse on continued coal use in the UK, suggests that key distributional questions - scalar, temporal, agency, economic, environmental and social – remain unanswered. In order to begin to consider these questions in useful depth, this research critically examines the evolution of social, economic and environmental organisational fields. Using the terms governance and sustainability as 'organising principles' (Baker and Eckerberg, 2010, p.6), the research adopts a multi-methods approach appropriate to this challenging environmental social science problem (Creswell, 2013).

To summarise, continued coal use in energy generation in the UK, whilst in decline, is characterised here as a wicked social and environmental science problem; complexities exist and are not well understood, in particular in terms of their emergence over time. The thick and rich, empirical and theoretical, understanding of the emergence of the current context as presented here matters for such wicked, complex environmental and social science problems. The conceptual aim of this research is to explore and explain whether new forms of governance influence the sustainability of coal use in UK energy generation. In order to address this aim, this research considers governance and sustainability of coal over time and at two levels (Gibson et al, 2010; Cash et al., 2006); UK and Yorkshire and Humberside.

1.3 Research aims, objectives and questions

The primary aim of this research is to establish whether, why and how new forms of governance affect the prospects for the sustainability of 'new coal'. The overarching research question simply reflects closely the research aim.

Do new forms of governance affect the prospects for sustainability of 'new coal'? If so, how and why?

The core research objectives are to:

1. Provide a characterisation (with theoretical and analytical underpinning) of coal use in the UK using governance and sustainability as organising principles.

Associated research question:

- a. What are the key characteristics of governance and sustainability relevant for UK coal use in electricity generation, in terms of:
 - Governance arrangements
 - Actors, agency and relationships
 - Organisations and institutions (entities)?
2. Develop a critical understanding of the existence and evolution of organisational fields of governance over time and at multiple levels, for the case of UK coal use.

Associated research questions:

- a. Are organisational fields of governance evident?
- b. Have these changed over time, if so how and why?
- c. Do organisational fields differ at different levels of governance? If so how and why?
- d. Why and how have changes occurred? What are the changing 'forces' for organisational fields for governance over time and at different levels?

3. Draw from this, conclusions on the prospects for sustainability of new coal and coal use. Contribute to knowledge on whether, how and why new forms of governance make 'new coal' more sustainable than 'old coal'. Provide recommendations for practice and policy in wicked contexts.

Associated research questions:

- a. What are the implications for continued coal use and sustainability of new coal?
- b. What are the implications for policy development?

These research objectives introduce interesting temporal and scalar issues relating to the evolution of governance without making '*...die hard ontological and epistemological commitments*' which may '*...blind us to alternatives because they mean that we view the world in a particular way*' (Burrell and Morgan, 1979, p.24).

This research has three main research purposes; description, understanding and change (Blaikie, 2010, p.59). It is essential given the breadth of purpose here, and complexity of the wicked phenomenon under study, that the ontological approach adopted reflects these layered purposes. Table 1 below summarises how this thesis is structured in order to address this issue.

| <i>Research</i> | <i>Research purpose</i> | <i>Chapter</i> |
|-----------------|------------------------------------|----------------|
| 1a | Description | 2, 4, 5, 6, 8 |
| 2a, b | Description | 4, 5, 6 |
| 2c | Description, understanding | 4, 5, 6, 8 |
| 2d | Understanding | 2, 6, 7, 8 |
| 3a | Understanding, change | 7, 8, 9 |
| 3b | Description, understanding, change | 1, 7, 8, 9 |

Table 1 Research questions and purpose with corresponding chapters

1.4 Novel contribution

Ultimately, this research employs well established terms to empirically and theoretically explore the important, but currently not well understood dynamics,

relationships and connections inherent to sustainability, in a real world context. In addressing these aims this thesis contributes to debates on the shaping of processes and outcomes of multi-level, multi-actor (ML/MA) or new governance arrangements. Specifically, this research makes epistemological, conceptual and applied contributions to knowledge in three main ways.

Firstly, from an epistemological and conceptual perspective, this research builds on and extends organisational fields literature to develop fields of governance as the unit of analysis. This novel approach adds strength to the use of fields as a legitimate means of exploring issues of power and agency when attending to wicked problems, in this case coal use. The organisational fields of governance developed in this research, look beyond a specific governance mechanism, policy or instrument. In this way, the inherent complexities of the wicked problem of coal use have been conceptualised and problematised effectively.

Chapters three and seven explore this process of conceptualisation in more depth, but to summarise here, in wicked contexts, examination of individual organisations, specific sectors or institutional scales at a single point in time would not sufficiently have addressed the complexity. Instead by critically reflecting on the *evolution* of governance and sustainability processes and outcomes, this research contributes to a better understanding of a wicked social and environmental problem. Bringing the use of organisational fields as a unit of analysis in to the governance literature in this way creates a deeper and 'thicker' (Geertz, 1973, p.14) understanding of the processes of change over both time and levels. This is a novel contribution to the governance literature, both in terms of using the organisational field as the unit of analysis and in developing a useful case to explore complex governance themes.

Following Dryzek (2005), the research identifies metaphors and the actors, entities and relationships within them to create a characterisation of multiple eras of governance of coal. This unique characterisation illuminates forces and dynamics of change, including the emergence of both consolidating and disconnecting forces over time. The insights drawn from this historical, explorative approach to the 'how' and 'why' questions posed, have not simply added a novel ontological dimension, but also, significantly, illuminated the *emergence* of current governance arrangements in terms of both structure and

agency. In contrast to pluralist descriptions of governance (Lindblom, 1979), this thesis finds that the power (Lukes, 1974) and agency of few dominant, in particular Government actors with political and nominally economic motives, is significant in determining governance processes, even where multiple actors are, ostensibly at least, involved in determining outcomes.

Dynamic processes of replication and isomorphic change happen within organisational fields. The concept of isomorphism has been used to describe the tendency for organisations to merge or homogenise over time (DiMaggio and Powell, 1983). Here, as discussed in chapters three and seven, in keeping with Milstein et al (2002, p.152) the concept is used to show that contrary to traditional views on change, isomorphic pressures do not always lead to homogeneity *within* the field. More specifically, this research shows that structure and agency issues can lead, over time, to diffusion within fields and disconnects between fields, as where powerful actors are dominant their interests are served. This diffusion makes outcomes from specific governance mechanism such as public engagement activities, or any single policy for example, difficult to predict. It also creates potential for conflict and contestation. In contrast, the economic field has become more focussed, centred and, evidently, dominant beyond economic organisational fields boundaries. This has important implications for sustainability in nominally ML/MA settings.

The second methodological contribution this research makes is that case specific outcomes relating to power and agency dynamics within ML/MA governance arrangements are generalizable to wider contexts. Because of the conceptual strength of organisational fields (DiMaggio and Powell, 1983; Hoffman, 2001, pp.34-35), case specific outcomes relating to power dynamics at different levels of governance (Gibson, 2010; Cash 2006) are generalizable to other wicked problems. In this sense, in agreement with Sneddon et al (2006), this research finds that '*...a pluralistic, critical approach to sustainable development offers fresh interpretations of intractable environment-development dilemmas*' (ibid., p.255), but critiques the extent to which this approach is adopted in wicked contexts. The bringing together of critical approaches to discourse analysis with the strength and legitimacy of new

institutionalism to explore a case study, overcomes critiques of the case study as a limiting tool (Yin, 2014).

In particular, this research proposes that wicked phenomena are likely to emerge where structural and agency imbalances have arisen over time. In such circumstances, the efficacy of new governance mechanisms as a means of *stimulating* and delivering sustainable development⁷ is limited. For the case of coal use in the UK, this research shows that place specific, economic, environmental and social drivers have led to diffuse social and environmental organisational fields. It also shows that whilst dominant throughout the discourse, the economic field consolidates over time and at both levels of enquiry. A final interesting feature of the case study is that actors operating at national level within the economic field have control over decisions (and non-decisions (Clegg, 1989, p.11)), policy instruments and action beyond the economic sphere. This dominance of economic actors, together with the legacy effect of coal, has implications for justice and power, and ultimately sustainable development at different levels discussed in chapter seven.

Thirdly, this research shows that the temporal dimension developed here not only adds complexity and conceptual interest to the *problem*, but also creates opportunities for greater understanding of wicked contexts in other applied settings. The research therefore lends support to practitioner and academic literature relating to limits of 'one-size-fits-all' governance arrangements, by efficiently illuminating features of wicked contexts such as coal use in the UK, that need to be focused on by policy makers if multi-level, multi-actor arrangements are to be directed to shape sustainability outcomes.

1.5 Structure of the thesis

The structure of this thesis follows a traditional logic which frames then explores the environmental social science problem under consideration. Following this introductory chapter, which presents a contextual narrative, chapter two provides in depth coverage and critical reflection of the literature with particular interest in implications and emergence of new governance arrangements for sustainable development, including the role of government,

⁷ Sustainability and sustainable development are used synonymously for grammatical reasons unless otherwise stated.

private and civic actors in decision making. Chapter three details the ontological and epistemological assumptions adopted in scoping and designing this research. It then describes and reflects on the methodological and analytical approaches employed. The remainder of the thesis then proceeds in six parts: three analytical chapters, each corresponding to an identified governance era and/or level, present the research findings. Together, these create a substantive narrative and deep understanding of the evolution of contemporary governance of coal. Chapter seven then presents an in-depth discussion that draws out themes emerging from the research. This discussion chapter critically reflects on the prospects for sustainability of 'new coal'. Chapter eight brings the thesis up to date with a critical reflection on changes to governance and policy conditions relating to coal use and the changing market for coal and CCS between 2013 and 2018. The final concluding chapter reiterates the contribution to knowledge made by this research, provides an internal critique of the thesis to address its limits, and suggests future direction of research.

Chapter 2 - Historical context of governance and sustainability of coal use

Economic, social and political factors drive the continued extraction and use of fossil fuels for electricity generation, despite recognised concerns over the sustainability of their use. Energy security, economic growth, stable commodity prices for coal, profit maximisation of firms and electricity demand amongst others, are all factors driving continued coal use for electricity generation. The challenges of anthropogenic climate change and environmental degradation associated with coal and other fossil fuel use are, however, clear; GHG emissions, public health concerns, underdevelopment in coalfields, environmental degradation. Individual nation states, including the UK, are responding to these global challenges in different ways for example by setting targets, notably Kyoto (United Nations Framework Convention on Climate Change (UNFCCC), 1997) and the Paris Climate Agreement (UNFCCC, 2015). In the UK the establishment of legislation and a legally binding policy framework under the Climate Change Act (2008), is designed to cut carbon emissions or otherwise mitigate against anthropogenic climate change. The establishment of emissions reductions targets delivered via five carbon budgets is considered an effective and innovative approach to climate change (Gillard, 2016, p. 26; The CCC, 2017) and considerable reductions in emissions have been witnessed (BEIS, 2018a).

To date, activity designed to meet targets, has focused on reducing carbon intensity of the energy sector; coal reduction has played a significant part in achieving emissions reductions (The CCC, 2017). New energy technologies are also being sought as one of a number of means of meeting GHG reduction targets (DECC, 2012a; BEIS, 2017a). In keeping with this focus, new, clean or sustainable coal technologies are being designed to reduce the environmentally harmful effects of coal combustion (Haszeldine, 2016). Clean coal technologies include; integrated gasification combined cycle (IGCC), flue-gas desulfurization, fluidized-bed combustion, low nitrogen oxide burners, and of particular interest in this thesis, Carbon Capture and Storage (CCS) (Haszeldine, 2016; WCA, 2018; Coal Industry Advisory Board, 2008). As discussed in this thesis, the latter, CCS, has become synonymous with new coal over other clean coal technologies. However, as noted in chapter one, as an end of pipe technology, CCS is a contested technology and considered a

temporary fix at best by some contributors (Tickell, 2015; Rochone, 2008; Flannery, 2007). For these actors, the environmental impacts of coal extraction and the technical unknowns associated with full chain CCS make new coal an unfavourable, albeit low carbon, technology. In this view, as a short-term measure to reduce carbon, CCS cannot sustainably contribute to either mitigating against anthropogenic causes of climate change or adapting to the effects of climate change. As this research will go on to demonstrate, others still, argue that CCS is not simply desirable, but essential if we are to reach emissions reduction targets in a broadly BAU context (BEIS, 2016; DECC, 2008, 2012; GCCSI, 2011, 2016).

An additional layer of complexity, raised in chapter one and discussed in chapter eight, is that in recent years, CCS, and other low carbon energy developments, have faltered and derailed where options for development are, typically, not deemed economically viable. Academic, practitioner and political debates relating to new coal are further complicated, by temporal issues; whilst CCS demonstration projects have been developed, new technologies have not been fully tested at scale⁸. Questions have been raised over whether these delays in CCS development are a consequence of technical, or economic, political or social issues (GCCSI, 2016; Haszeldine, 2016, p.222; Greenpeace, 2008a). Core debates explored here with particular reference to coal (new coal and old coal) and CCS - governance and regulation of new technologies, the role of civic, corporate and other non-state actors, social, economic and environmental justice and sustainable development - are timely given continued unabated, albeit reduced, coal use in the UK.

To date, literature relating to continued coal use in the UK has predominantly focused on assessing either financial or technical features⁹ (Haszeldine, 2012; Scott et al 2013) or public acceptance (Markusson 2013; Ashworth et al 2010, 2012; Brunstig and Upham, 2011; Upham and Roberts, 2011). The aim in both literatures has been to guide or shape the direction and acceptance of this technology. Whilst the latter literature usefully highlights the limits to public

⁸ Carbon Capture is not a new technology, and each aspect of the full chain has been tested at industrial scale (Haszeldine 2016). However, demonstration of full chain technology i.e. capture, transport and storage of CO₂ generated from power plants is at an early stage (GCCSI, 2018; Massachusetts Institute of Technology (MIT), 2018).

⁹ It must be noted here that a review of technical literature on CCS is beyond the remit of this thesis. For a useful summary see Rackley, S. 2010.

engagement (and this research builds on these solid foundations), existing works are arguably too narrow in focus and ‘theoretically opaque’ (Jordan, 2008) in terms of implications for governance and sustainability of this, and other, new technology. This research expands the debate from a narrow, snapshot focus of a specific technology, policy or government intervention, to consider and propose organisational fields of governance as the unit of analysis.

Drawing upon a range of interdisciplinary debates and insights, this chapter advances a conceptual framework that seeks to capture the core elements of the literature in these debates. It provides a useful backdrop to suggest how and why the current governance context has emerged and ultimately considers whether new forms of governance have implications for sustainability of new coal. The discourse is broad and varied and consensus amongst academics, practitioners and other stakeholders difficult to attain. However, by applying the lens of governance and sustainability to this problem, an understanding of, risks, complexities and paradoxes associated with spatial and temporal justice and power inequalities (economic, social and environmental) emerges. The resultant long exposure picture suggests that the future of a low carbon technology of coal and CCS as a *sustainable* solution to complex problems is questionable. Furthermore, what emerges, is that moves towards governance for sustainability; corporate and public engagement in decision making, new governance arrangements to promote green growth for example, are not sufficiently ingrained, granular or heterogeneous as would be necessary to meet sustainable development aspirations.

Two dominant literatures, governance and sustainability, and their relevance to the research challenge at hand are explored here. For Petschow (2005), linking these two literatures adds analytical strength to the debates which enables innovative insights in to this paradox (ibid., p9). In this sense, it is important to look at both literatures (as well as the junctures between them), as this wicked context can legitimately be portrayed as an issue of ‘*unsustainability*’, and therefore a ‘*crisis of governance*’ (Adger and Jordan 2009, xvii).

Following this preamble, section 2.1 continues with a brief profile of coal at two levels of enquiry; the national, UK level, and the sub-national Yorkshire and

Humberside. Section 2.2 and 2.3 then consider the two conceptual terms important to this thesis, sustainability and governance, respectively. Finally, section 2.4 provides a brief summary of the contribution chapter two makes to achieving the research objectives.

2.1 A profile of coal at two levels of enquiry

Coal use has a strong economic and social history in the UK; coal fuelled the industrial revolution, and at its peak, coal mining offered employment to hundreds of thousands (Beatty et al, 2007; The National Archives, 2014). In the 1940s and 1950s, the newly nationalised mining and power industries contributed significantly to post war recovery and growth (Humphrey and Stanislaw, 1979). Conversely, eras of boom and bust, economic underdevelopment, poverty and unemployment, social upheaval and disenfranchisement have been, in part at least, attributed to the collapse of coal mining and the industrial heartlands in 1980s and 1990s UK (Aragon et al, 2015; Foden et al, 2014; Strangleman, 2001).

At the level of the coalfield, for example in Yorkshire and Humberside, coal connects with heritage (Hall, 1981; Strangleman, 2001) and its continued use remains, in short, relevant. Recent mine closures and public inquiries in to police behaviour during mining strikes for example (BBC, 2015) have re-ignited debates on the significance of coal use in regions where mining and electricity generation have historically played a key part in local economies. This thesis proposes that new coal and CCS developments cannot be viewed in isolation from these debates on the legacy issues surrounding coal use.

2.1.1 UK coal usage for electricity generation

As noted in chapter one, coal use for electricity generation fluctuates during the period under study. Appendix A provides a summary of coal use statistics, some key points to note include:

- Between 2000 and 2012, coal accounted for an average of 35% per cent of the total electricity generated in the UK, with peaks in 2007 (37%) and 2012 (41%).

- Following a peak in 2007, coal use for electricity (trend) gradually fell in line with cheaper gas prices until 2011, and then increased again in 2012 and 2013 to 54.91million tonnes.
- Annual coal use (tonnage) for electricity generation increased over the period 2000 to 2013 by 6.7%.
- At peak usage times, coal use is estimated to be in the region of 50%.
- In 2012, the year the UK Government launched its CCS Roadmap (DECC, 2012a), usage was 7.42% higher than the average for the period 2000 to 2012 and 19.65% higher than in 2011.
- From 2015 onwards, coal use has been in decline.
- In April 2017, the UK experienced its first 24-hour period without using coal in electricity generation since the 19th century.
- In 2017 and 2018, coal use continues to decline but high levels of usage are witnessed during periods of cold weather.

As will be discussed in full in chapters five, seven and eight, higher (or at least comparable) levels of price uncertainty, immediate infrastructure costs for other low carbon energy options (for example natural gas, nuclear, renewables), contribute to coal's continued use. For much of the 20th and early twenty first centuries, eroding cost advantages in reducing coal as a feedstock for electricity generation (including associated costs of NO_x, SO₂ and CO₂ emissions reductions and plant closures under the EU Large Combustion Plant Directive (LCPD) and subsequently the Industrial Emissions Directive (IED)), have not been sufficient to offset low and stable commodity prices (UK CCS Research Council (UKCCSRC), 2013). In addition, whilst policy interventions and carbon taxation have been shown to impact coal use, there are limits to the extent to which further cuts are feasible under current policy conditions (The CCC, 2018b).

2.1.2 Coal and CCS

CCS is promoted as a technology option which potentially allows for continued coal use whilst significantly reducing carbon released into the atmosphere in a cost effective manner (DECC, 2012b; GCCSI, 2016; Haszeldine, 2016; WCA, 2012; Ashworth et al, 2010). Yet full chain use of CCS to abate emissions from coal and gas in energy generation remains a largely untested technology,

and questions exist over whether options for CCS with coal are commercially, economically or socially acceptable (Huijts et al, 2007; Scott et al., 2013; Shackley et al, 2009; Upham and Roberts, 2011). In addition, as discussed in full in chapter eight, funding commitments from the UK Government to test CCS projects in the UK at commercial scale, have been delayed and ultimately reneged upon (Energy and Climate Change Committee, 2016, p.3), despite planned targets to have operational CCS in the UK by the 2020s (ibid., p.9).

It is widely recognised that in order to ameliorate current economic and ecological crises, more sustainable modes of energy production will need to be developed. In response, commitments have been made at international level to test CCS capabilities particularly with regard to its use with coal in electricity generation. The 2008 G8 summit, for example, committed to development of twenty projects and to have CCS 'widely deployed' by 2020 (G8 Hokkaido, 2008, item 31). Whilst early commitments were ambitious (IPCC, 2005), progress towards these commitments internationally has been, at best, steady (GCCSI, 2011, 2016).

In 2012, the UK Coalition Government launched its CCS commercialisation programme and CCS Roadmap (DECC, 2012a) designed to support the development and roll-out of commercial scale CCS projects in support of wider efforts to reduce GHG emissions. Coal and CCS demonstration projects in the UK (appendix B) had already demonstrated key technical features of the technology. The Roadmap set out plans to have four operational CCS plants by 2017. By 2015, when the UK Government pulled out of its commercialisation programme, no CCS with coal projects were operational at commercial scale in the UK. For most projects, operational status has been dependent on frequently delayed (NAO, 2017a) UK or EU funding decisions expected in 2013 and 2014 (appendix B).

Whilst CCS can be used with all fossil fuels there are advantages to its use with coal. Coal is widely and readily available (World Coal Association (WCA), 2012, 2018). It is relatively cheap, easy to extract and transport, already forms a significant part of electricity generation worldwide and is likely to continue to do so (UNFCCC, 2015; International Energy Association (IEA), 2015; WCA, 2018). Additionally, the international community (at least as represented by UN, G8 and the OECD) proposes continued resource extraction and use as a

necessary aid to development and in order to satisfy demand for energy requirements. Finally, coal use worldwide, for electricity production, as well as steel, chemicals and cement, is forecast to increase to 2022, especially in China, India and the USA (IEA, 2017).

In summary, coal with CCS is seen by many policy, government and commercial actors as (*prima facie*) a technological solution to the problem of continued fossil fuel use. By others, however, it is seen as a temporary measure, albeit a necessary one (Friends of the Earth, 2005a, 2005b), and by others still as an untested and potentially detrimental technology which will inevitably lead to continued coal use (Rochone, 2008). CCS with coal remains an internationally contested technology and whilst research in to the technical feasibility of CCS is developing (UKCCSRC, 2018; Rackley, 2017; Talo & Pettinau, 2014), persistent questions remain regarding the shaping of its development and deployment (BEIS, 2016; Stephens et al., 2009; Markusson et al., 2011).

Whilst untested at scale¹⁰ in the UK, there is perhaps an underlying assumption that technical issues relating to capture, transport and storage of CO₂ *will* be solved (UKCCSRC, 2015, 2012). Front end engineering design (FEED) data from capture demonstration projects, suggests technical issues are less problematic to developers than economic, social and political ones (E.ON 2011; GCCSI 2011, 2015, 2018; World Coal Association (WCA) 2012, 2016). For some, these issues relating to socio-political drivers and barriers to CCS are not insurmountable (Scott et al, 2015) however the social and political issues relating to new coal, and continued coal use more widely, are not fully understood. This is problematic for a set of technologies which have been described as essential if the UK is to make deep CO₂ reductions (BEIS, 2016; IEA, 2016; GCCSI, 2016; Haszeldine, 2015; Boot-Handfield et al., 2014).

In the early years of the 21st century, CCS has been widely portrayed as a potential low carbon energy option which will support the transition to low carbon economies. CCS is also seen as contributory to economic development in otherwise underdeveloped regions (Trades Union Congress

¹⁰ The terms industrial scale and commercial scale are discussed later in chapter five. Here they refer to CCS on operational industrial or commercial plant as opposed to test facilities.

(TUC), 2014b). However, of the non-technical issues not yet fully explored in the literature, there is perhaps most concern with regards to whether economic conditions are right for the wholesale adoption of CCS at a commercial scale (Markussen et al., 2012; Rubin et al., 2012). Governments and industry associations have characterised CCS as a low carbon opportunity for green growth (BEIS, 2017b; DECC, 2012a, 2015, WCA, 2016), yet reviews of demonstration projects as well as forecasts for commercial scale activities are less conclusive (Rubin et al., 2012; Hammond and Shackley, 2010). A consistent feature of FEED studies is that deployment of new coal technologies will increase operating costs of electricity generation (E.On, 2011). As discussed in chapter eight, this is to a degree contested when considered in the context of costs of alternative low carbon energy (see 8.1.3) and more recent projects such as Boundary Dam¹¹ in Canada suggest that when considered with savings from emissions reductions, costs of electricity generation from coal with CCS become commercially viable (GCCSI, 2018).

Timing of the deployment of CCS matters (UNFCCC Conference of the Parties (CoP) 21, 2015; DECC, 2010a). According to the Global CCS Institute's early review of CCS projects' status, four commercial scale projects would need to be operative in the UK by 2017 (GCCSI, 2011). Critics point out that test facilities have been slow to develop largely for economic and governance reasons (Gough et al., 2010; Haszeldine, 2009). Attempts to establish commercial scale operations have been unsuccessful, at least in part, because economic conditions and market incentives were not clear to incumbent industrial and government actors (E.On, 2011). In addition, where there have been successful attempts to develop CCS at scale, for example in South Korea, or Canada, significant government and public sector funding has supported technology development. In such settings with high levels of social acceptance and public private partnerships, progress towards large scale deployment of CCS is improved (GCCSI, 2015). These features of the debate are explored more fully in chapter eight.

¹¹ Boundary Dam is a coal fired power station with retrofitted CO₂ capture facilities. The project was completed in 2014 and has been operational since. Captured CO₂ is transported by pipelines for Enhanced Oil Recovery (EOR) at a nearby oil plant and a portion is stored in a geological aquifer.

Another non-technical issue of significance to wide scale deployment of new coal technologies is public acceptance. This literature is consistent with debates that hold that for new technologies in general and for those relating to climate change or other wicked problems (Rittel and Webber, 1973) in particular, public acceptance is seen as a key part of adoption processes (Parry and Murphy, 2013). It has long been recognised that key to social acceptance is the relative trust with which the actors involved in projects are held in the local community (Ashworth et al., 2012; Huijts, 2007). Socio technical and political dimensions of new coal are complex and intractable (Stephens et al., 2009). However, the social acceptance of CCS is shaped by the social and political contexts of the countries and locations in which the projects occur (Markusson et al., 2012) and considered effort with multiple phases of development may be required for acceptance (Wilson et al., 2012). To summarise, Fleishman et al (2010) suggest that ultimately public perception of CCS technologies may impact the likelihood of wide-scale adoption of new coal. Ashworth et al (2010) for example, have found that public acceptance of CCS technologies improves with knowledge of the technology (Ashworth et al., 2012). Markusson et al's findings support this view, however with recognised limits regarding the extent to which different publics with cultural differences accept CCS as a new technology (2011, 2012, p.222). It is not clear that public acceptance will occur without considerable effort to address such differences. Similarly (and in keeping with Arnstein's Ladder of Participation (1969)), the limits to simple information giving and consultative approaches have been found in Germany where increasing scepticism to CCS projects has been voiced (Upham and Roberts, 2011).

The literature reflects diversity of opinion on CCS and the contradictory roles and views of actors and key stakeholders within the discourse. In addition, the politicisation of the technology, no doubt in part due to its potential as a key mitigation technology (IPCC, 2005), has in some ways further polarised and fragmented the international, national and regional landscape for CCS development, particularly with regard to institutional structure and governance (de Coninck and Backstrand, 2011). They present a useful picture of the relative power and influence of CCS actors at international, regional and national level which suggests that the IPCC special report on CCS (IPCC,

2005) had a defining role in shaping norms, understandings and expectations around CCS development, but that these norms have not been adopted equally by different actors and institutions at international or state levels (de Coninck and Backstrand, 2011).

For most projects (appendix B), as explored more fully in chapters five and eight, operational status of CCS projects is highly dependent on governance conditions, taxation and, ultimately, funding. Delays to funding decisions between 2011 and 2015, and contradictory signals to the market from government led to closure or derailment of planned projects. For example, just six months prior to withdrawing £1 billion of funding for CCS projects, the UK Government had confirmed its intention to invest in CCS developments in the UK in line with its CCS Roadmap (Energy and Climate Change Committee, 2016; DECC, 2012a). This is of relevance both at national and sub national levels, given significant CCS with coal projects were expected to be based in Yorkshire and Humberside region (White Rose, Don Valley Power Project).

2.1.3 Yorkshire and Humberside

From chapter one and as explored in depth in chapters four and six, the Yorkshire and Humberside region has a long history with coal mining and its use in electricity generation. During the first decades of the 21st century, the coal mining industry in the region declined further with the last deep coal mine in Kellingley, Yorkshire closing in 2015 (BBC, 2015). However, throughout the period of study, coal use in the region's coal fired power stations was significant. Between 2000 and 2015, the region generated an average 17% of UK GHG emissions (Pearce and Evans, 2015, no pagination). In addition, during the period of study, the region hosted the largest single source CO₂ emitter in Europe, one of three (now two¹²) coal fired power stations then operational in the region. For these and other technical and geological reasons, it has been stated (albeit by actors with vested interests in developing CCS with coal) that the UK and more specifically Yorkshire & Humberside region has the 'perfect' context for CCS (CO₂Sense, 2011, no pagination).

¹² The scheduled closure of SSE's Ferrybridge C plant closed was brought forward to March 2016 following a fire in one of its cooling towers (SSE, 2015)

The Yorkshire & Humber region was historically economically reliant on three core industries coal mining, steel works and textiles. In the mid-1980s, 56 collieries were active in Yorkshire (National Coal Mining Museum (NCMM), 2014). However, the politically active coal mining industry suffered during the 1980s and 1990s, when some 67,000 jobs were lost from the region's coal mines between 1981 and 2004. A significant number of these were not replaced (Beatty, Fothergill and Powell, 2007) and whilst unemployment rates are decreasing, levels in the region remain higher than average for the UK (Office for National Statistics (ONS), 2018), with a lower proportion of people with higher level skills during the early part of the 21st century (Leeds City Region Local Enterprise Partnership (LEP), 2016, p.1). This chimes with Beatty et al's (2007) findings that despite investment in regeneration in former coalfield regions, the decline of the coal mining industry, coupled with pre-existing high levels of unemployment, has resulted in long term and 'hidden unemployment' (ibid., p.1654). In addition, contemporary research noted that environmental features of redevelopment and regeneration were often under considered (Jackson and Roberts, 2000).

These findings correspond with the literature on the limits to the regenerative capacity of new governance arrangements in wicked contexts (discussed here in section 2.3 and chapter seven) and interview data presented in this thesis. Similarly, Perrons (2000) finds that regional inequalities that have developed over time are not addressed by considering single issue (e.g. employment) development pathways. Instead in her working paper, she advocates an alternative holistic approach that would overcome the limiting features of single regeneration projects (ibid., p.1).

Coal use had, and continues to have, significant environmental, social and economic impacts. As will be explored in more detail in chapters four and six, this research shows that coal, in and of itself, remains an issue in the Yorkshire and Humber region, both in terms of the legacy of its decline and in terms of its unabated use in the region's coal fired power stations.

2.2 Sustainability of coal

The profile of coal and new coal presented in section 2.1, identified that embedded within the discourse are core issues relating to environmental,

social and economic impacts of its use. Sustainability emerged as a concept in the early 1970s following the UN Conference on Human Environment and publication of seminal works such as Donella Meadows' 'Limits to Growth' (Meadows et al, 1972) and Goldsmith and Prescott-Allen's 'Blueprint for Survival' (1972). Both include the core principles that unfettered human development is unsustainable, and that alternative approaches to social and economic development consistent with environmental conservation must be developed. Early use of the term was intended to bring together broad conceptual facets relating to societal, environmental and economic issues. The Brundtland report provides a useful starting point in any discussion on the definition of sustainable development (SD). In it development is sustainable where it:

'...meets the needs of the present without compromising the ability of future generations to meet their own needs.'

(World Commission on Environment and Development, 1987, p.8)

This definition introduces notions of both intergenerational equity, and limits to resource use. As a broad concept, the intention of the World Commission on Environment and Development (WCED) was to include connectivity between social, environmental and economic facets of human-nature interactions (WCED, 1987; Kates et al, 2005; Baker 2006). The concept of sustainable development implies connections between these conceptual facets both within and between generations in the context of understood limits to resources:

'...not absolute limits but limitations imposed by the present state of technology and social organization on environmental resources and by the ability of the biosphere to absorb the effects of human activity.'

(WCED, 1987, p.8)

These points are relevant here because whilst often criticised for its unwieldy breadth, the term does not lack utility. Kates et al (2005), for example, suggest this broad definition makes it 'enduringly relevant' (ibid., p20) and useful for:

'...places from local to global; and institutions of government, civil society, business, and industry to each project their interests, hopes, and aspirations onto the banner of sustainable development.'

(ibid., p.10)

What is of particular relevance for the case of coal use in the UK, is the extent to which this broadest definition to include social sustainability, justice (Fraser, 1999) and equitable inter and intra-generational distribution of resources as essential, is practically applicable in real world problems. Our Common Future's (WCED, 1987) exploration of core, underpinning principles for sustainable development remains useful as a practical backdrop for analysis and therefore this well-documented definition of sustainable development will be adopted here.

At national (and sub-national) levels of governance, implementation of these critical objectives requires political effort and directed policies in order to recognise own and others' development needs. This set of strategic imperatives to '*allow nations to move from their present, often destructive, processes of growth and development onto sustainable development paths.*' (ibid, p49) are considered here:

'They include:

- *Reviving growth;*
- *changing the quality of growth;*
- *meeting essential needs for jobs, food, energy, water, and sanitation;*
- *ensuring a sustainable level of population;*
- *conserving and enhancing the resource base;*
- *reorienting technology and managing risk; and*
- *Merging environment and economics in decision making.'*

(ibid., p.49)

Whilst all of these strategic imperatives are integral to sustainable development, some are more directly relevant to this research. These are briefly explored here and used for reflection in chapter seven.

Reviving and changing the quality of growth: as indicated in chapter one and section 2.1.3 above, in the UK many formerly economically viable, coalfield regions are now underperforming in terms of social, economic and environmental indicators (appendix C). For the Yorkshire and Humberside region, low carbon, sustainable, economic growth has been identified as critical in multiple development targets (Leeds City Region LEP, 2012).

Meeting essential needs for jobs, food, energy, water and sanitation: Yorkshire and Humberside (and other coalfield areas) suffer from underdevelopment with lower levels of educational attainment than the national average, high unemployment and public health issues associated with poor air quality and particulate matter are more common than in non-coalfield regions (Foden et al., 2014; Appendix C).

Conserving and enhancing the resource base: Regardless of the efficiency of combustion, CO₂ capture methods or technology employed to clean coal, its use is still depleting a non-renewable natural resources (NRNR) and so at best weak sustainability can be achieved (Neumeyer, 2003). For the case of the governance of coal use in particular, it is also worth noting that the Aire Valley has reportedly poor and declining biodiversity despite conservation efforts in national and regional regeneration projects (RSPB, 2013).

Reorienting technology and managing risk: Carbon Capture (CC) technology has been used in extraction for enhanced oil recovery (EOR) for decades, the technology is now being employed – i.e. reoriented for use - alongside fossil fuel combustion as a proposed low carbon energy option. However full chain carbon CCS is relatively new and associated distribution of risks/benefits is untested. In this wicked context, this ‘reorienting’ also raises questions relating to carbon lock-in (Unruh, 2000).

Merging environment and economics in decision making: using sustainability as an organising principle allows environmental, economic and social implications of continued coal use to be explored in more depth.

In the thirty years since Our Common Future (1987), much of the discourse and literature on sustainability and sustainable development (SD) has focused on defining sustainability, and on providing robust mechanisms to assess sustainability. Pezzey (1992) for example produced an analysis of the terms such as sustainable resource use, sustainable development and sustainable growth. For him sustainability means:

‘...maintaining utility (human wellbeing) over a very long term future,’

(Pezzey, 1992, p.7).

Pezzey's review (1992) concludes that distribution of resources via free market forces is unlikely to lead to sustainable development that will enable intergenerational justice for a number of reasons. Importantly for this thesis, choosing a policy option which contributes to sustainability and intergenerational equity requires *judgement* over the natural and human capital inputs; the free market does not have this judgement (ibid., p8). Given the increasing hegemony of the market on future energy decisions in the UK, this raises concerns for sustainability of continued coal use.

In his informative work, Neumayer explores notions relating to human and natural capital in relation to strong and weak sustainability (2003). He defines development as being sustainable if:

'it does not decrease the capacity to provide non-declining per capita utility for infinity,'

(Neumayer, 2003, p.8)

In this way, he expresses sustainable development as being weak if capital (natural and human) is treated in aggregate i.e. where the total human and natural capital is viewed as significant for wellbeing of current and future generations, natural and man-made capital are seen as substitutes (ibid., p.128). In contrast, strong sustainability sees natural capital and human capital as non-substitutable (ibid., p172). For this case, the use and distribution of natural capital and, therefore non-renewable natural resources, is core to the problem; given the inevitable decline in non-renewable resources, prima facie only weak sustainability might be considered possible. This theme is explored further in the discussions in chapters seven and eight.

Kates et al (2005) summarise the literature on definitions of sustainability to suggest that sustainable development is about *sustaining* environment, systems and community and *developing* human behaviour, economies and society. Nicola Dempsey and others (2011) progress the debate by reconsidering the embeddedness of social features of sustainability, in her case within an applied, urban development and planning context. Sustainable communities have been described as communities with high degrees of social cohesion (Lister, 2000). In Dempsey et al (2011), the authors usefully summarise literature relating to the apparent lack of clear understanding of

what the social aspects of sustainability mean in a ‘real world context’ (Dempsey et al., 2011, p.290) as well as the homogenising treatment of community in the literature. They present two dimensions of social sustainability as relevant and operable, these are: equitable access to resources and ‘the sustainability of the community itself’ (ibid, 292). Communities in this sense may be viewed as sustainable where there exists:

‘...social interaction between community members; the relative stability of the community, both in terms of overall maintenance of numbers/balance (net migration) and the turnover of individual members; the existence of, and participation in, local collective institutional, formal and informal; levels of trust across the community including issues of security from threats, and a positive sense of identification with and pride in, the community.’

(Ibid, p.294)

For governance of coal use and sustainability outcomes in former coalfields, this debate ties with issues of social equity (Hopwood, 2005; Putnam, 2000).

To summarise, Tim O’Riordan usefully suggests, *‘sustainability is not just a word but a way of becoming’*, a way of developing science and society that is *‘geared to compassion, fairness, empathy, and social justice’* (O’Riordan, 2014, no pagination). Following Baker (2007), this research considers sustainable development as a useful *‘organising principle’* (2007, p1, Baker and Eckerberg, 2010), with which to consider the juncture between societal, economic and environmental problems. In this sense, these definitions and conceptions of sustainability are useful in the construction of sustainability as an organising principle for this research. From the discussion above, this thesis considers sustainability in three core ways: equitable access to resources, justice and integration in decision making, community sustainability. This is important where social issues relating to the sustainability of coal are underexplored in the literature.

2.3 Governance – an organising principle

Core to this discussion is the premise that for the wicked problem of coal use in the UK, it is not sufficient to look at governance of specific institutions,

policies or other interventions; governance of the firm, governance of technology, even governance of sustainability would be too narrow a focus. Instead wider debates on governance including structure and agency are used to draw out relevant features as related to continued coal use.

The literature on (environmental) governance as a concept and organising framework is broad and increasingly wide reaching, as a result, a wide range of definitions and conceptual frameworks have been developed with differing reflections and connotations (Lemos and Agrawal 2006, p.297). For most however, the simple concept that *governance* is not *government* features strongly. For this research, the importance of this concept becomes clear when considering the evolution of 'governance' from 'government' discussed in chapter seven.

The meaning and definition of governance, considerations on theory of governance and in some cases its relevance as a construct for analysis, are multiple and contested (Rhodes, 1996, Petschow et al, 2005 Adger & Jordan, 2009). However, for this research following Lafferty (2004), (also Gouldson & Murphy 1998, Kooiman 2003, Petschow et al 2005), governance is considered as an organising principle which can be defined, broadly and simply, as:

'...the act or process of governing...'

(Lafferty, 2004, p.6)

This remarkably simple definition, of course, has embedded within it multiple facets; most notably that governance is a process. In Stoker's useful essay he summarises the multiple views of governance in to five complementary propositions (Stoker, 1998) to suggest that governance:

'...refers to a set of institutions and actors that are drawn from but also beyond government ...identifies the blurring of boundaries and responsibilities for the tackling of social and economic issues ...identifies the power dependence involved in the relationships between institutions involved in collective action ...is about autonomous self-governing networks of actors ...recognises the capacity to get things done which does not rest on the power of government to command or use its authority. It sees government as able to use new tools and techniques to steer and guide.'

In the context of continued coal use, these propositions fit well. Certainly, at least *prima facie*, multiple actors from within and beyond government are nominally involved in determining the future of coal use through for example consultations¹³. The legacy of the historical context, in and of itself creates a '*blurring of boundaries*' which means it is not always clearly possible to denote responsibility for complex social and economic issues to one actor or institution.

As outlined in chapter one, this research seeks to better understand both power dependencies and relationships of governance: the extent to which these dependencies and relationships might be considered '*autonomous, self-governing networks of actors*' (ibid.) albeit as part of wider organisational fields of governance is relevant. Finally, the extent to which, new governance tools and techniques are used to guide sustainable development, is explored within the case context. Whilst desirable in the context of sustainability (Gillard, 2016), and useful as a means of defining governance as an organising principle, this is an arguably idealistic view of governance in practice and reality. Chapter seven returns to these themes to question the extent to which these propositions are evident in this wicked context.

Beyond these propositions on governance, this section summarises three core features inherent in many conceptualisations of governance. Firstly, governance is viewed as *purposeful* activity with the intention of creating change. Secondly, governance involves and includes actors *other than government actors* and *at multiple levels* in the act of governing. Thirdly, governance is, in and of itself, an iterative, abductive process; outcomes matter but, significantly, process matters too. The remainder of this section expands on these core features of governance and their relevance for this discussion on sustainability.

2.3.1 Governance as purposeful change

The view that governance is, perhaps foremost, about purposeful efforts to create change gained favour in the early 1990s in keeping with contemporary

¹³ As discussed in chapters five and eight.

processes of neo-liberalisation. Kooiman (1993, 2003) for example suggests that governance involves a:

'...purposeful effort to guide, steer, control, or manage sectors or facets of societies'

(Kooiman, 1993, p.2).

For new coal technologies, government and corporate policy is geared toward changing (either reducing or abating) coal use in order to meet regional, national and international targets for both energy generation and GHG emissions increases (BEIS 2017b; DECC, 2012). This links with governance for sustainability debates in which changes in the mechanisms of governance are designed to accelerate change (Dunsire, 1993, p.21) and the purposeful steering (Bailey and Grossardt, 2010) of society toward sustainability and sustainable development goals (Petschow et al., 2005).

Whilst predominantly emerging from a corporate centric, neo-liberal perspective, the new governance agenda moves away from the 'no holds barred, liberalise at all costs' type Washington consensus policy development of the 1980s and early 1990s (see tables 10 and 11). Instead, governance arrangements which encourage multi-actor partnerships between corporate, public and civil actors are encouraged to devise policy appropriate to local situations (Newig, 2008). The voluntary, complex, polycentric nature of these new mechanisms, suggests that a more thorough investigation of the behaviours, and associated impacts, of significant actors from government, civil society and business spheres at different levels becomes significant. This is especially pertinent given more recent findings which suggest that policy makers have a tendency to back track or capitulate on commitments when issues become complex (Howlett, 2014).

Rosenau (2003) makes a useful contribution to the discourse by outlining the ways in which the dual processes of globalisation on the one hand and decentralisation and localised policy development on the other create complexities in governance. Rosenau identifies sources of 'framgregation' (a confluence of 'aggregation' and 'fragmentation') which operate at micro to macro levels. These forces include the weakening of states, social mobility and technological advancements amongst others (Rosenau, 2003, p.27). He

concludes by suggesting that these dual processes and associated complexities of governance lead to three principal conceptual problems in the good governance for sustainable development debates. Firstly, there remains an argument between economic and environmental developers over what development should be (e.g. Ruggie, 2002). Secondly, there is a question of authority. Rosenau states that governance *'is crowded with diverse actors at every level of community who take positions and pursue policies relevant to sustainability'* (Rosenau, 2003, p.34), but that these actors have no authority at global or international level to enact changes. Thirdly, there is a disconnect between local, indigenous and global scientific knowledge; despite many environmental [and social or economic] problems originating in the local, solutions tend to originate in the scientific and/or autocratic international community. These three 'conceptual blocks' combined with the 'patchwork quilt' which is governance make it difficult to see how new governance arrangements can be assessed as beneficial to sustainable development or otherwise (ibid., p.35).

Rosenau's analysis provides a useful conceptual framework, but others have provided more practical insights, for example with specific reference to the environmental outcomes associated with the adoption of new governance arrangements. In their assessment of ways that environmental risks are governed, with particular reference to new ways of governing corporations, Gouldson and Bebbington (2007), for example, use the UN Global Compact to frame the debate (Gouldson and Bebbington, 2007, p.4). They identify a number of issues which make the assessment of new ways of governing difficult; corporations operate in 'complex networks' which are not governable within national boundaries and yet there are no statutory, international institutions to govern corporations' behaviours, furthermore the 'regulatory space' (Hancher and Moran, 2000) national government is reduced via the process of liberalisation (ibid, p.6). Gouldson and Bebbington's findings support the suggestion here that governance is complex:

'...new forms of governance are based on new forms of engagement between state, market and civic actors... the associated governance processes tend to be complex and fragmented, with power being

diffused amongst a wide range of actors operating at different scales in different contexts'

(Gouldson and Bebbington, 2007, p.17).

Governance arrangements are intended to create change and steer toward sustainability in the varied institutions, processes, actors, treaties, policies, legislative processes active at global, national and local levels (Campos and Nugent, 1999; Rosenau, 2003).

2.3.2 Governance and sustainability

In the preface to Adger and Jordan's reader, the authors suggest that sustainability (or rather unsustainability) is 'first and foremost' *about* (a crisis of) governance (Adger and Jordan 2009, xvii). Petschow et al., (2005) also set out a sound rationale for the linkage of these two concepts for analytical purposes. This research adopts this primary understanding of the organising principles under scrutiny here i.e. that governance and sustainability are interconnected processes with interconnected outcomes. It does not adopt the assumption of causality or suggest the relationship is unidirectional, instead it critically examines the *quality* of the relationship between governance and sustainability - the extent to which these two organising principles affect the multiple, iterative processes and outcomes inherent within them then becomes more interesting.

A central and pressing theme is whether institutional and governance arrangements help society move toward sustainability (Glasbergen, 2007, p.1). Referring once more to Stoker, he suggests that within governance processes, governments are able to '*...use new tools and techniques to steer and guide*' outcomes (Stoker, 1998, p.17), but the underpinning epistemology here suggests that within the complexities of governance and sustainability establishing the sustainability outcomes of a specific tool or techniques would not be possible. Core to the research aims here, is the view that whilst governance arrangements and sustainability outcomes are interrelated, the wicked context means such assertions are meaningless.

Whilst new governance arrangements are proposed by some as a means of mitigating against the negative impacts of the resource depletion (i.e.

aggregate human and natural capital, weak sustainability), the impact of new governance arrangements are not fully understood in wicked or complex contexts. Whilst this research supports the view that there are connections between sustainability and governance, this does not imply a linear relationship. Within the complexities of governance and sustainability of new coal, what becomes relevant are the multiple relationships that are context and place specific. Governance is complex (Rosenau, 2003) and new mechanisms, including polycentric approaches or stakeholder engagement, are not universally seen to be effective for environmental management or emphatically lead to sustainability. The remainder of this review moves on from definitions and normative constructions of governance to consider the multi-level, multi-actor nature of governance in relation to coal use.

2.3.2.1 Multi-level, multi-actor governance arrangements; opportunities and constraints

This section considers ML/MA governance arrangements for coal use in the UK to give an underpinning for the analysis in chapters four to six and to frame the discussion in chapter seven.

Core to definitions of both sustainability (Kates et al, 2005, Kasemir 2003, WCED, 1987) and governance (Stoker 1998; Kooiman, 2003) is the tenet that actors beyond state governments, should participate in decision making in meaningful ways. This includes community and other social actors (Cotton, 2014; Seyfang et al, 2014; Middlemiss, 2013), at multiple levels (Paavola, 2016), as well as business and corporate actors (Gouldson and Sullivan 2007; Van Alstine and Barkemeyer 2014; Fairbrass and Zueva-Owens, 2012; Brinkerhoff and Brinkerhoff, 2011; Blowfield, 2005). Beyond multiple actors' involvement, for governance for sustainability, a core feature as discussed above is the level at which meaningful governance activity occurs (Paavola et al., 2012).

Governance in this sense is considered as:

'...arrangements in which public as well as private actors aim at solving societal problems or create societal opportunities'

(Pierre, 2000, p.138).

Similarly, Kooiman (2003) sees governance as:

'...a process of interaction between different societal and political actors and the growing interdependencies between the two as modern societies become ever more complex, dynamic and diverse'

(Kooiman, 2003, p.12)

Especially relevant to the case of coal use in the UK, is the 'rolling back of the state' (Scott, 2013, p.65) of 1980s and 1990s. In particular for a sector once governed and managed by state actors, the privatisation of UK coal mining operations¹⁴ and the electricity generators¹⁵ had a significant impact on the governance arrangements associated with coal use. These statutory changes to governance arrangements introduced new roles for private sector firms in governance. Two features of the debate are relevant for the case of coal use. Firstly, the shift in priorities of private sector firms from public service provision of employment and electricity, to profit generation and shareholder return. Secondly the new relationships that emerged between corporate, government and civic actors in response to international concerns on the roles of firms in delivering sustainability (Blowfield and Murray 2008; Fairbrass and Zueva-Owens, 2012; Warhurst, 2005).

Calder and Culverwell (2004) suggest that there is significant pressure from the international community (for example the World Summit on Sustainable Development) on firms to operate responsibly and adopt sustainable practices. However, whilst the pressure to act exists, there is little material support for them to contribute to sustainable development and a deficit of guidance on the types of governance or CSR strategies which might benefit sustainable development means performance in this regard is not as positive as hoped (Calder & Culverwell, 2004, p.3). More recent research corroborates these findings: Whilst voluntary guidance and a multitude of sets of codes of practice are available to firms (ISO 14001, Equator Principles (Amalric, 2005) and IFC industry specific guidelines, ICMM standards and ISO 26000 for example), the

¹⁴ The National Coal Board was renamed the British Coal Corporation (BCC) in 1987. The BCC's role was to oversee the privatisation of British coal mines

¹⁵ The Electricity Act 1989 provides for the privatisation of electricity operations in the UK. The Central Electricity Generating Board (CEGB) assets were broken to become three new companies; Powergen, National Power and the National Grid.

adoption of standards and sustainability reporting is voluntary, and success is varied (Barkemeyer et al., 2015; Comyns et al., 2013), furthermore evidence on the impact on sustainable development not conclusive.

Chapters one and two identified that coal use, both in terms of new coal and its future use, and old coal and its legacy, has social implications. Civil society participation and consent is discussed in sections 2.2 and 2.3 as an integral component of both governance and sustainability debates. This feature of the discourse may be especially relevant for coal use in the UK, where communities located close to existing coal fired power stations, formed in large part because of connections to coal, will host new coal developments.

Public engagement is widely attested to as a key feature of good governance including corporate governance (Seyfang et al, 2014). For new coal projects, where targets for development have not been met (Haszeldine, 2014; GCCSI, 2015), Markusson, (2012) it has been suggested that project success will be improved where public acceptance of developments is better incorporated in to developments (Markusson, 2012; Ashworth et al, 2011; Brunstig and Upham, 2011). In addition, for larger scale new coal projects and the development of nationally significant infrastructure projects (NSIPS) such as power stations, engagement with stakeholders effected by the projects is a requirement under planning legislation (Cotton, 2014).

The discourse on public engagement in decision making; participatory approaches, community engagement, democratic processes and sustainable development, is becoming rich, particularly where it relates to governance and policy makers. Yet processes and outcomes of engagement are not fully understood or applied, this is especially the case in contested space and wicked contexts. Questions remain over the mechanisms employed to 'do' public engagement which are typically instrumental at best (Cotton and Devine-Wright, 2012; Doering 2014) i.e. where 'the public' is imagined, and by and large treated in practice, as essentially homogenous and external to decision making. An example of this in the context of coal is the Coal Consultation in the UK (BEIS, 2016, 2017a). The consultation was launched with the stated intention of reaching a wide range of stakeholders (BEIS, 2016, p.2). However, as will be discussed in chapter eight, little attempt was made to engage beyond a single questionnaire available through the BEIS website.

Consequently, a total of 94 unique respondents¹⁶, largely from industry and academia responded with little evidence of civic engagement. Returning to Pierre (2000), thoughts on interdependency between government, corporate and social actors are especially interesting and relevant to the case of coal use for two reasons. Firstly, in chapter one, the problem of continued coal use was characterised as being wicked with temporal complexities and changing agency and power dynamics over time. Chapter seven expands on this feature of the analysis to produce a timeline of governance.

Secondly, in keeping with Kooiman (2003) the governance arrangements for coal have become more complex and dynamic over time. However, a core finding of this research is that whilst more complex, it is not more diverse. As explored more fully in chapters five to eight, this research shows that whilst interdependencies exist, *diffuse* (i.e. rather than diverse) relationships are evident within organisational fields, with low levels of participation of non-governmental actors. As discussed here, business and civic engagement activities exist, however in the context of coal use, core questions on efficacy of the engagement and the extent to which wider actors than government have meaningful roles in governance and sustainability exist. For private firms, behaviours and decisions are governed by the market and regulatory framework, and for civic or community actors, mechanisms for engagement are tokenistic. Indeed, as chapter seven will go on to show, because of the dominance and power of government actors, the processes of change have created *diffuse* but not 'diverse' organisational fields. The effect of this is to reduce rather than increase chances for actors and groups beyond the state to engage with '*solving societal problems or create societal opportunities*' (Pierre, 2000, p.138). Whilst governments require societal consent to rule (Lukes, 1973), the interdependencies and power dynamics in this wicked context, mean that civic and public participation in decision making can legitimately be described as 'tokenistic' (Arnstein, 1969, p.216; Cornwall, 2008).

Intrinsically, sustainability requires that governance arrangements not only engage with actors from different spheres; public, civic, private, but also from

¹⁶ Including a campaign lead by an ENGO with 5845 signatories.

different levels; international, national, sub-national and local. Returning to Kooiman, change occurs at multiple levels (2000), similarly for Van Alstine change can be '*constructed from the bottom up*' (Van Alstine, 2009, p.108). Others (for example Wessilink and Gouldson 2014; Gouldson, 2006, p.402) have questioned whether (and with what outcomes) the governance processes adopted at national level 'filter through' to processes and outcomes at local level. Building on wider discourse this research considers whether characteristics of governance are evidently different at difference levels, this includes roles of non-government, civic and corporate actors.

A feature of this wider debate on multi-level governance relevant for the wicked problem of continued coal use, is that the level at which governance activity occurs has implications for sustainable development outcomes. Drake (2009) for example finds that fluctuations between national, international and sub-national governance arrangements in terms of institutions of government, effect prospects for the coal industry (Drake, 2009). Muinzer and Ellis (2017), extend the debate with their useful discussion on the complexity in legal framework which has been created by the devolution of energy governance in the UK. Interestingly, they find that devolution of responsibility for moving to low carbon energy systems, has created a 'territorialised' system (ibid., p.1187) which is arguably less capable of meeting national targets.

A connected feature of this debate is the spatial dimension of social justice (Roberts, 2003). For Roberts, the absence of awareness of socio-spatial features of development and planning (e.g. spatial justice) can and does lead to and '*spatial exclusion*' (ibid, 228). This ties with research that questions the effectiveness of governance arrangements that only nominally encourage public engagement with decisions at different socio-spatial scales (Keiron and Grossardt 2010, p.59). Again, referring to Beatty et al (2007), social and economic outcomes for former coalfield regions are typically below UK national averages despite more than two decades of regeneration projects in these regions. These issues are explored in the data.

Finally, an interesting feature of the recent debates relating to polycentric, ML/MA governance approaches to climate change governance which is relevant here, is the finding that the discursive norms and context are influential in determining policy outcomes (Gillard, 2016; Lorenzoni and Benson, 2014).

In the UK, a distinction has been drawn between the period 2005 and 2008 and the period between 2010 and 2015 (Gillard, 2016, p. 26). In the former, a degree of cross party consensus and purposeful intention to engage with actors beyond the state led to the development of '*innovative legislation*' (ibid.) designed to steer climate policy. Whereas the latter is characterised by the economics of austerity, notions of government responsibility and restraint and a watering down of climate policy.

This has significant implications for this debate on the future of coal. As Gillard puts it:

'...despite innovative legislation, institution building and strategic coordination of different types of governance actors the ideational foundations of ambitious climate change politics in the UK have been undermined'

(Gillard, 2016, p.26)

This chimes with the core findings of this research to show that rather than desirable polycentric, ML/MA approaches to governance, the unilateral decision making power of government actors determines policy and action in the UK, and links with discussions on power and agency in decision making.

2.3.2.2 *Agency and theories of power*

Considerations of agency and power are central to this thesis however, it is beyond the scope of this review to treat either concept in full. Instead, for brevity, agency and power are discussed in terms of their relevance in developing an understanding of dynamics and drivers for change discussed throughout. Lukes (1973, 2005) has usefully presented power debates in terms of three dimensions of power, this review briefly considers each in turn.

The one dimensional view of power, popularised by pluralists such as Dahl (1957, 2007) takes an operational and applied stance to power. For Dahl and others, power is demonstrated where a conflict exists between two parties such that A has power of B, where B succumbs to A's will. Whilst simply formed and much critiqued (Clegg, 1989), this view of power, i.e. that power is about cause and effect, has simple utility in explaining behaviour.

Bachrach and Baratz (1970) in contrast, present a two dimensional view of power (Lukes, 1974). In this view, individuals with power are able to shape society through processes of 'non-decision making'. Non-decision making power is exerted when:

'...a decision which results in the suppression or thwarting of a latent or manifest challenge to the values or interests of the decision maker'

(Bachrach and Baratz, 1970, p.44)

Clegg, similarly discusses power and agency in terms of non-decision making (Clegg, 1989, p.11). In this view of power, not only can A exert power over B, they are able to agenda set. For the wicked problem under discussion here, this conceptualisation seems instinctively relevant. However, it lacks an explanation of why and how power dynamics emerge or change. Lukes' (1974) third dimension is useful here. Two core features of Lukes' third dimension are, prima facie, significant for this review. Firstly, Lukes argued that power is not only witnessed in the explicit coercion of B by A, instead 'latent conflict' can and does exist where power may be exercised even where those affected by power are not aware of the existence of power (Lukes, 2005). Again, there is an intuitive appeal to this third dimensional view in a context where power dynamics are normatively plural, but not evidently so. These concepts of power will be discussed throughout to explore likely influences on the shaping of governance arrangements and outcomes.

2.4 Summary

To summarise this chapter on governance and sustainability of coal, it is useful to return to Our Common Future (WCED, 1987). In Our Common Future, (WCED, 1987, p.43) Brundtland proposed that in addition to limits to resources, issues of equity and justice in distribution of resources are key to sustainability, but not solely as a moral or ethical obligation, rather as a necessary requirement for effective policy implementation. Technical solutions to environmental and societal problems (for example suggested new coal) may be the most efficient in terms of sustainable use of physical resources, but may not necessarily be the most sustainable *per se*. Brundtland states:

'A development path that is sustainable in a physical sense could theoretically be pursued even in a rigid social and political setting. But physical sustainability cannot be secured unless development policies pay attention to such considerations as changes in access to resources and in the distribution of costs and benefits.'

(WCED, 1987, p.43)

[Emphasis added]

Operating efficiently and within limits in this sense may protect environmental resources in the immediate term, but it is not sufficient for sustainable development. Rather, processes which include due consideration for equitable inter- and intra-generational distribution of costs and benefits associated with human development should be considered integral to governance of sustainability. Adger and Jordan (2009) add to this debate by suggesting that:

'...the processes of decision making directly affect the sustainability of their outcomes'

(ibid, p.6)

[Emphasis added]

This useful observation of the interwoven nature of processes and outcomes of governance is adopted here. For the case of coal use, the arrangements of rule and government have changed over time, and these *process* changes have *outcome* changes that also change over time with implications for sustainability of new coal. However, in wicked contexts such as unabated coal use in electricity generation, the outcome changes are currently unknown, complex and non-linear.

