The roles of communities and local authorities in the GB sustainable energy transition: a commons and multi-stakeholder governance perspective.

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Title of work: The roles of communities and local authorities in the GB sustainable energy transition: a commons and multi-stakeholder governance perspective.

Declaration of originality

This thesis and the work to which it refers are the results of my own efforts. Any ideas, data, images or text resulting from the work of others (whether published or unpublished) are fully identified as such within the work and attributed to their originator in the text, bibliography or in footnotes. This thesis has not been submitted in whole or in part for any other academic degree or professional qualification. I agree that the University has the right to submit my work to the plagiarism detection service TurnitinUK for originality checks. Whether or not drafts have been so-assessed, the University reserves the right to require an electronic version of the final document (as submitted) for assessment as above

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Abstract

This research explores local energy initiatives through the theoretical frameworks of commons and polycentric (multi-stakeholder) governance, as theorised by the Ostrom workshop (Ostrom, 1990; McGinnis, 2016). It uses five case studies, two at the neighbourhood, one at the city, and two at the bioregional spatial levels. At the neighbourhood level, the thesis explores the use of Ostrom's design principles for common pool resources to design a neighbourhood flexible energy district. At the city and bioregional levels, it explores the evolution of polycentric institutions in a mature community energy sector and active local government. It also explores the challenge of including valuing within the commons and polycentric governance paradigm.

This thesis establishes that energy can usefully be framed as a commons: it is a resource that can be consumed, and one where exclusion of users is problematic. There are positive externalities of universal access to energy; there are negative externalities for the environment; and the infrastructure is at risk of monopoly rent-seeking. In a neighbourhood context, the research finds that supportive community accountability for consumption would be welcome, but that this must respect privacy and individual autonomy. At the city and bioregional scales, it finds that strong shared vision, coordination and collaboration between multiple organisations, individuals and sectors are essential to progress. It also finds that the fragmentation between the governance of the incumbent energy industry and the civic energy sector is a barrier to the transition needed to meet national carbon targets.

Finally, a set of 'design principles' for commons-based polycentric governance of energy systems are proposed, tested in relation to the case studies, and revisited following analysis, with implications for policy, industry and the civic energy sector. These include a mixed system with a greater role for commons, nested governance, diversity of institutions and protecting equality and the environment.

Acknowledgements

Dedicated: to commoners, past and present, and to all those working for energy democracy

Humans are social animals, and knowledge is a particularly social pursuit, and a natural public good. Enclosing it through claiming singular authorship doesn't sit well, particularly as I so dislike working alone. I claim authorship and responsibility for this work, in the way that is proper for the format of a thesis, but acknowledge that like all knowledge, very little of it is mine. In this spirit, I thank the many people who have been part of this process of knowledge creation – the great thinkers who I have been in dialogue with through reading their work, the everyday social connections, all of the conversations with friends, with colleagues, with strangers, at conferences, in cafes, in random encounters, that have provided moments of co-creation of new ideas.

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Sorry for anyone I've forgotten – it's always a risk when naming individual people, but I did want to thank those who were in my mind.

Use of text published elsewhere

Text from two academic journal papers written as part of this research has been used within the thesis. These are:

> **Melville, E., Christie, I., Burningham, K., Way, C., & Hampshire, P. (2017). The electric commons: A qualitative study of community accountability. *Energy Policy*, *106* (March), 12–21. https://doi.org/10.1016/j.enpol.2017.03.035**
>
> Text from this paper was used in particular in:
>
> - Chapter 4, description of the Less is More case study
> - Chapter 5, discussion of Ostrom's design principles for common pool resources
> - Chapter 9, discussion of additional concerns with commoning arising from the Less is More case study
> - Parts of chapters 10 and 11
>
> **Melville, E. (Under Review). Equality in local energy commons: a UK case study of community and municipal energy.**
>
> Text from this paper was used in:
>
> - Chapter 1, discussion of equality
> - Chapters 11, discussion of case study evidence of commons and equality

Additionally, text from a practitioner case study written for an Energy Democracy website, developed as part of this thesis, was used:

> **Melville, E. (2016). Nexus between community and municipal power in Bristol's quest for energy democracy. Available at http://www.energy-democracy.net/?p=359**
>
> Text from this case study was used in:
>
> - Chapter 4, background to the Bristol case study

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Some insights in this thesis are derived from projects paid for by clients of BuroHappold Engineering.

Contents

Tables

Figures

All figures were produced by the author for this thesis, unless otherwise referenced.

Executive summary

Motivation and context

The GB energy system must be radically transformed in order to reduce its impact on climate change. Some change in this direction is taking place. This is partly in response to increased use of renewable energy and smart technology, and partly due to political support for decarbonisation. However, a sustainable energy transition is not just a scientifically assessed necessity nor something that can be achieved through purely technological solutions. It requires changes to the ways we use and produce energy that have social implications. As with any change, there are winners and losers, and some of the potential losers, particularly in the fossil fuel industry and the energy industry incumbency, have strong political influence.

Community energy (CE) groups and local authorities (LAs) can have important roles in enabling a sustainable energy transition. Many LAs around the world are acting directly, collaboratively and independently on climate change, for example through the C40 group of cities or the Covenant of Mayors (Covenant of Mayors, 2008). Many community groups are developing renewable energy and energy efficiency initiatives, in GB and elsewhere. Both CE groups and LAs are embedded in places where the detailed work of changing buildings, resource systems and consumption practices must take place. Both are potentially closer to the interests of the population and the passion of those who want to make positive change for the future, and further from the centres of power influenced by the incumbency than central governments.

CE and LA initiatives have been widely researched. This thesis adds new knowledge by using theories of commons and polycentric governance to critically examine the roles of CE and LA energy initiatives within the wider GB energy transition. It uses a utopian and prefigurative methodology and draws on case studies from the South West of England, at a variety of spatial scales, and in-depth working knowledge as a CE practitioner and consultant working at BuroHappold Engineering (BHE), the company sponsoring this research. The research findings have implications for the CE sector and local government, for sustainability-oriented consultancy, for energy policy in GB, and for theoretical development of commons and polycentric governance.

The research set out with two main research questions:

- What are the roles of local and community organisations in a GB sustainable energy transition?
- How do theoretical frameworks of commons and polycentric governance contribute to understanding these roles?

In seeking to provide useful knowledge for practitioners, a further question was asked:

- How would the governance of a commons-based and polycentric energy system with a strong role for local communities and local government be structured?

These questions are explored through the research as outlined below.

Research strategy

The first part of the thesis provides background and describes the problem context and the methodology. The original research was developed in two stages, a theoretical analysis and an empirical analysis. These are presented in parts 2 and 3 of the thesis respectively, as shown in Figure 1.

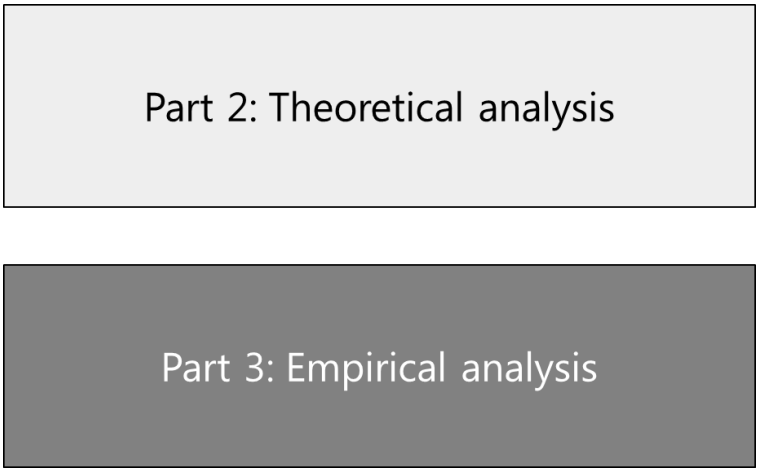

Figure 1: Theoretical and empirical parts of analysis

The theoretical analysis considers energy as a commons, and analyses the GB energy system through the theoretical lens of polycentric governance. It concludes by proposing a set of 'design principles' (DPs), or thinking tools for effective design of sustainable energy system governance, that can be used across a variety of contexts.

The DPs aim to achieve a 'sustainable energy system' which: maximises democracy; promotes innovation and learning; remains within environmental limits; and promotes equality.

The empirical part of the thesis tests the initial DPs in relation to case studies of local energy initiatives in the South West of England, asking whether the DPs are present, and to what extent their presence or absence contributes to the desired outcomes. This leads to the development of a revised set of DPs presented in the conclusion.

Case studies

The empirical aspect of the research took place through a series of case studies of local energy initiatives at different spatial scales as shown in Figure 2. These were approached using mixed qualitative methods, including qualitative interviews, participant observation, reflective journaling, focus groups and workshops. The Community Energy Aggregator (CEA) study used survey, focus group and expert interviews to explore the potential for configuring urban electricity contexts to resemble the small-scale community commons described by Ostrom, and intentionally design these to fit with Ostrom's DPs for common pool resource management. The Less is More (LiM) project used interviews to explore community accountability in the context of a community incentive for electricity demand management at the substation level. The Bristol case study used participant observation to observe the relationship between the CE sector and the LA in Bristol, and their respective roles. The Cornwall Energy Island (CEI) project explored the potential for Cornwall to be self-sufficient in energy, through a two-day workshop in March 2015 at the Eden Project in Cornwall. This was a BHE project which was used to explore local initiative within a national context, and polycentric governance. Similarly, the Zero West initiative, which aims to galvanise rapid decarbonisation of the WoE region, of which Bristol is a part, was observed as a polycentric governance setting.

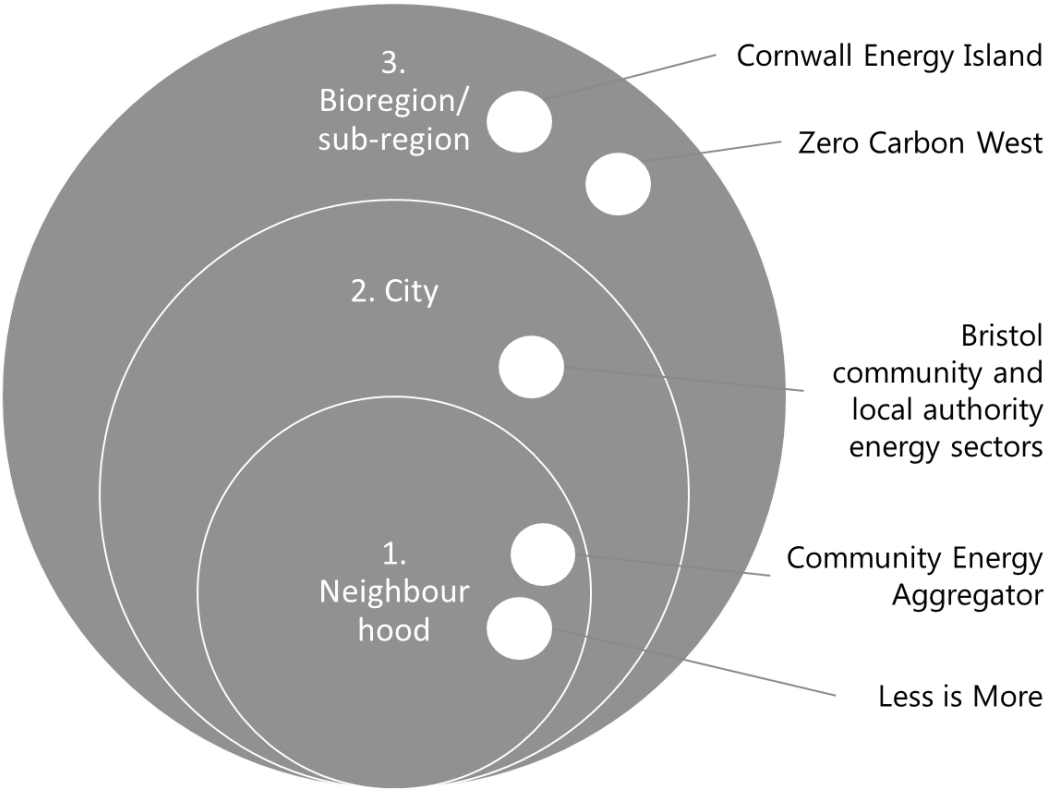

Figure 2: Five case studies, at three spatial scales

The empirical research also draws reflectively on my professional experiential knowledge from working in the local and community energy sector as a consultant and practitioner over a period of seven years.

Research philosophy and approach

This research is grounded in a set of values, under a framework of sustainable prosperity, prioritising democracy, equality and ecological integrity. The ontological and epistemological perspective is based in a complexity paradigm. The first person is used where appropriate, as my subjective position as a researcher is acknowledged and made explicit.

I draw on the ethics and approaches of action research, and utopian methodologies. This means seeking ways in which current reality and a utopian vision of the energy system as it could be can be reconciled, through making systemic changes.

Commons and polycentric governance

Part 2 of the thesis comprises a theoretical analysis based in theories of commons and polycentric governance.

Commons

The first theoretical theme is that of commons. Drawing on the analytic literature of the Ostrom workshop and on more politically engaged pro-commons literature, a commons is defined in this thesis in terms of collective, as opposed to private or individual, property rights. The social relations of governance and property institutions are emphasised above the physical characteristics of a resource, through use of the verb form 'commoning'. Commoning can be seen as the opposite of commodifying, as it involves the integration of consumption and production activities within one institution rather than their separation. Commoning takes place in contexts where people have a shared dependence on a resource and on each other, where

there is a social dilemma where the collective good may require different actions to those maximising individual benefit, and there is potential for conflict.

In chapter 6, I assess whether energy systems should be governed as a commons, based on economic, legal and political criteria as shown in Figure 3. I conclude that there are strong arguments for governing certain parts of the energy system as a commons or public good. Energy is a basic need, it has strong negative and positive externalities (e.g. pollution, importance for the economy), and large scale infrastructure has natural monopoly characteristics. This supports proposals for a mixed energy system governance, with roles for community ownership, state ownership at different levels, and private sector ownership.

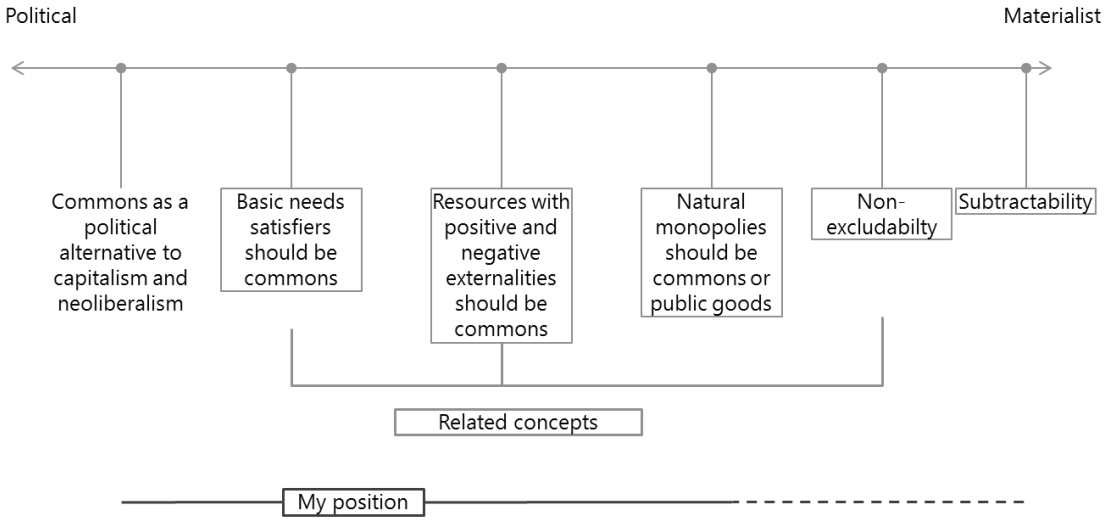

Figure 3: Ways of categorising appropriate property regimes for a resource

The CE sector and LA energy initiatives are broadly characterised as commons and public governance structures, respectively. However, the extent to which the CE sector can be characterised as a full commons is limited due to the separation of energy consumption and production in the energy market rules, and the inaccessibility of the licensed energy supplier role, which would bridge this gap, to community groups. At the same time, the potential for co-production and relationships in a local area makes it easier for LAs to develop commons governance features than it is for central government.

Economic and legal arguments show that there are good reasons for governing energy as a commons or public good. However, commoning has particular benefits as an alternative to market systems, and this thesis aims to highlight these in a context where state ownership is often seen as the only alternative to markets. Commoning can provide opportunities for participation, allow collective agency to flourish, keep wealth in local economies, and provide belonging, identity and responsibility in non-materialist ways, based on relationships and being individually known. This could enable rich human flourishing with less environmental impact, and provide opportunities for everyday participation, vital to develop the skills required for robust democracy.

However, by themselves commons governance systems do not provide sufficient protection for the environment. They can also risk entrenching or not addressing inequalities within and between communities. Their reliance on mechanisms of social accountability may impose a culture of conformity and not allow disruptive innovation or individual diversity to flourish.

This thesis concludes that a commons framework is valuable, but insufficient for imagining a system of GB energy governance for sustainable prosperity.

Polycentric governance

The Ostromian literature situates commons theory within a wider theoretical frame of polycentric governance. This is a rich and complex framework, and this thesis contributes to an emerging research agenda on polycentric governance of energy put forward by Goldthau and others (Sovacool, 2011, 2013; Bazilian, Nakhooda and Van de Graaf, 2014; Goldthau, 2014), and to the scholarship on empirical applications of polycentric governance (International Association for the Study of the Commons, 2017).

Polycentric governance is relevant to any system where there are multiple centres of decision-making, rather than centralised top down power structures. This can include markets, democracies and commons. Situating energy system governance within a polycentric perspective addresses some of the inadequacies of a commons framing. This theoretical framework came to the forefront in reflecting on the CEI project, where limits to Cornwall's grid capacity were being addressed through collaborative discussions between Cornwall Council, the Distribution Network Operator (DNO), National Grid and Department of Energy and Climate Change (DECC, then government ministry responsible for energy).

The polycentric perspective is also useful in considering how the CE sector could better link the use and the production of energy within one unit, and thus be more commons-like. A barrier to this is the requirement to have an energy supply licence in order to deliver energy to users, something which is out of reach of the CE sector. Developments such as local energy markets or collaboration with LA-owned energy supply companies could enable this through multi-organisational collaboration.

A polycentric system supports creativity and innovation beyond the narrow dichotomy of market vs state. Markets are often praised for encouraging innovation, allowing choice and dispersed expression of preferences and supporting diversity. It is possible to achieve some of the benefits of markets without relying on mechanisms of profit and competition. Markets are just one form of polycentric system, and a polycentric paradigm reveals approaches to autonomous creativity that do not rely on mechanisms of profit and competition.

However, although polycentric governance can nurture diversity, it doesn't necessarily address either inequality or environmental limits. Diversity in opinion about the human causes of climate change, for example, is not desirable for a sustainable future. Some shared values, shared worldview and intentions are needed for a functional system.

Design Principles

Following theoretical analysis of commons and polycentric governance in relation to energy systems, a set of DPs were developed for a sustainable energy system. These DPs are thinking tools for effective design which can be used in a variety of contexts, and are inspired by Ostrom's DPs for governing commons.

The initial set of DPs are discussed in chapter 8. They are as follows:

DP1 - mixed economy:	A thoughtful combination of commons, state-public, and market institutions and forms of ownership
DP2 - nested governance:	Use of nested forms of governance at different spatial scales, as well as non-spatial governance
DP3 - equality and redistribution:	National redistribution of value, sharing of risk, and sharing of learning
DP4 - responsibility and externalities:	Responsibility and accountability for the full impact of actions, in particular those affecting environmental limits.

These were tested against the empirical evidence from the case studies, asking:

- To what extent is this principle already present or not present in current local energy activities and the GB energy system?
- To what extent does the absence or presence of this principle lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from this principle?
- Does this principle need to be modified or rejected in light of analysis of the case studies?

A modified set of DPs were then developed, integrating insights from the case study analysis, including the blurred boundaries of commons, market and state, concerns with privacy in commons, the repetition of frustration with hierarchy at different levels, and the importance of shared vision for a successful polycentric system.

The final design principles are proposed as follows:

A Mix of state-public, private and community-commons ownership and governance, with a greater role for commons, and a lesser role for markets than there is currently.

B Differentiation of ownership models, core motives and mechanisms of interaction.

C Nested system organised according to principle of subsidiarity.

D The size of each spatial level of governance is congruent with the physical and technical boundary of the infrastructure being governed.

E Diversity of institutions and sharing of learning between them; with sharing of risk of failure.

F Shared vision, with values of human wellbeing, equality, democracy and environmental limits.

With necessary safeguards**:**

A Mechanisms of redistribution of power and wealth, including through capacity building.

B Protection of the equal worth and rights of all humans, including those potentially seen as 'other' within or outside a community.

C Responsibility for the impacts of actions, including externalities, in particular impacts relating to environmental limits.

D Effective mechanisms for addressing conflict, based in restorative justice systems.

These DPs are expected to achieve the desired outcomes of:

- Maximising democracy: this includes balancing autonomy and responsibility with care and solidarity, and providing multiple approaches to participation
- Promoting innovation and learning: by allowing multiple experiments in sustainable energy culture and institutions to take place simultaneously, and supporting shared learning from each other's successes and failures
- Remaining within environmental limits, by developing energy cultures that integrate appropriation and provision, and find ways to live well within the limits of the energy available in a geographical area
- Promoting equality, including compassionate human responsiveness to the diverse needs in a community, backed up by bureaucratic means-tested support for those that a community fails to support through reciprocity.

Reflections and implications

The conclusions of this thesis could have implications on many levels, including on the paradigm or narrative used in relation to energy governance, policy implications, implications for industry, for the CE sector and LAs, and for further research, for industry, the CE and LA energy sectors, policy and academic research.

Paradigm, framing and narrative

At the level of paradigm, this thesis proposes a shift from a market to a commons paradigm. The differences in these paradigms, as understood through the research in this thesis, for energy system governance and the wider economy, are summarised in Table 1.

Table 1: Reframing of policy narratives

	Market paradigm	**Commons paradigm alternative**
Innovation and performance	**Competition**: competition for survival in the market is seen as the main motivation of innovation and good performance.	**Diversity and autonomy:** many different organisations exist and are free to innovate, but they do not necessarily compete. It is autonomy, rather than competition, that is needed for innovation.
Pricing	**Cost reflectiveness:** the cost of production is reflected in the cost passed on to consumers.	**Socialising of costs:** the cost of production is shared across society, e.g. paid for by tax, rather than passed on proportionately to consumers.
Economic objectives	**Growth:** economic growth is a central objective for the economy as a whole.	**Prosperity:** rather than growth, a broader understanding of prosperity is seen as an economic goal.
Redundancy and slack	**Efficiency:** economic efficiency, achieving the greatest material output per financial input, is seen as a primary goal.	**Resilience:** the ability to continue following shocks or changes is valued. Redundancies and inefficiencies are valuable 'slack' that can be drawn on when needed, rather than a waste.
Interactions and transactions	**Transaction cost:** time spent in transaction with others is seen as a cost.	**Relationship building:** time spent in transaction with others is seen as a benefit of enjoying and nurturing relationships.
Worth of people	**Meritocracy:** people are valued differently based on their ability to contribute (to financially measured economic efficiency).	**Equality:** all people are valued equally and given equal dignity.
Access to a resource	**Access based on ability to pay:** this is tied to cost-reflectiveness.	**Access based on need:** a basic access to a resource is available to all, regardless of their ability to pay

	Only those who can pay the price can access a resource.	financially. This is enabled by socialising the cost.
Limits	**Supply must meet unlimited demand:** Although efficiency measures aim to reduce demand, it is not limited other than by ability to pay or through other price mechanisms. The 'system' is designed to meet anticipated demand.	**Limits to consumption:** consumption is limited, by agreements, rules or physical limits other than the ability to pay.
Consumer role	**Demand:** consumers of a resource can make demands on the system, and are entitled to have these demands met if they can pay. Lifestyles are not negotiable.	**Use/consumption:** avoiding the language of 'demand', and using the more neutral words 'use' or 'consumption' to refer to units of energy consumed, which are often referred to as 'demand' when quantified.
Public role	**Customer:** end users of service and the general population are increasingly referred to as customers, which narrows the frame to a particular relationship within a market exchange.	**User/citizen:** a more neutral word, 'user', is favoured for those who consume a resource, which allows diverse contractual or property relationships to be imagined. The general population are citizens with rights and responsibilities rather than customers paying for a service.
Role of market	**Market as default:** there is a lack of freedom to choose the rules of collective action, freedom only within market – freedom of Hirschman's 'exit'.	**Voice in choosing rules of collective action:** market as an option, freedom to choose alternatives such as commons or public ownership, and voice in shaping rules of market.
Exchange vs reciprocity	**Exchange:** transactions are based on exchange, usually of a commodity for money. These can be one-off, and rely on trust in the monetary system.	**Reciprocity:** transactions are based on relationships and expectation of repeated interactions and give and take. This builds trust between people.

Shifting from a market to a commons paradigm can be used to change our visions of a desirable future, what we see in what is currently taking place, and the changes we propose.

Implications for industry (BuroHappold Engineering)

BHE has a number of avenues for making use of knowledge from this thesis. This includes having evidence and expertise when dealing with complex, multi-stakeholder projects. Being able to credibly design collaboration at various scales will enhance our ability to convene. This can help us to position ourselves

competitively in projects that require stakeholder engagement, to provide greater value to our clients, and to develop thought leadership in areas relating to current global challenges.

BHE can promote commons by proposing commons governance approaches as an alternative to 'business as usual' ownership and procurement approaches. Having the confidence to propose a commons approach can be supported by understanding their success factors, weaknesses, and the mechanisms to put in place for commons governance to work well. At the same time, BHE can highlight the commons and collaboration already ongoing in processes of 'business as usual', and the existing interdependencies between commons, market and state approaches.

The study of polycentric governance has provided a deeper insight into the role of a commons within a wider system. It also provides insight into the characteristics of polycentric governance systems, and the problems that need to be addressed and strengths that can be built on. It has shown that the existence of a diversity of organisations can achieve innovation and progress in a complex situation. However, co-ordination and open communication is needed for the system as a whole to function well. Additionally, checks and balances are required to avoid excessive concentration of power.

Implications for the civic energy sector

The use of a commons paradigm within promotional narratives could support the case for CE as well as the commons paradigm itself. Additionally, the CE sector could see its own role within a wider polycentric context to identify weaknesses in a systemic way, so as to address problems.

For the LA, the conclusions of this thesis reinforce the importance of the role of the CE sector within a local energy transition ecosystem. It also highlights potential weaknesses in the CE sector in terms of accountability and representation, and the potential role of the LA in addressing these.

This work can also contribute to the ongoing public discussion about energy democracy and re-municipalisation, such as the Labour Energy Forum event at the Labour party conference 2017 (Labour Energy Forum, 2017).

The implications of this thesis for the CE sector, for LAs and for proponents of energy democracy will be further explored through working with colleagues in these settings and identifying suitable ways of disseminating the research.

Policy implications

Applying a commons and polycentric governance framing and implementing the DPs in the GB energy system would require changes in policy and regulation.

Policy changes that would support the emergence of a GB energy system based on the DPs could include:

1. A community right to provide energy, including selling energy within a local community.
2. Local financial institutions that support the development of local energy systems.
3. A community right to own energy assets in the community, and to develop sites that are suitable for storage or generation facilities for local benefit rather than for external developers.
4. Taking into account externalities, for example the impact on global climate change, in local authority planning decisions, rather than excluding these from material considerations.
5. Allow LAs to specify local economic benefit in procurement processes.
6. Developing local balancing units for electricity, as discussed by Cornwall Energy (2015).
7. Providing funding for capacity-building in communities in order to contribute to mitigating inequalities.
8. Strong protection of the equal rights of different people, through local accountability processes implementing the spirit of the Equalities Act and respecting individuals' dignity.

9. Increased devolution to local government, allowing income to be taken from provision of energy services, and providing a budget for non-income generating activities.
10. Not-for-profit public ownership of the transmission and distribution networks, at different levels.
11. Addition of a local system operator role as well as pursuing the change from the regional DNO to DSO (Distribution System Operator).

Some of these policy changes are already being recommended or lobbied for by organisations involved in the CE sector, campaigning on climate change, political parties, and others.

Further research

This thesis has identified a number of opportunities for further research. The main conclusions of the thesis could be taken forward by discussing them with practitioners and exploring their resonance in real life contexts. Additionally, there were a number of more specific avenues for further research identified in the course of this study, including exploration of the intersection of restorative justice, shame-based social control and commons in relation to people's attitudes to community accountability; the potential for commons approaches to limiting consumption to support sustainability through generating an 'abundance' mindset rather than the creation of artificial scarcity; and the application of the findings of this research to other sectors e.g. the digital economy.

Reader's Guide

This thesis has three parts, each of which is divided into chapters. The first part sets the scene for the thesis, giving an overview of the problem context and the approach taken. It comprises the introduction, background and methodology chapters.

The second part analyses the GB energy system theoretically, drawing on review of literature on commons and polycentric governance. It considers how these theories help us understand electricity and energy more widely, as a physical resource, as infrastructure, and as a set of institutions in GB. This part combines literature review with original analysis. It culminates with an initial proposal for "design principles"[1] (DPs) for creating effective polycentric energy governance systems, based on insights from the theoretical analysis.

The third part of the thesis analyses the empirical case studies in relation to the DPs outlined at the end of part 2. It uses this analysis to refine the original DPs and to propose a revised version. The implications of this are then discussed in the conclusion.

The chapters in each part are listed below, with a brief description of their purpose and contents.

Preliminaries

Abstract

Acknowledgments

Executive summary: Provides a summary of the thesis as a whole.

Reader's guide: this document

Abbreviations and glossary: defines key terms and acronyms used in the thesis.

Prologue: sets the scene imaginatively

Part 1: Introduction and background

Chapter 1: Introduction

The introduction gives an overview of the problem-space, the research question and the approach taken, and the underlying values. It also introduces the position of the researcher in relation to the research context.

Chapter 2: Background to the GB energy system

This chapter describes the problem-space that the thesis addresses: the changing GB energy system in the context of climate change. For readers not familiar with this context it provides basic information to facilitate reading the thesis as a whole. For readers whose expertise already lies in the GB energy system, this chapter highlights which aspects of the GB energy system are important to this thesis, and how they are framed.

[1] The term 'design principles' refers to a set of heuristic guidelines for designing a system, whether this is a website, building or governance institution. This is discussed in more detail in section 3.3.2

Chapter 3: Methodology

This chapter discusses the research question in more detail, and describes the methodological approach taken, making explicit the ontological and epistemological foundations of the research.

Chapter 4: Case studies

This chapter outlines the five case studies, and describes these in more detail, as well as giving an overview of the data collection methods and data available in each.

Part 2: Theoretical analysis

Chapter 5: Energy as a commons – part 1, definitions and politics

This chapter explores the literature on commons in relation to energy, including the physical categorisation of resources and the discourse of commoning as a concrete and historically rich alternative to capitalism and market exchange. This literature review and analysis is used to develop a utopian vision of energy as a commons, which is used as a critical standpoint from which to view the current and emerging GB energy system.

Chapter 6: Energy as a commons – part 2, should energy be governed as a commons?

This chapter analyses the extent to which energy as a resource can be seen as a commons. This includes consideration of the material properties of parts of the energy system, and more social and political factors.

Chapter 7: Polycentric governance and energy

The Ostromian theoretical work on commoning sits within a wider framework of institutional analysis grounded in a polycentric governance paradigm. This chapter critically reviews the governance of the GB gas and electricity markets from a polycentric governance perspective, and demonstrates what this framing can bring to identifying potential remedies to aspects that are currently not effective.

Chapter 8: Preliminary design principles

Drawing on the theoretical analysis in chapter 4 and 5, this chapter proposes a set of "design principles" for a commons-based and polycentric governance of the GB energy system. These DPs are preliminary – they are intended to be tested in relation to the case studies from the field, and then revised as necessary. This is discussed in part 3.

Part 3: Analysis and conclusions

Chapter 9: DP1 – Mixed economy

This chapter tests the first proposed DP in relation to the observations from the case studies, identifying ways in which the DPs do and don't fit with the observed reality.

Chapter 10: DP2 – Nested governance

This chapter tests the second proposed DP in relation to the observations from the case studies, identifying ways in which the DPs do and don't fit with the observed reality.

Chapter 11: DP3 – Equality and redistribution; and DP4 – Responsibility and externalities, and DPs revisited

This chapter tests the third and fourth proposed DPs in relation to the observations from the case studies, identifying ways in which the DPs do and don't fit with the observed reality. It also reviews the initial DPs, taking into account observations from the case studies. A revised set of DPs is proposed, which can be further refined with stakeholders as part of dissemination activities.

Chapter 12: Conclusions and implications

This chapter reflects on the implications of the thesis as a whole, including the insights not captured in the final DPs, and the value of the research outcomes for industry. It reflects critically on the robustness and potential shortcomings of the DPs. It considers the applicability of the findings in other sectors beyond energy, such as urban development. Finally, it proposes areas of further work for BHE, for the energy sector, and for academia.

Appendices

The thesis includes the following appendices:

Appendix 1: Extract from Community Energy Aggregator report

Appendix 2: Interview guide and focus group scenario wording from LiM study

Appendix 3: Melville, E. (Under Review). Equality in local energy commons: a GB case study of community and municipal energy.

Appendix 4: Development of design principles

Publications arising from this thesis available online:

- Bristol energy democracy case study, available from: http://www.energy-democracy.net/?p=359
- Melville, E., Christie, I., Burningham, K., Way, C., & Hampshire, P. (2017). The electric commons: A qualitative study of community accountability. *Energy Policy*, *106*(March), 12–21. https://doi.org/10.1016/j.enpol.2017.03.035
- Cornwall Energy Island white paper, available from: https://www.burohappold.com/in-deep/energy-island/
- BuroHappold Engineering. (2013). *Community Energy Aggregator Final Report to Technology Strategy Board*. Bath: BuroHappold Engineering. Retrieved from https://www.academia.edu/29211233/Community_Energy_Aggregator_Final_Report_to_Technology_Strategy_Board_032161
  (See Appendix C pp 14-19 for section exploring Ostrom's DPs, also attached as Appendix 1 to this thesis)

Additionally, Volume 2 collates all 6-month reports produced during the development of this thesis. This is available in electronic form.

Abbreviations and glossary

Appropriation - taking from a resource for consumption

BCC – Bristol City Council

BEC – Bristol Energy Co-operative

BEIS – department of Business, Energy and Industrial Strategy (2016-current)

BEN – Bristol Energy Network

BHE – BuroHappold Engineering, sponsoring company

Bristol Energy – Bristol Energy Company, a wholly owned subsidiary of BCC and fully licensed energy supply company

BWCE – Bath and West Community Energy – community renewable investment co-operative based in Bath and North East Somerset, neighbouring to Bristol

CEI – Cornwall Energy Island

Collective choice – decisions made together about operational rules, as per the processes set out at the constitutional choice level.

Constitutional choice – defining collective choice procedures

DECC – Department of Energy and Climate Change (2008-2016)

DG – Distributed Generation

DP – Design Principle

DR - Demand Response (changing time of use of electricity in response to price or other signals)

ELENA – European Local Energy Assistance fund

Excludability - the difficulty or cost of excluding people from using a resource

FiT – Feed in Tariff

Hegemony – dominant ideology

Heuristic – rule of thumb

IASC – International Association for the Study of the Commons, academic association founded by Elinor and Vincent Ostrom

LA – Local Authority – used synonymously with local council as this is the same unit of governance

LiM – Less is More

Operational choice – practical decisions made in day-to-day operation

Production – physically creating a resource

Provision - organising for a resource to be produced

PV – photovoltaic, as in solar photovoltaic

RE – Renewable Energy

ROC – Renewable Obligation Certificate – incentive scheme for large scale renewable energy generation

Subtractability - the extent to which the use of a resource subtracts from the amount of resource available for others to use

WoE – West of England, the area comprising the Unitary Authorities or LAs of Bristol, Bath and North East Somerset, North Somerset and South Gloucestershire.

Part 1

The first part sets the scene for the thesis, giving an overview of the problem context and the approach taken. It comprises the introduction, background and methodology chapters.

Prologue

Bristol, October 2018

Zach, CEPRO

Things always take longer and prove to be more complicated than expected. One day, hopefully, we'll be able to bring together more of the elements of a flexible energy district into one project, but for now it's just one step at a time. The battery project is really exciting, and great to have partnered with Bristol Energy Co-op to invest in it, but I was frustrated that the timings didn't all fit together well enough to combine the battery with a local microgrid and bring real value to the residents in that new development. At least we've learned a lot about the regulation and process of putting in a battery, and I really hope we'll find another opportunity to develop the full project.

Sim, Bristol Energy Company

Our first priority has to be to get the company financially sustainable, and that means focusing on getting more customers and ensuring that our trading activities are done well. We need to make sure that we do start providing profit back to the council, as they can't afford to lose the investment they made, even if it takes longer than we'd originally anticipated.

At the same time, our first social priority is to have fair tariffs for everyone, including customers who never switch, and to provide social tariffs to people in fuel poverty. I've been really busy over the past year developing our warm homes plus tariff with partner organisations. It's a cost-price tariff, so it won't contribute to our profitability, but I'm glad that we can fulfil our social mission in this way.

It's great that we have a bit of capacity for conversations with innovative organisations such as EnergyLocal, and with local community energy groups such as the Bristol Energy Coop. I can't wait to be able to innovate on local energy markets or sharing of energy behind a virtual private wire at some point, perhaps once we start bringing in smart meters – we had originally hoped to have a smart meter tariff from the start, but realised that we need to begin with the bread and butter before we start being too ambitious.

Frankie, Zero West

Tomorrow I'm presenting to the West of England Combined Authority, trying to persuade them to invest in the Zero West collaboratory. I'm quite nervous about it, as without their support this really isn't going to work effectively. Even if their financial contribution is relatively small, we need them to be invested in this in some way for it to have political legs. Ideally, we would also have direct membership of each of the local authorities in the West of England. We need a set of core partners – maybe starting with 5 or 6 organisations, who each invest £5-10k to get it off the ground.

We've already got some great stories of collaboration that would probably never have happened if people hadn't come together at Zero West events and developed relationships with each other. And I'm sure there will be even more once we develop a strong shared vision together. The most ambitious, which I'm excited about, is the potential to develop offshore wind in the Bristol Channel. Having an opportunity for community investment in offshore wind would be a massive boost to capacity, and it should really help the project happen. Not just because community ownership might reduce planning objections – that's not such a big issue with offshore wind – but because we need some positive political will and momentum behind the project to make sure it actually goes forward, rather than stalling as these things so often do when central government don't want to provide consistent policy support.

Frances, Western Power Distribution

It's going to be interesting to see how the transition from distribution network operator to distribution system operator works out, assuming that still goes ahead as is being discussed. That will give us a whole lot more responsibilities for balancing the network locally, and I know that there are places where it's out of balance. We also need to work out the relationship with National Grid – what happens if local and national balancing requirements conflict with each other, and clarity of who is responsible for what. There will probably be issues that we won't know about until we encounter them, and have to deal with them.

We've also been having very high level strategic discussions about the risk of state buy-out of the company. Corbyn's Labour party is doing well in the polls, and everyone's saying they plan to nationalise energy infrastructure and trains. Of course if they did win the next election they will probably find that implementing such policies isn't so straightforward. Personally, I don't think it's likely – we have our licence, we own the network – they would have to pay a lot to buy it, and the UK government isn't particularly cash rich! If they want to go down a licence route, that's pretty unfeasible too – they have to give us 25 years' notice of ending of our licence, and I don't see how that could ever be implemented, given likely political changes within those 25 years. If it did happen one day though, it shouldn't make too much difference to us operationally – we would expect people to remain in their jobs and continue working in similar ways based on their experience. But it could gradually lead to changes. And if there is local government ownership it could lead to splitting up of our network into smaller chunks, and that would be a mess.

1 Introduction

> *"To love. To be loved. To never forget your own insignificance. To never get used to the unspeakable violence and the vulgar disparity of life around you. To seek joy in the saddest places. To pursue beauty to its lair. To never simplify what is complicated or complicate what is simple. To respect strength, never power. Above all, to watch. To try and understand. To never look away. And never, never to forget."*
>
> Arundhati Roy (1999)

1.1 Introduction

This thesis aims to contribute insights that will support a transition to an ecologically sustainable, democratic and socially just GB energy system. The research is grounded in an interest in how people create systemic change towards sustainability through the crafting of new and evolved institutions. It uses concepts of commons, public goods, and polycentric governance to examine the current GB energy system, and explore the roles that different actors can have in a more sustainable and democratic energy system, with a focus on the activities of the community energy (CE) sector and Local Authorities (LAs) within the wider national energy system.

This can be framed as two research questions:

- What are the roles of local and community organisations in a GB sustainable energy transition?
- How do theoretical frameworks of commons and polycentric governance contribute to understanding these roles?

This research agenda has been developed through engagement with a number of community and local energy projects in the South West of England and through engagement with the Ostrom workshop literature on commons and polycentric governance and institutional analysis.

Elinor Ostrom won the Nobel Prize in economics for her work on governance of institutions, in particular her work on management of common pool resources. This sits within a broader theoretical concept of polycentric governance, developed by Vincent and Elinor Ostrom in a highly collaborative way with colleagues at the 'Ostrom Workshop', their research centre at the University of Indiana. The Ostromian theory is rich and detailed, and developed with a strong commitment to empirical research in the real world. Although a research agenda applying theories of polycentric governance to energy systems is emerging, there is a gap in research applying Ostromian theories of commons and polycentric governance to energy transition and governance of sustainable energy systems. The second research question aims to address this gap.

Both Ostroms made important contributions to knowledge, and both are cited in this thesis. As the thesis draws more on Elinor's work, citations referring to Vincent Ostrom are cited as 'V. Ostrom', whilst those referring to Elinor Ostrom are cited as 'Ostrom'.

This thesis uses case studies at the neighbourhood, local and regional levels to understand the ways in which local initiatives contribute to a GB energy transition. This includes both direct contributions of local initiatives, and ways in which they are shaped by and shape national institutional structures.

1.2 Commons and polycentric governance

The use of theoretical frameworks of commons and polycentric governance, as developed by the Ostroms, forms the second research question in this thesis. Whilst there are many theoretical approaches to studying the role of local and community organisations in energy transitions, these are selected as an interesting approach which has not yet been explored in depth. These theoretical frameworks, and the gap in literature applying these to energy systems, are discussed in depth in chapters 5 and 7. However, a brief outline of each is given below, in order to give context for the first part of the thesis.

A commons is defined in this thesis in terms of collective, as opposed to private or individual, property rights. The social relations of governance and property institutions are emphasised above the physical characteristics of a resource, through use of the verb form 'commoning'. Commoning can be seen as the opposite of commodifying, as it involves the integration of consumption and production activities within one institution rather than their separation. Commoning takes place in contexts where people have a shared dependence on a resource and on each other, where there is a social dilemma where the collective good may require different actions to those maximising individual benefit, and there is potential for conflict.

Polycentric governance is defined as:

> "A pattern of organisation where many independent elements are capable of mutual adjustment for ordering their relationships with one another within a general system of rules" (Ostrom, 1972, p. 21)

This combines decentralised decision-making, autonomy, interdependence and co-ordination. Polycentric governance sees order in a complex system, in contrast to perspectives that assume centralisation is required in order to avoid fragmentation.

1.3 Sustainable Prosperity: equality, democracy and respect for environmental limits

This research is explicitly normative, and grounded in core values of contributing to sustainable prosperity. Sustainable prosperity is interpreted here as involving living well within environmental limits, with care for ecosystems, and inter- and intra-generational justice. This means promoting human wellbeing and focusing on human agency whilst having an ecocentric rather than anthropocentric ethic. In this thesis, the conception of human wellbeing draws on capabilities theory (Sen, 1999; Robeyns, 2005, 2016; Deneulin, 2014), and theories of fundamental human needs (Max-Neef, 1992). For the purposes of this research, there is a particular focus on promoting equality, democracy, and remaining within environmental limits.

These values are all important for the community energy sector. Remaining within environmental limits is inherently a core value of sustainability. Equality is closely tied to intra- and inter-generational justice, which are also core values of sustainability. Although the simple political binary of left and right is avoided, a strong valuing of equality is the clearest reason that aligns me with the left. Equality needs to be explicitly valued at the outset in this thesis, as commons and polycentric governance approaches, the main focus of this work, do not necessarily protect equality.

Democracy also needs to be explicitly valued, as equality and remaining within environmental limits could arguably be achieved through centralised control. Democracy is a core value for commons and polycentric governance. This research also takes place in the context of a growing movement for energy democracy, and is strongly aligned with this. Localism is not included as a core value, as it is seen as a means to achieve democracy and environmental limits, rather than an end. The value of innovation is introduced later in the thesis, as this is a potential weakness of commons approaches that is addressed through polycentric governance, but it is not discussed in detail here. The meaning of equality, environmental limits, and democracy are discussed in the following sections.

1.3.1 Equality[2]

Wealth and income inequalities are growing, both within and between nations (Keister and Moller, 2000; Stiglitz, 2012). Whilst many people are willing to accept some inequalities in wealth and income, consistent growth in inequality is unacceptable. Equality is of instrumental value. It is associated with increased wellbeing (Wilkinson and Pickett, 2009), and remaining within environmental limits whilst meeting basic human needs is much easier if resources are equally distributed. Agyeman introduces the concept of 'just sustainabilites', arguing that "irrespective of whether we take a global, statewide or more local focus, a moral or practical approach, inequity and injustice resulting from, among other things, racism and classism are bad for the environment and bad for sustainability" (Agyeman, 2008a, p. 11).

This thesis additionally sees equality as being of intrinsic value, taking the position that one person is not worth more than another, as emphasised by Nussbaum, who promotes an ethic in which "everything is provisional and up for grabs except the notion that some are less valued than others" (Preskill, 2014).

The 'capabilities' approach, which is founded on a belief in the intrinsic value of equality, is Sen's answer to the question 'equality of what?' (Sen, 1979). Sen recognises the individual differences between people as a core part of considering equality (Robeyns, 2003), and argues that different individuals should receive the resources that they need to flourish, even if this means that different people receive different amounts of resources. This is illustrated in Figure 4. The first image shows that to have an equal outcome, different individuals (e.g. shorter/taller people) need differing levels of support. The second emphasises that it is not necessarily the individual characteristics (e.g. height) of people that are different, but that they also face different structural barriers (e.g. ground level, fence height).

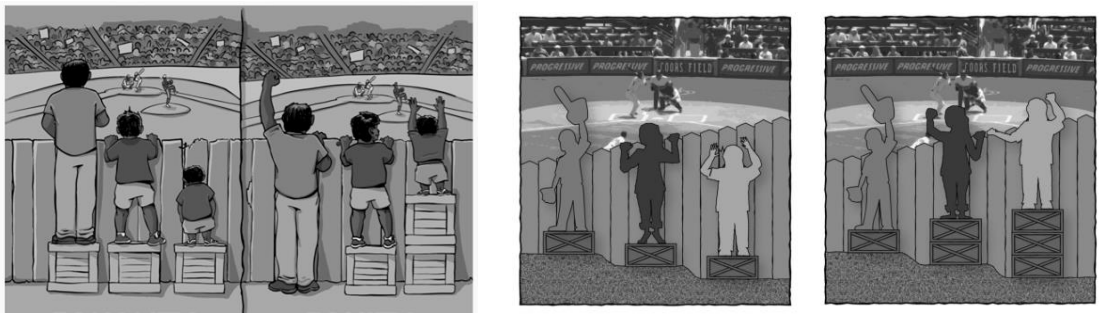

Figure 4: Illustrations of the different resources needed by different people, depending on their starting points Maguire (2016 adapted from Craig Froehle 2012) and Kultner (2016)

The capabilities framework is multi-dimensional and complex, and more specific conceptual tools are needed to implement reductions in inequality in practice.

One such tool is to use a heuristic, or rule of thumb, of three dimensions of justice: distributional, recognition and procedural. These relate to material wealth, dignity and respect for all, and voice or power in decision-making processes respectively. Although framed in terms of justice, these three dimensions can also be applied to equality. Walker and Day (2012) discuss these three forms of justice in relation to fuel poverty, as shown in Figure 5.

[2] This section is based on text produced for Melville (no date)

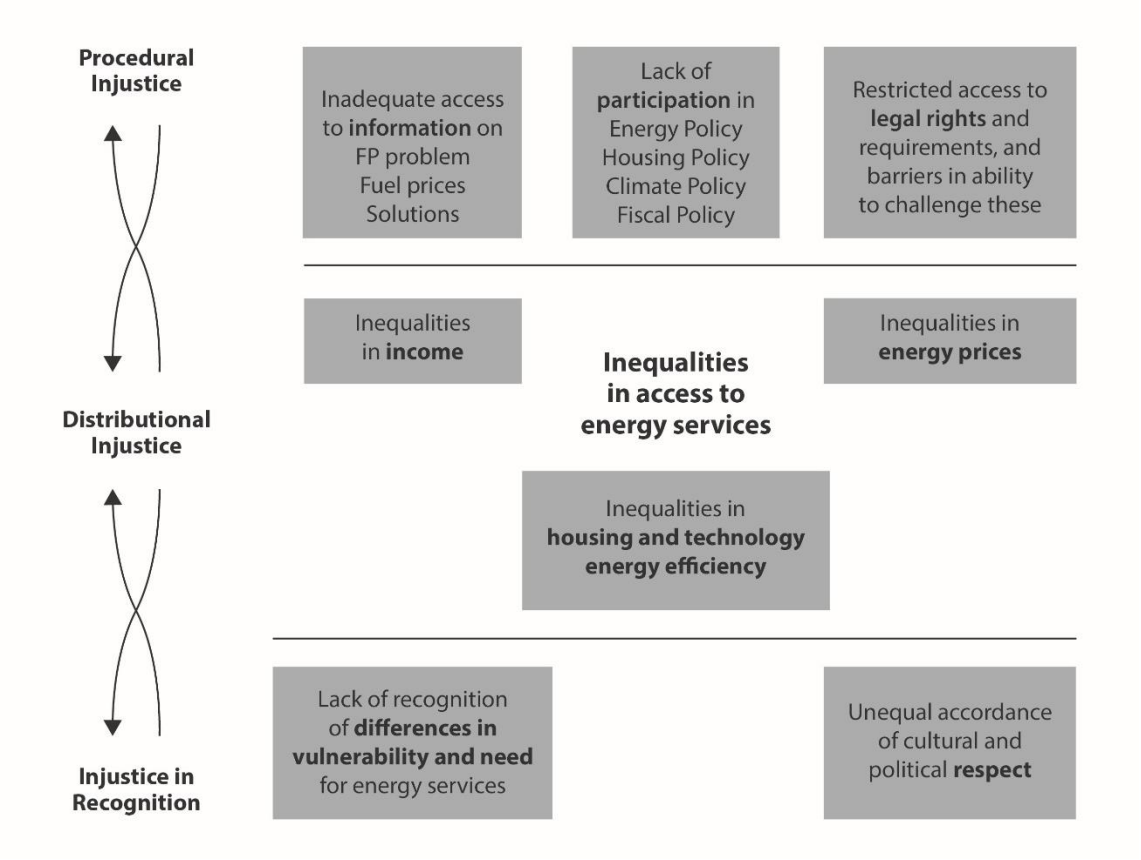

Figure 5: Three forms of injustice and their component parts in fuel poverty, from Walker and Day (2012, p. 74)

Another powerful tool, which responds particularly to the recognition element of justice or equality but also touches on distributional and procedural equality, is the discourse of power and privilege. This challenges the myth of meritocracy which believes that success comes purely from effort and talent, by showing that people do well in society because they have 'unearned advantages', due to structural and historic inequalities, or personal differences. Facing privilege is an uncomfortable process, partly because people with privilege want to feel like we are good people, and because it is easy to hear 'you have privilege' as 'you have had an easy life' (Kashtan, 2016). In fact, everyone is vulnerable (Levitas, 2013) and faces challenges in life. The concept of intersectionality coined by Kimberlé Crenshaw (Adewunmi, 2014), recognises that everyone has ways in which they are, and are not, privileged. Considering privilege involves a personal reflexive process, illustrated in McIntosh's (1988) process of 'unpacking the invisible knapsack'. She identifies unearned advantages she has as a white person, including seeing members of one's race represented in the history taught at school, not being followed or harassed by security guards in a shop, or being able to arrange activities so as to never experience feelings of rejection because of one's race. Another example is Brydon-Miller's (2004) reflection on her experiences of power and powerlessness in different contexts as part of her action research practice.