This research uses the well understood organising principle of governance to gain a greater understanding of how and why changes occur. Furthermore, it adopts the view that for sustainable solutions to environmental and social problems, *processes* of governance must have consideration for equity, power and justice as *outcomes* may not be as expected. The wicked problem under consideration requires a richer understanding of the related conceptual terms governance and sustainability. This chapter critically reflects on governance

and the roles of *multiple* actors at different levels to consider the relevance of these concepts for coal use in the UK. In doing so it promotes an understanding of which actors have power, what their relationships and influences are and what the implications of these are for sustainability. Tying governance and sustainability literatures in this way adds analytical strength which both underpins analytical chapters four to six and lays a foundation for the discussions in chapters seven and eight.

This chapter has brought together literatures on governance and sustainability and explored the relevance for the case of coal use in the UK. Chapter three moves the thesis forward by demonstrating how these organising principles have been brought together to develop an epistemological approach and analytical framework that allows for depth and detail of understanding of a wicked problem. In doing so a 'thicker' (Adger and Jordan, 2009 from Geertz, 1973, p.14), more complete, interdisciplinary view is achieved.

Chapter 3 - Research design and methodology

The wide reaching nature of the key themes of governance and sustainability poses a challenge for those seeking knowledge on, and a better understanding of, the relationships between and within these two phenomena. Added to this challenge is the complexity of the topic i.e. the wicked problem and case of coal use in the UK. These challenges are welcomed, as they present a timely opportunity to explore multiple social, economic, environmental phenomena, and to discover relationships which are of relevance to many wider social and environmental challenges.

This chapter describes the choice and suitability of the research design and methods adopted in order to deal with the environmental social science challenge being addressed. It falls in to three main sections: section 3.1 describes the ontological and epistemological underpinning for this research. Section 3.2 presents the research design; methodological tools and sampling techniques, ethical considerations, data generated and research phases. Section 3.3 then describes the design and development of a novel analytical approach employed here. In particular for this study, the social dimension of both governance and sustainability, arguably more difficult to grapple with than other dimensions, is given equal attention in the analytical approach. Finally, the chapter summary includes a brief discussion on the strengths and limitations of the research design adopted, before reiterating the original contribution in terms of methodology and analytical approach this study makes.

3.1 Research philosophy

3.1.1 *Ontology and epistemology*

The ontological tradition in social science research is well rehearsed in the literature, but for Blaikie (2010), from a methodological perspective, too often, the *design* of the research question is underestimated in this tradition (Blaikie, 2010, p. 57). The *process* of design, in particular of second order research questions, is key to the approach adopted throughout this research. As a result, the research aims and objectives (see section 1.3) introduce interesting temporal, structure and agency questions relating to the evolution of

governance, without making '*...die hard ontological and epistemological commitments*' which may '*...blind us to alternatives because they mean that we view the world in a particular way*' (Burrell and Morgan, 1979, p.24). In social science research, researchers are delving into an identified problem by exploring what is known, establishing what remains unknown or unanswered, and generating knowledge through research. However, '*knowledge is laced with personal bias and values*' (Creswell, 1998, p.19) hence it is important to start with suitably broad research questions, discussed in section 1.3 above.

This approach puts the research question at the heart of the ontology and epistemology (Creswell, 2007; Audi, 2007; Blaikie, 2010). It allows for greater ontological and epistemological freedom and some flexibility, but without resulting in 'meta-theorizing', which, for this complex case, may result in overly diffuse conclusions; a kind of 'anti-Gestalt' whereby the whole is *less* than the total of its parts. The need for structured questions which delve into the social-environmental problem, but in such a way that the research can be structured and managed to adequately tackle the research aim, through using questions which continually, reflexively explore the case as a deeper understanding of the research problem emerges (Creswell, 1998). Continual reinterpretation of the research question from different but related perspectives - firstly to look at whether organisational fields of governance exist, then whether they differ over time and levels, and then to gain an understanding of structure and agency within fields - builds a rich picture. In addition, the iterative generation of data using multiple methods appropriate to this inductive and abductive analysis, builds on constructivist approach *whilst* integrating thought and analytical processes associated with critical realist epistemology.

Considerable attention therefore has been paid to the iterative development of the research questions for both practical and epistemological reasons over the course of the research. As an environmental social science problem has been posed, the issue is complex and could be divided up in many legitimate ways. From a practical, applied perspective (Hoffman, 2001), the aim of this research is to reveal meaning from the data, to *describe* and *understand* the formerly only conceptual. It is essential given the breadth of purpose here, and complexity of the wicked phenomenon under study, that the ontology reflects these layered purposes.

The nature of social reality, ontology, is concerned with what things exist, the, the conditions and circumstances of their existence and the relationships between things (Blaikie, 2010). Ontologies typically fall in to one of two categories, relativist and realist, that traditionally ‘lock horns’ (Burr, 2003, p.6) or are seen as two ends of an ontological scale. The following paragraphs discuss the relative merits and limitations of the ontological and epistemological approaches adopted here, within a wider discussion on philosophy of ‘how we make knowledge’ (Dillon and Wals, 2006, p.550).

Fleetwood (2005) is useful as a starting point:

‘The way we think the world is (ontology) influences: what we think can be known about it (epistemology); how we think it can be investigated (methodology and research techniques); the kinds of theories we think can be constructed about it; and the political and policy stances we are prepared to take.’

(ibid, p.197)

For this research, it is important that the epistemology approach adopted is suited to both inductive and abductive techniques because of the layers of ‘what’, ‘why’ and ‘how’ questions (Blaikie, 2010) and corresponding description, understanding and change research outcomes.

The complexity of multi-level, multi-actor governance context means it is crucial that this study be bounded by ontological constraints. These constraints create a sense of safety within which to explore these complex and contested phenomena. Whilst, as noted there is a need to avoid ‘...*die hard ontological and epistemological commitments...*’ (Burrell and Morgan, 1979, p. 24), it is more important to avoid creating a kind of sociological trifle; the purpose here is to develop rich qualitative data and a deep understanding, but within limits of time and resource. Denzin and Lincoln (2013) are interesting on this point. Their discussion on traditions and complexity allows room for exploration so that the data should be allowed to direct understanding but, importantly, within epistemological limits (Denzin and Lincoln, 2013).

For this research, an interpretive, moderate constructionist approach, where both culture and society are relevant, provides such limits. However, for this research, elements of constructivism were also adopted in the interpretation

as findings suggest that the individual matters; participants were encouraged to expand their answers with personal experience during interview. This created challenges in interpretation of the data but gave unexpected richness and depth to the analysis. However, as discussed in section 3.2 the data are analysed with the understanding that individual voices are influenced by structure and agency within wider, socially constructed, organisational fields; history, place, relationships, over time and at different levels shape discourse. Alternative approaches, for example extreme positivist approaches, would risk being overtly reductive or even conflating structure with social processes and relationships in real domains. Extreme realist approaches would risk missing socially constructed relationships and motivations or fields themselves.

Whilst the dominant epistemology here is moderate social constructionist, elements of critical realism have been embedded in the research design, the interpretation of data and, ultimately, in drawing conclusions. This is appropriate for three main reasons: Firstly, it allowed for a close view of the data from all sides, so that unknowns (for example relationships) in a wicked context could be considered in depth. Secondly, to avoid conflation in interpretations of the data; for this case, considering governance arrangements for coal use over time, both structure *and* agency effect dynamics and changes in the dynamics (Archer, 1995), there is potential to conflate and fuse the effects. Thirdly, importantly, employing elements of both epistemologies increases the analytical strength of each approach. Here, the insights of Fairclough (2005) are useful as they provide recommendations on the use of critical realist ontology in organisational studies (Fairclough, 2005). Fairclough suggests that the use of discourse analysis as an analytical tool in organisational studies has, up to that point in its development, been limited given the dominance of postmodernism and extreme constructivist stances. What Fairclough presents as an alternative, a moderate constructivist approach appropriate to developing understanding through the adoption of critical realist ontology. He argues for:

'...a critical realist position which is moderately socially constructivist but rejects the tendency for the study of organization to be reduced to the study of discourse, locating the analysis of discourse instead within an analytically dualist epistemology which gives primacy to researching

relations between agency... and structure on the basis of a realist social ontology.'

(Fairclough, 2005, p.916)

Whilst primacy is given here to the constructionist approach, given the wicked phenomenon under study, it is appropriate to adopt this less ontologically rigid, *moderate* critical approach; as issues of agency, relationships, power dynamics and structure are not known or well understood.

From an epistemological perspective, it is important to state that the complexity and richness of the research aims means a positivist approach would be unsuitable (Yin 2014; Blaikie 2010). Due to the wicked nature of the conceptual problem identified, there would be a risk of reductionism (Neuman, 2003) where '*...empirical observations are at too low a level for the causal relationship that is stated.*' Instead there is no attempt here to identify causality or test an hypothesis, but rather the intention is to develop a rich understanding and illuminate relationships through novel use of solid, well understood methodological and analytical processes. This approach is at least in keeping with, if not essential for, contemporary interdisciplinary attempts to better understand and progress complex environmental social science phenomena. Gillard et al. (2016), for example, suggest an interdisciplinary approach to develop analytical frameworks is desirable in order to '*... become more theoretically robust and capable of informing effective, let alone transformational, climate change governance...*' (Gillard et al., 2016, 251). In this sense, challenges with multiple and complex dimensions benefit from approaches that reflect this complexity.

Blaikie (2010) suggests that for some social scientists, the only thing that research can do is descriptive and that this is useful in its own right. What this research tries to do is both develop a thoroughly grounded and theoretically underpinned description of the current situation and its evolution, as well as take some abductive steps which start to attend to the interesting 'why' and 'how' questions.

3.1.2 Developing organisational fields of governance as the unit of analysis

To gain a sufficiently rich understanding of the governance and sustainability of the continued use of unabated coal in electricity generation in the UK, it is necessary to look beyond individual organisations, policies or networks. Methodologies adopted by institutional and organisational theorists are particularly instructive here, as they consider the multiple dynamic processes that lead to change over time. At its most elemental level, the research looks at changes in organising structures (institutions) and actors of governance and sustainability over time. Hoffman (2001), DiMaggio and Powell (1983) and Scott (2008) provide useful insights into the use and success of institutional theory in explaining organisational change. In particular, Hoffman's structure and analytical framework employed in his landmark study of corporate environmentalism within and around chemical, oil & gas industries in 1960s-90s USA (Hoffman, 2001) has been instructive in the development of the analytical framework used here. In 'From Heresy to Dogma', Hoffman (2001) draws together data from different sources, scales, levels of governance and temporal junctures and teases the data apart to show how institutions evolve within multiple organisational fields. Furthermore, he illustrates that within these organisational fields, pressures and dynamics create change over time over time (Hoffman, 2001).

DiMaggio and Powell (1983) have described the isomorphic pressures that create change within organisational fields as being mimetic, coercive or normative. Mimetic isomorphism refers to the tendency for organisations to mimic one another. Coercive isomorphism, in contrast to mimetic, occurs when organisations are induced to change because of external pressures from other organisations, for example in the form of mandates or legislative requirements. Normative isomorphism occurs when organisational change results from the influence of societal norms and values, for example through professional codes of conduct or standards (DiMaggio and Powell, 1983).

For this research, following Milstein et al (2002), consideration of these processes is used beyond a single organisation or sector to consider the processes within organisational fields. There are two principal reasons for doing so. Firstly, *prima facie*, the governance arrangements associated with

continued coal use are not leading to intended outcomes for new coal (GCCSI, 2016); considering the effects of isomorphic pressures within fields and over time helps to illuminate otherwise unknown structures and outcomes. Historical institutionalism suggests that the evolution of change is an on-going and iterative process. Change in the structure of institutions is affected by the agency and motivations of actors: institutions evolve in sometimes unknown (and possibly unknowable) ways. In this sense, '*...structure and outcomes are not those planned or intended, but the consequence of unanticipated effects and constrained choice.*' (March and Olsen, 1984, p. 737).

Secondly, the organisational field, as an abstracted concept, is central to organisation theory (Furnari, 2015, p. ii). As such, it has been used to suit multiple theoretical and applied contexts. Scott usefully conceptualises organisational fields as:

'...a community of organizations that partakes of a common meaning system and whose participants interact more frequently and fatefully with one another than with actors outside of the field'

(Scott, 1994, pp. 207-208)

The organisational field is not simply a grouping of organisations with similar interests or purposes (typically producing similar products or services – chemical industry, health service, education providers or in this case electricity generators), but also those multiple organisations that influence their behaviours, actions and performance. In this sense, a field describes a broad set of organisations beyond, for example traditional classifications of networks, sectors or industries. In aggregate, these additional organisations (categorised here as actors and entities), such as regulators, funding sources, advocates or opposition groups, thereby forming, '*a recognized area of institutional life*' (Di Maggio and Powell, 1983, p. 148).' Fields therefore illuminate more than simply institutional change.

As detailed in chapter one, a core objective of this research is to establish the key characteristics of organisational fields relevant to coal use in electricity generation. This thesis employs the use of organisational fields to do this in two ways; as the unit of analysis and as a lens through which to examine the wicked problem under scrutiny. The remainder of this section explores the

relevance and efficacy of organisational field analysis in this context and signposts the conceptual contribution this thesis makes by bringing the use of organisational fields to conceptualisations of governance and sustainability.

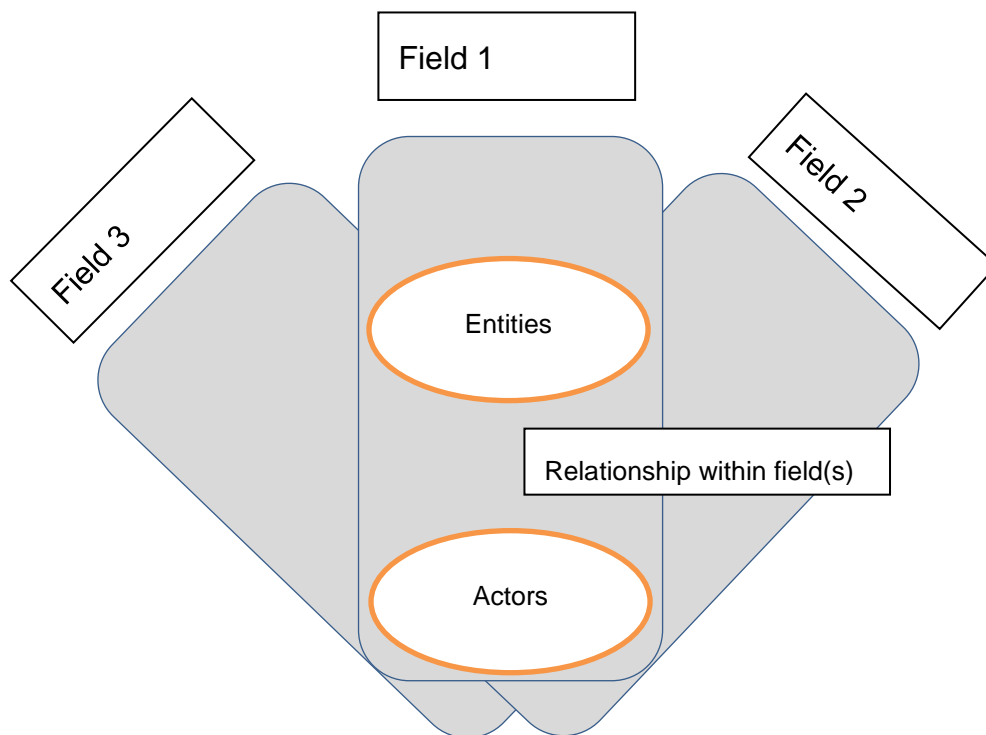
Section 2.2 and 2.3 above outlines that both sustainability and governance are contested terms, but that these terms can usefully be used as organising principles. What is clear from the discourse is that within these organising principles, multiple actors operating at different levels and spatial scales have nominal roles in processes and outcomes of both sustainability and governance. However, for the wicked problem under study, organisations across many institutions have roles in outputs. This complexity dictates the need to use a field approach rather than examine any single individual institution or organisation. In addition, in the wicked context being examined here, new coal and new governance arrangements designed to develop sustainable development options, have been conceptualised here as being inextricably linked with old coal and old governance. The emergence of the current shape of governance arrangements is not, therefore, seen in isolation; the organisational fields approach allows for consideration of the dynamics and isomorphic processes that effect these governance arrangements.

3.1.2.1 Development of analytical framework

A novel analytical framework appropriate to the study of organisational field change at multiple levels and over time has been developed. For Hoffman (2001), many, sometimes unconnected, competing or dissonant fields can exist and influence, or be influenced by different institutions and therefore organisational behaviour can and is affected by multiple fields (see figure 3.1). This research adapts Hoffman's approach to consider not a single organisation that exists within multiple fields, but the many actors, entities, and relationships that exist within an organisational field of governance.

The dominant approach in organisational sciences and institutional theory traditionally, has however been to understate the importance of agency over structure in determining action (Leca and Naccache, 2006, p. 627). However, over recent decades, leading institutional theorists have sought to better understand the relationships, power mechanisms and agency of actors, in terms of their capacity to develop strategies and shape institutional

reproduction and change (ibid, p. 628). One approach to doing this has been to adopt a critical realist approach in the study of institutions and change (for examples see Friedland and Alford, 1996; Milstein et al, 2002; Leca and Naccache, 2006). Whilst its utility in this context is still being explored (Delbridge and Edwards, 2013), certainly for this research, as discussed above, the appeal of adopting elements of critical realism (CR) within a broadly constructionist approach is strong. CR allows for a thorough and in depth understanding – one which because of the layered assumptions of reality can explore relationships beyond the empirical (Leca and Naccache, 2006, p. 630).



(Adapted from Hoffman, 2001, p.35)

Figure 1 Entities, actors and relationships exist within multiple fields

For the wicked problem of continued coal use, this view of the social world as being an open system in which multiple causal powers and influences may coexist (Archer, 1998) is appealing. However, as stated above, identifying specific causality is not an aim of this research, rather the critical realist approach will be used within a broadly constructionist grounding so as to

consider the real without conflating agency and structure. In Meyer et al's terms (2005):

'We argue that ingrained assumptions and habituated methodologies dissuade organizational scientists from grappling with problems to which these ideas and tools do not apply... We urge our colleagues to transcend the general linear model...'

(Meyer et al, 2005, p. 457)

Advancing here on organisational and institutional literatures, the intention is to avoid what has been characterised as an '*over deterministic view*' (Leca & Naccache, 2006, p.627) presented by traditional institutional theorists, which can lack deeper understanding of the ways in which reproduction and change occur in institutions. The analytical power of critical realism when combined with moderate constructivist approach rests in its ability to show, for example, how institutional change is a result of the actions of actors. They also consider the '*paradox of institutionally embedded agency*' (Leca and Naccache 2006, p. 628) i.e. question how change is possible where actors' intentions, behaviours, actions, rationality are conditioned and determined by the institutions they wish to change. Delbridge and Edwards' (2013) insights also suggest that the integration of critical realist ontology to new institutionalism is beneficial (Delbridge and Edwards, 2013). In providing empirical grounding for the advancement of theoretical work of Margaret Archer (1995, 2003), the authors illustrate the utility of critical realist ontology in new institutionalism. They do this by positioning agency *and* structure as distinct but as having historical associations which effect field dynamics within the organisational field (Delbridge and Edwards, 2013).

For the case of coal use in the UK, many organisations are involved (firms, networks, government bodies), whilst these are interesting, in order to reveal unknown relationships it is not possible (or sufficient) here to do a comparative analysis of how these have emerged in time at a specific organisational level. Hence, this research is concerned with (i) firms *and* (ii) communities *and* (iii) government actors in terms of their role in influencing organisational field level change in institutional and organisational field arrangements.

For this research then, using elements of critical realism within the boundaries of new institutionalism, makes it possible to not only identify and describe organisational fields of governance, but also to investigate the dynamics of change within and between fields.

3.2 Research design and strategy

There are a number of significant epistemological and interpretive challenges in the production of, methods used and analysis of data for research of this nature. Namely, core challenges in research design include:

- The historical social science context; equivalent (i.e. for comparison) longitudinal data are not available for the whole period of study
- Applying the organisational fields approach across levels and over time for governance and sustainability both of which are contested terms is novel
- Generalisability of conclusions from the analysis of a case study may be critiqued as limited

Options for research design are clearly extensive; the tools employed here were chosen based on their efficiency in addressing the research challenges identified. This results in a multi-methods approach. Using multiple data sources in this way both discourages research bias and increases generalisability of the research findings. By triangulating the data from naturally occurring events, historical data, bureaucratic and official records and personal accounts, potential biases with any single method are reduced (Yin, 2014) and data are cross verified to strengthen arguments. This section details and justifies this research design.

3.2.1 Case studies

Eisenhardt (1989), Blaikie (2010), Yin (2014) and others, have suggested that case studies are useful for dealing with 'what' and descriptive questions, as well as for gaining understanding and theory building. Whilst it is recognised that knowledge generated here – norms, values, institutions, structures – is case and context specific, it is not ethnographically so. Taking a case at

multiple levels and over time, increases the validity of generalisations made (Yin, 2014; Flick, 2015). The case study approach also encourages:

‘... frame breaking insights, the tests of good theory (e.g., parsimony, logical coherence), and convincing grounding in the evidence are the key criteria for evaluating this type of research’

(Jarvensivu, 2010, p. 100)

Given this potential for developing a solid understanding, the case of UK coal use at two levels was adopted in line with these principles.

3.2.2 Data generation

This section provides detail on the choices made regarding data collection and generation¹⁷, including case selection together with an outline of how the chosen methods were employed. Table 2 below provides a summary of how the data are used within each chapter.

| | <i>Research method</i> | <i>Chapter</i> |
|------------------|--|------------------|
| <i>Primary</i> | Scoping visits and informal meetings with expert witnesses | 1, 2, 3, 6 |
| | Semi-structured interviews | 4, 5, 6 |
| | Non-participant observation of naturally occurring events | 5, 6 |
| <i>Secondary</i> | Desk top study | 1, 2, 4, 5, 6, 8 |
| | CCS project data | 6, 8 |
| | Bureaucratic and grey literature | 4, 5, 6, 8 |
| | Demographic data | 1, 2, 4, 5, 6, 8 |
| | Media accounts | 5, 6, 8 |
| | Archival data | 4, 8 |
| | Company reports | 5, 6, 8 |

Table 2 Sources of data and associated chapters

¹⁷ A full list of data sources is held in appendix D.

Scoping/site visits:

Scoping visits have been identified as a parsimonious way of identifying research priorities (Levac et al, 2010). This worked well to:

- (i) Further streamline research priorities and questions
- (ii) Identify potential organisations and individuals as participants
- (iii) Gain an initial picture of context and case study locations.

A total of six visits to coal fired power stations and potential sites for new coal fired power stations were undertaken.

Document review:

Appropriate documents were identified using:

- Iterative topic based web searches (using google, google scholar, web of science, University of Leeds and public library search facilities)
- Initial exploratory and scoping/site visits
- Discussions and personal correspondence with supervisors and expert colleagues
- Snowballing – one document (text, discourse) leading to another
- Recommendations from (but not typically authored by) participants

Due to the broad, wide ranging nature of the subject matter, the relative paucity of social science literature in this field and the novelty of the research design, the initial desk top study and document review was necessarily far reaching (Gomm, 2004, p. 245) but bounded by both relevance to the question and time limitations.

These limitations made a strategic approach to sampling and document analysis essential¹⁸ and many documents were deemed inappropriate. Selection/exclusion criteria included:

- Evident bias where this was not either of specific interest or supported within multiple texts
- Availability in the public domain
- Solely technical reports or project information (for example CCS technical data on solvent efficiency)

¹⁸ This is especially the case for chapter 8

- Relative analytical distance from research questions (for example, archived miners accounts of police brutality or energy company financial reports)

Naturally occurring events:

This technique is useful and effective here as it fulfils Robson's 'observe' criteria perceived as essential for knowledge generation (Robson, 2011). Observing natural behaviour and using this to corroborate interview data, helps to some extent negate the possibility of researcher or interview bias (Gomm, 2004, p. 223).

Appropriate events for observation were identified by:

- Joining relevant on-line fora (LinkedIn, CCS Network, UKCCSRC)
- Joining company, government and community group mailing lists to receive email updates of activities
- Regularly visiting company, government departments and local council websites
- Personal, professional and academic contacts' recommendations

Events were then selected for attendance based on:

- Relevance to research topic
- Relevance to case locality/level
- Expected attendees
- Logistics (of cost, time and location, acceptance of attendance requests)

Non-participant observation of naturally occurring events formed an essential part of this research, in particular to gain in-depth understanding of what is characterised here as new governance/new coal era.

Interviews:

Semi-structured interviews formed a key and instructive part of this research, in large part due to the need to listen to and understand people from different social and organisational groups. For Creswell, semi-structured interviews allow the researcher to '*think about*' the phenomenon under study (Creswell, 1998). However, using interviews risks generating bias, but in this case given

the epistemological approach outlined above interviews are wholly suitable. As Creswell skilfully puts it:

'Knowledge is within the meanings people make of it; knowledge is gained through people talking about their meanings; knowledge is laced with biases and values...'

(ibid, p. 19)

The benefits to the research outweigh the risks and conducting semi-structured interviews within a multi-methods approach has reduced the potential for research bias. For this purpose, purposive (Palys, 2008) sampling, snowballing and self-selection techniques were employed. For Palys, using sampling of this nature applies a strategic approach geared toward addressing research aims and objectives (ibid, p. 697). Taking this understanding, the criteria for selection at UK level were:

- Expertise in coal for energy generation
- Expertise in governance and sustainability of energy (including CSR, stakeholder engagement)
- UK, or/and international remit

Criteria for selection at Yorkshire and Humberside level were:

- As above but with local expertise¹⁹
- Resident within 8 miles radius of existing coal fired power station
- Resident within 8 miles of a proposed CCS project
- Employee (or past employee) of coal fired power station or mine
- Employee of CCS project (planned or operational) in Y&H.

Within these groups, the sample of interviewees was generated through self-selection (in response to a notice), opportunistic meetings of individuals at events and snow balling. Appendix F shows a redacted list of interviews.

3.2.2.1 *Ethics approval*

Ethical approval was sought and granted (approval reference AREA 11-197, appendix G). Three core ethical issues were considered; participants'

¹⁹ A number of interviewees had expertise/knowledge at both local Y&H and UK levels these are indicated in the detailed interviewee lists in appendix F.

consent, confidentiality and data security, and commercial sensitivity. Consent was sought from each participant using a consent form giving a summary of the research and details of how data would be used (appendix H). All texts and transcripts have been redacted or anonymised to maintain confidentiality, other than where bureaucratic data are publicly available. To maintain data security, records of interviews and observations are stored in password protected folders following University of Leeds protocols for IT security. Finally, where interview or observation data might have proven commercially sensitive, data have been redacted or alternative texts used as examples.

3.2.3 Research phases

This research project was delivered through five main research phases as detailed below in table 3.

| | <i>Research Activities</i> |
|-------------------|--|
| <i>Phase one</i> | <ul style="list-style-type: none"> • Desk top study and document review • Scoping visits and informal meetings with expert witnesses • Phase one analysis |
| <i>Phase two</i> | <ul style="list-style-type: none"> • Proposal of eras • Interview design • Identifying events for observation • Ethics review |
| <i>Phase four</i> | <ul style="list-style-type: none"> • Non-participant observation of naturally occurring events • Document review • Interviews |
| <i>Phase four</i> | <ul style="list-style-type: none"> • Coding for metaphors, actors, entities, relationships • Analysis and construction of organisational fields |
| <i>Phase five</i> | <ul style="list-style-type: none"> • Reflection and write up |

Table 3 **Research phases**

The phases were non-exclusive, therefore elements of overlap and reiteration between phases occurred throughout the study.

3.3 Analytical approach – development of metaphors

3.3.1 Discourse analysis

The governance eras and organisational fields have been established using principles of discourse analysis adapted from Dryzek (2005). Whilst it is beyond the remit of this study to provide a full review of the meaning and value of discourse analysis, which would include debates from Habermas and Foucault amongst others, it is useful here in this methodology section to consider how this analytical approach has been used and why this is appropriate for this research.

Firstly, for context, the use of discourse analysis here is grounded in the understanding that the way things are discussed is important (Ellis and Bastin, 2010). Discourse can be viewed as both a way to find understanding of something (Hajer, 1995) and a way of creating change or action. As a key tenet of the seminal work of Foucault (Goverde et al., 2000), power is viewed as being '*embedded in and effectuated through a crucial combination of knowledge and language*' (Ellis and Bastin, 2010, p. 295).

For Foucault, discourse is a:

'... complex mixture of ideas and expression through which individuals both perceive and in turn try to explain social reality...'

(Goverde et al., 2000, p. 14).

The analysis of discourse to gain greater understanding of both governance and sustainable development has been discussed at length (Hajer, 1995; Dryzek, 1997, 2005; Jamison, 2001). Similarly, the link between language, discourse and power has been extensively demonstrated in the literature. One of the key features of the debate which is of particular relevance to this research, is the explicit link between discourse and power, and in particular the way that discourse is used to both create one set of truths and negate another. This theme re-emerges for discussion in chapter seven.

In this way, discourse is both a means of understanding society and a force that drives behaviour. For Dryzek, similarly, a discourse is:

'A shared way of apprehending the world. ...discourses construct meanings and relationships, helping to define common sense and legitimate knowledge.'

(Dryzek, 2005, p. 9)

This definition chimes with this research; the changes in the arrangements of governance (actors, structures) have, to some degree, allowed for a more open debate, and inclusion of wider range of actors in decision making, however prevailing, powerful actors and institutions still lead and shape the debate and decide who takes part (Rydin, 2003). For this research, a more critical approach to discourse analysis, which identified actors and their motivations, important entities – institutions, concepts, organisations - and the relationships between dominant actors was appropriate.

Dryzek's approach to discourse analysis is based on the principle that language and rhetoric have functional roles in developing an understanding of decision-making. He states that:

'The way a discourse views the world is not always easily comprehended by those who subscribe to other discourses.' And it follows that *'... the way we construct, interpret, discuss, and analyse environmental problems has all kinds of consequences'*

(Dryzek, 2005, p. 9).

Power and agency are embedded within discourse. This is an insightful principle, and relevant here given that the wicked nature of the problem dictates that there will be multiple answers and comprehensions. In this case, as changes to dominant discourse and metaphors are witnessed, we are simultaneously learning about which actors, entities and relationships are dominant for different eras.

For Dryzek, a discourse comprises four interrelated features; metaphors, entities, agents/actors and the relationships between them (Dryzek, 2005). Metaphors (and other rhetorical devices), are seen as useful conceptualising or bounding themes used to frame understanding of complex scenarios. The remainder of this section is a précis of how Dryzek's approach has been adopted for this study.

3.3.2 Coding; identifying dominant metaphors

Section 3.1 showed that the ontological approach adopted here is suited to the two dominant research strategies adopted; inductive and abductive²⁰ (Creswell, 2007), (Blaikie, 2010). Inductive strategies, whereby data are generated and then where generalisations or similarities are observed (ibid, p. 25) brought together, suited the identification of metaphors from within the texts. In keeping with adoption of a critical realist ontology within a broadly constructivist approach, abductive strategies (ibid, p. 25) to explaining the data seek to identify the real underlying structure or mechanism that underlies a feature of the texts.

The coding techniques employed as discussed below, work well with this strategy, however two assumptions were made about the codes in doing so. Firstly, the broad organisational principle of sustainability was used as an underpinning for coding; all texts were coded against one or more of the three pillars of sustainability i.e. economic, environmental or social. Where a text relates to more than one category, it was repeated in each until similarities and differences or a dominant pillar became apparent. This is purposeful to ensure the research is feasible within the given time and resource constraints but also to avoid trying to establish an ill fated 'theory of everything'. Secondly, as discussed below, where similar texts were coded, this was taken as an assumption of dominance of that metaphor or rhetorical device. Once texts were coded, a degree of additional discourse analysis to determine dominant metaphors was required. This meant iterative abductive processes. In summary, an inductive approach is used for 'what' and an abductive approach is used to treat 'how' and 'why' questions.

Three stages of coding were employed in the identification and analysis of metaphors and the actors, entities and relationships within them (Charmez, 2006).

²⁰ A discussion on minor definitional and semantic distinctions between abduction and retroduction is beyond the remit of this thesis. For the purposes of this research, the term abduction has been adopted as it connects with moderate constructivism.

Open Coding: Initial, open minded coding against economic, environmental and/or social. This approach, adopted from grounded theorists, allowed for gradual movement towards themes and metaphors.

Where codes initially identified were comparative (i.e. over time or level for economic, social and environmental features) rather than descriptive this was noted. For example, in interview L11, the interviewee frequently referred to how '*things used to be*'. This feature of the text was repeated in other data to suggest movement toward a pattern.

Where evident, comparisons between 'emergent', 'dominant' and 'declining' were noted. Examples of coded texts summarised in to an MS Excel spreadsheet for ease of data handling are included in appendix I.

Axial Coding: After open coding, patterns and relationships between coded texts emerged. Documents, texts, interview transcripts and notes from observations were analysed using close reading, then coded for metaphors, agents and their motives, entities and the relationships between them (Dryzek, 2005). Data were then summarised in to an MS Excel spreadsheet for ease of data handling. Once summarised, methodological triangulation techniques (Denzin and Lincoln, 20) (i.e. texts were coded using the same methods for primary and secondary data from different sources, and then triangulated for similarity and difference).

Selective Coding: The final stage of coding involved removing those codes that were either not relevant or deemed less relevant than others. Codes that emerged from a single document or text, were not repeated, or could not be triangulated from multiple, unconnected sources were removed. For example, an early metaphor relating to scepticism about climate change was repeated in more than one data source, however, as more texts were coded, this metaphor became less meaningful or representative of the data.

The metaphors developed are therefore representative of collections of data; in each case the example or extract given has been selected on the basis of its representation of the metaphor. The emergent metaphors, or collections of rhetorical devices (Dryzek, 2005) are presented as being relevant to economic, environmental or social issues. Where there is overlap, this is noted in the narrative.

3.3.3 *Presenting the discourse*

The iterative approach developed, reveals three core features: Firstly, organisational fields of governance emerge for at least three distinct eras²¹ characterised here for the purposes of analysis (see chapter seven) as old governance/old coal, new governance/old coal and new governance/new coal. 'Old coal' means coal that is unabated, i.e. the emissions from coal combustion escape to the atmosphere. 'New coal' means with new or clean coal technology adaptations (see 2.1.2). 'Old governance' means state rule and management of resources. 'New governance' means ML/MA governance arrangements which include non-state actors in meaningful decision making activities.

Secondly, during these eras, the significance of at least two levels of analysis becomes apparent; the UK level and the sub-national Yorkshire and Humberside level. In addition, both international and local levels were also noted as significant in the text, however, for this research problem, the UK and Yorkshire and Humberside levels were evidenced as being more significant.

Thirdly, temporal connections and drivers both within and between these levels, influence both organisational field makeup, structure and field dynamics over time. Both levels and temporal fields are, evidently, more complex than this summary suggests and the detail for how two levels and at least three eras emerge is unpacked here in chapters four to eight.

This characterisation of governance eras and levels is reflected in the structure of chapters four to six. Throughout, the metaphors are presented as a narrative, with each dominant metaphor denoted in the section heading to steer the narrative through time, feature and level. Specifically, chapter four demonstrates that distinct eras of governance emerge. It does this by presenting metaphors for the period 1960 to circa²² 1980 in section 4.1. Section 4.2 then demonstrates a change in dominant metaphors for the era c.1980 to 2000, characterised as a period of old coal/new governance. Chapter five the presents metaphors for the period 2000 to c.2014 at UK level. This period is characterised as being one of nominally new coal and new

²¹ It is worth noting that an additional 'post-new coal' era may begin to be evident as discussed in chapter 8, but this can not yet be verified.

²² The eras are characterisations rather than strictly delineated time periods.

governance. Chapter six then details the organisational fields of governance for the Yorkshire and Humberside level for this new coal/new governance era. Chapters five and six together demonstrate the distinct differences between organisational fields at different levels of governance. These interesting findings are brought together in chapter seven and discussed in terms of the dynamic and isomorphic pressures that drive change within and between fields over time. Chapter eight then provides a comprehensive update on the changes in the market for coal and coal use in the UK, from the end of the empirical research (2013/4) to the present day.

3.4 Summary

The wicked nature of the environmental social science problem of continued unabated coal use in the UK, dictates the need to employ appropriately varied methodological and epistemological approaches in order to adequately address the research aims. This research employs the core organising principles of sustainability and governance, as discussed in chapter two, to hang the analysis around, combined with the innovative use of discourse analysis to establish organisational fields of governance. Bringing the organisational fields approach in to the governance and sustainability arena adds analytical strength to the research to make case findings more widely generalizable.

This methodology chapter outlines how the research aims, objectives and questions have been addressed. It presents the epistemological and ontological underpinnings adopted with reference to suitability of mixed epistemology for this research to generate organisational field of governance as the unit of analysis. The resultant grounded analytical techniques and framework developed, is designed to contribute to theory and practice for studies of wicked phenomenon, providing a safety net for research, but without constraining the research with '*die hard ontological and epistemological commitments*' (Burrell and Morgan, 1979, p. 24). The research design and the tools employed ultimately reflect this epistemological approach, in a way that adds validity to the discussions and conclusions drawn in chapters seven and nine.

Chapter 4 – An historical characterisation of governance at two levels: dirty old coal?

This chapter contributes to the research question by presenting an overview and characterisation of governance processes and outcomes over the latter half of the twentieth century at two levels. Together with chapters five and six, it provides a characterisation of coal use in the UK using governance and sustainability as organising principles. In doing so it begins to address research questions:

1. *What are the key characteristics of organisational fields for governance relevant for coal use in electricity generation, in terms of:*
 - a. *Governance arrangements*
 - b. *Actors and agency*
 - c. *Organisations and institutions?*
2. *Have these changed over time, if so how and why?*

Specifically, by presenting findings from an historical, exploratory analysis of the longitudinal data, this chapter demonstrates that organisational fields for governance of coal have emerged and changed over time for at least two governance levels. This greater understanding of governance leads to knowledge of the drivers and forces for change or stagnation; intended and unintended consequences are then discussed in full in chapters seven and eight.

Taking each broad governance era (old coal/old governance and old coal/new governance) in turn, section 4.1 considers the era from the 1960s to the early 1980s; an era characterised by traditional ('old' for this synopsis) styles of governance. Section 4.2, then presents the analysis for the period from the early 1980s to circa 2000; a period of structural adjustment, change and turmoil, characterised here as new governance but old coal. Each section is presented in terms of economic, environmental and social metaphors and the actors, entities and relationships that come to light in line with the analytical framework presented in chapter three. Section 4.3 then summarises the analysis to propose organisational fields for governance emerging at the end of the twentieth century. These lay foundations for comparison across era and scales and begin to answer the research question.

4.1 1960s to early 1980s - old governance, old coal

The early part of this post-world war II era was dominated by Keynesian approaches to regeneration, economic and industrial recovery; house building, infrastructure development, government and public subsidies, and much of this development was fuelled by coal. Coal mining and electricity generation came under public ownership in 1947, and the period saw considerable activity in both sectors. Between the mid-1950s and early 1970s, 53 new coal fired power stations were built in the industrial heartlands of northern England, Wales and central belt Scotland (compared with 5 oil or gas). New power stations were built close to mining infrastructure, heavy industry or densely populated areas to meet demand for electricity. To service these power stations new rail links were built, and ports developed for import and export of coal to meet fluctuating demand (see figure 5.3).

Whilst this narrative is well rehearsed elsewhere (Hall, 1981; Strangleman, 2001), this analysis considers the historical context from an original perspective, i.e. it considers the wider governance contexts to form organisational fields in terms of dominant economic, environmental and social metaphors emerging from the data.

4.1.1 *Economic metaphors 1960 - 1980*

4.1.1.1 *King coal - a national treasure*

The coal mining industry in the UK was nationalised under the National Coal Board (NCB) in 1946²³ taking ownership of 958 collieries, formerly the property of over 800 companies (Hill, 2001, p36). At the same time, the UK Electricity Act nationalised 505 separate energy generators into one Central Energy Generating Board (CEGB), managed under 14 regional (area) boards. During the first decades of public ownership, coal use boomed in the UK and the nation's post-war regeneration was, quite literally, fuelled by coal (Cochrane, 1990). Whilst social and environmental consequences of mining were recognised, coal was dominantly associated with national economic gain and

²³ Established under the Coal Industry Nationalisation Act 1946 and brought in to operation from 1st January 1947

the 'King Coal' (Sinclair, 1917²⁴) metaphor was strong. Reflections on this era from interviews corroborate this sentiment:

'It felt like we were part of something... building the country up again. We were opening a new power plant almost every month in the 60s and still not really keeping up with demand. Can you imagine?'

(Interviewee L1, 2012)

However, whilst coal was used in electricity generation, the decline of the coal mining industry started from the early 1960s, with increasing imports of cheaper foreign coal. There is no suggestion of the direction of causality here, however during the 1960s and 1970s in the UK virtually all electricity generated was from coal yet, rising demand and instability of alternative fuels meant UK supply could not fulfil demand. Towards the end of the era, gas and oil increased in the energy mix and subsequently six new advanced gas-cooled reactor nuclear plants opened in early 1980s.

It is interesting to consider here whether the heavy investment in the early part of the era up until the early 1970s then lead to delays in progress of other fuel sources possibly because of extent to which other infrastructure linked with coal. This concept is considered further in chapters seven and eight, however, it is worth noting at this stage that parallels exist between discourse on investment in coal with CCS versus alternative sources of low carbon energy and current debates on carbon lock in. For this analysis, the arguably unintended consequences of economic decisions are of interest.

Regional pride in the localities hosting 'a national treasure' was high:

'It was phenomenal really. We could see six headframes and two power stations from our house. It felt like the whole country was powered from right here'

(Interviewee L12, 2013)

This economic and physical infrastructure issue, with coal as central to economic development contributes to regional as well as national features of coal governance.

²⁴ King Coal the novel by Sinclair is purposefully misquoted here.

4.1.1.2 *Keeping the lights on*

In keeping with 'King Coal' metaphors, metaphors relating to coal use in electricity generation and 'keeping the lights on' were dominant in this era. The expansion of the national grid and power to homes, reiterate that coal was very much at the heart of the post war economy. Energy efficiency and generation capacity was a core measure during the era, with individual plants and regional electricity boards competing for efficiency gains (NCMM archives). KWh per tonne was an important measure of efficiency rather than price or financial indicators. This is perhaps somewhat overstated here but the aim was, seemingly, to meet demand at any cost:

'We regularly got 90kwh, they don't get anything like that now because they buy the cheaper coal. We'd compete with other stations too, the [CEG] Board reported our weekly averages'

(Interviewee L1, 2012)

[parentheses added]

In this sense wider economic, i.e. rather than solely financial, costs and benefits were relevant, as growing demand for energy meant coal was an important part of economic functioning and regeneration of the UK. Publicly owned coal mines and coal fired power stations were heavily subsidised in order to 'keep the lights on' but, in a broadly Keynesian economic context, this was not seen as problematic.

4.1.1.3 *Economic communities of coal*

This metaphor, broadly relates to the emergence of economic communities, founded on and dependent on coal and other heavy industry. For Yorkshire and Humber three core industries dominated; textiles, steel, and coal and power. This regional distinction from national discourse suggests a degree of environmental determinism, for example, whole communities moved together because of environmental circumstances (e.g. new coal seams), and economic drivers associated with this.

This regional context has wider economic implications here; in these extracts the drivers for social and community change were economic:

'I started straight after school. A man from the [power] plant came to the grammar and asked us what job we wanted to do. I said I wanted to be an engineer, he asked me a few more questions, nothing very difficult, and I started an apprenticeship a few weeks later.'

(Interviewee L1, 2012)

[Parenthesis added]

'Everybody except the milkman worked in either the mines or the power stations... We thought we had jobs for life.'

(Interviewee L2, 2012)

The latter years of the 1970s and early 1980s were marked by a changing political economy; the end of the managed economy and what might broadly be defined as Keynesian socialism (Sheehan, 2009). Specifically, what that meant for coal mining and electricity generation was a rolling back of state subsidies and opening of the market. Public sector wages stopped rising in line with the private sector; strikes, black outs, the 'winter of discontent' and three day weeks for heavy energy users. The groundwork for neo-liberalisation was laid during this time and (explored in more depth in section 4.2), but dominant in this period is what might be classed as old style, managed economy led by government actors. What is also interesting here are the relationships between dominant actors and the institutional entities evident within the era. Table 4 draws these out to present a summary of dominant metaphors and associated agents, entities and relationships. The significance of this is explored more fully in section 4.1.4 once environmental and social issues have been detailed.

4.1.1.4 The political economy of change: thriving economy to three-day weeks

During the 1960s and early 1970s, levels of employment were high in the UK and the coal industry and energy sector both exemplified and reflected this. Mine closures were common in the UK during the 1960s especially in the North East, despite continued construction of coal fired power stations. However,

| <i>Metaphors/themes</i> | <i>Level</i> | <i>Agents and motives</i> | <i>Entities</i> | <i>Relationships</i> |
|---|-------------------------|--|---|--|
| Keynesian economics: public ownership, post war government investment to generate economic recovery | UK | National Government (development, economic recovery) British Electricity Authority (CEGB) | National Government Administrative state Energy demand Subsidies | Government with CEGB |
| National treasure: the industrial north, coal mines and coal fired power stations | UK Regional | National Government Government local British Electricity Authority Coal board Miners | National Government Power stations Coal mines Unions Pride | Government with CEGB Workers with mines and power stations |
| Keeping the lights on: coal meeting energy demands | UK Regional Local | Plant and mine managers National Government Plant and mine workers | Electricity Act Administrative state Energy demand | Government with CEGB Workers with mine and plant managers |
| Full employment: hard work but jobs for life. | UK Regional Local | Unions Plant and mine managers | Jobs Negotiated wages Community | Union stewards with regional Authority Board reps Local government with national |
| Economic and environmental dependency – moving communities | UK Regional | National Government Plant and mine workers | Jobs Negotiated wages Community | Government with CEGB Workers with mines and power stations |

Table 4 Economic metaphors 1960s to 1980s

whilst new mines opened, and mine workers moved to new sites by the late 1960s, decline in coal mining was evident with significant reduction in numbers employed in mining and power sectors and the early years of the 1970s saw the start of a period of change in the political economy. International concerns for inflation, oil price shocks and increased international trade (including with Europe) began to affect the status of coal (Van der Ven and Fouquet, 2014). Imports of cheaper coal increased (Digest of UK Energy Statistics, 2012, p.54) some mines became inefficient and closed, and wage restrictions for public workers lead to strikes and social unrest. Whilst mine closures and associated job losses plus wage restrictions were felt most strongly locally, and unemployment nationally high (Beatty et al, 2007) employment in the sector was higher. An interesting feature of this era however, is the increase in economic migration. Both coal mining and electricity generation were public bodies and miners (with their families) regularly moved between mines without losing jobs or changing conditions:

'We all moved down here [to Yorkshire] at the same time, my dad, brother, uncles, their families. They [the NCB] built houses – they were better than what we'd had - and pretty much everyone we knew except the older ones, just moved [from the NE] to where the coal was so we all stayed in work. Some moved to Nottingham at about the same time we came here and we'd have bus trips to see them'

(Interviewee L2, 2012)

[Parentheses added]

New and extended mining communities emerged in regions such as South Yorkshire and North Nottinghamshire as mines in the North East for example closed. This publicly managed programme meant that as less productive mines closed, and others expanded, whole communities and economies changed, but within understood governance arrangements, for example negotiated wages. The decline of coal during this era, however, was in some cases welcomed, but notably perhaps where other industry existed and opportunities for employment were less restricted.

'I'm glad my son doesn't have to work down the mine, he's a mechanic'

(BBC Archive, 1977, no pagination)

Coal use in UK power stations remained high during the era, and ‘virtually all’ UK electricity during the period came from coal (Digest of UK Energy Statistics Archive, n.d., p.13). As a result, coal miners were seen as different from other workers and consequently able to negotiate salaries above national increases:

‘...for a number of reasons which are exceptional to the mining industry— and do not apply in industry generally — the miners at this particular time have a case for special treatment.’

(HC Deb, 21 February 1972)

But three day weeks, strikes (notably those organised by the National Union of Mineworkers (NUM) in 1969, 1972 and 1974) and social unrest suggested the start of the decline of coal. It is interesting that despite this contextual backdrop, coal and coal miners, to a degree held a special position in society.

This quote suggests why this might have been:

‘I think even people who didn’t have anything to do with mining knew that it was hard work. The whole country relied on coal for electricity... it meant the miners got special treatment. But they probably went too far when others [public sector workers] were struggling too.’

(Interviewee L11, 2013)

[Parenthesis added]

Table 4 above summarises these metaphors to illustrate the overlapping entities and actors and the relationships between them. It also suggests that whilst metaphors are evident at different levels, they are connected through actors and arrangements for governance during this era.

4.1.2 Environmental metaphors

4.1.2.1 *Plentiful coal – the environment as a cupboard*

As summarise in table 5 below, coal in the UK was seen as a stable, readily available fuel stock, in particular during resource crises, where coal was used to meet essential needs. The coalfields of Northern England (the North East and Yorkshire), Wales and the Central Belt of Scotland have been active for many centuries (Durham Mining Museum, n.d.). Use of coal from these regions has fuelled periods of economic growth from the industrial revolution,

empire building, world wars, as well as regeneration of the UK during mid-twentieth century.

A feature of this discourse that ties with economic metaphors is the recognition of the environmental or geographical determinism observed as illustrated by this interview text.

'I don't think half these towns would be here if we didn't have coal under our feet'

(Interviewee L2, 2012)

Similarly, mine closures in the North East and expansion in Yorkshire and North Nottinghamshire with construction of new coal fired power stations; movement of people, new industry around coalfields, housebuilding, suggests a societal and community connection to the environment. This predisposition raises questions about structure and agency dynamics that create potential for carbon lock-in (Unruh, 2000), discussed in chapters five and seven.

4.1.2.2 *Environmental Regulations*

Regulation relating to public management of the environment (from 1970 through the Department of the Environment (DoE)) was enacted during the period 1960 to 1980. The remit for the DoE regulatory framework during the era related to:

'...planning, housing, construction, local government, water, the historic environment, environmental protection and for research into building and hydraulics.'

(The National Archives, n.d., p.3)

During the era, there was a notable increase in statutory instruments, legislative controls and policy development associated with environmental protection and, in particular, clean air (The National Archives, 2016). What becomes evident from this analysis is that concern for clean air and environmental protection exists at national level, with specific controls relating to coal.

4.1.2.3 *The dirty old man of Europe; acid rain*

International, transboundary and transgenerational environmental issues (see chapter 2), emerge as significant during this era. In particular, concerns about emissions from coal and environmental and public health impacts beyond the coalfields emerge from North America and Scandinavia. Dirty coal metaphors are supported with scientific evidence of the (long mooted) connection between coal combustion and acid rain:

‘Acid rain was not considered a serious environmental problem until the 1970s. During that decade, scientists observed the increase in acidity of some lakes and streams. At the same time, research into long range transport of atmospheric pollutants such as sulphur dioxide, indicated a possible link to distant sources of pollution.’

(US Environmental Protection Agency, n.d., p. 1)

It is worth noting, although not strongly evidenced in the texts, that this corresponds with a raising awareness internationally of issues relating to environmental justice. Environmental and social justice movements joined to form groups such as Friends of the Earth (1969) and Greenpeace (1972), and began to challenge governments. Rhetoric relating to cleaner gas and nuclear starts to emerge towards the end of this era in concert with this rise of socio-environmental movements. There are interesting parallels here with the political economy, and perceived inefficiency of national ownership emerge that tie with political economy and intentional ‘doing down’ of coal²⁵. In addition, increased pressure to manage resources as UK coal

²⁵ This closely relates to Gillard’s findings that ‘conspicuous and influential’ (2016, p.16) changes in discourse impact policy processes and outcomes as discussed in chapters two and eight.

| <i>Metaphors</i> | <i>level</i> | <i>Agents and motives</i> | <i>Entities</i> | <i>Relationships</i> |
|---|---------------------------------|--------------------------------------|--|-----------------------|
| Plentiful coal with many uses; resource security; environment as 'cupboard' | International UK Regional | Government UK The Coal Board | Powerful National Government Administrative state Energy demand | Government with CEEB |
| Emissions; dirty coal, acid rain, public health associations; environment as 'sink' | International UK Regional | Governments (esp UK and US) ENGOS | Dirty coal Pollution | No strong connections |

Table 5 Environmental metaphors

stocks become more difficult to mine resulted in the UK government (especially under Heath) was seriously challenged on the coal issue (Cochrane, 1990).

Interestingly, in contrast, and arguably as a reflection of the motivations of dominant actors, ‘clean coal’ metaphors were used as early as 1950s to influence the discourse on coal.

‘Clean coal was being promoted way back when I was an undergraduate student in the late 1950s. All the promises I read about then have now been updated and repackaged for the 21st century.’

(NCMM archives, accessed 2009, no pagination)

What this analysis as summarised above highlights is that the era is one of changing priorities; as economic needs are met, environmental discourse relating to potential harm comes to the fore.

4.1.3 Social metaphors

4.1.3.1 *We’re all in this together – coalfield communities*

National as well as regional social metaphors and discourse during the era relate closely to economic metaphors; community is inextricably linked with economy at regional and local levels. Consistent themes emerge from the texts relating to camaraderie, shared social wellbeing and community. There is recognition that coal mining and work in the power plants is hard work with associated health and environmental problems, but that good wages and connection between workers, managers, Unions and Boards meant the benefits outweighed the negatives.

‘People used to accept that the work was hard, but that there were benefits for people and communities from mining... it used to be that the Coal Board looked after people. They’d put on extra clinics and showed films on how to avoid getting ill’

(Interviewee L12, 2013)

‘I can honestly say I enjoyed every minute of it... It’s the men you work with that make it, we look after each other’

(NCMM Archives, n.d., accessed 2011)

'Pit feeling was one of unity... it was my life.'

(BBC Archive, 1972, 00:53 to 01:24)

There are close links here too with economic metaphors and geographic determinism as illustrated above in section 4.1.1. Whole, established communities moved to be closer to remaining operating mines. In addition, as well as regional significance of coal in terms of jobs and associated infrastructure, coal had cultural and social significance. This social significance relates closely to the economic significance, for example in terms of negotiated wages, but also local incentives to work in the mines or power stations. This extract from interview illustrates the point that whole communities were connected to the coal industry:

'We just had coal delivered, the whole street at the same time. It was really cheap then so there wasn't really any incentive to move to gas or electric boilers even when other parts of the country swapped.'

(Interviewee L11, 2013)

Again, the physical and economic infrastructure developed around coal mines with significant government investment in coal fired power stations, perhaps influenced slower developments of newer or alternative technologies during the era.

4.1.3.2 *Coal is different*

At regional scale, and to some degree at UK level as demonstrated above, the dominant rhetoric that mining is different from other industry and coal communities are different from other industrial communities is evident during the era.

'Many towns... owed their existence to coal, and mining was the focus of the whole community.'

(Durham Coal Mining Museum Archives, n.d., no pagination)

Coal affected every aspect of life in coal mining regions. Yorkshire, Nottinghamshire and the North East became synonymous with coal mining and power sectors.

'You'll get a lot of people saying it's different round here because of coal mining ...it was alright though. Dirty and hard work for my dad, but everyone was the same and we were proud of what we did.'

(Interviewee L12, 2013)

[Emphasis added]

This notion of coal being different and 'round here' being different because of coal recurs throughout the texts and is discussed again in chapter six in relation to evident social metaphors in Yorkshire and Humberside.

4.1.3.3 *Strong unions – social welfare and camaraderie*

During the era, public sector workers unions had a significant role in social and economic welfare for their members. In the sector, both the National Union of Mineworkers (NUM) and the Trades Union Congress (TUC) are seen to have major roles within the emerging organisational fields for this era. In addition, close relationships between publicly owned mines and power plants and between union stewards and plant managers existed. During the early part of the era, relationships between these groups were evident, two way and whilst not always positive connections existed especially at local and regional levels.

'Everyone used to go to the [working men's] club so if we did have a problem you knew who to speak to – it'd be your union steward, or your manager and both would be there of a Friday... we knew what was happening at Ferrybridge because we'd see the lads we went to school with in the club too. They'd joke we weren't working hard enough.'

(Interviewee L2, 2013)

The interview data here must be taken in the context of one set of views on an historical period. However, what emerges from these data when taken together with archived contemporary accounts is a picture that suggests coal was core to UK economy and industry, but also core to communities. Coal communities were not simply close networks with strong social capital, they were, inextricably linked with economic prosperity which was environmentally determined.

Table 6 below summarises the social metaphors and highlights the actors, entities and relationships within them. An interesting point to note here, and discussed further below, is that throughout the era for social (and other) emerging fields there are strong connections within and between fields. Arguably, the fields are connected and to a large degree overlapping with social, economic and environmental features related to coalfields. This would suggest that, in answer to research questions 1a and 1b in particular, distinct organisational fields for governance can be characterised; section 4.1.4 below expands on this point to describe the fields for governance for this old coal/old governance era.

| <i>Metaphors</i> | <i>Level</i> | <i>Agents and motives</i> | <i>Entities</i> | <i>Relationships</i> |
|------------------------------------|---|---|---|--|
| Coal 'community' – social networks | Regional ²⁶ Local ²⁷ | UK Government The Coal Board The CEEB Unions Plant and mine workers Families | Community Welfare Camaraderie | Other mining communities Workers with managers Unions and managers |
| Mining's different – pride, place | UK Regional | Miners | Community Welfare Camaraderie | Connection to community Connection to environment |
| Strong unions and relationships | UK Regional Local | UK Government Local government Plant and mine managers Unions | Welfare Camaraderie Pay 3 day week | Connection to economic |

Table 6 Social metaphors

²⁶ Yorkshire and Humberside

²⁷ Town, village, mine, power plant

4.1.4 Consolidated agents, entities and relationships – the emergence of an organisational field of governance

The core feature of this era is that the social (coalfield communities), the economic (jobs, growth) and the environmental (resources and sinks) are inextricably linked within the coal discourse. Relationships exist between different social groups and institutions, and whilst the State is the dominant actors, there is a witnessed degree of agency from social, economic and environmental actors at multiple levels; UK and local levels but also international. Evidenced through legislation and negotiated salaries. Strong national unions, connections between workers and managers within communities and understood common goals lead to structurally embedded relationships.

The consequence of this consolidated field is that when, towards the end of the era disconnects start to emerge in one field, other fields are quickly affected through mimetic isomorphic processes. Two examples of this are evidenced: Firstly, 'the environment' both in terms of resource limits but also newly, in terms of environmental protection emerges as a transnational issue. Metaphors relating to dirty coal emerge and legislation designed to 'clean coal' rather than reduce its use is enacted. Secondly, coal communities move to where jobs both for local gain and to meet national 'need' for coal as part of the energy mix.

A third feature, perhaps less well evidenced but interesting to consider, is the unintended consequences of events during the era as a result of the close relationships and ties between fields. The 1972 and 1974 national strikes over pay and conditions for example, at a time when international concerns relating to environmental consequences of coal lead to preference for natural gas or nuclear as less unionised energy options. Similarly, the international political economy context, and the rise of external/international economic and environmental pressures – international trade, oil price, transnational environmental issues such as acid rain – had implications for coal use beyond increasing imports of coal. The discussion in chapter seven considers the drivers and impact of these changes features of governance over time.

4.2 c1980 to early 2000s – New ways of governing ‘old’ coal

The previous section provides an outline of the governance arrangements and instruments, institutional entities, agents and the relationships between them in the era characterised as old governance/old coal. Dominant rhetoric during the era related to public ownership, high levels of dependency on coal and the need for energy and economic stability outweighing environmental concerns. What also becomes apparent however is the early signs of change. This section summarises the analysis of texts relating to the period from circa 1980 to early 2000s to suggest that this era is best described as being a period of structural adjustment, and characterised here as one of old coal, but new governance.

The radical changes to the political economy of the UK (and other countries) that took place during the 1980s and 1990s, including privatisation of public goods, reduction of the state and attempts to curb inflation, are well documented elsewhere. Similarly, contemporary and historical discourses on issues relating to social and economic justice, and in particular of relevance to this discussion, the decimation of the industrial north of England, Wales and central belt of Scotland are well versed (Hall, 1981). What this analysis adds to the discourse, is a view on *how* and *why* the resultant organisational fields for governance emerged from this structural adjustment, with key insights on the actors, entities and relationships dominant during the period.

These insights suggest fields emerge at two distinct levels of governance within what has been characterised here as the old coal/new governance era, with both clear points of connection, and clear points of disconnect unfolding. Notably, the disconnects occur where economic drivers at national level evidently take priority over local economic, social and environmental issues. Chapter seven goes on to consider how powerful forces and agency of dominant actors shapes the organisational fields over time to show that the effects of this era of significant change are still evident. This section concludes with a summary of the organisational fields for governance of coal. The drivers and forces for change or stagnation, with both intended and unintended consequences are then discussed in full in chapter 7.

4.2.1 *Economic metaphors – a political economy of change*

4.2.1.1 *Decline of king coal – the dash for gas and the start of ‘the long goodbye’*

In 1979 Margaret Thatcher was elected Prime Minister of the UK on a mandate of structural adjustment and modernisation following a decade of strikes, blackouts and inflation. For the following two decades, just as coal had been core to post- World War II industrial and housing economic boom, the decline of coal was core to this well documented period of structural adjustment. Public ownership and management of coal had suited the Keynesian political economy of the 1950s to early 1970s with subsidies to keep power plants operational in order to meet energy demand and keep unemployment at manageable levels (Sheehan, 2009). Whereas, the process of adjustment to free market economics of the 1980s transformed both mining and energy sectors.

As touched on in section 4.1.4, the era also saw a new threat to coal in the form of the ‘dash for gas’ (and to a lesser extent nuclear) which, as illustrated in the quote below, reinforced the decline of coal in the UK.

‘British Coal’s demise has been accelerated by the Government’s drive to privatise the coal industry, but more so by the recent privatisation of the electricity companies on whose custom British coal depends to survive’

(Fagan, 1992, no pagination)

Here, the disconnect between state and the coal and energy industries that started in the late 1970s widens.

4.2.1.2 *‘There is no alternative’²⁸ (TINA)*

Two commonly presented sides to this metaphor which exacerbate the disconnects both between actors within fields, and at different levels, emerged from the texts: Selling off the family silver versus economic efficiency through privatisation.

²⁸ This well known phrase was famously often used by Margaret Thatcher to strengthen the case to move toward free market economy.

- (i) Selling off the family silver. The quote below illustrates the rhetoric:

'It still doesn't make any sense to me thirty years later. Ferrybridge was profitable when it was privatised so why not keep those profits for the public purse.'

(Interviewee L1, 2012)

- (ii) Economic (and technical) efficiency - free market capitalism.

Conversely, privatisation brought with it economic and technical benefits. Foreign investment, sales of companies, takeovers in the early days post privatisation lead to new investment in technology with continued coal use but with environmental regulation leading to the extension of life of old coal fired boilers:

'They [new owners] brought us in to the 20th century really. It was an American company and they already had experience of reducing emissions.'

(Interviewee L1, 2012)

[Parentheses added]

'If it [coal fired power station] had stayed under public ownership, it would have closed or moved to gas decades ago there would have been no point in subsidising it'

(Interviewee L18, 2012)

[Parentheses added]

What is interesting about these extracts, is that the coal fired boilers were perceived at least, as being economically viable under private ownership, but the dominant TINA discourse suggested they were not considered so under public ownership. The introduction of market forces, albeit in a still subsidised and highly regulated industry, is in and of itself deemed to improve economic viability. In addition, had the coal fired power stations remained under public ownership, coal may have been phased out in favour of gas to an even greater extent than was witnessed in the 1990s. As discussed in chapters seven and eight, the dominance of market forces in determining fuel use influences continued coal use. This analysis, i.e. that economic viability is considered

automatically the domain of the private sector, regardless of the need for public investment, is mirrored in chapter five and discussed in more depth in chapter seven.

4.2.1.3 *Us and them*

Whilst somewhat clichéd, and treated more fully in section 4.2.3.1, a rhetoric emerges from the texts relating to an economic ‘us and them’ scenario. This is distinct from earlier texts, where analysis suggests a clearer common purpose with co-evolving economic relationships. For this era as new governance relationships develop, two economic disconnects start to unfold. Firstly, a distinction between national and sub-national levels emerges:

‘They wanted to destroy the North because we all voted Labour. We could have been the most efficient generators in the world, run on coal from right under our feet and they would have still got rid of us’

(Interviewee L3, 2013)

‘Mining, heavy industry and coal fired power plants of the North and Scotland just didn’t fit with the new world they [the Conservative government] had in mind so they started to close them down’

(Interviewee L30, 2015)

[parentheses added]

Secondly, a disconnect (or at least a new relationship) between the owners, shareholders and managers of the private firms and the (mine) workers and community becomes evident. Whilst not evidenced in the texts, the era corresponds with a rise in MNCs, technocratic management (Dryzek, 2005) and oligopoly power (Begg et al, 2005), which provides an interesting backdrop for this analysis. Ultimately, mine and plant closures lead to high levels of unemployment in formerly economically vibrant communities. The connection between workers and public sector employers has disappeared and the economic ‘purpose’ of mining communities was lost.

4.2.1.3 *Dole queues; regional unemployment*

When read with the analysis in chapters five and six, this metaphor might be seen as demonstration of a starting point for what becomes decades of

underdevelopment. High levels of unemployment and associated poor health, housing and educational attainment are evident. Whilst unemployment was a national problem, former coal mining regions were recognised as being especially affected as this extract from Parliament demonstrates. The Secretary of State for Industry was asked:

‘...what consideration he is giving to the reestablishment of assisted area status to areas of West Yorkshire where unemployment has been rising much faster than the national average in recent months.’

(HC Deb 24 November 1980 vol 994 cc193-4)

The graph in figure 2 below details unemployment rates. As well as the regional implications, this graph shows the extent to which coal and closure of mines and regional coal fired power stations effected employment in the region. The implications for sustainable development are discussed in chapter seven, here, prima facie, this would suggest economic sustainability of the region is poor given its continued dependence on coal.

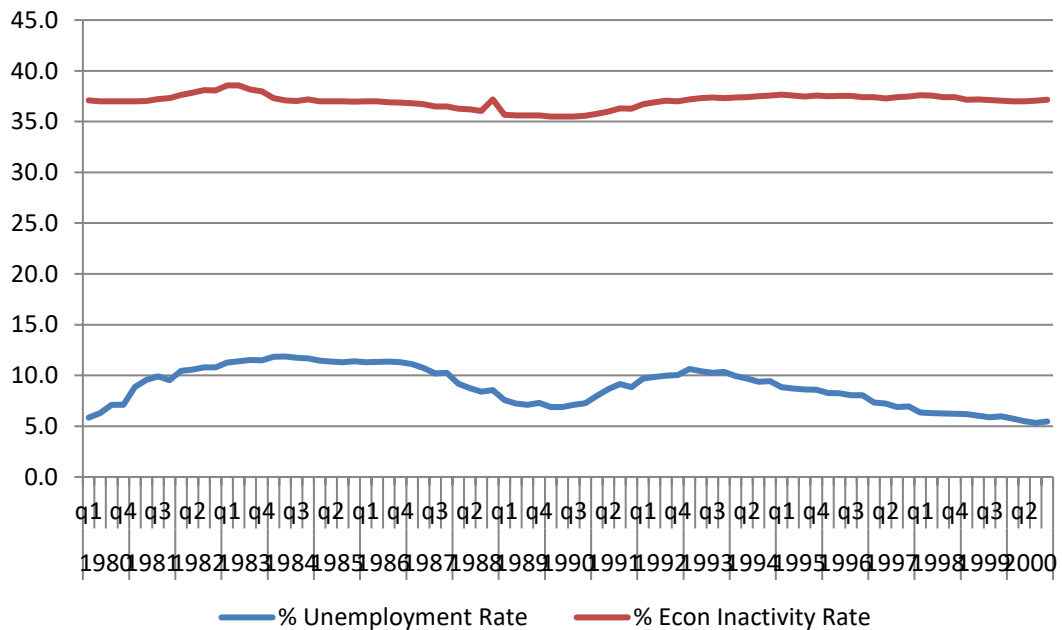


Figure 2 Regional unemployment

(Source: Office of National Statistics²⁹)

²⁹ The decline in unemployment in 1988/89 corresponds with a redefining of the term ‘unemployment’ whereby new definition no longer equates to claimant count. Instead it equates to all those in receipt of unemployment benefit and not for example income support,

4.2.1.4 *Things can only get better - regeneration*

Towards the end of this era of considerable political and economic change, notably following a change in government in 1997, but also following mine closures in early 1990s, a range of economic regeneration projects were implemented. Government funded QUANGOS (Pollitt and Talbot, 2004) and NGOs such as the Coal Regeneration Trusts were established during this era and return to work programmes given regional priority. The extract below typifies texts on regeneration projects of the mid to late 1990s:

'We had £15 to £17 million to invest in projects to get people in coalfields working again. Most of that was intended for Yorkshire and the North East, Wales and Scotland had additional funds. It was a sweetener really, I could have spent that every month developing the infrastructure needed for the region, but the grants did help individuals.'

(Interviewee L30, 2015)

As suggested in the text above, the limited success of these programmes in terms of longer term regeneration is attributed to both the scale of decline during the era, and the lack of economic alternative in the regions effected. Another feature of this metaphor relates to increasing divisions *within* the regions and communities hardest hit by unemployment during the era, with coal workers being seen as given special treatment. These points are exemplified by the following extracts from Hansard:

'Is the honourable gentleman aware that unemployment in West Yorkshire has risen by about 100 per cent. since the Government took office? ...unemployment in Batley, Dewsbury, Halifax and Huddersfield ...[has risen] by nearly 150 per cent...'

'Does my hon. Friend understand that, although inflation is the first enemy, my constituents are bitter about the feather bedding that has

Youth Training Scheme (YTS) or sickness benefit. Ex miners were encouraged by authorities to accept sickness (later incapacity) benefit which removed them from employment statistics (source: interview 30 plus researcher's own experience of working for the Department for Employment in 1988/89). This chimes with Beatty et al's 2007 findings relating to hidden unemployment in former coal fields.

been given to redundant workers in the steel and coal industries, and that they would like something similar?'

(HC Deb, 1980 vol 994 cc193-4)

To summarise economic metaphors during this era of significant change, table 7 identifies the actors and entities with agency within the metaphors. It shows that the political and economic changes have affected the agency of actors and entities and relationships between them within and between fields.

| <i>Metaphors</i> | <i>Scale</i> | <i>Agents and motives</i> | <i>Entities</i> | <i>Relationships</i> |
|--|----------------------------------|---|--|--|
| Decline of coal – strikes, pit closures, unemployment | Regional UK | Unions Miners | Strikes Unemployment | Weak or dysfunctional |
| TINA – neo liberal economics, privatisation and the rise of the MNC, public sector wage restraints, devolution | UK International Regional | Government Shareholders | Privatisation Structural adjustment Tax payers | Business and government International |
| Us and them | UK Regional Organisational | Managers Government Workers/communities | Strikes Wage freeze Unemployment | Increasing disconnect Weak or dysfunctional |
| Redevelopment | Regional UK | Government | Development agencies | Paternalistic |

Table 7 Economic metaphors 1980s to 2000

4.2.2 *Environmental metaphors – dirty old coal*

4.2.2.1 *Dirty old coal*

International discourse during the era became dominated by issues relating to environmental harm associated with industrialisation; pollution, acid rain, ozone depletion, deforestation and, ultimately, climate change. Evidently, this was especially relevant for coal use. National and international NGOs pressured governments to clean energy supplies and, especially to reduce coal use.

However, private sector generators (notably Npower (then Powergen) in the UK) remained in receipt of government subsidies to ‘clean up’ coal fired power stations and invest in alternatives to coal. Some coal fired plants closed.

‘...we had to stop burning coal in Wakefield but Ferrybridge carried on’

(Interviewee L12, 2013)

Coal is characterised as ‘dirty’ and earlier metaphors relating to the ‘dirty old man of Europe’ feature strongly. So called clean alternatives, namely natural gas and nuclear as clean emerge as preferable. Yet coal accounted for around half of the electricity generated annually between 1984 and 1999 (Digest of UK Energy Statistics, archived 2000, p.53). Arguably economic and market factors (for example cheap and stable price) stimulate continued use of coal despite environmental concerns and regulation.

4.2.2.2 *Sustainable development and light touch regulatory approach*

At the transnational level, as raised in chapter two, Rio Agenda 21, the UNFCCC Kyoto Principle and pressure from now significant ENGOs was translated in to EU and UK legislation and policy. In practice, this lead to the establishment of Environmental Agency and the Scottish Environmental Protection Agency with regulatory powers. Particularly relevant are Environmental Protection Act 1990 and the Clean Air Act, 1993 which prohibit grey smoke and impact home use of coal in urban areas as well as smoke from generators’ stacks, and the Large Combustion Plant Directive (LCPD, 2001/80/EC) which came in to force at the end of the old coal/new governance era, marking a change in the direction for coal.

This new governance approach (establishment of QUANGOs or government departments with target setting and regulatory powers, but low policing powers) to manage environmental problems illustrates a change in agency. A degree of separation between economic and environmental emerges here; coal is imported and therefore the economic benefits of extraction associated and the environmental harm associated with combustion have been disassociated. For Yorkshire and Humberside, this is relevant because physical and geographic infrastructure is very closely linked with coal and heavy industry, and whilst towards the end of the era, regional development targets begin to relate to greening the economy (Drake, 2009) beyond the decline in the early 1990s, coal combustion remained significant (DUKES, 2010).

The key features of the environmental metaphors are summarised below in table 8. Three interesting points emerge from this analysis. Firstly, local agency has been disassociated from environmental field because of associated disconnection from the economic field brought about by mining closures. This reduced agency by local actors is exacerbated by the strength of transboundary environmental concerns emerging, despite international recognition of significance of locally generated development paths. Secondly, during the era, environmental issues are dealt with using light touch national regulation (targets, fines), yet subsidies for private generators continue. Thirdly, state actors in the form of the EA and QUANGOs as well as NGOs become the new custodians of the environment within a more complex set of relationships than previously witnessed when this role fell to the limited role of the Department of the Environment.

| <i>Metaphors</i> | <i>Level</i> | <i>Agents and motives</i> | <i>Entities</i> | <i>Relationships</i> |
|---|---------------------------|--|---|---|
| Dirty old coal | Regional International | Government agencies NGOs Power companies | Environmental Regulation Coal fired power stations | Techno managerial NGOs as lobbyists |
| Sustainable development: transnational pressures | International National | NGOs | Rio Agenda 21 Environmental campaigns Environment Agency | Transnational groups International governments |
| Light touch environmentalism | Local | Trusts and charities | Custodians | Regulator with industry |

Table 8 Environmental metaphors 1980s to 2000

4.2.3 Social metaphors – ‘there’s no such thing as society’

4.2.3.1 No such thing as society - us and them

The era saw radical social change and the social disconnect between levels of governance identified in section 4.1 increases to the extent that for social metaphors in particular, the organisational fields for governance begin to split in to at least two separate fields. At UK level, dominant metaphors relate to anti-union rhetoric, individualism and benefits from economic rationalism. This core social metaphor emerging during this era relates closely to this disconnect as this extract demonstrated:

‘We’d had a good relationship with the police up until then. I went to school with them and they’d come in the club but then it changed’

(NCMM, accessed 2009)

‘I knew everyone who worked here, then they brought in managers from outside to organise the sale and we had to just watch them do it. I was lucky and kept my job but it was never the same after that’

(Interviewee L1, 2012)

At the local and regional level, the legacy effects of mine closures, privatisation and redundancies have changed the role of communities to that of providing welfare.

4.2.3.2 End of an era – rise of unemployment

The decline of coal mining and the inextricable link between coal and communities lead to more than economic decline. Very high levels of unemployment in former coalfields again increased the distinction between levels where former coal fields saw higher than national average levels of unemployment from 1984 onwards (appendix C).

‘We were so dependent on coal then that the whole place just collapsed. We were the only ones still employing [power station] and the miners hated that because we used imported coal.’

(Interviewee L18, 2012)

An unintended consequence of high levels of unemployment as discussed further in chapter seven, was that actors wider than state or private sector owners who had traditionally had roles in decision making no longer had relationships within the social field.

Table 9 summarises the social metaphors for this governance era. It is worth noting here, that as detailed above, the disconnect between governance at different levels of society becomes apparent for this field, where relationships between actors at different levels within each metaphor are weak or non-existent. In addition, it should be noted, that for 'us and them' and 'end of an era' metaphors, actors identifying these themes as relevant have little or no governance agency or representation within the field. Former social relationships and entities have significantly declined as has the connection between social and economic where job losses are high.

Three key points to note from chapter four will be explored in more depth in the discussion in chapter seven. Firstly, this is an era of structural adjustment and also civil unrest; where organisational fields had been homogeneous, fields now begin to split over time and level. Secondly, former 'groups' and associations lose their power and agency in favour of economic actors; 'tax payers', individuals, expert managers. The dominant actors change and the relative influence of civic society groupings, such as trades unions, declines. In keeping with the decline of the state is the rise of corporate actors, voluntarism and CSR begin to emerge as features of good governance. Thirdly, the role of the regulator changes and the emergence of pseudo governmental groups, organisations and QUANGOS influences relationships between private, public and civic actors. For all these issues, relationships within and between fields have weakened and organisational fields at two levels emerge. These core features for the old coal/new governance era are discussed in relation to the other organisational fields for this era as well as evident changes in power and agency.

| <i>Metaphors</i> | <i>Level</i> | <i>Agents and motives</i> | <i>Entities</i> | <i>Relationships</i> |
|--|--------------------------|-----------------------------------|--|-----------------------------------|
| No such thing as society – rise of individualism and market capitalism | UK Individual Firm | UK Government Corporate actors | Small government Capital Thatcherism | Individual Manager technocrats |
| Us and them | UK Local | UK Government | The Police Strikes | Weakened |
| End of an era | Regional Local | UK Government | Unemployment Ex-miners | Community |

Table 9 Social metaphors 1980s to 2000s

4.2.4 *Organisational field for governance – two levels, two eras?*

This analysis demonstrates that dominant, dynamic forces change the nature of organisational fields of governance including in terms of actors and their motivations, relationships and entities that emerge. Normative governance arrangements with the emergence of new corporate centric practices and reduced state including privatisation of formerly state owned industries correspond with increased coercion in terms of statutory instruments.

A notable feature for this era is that the reduction of the state also, somewhat counterintuitively, increases the disconnect between levels of governance. Private ownership with expert managers rather than public sector managers and shop stewards, means that connections between employers and employees are at the micro firm, even site specific, rather than community level. Market is nominally dominant, but powerful economic elites (nationally and internationally) reduce other actors' agency.

What this analysis demonstrates is that unexpected consequences occur when complexities such as the relationships and connections within and between fields are not fully understood. Also, an interesting feature discussed in chapter nine is that the organisational field of governance is more than simply a description of the mechanisms and instruments of governance. It is a *landscape* of cultural, societal, economic and environmental relationships which, because of temporal features, complex relationships and wicked context, lead to unknown and unintended consequences. What starts as an homogenous set of well understood relationships morphs, and ends with a complex set of fields with multiple disconnects within and between levels.

What is also interesting, is that over time, as fields diverge more clearly along economic, environmental and social lines, more consistency within fields starts to become evident. For the environmental field, new relationships though are at different levels, so political economy internationally has environmental/political economy connections, whereas social organisational field has regional, local and national connections, but not international (other than as extension of para/meta communities). Rise of sustainable development as an organising principle starts to work in to policy, however, issues relating to sustainability do not feature heavily in the texts.

Finally, it seems clear that there are useful benefits from taking a long exposure view of the emergence of the contemporary wicked problem of continued coal use. The historical fields are useful to give a backdrop from which to consider the wicked problem of continued unabated coal use in the UK electricity sector in chapters five to eight in order to consider whether fields differ over time and levels of governance.

Chapter 5 – UK organisational fields for new governance of new coal?

5.1 Introduction

This chapter is concerned with the period from the early 2000s to circa. 2013/14 at macro, UK level. Read together with chapters four and six, this chapter contributes to the research questions by considering the organisational fields of governance, how these have changed over time and level, and the implications for sustainability of new coal.

Following this brief introduction, section 5.2 presents metaphors, themes and other rhetorical devices (Dryzek, 2005) associated with new governance arrangements and new coal. Section 5.3 then draws together the organisational fields of governance for the period and (in response to objectives one and two) contributes a better understanding of the processes and outcomes of governance and implications for the sustainability of new coal.

5.2 New governance, new coal?

5.2.1 Economic Metaphors

5.2.1.1 *Coal + CCS 'win-win' scenario: low carbon economic growth, secure energy supply and emissions reductions*

A strongly represented economic theme running throughout the data, is that of so called 'new' or 'clean' coal, notably coal with CCS, as a 'win-win' solution to economic, energy and environmental problems. Coal with CCS will, in this sense, enable continued use of a cheap, readily available fuel stock, thereby underpinning economic growth and development. Simultaneously, the use of CCS technologies will contribute to national and international targets for reduction in CO₂ emissions in to the atmosphere. For example:

'CCS has the potential to: reduce emissions from fossil fuel power stations and industrial installations by around 90%; enable fossil fuels to continue to be an important element of a secure and diverse energy

mix; reduce the costs of tackling climate change; and create new economic opportunities for the UK.'

(CCS Association, 2009, p.1)

'Secure, reliable and affordable energy supplies are needed for sustainable economic growth... CCS is therefore an essential part of the portfolio of technologies that is needed to achieve deep global emission reductions.'

(G8 Hokkaido, 2008, item 31, p.3)

This metaphor strengthens throughout the period with continued coal use with CCS technology becoming core to energy policy:

'CCS is the only current means by which we can retain the benefits of fossil fuels in terms of significant resource availability, flexibility, affordability and diversity, whilst meeting our legally binding target to reduce carbon emissions by 80% from 1990 levels by 2050'

(DECC, 2010b, p.5)

[Emphasis added]

And from the industrial, commercial and trades associations:

'We have here an opportunity to meet our commitment to generate affordable energy whilst simultaneously cutting CO₂ emissions.'

(Workshop participant, O10, 2013)

In this way, the discourse framing coal with CCS as a low carbon technology presents the continued use of fossil fuel as consistent with mitigation against climate change. Within the metaphor a difference between discourses on *green growth* and *low carbon economy* emerges. For example:

'CCS also represents a major green growth opportunity for the UK. ...if CCS opportunities develop as anticipated, export opportunities for UK based firms have been estimated to be between £3 - 6.5 billion a year by the late 2020s'

(DECC, 2012a, p. 17)

[Emphasis added]

And, it is...

'...vital that progress is made to ensure coal burn remains at a level which can support UK production during the transition to the low carbon economy which has CCS at its heart.'

(Trades Union Congress, 2011, p.7)

The more nuanced theme that coal with CCS makes a *positive* contribution to a Low Carbon Economy (LCE) is evident in the texts. This extract from RH Ed Milliband MP, the then Energy Secretary perhaps best illustrates the features of the metaphor:

'...The future of coal in our energy mix poses the starkest dilemma we face: it is a polluting fuel, but it is used across the world because it is low cost and it is flexible enough to meet fluctuations in demand for power. In the UK, a third of our existing coal-fired power stations are due to close in the coming decade.'

To ensure that we maintain a diverse energy mix... we need new coal-fired power stations—but only if they can be part of the low-carbon future... There is a solution to the challenge—through carbon capture and storage.'

(Hansard. HC.Deb: col 382)

Evidently, coal extraction and use cannot be considered 'green' given other negative environmental connotations of extraction and use, however coal with CCS, at least, lowers CO₂ emissions to the atmosphere at point of combustion making it consistent with necessity to reduce GHG emissions to the atmosphere.

5.2.1.2 Market efficiency

Core to this metaphor, is the belief that coal (with or without CCS) is likely to be used as long as it remains economically efficient to do so. The data suggest that the extension of market led governance arrangements is seen as the best means of meeting energy challenges³⁰. Market reformation, specifically Electricity Market Reform (EMR), was designed during this era with the stated aim of attracting private sector investors to update ageing energy infrastructure in the UK (DECC, 2011b, p.15). EMR is intended to increase commercialisation through competition for government funding. This metaphor is exemplified in DECC texts:

'We need to reform the UK electricity market to attract the investment needed to replace our ageing energy infrastructure... Electricity Market Reform (EMR) is our initiative to make sure the UK remains a leading destination for investment in low-carbon electricity.'

(DECC, 2013, no pagination)

In this light, the UK is characterized as competing in international energy markets for investment. The dominant view that liberalised energy markets, and freedom from 'unnecessary regulation' is extended, to suggest market liberalisation contributes to energy security.

'The UK has experienced strong energy security from a combination of its liberalised energy markets, firm regulation³¹ and extensive North Sea resources.'

(DECC, 2013, no pagination)

The data indicate that public investment in new coal fired power stations is intended to incentivise commercialisation of CCS i.e. rather than fund CCS development itself:

³⁰ See also chapter eight for fuller discussion on this rhetoric.

³¹ Something of an oxymoron is observed here, however regulation in this case refers almost exclusively to environmental issues i.e. emissions and particulate matter limits for NO_x and SO₂.

'Development and deployment of CCS is key if the UK is to achieve our climate change targets whilst maintaining a vibrant, competitive economy... Government policy is not to dictate the [energy] mix, but to allow technologies to compete to ensure the overall system is delivered at the lowest possible cost to the bill payer.'

(DECC, 2012a, pp.15-16)

[parentheses added]

CCS is seen here as one of several, alternative low carbon energy technology options and the need to reform the market in order to ensure competition *between* technologies (i.e. economic rationality) determines which technology will ultimately be adopted.

'The Government's objective is to have competition between low carbon generation technologies in the 2020s with the market deciding...'

(DECC CCS Roadmap, 2012, p. 23)

[Emphasis added]

The commercialisation programme, including establishment of UKCCSRC and Cost Reduction Task Force as core activities in the CCS Roadmap, demonstrates dominance of economic rationale for decisions.

'The government is looking at how to remove unnecessary regulation to enable CCS with coal in its reforms.'

(Workshop participant, O10, 2013)

'...coal plus CCS will only have a future if it is profitable under the new EMR versus unabated gas.'

(UKCCSRC, 2013, p.2)

However, whilst the dominant metaphor suggests that an *efficient* market for electricity is essential, some inconsistency within this metaphor is evident. This extract exemplifies the point.

'It's a bit of a mess... compared with Ireland or Norway even where there's a lot more public ownership of utilities still, so you get a more

managed infrastructure. In some ways this [climate change] is just too big a problem to leave it to chance but that's what's happening here.'

(Interviewee L17, 2012)

[Parentheses added]

In addition, there is concern that the market led approach, and consequently EMR, whilst desirable is ultimately flawed. Whilst the data on this point are not sufficiently rigorous to draw firm conclusions, concern for efficacy of market led approach where for example the carbon floor price³² is low, was also expressed by industry delegates at the UKCCSRC Future of Coal workshop. To summarise:

'...there's too much at risk. We're talking billions to get these projects up and running, and then there might be a legislative change, or the price of carbon isn't high enough so it's not worth it. Shareholders won't support this sort of risk, so if the UK wants CCS at scale it's going to have to pay for it out of the public purse.'

(Workshop participant, O10, 2013)

The carbon floor price at the time is, in this view, so low that unabated coal remains economically viable. The IEA have suggested (IEA, 2014) that €50 would be required to make coal uneconomical and encourage generators to switch wholesale to gas; in April 2012 it was launched at £16. This metaphor is explored further in the update in chapter eight, but in summary, the price of carbon remains contested.

5.2.1.3 *Commercial scale and capture ready (or not at all)*

The UK CCS Roadmap focuses on developing CCS to commercial scale. However, the term 'commercial scale' (and also associated terms such as, large scale, 'Capture Ready', CCS Commercialisation Programme) is not understood fully. In one sense, commercial scale means bringing together

³² As one of the mechanisms employed to marketise carbon

multiple aspects of the CCS chain used separately to test full chain feasibility with coal. This is a costly process:

'CCS is not a new or emerging technology... While all the elements of CCS have been separately proven and deployed in various fields of commercial activity, a key step is the successful integration of large-scale CCS systems... A concerted effort is needed to commercialize CCS at large scale in the power sector.'

(WCA, 2012, no pagination)

'... The Government's interventions are intended to facilitate the development of CCS into a mature technology capable of being assessed by investors on a normal commercial basis.'

(DECC, 2012a, p.23)

In another, it relates to size of operation in terms of energy generation capacity, and here there is some confusion:

'The UK law on post combustion capture says the minimum capture is 300MW, but it doesn't matter what the plant size is, so that could be 300MW for an 800MW plant and it would still be fine. There's no guidance on what commercial scale means.'

(Presentation, O11, 2013)

'...new plants need one CC unit per 300MW. There's no regulations or guidance yet on type, size, capture rates...'

(Workshop participant, O10, 2013)

Similarly:

Participant A: 'It's understood that the whole plant must be capture ready³³ though.'

³³ There is a *'...requirement for all new fossil fuel power stations to be Carbon Capture Ready, to ensure that newly constructed unabated fossil fuel power stations are able to fit CCS'* (DECC, 2012a, p.24)

Participant B: 'Maybe so, but what does that actually mean? We can demonstrate some existing plants can be classed as capture ready, but we would need capture plant the size of a football pitch in some cases right next to a residential area?'

Participant A: 'Under the guidance we would need to take each case on its merits'

(O12, 2013)

This concern relating to specifics of what 'commercial scale' means is interesting for two reasons. Firstly, from an operational and commercial perspective, there is an inherent contradiction: Generators are not, without government backing, willing to run the risk of developing a commercial scale operation, yet government will only support funding for commercial scale operations to incentivise market actors to develop CCS as an economically viable technology. This also ties with environmental sticking plaster metaphor which suggests that, at best CCS will provide a short term respite rather than long term investment opportunity. For example:

'In the UK, a proposed new coal-fired power plant at Kingsnorth, Kent, is being sold as "capture ready"; able to incorporate CCS should the technology ever become available in the future. However, no one has any idea if and when this might be. In the meantime, and possibly for its entire lifetime, Kingsnorth (if built) will pump out around 8 million tonnes of CO₂ per year...'

(Greenpeace, 2009, p. 6)

Secondly, the technical leap from test to commercial scale is significant, and this in itself is delaying development. In the context of wicked problems, Grubler and Wilson (2013) suggest that multiple small scale developments are more appropriate to test feasibility of full chain CCS. An interesting associated point is explored by Wilson et al (2012) and Riahi et al., (2012) who also note that up-scaling to large scale plant for energy developments historically follows longer periods of small scale plant development.

5.2.1.4 *Uncertainty (due to ineffective UK Government)*

This complex and nuanced metaphor is particularly evident amongst industry texts. Observation and interview data from commercial and NGO texts in particular, suggest three complementary themes underpin this metaphor:

- (i) lack of 'level playing field' for CCS/coal in policy
- (ii) inconsistency, changing political scene, and
- (iii) cost and financial uncertainty

(i) Lack of 'level playing field' for CCS/coal in policy:

Despite government statements relating to market being allowed to determine most efficient energy, coal with CCS is perceived as being treated less favourably in policy than other low carbon energy options or, even, unabated gas.

'...at the minute we're assuming no new coal fired plants without CCS, and new plants will only get permits if they are capture ready, whatever that means, but then unabated gas is OK?'

(Participant, O10, 2013)

'There's a catch 22 situation being discussed... a bias towards gas, leading to policy and investment decisions based on gas even though this might not be best long term solution to low cost low carbon energy.'

(Observation notes, O12, 2013)

'If we had the same sort of investment and government backing as renewables, we would have working capture plants in operation already.'

(Participant, O10, 2013)

Similarly, from TUC Roadmap for Coal:

'Actions taken now ... can secure this core industry in a low carbon economy for the long term. Delays will drive investment and dependency on gas fired power without resolving the challenge of CO₂ capture...'

(Trades Union Congress, 2011, p.6)

(ii) Inconsistency, changing political landscape: From ‘no new coal’ to ‘putting the coal in coalition’

During the early part of this era, coal was very much characterised as a dirty fossil fuel. Dominant environmental metaphors (as discussed in section 5.2.2) relate to this, and government policies (UK, EU as well as regional) reflected the perception of coal as less desirable than either gas or nuclear. Coal fired power stations are seen as costly incumbencies and policy (economic and environmental) is geared toward closure of ‘inefficient’ plant. However, from mid to late 2000s, CCS emerges as an option for economically viable low cost, low carbon energy and the discourse changes from an emphatic:

‘A coal plant is a coal plant is a coal plant – still the dirtiest form of energy known to us, no matter which way you look at it.’

(Greenpeace, 2008b)

To:

‘...no new coal without CCS...’

(Rt Hon Ed Milliband MP, in Guardian, 2009)

And coal with CCS as:

‘one of the four pillars of a green economy’

(Rt Hon Chris Hulme MP, 2010)

And finally that Government should be:

‘putting the coal back in to coalition’

(RT Hon John Hayes MP, 2013 quoted in opening address O10)³⁴

Findings from the E.On Kingsnorth CCS Demonstration also suggest that political inconsistency is problematic in CCS demonstration projects. As discussed in section 2.1.2, the Front End Engineering Design (FEED) study notes that delays to adoption of CCS are largely due to economic and policy

³⁴ From the then Minister of State for Energy John Hayes welcome speech at the World Coal Association Leadership forum.

issues rather than, technical, environmental or geological reasons. In particular, incumbent generators do not sufficiently benefit from CCS for them to be able to absorb investment costs and do not want to be loss leaders whilst UK regulatory, policy and economic positions are not clear. The corollary being that the ‘test’ stage relates more to testing the market and economic feasibility of the technology than its potential for carbon capture.

‘We’re pretty much ready to go on the technical side. We know what we need to do and it’s case by case decisions and engineering workarounds. Almost everything that delayed and finally stopped Kingsnorth was about economics and politics.’

(Interviewee L21, 2012)

Prior to policy developed in 2012/13 and CCS Roadmap (and to a degree since), there was considerable confusion relating to whether CCS would be supported by government, and if so in what way. Under the Roadmap, policy promotes commercialisation and seeks ways to make CCS economically viable, but there is no commitment to, for example, fund CCS for environmental reasons if economic viability is not proven. From the observation data, during discussion on whether CCS could mean ‘new life’ for existing coal fired power stations:

‘I’d like to think it will... we just don’t know... we have a commitment to close the boilers [under LCPD], but then there’s new rules on capture readiness for new plant and some retrofits may legally be considered as new builds and so subject to the same minimum 300MW regulations...’

(Participant, O10, 2013)

[Parentheses added]

Similarly:

‘I feel like I’ve been to hundreds of these events [industry meeting] but we’re not really getting anywhere. We basically know what to do technically... but the government keeps pushing it in to the long grass.’

(Participant O11, 2013)

And from document texts:

'The limited number of industrial-scale CCS plants currently operating globally is primarily a result of public policy expecting CCS to be delivered by the private sector, while at the same time failing to address the barriers which are inhibiting CCS deployment.'

(World Coal Association, 2012, no pagination)

Delays are seen as specifically *caused* by changes in and delays to government policy and funding criteria. This quote from Greenpeace illustrates the point:

'The reason [for request for delays in Kingsnorth] appears to be because of confusion over where government coal policy currently stands.'

(Greenpeace, 2009, p.1)

[Parenthesis added]

(iii) Cost and investment uncertainties: moving goal posts

Changes in government as well as departmental ministers' positions on CCS, are seen as problematic by causing confusion and delay in CCS development which introduces additional risk. This uncertainty is seen as likely to further derail attempts to find technically and economically viable energy solutions. This metaphor is evident from both interviews and observations.

'Nobody can make any final decisions on investment until we know what's going on... this government doesn't have a clue about how to deal with the problem, they don't even seem clear on what the problem is.'

(Participant, O10, 2013)

Here, changing Governments' policies combined with unclear and unpredictable framework for funding exacerbate financial and economic uncertainties already intrinsic to market lead approach to governance thereby creating additional commercial risk. This in turn leads to project slippage and

slow progress towards operational CCS. Compare the intention for development of CCS during the early part of this era:

'The United Kingdom is advancing CCS via its large-scale demonstration competition, which will announce one major project to be operational by 2014... in April 2009 the government announced proposals to establish a mechanism to support up to four large-scale CCS demonstrations and to require any new coal-fired power plant over 300 MW capacity to demonstrate CCS on a proportion of its capacity.'

(IEA, 2009, p.5)

Versus more recent comments on progress toward operational CCS.

'We've been using carbon capture for ages, it's really not that difficult. We could have clean coal whenever we want it, but someone has to stick their hands in their pockets or we'll never get these projects off the ground.'

(Interviewee L23, 2012)

This is seen as problematic and potentially leading to project delays by business and commercial actors in an historically regulated industry unwilling to make investment decisions for CCS in a dominantly/increasingly market led sector. The complexity of the issue is not lost on commercial actors:

On a tricky choice



(Source: DECC, E.On FEED study presentation, 2011a, p15)

In this view the Government is ineffective at developing policy and a funding context suited to developing CCS at commercial scale. Conversely, the UK Government consistently reports that development needs to be a partnership, multi-level multi actor *governance*, market led approach. This is evidently problematic as discussed in chapters eight and nine. In essence, commercial actors want reduced regulation but increased public funding and security whereas the Government wants increased responsibility, private sector investment, and reduced public funding. This paradox seems part of the crux of the wicked problem under study.

Perhaps this metaphor may be best summed up by the following extract from a speech by the then head of the CCSA:

'There is nothing stopping CCS but policy.'

(Chapman, 2008, p.1)

5.2.1.5 Economic Agents

During this era at the macro level, the UK Government, especially as represented by DECC, is a key agent emerging from all texts, in particular their role in propagating the case for coal with CCS as a win-win scenario is evident. Reference to DECC from other actors, notably in the latter part of the period under study, i.e. during their production and roll out of the Roadmap for CCS and commercialisation programme is common. Government regulators in the form of the Environment Agency (EA) and the Scottish Environment Agency (SEA) also feature in metaphors relating to confusion and moving goal posts, but to a lesser extent at UK level than at Y&H scale (see chapter six). For example:

'...we don't know how they [new regulations on capture ready coal fired power stations] are going to work yet. I don't think anyone does, not even your lot [put to a representative of the SEA, who agreed with a nod].'

(Participant, O10, 2013)

Commercial actors, and their representatives (such as the World Coal Association, and UK Coal Importers), especially those involved in funded demonstrator projects (generators and distributors) or competing for EU or UK government funding are strongly evident throughout the texts. Their role in promoting both 'win-win' and market efficiency metaphors is strong, and commercial actors are evident in DECC and UK government policy and wider texts. However, agents from both business and public spheres see the UK Government, and especially DECC, as dominant and as playing a lead role in co-ordinating UK developments. This dominance of government as key economic agent is perhaps because CCS with coal is not yet a commercial entity. The government is active in trying to commercialise CCS projects, in part because financial/economic benefits to commercial incumbents in the private sector are not clear.

'It's not clear how we're [generator] going to benefit financially from CCS... DECC needs to lead the way on this'

(Interviewee L17, 2012)

As part of this process of commercialisation, the UK CCS Research Centre (from 2012), an EPSRC and DECC funded membership group of academics with associate business and government members, also plays a key role in economic metaphors.

'A key priority [for the UKCCSRC] is supporting the UK economy by driving an integrated research programme and building research capacity that is focused on maximising the contribution of CCS to a low-carbon energy system for the UK.'

(UKCCSRC, 2012, no pagination)

[Parentheses added]

Academics and researchers, as well as associated organisations such as the IEA, in this sense become *economic* agents; core to research funding in CCS is the demonstration of economic viability. Business and commercial actors, in particular power generators, chemical and extractives but also developers and consultancies, are represented strongly within UKCCSRC. Prior to this grouping there was greater inconsistency between economic actors from commercial and academic spheres.

Finally, at national scale the trades unions (notably the TUC) and other trades bodies as well as NGOs, are present in the discourse (for example at events, meetings and as report producers), but notably not frequently referred to by other dominant actors in the texts analysed. These TUs and NGOs in many cases offer opposition to mainstream government and commercial actors, again they are present in metaphors that emerge around confusion and disconnect in particular in economic metaphors 3 and 4.

It is worth noting in summary, that at this macro level, agency is witnessed predominantly at organisational level, with apparent 'collectivities' (Dryzek, 2005) rather than dominant individuals. This corresponds with findings from the analysis of economic entities at UK level for this era.

5.2.1.6 Economic Entities

Emerging metaphors suggest a dominant economic discourse relating to liberalisation of a free market for electricity. Core to this metaphor is the *intended* strengthening of market lead governance of energy sector through Electricity Market Reform and commercialisation programme embedded within it. This extends to EU and UK funding competitions which use economic tools such as EU Emissions Trading Scheme and Carbon Price Floor (CPF):

'CPF is the necessary first step in delivering a package of reforms for the electricity market to support low-carbon investment'

(DECC, 2011b, p.33)

Consortia of commercial organisations with interests in for example extraction, chemical processing, electricity generation and distribution emerge in line with government announcements on funding from circa 2008. Arguably these company alliances have emerged as entities which can both increase innovation (Dalziel, 2010) and reduce individual company risk; no single organisation is willing to be a loss leader and hence (funded) demonstrator projects proposals are led by consortia organisations established for the sole purpose of developing a funded CCS project, examples include 2COPower and the Don Valley Power Project, Kingholme and White Rose Consortia.

On the demand side of the electricity market, consumers and tax payers (sometimes expressed in the texts as 'bill payers' and occasionally 'voters') are referred to within metaphors as being ultimate funders of coal with CCS developments and are represented in the texts as part of the decision making process. However, what is clear is that neither consumers nor tax payers are involved in governance or decision making in any meaningful way, rather they are referred to as needing to be considered by other dominant agents. And policy recognises cost to bill and tax payers as significant with low cost energy becoming central to both EMR and policy reform more widely.

Finally, throughout the era, economic metaphors relate strongly to coal with CCS as a potential 'win-win' scenario. Within this metaphor, coal fired power stations, initially seen as dirty and nearing obsolescence, become entities with

potential to support this win-win metaphor. There is a change from ‘dirty’ coal fired power stations in the discourse, to power stations having ‘new life’ and being economically viable again where CCS is developed:

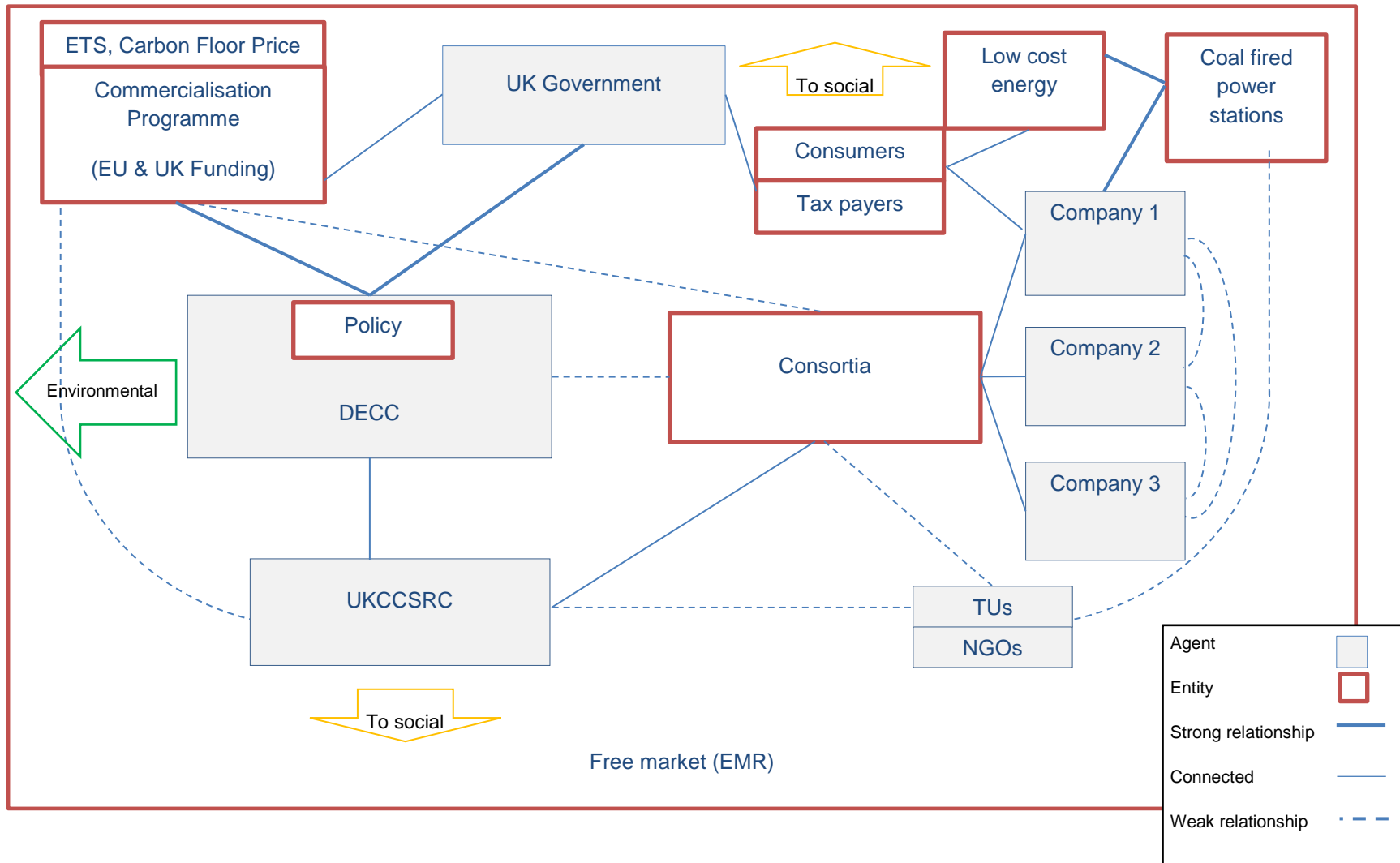
‘...some of these old turbines still have life in them...’

(Interviewee L18, 2012)

5.2.1.7 Economic Relationships

For these economic metaphors, relationships are strongest between government and business, but business to business relationships form and consolidate throughout the era also. Figure 5.1 illustrates these relationships and section 5.2.3 draws together the fields to infer prospects for sustainability understood from this analysis.

Figure 3 Economic relationships 2000-2013 – organisational field



5.2.2 Environmental Metaphors

The metaphors relating to environmental issues for 2000-2013, are, arguably more nuanced and complex than economic ones, reflecting wider environmental discourses that emerge and consolidate throughout the era³⁵.

5.2.2.1 Squaring the Circle - From 'dirty old' to 'new clean' coal

The post-industrial, 'dirty coal' discourse evident throughout the 1980s and 1990s prevailed at macro level from both government and civil society sources at least, until the mid-2000s. Environmental governance of coal was dominated by mine closures, legislation for NO_x and SO₂ emissions reductions, and closure of coal fired power stations under the conditions of the Large Combustion Plant Directive (LCPD). However, from the mid-2000s, coal with CCS was promulgated as a viable *technical* option. Continued coal use with CCS is presented by government and business actors in particular, as potentially having a positive environmental impact due to its expected CO₂ reduction. However, other environmental issues relating to coal use (for example air quality, extraction), are less evident.

The texts reflect at least a partial change in dominant discourse surrounding coal, from coal being portrayed as a *dirty* fossil fuel whose use must be stopped, to a potentially *relevant*, indeed an *essential* part of the energy mix. It is worth noting, that whilst data cannot suggest causality this change in discourse corresponds with an era of increased coal use. When considered in concert with the metaphor, this increased coal use at least suggests a renewed acceptance of coal as an energy source as part of the energy mix on the part of dominant actors. At UK level, this environmental metaphor is exemplified by this statement from the then Secretary of State for the Environment Ed Milliband:

[There will be] '*...no new coal without CCS... There is no alternative to CCS if we are serious about fighting climate change. We need*

³⁵ In concert with changing economic metaphors during structural adjustment of 80s and 90s

new coal-fired power stations... Without it [CCS] we will not succeed.'

(Guardian, 2009, p1)

[Parentheses added]

Coal with CCS, and other technologies such as IGCC, bio-fuel combustion at coal fired power stations are then presented as 'clean' technologies. Government and business texts especially present coal as a clean energy option, with 'new coal' and 'clean coal' and 'low carbon energy' used synonymously with reference to coal use with CCS.

'...a new world-leading UK CCS industry... that could compete with other low-carbon sources...'

(Davey, 2012, no pagination)

Interestingly, this corresponds also with a growing use of environmental and sustainability reporting by incumbent industrial actors (see appendix B for examples). This is in concert with the literature relating to CSR and voluntarism as part of good governance, replacing the state, as well as discourse on avoidance of legislation.

The view of 'clean' coal developments as a means of meeting GHG reduction targets (as well as in conjunction with existing technologies reduction in other pollutants associated with coal combustion e.g. mercury, particulate matter) becomes commonplace in the texts. Indeed, by the end of the era under study and in keeping with economic metaphors above, clean coal development is presented as the 'only' viable way of meeting both energy and environmental targets.

'CCS is the only way we can reduce carbon dioxide emissions and keep fossil fuels (coal and gas) in the UK's electricity supply mix. Fossil fuels are an important part of the electricity mix (and will remain so for some time to come).'

(DECC, 2013, p25)

[Emphasis added]

The environmental language associated with new coal technologies - clean coal, sustainable coal, new coal - allows for a squaring of the circle in discourse on continued coal use at macro scale.

Within the texts from NGOs, however, the metaphor becomes more nuanced still; Greenpeace, No Coal and others argue that CCS should not be compared with e.g. renewables in policy terms, as essentially the technology is a 'sticking plaster' and contributes to carbon lock-in (see sticking plaster metaphor).

5.2.2.2 *Abated coal - CCS as a technical solution to the problem of coal*

As an extension of the squaring the circle metaphor above, two themes emerge at UK level (i) emissions reduction and (ii) decarbonisation, which combined present new coal as 'abated coal', each is developed here in turn.

(i) Emissions reduction

UK Government policy has a particular focus on CCS as a technology that will contribute to UK's emissions reduction targets. Policies relating to coal developed since 2001 directly refer to the technology's potential for use in reducing GHG emissions. In addition, in the UK policy context the stated intention for CCS as an emission reducing technology is consolidated in both the CCS Commercialisation Programme and the DECC CCS Roadmap:

'...the power sector is the largest source of emissions – and therefore the sector which can contribute most to the reduction of those emissions.'

(DECC, 2012a, p23)

'...with CCS we have a technology that will help us meet environmental commitments to reduce CO₂ emissions.'

(Participant, O10, 2013)

Well thought out environmental regulation is seen as crucial in the context of abatement; for incumbent business actors, this also connects with economic metaphors for what they class as a level playing field for abated coal.³⁶

For the UK, coal is seen as a good option to meet CO₂ reductions and NO_x, SO₂ legislation, but recognition that we need to have CCS and CO₂ abatement technologies in place to continue to use coal.

(Observation notes, O10, 2013)

(ii) Decarbonisation and mitigation technology

Decarbonisation of energy supply features strongly in the texts. Coal with CCS is seen as an opportunity to, specifically, decarbonise electricity production in the UK.

'Carbon Capture and Storage is a mitigation technology essential in tackling global climate change... Up to 90% of carbon dioxide (CO₂) from a fossil fuel power station can be captured using CCS technology.'

(UK Coal Ltd, 2013, p. 2)

It is interesting to note, that the government and business texts consistently quote the upper reaches of potential for decarbonisation. However, a contrary view relates to the fact that full chain technology is not yet tested at scale. In addition, capacity to mitigate emissions is questioned; government and business texts typically estimate up to 90% of CO₂ emissions could be captured as above, however academic and NGO sources are more cautious:

'Assuming that commercial viability is reached, scenario studies indicate that by 2050 only 20-40% of global fossil fuel CO₂ emissions could be technically suitable for capture. This includes 30-60% of emissions from the power sector. Therefore, up to 70% of emissions from electricity generation in 2050 may not even be technically suited to CCS.'

³⁶ It is worth noting here again, that the level playing field is seen as necessary to make coal + CCS economically viable rather than environmentally or technically viable.

(Greenpeace, 2008a, p. 6)

It is also worth noting here that in 2008, along with statements on the future of coal, the incumbent Labour Government made announcements re construction of new nuclear. The aim was to develop a policy and regulatory framework which would see coal with CCS as a means of smoothing the transition to a more sustainable, low carbon energy system. As discussed further in chapter eight, the relatively low capital investment required to develop new coal plant versus new nuclear was appealing to both public and private sector investors.

5.2.2.3 Ideal geo-political context for clean coal in UK - environmental regulatory framework

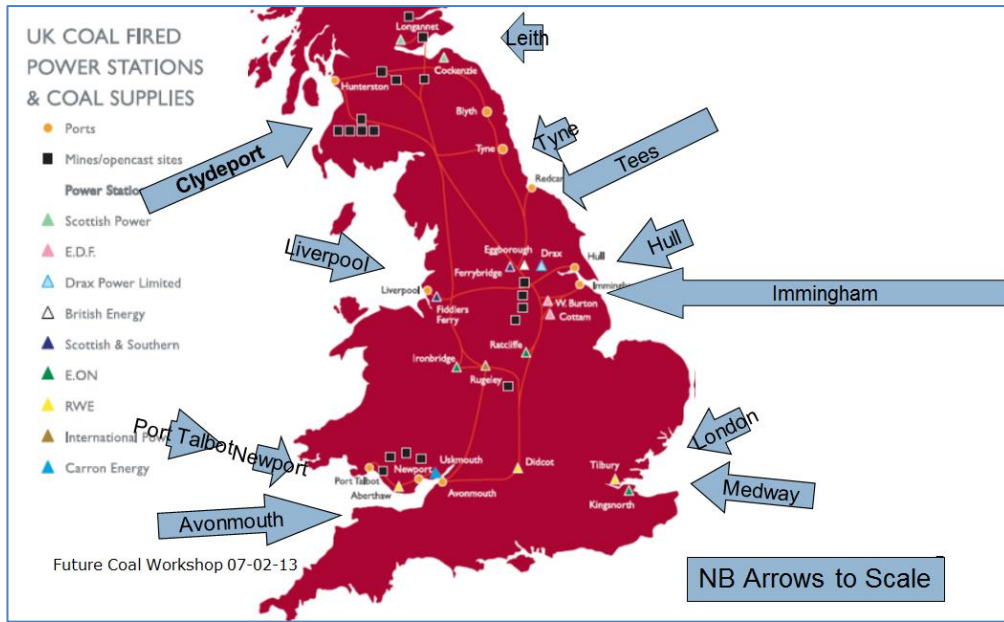
In concert with win-win economic metaphors, data from government sources in particular, as well as texts from business and limited civil society sources, suggest that the UK is actively presented as having an ideal geo-political context for CCS with fossil fuels and coal in particular.

'The UK is in a very advantageous position as we have access to offshore CO₂ storage locations, under the North Sea... The UK is well placed to deliver on its climate change targets and coal with CCS can provide a secure, affordable and low carbon solution.'

(UK Coal, 2013, pp. 2-3)

At the UK level, existing infrastructure is presented as contributing to the 'ideal' geo-political context. The physical location of energy infrastructure (i.e. close to former coalfields), makes continued coal use technically and environmentally, as well as economically, efficient.

Figures 4 and 5 below and the accompanying extracts observed at a UKCCSRC workshop, exemplify this metaphor.



(Source: Anonymised slides from UK CCS Future Coal Workshop, observation O10, 2013)

Figure 4 Imported coal to UK coal fired plants via established routes



(Source: Anonymised slides from workshop)

Figure 5 Existing rail infrastructure and links

As a counterpoint to this ‘ideal’ scenario metaphor, the pre-existence of an energy infrastructure grounded in old technologies (old coal) is evidently

problematic in two ways: Firstly, reliance on existing infrastructure and resource use may be contributing to ‘carbon lock-in’ (Unruh, 2000). There is some evidence here to support this: UK infrastructure has been developed based on coal use (environmental determinism – see chapter 4 it is no coincidence that the industrial cities of England and Scotland sit on coal fields), it will prima facie be less suited to other fuel sources.

‘... coal forms the backbone of our energy infrastructure. Ports, railways, canals, roads were all developed to export coal and distribute it to industrial centres... Make no bones about it, if we stopped using coal we wouldn’t just have to build new power plants we’d have to build a whole new infrastructure to support whatever other fuel we used.’

(Participant, O10, 2013)

Secondly, in attempts to decarbonise energy infrastructure *quickly* and at low cost, continued coal use on these grounds, might be seen as evidence of carbon lock-in (Unruh, 2000). The complexity of this wicked scenario, discussed below, is exemplified in the following extract:

‘Basically, the Government has to decide whether we want to carry on using coal or not now... There are some sound reasons why we would want to, infrastructure, transport networks... but obviously with CO₂ emissions [it is a problem]. And they’re not thinking about where these new plants are going to be. They can’t always be where existing ones are because capture plants are huge, so unless they’re under-ground where would they go?’

(Interviewee L19, 2012)

[Emphasis and parenthesis added]

An additional level of complexity relates to the extent to which coal and its environmental impacts are understood by both commercial actors and the wider public. For coal, the business as usual scenario is at least well understood and coal, whilst not desirable, has a degree of public acceptance.

However, new technologies such as CCS associated with continued coal use, do not. It is interesting to consider how this conundrum is viewed by UK actors:

'The environmental risks of CCS are no worse than natural gas, probably less than fracking, but we still need to convince people of that.'

(Interviewee L21, 2012)

'Consumers can be educated about what to expect – with coal starting from a better place than either nuclear or fracking'

(Observation notes, O11)

This feature of the data is explored in more depth as a dominantly social metaphor, however, a point to note here is that the decision to continue to use coal, given the environmental issues associated with its combustion, is seen by dominant commercial actors as an issue for the *Government* rather than wider *governance* actors. A final connected point relating to the ideal geo-political context for new coal is that the environmental regulatory framework in the UK is presented as being well established and fit for purpose. A combination of regulated limits to emissions, good reporting practices, strong relationships between the regulators and energy sector actors and good corporate governance is seen as ideal. This ideal context is portrayed by dominant actors as ameliorating environmental harm (as well as public concerns about *potential* environmental harm) through existing governance processes.

Discussion on planning being two-way process, BATT as basic and encouraged to go beyond. EA involved from start.

(Observation notes, O12, 2013)

This metaphor therefore becomes disconnected on this point. Incumbent commercial actors are present in the discourse, and new governance arrangements require their involvement in two-way governance and decision making processes, however, if new, low carbon coal technologies are to be deployed as a means of decarbonising energy supply, decision making ultimately rests with the Government.

5.2.2.4 *Carbon lock-in, business as usual*

At macro level, this metaphor around CCS ultimately extending fossil fuel use emerges in two opposing ways. Firstly, environmental NGOs and (some) civil society texts present CCS as an ‘environmental bad’ by encouraging business as usual and carbon lock-in. Secondly, and in opposition to this view, government and especially business texts present coal with CCS as an economically and technically viable means of decarbonising UK energy supply. Coal with CCS is in this sense portrayed as an ‘environmental good’ - a sustainable, low carbon energy solution and an opportunity to continue using cheap coal and other fossil fuels. These opposing views within the same metaphor are explored here in turn.

(i) Sticking plaster:

At the core of this metaphor is the view that continued use of coal, even with carbon capture has associated negative consequences; carbon lock in and at best weak sustainability; post-industrial agglomeration of environmental harm; exacerbated harmful climate change. In addition, the national focus on developing CCS is seen as a distraction in the short and medium term from longer term sustainable energy options such as renewables.

Coal with CCS as a sticking plaster is especially exemplified by texts from environmental NGOs who present concerns relating to the construction of new coal fired power stations as ‘capture ready’.³⁷ This is problematic for a number of reasons including cost, diversion of resources from alternative renewable options, untested technology, associated risks and, in particular, that the technology will not be effective in time to avert climate change:

‘Proposals to approve new coal stations that are “capture ready” are a dangerous distraction. Carbon capture and storage may have a role in future to deliver the deep emission reductions that are needed to avoid climate chaos. However, CCS technology has not yet been proven at scale... to be technically or economically feasible. Building

³⁷ This clearly relates to capture ready metaphors and concern with regulatory confusion in section 5.2.1.4

“capture ready” stations now would therefore impose unacceptable risks both to the climate and to the taxpayer, who may well be trapped into footing the bill for any future CCS retrofit.’