1.3.2 Democracy

A second core value of this thesis is democracy. Democracy is a political process that supports individual liberty and autonomy, whilst also enabling collective action, participation and community. Democracy is a process for enacting 'power with', one of three types of power identified by Starhawk (1987), along with 'power to' (individual personal power), and 'power over' (domination). This supports fundamental human needs (Max-Neef, 1992) of participation, creativity and identity.

Effective democracy is a skill that needs practice, and voting for a representative candidate once every four years is not enough. This was noted by Toqueville in the 1800s, who observed that participating in town

meetings where people made local decisions about things that matter to their lives gave people an opportunity to learn the skills of democracy:

> "Town meetings are to liberty what primary schools are to science; they bring it within the people's reach, they teach men (sic) how to use and how to enjoy it." (Toqueville, 1838)

The importance of frequent meaningful practice of democracy is also noted by Ostrom in this century:

> "A democratic citizenry who do no more than vote in national elections cannot sustain a democracy over the long term." (Ostrom, 2006)

The representative democracy of countries such as the USA and the UK is therefore insufficient for people to develop competent skills in democratic decision-making. The core skills required for good democracy include listening, finding common ground, and considering the good of the whole. Listening was important for early American democrats such as William Manning (1747-1814): "democracy involved a "duty to listen" just as much as a "duty of everyone to speak their minds freely on all laws and measures of government, and all men (sic) in office."" (Martin, 2005, p. 383 citing Manning).

Commons organisations and local democratic bodies, particularly through consensus-based democratic processes, can be an arena for practicing democracy, and learning the skills required. Mature participation in a consensus process means active listening, active participation, differentiating clearly between needs and desires and being oriented towards the needs of the group as a whole (Seeds for Change, 2013).

In the context of community-based commons management processes, Ostrom argues that a consensus-based process is likely to be more robust than voting. On the other hand, democracy inevitably entails conflict. Agonistic democratic theories, promoted for example by Mouffe (2006), see conflict as inevitable in politics, and criticise Habermasian 'public opinion' based on rational consensus for excluding dissenting voices.

Agonistic and consensus-based approaches both have value. They also may be less different than they first appear. In order to make decisions together, whether through consensus processes or otherwise, there is always a need for some common ground of shared values. Yamamoto (2011) argues that even an agonistic democracy needs some form of 'container' of shared values, 'shared symbolic space' or 'deliberative framework'. In the form of consensus used by Seeds for Change, the process relies on conditions including: common goal; commitment to reaching consensus; trust and openness (Seeds for Change, 2013, p. 13). If there is an insufficient common goal, the consensus decision-making process fails.

Democratic decision-making relies on each person having a meaningful voice. In practice, the power of different individuals or groups plays an important role. This is perhaps at the core of the difference between consensus and agonistic theories of decision making, and resonates with Røpke's (2015) distinction between 'consensus' and 'conflict and power' orientations to ecological economics. It is important to recognise that power and conflict are present even in discourses that are ostensibly consensus oriented, as well as seeing that it is possible to find common ground even in conflict situations.

1.3.3 Environmental limits

The third core value is to respect environmental limits. Many of the global ecosystems and planetary cycles that sustain life are at risk or severely disrupted (Rockström *et al.*, 2009; Millenium Ecosystem Assessment, cited in Wells, 2013, p. 110; Scoones, Newell and Leach, 2015). If humanity is indeed globally overshooting planetary boundaries (Rockström *et al.*, 2009), humans are potentially reaching limits to economic growth, at a global level. This prospect is a serious concern, as the current global political and economic system is dependent on continual growth in GDP for stability (Jackson, 2009; Jackson and Victor, 2011).

The existence of planetary boundaries also has implications for equality. If the size of the material pie is finite, population is growing, and inequality and poverty are too high, then a redistribution of wealth is desirable. This is deeply politically challenging, as it is not enough to argue that people will be lifted out of poverty through overall increase in wealth – those who consume too much also must consume less. The biggest overconsumers are the most wealthy, who are also the most powerful in society, and like most people they do not want to let go of the power, status and comfort that they have.

Some claim that through increases in efficiency, the total material wealth can be increased whilst reducing overall environmental impact. However, ultimately there will be physical limits, and there are also other reasons why efficiency may not lead to greater material wealth whilst remaining within planetary boundaries. Efficiency creates more material wealth per unit of environmental impact, but can lead to rebound effects (Sorrell, Dimitropoulos and Sommerville, 2009; Druckman *et al.*, 2011; Chitnis *et al.*, 2013); and increasing labour productivity, one type of efficiency gain, is part of the system dynamic that traps us in economic growth (Jackson, 2009; Jackson and Victor, 2011).

However, this is not necessarily a pessimistic outlook. There are many ways to use regulation, taxes or other mechanisms to reduce inequality by redistributing wealth. GDP, in itself, is a poor measure of social good, and includes many 'bads' within the measure (Kubiszewski *et al.*, 2013). The dependence on economic growth of a system with ever-increasing labour productivity for stability can potentially be interrupted by policies such as reducing working hours (Coote, Franklin and Simms, 2010), with potential immediate benefits for wellbeing. This has long been part of the vision of progress promoted by economic thinkers such as Keynes (Graeber, 2013). The question of working hours is important for our discussion of community and commons management, where involvement in local energy systems is limited partly by the amount of time most people spend in waged or self-employed labour.

Although many people in the world would benefit from an increase in material wealth, for those of us in the 'overdeveloped' countries, increases in material throughput do not directly increase our wellbeing (Jackson, 2009). Daly and Farley (2011) represent this diminishing return on growth of the economy as a marginal utility, which they contrast with the marginal disutility caused by pollution and overwork. As we reach ecological overshoot on planetary boundaries, we are in or at risk of entering into a 'full world' system where increases in material throughput create uneconomic rather than economic growth, as shown in Figure 6.

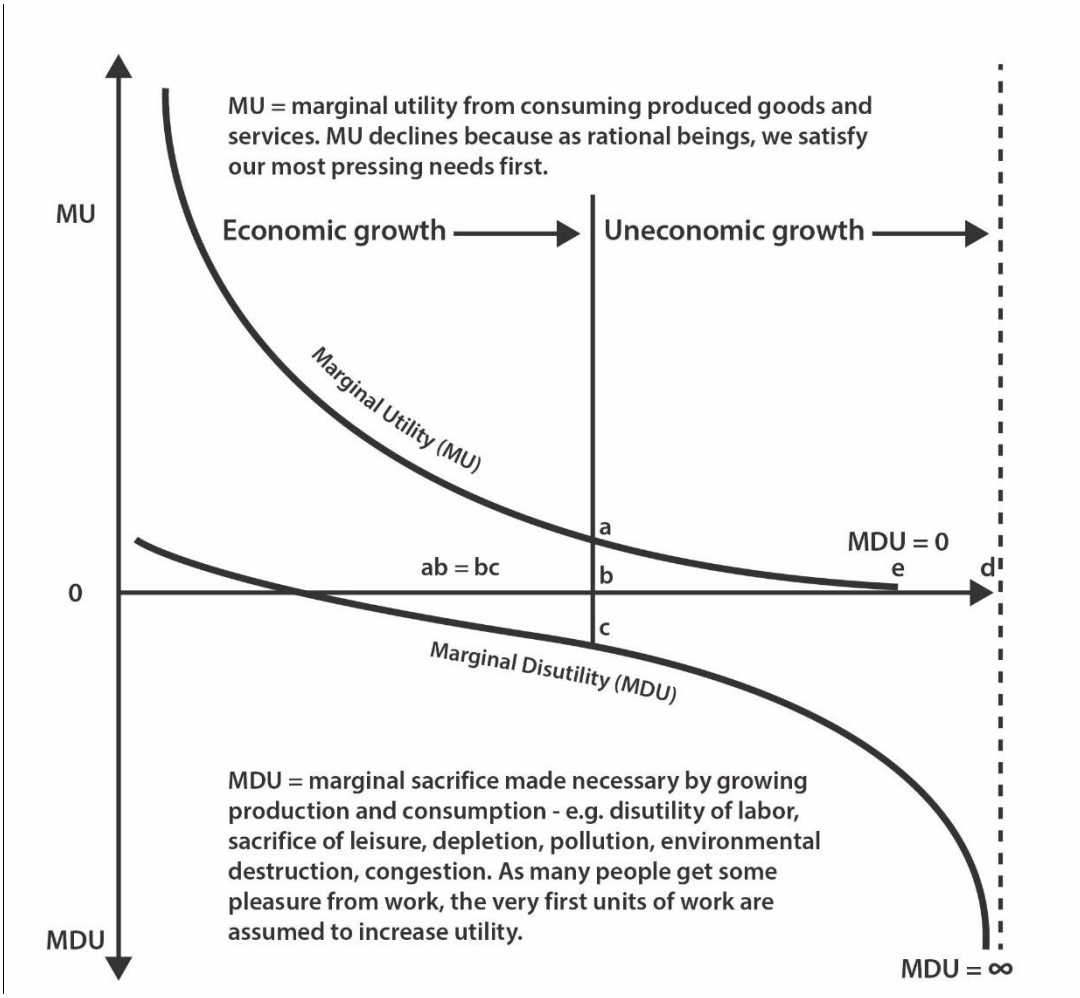

Figure 6: Marginal utility and marginal disutility of growth in the economy (Daly and Farley, 2011)

Perhaps one way forward, then, is to create an economy that is growth agnostic, where the economy could grow or not grow, and the question of GDP is no longer central (Ott, 2012). Recognising that growth in material wealth is still important in much of the Global South, Mueller (2014) suggests an alliance between the Degrowth movement of the Global North and the climate and environmental justice movements of the Global South. As this research is based in the UK, degrowth is relevant, as is the recognition of inequalities within the UK and the importance of solidarity with those in very different contexts in other parts of the world.

This thesis considers resilience to degrowth as a desirable characteristic for a sustainable energy system in GB. This is implicit throughout the thesis, but is not further discussed directly. The term environmental limits is used in the main part of the thesis rather than degrowth, as a detailed analysis of degrowth resilience is beyond the scope of this thesis.

1.4 Research context and researcher positionality

This research is based in an ontology of complexity, and has an action research approach, both discussed in more detail in chapter 3. As such, the context of the research and positionality of the researcher are important.

1.4.1 Research context – the EngD

This thesis has been produced through an engineering doctorate, or EngD, rather than a PhD. The EngD programme aims to produce doctoral research that is of value to industry, and embedded within a practical context, rather than pure academic outcomes. The contribution to knowledge is assessed to the same standard as a PhD, but real-world value to industry must also be demonstrated, and integrated with the production of knowledge.

The EngD takes place through partnership with a company, in this case BuroHappold Engineering (BHE), in the sustainability consulting team.

1.4.2 Introducing myself - the researcher

An EngD is a practice-based doctorate. This means that the work is not purely theoretical, but is about practical outcomes, and the messy process of action in the world. A complexity paradigm recognises that action always requires decisions to be made without complete knowledge of the outcomes, which may be chaotic and evolutionary. In particular, this thesis deals with questions of governance and politics, where there is no singular 'right answer', but many contesting views. A reflexive approach is taken to the research process itself, acknowledging the subjectivity of the researcher, and being explicit about the normative framework motivating the research. As such, the following section provides a brief overview of my positionality as a researcher, and is written in the first person.

I am a white, middle-class, British cisgendered woman, with a degree in engineering from an elite university, and lifelong experience and expectation of financial security. I am aware of the privilege that comes with this background, and that this experience shapes my perceptions. I also bring a number of different perspectives and identities to this research: as a research engineer in the sustainability team at BHE; as a founding director of the Bristol Energy Co-operative (BEC) (2010-2013); as a climate change activist involved in direct action and social movements; as a doctoral student working to the norms of academic knowledge production. I believe that this plurality brings a richness and creative tension to my research, but it can also be challenging to find solid ground to stand on when I feel that I am being pulled in different directions. Although each of these worlds broadly shares my core values, they have different beliefs, norms, and visions of what a good future looks like and how to get there. The EngD gives me the opportunity to consolidate my own position and be clearer in what I bring to any context. I identify with each of these worlds to varying degrees, and have maintained a foot in each throughout the EngD.

Prior to starting the EngD (2010-2013), I worked for BHE, which is now the sponsoring company of the EngD. BHE is an engineering consultancy with a primary focus on the built environment. The largest teams are in structural engineering and building services, and the majority of the work comes through repeat contracts with architects with whom the company has relationships. The sustainability team is one of the specialist teams within the company. Having been heavily involved in the UK Climate Camp movement before starting at BHE, I brought a critical perspective to the capitalist dynamics of consultancy work. The reality is much more complex than I expected. Over the years I have come to see the leadership of the sustainability team as providing an umbrella of overall financial viability which enables values-driven non-commercial work to take place – an organisation that is capitalist on the outside and co-operative on the inside[3] . However, my sense of accountability to this commercial context has created a hegemonic censor in my head that tells me that critique of capitalism and neoliberalism, histories of enclosure and colonialism, and narratives of oppression and privilege do not belong in this research. No-one has told me to censor my thinking in this way. I have

[3] adapting Bollier's idea of land trusts as being "private property on the outside, commons on the inside" (Bollier, 2014, p. 102)

chosen to make an active effort to be aware of and challenge the internal self-censor of neoliberal hegemony in mind. I am aware that this risks alienating some of my colleagues.

When I was working for BHE, I was involved in the early stages of the BEC (2010-2013). BEC is one of many CE projects set up in GB in 2009-2011, in response to the Feed in Tariff (FiT), a subsidy for renewable energy (RE) generation which enabled a viable business model for an investment co-operative. I first learned about the FiT at a solar photovoltaic (PV) training organised by BHE, and heard that it was being used to install large solar PV farms on the fields of wealthy landowners in Cornwall. This is an unequitable outcome, as those who owned land, or a home with a south-facing roof, and who had enough capital to invest in the upfront cost of a solar PV system could access the FiT, but not those who were renting or with limited financial means. I wondered if some form of co-operative might be a way to widen access and share the benefits by pooling resources, and soon discovered that people involved in the recently formed Bristol Energy Network (BEN) had already gone through this thought process and started to set up BEC, and so I became involved. My vision for this, inspired by my experience of consensus decision-making and grassroots collective action in Climate Camp, was for a broad-based democratic organisation for the city which would be able to respond equitably to future energy challenges and hold the city council accountable. In practice, the reality has been less utopian.

As a student, in 2006 I had attended the first Climate Camp which took place in a field near Drax, the UK's biggest coal fired power station, with the aim of shutting it down for a day. Climate Camp had its roots in the alterglobalisation movement, and ecovillage camp that was part of the anti-G8 protests at Gleneagles, Scotland, in 2005, and in the UK Earth First movement. The aims of Climate Camp were: movement-building; education; sustainable living and direct action (Bowman, 2009). Over the following four years (2006-2010), camps were held each summer, with up to 3000 or 4000 people attending workshops; direct action trainings; running the camp together with compost toilets, vegan food and RE; attempting to have an economic impact on fossil fuel power stations, airports, and global finance through direct action; and attempting to bring climate change into public discourse through the media. Being involved in this world gave me an experience of the potential and the limitations of anti-hierarchical organising and consensus decision making, which can be amazingly effective, and gave me skills in facilitation of Quaker-derived large group consensus processes (Seeds for Change, 2013). I was immersed in anti-capitalist and anarchist worldviews. I experienced some perennial political tensions: hierarchist vs horizontalist ways of organising; radical vs reformist approaches to making change; whether to affiliate with the PGA hallmarks (People's Global Action, 2001), which include taking a confrontational and explicitly anticapitalist stance vs the risk that this might alienate potential allies, whether a commitment to non-violence was playing into 'good activist/bad activist' discourses, and would distance us from the less widely celebrated social movements which have fought for social justice, such as the Black Panthers, the Zapatistas, etc. Being part of a social movement that valued autonomy, squatting and skipping for food, combined with the security provided by my privilege as a middle class white person with educational capital and a sense of entitlement, gave me a freedom and boldness to take risks with asserting what I believed in.

I am now working in an academic context. The standards and meanings of truth and knowledge are different to those in other parts of my life. In consultancy, truth is sufficient information to demonstrate compliance, communicate the outcomes of modelling, or persuade a potential client to choose us. In my first degree, of engineering, knowledge meant being able to derive the right answer in a calculation. In the CE sector, knowledge is valued for being useful in delivering projects. In the anticapitalist horizontalist climate movement, truth is social justice, climate justice, awareness of privilege, and being willing to put your body in the way of environmental destruction. In social science, knowledge is more complicated. There are no right answers, there are choices between alternative epistemological and ontological positions, and according to Booth et al. (2008), knowledge is demonstrated by making a logical and well-evidenced argument.

I also found it challenging to move from a competent consultant role at BHE, to the bottom of a learning curve in social science research, which resonates with Burgess' description of moving from practitioner to action researcher in a nursing context:

> "This shifting between the worlds of community leader and novice scholarship, and maneuvering between hierarchies of health and now academia, confronts my sense of identity and confidence." (Burgess, 2006, p. 420)

I am interested in exploring how BHE can use the knowledge generated through this research to be of better service to the world and to the transformation of our society into one that is sustainably prosperous. My vision of sustainable prosperity may be different to that of my colleagues, and this is a difference that I am interested in exploring, to understand where there is common ground that we can build from and where there is difference that will keep us sharp and creative. Finding where those differences are without making assumptions may involve difficult conversations that bring disagreement into the open, but that are committed to finding out how deep we need to go towards the values that are universal before we can find a place of agreement. I understand that financial viability is part of how BHE can serve sustainable prosperity. However, for me this is a means that is part of survival, and always open to question, not an end.

1.4.3 Introducing BuroHappold Engineering - the sponsoring company

BHE is an engineering consultancy with 1,800 staff worldwide, 300 of whom are based in the headquarters in Bath. Its core expertise is in structural design and building services design for the built environment, primarily prestigious and high quality buildings in commercial, cultural, sport and entertainment, science and technology, transit hubs and education sectors, as well as urban development and city masterplanning. A large part of BHE's business takes place in the Middle East, with three offices in the region. This EngD is situated in the sustainability team in the Bath office. As a consultancy, BHE does the work that clients are willing to pay for, although there is also some internal support for pro-bono work that is of social value, through the SOS (share our skills) programme, and through discretionary spending on business development, training and learning within the teams. Projects where I worked with colleagues at BHE as part of this research were funded through national government innovation programmes, national government support for LAs to develop district heating networks, or internal BHE development funding. The market for further sustainable energy work in GB is limited due to current government policy favouring fossil fuels, and undervaluing the role of coordination. There may be potential for BHE to take an active role in developing this market in the future.

1.4.4 Personal motivation for the study

This research, which adopts an action research approach, has a strong purpose and theory of change.

I am interested in how people can create systemic change towards sustainability through the crafting of new local institutions for the use and delivery of energy.

This question is both about how people craft such institutions, and how such institutions can help create systemic change towards sustainability. The objective of change is unashamedly normative. It is to move from our current situation where we systematically increase inequality between people and deplete the non-human environment, to a system which reduces inequality and has a restorative effect on the environment. This is essentially an articulation of the fundamental tenets of sustainable development.

Achieving this requires a transformational and systemic change. There are fundamental unanswered questions as to whether or how such change can be intentionally created. Meadows (1999) talks of twelve levers of system change, from changing the 'numbers' as the least effective, to changing the paradigm, and transcending paradigms. Revolutionary theorists argue for the destruction of existing institutions before

replacing them with new ones. Alinsky (1971), Freire (1968), Boal (1992) and others take an emancipatory approach to building power among the oppressed. The Dark Mountain Collective (2015) and Anti-civilization movement see the wholesale destruction of civilization as the only way to protect ecosystem integrity in the long term. Corporate Social Responsibility seeks to encourage the benevolent activity of the powerful. Social movements aim for change through mass support for or against an issue. Each of these theories of change has its limitations, and the creation of an alternative through the crafting of institutions of the commons is no exception. Collective action institutions are also not new, and have been well documented from agricultural commons and guilds of the middle ages to the cooperatives of the 18th and 19th century, and the present day.

My approach is one of purposeful institutional crafting, attempting to both change the system and to understand and reveal the barriers to that change through developing institutions which work according to a different logic to that of profit maximisation, but which can exist within the complex and inconsistent system that we do have. This approach has points in common with the idea of prefigurative politics, or acting now as though a desired future was already here, and of making transitional demands, or demands which appear politically feasible, but if enacted would have systemic consequences. It is an approach shared with the Transition Towns movement, the co-operative movement and with social entrepreneurship. It is a method of change that is a craft, or an art, a creative process led by an intention and a vision, a desire to create something in particular, to move in a particular direction or according to a set of principles. The exact form of the final product is not known at the outset, but evolves in response to the material being shaped. In the context of crafting institutions, that material is the other people involved in the process, the rules of interaction they are using, and the inertia of existing institutions.

I aim to both seek innovative, transformational change by pushing at the boundaries of what is possible, and to understand the limitations of this approach by testing those boundaries to the limit and experiencing failure. To quote Woody Allen, "If you're not failing every now and again, it's a sign you're not doing anything very innovative", and a saying quoted by University of Surrey lecturer Walter Wehrmeyer "Do you want Success, or Wisdom?", saying that one becomes wise only through failure (if this thesis is a failure, I hope to glean some wisdom from it!). The methodological approach taken is one of action research, which aims to simultaneously improve the situation where the research takes place, to develop new knowledge, and to create transformational learning for both the researcher and the participants.

1.5 Content and structure of thesis

The thesis is structured in three parts, each of which is divided into chapters. The first part sets the scene for the thesis, giving an overview of the problem context, the research questions, and the approach taken. It comprises the introduction, background, methodology and case study chapters.

The introduction (this chapter) has provided an overview of the thesis, and introduces the context of the thesis and the positionality of the researcher, as well as the core values and theory of change which guide this research. Chapter 2 provides background to the GB energy system, including the changes that are needed and are taking place in response to climate change, and different potential pathways for the future of the GB energy system. Chapter 3 gives a detailed description of the methodology, including the philosophical foundations of the research. Chapter 4 introduces the case studies and their detailed methodologies.

The second part analyses the GB energy system theoretically, in relation to the core theories of commons (chapter 5 and 6) and polycentric governance (chapter 7). It considers how these theories interact with electricity and energy more widely, as a physical resource, and infrastructure and a set of institutions in GB. This part combines literature review with original analysis. It culminates with an initial proposal for "design

principles" (DPs) for polycentric governance of energy (chapter 8), based on insights from the theoretical analysis.

The third part of the thesis analyses the empirical case studies in relation to the initial DPs proposed (chapters 9, 10 and 11). It uses this analysis to refine the original DPs and to propose a revised list at the end of chapter 11. Finally, chapter 12 discusses conclusions and implications for various stakeholders.

2 Background to the GB energy system

Essentials

No rose tinted tea-lights for us,
we hoarded solid slabs of light.
Each one ten hours worth of evening:

a meal, a bedtime story,
the nuanced eyes of arguments,
the washing up.

We knew the flickering of lamps,
the gnarled wind's talons at the wires,
its whoosh of sudden darkness.

Wax bricks arrived in bulk
with rice and sugar, immutable as marble
till we coaxed them back to liquid,

poured their shifting bodies into moulds.
At night, our homemade candles
stood like sentinels, positioned

for the sweep of match to box.
One family, we'd crowd their flames
while slates swooped from the roof

like leaden bats. The house swayed
on its hinges, a frightened mother,
belly pulled inwards.

When a bulb blows, when strip lights stutter
when tube lamps stumble out in tunnels,
when the BBC broadcasts from Gaza

I think of them, our fat light towers,
how we needed them as much as laughter.
While outside, the landscape mutated,

another monster cracked and hungered,
its own electric flare illuminating us:
tiny, clinging to wax and wick
in the mouth of its wake.

Miriam Nash, Small Change (2013)

2.1 Introduction

The UK is undergoing an energy transition, from a high carbon, centralised system to a low carbon, more decentralised system. This is motivated to a great extent by the need to move away from burning fossil fuels in order to mitigate climate change, and is enabled by technological innovation in RE generation, and smart energy controls.

This thesis primarily focuses on the electricity system. However, it also touches on other aspects of energy, such as the demand for heating in a domestic context, and the effect of transitioning heating and transport to electricity. As the electricity and gas industries involve national scale network infrastructure, these are subject to regulation by Ofgem (the Office of Gas and Electricity Markets), unlike transport fuels or other forms of energy. Therefore the term 'energy industry' is used to refer to the gas and electricity industries.

Regulation and policy for the energy system is partially devolved in the UK. The community energy strategy, for example, includes the whole of the UK. However, the electricity and gas markets are devolved in Northern Ireland, so the regulator Ofgem, and the energy industry codes apply to GB rather than the UK. Following from this, the Feed in Tariff applies to GB rather than the UK. Some policies are devolved to Wales and Scotland – for example support for the CE sector is different in Scotland to England. The case studies in this thesis are in South West England, but some reference is made to projects in Scotland and Wales, and as such the scope of this thesis is GB. The distinction between UK and GB energy matters is not widely recognised, but efforts have been made to minimise errors in this text.

This research considers a sustainable energy system to have low energy demand, and to use energy primarily from renewable sources. This broadly follows the approach taken by the iGov research programme, where "sustainable is taken to mean a non-nuclear, primarily low carbon, low energy demand system" (Mitchell, 2014, p. 2). It involves an almost complete transition away from fossil fuel based energy, and high reliance on renewable, distributed electricity.

The 'transition pathways' research programme (Foxon, 2013) proposes three pathways for a low carbon electricity transition, which can also apply to energy more generally: a 'market rules' pathway, a 'central coordination' pathway and a 'thousand flowers' pathway. These are characterised by different 'logics' of market, state and civil society leadership. This thesis focuses on the governance of the 'thousand flowers' civil society led and decentralised energy pathway.

The theoretical frameworks of commons and of polycentric governance are particularly well suited to developing theories of governance of the thousand flowers pathway. These theories are discussed in detail in chapters 0 and 7, so this is not the place to describe them fully. In broad terms, polycentric governance refers to multiple centres of decision-making, a decentralised system that fits with both the civil society and the market logic. On the other hand, the commons, although it can be used to describe only the civil society logic, can also be considered as the opposite of the competitive, commodified market, inclusive of both civil society and state logics. The intersection of commons and polycentric governance theory therefore falls in the civil society logic of the 'thousand flowers' pathway, which is the focus of this study. This is illustrated in Figure 7.

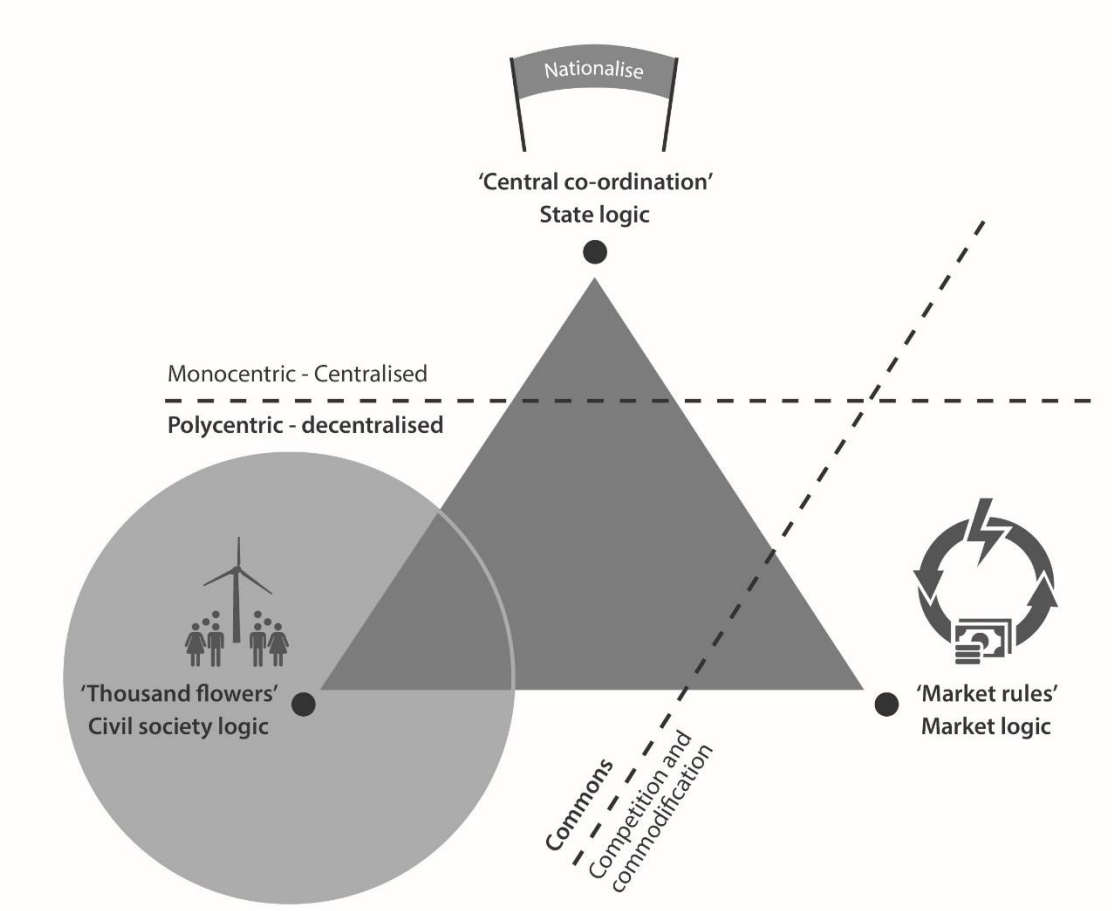

Figure 7: Mapping the Transition Pathways with the theoretical frameworks of polycentric governance and commons

This chapter uses a heuristic framework with top-down vs bottom-up and marketised vs political polarities as a structure for discussion, shown in Figure 8. The meaning of these axes is discussed in more detail throughout this chapter. This graph is similar to one offered by Pahl-Wostl and Knieper (2014), who separate the axis of cooperation and coordination vs lack of coordination from the axis of centralisation of power vs distribution of power to categorise governance regimes, creating space to explore the decentralisation vs centralisation dilemma in a nuanced way[4]. They derive four 'ideal types' of centralised coordinated; centralised rent-seeking; fragmented; and polycentric, which are mapped onto Figure 8. This enables some of the political dimensions of different approaches to energy systems to be made explicit. The 'ideal type' of polycentric governance maps onto the roles of local government and the CE sector, which is the focus of this thesis. The theory of polycentric governance is explored in more detail in relation to energy in Chapter 7.

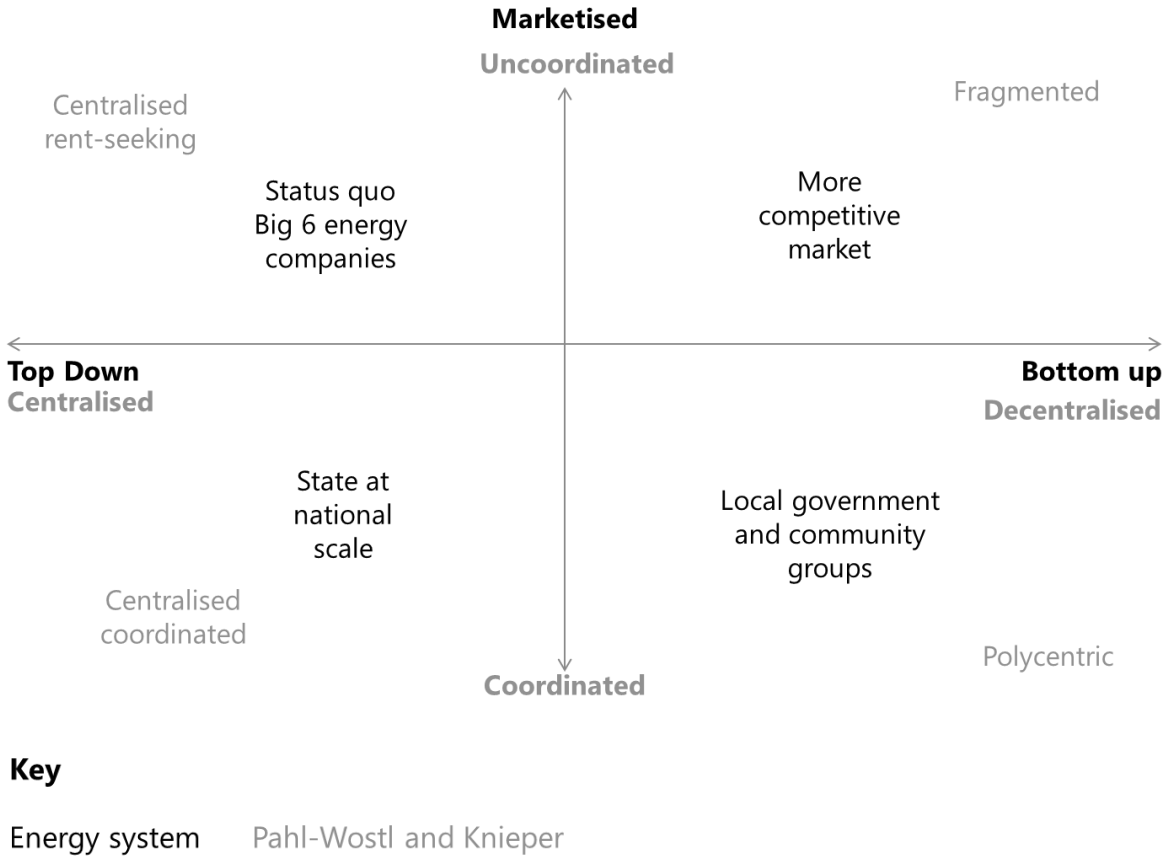

Figure 8: Framework of top-down vs bottom-up and marketised vs political mapped onto Pahl-Wostl and Knieper framework

2.2 History of energy governance paradigms

The UK energy system is a top-down, market based system dominated by large, incumbent private companies. However, this has not always been the case. Historically, UK electricity and gas networks were first developed in towns by private entrepreneurs and LAs (Fudge, Wade and Peters, 2012). This provided an income to local governments. According to ex-labour party MP Alan Simpson, income from municipal utilities, including gas, water and electricity, represented almost 50% of local government revenue in 1948, when nationalisation took place, and was used to finance public amenities such as parks, libraries and

[4] This is discussed in more detail in chapter 7 in the definition of polycentric governance

swimming pools (Simpson, 2017). From 1926 to 1933 the national electricity grid was constructed, with nationalisation of the electricity system taking place from 1947 (HM Government, 1947). From 1979 there was a shift towards privatisation, deregulation and the creation of a liberalised market system, with the Electricity Act 1989 (HM Government, 1989).

This history is shown in relation to the axes of marketised vs political, and top-down vs bottom-up in Figure 9.

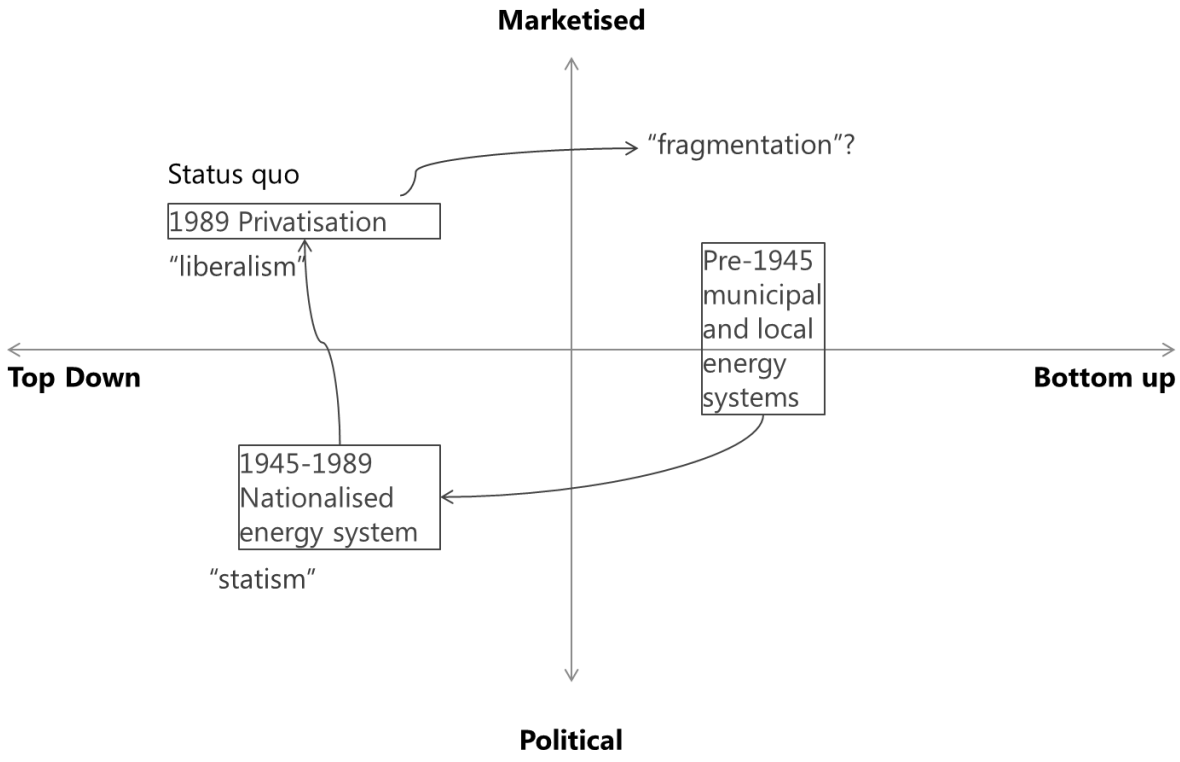

Figure 9: Mapping of history of UK electricity system

Goldthau (2012) considers historical shifts in energy system paradigms at a global level. These shifts in paradigm are shown in Figure 10, and also mapped onto Figure 9. Goldthau does not represent the early pre-nationalisation stage of local energy systems, but begins with 'statism', corresponding to nationalisation, followed with liberalism, which corresponds to privatisation. He considers that from the 1990s, concern about climate change and fuel poverty led to greater state intervention in energy policy at national and global levels, the 'intervention' paradigm. Goldthau sees increasing fragmentation going forward, where LAs, CE groups, and smaller private enterprises all have a role. This has some echoes of the early stages of the electricity system's development, but crucially is taking place in the context of existing national infrastructure and synchronisation.

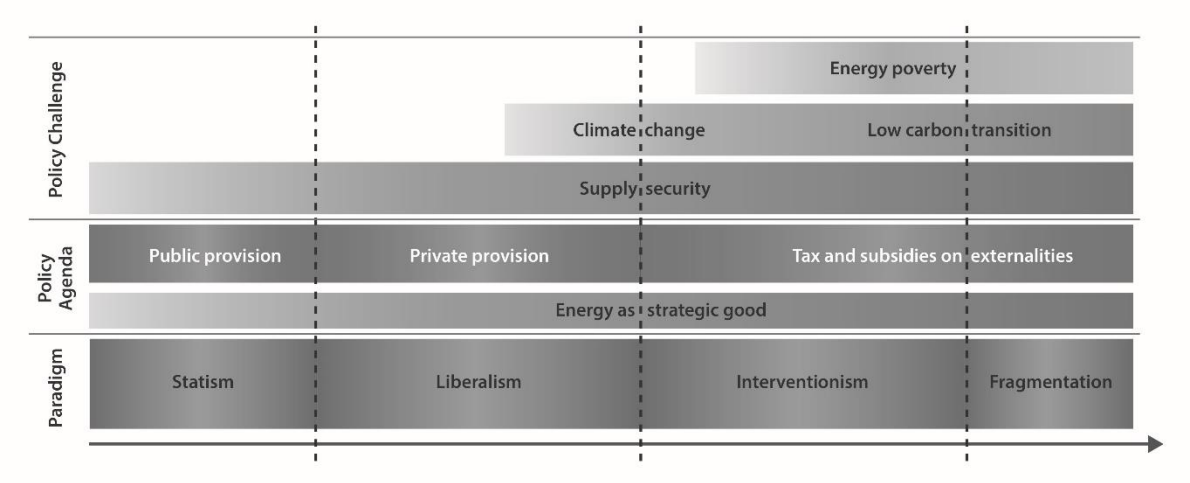

Figure 10: Energy paradigms, policy agendas and governance patterns. Adapted from (2012)

Goldthau sees fragmentation as a future trend that has already started. However it is never possible to know what the future will be, and the use of scenarios or pathways can be a useful approach to considering possible futures. Several organisations have developed UK energy system scenarios. The Transition Pathways research programme mentioned at the start of this chapter proposes three scenarios of market rules, central coordination and thousand flowers (Foxon, 2013). These are characterised by different 'logics', of market, state and civil society leadership. The Energy Technologies Institute (ETI) proposes two scenarios (Energy Technologies Institute, 2015): a top-down 'clockwork' scenario resembling the statist and liberalist paradigms proposed by Goldthau, and a bottom-up 'patchwork' scenario resembling the 'fragmentation' paradigm. These are based on whether the state takes strong leadership or not. The ETI and Transition Pathways models are mapped onto the diagram in Figure 11.

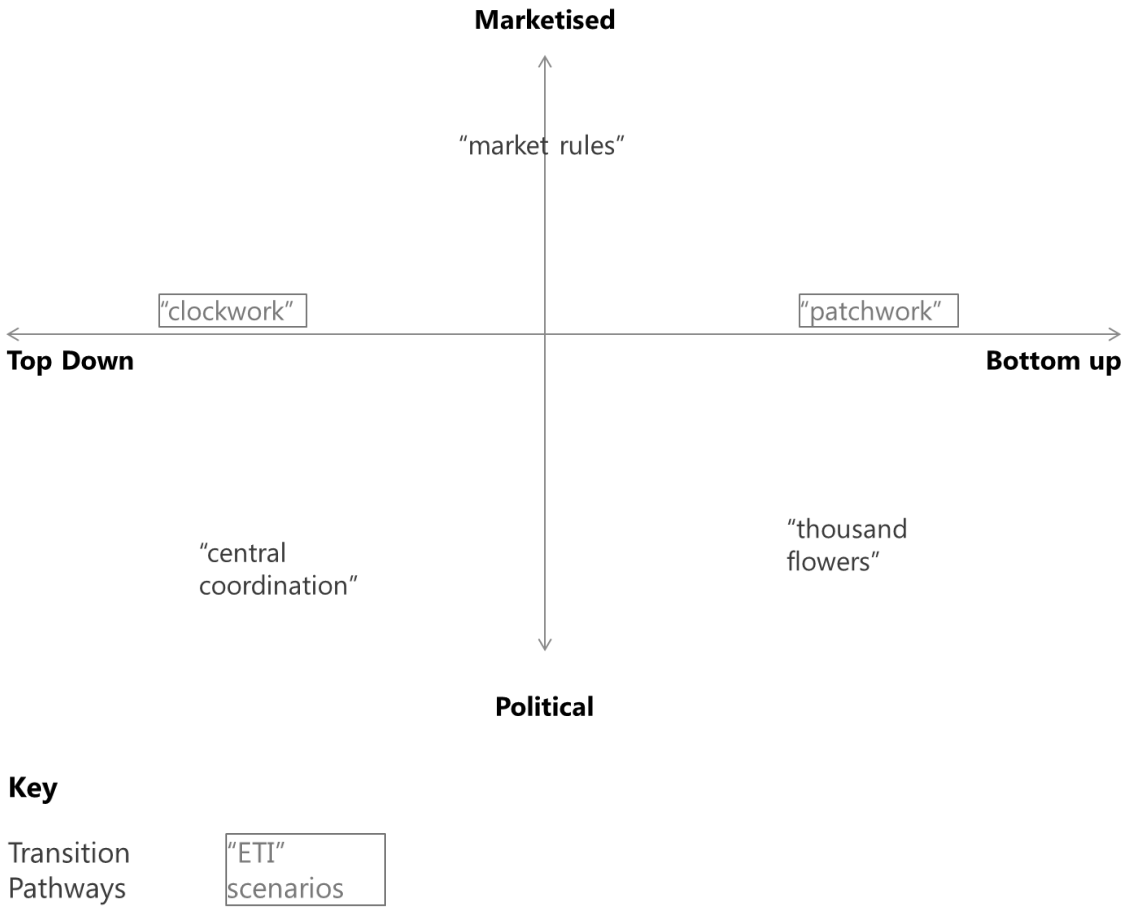

Figure 11: Mapping scenarios onto top-down vs bottom-up and marketised vs political framework

These scenarios were developed by imagining possible governance structures and the technologies that would be used in each governance structure. This was then used as a basis to model levels of total energy used, mixes of technologies, overall carbon emissions and capital investment costs. In practice different paradigms and modes of governance can exist in parallel with each other, in mixed mode situations described vividly by De Landa (1997), in a variety of historical contexts.

2.3 UK energy policy priorities

In the UK, energy policy is often framed in terms of a 'trilemma' of energy security, affordability and decarbonisation (DECC, 2014). There are tensions between the three parts of the trilemma, and varying interpretations of each term, as shown in Figure 12.

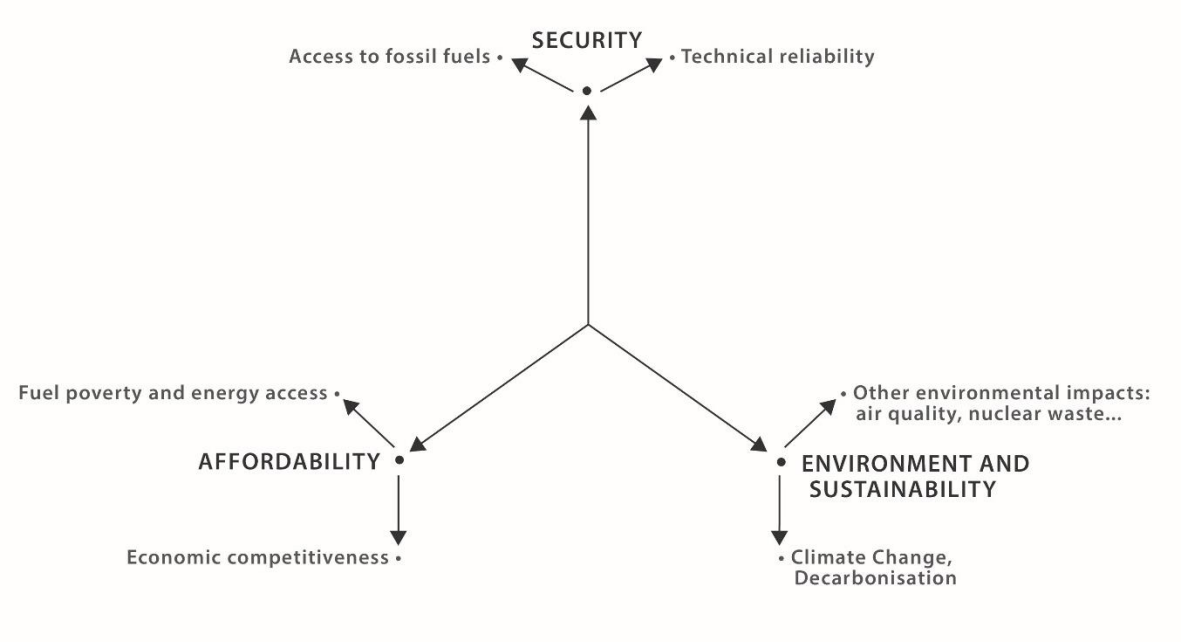

Figure 12: The energy trilemma of security, affordability, environment and sustainability, and different interpretations of each

For some, energy security is primarily a geopolitical question of access to sources of primary energy, particularly fossil fuels, whilst for others it is focused on technical reliability of UK infrastructure systems. For some, affordability is primarily about the impact on the national economy of the cost of energy for industry, whilst for others it is about access to enough energy for households to meet their needs. For some sustainability is about all environmental impacts, whilst for others it is only concerned with climate change.

Increasing prices could make energy efficiency financially attractive and reduce consumption, but could exacerbate fuel poverty. A rising block tariff, where a basic allowance of energy is priced at a low rate, could ensure universal basic energy access, but would require cross-subsidisation (Sun and Lin, 2013)[5], potentially risking national economic competitiveness. Reducing the reliability of supply could potentially achieve carbon savings through enabling greater renewable deployment with lower costs of flexibility and storage. However, achieving this in a way that protects wellbeing would require a substantial cultural and economic shift.

Currently, the UK energy system performs well in terms of reliability and low price, although fuel poverty is a problem for people with low incomes living in poor quality housing, and there is fear about the consequences of not being able to 'keep the lights on'. Energy security and affordability are political priorities for governments, because they are essential to achieving governments' 'core imperatives' of national security and economic growth (Scrase and Ockwell, 2010). However, the energy system does not perform adequately in terms of climate change. Transformational change is needed in order to achieve the UK's share of international decarbonisation, and to comply with targets enshrined in law in the 2008 Climate Act (HM Government, 2008).

[5] A rising block tariff involves a low price for the first few units of energy used by a household, based on a calculation of a 'basic need' allowance. Use above that amount is more expensive. This involves cross-subsidisation, which could be by charging more for energy used by industry than by households. It is an equitable policy type, and forms of rising block tariff are used in several countries around the world. However cross-subsidisation does not fit with the 'cost reflective' paradigm of the EU energy markets, which aims for prices seen by consumers to reflect the cost of production of energy.

2.4 Energy technical definitions and thesis scope

This thesis primarily focuses on the electricity system, and on energy demand. However, drawing a boundary clearly around this scope is difficult, as different types of energy are interconnected, for example heating and transport may use electricity.

It is worth defining a few terms, in order to define scope clearly:

Primary energy is the energy that is first captured by humans and enters the energy 'system' of infrastructure. This includes fuels, such as natural gas, biomass, coal, uranium and oil, which can be transported from one place to another, and dispersed RE sources such as solar, wind and wave energy, which can be captured where they are and converted into electricity.

Energy vectors are the medium by which energy is moved from one place to another, but are not forms of primary energy. Electricity is an energy vector, as it must be generated in a solar panel, wind turbine or thermal power station. Hydrogen is also an energy vector, as it is not available to capture from the air or mine from the ground, but can be produced using electricity. Hot water in a house central heating system or district heating network; and methane produced from hydrogen using electricity rather than taken from the earth as a fossil fuel, are also energy vectors.

Energy storage refers to the medium in which energy can be stored over time. Solid, liquid and gaseous fuels can be stored in their primary energy form. Hydrogen and hot water can also be stored. Electricity cannot be stored as electricity, but can be stored by converting it to other forms of energy and back, e.g. chemical energy in batteries, potential energy in pumped storage facilities, pressure in compressed air storage, or hydrogen.

Final demand usually refers to the energy consumed for different uses, such as transport, heating, or commercial uses. It is generally measured in energy units of the energy vector or fuel that is used, e.g. gas, electricity, petrol or coal.

Some energy is lost in every conversion, from coal to electricity, from electricity to storage and back, or in transportation, as heat from electricity transmission cables, or leakage from gas pipes.

Primary energy, final demand, and energy vectors are represented in the UK national energy flow chart. The UK national energy flow chart for 2015 is shown in Figure 13.

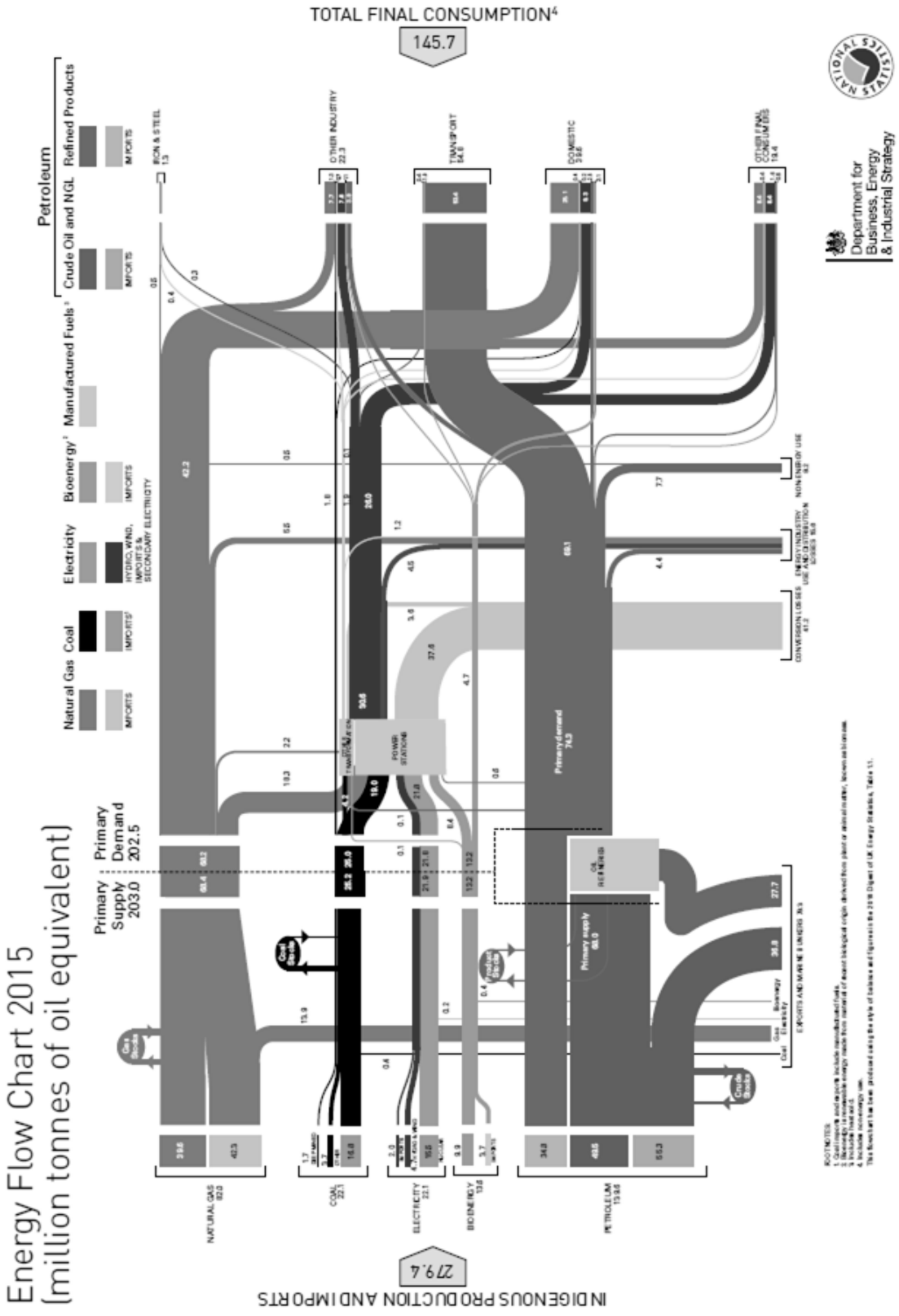

Figure 13: 2015 UK energy flow chart, reproduced from BEIS (2015)

Energy services refers to the useful service provided by energy. In modern industrial societies, we need modern energy for warmth, cooking, light, social connection, information, leisure and entertainment, satisfying fundamental human needs for participation, affection and subsistence. This is powerfully evoked by Nash (2013) in her poem cited at the start of this chapter. Energy statistics do not tend to measure the amount of light we obtain, or the amount of communication achieved, the heat that actually enters food, or the room temperature achieved in homes. However, energy is lost in the appliances producing the energy service, or the fabric of buildings. The amount of light produced per unit of electricity in an LED bulb is much higher than that produced in a filament bulb, which loses most of the electricity as heat. Measuring this energy service provision would enable a better understanding of the real value produced from the primary energy, but it is difficult to measure. Santos et al. (2017) attempt to quantify 'exergy', a concept similar to energy services as defined here, in national accounts.

Transitioning away from fossil fuels means replacing fossil fuel based primary energy with other forms of primary energy. With the exception of solid, liquid or gaseous biofuels, which can be transported directly, transporting RE from one place to another requires use of energy vectors such as electricity, hydrogen, synthetic methane, or hot water.

Electricity is the form of energy that is easiest to decarbonise, as most RE sources generate electricity. Nuclear power also generates electricity. Carbon Capture and Storage (CCS), which is part of the UK government's low carbon energy strategy (although it has not been commercially proven nor tested over the long term), is a technology that could potentially remove carbon emissions from electricity generating combustion based power stations. Because of this, electricity plays a dominant role in many low carbon energy scenarios. However, converting final energy demands for transport and space heating, which currently rely mostly on petroleum and natural gas, would make a huge increase in the total electricity demand, which would risk exceeding the capacity of existing electricity infrastructure (Quiggin and Wakefield, 2015). Moving away from natural gas could also leave the extensive gas network redundant. Converting low carbon electricity to hydrogen or synthetic methane could provide resilience by using more than one energy vector, reduce the strain on the electricity infrastructure, and provide some storage. However, this would lead to energy losses in conversion, and faces technical and cost challenges that have not yet been fully resolved.

2.5 Electricity system technical challenges

The GB electricity system was designed to transmit electricity generated in large thermal power stations, through the high voltage transmission network, to homes and buildings connected to the lower voltage distribution network, as shown in Figure 14. This is a one-way flow of electricity, from generation to consumption. It responds to unlimited demand from consumers (Lockwood, 2014), who receive electricity or gas at any time, with little feedback on their consumption.

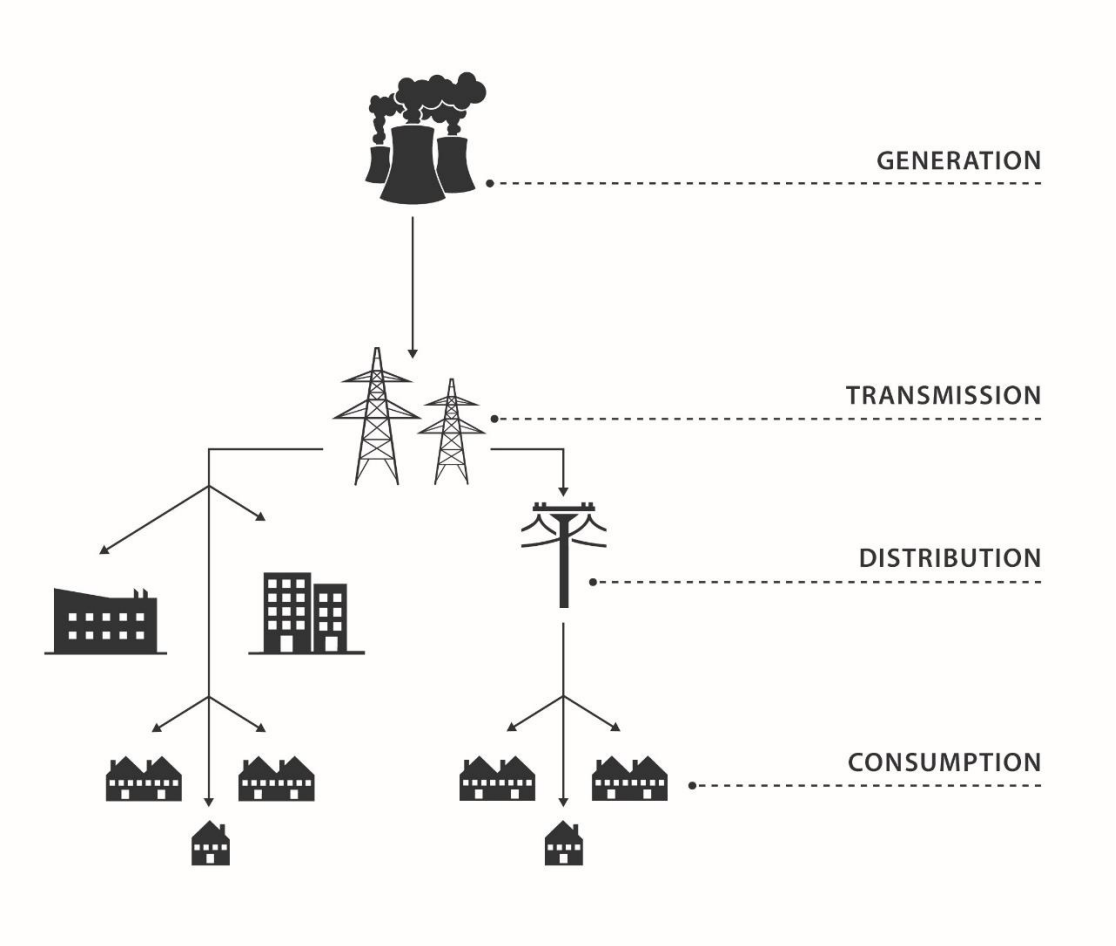

Figure 14: Traditional centralised electricity system

A renewable based energy system creates new challenges for electricity system management. One reason for this is that electricity generation is connected in different places to traditional power stations, such as large scale wind farms in remote locations or offshore, or smaller and building based generation connected to the distribution network which was designed to bring electricity to consumers, not to connect generation. This is shown in Figure 15.

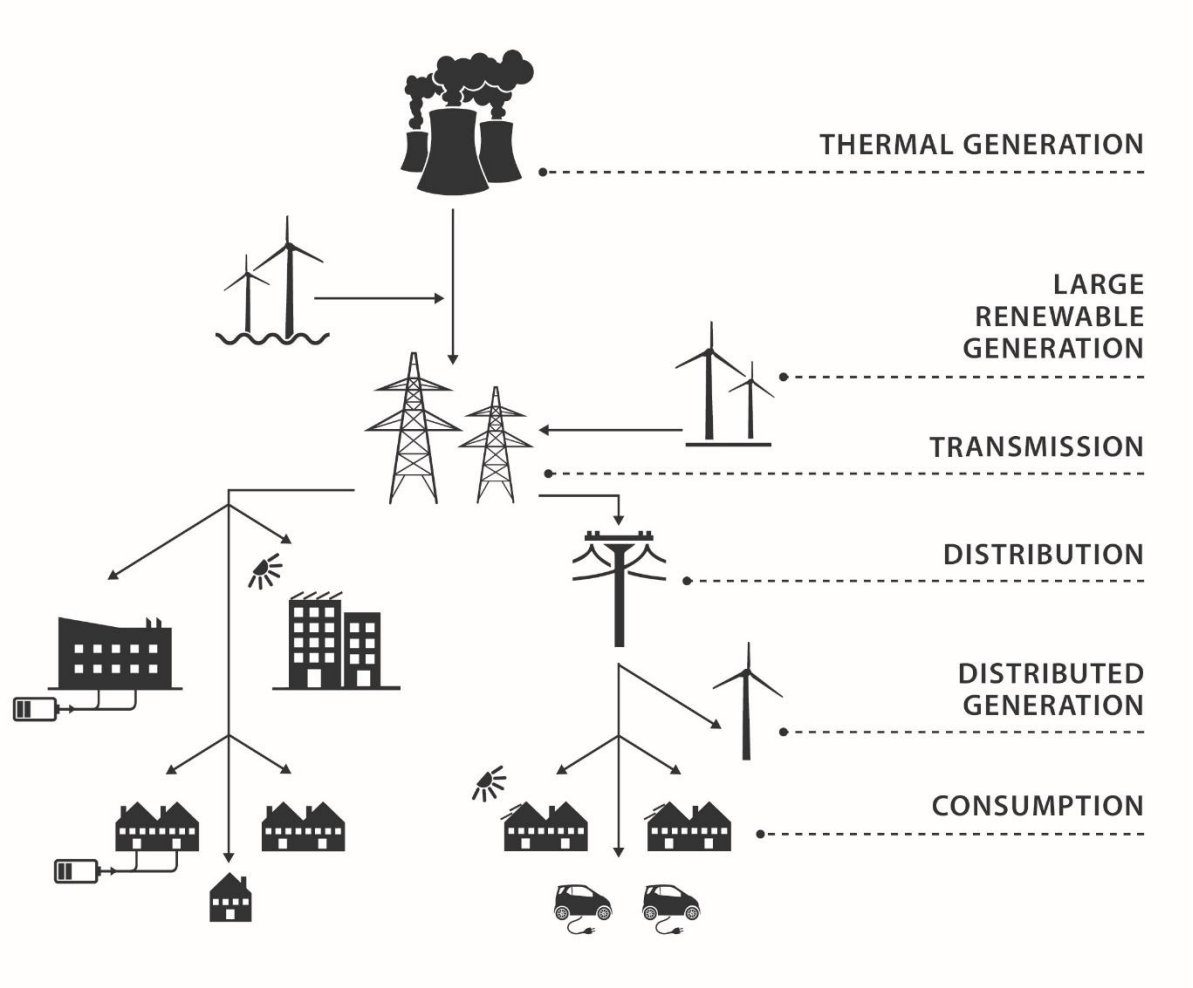

Figure 15: Low carbon electricity system

A second reason is that many sources of renewable electricity are variable or intermittent, generating when the sun shines or the wind blows, rather than controllable or dispatchable, generating at chosen times. Nuclear power does not help with this, as it operates generating a consistent electrical power output and cannot quickly vary its output. This is also the case with coal fired power stations. Currently, dispatchable sources of electricity that can quickly vary output are fossil fuel based, primarily from gas fired power stations.

Two categories of electricity system challenge will be explored in more detail in relation to commons in chapter 6: balancing and network capacity. Balancing is the process of keeping demand and supply equal to each other at all times, across the whole system. The difference between demand and supply affects frequency and voltage, which must be kept within regulated boundaries. Network capacity is the amount of power that can flow through a particular part of the network at any one time, determined by the size of the wires.

Balancing is currently managed by National Grid as the System Operator[6]. Traditionally, this has made use of dispatchable thermal power stations, which can be switched on or off and have their power output increased

[6] National Grid has two separate roles – as 'transmission network operator' – responsible for network capacity in the high voltage transmission system, and as 'system operator', responsible for balancing in the whole system, including high voltage transmission and distribution.

or decreased when needed. These also provide system inertia and keep frequency stable. Moving to a greater reliance on variable generation creates challenges for balancing, as does the increased peak demand caused by a greater proportion of heat and transport final demands being met by electricity. This is a temporal issue that can mostly be managed at a national spatial scale, although high concentrations of new generation or demand in particular locations can lead to local rises or drops in voltage which may need to be managed locally. For this reason, there have been proposals for a more active balancing role at the distribution level, changing the Distribution Network Operator (DNO) role to a Distribution System Operator (DSO) role (Mitchell, 2016a).

Alternative balancing mechanisms based on energy storage and changing the time of use of electricity: demand response (DR) are being developed. National Grid incentivises DR through payments for balancing services. These payments are available for organisations able to make very large scale shifts in demand. Organisations with relatively large flexible demands can access these payments if they are brought together in one aggregated unit. There is currently a market for aggregator companies to bring together the flexible demands of a number of commercial clients with refrigeration or backup generators, such as banks, hospitals and supermarkets. Commercial aggregators have viewed domestic consumers as too small to engage with, but there may be potential for households to coordinate together to obtain balancing services contracts through an aggregator. This is explored in the neighbourhood level case studies.

Network capacity constrains the generation that can be connected. Capacity is primarily a spatial problem, with some temporal dimensions relating to the potential for coordinating the timing of peak generation and demand in a particular geographical location. Distributed generation (DG), remote generation, and electric heat and transport all cause challenges for network capacity. This is a nested spatial challenge, occurring at neighbourhood, local, regional and national levels simultaneously. Using storage, DR, smart control systems and active network management within each spatial scale can contribute to reduced need to re-inforce networks. However, there are limits to this: wind power needs to be transmitted from remote and rural areas to urban areas, and solar PV may need to be transmitted from residential to commercial areas during the daytime. Where smart and active management is not enough, reinforcement of the transmission and distribution networks will be needed.

2.6 Energy generation and demand

Different forms of energy generation can be developed at different scales, and with different levels of government or commercial support. Figure 16 maps small and large scale RE generation, nuclear power, and carbon capture and storage on the ‘marketised vs political’ and ‘top-down vs bottom-up’ diagram, with the ETI and Transition Pathways scenarios included for reference.

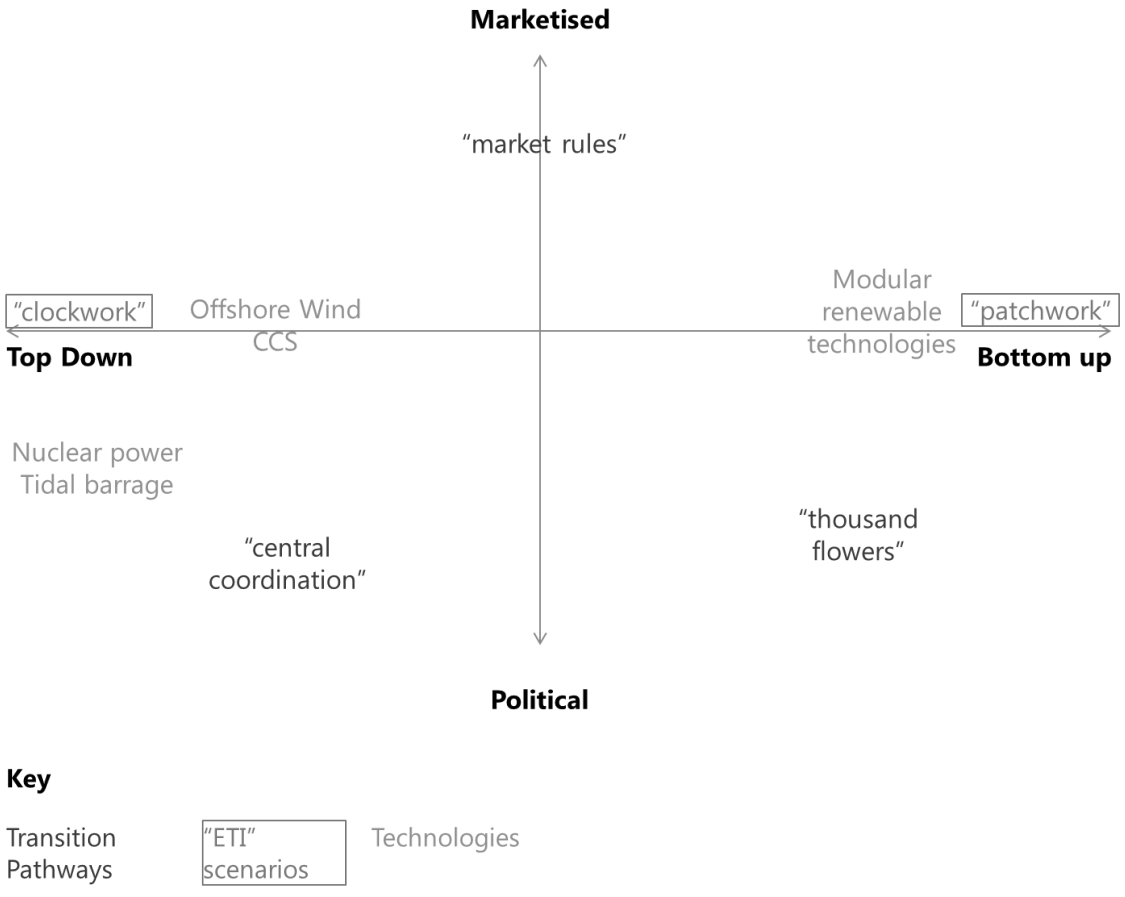

Figure 16: Generation technologies in terms of top-down vs bottom-up and political vs marketised

Nuclear, offshore wind, and CCS are all in the left side of the graph – large scale, centralised and top-down. This maps on to the 'clockwork' scenario proposed by the ETI, which relies on nuclear and CCS, with investment in renewables from 2040 (Energy Technologies Institute, 2015).

Nuclear power has been positioned in the bottom left quadrant. The UK government in 2016 is strongly committed to nuclear, but is aiming to deliver this through private sector investment, incentivised by a guaranteed long term price for the energy generated. John Kay (2014) argues that it would be much cheaper for the government to directly invest in nuclear power, given its ability to obtain low cost long term loans. He argues that the government guarantee of a fixed price is not certain over the long term, and that the potential for policy change is seen as a risk by investors. The Transition Pathways research sees nuclear power as having the greatest role in the central coordination scenario, and a strong role in the market rules scenario (Foxon, 2013), supporting the above analysis.

Similar issues apply to a large tidal barrage, or to tidal lagoons. The biggest such project, a tidal barrage across the Bristol Channel, has been proposed since the 1930s, but this large project is unlikely to go ahead without strong national government intervention. The current project for a Tidal Lagoon in Swansea Bay is also reliant on direct government support in order to go ahead (Tidal Lagoon Swansea Bay, 2016). A tidal barrage has therefore been positioned as a 'top-down' 'political' based project.

Offshore wind development also involves large infrastructure investments, with high risk. It is currently supported through a guaranteed price of electricity generated, through the same mechanism that supports nuclear power. However, offshore wind has been positioned as 'top-down' and part way between 'marketised' and 'political', as creating a wind turbine array involves a series of repetitions of constructing

individual wind turbines, with the opportunity for learning and cost reduction. Nuclear and tidal power involve gigantic, bespoke, complex projects, where those working on them may only develop one or two in their entire career. This means there are higher risks and less opportunities for cost reduction than for offshore wind.

Coal with CCS has also been positioned as 'top-down'. It is a technology which would fit with the current configuration of large thermal power stations. It will require strong political intervention in the form of legislation, funding or a high carbon price, as its only value is in mitigating climate change, and it adds substantial capital and fuel cost per unit energy produced. However, once the technology has been developed and is mandated, this could potentially be delivered by the market. The market rules pathway is the one with the most reliance on CCS (Foxon, 2013).

On the right side of the graph, the small scale, bottom-up approaches map onto the 'patchwork' approach of the ETI scenarios. This focuses on renewables, with CCS being developed later (Energy Technologies Institute, 2015). Smaller scale RE technologies, such as solar PV, solar thermal, biomass and onshore wind are relatively accessible for investors of all sizes, including individuals, community groups, LAs, and small and large commercial developers. This is due to their smaller size (many of these technologies can be developed at a household scale) and moderate risk. These currently still require some policy support to compete with conventional power, although some commentators claim that they are fast approaching grid-parity (Cleantechnica, 2016; Ritchie, 2017). This bottom-up approach is comparable to the early GB electricity system by local government and private entrepreneurs, prior to nationalisation.

Consumption of energy is usually referred to as 'demand'. However, the term 'demand' is based in a market paradigm, where consumers can demand as much energy as they want, and are entitled to consume as much as they have money to pay for. The 'system' is then expected to provide as much energy as consumers have demanded, with price-based balancing of supply and demand. However, given the substantial negative externalities of production of modern energy, it is not clear that everyone should be entitled to consume as much as they demand (Robeyns, 2017). Limiting consumption or regulating time of consumption through means other than price is alien to current expectations in the UK, but could be achieved through national top-down mechanisms such as rationing, or through community approaches such as sharing energy generated within a geographical boundary. Hybrid systems could also be used, such as rising block tariffs which give everyone an allowance of cheap electricity and charge extra above basic levels of consumption, or a combination of nationally set local targets and local discretion. These are mapped in Figure 17.

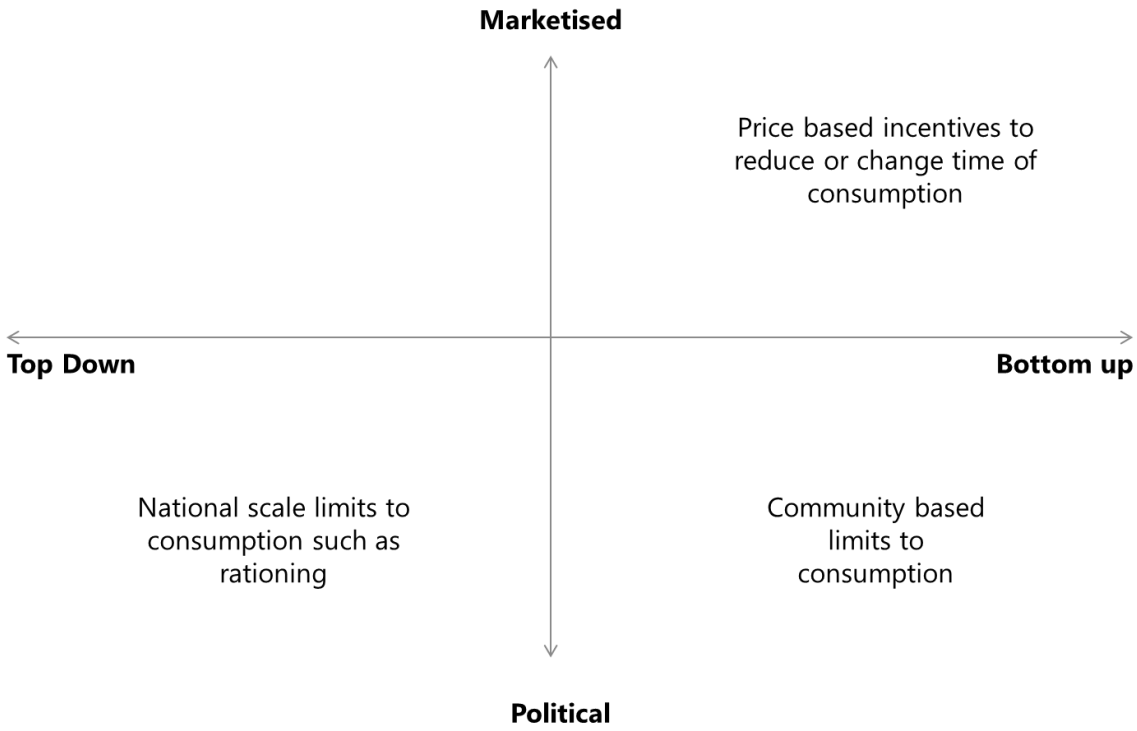

Figure 17: Different approaches to limiting consumption to sustainable and equitable levels

2.7 Governance of gas and electricity systems

In GB, the energy system is fully privatised. The transmission network is owned and operated by a national private monopoly company, the distribution networks are run by large regional monopolies, generation is a competitive market dominated by ten companies, and supply, the retail part of the market, is competitive and dominated by six private companies. Entry into the supply market is challenging due to complex energy industry rules (Lockwood *et al.*, 2015), and a business model based on maximising market share (Centre for Sustainable Energy, 2008).

The structure of governance for the GB electricity and gas system is shown in Figure 18.

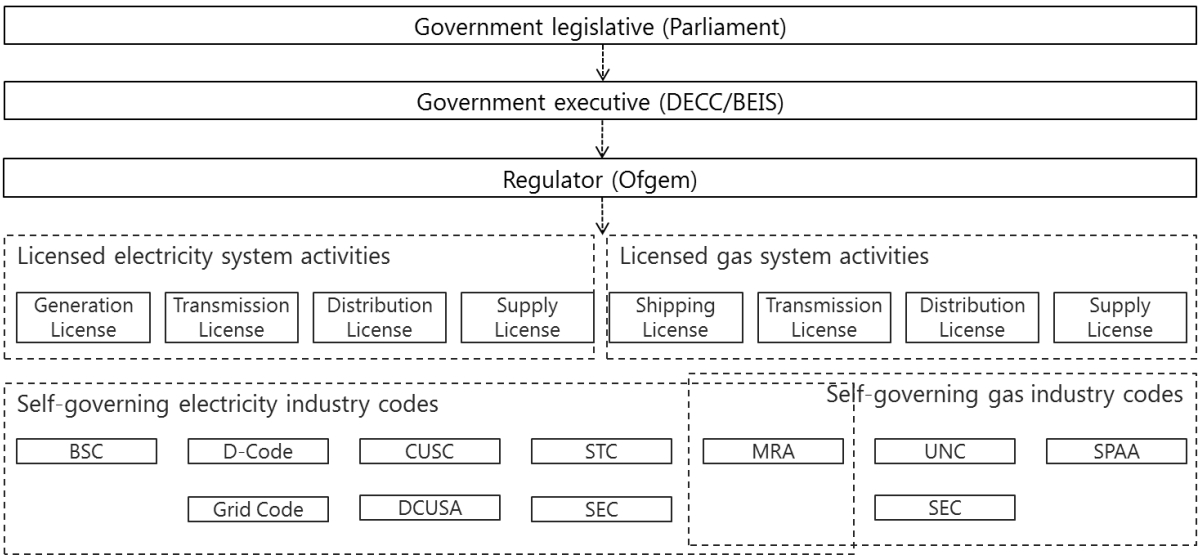

Figure 18: Governance structure of electricity and gas in the GB

The most regulated parts of the GB energy system are the electricity and gas systems. Many activities in these industries require a licence, and licence holders must comply with detailed rules or 'codes'. This is because as networked infrastructures a greater amount of coordination is required than for transport fuel, which is liquid and stored in separate units throughout the supply chain rather than in one physically connected network.

Parliament has ultimate legislative power, and can pass acts such as the 1947 electricity act (HM Government, 1947) which nationalised the electricity system, the Electricity Act 1989 (HM Government, 1989) which privatised it, or the Energy Act 2013 (HM Government, 2013) which reformed the electricity markets. The national government ministry responsible for energy from 2008-2016 was the Department of Energy and Climate Change (DECC). This was abolished in 2016, and responsibility for energy moved to the newly established department for Business, Energy and Industrial Strategy (BEIS). This thesis refers to DECC for events taking place during the time that department was in existence, which is most of the study period.

The gas and electricity markets are regulated by Ofgem, the Office of Gas and Electricity Markets. The principal objective of Ofgem is "to protect the interests of existing and future electricity and gas consumers" (Ofgem, 2017). This is through: "promoting value for money; promoting security of supply and sustainability, for present and future generations of consumers, domestic and industrial users; the supervision and development of markets and competition; regulation and the delivery of government schemes." (Ofgem, 2017).

Ofgem is responsible for issuing licences to companies acting in each role in the gas and electricity markets. Licence holders must comply with a set of commercial and technical operational rules, called the Energy Industry Codes. Each code is associated with a number of specific licences, as shown in Figure 19. The codes are self-governed by industry.

		D-Code	DCUSA	CUSC	Grid Code	STC	BSC	MRA	UNC	SEC	SPAA
Elec.	Transmission					✓	✓				
	Distribution	✓	✓	✓	✓		✓	✓			
	Interconnection	✓		✓	✓		✓				
	Generation	✓	✓	✓	✓		✓				
	Supply	✓	✓	✓			✓	✓			
Gas	Interconnection								✓		
	Shipping								✓		
	Supply							✓	✓		✓
	Transmission								✓		
	Distribution										✓
Both	Smart Meter Communication Licence									✓	

Source: Licence Standard Conditions documents

Figure 19: Codes and licences table, from Lockwood et al. (2015)

2.8 Marketisation, privatisation and depoliticisation

Privatisation, marketisation and depoliticisation are related concepts which are all promoted in neoliberal ideology. This is based in a belief that the emergent outcomes of market transactions, which assume all people to be primarily selfish and calculating, will lead to the best possible result, even in traditionally political or public sector arenas. Rather than appealing to the ideals of public interest, the public choice theory that underpins neoliberalism assumes that politicians, like other humans, are adequately characterised as 'homo economicus', motivated by narrow self-interest (Wall, 2014; Mariotti, 2015). This view of human nature is discussed in more detail in section 3.5.3.

Amber Rudd, at the time when she was Secretary of State for Energy and Climate Change, wanted energy system decisions to be made by a market rather than through political processes: "We want to see a competitive electricity market, with government out of the way as much as possible, by 2025" (Rudd, 2015). This is an agenda of depoliticisation, "the process of placing at one remove the political character of decision-making" (Burnham, 2001, p. 128). Depoliticisation is desired in order to reduce investment risk, as well as to achieve purity of competitive market functioning. When investment in infrastructure is a private capital investment based on an expectation of financial return, political decisions which affect the expected income become an investment risk, and increase the cost of capital. For example, the politicised reduction in subsidy support for RE, carbon capture and storage and energy efficiency in 2015 and early 2016 led to instability for industry, and leads to RE being seen as a greater investment risk.

However, it is not possible to depoliticise energy governance completely. Energy is inherently political, as it is needed for economic competitiveness and national security, as discussed on p45. For Flinders and Buller (2006, p. 296), "depoliticisation is something of a misnomer. In reality the politics remains but the arena or process through which decisions are taken is altered". In the context of nuclear power, John Kay (2014) argues that the "government feels obliged to pretend that the outcomes which it is prescribing in considerable detail are the result of market forces", and that it would be better for them to directly invest in nuclear power, rather than create an income subsidy and an illusion of market-based investment.

The benefits of 'depoliticisation' accrue primarily to politicians and big business, simultaneously protecting politicians from blame, and reducing investment risk (Flinders and Buller, 2006, p. 296). Whilst full depoliticisation is impossible, there has been some reduction of government involvement in energy system governance, in particular in the operational rules of the gas and electricity industries. Kuzemko (2015) argues that the depoliticisation of the GB energy system has resulted in a lack of political capacity for government to

implement energy policy that aims for a low carbon energy transition. The process of privatisation resulted in a principle of industry self-governance, with rules or 'industry codes' which can be modified by the incumbent companies, or 'parties' to the codes. This is a process of 'double delegation' from government to Ofgem, and from Ofgem to the codes governance (Lockwood *et al.*, 2016). The codes modification process does not allow modifications to be directly made by the regulator, and neither the regulator nor the Department of Energy and Climate Change (DECC) have the expertise to fully understand the detail of the codes, resulting in a need to take energy incumbent employees on secondment (Mitchell, 2014).

Thus privatisation and marketisation require an attempt at depoliticisation. However, in practice the extent of depoliticisation possible is limited, and the risk is that the system remains political, but becomes less democratic through the process of double-delegation.

2.9 GB energy policy following 2015 General Election

The 2015 Conservative government claims to want to depoliticise energy, as seen by Amber Rudd's speech cited above. However, following the general election in May 2015, the government made a number of substantial changes in energy policy, which shift the overall narrative of the energy policy direction relative to that of the 2010-2015 coalition government. The broad trend as of May 2015 is that a previously more technology neutral position, where nuclear, shale gas, CE, RE and energy efficiency were all supported, has been replaced by a one-sided support for nuclear power and shale gas, with some support for offshore wind. A timeline of some of the energy-related policy announcements made between the general election in May 2015 and the publication of the budget in March 2016 is shown in Figure 20. For proponents of a low demand, RE based vision of sustainable energy, this constitutes a concerning shift in the energy policy paradigm.

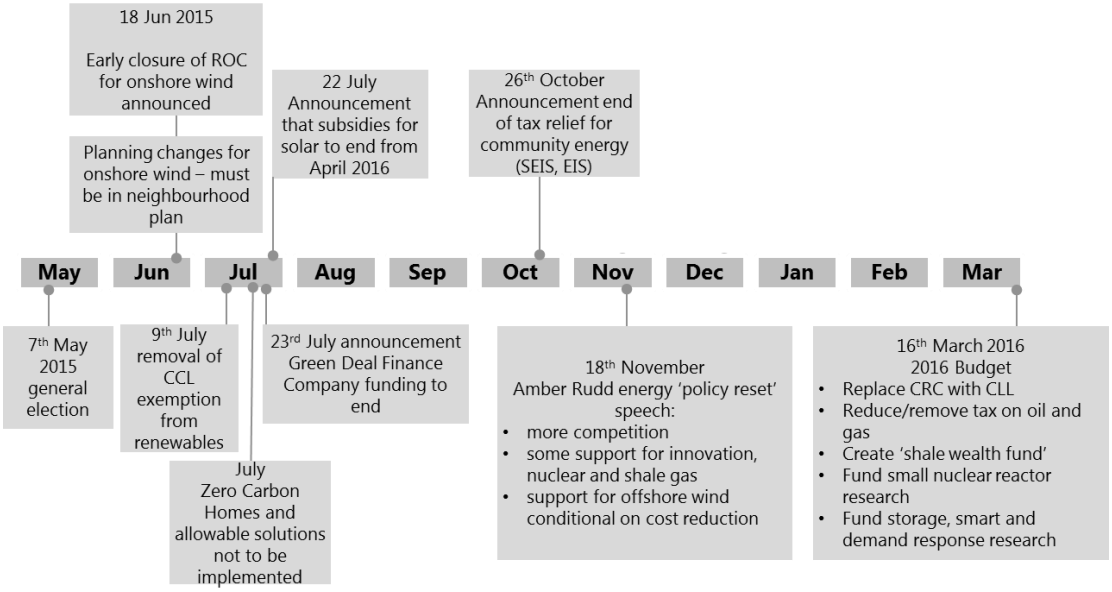

Figure 20: GB energy policy announcements from May 2015 general election to March 2016 budget

2.10 Agendas for changing the system

The current status quo of the energy system is a market dominated by large players. Six big energy companies still dominate the supply market, although market share has been steadily decreasing over the past few years from 99% in 2010 to 87% in 2015 with 26 smaller licensed suppliers now in the market (Rudd, 2015). National and regional monopolies operate the transmission and distribution networks. Generation is

dominated by 10 companies, including sister companies of the main supply companies. This situation is widely criticised for benefiting the incumbent, large players and providing profit to their beneficial owners at the expense of consumers and the environment.

There are a number of different agendas for changing the electricity system. These are mapped in Figure 21.

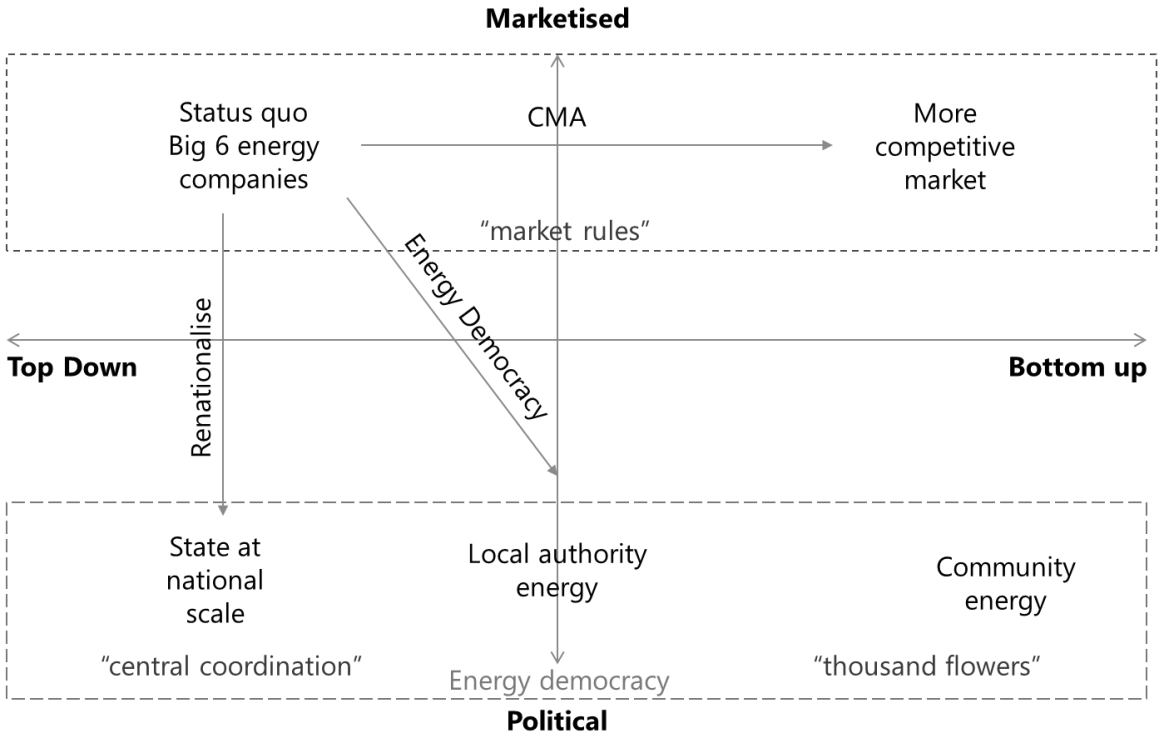

Figure 21: Energy democracy vs market approaches to reducing monopoly in the energy industry

One, within the marketisation paradigm, aims to increase competition in the market. Concerns that the energy supply market was insufficiently competitive led to a review of the energy markets by the Competition and Markets Authority (CMA, 2014). A number of recommendations have been made, including removal of the restriction on the number of tariffs that a supplier may offer (Competition and Markets Authority, 2016), with the aim of moving towards the top right quadrant, with more competitive, liberalised market. Mitchell (2016b) welcomes these recommendations, but criticises the CMA review for being too narrow in scope to address the broader challenges of the energy system.

In contrast to increasing competition in the market, some activists are promoting democratisation of energy systems. This agenda is in opposition to depoliticisation. Definitions of energy democracy not only include the expected references to participation and control, but also include concepts of environmental sustainability and equal access to energy. For example, Sweeney, writing about Trade Unions for Energy Democracy, talks about "investment in RE and energy efficiency, taking privatised parts of the energy system back into public ownership or control, and local economic benefit" (Sweeney, 2012, p. 31); the German Climate Camp Lausitzcamp 2012 agreed that "Energy democracy means that everybody is ensured access to sufficient energy. Energy production must thereby neither pollute the environment nor harm people." (Kunze, no date).

In a report which sets out to define energy democracy, Angel contends that "energy transition must be politicised" (Angel, 2016b, p. 32). This is an agenda of asserting "community and democratic control over the energy sector" (Sweeney, 2012, p. 31), and is associated with (re-)nationalisation, (re-)municipalisation and CE. The concept of energy democracy is being promoted as a global social movement for an "emancipatory

energy transition" (Angel, 2016b), perhaps comparable to the concepts of food sovereignty and of climate justice. However, the term "energy democracy" is primarily in the Global North, whilst 'energy sovereignty' and 'energy justice' have more traction in the Global South. Angel also compares the term with "energy commons", the promotion of which he sees as "betraying a desire for collectivised, participatory control in opposition to both privatisation and top-down statism" (Angel, 2016b, p. 12).

Democracy is about participation. There can be many forms of participation. In the context of the energy system, participation includes participation in decision-making, through voting, lobbying, and deliberation. This is the type of participation that is most often considered in relation to democracy. However, participation in the context of energy also includes practical participation through jobs, such as constructing wind farms or installing insulation; participation in energy-using through access to energy services; participation in innovation of new institutions, new processes and new technologies; and participation in vision-creation, for example through art, storytelling and research.

There have recently been arguments for moving parts of the electricity system back into not-for-profit, independent hands. Lockwood et al. (2015) recommend creating a not-for-profit, independent integrated system operator (IISO), which would include electricity, gas and heat networks. There have also been suggestions that the EMR[7] delivery body role of the National Grid should be separated from its role as transmission network owner (House of Commons Energy and Climate Change Committee, 2015). The 2017 Labour Party manifesto promised greater local community control of energy and a 'right to supply', with support for co-operatives and public, not-for profit companies (Corbyn, 2016).

These proposals would move national electricity infrastructure coordination towards central government control, which could be seen as a re-nationalisation. National Grid is not in favour of such a move (Macalister, 2016), but campaign group We Own It calculates that there could be savings of £158 per year per UK household from public ownership of energy generation and transmission companies, due to the lower cost of capital available to government, and the avoided cost of dividends to shareholders (Corporate Watch, 2014; We Own It, 2016). However, it is a more decentralised approach to national ownership than historic nationalised industry. A Labour party report to the shadow chancellor of the exchequer and shadow secretary of state for business, energy and industrial strategy, on alternative models of ownership explores cooperatives, municipal and locally-led ownership and national ownership models (Labour Party, 2017). The We Own It proposal in Figure 22 involves a combination of different public ownership types.

[7] Energy Market Reform Act, which includes several policies aimed at addressing climate change

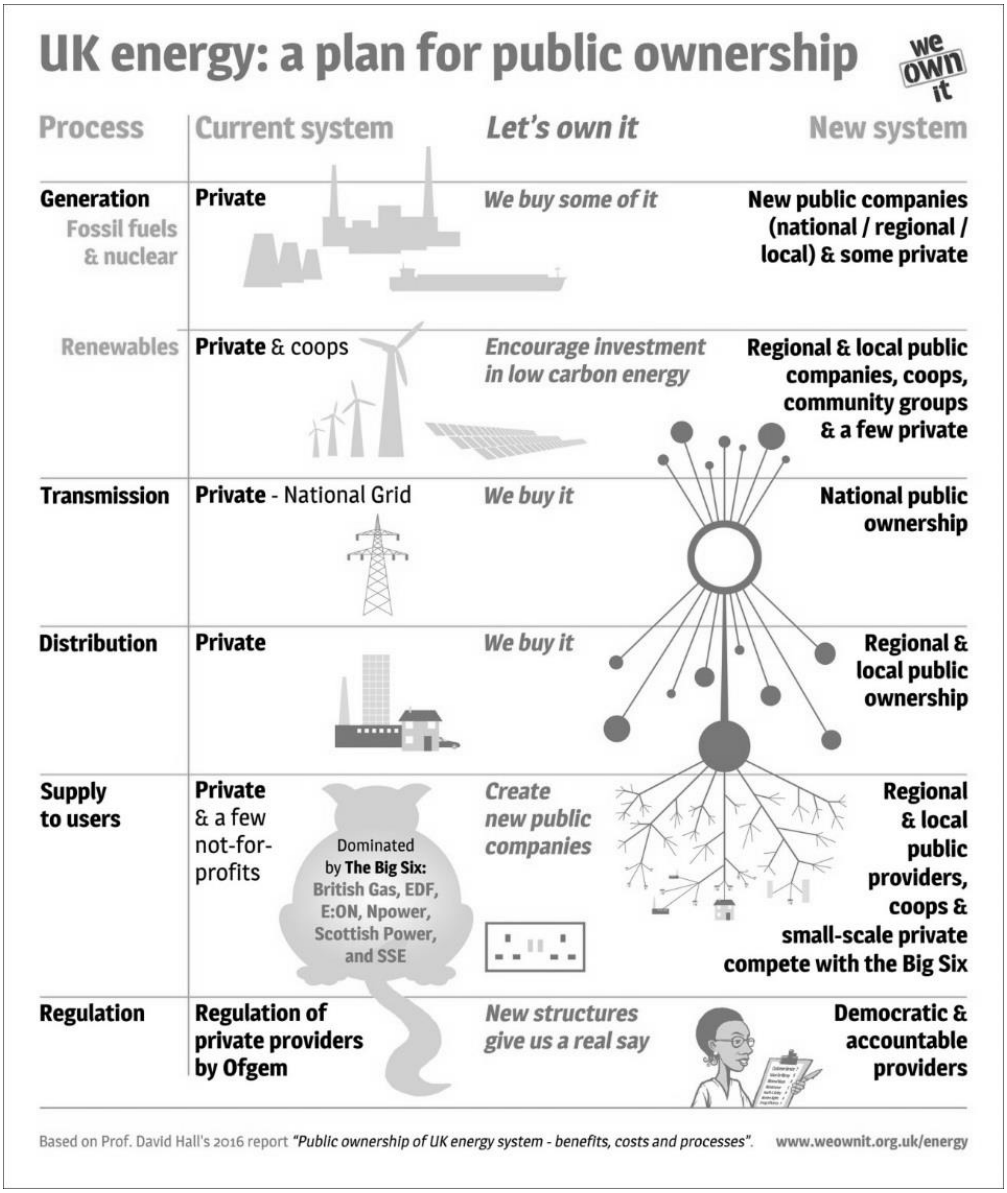

Figure 22: Public ownership proposal (We Own It, 2016)

2.11 The emerging civic energy sector

The focus of this thesis is on the roles of local government, or local authorities (LAs) and the community energy (CE) sector[8]. Together, these are called the 'civic energy sector' (Hall, Foxon and Bolton, 2015), and are positioned in the bottom-up, political quadrant of the diagram in Figure 23.