(NGO joint statement; 2008, p.1)

This statement in itself represents something of a compromised, tempered account of the discourse as compared with individual NGO statements earlier in this governance era.

Within this metaphor there is also a concomitant concern regarding sequestration and longevity of storage of CO₂ and the inevitability of continued fossil fuel use if the technology is developed at scale. In the early part of the era, CCS was at best seen as a stop gap or ‘sticking plaster’ to be employed until more sustainable energy solutions could be developed.

(ii) Magic bullet (win-win... win?)

As expectations associated with environmental benefits from clean CCS developed, so too did concerns that clean coal technologies were being seen as a magic bullet. From Greenpeace’s ‘False Hope: Why CCS won’t save the climate’ for example:

‘The earliest CCS may be technically feasible at utility scale is 2030. The Intergovernmental Panel on Climate Change (IPCC) does not expect CCS to become commercially viable until at least the second half of this century. Even then, plants responsible for 40-70% of electricity sector CO₂ emissions will not be suitable for carbon capture. Despite this, CCS is being used as an excuse by power companies and utilities to push ahead with plans to build new coal-fired power plants; branding them “capture ready.” The International Energy Agency (IEA) describes a “capture-ready” plant as one “which can be retrofitted with CO₂ capture when the necessary regulatory or economic drivers are in place”. This definition is broad enough to make any station theoretically “capture-ready”, and the term meaningless.’

(Greenpeace, 2008a, p.6)

The connection to the 'capture ready' metaphor explored earlier is evident, here however 'capture ready' is discussed as harmful rhetoric. The opposite view, i.e. that coal with CCS is a potential environmental good is, dominantly presented from business and government texts; coal is plentiful, cheap, easy to extract, readily available and available abatement technologies will reduce GHG emissions to the atmosphere. This, again, ties closely with economic metaphors relating to coal with CCS as a win-win opportunity.

Commercial actors in particular express this metaphor in terms of availability and stable cost of coal at current rates of energy use. Most clearly exemplified by various national and international coal related business consortia, for example:

'Proven world coal reserves amount to around 900 billion tonnes, equivalent to 125 years supply at current rates of usage. Against this background, and with the massive growth in coal use in economies such as China and India, climate change policies need to include clean coal as part of the solution'

(Coal Importers Association, no date, p.1)

'With the aid of CCS our new, highly efficient coal-fired power stations will make a significant contribution to achieving our climate protection targets and halving carbon dioxide emissions from our power stations by 2030.'

(E.ON, 2009, no pagination)

The point to note here is that environmental, technical, geological and geopolitical issues are integral yet, once again, secondary to economic considerations. It also introduces a related, more nuanced metaphor that whilst environmental problems (associated with coal extraction and combustion) exist and are well understood, technical solutions will be available to overcome these environmental challenges.

This interesting passage from the World Coal Association exemplifies this somewhat promethean (Dryzek, 2005) perspective:

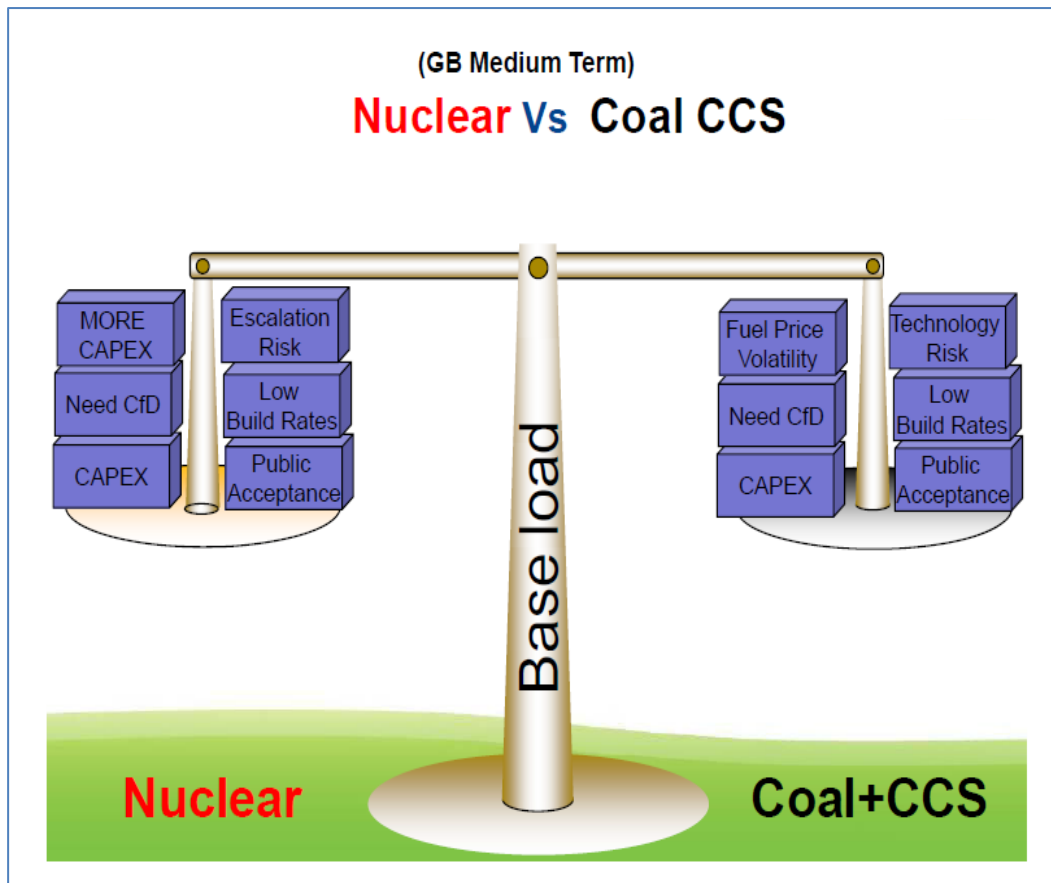
'The deployment of all energy generating technologies invariably leads to some degree of environmental impact... The use of coal for power generation is not exempt from these impacts and has been associated with a number of environmental challenges, primarily associated with air emissions. Coal has demonstrated the ability to meet such challenges in the past and the expectation is that it will successfully meet future environmental challenges.'

(World Coal Association, 2013, p.1)

In this sense, environmental problems associated with coal use are considered an inevitable by-product of energy generation; if not coal then *other* generation technologies will cause *other* problems. In concert with economic metaphors already explored at UK and also Yorkshire and Humber level in chapter six, an element of 'better the devil you know' emerges from the business and government texts as these excerpts from observation data illustrate:

Coal is being compared to other energy options, at least balanced, sometimes favourable if with CCS... coal with CCS is thought better than many options in both environmental and economic terms. Public acceptance less of an issue for coal than for nuclear, location of existing plant close to coal seams means hard work and environmental damage already done, new plant - gas or nuclear, or on-shore wind sufficient for base-load would be worse for environment.

(Observation notes, O11, 2013)



(Source: Anonymised slide from workshop presentation, O10, 2013)

Figure 6 Balancing nuclear versus new coal options

This, of all environmental metaphors perhaps demonstrates the complex, wicked nature of the environmental social science problem being investigated in this thesis: scalar and temporal issues and contradictions are inherent in the problem. This interesting passage from UNDP 2008 Human Development Report perhaps best summarises this complexity:

'No single technology offers a magic bullet for climate change mitigation, and 'picking winners' is a hazardous affair. Even so, CCS is widely acknowledged to be the best-bet for stringent mitigation in coal-fired power generation... CCS technology is projected to come on-stream very slowly in the years ahead. With planned rates of deployment, there will be just 11 CCS plants in operation by 2015. The upshot of this late arrival is that the plants will collectively save

only around 15 Mt CO₂ in emissions, or 0.2 per cent of total coal-fired power emissions. At this rate, one of the key technologies in the battle against global warming will arrive on the battlefield far too late to help the world avoid dangerous climate change.'

(United Nations Development Programme, 2007, p.145)

Note the date of this report, and that the target for operative, commercial scale CCS plant by 2015 was not reached.

5.2.2.5 *Environmental Agents*

Not unexpectedly within this environmental organisational field, the UK Government, plays a lead role in governance of coal use for electricity generation. This role manifests in two ways: firstly, environmental metaphors relating to GHG emissions reductions are evident in government texts. In particular national and EU emissions reduction targets are seen as motivating factors for Government involvement in supporting the development of new clean energy opportunities throughout the era. What is perhaps more interesting here is the clear connection between the economic and environmental metaphors and motivations in Government and bureaucratic texts.

Secondly, importantly and discussed in greater depth in chapter seven, the Government is dominant in the environmental field where there are clear linkages with its dominance within the economic field for this wicked problem. This suggests the economic power held by the UK Government has influence over the environmental field and relationships within it. The texts suggest this power manifests in terms of both the Government's power to determine action of others (through legislation and regulatory controls or support for the market through ETS for example), and, crucially, through its non-decision making powers. By heralding supremacy of market forces (despite lack of adequate features of a successful market e.g. competition) and tripartite governance arrangements, the UK Government is in part negating its own position as dominant within the environmental field.

An additional feature of Government agency is the influence of changing nature of views of key Government actors (successive Secretaries of State for example) and the impact these fluctuating political contexts have on CCS developments. Again, financial and funding related decisions feature significantly in the environmental texts. The change in national government in 2010 lead to a wave of policy changes for CCS in particular. The introduction of the CCS commercialisation programme increased the relevance of markets and economic issues in environmental governance.

In concert with economic metaphors, commercial actors, notably industrial incumbents in coal (extract and import), power generation and transmission sectors, but also chemical processing and developers are evident during this era. An interesting feature of the environmental metaphors in relation to commercial actors is that whilst consortia are formed during the era as discussed above, their role in tackling environmental issues is less evident. Increasingly during the era, individual companies include support for coal with CCS as part of their CSR or sustainability reporting, most usually in the form of commitments to research or partnerships to develop test facilities (see appendix B). Interestingly, within the environmental organisational field, commercial actors are referred to as both emitters and generators.

Whilst consortia have a less significant role in environmental organisational field than economic, other groups with mixed commercial, research and political roles emerge as significant governance actors during the era. Lobbying groups, associations, NGOs and ENGOs play a lead role in environmental discourse. The differing views of these groups, with often single issue remits, creates interesting relationships within the environmental organisational field for governance, as illustrated below. What is worthy of note here, is that this single issue nature of what might be termed opposition potentially weakens the cause for each group. Towards the end of this era however, groups of organisations with similar issues begin to emerge and focus on core environmental metaphors. For example, Friends of the Earth, Greenpeace with other ENGOs create working groups and joint statements to set out their combined views on environmental impact of CCS. This albeit slow

merging of views through isomorphic in to a middle ground could arguably be evidence of 'processes' of governance and the dominant agency (power) of incumbents leading to organisational field change.

5.2.2.6 *Environmental Entities*

Two environmental entities are integral to the discourse; emissions from coal combustion and climate change with a core corollary throughout the texts that reducing emissions from combustion at source is sufficient to limit climate change. However, the dominance of these two entities in the discourse means that other environmental issues, even those directly related to climate change (fossil fuel use, emissions from shipping of coal and biomass, water use, effects on biodiversity of particulate matter) do not feature strongly in the rhetoric.

Underpinning these two core entities is the environmental problem of coal use in 'dirty, old' coal fired power stations. However, during this era at national scale, synonymous entities, future coal, clean coal, new coal, and sustainable coal emerge to linguistically ameliorate the problem. CCS is at the core of new coal technologies with DECC's CCS Roadmap intended to deliver operational CCS in the UK. Whilst emissions reduction is nominally a driver for the roll out of CCS, in essence, the roadmap focuses on harnessing new coal's potential for emissions reductions in *economic* terms. The programme intends for CCS to be a 'competitive clean energy' option, and as seen above embeds economic and market led governance arrangements (competition for funding and the ETS for example) in to deliver. Integral to this is the view that tax payers and/or consumers ultimately pay for developments of new technology. Perceived good environmental governance in the UK context including corporate governance - CSR and sustainability reporting or strategies – allows generators freedoms in developing strategies to develop new coal technologies. The corollary is that developments must be seen in terms of cost effective emissions reduction within a business as usual context, rather than a more heavily regulated framework for emissions reductions per se.

The emergence of ENGOs as a fragile opposition to dominant agents, initially in opposed to CCS and then from mid-2000s in somewhat resigned acceptance of technical potential for CCS. NGOs and ENGOs provide a degree of opposition to dominant rhetoric, however there is a limit to their role and evidence of some crowding out of non-governmental civic or public actors. In many ways it is this very point, i.e. the lack of breadth and depth of environmental metaphors or powerful actors that is of most interest here. (Lukes, 1974, might discuss this in terms of the crowding out of alternatives). There are potentially contradicting interpretations available; evidence of weak sustainability, weak (albeit new) governance in competition with strong government in terms of non-decision making power. As discussed in chapter seven, these contradictions develop into a picture of the dominant entities and how relationships between entities and actors shapes dominant metaphors in turn has implications for both effectiveness of new governance and sustainability of coal use. This in turn allows a deeper understanding of the isomorphic processes at play in development of the organisational field, which helps to illuminate prospects for new coal.

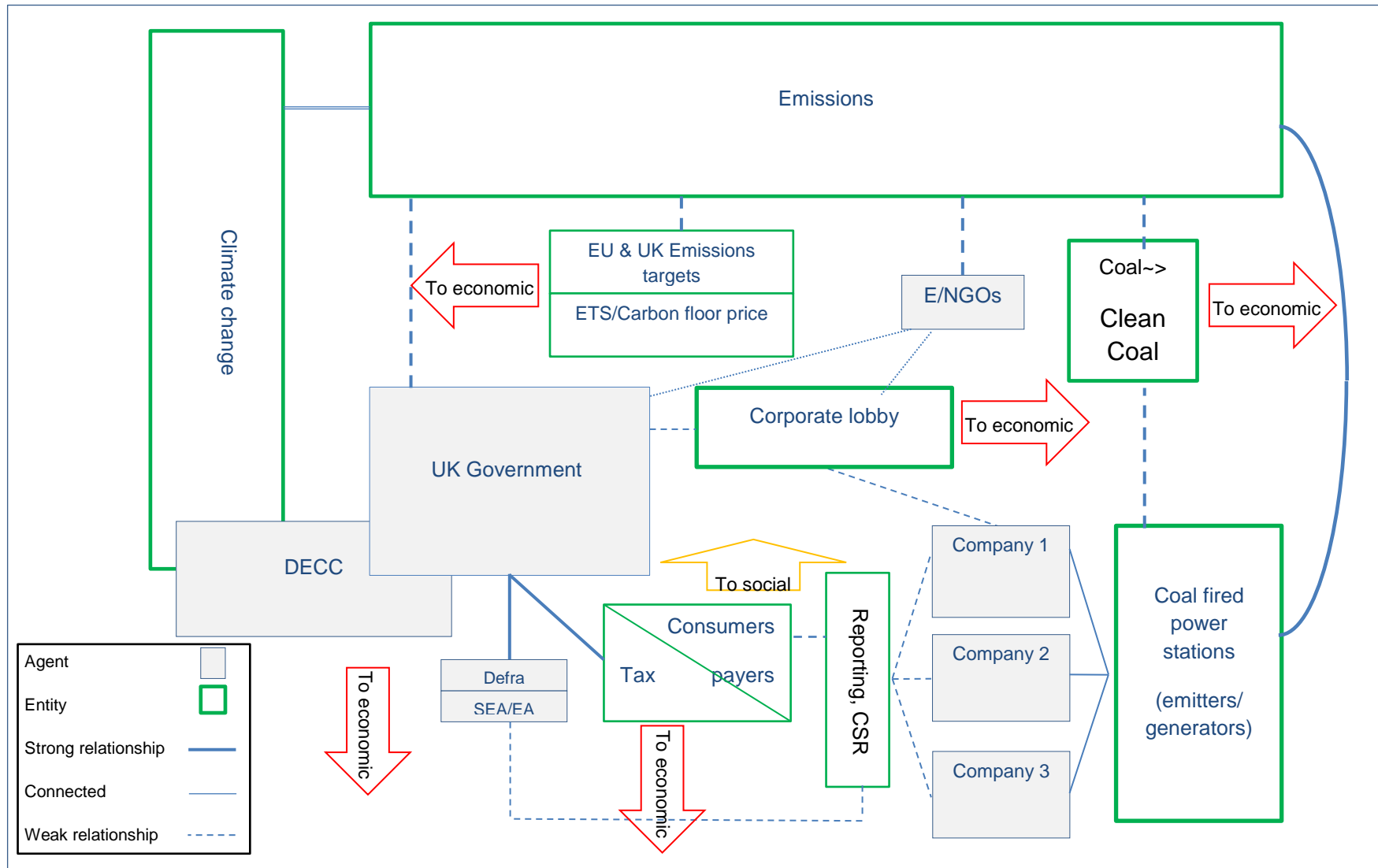
5.2.2.7 *Environmental Relationships*

An interesting characteristic of this analysis is that within the environmental organisational field, economic rhetoric features strongly, but other aspects of sustainability (inter and intra generational equity, social sustainability, justice) do not. Figure 5.5 illustrates the relationships between agents and entities emergent from the metaphors, but also the connection between the environmental field and the economic. In addition, within each metaphor however, there is a greater degree of disconnect and opposition, and whilst more actors and opposition to the dominant discourse are evident, actors other than Government actors have only weak or diffuse agency or relationships.

The environmental discourse in this era is dominated by the relationship between two key agents; UK Government and commercial organisations operating at national and international levels. Their core motivation, in concert, is to find *economically* viable solutions to environmental problems, notably GHG emissions in order to maintain business as usual context for energy

generation. At UK level, other environmental entities do not feature strongly in the discourse relating to the wicked problem of continued coal use, and where the texts do reflect wider discourse this is presented by what might be classed as less powerful actors, with weaker relationships with other agents or on the periphery of the discourse. It is also interesting that where there are stronger relationships between agents and entities these are closely related to the economic field also, whereas connections between environmental and social organisational fields at UK level are somewhat tenuous.

Figure 7 Environmental relationships 2000-2013 – organisational field



5.2.3 Social Metaphors

Coal, as discussed in chapter two has social and cultural as well as environmental and economic significance (Strangleman, 2001). For much of the industrial UK, coal mining and combustion has been core to industrial development, and as discussed in chapter four, contemporary views and public opinion on coal cannot be divorced from their cultural, societal and historical origins. This section explores the dominant social metaphors evident at UK level evident from a consideration of the texts to ultimately present a social organisational field.

5.2.3.1 Energy security - Keeping the lights on

Core to UK level texts during this governance era is the rhetoric that coal is essential for 'energy security' in the UK. This links to the economic discourse that views the public as net beneficiaries of coal use identified in UK and also Yorkshire and Humberside levels. Coal with CCS is seen as an opportunity to exploit cheap and readily available resource at an acceptable cost to consumers. This rhetoric evidently links with economic organisational field, for example:

'You just have to look at coal price over gas prices for the last couple of decades, especially with cheap coal from the states since fracking, to see it makes sense to think of coal as a cheap, reliable feedstock.'

(Participant O11, 2013)

Note also that concerns around the so called 'energy gap' which could arise if coal fired power stations are closed ahead of an alternative base-load as an economic *and* social risk.

'There simply isn't an alternative to coal for base load at present.'

(Interviewee L17, 2012)

The physical supply of coal as a reliable feedstock, readily available at an acceptable price underpins these 'keeping the lights on' and related 'reliable coal for base-load' representations.

5.2.3.2 *Tokenism; pleasing some of the people some of the time*

Public acceptance of coal with CCS is a dominant and complex feature of the discourse relating to continued coal use. Wider discourse suggests public engagement and acceptance is a feature of success of adoption of new technology (Devine-Wright, 2005; Ashworth et al, 2012; Cotton, 2014; Wesselink et al, 2014), but that mechanisms employed in gaining public acceptance vary in their efficacy (Kates et al, 2005). For coal and the future of coal, the need for public acceptance is seen (by dominant actors) at UK level as a necessary part of the process of development: public engagement is integral to the *processes* of governance. However, full public *acceptance* is not seen as essential beyond certain basic levels in order for development to take place. In this sense, engagement is seen as sufficient for social license (see chapter two) with consultation and information giving activities i.e. to inform and placate opposition in order to gain social license to operate commonplace. In particular, consultation with ‘the public’ and wider stakeholders on the part of Government and developers, is widely reported as necessary but somewhat perfunctory:

Discussion - seems industry and developers content to have ‘tolerance’ of CCS rather than acceptance or support for new technology. Whatever works to get things operational – licence to operate

(Observation notes, O12, 2013)

In part, this need for public (stakeholder) engagement is an established feature of regulatory requirement on developers: Issues relating to public acceptance i.e. over and above public engagement, of CCS as a low carbon energy development do emerge to a degree toward the latter part of the era, most notably from the observation data.

Discussion on concerns that developments fail because of lack of public knowledge/acceptance – DVPP and Vattenfall mentioned as struggling because of lack of knowledge and ‘ill-informed opposition’ to development being ‘louder’ than developers and funders.

(Observation notes, O12, 2013)

Here, the need for a minimum level of public acceptance of CCS, is perceived as necessary because of earlier failings of Government(s) and developers to effectively engage with publics.

Within the discourse (and in keeping with the uses and abuses of ‘community’ literature discussed in chapter two, ‘the public’ (or sometimes ‘communities’) are perceived by dominant actors as largely homogenous. In this view, the public (albeit in a number of guises; consumers, tax payers, voters) are seen as net beneficiaries of affordable energy, one subsection of which is considered passive, tolerant or persuadable, the other as obstructive NIMBYs who cannot.³⁸

‘Whatever we do; coal, CCS, fracking, nuclear, wind... some people won’t like it, but we can persuade enough people to get any option through [planning]. When it boils down to it, people would like it less if we stopped’

(Participant, O12, 2013)

Or:

‘They [the public in this case construed as NIMBYs] hate it all... but they want the lights kept on, so in the end we should do what makes most sense. You’re lucky if you can please some of the people some of the time...’

(Participant, O10, 2013)

[Parenthesis added]

Further to this, the mechanisms by which ‘some of the people’ can be pleased ‘some of the time’ are business as usual practices; CSR (noted as a pacifier in observations), reporting, public consultation. Consultation on specific projects, stakeholder engagement to regulatory requirement levels is seen as necessary (Ashworth presentation and responses at UKCCSRC Bi-annual

³⁸ As discussed in chapter six, this feature is similar at both levels of enquiry

meeting) and CSR more generally (especially at local level) is seen as the way to smooth over any problems.

In concert with the sustainability literature which suggests that this somewhat paternalistic approach to imaginaries of ‘the public’ is contributory to low levels of integration of civic actors with governance processes. Where consultations have taken place considering Sherry Arnstein’s seminal work (1969), these activities can at best be considered in terms of degrees of tokenism. This creates a challenge within the social organisational field, whereby public acceptance is deemed as necessary, but understanding of public engagement on the part of key actors (see 5.2.3.6) is poor. This creates challenges for governance processes and outcomes when there is a lack of effective engagement with civic and public actors at macro level. This finding links with wider distributional and justice debates on the effectiveness of such tokenistic approaches to public engagement for sustainable outcomes. Chapter seven expands on these debates.

5.2.3.3 *The risks (to the public) will be worth it (and manageable)*

This social metaphor falls broadly in to two themes: Firstly, risks (either actual or perceived) to, for example potential public health or environmental risks associated with CCS or coal. Secondly, the risks associated with doing nothing; unmitigated climate change, energy gaps due to closure of coal fired plant, job losses:

‘storage and transit issues have risks associated with them, of course they do, but we’re ironing out the issues all the time. We also know that because we [generators] are being scrutinised, the risks are being exaggerated. There is less immediate risk from [pressurised CO₂] pipelines, than from natural gas that we all pipe in to our homes every day but people don’t think of it like that.’

(Observation notes, O11, 2013)

The risks associated with doing nothing, again link with the economic discourse (and in line with Stern, 2006); risks are expressed in terms of

potential economic costs of not doing anything and to a lesser degree, the social and environmental implications.

'Whilst CCS will add significantly to the costs of electricity generation from coal... According to the International Energy Agency, without CCS, limiting a rise in global temperature to 2°C will be that much more difficult, and up to 70% more costly.'

(Coal Importers Association, no date, p.1)

In both cases, UK level texts suggest there is a consistent view from government and commercial (i.e. dominant governance) actors that risks can be ameliorated with adoption of new technologies. Furthermore, in keeping with rhetoric relating to public engagement and acceptance of new technology, public engagement activities are seen as sufficient to allay concerns and over time new technologies associated with potential public health risks will be acceptable.

'People used to worry about pylons now it's wind turbines or CCS or fracking, they'll get used to it.'

(Participant O11, 2013)

5.2.3.5 *Coal + CCS = economic growth = jobs*

In keeping with the strong win-win metaphor that runs through the texts for this era at the UK level, potential social benefits of new coal are seen as relating to socio-economic issues. The potential for jobs growth in typically poor, post-industrial regions of the UK is central to this rhetoric.

'Clean electricity, new jobs and reduced emissions, an impressive triumvirate'

(Plenary session. Scottish parliament 5m27s 10/10/2013)

And in terms of renewing and reinvigorating depleted UK coal sector.

'The future of the UK coal and coal power industry and its 10,000 direct employees hangs in the balance.'

(Trades Union Congress, 2012, p.6)

At UK level, this metaphor extends to suggest particular relevance for the UK due to the existence of transferrable skills.

'We have the industries needed for CCS already, in the North of England and Scotland. Everyone recognises that there are skills shortages, but these are transferrable skills. We could become leaders in the sector.'

(Interviewee L24, 2013)

Throughout the texts, the social is inextricably linked with economic, in this case employment, employability (skills) and development link to evolution of longer term distributional issues. These, as discussed in chapter four, emerged post structural adjustment and privatisation of power generation and coal mining in the UK but have significance decades later (Beatty et al, 2007; Foden et al, 2014).

5.2.3.6 *Social agents*

An interesting feature of the data at UK level is that one of the key social agents, the public, is perceived and treated by dominant government and corporate agents throughout the discourse as an homogenous group. This homogeneity is granulated only to a small degree with reference to 'customers', 'consumers' and 'tax payers' as distinctive (note these distinctions suggest economic agency). There is also a distinction in the texts between passive net beneficiaries, i.e. in this case tax payers and/or consumers, and active oppositional publics, most often characterised as NIMBYs. Whilst interesting, the relatively low levels of representation of civic actors in the primary data texts at UK level means it is difficult to conclude (i) whether this homogeneity is warranted and (ii) whether this low level of engagement reflects levels of power (Lukes 1974, 2005) and representation in decision making.

As an extension of this, both the UK Government, and corporate actors demonstrate social agency by homogenising multiple potential publics in two related ways: Firstly, by representing socio-economic actors' perceived best interests, again in an homogenising way, Government decision makers

demonstrate a somewhat paternalistic role. Secondly, corporate actors maintain their social license to operate in assuming their customers' and consumers' best interests by providing low and stable cost electricity. Both agents' texts reflect economic primacy with regard to their perceptions of other social actors.

UK government bodies have additional agency in their role as the regulators. This is perhaps the most weakly evidenced agency at UK level, but corporate actors in both interview and observation texts defer to the role of the regulator as relevant in managing public interests:

'It's up to the regulator to decide whether individual developments are in the public best interest, we can't make that decision.'

(Interview L17, 2012)

An additional interesting feature of this governance era at UK level is that corporate actors, developers, generators and others, become *proxy* agents of social change. As compared with the eras discussed in chapter four, these private sector actors evidently have an increased role relating to wider range of social characteristics; public health, job creation, public engagement, fuel poverty, energy security. Corporate actors become representatives and guardians of public interests as a specifically noted feature of the UK CCS commercialisation competition. The public has a degree of deferred agency in that their relationship with government and corporate agents is necessary for those dominant actors to continue to either operate or stay in power respectively.

In a similar vein, but an issue that needs further exploration beyond this study, the role of NGOs and especially trades unions as 'representatives' of non-governmental public actors emerges then fades during this era. The UK CCSRC and other groups established as part of the commercialisation programme also demonstrate social agency, albeit to a lesser extent. Within this group and others, Universities and research bodies with interests beyond technical CCS capabilities – e.g. STS, social/public engagement, sustainability

- influence the agenda for inclusion of public engagement in new technology development.

The speculation on views and perceptions of the 'public' in their guises as tax payers and consumers by such a limited range of dominant actors, is exacerbated by a notable lack of alternative public representation in governance processes at macro scale. The literature on public engagement is useful here to suggest four key aspects may be most relevant (i) uses and abuses of 'community' as homogenous (ii) public acceptance as dependent on understanding of the development (iii) trust of dominant actors and (iv) perception of associated risk. For new coal use and development around new coal, therefore a summary may be: (i) at UK level there is a lack of social agency and engagement with the public on decision making (ii) low levels of technical understanding of CCS amongst wider publics (Markusson, 2012) and untested technology (iii) commercial and government dominant actors are not well trusted (iv) risks are unknown and unquantified at scale.

This somewhat gloomy, but evidently realistic summary, suggests a potentially compounded wicked problem, where low levels of social agency coupled with poor understanding of technical developments lead to lack of agency within the organisational field. This in and of itself may not appear problematic unless one considers public engagement in decision making as critical for both good governance and ultimately the sustainability of decision making.

5.2.3.7 Social entities

The public as discussed above, emerges as being viewed as an homogenous group with minor distinctions around their essentially economic roles i.e. as tax payers and/or consumers. This homogenous entity is, to some degree, core to the complexity of the wicked phenomenon under study. To expand, dominant social, government and corporate actors have primarily economic motivations, are paternalistic in their views and actions towards the public as a single entity in order to gain sufficient public acceptance of new technology. There are few if any, non-governmental public voices in decision making processes at UK level (some from self-appointed representatives e.g. NGOs

and TUs), and so this paternalistic, constructed view of public views on new coal are presented as representative of wider social views. The problem is exacerbated then in two ways: firstly, new governance processes require tripartite approaches to develop sustainable solutions to energy challenges faced, this is not evident here. Secondly, where the needs and wants of an amorphous homogenised 'public' are summarised and extrapolated by dominantly economic rather than social actors, the economic remains dominant. Issues of public health, visual amenity, use of resources, well-being are subsumed at UK level in to two key socio-economic entities; jobs and keeping the lights on at acceptable cost.

Again, as a construct of dominant actors, so called NIMBYs are viewed as an inevitable distraction from development. To return to a metaphor explored earlier:

'They [the public construed as NIMBYs] hate it all [referring to different energy options]... but they want the lights kept on, so in the end we should do what makes most sense. You're lucky if you can please some of the people some of the time...'

(Participant, O10, 2013)

[parenthesis and emphasis added]

NIMBYism as a construct³⁹ is a well-established phenomenon (Devine-Wright, 2005; Cotton, 2014), what these data and the analysis add to the discourse is the *use* of NIMBYism to, in part support (or in some cases exonerate) actions of dominant actors in their decisions on coal use. By including, in the paternalistic way described above, those imagined priorities of other *wider* publics as in opposition to NIMBYs' views, dominant social agents crowd out opportunities for inclusion of opposition in decision making processes (Lukes, 1974).

³⁹ Albeit a misconstrued and unhelpful one

Furthermore, the data suggest that the processes of governance adopted (including CSR, public engagement and consultation) at UK level in this case, are also controlled and owned by dominant actors. To reiterate:

'...we can persuade enough people to get any [energy] option through [planning]. When it boils down to it, people would like it less if we stopped generating'

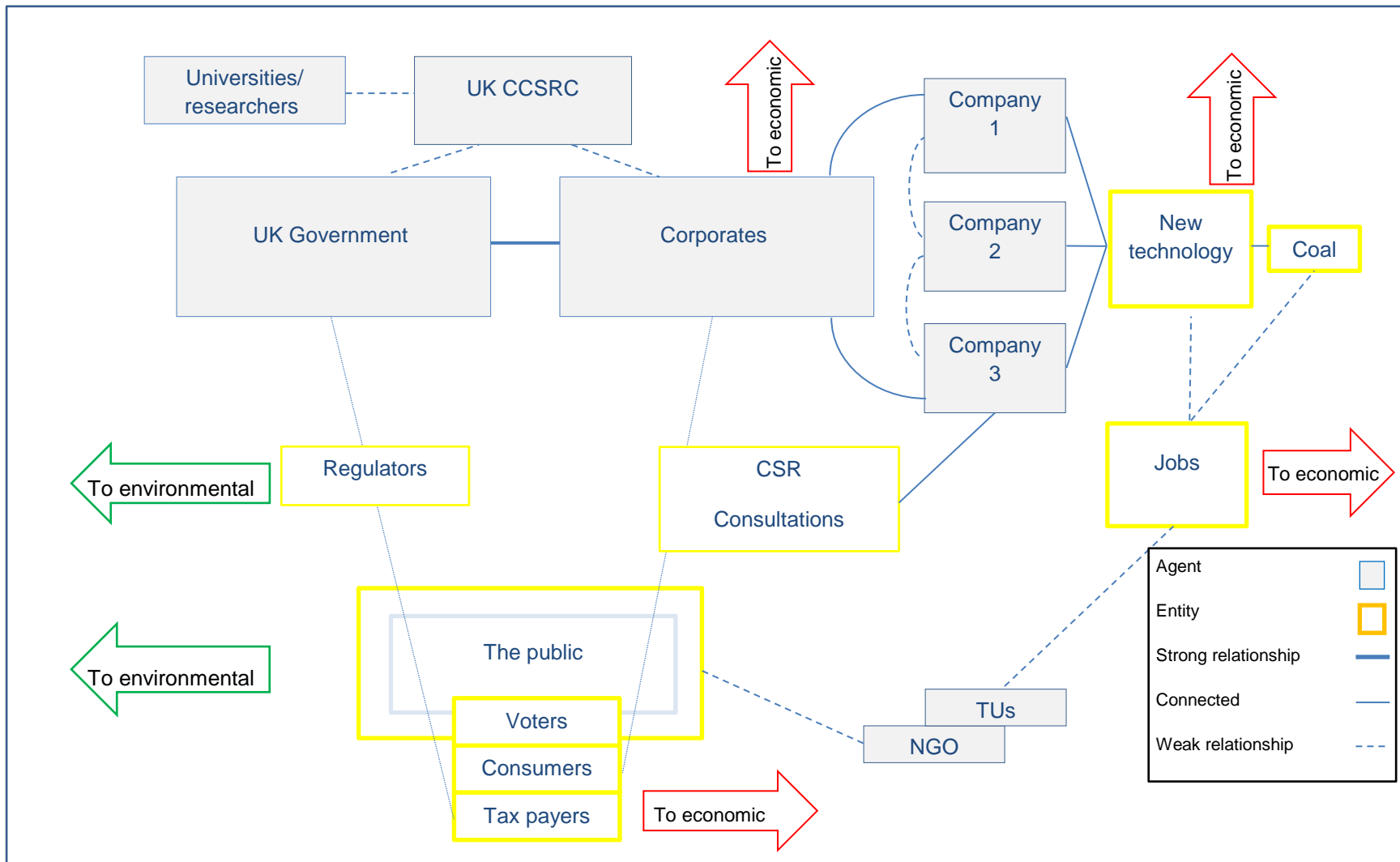
(Participant, O10, 2013)

In doing so, dominant actors both perpetuate the perception of 'whatever they do' as being in the best interests of the public, crowd out alternative perspectives, miss opportunities for support and, ultimately, misuse governance processes designed to generate potentially more sustainable energy solutions. This chimes with Lukes (2005) three dimensional conception of power (p. 21).

5.2.3.8 *Social relationships*

As alluded to above, relationships between actors and entities within the social organisational field at the UK level are weak with the exception of that between government and corporate actors. The motivation of these dominant actors is to engage with the public in a functional manner in order to allow development. Relationships then between other social actors at UK level are at best tenuous and typically government and corporate actors act as a conduit for other relationships. Figure 5.6 below explores these relationships in more detail.

Figure 8 Social Organisational Field



5.3 Organisational Field for Governance 2000- 2013: New Coal, New Governance or Economic Dominance?

It is evident from this analysis of the discourse, that the dominant rhetoric during this era at UK level is one of economic rationality (following Dryzek's use of the term (2005)) and that this dominance extends beyond the economic organisational field of governance to both social and environmental fields. However, this dominance masks complexities within the organisational fields relating to relationships between dominant actors, within specific metaphors and between fields themselves. These complexities are teased out here to conclude this section with a picture of the organisational field of governance for the 2000-2013 at UK level.

In response to research objective 1 this section reflects on the characteristics of coal use in the UK using governance and sustainability as organising principles. The era saw some consolidation of industry and government positions within org fields as dominant; CCS implementation seen as essential and coal use as inevitable as part of the UK energy mix for some time to come unless unconventional gas or nuclear developed. Ultimately, the dominant discourse relating to CCS implementation is of governance as through existing and reformed market mechanisms. Issues of sustainable development were subsumed by those relating to implementation of 'low carbon' energy technologies which do not disturb the economic status quo in the short to medium term, and by the economic (and social) need to 'fill the energy gap' which will be created by the closure of older coal fired power stations. By the mid-2000s at UK level there is a degree of consistency between dominant actors around the potential for CCS with coal to positively contribute to economic, environmental *and* social problems.

What appears problematic however is that across all three organisational fields, agency is witnessed in very few actors; the impacts of this on the market for coal are explored further in chapter eight (8.2), but in brief engagement with decision making by non-state actors is limited. In addition, agency at organisational field level, is associated with slow moving change whereas the utility of CCS with coal both in terms of reducing emissions, and as a means of development is time sensitive. The contradictory and negative metaphors from NGOs and other groups outside of government and industry operating at

macro scale to a degree subside to reveal some pragmatic unity with government and business actors. However, this quietening, may be the result of a crowding out of alternatives and non-dominant agents.

Whilst the win-win potential for CCS with coal dominates the discourse, there is a degree of discord between dominant actors on how best to capitalise on the opportunity that new coal technologies afford. Both government and corporate actors want market led governance of a commercialisation programme for CCS, however, corporate actors pressure for a level playing field (with regulatory backing) and longer term investment from public funding to operationalise CCS.

The era culminates with a documented (if not yet operationalised) intention to support new coal with CCS, and a degree of consensus between government and industry actors over potential economic viability and market mechanisms for commercialisation, albeit with noted caveats. However, whilst policy underpinning CCS competition and market reform has been established, as yet no commercial scale operation exists in the UK and as discussed in section 8.2, funding and wider policy contexts remains uncertain.

Research question two (p.8) asks whether organisational fields have changed over time. The answer in short is yes, in some fundamental ways. At the heart of these changes is an embedding of neo liberalism and dominance of at least the desire for market mechanisms to determine outcomes for new coal. However, the analysis shows that whilst private sector actors have new roles in governance which extend and consolidate during the era, it is apparent that state, Government power (including non-decision making and delaying power) remains dominant. Attempts to liberalise energy markets have not lead to development of clean coal technologies; however, market forces have driven continued coal use. Chapter seven reflects on whether and in what ways this seemingly paradoxical context has implications for the sustainability of new coal.

Toward the end of this era, the need for 'public acceptance' of CCS with coal as a new low carbon technology emerges; industry and some government actors call for CCS to be classified as a renewable energy for policy purposes. As a discourse amongst corporate and government actors – in Dryzek's terms, the discourse here is somewhat promethean. This is of particular relevance

to the Yorkshire and Humber region with two of the favoured Nationally Significant Infrastructure Projects (NSIP) (as at Dec2013) in the region, plus operational demonstration projects of significant (if not commercial) scale.

Finally, this narrative suggests that (when considered with chapter four) that whilst some of the dominant metaphors identified have galvanised and strengthened over time, others have weakened. Notably, metaphors relating to social organisational fields and the role that non-governmental public and civic actors play in governance suggest a closing down of discord or opposition to business as usual through only nominally engaging governance processes. These features of the organisational fields are discussed in depth in chapter seven and considered below in chapter six in the context of the Yorkshire and Humberside region.

Chapter 6 - Yorkshire & Humberside 2000-2013: From home of 'dirty coal' to host of 'clean energy'?



Figure 9 Iconic Ferrybridge C Power Station

(Source: <http://www.industcards.com/st-coal-uk-eng-n.htm>)

6.1 Introduction

Chapter six considers the new coal, new governance era in depth for the Yorkshire and Humberside level of enquiry. This provides an interesting counterpoint from which to then build a picture of organisational fields dynamics between levels of governance, core features of sustainability discourse and over time. The remainder of this section presents metaphors identified in the texts and the agents, entities and relationships emerging as key from within them. The data are presented in terms of economic, environmental and social factors in keeping with the use of sustainability as an organising principle; it is understood that there is some overlap, where this overlap is deemed most relevant to the discourse, this is drawn out further in the discussion in chapter seven.

6.2 Unabated coal – legacy of an industrial past

As discussed in chapter two, the Yorkshire and Humberside region has close Following this introduction, this chapter drills in to the detail of the Yorkshire and Humberside (hereafter Y&H) case for the era c.2000 – 2013. The case study data were generated through discourse analysis of interview, observational and document texts.

6.2.1 Economic Metaphors

6.2.1.1 *'Clean coal' as a local win-win scenario - green energy, local jobs*

In keeping with data for the national scale, this metaphor is witnessed at the sub-national, Yorkshire and Humberside scale. What differs at Y&H scale is that the dominant view relates to the place related economic (and geological, geo-political) nature of the region as being specifically suited to new coal developments.

'A major new report to MPs highlights the significant economic benefits of investing in the Yorkshire & Humber Carbon Capture Storage (CCS) cluster... this would generate £1.3bn for the UK economy, deliver 4000 jobs and help attract as much as £11billion in foreign investment.'

(CO2Sense, website 2012, no pagination)

Furthermore, the regionally felt legacy/post-industrial impacts of coal means the region is in need of development.

'CCS is exactly the kind of new green technology needed in Yorkshire, Humber and the Tees Valley, it could create thousands of jobs'

(Interviewee L24)

It is worth noting here (and explored in more depth later), that whilst this is a strongly evidenced metaphor, its significance for different actors differs at local level to national scale. So, for government (UK & regional/local), business and other dominant economic actors, the metaphor is strongly evidenced both scale. However, whilst it is evident amongst local and community scale (non-economic/commercial) actors, it does not have the same significance for example for either local (parish) or non-business community and instead

morphs in to something more akin to ‘better than nothing’ for non-business/non-government actors at Y&H scale. In addition, the ‘win-win’ metaphor for ‘clean coal’ *specifically* i.e. as opposed to economic development more generally, or even broad representations of green growth (which of itself does not present strongly amongst civil society/public actors at Y&H scale), is somewhat fragile.

*‘[People] used to be rich round here – you’ve heard people calling us ‘Pontecarlo’⁴⁰? It’s a p*** take now, but used to be we had money’*

(Interviewee L16, 2013)

‘We need something to happen here, doesn’t matter what.’

(Interviewee L33, 2013)

There is a specific role for economic growth at local level and potential for creation of employment opportunities in a region with lower than national average levels of employment (appendix C)

‘Not only will this [CCS] mean cleaner air, it will bring jobs to the region.’

(Opening address at B2B event, O6, 2013)

CCS in Yorkshire and Humberside will ‘...deliver 4000 jobs...’

(CO2Sense, website 2012, no pagination)

However, within the field there is a degree of disconnect over perceptions on whether and how new jobs will materialise:

‘...CCS ...could mean thousands of new jobs in an area of high unemployment, but this government won’t commit to any investments. They’re clueless if they think it’ll come from the private sector.’

(Interviewee L24, 2013)

The dissimilarity between the document texts (especially government and QUANGOs or other agencies), and the interview data becomes evident. Document texts promote the *potential* for development and jobs resulting from investment in CCS whereas interviews reflect a more questioning, critical perception on the *likelihood* of developments in the region. In addition, the

⁴⁰ i.e. for Pontefract

dominant perception from civic actors is that economic benefits will not be felt in Y&H for largely structural reasons:

'I hope that they take on new people, but I doubt it will be many and I doubt it will be anyone from [...]'

(Interviewee L15, 2013)

[Redacted for anonymity]

When asked to expand as to why that might not be the case, the interviewee pointed at a terraced street visible from the window:

'Pretty much the whole of that street is single mothers on benefits and that's what it's like all over. I should think they'll bring graduates in from elsewhere.'

(Interviewee L15, 2013)

In a similar vein,

'The trouble is no-one has the skills here anymore. Even if it [planned new coal fired power station with CCS] does bring jobs they won't be for lads from round here.'

(Interviewee L1)

[parenthesis added]

What emerges from the data in this respect is that *place*, specifically connotations of 'round here' and local interpretations of the need for (and limitations of) economic development is significant.

6.2.1.2 *It's different 'round here'*

This place related metaphor emerges in two ways, each is dealt with in turn below:

(1) *Y&H Ideal political economy for CCS*

The policy and governance context in Yorkshire & Humberside has been described as 'ideal' for the CCS commercialisation programme (see DECC, TUC, CO2Sense, DVPP, texts). The combination of a history of coal mining and use, resultant energy infrastructure, current high emissions from generators and other heavy industry and close offshore aquifers make it

particularly appealing. In addition, the region is characterised as in need of investment and development. This combined with perceived public acceptance of existing energy infrastructure means the region is portrayed as an ideal setting for new coal developments.

'Unique geographic and industrial assets make the Yorkshire-Humber region best-placed to become a world-leading CCS location. It is not only within easy reach of offshore CO2 storage sites in the North Sea but the region also represents the heart of the UK's coal-fired power generation emitting 90mt CO2 per year - almost one fifth of the UK's annual CO2 emissions.'

(GCCSI, 2011a, no pagination)

[emphasis added]

Similarly, Yorkshire and Humberside sites are:

'...particularly suitable due to their location near the North Sea oil fields and potential power sector regional CCS infrastructure...'

(TUC, 2012, no pagination)

However, whilst new and 'clean' coal developments are also seen as potential economic development opportunities there are two key caveats. Firstly, the intention of government (UK and EU funders) to fund only commercial scale operations poses specific operational challenges at the level of the firm:

'...we're interested in CCS, but it's not something we can develop at scale on our own, we've tried – we are still trying - to set up a network to see what might be possible.'

(Observation notes, O1, 2011)

What is interesting here is that commercial challenges for developers and incumbent industrial actors (e.g. being a loss leader, planning consents, meeting existing regulatory obligations around NO_x and SO₂ emissions), are driving the establishment of consortia and networks comprised of local, national and international actors. As seen in section 5.1.3, these networks and consortia have agency at local as well as scale, suggesting multi-scale organisational field and power dynamics. In this sense, the economic organisational field is cross scalar.

Secondly, the slow decision making processes and delays (or avoidance) of decisions by Government introduces and adds complexity to a temporal dimension - the power of *not* making decisions is significant here.

(2) Anything is better than nothing

In contrast to the win-win metaphor particularly expressed from government and commercial texts at UK and regional scale, local metaphors developed from civic and public texts are stronger in relation to ‘anything is better than nothing’ metaphors.

A commonly identified metaphor in the texts from interviews and observation data is that where problems of high unemployment, industrial agglomeration, poor public health and high GHG emissions are felt strongly, *any* development is viewed better than no development. This metaphor is exemplified in particular in responses from social actors responding to economic and governance questions. The following extract typifies the sentiment:

‘I couldn’t not have a job though... but there’s loads [of people] haven’t got anything... We need something to happen round here, doesn’t matter what.’

(Interviewee L33, 2013)

Whilst, Y&H is widely viewed as being politically, economically, strategically, geographically and geologically unmatched for potential CCS developments, ignorance of these local cultural and social perspectives is imprudent. In concert with Archer’s (1995) reflections on morphogenic change and the need to consider and reflect on the cultural and legacy backdrop for structure agency issues:

6.2.1.3 *Doing the right thing*

A parallel emerges here with historical texts relating to coal and energy generators as being at the heart of the UK economy. At this Y&H scale, energy companies are ‘doing the right thing’ for communities they operate in: creating employment in an otherwise low employment region; demonstrating good corporate governance and CSR; community engagement and, importantly for coal with CCS projects, encouraging economic development and supporting other local businesses. This ties with metaphors relating to ‘keeping the lights

on', but at an acceptable cost, suggesting scalar and temporal connections between the economic organisational fields as well as connections between social and economic fields (see 6.3). Government and especially business texts exemplify this metaphor:

Need to get economy moving again in region. Generators central to local economy and communities, whatever technology they are adopting – as they move away from unabated coal. Note – most attendees MNCs (Hitachi, Doosan, SSE, Siemens, NG), some SMEs from across North of England and Scotland (caterers from South Shields, pipefitters from Livingston)

(Observation notes, O6, 2013)

This text also suggests an additional layer of complexity relating to both the intended and unintended consequences of investment in coal, as observed in different texts. The 'intended' consequence of the Business to Business event noted in the observation above (O6) was to open up new opportunities for small, local businesses to engage with MNCs operating in the energy industry in the region. This no doubt happened, however, given the attendance list many of the SMEs in attendance were from beyond the region. The unintended consequence, whilst arguably positive, arose in part because few local businesses work in this area. In addition, because of the nature of the economic organisational field for governance and the relationships within it, Business 2 Business (B2B) events attended also created greater opportunities for MNCs to strengthen existing relationships with other MNCs i.e. where these already existed within consortia (see figure 6.1).

6.2.1.4 *It's not fair*

Throughout the texts, a strongly evidenced rhetoric and Y&H scale relates to decision making and power of agents operating at different, that is *other*, levels. As suggested above, economic actors have cross scalar agency. The data suggest, however, whilst economic agency is cross scalar (for government and national/international commercial actors), decisions are made (or perceived to be made) at national or supra-national scale i.e. without significant local influence (Cotton and Devine-Wright, 2012). Texts from civic, community, business and local government actors suggest decisions on

continued use of coal and CCS developments were made, based primarily on opportunities for commercial benefit or national economic growth. In addition, civic actors in particular perceived that the economic benefits whilst accrued locally would not be felt locally.

'It feels like decisions were made ages ago by someone else'

(Interviewee L12, 2013)

'It's all about the shareholders. It'll only happen if it's going to make a profit.'

(Interviewee L1, 2012)

During this new coal/new governance era, there were a number of changes of ownership of power plants and generators under new private ownership, corporate sell offs and company closures/splits are commonplace. Formerly publicly owned became national oligopolies through processes privatisation then sales e.g. Drax and Ferrybridge. The (re)distribution of economic risks and benefits is observed as a result; large, new technology companies for example have interests in the area with skilled work opportunities e.g. Hitachi, Doosan. They also, notably bring in skilled labour and this shapes part of the local discourse:

'Anyone they bring in will need to be catered for, hotels to stay in, local businesses set to benefit indirectly'

(Observation notes O6, 2013)

Similarly, for many participants there was a perception of an unbalanced distribution of economic benefits.

'If I thought we were getting some sort of local energy from local coal – keeping people in jobs, and we could use CCS for the emissions and what have you, well then I would happily pay more for that.'

(Interviewee L8, 2013)

There is an additional nuance here however, that links with social metaphors. Whilst disproportionate/imbalanced economic benefits and decisions at 'other' scale, parts of the region, especially those with historic links with coal mining and energy, are in need of *any* economic development:

'... I took a bloke from the plant all the way back to Glasgow last week. They must have some money getting a taxi from here to Glasgow? There must be something going on [at the power station] and we could do with it really.'

(Interviewee L33, 2013)

In this view, ownership matters. Public reflections on the history of coal mining and electricity generation relate to ownership and dissatisfaction with Multinational Corporations (MNCs) and private consortia running the power stations. In addition, there is a perception that *historically*, economic and social benefits *were* accrued and distributed locally for example through high levels of employment, better than average salaries, public health schemes and cheaper fuel costs.

'It used to be that we got free coal, then for a while there were discounts... but that's all stopped now. It all used to be ours of course but now it's owned by [a company]'

(Interviewee L12, 2013)

'We don't even get cheaper electricity anymore.'

(Interviewee L7, 2013)

'I used to take school children [to the power station] for visits, and they would always say how clean it is now they've introduced these new measures but they had to do it or they wouldn't have. It would be just the same if it was publicly owned.'

(Interviewee L11, 2013)

'It's not fair, they are playing with our health'

(Interviewee L2, 2013)

An additional nuance here, is that the risk of developments *not* going ahead is high and the resultant closure of coal fired power stations leads to further deprivation in the region.

'It's like we have to put up with the pollution and the noise and everything but don't get any of the benefits. Then when there's a chance to improve things and invest in the area with clean technology,

we don't get that either. It doesn't seem fair when you think about, so I try not to think about it.'

(Interviewee L6, 2013)

Whilst undoubtedly there is an element of individual perceptions being reflected here, this adds a richness where, as Creswell states '*Knowledge is within the meanings people make of it*' (Creswell, 1998). In addition, again, the historical context setting is relevant. Place appears to matter in this case, and culture and agency cannot be divorced from an understanding of either the emergence of organisational fields for governance, or the dynamics, forces and morphogenic processes of change at play within fields.

6.2.1.5 Y&H Economic Agents

During this 'new/new' era at regional level, a class of what might legitimately be thought of as powerful elites (Wright-Mills, 1958) emerges. Elites in this case are not individuals but rather organisations/groups with considerable power within and beyond the economic organisational field; they exhibit agency at multiple levels; local and regional, but also, importantly for decision making national, supra-national and multinational scale. In addition, they hold sovereignty over the temporal dimension (Jessops, 2006) due to their non-decision (Clegg, 1989) making capacity, in particular over funding decisions.

To expand, the UK Government, in particular DECC but also the EA (and Defra) as regulators and the Department of Trade and Industry (DTI) as investors but with less agency on the issue of new coal, have considerably greater impact on decisions at local level than does either local government or civic or social actors.

The political economy and governance arrangements established during the 1990s are consolidated during the era. Incumbent corporate actors, in particular the generators and also noted emerging consortia and networks, would be expected to have agency in decision making. However, it must be noted as relevant here, that a disconnect exists (which becomes especially apparent in environmental and social organisational fields), that national and international corporates either generators or within consortia (oligopolistic?) demonstrate greater leverage in decision making contexts than, say, local

corporate actors (e.g. Drax or Don Valley Power Project) working in isolation. This is perhaps in keeping with UK government as having greater power than others due to their role in determining funded projects where market approach would not lead to commercial scale CCS programmes. It is worth noting here also, that the dominance actors are groups or ‘collectivities’ (Dryzek, 2005), but with common discourse.

The picture for government actors with local and regional remits is somewhat different, MPs are seen as more powerful than individuals, but as ineffective when in opposition and not representative of constituents’ views.

‘...constituents’ views are diluted. They [MPs] have to keep everyone happy which in the end means not keeping anyone but those with power happy’

(Interviewee L11, 2013)

‘We vote, and hope that the person we vote for makes their decisions based on evidence and sound economics but that’s not always the case.’

(Interviewee L2, 2013)

The texts also evidence a lack of what might be considered representation in opposition to dominant agency from other actors/groups.

‘...parish councils are useless really. They’re all co-opted and it’s the same people get to everything...’

(Interviewee L10, 2013)

A thought-provoking feature of this analysis is the *lack of agency* demonstrated by groups or organisations representing local actors. Little participation in economic field is evident in document, observation or interviews, other than from individual local residents who for example attend consultation events, but do not have individual influence or significant roles within the organisational field. Similarly, individual plant managers and local business leaders, who perhaps have a more significant role, at interview and observations express opinion on new coal development, but do not appear to exert power within the field. In this sense, a degree of paternalism is exhibited in the texts; powerful elites are confident that; planning and consultation for any individual development will ameliorate local concerns; development will be good for

communities in need of jobs; anyone in opposition is a NIMBY. However, this paternalism and positive spin on CCS without actually committing means that not considering local complexities or need.

Similarly, multiple associations, NGOs and QUANGOS (notably CO2Sense and TUC) are evident in the document texts (government and business) as being in support of new coal developments, however these actors are not observed as having significant agency. In addition, whilst broadly in line with the Government led consensus on CCS, there is some disagreement between actors and more nuanced views on new coal in the interview and observation text. There is some evidence from observation texts and interviews that local businesses (i.e. in addition to generators) view developments positively as potential opportunities for economic growth in the region. However, there is little evidence that beyond B2B type events, businesses other than those directly involved with new coal technologies, are in engaged in decision making or demonstrate significant agency.

A final point to note in summary, is that whereas government and business actors are grouped in to consolidated organisations, for social actors this is not the case. Similarly, whilst Government and business actors demonstrate agency at multiple levels, this is not the case for individuals or social actors. In this sense, pluralism is not evident.

6.2.1.6 *Y&H Economic Entities*

New coal, clean coal, new coal technologies and CCS are synonymously presented as economic entities at the Y&H level. The Y&H cluster of developments is seen as increases economic benefit of individual projects and clean coal in the region:

'...benefitting from the cost savings to be had from using the same CO₂ transport and storage infrastructure and demonstrating the cost benefits of developing a cluster of projects in the Yorkshire–Humber area.'

(CCS Association website, 2014, no pagination)

Government (UK and EU) funding in the form of the CCS competition is core to underpinning options for development, widely voiced opinion amongst government and business actors that without government funding, CCS at

scale is not likely to be get off the ground in the region despite perceptions on the region's suitability for development. As an extension of this entity, and in keeping with UK level data, commercial scale developments have potential to drive local economic development.

In contrast to the dominant discourse, planning and consultation activities are viewed as giving the green light to new coal developments in two senses: firstly, planning consent gives confidence to markets, consortia and funders; secondly, the procedural consultation processes embedded within planning process then *informs* publics and smooths the way for next stages of development. Involvement of actors beyond state and business actors in this view comes either in the form of individual relationships, or as at the bottom of Arnstein's 'ladder of participation' (1969). This is discussed in chapters seven and eight in terms of the implications of this tokenism for sustainability but a key part of governance at the sub regional level, even if only nominally so.

The regulators (EA) themselves are evident as part of the planning and consents process. And Quangos (e.g. CO2Sense, Yorkshire Forward, Yorkshire Futures) have what might classed as supporting roles at regional scale. Mergers, MNCs and then consortia and networks (both commercial, research and a mixture, MNCs and tech companies) emerge during the era as being relevant at the Yorkshire and Humber level despite having largely national roles.

Finally, importantly, existing, active coal fired power stations in the region Drax and Ferrybridge especially, are themselves economic entities in two senses. Firstly, they underpin local (and national) economy and with new coal technologies provide opportunity for future low carbon development that will 'keep the lights on'. Contrasted to this is the view that 'old' dirty emitters are inefficient and need to be closed.

6.2.1.7 Y&H Economic Relationships

Relationships at the Y&H level focus around two key economic entities (i) funding for CCS and (ii) planning for new developments. For both, the UK government is dominant within the economic organisational field of governance, with consortia, notably relating to the Y&H cluster also significant. A key feature of the relationships at this scale is that community, regional

actors (e.g. Quangos) and local government actors come in and out of the organisational field at different stages but there is a lack of consistency here which suggests some fragmentation at this scale.

It is also worth noting here the relationships that *do not* exist or are not strongly represented at this level, in particular when considered in contrast with previous eras. It is evident that there are weakened relationships between individuals/communities and corporate actors as compared with old coal/old governance era due to lack of employment and very little direct engagement with power plants. Again, this corroborate the themes developing around lack of agency amongst public actors, in part because the roles have changed. It is worthy of note here and discussed in chapter seven, that the level at which agency does occur is different for different actors; business and government actors are typically in groups however for social actors there is little institutional capacity beyond weakly constructed 'community'

Figure 6.1 below summarises these relationships. The key feature of this analysis is that within the organisational field, whilst funding and planning decisions on CCS and clean coal developments are to be based on economic factors (e.g. commercial viability), economic relationships within the organisational field are weak and skewed; government actors are dominant, commercial actors are risk averse and public actors not represented.