[8] The terms 'local authority', 'local government' and 'council' are used interchangeably as they all refer to the same governance unit in the UK and are all in common usage.

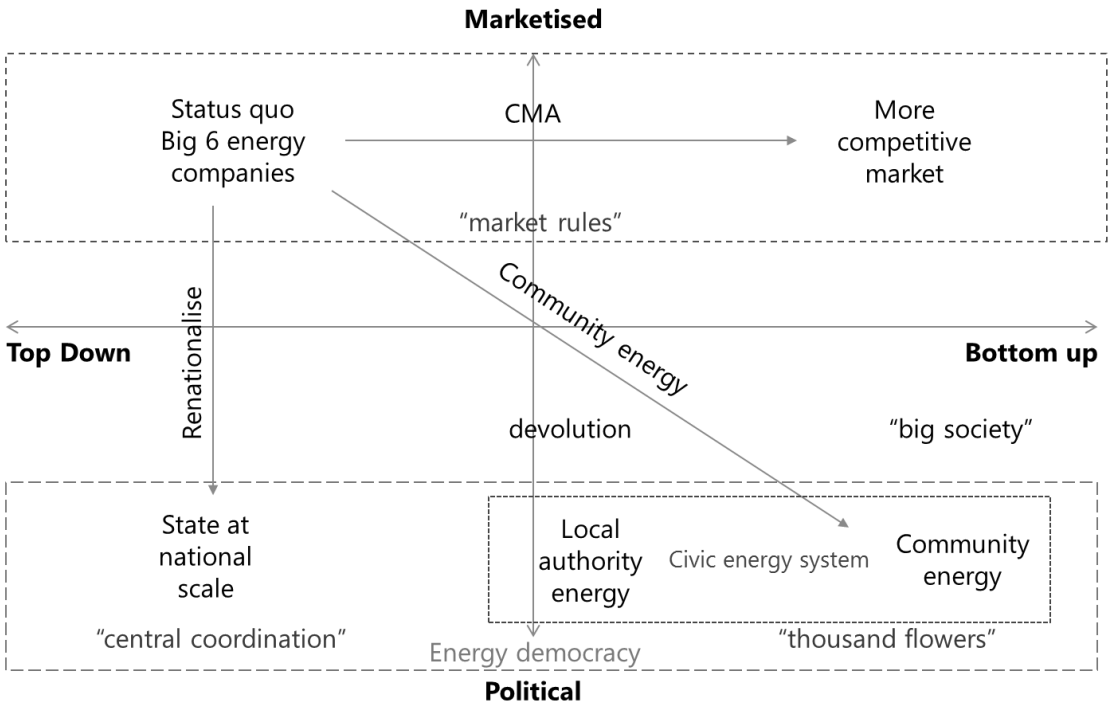

Figure 23: The emerging civic energy system

The term 'civic energy sector' is useful as it includes both the CE sector and LA energy projects without conflating them. The CE sector and LA energy initiatives share common values of "regional economic development, fuel poverty reduction, energy system decarbonisation and self-governance/self-determination" (Hall, Foxon and Bolton, 2015, p. 11), distinguishing them from the profit and market-oriented new entrants which are positioned in the marketised and top-down segment of the diagram in Figure 23. Both LA and CE initiatives are dependent on, enabled and restricted by government policy and the energy industry rules. Campaigns such as We Own It and Switched On London do not make a clear distinction between state and community ownership, although their emphasis is on the role of state public ownership.

On the other hand, LA and CE ownership have different forms of accountability, governance, and capacities. They are each described in turn below.

2.11.1 The Community Energy sector

The 2010 coalition government's Community Energy Strategy defines CE as emphasising "community ownership, leadership or control where the community benefits", with activities aimed at "reducing energy use, managing energy better, generating energy or purchasing energy" (DECC, 2014, p. 20). There were 5000 CE groups active in the UK at some point between 2008 and 2014, with "60MW of community owned renewable electricity generation … in operation" in 2014 (DECC, 2014, p. 21). In Bristol, a rich tapestry of neighbourhood energy efficiency groups, education groups and renewable electricity generation are gathered under the umbrella of the Bristol Energy Network (BEN). This is the subject of one of the case studies in this thesis.

The generation activities are the most commercial aspect of the CE sector, and have often been structured in co-operatives. BEC is discussed in more detail as part of the Bristol case study. It is typical of CE co-operatives set up from 2009 in the context of a generous FiT subsidy for generation of small scale RE generation, which enabled business models with good financial returns for member investors. These co-operatives followed the

structure of earlier renewable investment co-operatives such as Baywind (Baywind energy co-operative, 2017).

In a very different context, the Scottish island of Eigg replaced its individual household diesel generators with an island-wide electricity grid based on wind, solar and hydro power. This is not connected to the national grid, and limits the total power that any household can consume at one time to 5kW (10kW for businesses). If a household goes above the 5kW limit, they are automatically cut off, and the Eigg energy maintenance team must be called to reconnect them (Community Power Scotland and Friends of the Earth Scotland, 2016).

There are also innovative projects which push the boundaries of what is possible under current regulation, such as EnergyLocal which pools renewable electricity in a local community; the Sunshine Tariff, which offered cheaper electricity when the sun is shining; and Tower Power, which shares electricity within a tower block.

Although often motivated by a desire for autonomy and grassroots agency, the CE activity is also dependent on, enabled and restricted by government policy. The rapid reductions in FiT solar PV, which many CE groups relied on, was abruptly reduced in 2012 and in 2016. This left CE groups struggling to identify financially viable projects. One approach proposed by Capener (2016) would be to directly sell electricity to members, benefiting from the much higher retail price of electricity relative to wholesale price. However, this is difficult due to the need for electricity to be balanced at all times. A consequence of this is that supplying (or retailing) electricity directly to consumers is a licensed activity, and the onerous conditions for becoming a licensed supplier make this inaccessible to local CE groups. Mongoose Energy, set up by Bath and West Community Energy (BWCE), have been considering setting up a national community owned social enterprise with a supply licence, which could partner with local CE groups to provide a good price for electricity generated (Walton, 2016). Alternatively, CE groups could partner with LA owned licensed supply companies.

2.11.2 Local government energy

LAs are much better placed than CE groups to set up licensed energy supply companies to sell electricity and gas. They are able to borrow from central government at preferential rates, and have institutional capacity, size and longevity on their side, as well as statutory duties to the interests of all residents within their jurisdiction. Bristol City Council (BCC) and Nottingham Council set up fully licensed supply companies in 2015 (News, 2015; The Bristol Post, 2015; Bristol Energy, 2016a), with objectives including more affordable or social tariffs, support for local renewable generation, and income for public services. Councils including Cheshire East and Southend (APSE, 2015) have partnered with licensed supply company OVO energy to offer a "white label" local tariff. This enables LAs to reap some of the benefits of offering a tariff to local customers, with OVO Energy carrying out billing and energy wholesale market backoffice functions. Greater Manchester, Cornwall Council and the GLA are all considering setting up their own energy companies. However, this is a difficult decision for an LA to make. The expected setup cost for Bristol Energy was £1.575m (Bristol City Council, 2015c), and by 2017 BCC had invested £15.3m, with profit expected in 2021 (BBC News, 2017). The supply market is challenging for smaller companies, as profitability is strongly dependent on hedging and buying energy a long time in advance (Littlechild, 2005), as well as attracting a sufficient number of customers. Newer market entrants challenging the 'big six' find it easier to attract customers who switch often than those who never switch, meaning that the 'big six' tend to retain access to the more valuable 'sticky customers' whom they can charge more for their energy (OVO Energy, 2015).

2.11.3 Political support for the civic energy sector in the UK

Political support for the civic energy sector has varied over the years of this study. The civic energy sector, particularly the CE sector, did well in 2009-2015 due to revenue support for RE. The role of LA and CE was implementation, including investing in and developing RE generation, and using income from this to support

energy efficiency, demand reduction, education and engagement programmes. The 2015 policy announcements detailed in section 2.9 made this implementation role more challenging, particularly for small organisations, and has politicised local advocates of sustainable energy, who have turned to lobbying for greater policy support. The momentum behind the CE sector that was incubated between 2009 and 2015 means that there are now a large number of committed, experienced and well organised people who have a personal stake in the future of the RE sector in the UK. These people also have an experiential understanding of the barriers to small scale RE development, and are therefore able to lobby effectively on specific policy changes that are needed. The challenging policy environment has also stimulated institutional innovation, with CE groups seeking ways to directly sell energy to members. Cornwall Council has also developed ambitious sustainable energy goals for 2020, including "30% of energy spend retained in the Cornish Economy" and "100% of electricity met by renewables" (Cornwall and IoS LEP; Cornwall Council, 2017).

The 2010-2015 coalition government's localism agenda provided some support to the civic energy sector, through devolution and 'big society' policies. Devolution deals have been granted to several local areas. Cornwall's devolution deal stands out for having specific mention of energy, with policies including: the development of a low carbon Enterprise Zone; support for deep geothermal energy; energy efficiency; addressing electricity network constraints and developing smart electricity grid infrastructure; CE including local ownership, local and neighbourhood plans and a community heat pilot; ERDF low carbon funding to several projects, including one on local energy markets; grid task and finish group (Cornwall Council *et al.*, 2015).

The 'big society' policy provided a context for support for the CE sector, but arguably at the cost of undermining the LAs, as it aimed to increase the role of community relative to LA activity (North, 2011; Civil Exchange, 2015), with a rhetoric of empowering people. Big Society was criticised as a hidden mechanism for making cuts to LA budgets and relying instead on volunteer labour. This risks exacerbating spatial inequalities, as better-resourced communities would be better able to provide their own services on a volunteer basis than those with lower financial, time or skill capacity (Catney *et al.*, 2014; Civil Exchange, 2015). These concerns about exacerbating inequalities apply to the CE sector (Park, 2012; Catney *et al.*, 2014; Johnson and Hall, 2014). On the other hand, community ownership can provide an opportunity for participation and for communities to develop their capabilities and responsibilities.

Whilst support was provided to the CE sector through the publication of a Community Energy Strategy (DECC, 2014), the definition of community energy explicitly excluded local authorities, social housing providers and other 'public sector' organisations. It is useful to define CE as separate to the civic energy sector as a whole, but given the absence of similar support for the wider civic energy sector it is understandable that CSE (Coxcoon, 2014a), argued for the inclusion of these other local, non-commercial actors in the Community Energy Strategy. Following the 2015 general election, policy support for CE and 'big society' rhetoric diminished.

2.12 Conclusion

This chapter has given some context to the challenges faced by the GB energy system as it transitions to a low carbon system. It has shown that different paradigms, and the positionality of different actors, inform the types of solutions developed. There is an emergent civic energy system challenging the incumbent oligopolies and monopolies of the energy industry with values of local economy, self-reliance, fair shares and sustainable generation. This is facing barriers of reduced support for RE and energy system rules set up for a centralised, fossil fuel based energy system. At the same time, campaigns for energy democracy and public ownership of energy are gaining momentum and potentially creating political space for change.

3 Methodology

> *"Even when our trust is heavily placed in them, reasoning and education cannot easily prove powerful enough to bring us to actually do anything, unless in addition we train to form our Soul by experience for the course on which we would set her; if we do not, when the time comes for action she will undoubtedly find herself impeded."*
>
> Michel de Montaigne

> *"If we in the west are alienated from our experience by the separation of mind and matter introduced by Descartes, we are even more alienated if all we can do is circle round various forms of relativist construction: any sense of a world in which we are grounded disappears"*
>
> Peter Reason and Hilary Bradbury (2006a, p. 6)

3.1 Introduction

This chapter presents the methodology used in the thesis. It sets out the research objectives, questions, and strategy, and discusses the research approach and underlying research philosophy. It then outlines methodological considerations for this study. Details of the case studies are provided in the following chapter.

3.2 Research objectives and questions

Chapter 2 described the problem-space of the sustainable energy transition taking place in the UK. This research engages with this problem-space from the standpoint of the local. It has a clear and consistent objectives and curiosity which give the research direction, in addition to research questions formulated as such.

The research aim of this thesis is to understand the roles of local and community initiatives in a GB sustainable energy transition; using the theoretical frameworks of the Ostrom Workshop's work on governance of common pool resources and polycentric governance.

This can be framed as two questions:

- What are the roles of local and community organisations in a GB sustainable energy transition?
- How do theoretical frameworks of commons and polycentric governance contribute to understanding these roles?

The research is led both by an intention to contribute to sustainable development at local and national levels, and a curiosity about the value of the Ostromian theoretical frameworks for understanding the sustainable energy transition. It aims to develop principles for governance of the energy transition and the post-transition sustainable system; which can be of heuristic value to practitioners involved in LA and CE projects and to their advisors.

3.3 Research strategy

The original research in this thesis was developed in two stages, a theoretical analysis and an empirical analysis. These are presented in parts 2 and 3 of the thesis respectively, as shown in Figure 24. Part 1 of the thesis, including this chapter, provides background and describes the problem context and methodology.

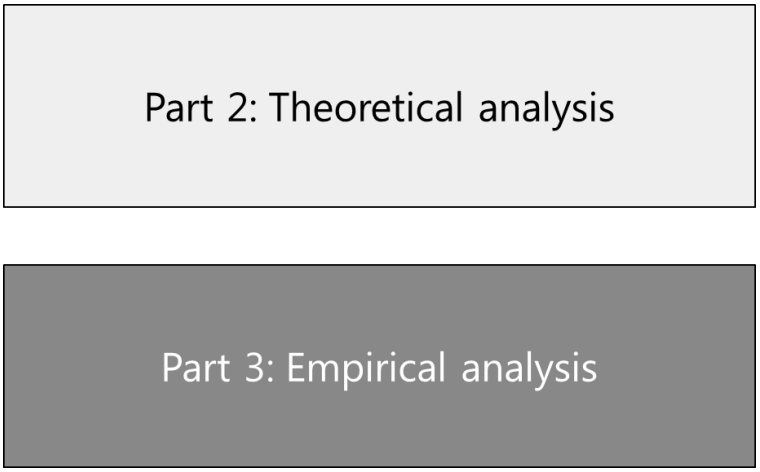

Figure 24: Theoretical and empirical parts of analysis

3.3.1 Theoretical analysis

Part 2 presents the outcomes of in-depth theoretical analysis of the GB energy system in terms of the core Ostromian theoretical frameworks of commons and of polycentric governance, in chapters 0 and 7 respectively. These chapters are based on a literature review of the theoretical literature, and original analysis of the implications of this theory for the GB energy system. This includes documentary analysis of grey literature in the CE sector, local government and the energy industry. It also includes an understanding of the sector drawing on six years of professional experience.

3.3.2 Empirical analysis

Chapter 8, at the end of Part 2, proposes a set of "design principles" (DPs) following Ostrom's usage of the term 'design principles' in her work on common pool resource governance, as discussed in section 5.4.5. The term 'design principles' is used in the context of graphic and website design (Cable, 2015), permaculture (permaculture design principles, no date), and other contexts; as thinking tools for effective design that can be used across a variety of contexts. Ostrom uses the term 'design principles' for the "essential element[s] or condition[s]" (McGinnis and Ostrom, 1992, p. 8) found in successful commons management organisations; which operate with diverse, context-specific rules.

The DPs developed in this thesis were developed from synthesising the findings of the theoretical analysis of commons and polycentric governance; addressing gaps in these frameworks with respect to outcomes of sustainable prosperity and with cross-comparison with a number of other sustainability frameworks. This process is described in more detail in chapter 8.

The DPs aim to achieve the following outcomes:

- Maximising democracy,
- Promoting innovation and learning,
- Remaining within environmental limits, and
- Promoting equality.

The initial DPs proposed in chapter 8 are then tested through detailed analysis of data from the case studies in chapters 9, 10 and 11. This leads to the development of a revised set of DPs presented in chapter 11.4 as part of the conclusion.

3.4 Research approach

The research approach is grounded in the epistemology of action research, but does not take the form of full action research, as it is led by a pre-existing theoretical interest, and by the individual researcher rather than by the priorities and questions raised by research participants. Additionally, the role of the researcher is as an involved observer reflecting on events, rather than observing the impact of actions planned as part of the research. As such, this research could be seen as an initial, researcher-led exploratory cycle of action reflection, which would need to be followed by several more action reflection cycles in order to fully constitute action research.

Action research is "a way of generating knowledge about a social system, whilst at the same time trying to change it" (Lewin, 1946, cited in Hampshire, 2015, p. 179). This positions the researcher as an active, partisan participant in the research context, rather than as a passive, impartial observer with reflective action that is both an outcome of the research and part of the research process. Such a research approach is well-suited to a design and engineering context, where the starting point is a vision of a building, a city, a place, and the role of the designer is elaborating this vision and 'making the vision viable', according to BHE's strapline.

Reason and Bradbury add an explicit normative perspective and epistemology to the definition of action research, defining it as "a participatory, democratic practical knowing in the pursuit of worthwhile human purposes, grounded in a participatory worldview" (Reason and Bradbury, 2006a, p. 1). This resonates with the normative and epistemological framework of this thesis, which will be discussed in more detail in section 3.4.1.

Marshall et al, in their book about their sustainability leadership MSc, say that:

> "Action researchers usually pay attention to issues they care deeply about, and in this sense action research projects are unashamedly value-laden, asking what is most likely to help us build a freer, better society and contribute to the flourishing of human communities and the ecologies of which they are a part." (Marshall, Coleman and Reason, 2011, p. 28)

This both justifies bringing values into the forefront of the research, and makes action research an appropriate approach for sustainability practice, which is itself inherently value-laden.

Action research is challenging for doctoral level research because it involves working with others and allowing the research agenda to emerge collaboratively, whereas doctoral research must demonstrably be the individual work of the candidate and must be completed within fixed timescales, with limited time for fieldwork. Many university processes are not set up to fit the cycles and timings of action research. However, there are examples of successful PhD level action research (e.g. Snoeren et al. 2011; Burgess 2006; Rogers et al. 2012; Adili et al. 2012).

The EngD research context means that the research process must be responsive to the needs and project opportunities in the consultancy. It also means that the researcher is not a neutral observer, but a participant in the research context. This was particularly the case in the Cornwall Energy Island (CEI) case study which was a project led by BHE. There was also a tension, however, between the different stakeholders in this research setting. Participatory action research in the CE sector would have involved developing research questions with CE practitioners, which would potentially have caused a conflict of interest with BHE as the sponsor of the research.

This research therefore draws on the action research approach, but is not a fully fledged action research study. It uses mixed qualitative methods, including qualitative interviews, participant observation, reflective journaling, focus groups and workshops. The details of the methodologies used for each case study are provided in chapter 4.

Reflective journaling, in particular, is a challenging methodology to use rigorously. This involved writing about events as they happened, in detail and in an uncensored way, including reflection on my own emotional responses to situations. This text was then analysed a year later, which provided a reflective distance from the events described. The record of immediate emotional responses allowed my own biases at the time to be made visible during the later analysis.

Participant observation similarly involved writing contemporary notes and reflecting on these with some temporal distance. The other data, from interviews, focus groups and workshops was a verbatim record of interviewees and participants contributions, and therefore more standard approaches to robustness could be used. These are discussed in more detail on p73.

Research data was coded in Nvivo, with a priori codes drawn from the theoretical frameworks described in chapters 5 and 7, in particular Ostrom's Design Principles for Common Pool Resources and McGinnis' characteristics and persistent problems of polycentric governance. A priori coding based on the proposed design principles described in chapter 8 was also used, and this formed the organising principle for selecting data to analyse in detail, and for discussing the case study data. This was combined with emergent coding from the data itself. The coding of the data from each of the case studies is described in more detail in chapter 4.

3.4.1 Action research cycle

Action research is an iterative process, with an action reflection cycle of stages including planning, action, observation, reflection, and replanning (Gordon 2006), as shown in Figure 25.

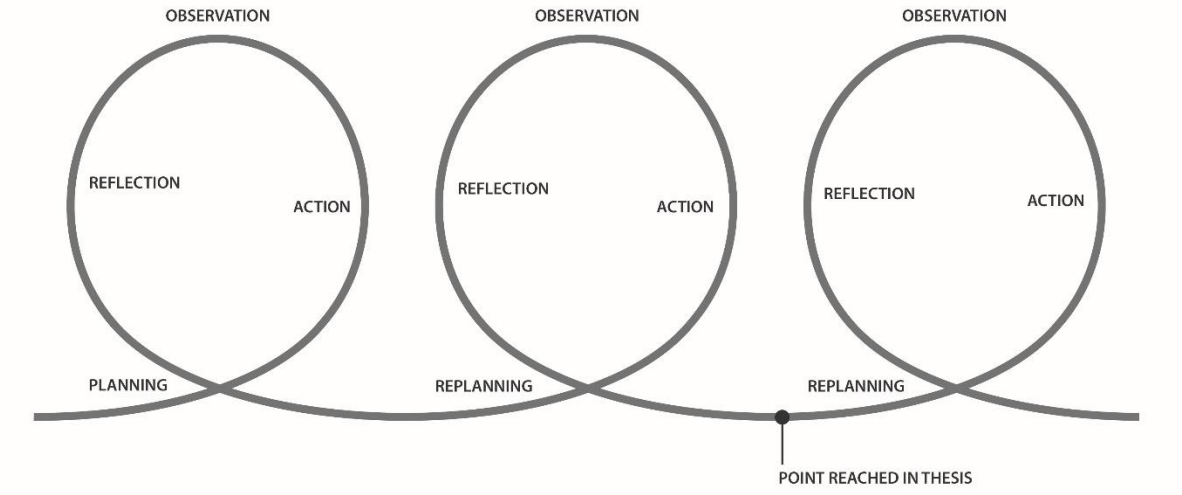

Figure 25: Action reflection cycle

This iterative approach enables the research to remain relevant to the evolving context, and for reflection on the effect of action to be considered. In practice, the iterative cycle of action and reflection is messier than is depicted in schematic form in Figure 25.

In this research, a first cycle of action research involved considering the GB energy system in relation to theories of commons and polycentric governance, which led to the development of an initial set of DPs. A second cycle of action research took place in testing these DPs in relation to the empirical case studies. A third cycle, which is outside the scope of this thesis, would be to test the resonance of the revised DPs with the research participants in the CE sector, and with other interested parties. This could be followed by testing them in other contexts and developing them further.

3.4.2 Types of action research

Bradbury and Reason (2006b, p. xxii) see action research as a 'family of approaches' with roots in practices of individual reflexive learning, organisational development and liberationist practices originating in the majority world.

Burns (2014) defines five different 'levels' of action research, as shown in Table 2. Although in depth action research at the level of a whole system can be too ambitious for a doctoral research project, systems thinking is an approach that can be applied as a framing of research questions and analysis for any scale of research project.

Table 2: Types of action research as categorised by Burns (2014, p. 4)

Reflective practice	Individuals reflect on their own practice
Action learning, action science and action inquiry	Group process to support individual reflection
Co-operative inquiry	Group reflection on group endeavour
Participatory action research	Community based generation of knowledge for community action
Systemic action research	System wide learning

This research combines individual practitioner reflection through journaling and personal reflection with systemic thinking at a number of different levels of spatial scale and organisation size. Developing an understanding of the whole system has been prioritised over developing participation and community action. This has involved using case studies at three different spatial scales. These case studies are described in chapter 4.

3.5 Research philosophy

This section describes the philosophical foundation of this research. The main components of this are shown in Figure 26. These include theory of being, or ontology, theory of knowing, epistemology, and a theory of reflexive doing, or praxis. Underlying this is a normative foundation of values, or axiology.

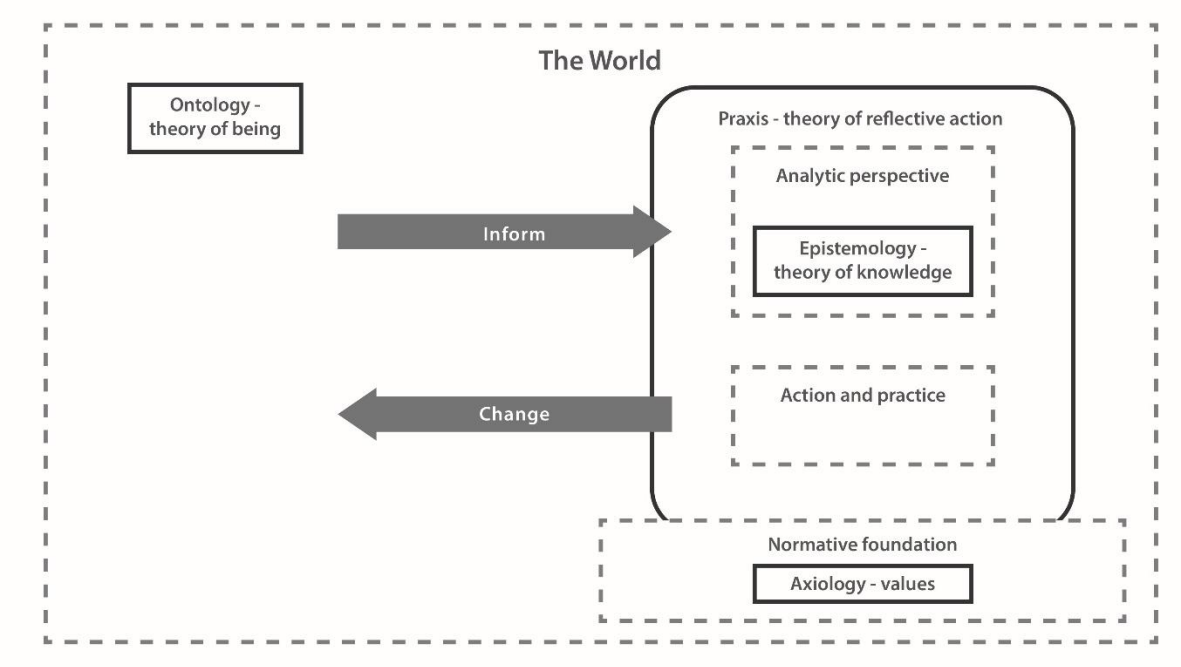

Figure 26: Philosophical foundations: values, ontology, epistemology, praxis

Praxis means acting on the world through practice, and reflecting analytically on the impacts of the action that as observed in the world, which fits well with action research. It is therefore in relationship with the world, whose nature is perceived to be as defined by ontology. The action taken, and the focus of reflection, sits on a normative foundation of values, or axiology.

This research has an underlying axiology of sustainable prosperity, which is taken to mean remaining within environmental limits and systematically decreasing human inequality. The action that is the focus of this research is the work of the consultant, and the roles of LAs and CE groups in a transition to a sustainable energy system. This is engaged with in a reflexive way, through praxis, which connects the action with reflection and theoretical development. It is a utopian and prefigurative praxis, which aims to act based on a vision of a desired future world. This is grounded in an ontology and epistemology of complexity.

3.5.1 Ontology and epistemology of complexity

It can be difficult to distinguish between theories of being (ontology), and theories of knowing (epistemology), despite the ease with which they can each be defined separately. This is because theories of what can be known and how things can be known are intertwined with theories of what the world is, of how it reveals itself, and of causality. This section therefore discuses epistemology and ontology together.

An ontology and epistemology of complexity means knowing that there are limits to science and limits to ethics (Wells, 2013) and that action must be taken without knowing the full consequences. It means considering whole systems, plurality of perspectives and contextually specific knowledge.

Achieving a governance arrangement for global sustainability is extremely challenging: it involves making decisions in a complex world of unknowns, incommensurability, and uncertainty, where values, politics and evidence all influence decision-making. The premises of complexity proposed by Noorgard (1994, cited in Wells, 2013), and shown in Table 3, are increasingly gaining influence, with implications for science, policy and ethics.

Table 3: Dominant and alternate premises (Noorgard 1994, cited in Wells, 2013, p. 101)

[Titles in square brackets added]

Dominant premises **[reductionist determinist paradigm]**	**Alternate premises** **[complexity paradigm]**
Atomism: Systems consist of unchanging parts and are simply the sum of their parts	Holism: Parts cannot be understood apart from their wholes and wholes are different to the sum of their parts.
Mechanism: Relationships between parts are fixed, systems move smoothly from one equilibrium to another, and changes are reversible.	Chaos and evolution: Systems might be mechanical, but they might also be deterministic yet not predictable or smooth because they are chaotic or simply very discontinuous. Systems can also be evolutionary.
Universalism: diverse, complex phenomena are the result of underlying universal principles which are few in number and unchanging over time and space	Contextualism: Phenomena are contingent upon a large number of factors particular to the time and place. Similar phenomena might well occur in different times and places due to widely different factors.
Objectivism: We can stand apart from what we are trying to understand	Subjectivism: Systems cannot be understood apart from us and our activities, our values, and how we have known and hence acted upon systems in the past.
Monism: Our separate individual ways of understanding complex system are merging into a coherent whole.	Pluralism: Complex systems can only be known through alternate patterns of thinking which are necessarily simplifications of reality. Different patterns are inherently incongruent.

The premises of complexity are integrated into the research approach. This means seeing the transformational potential of local and CE beyond the sum of individual initiatives, engaging with the messiness of the real world, openly listening to and being explicit about my own and others' individual perspectives, as far as possible. It means considering governance systems to be historically contingent, evolutionary, and contextually specific. This means that findings of this research may be transferable to other contexts, but are not expected to be generalizable. The complexity paradigm fits well with the research philosophy of action research.

Reason and Bradbury (2006a) set out a participatory worldview for action research, which they see as competing with both the positivist modern wordview and the linguistic, deconstructionist perspective of postmodernism which has had an important role in social science since the 1960s. This participatory perspective includes a pluralist 'extended epistemology', which recognises several different forms and sources of human knowledge beyond mainstream formal academic knowledge. These different forms and sources have been formulated in different ways by different scholars. They include: Park's concept of relational, reflective and representational ways of knowing; Shotter's concepts of knowing that, knowing how, and knowing with other people in conversation; and Heron and Reason's experiential, presentational, propositional and practical knowing (Reason and Bradbury, 2006a, p. 9).

Action Research is also influenced by feminist approaches which consider gender, multiple identities and interlocking oppressions, voice, everyday experiences and power (Maguire, 2006). Feminist research is compatible with a complexity paradigm. It is pluralist, subjectivist and contextual in that different voices are valued, and holistic and evolutionary in considering structural and historic sources of oppression. Liberation discourses and consideration of a researcher's own positionality are integrated into action research methodologies, giving them a valuable integrity.

3.5.2 Utopia as method

The participatory worldview of action research is actively normative. It is research that aims to make the world better, both to leave the site of research better than when the researcher arrived, and to learn how to bring these positive changes to other places. It is therefore a utopian practice, reliant on a vision of how we would like the world to be. This is one of the core aspects of 'utopia as method' identified by Levitas (2013), who argues for reclaiming utopian thinking as the proper methodological approach of sociology.

Levitas (2013), describes three modes of utopia as method: utopia as archaeology, utopia as ontology, and utopia as architecture. These deal respectively with: constructing a vision of the world we want to create; critically uncovering hidden visions of the future that are implicit in current modes of thinking and policy making[9]; and considering our vision of human nature.

This thesis deals with all three modes of utopia as method. Utopia as architecture is involved in developing the DPs for a polycentric, commons-based energy system, in imagining what commons governance of energy would mean, and in designing some of the case studies. Utopia as architecture is also involved in prefigurative politics. Some of the more innovative CE projects described in chapter 2 are prefigurative in nature – they are engaging with the energy system on the basis of a vision of something that is not yet possible, and aiming to change the system through this process. Utopian thinking allows alternative futures to be imagined, and marginal practices in the present to gain visibility. Without a bit of imagination, the potential for research to take us beyond the status quo is limited.

Utopia as archaeology was involved in critiquing depoliticised and commodified ways of governing energy in the current system, in chapter 2. Utopia as ontology is explored in the context of the 'ontology of humans', informing the research philosophy of this thesis.

3.5.3 Beliefs about human nature and governance paradigms

This research is concerned with the governance of energy systems, and the potential for social change to modify the impact of the GB energy system on the climate. Therefore considering the nature of human beings, or ontology of the human, is important. This includes the question of the extent to which agency lies with the individual or in social structures, which is framed in the social sciences as a debate between methodological individualism and structuralism or collectivism.

Levitas (2013), Thompson (2008), and Verweij et al. (2015) all see humans as being socially constituted – our human nature, individuality and brain structures are partially created by the societies that we live in, and our relationships with other people. This begins from infancy or before birth, as described by Gerhardt (2011). This is a perspective on human agency which sees that "social and organizational realities may be understood to be outcomes of patterns of interaction between the members: [and] in turn, the members'

[9] Utopian thinking is sometimes dismissed as unrealistic or dangerous, and utopia as archaeology shows that even those who see utopianism as unrealistic have some form of implicit vision of how the world should/could be which can be seen as utopian. Utopianism of some form is pervasive.

dispositions and practices are shaped by social and organizational procedures" (Reason and Bradbury, 2006b, p. xxvii), following Giddens and Bourdieu in structuration theory.

In contrast, "methodological individualism" holds that agency resides in the individual, rather than in social structures which can be seen as a 'collective' or a 'whole' (Epstein, 2009), and that "meaningful social science knowledge is best or more appropriately derived through the study of individuals" (Samuels, 1972).

A complex understanding of human nature as socially constituted challenges the reductionist ontology of human nature of 'rational economic man' or 'homo economicus' used to simplify mathematical modelling by mainstream economists. In fact, human nature is as cooperative, or more cooperative than it is competitive. Despite the oversimplification of human nature behind the theory of rational economic man; neoclassical economic theory, built on this view of human decision-making, informs many political and business decisions. It is therefore important both to critique the myth of rational economic man, and to develop alternative and more accurate ontologies of human nature as a basis for co-operative governance systems.

Levitas' third mode of utopia, utopia as ontology, is an ontology of the human that asks not just about our theory of what human nature is, but also about our vision of what we want human nature to be. This is based on an ontology of the human that believes that "it is characteristic of human nature to require completion through culture" (Levitas, 2013, p. 176).

Levitas invites readers to imagine their own utopian visions of human nature, but also makes some suggestions. Her utopian vision of human nature includes: valuing the dignity of every person, and the need for 'equality of condition' to enable relationships based on dignity; the importance of care and attachment, love and kindness, and the recognition that we are all vulnerable; the need for flexibility of self – the idea that each person's identity is continually changing, as we learn and are in a process of becoming; the value of the emotion of hope, and our capacity for wonder, as an attitude and a receptivity. This vision of human nature, she argues, could be supported by a society built around human flourishing, equality of condition as essential for dignity, basic income, good work, revaluing care, and environmental sustainability; and is set against the current mainstream political values identified as meritocracy, civil society and economic growth.

Considering that the way that we are, as humans, is shaped by the social structures we live in has implications for desirable institutions in our energy systems. Could commons-based institutions nurture a more caring, connected type of human than the current individualist, market and commodity based institutions? To what extent do social structures modify the competitive aspects of human nature?

3.5.4 Places to intervene in a system

An ontology of complexity means thinking holistically, and thinking about systems as a whole rather than their separate parts. There are many tools for thinking about systems. It is beyond the scope of this thesis to discuss systems theory in detail. However, the thesis does draw on the heuristic 'twelve levers' for acting to change a system, proposed by Meadows (1999). These are listed below, where number 12 is the least effective place to act, and number 1 is the most effective.

"Places to Intervene in a System (in increasing order of effectiveness):

12. Constants, parameters, numbers (such as subsidies, taxes, standards)

11. The sizes of buffers and other stabilizing stocks, relative to their flows

10. The structure of material stocks and flows (such as transport networks, population age structures)

9. The lengths of delays, relative to the rate of system change

8. The strength of negative feedback loops, relative to the impacts they are trying to correct against

7. The gain around driving positive feedback loops

6. The structure of information flows (who does and does not have access to what kinds of information)

5. The rules of the system (such as incentives, punishments, constraints)

4. The power to add, change, evolve, or self-organize system structure

3. The goals of the system

2. The mindset or paradigm out of which the system—its goals, structure, rules, delays, parameters—arises

1. The power to transcend paradigms" (Meadows, 1999, p3)

Meadows argues that the second most powerful lever available for changing a system is "the mindset or paradigm out of which the system—its goals, structure, rules, delays, parameters—arises" (Meadows, 1999). Meadows' most powerful lever, however, is "the power to transcend paradigms". This may be something which can only be achieved in brief moments of insight, or experiences of universal connection. Or it may be a power that can be developed through being able to hold and understand the logics of several different paradigms at the same time.

This research acts at the level of changing the paradigm, aiming to replace the dominant individualist and market paradigm of the GB energy system with an egalitarian and commons paradigm. It also attempts to transcend paradigms, by understanding and by acknowledging that this worldview is not and will never be shared by everyone. This involves seeing the roles of market logics, state logics and commons logics as each being valuable, and interacting with each other. The ability to understand and go between a number of different paradigms is helped by my multiple positions in academic, commercial and egalitarian activist social settings. Reflection on the tensions and commonalities between these is a good starting point for developing an ability to transcend paradigms.

3.6 Methodological considerations in action research

3.6.1 Quality and rigour in qualitative research

It is important to ensure quality and rigour in research. However, the appropriate ways to do this depend on the ontological paradigms, such as: positivism, post-positivism, critical theory and constructivism identified by Guba and Lincoln (1994); or realist, constructionist and activist approaches listed by Hammersley (2007). The complexity paradigm and action research approach of this thesis fits with activist, critical and constructivist approaches to quality in research.

Shenton (2004) offers a table of provisions for quality and rigour in qualitative research, shown in Table 4. It is not intended that every research project should achieve all of the provisions listed, but this provides a useful reference point. Provisions made within this thesis are listed in the third column.

Table 4: Provisions for quality and rigour in qualitative research

Provisions that may be made by a qualitative researcher wishing to address Guba's four criteria for trustworthiness, taken from (Shenton, 2004)		Provisions made in this research
Quality criterion	**Possible provision made by researcher**	

Credibility	Adoption of appropriate, well recognised research methods	Use of participant observation, interviews, workshops
	Development of early familiarity with culture of participating organisations	CE sector was familiar to researcher
	Random sampling of individuals serving as informants	
	Triangulation via use of different methods, different types of informants and different types	Multiple methods and sources of data used (interviews, documentary analysis, participant observation, workshops)
	Tactics to help ensure honesty in informants	Building trust through open communication of intentions, ongoing relationships
	Iterative questioning in data collection dialogues	Longitudinal studies, multiple interviews in LiM
	Negative case analysis	
	Debriefing sessions between researcher and superiors	Supervisor discussions
	Peer scrutiny of project	To some extent with BHE colleagues
	Use of 'reflective commentary'	Reflective diary
	Description of background, qualifications and experience of the researcher	Provided in Introduction chapter of thesis
	Member checks of data collected and interpretations/theories formed	
	Thick description of phenomenon under scrutiny	In participant observation
	Examination of previous research to frame findings	Literature review
Transferability	Provision of background data to establish context of study and detailed description of phenomenon to allow comparison to be made	Reflections on the contexts to which conclusions may be transferrable or generalizable are made explicitly in the conclusions chapter.
Dependability	Employment of 'overlapping methods'	Use of interviews plus focus group in LiM
	In-depth methodological description to allow study to be repeated	Case study chapter, and more detail in other publications
Confirmabilty	Triangulation to reduce effect of investigator bias	Multiple types of data used. Could be improved by testing resonance with participants.
	Admission of researcher's beliefs and assumptions	Explicit statement of values and motivations of researcher
	Recognition of shortcomings in study's methods and their potential effects	Reflection on limitations
	In-depth methodological description to allow integrity of research results to be scrutinised	Methodology is described
	Use of diagrams to demonstrate 'audit trail'	

In this thesis, quality and rigour is not achieved by attempting to be detached and objective. Instead, the subjective is acknowledged and reflected upon, and its potential impact on the research is mitigated through transparency.

Any action research project involves the negotiation of multiple identities or roles of the researcher, whether as a practitioner stepping into research (e.g. Burgess, 2006), or as a researcher stepping into practice (e.g. Rogers *et al.*, 2012). The challenge of holding a balance of insider participant action and outsider reflective research that was experienced in this study is therefore typical of action research. Levin describes using the metaphor of the 'Janus face', where:

> "the essential challenge in AR is the unique combination of deep empathic and political involvement coupled with critical and reflective research, which expects the researcher to treat his or her own experiences at 'arm's length'." (Levin, 2012, p. 134)

This negotiation of roles is particularly relevant to the Bristol case study, as discussed on p.91. It leads to some ethical challenges discussed below, as well as challenges for research quality. Quality is addressed in part through use of reflective practices, including providing a description of my positionality as a researcher (p34). This fulfils Shenton's criterion of credibility through the provision of "description of background, qualifications and experience of the researcher" (see Table 4). Confirmability of the research is supported by reflecting on how this positionality may affect research findings, using first person reflective comments where appropriate.

Another test of quality in action research is 'resonance', or the way that research outcomes are perceived by the wider group of participants. Burns (2014, p. 7) considers resonance to be an important "means by which we assess the significance and importance of what we learn." Reviewing research outcomes in detail with research participants through feedback workshops has not been possible within the scope of this thesis, and so fully testing resonance with wider participants is intended as further work. Some resonance testing has already taken place through presentations and discussion with others involved in CE during the course of the thesis, e.g. presentations to the Energy Services team at BCC, to members of the BEN board of directors, and informal conversations with members of BEN at BEN meetings, and through requesting permission to quote sections of emails, see discussion of ethics in section 3.6.2. The idea of resonance is also applicable in the researcher's own experience, in the 'first person' part of the research. This involves paying attention to emotional responses to insights and research situations.

Payne and Williams (2005) argue that all qualitative research should include a discussion of the extent of generalisability of the research, rather than expecting the reader to make judgments about generalisability themselves based on 'thick' description, as Lincoln and Guba (1985, cited in Payne and Williams, 2005) propose. This is called 'moderatum generalisability', and is not dissimilar to the 'transferability' in Table 4. As already mentioned, this research is expected to be transferable to certain other contexts rather than generalizable. Reflections on the transferability of this research are made in the conclusions.

3.6.2 Ethics

The ESRC, Economic and Social Research Council, has six key principles of ethical research which are applicable to this thesis as this is social research. These are as follows:

> 1. Research should be designed, reviewed and undertaken to ensure integrity, quality and transparency.
>
> 2. Research staff and participants must normally be informed fully about the purpose, methods and intended possible uses of the research, what their participation in the research entails and what

risks, if any, are involved. Some variation is allowed in very specific research contexts for which detailed guidance is provided in Section 2.

3. The confidentiality of information supplied by research participants and the anonymity of respondents must be respected.

4. Research participants must take part voluntarily, free from any coercion.

5. Harm to research participants and researchers must be avoided in all instances.

6. The independence of research must be clear, and any conflicts of interest or partiality must be explicit.

(ESRC, 2012, pp. 2–3)

The first principle is addressed through ensuring quality and rigour of research as described below, and through the peer-review process for publications and the examination process for this thesis.

The sixth principle is addressed through acknowledgement of funding sources, and reflective description of the researcher's positionality and the sponsoring company, in chapter 1.

The other principles warrant more discussion. The Less is More (LiM) and the Bristol case studies were given favourable ethical opinion from the University of Surrey ethics committee. For formal interviews, participants consented to the interview being audio recorded and transcribed, and a commitment was made to anonymise the presentation of the information provided. This has been done through use of pseudonyms. For the Bristol case study, interviewees were made aware that although every effort would be made to anonymise them, they may be identifiable due to their position. In order to further protect anonymity in this context, all participants in the Bristol case study have been assigned gender-neutral pseudonyms.

Consent and confidentiality in participant observation is more challenging. Members of BEN, particularly those with whom I had repeated interactions and ongoing working relationships, were aware of my role as a researcher, and I was available for discussion of any concerns they may have had. However, the feasibility of providing meaningful information about the nature of the research and its potential implications during an emergent research process was limited. I had insider access to meetings, informal conversations and email discussions due to my position as a practitioner, and was trusted to be on their side with broadly supportive intentions. This trust was also based on longer term relationships. However, it would have been difficult for BEN members to escape my research gaze, which potentially compromises ESRC ethical principle 4 of freedom from coercion. Additionally, participants may at times have forgotten my research role, and observation from interactions that were not explicitly 'research' creates an ethical risk. This was addressed as far as practicable by asking for explicit consent to use quotations from emails or descriptions of incidents which were judged to involve particular risk to confidentiality or consent.

Similar issues arose in relation to other projects. All colleagues at BHE were aware of my role as a researcher, as were key external participants, but this may not have been front of mind, and they were not aware of the way the research story would be told as this has emerged following analysis of the data. Access at BCC took place through a gatekeeper who decided to invite me to sit in and observe. Others within that team may not have felt free to withhold their consent.

Overall, this methodology leads to potential compromise of the ESRC ethical principles 2, 3 and 4, of fully informed free consent and confidentiality. This creates a greater onus on the 5th ethical principle of avoiding harm to research participants. This is important both at the level of the individual, and at the level of the group. Consideration has been given to any potentially harmful impact of revealing the information provided here, for the CE sector in Bristol, for BHE, for BCC and other research participants. The ethical principle of

avoiding harm can conflict with the first principle of producing rigour in research, as discussed by Newkirk (1996) who describes the process of gaining trust as one of 'seduction' so as to extract information, and the process of writing up the research as one of 'betrayal', particularly when unflattering or potentially painful interpretations are provided by the researcher.

One way to address this ethical dilemma is to feed back observations to research participants during the course of the research. This is an important part of an action research approach. In practice, this phase of feeding back and reflecting on research outcomes with participants has only partially taken place, as the writing of this thesis has effectively formed the researcher-reflection preceding feedback and reviewing the outcomes with practitioners. Whilst this is not ideal, it is a compromise involved in attempting action research in an EngD context.

3.7 Summary

The methodological approach of this thesis is underpinned by an action research philosophy which is values-based and pragmatic. The analysis is in two parts: a theoretical part which considers energy as a commons, and the application of polycentric governance to energy, and develops a set of DPs for sustainable local energy transition governance; and an empirical part, which uses case studies at multiple spatial scales to test the DPs.

The details of the case studies and their methodologies are described in the following chapter.

4 Case studies

This chapter introduces the case studies which form the empirical part of the research. A case study approach is appropriate for exploratory research, which fits the research questions of this thesis. It can provide a rich qualitative understanding of ways in which the theories of polycentric governance and commons relate to the context of GB local energy transitions. An iterative approach was selected, with a combination of theoretically led and opportunistic sampling, where each case study was designed to explore particular aspects of theory, to address questions raised in the previous study, or to respond to opportunities for industrial relevance to the sponsoring company. Learning from each case study informed theoretical development, and selection of further case studies. The opportunistic sampling method was appropriate for the industry setting of the research within BHE, as real projects which fit the themes being explored in the research arose, and could be included into the research process. Some of the case studies arose out of BHE priorities and engagement rather than being driven by my research agenda, a situation which is characteristic of the EngD.

A mixture of data collection methods were used, including interviews, workshops, participant-observation (or observant participation), document analysis, collaborative relationships, and conversations. Some case studies were of fixed duration, with clear project start and end dates, whilst others have a longer term ongoing engagement. The action role of the researcher varied in each case, including collaboration, co-authoring, presenting to participants, facilitating, self-reflection and observing.

The case studies were used to test the DPs for commons-based and polycentric governance, which were developed from the theoretical analysis.

The five case studies in this thesis took place at three spatial scales: the neighbourhood; the city; and the bioregion or sub-region, as shown in Figure 27.

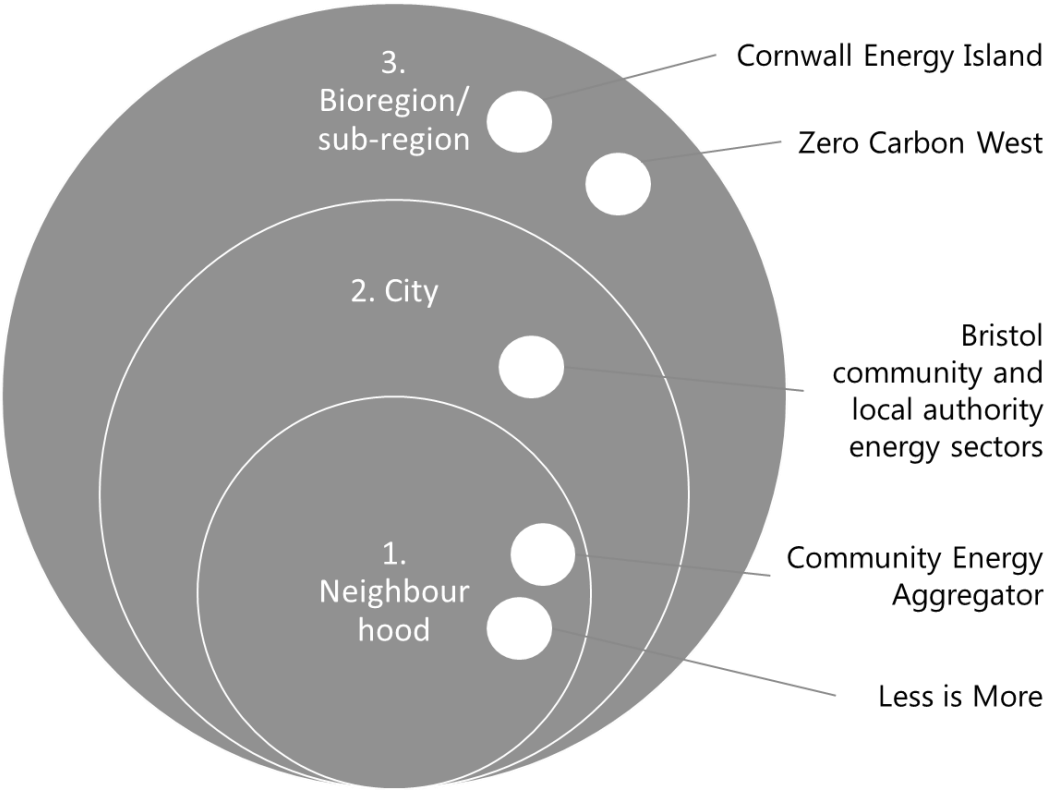

Figure 27: Five case studies, at three spatial scales

Each case study explores the interaction of concepts and theories of commons and polycentric governance with salient issues emerging from the field. The salient issues and theoretical focus of each study are different. Together, they provide different perspectives on how commons and polycentric governance themes interact with community and locally led decarbonisation of GB energy systems. Each case study provides a snapshot of some activities taking place at a particular scale. They do not aim to be representative or comprehensive of all energy projects taking place at that scale, but rather to give a rich description of the case study project.