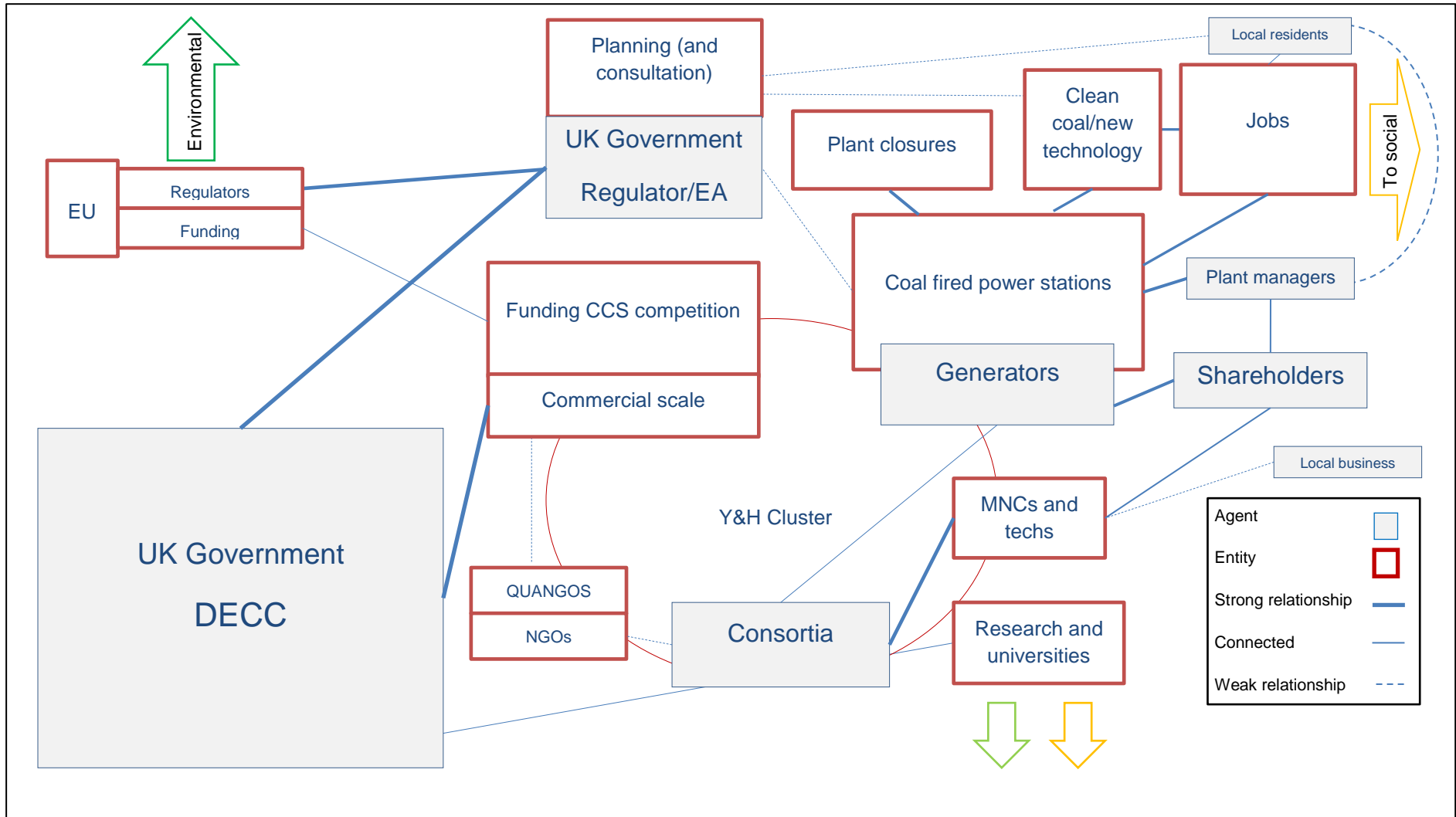


Figure 10 Economic Relationships Yorkshire & Humberside

6.2.2 Environmental Metaphors

6.2.2.1 Clean coal/dirty coal; it's still coal

The clean coal, win-win metaphor widely heralded at national scale as an opportunity to reduce CO₂ emissions to the atmosphere whilst contributing to economic growth, is mirrored in texts at Y&H scale. CCS is presented by dominant actors as an opportunity to improve environmental conditions in the region; a technical fix to the wicked problem of coal use.

'The low carbon hub for the Aire Valley is a powerful example that green is good for growth. The great prize will be thousands of new jobs and massive inward investment, transforming the UK's highest emitting region with a huge carbon capture network for power companies and heavy industry.'

(CO2Sense press release, 17.10.12, p.2)

However, an interesting feature of this rhetoric, is that at Y&H level, understandings of coal are more nuanced and arguably place based, rather than technically understood. Predominantly reflected in interview responses this understanding translates the 'old dirty' to 'new clean' coal metaphor in to something more like 'it's still coal'. Interview responses and observation notes introduce a different dimension⁴¹ i.e. that reduced CO₂ emissions and cleaner air is only part of the coal use story at local level.

Discussion on clean coal or dirty coal – it's still coal. What about all the stuff that's not measured or not measured properly? Quote '...you can tell me all this about reduced emissions, but at the end of the day we don't know what to think and we've heard it all before.'

(Observation notes O3, 2012)

This extract exemplifies a wider understanding of issues relating to coal use and the historical, cultural understandings which complicate already complex issues. Whilst clean air is welcomed, there is an awareness that it does not

⁴¹ Supports methodological approach

mean that coal itself is clean; local memory of coal means greater recognition of environmental implications beyond the region.

'Oh we used to come in black walking home from school. Black! We'd have to wear scarves over our mouths. It's not like that now of course it's better, but they still use coal you know... I've been to Mexico City [where we get our coal from] and they all have to wear scarves on their faces like we used to!'

(Interviewee L12, 2013)

'We ship our coal in from all over the world now, that can't be environmentally friendly can it?'

(Interviewee L9, 2013)

In addition, civil society respondents in particular noted that whilst the air is cleaner in some respects, other environmental conditions have worsened:

'...this is great and everything [referring to RSPB Fairburn Ings where interview took place], it's good that we have green spaces now but it's not the same as actually being wild – really it's just a big garden. And we have cleaner air but they're still burning coal which is terrible for the environment.'

(Interviewee L11, 2013)

'We might have cleaner air but environmentally it's the worst it's ever been...it's like we're putting out one fire and starting another.'

(Interviewee L26, 2013)

'What I'm worried about now is what we can't see.'

(Interviewee L12, 2013)

Whilst the data are not sufficiently robust to draw conclusions, these extracts reflect perhaps higher levels of public understanding of issues relating to coal use than are typically found in the literature (e.g. see Markusson et al, 2012), again, suggesting place based environmental understandings.

Another interesting feature of this 'it's still coal' metaphor relates closely to public perceptions of the environmental risks and benefits associated with continued coal use and, in particular, relating to private ownership. In

response to the question, 'Who has benefitted from the changes? In what ways (economically, socially, environmentally)?'

'The air's cleaner now obviously, but that's because of the clean air act, not because of anything the power station does voluntarily. It was the clean air act brought about the major change in the environment not privatisation. If we leave it up to them [pointing at visible cooling towers] they're going to do what the shareholders want them to do or the government tells them to do which will mean the bare minimum'

(Interviewee L11, 2013)

In this sense, lower emissions are viewed as having been brought about by enacted legislation, and the threat of imposition of fines and limits, i.e. arguably what might be classed as 'old style', regulatory governance arrangements rather than market led change or voluntarism. This view is supported by texts from business actors also:

'We have to focus our investment on continuing to meet current legal requirements and for now that means NOx and SO₂ rather than carbon. I'd go further than that actually and say that whilst there isn't a legal limit, and with plant closures around the corner we can't focus on carbon, we have to focus on what we are required to do.'

(Interviewee L18, 2012)

Perhaps an unintended consequence of these governance arrangements is the focus on meeting regulatory requirements. CO₂ emissions during the era, whilst discussed, are not seen as a legislative issue for consideration at operational scale in the same way as NOx, SO₂ and particulate matter, so companies operating in power industry have little incentive to deal with it in same way. Given the complexity and poor understanding of the regulatory context at UK level (see section 5.2.1 and chapter eight), it is not clear that the step change (Gillard et al, 2016; Bolton et al, 2016) required to reduce GHG emissions is likely to materialise whilst market centric approaches dominate the discourse on new coal.

6.2.2.2 *Regulatory confusion*

A problematic feature of the texts is that there is a distinction between government and business views on the effectiveness of regulation where either detail or intention of the regulation is not clear, or where there is contradiction on stated intentions to reduce CO₂. Difficulties associated with interpreting and enacting fluid or ill defined targets for example are understandable. What results from dominant business actors is, arguably, a partial temporary withdrawal from the discourse at level of the organisation:

'We recognise that carbon capture would mean we could radically reduce our CO₂ emissions, but there are alternatives for that – gas, nuclear - and we are just so wary of investing in something that could instantly become a costly waste of time⁴² [if legislation changes] when we don't have any realistic targets.'

(Interviewee L18, 2012)

[Parenthesis added]

Similarly, in this extract:

'We don't know where we stand with CCS here... we're so close to housing so there's the planning issues. We have to, by law, focus on particulate matter and NOx and SOx [sic] so won't prioritise CO₂ until we have to.'

(Observation notes O3, 2012)

There are parallels here with national discourse, that CCS is not a one size fits all opportunity to reduce emissions in every coal fired power station. At operational scale, managers repeatedly expressed priorities relating to existing regulatory requirements rather than developing solutions to *potential* legislative change.

⁴² Referring here to potential for ban on coal in UK power stations if mood changes in 5 years...

'Our focus has to be NO_x & SO₂ and particulate matter and getting that down because that's what we are regulated for. We think the best way to do that is to look at bio-fuels.'

(Observation notes O1, 2011)

Similar frustrations exist beyond business spheres:

'Nobody seems to be thinking about the issues in any co-ordinated way. It's all about this issue, then the next, then the next...'

(Observation notes O3, 2012)

'Someone in government needs to grasp the nettle, make a decision and legislate.'

(Interviewee L1, 2012)

6.2.2.3 *Technical solutions to climate change*

The dominant metaphor relating to the 'win-win' scenario evidenced at Y&H level from business and government actors, is that CCS has a potential to be a technical fix for a wicked problem. CCS's potential to contribute positively to local environment is expressed in multiple ways:

Project manager comment: 'The emissions from the plant will be cleaner than the air we take in; we'll actually improve the local air quality'

(Observation notes O3, 2012)

In contrast, there is a view that whilst a technical solution may be achievable and suited to the unique geology and geography of the Y&H region, it is not well understood along the full chain, i.e. from capture and compression, to transport to storage. In addition, new coal is perceived as technically complex and the planning and consultation processes may make it harder for lay people to grasp what they are being asked to accept. This comment from an attendee during a plant visit:

'...there are just so many stats and figures, my head is still spinning. It's all very interesting but I don't know what to make of it all really... I feel like I need an expert to explain everything.'

(Observation notes O1, 2011)

'I asked to see the project plans before the [planning consultation] meeting and was sent a huge technical document, I'm not thick but I didn't understand a word of it'

(Interviewee L29, 2013)

In keeping with economic and social metaphors, the lack of understanding of the technical issues causes public concern which in turn is exacerbated by the organisational field relationships leading to perceptions of seems unfair distribution of environmental risks and benefits:

'You can tell me all this about reduced emissions, but at the end of the day we don't know what to think.'

(Observation notes O3, 2012)

'We [local single issue NGO] have invested in some air quality monitors ourselves so we properly understand what is happening'

(Interviewee L15, 2013)

This fits with Markusson et al (2012) and Brunstig and Upham (2011) for specific examples relating to CCS, but also to the wider stakeholder engagement literature (Swift, 2002; Kates, 2005; Greenwood, 2007), that lack of trust of government and business actors where people feel they are being asked to make decisions by actors with little invested interest in the area.

6.2.2.4 *Public health & the environment – lack of connection*

The rhetoric relating to public health issues being seen by dominant actors as no longer related to coal is exemplified by this extract from observation data:

Participant: 'There's a lack of joined up thinking around public health and continuing to use coal no-one seems to think of coal as a public health issue any more since we stopped mining. CCS with existing particulate reduction techniques could be an option to improve things but nobody is looking at it from that angle.'

(Observation notes O2, 2012)

However, public actors (local residents and local government) recognise the continued relationship between air quality and public health. This disconnect extends to issues of justice:

'... we're still feeling the effects of mining round here, of course we are. But now no one cares. There used to be all sorts of screening and health care and pay outs when the Coal Board took care of things. We don't have any contact with the mines or the station or anyone any more. I wouldn't know who to get in touch with, I don't suppose anyone does so we just put up with it. It's not fair really, they're still making all the money but our health suffers.'

(Interviewee L12, 2013)

When asked to expand on this point, the interviewee explained, in her view, companies running power stations are now more concerned with making sure they are not 'blamed' for poor health outcomes. As individuals it is difficult to know who to speak to and not clear who has responsibility for some of the negative legacy impacts associated with historic mining operations in the region. The texts exemplify two dominant themes; firstly, that public health is not sufficiently tied in to environmental health at policy or governance level. Secondly, that the support mechanisms and practices required to treat and deal with conditions associated with industrial agglomeration in the region are no longer evident, but once were.

Interestingly, the focus on single (albeit most significant) issue of climate change as a dominant issue is seen as problematic for both eco-system and public health.

'...in my view it's the very fine particulate matter that creates problems for human health and the environment. It's like we're putting out one fire and starting another.'

(Interviewee L26, 2013)

6.2.2.5 *It's better than nothing⁴³, but it's not fair*

One of the key narratives around new coal, i.e. that it is a potential win-win scenario, is evident also at local level, particularly amongst civic and public actors, but this perception is more nuanced. CCS and other new, clean coal developments are seen as being better, environmentally, than old, dirty coal, but not better than *no* coal at all.

⁴³ For example getting involved with planning

'I guess at least with this carbon capture it'll be better than it has been but I really don't understand why we don't close them all now and get on with getting renewables, even nuclear.'

(Interviewee L7, 2013)

'It's much better to plan environmental benefits from a project at the start than leave it to chance – or leave it to the developers and planners for that matter.'

(Interviewee L26, 2013)

However, amongst residents and community groups, there is more difference within groups and a range of concerns relating to ownership of power stations and decision making. For example:

Speaker is very concerned because the government wants fracking and nuclear more than it wants coal with CCS, so even if there's foreign investment (e.g. at Eggborough) they will find a way to green light any project they can

(Observation notes O8, 2013)

An interesting feature of this narrative though, is that planned developments in clean coal and new technologies, with consultative approaches to governance, allow for a more managed approach to the environment than has historically been the case in the region. Coal fired power stations along the Aire valley have particular significance here given the valley's importance as a biodiversity corridor in an otherwise industrialised belt. The legacy of planning, CSR and conservation activities are seen by communities as better than nothing. A managed approach to continued coal use in the region offers opportunity for planned environmental developments and habitat creation:

'It's ironic - the disused mines are opportunities to create green spaces because basically they're no good for building or development.'

(Interviewee L27, 2013)

'...it's important that we [national environmental charity] get involved as early as possible but there are limits to what we can do. Individuals don't have the opportunity to [get involved] in the same way.'

(Interviewee L26, 2013)

However, there is a degree of conflict and reticence embedded within the texts.

'They're⁴⁴ supposed to think about this when planning new big developments aren't they? But it just doesn't seem to matter to them that the Aire valley is one of the most important wildlife corridors in the UK. They don't get that it's an eco-system.'

(Interviewee L11, 2013)

'When there's a conflict between nature and energy, when we need something from the environment, energy will win every time. Nature versus economics, economics will win every time'

(Interviewee L26, 2013)

These extracts draw out features of the narrative which suggest that unlike for economic metaphors, within the environmental organisational field for governance, civic and public 'groups' demonstrate a degree of agency, however, there is an imbalance in agency both in terms of the level of actors effecting change, and the different environmental issues being discussed. When compared with the national picture, whilst national (and international) actors have agency across both fields this is not the case for local actors with more locally and individually relevant environmental concerns.

6.2.2.6 *Environmental Agents*

The texts are enlightening in three key ways: firstly, a picture emerges here from interview and observation texts in particular that public views on coal with CCS, challenge the 'mainstream' dominant narrative relating to CCS being an environmental good. Instead, the more nuanced narrative that CCS is better than nothing but lacking in many respects is strong amongst civic actors. This might be seen to represent a scalar disconnect but does at least allow for discourse and (limited) space for sustainability.

Secondly, the presence of groups, ENGOs, environmental charities and single issue groups becomes evident. This differs from economic organisational field for governance as public albeit single issue, not democratic voices are heard, again creating at least space for discourse.

⁴⁴ Planners and developers

Thirdly, and this is especially key to an analysis of organisational field for governance, it is not at all clear that these groups (or individuals) have agency within the field in terms of involvement in decision making. Rather, the texts would suggest that agency in decision making remains strong amongst few powerful elites, with ‘tame’ NGOs involved in prescribed consultation and planning processes (Edwards and Tallontire, 2009).

To expand on the detail. Electricity generators are framed as polluters and separate from communities, but at local level making efforts to develop CSR or legacy plans which will ameliorate their environmental impacts. Their behaviours however are steered by Government and shareholders. The regulator, the Environment Agency also connects business and government with a liaison role.

‘My role is to work closely with industry to make sure they understand their obligations under the legislation and have sound plans to satisfy these obligations. I also make sure we listen to their concerns and come up with solutions that are commercially viable. Putting the generators out of business wouldn’t help anyone.’

(Interviewee L31, 2012)

6.2.2.7 *Environmental Entities*

The primary entity throughout the discourse is ‘Clean Coal’. Document texts, company literature, bureaucratic data, notifications, public consultation events, B2B events (see appendix F) all use the terminology to imply that ‘coal’ has changed. Whilst there are differences in views from individuals, there is some consistency that for social actors within the environmental field though, ‘old coal’ and its historical context remains relevant.

In addition to their stated aims in conservation and stewardship, local and national ENGOs are to a degree seen as ‘representatives’ of local opinion – willing or unwilling.

‘We’re often asked to comment on behalf of some issue or other, then slated if we’re saying something people don’t like such as CCS is a good idea... We act as guardians of the environment – it’s not perfect, but we can act as opposition to government and business. Local people often

don't like this though because we take a scientific and national view, we're not NIMBYs'.

(Interviewee L26, 2013)

When asked to expand, the interview elaborated.

'...for instance, we have supported wind turbines in the area, and even mines where it makes environmental sense. Locals hate it but it's better to have a small mine here where we can manage the legacy like we have done here.'

(Interviewee L26, 2013)

The Aire Valley itself manifests as both source and sink. During the era, issues of local conservation, stewardship, biodiversity emerge as significant, there is a temporal link here with conservation metaphors at UK level during 1990s.

The coal fired power stations are, represented as local physical icons, part of landscape and culture. Regulation (and other statutory instruments) is perceived as essential and having improved environmental conditions. However, regulatory approach is not being responsive enough to environmental challenges. In addition, the LCP Directive at EU scale and Emissions Performance Standards are influencing operational activities to a greater extent than any local plans. The regulator – at this scale the EA - also maintains a liaison role in concert with national discourse.

Locals, viewed as homogenous by corporate and government actors and to be appeased (different from the public), as well as known individuals who go attend community and liaison meetings with single issues, can be considered entities, although their agency is restricted to influencing non-material and local environmental issues. Such locals, and to some degree those characterised as NIMBYs, are viewed as not understanding the technical issues and there is an emergence of technical elites with roles within the environmental organisational field, however this is not dominant.

'They wouldn't like it if we stopped operating and took away our [flood prevention] pumps'

(Interviewee 23, 2012)

Again, as this extract suggests and in concert with national levels discourse, there is a degree of paternalism.

6.2.2.8 *Environmental Relationships*

An interesting feature of the data is the nature of the relationship of different actors (and entities) with the environment and in particular, with the Aire Valley, and the heritage of coal in the region. In earlier 'old coal' eras, the environment was viewed as a source of coal, whereas interesting relationships relating to conservation emerge during the new coal era. An additional new feature of the discourse is the relationship between experts, research groups and academics as actors. A point to note here, is that their role and agency is national, but their activities are regionally based in the regions where CCS projects are closest to fruition.

The regulatory and procedural relationships (administrative pragmatism) between business and government actors and entities, i.e. those relationships established to meet regulatory requirements, are dominant. However, in concert with the economic organisational field, some relationships and institutions that are arguably a requirement for ML/MA do not exist or are weak. Notably, connections and relationships between the environmental and the social organisational field are weak. Similarly, whilst 'local' and national ENGOs emerge as stewards of the environment, they are, by proxy, also taking on wider environmental and social issues. Arguably their role, along with that of CSR, stakeholder engagement or consultation practices are filling an institutional gap between the organisational fields at different levels left by the rolling back of the state (Scott, 2013).

These relationships are illustrated in figure 6.2 below and discussed in chapter seven. When read with chapters four and five, this analysis has demonstrated that (from research objectives 1 and 2) environmental organisation fields of governance exist at multiple levels and are changing over time in terms of dominant discourse and actors within the fields.

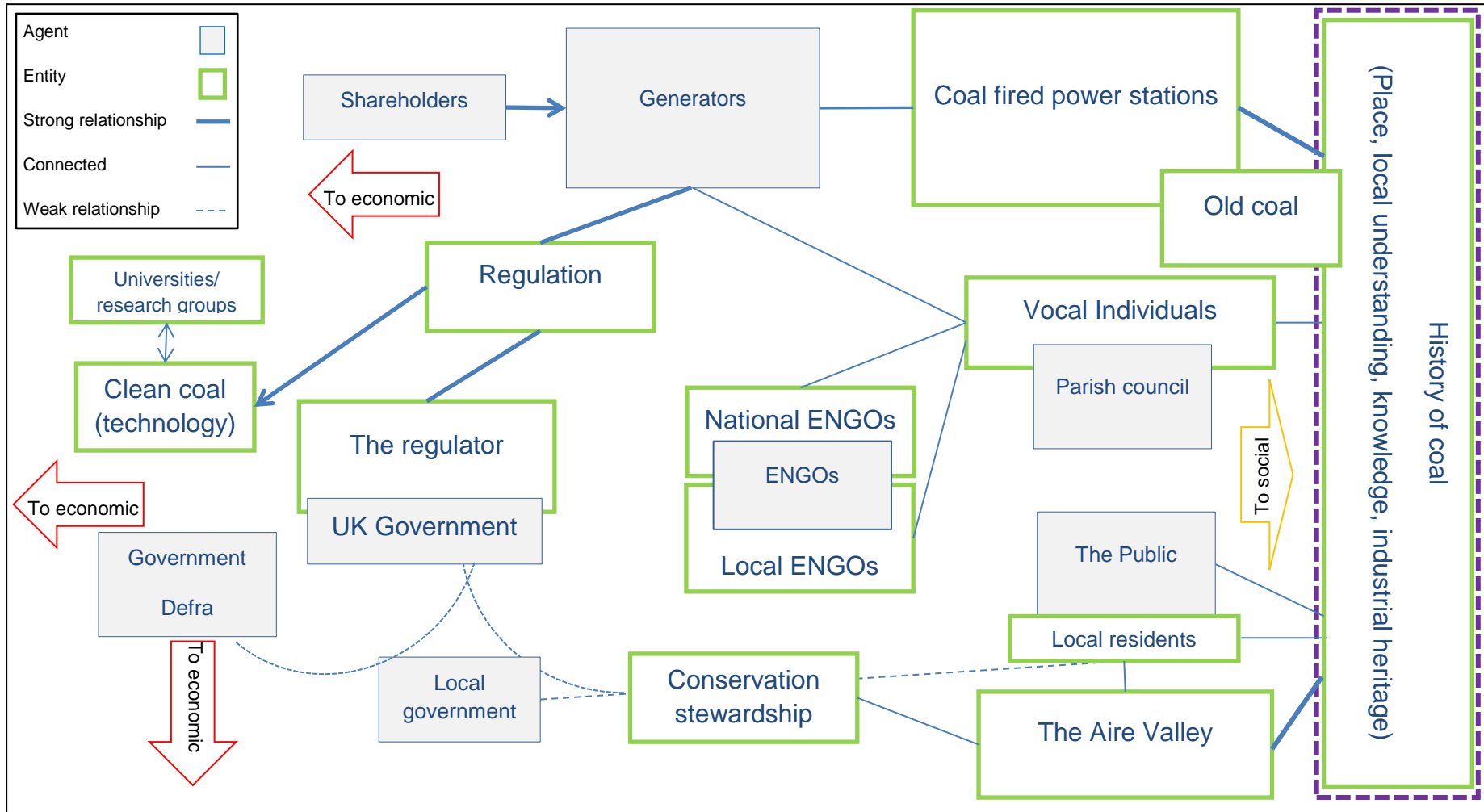


Figure 11 Environmental Relationships Yorkshire & Humberside

6.2.3 Social Metaphors

6.2.3.1 Decline of community

One consistent feature of the discourse relating to social features, is the decline of community, with disenfranchisement and underdevelopment commonplace in many parts of post-industrial Northern England. This may seem somewhat reductive, but this metaphor emerges strongly from the texts; community for localities within the region (in particular those geographically close to coal mining and now the developments under discussion) developed *around* coal and heavy industry. The decline in the industry is inextricably linked with the decline in community. For this research, what is interesting is how this relates to potential for *new coal* and other energy generation developments. The remainder of this section presents the *key* features of the decline in community rhetoric relevant to this case.

In a similar way to understandings of wider environmental impacts of coal (see 6.2.1), a key feature of the texts is an underlying understanding across social groups, that the decline of community is tied with economic decline and closure of coal mines. This is evident across the texts from government, business and public actors. However, the implications of this understood, social phenomenon for new coal development in the region, differ for different actors. For (local and national) government actors, lack of community implies two things: firstly, development will lead to improved community (ties with win-win):

'This is a region that needs jobs above all else, once people are working, there will be a better sense of community again. These CCS projects are an opportunity to bring something needed to the area.'

(Interviewee L31, 2012)

Secondly, low levels of participation in local governance activities are challenging for engagement which leads to a perpetuation of the problem.

'We put on events in schools and community centres, but people don't come. It's difficult when there's no interest from the community, they need to know what's going on if we're going to make the projects work, in the end it's for their benefit'

(Interviewee L32, 2012)

This extract also introduces a key feature of the social organisational field for governance, that, as with environmental discourse, the Government (and industry) actors have a paternalistic view of an homogeneous community.⁴⁵

For business, perception of lack of community becomes relevant in similar but nuanced ways. At local level, business leaders see their role expanding⁴⁶ as part of community because of lack of alternatives.

'There might not be much going on round here anymore, but we do our bit. That's why we brought the cricket pitch back to life, anyone can use it.'

(Interviewee L18, 2012)

Quote: 'It's not like it used to be when the (CEG) Board ran it, but we try – we put on film nights and the club house is open to everyone not just staff. And we have our newsletter to let locals know what community events we're putting on, fund raisers, things like that.'

(Observation notes O3, 2012)

Furthermore, the community and the public are seen as synonymous terms, and both in terms of self-interest. Although not dominant, metaphors relating to NIMBYism emerge.

'Whatever we do there will be NIMBYs who don't like it. To be honest, I can tell you now who they will be, you get to know them'

(Interviewee L22, 2012)

CSR and local community activities are considered part of the role of corporate actors, however those activities are arguably not salient to operations, but instead are designed to maintain social licence as this comment from a senior manager exemplifies:

⁴⁵ Whilst a phenomenological analysis is beyond the remit of this research, there is a sense of 'otherness' and separation in the language used 'they' 'their' 'the community' 'community stakeholders'.

⁴⁶ Fits with CSR and increasing roles of business in social literature

'I don't mind sending a couple of lads out to wash windows when the winds blowing dust from [factory X], it's not our dust, but people think it is... it's our way of showing we are part of this community'

(Interviewee L19, 2012)

For public actors, the texts are perhaps less consistent. 'Lack of community' resultant from pit closures is still core to this rhetoric with *'It's different here'* as an understood running through the texts, however, what is interesting is that the significance of this for new coal and governance is evident; the drivers and implications of lack of community/public involvement for governance are understood differently by different actors:

'People are disengaged from governance, they don't trust government, and they don't want to get involved. Community doesn't exist anymore - I don't think you can have strong communities when there's no work.'

(Interviewee L11, 2013)

'It's always us same few at all these community events, and we're all grey haired. What's going to happen down the line?'

(Interviewee L29, 2013)

'We [national environmental charity] kind of take on the role [of community] because we have a huge membership - we take on the governance role and "take on" government where no one else does'

(Interviewee L26, 2013)

Whilst wider collective views are not clearly evident from the texts from public actors as is the case for government and business actors, these extracts at least exemplify three of the key features of the texts relating to community. Firstly, members of the public are disengaged from governance and democratic processes beyond voting. Secondly, specific individuals and their personal, often long standing relationships with individual business and government actors are more significant than wider democratic processes. Thirdly, non-elected groups such as charities and NGOs have emerged as having a role in 'representing' community from their membership.

For the social organisational field for governance, paternalism and procedural levels of engagement are evident, combined with low levels of understanding

of clean coal technologies may be problematic. This dynamic is discussed further in section 6.3, and ties with discourse relating to public engagement in decision making for this case.

6.2.3.2 *Public engagement: a sop to the masses*

The discourse surrounding the relative merits and demerits of public and stakeholder engagement is well established, what is remarkable here is the consistency across the groups, fields and scales for this metaphor. Across the social organisational field for governance, this key feature of governance is widely perceived as (procedurally at least) necessary but at best a waste of time and a purposeful means of distracting from the salient issues at worst.

From local residents and non-governmental public for example, some expressed an interest in wanting to be more involved in decision making but felt it would either be pointless as decisions would not be influenced by engaging with prescribed processes, or, interestingly that they do not understand all the issues and have their own biases so should not be involved. These distinctions are exemplified by the following quotes in response to the question 'Do you personally get involved in making decisions about coal use or energy in the region? If so, in what ways?':

'...I might sound cynical but what would be the point? I've signed petitions before, and I vote but that's about it.'

(Interviewee L19, 2012)

'Well it wouldn't make any difference if I did, sometimes it's like they decided what to do years ago... it seems to me that decisions are made, I don't know by who, but by someone fifty years ago and decisions for what's coming next have already been made. So it doesn't matter what I do or think... these [public engagement] events just mean they can say the public wanted this or that, it's not legitimate.'

(Interviewee L12, 2013)

'[Company A] aren't bothered about what happens here'

(Interviewee L1, 2012)

Culturally and historically defined perceptions on who is or ought to be involved in governance become relevant: In response to the question 'Who are the main people involved in decision making about coal use?'

'Well it's the government I suppose'

(Interviewee L20, 2012)

'I have no idea to be honest... I vote and hope local councillors and MPs are involved. The power companies?'

(Interviewee L16, 2013)

'MPs are eloquent aren't they, and I'm not really, well not in that sort of setting if you know what I mean. People as individuals don't have much say.'

(Interviewee L19, 2012)

As procedural processes are dominant, what becomes interesting is whether these are understood; when questioned on how to get involved with developments, few non-governmental/non-business respondents knew the processes for how to get involved.

'I wouldn't know how to. Would they send me a letter if there were plans?'

(Interviewee L6, 2013)⁴⁷

This is exacerbated by an evident lack of trust of government and business.

'[Company A] aren't bothered about what happens here. They're not from round here, they're here because the plant's making money for now and they'll go again as soon as it isn't.'

(Interviewee L1, 2012)

'It won't last'

(Interviewee L11, 2013)

'I go along to all these meetings because I know if I don't no-one else will... it's always the same people isn't it? And there's such a lot of work - I've got a 400 page report from Selby council waiting for me - I mean

⁴⁷ Interesting that this interviewee lived less than ¼ of a mile from a major proposed development

who is going to read that? But then they tick the box to say the public has been consulted because they put up some displays.'

(Interviewee L14, 2013)

This view is not uniquely held by non-governmental public actors, but also expressed (albeit in different ways) by business and government actors.

'It doesn't matter what [individual local] people think about a project, it's about getting it through planning'

(Interviewee L21, 2012)

'...our processes make sure that the best strategic result gets through in the end. We follow guidelines for public engagement of course, but we have the bigger picture to consider not just members of the public.'

(Interviewee L31, 2012)

[Emphasis added]

This links to national debates relating to nationally sanctioned, strategic approaches to climate change, where strategic national issues (climate change, energy security) take priority over local or regional sustainability issues. It also ties with discourse on NIMBYism when taking in to account local views on developments. As with economic texts, these extracts suggest that cultural and temporal features (whether perceived or actual) to power dynamics are observable here. This exemplifies the theme that public engagement activities are largely perceived as procedural. Part of the decision to *not* be engaged then emerges, at least prima facie, due to feelings of procedural failings, lack of perceived knowledge, isolation and disengagement. There is a circularity here that links with wider justice and power debates; individuals feel (and are perceived to be) external to powerful (decision making) groups. This disengagement takes them further from the procedural processes designed *by others* to engage wider publics. Without intervention, the isomorphic processes at play within the social organisational field for governance will, over time, exacerbate this circularity.

There is however a counterpoint to this discourse relating to efforts from business and government actors to engage with publics:

'We're part of this community, most of us grew up here.'

(Interviewee L19, 2012)

'...people are lazy. It used to be that everyone did their bit and got involved, but then pretty much everyone worked in the mines or the power stations. Now people don't work at all. This is a really poor village now, everyone is on benefits, and so they're not involved in the same way.'

(Interviewee L16, 2013)

'All we're doing is what people've done for centuries – burning coal to make heat, but suddenly we're these bad guys'

(Interviewee L22, 2012)

'Credit to them though, they do try, but people can't be bothered anymore.'

(Interviewee L14, 2013)

Here the interviewee was referring to a number of local consultation events designed to give the public more information both about CCS in general and specific CCS with coal developments in the region. However, arguably, the public engagement activities are dominantly CSR activities and lack salience or materiality, rather they are designed to work within planning requirements or to gain social licence to operate rather than to include local people in decision making, gain mutual benefits from local knowledge or experience. To summarise, two key features emerge from this analysis: Firstly, public engagement is procedural to maintain social licence to operate. It is part of the planning process (key feature of governance), however, as very few actors get involved other than technical and managerial elites and co-opted individuals, low levels of 'engagement' beyond procedural.

Secondly, one size fits all employed consultation occurs. CSR activities are not salient either to operations or to place. This corresponds strongly with (and provides a degree of empirical evidence for) critiques of stakeholder engagement as procedural in wicked contexts

6.2.3.4 *It's not fair*

This 'it's not fair' metaphor relates to procedural outcomes, but also connects to issues of distribution of economic and environmental risks and benefits. In chorus with dominant social metaphors i.e. that community has declined and this exacerbates issues associated with a diffuse social organisational field for governance. Where public engagement activities are designed to engage with a perceived homogenous community, there is a disconnect between actors within the field; Government and business actors have procedural parallels, however public actors, because diffuse, do not demonstrate agency in the organisational fields with important consequences for sustainability outcomes at Y&H level.

This metaphor is perhaps best exemplified by the following extract:

'We live here, they [company shareholders] don't. I can't see what benefit it is to us to have the power station here. I don't know anyone who works there anymore. We don't even get cheaper electricity.'

(Interviewee L7, 2013)

'It's all about the share-holders. If it's not going to make a profit it won't happen, if it is, it will'

(Interviewee L1, 2012)

This is a complex rhetoric. Rather than evidence of NIMBYism as suggested from government and business texts, actors are broadly supportive of developments where this brings local benefits (whether that be jobs, investment or cleaner air) and the win-win metaphors explored in 6.1 are broadly accepted. However, in part due to the disconnect and diffusion within the field, it is not clear what, how, or whether local economic, environmental or social benefits are likely to materialise from new coal development. To reiterate, decline hampers development opportunities and temporal and culturally formed issues are not well understood:

'The trouble is no-one has the skills here anymore. Even if it [planned new coal fired power station with CCS] does bring jobs they won't be for lads from round here.'

(Interviewee L1, 2012)

'It doesn't seem fair when you think about, but I try not to think about it.'

(Interviewee L6, 2013)

An interesting process related feature of this rhetoric that fits with national rhetoric within the economic organisational field of governance emerges from the texts. Complexities and difficulties with adopting market led approaches to development emerge *because* energy is considered as a public good, a necessity; climate change is evidence of market failure. In this view CCS will not be developed without Government intervention, it is not likely to be a market based solution to climate change. Public and social goods not factored in to decision making when governed by the market.

'I'm not against the market, but it's not going to work here. Energy should be owned by the public and run by the public otherwise we will lose out to shareholders. It won't work for the benefit of society unless the government steps in. Everyone is talking about less government but we need more, and we need more people involved.'

(Interviewee L11, 2013)

Jobs are needed, and development is welcomed, but there is a link here to the economic rhetoric relating to people 'settling for anything' at local level because of underdevelopment and the 'it's different round here' social context. The following extract summarises:

'I couldn't not have a job though... but there's loads [of people] haven't got anything... We need something to happen round here, doesn't matter what.'

Interviewer: Do you mean it doesn't matter what type of job but that any jobs would be good?

Interviewee: *Yeah*

Interviewer: Is that different here to other places do you think? Why's that?

Interviewee: *'...cos it's s**t round here'*

(Interviewee L33, 2013)

6.2.3.5 *Social Agents*

At this Y&H level, the national UK Government, in terms of planning and regulatory issues as well as in terms of its role in making funding decisions about new coal, has agency within the social organisational field. Interestingly, local government agency is not as evident from the texts. Similarly, the EA and national level organisations have local level agency.

The texts very strongly suggest that power plant managers as *individuals* as well as ‘vocal locals’, i.e. local individuals who are perceived as representatives of wider publics, have agency within the field, however this is limited and diffuse. These personal, individual relationships (as entities) have agency and are referred to by multiple actors, sometimes:

‘I’ve known [A] since school, I just ring him up’

‘If you don’t know [B] you won’t get anywhere’

[Redacted for anonymity]

In industry and government texts, residents and local people are, to some extent, characterised as homogenous ‘community’ and are typically perceived as either lacking interest (in which case adopt paternalistic CSR type approach), or oppositional NIMBYs in which case ‘community’ is engaged through either individual relationships as noted above, or via formal channels such as consultations. Whilst, parish councillors and to some extent single issue NGOs emerge as proxies for homogenous community to engage with, in both cases, low levels of agency are observed.

An additional core feature of the texts relevant for the new governance/new coal era at Yorkshire and Humberside level, is the evident disconnect between social and economic organisational field other than through representations of the public as bill or tax payers. As compared with the connection between social and economic agency in the old coal/old governance era discussed in chapter four, this would suggest a growing disconnect.

6.2.3.6 *Social Entities*

For the social organisational field of governance, there is a considerable overlap between agents and entities. Individuals, and vocal local residents, sometimes characterised as NIMBYs play significant roles within the field.

However, their individual agency is not strong and personal relationships between specific individuals are seen as more relevant in governance and decision making, than are the procedural activities relating to community liaison and public engagement.

One important entity in its own right is the notion of 'community' and also lack of community: core to the discourse is an underpinning understanding that there is a lack of community due to decline of structures and agency associated with public ownership of coal. This lack of community means poor representation of publics and social actors in governance and decision making. This core features extends to entities relating to the region itself – notably 'round here' – culturally and environmentally placed understandings of the region, a history of coal use and perception that this matters contemporarily.

6.2.3.7 Social Relationships

As discussed, individual relationships are material and salient, however, over and above these relationships, there are few significant connections between social actors *within* the field at this scale other. The exception is that where these relationships relate also to economic (and/or environmental) and strength is given to these relationships because of associations in other fields.

An interesting single disconnect observed relates to local government and governance practices. Again, what is missing is of interest. Parish council and local government disconnects, and local government and national government relationships are at best weak or unidirectional.

Corporate and government relationships with homogenised community may be seen as liberal paternalism, beyond that these are founded primarily on individual relationships, with some e.g. through community liaison groups for example.

The social organisational field of governance, illustrated in figure 6.3 below, may be characterised here as diffuse. An interesting point for discussion is that this diffusion means there are, no longer strong economic, environmental or social relationships across the fields at this scale other than individual. To summarise, what this implies for both governance and sustainability will be discussed in brief in section 6.3 and fully in chapter seven.

6.3 Organisational Field for Governance – diffuse at Y&H scale

This chapter presents a discourse analysis of the Yorkshire and Humberside organisational fields of governance for the period 2000 to 2013, and era characterised her as being new coal/new governance. In doing so it illustrates that organisational fields of governance have changed over time and at different levels. Furthermore, it finds that these changes have three significant implications for sustainability discussed in brief here and further in chapter seven.

Firstly, in concert with the national discourse in chapter five, the degree of consolidation witnessed within the economic organisational differs greatly from that in other organisational fields at the Y&H level. This suggests dominance of few actors and entities with agency – powerful elites – and otherwise disparate/diffuse field at this level which raises questions for efficacy of new modes of governance.

Secondly, social and public actors are represented in the texts to a greater degree than for UK fields. This feature is especially evident for the environmental field where place specific, cultural connections and relationships are evident. However, this representation does not translate to governance or decision making power; engagement with publics is notably procedural and paternalistic rather than in any way intrinsic to governance processes. Furthermore, within the social organisational field, whilst social actors are evident, diffuse views on coal use and new technology (other than where these relate to lack of community and mistrust of corporate and government actors) means that processes for engagement designed to favour homogenous groups do not capture diffuse public discourse.

Finally, for the Yorkshire and Humber case, there are also evident pressures (and disconnects) between UK Government and business owners of power plants with agency at both levels of governance explored. This creates opposing local (governance and operational) pressures. Disconnects exist over time and levels and within and between fields; for governance outcomes, where Government and commercial actors have more power than other actors and the UK interests are prioritised over local this has consequences for sustainability.

This also demonstrates an emerging theme especially evident in the interview data, but also in observations, relating to assumptions and characteristics of 'old' governance roles and relationships where newer practices are not understood, adopted or trusted. Despite attempts to create laissez faire, market friendly governance arrangements with engagement from public actors beyond the state, 'The Government' is assigned the roles beyond that of policy maker and regulator by other actors. In addition, Government and corporate actors are seen by some civic and public actors as being co-opted, 'in each-others' pockets' and, because economic field is dominant, environmental and social issues associated with coal use are of lesser significance.

Organisational field and institutional logics around community in this context are weak and diffuse. This was not historically the case in mining community where large numbers were involved in coal mining, power and associated industry and economy resource based.

This diffusion and gaps between and within the fields leads where previously relationships existed (through employment, unions, managers) is problematic when considering the wicked problem under study. Diffusion within the field, whilst not so weak that no field exists, means that slow isomorphic change is likely; dynamics required to make new governance practices work are not strong enough. Social and civic roles and responsibilities in decision making processes intended to engage (ecological modernisation, new governance models) are ineffective. Old roles, for example trades unions, no longer exist (or have no agency) and knowledge of governance practices and mechanisms are limited beyond the procedural.

This analysis, when read together with chapters four and six begins to address the research objectives to both characterise and understand the organisational fields for governance. Chapters four to six together have shown how fields have changed and laid the foundation for consideration of why. What follows in chapter seven is a consideration for why fields have changed and the dynamic 'forces' for organisational fields of governance over time and at different levels.

Chapter 7 - Governing complexity: slowing coal's long goodbye?

This discussion chapter reviews the key themes developed throughout the thesis; exploring the evolution of a wicked problem through consideration of the changing characteristics of organisational fields for governance at UK and Yorkshire and Humber levels. It summarises and reflects on findings to explicitly address the research objectives presented in chapter one. To do this, section 7.1 summarises governance characteristics identified to shape a governance timeline. Section 7.2 then builds on this to discuss the emergence of organisational fields of governance. How and why these fields change over time and levels of analysis is discussed in section 7.3. Finally, section 7.4 provides a summary of the discussion with considerations for the prospects for sustainability of coal discussed in greater depth in chapter 8.

7.1 Characteristics and timeline of governance and sustainability

Objective 1: Provide a characterisation of UK coal using governance and sustainability as organising principles.

A review of the literature and desk top study of the historical context for this research reveals a number of core characteristics of the governance setting as relevant for coal use. From the detail in chapter two together with open coding of the texts (see 3.3.2), table 10 below draws these together in to broad eras of governance. Whilst not entirely distinct, these eras provide a useful description of governance context to underpin the more rich findings presented in chapters four to six. To add a layer of understanding, table 11, summarises the key metaphors and actors identified for these eras. This illustrates that as a major fuel source in the UK throughout the period of study, coal use has differing but overlapping environmental, economic and social implications. It also shows that multiple, often discordant, metaphors relating to coal are most evident during latter, new governance eras.

Together, these summaries also suggest that whilst key governance characteristics change over time with intended implications, there is not a clear correlation between these and coal metaphors or outcomes for sustainability; dominant metaphors relating to king coal or clean/dirty coal for example, come and go under different governance contexts.

7.2 Organisational fields of governance for UK coal use

Objective 2: Develop a critical understanding of the existence and evolution of organisational fields of governance over time and at multiple levels, for the case of UK coal use.

The new understanding of eras of governance developed here underpins this research. By identifying and exploring the changes in metaphors over time, it has been possible to categorise otherwise unknown organisational fields of governance. As detailed in chapters four to six, organisational fields of governance change over time and levels in terms of both structure and agency. The texts also demonstrate that organisational fields emerge at different levels of governance with implications across the three pillars of sustainability. Furthermore, that over time, the fields change, and as discussed in more depth in section 8.1.2, the impact and effectiveness of specific policies is influenced by the context within which powerful actors and decision makers operate.

This section goes beyond a description of the fields identified to demonstrate how and why the evidenced changes have occurred. It explores these similarities and differences over time and between levels of governance, to suggest that isomorphic processes (DiMaggio & Powell, 1983) are influencing organisational field dynamics but in unexpected ways.

| | Old governance/old coal | New governance/old coal | New governance/new coal |
|----------|---|---|--|
| | Post WW2 – c.1980 | c.1980 to c.2000/5 | c.2000/5 to circa 2015 |
| Features | Nationalised electricity and mines Energy security for growth Negotiated wages Guarantee supply Little related regulation | Structural adjustment/change Privatisation and MNCs Old style environmental regulation New policy mechanisms (limits to emissions) Mine closures/strikes Imported coal/globalisation | Climate Change Act 2008 Mergers and acquisitions Market mechanisms preferred Regeneration/welfare liberalism Corporate governance and reporting Sustainable development |
| | High coal use | Reduced coal use | Static coal use |
| Agents | Government/state – CEB and Coal Board Managers Workers Strong unions | Government Private sector managers Weakened union reps | Government Private sector managers NIMBYs |
| Orgs | State owned industry | Government departments | Government departments |
| | Unions | Private sector firms | Private sector firms |
| | Community associations | QUANGOs | Weak NGOs |

Table 10 Governance era characteristics

| | | 1960 | 1970 | 1980 | 1990 | 2000 | 2010 | | |
|--------------------|------|--|--|------|------|--|--|--|--|
| | | Key governance characteristics | | | | | | | |
| | | State ownership Strong unions Little social or environmental legislation | Reduced state Privatisation Quangos Structural adjustment Increase in legislation Globalisation | | | Welfare liberalism Third way, rise of NGOs CSR/Public engagement Increase in legislation and policy | Austerity – cuts in welfare Reduced state | | |
| Dominant Metaphors | ECON | King coal | | | | | | | |
| | | Keeping the lights on | | | | | | | |
| | | There is no alternative | | | | | | | |
| | | New coal = Green growth | | | | | | | |
| | ENV | Plentiful coal | | | | | | | |
| | | No new coal | | | | | | | |
| | | Dirty coal - emissions | | | | | | | |
| | | New clean coal | | | | | | | |
| | SOC | Coal at heart of community | | | | | | | |
| | | Decline/disengaged | | | | | | | |
| | | NIMBYs | | | | | | | |
| | | It's not fair | | | | | | | |

Table 11 Timeline - characteristics of governance and sustainability

7.2.1 *Field dynamics over time and levels of governance*

Applying a temporal lens to this analysis has revealed interesting features relating to how fields have changed, but also, notably, how and why they have *not* when it has nominally been the intention of new governance arrangements to steer towards development of new coal.

Economic

Throughout the governance eras identified for coal use, economic metaphors relating to coal are dominant. Evidently, the well documented structural changes to management of the UK political economy from largely Keynesian, to neo-liberalism during the 1980s and 1990s (Jessops, 2002; Palley, 2004) had significant impacts on coal use in the UK. However, two features of the analysis for economic fields stand out as particularly interesting for this wicked problem: the effect of market centric governance arrangements on coal use, and the changes to distribution of economic benefits.

Firstly, beyond the initial decline in coal use during the ‘dash for gas’ era (4.2.1.1), economic drivers (stable price, abundance, infrastructure) mean that coal use did not decline again until well in to the 21st century, despite governance arrangements intended curb its use. Throughout all the eras, metaphors relating to both stable price for coal and resource availability (albeit nuanced) were witnessed. Despite reported intentions to reduce and phase out coal use (DECC, 2005), coal use remained stable in both old, and new coal eras.

The regulatory and governance framework established from the 1980s onwards (characterised here as new governance), focussed on using market centric mechanisms to encourage reduced coal use or limit the impact of coal use rather than specifically reducing coal use (Department for the Environment Farming and Rural Affairs (Defra), 2015). The Clean Air Act 1993 and the EU Large Combustion Plant Directive for example, have arguably led to some closures of old coal plants, but also extended the use of some old coal generators without refurbishment or supplements of bio-fuels. The unexpected consequence of environmental legislation designed to improve air quality in this case is extended use, in some cases, of coal fired power stations without refurbishments where legislation does not require it.

This thesis does not suggest a specific correlation between the volume of coal used and specific governance arrangements. Rather, what is suggested here, is that where the overall governance arrangements rely on market centric approaches, in a context where economic metaphors for continued coal use are strong, and market conditions for coal (stable price, abundance, infrastructure), unabated coal use is likely to remain a feature of UK energy production. Furthermore, the UK is arguably entering, or indeed is in, a new 'dash for gas' era (Friends of the Earth, 2015, p.1). An unintended consequence of new governance for new coal in this context may, although beyond the remit of this study to confirm, have led to increased unabated gas.

Secondly, the nature of the economic benefits associated with coal use, and the actors who are beneficiaries, change over time. As seen in chapter four, the 'king coal', and 'keeping the lights' on metaphors for example suggest that the economic costs to the state i.e. from subsidising coal mining and building infrastructure during the post-war period were deemed acceptable given the perceived economic and social benefits of industrial growth and high levels of employment. Economic benefits were also felt by power sector and mine workers in the form of higher than average salaries, and end users in the form of subsidised fuel prices. The decline of the coalfields however, in particular when considered in conjunction with continued use of imported coal, leads to a redistribution of the economic benefits associated with coal use in electricity generation. Specifically, benefits (and agency, see 7.2.2) transferred away from the coalfields and towards the state and new private actors. In addition, new private owners and shareholders of both power stations and mining firms, received economic incentives through subsidies and favourable taxation.

Beyond these specific features of the discourse, as evidenced for all eras for coal use in the UK, the economic organisational field of governance, and key actors within the fields are dominant; this pattern is witnessed across time and levels. These features relate to the agency of dominant actors and their ability to use agency to manipulate resources within the fields to achieve their goals. Table 12 summarises how the key similarities and differences between levels of governance have changed.

| <i>UK</i> | <i>Y&H</i> | <i>Movement</i> |
|---|---|-----------------------|
| Consolidated: few actors, strong relationships within level | Many actors – many connections some strong some weak, within level and within field. Low influence. | Increasing difference |
| Coal fired power stations as economic entities | Coal fired power stations as economic entities | Increasing similarity |
| CCS with coal as win-win-win | CCS with coal as local development opportunity | Consolidated |
| Market friendly policies: commercial scale | Public investment opportunity | Increasing difference |
| Potential economic benefits | Perception that economic benefits at national level | Increasing difference |

Table 12 Economic field similarities and differences

Table 12 also draws from the analysis the direction of movement where there is a change i.e. to either increase difference or similarity. Whilst economic fields are similar and to a degree consolidated at both levels of enquiry, there are some differences in particular in agency demonstrated by powerful actors. When read with the timeline in table 11, it also becomes clear that dynamics within fields and between levels are compelling change; for some metaphors, for example coal with CCS as a win-win scenario there is consolidation, for others, for example the UK having a good policy setting for new technology there is increased diffusion over time.

Environment

The environmental fields are interesting and difficult to interpret in this wicked context. Initially, features of the environmental field relate almost exclusively to resource use, security and abundance (see 4.1.2). However, as international debates relating to transboundary issues such as acid rain and climate change come to the fore, the field becomes more complex with competing metaphors within each era and at each level. Dominant *competing* metaphors exist, including 'plentiful coal' versus 'dirty old coal' metaphors. It is

worth noting that legislation and policy instruments also increase during the old coal/new governance era. As noted in chapter two, this spatial disconnect suggests issues of spatial justice may not be embedded within planning and governance arrangements (Roberts, 2003). In addition, in keeping with Parry and Murphy (2013) this would suggest that the old style and new style governance arrangements are, in a sense, competing for dominance within this complex field.

Political inconsistencies and changes are seen to affect governance of the environment and, whilst the economic field broadly consolidates around metaphors for new coal as a win-win solution to an ostensibly environmental problem, the environmental itself field becomes more complex and diffuse. In addition, actors within the environmental field change (at least nominally), from state owners and managers, with very few environmental responsibilities in the old coal/old governance era, to the state as regulators with the emergence of government departments and QUANGOs to take on new governance roles. An interesting point to clarify is that during the period of study, the effect of changing UK Governments is arguably more influential than it *should* be under nominally pluralist (or at least ML/MA) governance arrangements. For example, the negative impact of DECC's delays and ultimately decision to pull out of funding new coal projects is evidence of non-decision making power (Clegg, 1989, p11). This demonstrates that the Government has agency within and between fields, i.e. where their changing political intentions and motivations are acted out.

A final note on field dynamics with the environmental organisational fields, is that whilst there is a strong link between the environmental and the economic fields, connections to the social fields become increasingly weak in particular at national level. As discussed below, throughout the period of study, the social organisational fields of governance become increasingly diffuse and more complex than either the economic or the environmental fields. However, historically this was not so. During the era of old governance/old coal, the metaphors identified for example are clear that social features were inextricably linked with the core narrative that (environmentally determined) economic benefits of coal mining and use outweighed the environmental costs.

For environmental fields, as with economic fields, there are differences and similarities between levels and over time. Notable differences include the relevance of transboundary environmental issues: At the national level, drivers for change are to some degree driven by international targets and attempt to, for example, reduce GHG emissions. These drivers are not, however, significantly reflected at local level, on the contrary, where the data do relate to transboundary environmental issues, it is with regard to for example importing coal from Mexico or bio-fuels from USA and Brazil and contradiction rather than either continued coal use or carbon reduction through CCS.

At local level, place related, local environmental issues are witnessed to a greater extent, for example visual or environmental amenity of new developments. However, it should be noted that dominant actors, i.e. those that demonstrate agency, at both levels are national rather than local actors. So, in this view it is not clear that these multiple, place related environmental priorities will be addressed in new coal developments.

| <i>UK</i> | <i>Y&H</i> | <i>Movement</i> |
|---|---|--|
| Technical solution to problem of using coal | Better than nothing when with consultation | Increasingly different |
| Structured regulatory framework – Government and corporate actors | Regulatory confusion. Old style governance relationships in place | Increasingly different |
| Climate change | Public health and local environmental concerns | Unknown |
| Clean coal | Still coal | Unknown |
| Close ties with economic | Economic ties only through dominant actors. | Increasingly similar around economic dominance |
| Global drivers | Local impact | Increasingly different |

Table 13 Environmental field similarities and differences

These similarities and differences between environmental organisational fields at two levels are summarised in table 13 together with, where it is possible to assert from the data, the direction of movement.

In summary, for the environmental organisational field, metaphors at the Y&H level relate more closely to the immediate, local, physical environment with issues of public health and amenity at the fore. For the UK level, environmental issues are closely related with transboundary and international issues notably climate change and greenhouse gas emissions. New coal is seen as a way of addressing the latter, but not necessarily the former.

Social

The use of organisational fields as the unit of analysis has been especially useful in highlighting otherwise understudied social features on debates new coal. As will be shown in this discussion, the period from c1980 onwards, so new governance for this characterisation, can be considered as an era of slow disaggregation within the field, and to some degree the emergence of separate fields. There are three core features to the social organisational fields to be discussed here.

Firstly, as has been noted, the social fields are becoming increasingly diffuse over time. In the old coal/old governance era, coalfield communities existed primarily because of economic benefits from mining and burning coal. As these economic benefits eroded over time however, and the links to the economic benefits associated with coal; employment, wages, association, decline and are not replaced it becomes evident that the connection between social and economic fields weakens also. Furthermore, by the end of the period of study, where any connections between social and economic fields are evident (for example in the *prospects* for new jobs), there is what has been described here as a discord between the dominant actors of the dominant field at national level, and the less powerful actors in weaker diffuse social fields at regional level.

Secondly, whilst in the new governance/new coal organisational fields, social actors are not widely engaged at either local or national levels, this has not always been the case. This analysis relates closely to the discussion on temporal disconnects and increasingly diffuse social fields.

The towns and villages next to coal fired (or now multi-fuel) power stations along the Aire Valley in Yorkshire and Humberside, were built around coal. The analysis in this thesis has demonstrated that the institutions that evolved around mines and power stations, but which no longer exist or have little influence had both social and economic agency. This thesis argues that the arrangements for governance were, historically, embedded in the daily routines of social *and* economic activity; work, family, community. Chapter four shows that up until the period of structural adjustment in the 1980s, social and economic organisational fields for governance were highly homogenous and strongly connected at both national and regional levels. Social and economic institutions and organisations (Trades Unions, Working Mens' Clubs), were in this sense formerly part of the fabric of governance. Whilst some of these institutions are still in existence and do feature in this analysis, they have little agency within social, environmental or economic organisational fields or significance in the processes of governance.

Finally, there are significant differences between the social organisational field at Y&H level and at the UK level. These are summarised below in table 14 but to draw out key features here, it is evident that whilst there are many actors in the local level field that express interest (either positive or negative) in new coal or coal use, or are otherwise influenced by new coal developments, few social actors have agency. Furthermore, those who do, for example corporate actors with community engagement roles, operate dominantly at national rather than local level, or on single issues. In addition, the main connection between these actors with agency at both levels is through the economic field for example in relation to gaining social licence for new coal developments. A corollary of this feature is that non-government, non-business social actors (public, civic or community actors for example) do not evidently demonstrate agency in governance at national level beyond external, homogenised characterisations of the public, consumers or NIMBYs (Devine-Wright, 2005; Markusson et al, 2012).

At national level 'the public' is imagined, and principally treated in policy and practice, as essentially homogenous. In a paternalistic sense, 'the public' (or publics) is external to decision making but needs to be 'engaged with' in order to gain social licence (Prno and Slocombe, 2012; Owen and Kemp, 2013).

Table 14 illustrates these increasing differences between UK and Y&H level social organisational fields.

| <i>UK</i> | <i>Y&H</i> | <i>Movement</i> |
|-------------------------------|---|--------------------------------------|
| New technology, win-win, jobs | Local development opportunity | Increasingly similar |
| Corporates as social actors | Us and them | Consolidated – increasingly negative |
| Homogeneous public | Diffuse publics | Increasingly different |
| Few actors with high agency | Many actors, weak relationships, low agency | Increasingly different |

Table 14 Social field similarities and differences

To summarise, the increasing disconnects between and within levels for the social organisational field occurs because fewer social actors have either environmental or economic connections or relationships, for example through employment in power plants or mining. Whilst social actors are at least nominally more evident at local than at national level, this is in part due to locals attending tokenistic (Arnstein, 1969; Devine-Wright, 2005) consultation events rather than meaningful engagement with governance. These evidently diffuse social organisational fields, arguably an unintended consequence of neo-liberalisation, do not fit well with such notions of homogeneous community with agency intended ML/MA governance arrangements.

When read together, the summaries above contribute to an answer to the research questions ‘Why and how have changes occurred?’ Section 7.2.2 and 7.2.3 below now consider ‘What are the changing ‘forces’ for organisational fields of governance over time and at different levels?’

7.2.2 Power and agency

An interesting dimension that this analysis highlights is that dynamics of power and agency have been observed by using organisational fields as the unit of analysis. By using the fields to identify connected metaphors and the actors, entities and relationships between them, assumptions about the agency of

dominant actors within and between fields can be asserted. This analysis becomes interesting when considered in the context of new governance arrangements that by intention *include* social actors beyond the state as governors. For the wicked case of coal use, however, what emerges in reality, is a set of governance arrangements in which Government actors have primacy and corporate and private actors' behaviours are governed by a complex arrangement of new and old governance mechanisms within which they have limited agency. In addition, importantly under these arrangements dominant actors do not require involvement of social actors beyond tokenistic requirements for license to operate. These three features of power and agency are explored in turn.