The case studies were carried out consecutively over the period of the research, with some overlap between them. The timings of each of the case studies is shown in Figure 28.

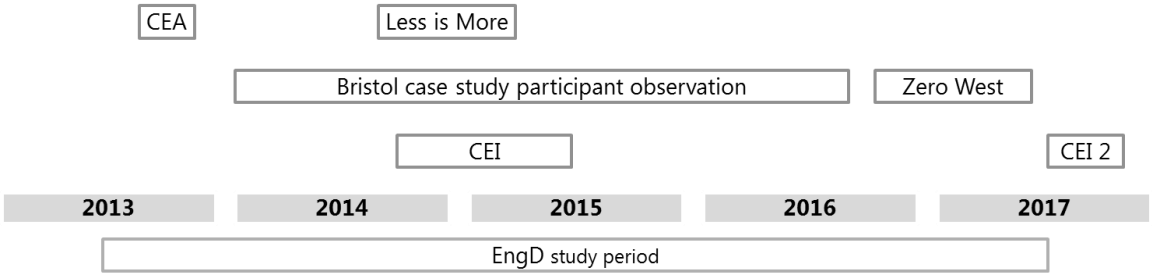

Figure 28: Case study timeline

The case studies used a variety of different methodologies. The Bristol case study and CEI project were longitudinal and rich in variety of data. The LiM study relied on more formal interview and focus group methodologies. The CEA project used a mixture of interview, survey and focus group methodologies, and was exploratory in nature. The Zero West study used participant observation methods, and is a follow-on from the Bristol case study as it was part of the same energy transition practice context.

The level of detail in which each case study is described varies, with a more detailed description of the Bristol case study than the others. In part, this is because details of the context and methodology of the LiM, Community Energy Aggregator (CEA) and Cornwall Energy Island (CEI) case studies are available in separately published reports. Additionally, the Bristol case study has particularly rich data, due to the mixed methods approach of this case study, which includes participant observation. Providing context for understanding this is important.

The analysis in this thesis draws on my experiential knowledge as a practitioner in the local energy sector from 2010, in addition to the more formal data from the case studies themselves. A table summarising all formal data collected is presented on p97.

4.1 Neighbourhood electricity commons

The first scale of study is the neighbourhood, the context where much of GB's electricity is consumed. Two case studies at this scale explore time of use of electricity in urban households, in communities of place. Changing the time of use of electricity in a domestic setting can support the integration of variable renewable generation in the electricity system, as discussed on p51. Organising neighbourhoods to play an active role in managing the timing of their electricity demand could be a source of income for community groups.

This type of neighbourhood community action was of particular interest for this thesis, as it could be a good setting for commons institutions similar to those studied by Ostrom. The CEA (CEA) case study was designed to explore this. It was funded by Innovate UK (then the Technology Strategy Board) and carried out through BHE working with colleague Henrietta Cooke (BuroHappold Engineering, 2013).

This led on to participating in the LiM study which was testing the use of a community incentive for electricity demand management. Interviews from this study were used as the primary data for a paper published in Energy Policy (Melville *et al.*, 2017).

4.1.1 Community Energy Aggregator (CEA)

The CEA study explored the potential for configuring urban electricity contexts to resemble the small-scale community commons described by Ostrom, and intentionally design these to fit with Ostrom's DPs for common pool resource management. The section of this report which discusses the analysis of Ostrom's DPs is included as Appendix 1. This was framed around a feasibility study for a neighbourhood based DR organisation, or community 'aggregator' of DR, learning from the commercial 'aggregators' described in section 2.4. Payment for electricity time of use management, or DR, was seen as a potential motivation for neighbourhood scale cooperation in relation to urban electricity. It was found that the income generated from this activity, based on existing payments available from National Grid, would be too low to motivate the substantial changes in consumption patterns required to access the payments. A proposal for a further full pilot study was developed, and submitted to the funder, but did not receive further funding.

The study was carried out in collaboration with community organisation the Knowle West Media Centre, and PhD candidate Daniel Quiggin. It involved 13 expert interviews with regulators, policy makers and industry regarding the potential to develop a community business model for DR; a survey of 40 individuals, two focus group sessions at the Knowle West Media Centre, a stall at a public event, all of which explored respondents' willingness to change time of use of electricity individually or as a community; the development of a number of potential business models using the Business Model Canvass (Osterwalder and Pigneur, 2009); and an initial analysis of both the current energy system and an imagined community based energy system using Ostrom's DPs.

4.1.2 The Less is More (LiM) project[10]

The effectiveness of community accountability for time of use of electricity in urban neighbourhoods was further developed in collaboration with the LiM. This project, led by WPD and implemented by CSE, tested the use of a community incentive for electricity demand management at the substation level[11]. This section describes the wider LiM project as a whole, before discussing the interview and focus group methodology used in this study.

The LiM project trialled the use of a community incentive for electricity demand management at ten substations in the Western Power Distribution (WPD) area, where the community around each substation in the trial was offered a financial incentive of up to £5000 over the project period, earned by achieving target reductions in peak and overall demand. The community suggested how to spend the money earned. Minute-by-minute electricity demand data was recorded at the substation level by WPD, but no household level data was recorded, due to privacy and data protection considerations[12]. The collective incentive created a commons situation, but there was no direct community accountability of individuals. Progress towards fundraising was shown on the graph on the LiM website which also showed the target consumption line (see Figure 29).

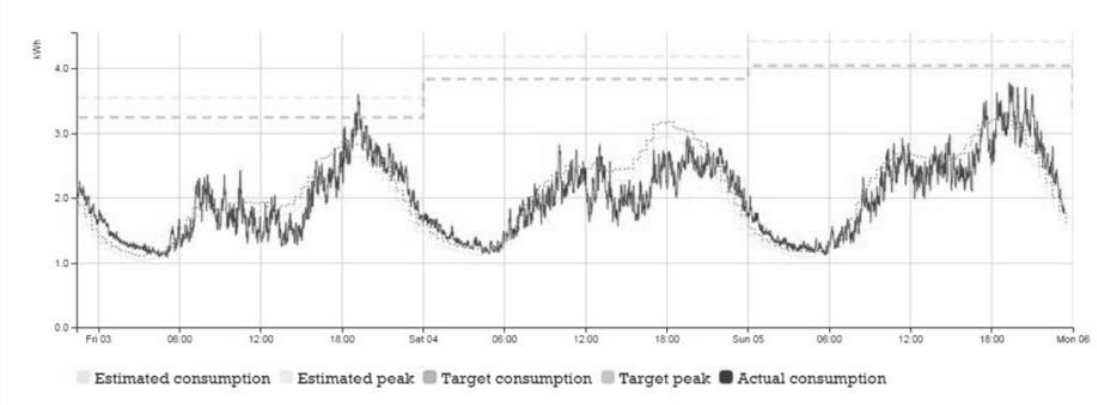

Figure 29: Example of screenshot from LiM website showing estimated, target, and actual consumption (Coxcoon et al., 2015, p. 18)

Community interventions were coordinated by the Centre for Sustainable Energy (CSE), and engagement activities and events were carried out by local charity and community partners. At the substation chosen for the interviews, the project also trialled a specifically designed energy monitor, the Greenbank Energy Monitor (GEM), which enabled some awareness of the level of collective action taking place in the community, a step towards the mutual monitoring described by Ostrom's DP 4A (see chapter 5, p 112), without infringing on individuals' privacy.

The GEM was designed to alert householders connected to the substation to the times when the substation was under pressure (i.e. times of peak demand). This prompted them to look for opportunities to turn off or delay using electricity consuming devices in the home for a period of time, called a 'challenge', which

[10] This description of the Less is More study is adapted from the text produced for (Melville *et al.*, 2017)
[11] Full details of the LiM project, and the methodology used, are available in the final project report produced by CSE (Centre for Sustainable Energy, 2015b)
[12] This was because the LiM project design involved monitoring the substation for several months before the participants were aware that the study was happening, in order to measure a baseline. It was judged to be acceptable to monitor the aggregate at the substation level without informed consent, but not acceptable to do this at the individual household level.

occurred once a day, at some point during the evening, for 30-45 minutes. The GEM units displayed one of two screens. Most of the time, the display showing was the 'default mode' shown in Figure 30. Once a challenge period started, the display changed to the challenge screen, shown in Figure 31.

Figure 30: Greenbank Energy Monitor 'default display'

Figure 31: Greenbank Energy Monitor 'challenge display'

The LiM project was designed with the intention that the GEM would be in place for several months. However, due to delays in the production and development of the GEM, it was in place for a shorter duration

than was originally planned[13], which may have affected participants' perceptions of the GEM and reduced the extent to which they discussed it with their neighbours.

4.1.2.1 Interviews and focus group methodology

This study involved two interviews and a focus group exploring neighbourhood energy management, as described in more detail below. These involved LiM participants in the Greenbank substation area, where the GEM was used. All residents of the substation area were invited to be interviewed, with a flyer posted through their door. CSE workers also promoted the research as part of their project engagement activities. There were twelve respondents overall, who received a payment of £15 for each session in which they took part, funded by CSE. Interviews took place in the respondent's home, and the focus group was held in a local community centre.

Respondents had a basic understanding of and engagement with DR due to their participation in LiM, where this was framed as a community activity. They also had an experience of observing the participation of others in their neighbourhood through their use of the GEM, which provided a limited level of mutual monitoring. The sample had no particular prior interest in energy conservation. However, self-selection bias is possible as the more community-minded or energy-conscious individuals may have responded to the interviews.

Only one of the research participants was male. All of those who completed a demographic survey identified as white-British and were aged between 25 and 55, with a mixture of house tenure types. As this is exploratory research with a small sample, the study was not intended to be representative. Horne et al. (2015) report that privacy concerns in their study were not related to demographic characteristics. However, approaches to commons management may be related to demographic characteristics. Further research might usefully explore this with different demographics.

The study consisted of three steps: a first interview prior to the installation of the GEM, with a total of twelve respondents; a second interview at the end of the GEM implementation period, with seven of the original twelve respondents; a final focus group attended by five of these seven respondents. Interview guides for both interviews, and the wording of the scenario presented in the focus group session, are available in Appendix 2.

The first interview aimed to understand how respondents' sense of community and level of social trust affected their concern about free-riding behaviour and desire to monitor others' participation, and their energy consumption patterns and perceptions of time of use flexibility. The second interview began with questions about the respondent's experience of the GEM, including how easily they understood its functioning, their perception of their neighbours' participation in 'challenge periods', and their attitudes to the gadget and to having information about others' participation. It then raised questions about local infrastructure, including hypothetical community responses to a risk of local blackouts, and who should be responsible for investment in electricity system reliability.

The focus group session started with a discussion of the GEMs, two examples of which were in the room. In the first stage, there was minimal prompting from the facilitator. In the second stage, an imaginary future scenario was introduced. This described a situation where a neighbourhood had taken responsibility for keeping demand below a certain peak, to manage stress on the local substation, and had to deal with a blackout. After some clarifying discussion, participants were asked how they would manage the grid in such a

[13] GEMs were installed in participants' houses in a staggered way, over a period of two weeks. This resulted in some participants having GEMs in place for 4 weeks, and others for only 10 days. If they had been in place for longer, this may have resulted in reduction of interest as the novelty wore off, but it may also have provided greater opportunity to discuss with neighbours.

scenario, with questions about the difference between different people's needs, privacy, allocation of responsibility, and decision-making processes.

Qualitative analysis of the data used a combination of inductive and deductive approaches (Hyde, 2000; Morse and Mitcham, 2002). The central theoretical construct explored in the research was community accountability for energy consuming behaviour. Themes were introduced explicitly through the framing of the questions, but analysis was carried out with attention to emergent as well as a priori themes. All interviews and the focus group session were audio-recorded and transcribed. They were coded in Nvivo[14] with some codes arising out of an a priori theoretical interest, and others emerging from the data. For example, an a priori code of 'community as motivation' had a priori sub-codes of 'fun' 'fairness' and 'normal' arising from the interview questions, as well as sub-codes arising from the data such as 'part of a joint effort', 'demonstration of possible', 'share ideas and learning'. These were developed in part through the use of sensitizing concepts, (Bowen, 2006) such as 'reasons why respondents might find community activity motivating'. Names of all respondents were changed to pseudonyms to preserve anonymity.

4.2 City scale civic energy sector development

This second scale of study is the city. There was one case study at this scale, a study of the development of the civic energy sector in the city of Bristol. This includes the CE sector as a community of interest, the local government or local authority (LA) energy services team, and the LA owned energy supply company. The relationship between the CE sector and the LA had been an important focus of the study, as this was identified as an important success factor for the CE sector in other places, in particular in Brixton, where Lambeth council provided crucial in-kind support to Repowering Brixton, and B&NES, where B&NES council signed a co-operation agreement with CE group BWCE.

4.2.1 Methodology and approach

This case study used mixed methods, with a combination of participant observation, reflective diary, formal interviews and recorded conversation, as well as document analysis and participation in email discussions. Particular attention was paid to the relationship between the LA and the CE group, their respective roles, and how they understood each other's roles. Attention was also paid to moments of conflict, and to my own emotional responses as part of a reflective practice.

This is a longitudinal study over three years, from 2014 to 2017, which also draws on publicly available information and my experience in the setting prior to the study period. Qualitative data was analysed using Nvivo[15], with a mixture of a priori coding based on the DPs proposed in chapter 8 and pre-existing theoretical frameworks, and emergent coding from the data. The data from this case study is both rich and messy. Detailed context is provided. This will help readers to judge the meaning and transferability of observations and conclusions.

4.2.2 Bristol background and context[16]

Bristol is the largest city in the South West of the United Kingdom. It has a strong history of environmental and sustainable initiatives, and was awarded Green Capital of Europe in 2015. This award was won partly thanks to the richness of grassroots sustainability initiatives, including urban food growing projects and CE projects.

[14] A widely used qualitative analysis software package
[15] A widely used qualitative analysis software package
[16] Much of the text in this section is based on a case study published on an Energy Democracy website: (Melville, 2016)

Figure 32: Bristol location in GB

Bristol has many leaders in sustainable energy, including the city council, the CE sector, and national energy charity the Centre for Sustainable Energy (CSE). It is also a centre of resistance against energy projects seen as being unsustainable, including nuclear power at Hinkley Point, 40 miles away (South West Against Nuclear, 2016), fracking in the Bristol area and surrounding countryside (Frack Free Somerset, 2015), a biomass power station burning imported wood in the port area (South West Business, 2015), and diesel powered backup generators providing to grid flexibility contracts.

Bristol is a divided city. It is a port whose historic wealth is associated with the transatlantic slave trade, and a place of arrival for Afro-Caribbean people in the 1950s. In the 1980s, racial tension erupted into riots. Parts of the city are very affluent, whereas other neighbourhoods, particularly in central and in south Bristol, are in the top 1-2% most deprived wards in the UK as shown in Figure 33, (Bristol City Council, 2015b). Tackling inequality was at the top of the Mayor's 2015 manifesto commitment (Rees, 2016).

Map 3: Index of Multiple Deprivation showing Most Deprived LSOAs from 1% to 10%
Source: Department for Communities and Local Government, Indices of Deprivation 2015

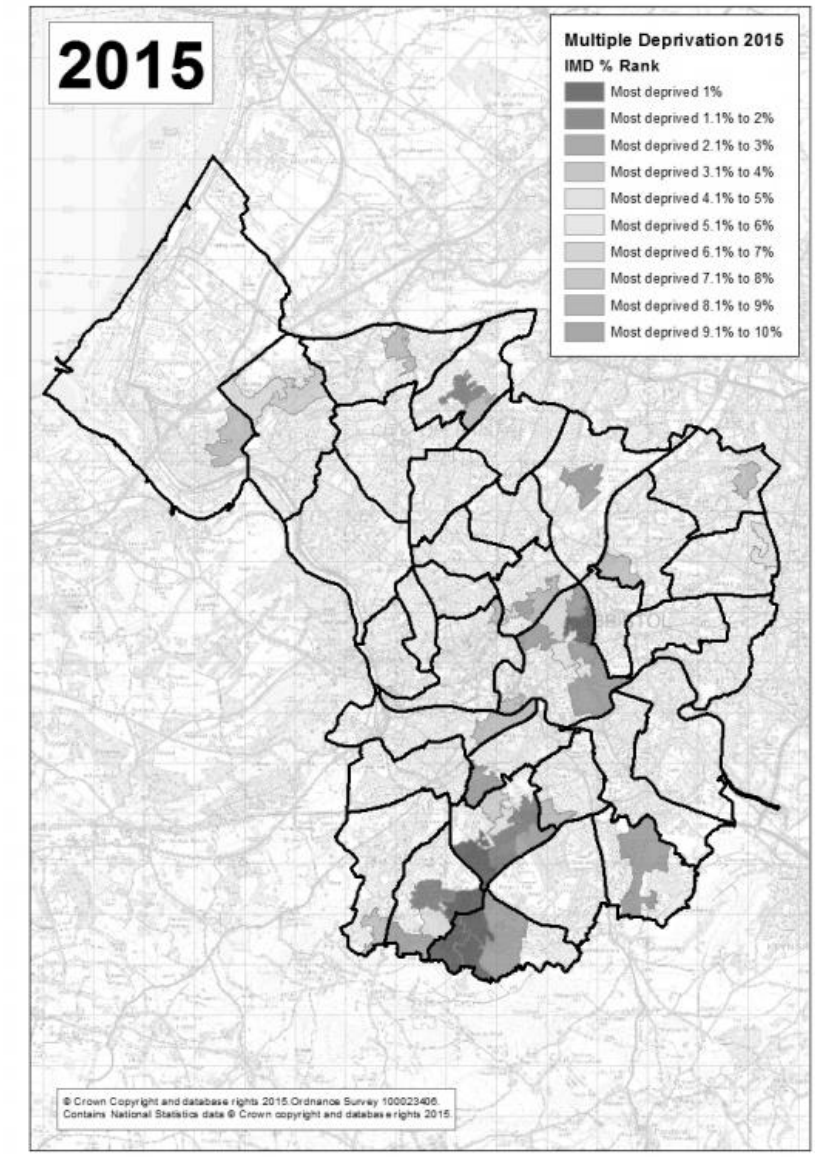

Figure 33: 2015 Bristol indices of multiple deprivation (Bristol City Council, 2015b)

Much of the environmental grassroots work in the city is led by relatively affluent, educated, white, middle class people. The Green Capital year provided an opportunity for critical discussion of the lack of representation of Black and Ethnic Minority groups in the environmental sector, through a series of 'Green and Black' debates led by community radio station Ujima (Ujima Radio, 2015). The Bristol Energy Network (BEN), which is described in more detail below, participated in these discussions.

Bristol exists in a context of messy local administrative boundaries. It is one of the four 'unitary authorities' in the West of England (WoE) area, along with South Gloucestershire, North Somerset and Bath and North East Somerset (B&NES), as shown in Figure 34. These were formerly the county of Avon (1974-1996), and prior to that were part of the neighbouring counties of Somerset and Gloucestershire. The spatial boundary continues to be important with a WoE Local Enterprise Partnership, joint transport and waste planning, and joint commissioning of a RE technical potential study from BHE in 2012 (BuroHappold Engineering, 2012). It is seen as a Greater Bristol bioregion, or 'city region' (Forum for the Future, 2008; Carey, 2011). This history leads to rural-urban tensions, with some resentment that Bristol dominates the area. In 2016, a Devolution

Deal was negotiated with national government, which involved the direct election of a WoE 'metro mayor' to cover South Gloucestershire, B&NES and Bristol (North Somerset has opted out), in May 2017.

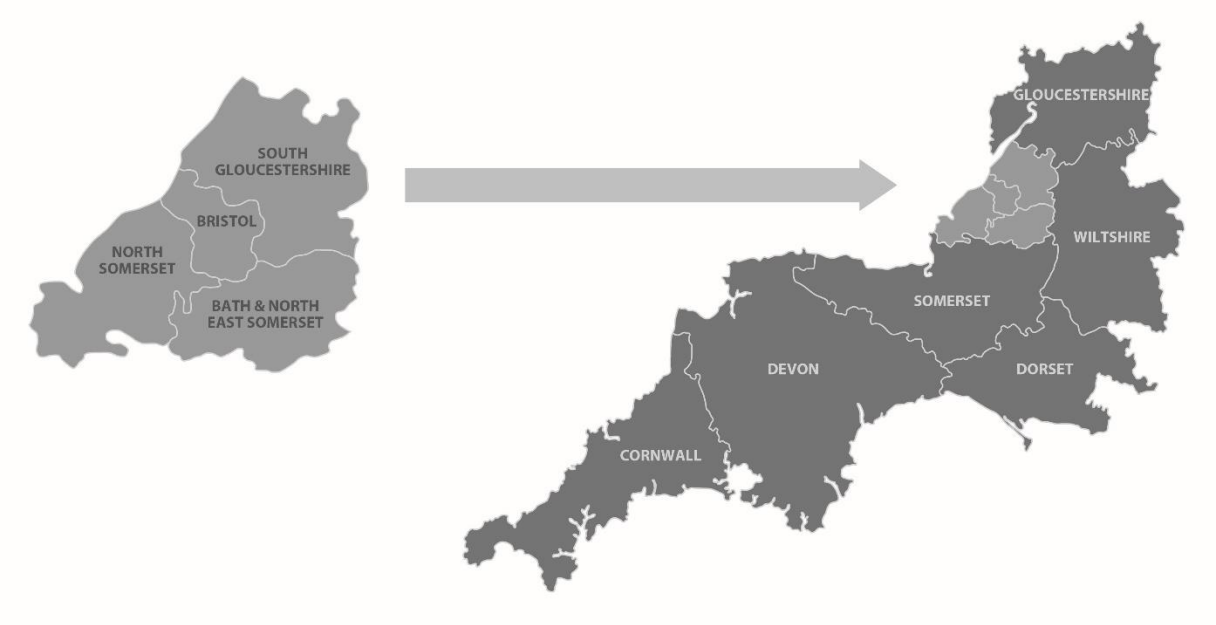

Figure 34: Map of the West of England

Whilst this case study focuses on activities within the Bristol authority area, it is very hard to meet energy needs from within a densely populated urban area (BuroHappold Engineering, 2015). The need to work at a larger scale recognised, with the Zero Carbon Bristol initiative started by BEC moving to the name Zero West in early 2017, as discussed in section 4.3.2.

Timelines for the history of the BCC's work on energy, from 1992 to 2016, and the history of BEN and its member groups from 2009 to 2016, are shown below in Figure 35 and Figure 36.

4.2.2.1 Bristol City Council energy

BCC is the second local authority in GB (after Nottingham) to set up a fully licensed energy supply company (Bristol Energy, 2016b). BCC has also set up an ambitious residential energy efficiency scheme (Warm Up Bristol, 2016), and is investing in RE and energy efficiency on its own buildings and land. This has developed over many years, as shown in the time line in Figure 35.

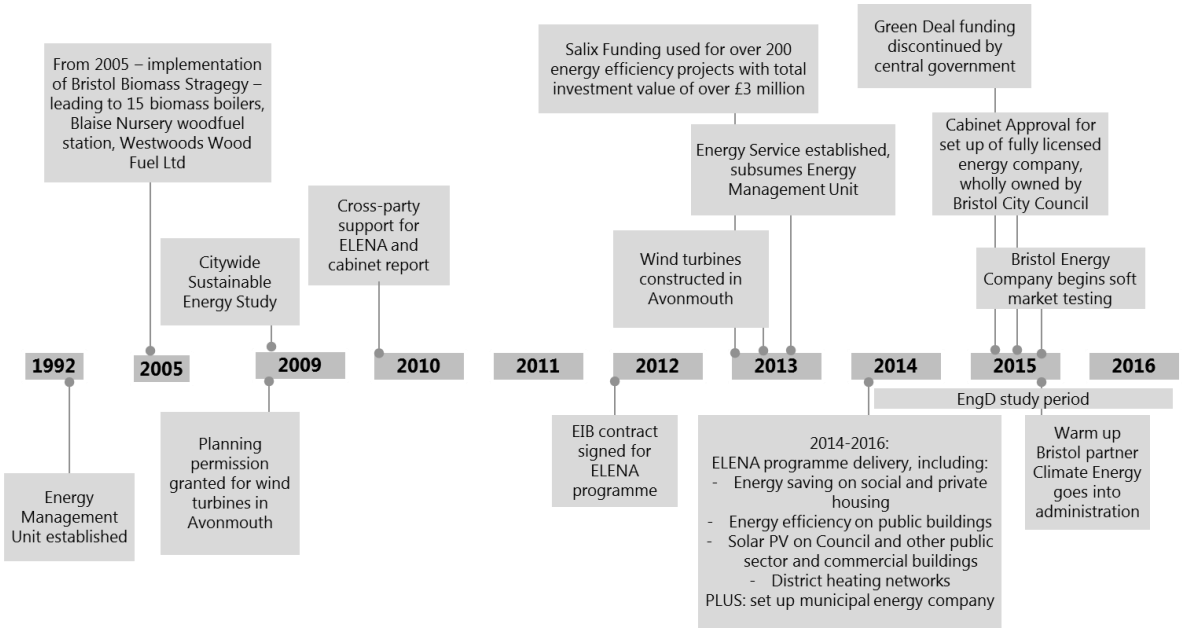

Figure 35: Bristol City Council Energy Services timeline, 1992-2016

The Energy Management Unit was founded in 1992. It implemented a local biomass strategy, used the public sector revolving fund Salix to carry out £3million worth of energy efficiency investment, and developed wind turbines in Avonmouth (Council, 2013), the port area of Bristol. It also commissioned several studies of the technical potential for RE in Bristol (Centre for Sustainable Energy, 2009). In 2013, the Energy Management Unit and the ELENA (European Local Energy Assistance fund) team were brought together in a new Energy Services team (Bristol City Council, 2014b), which delivered the EU ELENA programme. This provided £2.5 million of technical assistance funding for local energy projects, and comes with a requirement to leverage 25 times the initial investment, i.e. a total of £62.5 million in three years (RegenSW, 2012). The ELENA programme includes four streams: energy saving for social and private housing, energy efficiency of publicly owned buildings, Solar PV on Council and other public sector and commercial buildings, and district heating networks. The programme also includes the setting up of a fully licensed energy company. Three of these, the private housing energy saving scheme, the solar PV installations, and the setting up of the Bristol Energy Company (Bristol Energy), are described in more detail.

Warm Up Bristol

The private housing energy saving scheme set up by BCC is named Warm Up Bristol (Warm Up Bristol, 2016). This scheme has successfully implemented over 1000 measures, particularly solid wall insulation, with a focus on three neighbourhoods which were supported by grant funding under the 'Green Deal for Communities'. However, it has faced many challenges, as would be expected in a large scale energy efficiency scheme. The Warm Up Bristol scheme was designed to be aligned with the national Green Deal programme for energy efficiency. In July 2015, the UK government announced that further funding to the Green Deal finance company would be discontinued (DECC, 2015).

BCC initially contracted a single company, Climate Energy, to deliver the programme. Climate Energy ceased to trade in October 2015, following the government announcement of cuts to the FiT for solar (Macalister, 2015). BCC addressed this by taking responsibility for the completion of the remaining work to be delivered. This included stepping into climate energy's contracts with local builders. BCC held household events and open discussions with the community group BEN about the next steps (Bristol Energy Network, 2015a). The

Warm Up Bristol scheme was re-launched, and is currently offering support to households for energy efficiency of their homes, but with reduced financial support due to cuts in availability of grants and loans from central government. This is an important role for BCC to play, as navigating the complexity of domestic retrofit, including quality aspects, without help can be too difficult for many households.

Bristol City Council Solar PV

A large part of the original ELENA proposal from BCC included solar photovoltaic (PV) installations on council owned properties. In 2010, when the ELENA project was first agreed by BCC, this was a financially attractive option, which would support the leverage factor of 25 that ELENA required. However, FiT levels for solar have repeatedly been abruptly reduced by central government, and the final ELENA plan included less solar PV than originally intended. During this time, CE groups were being set up to invest in RE, as described in the following section, with eventual collaboration between the two.

Bristol Energy Company

The Bristol Energy Company (Bristol Energy) was set up in 2015. It is the second fully licensed energy company in GB that is wholly owned by a local authority, closely following Nottingham's Robin Hood Energy. Launching a supply company is a large investment and a risk for the local authority, as discussed in section 2.11.2. Bristol Energy has a mission to offer fair and transparent tariffs; reinvest in local communities; and support and invest in local renewables (Bristol Energy, 2016a).

4.2.2.2 Community energy sector in Bristol

In addition to very pro-active local government, Bristol has a very active CE sector. BEN is an umbrella organisation which supports its member groups in sharing information and skills and developing their projects (Bristol Energy Network, 2017a). It was founded in 2009, by two neighbourhood CE groups, the Easton Energy Group and Transition Montpellier (a group coming out of the Transition Towns movement), with the aim of sharing resources and knowledge between neighbourhood energy groups. BEN now has 25 member groups (Bristol Energy Network, 2017b). These include eleven neighbourhood CE groups, two other neighbourhood groups, seven city-wide CE groups, two other city-wide community groups, and three advice agencies. In 2013, BEN coordinated the participatory writing of a Community Strategy for Energy (Bristol Energy Network, 2013b) in Bristol. This was an open, multi-author process, coordinated by BEN members who also have roles in BCC, at CSE, and in various CE groups. This strategy was endorsed by the then elected Mayor of Bristol, George Ferguson.

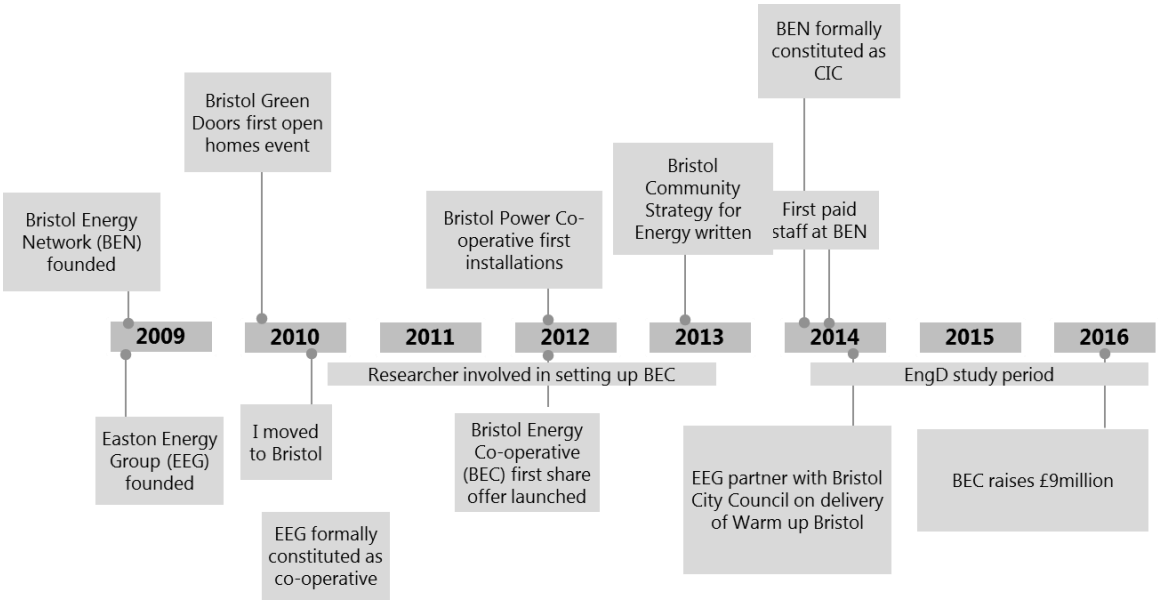

Figure 36: Bristol Energy Network timeline, 2009-2016

The number and diversity of groups involved in BEN is a richness, but it can also be confusing as there are so many groups, which sometimes compete with each other when they could collaborate. As mentioned in the introduction, the people involved are mainly white, male, and highly educated professionals, although this has been shifting over the past two to three years. A selection of BEN member groups is described below, to give a sense of the breadth of activities taking place.

Easton Energy Group

The Easton Energy Group is a neighbourhood group in central east Bristol, which describes itself as "A community group to help individuals reduce energy use in the home organised by a group of Easton residents who are working in the energy and sustainability field" (Easton Energy Group, 2017). It has been involved in a number of projects over the years, including using thermal imaging to help householders visualise heat losses from houses, interseasonal heat storage using boreholes in a park next to a community centre (ICAX, no date), and partnering with BCC on the local delivery of their Warm Up Bristol scheme. This is one of the most active neighbourhood energy groups in the city, and in contrast to other neighbourhood groups has paid members of staff.

Bristol Green Doors

Bristol Green Doors ran "educational events to inspire, encourage and enable domestic green refurbishment in our community and support others to do the same" (Bristol Green Doors, 2016a). This was primarily in the form of open homes weekends, where people who had carried out retrofit opened their homes to the public, and shared their experience. Being able to ask questions to people who have gone through the retrofit process, hear the good, the bad and the ugly, and see and feel what the finished project or work in progress looks like, makes energy efficient refurbishment less intimidating. The opportunity to look inside other people's houses also attracts visitors who are curious. The Open Homes events were discontinued in 2016 due to lack of funding or a sustainable business model, in the context of a stagnant domestic retrofit market (Bristol Green Doors, 2016b). The website with case studies of the member households who have opened their homes to the public was still operational in 2017. The lack of funding was not due to lack of success or recognition, as the Bristol Green Doors project led the government to support the development of a national network of Green Open Homes (Green Open Homes, 2017), advised by Bristol Green Doors.

Renewable energy investment co-operatives

BEC was set up in 2010-2011, to facilitate community investment in RE, through the use of community share offers (Community Shares Unit, 2015). The first share offer in 2011 raised £130k, which was invested in solar panels on the roofs of three community buildings. The 2016 share offer raised a total of £10 million, including bank and social finance loans (Bristol Energy Cooperative, 2016b), which was invested in two large solar farms, as well as solar community roof installations. In BEC, investor-members expect a 5% return on investment, and all have equal voting rights, regardless of how much money they invested. Members elect directors from the membership. The Bristol Power Co-operative was set up along similar lines, with a greater focus on domestic installations (Bristol Power Co-operative, 2016). Both have business models which have relied on the high FiT for solar PV, and like many CE investment projects around the country, are now having to seek new business models for future activities. One possible way forward could be to enter into the supply market, and BEC are considering a partnership with Mongoose Energy, who are planning to launch a new CE supply business (Mongoose, 2017), as mentioned on p62 and discussed in more detail on p171.

4.2.3 Researcher role and observations

As discussed in the section on positionality in chapter 1, I was involved in setting up the BEC and was a founding director in 2011. This gave me a familiarity with the Bristol case study context, and a position as more of an insider than outsider. I was able to draw on existing working relationships with the directors of BEC and active members of BEN, who saw me as a one of them, and with BCC officers who worked with the CE sector.

I was open with those I came into contact with about my role as a researcher, and introduced myself as a researcher in meetings or public events, as discussed in relation to research ethics on p75. I stepped down from my role as director of BEC in 2013, but became more involved with BEN than I had been previously. I attended and actively participated in BEN open meetings and member meetings throughout the EngD, attempted to develop an action research methodology that would be of direct value to BEN, had informal conversations with core members of BEN and directors of BEC in person and on the phone, who were open with me as a trusted present/former/future colleague. I had the expectation that after the thesis was complete I would re-engage with the CE sector in Bristol, and I felt that people involved expected that of me and treated me collegially as such.

4.2.3.1 Challenges and limitations

This study faced a number of challenges, including negotiating an insider-outsider role within my own community of practice, the difficulty of effectively developing participatory action research in this context, and the shifting priorities and time constraints of an industry based doctorate.

Whereas the participant observer or action researcher is often an outsider becoming increasingly involved within a research context, and challenged by the ethics of entering into a community from the outside and imposing their external values and interpretations on those being studied (Rogers *et al.*, 2012), here I was researching my own community, and myself within it.

In the discussion and analysis of this case study, I deliberately use first person narrative in order to make visible the emotional reactions that I had at the time, as a subjective participant within the research context. I also attempt to take a more reflective distance in writing about events with the benefit of hindsight and in dialogue with theory. This also applies to the bioregion based studies described in section 4.3.

The study has aspects of auto-ethnography (Reed-Danahay, 1997; Ellis and Bochner, 2003), or of first person action research. Bristol is my home, and the people working towards its sustainable energy future are my potentially long term community of practice. I was involved in setting up BEC from 2010, with a passionate

belief in the project, and stepped back from being a director shortly after beginning the EngD. This was partly due to a need to prioritise the attention I gave to the research, and partly in order to have sufficient distance to be able to critically reflect on the roles of CE from the outside. This is a shift was a source of internal conflict for me – I simultaneously value and enjoy stepping back in critical and theoretical reflection, and feel guilty and frustrated by not participating actively in developing projects.

This conflict led to a strong desire to provide something useful to the Bristol CE sector through the research itself. This desire was at times in tension with the requirement to produce outcomes of academic value, and the interests of BHE. This 'insider' position has given me privileged access to information and understanding the detail of the context of local energy development in Bristol, through ongoing trusting relationships. At the same time, it means that I have my own position within each of these relationships, and am subject to the biases of any personal relationship.

My desire to contribute something directly useful led to an attempt to initiate a participatory action research process. The focus of this was the relationship between the LA and the CE group. Although I heard comments from both sides that this was a difficult relationship which could benefit from help with moving past some issues, I felt unsure that enough of those involved wanted me to take on this role. The action research planned was therefore never fully taken forward. This was also partly due to the challenge of carrying out participatory action research in a doctoral setting, where I was caught in a tension between having my own theoretical agenda, my inexperience and lack of confidence in generating academic knowledge, my desire to ensure the researched focused on participants' priorities, and inexperience in judging how far these could fit together.

Finally, other project commitments, in particular to the CEI project, initiated at a senior level within BHE, made increasing demands on my time and attention. I felt that I would not be able to be present to and commit to facilitating the emergent requirements of a participatory action research project, and allowed the Bristol study to remain an 'observant participant' rather than full action research study.

A more detailed description of my participation in the CE sector and with the LA is provided below.

4.2.3.2 Community Energy Sector – Bristol Energy Network (BEN) and its members

In addition to ongoing discussions with individuals based on previous collegial relationships, I participated actively in a number of ways. I carried out an evaluation of some CE projects in Bristol in collaboration with another PhD student, testing out a methodology developed by researchers at the University of Oxford, and presented results back to participants. I presented an evaluation of the Bristol Community Strategy for Energy at a BEN meeting which was considering updating this strategy document. I was copied in to email discussions of the relationships and roles of various CE organisations in the area. I had discussions with one BEN member regarding the potential for a pro bono contribution from BHE to developing an energy plan for Bristol similar to the existing Food and Transport plans created during the Green Capital year. This led to proposals from BHE but was not taken forward. I organised an event under the BEN banner, with the theme 'creation and resistance: building a global movement for energy democracy?' This was a panel of four women, with a focus on the social impacts of fossil fuel exploitation in the global south (Colombia and Ecuador), and the experience of energy of the African Diaspora in Bristol. I attended BEN training on 'building diverse and inclusive groups'. I discussed the dominance of men in the CE sector with some of the women involved in BEN, from an inclusion/diversity perspective, and informally organised some 'women in BEN' gatherings. This was feasible partly because there were many more women involved in the CE sector during the study years than there had been when I was first involved in 2010.

4.2.3.3 Bristol City Council (BCC)

During summer and autumn 2014, I was invited by a BCC officer to spend some time in their offices sitting with the Energy Services team as a participant observer. This was formalised by me providing written information about my research to people working in that space, and them signing consent forms. I sat in the energy services office on five occasions in July to October 2014. I attended meetings with members of the team, and offered to help BCC in developing their relationship with the CE sector. In particular, I commented on draft documents as part of BCC selecting a CE group to install solar PV panels on roofs of buildings owned by BCC, and in relation to BCC developing a co-operation agreement with BEN. I presented my planned research methodology to officers, and carried out formal and ad hoc audio-recorded interviews with some of them. I was also invited by a BCC officer to chair a forum between BEN and BCC, but was not invited to this role by BEN, and so this did not actually take place. I was also invited to attend a meeting between BCC and DECC in London, during August 2014, as an observer. During that time, I had some limited insight into the development of Bristol Energy, although detailed information was not shared with me due to its confidential nature. I also had some insight into the development of Warm up Bristol which was taking place whilst I was in the office. Relationships with BCC officers gave me the opportunity to better understand the impact of EU procurement rules on their work.

4.2.3.4 Mixed and other stakeholders

Additionally, through the study period, I participated in a number of other events and projects. One of these was creating a 'WoE Energy Game' with BHE colleagues based on the game developed for CEI, and hosting a workshop for WoE wide sustainability officers from all four LAs, and key CE representatives. This was funded by BHE from pro bono funds. An objective of this event was to support collaboration between the different WoE LAs (see p87). I also worked on a BHE study commissioned by B&NES council into options for governance of their energy services, including interviewing five LAs about their energy services and relationship with CE in their area. I attended Bristol Green Capital Energy Action Group meetings as part of the 2015 Green Capital of Europe year. From December 2016 onward, I participated in the 'Zero Carbon Bristol', or 'Zero West' project, initiated by BEC. This included presenting outcomes of the WoE Energy Game at a public event, participating in a project working group identifying investment opportunities, and steering group discussions of the potential organisational structure.

4.3 Bioregional: visions for regional energy autarky?

The fourth and fifth case studies take place at the sub-regional or bioregional scale, where it is possible to imagine whole-system energy design, and where a full range of stakeholders, including businesses, are included. The CEI project explored the potential for Cornwall to be self-sufficient in energy, through a two-day workshop in March 2015 at the Eden Project in Cornwall, attended by 130 people. This was initiated and funded by BHE and the Eden Project. The Zero West initiative aims to galvanise rapid decarbonisation of the WoE region, of which Bristol is a part. This is an initiative started in late 2016 by BEC, and has many parallels with the CEI project, hence its inclusion here rather than in the Bristol case study. Both the Zero West and the CEI initiatives are based on a theory of change where creating an ambitious shared vision is central. They also make use of events to bring people together in collaboration, a potential arena for overcoming social dilemmas.

4.3.1 Cornwall Energy Island

In the summer of 2014, BHE and the Eden Project created a partnership to develop the concept of a 'Cornwall Energy Island'. This included technical analysis of the potential for RE in Cornwall, one-to-one meetings with key stakeholders, a large two day workshop event, and follow up analysis and writing. The project provided organisational learning within BHE, stronger relationships with colleagues in BHE, and a

greater engagement with the interrelations between regional and national scales of action on energy system development.

4.3.1.1 Methodology

The focal point of the project was the two-day event at the Eden Project in March 2015. There was substantial preparatory work in the lead-up to the event, and follow up which led to the publication of an Energy Island White Paper (BuroHappold Engineering, 2016a) and is a shorter 'Outcomes for Cornwall' report (BuroHappold Engineering, 2016b) framed for Cornish stakeholders, both available to download from the BHE website. These detail the form and outcomes of the workshop. A two-year follow up event took place in early July 2017. Key events for the project are shown in the timeline in Figure 37.

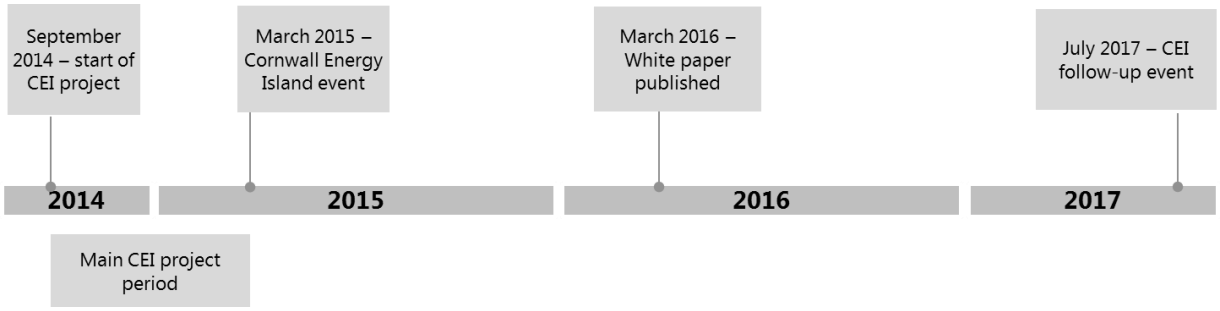

Figure 37: CEI project timeline

4.3.1.2 Preparation

Preparation for the event took place between September 2014 and March 2015. It consisted of:

- A desktop review of previous studies, including the technical potential for onshore and offshore RE in Cornwall and the Isles of Scilly and understanding of the socio-economic context of Cornwall.
- Stakeholder mapping of public, private and third sector stakeholders, leading to production of a long-list of invitees.
- Discussion of what we meant by 'Energy Island': being 100% self-sufficient and cut off from national energy systems; annual energy balance; or simply a provocative and ambitious narrative.
- Creation of an hourly model of demand and supply of energy, including heat, transport fuel and electricity, and the hourly generation from different forms of RE, leading to an appreciation of the huge amount of battery storage required for full 'islandness'.
- Creation of a Cornwall version of the 'energy game' where participants aim to balance supply and demand based on actual local data.
- One-to-one meetings with a variety of stakeholders in Cornwall including Cornwall Council, Wales and West Utilities, Western Power Distribution, the University of Exeter, deep geothermal energy developers, and landowners including China Clay mining company Imerys.
- A 'VIP' dinner and lunch in London in November 2014 to encourage powerful and wealthy stakeholders to support the project.
- Holding a 'dress rehearsal' event in February 2015 with BHE colleagues.
- Developing the agenda and facilitation plan for the event, training facilitators.
- Inviting speakers and participants.

This work was carried out by a core project team of six or seven people across BHE and Eden Project, supported by additional colleagues where specialist skills or extra capacity were needed. For details of the Cornwall context and the technical potential for RE, see the CEI White Paper (BuroHappold Engineering, 2016a).

4.3.1.3 The event

The event itself took place on the 16th-17th March 2015. Twenty-three people attended from BHE, to facilitate, network with attendees, and share their knowledge. The first day of the event focused on sharing information and engaging the participants. The second day focused on identifying actions that could be taken following the event. The form of the event is described in Figure 38, where 'enthuse', 'educate' and 'energise' took place on day 1, and 'empower' took place on day 2.

Figure 38: Our Approach - the form of the original CEI event, from the white paper (BuroHappold Engineering, 2016a, p. 13)

4.3.1.4 Follow up

All participants were asked to complete a survey at the end of the event, on paper or online. This asked for feedback on the event itself, and for comments on the roles of Cornwall Council and communities in achieving a Cornwall Energy Island.

Workshop outputs were analysed in summer 2015, and a White Paper was produced and published in March 2016, alongside an abridged version for a Cornwall stakeholder audience.

The BHE team held critical reflection sessions to learn from the event, and also pursued business opportunities arising from the connections made during and after the CEI event.

These findings are not analysed in detail as part of this thesis, but generally inform the reflections and could be used for further analysis.

4.3.2 Zero West

The Zero West initiative aims to galvanise rapid and effective decarbonisation of the WoE area. In an email to participants sent on 16th March 2017, it was described as follows:

> "Zero West is a collaboration of individuals and organisations in the West of England working to accelerate the regions transition to a low carbon society."

This initiative grew out of a series of 'zero carbon Bristol' events, which brought the ideas of the Zero Carbon Britain report published by the Centre for Alternative Technology (CAT) to a local level through a series of talks and discussion events. The first of these was in June 2010, organised by David Saunders, founder of the Bristol Power Co-operative[17], where CAT launched their initial report. The initiative was taken up again in

[17] There is a Zero Carbon Bristol website (Zero Carbon Bristol, 2010), with links to a YouTube channel (Saunders, 2010) of videos of all of the talks from the day.

2014 by BEC, who invited Tobi Kellner from CAT to present the updated Zero Carbon Britain report. This story is described on the BEC website (Bristol Energy Cooperative, 2016a).

In practice, achieving 'zero carbon' would not be possible within the urban boundary of Bristol: the surrounding countryside is needed for generation of energy and carbon sequestration through land management. Given the politics of the former Avon, or WoE, using the name 'Bristol' is counterproductive to encouraging the participation of the wider area. The name Zero West was adopted in February 2017, in order to develop an initiative with participation and ownership by all of the WoE area.

In December 2016, the initiative began to build momentum, with a half-day invitation-only workshop sponsored by local companies and organised by BEC, attended by 60-80 participants. I was invited to speak at this event to present our previous work on the technical potential for energy self-sufficiency in the region, including a 2012 report collating technical studies from the four unitary authorities (BuroHappold Engineering, 2012), and our 2015 development of a WoE version of the energy game used in CEI (BuroHappold Engineering, 2015). This was followed by a half-day event in February 2017, where I presented a set of options for the definition of 'zero carbon', based on the options for defining an energy island that we had developed for CEI: isolation; annual balance; something in between.

The development of the initiative is ongoing, with working groups set up to develop new projects, consider public engagement, finance and data, and a steering group.

4.4 Summary

This chapter has provided an overview of the three different fields of study where the theoretical ideas in this thesis were explored: the neighbourhood scale, imagined as analogous to the traditional commons studied by Ostrom; the city scale, where the CE sector and LA were observed longitudinally, and finally the bioregional scale where the potential for energy self-sufficiency among multiple stakeholders is explored. The findings of these case studies, in relation to the DPs proposed in chapter 8, and the theoretical analysis presented in Part 2, will be discussed in chapters 9, 10 and 11.

4.5 Data

A full list of the data types collected in each case study is provided in Table 5:

Table 5: Summary of data for each case study

Project	Data content	Data type
Community Energy Aggregator	Survey of willingness to change time of use of energy individually or as a community (sample size 40)	Excel spreadsheet
Community Energy Aggregator	Field notes and audio recordings from stall at KWMC Green Doors day	5X MP3 audio, short bits of conversation 1X word document with notes taken after the event
Community Energy Aggregator	13 Expert interviews and stakeholder conversations, with policy makers, regulator, academics and industry, regarding the potential development of a community business model for domestic electricity DR aggregation.	11X audio recording MP3 or Windows Media audio file Written notes and summaries of interviews written during or shortly after the interviews
Community Energy Aggregator	Focus group audio (8 participants in two sessions – 3 then 5)	2x audio from workshops, MP3 sound format
Less is More	Interview 1, neighbourhood, community, social trust, energy use practices (12 participants)	12 X audio files (MP3) plus 12 times word document transcript
Less is More	Interview 2, GEM responses and discussion of local responsibility for energy infrastructure (8 participants)	8 X audio files (MP3) plus 8 times transcripts
Less is More	Focus group reflecting on use of GEM and responding to hypothetical scenario of community responsibility for substation (5 participants)	1X audio file, 1x transcript, copy of written scenario given to participants
Bristol local energy	Interview audio with senior officer in BCC Energy Services team, pseudonym Riley.	1x audio file, 14th Sept 2014

Bristol local energy	Interview audio with senior manager at Bristol Energy, pseudonym Morgan	1x audio file, 12th May 2016
Bristol local energy	Research diary with notes from May 2014	Mainly word documents, organised in folders month by month
Bristol local energy	Record of interactions with stakeholders in Bristol, kept rigorously from May 2014 to December 2014	Spreadsheet
Bristol local energy	Correspondence with Bristol energy network members, as a colleague and participant	Emails, cited only with explicit retrospective consent
Bristol local energy	Documents in the public domain including organisation websites, published minutes of meetings and official council documents	PDFs, websites and word documents
Cornwall Energy Island	Energy game outputs	Spreadsheet
Cornwall Energy Island	Workshop outputs from the two parts of the 'call to action' session. - force field diagram (barriers and strengths) -actions ease/impact diagrams	Photos of post its and transcription of all content written by workshop participants in a thematically coded spreadsheet
Cornwall Energy Island	Feedback survey - feedback on quality and usefulness of workshop itself - responses regarding next steps, including roles of local, national, community actors	Spreadsheet
Cornwall Energy Island	Notes on meetings, including internal to BH some reflective field notes	Notes
Cornwall Energy Island	Reflection of BH team on lessons learned in process	Word document
Cornwall Energy Island	White papers	Interactive PDF, published on BHE website
Zero West	Notes from meetings - field notes	Word documents
Zero West	Minutes and other documents sent to project participants	Word document, spreadsheet
Zero West	Documents in the public domain including websites	Websites

Part 2: Theoretical Analysis

This part of the thesis analyses the GB energy system theoretically, drawing on review of literature on commons and polycentric governance.

Chapter 5 considers the definitions and political aspects of commons. Chapter 6 develops these ideas in more detail, and applies them to the GB energy system. Chapter 7 explores the concept of polycentric governance, and assesses the polycentric characteristics and challenges present in the national GB energy system. Chapter 8 draws on insights from the theoretical analysis to propose an initial set of DPs for creating effective polycentric energy governance systems, to be tested in part 3 relation to the case studies.

5 Energy as a commons – part 1, definitions and politics

The law locks up the man or woman
Who steals the goose off the common
But leaves the greater villain loose
Who steals the common from the goose.

The law demands that we atone
When we take things we do not own
But leaves the lords and ladies fine
Who takes things that are yours and mine.

The poor and wretched don't escape
If they conspire the law to break;
This must be so but they endure
Those who conspire to make the law.

The law locks up the man or woman
Who steals the goose from off the common
And geese will still a common lack
Till they go and steal it back.

17th century, anon

5.1 Introduction

This chapter aims to analyse the extent to which the GB energy system should be governed as a commons. It begins by introducing the concept of the commons and contextualising it politically, historically, and in relation to economic thought. It then introduces intellectual tools for policy analysis from the Ostrom workshop. These are useful for developing a more refined understanding of a resource as a commons, which are used later in this thesis to analyse the case studies in relation to theories of commons. Finally, it asks whether energy should be governed as a commons in the GB, based on a set of criteria ranging from the physical characteristics of the energy system to the social function of energy and political values.

5.2 Initial Definitions

A commons is often defined in terms of collective, as opposed to private or individual property rights. Bollier (2014, p. 15), defines a commons as "a resource + a community + a set of social protocols". This definition brings together the physical characteristics of a resource with the social relations governing the resource. In particular, the social relationship of property rights is important for commons. For Linebaugh (2008) the activity of 'commoning' as a verb is more meaningful than the material resource of commons as an object.

Commoning can be seen as the opposite of commodification. It is a social-material relation based on: use, cultural and symbolic value rather than exchange value; rich relationships of reciprocity rather than anonymous price-based transaction; integration of consumption and provision activities within one institution rather than their separation; and culturally specific, place-based and historically contingent rules rather than universalising principles of efficiency and optimisation. Commoning takes place where there is some form of interdependence, a social dilemma and potential for conflict.

Traditionally, resources such as pasture, forests, fisheries and irrigation systems have been managed as commons, with rules about who may take how much, when, and using what technologies, or about who must provide how much labour for maintenance and when. The concept of commons has also been applied to

other contexts, and there is now a large literature on knowledge commons, such as Wikipedia or academic knowledge; and on urban commons such as urban agriculture projects, parks or historic guilds. One could also think about meta-commons, such as the property rules, contracts and financial systems that enable markets to function. This chapter contributes to the literature on infrastructure commons, by elaborating a theory of energy as a commons.

Chapter 2 introduced a binary of marketised vs political. This binary in governance of the management of economic systems has often been framed as one of market and state (Ostrom, 2009b; Bollier, 2014; Vercellone *et al.*, 2015). At the same time, Bollier argues that "The Market and State… are now joined at the hip… with a shared vision of technological progress, corporate dominance and ever-expanding economic growth and consumption" (Bollier, 2014, p. 5). The 'third sector', of civil society, charities and voluntary sector is also recognised as playing a role (Foxon, 2013; Avelino *et al.*, 2014), and the world of commons, 'beyond market and state', has recently seen a revival. This "rediscovery of … the common … in economic theory and political debate" (Vercellone *et al.*, 2015) is in part thanks to the award of the 2009 Nobel prize for economics to Ostrom, for her detailed work on common pool resource management (Ostrom, 2009b; Helfrich and Bollier, 2012; Bollier, 2014; Vercellone *et al.*, 2015).

Whilst the boundaries of market, state and commons are more complex than a simple set of three types of property regimes, it is useful at this stage to sketch out three archetypal property regimes:

> Commons: collective ownership and/or management of a resource by a group of people or organisations who both use and create a resource. This group may or may be large or small and may be a community of place or of interest. Typically, in a commons, the users have a direct say in important decisions about the commons. They also have responsibility for creating and maintaining the commons, and use collectively agreed rules to avoid overconsumption and destruction of their shared resource.
>
> State-public: ownership and management of a resource or service by the state, idealised as being on behalf of or for the benefit of the citizens. This includes local and national government. Typically, the users of the resource or service have a passive role as recipients, and little responsibility other than paying taxes or national insurance contributions. The management of the resource takes place through top-down bureaucratic rules, and users have limited scope to change the rules or be involved in day to day decisions.
>
> Market-private: ownership of property by individuals. Individual owners have full control, use and responsibility for the resource. They may buy or sell the resource at any price which others are willing to exchange it for on the market. The individuals can also be corporations, or occasionally other constituted groups. Rules of market exchange are often assumed to be universal 'natural laws'. No deliberative, collective decisions are available.

This set of three 'sectors' fits with the three 'transition pathways' that were introduced at the beginning of this thesis, as reproduced in Figure 39 below. Here, the 'commons' is broadly defined to include civil society and state logics of sharing, stewardship and inclusivity rather than the market logic of competition and commodification, and both civil society and the market are seen as polycentric, whilst the state is centralised or hierarchic.

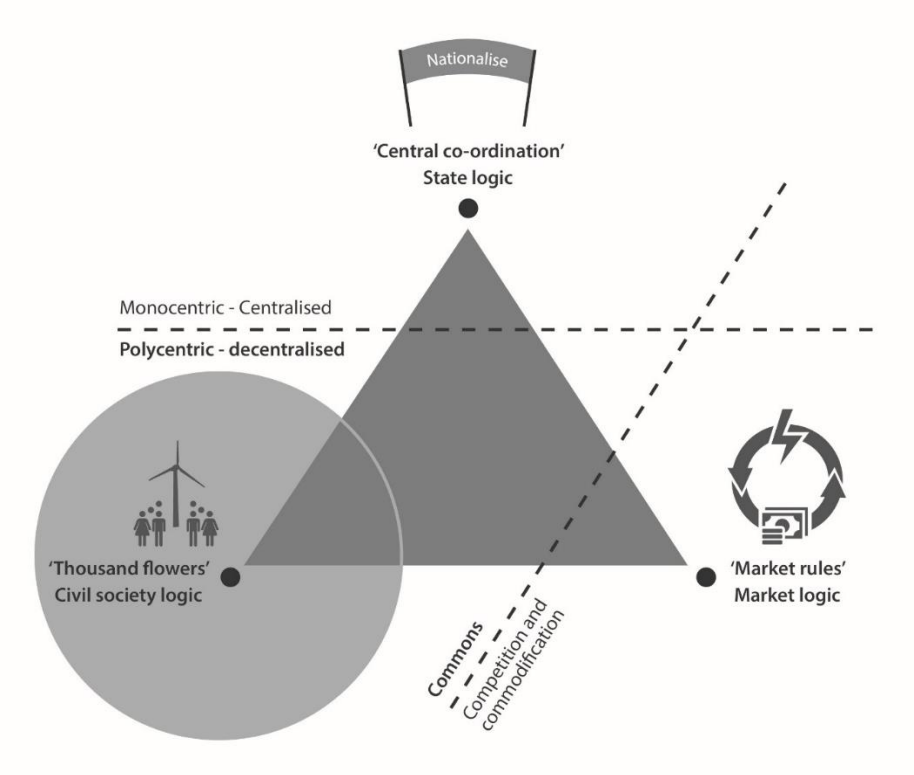

Figure 39: Mapping the Transition Pathways with the theoretical frameworks of polycentric governance and commons

Avelino et al. (2014) offer a similar form of diagram with their Multi-actor Perspective, shown in Figure 40. Here, 'community' is used in the place of 'civil society'. State and community are separated from market by the logic of non-profit/for-profit, rather than commons/commodification; and state is separated from community and market by the logic of public/private rather than hierarchic/polycentric; and community is separated from state and market by the logic of formal/informal, a distinction not made in Figure 39. A fourth category, of 'associations' arises in the middle, the formal, non-profit and private sector. This forms the heart of the third sector, which also overlaps into the other three categories.

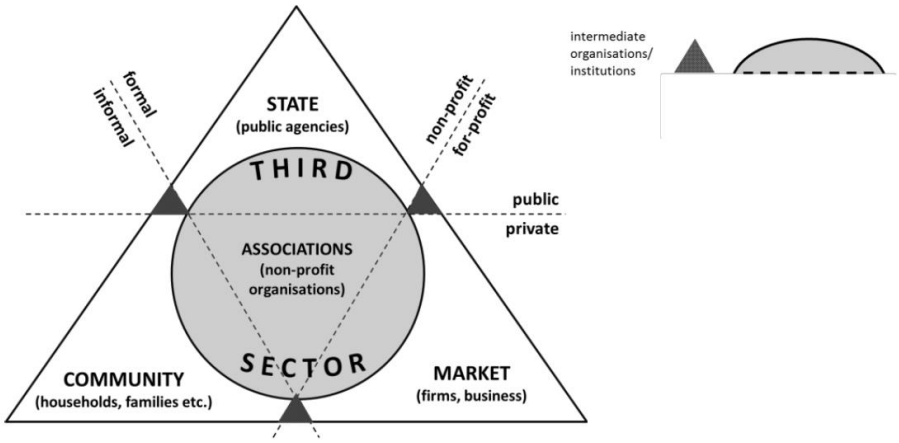

Figure 40: Multi-actor Perspective (Avelino & Wittmayer 2014, reproduced in Avelino *et al.*, 2014)

The position of local government is ambiguous. It is part of the state, so ownership by local government can be categorised as state-public. However, it does not have national legislative power, and is subject to national legislation, policy and regulation of energy. Different local governments in GB have different

approaches to energy services, and to CE. In some areas, there is very little CE activity, and the LA delivers some energy services themselves. In Plymouth, the LA pro-actively set up the CE sector. In places such as B&NES and Cornwall, the LA sees itself in an enabling role. In Bristol, the ELENA funding resulted in an unusually high capacity to deliver energy services themselves, which led to a slightly competitive as well as supportive relationship between the LA and CE sector. In Figure 23, reproduced in Figure 41, it is defined as part of the 'civic energy system', but between national level state and community.

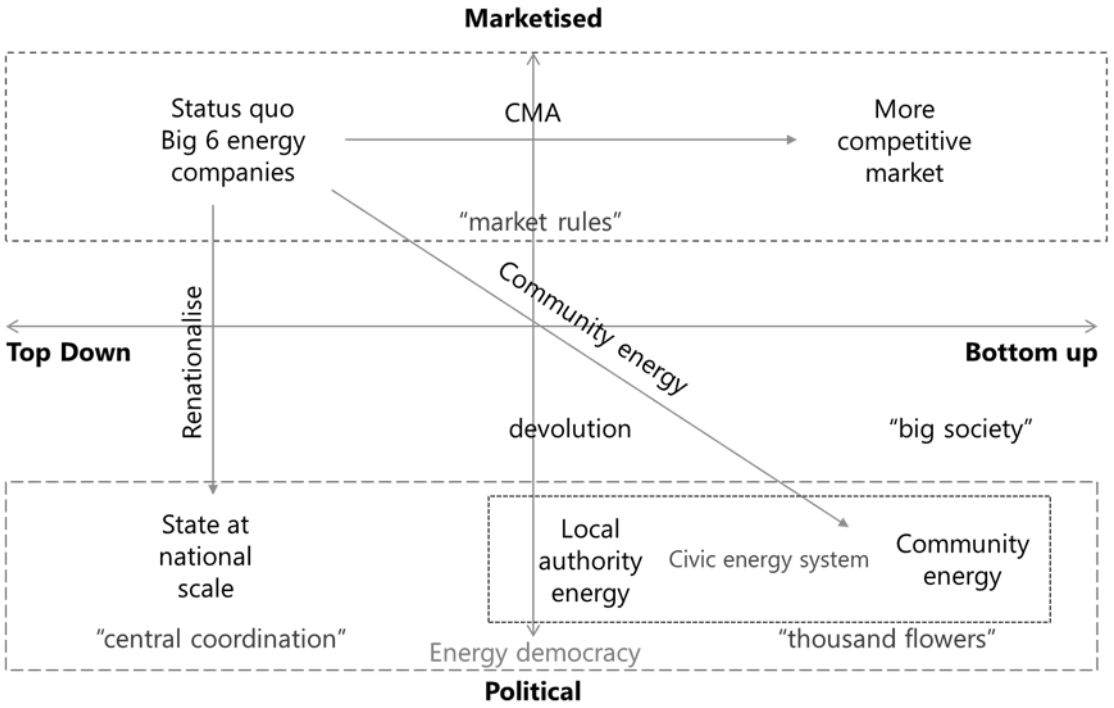

Figure 41: The emerging civic energy system

This set of three archetypal of property regimes is useful to bear in mind in the following discussion of the 'resource matrix', which assigns 'appropriate' property regimes to a resource through assessment of its physical properties. The 'resource matrix' approach is problematic, as the property or governance regime used for a resource should be selected through a process of public deliberation, rather than being determined by its physical properties.

5.3 The politics of commoning

The history of commons property regimes is very long. Some currently (or until recently) functioning commons, such as irrigation systems in the South of Spain, have existed continuously for 500 or 1000 years (Ostrom, 1990). Commons can provide subsistence to people through times of hardship and of plenty, and can be managed in a way that sustains the 'carrying capacity' of a resource over a long term. It is a much older social form than either market or state property as defined above.

However, this history has often been made invisible, for instance during the 'enclosures' which took place in England in the 18th and 19th centuries. These were justified as making land more productive, increasing the efficiency of agriculture, and enabling 'improvement' through use of modern technology and agricultural techniques. However, this process involved dispossessing poor rural people of access to land, and to subsistence from gathering firewood, hunting game, grazing cattle or geese, taking pigs to forage for acorns in the forest, and gleaning leftover crops after harvest from open fields (Humphries, 1990; Linebaugh, 2008). The impact of this dispossession on the household economies of poor rural labourers was dismissed by

contemporary proponents of enclosure as "trifling" (Humphries, 1990). However, Humphries (1990) shows that commons in fact provided significant livelihood for the rural poor in 18th century England, relative to their potential income from wage labour. This was particularly the case for women, whose wages were lower than men's, and who could combine gathering from commons with childcare, unlike wage labour from which childcare was excluded.

Interestingly for the present discussion of commons and energy systems, Humphries notes that fuel, in the form of coal, wood, peat, turf or other burnable biomass was not dismissed as 'trifling' by proponents of enclosure, unlike other resources from the commons. Access to energy was regarded as an important economic contribution from commons, and there were suggestions that enclosure of land used for cutting peat or turf should be compensated for with a 'coal fund'.

Commons were also characterised by contemporary enclosers as overgrazed, when in practice many commons had strict rules regulating how many cattle could be grazed and when (Humphries, 1990). This belief in the inevitability of depleting common resources was further perpetuated by Hardin in 1963 with his seductively named 'tragedy of the commons'. At the time that Humphries was studying the historic contribution of commons, and the role of enclosures in making the rural poor dependant on wage labour, Ostrom (1990) was contributing to the fields of economics and policy analysis. Through empirical evidence and case studies of contemporary commons, game theory and experiments, she demonstrated that people can and do overcome social dilemmas to cooperate to effectively maintain a resource over the long term. Vercellone et al. (2015, p. 7) recognise that "Ostrom's reflection … on common-pool resources (CPR) undoubtedly constitutes the best formed expression in the field of academic economic theory". Ostrom successfully refutes Hardin's argument that 'tragedies of the commons' are inevitable. She shows that commons are depleted only in particular contexts, which Hyde describes as "unmanaged, laissez-faire, common-pool resources with easy access for noncommunicating, self-interested individuals", (Lewis Hyde, cited in Bollier, 2014, p. 25).

The discussion above shows that academic study of the commons has an important descriptive role, in making visible a form of governance and property ownership that has been dismissed by mainstream discourse. It also has a more normative stream of thought, which draws on political thought and the praxis of social movements to promote commons as a "kind of political philosophy with specific policy approaches, [which] goes much deeper because it engages us as fully human and complex creatures"(Bollier, 2014, p. 4). Both of these have value for the discussion of how energy infrastructure should be owned, paid for, accessed and governed.

Mainstream economics textbooks often present a two by two matrix through which they categorise the physical characteristics of different types of resources, and thus assign a particular property regime as being appropriate to that resource. This is shown in Table 6, with axes of 'rivalrous/non rivalrous', and 'excludable/non-excludable', which refer to whether people must compete for access to a resource, and whether unauthorised individuals can be excluded on a resource. Resources are classified as private, public, common pool, or club goods depending on their position in the matrix.

Table 6: Mainstream economic textbook classification of resources adapted from Helfrich (2012a)**.**

	Rivalrous	**Nonrivalrous**
Nonexcludable	Common Pool Resource	Public good
Excludable	Private good	Club good

Ostrom, who also uses this matrix, develops it by replacing the word 'rivalrous' with 'subtractible', conceptually separating the physical nature of the resource from the social or property relations associated with it; and by moving away from discrete categories (e.g. 'excludable, nonexcludable') to a spectrum of subtractability and excludability. Subtractability is a measure of the extent to which the use of a resource subtracts from the amount of resource available for others to use. Excludability measures the difficulty or cost of excluding people from using the resource. Ostrom's two by two matrix is shown in Table 7, with examples of each type of resource.

Table 7: Four types of goods, adapted from Ostrom (2005)

		Subtractability of use	
		High	Low
Excludability (difficulty of excluding potential beneficiaries)	Difficult	**Commons**	
		Common-pool resources (CPR): groundwater basins, lakes, irrigation systems, fisheries, forests etc.	Public goods: peace and security of a community, national defence, knowledge, fire protection, weather forecasts etc.
	Easy	Private goods: food, clothing, automobiles etc.	Club or Toll goods: theatres, private clubs, daycare centres, subscription magazines

There may seem to be a paradox in Ostrom defining a CPR as one where it is difficult to physically exclude people from accessing it, and demonstrating that commoners successfully manage CPRs by enforcing rules of exclusion, but these rules are a social, rather than a physical fence, and collective rather than individual. For example, it may be difficult to physically prevent people from fishing in a particular location, but fishers in a community may easily be able to spot intruders whilst going about their daily business, and develop rules for sanctioning unlawful fishing. This lessens the apparent paradox in Ostrom's definition. However, it seems that Ostrom assumes that only resources that are difficult to fence raise questions about the most appropriate type of exclusion.

The categorisation of resources based on their physical characteristics implies a 'natural' law for determining the appropriate property regime for a resource. However, even commons theorists who use the excludability-subtractability matrix, including Ostrom (2003) and Aligica and Boettke (2009), recognise that we can choose our institutions, our decision-making processes and property regimes. These are the product of human agency, not ontological facts (Aligica and Boettke, 2009), and so we can distinguish between the property regime and the nature of the resource (Cole, 2013). For example, food in a shared house is subtractible and could be excludable if it is kept in a locked cupboard. However, housemates may choose to share all of their food with each other, in which case the property regime around food is of a commons, even if the 'nature of the resource' would categorise it in the 'private' box. Commons theorists with a normative perspective give even more emphasis to human agency in creating the property and institutional regimes that govern a resource, and less to the physical characteristics or 'nature' of the resource (Linebaugh, 2008; Helfrich, 2012a; Bollier, 2014). It may be possible to exclude those who do not pay for it from drinking water, but doing so is highly socially contentious, as seen, for example, in the resistance to privatisation of water in Bolivia (Hall, Lobina and Motte, 2005).

The use of this matrix to assign property regimes based on the physical characteristics of a resource is deterministic, and biased towards private property. A resource is categorised as private if it is subtractible and people *can* be physically excluded from it. This has its roots in the claim made at the time of the English enclosures that private ownership of land has inherently more economically efficient outcomes than common property, and economic efficiency is valued above distributional outcomes, with the conclusion that if something can be governed as private property, it should be. It may also have its roots in the intellectual lineage of the matrix[18]. In this paradigm, technological innovation, such as the invention of the barbed wire fence (Anderson and Hill, 1975), can be seen as making a previously 'non-excludable' resource, such as prairie land, become excludable (Cole, 2013).

This technocratic approach hides the often contested and political nature of these decisions. The normative pro-commons narratives of left wing scholars such as the Midnight Notes Collective (no date), Linebaugh (2008), and Federici (2008) emphasise this history of forcible enclosure of commons, as discussed above. These scholars see the protection of the commons as a political struggle, where the interests of the powerful are to be resisted by social movements. The history of enclosure of common lands in England was also a history of resistance, with numerous well-documented rebellions whose stories are outside the scope of this thesis. As Wall puts it, "commons have not generally been tried and proved to fail, but more often than not they have simply been seized" (Wall, 2014, p. 155). From a pro-commons perspective, this is the real tragedy of the commons, and this process of enclosure and commoditization continues in the present, through land grabs, marketisation of the climate, privatization of water. Commons property rights are often not recognised "the juridical categories for protecting collective interests have scant legal and philosophical standing in the liberal worldview" (Bollier, 2014, p. 161).

Whilst acknowledging this context, it is still valuable to understand the different physical characteristics of a resource. A non-subtractible, non-excludable 'public good' is often well-suited to being governed through a 'state-public' property regime. This could include funding academic research through general taxation and making the knowledge openly available to all, and national funding of defence. Drawing on the four categories in the physical characteristics matrix, one could define four types of property regimes to fit them, as follows:

> Commons ownership: collective ownership by a defined group, who determine collectively how to share out the limited resource with the group.
>
> Public ownership: open access to everyone to an unlimited or quasi-unlimited resource that doesn't get depleted, but may need to be created.

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[18] The intellectual lineage for this classification traces back to the definition of "public goods". Samuelson (1954) first proposed a classification of public goods as those which were not subtractible. Musgrave (1959, cited in Ostrom, 2003) argued that public goods should be defined as those which were not excludable, an approach followed by Olson (Ostrom, 2003). This discourse was centred on two different options for categorisation: of public vs private, a binary which reflects the state vs market duality. The classes of 'common pool' and 'club' goods were added later: Buchanan (1965, cited in Helfrich, 2012a) introduced a new category of 'club' goods, which Ostrom later called 'toll' goods; The clear definition of common goods, or Common Pool Resources as nonexcludable and rivalrous (subtractible), is referenced to Ostrom and Ostrom, 1977 (cited in Ostrom, 2003). For the political movement for the commons, commons is about sharing and not excluding, and the subtractability aspect is less important.
Hardin, Samuelson, Musgrave, Buchanan, Olson, Vincent and Elinor Ostrom were all late 20th Century American economists, writing during the cold war, in an intellectual climate that constrained any mention of communism during the and after the McCarthy era. America is also a country founded on the belief that the American continent was a 'terra nullis', a land owned by no-one and open to settlement, a lack of recognition of the existing communal property regimes of native Americans. In this context, a bias in favour of private property regimes, and a blindness to the possibility of commons, would not be surprising. It is difficult to resist powerful hegemonic framings if this is not a primary activity in itself.

Club or toll: limited number of members with unlimited usage rights to a resource

Private ownership: individual ownership of a partitioned resource.

On the other hand, some subtractible, non-excludable 'CPRs' can also effectively be governed through a state-public property regime. The NHS is a good example of this. Healthcare is 'non-excludable' because there is a public consensus that it should be free at point of use, for everyone who needs it. At the same time, providing healthcare has a high cost, and the more someone consumes the less is available for others. There is a need to regulate access, and this is done through use of waiting lists and triage by healthcare professionals.

Resources that are non-subtractible and non-excludable can also be managed through a commons property regime. Wikipedia is a good example of this – anyone can access it, at no additional cost (other than the cost of servers), but there is no state involvement, only a vast global community of writers, and a non-governmental coordinating body, the Wikimedia foundation.

For those with a normative pro-commons perspective, exclusion (or inclusivity) is a more important part of the definition than subtractability. Contrary to my definition of 'commons' property regimes as "collective ownership and/or management of a resource by a group of people who both use and create a resource", the term 'commons' is sometimes used to refer to both commons property regimes, and state-public property regimes. Similarly, as commons property regimes are associated with (although not the same as) the physical characteristics of CPR and public goods, the term 'commons' is also used to refer to both common pool resources (CPR), and public goods.

Choosing a governance regime for a resource is partly a question of understanding its physical characteristics. This includes the excludability (and desirability of exclusion) and subtractability discussed above. It also includes other characteristics, such as natural monopoly and externalities that are discussed in more detail in chapter 6. Choosing a governance regime is also a political choice. As the type of governance has an impact on the public, the choice of governance regime should be a collective matter, decided through public deliberation, and with regard to the distributional impacts and processes as well as the physical characteristics of a resource.

The following section introduces a set of intellectual tools from the Ostrom workshop, which are used later in this chapter and in following chapters to more precisely analyse the governance of the GB energy system at different spatial levels, using both document analysis and the empirical case studies.

5.4 Intellectual tools from the Ostrom workshop

The Ostromian literature offers a set of intellectual tools for examining the commons and other human institutions. These include, in addition to the subtractability/excludability matrix, a more subtle conceptualisation of property rights, terminology of appropriation, provision and production, eight DPs for managing common pool resources, and theories of fit. Using a shared language with precise definitions is important for Ostrom[19]. These intellectual tools are used in the discussion of case studies and the GB energy system more widely. They also add to the more nuanced understanding of commons governance.

[19] Ostrom's conceptual framework is brought together in the IAD (Institutional Analysis and Development) framework. Michael McGinnis (2013), a longstanding member of the Ostrom Workshop, has written a detailed lexicon of terms from the IAD framework: Updated Guide to IAD and the Language of the Ostrom Workshop: A Simplified Overview of a Complex Framework for the Analysis of Institutions and their Development (McGinnis, 2013). This is a useful reference for more information.

5.4.1 Unbundling of property rights

The discussion of property rights so far has discussed different options for the property regime to govern a resource, as though one regime must be chosen to relate to a particular resource. However, reality is more complex, and several different specific property rights can be assigned to a resource. Schlager and Ostrom (Schlager and Ostrom, 1992) distinguish five separate types of property rights: access, withdrawal, management, exclusion and alienation. Taking the example of a forest: access would be the right to walk through the forest; withdrawal would be the right to take fallen wood or game (hunting animals for meat) from the forest; management would be the right to plant trees or clear ditches; exclusion would be the right to decide who may enter, withdraw from or manage the forest; and alienation would be the right to sell the forest to another owner. Bundles of rights can be associated with different positions, as shown in Table 8. Recognising that these can be allocated separately allows a more precise analysis of property rights. For example, the 'right to roam' legislation in Scotland gives the general public rights of access to all land, whilst the landowner has all rights except that of exclusion. In relation to electricity transmission infrastructure, consumers of electricity have the right to access the infrastructure and to withdraw units of electricity and balancing services, as long as they pay their bills. However, they do not have rights or responsibilities of management, nor the right to decide who should have access. Consumers are therefore in the position of 'authorised user', according to Schalger and Ostrom's schema. The companies which operate the electricity transmission and distribution networks, however, have rights of access, withdrawal, management, exclusion and, as far as I understand, alienation[20]. They are therefore full owners of the infrastructure, subject to licence requirements. Indigenous peoples who hold that one cannot buy or sell the land have property regimes which do not assign a right of alienation to anyone in relation to land. This is not incompatible with having rules restricting access, withdrawal or exclusion rights. When considering the appropriate property regime for a resource, it is valuable to differentiate between the five different types of property rights, and consider the possibility of assigning different rights separately.

Table 8: Bundles of rights associated with positions, from Ostrom and Schlager (1996, p133, cited in Ostrom, 2003)

	Full owner	Proprietor	Authorised claimant	Authorised user	Authorised entrant
Access	X	X	X	X	X
Withdrawal	X	X	X	X	
Management	X	X	X		
Exclusion	X	X			
Alienation	X				

It is interesting to note that this characterisation of property rights emphasises 'exclusion' as a socially constructed legislative phenomenon, rather than 'excludability' as a physical characteristic of a resource. The two final property rights, exclusion and alienation, are key to the potential for monopoly rent-seeking behaviour. The ability to charge others for access to a resource, i.e. command a rent, is based on the right of exclusion, and the right of exclusion from the means of production is a key aspect of the definition of property under capitalism. The ability to speculate on the rising value of an asset, as such as housing, is based on the right of alienation. Value systems that prioritise exchange value over use value also rely on

[20] Energy infrastructure companies in the UK are permitted to sell the assets in the market to the highest bidder. The system in Germany is a different one, where distribution network operators have franchises, that expire after a certain time period. This provided an opportunity which the Berlin EnergieTisch and Burgerenergie campaigns attempted to make use of. Network operators' rights of management are conditional on having a transmission or distribution license (this may also limit other property rights). The removal of distribution licenses is subject to a 25 year notice period.

property rights including the right of alienation. Ideas for alternative land ownership systems, to avoid the social problems of rising land prices due to speculation, have been proposed. For example, community land trusts holding the right of alienation, and occupiers having the rights of a 'proprietor' (Urbed, 2014)[21].

In the context of energy, the rules of BEC specify that shares held by members are 'withdrawable', but not 'transferrable' (Bristol Energy Co-operative, 2016). This means that a member can take out the money they invested, and cease to be a member, but they may not sell their share to someone else, effectively a restriction on the alienation rights of individual members. The privatisation of energy infrastructure in GB was based on an assumption that the government had a right of alienation, an idea that is disputed e.g. by campaigns such as We Own It (We Own It, 2016).

5.4.2 Appropriation, provision, production

A second thinking tool that Ostrom provides is the distinction between 'appropriation', 'provision' and 'production' activities. This is a useful thinking tool to combine with the assessment of the subtractability of a resource. Appropriation, provision and production are defined as follows:

Appropriation is taking from the resource for consumption. In traditional commons contexts, this could include taking fish from a body of water, or wood from a forest. In the context of energy, this primarily refers to taking units of energy (kWh) from electricity, gas or heat networks. Rules for appropriation can specify the type of resource taken (e.g. breeding female lobsters must not be taken); the time when a resource is taken (e.g. restrictions on electricity consumption at peak times); the technology used (e.g. use LED lightbulbs not filament bulbs, fish with a line not a trawler). In construction industry terms, 'appropriation' is done by the end user.

Production is the "physical process of constructing a public good/service" (McGinnis, 2013, p. 19). This would include the construction of a wind farm or installation of solar panels, installation of insulation, and operation and maintenance tasks. Typically in a community RE project, production activities are contracted to paid professionals rather than done by the CE group itself. However, a CE group which directly installs draught proofing measures in people's homes, for example, would be carrying out 'production' activities. In construction industry terms, 'production' is done by the contractor.

Provision is organising for a resource to be produced. This may include financing, making decisions about priorities or commissioning construction and maintenance. It would also include ensuring that the resource is effectively monitored. Many community RE co-operatives are 'providing' rather than 'producing' energy resources. In construction industry terms, 'provision' is done by the client.

In a commons, provision, production and appropriation may be carried out by the same people, or some roles may be delegated. For example, community members may carry out the construction of an irrigation system, and also sit together to discuss how the water will be distributed among them. They may also delegate monitoring of compliance to a paid guard. Users can participate in coproduction of a service, with collaboration between users and producers, or even a blurring of that separation. However, part of what characterises a commons is that both appropriation and provision take place within the same institution, rather than being separated through market exchange (although one could also characterise both sides of a market exchange as taking place within one institution, so it is not so clear-cut).

[21] This builds on the idea that the value of land is created by activities taking place around that area of land (e.g. the development of new cafes, planting of trees, people taking care of their gardens, affects house prices in an area without the house owner working for this increase in value). These ideas were written about by Henry George who developed concepts of land value tax as a solution.

In the context of local public economies, Oakerson proposes that "local governments are primarily provision units" (Oakerson, pp. 122-123, cited in McGinnis, 2013), and that production should be separated from provision. An example of this distinction is clinical commissioning groups in GB who have a 'provisioning' role in deciding on what services to commission, whilst the organisation actually doing the health care would be seen as 'producing' health care[22]. In the context of energy, a LA may finance a district heating network (provision), but may pay a contractor to carry out the maintenance (production). The separation of provision and production described in relation to CE, in the examples given as part of the definition, also fit this pattern.

The subtractability of a resource relates to whether there is a challenge of provision, or a challenge of provision and appropriation. With a subtractible resource, there is usually a challenge of provision and also a challenge of appropriation (e.g. how do we produce the food we need, and how do we share it out among the people in our community?). Renewable resources reproduce themselves, or are reproduced within a functioning ecosystem. In this case, the human action needed is to regulate appropriation (e.g. how do we ensure we don't take too many fish, and don't pollute the water, so that the fish population remains healthy?). With a non-subtractible resource, there is only a challenge of provision (e.g. how do we motivate enough people to produce the knowledge that we will all benefit from, and provide for their subsistence whilst they are doing this work?).

5.4.3 Levels of decision-making

In addition to categorising the roles of appropriation, production and provision, Ostrom categorises different levels of decision-making. As with the distinction between production and provision, these are categories that might be useful for determining the level of democratic input that is appropriate for a decision. The levels of decision-making are as follows, described in relation to the GB energy system.

1. Operational choice: "implementation of practical decisions by those individuals who have been authorized (or allowed) to take these actions as a consequence of collective choice processes." (McGinnis, 2013, p. 10). In the context of energy, this includes day to day decisions about how much energy to use, how much to produce, what to use it for, when to use it or produce it. These are decisions made by individuals or organisations who consume energy and organisations that operate generation plant or other energy infrastructure. It also includes market mechanisms of the wholesale and retail energy markets.
2. Collective choice: "the processes through which institutions are constructed and policy decision made, by those actors authorized to participate in the collective decisions as a consequence of constitutional choice processes, according to the procedures as established by constitutional choice processes." (McGinnis, 2013, p. 10). In the context of energy, this involves decisions about the rules governing operational choice situations. In the current energy system, it includes the development of the energy market rules, which takes place primarily through the energy industry codes. This level of decision-making may also include determining which operational choices take place through market mechanisms, which take place through deliberative processes, where there is competition, where there is collaboration, where there is co-production, public, community or private ownership, although it is not always easy to distinguish between collective choice and constitutional choice categories. Democratic participation and accountability are more important at the collective choice level than at the operational choice level.
3. Constitutional choice: "the processes through which collective choice procedures are defined, including legitimizing and constituting all relevant collective entities involved in collective or

[22] This example also shows how the terms are used differently in the Ostrom jargon to common language, as what we would commonly call 'healthcare provider' would be classified as 'production'.

operational choice processes." (McGinnis, 2013, p. 10). In the context of energy, it could also include decisions about the way that different geographical scales relate to each other, such as devolution of energy governance powers from national government to local government. Constitutional choice in the UK ultimately involves general elections and referenda. This is the highest level of decision-making, which determines who can be involved in decisions at collective choice level, and what the process is for this. This is the level where democratic participation and accountability is most important. Ideally, at the constitutional choice level, decisions should be inclusive of everyone affected, and arguably should involve consensus-based decisions rather than majority voting.

5.4.4 Exit and voice

The mechanisms of 'exit' and 'voice' are defined by Hirschman (1970), rather than being part of the Ostrom lexicon. However, these are useful concepts for thinking about commons and other governance systems.

Exit is defined as removing custom, leaving a situation or organisation. The other side of the same mechanism is **entry**, defined as creating a new institution, resource or service. This adds to Hirschman's original definition.

Voice is defined as "any attempt at all to change, rather than to escape from, an objectionable state of affairs" (Hirschman, 1970, p. 30).

For example, in the context of customers buying a product, if a product is unsatisfactory, and many customers use the mechanism of exit (i.e. stop buying it), this can alert a firm to the fact that there is a problem as they observe a reduction in sales. However, this does not automatically give them information about what the problem is. On the other hand, voice could involve customers making a complaint with details of why they are dissatisfied which gives the firm direct[23] information that they can act on.

Exit is the mechanism of market economics, where socially beneficial outcomes are expected to arise through Adam Smith's famous 'invisible hand of the market'. This is an emergent property, sometimes called 'spontaneous order', much as flocking behaviour is an emergent property of birds individually moving according to their own internal 'algorithms' in relation to their neighbours[24]. The other side of exit is 'entry', which is equally crucial for effective markets. Entry is the mechanism of entrepreneurship, the freedom to set up a new company or start selling a new product. Entry can also be used outside of market contexts to set up a new collaborative organisation. This is discussed more in chapter 7 in the context of polycentric governance.

Voice is the mechanism of politics. It is needed for deliberative decision-making. In her exploration of social dilemmas, Ostrom conducted game theoretical experiments which showed that when communication between participants was allowed, it was possible to achieve overall socially beneficial outcomes in a non-zero-sum game. Voice, and direct communication, is therefore a vital element of addressing social dilemmas.

Hirschman considers both exit and voice to be important, and interdependent. If a user has no ability to exit, then the management can ignore their complaints with impunity, and voice may have limited impact. For

[23] Milton Freidman considers exit to be a 'direct' mechanism: "Parents could express their views about schools directly, by withdrawing their children from one school and sending them to another" (Freidman, cited in Hirschman, 1970, p. 16). As Hirschman ironically points out, this is evidence that economists have severe blind spots in favour of exit rather than voice: "A person less well trained in economics might naively suggest that the direct way of expressing views is to express them!"

[24] Bird flocking movement has been modelled through assigning each bird an algorithm where they keep a certain distance from the bird in front, and face in the same direction and remain near to the next six or so birds next to them. This simple individual behavioural logic can result in the beautiful patterns such as starling murmurations (Friederici, 2009).

example, in the UK housing market, renters have limited ability to demand better tenure arrangements or quality of housing, as it is a captive market. On the other hand, if exit is too easy, then the users with the most concern about quality may leave first, leading to further deterioration.

In some cases, one can exit but still actively try to change an organisation. This includes situations where "the output or quality of the organization matters to one even after exit" (Hirschman, 1970, p. 100). For example, I may choose to pay a private health service for a particular treatment so as to be able to access it immediately without waiting, but the availability of good quality public health services, free at the point of access, makes a big difference to my health security, and so I still have good reason to campaign for the protection of the NHS. In another example, parents who move their children from a state school to a private school are not immune from the impacts on their community of further deterioration of the local state school.

In the context of climate change, and other global commons, exit is not possible at all (unless you leave the earth on a spaceship). It is difficult to escape from contributing to the problem of climate change through our use of energy, and still to participate in society. In the UK, we have become dependent on fossil fuels to communicate, travel, prepare food, extend hospitality, be decently clothed and clean, all of which are necessary to participate in society without shame, a basic capability described by Sen, drawing on Adam Smith (Sen, 2004). Even if one does exit from creating the problem of climate change by radically reducing one's carbon footprint, exit from experiencing the impacts of climate change is not possible, and so this is a problem that needs collective action.

In certain conditions, the mechanism of voice can be a substitute for exit (Hirschman, 1970, p. 37), and perhaps this can provide an acceptable alternative route for consumer protection. This is a core objective of the energy markets regulator, currently achieved exclusively through ensuring consumers have choice of suppliers in a competitive market. Gas and electricity are regulated, but heat is currently unregulated in GB. District heat networks can contribute to reducing GHG emissions from heating of buildings. However, economies of scale mean that the financial viability of new district heat networks is increased if consumers' ability to exit is restricted. Organising a district heating network as a cooperative, where all customers have voice in the financial management and price setting process, and participate in provision decisions e.g. decide what level of service to provide and select the operation and maintenance contractors, could be an effective alternative to competition. However, some way of providing an 'exit' option, without having to move house, may still be important.

Hirschman doesn't include the concept of 'entry' in his framework. Entry is a powerful way of participating in society which is not reliant on being articulate and confident in verbally expressing explicit arguments for change. Entry allows the expression of tacit knowledge and intuition through directly creating a new way of doing things. Market theory recognises this as entry to a market, through entrepreneurs creating new businesses. However, entry can also be considered more broadly, to include social initiatives, voluntary participation, setting up of commons and mutual organisations, or public entrepreneurship such as developing new ways of organising municipal services. This is discussed in more detail in chapter 7.

5.4.5 Ostrom's design principles for Common Pool Resource management[25]

A community of prosumers[26] needs new approaches for successful governance, and could learn from management of traditional commons. Through her meta-analysis of common pool resource systems around the world, Ostrom developed a set of design principles (DPs) common to those community governance

[25] Parts of this section are adapted from (Melville *et al.*, 2017).
[26] A term being used in the context of smart and distributed energy systems, meaning 'producer-consumer'.

regimes that successfully maintained their resource over the long term. This is her most well-known contribution, as it provides a heuristic that is easy to relate to. These are effective in the context of small-scale commons, with stable communities, not subject to strong external disruption (Cox, Arnold and Tomas, 2010; Araral, 2013). The DPs originally published by Ostrom in 1990 were updated by Cox et al. (2010), following reviews of their robustness by many researchers in the intervening years. Wilson et al. (2012) generalise the use of Ostrom's DPs to other contexts. These DPs were used in the CEA case study as a framework for imagining a commons based arrangement for a GB energy system, with a focus on community DR[27]. Roelich and Knoeri (no date) also use the DPs to analyse the GB CE sector.

The DPs are as follows: (DPs for successful groups as updated by Cox et al, (2010), developed from those originally published in (Ostrom, 1990)):

> *1A Clearly defined user boundaries: Individuals or households who have rights to withdraw resource units from the common-pool resource (CPR) must be clearly defined.*
> *1B Clear boundaries of resource system: The boundaries of the CPR must be well defined.*
> *2A Congruence with local conditions: Appropriation and provision rules are congruent with local social and environmental conditions.*
> *2B Benefits of appropriation and provision inputs are proportionate*
> *3 Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.*
> *4A Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.*
> *4B Monitoring the resource: Monitors who are accountable to the users monitor the condition of the resource.*
> *5 Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense)[28] by other appropriators, by officials accountable to the appropriators, or by both.*
> *6 Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.*
> *7 Minimal recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.*
> *8 Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.*

A successful community management institution is characterised by the presence of all eight DPs. However, the LiM case study focuses on one aspect, community accountability, which is addressed by DPs 4A, 5 and 6[29].

5.4.6 Theories of fit

In addition to the DPs themselves, several studies propose 'theories of fit' (Cox, 2012). A theory of extent fit suggests that spatial extent of the resource should fit the spatial extent of the governance system, for example the governance of the extraction of water and fish resources from a river should fit the river basin, rather than a national or jurisdictional boundary. In the context of the electricity system, this could mean that a neighbourhood electricity governance boundary would match the branching patterns of the distribution

[27] See Appendix 1 for section of the project report exploring Ostrom's design principles
[28] The phrase 'assessed graduated sanctions' means that a smaller sanction is demanded of an individual who breaks a rule for the first time, or in time of need, whereas a repeat or casual offender will be more severely sanctioned.
[29] This paragraph is adapted from (Melville *et al.*, 2017).

network. This relates to congruence between DPs 1a and 1b. However, boundaries of community or spatial neighbourhood that are meaningful to people living there may not be the same as boundaries of infrastructure. A theory of temporal fit could suggest that information about the state of the electricity system should be provided instantaneously to trigger DR, given that supply and demand must be balanced instantaneously, bringing together DPs 4b and 1b. A spatial dimension could be added to this, that stress at a substation should be made known to users of that substation.

The fact that the electricity system operates on so many spatial and temporal levels makes designing a governance system to fit with physical systems of infrastructure a complex problem. Theories of fit are insufficient, as are simple theories of commons management. This is particularly the case when several different energy infrastructure systems, including electricity, gas and potentially district heating, are managed in an integrated way. These may not have a perfect geographical overlap. The theories of polycentric governance discussed in chapter 7 are therefore needed to address some of the limitations of theories of fit, and to complement the commons theories discussed in this chapter.

This section has introduced some of the core concepts in the Ostrom literature, and demonstrated their application to parts of the GB energy system. These concepts, or thinking tools, include: the unbundling of different property rights into access, withdrawal, management, exclusion and alienation; the distinction between appropriation, provision and production; the separation of different levels of decision-making into operational choice, collective choice and constitutional choice; the importance of voice as well as exit for sharing resources effectively; Ostrom's classic eight DPs for common pool resource management; and the theories of fit. These selected tools can now be used in the context of considering the GB energy system as a commons.

5.5 The shadow side of commons and community[30]

Whilst there are passionate proponents of commons who believe that people should have more ability to have a direct say in how resources are produced and distributed in their communities, there are some potential risks in commons institutions, particularly in relation to the core value of equality which forms part of the foundation of this thesis. These include the risk of exclusion, the risk of scapegoating, and the risk of abandoning of the weak.

5.5.1 Boundaries – the risk of exclusion

Whilst Ostrom's first DP advises having clear boundaries of users this mechanism can have the unwanted side effect of violence and hostility towards outsiders. Fleming (2016), in his description of a potentially commons-like post-market economy, argues that multiculturalism is unhelpful, and that separate, homogeneous cultural groups will be more successful. Scruton (2017) argues for 'oikophilia' or love of home as a key mechanism for achieving sustainable prosperity, reasoning that this can create greater respect for 'absent generations', the unborn and the dead, through an ethic of stewardship. However, as Anderson (2017) states, "although love of home can be entirely positive, it can also easily shade into antagonism towards others who either are outside of 'home' or located inside but not seen as belonging." Hostility towards outsiders is particularly poignant with the rise of nationalistic and socially regressive (racist, sexist, anti-LGBT) politics in the USA, and many countries in Europe, including the UK in 2016-2017. Moving towards commons mechanisms, with strong boundaries of membership could risk exacerbating these exclusive political dynamics.

[30] This section draws heavily on text produced for (Melville, no date).

5.5.2 Community accountability – the risk of scapegoating

The reliance on tradition and social sanction, or community accountability as identified in Ostrom's fourth, fifth and sixth DPs, can lead to a social conservatism that is hostile to the 'other' within – those who do not conform to norms of gender presentation, sexual orientation, skin colour, or religion, as well as those who are 'other' in a multitude of ways. Sanctioning can involve punitive justice systems, which can take the form of exclusion or other forms of violent retribution, and can lead to scapegoating. The risk of scapegoating could potentially be mitigated through the development of restorative justice systems which aim to resolve conflict in ways that build rather than destroy community relationships.

5.5.3 Fiscal equivalence – the risk of abandoning the weak

Commons governance systems often rely on mechanisms of reciprocity, which can risk abandoning those who are perceived as less able to contribute, in socially valued ways, such as people with disabilities. Cox et al's (2010) wording of Ostrom's second DP states 'benefits of appropriation and provision inputs are proportionate', an emphasis on 'fiscal equivalence' rather than equality of access to resources. This is a stronger stance for reciprocity than Ostrom's original formulation "congruence between appropriation and provision rules and local conditions". This is discussed in relation to the case studies on p209.

In addition to those unable to contribute, a stance of fiscal equivalence may not acknowledge historic and structural inequalities which affect people's starting positions. For example, in the irrigation communities described by Hunt (1992), water is distributed according to the amount of land owned. Unequal land distribution leads to unequal access to water. This does not fit with the stance of social equality taken in this thesis, but the rules in place fit local perceptions of fairness, where conflict is caused by a person taking more water than they are entitled to, rather than a sense that the entitlement is unfair. A stable traditional commons institution, which distributes water equally to the land but not equally to the people, may have value, but does not support (anthropocentric) equality. In the context of electricity, this would be equivalent to a bigger house being entitled to more electricity, rather than a greater number of people in a house being entitled to more electricity.

5.5.4 A balanced approach to commons

The discussion above shows that there are negative sides to community and commons governance, and it is important not to romanticise the commons. This supports Ostrom's frequent warning that 'there are no panaceas', and that the detail of institutions, including formal rules and informal cultural norms, are important. Guhyapati's (2016) argument that groups need balance in four key dimensions is helpful here, in order to find a pragmatic approach to commons that avoids either condemnation or idealisation. These dimensions are framed in terms of pairs of opposites: autonomy and cooperation; innovation and conservation; diversity and commonality; inclusivity and exclusion. The purpose is to optimise rather than maximise any of these factors, but the perfect balance will never be reached, and there will always be movement and a need for responsiveness. This need for balance and equilibrium is also identified by Bollier (2014, p. 80), in relation to the role of the individual and the collective in a commons: "Even though we like to contrast "individualism" and "collectivism" as opposites, in the commons they tend to blur and intermingle in complicated ways. The two are not mutually exclusive, but rather dynamic yin-yang complements."