Firstly, government actors have primacy across social, environmental and economic fields at both levels of enquiry and along the governance timeline. To qualify this statement, for example, over the period of study, the redistribution of economic, social and environmental risks and benefits has been observed. Specifically, social and economic benefits associated with coal mining and use in electricity have been redistributed away from social actors (mine and power workers, coalfield communities) to government (reduced subsidies, neo-liberal motivations) and commercial actors (ownership, profits). This redistribution may be attributed to either changing dominant actors, or changing motivations of the dominant actors (Hoffman, 2001; McIntyre and McKee 2012). This analysis suggests a combination of both these factors applies: Following the processes of privatisation, workers' agency, either individually as employees, or through trades unions declined significantly over the eras. At the same time, private sector and shareholder benefits have increased. In addition, for the UK Government however, as a dominant actor throughout the eras, agency increased but more notably its role and motivations changed. This suggests that agency and power of government and market actors have been acted out (Lukes, 1974, 2005; Clegg, 1989) above those of other actors.

Secondly, the roles of corporate and business actors in setting and shaping new governance of new coal have been discussed in this thesis. To summarise, corporate actors (often in the form of networks and consortia) have connections and relationships with government actors. However, their power

and agency over decision making in terms of new coal is limited within constraints of competing governance arrangements of the market and complex, changing regulatory framework (see 5.2.1.4). One of the observable features of this is that, risk-averse corporate actors are not prepared to invest in untested new coal technologies at a time when Government policy and decisions on future coal use are shifting. Their power in this sense, whilst evident in shaping language and discourse of new coal, is limited in shaping the future use of coal.

An extension of this limit to corporate power is evidenced by the weak and increasingly diffuse connections between fields through corporate actors. Where specific relationships exist between economic and environmental, or economic and social fields, these relate to regulatory commitments such as the Clean Air Act or consultations for planning requirements. The social materiality of continued use of coal, either as unabated coal or with CCS, is not reflected in the texts beyond the need of dominant actors to gain social licence to operate or govern.

This relates to the third feature of the analysis of power and agency which suggests that social actors have little agency or role in shaping governance arrangements for new coal. Connections between social and both environmental and economic fields, in particular at national level are dominantly procedural or (in Arnstein's (1969) terms) tokenistic and designed to sufficiently gain social acceptance of new coal. This feature of the discourse connects with Lukes' (1974, 2005) analysis of power. He questions:

'...is it not the supreme and most insidious exercise of power to prevent people, to whatever degree, from having grievances by shaping their perceptions, cognitions and preferences in such a way that they accept their role in the existing order of things, either because they can see or imagine no alternative to it, or because they see it as a natural and unchangeable, or because they value it as divinely ordained and beneficial?'

(Lukes, 1974, p24)

This chimes closely with the extent to which consultation is used by dominant actors as a means of placating opposition.

A final point on the relative power and agency of social actors in this case. The organisational fields show that there are many social actors with differing views on coal and new coal. It could be argued that this is evidence of pluralism (Dahl, 1983) in the governance arrangements for new coal, with multiple actors involved in decision making. However, as discussed above, whilst there are many *individual* actors, the findings here suggest that the organisational field is diffuse, rather than diverse. Beyond the tokenistic, there are fewer opportunities for community or civic actors to influence institutional structure of social organisational field, than there are for economic and environmental actors to through existing governance processes.

The decline of employment and associated community and means social actors cannot condition or co-ordinate their actions in a manner that serves their own interests. This results in higher levels of disengagement and diffusion, which prima facie without intervention on the part of dominant actors to reduce their own agency or redirect their motivations, seems unlikely.

The discussion above illustrates that over the period of study the agency of different actors across environmental, social and economic fields has demonstrably changed. This section explores these changes.

7.2.3 Isomorphic processes; coercion leads to diffusion

The detail here will demonstrate one of the key features of this analysis i.e. that 'new coal' is inextricably linked with 'old coal'. Similarly, it shows that new governance is inextricably linked with old governance through agency and power dynamics. These insights add an underexplored temporal dimension to the ML/MA governance discourse.

The discussion above shows that the multiple organisational fields for governance developed, have changed over time and level. In particular changes in the agency demonstrated by different actors, as well as the relationships between different actors and entities within and between fields have been shown. These dynamics have implications for the efficacy of governance arrangements in steering development toward sustainability. In answer to the research question 2.c 'Why and how have changes occurred? What are the changing 'forces' for organisational fields for governance over time and at different levels?' This section details how and why coercive,

mimetic and normative isomorphic processes of change have created previously unknown field dynamics which affect the prospects for coal use in the UK. It concludes that beyond traditional institutionalist interpretations of isomorphism compelling fields toward homogeneity and harmony, (mimetic) processes of replication have exacerbated disconnects between and within fields.

From a starting point of largely harmonious fields in post war UK, all organisational fields in this study have changed over the eras. Notably, the processes of structural adjustment of 1980s and 1990s; the sale of state owned industries, redundancies and introduction of legislative controls over environmental issues, characterised here as new governance/old coal was a period of change. The dominant isomorphic force evident for this era is coercive; government mandates and legislative changes created a new set of governance arrangements for institutions to work within. However, as illustrated in table 15 below, the effect of this coercive change differs over time and level for different fields. The differences can be explained by differences in structure and agency within the fields, but also by wider isomorphic processes beyond the fields. To expand, for the economic field, institutional arrangements for the distribution of resources changed dramatically during the period of structural adjustment, however, new institutions were established with roles in keeping with those formerly taken on by state actors; financial regulation and governance for example. Whilst coercive forces created change, mimetic and normative forces emerge to maintain the status quo.

In contrast, for the environmental fields, again, coercion and radical change during the new/old era is evident, however, this is largely brought about due to transboundary issues and new institutions are established over time to govern, for example international target setting and protocols and corresponding legislation. This leads to persistence in coercive forces, but also normative at national level. What is interesting here, is that at local level, connections with the environment remain place based and mimetic over time.

| | | Isomorphic pressures | | | |
|---------------|-------|----------------------|----------|--------------------------------|-------------------------|
| Field | Level | Old/Old | Old/New | New/New | Moving towards |
| Economic | UK | Normative | Coercive | Normative and mimetic | Harmony |
| | Y&H | Normative | Coercive | Normative and mimetic | Harmony |
| Environmental | UK | Normative | Coercive | Normative Coercive | Conflict/split field |
| | Y&H | Mimetic | Mimetic | Mimetic | Conflict/between levels |
| Social | UK | Mimetic | Coercive | Mimetic, Coercive Normative | Dysfunction |
| | Y&H | Mimetic | Coercive | Mimetic, Coercive Normative | Dysfunction |

Table 15 Isomorphic pressures for field dynamics

The social organisational field is, in short, different. In contrast to traditional institutionalism which would suggest movement toward harmony within the field over time (Bradach, 1998; McCarthy, 2005), the social organisational fields have moved from being homogeneous, to being diffuse. This might again corroborate the suggestion that the social field is weak and dysfunctional, perhaps to the point of no longer existing in the context of governance arrangements for the wicked problem of coal use. For Milstein et al (2002), however, this premise would not explain the differences between the fields given the coercive forces had different effects in each field. Instead, bringing an element of realist analysis in to institutionalism is useful here. Margaret Archer's (1995) seminal insights on change and dynamics are instructive here. She suggests that change occurs where morphogenic processes of replication⁴⁸ occur; dominant actors use their agency and resources. Through this lens, the diffuse social organisational field of governance with its weak connections and relationship and low level of agency for actors other than state actors, morphogenic processes of replication will be slow. To use an analogy from the natural sciences, it is easier to move a canister of gas than it is to move the gas once it has been dispersed. In this light, in the absence of additional isomorphic forces to change the social organisational field, the replicatory processes within the field are likely to lead to further diffusion and, ultimately, collapse.

The analysis here suggests that change within organisational fields over time, is in part determined by the relative diffusion of the organisational field, and in part by the relative consolidation around common motivations expressed through dominant actors' motivations. For the case of coal use in the UK, the dynamic processes of reproduction and conformity are not the same across different organisational fields. This creates an additional layer of complexity with greater discord replicated over time and levels.

An alternative interpretation here is that rather than isomorphic processes leading to coercion and diffusion, what is being witnessed here is what Hannon and Freeman describe as a 'squeezing out' of inefficiency in the system (Hannon and Freeman, 1989, p.22). There is some merit in this argument,

⁴⁸ Note the distinction between mimetic and morphogenic where, for the latter agency is purposeful

and in particular where lay and social actors do not for example have technical knowledge of CCS technologies it could be argued that contemporary arrangements for governance are simply efficiently placating concerns rather than engaging a wide range of actors unnecessarily. However, this view is limited on two counts, firstly it does not explain the complexity of the dynamics and multiple forces in each era and alternative solutions might be deemed efficient by different actors. Secondly, importantly, this view does not account for agency, and in particular the temporal agency ('sovereignty for Jessops, 2002, 2006) government actors use to affect dynamics.

So, whilst institutionalism would suggest an emergence of harmony over time, this wicked problem of continued coal use plus intentional change from state control to ML/MA governance and all that entails in reality leads to greater instability within and between organisational fields. This should be no surprise, returning to Dryzek,

'...environmental problems tend to be interconnected and multi-dimensional, they are, in a word, complex...'

(Dryzek, 2005, pp.8-9)

So, whilst institutionalism would suggest an emergence of harmony over time, for the wicked problem of continued use of unabated coal in UK electricity generation multiple contradictory processes are at play. For Fairclough (2005, p. 921) organisational processes are about managing contradictions. However, this research has shown that whilst the 'intention' is for new governance arrangements to steer society toward sustainable outcomes, temporal and agency disconnects mean that dominant actors are able to demonstrate agency. This in turn means that, contrary to assertions that multiple actors and multiple levels are engaged in governance arrangements for new coal, few actors have agency. In addition, rather than being diverse with actors from different spheres meaningfully involved in decision making relating to new coal, organisational fields of governance beyond the economic are diffuse which means social and environmental actors have few opportunities to engage. This has important implications for the sustainability of coal use in the UK discussed in section 7.3 below.

7.3 Prospects for a new technology

Objective 3: Draw from this understanding, conclusions on the prospects for sustainability of new coal. Contribute to knowledge on whether, how and why new forms of governance make 'new coal' more sustainable than 'old coal'. Provide recommendations for practice and policy in wicked contexts.

Returning to discussions in chapter one and two on the strategic imperatives for sustainability, this section uses what is now known about the nature of organisational fields for governance and implications for the sustainability of new coal. Three core features of the analysis are relevant to this discussion: the dominance of economic factors and actors in governance arrangements; disconnects between UK and Y&H environmental fields; increasingly diffuse and dysfunctional social field. These features in concert make it difficult to consider positive prospects for sustainability of new coal. Each of these features will be discussed in turn to address objective three.

Firstly, the dominance of economic factors in decision making and governance arrangements is evident throughout this analysis. The motivations and agency of dominant actors are strengthened through mimetic and normative processes within economic fields, which leads to consolidation over time. However, as has been noted and discussed again in chapter eight, CCS is being characterised as a potential economic, technical solution to an environmental problem, i.e. climate change and there are disconnects between the economic and environmental fields at different levels.

For new forms of ML/MA governance to perform functions beyond the economic sphere, there needs either to be a degree of agreement and ultimately consensus between diverse actors from different spheres (Adger and Jordan, 2009). Or, alternatively, where there is not consensus (or diversity), as is the case here, then sustainable solutions will, due to slower morphogenic processes of change within and between fields diffuse fields, take longer to reconcile. Whilst the latter is likely to produce stronger socially and economically sustainable outcomes in the longer term, the complexity and nature of wicked problem of coal use, which has developed over decades, means that targets for reduced emissions would not be reached.

So, thinking about the ways that new institutions mirror or mimic old ones, and the now mimetic, normative processes within economic field, the implication is that without another coercive force (e.g. a new government mandate) the economic organisational field is unlikely to change radically. This has significant implications for sustainability. Notably, sustainability has been characterised as relating to environmental, social and economic issues, this has been shown to be the case in particular for coal use in the UK, where economic benefits and risks associated with coal are inextricably linked with social and environmental benefits and risks. Embedded within the conceptualisation of the research problem, is the notion that for new governance arrangements to have a positive effect on the sustainability of new coal, these three core features of sustainability would need to be meaningfully integrated.

Secondly, it has been shown here that the environmental organisational fields are disconnected between levels. In addition, there is diffuse agency within the field beyond economic actors who have agency (notably government actors with non-decision (Clegg, 1989, p.11) making powers). Again, these disconnects are problematic when considering the prospects for the sustainability of coal use. In addition to issues of lack of agency of actors other than economic (and dominantly Government) actors in the governance arrangements, and notwithstanding social impacts of mining, continued use of fossil fuels is, essentially, a wicked environmental problem. However, the discourse relating to coal and new coal dominantly relates to one environmental issue, i.e. GHG emissions from combustion of coal. Any future for new coal in the UK would therefore likely omit consideration for wider environmental issues either associated with local amenity, biodiversity, with mining and extraction or alternative fuel sources.

To summarise, whilst international and transboundary environmental issues have come to the foreground, the subservience of environmental to economic is problematic for this new low carbon technology where long-term economic feasibility of CCS is questioned. If sustainability discourse and practice emerges from the space where social, environmental and economic overlap, then from this analysis opportunities for sustainability appear limited.

Thirdly, the evident lack of institutional capacity for social and environmental actors (beyond Government actors), within diffuse and fragmented fields combined with weak relationships at both levels of enquiry, suggests that consensus will only be reached over a longer time frame. Decisions on CCS with coal are, however, being made on dominantly economic grounds without a balanced view on environmental or social risks associated with not investing in CCS. This is problematic in particular for sustainability as a key tenet of sustainability is that social actors and issues are integral to sustainability (WCED, 1987, p8).

The consequences of these three features when read together with the discussion on differential power and agency within fields, suggest that prospects for sustainability of new coal are reduced. Unabated coal use however is likely to continue⁴⁹ where market Government policy and drivers influence levels of use rather than restrict it. Returning to the strategic imperatives identified from Our Common Future as being especially relevant to the case of coal use in electricity generation, these were:

- *Reviving growth;*
- *changing the quality of growth;*
- *meeting essential needs for jobs, food, energy, water, and sanitation;*
- *conserving and enhancing the resource base;*
- *reorienting technology and managing risk; and*
- *Merging environment and economics in decision making.'*

Continued coal use does, when coupled with new coal technologies, in many senses meet these strategic imperatives, in particular when considered in conjunction with alternative low carbon technologies (section 8.1.3). With the exception of conserving the resource base, new coal discourses are not consistently contrary to sustainable development discourses.

Where fields are diffuse or disconnected (as in social) or there are multiple unknowns and contradictions within fields (as in environmental), agency is mismatched, and dominant actors crowd out others. The result is that

⁴⁹ Anecdotally relevant at time of going to press; in the UK on 10/05/2016 electricity was generated for four hours without coal for the first time since (Gosden, 2016). It is interesting to note however, that in the same week, the UK government removed tariffs on coal use.

intentionally multi-actor governance processes are ineffective because sufficient agency is not exhibited across all pillars. Returning to Stoker's propositions (Stoker, 1998), the implications for governance are considerable. The lack of agency amongst diverse actors within the fields would suggest the multi-actor features of governance are not being acted out for the case of UK coal use. In addition, where dominant actors across all fields and at both levels of analysis here are national actors, prospects for multi-level governance of coal are similarly weak.

Whilst it has not been the aim of this research to forecast volumes of coal use in future, this analysis does suggest that coal will remain part of the energy mix for some time to come along albeit in small measure and with continued (expanded) gas use, and large-scale biofuel and nuclear. What is concerning is that if coal with CCS is only to be developed if it can overcome barriers and become a commercial viability without Government investment then its prospects in the UK are limited. This means that any future coal use will be unabated. In a sense, new governance arrangements are not limiting the prospects for coal, rather the dominance of Government actors and their motivations for market lead solutions to environmental problems suggests that it is conceivable that where coal is cheap and stable prices then likely to be used in whatever form is legal.

7.4 Summary

This thesis asserts that changes to governance arrangements over time have unexpected economic, social and environmental impacts; what on the face of it may be classed as 'new' governance with multi-level/multi-actor approaches to decision making and policy reform, in reality is less impactful because of wicked context which emerges over time. This deeper understanding of the organisational fields, identified through discourse analysis in chapter four to six, has illuminated fascinating field dynamics. These dynamics are shaped by isomorphic processes, in turn influenced by the power and agency of dominant actors and their capacity to affect institutional arrangements and sustainability outcomes.

Mimetic, coercive and normative processes perpetuate consolidation and exacerbate discord within and between fields. Over time, these isomorphic

processes have changed the shape of the organisational field(s) of governance from a consolidated one with multiple actors and multiple levels demonstrating agency to create change, to a set of complex and diffuse fields, with multiple and changing actors demonstrating little agency and few Government actors and entities exhibiting considerable agency despite normative pressures for multi-level, multi-actor governance. The analysis and rich understanding highlights how dominant actors use their resources and power to shape fields according to their own motivations.

To summarise, this analysis of the evident organisational fields of governance shows that even when new governance arrangements that are intentionally ML/MA are instituted, for this wicked problem, outcomes are effectively determined at national level by state and corporate actors. This has negative implications for the prospects of sustainability of new coal.

Chapter 8 – Economic dominance in policy and practice? The collapse of new coal.

The findings developed in chapters four to six and discussed in chapter seven, clearly establish that the governance context for coal use in the UK, characterised here as the organisational field for governance, is only nominally polycentric, multi-level or multi-actor. Power dynamics within organisational fields, at both national and Y&H levels, determine that government actors at national level, dominate the discourse and outcomes. The empirical study demonstrates that economic and market features are also dominant, and therefore key decisions, i.e. those having the greatest impact on policy relating to coal, are taken by few, homogenous (as opposed to many, diverse) actors based on narrow interests. Furthermore, a principal finding that this thesis presents is that, over time, the economic metaphors, and government actors are becoming increasingly dominant in the organisational fields of governance. This monocentrism, evident both within and between organisational fields (and over time), is instrumental in determining future use of coal, both in terms of volumes used, its impacts and sustainability.

This chapter provides a comprehensive update on the changes in the market for coal and coal use in the UK, from the end of the empirical research to the present day⁵⁰. It then reflects on how and in what ways the organisational fields of governance developed in this thesis, contribute towards a ‘thicker’ (Geertz, 1973, p.14) understanding of the recent significant decline in coal use, and the future of coal in the UK energy mix. Specifically, it draws out the implications of the evolving market for coal and CCS in the UK and uses the analysis to consider:

- The changing nature of the market for coal and the impact of carbon tax;
- The use of CCS and the changing economics of its application;
- The implications of the above two points for the nature of decision making and implementation;

⁵⁰ 2014 to 2018 where data are available.

- The consequences for the economic, social and environmental aspects of sustainable development as discussed elsewhere in this thesis.

First, in section 8.1, this chapter brings the thesis up to date with a useful summary of the significant changes that have taken place in the market and economics for coal and CCS in the UK from 2014 to 2018. Section 8.2 considers the policy and governance features impacting coal use, including specific energy policy as well as the wider context this has been established within. The discussion and thematic analysis in section 8.3 considers the implications for decision making, linking to and building on earlier discussions in chapters four to seven, to reflect on current coal use as well as the prospects for coal in the UK. Finally, section 8.4 summarises the chapter and provides a link to the thesis conclusions drawn in chapter nine. In doing so it highlights the otherwise unseen, consequences for the economic, social and environmental aspects of sustainable development as discussed in this thesis.

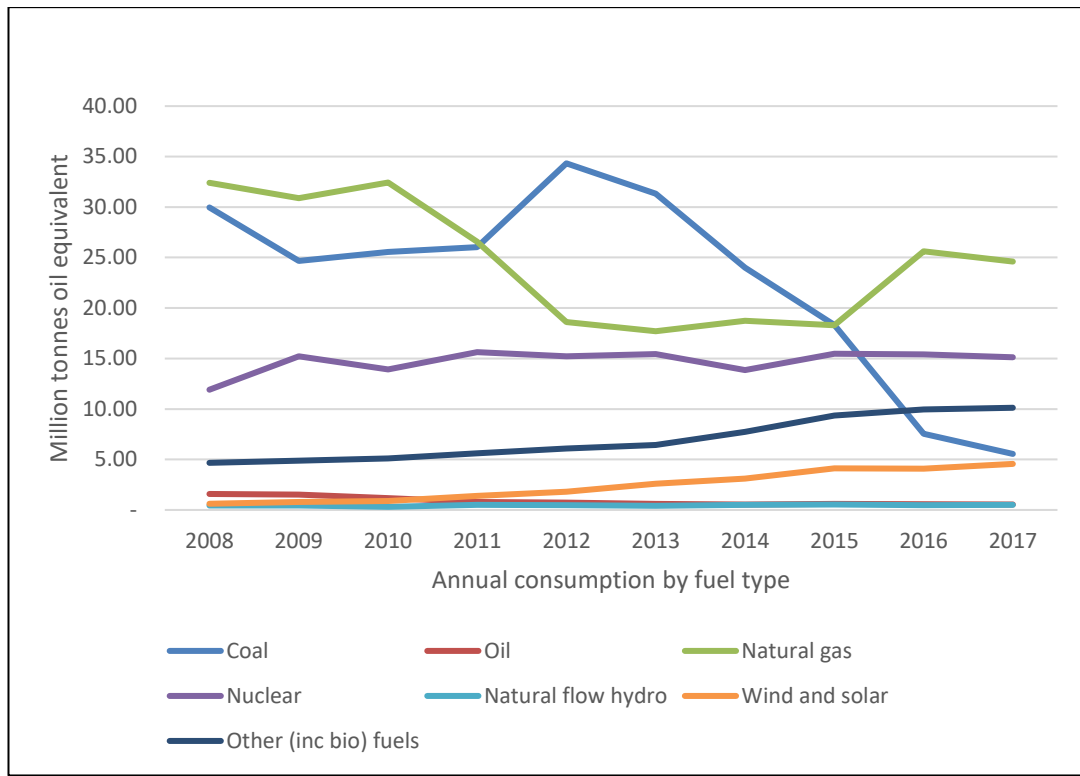
8.1 Changing economics of coal. 2014 to 2018, post new coal?

Coal as a fuel source for electricity generation is in significant decline in the UK. In 2017, coal accounted for as little as 2% (i.e. lowest monthly average) of electricity generation in the UK (Vaughan, 2017; no pagination, BEIS, 2018). In the same year, coal use peaked at 20% (on 11.2.17) during periods of cold weather (Drax, 2018a, no pagination) as compared with a peak of 38.44% in 2012⁵¹. Figure 13 below provides a summary of annual changes to volumes of different fuel stocks over the period from 2008 to 2017. A fuller breakdown of energy statistics, trends and fuel sources is included in appendix A and discussed in section 2.1, here a number of prima facie features of the changes in the market for coal emerge. These include:

- Coal use as a fuel stock is in significant decline in the UK, both as a proportion of electricity generated and in terms of volume of fuel.
- Renewable energy has increased beyond 2015 targets of 17% of electricity generated.

⁵¹ 2013 and 14 saw higher *volumes* of coal use, however 2012 was highest as a proportion of fuel use.

- Gas has increased as coal has declined, however UK gas capacity does not consistently meet demand for electricity in Q1 and Q1.
- Nuclear energy has not changed significantly over the period.



(Source: BEIS, 2018a, DUKES Table 5.1.1)

Figure 13 – Fuel sources in energy generation 2008 to 2017

Beyond these prima facie findings, key underpinning themes emerge. These are, firstly, that whilst coal is in decline and the closure of coal fired power stations has brought about a significant reduction in coal use, the timing of closures has been (and continues to be) complicated by a number of externalities including economic, policy and political issues. Secondly, the UK Government's withdrawal from CCS programme hampered and delayed plans to develop abated coal. Thirdly, scalable lower carbon alternatives to coal with CCS are in development, but are slow to materialise, in significant part due to the high capital expenditure associated with such developments. Fourthly, the introduction of the carbon tax in the UK has affected coal use, but there are limits to its continued efficacy and the impact it can have on further, deep, carbon reductions in energy and other industrial sectors. Finally, the wider governance and policy context for coal use remains complex and wicked, yet,

it will be argued here, existing policy is not sufficiently robust to be certain of bringing about this desired change.

8.1.1 Coal use and decline 2013 – 18: collapse of the market

On 21st April 2017, the UK did not use coal to generate electricity for a complete 24-hour period for the first time since the 19th century (Brown, 2017, no pagination; Carbon Brief, 2018, no pagination). In April 2018, electricity was generated without coal for 55 consecutive hours (Vaughan, 2018; BEIS, 2018a, table 5.1) confirming a reduction in the UK's dependency on coal. As noted above, coal use as a proportion of fuel stock has also declined significantly over the period 2015 to 2017. However, the picture is more complex than these summative statistics imply. Coal usage rose again in the first quarter of 2018, with coal accounting for an average monthly proportion of electricity generated of 9.8%⁵² (Drax, 2018a, p.11) and monthly coal usage peaks of 24.9% (Drax, 2018b, no pagination) as compared with peaks of 20% and 16.8% in 2017 (BEIS, 2018a, table 5.1). Anecdotally these peaks can be attributed to cold weather, however, this is important as it demonstrates that whilst coal is in decline, there are periods when the UK remains dependent on unabated coal. This section explores the causes of the decline in coal use as well as the complexities creating limits to further, deep reductions.

The reduction in the UK's emissions of CO₂ between 2012 and 2017 has been attributed in large part to the decline in coal use over the period (Carbon Brief, 2018, p.3). As discussed in depth in section 8.1.2, the decline in coal specifically (i.e. as compared with fluctuations in gas and other fossil fuels), corresponds with implementation of key policy measures and industry decisions. These include the introduction of carbon tax in the UK and closure of coal fired power stations in line with EU LCPD and IED commitments. UK coal capacity has, evidently, reduced because of these closures, and government policy aims to reduce coal use further to 2025 (see 8.2). It is worth noting that coal capacity does though remain active in the UK and will continue to until at least 2025. Table 16 below, provides a summary of remaining coal capacity⁵³ along with plans for closure or future change of use.

⁵² Usage as a proportion is relevant here rather than volume in colder months. Higher than average for Q1 2017 because of colder weather.

⁵³ As at January 2018 when coal consultation report was launched.

| <i>Name</i> | <i>Owned by</i> | <i>MW</i> | <i>Location</i> | <i>Plans</i> |
|-------------------|------------------|-----------|-----------------|--|
| Drax 4-6 | Drax Group (UK) | 1,960 | Yorkshire | Due to convert to biomass by 2019 |
| Eggborough | EPH (Czech) | 2,000 | Yorkshire | Closure announced 2nd Feb 2018 plant now due to close September 2018 but could remain open until 2023 to meet ancillary demand ⁵⁴ . |
| Ratcliffe on Soar | Uniper (German) | 2,000 | Nottinghamshire | No plans to close |
| Fiddlers Ferry | SSE | 1,960 | Cheshire | Full closure postponed but likely 2018. Remains National grid ancillary service |
| West Burton A | EDF (UK, France) | 2,000 | Nottinghamshire | No plans to close |
| Cottam | EDF (UK, France) | 2,000 | Nottinghamshire | No plans to close |
| Lynemouth | EPH (Czech) | 420 | Northumberland | Co fired. Due to convert to biomass |
| Aberthaw B | RWE npower (UK) | 1,580 | Glamorgan | Partial closure increased co-firing |
| Kilroot | AES (US) | 520 | County Antrim | Due to close May 2018, now planned for September 2018 |

Table 16 Coal fired capacity in the UK

An interesting feature of the data, especially when read together with peaks in coal use between 2011 and 2014 explored in chapters five and six, is that many of the remaining coal fired power stations, have had their lives extended beyond earlier planned closures due in 2015 and 2016. No plants closed in

⁵⁴ BEIS, 2018b

2017 despite plans for closure, and remaining plants have in some cases, been deemed essential for ancillary provision up to 2025 and potentially beyond in emergency situations.

“We consider it prudent for the secretary of state to retain provisions to act in emergency situations, as a last resort, where there might be a shortfall in electricity generation, or risk of one, and that suspension would wholly or partially mitigate that risk.”

(BEIS, 2018b, p.10)

The decline in coal over recent years must, in this sense, be seen in the context of planned reductions in unabated coal over time, but not as a guaranteed, full and total removal of coal from the energy mix.

As discussed in chapter five, the UK experienced high levels of unabated coal use in the early part of the 21st century. By considering these peaks over the longer time frame, the analysis here suggests they were due to three main factors. Firstly, the period 2000 to 2013 saw stable (and typically low) price for coal on world markets. Operational costs for existing coal fired plants were low⁵⁵, and despite dominant environmental metaphors relating to the need to reduce coal use in the energy mix, market and pre-existing infrastructure factors influenced higher levels of coal use. Secondly, allowances for coal use up to given limits were, as discussed in chapter 5, planned under the framework of the LCPD (IED from January 2016). Energy providers were effectively committed to using coal until these limits were reached; where allowances have not yet been reached, plants remain open.

Finally, interestingly, the launch of the CCS Roadmap and Commercialisation Programme, presented potential benefits from continued (in some cases expanded) coal use when mitigated with CCS (see chapter five). In the context of a regulated market, this, as integral to the dominant ‘win-win’ (5.2.1.1) discourse gave signals to suppliers that new investment in coal may be justified (SSE, 2012; 2CoEnergy⁵⁶, 2012). In addition, as noted above and discussed in greater depth in section 5.2, some planned closures were delayed as part of intended CCS developments (or so called ‘capture ready’ units) under the

⁵⁵ Although increasing due to higher maintenance costs of old plant.

⁵⁶ The company behind the Don Valley Power Project

CCS roadmap (e.g. Ferrybridge). Taking these features together, higher levels of coal use correspond with the era of new governance/new coal characterised in this thesis.

The closure of coal fired plants since 2014 and reduced use of coal in remaining plants have, evidently, had a direct and significant impact on CO₂ emissions in the UK. Annual reductions in emissions from the energy sector have been directly associated with the UK's reductions in CO₂ emissions in line with its Carbon Budgets (The CCC, 2017). Unabated coal has been replaced, in large part, with unabated but lower carbon gas (Williams, 2018; BEIS, 2018a) and renewables (appendix A). There are, however, complexities in both these markets (discussed in section 8.1.3) which impact both the demand for coal and the sustainability of UK energy mix. In addition, whilst it is recognised that the decline in coal use is positive, this analysis supports earlier findings that *unabated* coal use has been extended in significant part because of UK government and other dominant actors' prevarications on low carbon alternatives.

As discussed in chapters four and seven, the UK's remaining, operational coal fired power stations, have been characterised widely as 'old, polluting and ripe for retirement' (E3G, 2016, p.2), and further delays in their closure are problematic (BEIS, 2017a). The extract below illustrates the point:

'In 2014 the UK's 10 remaining coal plants were responsible for 20% of total CO₂ emissions. Nine of them featured in Europe's top 'Dirty 30' coal plants. They are old, polluting and ripe for retirement. Five are set to close during 2016, totalling 8GW. This will leave just five in operation, totalling 10.5GW of capacity.'

(E3G, 2016, p.2)

However, of the five plants (Pearce and Evans, 2015, no pagination) that had been scheduled to close in 2016, only three⁵⁷ did. Furthermore, forecasts in the first decade of the 21st century (IEA, 2010) suggested that UK energy demand could not be met in an economically sustainable way *without* coal with CCS as part of the energy mix. The government's recent report on energy

⁵⁷ Ferrybridge, which had previously had its operational use extended, also closed unexpectedly due to a fire in the cooling tower (Yorkshire Post, 2016).

trends (BEIS, 2018c) recognises that carbon budgets cannot be met *with* increases in gas use required to meet demand (ibid.) and so plans to expand gas and nuclear. In addition, the government noted its continued commitment to bring full-scale CCS operations on line in the 2030s (BEIS, 2017b). It has been argued, however, that unless CCS comes on line in the 2020s it will not be possible to achieve the CCS capacity required in the 2030s to meet commitments under carbon budgets four and five (Holder, 2018, p. 1; The CCC, 2017).

This crucial point from the Commission on Climate Change is illustrative of the complexities of the challenge:

'UK emissions have fallen while the economy has grown, but progress will not continue without new policies. It would be wrong to assume that the UK has permanently shifted to a path of falling emissions. Three-quarters of the decline in emissions from 2012 to 2016 has come from the reduction in the use of coal for power generation, which is now at low levels. Eliminating the remaining coal-fired generation would deliver less than two years' worth of the required progress to 2030.'

[Emphasis added]
(The CCC, 2017, p.8)

In this sense, despite record levels of carbon reduction, unless new approaches are developed, the UK will not be able to make the deep carbon reductions required (in energy and wider sectors) to meet carbon budgets 4 and 5 (ibid., p.8) without CCS.

In summary, whilst coal use has fallen and plans to close most of the remaining coal fired power stations by 2025 have been announced (BEIS, 2016), delays and uncertainty have impacted on the UK's ability to reach future national targets for CO₂ emissions without coal and CCS. Whilst somewhat polemic, the contradictions raised here warrant further exploration in the remainder of this section.

8.1.2 The impact of the UK Carbon Tax

The Carbon Tax and Carbon Price Floor (CPF), was established as part of the reforms under the EMR (DECC, 2011b) as a means of creating a '*cleaner, more diverse, more sustainable electricity mix*' (ibid., p.3). This section

considers whether and in what ways one of the UK's main tools to reduce carbon and meet commitments under the Climate Change Act 2008, have had an impact on the use of and market for coal in the UK.

Two connected, yet somewhat contradictory, themes relating to the impact of the Carbon Tax on UK coal use emerge from the data. These are, firstly, that the introduction of the tax was a catalyst for dramatic decarbonisation from 2013 to 2018. Secondly, that the decline in coal use is only *in part* due to the carbon tax, that plant closures were due prior to its introduction and that further reductions in CO₂ emissions as a result of the tax will, therefore, be limited. In this latter sense, as a policy tool, the CPF is useful but not sufficient. Concerns remain, in particular from industry and environmental actors, that the CPF is too low and lacks required nuance to tackle deeply ingrained carbon dependency on fossil fuels. These themes are discussed in turn.

8.1.2.1 *Dramatic decarbonisation due to Carbon Tax*

Introduced in 2013, the CPF is the main UK government policy designed to support and supplement the EU Emissions Trading Scheme (ETS) by raising the cost of emitting carbon (Carbon Brief, 2013). There are two components to the tax; the EU ETS and the Carbon Price Support (CPS) which together constitute the Carbon Price Floor (CPF). The CPS is set annually by HM Treasury to be applied for the following three years. The rate of the CPS is intended to be sufficient to increase the cost of emitting and hence reduce emissions and incentivise investment in lower carbon alternatives. The current rate of £18/tCO₂ is fixed until 2021 (HM Treasury, 2017b).⁵⁸

In 2016, emissions from CO₂ coal fell by 52% on 2015 levels to 37MtCO₂ (Carbon Brief, 2017, no pagination). This reduction has been associated with the introduction of the CPF as it is viewed as having sufficiently increased the cost of emitting CO₂ to a level that provides disincentives for producers (HM Treasury, 2016). In addition, as a consequence, the signal to the market, i.e. that higher emissions will incur higher costs for producers, is intended to

⁵⁸ A full discussion on the merits and demerits of carbon trading and taxation is beyond the remit of this thesis, however in short, creating a market mechanism for carbon in this way, is in keeping with wider neo-liberal approach to reducing GHG emissions discussed further in section 8.3 and chapter 9.

provide incentives to producers to reduce coal use in electricity generation and invest in lower carbon alternatives (ibid., 4; Drax, 2017a).

Evidence of the impact of pricing carbon in the UK case, and its impacts on coal use is presented in two main guises; coal use statistics and industry strategies. Demand for coal by electricity generators in the UK fell dramatically to record lows of 0.6 million tonnes⁵⁹ by Q2 of 2017 (BEIS, 2017b, p.17). This decline is in keeping with previous reductions in coal use from 2014 (appendix A). In addition, the latest round of the Capacity Auction for electricity resulted in demand for renewables overtaking coal (National Grid, 2016) which suggests the longer term prospects for coal are poor. In keeping with this reduction, leading electricity suppliers in the UK have been seen to adapt their strategies to reduce coal use in line with carbon pricing. Whilst there are caveats as discussed below, examples such as Drax's move from coal to biofuels as a feedstock (Observation O1, 2011; Drax, 2016, 2017b) suggest the mechanism is encouraging demand for lower carbon electricity. Similarly, SSE's strategy to increase its use of multi-fuels, hydro and gas (SSE, 2018a; 2018b, p.27), and move away from coal to a more varied and robust model in line with the UK's commitments under the Paris Accord (SSE, 2017, p. 3), indicate such incentives are effective.

This analysis suggests that the impact of the CPF has been positive in terms of incentivising reductions in coal use. However, wider market and other external factors affect the market for coal beyond the effects of the carbon tax. During periods of lower temperature and gas price fluctuations for example, coal use is comparable with (and even overtakes) gas usage (Drax, 2018b, see 2/3/18 for example). In addition to pricing carbon, reductions in coal, have been associated with two main features of the changing economics of coal (BEIS, 2018b, p.3), these are:

- Requirements under the EU Industrial Emissions Directive
- Poor economic conditions for coal when compared with alternatives

The following section explores the connections between these factors in more detail.

⁵⁹ Use of existing stock also rose (stocks held fell by 33%, i.e. 3 million tonnes) as generators used stock.

8.1.2.2 *CPF: one factor but not sufficient*

As discussed in chapter two and section 8.2, policy mechanisms and governance tools designed to strengthen market solutions to problems in the energy market, are preferred by dominant government actors. In this case, the Carbon Tax is being presented as the main policy tool for carbon reduction with other policy tools (notably the Capacity Market (CM)) designed to support market centric approaches to energy governance. Metaphors relating to the limits of a monocentric approach which does not reflect the complexities of the energy market in the UK, and concerns over a market centric approach to energy provision have been discussed previously in chapter seven. This section explores, these complexities in terms of three main features of the discourse; the value of the CPF, the potential for the Carbon Tax to stimulate private sector investment in low carbon technology, and the limit of its impact in further reducing coal use.

A common theme expressed in industry and ENGO texts, and in keeping with the analysis presented in section 5.2, is that the CPF is too low to be a sufficient incentive to overcome deeply engrained, structural dependencies on fossil fuels including coal. When implemented in 2013, the CPF was initially set at £13 and due to rise gradually to £30/tCO₂ by 2020 (Harris, 2018, p. 2) and then to circa. £70/tCO₂ by 2030. The view from HM Treasury at this time was that this rate:

‘...achieves the right balance between encouraging investment without undermining the competitiveness of UK industry.’

(HM Treasury, 2011, p. 5)

However, scheduled increases in the CPF have not been mandated by successive governments. In 2016, the CPF was frozen at £18/tCO₂ until 2019/20 and in the 2017 budget, the Chancellor of the Exchequer, Philip Hammond MP, confirmed that the current price of £18/tCO₂ will be maintained until 2021 (Harris, 2018, p. 3). This pricing level was deemed appropriate because:

‘The government is confident that the Total Carbon Price... is set at the right level and will continue to target a similar total carbon price until

unabated coal is no longer used. This will deliver a stable carbon price while limiting cost on business.'

(HM Treasury, 2017a, p. 37)

In response, there have been calls, notably from the utilities sector, but also from ENGOs and the CCC, that the UK commitment to carbon tax needs to be strengthened both in terms of value of the tax and in terms of its use in the longer term (Financial Times, 2017a). This would more decisively incentivise electricity producers to continue to move away from high carbon emissions (Harris, 2018). Finally, on this point, ENGOs also argue that the total carbon price does not adequately account for externalities and environmental costs associated with burning fossil fuels (FoE, 2016; The CCC, 2017).

There are two main reasons why the price has been kept at its current rate which stem from the preference for a market centric approach. Firstly, the UK government has repeatedly stated its aims to create an energy *market* that favours 'low carbon generation' without favouring or ruling out any specific technology (BEIS, 2016). Secondly, without subsidies, ultimately the cost of energy is passed on to domestic and business consumers, which means setting a price for carbon is a complex, and a political balancing act. High levels of fuel poverty (National Energy Action, 2016; National Statistics, 2018), low UK productivity and competitiveness and a backdrop of austerity economics, and Brexit⁶⁰ all affect the palatability of increases to the CPF. The government has stated that it will continue to set the CPS at a level which provides savings to consumers and ensures UK businesses are able to be competitive (HM Revenue and Customs, 2016, p.3). This means not penalising UK industry more than their EU counterparts. In this view, gaps between the UK's and other countries' carbon taxation policies means the UK may become increasingly uncompetitive in global energy markets if the price of carbon rises (CBI, 2014).

However, pricing models suggest that a higher carbon tax would directly affect coal use more than other fuels and consequently reduce coal in the energy mix without impacting electricity prices. For example:

⁶⁰ A full discussion on Brexit and the implications for coal use in the UK is beyond the remit of this thesis given universal uncertainty on the outcomes of the withdrawal from the EU in March 2019. However, for this discussion, this uncertainty in and of itself is relevant.

'Changing fuel price dynamics could lead to a revival of coal in the early 2020s. Phasing out coal using carbon prices alone would require the price to double to over £40/tonne by 2025.'

(Aurora, 2018, p. 11)

Furthermore, it has been demonstrated that short run marginal costs and demand for low carbon energy that would be stimulated by a higher CPF, would lead to only marginal increases in wholesale energy costs to consumers (ibid., 9). In addition to these critiques relating to the low value of the price floor, there have been concerns raised, both from environmental groups and industrial actors, regarding a lack of long term plans for investment in low carbon energy. Concerns relate in particular, to whether the CPF, as the Government's main policy tool, is able to stimulate investment in alternatives to fossil fuels without additional Government direction or economic incentives. A principal aim of the Carbon Tax is to not only reduce carbon emissions from source by encouraging alternative fuels, but also to stimulate investment in low-carbon electricity generation. It is worth noting the original pricing intention when the tax was introduced:

'The £30/tCO₂ price floor in 2020 rising to £70/tCO₂ in 2030 will drive £30-£40 billion of new investment in low-carbon electricity generation.'

(HM Treasury, 2011, p.5)

Two points are important here; firstly, tax receipts from implementation of the carbon taxation are lower than HM Treasury had forecast (Scottish Government, 2016; Harris, 2018, p.1) in part because of lower than anticipated returns from coal (Yeo, 2016):

'...the OBR's forecasts for receipts from the CPF have been reduced slightly, suggesting that the phase out of coal could reduce the Exchequer's income more than it had anticipated.'

(ibid., no pagination)

Secondly, tax receipts have not been ring fenced to invest in (or to stimulate investment in) low carbon energy, rather, the Clean Growth Strategy (see 8.2) when coupled with the CPF, is intended to provide sufficient signals to investors.

At present, the economics for continued unabated coal use are relatively poor as compared with alternatives to coal (BEIS, 2018): Without CCS, coal generates almost twice as much CO₂ per kWh as unabated gas, and so carbon taxation favours gas use over coal use. Plus, coal stock is aging and maintenance costs likely to increase in the short term⁶¹.

These points combined suggest that, for industrial actors at least, the benefits in reducing coal are accrued by *avoiding* costs from emissions rather than from investing in any specific low carbon alternatives. Those decisions are made on wider strategic grounds and impacted by additional factors such as the relative economics of coal and the feasibility of low carbon alternatives.

8.1.3 Low carbon alternatives to coal with CCS – emerging policy and technology gaps?

In and of itself, the significant reduction in coal as witnessed from 2015 to 2017 is an environmental good, however, what is of concern to some actors is the lack of alternative to unabated coal since pulling out of CCS funding in 2015. This debate is exemplified by these extracts from ENGOs and campaign groups. As the dominant actor in this context, the UK Government is characteristically viewed differently by different groups as either:

‘...hitting this dirty industry where it hurts.’

(WWF, 2018, no pagination)

Or as prevaricating which causes concern where there is potential for continued carbon lock in (Unrah, 2000), for example:

‘We are concerned that the door is left wide open for investments in new, long-term gas capacity, locking us into another generation of fossil fuel power...’

(Client Earth, 2018, no pagination)

Contrasting logics in the discourse have re-emerged since the significant changes to policy from 2015 onwards: on one hand, withdrawal from

⁶¹ With the caveat that some operators, e.g. Uniper at Ratcliffe, argue that some stations are running efficiently (<https://uk.reuters.com/article/uk-britain-coal-uniper/uniper-says-ratcliffe-coal-plant-in-uk-could-run-beyond-2025-idUKKBN13O1RS>)

investments in coal with CCS is viewed as a missed opportunity for low carbon and cost effective energy, on the other policy measures for coal free electricity will stimulate investment in low-carbon alternatives. Both logics are based on significant unknowns given the cessation of CCS viability programmes and the increasingly market centric approach to energy policy. The following sections explore these conundrums in relation to development of and the market for low carbon alternatives to coal with CCS. Section 8.1.3.1 considers CCS and the changing economics of its use. Section 8.1.3.2 then considers alternatives to CCS in more detail.

8.1.3.1 CCS and the changing economics of its use

The UK Government withdrew their support for the competition for the CCS Commercialisation programme in November 2015⁶² (Carrington, 2015; NAO, 2017a) and subsequently cancelled the competition in January 2016, following repeated delays in funding decisions between 2012 and 2015. The Conservative Party decision was based in the view that removing coal from the energy mix (as opposed to mitigating against emissions from coal) is an efficient and quick way of meeting emissions targets (HM Treasury, 2015). The UK Government stated that this move would also encourage private sector investment in alternatives to coal, notably natural gas (fracking), renewables and nuclear (ibid., no pagination). However, it is not clear that arguments in favour of stopping the CCS funding programme before potential economic and environmental benefits have been fully tested are justified, on either economic (NAO, 2017a, p.5) or environmental (The CCC, 2017) grounds.

During the new governance/new coal era, coal with CCS was heralded by industrial and (some) government actors, as a potential economic win-win option (5.2.1). The end costs of meeting decarbonisation targets for the UK energy sector without CCS have been estimated at '*at least £30 billion*', not including developments at Hinkley C (NAO, 2017b, p.4). This figure is substantially greater than the forecast £8.9 billion cost to tax payers over 15 years associated with developing full scale CCS as previously outlined in UK CCS Roadmap (ibid.; DECC 2012).

⁶² The cancellation was announced in the November 2015 spending review and finally confirmed in January 2016 (NAO, 2017a).

This analysis suggests that the government's unilateral decision, marked a move away from a growing industry, ENGO and expert consensus on coal with CCS, i.e. that it represents an important tool in the move towards a more sustainable, low carbon energy mix in the UK. This departure from the consensus also chimes with questions that have since been raised (i.e. beyond those from industrial actors with economic vested interests), over the financial, economic and environmental logics of government withdrawal from the programme.

An interesting feature of current developments in CCS is that despite having pulled out of the programme for its development, the government continues to at least nominally support its development (BEIS, 2017b) and expects CCS to be developed in full and on stream in 2030s as a means of mitigating against emissions from gas and bioenergy. This timescale has been considered problematic for a number of reasons:

- (i) International developments (and test cases in UK) have in most cases used coal as a feedstock (GCCSI, 2018; MIT, 2018). Globally 22 CCS projects are operational (GCCSI, 2018). The technology and infrastructure for CCS with gas or bioenergy differs considerably from that with coal (Appendix F(iii), observations 01 (2011) and O10 (2013)).
- (ii) The economics of CCS determine that either carbon tax needs to be at a level of £30/tCO₂ or requires investment to offset capital expenditure.
- (iii) World energy forecasts from a wide range of industry, government and academic sources (GCCSI, 2018; IEA, 2015) maintain that coal will remain an important energy source over coming decades. Investment in clean coal technologies worldwide - syngas, coal combustion to extract hydrogen from water, coal with CCS.

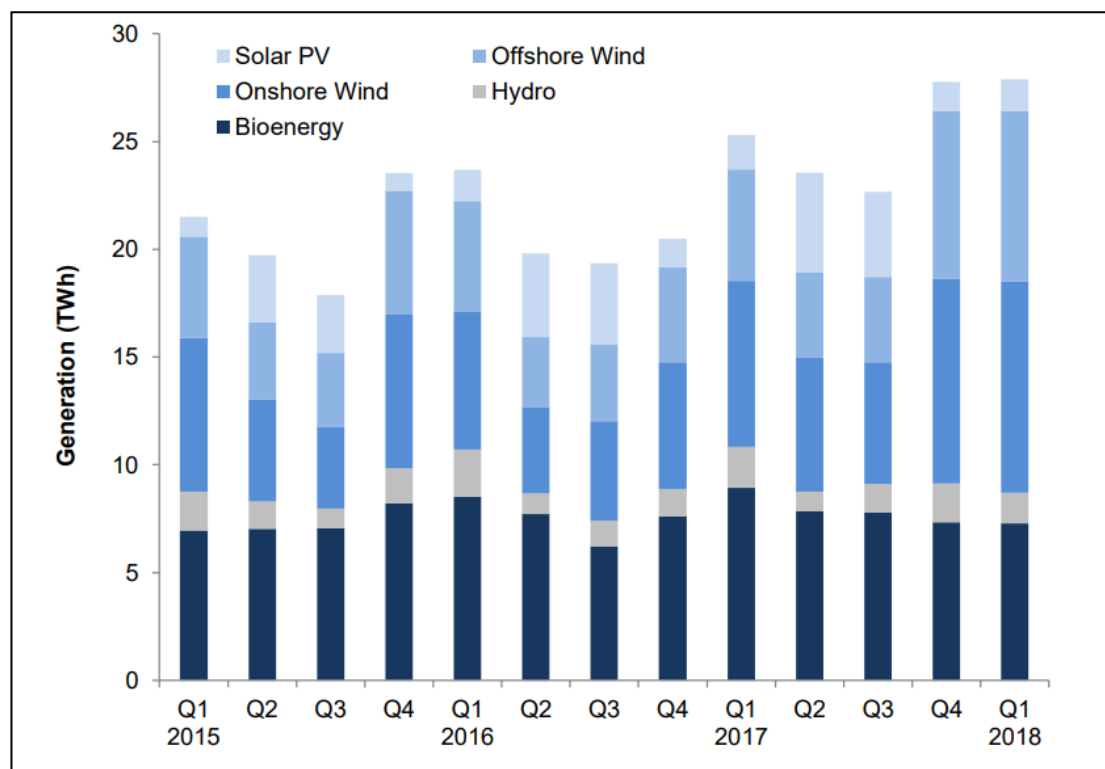
This summary, when read in conjunction with questions relating to the ability of the carbon tax to either further reduce CO₂ emissions at its current price or stimulate investment in low carbon alternatives raises doubts over whether the government's current plans for CCS are realistic. What follows is a consideration of alternatives to coal with CCS in this context.

8.1.3.2 Low carbon alternatives to coal with CCS

As discussed above, the decision to pull out of investments in CCS was intended to signal the government's plans to reduce/remove coal and stimulate investment in low (or lower) CO₂ sources of energy. This decision must be seen in the context of changes in the wider energy market, in particular in relation to three main alternatives to coal; renewables, natural gas and nuclear.

Expansion of renewables.

Figure 14 below shows that by Q1 of 2018, the UK's renewable energy (including wind, solar, bio-fuels, hydro and other sources) capacity was 49.1 TWh, an increase of 11% on Q1 2017. This accounted for 30.1% (BEIS, 2018, table 6.1) of the UK's electricity. The expansion of renewable energy in the period is accounted for by three main sources: wind, solar and bioenergy. Both in terms of volumes of energy and proportion of renewables, bioenergy accounts for the largest proportion of the expansion.



(Source: BEIS, 2018, Table 6.1)

Figure 14 – Sources of renewable energy in the UK 2015 to 2018

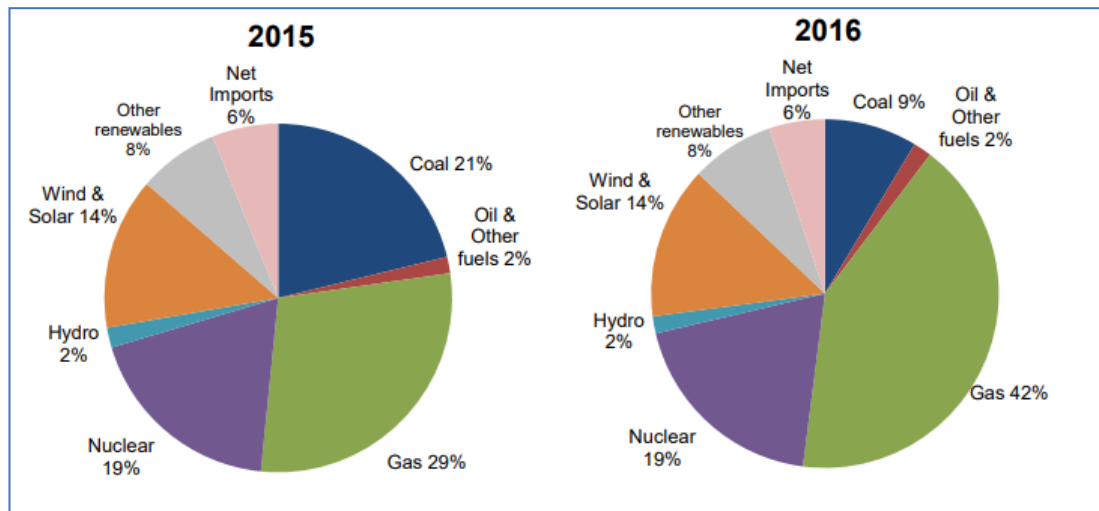
This increase from 2014 is, in part, due to Drax's conversion from coal to biofuel as a feedstock. Three factors make this especially interesting here;

firstly, as shown below in figure 14 below, there has been a slowing of expansion of renewables since the conversion of Drax to bioenergy. This is important, as there may not be capacity in the UK to expand beyond current levels. Secondly, it is relevant that the change in fuel stock was facilitated without a period of significantly lower production (Drax, 2018a) in part because changes to infrastructure (for example new plant, fuel transportation or connection to the National Grid) were not as costly or technically challenging as for example changes from coal to onshore wind or nuclear would have been. Thirdly, there are (at least) short term implications for Y&H region, such as retained jobs in the region and improved air quality.

It must be noted, however, that key questions relating to economic and environmental sustainability and security of bioenergy remain. Proposals in development under the EU Renewable Energy Directive are being designed to ensure that whole life cycle CO₂ is accounted for in bioenergy e.g. including processing and transport (European Commission, 2018, p.1). It is not yet clear whether the UK will adopt these amendments to the regulations as they materialise post Brexit. In addition, there are (physical and political) limits to further expansion of renewable sources of energy to meet energy gap left from coal reduction. For these and other reasons, coal has dominantly been replaced by natural gas.

Expansion of natural gas:

The Government has stated that it is 'essential' to build a 'fleet' of gas and nuclear power stations in the UK over the coming decades in order to meet our commitments to reduce CO₂ (BEIS, 2015, no pagination). Figure 14 below shows that gas has increased in line with the decline of coal (BEIS, 2016). CO₂ emissions from unabated gas are around half those from unabated coal, however, gas clearly is a fossil fuel with the environmental and human health consequences of its use. Consequently, CO₂ emissions from gas have also increased since 2014 (Carbon Brief, 2017; BEIS, 2017a), but less than emissions from coal have fallen.



(Source: BEIS, 2017a)

Figure 15 – Electricity supplied by fuel type 2015 and 2016

Energy projections from the early part of this century suggested that natural gas, whilst remaining part of the energy mix would need to be abated by CCS to meet future carbon budgets (DECC, 2010b). More recent energy projections including the Government's Energy Trends report (2018) have confirmed that gas will either need to be reduced (at least one forecast suggests to as little as 10% (McGlade et al, 2017, p. 21; McGrath, 2017, no pagination) or abated (BEIS, 2017b) with CCS in the 2030s.

The UK government's Clean Growth Strategy includes plans to bring more gas on stream until 2030, (BEIS, 2017b; DECC, 2012a, p. 4). However since the withdrawal from the CCS programme, it is not clear whether plans for *abated* gas have been fully formed (BEIS, 2017b; The CCC, 2018b). This lack of clarity at a time when gas capacity needs to rapidly expand is problematic as it makes investment decisions challenging (Financial Times, 2017b; Client Earth, 2018). This is especially so given complexities in the economics for gas. It is important to note, for example, that in periods of high price variability (e.g. when energy demand is higher than expected during periods of cold weather) demand for coal rises. This ties with forecast increases in price per therm for gas which, under the current policy scenario (IEA, 2016) are not expected to stabilise until 2030 (BEIS, 2017b, p. 30) at which point the price per therm will be, once again, comparable with coal (ibid., 36). In addition, UK gas reserves are limited and fracking relatively untested in the UK.

Consequently, imports increased by 22% in 2016, with a corresponding fall in export market (BEIS, 2018, table 4.1).

This increase in dependency on gas imports potentially means that the UK energy market is more vulnerable to externalities (Van der Ven and Fouquet, 2014). Furthermore, from a social-economic perspective, the expansion of gas for electricity generation creates a monopoly of fuel for many consumers. Fuel poverty is already high in parts of the UK including the Yorkshire and Humber region (National Energy Action, 2016), therefore concerns have been raised regarding potential for price increases in gas and electricity. In this respect, it is worth noting that the aggregate fuel poverty gap (i.e. the amount households living in fuel poverty fall short each year) is higher, on average, for households with a gas connection than for those without see (ibid.,). Without price caps, or other adequate price regulation for gas⁶³, prices to consumers are likely to fluctuate in line with commodity pricing.

Nuclear energy:

The UK's Clean Growth Strategy (2017) sets out the 'vital' role that nuclear energy is set to play in energy generation beyond 2025. Current nuclear capacity in the UK is 8,883 MWe delivered from 15 nuclear power stations (World Nuclear Organisation, 2018, no pagination). Development of Hinkley Point C, which is due to come on line in 2025, will add a further 3,300 MWe capacity and provide an estimated 7% of the UK's electricity for up to 60 years (EDF, 2018, no pagination).

The intended contribution to UK electricity from Hinkley Point C is considerable, however, critics of the development have noted that although the scheme will deliver low carbon energy, construction, operational and decommissioning costs are extremely high. Hinkley Point C construction costs have been estimated at between £18 and £21 billion (NAO, 2017a, p.4), and full construction, operating and decommissioning costs estimated at £79.3 billion over its lifetime (ibid). In this view, Hinkley is the '*most expensive power plant in the world*' (Dorfman, 2017, no pagination), having been given the

⁶³ A full exploration of impacts of energy pathways on fuel poverty, whilst interesting, is beyond the remit of this thesis. For interest, see Policy Pathways to Justice <http://www.ukerc.ac.uk/programmes/energy-economy-and-societal-preferences/policy-pathways-to-justice-in-energy-efficiency.html>.

preferential strike price of £97/kwh for 35 years, compared with 15 years for renewables (ibid., 2017, no pagination; Watt, 2017).

The decision to withdraw support for coal with CCS on economic grounds, was concurrent with decisions to increase support for new nuclear and gas developments despite unconvincing economics. Such preferential treatment for one energy over others is contrary to the government's stated intentions not to favour any particular industry but instead to create market conditions that favour low carbon (BEIS, 2017b). Any future government decision to expand nuclear must reasonably be suggestive of evidence of its unilateral power. Similarly, in June 2018, the Government withdrew backing for a £1.3 billion Tidal Lagoon development in Swansea, even though independent reviews had previously concluded economic, technical and environmental feasibility (Clark, 2018; BBC, 2018). On this point the Secretary of State for Business Energy and Industrial Strategy said:

'Securing our energy needs into the future has to be done seriously and, when much cheaper alternatives exist, no individual project, and no particular technology, can proceed at any price.'

(Clark, 2018, no pagination)

In addition, the evident inconsistencies and lengthy timescales for decision making,⁶⁴ whilst anecdotal, send further signals to wider stakeholders that the government appears to support certain types of lower carbon energy over others. This matters for three significant reasons; firstly, it corroborates findings here that whilst it is government's stated intention to encourage market solutions to perceived problems with the energy market, the dominant discourse of economic prudence and fiscal responsibility (Gillard, 2016), and the power and temporal sovereignty (Jessops, 2006) it maintains, give the government license to unilaterally determine outcomes. Secondly, it reiterates points raised in chapter five relating the weak and inconsistent messages from government causing confusion and uncertainty in markets and amongst investors. Finally, it suggests that beyond planned coal closures and expansion of gas, it will be difficult to meet carbon emissions reduction targets with a market only approach.

⁶⁴ 2003 to 2018 for Swansea Tidal (BBC, 2018)

What becomes evident from this analysis, which corroborates findings discussed in chapters five and seven, is that for each of the alternatives to coal with CCS, there are corresponding technical, economic or policy complexities which will make their development problematic. In addition, it is unclear whether the Government's main policy on carbon reduction is based in economic rationality as claimed or on political preference. This is potentially problematic as it may either lead to shortages in energy supply (the energy gap), or CO₂ emissions reduction commitments not being met. This has clear implications for decision makers and the implementation of policy. It suggests that decision makers need to look beyond the impacts of one single policy measure. The following section expands on this to highlight the wider policy and regulatory changes between 2014 and 2018 that are key in affecting both the market for coal and the future of CCS.

8.2 Policy context and the consultation on coal

As discussed in chapter two, under the Climate Change Act 2008, the UK government is required to establish and implement policies which will ensure the UK is able to meet its five carbon budgets up to 2050. This section links with this and wider debates on the government's approach to policy to underpin the discussion on the implications for future coal and CCS use in section 8.3. To do this, it brings together the key features of the discourse including government policy, energy and industrial strategies, with a discussion on the government's Consultation on Coal (BEIS, 2016).

Government policy to reduce coal in the energy mix is progressive in terms of instituting further reductions in GHG emissions from coal combustion and reductions in coal use to 2025. As this quote suggests, it is also seen as an efficient way of meeting carbon reduction targets:

'Ending our reliance on coal for power generation is... a swift and effective way of reducing the carbon intensity of electricity generation.'

(Clark, 2016, p.6)

Policy changes in the UK over the period 2014 to 2018 intended to move toward an increasingly market centric approach to dealing with complexities in energy supply, have been implemented. Of these, key activities and strategies

that have implications for coal use are: The Clean Growth Strategy, the Industrial Strategy, and the Consultation on Coal.

The Clean Growth Strategy

The Clean Growth Strategy (BEIS, 2017b) is designed to form the corner stone of UK policy relating to energy. It sets out government actions and policy aspirations designed to meet the UK's commitments under the Climate Change Act 2008. Metaphors relating to economic sustainability being core to government policy in the context of the opportunities available from developing a low carbon economy (BEIS, 2017b, p. 30; The CCC, 2017, no pagination), are evident throughout. The strategy, if executed in full (The CCC, 2017), has been widely presented as a positive step towards national goals for both economic growth and deeper GHG reductions. However, questions have been raised over whether the current iteration of the Clean Growth Strategy will be operationalised in time to meet the requirements for the fourth and fifth carbon budgets (ibid., no pagination) especially with current plans for closure of coal, expansion of gas, and no workable strategy to fully develop CCS required by 2030s (Holder, 2018, p1; Aurora, 2017).

It is also worth noting that responses to these concerns about a lack of detail to underpin the strategy and the resultant potential for slippage⁶⁵ from industrial and environmental groups, have been met with confident (somewhat 'promethean' in Dryzek's terms) assurances from the government. This ties with features of the discourse relating to a potential emergence of policy and energy gaps.

The Industrial Strategy

First launched in 2016 and amended in 2017 the government's Industrial Strategy is, again, designed to provide a signal to investors to move away from heavy, carbon intensive industry. Two features of the strategy are notable for this research. Firstly, whilst there is an intention for the Industrial Strategy to be read alongside the Clean Growth Strategy (BEIS, 2017b) the limited specific connection to energy, existing industrial sectors (Fothergill et al, 2017, p.5) or the environment has been critiqued (CCC, 2017). Secondly, and

⁶⁵ For an interesting example see Lord Deben's letter to the RH Claire Perry MP, Minister for Climate Change and Industry and her response.

importantly for this thesis, the dominant focus on R&D in high technology industries favours ‘...*an exceptionally narrow range of sectors...*’ (Fothergill et al, 2017, p.2) dominantly based in the south of England is problematic. One of the core features of this discourse is the implication that the government is potentially ‘...*trying to pick winners...*’ (ibid., p.5) rather than providing conditions under which a range of industries will thrive. This chimes with the discourse relating to government’s power and sovereignty and unilateral decisions to back one energy option over others.

The second iteration of the strategy published in 2017 included amendments designed to specifically address the challenges of clean energy, and link to the Clean Growth Strategy. However, critiques relating to the absence of clear action plans for CCS and a missed opportunity to reduce emissions in existing industrial sectors such as cement and chemical production (Haszeldine et al, 2015) are evident.

The UK Consultation on Coal

In November 2015, the UK Government announced their intention to support a phased reduction in coal use in electricity generation with a view to removing coal from the energy mix entirely by 2025. As part of their approach, they launched the Consultation on Coal in 2016, the aim of which was:

‘...to ensure that the closure of remaining unabated coal-fired power stations in Great Britain takes place in a way that minimises the impact on the electricity system and provides certainty for investors to enable them to invest in lower-carbon alternatives in good time to replace the lost capacity.’

(BEIS, 2018, p.5)

What is notable in this aim, is that in and of itself it connects the coal reduction debate with expanding the market centric approach to delivering future energy objectives. Table 17 below summarises the consultation process and outcomes to date; the timeline, and especially delays in the process are relevant here. Two interesting features that chime with the metaphors and power dynamics identified in chapters five and six, and with this thematic analysis of changes to market may be drawn from the consultation as follows.

| <i>Date</i> | <i>Action</i> |
|-----------------|---|
| November, 2015 | UK government withdrew support for CCS programme |
| November, 2016 | Launch of consultation on coal. Questionnaire on BEIS website. Published Impact Assessment |
| September, 2017 | Prime Minister Theresa May announced (in Canada) UK intention to phase out unabated coal by 2025 |
| October, 2017 | Summary of consultation released: <ul style="list-style-type: none"> • 94 unique respondents (40 business, 29 NGO, 16 individuals, 6 academics, 2 political parties, 1 trade union). 5845 total responses through NGO campaign (BEIS, 2017c, p. 4). • Announcement that full response due by November 2017. Response delayed until January 2018. |
| January, 2018 | Government response to consultation report released: <ul style="list-style-type: none"> • Support for government proposal on closure of coal • Some preference for closure before 2025 deadline • Coal with CCS no longer seen as viable without Government backing • Calls for more joined up approach to coal closures and energy policy e.g. investment in renewables and abated gas |

Table 17 UK Consultation on Coal 2016 to 2018

Complexity in the governance of coal: The economics of coal use are complicated by ‘distortions’ in the wider energy market (Financial Times, 2017b) which lead to uncertainty in decision making. The Government response to the consultation therefore has many (no doubt necessary) caveats and conditions within it as exemplified by this extract:

‘This suggests that the majority of our remaining coal power stations will close (or invest to abate emissions) in the early 2020s, with around 1.5 GW of unabated coal capacity likely to remain until 2025.’

[Emphasis added]

(BEIS, 2018, p.8)

This complexity and lack of clarity becomes relevant given the importance of both detail and timing of Government decisions for investors. The market for coal (and wider energy) is not yet structured in a low carbon way; it still favours low capital expenditure projects (such as conversion to bioenergy at Drax (Drax, 2016)).

Government power and sovereignty: The Impact Assessment which accompanied the consultation set out potential timescale scenarios for the closure of coal fired plant. One option presented was to close/abate coal earlier than the government target of 2025. In the summary of respondents, it is noted that:

'Many stakeholders, particularly from NGOs, private individuals and some elements of industry reflected on the analysis presented in the Impact Assessment accompanying the proposals, which suggested it is feasible that all coal plants might close without further intervention in 2021/22. Roughly half of unique responses argued that the date for ending unabated coal should be brought forward (2023 being commonly cited). The responses through the NGO campaign argued this point.'

(BEIS, 2017c, p.5)

In the response to the consultation, this point is noted but rejected without significant justification.

'...we have considered this, but our assessment is that 2025 is the appropriate date for intervention, balancing the need to ensure security of our electricity supplies, maintaining affordability and the benefits of emissions reductions.'

(BEIS 2017c, p.8)

Here, whilst the government aims to promote investment in low carbon alternatives to coal, it will maintain its final say on coal use:

'Ministers will also retain emergency powers to suspend the phase-out in the case of an emergency shortfall in electricity supplies... We consider it prudent for the Secretary of State to retain provisions to act ...where there might be a shortfall in electricity generation, or risk of one, and that suspension would wholly or partially mitigate that risk.'

(Williams, 2018, no pagination)

It is also worth noting that during the consultation, there was little attempt to engage with wider stakeholders. The government had stated their intention to engage widely (BEIS, 2016), but in reality, took little action to engage beyond consultations with incumbent actors.

By drawing out the detail of these features, this section has highlighted the degree of complexity that remains in the market for coal. On balance, the analysis suggests that UK energy policy does not currently adequately reflect on or address the complexities of coal use. If coal is to be removed from the energy mix by 2025 as the government intends, policy will need to be strengthened and more coherently aligned with wider strategies in order to support decision making in this direction. Under current conditions, coal use will undoubtedly stay low, and there will be periods of no coal, but it will remain an option for suppliers unless the regulatory framework relating to coal is made more robust or signals to stimulate investment in low carbon alternatives are strengthened.

8.3 The future of CCS and sustainability of coal.

This thematic analysis has so far illuminated a number of interesting and interconnected themes which have consequences for the economic, social and environmental aspects of sustainable development as discussed elsewhere in this thesis. This section briefly summarises these themes and draws out connections with the earlier analysis.

Embedded governance complexities mean a market centric approach will be challenging

The UK government seeks market-centric solutions to energy problems and is implementing policies designed to (i) increase the cost of emitting carbon and (ii) stimulate investment in alternative technologies to coal with CCS. In addition, investment in lower carbon technology is not yet leading to an increase in electricity capacity which is concerning as further coal plants are set to close in near future (National Grid, 2016).

This chimes with the discussion in chapter seven which asserts that changes to governance arrangements over time have unexpected economic, social and

environmental impacts. Policy prescriptions designed to in this case reduce CO₂ and phase out coal, may, in reality be less impactful because of a wicked context which has emerged over time.

Current policy does not support joined up thinking across sectors

Environmental and industrial actors are consistent in their views on the need for the government deliver a regulatory and governance framework that adequately reflects the complexity of the issue, but does not lower its commitments to low carbon. This chimes with findings in chapter five and it is interesting to note that this rhetoric has been dominant for well over a decade. For example:

‘A number of respondents, mostly from industry and academia/research organisations, expressed views on the importance a whole-system approach to determining security of supply.’

(BEIS, 2017c, p. 7)

In this sense it is viewed as important to develop policy which support connections across the energy and wider industrial sectors. Whilst the Clean Growth Strategy and the Industrial Strategy have been recognised as a foundation for this, the lack of meaningful connection to other government strategies (industrial, transport, health, employment), and narrow focus (Fothergill, et al, 2017) is problematic. In addition, the detail of policy and plans which will allow investors and other decision makers to act on the strategy is slow to materialise.

Government sovereignty; economic precedence, ‘post new coal’?

This thesis contests that the collapse of the market for coal with CCS is illustrative of government sovereignty and power in decision making. What this thematic analysis of the period 2014 to 18 has added to the understanding developed here is that, whilst nominally dominant, economic rationality is *not* evident across the whole energy debate. Government decisions on energy are political and strategic, and whilst there is an ideological preference for market centric, ML/MA policy tools, ultimately unilateral government decisions determine the what, how and when of low carbon technology development. This sovereignty suggests that a ‘post new coal’ era – i.e. one in which monocentric governance and removal of coal from the energy mix dominate -

is emerging. The consequences of this are considered further in chapter nine with reference to the contribution this analysis makes to wider understanding of governance of complex contexts.

What this means for CCS and the sustainability of coal

The government has stated that in order to meet commitments under the Climate Change Act 2008, full-scale CCS will need to be on line for gas and bio-energies in the 2030s (BEIS, 2017b), yet there are no meaningful plans in place to do this. In the current context the economics of CCS depends on the rate of carbon tax, but also wider on market features as discussed above in section 8.1.2 and in chapter five.

It is important to note, that without intervention, the costs of energy are ultimately passed on to business and domestic consumers. For the UK, the costs of meeting both energy demand and emissions reduction targets *without* coal and CCS have been estimated as significantly higher than with it (NAO, 2017a; IEA 2015). In addition, as discussed in section 2.1.2, coal use is forecast to increase worldwide (IEA, 2017) with continued use for electricity as well as other industrial purposes. In removing funding and support for UK based clean coal technologies, the government has done two things: removed the option of clean coal in the energy mix in the near term and reduced, but not removed, uncertainty in the market for coal. By maintaining a get out clause, whereby the government holds an option to keep coal on the grid should it be necessary (see 8.2), the signals to the markets are inconsistent. This implies that even given the significant changes in coal use over recent years, the policy detail does not support the *fundamental* (i.e. irreversible) changes required to remove coal from UK energy picture permanently. This analysis suggests that unilateral decisions by the UK Government on coal and wider energy issues, have, ultimately determined the immediate future of coal and CCS in the UK. However, the longer-term role of coal and the role of CCS is more complex.

8.4 Chapter summary

This chapter has brought the thesis up to date with a reflection on how the complications of the changing market dynamics for coal and CCS affect the nature of decision making. To do this, key features of the changing economics

of coal in the period 2014 to 2018 were presented in section 8.1. These have then been drawn out to explicitly consider the effect of key government decisions and actions on coal use and the future of coal. In particular in withdrawal from CCS funding, the capping of the Carbon Price Floor, and Clean Growth and Industrial strategies have been explored.

This analysis connects with earlier finds that wicked complexities in the market for coal contribute to both the collapse of CCS and the continued, albeit reduced, unabated coal use. The limitations of a weak, liberalised regulatory framework (one which does not address social, environmental and economic challenges), together with government dominance, suggest it will be challenging for the UK to continue to meet both energy demand and emissions reduction targets without considerable policy changes. This feature of the debate links with discussion and conclusions drawn in chapter nine to give a comprehensive commentary on sustainable development in the case of a particular industry.

Chapter 9 - Conclusion

The primary aim of this research has been to establish whether, why and how, new forms of governance affect the prospects for sustainability of 'new coal'. This thesis conceptualises coal use in UK electricity generation as a wicked problem (Rittel and Webber, 1973); one that is multi-layered, complex and has multiple, competing explanations. It uses both governance and sustainability as organising principles to explore, characterise and understand the changing features of the governance of coal and implications for the prospects of the sustainability of coal use in the UK.

To gain an in-depth, qualitative understanding of the research problem, the novel approach of bringing the organisational fields literature to the governance literature was developed here. By building on new institutionalism, this approach works well to explore a wicked problem where considering a single snapshot, or policy, or transition pathway, or economic model would not equally illuminate the distributive effects of dominant actors within and between fields, or over time or levels. This analysis finds that whilst the characteristics of governance - arrangements, agents and institutions - impact prospects for the sustainability of coal, they do so in unexpected and potentially unknowable ways in this wicked context.

The insights developed here show that dynamic processes of organisational field change, create and exacerbate complexity, leading to multiple disconnects both between and within fields which allows dominant actors to maintain (and indeed increase) power over time. Specifically, social organisational fields have become diffuse, heterogeneous and unpredictable and environmental fields have embedded disconnects over time and level of analysis. In contrast, economic fields have, over time and levels, become more focussed with dominant actors exhibiting power beyond the economic organisational fields and at both levels. This wicked context has potential for conflict and contestation and makes outcomes from ML/MA governance arrangements, designed to promote new coal, difficult to predict. Ultimately, this has important implications for the sustainability of future coal use discussed here.

This chapter provides a summary of the research structure, content and overarching findings. It then outlines the main contributions of the research in applied and academic contexts as well as the limitations in the context of how these create opportunities for future research. Finally, it presents some concluding thoughts on this environmental social science challenge.

9.1 Summary of the research

This research conceptualised coal use in the UK as a wicked problem (Rittel and Webber, 1973) with multiple layered complexities, with different potential solutions that are difficult to ascertain. Coal use in electricity generation was identified as having significant economic, environmental and social impacts, both contemporarily and historically. In the UK and internationally, coal use is at an interesting juncture; despite recognised concerns about the unsustainability of its use, coal, for the substantive part of the period under study and for some key actors at least, is seen as a stable, readily available fuel source which, with technological adaptations such as CCS, has the potential to become a low carbon energy option. For others, removing coal from the energy mix is an effective way of further reducing carbon emissions in line with carbon budgets.

In order to attend to this wicked problem, a novel analytical approach has been developed and applied to good effect. Governance and sustainability literatures have been brought together to add strength to both debates where, as suggested by Adger and Jordan, ‘unsustainability’ can be considered a ‘crisis of governance’ (2007, vii). By using both governance and sustainability as organising principles, it was possible to illicit deeper meaning from the data in order to first discover and then analyse distinct eras of governance. The ‘desirability’ of multi-level, multi-actor polycentric governance when dealing with complex environmental challenges (Gillard, 2016; Gouldson and Bebbington, 2007) has been discussed in chapters one and two.

A multi-methods methodology was adopted to consider the case of UK coal use between 1960 and 2018. Texts from interviews (35), non-participant observation of naturally occurring events (12) and document analysis (317 documents) were generated. An adapted version of Dryzek’s (2005) approach to discourse analysis was used to identify key metaphors, actors, entities and

the relationships between them were identified for each era up to 2014. This approach illuminated organisational fields of governance which became the useful unit of analysis for this work. The analysis shows that within each era, isomorphic forces create field dynamics which effect change. Specifically, the analytical strength this approach afforded as allowed the research questions to be addressed.

Chapters four to six present the organisational fields of governance discovered and illuminated for the case of coal use in the UK. Institutional theory would suggest a 'merging' and gradual coming together of institutions and fields through processes of structuration, however what has been demonstrated clearly for this wicked context, played out over time and across multiple levels, is that there is an often ignored temporal disconnect between organisational fields. This disconnect (and others) has arisen, and is relevant, because of distinct power dynamics that have emerged differently over time in different fields. In short, government, political and business time frames (i.e. economic) do not match environmental, cultural or societal time frames for change. In this sense, one of the core outcomes of new governance arrangements in this wicked context, is the creation of discord between fields and within fields where economic actors and entities have significant agency.

Chapter seven provides a fuller discussion of the research findings and implications for the sustainability of coal. In summary, the organisational fields of governance show that structure and agency associated with decision making and governance of coal are heavily skewed toward economic factors. Social and environmental issues do not feature equally in the discourse over time, beyond single policies which are changed depending on economic principles of powerful actors within the organisational fields. This is evidenced for example, by the impact of changes in government.

Chapter eight then brings the research up to date by developing a thematic analysis of documents and bureaucratic data from 2014 to 2018. In doing so it highlights and then and considers the implications of this analysis on the current market for coal and future of CCS in the UK. This approach to considering wider contexts and organisational fields is useful in considering not simply *how* a context has emerged, but *why* and the likely future outcomes of current dynamic processes. Whilst it is neither possible nor intended to

forecast specific outcomes, there is benefit (in practice and policy as well as academic terms) from explaining these complexities. This approach also leads to a more complete thesis which offers a thorough appreciation of the connections and disconnects between the three fundamental elements of sustainable development in this wicked context.

Returning to the overarching conceptual question, 'Do new forms of governance effect the prospects for the sustainability of new coal?' The answer is yes, but in this wicked context (i.e. in this case where there is not a straightforward market solution to an environmental problem), new governance arrangements are not performing in such a way as to steer society toward harmonious, sustainable outcomes. Instead, the role and motivations of dominant Government actors for this case and the relative diffusion of social fields mean that governance arrangements cannot be considered either multi-actor or multi-level in any meaningful way. In the absence of either further regulatory mandates to reduce coal use, or stronger economic conditions in favour of alternatives to coal, dominant actors' motivations are being acted out. At present this means intended moves toward reducing coal further. However, what this research demonstrates is that complexities in the market for coal have already extended the use of unabated coal beyond scheduled closures. Given noted gaps in policy (The CCC, 2017), lack of strategy for developing CCS and the Government's intention to maintain the option of continued coal use, unabated coal may remain part of the energy mix beyond 2025.

9.2 Contribution

In answering the research questions, this thesis contributes to debates on the shaping of processes and outcomes of multi-level, multi-actor (ML/MA) or 'new' governance arrangements. In particular, it makes generalizable epistemological, conceptual and applied contributions to knowledge in three core areas. These are:

Firstly, from an epistemological and conceptual perspective, this research builds on and extends the organisational fields literature to develop organisational fields of governance as the unit of analysis. Using both governance and sustainability as organising principles adds analytical strength, and also enabled the wicked problem of coal use to be

conceptualised in an effective manner where a single policy approach would have delivered too narrow results.

Secondly, by bringing together critical approaches to discourse analysis with the strength and legitimacy of new institutionalism to explore a case study, critiques of the case study as a limiting tool (Yin, 2014) are overcome. This methodological advancement means that case specific outcomes relating to how and why fields change due to power dynamics and isomorphic processes at different levels of governance are generalizable to other wicked problems. In doing so, this research also contributes a new way of thinking about novel temporal dimensions to ML/MA governance arrangements. In particular, it proposes that wicked contexts are likely to emerge where structural and agency imbalances have arisen over time. In such circumstances, the efficacy of new governance mechanisms as a means of *stimulating* sustainable development is limited. For the case of coal use in the UK, this research shows that place specific, economic, environmental and social drivers have led to diffuse social and environmental organisational fields. This in turn allows for economic dominance in discourse and policy, which has affected decision making on coal and CCS.

Thirdly, this research shows that the temporal dimension developed here adds not only complexity and conceptual interest to the research problem, but also creates opportunities for greater understanding of wicked contexts in applied settings. As a result, the research lends support to applied and academic literatures relating to limits of 'one-size-fits-all' governance arrangements and provides a means of efficiently illuminating features of the governance arrangements in wicked contexts such as coal use in the UK.

9.3 Limits and critique

As with most research projects, there are limits to the reach and scope of this research and alternative approaches to the analysis could have been applied. Chapters seven and eight, and section 9.2 above set out the strengths and contributions of this research, this section considers some of its limits.

This was a necessarily a large wide ranging study, that covered a long time frame in order to develop a meaningful understanding of the problem under consideration. Whilst the historical institutional approach added depth and

interest and using governance and sustainability as organising principles helped to limit the scope, there were notable methodological challenges associated with the scale and scope of the research. Firstly, it was difficult to get either depth or comparability over the longer time frame. To overcome this challenge, archive and bureaucratic data were triangulated with reflections from individuals generated in primary data. Secondly, linking methods and literatures has produced analytical and conceptual benefits here but the approach is time consuming. An alternative approach would have been to limit the study either to a shorter time frame or to a smaller problem, however, neither approach would have yielded similarly generalizable results or the novel contribution in the same way.

Notwithstanding the discussions above on the analytical strength of the novel approach adopted, as expected for a wicked social science problem, the data could have been differently interpreted. One feature of the discussion in chapter seven was that through isomorphic processes, organisational fields move toward harmonious states; this thesis suggests that where there are diffuse or dysfunctional field, they can move toward collapse. A different interpretation might suggest that whilst there has been some diffusion, the fields are now moving toward harmony around dominance of government actors for a wicked problem. There is legitimacy in this interpretation, however the temporal dimension of the problem suggests that even if this is the case, the wicked context means that harmony will not be reached because of competing isomorphic processes across fields. Instead, the imposition of new governance mechanisms through coercive measures has led to *more* discord not harmony. In practice the evidence presented in chapter eight since the collapse of coal with CCS in the UK supports the interpretation here.

A final reflection on the limits of this study also introduces potential for future research. One of the features of the discourse that (if time and resources had permitted) that could usefully have been explored in more depth is the drivers and dynamics beyond the levels of analysis here. Both international and local level metaphors emerged from the discourse, but to a lesser extent than national and regional; further consideration of these additional levels would no doubt have helped to identify additional or corroborate dynamic forces discussed here.

9.4 Future direction

The findings from this research and the limitations of this study both provide opportunity for, and potential future direction for this work. Starting with the limitations, as noted above, the research is wide ranging which provides opportunities for further study within each of the areas explored. Of particular interest is further consideration for how the organisational fields of governance approach can be used to develop a better understanding of how drivers and dynamic processes at one level, drive change with implications for sustainability at another. In terms of future direction of the research, the method developed proved especially useful in conceptualising and then compartmentalising a wicked problem without losing depth or richness. This approach could legitimately be tested further for its efficacy in other wicked problems.

From an applied policy perspective, this research has found that for wicked problems policy makers (i) need to look beyond single policy to the organisational field(s) to better understand problem (ii) explore the historical emergence to better understand drivers of discord useful, and (iii) look beyond favoured market centric solutions where these complexities dictate ML/MA governance arrangements will be limited. This thesis both provides theoretical underpinning for why and how, and also suggests methodologies for how to adapt to other wicked scenarios.

9.5 Concluding thoughts

This research makes significant methodological and conceptual contributions to debates on the efficacy of ML/MA governance arrangements in steering sustainable development outcomes in wicked contexts. Using the organisational field as the unit of analysis, it illuminates the relationships and circumstances that create such wicked problems that might not otherwise be understood.

This thesis adds an interesting temporal dimension to ML/MA debates for wicked contexts. Through use of a novel approach it illuminates previously unknown dynamics within and between organisational fields. These dynamics reveal that although policy and governance arrangements are on the surface, pluralistic, multi-level, multi-actor, in reality power and agency is centred with

dominant economic actors who are able to shape fields through coercive, mimetic and normative isomorphic processes. Furthermore, the diffuse social field together with pacifying, homogenising nature of existing mechanisms of public engagement within the contemporary organisational field for governance, delegitimises 'non-legitimate' and means dominant actors continue to shape policy and development outcomes to suit their motivations. In the case of coal, this has meant, and continues for the present to mean, that sustainability features beyond the economic are not fully embedded in to policy or practice.

Powerful institutional logics of governance have evolved through isomorphic processes from within the economic organisational fields which are shaped by and shape business and state actors more significantly than. The resulting institutional logics include notions that CSR, community engagement, public consultation and acceptance, new forms of governance, efficiency of markets and SD are essential, yet the form these initiatives take are less well considered and rarely address material issues. Further to this, institutional logics have evolved from *within* dominant government and state fields and without equivalently community or social actor agency. Fields have diversity required for sustainability. To return to Scott:

'Structure and outcomes are not those planned or intended, but the consequence of unanticipated effects and constrained choice.'

(Scott, 2008, p31)

The thesis agrees that because of isomorphic ripples over time and within fields, power and agency dynamics are evident in organisational fields of governance. This insight and understanding of the evolution of fields is useful to consider prospects for sustainability of coal and why, currently, unabated coal is 'accepted' as being part of the energy mix. This timely research contributes to debates that aim to unpick this elaborate, wicked problem. In concert with Rittel and Webber (1973, p.159), the conclusions drawn suggest the need for greater understanding of issues wider than the market for energy if sustainable outcomes are to be achieved.

'As we seek to improve the effectiveness of actions, as system boundaries get stretched, and as we become more sophisticated about

workings of open societal systems, it becomes ever more difficult to make planning the idea operational.'

(Rittel and Webber, 1973, p.159)

To conclude, the compelling argument developed in this thesis shows that, in answer to the research questions, yes, new forms of governance do impact the prospects for the sustainability of new coal, but in unexpected ways for this complex, wicked problem.

References

- 2CoEnergy. 2012. Making the Business Case for CCS. *2CoEnergy Ltd.* [Online]. No date. [Accessed 28 April 2013]. Available from: <http://hub.globalccsinstitute.com/sites/default/files/publications/85746/making-business-case-ccs.pdf>.
- Adger, W N. and Jordan, A. 2009. *Governing Sustainability*. Cambridge, UK: Cambridge University Press.
- Agyeman, J. 2005. *Sustainable Communities and the Challenge of Environmental Justice*. New York: NYU Press.
- Amalric, F. 2005. Working Paper 01/5 The Equator Principles, a Step Towards Sustainability? *Nottingham: Centre for Corporate Responsibility and Sustainability*.
- Aragon, F M., Rud, J P, and Toews, G. 2015. Mining closure, gender and employment reallocations: the case of UK coal mines [Online] Oxford Centre for the Analysis of Resource Rich Economies, University of Oxford. [Accessed 10 October 15]. Available from: <https://www.oxcarre.ox.ac.uk/images/stories/papers/ResearchPapers/OxCarreRP2015161.pdf>.
- Archer, M., 1995. *Realist Social Theory: The Morphogenetic Approach*, Cambridge, UK: Cambridge University Press.
- Arnstein, S. 1969. A ladder of citizen participation. *Journal of American Institute of Planners* **35**(4), pp.216–224.
- Ashworth, P., Bourghan, N., Mayhew, M., and Miller, F. 2010. From research to action: Now we have to move on CCS communication. *International Journal of Greenhouse Gas Control*. [Online] **4**(2), pp.426-433 [Accessed 30 June 2014]. Available from: <https://www.sciencedirect.com/science/article/pii/S1750583609001339>.
- Ashworth, P., Bradbury, J., Wade, S., Ynke Feenstra, C.F.J., Greenberg, G. Hund, G., and Mikunda, T. 2012. What's in store: Lessons from implementing CCS. *International Journal of Greenhouse Gas Control* **9**, pp.402-409.

- Atkinson, G, Dietz, D and Neumayer, E (2007). *The Handbook of Sustainable Development*. Cheltenham, UK: Edward Elgar.
- Audi, R. 2007. *Epistemology: A contemporary introduction to the theory of knowledge (2nd edition)*. Routledge, London UK.
- Aurora. 2017. *Carbon price thaw post freeze future*. UK: Aurora Energy Research. [Online]. July 2017. [Accessed 23 February 2018]. Available from: <https://www.auroraer.com/insight/carbon-price-thaw-post-freeze-future-gb-carbon-price-2/>.
- Bachrach, P., and Baratz, M.S. 1970. *Power and Poverty: Theory and Practise*. New York, USA: Oxford University Press.
- Bailey, K, and Grossardt, T. 2010. Toward Structured Public Involvement: Justice, Geography and Collaborative Geospatial/Geovisual Decision Support Systems. *Annals of the Association of American Geographers*, 2010, **100**(1), pp.57-86.
- Baker, S., 2006 *Sustainable Development*. London, UK: Routledge.
- Baker, S. A., and Eckerberg, K. 2010. *In Pursuit of Sustainable Development: New Governance Practices at the Sub-National Level in Europe*. Oxford, UK: Routledge.
- Barkemeyer, R., Stringer, L.C., Hollins, J.A. & Josephi, F. 2015. Corporate reporting on solutions to wicked problems: Sustainable land management in the mining sector. *Environmental Science & Policy*, **48**, pp.196 - 209.
- Bauer, M.W., Jordan, A., Green-Pedersen, C., and Héritier, A. 2012. *Dismantling Public Policy: Preferences, Strategies, and Effects*. Oxford, UK: Oxford University Press.
- BBC. 2015. Closure of Kellingley pit brings deep coal mining to an end. *BBC* [Online]. 18.12.15. [Accessed 18 December 15]. Available from: <http://www.bbc.co.uk/news/uk-england-york-north-yorkshire-35124077>.
- BBC. 2018. £1.3bn Swansea Bay tidal lagoon project thrown out. *BBC*. [Online] 25.06.18. [Accessed 30 June 2018]. Available from: <https://www.bbc.co.uk/news/uk-wales-south-west-wales-44589083>.

- BBC Archives. 1938 to 1990. Coal mining in Britain collection: the tory of coal mining from coal face to the strike. *BBC Archives*. [Online]. Archived 2014. Available from: <http://www.bbc.co.uk/archive/mining/>.
- Beatty, C., Fothergill, S., and Powell, R. 2007. Twenty years on, has the economy of the coalfields recovered. *Environment and Planning A* **39**, pp.1654-1675.
- Begg, D, Fischer, S and Dornbusch, R. 2005. *Economics*. Eighth Edition. London, UK: McGraw Hill.
- Blaikie, N. 2010. *Designing Social Research*. 2nd Edition. Cambridge: Polity Press.
- Blowfield, M. 2005. 'Corporate Social Responsibility: reinventing the meaning of development?' *International Affairs*. **81**(3), pp.515–52.
- Blowfield, M. and Murray, A. 2008. *Corporate Responsibility: A Critical Introduction*. Oxford, UK: Oxford University Press.
- Bolton, R., Foxon, T., and Hall, S. 2016. Energy transitions and uncertainty: Creating low carbon investment opportunities in the UK electricity sector. *Environment and Planning C: Government and Policy*. **34**(8), pp.1387–1403.
- Boot-Handford, M. E., Abanades, J. C., Anthony, E. J., Blunt, M. J., Brandani, S., Mac Dowell, N., Fernández, J. R., Ferrari, M.-C., Gross, R., Hallett, J. P., Haszeldine, R. S., Heptonstall, P., Lyngfelt, A., Makuch, Z., Mangano, E., Porter, R. T. J., Pourkashanian, M., Rochelle, G. T., Shah, N., Yao, J. G., and Fennell, P. S. 2014, 'Carbon Capture and Storage Update', *Energy and Environmental Science*, **7**, pp.130–89.
- Bradach, J. L. 1998. *Franchise Organisations*. Boston, US: Harvard Business School Press.
- Brinkerhoff, D., and Brinkerhoff, J. 2011. 'Public Private Partnerships: Perspectives on purpose, publicness and good governance' *Public Administration and Development* **31**, pp.2-21.
- Brown, G. 2017. British power generation achieves first ever coal-free day. *The Guardian*. [Online]. 21.04.17. [Accessed 22 April 2017]. Available

from: <https://www.theguardian.com/environment/2017/apr/21/britain-set-for-first-coal-free-day-since-the-industrial-revolution>.

- Brunstig, S., and Upham, P. 2011. Communicating CCS: Applying communications theory to public perceptions of carbon capture and storage. *International Journal of Greenhouse Gas Control* **5**(6), pp. 1651-1662.
- Bryman, A., 2012. *Social Research Methods*. 4th Edition. Oxford, UK: Oxford University Press.
- Burr, V. 2003. *Social Constructionism*. 2nd edition. East Sussex, UK: Routledge.
- Burrell, G. A. and Morgan, M A, 1979. *Sociological Paradigms and Organisational Analysis: Elements of the Sociology of Corporate Life*. London: Heinemann Educational.
- Calder, F and M Culverwell 2004. *Following up the World Summit on Sustainable Development Commitments on CSR*. Chatham House, Royal Institute of International Affairs [Online]. [Accessed on 12 December 08]. Available from: <http://www.eldis.org/go/home&id=15904&type=Document>.
- Campos, N. and Nugent, J. 1999. Development Performance and the Institutions of Governance: Evidence from East Asia and Latin America. *World Development*, **27**, pp.439-52.
- Carbon Brief. 2013. Unpopular but tenacious: A guide to the UK carbon price floor. *Carbon Brief*. [Online]. 19.11.2013. [Accessed 01 July 2018]. Available from: <https://www.carbonbrief.org/unpopular-but-tenacious-a-guide-to-the-uk-carbon-price-floor>.
- Carbon Brief. 2015. UK carbon emissions fell 9% in 2014. *Carbon Brief*. [Online]. 04.03.2015. [Accessed 01 July 2018]. Available from: <https://www.carbonbrief.org/analysis-uk-carbon-emissions-fell-9-in-2014>.
- Carbon Brief. 2016. Two charts show how UK coal use is collapsing. *Carbon Brief*. [Online]. 22.12.2016. [Accessed 01 July 2018]. Available from:

<https://www.carbonbrief.org/two-charts-show-how-uk-coal-use-is-collapsing>.

Carbon Brief. 2017. UK carbon emissions fell 6% in 2016 after record drop in coal use. *Carbon Brief*. [Online]. 06.03.2017. [Accessed 01 July 2018]. Available from: <https://www.carbonbrief.org/analysis-uk-cuts-carbon-record-coal-drop>.

Carbon Capture and Storage Association. 2009. Tackling Climate Change. CCSA [Online]. No date. [Accessed 10 April 2009]. Available from: <http://www.ccsassociation.org/why-ccs/tackling-climate-change/>.

Carbon Capture and Storage Association. 2014. *CCSA web pages* [Online]. Available from: <http://www.ccsassociation.org>.

Carrington, D. 2009. No new coal without carbon capture, UK Government rules. *The Guardian* [Online] 23.04.2009 [Accessed 28 April 2009] Available from <https://www.theguardian.com/environment/2009/apr/23/carbon-capture-plans>.

Carrington, D. 2015. UK cancels pioneering £1billion carbon capture project. *The Guardian*. [Online]. 25.11.15. [Accessed 20 December 2015]. Available from: <https://www.theguardian.com/environment/2015/nov/25/uk-cancels-pioneering-1bn-carbon-capture-and-storage-competition>.

Cash, D. W., Adger, W.N., Berkes, F., Garden, P., Lebel, L., Olsson, P., Pritchard, L., and Young, O. 2006. Scale and cross-scale dynamics: governance and information in a multilevel world. *Ecology and Society*. [Online]. 11(2), p8. [Accessed 10 October 2009] Available from: <http://www.ecologyandsociety.org/vol11/iss2/art8/>.

Casti, J. 1986. On system complexity: identification, measurement and management. *Biomathematics* **16**, pp.146-173.

Chapman, J. 2008. CCS Association Press Release [Online]. [Accessed 10 October 2009]. Available from: <http://www.ccsassociation.org/press-centre/ccsa-press-releases/>.

- Charmaz, K., 2006. *Constructing Grounded Theory: A Practical Guide Through Qualitative Analysis*. London, UK: Sage.
- Clark, G. 2016. *Coal generation in Great Britain: The pathway to a low carbon future consultation document*. UK: BEIS [Online]. November 2016. [Accessed 3 March 2017]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/577080/With_SIG_Unabated_coal_closure_consultation_FINAL_v6.1_.pdf.
- Clark, G. 2018. Proposed Swansea tidal bay lagoon. *BEIS* [Online]. 25.06.18. [Accessed 28 June 2018]. Available from: <https://www.gov.uk/government/speeches/proposed-swanssea-bay-tidal-lagoon>.
- Clean Air Act 1993. London: The Stationery Office. [Accessed 25 June 2010]. Available from: <http://www.legislation.gov.uk/ukpga/1993/11/contents>.
- Clegg, S. 1989. *Frameworks of Power*. London, UK: Sage.
- Client Earth. 2018. *We must make sure UK coal phase out does not mean gas lock-in*. Client Earth. [Online]. 05.01.18. [Accessed 21 January 2018]. Available from: <https://www.clientearth.org/must-make-sure-coal-phaseout-not-mean-gas-lock/>.CO2Sense. 2012. [Online]. *CBI, IPPR North & TUC back CO2Sense's CCS report*. [Accessed 30 April 2013]. Available from: <http://www.co2sense.co.uk/news/cbi-ippr-north-and-tuc-back-co2sense-s-ccs-report/>.
- Coal Importers Association, no date. *Coalimp website*. [Online]. Available from: <http://www.coalimp.org.uk/4.html>.
- Coal Industry Advisory Board and International Energy Agency. 2008. [Online] *Clean Coal Technologies: Accelerating Commercial and Policy Drivers for Deployment* [Accessed 20 October 2012]. Available from: https://www.iea.org/publications/freepublications/publication/Clean_Coal_CIAB_2008.pdf.
- Cochrane, R. 1990. The CEGB story. *National Power PLC*. [Online]. 30.03.90. [Accessed 10 June 2018]. Available at

https://archive.is/20121209080524/http://www.aboutblyth.co.uk/html/ceg_bstory.html.

Committee on Climate Change (The CCC). 2017. Report to Parliament – meeting carbon budgets: closing the policy gaps. CCC. [Online]. [Accessed 25 January 2018]. Available from: <https://www.theccc.org.uk/publication/2017-report-to-parliament-meeting-carbon-budgets-closing-the-policy-gap/>.

Committee on Climate Change (The CCC). 2018a. An independent assessment of the UK's Clean Growth Strategy: From ambition to action. CCC. [Online]. [Accessed 25 January 2018] Available from: <https://www.theccc.org.uk/publication/independent-assessment-uks-clean-growth-strategy-ambition-action/>.

Committee on Climate Change (The CCC). 2018b. Apply the lessons of the past decade or risk a poor deal for the public in the next. CCC. [Online]. [Accessed 30 June 2018]. Available from: <https://www.theccc.org.uk/2018/06/28/apply-the-lessons-of-the-past-decade-or-risk-a-poor-deal-for-the-public-in-the-next/>.

Comyns, B., Figge, F., Hahn, T. & Barkemeyer, R. 2013. Sustainability reporting: The role of 'Search Experience' and 'Credence' information. *Accounting Forum*, **37**, pp.231-243.

Confederation of British Industry (CBI). 2014. *British businesses must have secure and affordable energy*. Statement from John Cridland, CEO. CBI. [Online]. Available from: <http://www.cbi.org.uk/>

Conklin, J. 2006. *Dialogue Mapping: Building Shared Understanding of Wicked Problems*. Chichester, UK: John Wiley and Son.

Cornwall, A. 2008. Unpacking 'participation'; models, meanings and practice. *Community Development Journal*, **43**(3), pp. 269–283.

Cotton, M. 2014. Environmental justice challenges in UK infrastructure planning: lessons from a Welsh incinerator project. *Environmental Justice*, **7** (2), pp. 39-44.

Cotton, M. & Devine-Wright, P. 2012. Making electricity networks "visible": Industry actor representations of "publics" and public engagement in

- infrastructure planning. *Public Understanding of Science*, **21**(1), pp.17-35.
- Creswell, J. 1998. *Qualitative Inquiry and Research Design: Choosing Among Five Traditions*. London: Sage Publications.
- Creswell, J. W. 2007. *Qualitative Inquiry and Research Design: Choosing Among Five Traditions*. 2nd Edition. California, USA: Sage.
- Creswell, J. W. 2013. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*. 3rd ed. California, USA: Sage.
- Dahl, R. 1958. The Concept of Power. *Behavioral Science* **2**(3), pp.201-215
- Dahl, R. 1983. *Dilemmas of Plural Democracy*. New haven, US: Yale University.
- Dahl, R. 2005. *Who Governs; Democracy and power in an American city*. New York, US: New Haven.
- Dalziel, M. 2010. Why do innovation intermediaries exist? In *Opening Up Innovation: Strategy, Organization and Technology*. London. 16th to 18th June 2010. London: Imperial College, London Business School.
- Davey, E. 2012. CCS competition launched as government sets out long term plans. *DECC*. 3.4.12. [Accessed 30 April 2013]. Available from: <https://www.gov.uk/government/news/ccs-competition-launched-as-government-sets-out-long-term-plans>.
- De Coninck, H. and Bäckstrand, K. 2011. An International Relations perspective on the global politics of carbon dioxide capture and storage. *Global Environmental Change* **21**, pp.368–378.
- Delbridge, R., and Edwards, T. 2013. Inhabiting Institutions: Critical Realist Refinements to Understanding Institutional Complexity and Change. *Organization Studies*, **34**(7), pp.927-947.
- Dempsey, N., Bramley, G., Power, S., and C Brown. 2011. The Social dimension of sustainable development: defining urban social sustainability. *Sustainable Development* **19**, pp.289-300.
- Denzin, N., and Lincoln, Y. 2013. *The Sage Handbook of Qualitative Research* USA: Sage Publications.

Department for Business, Energy and Industrial Strategy (BEIS). 2015. New direction for UK energy policy. *BEIS* [Online]. 18.11.15. [Accessed 2 February 2017]. Available from: <https://www.gov.uk/government/news/new-direction-for-uk-energy-policy>.

Department for Business, Energy and Industrial Strategy (BEIS). 2016. Coal generation in Great Britain: The pathway to a low carbon future consultation document. *BEIS*. [Online]. November 2016. [Accessed 3 March 2017]. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/577080/With_SIG_Unabated_coal_closure_consultation_FINAL_v6.1_.pdf.

Department for Business, Energy and Industrial Strategy (BEIS). 2017a. Energy Trends. *BEIS* [Online]. July 2017. [Accessed 4 January 2018] Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/631146/UK_Energy_in_Brief_2017.pdf.

Department for Business, Energy and Industrial Strategy (BEIS). 2017b. The Clean Growth Strategy: Leading the way to a low carbon Britain. *BEIS*. [Online]. October 2017. [Accessed 20 December 2017]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/700496/clean-growth-strategy-correction-april-2018.pdf.

Department for Business, Energy and Industrial Strategy (BEIS). 2017c. Coal generation in Britain: Summary of responses to consultation. *BEIS*. [Online]. October 2017. [Accessed 20 December 2017]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/650476/unabated-coal-consultation-summary-of-responses.pdf.

Department for Business, Energy and Industrial Strategy (BEIS). 2018a. Digest of UK Energy Statistics (DUKES) 2018: long-term trends. *BEIS*. [Online]. 26.7.18. [Accessed 09 November 2018] Available from:

<https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/statistics>.

Department for Business, Energy and Industrial Strategy (BEIS). 2018b. Implementing the end of unabated coal by 2025: Government response to unabated coal consultation. *BEIS*. [Online]. January 2018. [Accessed 2 February 2018]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/672137/Government_Response_to_unabated_coal_consultation_and_statement_of_policy.pdf.

Department for Business, Energy and Industrial Strategy (BEIS). 2018c. Digest of UK Energy Statistics. Energy Trends: Solid Fuels and Derived Gases. Tables ET2.1 to ET2.6. *BEIS*. [On-line]. June 2018. [Accessed 28 June 2018]. Available from: <https://www.gov.uk/government/statistics/solid-fuels-and-derived-gases-section-2-energy-trends>.

Department for Energy and Climate Change. 2005. Digest of UK Energy Statistics (Archive). *The National Archive*. [Online]. 15.06.06. [Accessed 30 April 2013]. Available from: <http://webarchive.nationalarchives.gov.uk/20060715170620/http://www.dti.gov.uk/energy/statistics/publications/dukes/page19311.html>.

Department for Energy and Climate Change. 2010a. *Developing Carbon Capture and Storage (CCS) Infrastructure*. London, UK: Office of CCS

Department for Energy and Climate Change. 2010b. *UK Carbon Capture and Storage (CCS) Commercial Scale Demonstration Programme: Delivering project 2-4*. London, UK: Office of CCS.

Department for Energy and Climate Change. 2011a. *E.On 2011. FEED Study Presentation*. London, UK: Office of CCS

Department for Energy and Climate Change. 2011b. *Planning our electric future: a White Paper for secure, affordable and low-carbon electricity*. [Online]. [Accessed 1 July 2018]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48129/2176-emr-white-paper.pdf.

Department for Energy and Climate Change. 2012. *Digest of UK Energy Statistics*. London, UK: Office for National Statistics.

Department for Energy and Climate Change. 2012a. [Online] *A Roadmap for CCS* Office of CCS. [Accessed 1 July 2018]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/48317/4899-the-ccs-roadmap.pdf.

Department for Energy and Climate Change. 2012b. [Online] *CCS competition launched as government sets out long term plans*. UK Government announcement 23rd April 2012. [Accessed 25 April 12] Available from: <https://www.gov.uk/government/news/ccs-competition-launched-as-government-sets-out-long-term-plans>.

Department for Energy and Climate Change. 2013. *Maintaining UK Energy Security: Electricity Market Reform* [Online]. [Accessed 20 December 2013]. Available from: <http://webarchive.nationalarchives.gov.uk/20140320233615/https://www.gov.uk/government/policies/maintaining-uk-energy-security--2/supporting-pages/electricity-market-reform>.

Department of the Environment, Farming and Rural Affairs. 2015. *Policy paper 2010 to 2015 government policy: environmental quality*. Defra. [Online]. 08.05.15. [Accessed 24 June 2018] Available from: <https://www.gov.uk/government/publications/2010-to-2015-government-policy-environmental-quality/2010-to-2015-government-policy-environmental-quality>.

Department of the Environment, Farming and Rural Affairs (no date). *Large Combustion Plant Directive 2001/80/EC*. Defra [Online]. Archived 02.07.15. [Accessed 24 June 2018], Available from: <http://webarchive.nationalarchives.gov.uk/20130822084033/http://www.defra.gov.uk/industrial-emissions/eu-international/lcpd/>.

Devine-Wright, P. 2005. Beyond NIMBYism: towards an integrated framework for understanding public perceptions of wind energy. *Wind Energy* **8**(2), pp.125-139.

Digest of UK Energy Statistics (2010 – 2018). [Online]. [Accessed 2011 to 2018, last accessed 20 July 2018]. Available from:

<http://webarchive.nationalarchives.gov.uk/200012061239/http://www.dti.gov.uk:80/epa/digest.htm>.

- Dillon, J., and Wals, A. 2006. On the dangers of blurring methods, methodologies and ideologies in environmental educational research. *Environmental Education Research*, **12**, pp.549-558.
- DiMaggio, P., and Powell, W. W. 1983. 'The iron cage revisited: Institutional isomorphism and collective rationality in organizational fields.' *American Sociological Review*. **48**, pp.148-149.
- Doering, H. 2014. Competing Visions of Community; Empowerment and Abandonment in Governance of Coalfield Regeneration. *International Journal of Urban and Regional Research*. [Online]. **38**(3) pp. 1003-1018. [Accessed 5 June 2015] Available from: <https://onlinelibrary.wiley.com/doi/abs/10.1111/1468-2427.12035>.
- Dorfman, P. 2017. From Fukushima to Hinkley: Dismantling the nuclear argument for a sustainable energy future. UK: UCL [Online]. No date. [Accessed 22 January 2018]. Available from: http://mollymep.org.uk/wp-content/uploads/Presentation_PDorfman.pdf.
- Drake, F. 2009. Black gold to green gold: regional energy policy and the rehabilitation of coal in response to climate change. *Area* [Online] **41**(1), pp.43–54 [Accessed 10 March 2010]. Available from: <http://onlinelibrary.wiley.com/doi/10.1111/j.1475-4762.2008.00853.x/abstract>.
- Drax. 2016. Sustainable Biomass Program: proving biomass is sustainable. UK: *Drax Group Ltd*. [Online] 14.04.16. [Accessed 30 June 2018]. Available from: <https://www.drax.com/sustainability/sustainable-biomass-partnership-proving-biomass-sustainable/>
- Drax. 2017a. Taxing coal off the system. UK: *Drax Group UK*. [Online]. 13.03.17. [Accessed 30 June 2018]. Available from: <https://www.drax.com/energy-policy/taxing-coal-off-the-system/>.
- Drax. 2017b. Annual Sustainability Report 2017. UK: *Drax Group Ltd*. [Online]. 21.03.18. [Accessed 30 June 2018]. Available from: <https://www.drax.com/sustainability/sustainability-reporting-2017/>

- Drax. 2018a. Electric Insights: Fuel usage figures UK. *UK: Drax Group UK*. [Online]. No date. [Accessed 30 June 2018]. Available from: http://electricinsights.co.uk/#/dashboard?period=1-year&start=2017-01-01&&_k=ijcq9v.
- Drax. 2018b. Electric Insights Quarterly: January to March 2018. *UK: Drax Group UK*. [Online]. No date. [Accessed 30 June 2018]. Available from: https://s3-eu-west-1.amazonaws.com/16058-drax-cms-production/documents/180516_Drax_Q1_Report.pdf
- Dryzek, J. 2005. *The Politics of the Earth*. Oxford, UK: Oxford University Press.
- E3G. 2016. Briefing Note: UK coal plant closures: a structural shift away from coal. *E3G [Online]*. March, 2016. [Accessed 30 June 2018]. Available from: https://www.e3g.org/docs/E3G_UK_Coal_Plant_Closures_Briefing_Note.pdf
- EDF. 2018. Nuclear new build projects: Hinkley-C. *EDF Energy*. [Online]. Available from: <https://www.edfenergy.com/energy/nuclear-new-build-projects/hinkley-point-c/about>.
- Edwards, P and Tallontire, A. 2009. Business and development: Towards re-politicisation. *Journal of International Development*. **21**(6), pp.819-833.
- Eisenhardt, K. 1989. Building Theories from Case Study Research. *The Academy of Management Review*. **14**(4) pp. 532-550.
- Ellis, L.A., and Bastin, C.F. 2011. Corporate social responsibility in times of recession: Changing discourses and implications for policy and practice. *Corporate Social Responsibility and Environmental Management*. **8**(5), pp. 294–305.
- Energy and Climate Change Committee. 2016. Future of Carbon Capture and Storage in the UK. *House of Commons HC.692*. [Online]. 02.02.16 [Accessed 12 February 2016]. Available from: <http://www.publications.parliament.uk/pa/cm201516/cmselect/cmenergy/692/692.pdf>.
- E.On. 2009. E.On and Rotterdam Climate Initiative start joint development of CCS Press release 25.02.09. E.On [Online]. [Accessed 2 March 2009]

Available from: <http://www.eon.com/en/media/news/press-releases/2009/2/25/e-dot-on-and-rotterdam-climate-initiative-start-joint-development-of-ccs.html>].

Fagan, M. 1992. [Online]. Crisis in the Pits: 'Dash for gas' that hastened miners' fate. *The Independent*. [Online]. 14.02.92. [Accessed 10 March 2014]. Available from: <https://www.independent.co.uk/news/uk/crisis-in-the-pits-dash-for-gas-that-hastened-miners-fate-1557211.html>.

Fairbrass, J., and Zueva-Owens, A. 2012. 'Conceptualising Corporate Social Responsibility: 'Relational Governance' Assessed, Augmented, and Adapted. *Journal of Business Ethics* **105** pp.321-335.

Fairclough, N. 2005. Peripheral Vision: Discourse Analysis in Organization Studies, the Case for Critical Realism. *Organization Studies*, **26**(6), pp. 915-939.

Farrell, K.N., Kemp, R., Hinterberger, F., Rammel, C., and Ziegler, R. 2005. From 'for' to governance 'of' sustainable development in Europe: what is at stake for further research? *International Journal of Sustainable Development*. **8**(1-2), pp.127-150.

Financial Times. 2017a. UK Urged to renew carbon tax pledge. *The Financial Times*. [Online]. 22.10.17. [Accessed 12 December 2017]. Available from: <https://www.ft.com/content/9b43eba6-b70c-11e7-8c12-5661783e5589>.

Financial Times. 2017b. Gas switch on masks empty pipeline of new UK plants. *The Financial Times*. [Online]. 12.03.17. [Accessed 28 June 2018]. Available from: <https://www.ft.com/content/5d6e99a0-05c0-11e7-ace0-1ce02ef0def9>.

Flannery, T. 2007. *The weather makers: How man is changing the climate and what it means for life on earth*. London, UK: Penguin Books.

Fleetwood, S. 2005. The ontology of organisation and management studies: A critical realist approach. *Organization*, **12**(2), pp.197- 222.

Fleishman, L., Bruine de Bruin, W., and Granger-Morgan, M. 2010. Informed Public Preferences for Electricity Portfolios with CCS and Other Low-Carbon Technologies. *Risk Analysis*, **30**(9). pp. 1399-1410.

- Flick, U. 2015. *Introducing Research Methodology: A Beginner's Guide to Doing a Research Project*. London, UK: Sage Publishing.
- Foden, M., Fothergill, S. and Gore, T. 2014. The State of the Coalfields: Economic and social conditions in the former mining communities of England, Scotland and Wales. *Centre for Regional Economic and Social Research*. Sheffield, UK: Sheffield Hallam University.
- Fothergill, S., Gore, T., and Wells, P. 2017. Industrial Strategy and the Regions: The shortcomings of a narrow sectoral focus. *Centre for Economic and Social Research*. Sheffield, UK. [Accessed 01 July 2018]. Available from: <file:///C:/Users/clair/OneDrive/Documents/PhD%20final/Lit/Fothergill%202017%20cresr30th-industrial-strategy-regions%20shortcomings%20of%20a%20narrow%20sectoral%20focus.pdf>.
- Friedland, R., and Alford, R. 1991. Bringing Society Back In: Symbols, Practices and Institutional Contradictions, in Powell, W.W., and DiMaggio, P. 1991. *The New Institutionalism in Organizational Analysis*, pp. 232-263. Chicago, USA: University of Chicago Press.
- Friends of the Earth, 2005a. Carbon Capture a new solution or another problem. *FoE* [Online]. No date. [Accessed 30 June 2010] Available from: <http://www.foei.org/en/blog/carbon-capture-and-storage-a-new-solution-or-another-problem>.
- Friends of the Earth, 2005b. Briefing paper on Carbon Capture and Storage *FoE*. [Online] No date. [Accessed 30 June 2010]. Available from: https://www.foe.co.uk/sites/default/files/downloads/carbon_capture.pdf.
- Friends of the Earth, 2015. Briefing paper: The return of the dash for gas? *FoE* [Online]. May 2015 [Accessed 25 July 16]. Available from: <https://www.foe.co.uk/sites/default/files/downloads/return-dash-gas-77109.pdf>.
- Friends of the Earth. 2016. *Statement on carbon price support*. Yeo, S. 2016. 'Autumn statement 2016: Key carbon and energy announcements.' *Carbon Brief*. [Online]. 23.11.16. [Accessed 18 February 2017].

Available from: <https://www.carbonbrief.org/autumn-statement-2016-climate-energy-announcements>.

- Furnari, S. 2014. Interstitial spaces: Microinteraction settings and the genesis of new practices between institutional fields. *Academy of Management Review*. **39** (4), pp.439–462.
- G8. 2008. *Item 31 Statement of G8 leaders at Hokkaido Toyako Summit*. The 34th G8 Tōyako, Hokkaido, Japan, on 7th to 9th July, 2008.
- Geertz, C. 1973, *The Interpretation of Cultures*. p.14 in Adger, W. N. and Jordan, A. 2009. *Governing Sustainability*. Cambridge, UK: Cambridge University Press.
- Gibson, C. C., Ostrom, E., and Ahn, K. 2000. The concept of scale and the human dimensions of global change: a survey. *Ecological Economics* **32**, pp.217–239.
- Gillard, R., 2016. Unravelling the United Kingdom’s climate policy consensus: The power of ideas, discourse and institutions. *Global Environmental Change* [Online] **40**, pp.26–36. [Accessed 1 March 2017]. Available from:
<https://www.sciencedirect.com/science/article/pii/S0959378016300863>.
- Gillard, R., Gouldson, A, Paavola, J and Van Alstine, J. 2016. Transformational responses to climate change: beyond a systems perspective of social change in mitigation and adaptation. *WIREs Climate Change* [Online], **7**, pp.251–265. [Accessed 01 March 2017]. Available at http://eprints.whiterose.ac.uk/92526/8/Gillard_et_al-2016-Wiley_Interdisciplinary_Reviews-_Climate_Change.pdf.
- Glasbergen, P. 2007. *Partnerships, Governance and Sustainable Development: Reflections on Theory and Practice*. London, UK: Edward Elgar Publishing.
- Global Carbon Capture and Storage Institute. 2011. [Online] *Global Status of CCS: 2011* [Accessed 23 February 2012]. Available from: <http://hub.globalccsinstitute.com/sites/default/files/publications/22562/global-status-ccs-2011.pdf>.

- Global Carbon Capture and Storage Institute. 2011a. A large scale CO₂ transport network for Yorkshire and Humber. *GCCSI* [Online]. No date. [Accessed 23 February 2012] Available from: <http://www.globalccsinstitute.com/insights/authors/stephenbrown/2011/06/02/large-scale-co2-transport-network-yorkshire-and-humb>.
- Global Carbon Capture and Storage Institute. 2015. [Online] Global Status of CCS: 2015. *GCCSI*. [Online]. No date. [Accessed 5 March 2018] Available from: <https://www.globalccsinstitute.com/publications/global-status-ccs-2015-summary-report>.
- Global Carbon Capture and Storage Institute. 2016. [Online] *How funding cuts stalled the fight against climate change and shredded the UK's reputation* [Accessed 1 July 16] Available from: <http://www.globalccsinstitute.com/>.
- Global Carbon Capture and Storage Institute. 2018. [Online] *Boundary Dam Carbon Capture and Storage Project*. [Accessed 15 April 2018]. Available from: <https://www.globalccsinstitute.com/projects/boundary-dam-carbon-capture-and-storage-project>.
- Goldsmith, A., and Allen-Prescott, R. 1972. A Blueprint for Survival. *The Ecologist*. Penguin. Harmondsworth, UK.
- Gomm, R. 2004. Social Research Methodology: A critical Introduction. Palgrave Macmillan. Basingstoke, UK.
- Gough, C, Mander S, and Haszeldine S. 2010. 'A roadmap for carbon capture and storage in the UK' *International Journal of Greenhouse Gas Control* **4**, pp.1–12.
- Gouldson, A and Bebbington, J. 2007. Corporations and the Governance of Environmental Risk. *Environment and Planning C: Government and Policy*. **25**, pp.4-20.
- Gouldson, A and Murphy, J. 1997. Ecological Modernisation: Restructuring Industrial Society. *The Political Quarterly*. **68**(B), pp.74 – 86.
- Gouldson, A., and Murphy, J. 1998. *Regulatory Realities: The Implementation and Impact of Environmental Regulation*. Earthscan, UK.