The next chapter explores the question of whether energy should be governed as a commons, by analysing different elements of energy systems. The need for balance, pragmatism and the understanding that there are no panaceas should be borne in mind through this discussion.

6 Energy as a commons – part 2, should energy be governed as a commons?

Oil lamp fashioned from an incandescent light-bulb

Glass, metal, cotton. Date unknown

The incandescent light-bulb was an early type of electric light. The current ran through a filament suspended in a vacuum or inert gas inside the bulb. The bulbs were fragile and energy-hungry, and were not in use for more than a few decades before they were replaced with more efficient types. This specimen survived as a family heirloom after it was transformed into an oil-burning lamp, possibly as a novelty gift.

Artwork from the Future Museum, Sage Brice (2013)

This chapter assesses the extent to which the resource of energy, particularly in the modern industrial context of GB, can or should be governed as a commons. This is important for answering the second main research questions for this thesis: how do theoretical frameworks of commons and polycentric governance contribute to understanding the roles of CE and LAs in GB's energy transition? Chapter 5 started to answer this question by discussing the concept of commons in relation to energy systems. This chapter deepens this analysis by systematically asking whether energy should be governed as a commons. If the conclusion is positive, this would mean that the theoretical framework of commons is potentially valuable for understanding the roles of CE and LAs in GB's energy transition.

In practice, a society is likely to make use of a mixture of different property regimes. It is therefore valuable to identify criteria we might use to identify which resources could be most effectively governed through which range of property regimes. One approach is to attempt to understand the types of governance challenges likely to be faced for a particular resource, and which types of institutions might be effective in addressing this.

6.1 Criteria for selecting a governance regime

The assessment of property regimes in terms of politics and in terms of the physical characteristics of the resource have already been discussed in chapter 5. Additional criteria for assessing the appropriate property regime for a resource include: the extent to which it is a natural monopoly; the extent to which it generates positive and negative externalities; and the extent to which it is needed to satisfy basic needs. These factors are all mapped in terms of how political or materialist they are, in Figure 42. They are then defined and discussed in relation to energy.

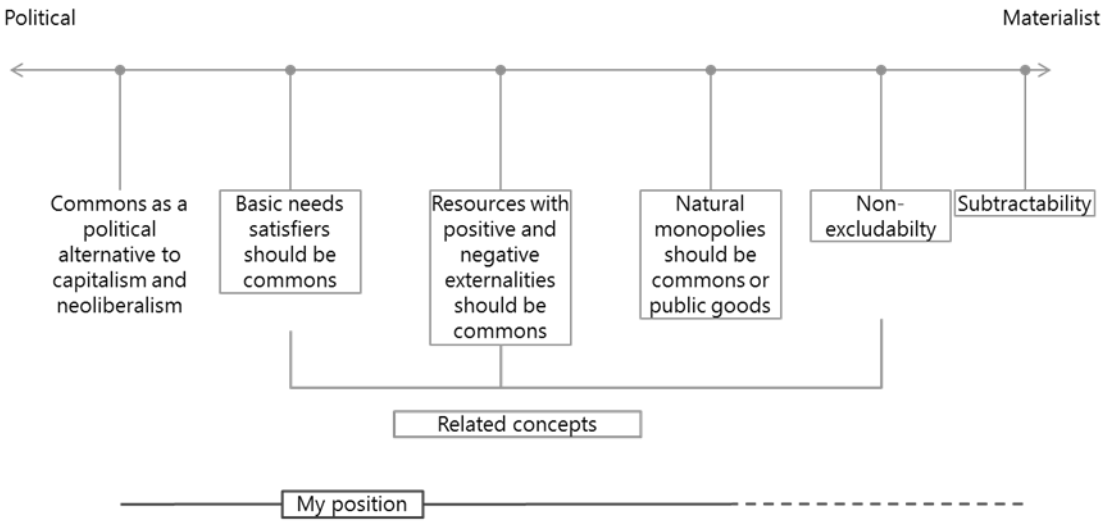

Figure 42: Ways of categorising appropriate property regimes for a resource

The question of commons as a political alternative to capitalism and neoliberalism has already been discussed. This is a generalised political position, and does not apply in particular to energy rather than other resources. The following discusses each of the other criteria in Figure 42 in relation to different parts of the energy system.

6.1.1 Energy as a basic need for humans

From an anthropocentric, humanistic, needs-based and capabilities perspective, no-one should be excluded from access to meeting their fundamental human needs. In industrialised societies such as GB, access to modern energy, particularly electricity and heat, is essential for satisfying subsistence and social participation needs of shelter, warmth, cleanliness, cooking food and communication.

If energy is a basic good, like water, it is socially undesirable and unethical to exclude anyone from access to it, and therefore potentially valuable to treat it as a commons. The quantity used may still need to be managed in some way. Vercellone et al. propose "the establishment of shared rules of rationing" and "responsible and participative inclusion" rather than exclusion through price[31] (Vercellone *et al.*, 2015, p. 21). This could include mechanisms such as rising block tariffs or basic allowances of energy, available to all regardless of income. In many irrigation systems, the rules for allocation of water are different when there is a drought relative to when there is plenty, ensuring that water is shared out to everyone for their basic survival, even if those who own more land can claim more water when there is enough. A similar approach could be taken to energy as a commons.

6.1.2 Externalities

Another approach to identifying what should be a commons is to consider positive and negative externalities. Externalities take place in "any situation in which the activities of one or more economic agents have consequences on the well-being of other agents without there being exchanges or contracts between them."(Vercellone *et al.*, 2015, p. 100). For example, choosing to travel by bicycle rather than by car has

[31] This type of approach could support sustainability through generating an 'abundance' mindset rather than the creation of artificial scarcity that is part of capitalism. Exploring this is beyond the scope of this research, but would be an interesting area for further research.

positive externalities of reducing congestion, whereas car travel has a negative externality of causing air pollution in the local area.

Externalities are a form of market failure (Young, 2011). In a context where outcomes are produced purely through individual market interactions, externalities are not sufficiently taken into account, as impacts are separated from decision-making and positive and negative feedback loops are not properly closed. Without some coordinating or regulatory process, economic goods with positive externalities tend to be underproduced, as the benefits are shared rather than being felt primarily by the one who produced them. Economic outputs with negative externalities tend to be overproduced, as the costs are shared by many, including non-humans and future generations[32].

Energy has strong positive externalities, with benefits for society, if everyone has access to affordable energy services, and for national economic success, if electricity prices for industry are low (Künneke and Finger, 2009; Frischmann, 2012; Karlsson-Vinkhuyzen, Jollands and Staudt, 2012). It also has strong negative externalities, including: local air pollution; global greenhouse gas emissions, (Karlsson-Vinkhuyzen, Jollands and Staudt, 2012; Goldthau, 2014); depletion of fossil fuel resources (Karlsson-Vinkhuyzen, Jollands and Staudt, 2012; Bolton and Foxon, 2014); landscape visual impact (Cass, Walker and Devine-Wright, 2010); capture of the RE resource in itself (Van Der Horst and Vermeylen, 2010).

One could consider externalities themselves to be a commons or public good i.e. the congestion on the road or the quality of the air we breathe are commons. Travel is therefore an activity that is linked to (i.e. impacts on) a commons. Alternatively, one could say that an activity with links to strong positive or negative externalities should be governed as a commons in itself. This would mean that an economic activity with strong externalities should be treated as a commons. Using this second approach, travel would be treated as a commons, and a similar argument could be applied to energy, which is linked to the commons of the climate

Hirschman, (1970), has an interesting approach to public goods. Although he explicitly defines public goods as being non-subtractible, he bases his argument on the idea that public goods are not only non-excludable, but inescapable. In this context 'full exit is impossible'. For example, "what is a public good for some - say, a plentiful supply of police dogs and atomic bombs - may well be judged a public evil by others in the same community" (Hirschman, 1970, p. 101). This concept of inescapability can be related to the idea of negative externalities.

There will always be some externalities, but it is possible to reduce the amount of externalities by bringing together different elements of a decision within one institution, i.e. governing as a commons, rather than separating production and consumption through commodification. In the context of energy, one could bring some of the current 'externalities' within the frame of decision-making by making many decisions within one decision unit, for example bringing together decisions about the quantity of electricity to be produced, the impact on the landscape, the level of capital investment in electricity infrastructure, the use of air-polluting thermal power stations, and the way that units of electricity are shared out. However, this would not remove externalities completely. . Climate impacts, for example, would remain external to the decision unit.

[32] In his 1970 economics textbook, Samuelson includes the presence of externalities as a reason for categorising a resource as not fully private, a comment which Vercellone et al. claim has "heavy theoretical implications that go beyond the intentions of the author himself" (Vercellone *et al.*, 2015, p. 10), as any economic activity has some positive or negative externalities (Mozsár, 2003, p. 71 citing Albert and Hahnel 2002 and Hayek 1992; Vercellone *et al.*, 2015, p. 11).

6.1.3 Natural monopolies

Markets are theorised to be efficient when there is competition. When there is a monopoly, such as a landowner who controls the only road between two villages and is able to charge a toll for its use, they are not prevented by market competition from charging more for people to use the road than they need to cover the costs of construction and maintenance. This is called rent-seeking, defined as obtaining excessive unearned income by virtue of having control over a desirable resource that is in limited supply (Robertson, 2016). Monopoly rent-seeking is identified by legal historical scholar Carol Rose as the primary reason for categorising roads, rivers and public spaces as 'public goods' (Rose, 1986).

Gas and electricity distribution infrastructure is, like roads, seen as a natural monopoly. Electricity transmission infrastructure has a high capital cost, and large economies of scale, including the smoothing effects of connecting many different sources of generation and demand. Achieving these economies of scale requires coordination between different parts of the system (Finger and Künneke, 2011; Bolton and Foxon, 2014), which means that separating the system into distinct entities (e.g. generation, transmission, distribution, supply) leads to high transaction costs.

Land is the classic case for rent-seeking and monopoly. Karl Polanyi calls land a 'fictitious commodity', because it is a 'gift of nature' rather than created by human labour (Vercellone *et al.*, 2015, p. 100). Land is the earth, the ecosystem that humans live in and are part of. Many cultures do not recognise human ownership of land, and see this as absurd in a paradigm where the human animal lives within and is dependent on the ecosystem. However, the western, colonial and currently dominant global paradigm does assign property rights to land. The question of land, monopoly, taxation and rent-seeking was discussed by Ricardo (1819), inspiring work by Henry George and Marx, as well as many other western classical economists.

Primary energy resources are land based resources. To avoid rent-seeking which would lead to positive externalities not being created, primary energy systems should be regulated or in public ownership. Primary energy sources, and energy infrastructures, are basic goods needed for production and welfare, and sit on land. This is most visible with the wind farms and solar panels which take up space in our landscapes and rooftops, but it is also true of the open cast coal mines, uranium mines, and shale oil fields that fuel thermal power plants. The mining of fossil fuels and uranium may be more energy dense per land area, it may be mostly in places that are far away and where people have less capacity to resist (Harris *et al.*, 2016), but it still uses land. It is also true of the mines from which the raw materials for solar panels, batteries and electronic control systems are made. Land is the basis of traditional commons, including commoning rights of fuel collection which were seen as economically important even by proponents of 18th and 19th century English enclosures (Humphries, 1990). Production of RE may become cheap, but owners of land could charge increasingly high rents and thus there is a risk that future RE could be unaffordable under an unregulated private ownership regime.

6.1.4 Excludability

Non-excludability has already been discussed in the context of the politics of commoning. Although it is used as a means to identify a common pool resource or public good by mainstream economists, for Ostrom it is more relevant to think of a scale of difficulty of exclusion. It is more difficult to keep people out of a forest or a fishery than it is to lock a house or a car. However, management of subtractible CPRs only tends to function well when Ostrom's DPs are in place, and this includes having clear boundaries of the users, i.e. some form of exclusion.

At the same time, exclusion is a choice, and it can be ethically problematic to exclude people from access to a resource, particularly when it is an essential satisfier of a basic need. For commoners in 18th century

England, it was very clear that they were being forcibly excluded from former commons by the choice of landowners, through the process of enclosure and clearances. Non-land owning poor had been able to survive through grazing a cow on the common and making milk and butter, feeding pigs on acorns in the wood, gathering firewood, gleaning leftover grain after harvest in the open field system, and hunting rabbits or birds for meat. Enclosure left them without this source of livelihood, particularly affecting women and children, and forced people into wage labour in factories (Humphries, 1990).

In the electricity system, access is regulated through the use of metering, so it can be seen as 'excludable'. For domestic consumers, however, only total quantities of electricity are metered, and the time at which it is used is 'not-excludable' using standard, non-smart metering technology. The introduction of smart metering will provide potential to monitor minute-by-minute consumption of electricity, and charge people for the time at which they use it. This can enable more active management of time of consumption, and enable greater integration of RE as discussed in chapter 2. This also risks excluding those with less money from access to electricity at peak times. This could be seen as a form of 'enclosure' of the open-access, unregulated commons of balancing services and network capacity. On the other hand, the time of use of electricity impacts on a resource that is becoming increasingly subtractible, as discussed below, so it is socially valuable to implement some form of limit or accountability for appropriation.

In practice, all functional human institutions, however inclusive they may try to be, have formal or informal exclusion rules - whether it is having a ticket, queuing, assessment of need (e.g. medical triage, means testing), sharing political values, not being drunk or antisocial, having citizenship documentation, residence in a local area or particular address, making a minimum financial investment, speaking or dressing in a particular way.

6.1.5 Subtractability

Subtractability means that if someone uses a resource, there is less of it available for others to enjoy. Cake is a good example of a subtractible resource: we can share it equally, but if there are more people to share between, each will have a smaller portion. In contrast, articles on Wikipedia are not subtractible: if 20 people read an article, they do not get any less of it than if 20,000 people read it. In this case, the challenge is how to get enough people to contribute good quality information to Wikipedia, rather than how to regulate how much they use it. A non-subtractible resource faces problems of provision, but not problems of appropriation. A subtractible good, however, also needs rules governing appropriation, as one person's use reduces what is available for others.

Even if we do not use 'subtractability' to directly determine whether a resource is a CPR or a public good, measuring subtractability does help with understanding whether a resource faces governance challenge of appropriation, as well as challenges of provision and production. This is the criterion which is most purely about the physical characteristics of a resource, rather than the social relations around a resource.

Measuring subtractability as a continuous variable

For an ecosystem resource such as a fishery, there are limits to the amount of fish that can be harvested without depleting the resource, sometimes measured as a 'maximum sustainable yield'. This is a challenge of appropriation, and not so much a problem of provision. For a manufactured good, such as electricity infrastructure, the situation is different. If we want to use more electricity, we can build a larger infrastructure to produce and deliver it. This is a challenge of provision and production. In this case, the question of subtractability could be conceptualised as the variation of cost of production with consumption. This could also be conceived of as the quality of service available per person for a given cost.

Figure 43 illustrates the way in which cost of production varies with usage for public, toll, and subtractible (private or common pool) resource archetypes, in terms of the mainstream economics categorisation

according to physical characteristics. A pure public good, such as Wikipedia, has a fixed cost of production for a given level of service, and the cost does not vary with the number of users. A toll good, such as a theatre or a road, has a fixed capacity, but the costs of production are the same regardless of the number of users, as long as this is below the capacity limit. A private good such as a cake, or a CPR such as a fishery, has a cost of production that increases in some way with the usage, represented here as a linear relationship.

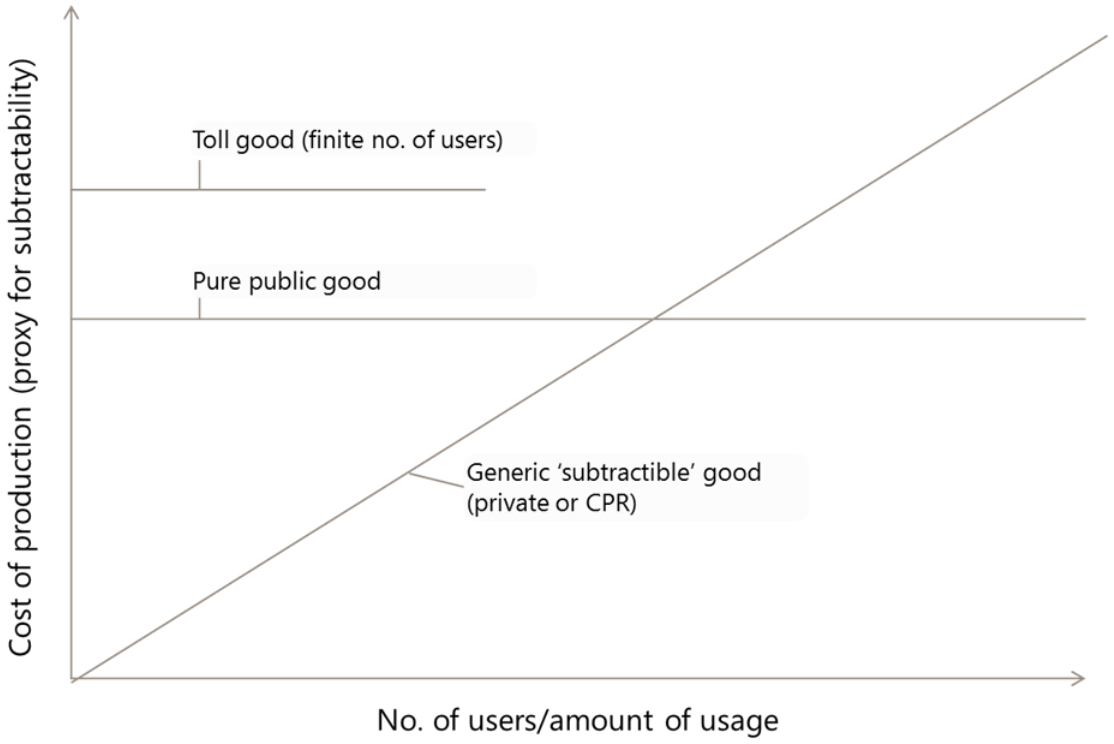

Figure 43: Subtractability of manufactured resources

Electricity and subtractability

Units of energy, i.e. kWh, are subtractible. For each unit consumed more than one unit of primary energy must be provided to account for losses from primary to final energy. It is less clear whether infrastructure services such as electricity balancing and network capacity[33] are subtractible. It is also possible that 'use' of the infrastructure by consumers of energy has different characteristics to 'use' of the infrastructure by generators.

The relationship of cost of production vs number of users, as discussed above and shown in Figure 43, is used as a proxy for the subtractability of electricity infrastructure. In the graphs below, a conceptual sketch is mapped for four cases: network capacity for users consuming electricity; balancing services for users consuming electricity; network capacity for users generating distributed, renewable electricity; and balancing services for users generating distributed, renewable electricity.

Network capacity for consumption

[33] Balancing is ensuring that electricity consumption and generation are equal at all times. Network capacity refers to the maximum flow of electricity that can be transmitted through a given infrastructure. See chapter 2 for a discussion of how balancing and network capacity relate to decarbonisation.

Jacobsen and Jensen (2012) describe electricity infrastructure as 'congestible'. This is analogous to a road becoming congested when there is too much traffic. Up to a certain level of traffic, vehicles move smoothly. After a certain limit, movement slows down. Similarly, up to a certain level of power, electricity can be transmitted, above a certain level, there are problems for the infrastructure, including overheating. High voltage electrical engineers consider 'voltage' and 'thermal' thresholds for the power and current that can be transmitted.

Figure 44 shows an illustrative sketch of how the cost of production of network capacity (e.g. construction of transmission and distribution infrastructure such as pylons and cables) might vary with level of consumption. The network capacity is assumed to be at a fixed cost, up to a certain amount of consumption. At that point, incremental investments are made, to upgrade small parts of the network (e.g. upgrading substations or the local distribution network). If consumption increases further, a large investment may be needed (e.g. upgrading the high voltage transmission network), leading to a new substantially higher capacity, with no further costs until a substantially higher consumption level is reached. This could be analogous to managing congestion on a road initially through use of speed limits and traffic flow infrastructure, but eventually needing to add a lane if traffic increases considerably[34]. Traditionally, domestic electricity consumption has increased through gradual increases in the usage of gadgets by households, or the connection of new houses. In an electricity based low carbon energy system, peak demand might increase suddenly through the connection of electric vehicles or electric heating. This prospect is a concern for network operators, which motivates research such as the LiM project.

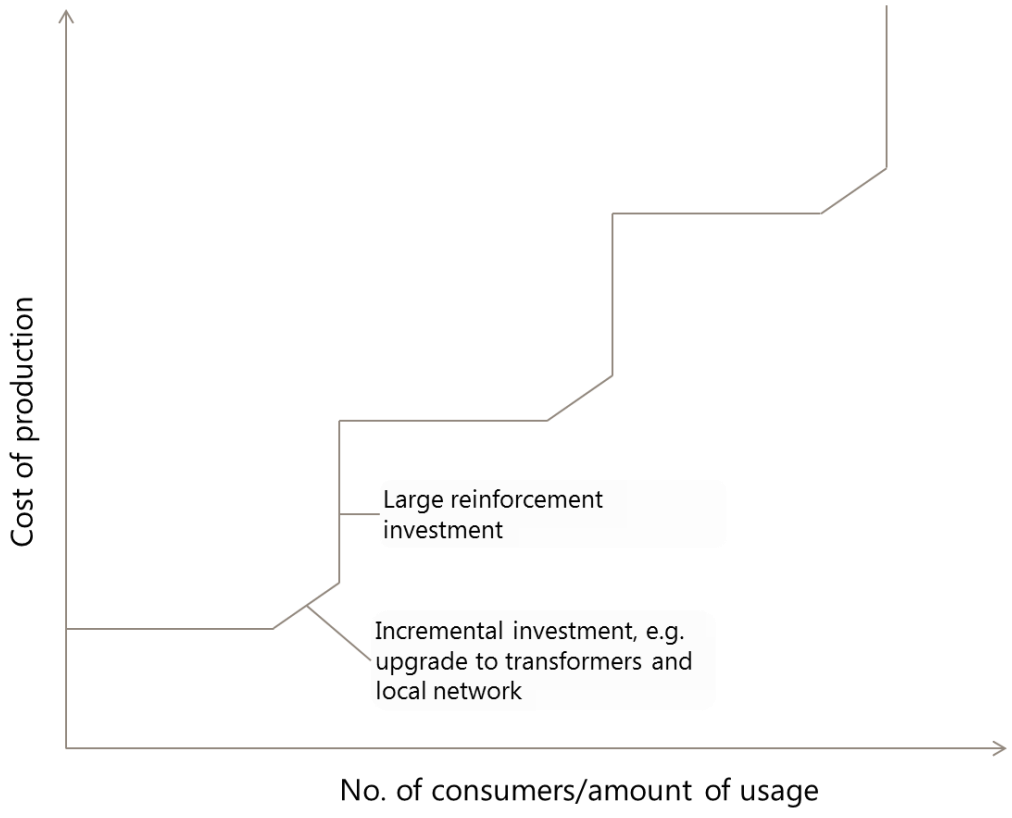

Figure 44: Subtractability of electricity distribution and transmission capacity as a congestible good

[34] Although congestion tends to occur when road space is increased, rather than vice versa as implied here.

This pattern of cost of production relative to level of consumption is effectively phases of subtractability and phases of non-subtractability.

Network capacity for balancing services

For balancing services, the pattern is slightly different. Balancing electricity consumption and generation is similar to trying to keep a consistent water level in a bathtub, whilst the plug and the tap are both open. Here, the number of users is more important. Each user may consume the same quantity of electricity, but at slightly different times, for example I'm unlikely to put the kettle on at exactly the same time as all of my neighbours, unless we are all watching the same TV show. This means that when there are few users, the cost of balancing per person is greater than when there are many users, due to the smoothing effects of 'diversity of load' created when people consume electricity at different times (Alam, Ramchurn and Rogers, 2013). This is analogous to having several holes in the bottom of the bath which are unplugged at different times, rather than all unplugged at the same time – the water level can be kept constant using a smaller sized tap than the sum of all taps needed if each plughole was in a separate bath. This is sketched in Figure 45.[35]

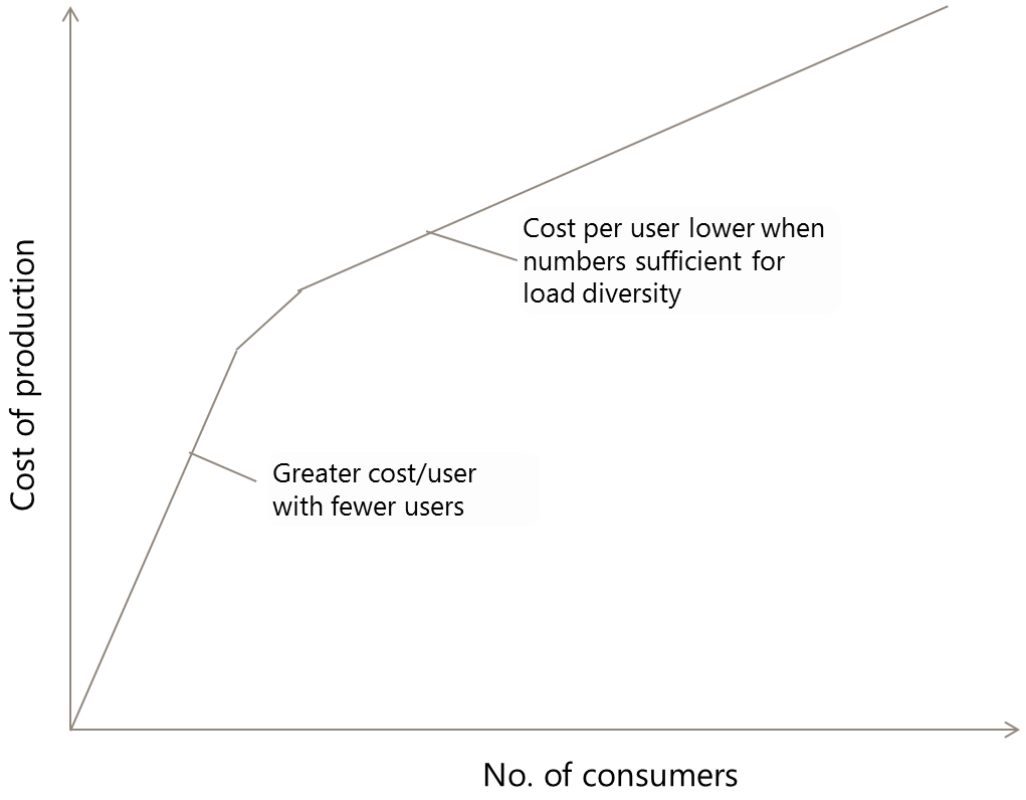

Figure 45: Illustrative diagram showing subtractability of electricity balancing services

The time pattern of electricity consumption will also have an impact on balancing. For example, the impact of electric vehicle (EV) charging on network balancing will depend on the flexibility of the timing and location of EV charging. If the timing is very flexible, then EV charging could help with electricity system balancing, for

[35] This is one of the reasons for having an electricity network in the first place. In remote areas not connected to a national electricity grid, a local network with shared batteries has substantial efficiency savings over individual household batteries for the same reason. Alam et al. (2013) have modelled ways of sharing batteries in a regulated common property regime designed for non grid-connected villages in developing countries, so as to achieve an acceptable degree of fairness. This is an example of energy infrastructure being managed as a common pool resource in order to achieve efficiencies.

example by using up spare electricity when it is very windy. If it is inflexible, then it will create a challenge for balancing the system, as well as a greater challenge for network capacity. Balancing is also an issue for the gas network, although much less so than for electricity. In the UK, gas based central heating systems which included a hot water storage tank have been largely replaced with combi-boilers which provide instantaneous hot water for central heating, showers etc. This has resulted in a much more peaky domestic heating load, which currently puts stress on the gas distribution network (Winnan, 2015). If heating is electrified without re-installing hot water tanks, this challenge of balancing would be transferred to the electricity system, where balancing is more sensitive than in the gas network.

Impact of generation

When DG is added to the system, this can require additional capacity and balancing services, and the addition of new generation on the grid is carefully managed by DNOs (Western Power Distribution, 2015). However, it is also possible for timing of generation and consumption to be coordinated so as to have an overall effect of reducing the demand for capacity and balancing, for example charging EVs from solar power in the daytime, or using solar electricity to heat hot water that is stored until it is needed in the evening or morning.

Network capacity for generation

Figure 46 shows the effect of connection of DG on electricity network capacity, in a simple case where smart supply and demand matching at a local level is not used. It uses an illustrative case where making one large investment upfront is cheaper overall than the cumulative cost of a number of smaller investments. In reality, the detail of this will depend on the particular situation.

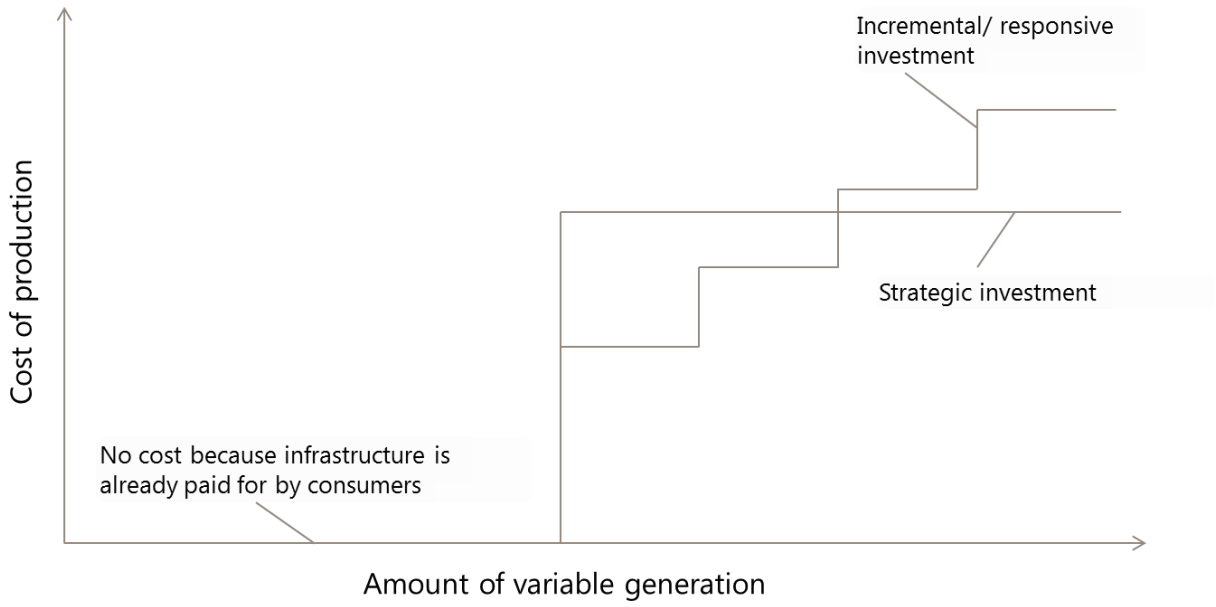

Figure 46: Subtractability of electricity infrastructure capacity for variable generators

Historically, RE in some locations could be connected using the existing extra capacity in the network, but in places with no spare capacity they have had to pay for reinforcement costs. The network is becoming increasingly congested, leading to the need for substantial reinforcement, and discussion of how this should be planned and paid for (Ofgem, 2015; Western Power Distribution, 2015).

Balancing services for generation

Figure 47 shows the effect of connection of DG on balancing services.

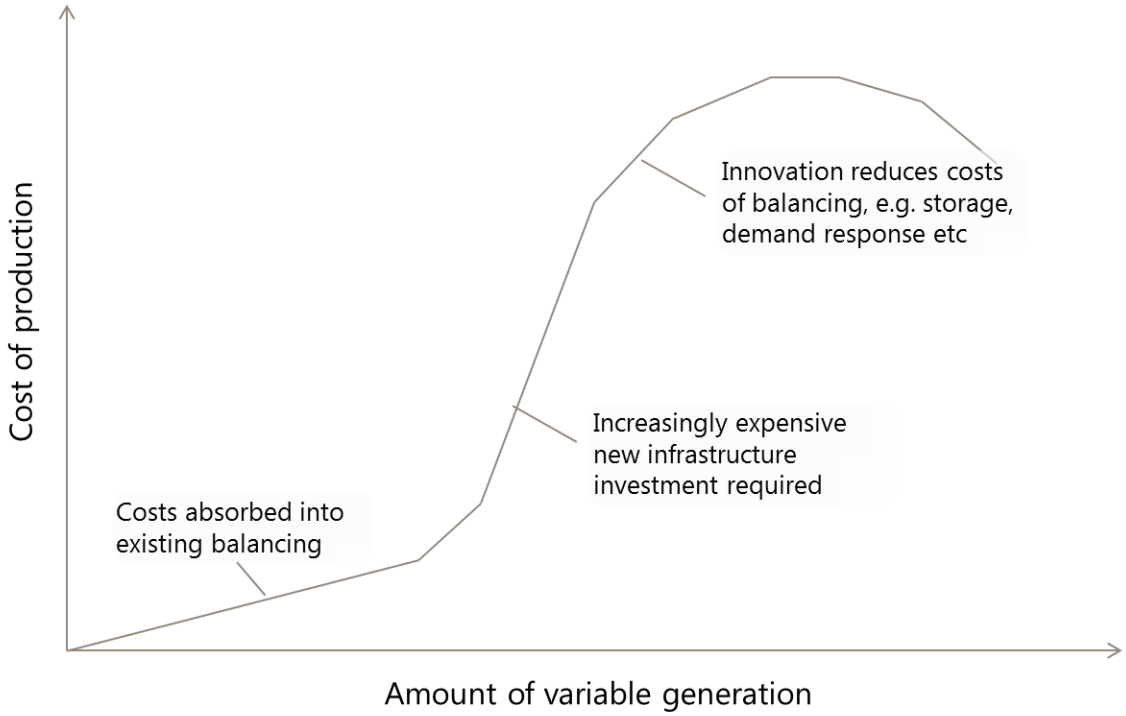

Figure 47: Subtractability of electricity balancing services for variable generators

At low levels of grid penetration, RE can easily be absorbed into the existing balancing infrastructure, with fossil fuel peaking plant being used to balance the peaks and troughs in generation caused by changes in weather. As renewable penetration percentage increases, however, the utilisation rate of the peaking plant reduces, and it becomes more expensive to maintain existing or develop new peaking plant per unit of energy they generate, a problem that the capacity market in the Energy Market Reform bill seeks to address. Figure 47 shows this phase as being followed by an innovation phase, where electricity storage and use of smart systems for matching the timing of supply and demand reduces the cost of high levels of variable renewable generation. In practice, this innovation is already taking place, and it may be possible for some of the more expensive investment to be avoided by making better use of spatially coordinated DR.

Whist it is clear that units of energy, i.e. kWh, are subtractible, this discussion shows that the balancing services and network capacity are more ambiguous in terms of their subtractability. This has implications for the design of pricing or charges for use of infrastructure. There has recently been a debate about whether local generators are exempt from paying for national transmission costs , as they only use the local electricity network, called 'embedded benefits' (RegenSW, 2017). There has also been debate about the 'double charging' of electricity storage units such as batteries, as they are charged for infrastructures both when they charge the battery, as 'consumers', and when they discharge the battery, as 'generators' (RegenSW, 2017). However, batteries are included in Figure 47 as an innovation that reduces the cost of balancing variable generation – they provide an infrastructure service, rather than consuming infrastructure services.

6.1.6 Summary

This section has opened up the question of the proper mode of governance and ownership of energy systems. Both from an analytic perspective based on the intrinsic characteristics of energy infrastructure, and from a political and normative perspective based on outcomes for people and the environment, there is an

argument to support a greater role for public or commons ownership of energy. This is summarised in Table 9.

Table 9: Summary of energy and criteria for whether it should be governed as a commons

Criterion	Assessment of energy
Basic need	Yes, access to modern forms of energy is necessary to satisfy basic needs in early 21st century GB. From a basic needs perspective, energy should be governed as a commons.
Positive externalities	Yes, there are strong positive externalities of universal access to energy for individuals and businesses, in terms of benefit to society and to the economy.
Negative externalities	Yes, there are strong negative externalities of energy production, including GHG emissions and air pollution.
Natural monopoly	Electricity infrastructure is a natural monopoly, as it has large economies of scale. This is similar to road networks. Primary energy of all forms is also a land-based resource, which is at risk of rent-seeking and natural monopoly relations.
Excludability	Currently, consumption of units of electricity is excludable through metering, but the balancing and network capacity are not excluded. Smart meters will enable exclusion in relation to balancing and network capacity. This could be seen as a form of enclosure. This also means that these services can be treated as a private good if decision-makers choose to do so.
Subtractability	Units of energy are subtractible. The use of infrastructure balancing services and network capacity is more complex, but is broadly congestible, meaning that it can become subtractible above a certain level of usage. From this perspective energy infrastructure needs some regulation of appropriation as well as provision and production.

As summarised in Table 9, energy is subtractible and excludable. This would make it a private good, according to the earlier two-by-two matrix which physically characterises a resource. However, the other criteria, of natural monopoly, externalities and energy as a satisfier of basic needs, shows that energy should be governed as a commons.

This raises the question of whether all forms of energy should be governed as a commons. Schlager and Ostrom's (1992) list of different forms of property rights shows that property rights can be assigned in a specific way to different parts of a resource. The different property regimes appropriate to different parts of the energy system are discussed in more detail in the next section.

6.2 Property regimes for different parts of the energy system

There are certain parts of an electricity system which lend themselves more or less to different forms of ownership. The main parts of the electricity system, as discussed in chapter 2 Background to the GB Energy System, are shown in Figure 48 for reference.

Figure 48: Parts of the energy system.

Generation

The generation of energy is an area where the greatest change is required in order to transition to a low carbon energy system. In this case, negative externalities of climate change could be regulated through a strong carbon price and subsidies for RE, such as those already existing in Renewable Obligation Certificates (ROCs), FiT and Contracts for Difference. Local community ownership of generation assets can reflect the natural commons of ambient forms of energy, and the inescapability of the landscape impact. A mixture of private, community and state-public ownership of generation could be appropriate, in this case, under a regulatory regime that recognises both positive and negative externalities.

Transmission and distribution

The arguments regarding natural monopolies and positive externalities apply strongly to transmission and distribution networks, and there are therefore strong arguments for these to be in state ownership at national or municipal level. The level of investment and scale of these infrastructures is such that there may be limited scope for meaningful community involvement in the operation, although greater democratic accountability at the collective-choice level may be desirable.

Supply

The supply of energy connects the energy infrastructure system with consumers. It currently operates on a logic whereby there is an incentive for suppliers to maximise the amount of energy consumed by their customers. Alternative models of providing energy services rather than units of energy through ESCos (Energy Service Companies) have been used on a small scale, and have been proposed as an alternative model for municipal energy companies. ESCOs can exist in a commercial market system, and lead to reduction in energy demand. An alternative model for reducing demand is through progressive tariff structures, such as a rising block tariff (Lin and Jiang, 2012; Sun and Lin, 2013). This involves a degree of cross-subsidisation, and so cannot be implemented unilaterally by a company, but would need to be enforced across companies through regulation or public ownership. LA energy companies, including Bristol Energy, Robin Hood Energy and those in partnership with OVO energy promote themselves as having 'fair' tariffs, but the market limits their ability to create tariffs that support those in fuel poverty or encourage energy efficiency.

Consumption

The consumption of energy has traditionally been a private matter, where consumers are entitled to use as much energy as they pay for. However, consumption itself has impacts all the way through the supply chain,

and can be modified through change in social practices around energy as well as through energy efficiency. This is also an area where reliance on market mechanisms to modify consumption behaviour can exacerbate wealth and income inequalities. Increase in price would incentivise people to use less, but lead to greater fuel poverty. There is perhaps therefore a case to be made for some common or public intervention in consumption.

A summary of a suggested ownership structure for the elements of the electricity system, that fits the analysis in this chapter, is shown in Figure 49.

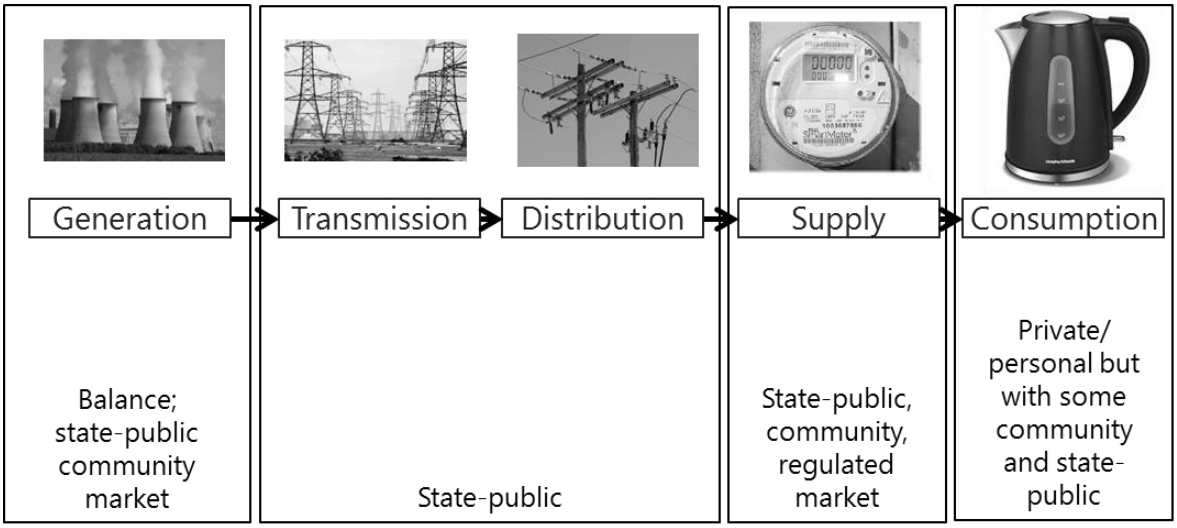

Figure 49: Suggested ownership or sector structure through the energy system

This suggested system has a lot in common with the proposal by We Own It, show in Figure 50, and thus provides theoretical support to their campaign.

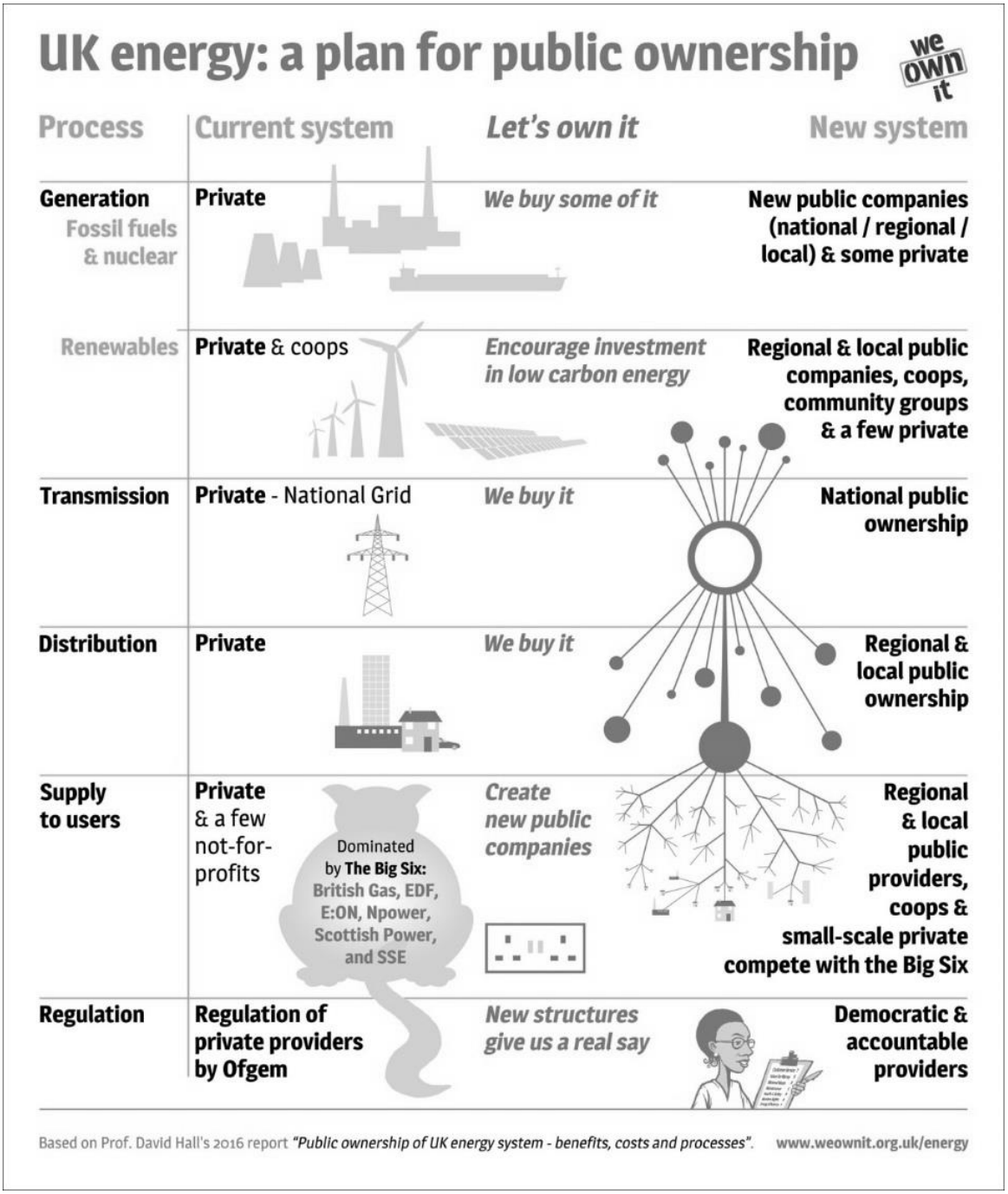

Figure 50: Public ownership We Own It diagram (We Own It, 2016)

This proposal increases the democratic accountability of parts of the energy system, and could enable greater provision of public goods, but does not create a commons, in the sense that the parts of the energy system are still separated rather than provision and consumption being brought into one unit.

6.3 Conclusion

This chapter has analysed the potential of considering energy to be a commons, in the context of the GB energy system. It has found that electricity and electricity infrastructure is mostly excludable and subtractible, which according to the resource matrix would mean that it would be categorised as a private good. However, access to energy is necessary for satisfying basic needs and capabilities in the GB context, and universal

access to energy has strong positive externalities. From this perspective, it makes sense to consider energy as a commons. Additionally, burning of fossil fuels has a major negative externality of causing greenhouse gas emissions, which affects the global commons of the climate. Burning fossil fuels is therefore a matter of public/common rather than private concern. Electricity and gas infrastructures are natural monopolies, and as such should be governed through some form of public ownership. Similarly the primary sources of energy are land-based resources, and land is a classic case for monopoly rent-seeking. Land is also the basis of many traditional commons.

Perspectives on commons are political. Deciding on an appropriate property regime and governance system for a resource is not simply a question of technocratic assessment of the physical properties of a resource. It is also a question of values, desired outcomes, political priorities and beliefs. Determining the 'best' governance system in a complex context with multiple objectives is not easy.

The campaign group 'We Own It' propose a mixed ownership regime for the GB electricity system. The monopoly infrastructures are proposed to be publicly owned by national and local government, which fits the analysis that natural monopolies should be treated as a public good. Generation and supply are proposed to be mixed economies. There are arguments for governing these as commons, ensuring everyone has access, and integrating provision and appropriation.

The consideration of energy as a commons, however, goes beyond questions of who should own which part of the system, as proposed in the We Own It diagram (p129). It raises questions about the detail of what types of rules for appropriation there should be, e.g. whether the system of unlimited demand and distribution based on financial resources should be retained, or whether there should be limits on when and how much energy is used, and a more egalitarian distribution system such as rising block tariffs, rationing, or equal sharing of a local resource.

Additionally, attempting to govern all generation and supply as a commons may not be realistic or desirable. For Bollier, commons have never been completely independent, but have tended to be co-dependent with other institutional forms such as capitalism, communism, or feudalism. He says that "The stark reality is that commons tend not to be dominant institutional forms in their own right" (Bollier, 2014, p. 80).

Additionally, this thesis has core values of environmental limits, equality and democracy. This raises the question of whether commons management promotes these values. Whilst there are benefits to commons, in terms of voice and democracy and participation, there are also limitations. Traditional commons management systems can be conservative, in contrast to markets which are praised for their capacity to innovate. These challenges of innovation are addressed in the discussion of polycentric governance in chapter 7. Ostrom demonstrated that commoners are able to sustain natural resources over long periods of time. However, they are not always successful, and moving towards commons governance systems is not a panacea for remaining within global environmental limits. Ostrom's DPs for common pool resource management also raise some concerns for equality.

On the other hand, commons governance systems have the potential to provide people with an opportunity to practice democracy, in a way that is not possible in large scale 'representative' democracy. To have a say in what is happening in their local economy, to find ways of thriving and creating their own sustainable prosperity is important as austerity and a sense of economic disenfranchisement have been partly blamed by some commentators for the rise of populist right-wing politics in many parts of the world (Sriskandarajah, 2017). In a world dominated by individual market-based decision-making and top-down state rules and welfare provision over which people have little say, even in 4-yearly elections, rebuilding commons could provide an avenue for having a say. This rebuilding of commons is emerging in many sectors: in food and agriculture; in housing; and also in energy in the form of the civic energy sector.

7 Polycentric governance and energy

> "It is not our differences that divide us. It is our inability to recognize, accept, and celebrate those differences."
>
> Audre Lorde[36]

> "Town meetings are to liberty what primary schools are to science; they bring it within the people's reach, they teach men (sic) how to use and how to enjoy it."
>
> Alexis de Tocqueville, (1838)

> Polycentric governance is "A pattern of organisation where many independent elements are capable of mutual adjustment for ordering their relationships with one another within a general system of rules"
>
> Vincent Ostrom, (1972, p. 21)

7.1 Introduction

This chapter proposes the concept of polycentric governance as a way of combining the best of both top-down and bottom-up approaches to energy system governance, in answer to the dilemmas of centralisation vs decentralisation discussed in chapter 2.

One of the weaknesses of commons governance regimes is that they can be conservative and traditionalist, in contrast to market systems which are praised for supporting innovation and creativity. Theory of polycentric governance sees markets as a subset of polycentric systems, and business entrepreneurship as just one way of creating new institutions. It can provide space to creatively combine the communal and democratic benefits of commons, with the dynamic and innovative benefits of market. This relates particularly to Guhyapati's (2016) tension of autonomy vs cooperation, discussed in section 5.5.4.