- Gouldson, A and Sullivan, R. 2007. Corporate Environmentalism: Tracing the Links between Policy and Performance Using Corporate Reports and Public Registers. *Business Strategy and the Environment*. **16**, pp.1-11
- Goverde, H., Lery, P., and Letner, H. 2000. *Power in Contemporary Politics: Theories, Practices, Globalisation*. London, UK: Sage.
- Greenpeace. 2008a. [Online]. *NGO Joint Statement on CCS*. [Accessed 15 December 2009]. Available from: <http://www.greenpeace.org.uk/files/pdfs/climate/joint-ngo-statement-coal-ccs.pdf>.
- Greenpeace. 2008b. [Online]. When is a coal plant not a coal plant? *Greenpeace*. [Accessed 23 November 2011]. Available from: <https://www.greenpeace.org.uk/when-is-a-coal-plant-not-a-coal-plant20080521>.
- Greenpeace. 2009. [Online]. *Hutton humbled as E.On calls for Kingsnorth delay*. [Accessed 1 July 2018] Available from: <http://www.greenpeace.org.uk/files/pdfs/climate/FOI-1.pdf>.
- Greenwood, M. 2007. Stakeholder Engagement: Beyond the Myth of Corporate Responsibility. *Business Ethics*. **74**(4), pp.315-327.
- Grubler, A. and Wilson, C. (Eds.). 2013. *Energy Technology Innovation: Learning from Historical Successes and Failures*, Cambridge, UK: Cambridge University Press.
- Guardian. 2009. Ed Miliband promises new era of clean coal - but who will pay? *The Guardian*. [Online]. 24.04.09 [Accessed 28 April 2009] Available from: <https://www.theguardian.com/environment/2009/apr/24/energy-coal-carbon-capture-environment>.
- Hajer, M. A. 1995. *The politics of environmental discourse: Ecological Modernisation and the policy process*. Oxford, UK: Oxford University Press.
- Hajer, M., and Versteeg, W. 2005. A decade of discourse analysis of environmental politics: achievements, challenges, perspectives. *J. Environment Policy Planning*. **7**, pp.175– 184.

- Hajer, M., and Wagenaar, H. 2003. *Deliberative Policy Analysis: Understanding Governance in the Network Society*. Cambridge, UK: Cambridge University Press.
- Hall, T. 1981. *King Coal: Miners, Coal and Britain's Industrial Future* Middlesex, UK: Penguin Books Ltd.
- Hammond, J., and Shackley, S. 2010. 'Towards a public communication and engagement strategy for carbon dioxide capture and storage projects in Scotland: A review of research findings, CCS project experiences, tools, resources and best practices.' *CCS project experiences, tools, resources and best practices*. Edinburgh: Scottish Carbon Capture and Storage.
- Hancher, L and Moran, M. 2000. *Capitalism, culture and economic regulation*. Oxford, UK: Clarendon Press.
- Hannan, M. T. and Freeman, J. 1989. *Organizational Ecology*. Cambridge, USA: Harvard University Press.
- Harris, D. 2018. Briefing Paper No. 05927: Carbon Price Floor (CPF) and the price support mechanism. *House of Commons Library* [Online]. 8.01.18 [Accessed 23 January 2018]. Available from: <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/SN05927#fullreport>.
- Haszeldine, R. S. 2009. Carbon Capture and Storage: How Green can Black be? *Science* 325 (5948), pp.1647-1652.
- Haszeldine, R. S. 2016. Can CCS and NET enable the continued use of fossil carbon fuels after CoP21? *Oxford review of economic policy*. **32**(2), pp. 304-322.
- Haszeldine, R S, and Scott, V. 2015. Working Paper: Carbon Capture and Storage (CCS) in the European Union Energy Union's Governance: Submission to the House of Lords EU Energy and Environment Sub-Committee inquiry: EU Energy Governance. *Scottish CCS*.
- Hill, A. 2001. *The South Yorkshire Coalfield A history and Development*. Stroud, UK: Tempus Publishing.
- HM Treasury. 2011. Carbon price floor consultation: The Government response. *HM Treasury* [Online]. March 2011. [Accessed 2 February

- 2017]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/190279/carbon_price_floor_consultation_govt_response.pdf.
- HM Treasury. 2016. Carbon Price Floor. *HM Treasury* [Online]. No date. [Accessed 2 February 2017] Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/179259/carbon_price_floor.pdf.
- HM Treasury. 2017a. Carbon Price Floor (CPF) and the price support mechanism. *HM Treasury* [Online]. 2017. [Accessed 4 January 2018]. Available from: <https://researchbriefings.parliament.uk/ResearchBriefing/Summary/SNO5927>.
- HM Treasury. 2017b. *The Autumn Budget 2017*. London: Crown Publishing. [Accessed 04 December 2017]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/661480/autumn_budget_2017_web.pdf.
- Hoffman, A. J. 2001. *From Heresy to Dogma: An Institutional History of Corporate Environmentalism*. Stanford (CA), USA: Stanford University Press.
- Holder, M. 2018. Government must provide more certainty: Drax, biomass CCS, and the end of coal. *Business Green* [Online]. 19.06.18. [Accessed 30 June 2018]. Available from: <https://www.businessgreen.com/bg/interview/3034457/the-government-must-provide-more-certainty-drax-biomass-ccs-and-the-transition-away-from-coal>.
- Hopwood, B, Mellor, M and O'Brien, G 2005. Sustainable Development: mapping different approaches. *Sustainable Development*, **13**, pp. 38-52.
- House of Commons, Hansard HC Deb 24 November 1980 vol 994 cc193-4.
- House of Commons, Hansard HC Deb 23 April 2009 382.

- Howlett, M. 2014. 'Why are policy innovations rare and so often negative? Blame avoidance and problem denial in climate change policy-making.' *Global Environmental Change* **29**, pp. 395–403.
- Huijts, N. M. A., Midden, C. J. H., and Meijnders, A. L. 2007. 'Social acceptance of carbon dioxide storage' *Energy Policy*. **35**, pp.2780–2789.
- Hulme, C. 2010. 'The Rt. Hon member Chris Hulme's speech to the LSE' *DECC*. Delivered on 02.11.10. [Accessed 22 November 2011]. Available from: <https://www.gov.uk/government/speeches/the-rt-hon-chris-huhne-mps-speech-to-lse>
- Humphrey, W. S., and Stanislaw, J. 1979. 'Energy Growth and Energy Consumption in the UK 1700 to 1975' *Energy Policy* **7**(1), pp.29-42.
- International Energy Agency. 2009. Carbon Capture and Storage: Full-scale demonstration progress update. *IEA*. [Online]. July 2009. [Accessed 8 June 2010]. Available from: https://www.iea.org/publications/freepublications/publication/ccs_g8july09.pdf.
- International Energy Agency. 2015. Carbon Capture and Storage: The solution for deep emissions reductions. *IEA*. [Online]. [Accessed 12 May 2016]. Available from: <http://www.iea.org/publications/freepublications/publication/CarbonCaptureandStorageThesolutionfordeepemissionsreductions.pdf>.
- International Energy Agency. 2016. Key Coal Trends. *IEA*. [Online]. [Accessed 12 May 2016]. Available from: <http://www.iea.org/publications/freepublications/publication/KeyCoalTrends-1.pdf>.
- International Energy Agency. 2017. World Energy Outlook. *IEA*. [Online]. 2017. [Accessed 01 July 2018]. Available from: <https://webstore.iea.org/world-energy-outlook>.
- International Panel on Climate Change. 2005. *Special Report on Carbon dioxide Capture and Storage*. WMO, Geneva.
- International Panel on Climate Change. 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change *Geneva, Switzerland: IPCC*.

- Jackson, T., and Roberts, P. 2000. Enhancing the environmental component of Structural Fund Regional Programmes: the case of the East of Scotland. in Shaw, D., Roberts, P., Walsh, J. (eds). 2000. *Regional Planning and Development in Europe*. pp.89-116. Aldershot, UK: Ashgate.
- Jarvensivu, T., and Tornroos, A. 2010. Case study research with moderate constructionism: conceptualization and practical illustration. *Industrial Marketing Management*. **39**(1), pp.100-108.
- Jessops, B. 2002. Liberalism, Neoliberalism, and Urban Governance: A State–Theoretical Perspective. *Antipode* **34** (3), pp. 452-472.
- Jessops, B. 2004. Multi-level governance and multi-level meta-governance, in I. Bache, I., and Flinders, M., (Eds). 2004. *Multi-Level Governance*, pp.49-74. Oxford: Oxford University Press.
- Jessops, B. 2006. Spatial fixes, temporal fixes, and spatio-temporal fixes, in Castree, N., and D. Gregory, D., (Eds). *David Harvey: a Critical Reader*, Oxford: Blackwell, 142-66.
- Jordan, A. 2008. 'The Governance of Sustainable Development: Taking Stock and Looking Forwards.' *Environment and Planning C Government and Policy*. **26**(1), pp.17-33.
- Jordan, A., Van Asselt, H., Berkhout, F., and Rayner, T. 2012. 'Understanding the Paradoxes of Multi-level Governing: Climate Change Policy in the European Union.' *Global Environmental Politics* **12** (2), pp. 43–66.
- Kasemir, B., Jager, J., Jaeger, C., and Gardner, M. T. 2003. *Public Participation in Sustainability Science*. Cambridge, UK: Cambridge University Press.
- Kates, R. W., Parris, T. M., and Leiserowitz, A. A. 2005. What is Sustainable Development? *Environment: Science and Policy for Sustainable Development* **47**(3), pp.8-21.
- Kooiman, J. 1993. *Modern Governance: New Governance-Society Interactions*. London, UK: Sage.
- Kooiman, J. 2003. *Governance and Governing*. London, UK: Sage.

- Pepper, D. 1996. *Modern Environmentalism: an Introduction*. London, UK: Routledge
- Lafferty, W (2004) eds. *Governance for Sustainable Development*. Edward Elgar, Cheltenham, UK
- Leca, B., and Naccache, P. N. 2006. A Critical Realist Approach to Institutional Entrepreneurship. *Organization*, **13**(5), pp. 627-651.
- The Leeds City Region - Leeds Enterprise Partnership. 2012. [Online]. Leeds City Region welcomes Drax short listing for CCS. [Accessed 21 January 2013]. Available from: <http://www.the-lep.com/news-and-blog/news/leeds-city-region-welcomes-drax-short-listing-for/>.
- The Leeds City Region - Leeds Enterprise Partnership. 2016 [Online] Skills at the heart of Leeds City Region economy. [Accessed 27 March 2017] Available from: <http://www.the-lep.com/news-and-blog/blog/february-2016/skills-at-the-heart-of-leeds-city-region-economy/>.
- Lemos, M.C., and Agrawal, A. 2006. Environmental Governance. *Annual Review of Environmental Resources* **31**, pp.297-325.
- Levac, D., Colquhoun, H., and O'Brien, K. 2010. Scoping studies: advancing the methodology. *Implementation Science* **5**(69), pp.1-9.
- Leventon, J., Dyer, J., and Van Alstine, J., 2015. The private sector in climate governance: Opportunities for climate compatible development through multilevel industry-government engagement. *Journal of Cleaner Production*, **102**, pp.316-323.
- Lindblom, C. E. 1979. Still muddling, not yet through. *Public Administration Review*, **39**, pp. 517–526.
- Lorenzoni, I., Benson, D., 2014. Radical institutional change in environmental governance: explaining the origins of the UK Climate Change Act 2008 through discursive and streams perspectives. *Global Environmental Change* **29**, pp.10–21.
- Lukes, S. 1974. *Power: a radical view* Macmillan. London, UK
- Lukes, S. 2005. *Power: a radical view 2nd edition* Basil Blackwell. Oxford, UK

- March, J. G, and Olsen, J. P. 1984. The New Institutionalism: Organizational Factors in Political Life. *The American Political Science Review* **78**(3), pp. 734-749.
- Markusson, N, Shackley, S and Evar, B. 2012. *The social dynamics of carbon capture and storage: understanding CCS representations, governance and innovation*. Abingdon, UK: Routledge.
- Massachusetts Institute of Technology (MIT), 2018. [Online] Carbon Capture and Storage Projects [Accessed 4 January 2018]. Available from: https://sequestration.mit.edu/tools/projects/index_capture.html.
- McCarthy, J. D. 2005. Persistence and change among nationally federated social movements, in Davis, G.F., McAdam, D., Scott, W.R., and Zald, M.N. 2005, *Social Movements and Organization Theory*. Cambridge UK: Cambridge University Press.
- McGlade, C., Pye, S., Watson, J., Bradshaw, M., and Ekins, P. 2017. The Future Role of Natural Gas. *UK ERC*. [Online]. February 2016. [Accessed 6 January 2018]. Available from: <http://www.ukerc.ac.uk/publications/the-future-role-of-natural-gas-in-the-uk.html>.
- McGrath, M. 2016. Limited role for gas. BBC [Online]. 23 February 2016. [Accessed 6 January 2018]. Available from: <https://www.bbc.co.uk/news/science-environment-35632075>.
- McIntyre, Z., and McKee, K. 2012. Creating sustainable communities through tenure-mix: the responsabilisation of marginal homeowners in Scotland. *GeoJournal*. **77**(2), pp.235-247.
- Meadows, D., Meadows, D. I., Randers, J., and Behrens, W. W. 1972. *The Limits to Growth*. Tunbridge Wells, UK: Earth Island.
- Meyer, A., Gaba, V., and Colwell, K. 2005. Organizing Far from Equilibrium: Nonlinear Change in Organizational Fields. *Organization Science*. **16**(2), pp.456-473.
- Middlemiss, L. 2011. The power of community: how community-based organisations stimulate sustainable lifestyles among participants. *Society and Natural Resources*. **24**, pp.1157-1173.

- Milstein, M. B., Hart, S. L., and York, A. S. 2002. Coercian breeds variation: the differential impact of isomorphic pressures on environmental strategies, pp.151-172 in Hoffman, A., and Ventresca, M. 2002 *Organizations, Policy and the Natural Environment: Institutional and Strategic Perspectives*. Stanford (CA), USA: Standard University Press.
- Muinzer, T., and Ellis, G. 2017. 'Subnational governance for the low carbon energy transition: Mapping the UK's Energy Constitution'. *Environment and Planning C: Politics and Space* [Online]. **35**(7), pp. 1176–1197. [Accessed 4 January 2018]. Available from: <http://0-journals.sagepub.com.wam.leeds.ac.uk/doi/pdf/10.1177/2399654416687999>.
- The National Archives. n.d. Cabinet Papers: coal. [Accessed 2012 to 2016] Available from: <http://www.nationalarchives.gov.uk/cabinetpapers/themes/coal.htm>.
- The National Archives. 2016. Legislation search 1960 to 1999. Available from: <https://www.legislation.gov.uk/uksi/environmental%20protection>
- National Audit Office. 2017a. [Online] Carbon Capture and Storage: the second competition for government support [Accessed 04 January 2018]. Available from: <https://www.nao.org.uk/report/carbon-capture-and-storage-the-second-competition-for-government-support/>.
- National Audit Office. 2017b. [Online] Hinkley Point C. NAO HC 40 Session 2017-18 23.06.17 [Accessed 01 July 2018]. Available from: <https://www.nao.org.uk/wp-content/uploads/2017/06/Hinkley-Point-C.pdf>
- National Coal Mining Museum 2014. Accessed 2012 to 2016 Available from: <https://www.ncm.org.uk/collections>.
- National Energy Action, 2016. UK Fuel Poverty Monitor 2015 – 2016: A review of progress across the nations. *NEA and Energy Action Scotland*. [Accessed 1 July 2018]. Available from: https://www.nea.org.uk/wp-content/uploads/2016/05/FPM_2016_low_res.pdf.
- National Grid. 2016. Final Auction Results: T4 Capacity Market Auction for 2020/21. National Grid, EMR Delivery Body [Online]. 20.12.16. [Accessed 5 July 2018]. Available from

<https://www.emrdeliverybody.com/Capacity%20Markets%20Document%20Library/Final%20Results%20Report%20-%20T-4%202016.pdf>

National Statistics, 2018. Fuel Poverty Trends. *UK: National Statistics Office* [Online]. [Accessed 1 July 2018] Available from: <https://www.gov.uk/government/statistics/fuel-poverty-trends-2018>.

Neuman, W. L. 2003. *Social Research Methods: Qualitative and Quantitative Approaches*. Fifth ed. Boston (MA), USA: Allyn and Bacon.

Neumayer, E. 2003. *Weak Versus Strong Sustainability: Exploring the Limits of Two Opposing Paradigms*. Cheltenham, UK: Edward Elgar.

Newig, J, and Fritsch, O. 2008. Environmental governance: Participatory, multi-level - and effective? UFZ Diskussionspapiere, No. 15/2008, UFZ, Leipzig. [Online]. [Accessed 1 July 2018]. Available from: <https://www.econstor.eu/handle/10419/44744>.

Office for National Statistics. 2018. *Regional Labour Market Statistics*. [Online]. [Accessed 01 July 18]. Available from: <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/bulletins/regionallabourmarket/june2018>.

O’Riordan, T. 2014. [Online]. *Reflections on the environmental future dialogue*. [Accessed 4 January 2015]. Available from: <http://blogs.cardiff.ac.uk/environmentalfuturesdialogue/2014/02/13/reflections-on-the-environmental-futures-dialogue-from-tim-oriordan/>.

Owen, J., and Kemp, D., 2013. Social licence and mining: A critical perspective. *Resources Policy* 38(1), pp.29-35

Paavola, J. 2016. Multi-Level Environmental Governance: Exploring the Economic Explanations. *Environmental Policy and Governance*. [Online] **26** pp.143-154 [Accessed 2 February 2016]. Available from: <https://onlinelibrary.wiley.com/doi/pdf/10.1002/eet.1698>.

Palley, T. 2004. From Keynesianism to Neoliberalism: Shifting Paradigms in Economics, in Johnston, D., and Saad-Filho, A., (Eds.), 2004. *Neoliberalism-A Critical Reader*. USA: Pluto Press.

- Palys, T. 2008. Purposive sampling, in Given, L. M. (Eds.) *The Sage Encyclopaedia of Qualitative Research Methods*. 2, pp. 697-8. Los Angeles, USA: Sage.
- Parry, S., and Murphy, J. 2013. Problematizing interactions between social science and public policy. *Critical Policy Studies*, 9(1), pp.97-107.
- Pearce, R., and Evans, S. 2015. *Mapped: How the UK Produces its Energy*. Carbon Brief [Online]. [Accessed 30 October 15] Available from: <https://www.carbonbrief.org/mapped-how-the-uk-generates-its-electricity>.
- Perrons, D. 2000. The New Economy and Uneven Geographical Development: Towards a More Holistic Framework for Economic Geography. *Economic Geography Research Group Working Paper* 00/01. London: Royal Geographical Society/Institute for British Geographers.
- Petschow, U. 2005. Governance and Sustainability in a Dynamic World, in Petschow, U, Rosenau, J and Ulrich von Weizsacker, E. (Eds.) 2005 *Governance and Sustainability*. Sheffield, UK: Greenleaf Publishing.
- Petschow, U., Rosenau, J., and von Weizsacker, E. 2005. *Governance and Sustainability*. Sheffield UK: Greenleaf Publishing.
- Pezzey, J. 1992. Sustainable Development Concepts: An Economic Analysis. *World Bank Report 11425* [Online]. November 1992. [Accessed 2 April 2009]. Available from: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/1999/10/21/000178830_98101911160728/Rendered/PDF/multi_page.pdf.
- Pierre, J 2000. *Debating Governance: Authority, Steering and Democracy*. Oxford, UK: Oxford University Press.
- Pierre, J., and Peters, B. G. 2000. *Governance, Politics and the State*. Basingstoke, UK: Macmillan.
- Pollitt, C., and Talbot, C. 2004. *Unbundled Government: A Critical Analysis of the Global Trend to Agencies, Quangos and Contractualisation*. London, UK: Routledge.

- Prno, J., and Slocombe, D.S. 2012. Exploring the origins of 'social license to operate in the mining sector: Perspectives from governance and sustainability theories. *Resources Policy*. **37**(3), pp.346-357.
- Putnam, R., D. 2000. *Bowling Alone*. New York, USA: Simon and Schuster.
- Rackley, S. 2017. *Carbon Capture and Storage*. Second edition. Oxford, UK: Butterworth-Heinemann.
- Rhodes, R. A. W. 1996. The New Governance: Governing without Government. *Political Studies*. **XLIV**, pp.652-667.
- Riahi, K., Dentener, F., Gielen, D., Grubler, A., Jewell, J., Klimont, Z., Krey, V., McCollum, D., Pachauri, S., Rao, S., Ruijven, B. J., van Vuuren, D. P., Wilson, C. 2012. *Global Energy Assessment - Toward a Sustainable Future*, pp. 1203 – 1306.
- Rittel, H. W. J. and Webber, M. M. 1973. Dilemmas in the General Theory of Planning. *Policy Sciences*, **4**, pp.155-169.
- Roberts, P. 2003. Sustainable Development and Social Justice: Spatial Priorities and Mechanisms for Delivery. *Sociological Inquiry*, **73**(2), pp. 228–244.
- Robson, C. 2011. *Real World Research 3rd Edition*. Chichester, UK: Wiley.
- Rochone, E. 2008, *False Hope: Why carbon capture and storage won't save the climate*. Amsterdam, The Netherlands: Greenpeace International.
- Rosenau, J. 2003. *Distant proximities: dynamics beyond globalisation*. Oxfordshire, UK: Princeton University Press.
- Royal Society for the Protection of Birds. 2013. *The State of Nature in the UK and its Overseas Territories*. UK: RSPB.
- Royal Society for the Protection of Birds. 2016. [Online]. *The State of Nature*. [Accessed 1 July 2018]. Available from: <https://www.rspb.org.uk/globalassets/downloads/documents/conservation-projects/state-of-nature/state-of-nature-uk-report-2016.pdf>.
- Rubin, E. S. 2012. Understanding the pitfalls of CCS cost estimates. *International Journal of Greenhouse Gas Control*, **10**, pp.181-190.

- Ruggie, J. 2002. Trade, Sustainability and Global Governance. *Journal of Environmental Law*. **27**, pp297-309.
- Rydin, Y. 2003. *Conflict, consensus, and rationality in environmental planning. An institutional discourse approach* Oxford, UK: Oxford University Press.
- Scott, A. 2013. We are the State: Pierre Bourdieu on the State and Political Field. *Journal of the History of Ideas*, **2** (1), pp.65-70.
- Scott, V., Gilfillan, S., Markusson, N., Chalmers, R., and Haszeldine, R. 2013. Last Change for Carbon Capture and Storage. *Nature Climate Change* **3** (2), pp105-111.
- Scott, W. R. 2008. *Institutions and Organizations: Ideas and Interests*. Third edition. London: Sage Publications Ltd.
- Scottish Government 2016. *UK Carbon Price Floor and Carbon Price Support Mechanism*. UK: Scottish Government. [Online]. 15.04.15. [Accessed 23 March 2017]. Available from: <http://www.gov.scot/Topics/Environment/climatechange/ukandeuclimatechange/Carbon-Price-Floor>.
- Seyfang, G., Hielscherb, S., Hargreaves, T., Martiskainen, M. and, A Smith 2014. A grassroots sustainable energy niche? Reflections on community energy in the UK. *Environmental Innovation and Societal Transitions* **13**, pp.21–44.
- Shackley, S., Reiner, D., Upham, P., de Coninck, H., Sigurthorsson, G., and Anderson, J. 2009. 'The acceptability of CO2 capture and storage (CCS) in Europe: an assessment of the key determining factors: Part 2. The social acceptability of CCS and the wider impacts and repercussions of its implementation.' *International Journal of Greenhouse Gas Control* **3**, pp344–356.
- Shearer, C. 2018. Peak coal is getting closer: latest figures show. *Carbon Brief* [Online]. 31 July 2018. [Accessed 08 November 2018]. Available from: <https://www.carbonbrief.org/guest-post-peak-coal-is-getting-closer-latest-figures-show>.

- Sheehan, B. 2009. *Understanding Keynes' General Theory*. UK; Palgrave Macmillan.
- Smith, L. 2010. Key Issues for New Parliament 2010; Carbon Capture and Storage, *Environmental Audit Committee*, [Online]. House of Commons Library Research Paper [Accessed 30 April 16]. Available from: <http://www.parliament.uk/business/publications/research/key-issues-for-the-new-parliament/green-growth/carbon-capture-and-storage/>.
- Sneddon, C., Howarth. R. B., and Norgaard, R. B. 2006. Sustainable Development in a post-Brundtland World. *Ecological Economics* 57, pp.253–268.
- SSE. 2012. Making Energy Better. SSE Annual Report 2012. UK: SSE [Online]. 2012. [Accessed 12 March 2014]. Available from: http://sse.com/media/108440/SSE_AnnualReport2012.pdf.
- SSE. 2015. SSE announces closure of Ferrybridge Power Station. *SSE News* [Online] 20.05.15. [Accessed 04 April 2018]. Available from: <http://sse.com/newsandviews/allarticles/2015/05/sse-announces-closure-of-ferrybridge-power-station/>.
- SSE. 2017. Post-Paris Agreement: Understanding SSE's resilience to climate change. *SSE plc*. [Online]. [Accessed 30 June]. Available from: http://sse.com/media/473275/Post-Paris_FINAL_06072017.pdf.
- SSE. 2018a. Sustainability Report. *SSE* [Online]. [Accessed 1 July 2018]. Available from: <http://sse.com/media/522476/SSE-plc-Sustainability-Report-2018.pdf>.
- SSE. 2018b. SSE Annual Report. UK: *SSE plc*. [Online]. [Accessed 1 July 2018]. Available from: http://fr.zone-secure.net/-/SSE_plc_Annual_Report_2018/-/#page=1.
- Stephens, J. C., Wilson, E., and Peterson, T. R. 2008. Socio-Political Evaluation of Energy Deployment (SPEED): An integrated research framework analysing energy technology deployment. *Technological Forecasting and Social Change*. **75**(8), pp. 1224-1246.

- Stoker, G. 1998. Governance as theory: five propositions. *International Social Science Journal*. [Online]. **50**(155), pp.17-28. [Accessed 23 February 2011]. Available from: doi:10.1111/1468-2451.00106.
- Strangleman, T. 2001. Networks, place and identities in post-industrial mining communities. *International Journal of Urban and Regional Research* **25**(2), pp.253-267.
- Swift, T. 2002. Trust, reputation and corporate accountability to stakeholders. *Business Ethics: A European Review* **10**(1), pp.16-26.
- Talo, V., and Pettinau, A. 2014. Power generation plants with carbon capture and storage: A techno-economic comparison between coal combustion and gasification technologies. *Applied Energy* **113**, pp.1461–1474.
- Teesside Collective, 2017. [Online]. [Accessed 10 July 18] Available from: <http://www.teessidecollective.co.uk/>.
- Tickell, O. 2015. Reclaim the Power! Climate protestors rout security with UK-wide fossil fuel strikes. *The Ecologist* [Online]. 01.06.15. [Accessed 10 December 2015]. Available from: http://www.theecologist.org/News/news_analysis/2891690/reclaim_the_power_climate_protestors_rout_security_with_ukwide_fossil_fuel_strikes.html.
- Trades Union Congress. 2011. [Online]. *Roadmap for coal: Clean coal task force*. [Accessed 15 May 2012] Available from: <https://www.tuc.org/sites/default/files/tucfiles/coalroadmap.doc>.
- Trades Union Congress. 2014a. *The Roadmap for CCS*. London, UK: TUC.
- Trades Union Congress. 2014b. *The Economic Benefits of CCS in the UK*. London, UK: TUC.
- UK CCS Research Centre. 2012. [Online]. About the UKCCSRC website. Available from: <https://ukccsrc.ac.uk/about>.
- UK CCS Research Centre. 2013. [Online] *Future UK Coal & CCS Options Workshop*. Available from: https://ukccsrc.ac.uk/sites/default/files/documents/event/futurecoalfeb13/notes_future_coal_feb13.pdf.

- UK Coal. 2013. At a glance. *UK Coal* [Online]. No date. [Accessed 20 July 2014]. Available from: <http://www.ukcoal.com/at-a-glance.html>.
- United Nations. 1997 *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. Adopted at COP3 in Kyoto, Japan, on 11 December 1997.
- United Nations Development Programme. 2007. *Human Development Report on Climate Change*. New York, USA: UNDP.
- United Nations Framework Convention on Climate Change. 1997. Kyoto Protocol to the United Nations Framework Convention on Climate Change adopted at COP3 in Kyoto, Japan, on 11 December 1997.
- United Nations Framework Convention on Climate Change. 2015. [Online] *UN Conference of the Parties (CoP) 21: The Paris Agreement*. [Accessed 19 July 2018]. Available from: https://unfccc.int/sites/default/files/english_paris_agreement.pdf.
- United States Energy Information Administration, 2016. *Carbon Dioxide Emissions Coefficients*. [Accessed 10 June 2018] https://www.eia.gov/environment/emissions/co2_vol_mass.php
- United States Environmental Protection Agency. No date. [Online] Report to the Acid Rain Advisory Committee. Available from: <https://www.epa.gov/castnet>
- Unruh, G 2000. Understanding Carbon Lock-in. *Energy Policy* **28**(12), pp. 817-830
- Upham, P., and T. Roberts 2011. Public perceptions of CCS: Emergent themes in pan-European focus groups and implications for communications. *International Journal of Greenhouse Gas Control* **5**, pp.1359-1367.
- Van Alstine, J., 2009. Governance from below: contesting corporate environmentalism in Durban, South Africa. *Business, Strategy and the Environment* **18**, pp. 108-121
- Van Alstine, J., and Barkemeyer, R. 2014. Business and development: Changing discourses in the extractive industries. *Resources Policy*. [Online]. **40**, pp. 4-16. [Accessed 4 January 2015]. Available from:

https://ac.els-cdn.com/S0301420714000075/1-s2.0-S0301420714000075-main.pdf?_tid=def8f7c2-75de-44e9-bef6-3d75dd48a160&acdnat=1532460226_51b11102dfd0fb36a109d80ec766d346

Van der Ven, D.J., and Fouquet, R. 2014. [Online] Historical Energy Price Shocks and their Changing Effects on the Economy. *Centre for Climate Change Economic and Policy*. Working Paper 171 [Accessed 20 July 18] Available from <http://www.lse.ac.uk/GranthamInstitute/wp-content/uploads/2014/03/WP153-Historical-energy-price-shocks-and-their-changing-effects-on-the-economy.pdf>.

Vaughan, A. 2017. The coal truth: How a major energy source lost its power. *The Guardian*. [Online]. 19.07.2017. [Accessed 01 July 2018]. Available from: <https://www.theguardian.com/business/2017/jul/19/how-coal-lost-power-britain>.

Vaughan, A. 2018. UK runs without coal for three days in a row. *The Guardian*. [Online]. 24.04.18. [Accessed 24 April 2018]. Available from: <https://www.theguardian.com/business/2018/apr/24/uk-power-generation-coal-free-gas-renewables-nuclear>.

Warhurst, A. 2005. Future roles of business in society: the expanding boundaries of corporate responsibility and a compelling case for partnership. *Futures* **37** pp.151–168.

Watt, H. 2017. Hinkley point C: The ‘dreadful deal’ behind the world’s most expensive power plant. *The Guardian*. [Online]. 21.12.17. [Accessed 22 April 2018]. Available from: <https://www.theguardian.com/news/2017/dec/21/hinkley-point-c-dreadful-deal-behind-worlds-most-expensive-power-plant>.

Welford, R. 2002. *Corporate Environmental Management: Towards Sustainable Development.* London, UK: Routledge.

Wesselink, A. and Gouldson, A. 2014. Pathways to impact in local government: the mini-Stern review as evidence in policy making in the Leeds City Region. *Policy Science* **47**, pp.403-422.

- Williams, D. 2018. UK confirms coal fired plant closure plan. *Power Engineering* [Online] Available from: <http://www.powerengineeringint.com/articles/2018/01/uk-confirms-coal-fired-power-closure-plan.html>.
- Wilson, C., Grubler, A., Gallagher, K. S., and Nemet, G. F. 2012. 'Marginalizing end-use technologies in energy innovation for climate protection.' *Nature Climate Change*. **2**. pp.780-788.
- World Coal Association. 2012. [Online]. *Coal Statistics* [Accessed 4 January 2013]. Available from: http://www.worldcoal.org/file_validate.php?file=Coal%20Facts%202015.pdf.
- World Coal Association. 2013. [Online]. *Coal use and the environment*. [Accessed 2 October 2013]. Available from: <https://www.worldcoal.org/environmental-protection/coal-use-environment>.
- World Coal Association. 2015. [Online]. Reducing CO2 emissions. [Accessed 4 January 2016]. Available from: <https://www.worldcoal.org/reducing-co2-emissions>.
- World Coal Association. 2018 [Online]. *A pathway to zero emissions from coal*. [Accessed 1 July 2018]. Available from: <https://www.worldcoal.org/reducing-co2-emissions/pathway-zero-emissions-coal>
- World Commission on Environment and Development. 1987. *Our Common Future*. Oxford, UK: Oxford University Press.
- World Wildlife Fund. 2016. New report finds that UK is on track to phase out coal by 2025 and can keep the lights on without new gas plants. [Press release]. [Accessed 24 May 18]. Available from: <https://www.wwf.org.uk/updates/renewables-replace-coal-planned-gas-plants-destined-become-expensive-white-elephants>
- Wright-Mills, C. 1958. The Structure of Power in American Society. *The British Journal of Sociology* **9**(1), pp.29-41.

- Yeo, S. 2016. Autumn statement 2016: Key carbon and energy announcements. *Carbon Brief*. [Online]. 23.11.16. [Accessed 18 February 2017]. Available from: <https://www.carbonbrief.org/autumn-statement-2016-climate-energy-announcements>.
- Yin, R K. 2014. *Case study research, design and methods*. Newbury, USA: Sage Publications.

Appendices

- A UK coal use and energy statistics.
- B CCS project status.
- C Regional discrepancies in former coal mining regions.
- D Documents reviewed.
- E Advert for project involvement.
- F Interviews and non-participant observations list.
- G Ethics approval.
- H Participant consent form.
- I Examples of coded texts.

Appendix A UK coal use and energy statistics

Table A1 - Coal use and supply 2000 to 2012

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | Average /annum |
|---|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|--------|----------------|
| Coal supply (gross) ⁽¹⁾ | 59,838 | 63,530 | 58,639 | 62,865 | 60,567 | 61,780 | 67,340 | 62,903 | 58,219 | 48,786 | 51,448 | 51,500 | 64,327 | 59,365 |
| UK production (total) | 30,600 | 31,513 | 29,539 | 27,759 | 24,535 | 20,008 | 18,079 | 16,540 | 17,604 | 17,374 | 17,817 | 17,892 | 16,287 | 21,965 |
| Imports | 23,446 | 35,542 | 28,686 | 31,891 | 36,153 | 43,968 | 50,528 | 43,364 | 43,875 | 38,167 | 26,541 | 32,527 | 44,815 | 36,885 |
| Coal use for electricity | 46,197 | 50,931 | 47,741 | 52,464 | 50,444 | 52,058 | 57,438 | 52,511 | 47,808 | 39,681 | 41,498 | 41,850r | 54,906 | 48,887 |
| UK electricity from coal ⁽²⁾ | 34% | 33% | 34% | 35% | 35% | 36% | 37% | 36% | 36% | 31% | 32% | 33% | 41% | 35% |

Sources: Digest of UK Energy Statistics (2015) Table 2.1.1 - Supply and Consumption of Coal 1970 – 2014. Digest of UK Energy Statistics (2014) Table 2.4 – Coal Production and Stocks

- (1) Million tonnes oil equivalent
- (2) Coal supply = production plus import
- (3) Annual average percentage of total energy from coal (million tonnes oil equivalents)

| | | | | | | | | | |
|-----------------------|--------|--------|--------|--------|--------|--------|--------|-------|-------|
| Major power producers | 21,770 | 13,370 | 13,496 | 9,561 | 11,871 | 17,091 | 12,595 | 6,962 | 4,387 |
| Coke ovens | 806 | 1,338 | 1,355 | 831 | 518 | 795 | 553 | 611 | 331 |
| Undistributed stocks | 1,450 | 1,517 | 926 | 1,120 | 530 | 633 | 360 | 406 | 4 |
| Total stocks | 24,091 | 16,885 | 16,041 | 13,003 | 15,644 | 20,775 | 13,906 | 8,359 | 5,200 |

Sources: DECC, DUKES_2.4 Supply and consumption of coal 1996 to 2016. BEIS 2018a Energy Trends Tables 2.1 to 2.6

Table A3 – TWh per fuel source 2009 to 2016

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|----------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Fuel source | TWh | | | | | | | |
| Coal | 103.04 | 107.59 | 108.44 | 142.79 | 130.26 | 100.24 | 75.88 | 30.71 |
| Oil | 5.99 | 4.81 | 3.12 | 2.89 | 2.07 | 1.92 | 2.04 | 1.84 |
| Gas | 166.50 | 175.65 | 146.50 | 100.17 | 95.84 | 100.89 | 99.88 | 143.36 |
| Nuclear | 69.10 | 62.14 | 68.98 | 70.41 | 70.61 | 63.75 | 70.34 | 71.73 |
| Hydro (natural flow) | 5.23 | 3.59 | 5.69 | 5.31 | 4.70 | 5.89 | 6.30 | 5.39 |
| Wind and Solar | 9.30 | 10.33 | 16.21 | 21.21 | 30.41 | 36.02 | 47.86 | 47.79 |
| - of which, Offshore | 0.00 | 3.06 | 5.15 | 7.60 | 11.47 | 13.40 | 17.42 | 16.41 |
| Bioenergy | 10.71 | 12.26 | 13.31 | 14.73 | 18.10 | 22.62 | 29.24 | 30.04 |
| Pumped Storage | 3.69 | 3.15 | 2.91 | 2.97 | 2.90 | 2.88 | 2.74 | 2.96 |
| Other fuels | 3.20 | 2.54 | 2.82 | 3.40 | 3.39 | 3.89 | 4.64 | 5.57 |
| Total | 376.75 | 382.07 | 367.98 | 363.87 | 358.28 | 338.10 | 338.92 | 339.40 |

Source: BEIS, 2017a, Table 5.1. Fuel used in electricity generation and electricity supplied

Table A4 - Proportion of electricity from coal 2009 to 2016

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|-----------------------------------|----------------------------|--------|--------|--------|--------|--------|--------|--------|
| <i>Total TWh</i> | 376.75 | 385.13 | 373.13 | 371.48 | 369.76 | 351.50 | 356.34 | 355.80 |
| Fuel source | % of total for each source | | | | | | | |
| <i>Coal</i> | 27.35 | 27.94 | 29.06 | 38.44 | 35.23 | 28.52 | 21.29 | 8.63 |
| <i>Nuclear</i> | 18.34 | 16.13 | 18.49 | 18.95 | 19.10 | 18.14 | 19.74 | 20.16 |
| <i>Renewables (including bio)</i> | 7.68 | 8.41 | 11.60 | 13.95 | 18.28 | 22.99 | 29.06 | 28.83 |
| <i>Gas</i> | 44.19 | 45.61 | 39.26 | 26.97 | 25.92 | 28.70 | 28.03 | 40.29 |
| <i>Oil</i> | 1.59 | 1.25 | 0.84 | 0.78 | 0.56 | 0.55 | 0.57 | 0.52 |
| <i>Other listed</i> | 0.85 | 0.66 | 0.76 | 0.92 | 0.92 | 1.11 | 1.30 | 1.57 |
| | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

Source: BEIS, 2017a, Table 5.1. Fuel Used in electricity generation and electricity supplied

Table A5 - Fuel volumes consumed per annum by fuel type, 2008 to 2017.

| Year | Total of all fuels | Coal | Oil (1) | Natural gas (2) | Nuclear | Natural flow hydro (3) | Wind and solar (3) | Other fuels (4) |
|----------------------------------|--------------------|-------|---------|-----------------|---------|------------------------|--------------------|-----------------|
| Million tonnes of oil equivalent | | | | | | | | |
| 2008 | 81.58 | 29.96 | 1.58 | 32.40 | 11.91 | 0.44 | 0.61 | 4.67 |
| 2009 | 78.42 | 24.66 | 1.51 | 30.90 | 15.23 | 0.45 | 0.80 | 4.87 |
| 2010 | 79.41 | 25.56 | 1.18 | 32.43 | 13.93 | 0.31 | 0.89 | 5.11 |
| 2011 | 76.52 | 26.03 | 0.78 | 26.58 | 15.63 | 0.49 | 1.39 | 5.62 |
| 2012 | 77.24 | 34.33 | 0.73 | 18.62 | 15.21 | 0.46 | 1.82 | 6.07 |
| 2013 | 74.52 | 31.33 | 0.59 | 17.70 | 15.44 | 0.40 | 2.61 | 6.45 |
| 2014 | 68.48 | 24.01 | 0.55 | 18.73 | 13.85 | 0.51 | 3.10 | 7.73 |
| 2015 | 66.72 | 18.34 | 0.61 | 18.28 | 15.48 | 0.54 | 4.11 | 9.36 |
| 2016 | 63.68 | 7.54 | 0.58 | 25.63 | 15.41 | 0.46 | 4.10 | 9.96 |
| 2017 | 61.00 | 5.55 | 0.54 | 24.60 | 15.12 | 0.51 | 4.56 | 10.12 |

Source: BEIS, 2018a. <https://www.gov.uk/government/statistics/digest-of-uk-energy-statistics-dukes-2018-long-term-trends>

(1) Includes oil used in gas turbine and diesel plant or for lighting up coal fired boilers and refinery gas.

(2) Includes colliery methane

(3) Fuel inputs have been calculated on an energy supplied basis

(4) Main fuels included are coke oven gas, blast furnace gas, waste products from chemical processes, refuse derived fuels and other sources including biofuels.

Appendix B CCS project status

| <i>Project</i> ⁶⁶ | | <i>Location</i> | <i>Lead organisation(s)</i> | <i>Status/key features</i> | <i>Status as at June 2016</i> |
|--------------------------------|--|------------------------------|--|---|--|
| CCPilot 100+ | | Ferrybridge, North Yorkshire | SSE UK Government | Operational 2010 -2015. Demonstration of post combustion capture from coal | Closed |
| White Rose | | Drax, North Yorkshire | Capture Power consortium (Drax Power Ltd, Alstom UK Power Ltd, National Grid PLC) | 426Mw generator (90% CO ₂ capture predicted = 2Mt/yr) Off-shore storage – saline aquifer/EOR options considered FEED stage - Shortlisted for government investment | No government investment. Project on hold |
| Teesside Low Carbon Consortium | | Wilton, Teesside | Progressive Energy Ltd BOC, Premier Oil, GDF SUEZ | 400Mw, pre combustion Off-shore storage – depleted oil Planning/FEED | Delayed decision on government investment |
| Don Valley Power Project | | Hatfield, South Yorkshire | 2CoEnergy EU, CCS Humber cluster National Grid | 650Mw (net), pre-combustion. Off-shore storage – saline Planning/FEED Shortlisted for EU/UK investment 2011 | No government investment |
| Captain | | Grangetown, Scotland | Summit Power Ltd | 570 Mw, post combustion Planning/FEED | Closed |
| C.Gen | | Killingholme, Yorkshire | C.Gen NV National Grid | 470Mw, pre combustion CCGT Post FEED | Awaiting belated UK Gov and EU decisions on investment |

⁶⁶ At time of research, other CCS with coal (and different feedstock/industrial applications) research projects were operational in the UK but on either micro or test facility scale e.g. at Universities of Nottingham/Leeds/Sheffield/Edinburgh, PACT (UKCCSRC) but these are not intended as commercial projects

Appendix C Regional discrepancies in former coal mining regions

State Of The Coalfields

In the coalfields, one-in seven adults of working age are on out-of-work benefits

- Coalfields out-of-work benefit claimant rate: 14.1%
- GB average: 10.9%
- South East England: 7.6%

There are 50 jobs in the coalfields for every 100 residents of working age

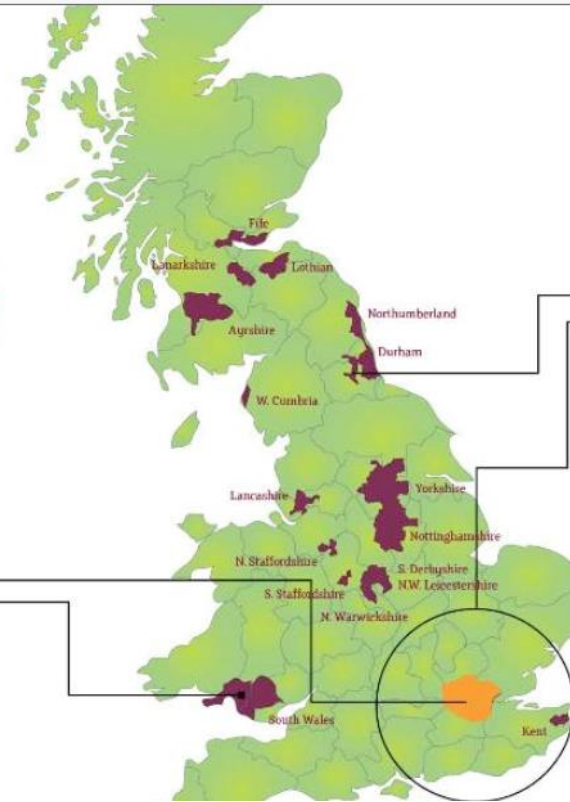
- GB average: 67 per 100
- London: 79 per 100
- South Wales coalfield: 41 per 100

Across the coalfields 8.4% of all adults of working age are out-of-work on incapacity benefits

- South Wales coalfield: 11.2%
- Durham coalfield: 9.1%
- South East England: 4.5%

People reporting 'bad or very bad' general health

- Across the coalfields: 7.6%
- South East England: 4.3%



Sheffield Hallam

the coalfields
renewing the west

Source: Foden, M., Fothergill, S., and Gore, T. (2014, p1)

Appendix D Documents reviewed

| <i>UK</i> | <i>Yorkshire and Humberside</i> |
|---|--|
| BEIS CCS related | CO2Sense reports and presentations |
| BEIS Industrial Strategy | Company sustainability and CSR reports |
| BEIS Clean Growth Strategy | Company newsletters |
| CCS Association | EA special reports on CCS |
| Carbon Briefs | Local newspapers |
| Coal Authority | Local and regional strategy docs and annexes |
| Committee on Climate Change | Minutes of public meetings |
| DBERR consultation on CCS | Parish council meetings |
| DECC CCS related | Pontefract & Castleford Gazette |
| Defra CCS related | Project websites: Drax, White Rose, DVPP, Ferrybridge CC100+ |
| E.On FEED reports | The Stainforth Voice 2010 - 2014 |
| Environment Agency Coal Resources | The Yorkshire Insider |
| EU Energy Strategies | Trades Union Congress (Y&H) Reports |
| EU Large Combustion Plant Directive | Yorkshire Forward |
| Friends of the Earth | |
| Global Carbon Capture and Storage Institute | |
| Greenpeace press releases | |
| Greenpeace CCS resources | |
| Hansard | |
| International Energy Agency | |
| IPCC special report on CCS | |

| | |
|---|--|
| National Grid | |
| National Newspapers | |
| Project data from MiT | |
| National Coal Mining Museum Archives | |
| National Archives | |
| National Audit Office | |
| National Statistical Office | |
| RSPB State of Nature reports | |
| Scottish CCS | |
| Scottish Parliament CCS resources | |
| The Treasury | |
| Trades Union Congress CCS | |
| UK Energy Policy | |
| UK Energy Research Council | |
| World Coal Association | |

Appendix E Semi-structured interview structure

The following interview schedule is designed to be semi-structured allowing. The questions were used to guide discussion without being so rigid as to miss opportunities to find out about participants' knowledge.

1. In your experience, how are decisions on using coal in UK electricity made?
2. Who is involved in the decision making process? That can be individuals or groups of people
3. What are the key ways for different people to get involved in decision making?
4. Is this appropriate/legitimate in your opinion?
5. Have there been changes over time? If so, what has changed?

Processes

People

Outcomes

6. Have there been any changes in environmental outcomes over time in your opinion?
7. Have there been any changes in social outcomes over time?

8. Have there been any obvious changes in economic outcomes over time?
9. Who has benefitted from the changes? In what ways (economically, socially, environmentally)
10. Who has not? Who has lost out?
11. Are the outcomes fair and balanced?

Anything more you would like to add that you think I would be interested in? Thank you very much for taking part!

Appendix F Primary data

(i) Interviews conducted for Yorkshire and Humber level⁶⁷

| <i>No</i> | <i>Interviewee type</i> | <i>Position/role</i> | <i>Date/duration</i> |
|-----------|-------------------------|------------------------------------|---------------------------|
| L1 | Public | Local resident Retired engineer | 11.09.12 10:30 – 11:57 |
| L2 | Public | Local resident Retired miner | 17.10.13 11:30 – 11:50 |
| L3 | Public | Local resident* | 27.10.13 10:45 – 11:10 |
| L4 | Public | Local resident | 27.10.13 12:20 – 12:45 |
| L5 | Public | Local resident | 27.10.13 15:00 – 16:10 |
| L6 | Public | Local resident | 03.12.13 11:10 – 11:35 |
| L7 | Public | Local resident | 03.12.13 13:45 – 15:00 |
| L8 | Public | Local resident | 06.12.13 09.15 – 10.05 |
| L9 | Public | Local resident | 14.12.13 10:20 – 10:45 |

⁶⁷ * Not voice recorded + interview relevant for both levels

| | | | |
|-----|----------|-------------------------------------|---------------------------|
| L10 | Public | Local resident | 14.12.13 11:20 – 11:55 |
| L11 | Public | Local resident | 14.12.13 12:30 – 13:25 |
| L12 | Public | Local resident | 14.12.13 14:00 – 16:00 |
| L13 | Public | Parish councillor* | 06.11.13 20:00-20:20 |
| L14 | Public | Parish councillor* | 06.11.13 20:25-20:50 |
| L15 | Public | Parish councillor | 27.11.13 10:00 – 10:48 |
| L16 | Public | Parish councillor | 27.11.13 11:00 – 12:14 |
| L17 | Business | Environmental Consultant* | 07.12.12 19:20 – 19:55 |
| L18 | Business | Senior manager 1 at power station** | 27.06.12 09:00 – 09:45 |
| L19 | Business | Senior manager 2 at power station* | 19.07.12 13:45 – 14:50 |
| L20 | Business | Project manager at power station | 02.08.12 13:30 – 14:05 |
| L21 | Business | CC project manager | 02.08.12 |

| | | | |
|-----|----------------------|---|---------------------------|
| | | | 15:00 – 15:40 |
| L22 | Business | Community liaison officer at power station* | 08.05.12 09:30–10:00 |
| L23 | Business | Environmental manager at power station* | 08.05.12 10:05-10:45 |
| L24 | Trades Union/NGO | TUC+ | 07.02.13 13:15 – 13:50 |
| L25 | Trades Union/NGO | RSPB | 30.10.13 11:00 – 11:25 |
| L26 | Trades Union/NGO | RSPB | 30.10.13 11.40 – 12:25 |
| L27 | Trades Union/NGO | RSPB | 30.10.13 13:00 – 14:20 |
| L28 | Trades Union/NGO | Local NGO - AIRE | 14.11.13 12:30 – 13:45 |
| L29 | Trades Union/NGO | Local NGO - AIRE | 14.11.13 14:00 – 15:50 |
| L30 | Trades Union/NGO | Retired community development org CEO | 10.07.15 11:00 – 12:20 |
| L31 | Government/Regulator | EA+ | 10.08.12 10:00 – 11:20 |
| L32 | Government/Regulator | EA | 10.08.12 11:30 – 12:10 |

| | | | |
|-----|---------------|---|---------------------------|
| L33 | Business | Local business owner and resident | 27.10.13 08.45 – 09.10 |
| L34 | Business | Local business owner and resident | 19.09.13 15:00 – 15:20 |
| L35 | Public sector | Energy Business Development Manager – public sector | 03.02.16 14:05 – 14:55 |

(ii) Non-participant observations Yorkshire and Humberside

| | <i>Events</i> | <i>Attendee type</i> | <i>Date/duration</i> |
|----|-----------------------------|---|----------------------|
| O1 | Drax visit | Leeds based green group members | 23.08.11 2hrs |
| O2 | Community Liaison Meeting 1 | Industry, local government, local residents | 04.05.12 1hr30m |
| O3 | Community Liaison Meeting 2 | Industry, local government, local residents | 27.06.12 1hr35m |
| O4 | FBC CCPilot100+ visit | University PG students and researchers | 02.08.12 2hr45m |
| O5 | B2B event 1 | Business representatives | 04.10.12 4hr15m |
| O6 | B2B event 2 | Business representatives | 19.09.13 2hr30m |
| O7 | Parish council meeting | 5 parish councillors | 06.11.13 2h20m |

| | | | |
|----|--|----------------------|---|
| O8 | Parish council meeting | 7 parish councillors | 21.11.13 2h05m |
| O9 | White Rose Public Consultation, Drax Sports & Social | Public meeting | 17.07.14 14:00 – 20:00 Attended 2hr |

(iii) Non-participant observations UK

| | <i>Event</i> | <i>Attendee type</i> | <i>Date (duration)</i> |
|-----|--|--|--|
| O10 | UK CCS Research Council – Future Coal Workshop | Business (10) Academic/research (14) NGO/other (4) Government (2) | 06.02.13 (2 hrs) 07.02.13 (7 hrs) |
| O11 | UK CCS Bi-annual meeting | Academic, business, government | 8-9 April 2013 Attended 8 hrs |
| O12 | UK CCS Bi-annual meeting | Academic/research, business, government, NGO/TU | 4 September 2013 Attended 4 hrs 30 mins |

Appendix G Ethics approval

Performance, Governance and Operations
 Research & Innovation Service
 Charles Thackrah Building
 101 Clarendon Road
 Leeds LS2 9LJ Tel: 0113 343 4873
 Email: Jm.blaikie@leeds.ac.uk



UNIVERSITY OF LEEDS

Claire Bastin
 Sustainability Research Institute
 School of Earth and Environment
 University of Leeds
 Leeds, LS2 9JT

AREA Faculty Research Ethics Committee
 University of Leeds

Dear Claire

Title of study: New forms of governance and the sustainability of 'new coal'
Ethics ref: AREA 11-197 response 1

I am pleased to inform you that the above research application has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee and following receipt of your response to the Committee's initial comments, I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

| Document | Version | Date |
|---|---------|----------|
| AREA 11-197 Summary consent for interviews v1.doc | 1 | 03/12/12 |
| C Bastin Response to Ethics Ref AREA11-197.doc | 1 | 14/09/12 |
| AREA 11-197 Summary consent for interviews.doc | 1 | 14/09/12 |
| AREA 11-197 Ethical Review Form_V3 CBastin.pdf | 1 | 12/07/12 |
| AREA 11-197 sample_email.doc | 1 | 18/07/12 |
| AREA 11-197 further_info.doc | 1 | 18/07/12 |

Please notify the committee if you intend to make any amendments to the original research as submitted at date of this approval, including changes to recruitment methodology. All changes must receive ethical approval prior to implementation. The amendment form is available at http://researchsupport.leeds.ac.uk/index.php/academic_staff/good_practice/managing_approved_projects-1/applying_for_an_amendment-1.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at http://researchsupport.leeds.ac.uk/index.php/academic_staff/good_practice/managing_approved_projects-1/ethics_audits-1.

Yours sincerely

Jennifer Blaikie
 Senior Research Ethics Administrator, Research & Innovation Service
 On behalf of Dr Emma Cave, Chair, [AREA Faculty Research Ethics Committee](#)
 CC: Student's supervisor(s)

Appendix H Participant consent form

Consent to take part in C Bastin's PhD Research.

| | |
|--|---|
| | Add your initials next to the statements you agree with |
| I confirm that Claire Bastin has explained the above research project to me on _____, I have received a written summary sheet and I have had the opportunity to ask questions about the project. | |
| I agree/do not agree for the data collected from me to be used in relevant future research. | |
| I agree to take part in the above research project and will inform the lead researcher should my contact details change. | |
| Name of participant | |
| Participant's signature | |
| Date | |
| Name of lead researcher | Claire Bastin |
| Signature | |
| Date* | |

*To be signed and dated in the presence of the participant.

Once this has been signed by all parties you will receive a copy of the signed and dated participant consent form, the information sheet and any other written information. A copy of the signed and dated consent form will be kept with the project's main documents which will be kept in a secure location

Appendix I Coding example

| <i>Item ID</i> | <i>Event</i> | <i>Metaphors</i> | <i>Agents & Motives</i> | <i>Assumptions about relationships</i> | <i>Entities</i> | <i>Econ/env/soc</i> |
|----------------|-------------------------------|---|-----------------------------|--|---------------------------|---------------------|
| 2.01 | Community Liaison Meeting 1 | | Power plant | | | Mixed |
| 2.02 | Community Liaison Meeting 2 | | Managers, locals | | | Mixed |
| 2.03 | B2B event - Castleford | | | | | Economic |
| 2.04 | UKCCSRC Future Coal w/s notes | New coal | UKCCSRC - R&D | Business and academic | - | Mixed |
| 2.04 | UKCCSRC Future Coal w/s notes | Future coal | UKCCSRC - R&D | Business and academic | - | Mixed |
| 2.04 | UKCCSRC Future Coal w/s notes | Abated coal | UKCCSRC - R&D | Business and academic | - | Environmental |
| 2.04 | UKCCSRC Future Coal w/s notes | Abated coal | SEPA | Gov & Bus | Emissions regulations | Environmental |
| 2.04 | UKCCSRC Future Coal w/s notes | Flexibility for use in coal gasification | UKCCSRC - R&D | Business and academic | - | Economic |
| 2.04 | UKCCSRC Future Coal w/s notes | - | - | - | Networks | Mixed |
| 2.04 | UKCCSRC Future Coal w/s notes | Place - site specific acceptance of future coal | - | - | CF power stations, NIMBYs | Social |
| 2.04 | UKCCSRC Future Coal w/s notes | Retrofit options viable – life in old plant | Power station managers | - | CF power stations | Economic |
| 2.04 | UKCCSRC Future Coal w/s notes | Capture ready plants | - | - | CF power stations | Mixed |
| 2.04 | CSRC Future Coal w/s notes | - | DECC | - | | Mixed |

| | | | | | | |
|------|-------------------------------|-----------------------|------------------------------|------------------------------------|-----------------|----------|
| 2.04 | UKCCSRC Future Coal w/s notes | New coal, future coal | Energy Minister (John Heyes) | - | | Economic |
| 2.04 | UKCCSRC Future Coal w/s notes | - | - | - | Communities | Social |
| 2.04 | UKCCSRC Future Coal w/s notes | - | - | Incumbant industrial relationships | - | Economic |
| 2.04 | UKCCSRC Future Coal w/s notes | - | - | - | Power companies | Economic |
| 2.04 | UKCCSRC Future Coal w/s notes | - | - | - | Markets | Economic |
| 2.04 | UKCCSRC Future Coal w/s notes | - | - | - | Consultants | Economic |
| 2.04 | UKCCSRC Future Coal w/s notes | - | - | - | Investors | Economic |
| 2.04 | UKCCSRC Future Coal w/s notes | - | - | - | Regulators | Mixed |
| 2.04 | UKCCSRC Future Coal w/s notes | - | SEPA - seen as regulators | - | - | Mixed |