The concept of polycentric governance can be used in a number of different modes: paradigmatically, as a conceptual lens through which to view systems of governance; analytically, as a characteristic which can be more or less dominant in a system of governance; and evaluatively, where the dominance of the characteristic of polycentricity is compared with outcomes. Ostrom's more famous work on commons sits within a broader theoretical framework of polycentric governance. This is a powerful framework for understanding decentralised systems of governance, and so valuable for considering the roles of local organisations in the energy transition.

The chapter begins by defining polycentric governance, as it is a complex and subtle concept, and discussing its historical development and related concepts. It then goes on to discuss the benefits of polycentric governance systems, taking a normative perspective. The characteristics of polycentric governance are then described in more detail, and the extent to which the GB energy system conforms to these characteristics is considered analytically. Following this, an evaluative and critical perspective is taken, examining the problems

[36] This is a quote widely attributed to Audre Lorde. In her 1980 Age, Race, Class and Sex: Women Redefining Difference, Lorde wrote: "Certainly there are very real differences between us of race, age, and sex. But it is not those differences between us that are separating us. It is rather our refusal to recognize those differences, and to examine the distortions which result from our misnaming them and their effects upon human behavior and expectation". It is therefore fair to attribute the widely quoted phrase as the insights of Audre Lorde, even if the precise words may or may not be hers.

with polycentric approaches to governance and how these arise in the GB energy system. Finally, the chapter concludes by considering what could happen if a polycentric governance paradigm became widespread among those involved in GB's energy system.

7.2 Definitions and background

This section discusses the definition and background of the term polycentric governance. It begins by outlining ways in which the concept of polycentric governance transcends the centralisation vs decentralisation dilemma, before going into detail in the more subtle definitions of polycentric governance developed in the Bloomington School of institutional analysis from 1972 to 2016.

The dilemma of centralisation vs decentralisation is a perennial question for political thought, and can be summarised as follows: highly centralised systems lack opportunities for participation and self-governance, whereas decentralised systems can lack the coordination needed at larger spatial scales. This can be conceptualised as an axis as shown in Figure 51:

Figure 51: Simple polarities of centralised and coordinated vs decentralised and uncoordinated

As Toqueville put it in the 19th Century, regular participation and self-governance is necessary to practice the skills of democracy.

Pahl-Wostl and Knieper (2014) escape this dilemma by separating the axes of concentration of power and coordination in their definition of polycentric systems. They define four 'ideal type' governance regimes from this axis, and argue that a polycentric system combining effective coordination with distribution of power has the greatest adaptive capacity. Adaptive capacity is important for a system undergoing transition, as the GB energy system is. This is shown in Figure 52, and compared with the mapping of the GB energy system from chapter 2, reproduced in Figure 53. The shaded boxes in the corners of Figure 52 denote the ideal-typical configurations (recreated from Pahl-Wostl and Knieper, 2014, p. 141).

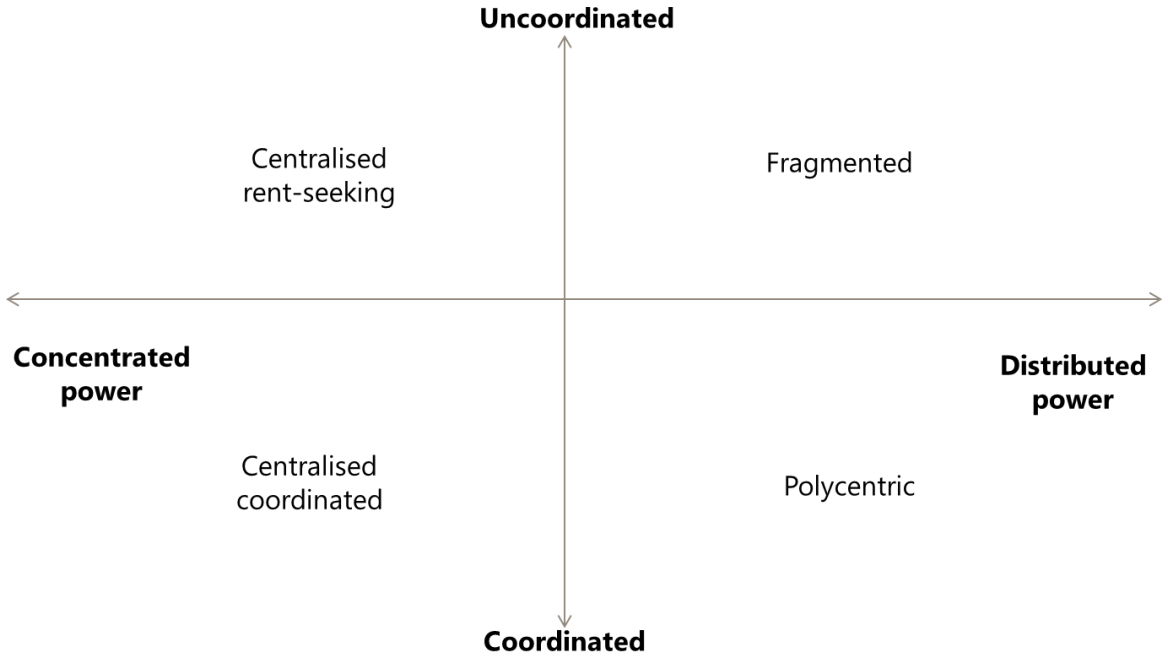

Figure 52: Categorisation of governance regimes in a two-dimensional grid of distribution of power and degree of coordination/cooperation.

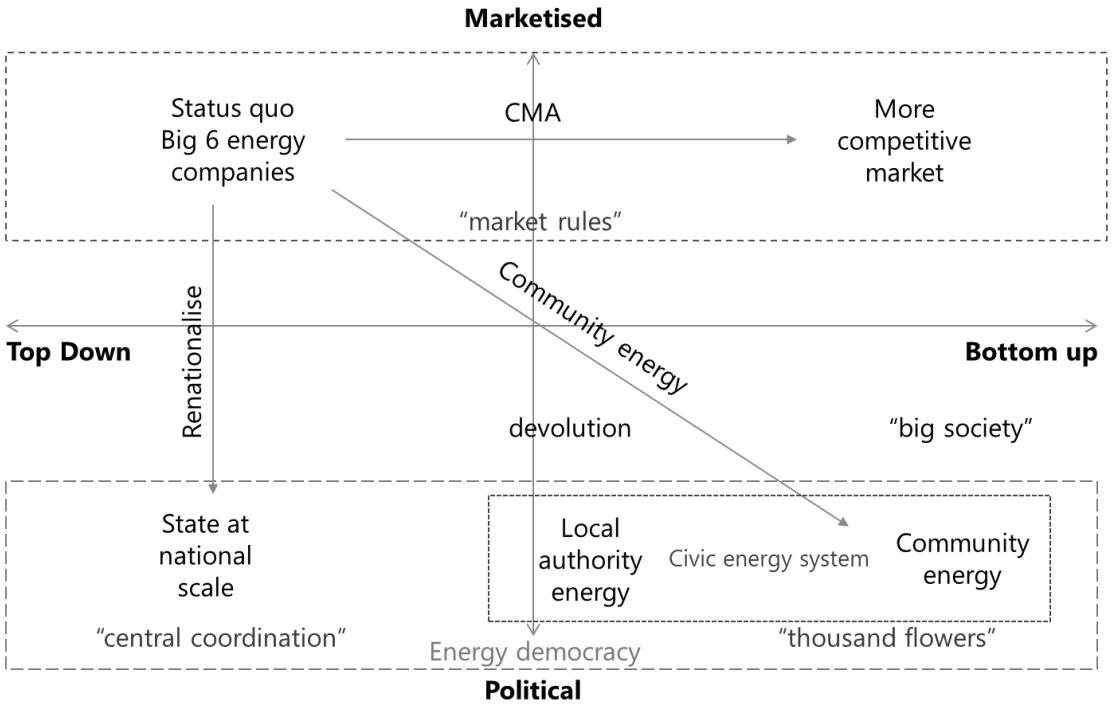

Figure 53: Marketised vs political; top-down vs bottom-up: political tensions of energy system change

Although the Pahl-Wostl & Knieper definition of polycentric governance as coordinated and distributed power is a helpfully accessible heuristic, the definitions and discussion provided by Vincent Ostrom in 1972, and by McGinnis in 2016 show a richness and complexity that is worthy of more subtle consideration.

Vincent Ostrom (1972, p. 21), gives a succinct definition of polycentric governance as:

> "A pattern of organisation where many independent elements are capable of mutual adjustment for ordering their relationships with one another within a general system of rules"

The concept of polycentric governance is central to the Ostrom tradition and Bloomington school of institutional analysis. The term 'polycentric' was originally developed by Michael Polanyi (1951, cited in Aligica and Tarko, 2012), who wrote about polycentric spontaneous order in the governance of the sciences. It has been applied to the governance of art, science, religion, law, constitutional democracy and urban studies (V. Ostrom, 1972; Davoudi, 2003; Green, 2007; Cowell, 2010; Fuller 1978, Hayek 1973 and King 2006 cited in Aligica and Tarko, 2012; Burger and Meijers, 2012). Other concepts similar to polycentric governance include: ''adaptive governance'' (Folke et al., 2005) ''polyphonic federalism'' (Schapiro, 2005) ''interactive federalism'' (Sovacool, 2008a, 2008b) ''multilevel governance'' (Bulkeley and Betsill, 2005) and ''consociational'' forms of power sharing (Lijphart, 2004) , all cited in (Sovacool, 2011), and "hybrid governance" (Meagher, 2012).

A number of scholars have considered polycentric approaches to energy governance, including Sovacool (2011, 2013) and Bazilian et al. (Bazilian, Nakhooda and Van de Graaf, 2014)[37], for a number of reasons: the liberalisation of energy markets leading to multiple private actors being involved rather than one central decision-maker; the increasing use of decentralised generation; the common pool characteristics of energy infrastructure; the fact that energy infrastructure is a sociotechnical system operating at multiple scales, and that coordination is required (Goldthau, 2014). Goldthau (2014) sets out a research agenda for further study of energy governance through a polycentric lens. Energy is deeply linked to the global commons of the climate, and Ostrom's discussions of polycentric approaches to climate change (2009a, 2010a, 2010b, 2012) make a useful contribution to a context where international agreements are slow and insufficient.

Many of the definitions of polycentric governance discussed above are under-theorised. Two papers in particular attempt to add more detail to the concept of polycentric governance. They offer more mature and complex definitions of polycentric governance systems than that of V. Ostrom in 1972. Aligica and Tarko (2012) offer a "logical structure of polycentricity" which can be used to map and compare different polycentric systems. McGinnis (2016) offers a list of six characteristics, and six common problems of polycentric governance systems. Both have valuable insights to offer, although their interpretations and emphases differ.

7.2.1 McGinnis' characteristics of polycentric governance

McGinnis (2016) describes polycentric governance as being both normative and explanatory. He identifies six key characteristics of polycentric governance, which he categorises as relating to structure (1), process (2) and outcome (3).

> "A polycentric system of governance consists of (1) multiple centers of decision-making authority with overlapping jurisdictions (2) which interact through a process of mutual adjustment during which they frequently establish new formal collaborations or informal commitments, and (3) their interactions generate a regularized pattern of overarching social order which captures efficiencies of scale at all levels of aggregation, including providing a secure foundation for democratic self-governance." (McGinnis, 2016, p. 5)

[37] This includes a comparative analysis of four case studies (Sovacool, 2011); a more detailed study of Denmark (Sovacool, 2013), and considering the potential for energy poverty reduction in sub-Saharan Africa (Bazilian, Nakhooda and Van de Graaf, 2014).

McGinnis sees polycentricity as an ideal, which can never be fully realised. He draws analogy with the ideal of a fully competitive market, which does not exist in real life, although arguing that polycentricity is a more complete theory of governance than the market.

McGinnis also identifies the following 'persistent problems' of polycentric systems:

1. Structural inequities
2. Incremental bias
3. High complexity
4. Deep structural fissures
5. Coordination failures
6. Lack of normative clarity

Many of these problems are present in the GB energy system.

7.2.2 Aligica and Tarko's logical structure of polycentricity

Aligica and Tarko (2012) also offer a deeper exploration of polycentric governance systems. Paraphrasing V. Ostrom, they define polycentric systems as "social systems of many decision centers having limited and autonomous prerogatives and operating under an overarching set of rules". As with McGinnis' definition there is a focus on multiple centres of decision-making, and mutual adjustment (limited and autonomous perogatives). However, there is a greater emphasis on rules, and less emphasis on overlapping jurisdictions than for McGinnis.

They develop a 'logical structure of polycentricity', shown in Figure 54. This has three main features: multiplicity of decision centres; overarching system of rules (which can be intuitional or cultural); and spontaneous order or evolutionary competition. Within this, they define three 'necessary conditions for polycentricity', denoted P1, active exercise of diverse opinions; P2, autonomous decision-making layers; P3, incentive compatibility: alignment between rules and incentives.

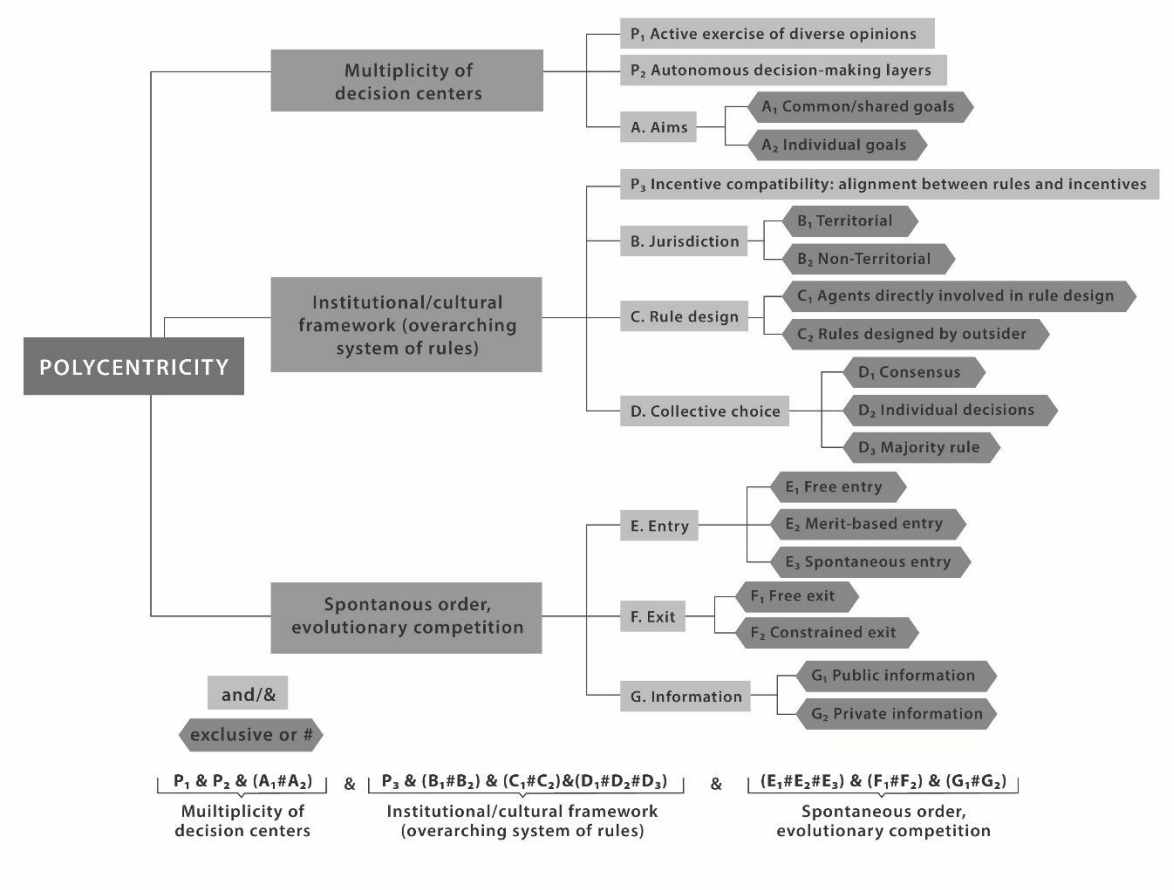

Figure 54: Logical Structure of Polycentricity, (Aligica and Tarko, 2012, p. 257)

This allows different types of polycentric governance to be categorised, and provides a logic for identifying whether a governance system is or is not polycentric. They also use the logical structure to identify different types of breakdown of polycentric systems: multiplicity of decision centres breakdowns, associated with the absence of P1, P2, or A1/A2; overarching system of rules breakdown associated with absence of P3, B1/B2, C1/C2 or D1/D2/D3; and spontaneous order breakdown associated with absence of E1/E2/E3, F1/F2 or G1/G2.

7.2.3 Comparison

It would be convenient if McGinnis' and Aligica and Tarko's approaches to understanding polycentricity were easily integrated into a single, richer understanding. However, they are structured differently, and have different emphases. The focus on 'overlapping jurisdictions' by McGinnis, and on 'overarching system of rules' by Aligica and Tarko has already been noted. The outcome of 'scale economies' does not feature in Aligica and Tarko's structure, and they see spontaneous order as main feature whereas McGinnis puts this as an outcome. McGinnis' other characteristics can all be mapped onto the various logical structure items: P1 corresponds to multiple centres of decision-making, P1 and P2 correspond to mutual adjustment, B2 corresponds to overlapping jurisdictions; A, C, D, E and F correspond to dynamic institutional relationships, and 'spontaneous order' corresponds to emergent order.

Aligica and Tarko's logical structure is more detailed than McGinnis' approach. However, this risks narrowing the options for what a polycentric system could look like. It seems that Aligica and Tarko separate the process of 'spontaneous order' from the process of creation of rules, consistent with the idea that spontaneous order is synonymous with competitive market activity, ignoring the human creation of the market. Whereas McGinnis looks for emergent order in the system as a whole, seeing the rules themselves,

which are created through collective choice processes and active design and planning processes, as part of the emergent order. Perhaps this is why McGinnis challenges Aligica and Tarko's use of the word 'spontaneous', and argues that the order does not 'just happen', but

> "a polycentric system can be described as spontaneous in only the very limited sense of not being the result of the actions of a central planner. In all other respects, it is chock full of planners and schemers, entrepreneurs of all types, actively engaged at all levels of aggregation." (McGinnis, 2005, p. 169)

Additionally, McGinnis is more critical of markets, which he sees as providing an incomplete picture of a polycentric system. This is important, in a context where the neoliberal ideology pushes for 'depoliticisation' of energy, with the idea that the market should be left alone to deliver all of our needs. McGinnis puts the limitations of markets as follows:

> "To me, this suggests that a competitive market can be interpreted as a special, actually degenerate, case of polycentricity, one which allows for only a limited range of interactions, namely, mutually beneficial contracts and trades shaped by the price signals reflecting relevant levels of supply and demand. In effect, the parties in a market are engaged in mutual adjustment, via prices. It would, of course, be possible to take a broader perspective and to include the public actors responsible for the production and maintenance of the public goods (protection of property rights, legal system, currency, etc.) upon which market actors routinely rely in making their exchanges, but, for most analytical purposes, only voluntary exchanges are allowed in market systems. From this perspective, a market is a polycentric system reduced to a single dimension, a single form of interaction." (McGinnis, 2016, pp. 18–19).

McGinnis's framework will be used as the primary approach for understanding the extent to which the GB energy system is currently polycentric, and the problems of polycentric governance. Aligica and Tarko's logical structure will be used to add detail where appropriate, and to discuss the benefits of polycentric governance.

7.3 Benefits of polycentric governance

Polycentric governance systems are contrasted with 'monocentric' systems. A pure monocentric system would involve a complete monopoly of power, so any valuing of democracy, decentralisation and participation involves a degree of polycentricity.

Many of the benefits of polycentric governance systems are shared with markets. These include free entry and exit, enabling creativity and innovation, and distributed and direct expression of preferences, enabling the full complexity of different people's preferences to be visible in a way that would overwhelm a centrally planned economy. However, the polycentric governance paradigm is broader than the market paradigm, and can provide a useful way of retaining the benefits of markets without relying on profit motives or price mechanisms.

A polycentric governance system, at its best, can have many of the benefits attributed to markets, whilst making space for mechanisms of voice and motivations beyond the narrow self-interest of 'homo economicus', and making the institutions that create a market more visible.

Similarly to markets, a polycentric system allows the varied preferences of individuals to be expressed directly, through 'active exercise of opinion', (Aligica and Tarko, 2012) which means an opinion that is not just stated, but is implemented in some way. This is redolent of Freidman's claim that leaving a school is a more direct expression of dissatisfaction than speaking about what is wrong, which Hirschman derided (see

footnote 23). In a market, expression of preferences takes place through purchasing decisions, and judgments about price and exchange value. A market gives more weight to the preferences of those with more money. A polycentric system, in contrast is more open in recognising the diversity of individual preferences, and the complexity of individual motivation, as it can make use of the mechanism of voice in addition to the mechanism of entry/exit. This enables preferences for collective action to be expressed, and the strength of preferences of those with less money to be heard.

A polycentric system supports human creativity, freedom, ingenuity, individuality, without assuming that either markets or anarchism are the answer. The mechanism of 'entry' allows innovators to test new ideas in practice, without needing to first persuade others that they will work. This enables greater learning by trial and error than might be possible in a consensus-based deliberative commons institution. In complex situations where outcomes are unpredictable, this openness to experimentation can provide resilience. Polycentricity was described by Polanyi in the context of the scientific process. Scientists share a commitment to the ultimate objective or ideal of truth, but as the nature of truth is unknown reaching it means allowing many different explorations to take place at the same time, in real life, not just as proposals. The overall outcome of advancing scientific knowledge is emergent from the diverse efforts of the individual scientists, each of whom is focused on their own task, and none of whom can see the potential broader-reaching outcome of their work. In this way, the polycentric system works through an 'invisible hand' which does not take the market as its only mechanism.

A polycentric system may achieve scale economies, by allowing scales to be matched to the activity in hand. However, there may be higher transaction costs. McGinnis argues that "these higher transaction costs … are likely to be offset by the higher benefits of public satisfaction with the quality of the public goods and services to which they have access, and to which they often contribute in direct and meaningful ways." (McGinnis, 2016, p. 3). Indeed, transactions in a polycentric system may not necessarily be viewed as costs, as they may be valued as enjoyable interactions, or as building relationships of reciprocity in a community which are part of its social capital, and thus a form of wealth.

The dispersion of decision-making capabilities associated with polycentricity can make it difficult to identify who is responsible for unsatisfactory results, leading to a lack of accountability (McGinnis, 2016, p. 3). On the other hand, this dispersion also "allows for substantial discretion or freedom to individuals and for effective and regular constraint upon the actions of governmental officials" and as such is an essential characteristic of democratic societies (V. Ostrom 1972).

The rule of law is a core element of polycentric governance. This means that decisions are made according to agreed rules, rather than through use of coercive power. Polycentric governance is thus seen as essential for preserving values of 'liberty' and 'justice' (Aligica and Tarko, 2012). Polycentric governance, as a rules-based system without any monopoly of legitimate force can be seen as overlapping with peaceful and rule-based forms of anarchism (Aligica and Tarko, 2012).

In summary, polycentric governance systems can enable the expression of diverse individual preferences through a dispersed process. They can support innovation, by allowing individuals or groups to create new initiatives and test new ideas, which may prove to succeed or fail. The absence of any monopoly of legitimate use of force supports freedom. These are benefits that are claimed of markets, but which can be achieved through polycentric governance systems without relying on competition or 'rational economic' selfish behaviour, and allowing direct, voice-based communication.

7.4 The value of polycentric governance theory in understanding the roles of CE and LAs in GB's energy transition

In the commons section, the research question "how do theoretical frameworks of commons and polycentric governance contribute to understanding the roles of CE and LAs in GB's energy transition?" was addressed by asking whether energy should or could be considered a commons. This hypothetical and normative approach was taken because energy is currently primarily organised through market institutions, rather than as a commons. The extent to which CE and LA energy initiatives are governed as commons is discussed in (Melville, no date), reproduced in Appendix 3.

This chapter addresses the second part of that question, considering the value of polycentric governance theory for understanding GB's energy transition. Here a different approach is taken, beginning by asking to what extent the current GB energy system is polycentric, based on McGinnis' six characteristics of polycentric governance. It then asks in what ways the common problems of polycentric governance are present in the governance of GB's energy system.

As the case studies in this thesis primarily focus on local level activities, this chapter particularly focuses on national scale regulation of the energy system. This is the context in which local energy sector activities take place, and the polycentric lens includes considering the interactions of the local and the national scales.

7.4.1 The characteristics of polycentric governance in GB energy governance

This section draws on McGinnis' (2016) description of the key characteristics of polycentric governance to test its explanatory power with reference to GB's energy system, using the analytic mode of the concept of polycentricity. The question asked in this section is 'to what extent is the GB energy system currently polycentric?' Each of McGinnis' six characteristics is addressed in turn.

7.4.2 Multiple centres of decision-making

The first characteristic, which McGinnis classifies as structural, is that of having multiple centres of decision-making, which he also calls 'centres of authority' or 'decision units'. Each interacts with others, and is partially autonomous.

> "There exist multiple centers of decision-making authority (or decision units), each sufficiently autonomous to be able to make collective decisions for explicitly organized or latent groups whose members share at least some common interests" (McGinnis, 2016, p. 5).

There are multiple centres of decision-making in the GB energy system, some of which exhibit a variety of different characteristics described by McGinnis. For example: the government department for Business Energy and Industrial Strategy (BEIS), energy supply companies; consumers; the energy system regulator Ofgem; CE groups; RE trade bodies; DNOs; the National Grid; and generators. Some make decisions on behalf of others, such as BEIS which develops policy and thus sets the rules under which others must operate. Others make decisions autonomously about their own actions, but are responsive to the decisions of others. For example, energy supply companies compete in the retail market and set prices autonomously, but with awareness of prices set by competitors.

For McGinnis, the multiple centres of decision-making are conceived of as decision units made up of groups of individuals. These groups, rather than the individuals of which they are formed, constitute the main unit of analysis, although it is considered that agency ultimately lies with individuals. This is true to the Ostroms' mixed approach to methodological individualism.

Individuals may be part of several different decision units, where they have "partially shared interests" (McGinnis, 2016, p. 6) with others within the group, but may disagree on other matters. This combination of

some shared interests with acceptance of some disagreement is compatible with an agonistic approach to democracy, as discussed in chapter 1. In the GB energy system, the same individual may be a consumer, an employee of an energy charity and a volunteer in a CE group, or part of a government department on secondment and a longer term employee of a large energy company, thus participating in several different decision units.

A system may also have latent groups which could become active, and which need to be considered in analysis. McGinnis argues that "no polycentric system of governance can be fully understood without acknowledging potential groups that remain latent" (McGinnis, 2016, p. 6). Although consumers are individual decision-makers in the energy market, they are not a decision unit, but could become one if they were to organise into a group. On the other hand, they are taken into account as a group by the regulator, which has a duty to protect their interests, and by energy supply companies who compete for their custom.

7.4.3 Overlapping jurisdictions

The second characteristic of a polycentric governance system is that the decision units

> "have overlapping jurisdictions (or areas of responsibility)." (McGinnis, 2016, p. 5)

In the GB energy system, the extent to which decision units have overlapping areas of responsibility is mixed. Energy supply companies may supply customers in any part of the country, and compete for their custom. They therefore do have overlapping jurisdictions in terms of territory. DNOs, however, each have responsibility for one region, and do not overlap with each other in terms of territory. However, for McGinnis, the overlapping jurisdictions are defined more broadly than simply by territorial boundaries, and can be defined "in functional or other terms" (McGinnis, 2016, p. 7). He considers that "two jurisdictions overlap when they share some of the same people, resources, or institutions in common" (McGinnis, 2016, p. 7). DNOs and the National Grid are both concerned with regulating the frequency and voltage of the electricity system[38], and both generators and consumers also affect these power quality factors, which are a shared resource. The rules of the energy system, or energy industry codes, are developed by the parties to the code, which include representatives of each of these groups, thus several decision units have institutions in common. They can therefore be seen as having overlapping jurisdictions.

At the local level within the GB, many types of organisation are concerned with the development of RE and energy efficiency, including the local government, private sector, charity sector and community organisations, another form of overlapping jurisdiction.

These two first characteristics, of multiple centres of decision-making and overlapping jurisdiction, are 'structural' factors. If both are present in a governance system, McGinnis would class this system as fragmented, but not necessarily polycentric, perhaps representing the right hand side of Pahl-Wohstl and Knieper's diagram (Figure 52), where power is distributed, whether coordinated or uncoordinated.

7.4.4 Mutual adjustment

The next two characteristics of polycentric governance are questions of 'process'. For the first of these, the centres of decision-making:

[38] If the Distribution Network Operators (DNOs) are converted to Distribution System Operators (DSOs) as is proposed, this would lead to even greater overlap in the jurisdiction of frequency and voltage with the National Grid (BEIS and Ofgem, 2016)

> "interact with each other through a process of mutual adjustment (which is limited in the sense that it rarely requires the complete submission or conversion of all parties to a uniform standard of behavior)" (McGinnis, 2016, p. 5)

These processes of mutual adjustment take place through behaviours of "competition, negotiation, contracts, joint production, coordination and dispute resolution" (McGinnis, 2016, p. 9, citing Ostrom, Tiebout and Warren 1961). It is a 'partisan mutual adjustment' process where groups respond to each other whilst protecting their own interests (McGinnis, 2016 citing Lindblom, 1965). In the GB energy system, mutual adjustment takes place at many spatial and temporal scales. For example, the electricity wholesale market makes use of both competitive market mechanisms and negotiated rules. The industry codes clearly define what each decision unit must do to maintain the shared resource of regulated voltage and frequency. The grid code, for example, specifies the rules by which generators increase or decrease their generation during a half-hour 'settlement' period, in response to requests from National Grid, including a competitive bidding process and price mechanism (National Grid Electricity Transmission plc, 2013). On a longer temporal scale, the regulator Ofgem consults with industry when developing new regulation, and adjusts to information received through this process, and industry complies with regulation from Ofgem. This is not a fully mutual adjustment, as Ofgem can enforce compliance whilst it does not have to act on consultation responses. Arguably, this may involve 'conversion of all parties to a uniform standard of behaviour', and therefore may not comply with MgGinnis' definition of a polycentric system.

The focus on the process of everyday mutual adjustment as a core political process is very different to the large-scale electoral politics that are the focus of much political discourse. For McGinnis, governance is embodied in our day to day existence:

> "Much of our political discourse (and academic work in political science) obsesses on elections and lobbying and campaign contributions, but most real policy outcomes emerge from other processes, undertaken by other kinds of actors, especially by citizens themselves. In short, government is not some kind of *disembodied* force imposed on us from above; instead it IS us, since processes of governance are constructed out of the tools that we and others have devised to help us address practical policy problems and to realize our shared aspirations." (McGinnis, 2016, p. 8 italics added)

This perhaps echoes some of the feminist emphasis on the politics of the everyday, the idea that 'the personal is political' (Hanisch, 1969) . It also has a strong resonance with the Ostroms' emphasis on the development of institutions as a craft, requiring skills and responsiveness to the organisational context analogous to the embodied practice of working in relationship with a material, rather than with abstractions. However, it is perhaps an idealised view, which does not interrogate who the 'us' are whose actions effect policy outcomes. Inequalities, unearned privilege, and intersectional oppressions also need to be considered in the context of the tools we use to solve policy problems.

Mutual adjustment is, at its core, about relationships. It is an ideal of relationship between equals, where both parties adjust to each other. In the context of organisational theory, Ladkin (2010) and Laloux (2016) attempt to understand processes of mutual adjustment in a grounded way. Ladkin theorises leadership as taking place in moments of relationship between people, and moving from one person to another as their skills and experience and the context require. Laloux describes an "advice process" of decision-making in "re-imagined" organisations, whereby individuals in a team are empowered to make decisions autonomously, but expected to listen to others first. Relationships between organisations are not necessarily the same thing as relationships between people, but take place primarily through interpersonal relationships of their members, as well as through more formal contracts and rules of interaction.

In practice, achieving equality in a relationship is not easy, particularly in contexts where hierarchy is the norm. The principle of subsidiarity ensures that in a case of ambiguity, the smaller decision-unit takes

precedence. Given existing inequalities, this may be a more effective way of recognising and compensating for the advantages of larger or more powerful parties than pure mutual adjustment.

7.4.5 Dynamic institutional relationships

In a polycentric process, during mutual adjustments, centres of decision-making

> "frequently establish new formal collaborations or informal commitments (in order to address common problems and/or realize shared aspirations)." (McGinnis, 2016, p. 5)

This is enabled by processes of collective choice and rule design, and free entry and exit identified by Aligica and Tarko (2012).

In the GB energy system, community and independent actors do develop collaborations, but the scope of their actions is limited by the regulation and the energy industry rules. The parties to the codes collaborate with each other in code modification processes overseen by code panels. At the same time, their collaboration in the market is limited by regulation which enforces competition. New entrants to the market, and CE groups and local authority energy initiatives which fall outside of the formal codes governance process, also create shifts in relationships in the energy system. However, these have limited power to change the codes themselves.

McGinnis discusses dynamic institutional relationships under the heading of 'institutional diversity'. Ostrom et al. (1999) see institutional diversity as valuable, because developing effective rules for use of a resource is always a process of trial and error, and diversity in a linked system means that several different institutional experiments are running at the same time and learn from each other. A polycentric system both creates and needs diversity of institutions, cultures and values. Dealing with this diversity involves skilful agonistic governance, which relies on some shared values but also embraces heterogeneity. In practice the insights of Audre Lorde are pertinent here "It is not our differences that divide us. It is our inability to recognize, accept, and celebrate those differences."[39]

7.4.6 Emergent order

The final two characteristics of polycentric energy systems relate to their outcomes.

> "Their interactions generate a regularized pattern of social order (which either emerges spontaneously or involves some level of coordination);
>
> > a. This social order reinforces the continued operation of the overarching system of law (or more broadly a shared repertoire of institutions, including laws, rules, norms, and shared understandings),
> >
> > b. And yet this social order nonetheless supports relatively separable subsystems within which diverse groups live under different cultural understandings and norms," (McGinnis, 2016, p. 5)

This values both homogeneity and heterogeneity in culture and values, recognising that both are necessary.

The GB electricity system is highly ordered. It operates under a system of rules, which are written down in the energy system codes and other regulations, and these direct the activities of all of the actors in the system, from the National Grid to the consumers. One could identify a number of 'relatively separable subsystems' within the energy system, for example the gas and electricity systems. The gas system and the electricity

[39] See note 36.

system share few codes. The infrastructures are physically separate, and interact mainly where gas is burned to produce electricity. Within the each of the gas and the electricity systems, the different licence types share multiple codes, as one role of the codes is to regulate the interactions between the different roles within the electricity or the gas systems. There are not obviously 'different cultural understandings and norms' through the system, however, as shared regulatory principles of competition, non-discrimination and cost reflectivity (Lockwood *et al.*, 2015) operate throughout the codes and regulation. The rules are generally uniform throughout the country. On this measure, therefore, the GB electricity system is only partially polycentric.

However, the CE sector and the local authority energy system are beginning to form an emergent polycentric system of local energy transition. These share values of "regional economic development, fuel poverty reduction, energy system decarbonisation and self-governance/self-determination" (Hall, Foxon and Bolton, 2015, p. 11), a different set of cultural understandings and norms to those of the regulated energy industry.

7.4.7 Scale economies

In addition to a system of rules and pattern of social order, a polycentric system

> "supports outcomes that capture efficiencies of scale at all levels of aggregation, including sustaining capacities for self-governance (which includes protection of individual liberty, significant autonomy for minority groups, and effective forms of cooperation at the level of the broader society)" (McGinnis, 2016, p. 5)

Part of the argument here is that different goods and services are best provided at different scales. Scale economies does not necessarily mean that bigger is better or more efficient, but that it is a question of finding the right scale for the particular activity taking place. Different GB sustainable energy system outcomes are best addressed at different scales. Insulating of buildings to make them more energy efficient, for example, requires detailed attention to the idiosyncrasies of each building and the requirements of its occupants, and is not likely to be more efficient at a larger scale. Manufacturing insulation materials, and developing supply chains for these materials, on the other hand, is more efficient at a larger scale. In practice, initiatives such as the Green Deal have favoured large scale insulation approaches, rather than making full use of smaller scales where appropriate.

In the electricity sector, national and international interconnection allows reliability of electricity supply to be achieved with much lower generation and storage costs than would be needed for local isolated electricity systems. This is because it makes use of diversity of time of demand, and diversity of time of generation in different geographical locations, as well as economies of scale associated with some forms of generation. However, there are also opportunities for cultural shifts in demand patterns, local generation, and local balancing that are not being realised. Local energy markets (Cornwall Energy, 2015) are being trialled in some innovative projects but are not generally possible under current regulation. Additionally, some scale economies are primarily associated with concentration of activity rather than pure size. For example, electric cars work well in a locality which has a high density of charging points.

On the other hand, "there is no reason to preclude the possibility that individuals or communities living within polycentric order might trade off economic efficiency for other goals, such as clarity, accountability, fairness, or physical sustainability" (McGinnis, 2016, p. 13). Transaction costs of a local, democratically accountable energy organisation that supports widespread participation may be greater than the current centralised one, but the value of participation may make it worth the compromise in economic efficiency. In addition, democratic skills need to be learned (Toqueville, 1838; Dobson, 2014), and local decision-making may be a good way to enable this. The neoliberal economic and political paradigm does not allow citizens to make this kind of trade-off, but rather assumes that economic efficiency is always the primary or only goal.

7.4.8 Summary

This section has assessed the extent to which the GB energy or electricity system fits with each of McGinnis' characteristics of polycentric governance. Overall, there is no characteristic where the GB electricity system perfectly fits. However, there is a reasonable amount of fit with the structure characteristics, a moderate fit with the process characteristics, and limited fit with the outcome characteristics. This is shown in Table 10, where the paler cells represent good fit, and darker cells less good fit.

Table 10: Fit of the GB electricity system with McGinnis' characteristics of polycentric governance

McGinnis' characteristics of polycentric governance		**GB electricity system fit**
Structure	Multiple centres of decision-making	Yes, but some are more powerful than others
	Overlapping jurisdiction	Yes, in some cases
Process	Mutual adjustment	Yes, but some actors more powerful than others so not fully mutual
	Dynamic institutional relationships	Yes, within the codes system, but slow-changing
Outcome	Emergent order	Order, but not very diverse or emergent
	Scale economies	Very restricted ability for local electricity development

There are many ways to interpret this analysis. If the GB energy system is structured as polycentric, but is not achieving the outcomes of emergent order and scale economies, does this mean it is suffering the 'worst of both worlds'? Does this mean that there is room for improvement towards the polycentric ideal? Or that the polycentric features should be removed and replaced with a simple hierarchical structure? Does this mean that the polycentric lens is an appropriate one for exploring the GB energy system?

Ultimately, perhaps a core test for a polycentric political system is that

> *"No one office or decision structure has an ultimate monopoly over the legitimate use of force in a polycentric political system"* (McGinnis, 2016, p. 8, citing Vincent Ostrom (Ostrom [1972] in McGinnis 1999: 54, 55; italics in original)).

In principle, one could say that the UK parliament has got 'an ultimate monopoly over the legitimate use of force' in the GB energy system, as it can pass bills and acts which the wider system of rules and practices of the energy industry must ultimately comply with. In theory, parliament itself is accountable to the electorate. In practice, energy industry incumbents have important lobbying power, particularly through working with civil servants on energy policy development.

7.5 Persistent problems of polycentric governance in GB energy governance

This section will take a normative perspective. It considers the perceived benefits of polycentric governance, as well as the 'persistent problems' and potential remedies identified by McGinnis in relation to the GB energy system.

7.5.1 Structural inequities

Some groups find it easier to organise themselves and act effectively within a polycentric system than others. In particular it is more difficult for large, heterogeneous and geographically dispersed groups to organise effectively (McGinnis, 2016, p. 16, citing Olson 1965). This may mean that smaller, more homogeneous groups dominate the dynamics of the system as a whole, as they are easily able to coordinate with each other and promote their own interests. One way that this inequity can be addressed is to reduce the 'transaction cost' of organising and coordinating actions (McGinnis, 2016, p. 16). Social media and other digital communications can play a role in this.

The CE sector in the UK, and the rhetoric of 'big society' employed by the 2010-2015 UK government, both provide some opportunity for greater participation and a more polycentric system. However, setting up effective CE groups is much easier for communities with financial resources, social capital, business and technical experience and knowledge, and time to spend on voluntary work (Catney *et al.*, 2014; Johnson and Hall, 2014). CE support services, funding and low interest loans can help to address this. Similarly, the big six energy companies are much more able to participate in modifying the energy industry codes than smaller suppliers (Lockwood *et al.*, 2015). Both of these lead to structural inequities.

Supporting those groups or individuals who have higher 'transaction costs' of organising is one useful way of addressing structural inequalities, although this does not remove the need to address underlying social inequalities themselves. A more equal society has much greater potential for equal democratic participation.

7.5.2 Lack of normative clarity

McGinnis describes the problem of 'lack of normative clarity' in situations where different groups or individuals have conflicts of interest, or act to the benefit of their own interests rather than for the benefit of society as a whole. The groups whose interests dominate are likely to be those who have advantages in organising collectively, as described under the heading 'structural inequities'. Mechanisms to protect the interests of those with less collective power in the polycentric system are needed to balance this (McGinnis, 2016, pp. 21–22).

Clarity over the macro objectives of society is a complex matter, where self-interest may be hidden behind a rhetoric of universal values. Measures of progress which take no account of distributional impacts, such as GDP, profit, or simplistic economic efficiency, are presented as being for the overall good of society, whereas they can mask dynamics of growing material inequality. Alternative measures of progress, such as wellbeing or happiness attempt to unsettle this hegemony, and measures that explicitly include measures of inequality (Cobham, 2013; New Economics Foundation, 2014) make the distributional dynamics visible.

In relation to the GB energy system, the elements of the 'trilemma' (DECC, 2014) of environmental sustainability, affordability, and reliability/security are in tension with each other, and there is also lack of normative clarity about what each of them means, as discussed in Chapter 2. Distinguishing between normative debates that are about the unjust interests of different individuals or groups, and normative debates that are about valid individual preferences, is not easy, and this uncertainty is used by all sides in political debate.

7.5.3 Incremental bias

McGinnis sees polycentric systems as changing incrementally, rather than being able to make big changes easily. Polycentric systems are therefore sometimes criticised for being conservative, although they are continually changing in small ways. This incrementalism is partly because of the large number of actors who have veto power, and can create an inability to make substantial changes when needed the entrenched power of the incumbents and barriers to entry for new entrants, (McGinnis, 2016, pp. 16–17).

This description fits very closely with the criticism of the GB energy industry codes made by Lockwood et al. (2015), without any reference to the term 'polycentric governance'. They argue that the current system is unable to innovate sufficiently for a sustainable energy transition, partly due to historic restrictions on the ability of the regulator, Ofgem to propose modifications to the code directly and take control of strategic changes[40]. At the same time, the codes are changing incrementally all the time: "For example, there have been 241 proposed modifications to the CUSC since 2001, and 327 to the BSC since 2010. The UNC has been updated 275 times since 2005." (Lockwood *et al.*, 2015, p. 20).

McGinnis suggests that to avoid incremental bias, a polycentric system needs to ensure that entry, exit and switching are easy, and that incumbent power is limited. The 2016 Competition and Markets Authority review of the GB energy industry aims to ensure free entry and exit to the market (Competition and Markets Authority, 2016), which can reduce incumbent power, although Lockwood et al. (2016) argue that their remit was too limited.

7.5.4 High complexity

Polycentric governance systems tend to become increasingly complex, as people add new rules and ways of making changes. Although participation is supported by the openness to people adding their own ideas to the "institutional repertoire", if it gets too complex, they could get "immobilized by confusion", leading to a barrier to participation (McGinnis, 2016, p. 18).

This is seen in the rules of the GB energy system, where the energy industry codes run to a total of 10,000 pages (Lockwood *et al.*, 2015, p. 18), and the complexity creates a severe barrier to participation:

> "It also appears to be the case that many even in the large incumbent actors struggle with the complexity and burden of codes, and there is a view that the process is in practice dominated by a few highly skilled individuals who have developed in-depth knowledge of codes and governance processes over many years, surpassing that even of code administrators, let alone that of the regulator or government." (Lockwood *et al.*, 2015, p. 32)

McGinnis' description of the tendency for polycentric systems to ever-increasing complexity suggests that this complexity may not be strictly necessary for the effective functioning of the energy industry under a market, but may be the result of historical processes of adding to the 'institutional repertoire'. At the same time, this complexity may be seen as functional and useful to the incumbents, who have an oligopoly of skills in negotiating the complex system, and thus gain power from the complexity.

7.5.5 Deep structural fissures

The ideal of a polycentric system is holistic. There is polycentricity in each subsystem, and these subsystems are connected and interact with each other. McGinnis identifies several different 'subsystems' within a polycentric system of overall governance, including economic, political, legal, scientific-technological, social and cultural. Energy could be seen as one such subsystem. He also identifies different dimensions or forms of interaction, including voluntary exchange (markets) and obedience to authority (bureaucracy). One could also add 'mutual agreement' or 'deliberative discussion' to this list. The fact of being limited to "a single dimension of permissible interactions", i.e. exclusively acting through obedience to authority, or exclusively acting through voluntary exchange, limits the polycentricity of the system. Separation between bureaucratic, market and democratic systems of decision-making can be seen as a deep structural fissure.

[40] This is subject to reforms as part of the 2016 Competition and Markets Authority review, discussed in Lockwood et al. (2016).

Another type of deep structural fissure exists when one part of the system is isolated from another, or becomes captured by one authority such as a hierarchical sovereign or a monopoly. Connections between different subsystems can mitigate the risk of complete monocentric capture of any other part of the system and achieving total hegemony. In practice, total hegemony of a monocentric system is as unattainable a governance pattern as is a fully polycentric system (McGinnis, 2016, pp. 18–20).

In the context of sustainable energy, there are fissures between the subsystems of climate policy and the energy policy; the interests of incumbent fossil fuel companies and the wider global interests in relation to climate change; the interests of fossil fuel companies and local environment, the health impacts of fuel poverty and investment in healthy housing, the health impacts of poor air quality and the car industry and transport policy. For example, the energy industry codes aim to be 'cost reflective', but the cost of climate change or air quality is not included in the calculation.

Similarly, there are fissures between the modes of interaction of market principles of 'cost reflexivity', and a needs-based approach to ensuring universal access to basic energy services.

However, as McGinnis says, where there are deep structural fissures, there is an opportunity to make connections. Connections, for example between energy and climate, and between energy and health dimensions are being made by many people, leading to positive outcomes.

7.5.5.1 Deep structural fissures and coordination in the Bristol case study

In the Bristol case study, the emergent CE sector, which has matured into BEN, is an example of a polycentric governance system with multiple centres of decision-making, overlapping jurisdictions, mutual adjustment, emergent order, dynamic institutional relationships and scale economies. The LA, which is primarily a top-down hierarchical organisation, does not fit the image of polycentricity so easily, although there is some mutual adjustment as different departments coordinate and discuss with each other. These local organisations are part of a wider national energy system, with a polycentric system of energy industry codes, and a hierarchic set of national energy governance organisations in the form of parliament, DECC/BEIS and Ofgem. BCC (Bristol City Council) is a hierarchical organisation that is accountable to parliament as well as to the local electorate. It has energy initiatives of its own, and the energy services team has a relationship with BEN. These organisations are shown in Figure 55.

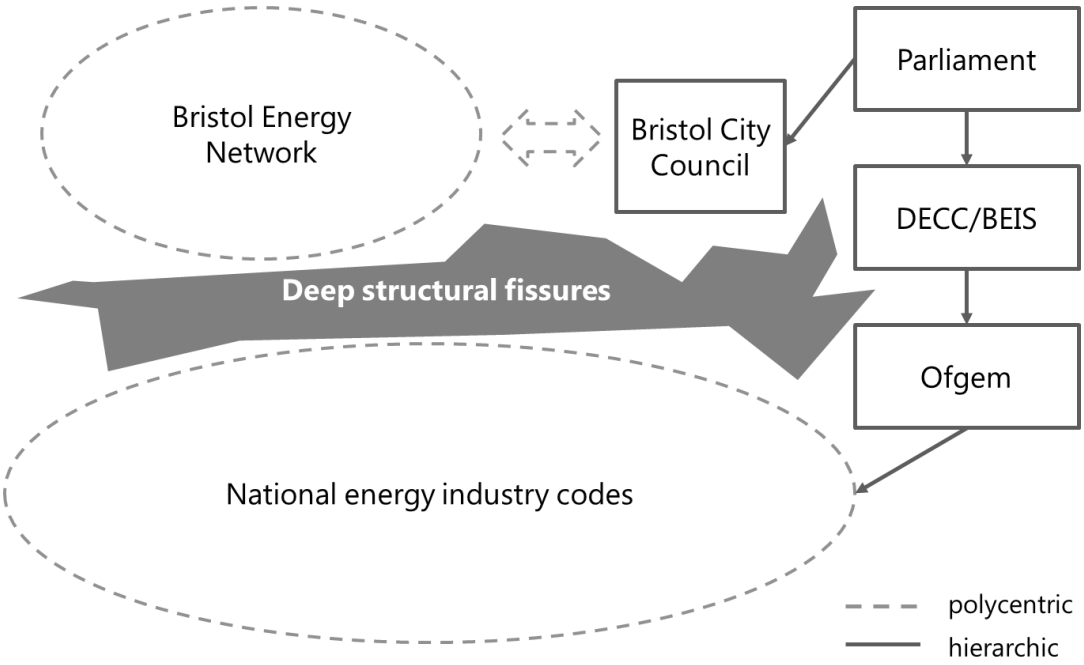

Figure 55: The Bristol and national organisations involved in energy development

This system has a problem of deep structural fissures. There are two separate polycentric systems: BEN, and the national energy industry codes, which do not have any direct relationship with each other, and a tenuous indirect relationship. The national regime of energy industry codes, and Ofgem licences constrain the scope of local action. However, local actors are increasingly coordinating with each other, and building institutional power that can challenge the power of the codes and licences.

In setting up Bristol Energy, BCC has created a potential link that addresses this 'fissure'. As a fully licensed energy supplier, the Bristol Energy can participate in modifications to the energy industry codes. It is wholly owned and accountable to BCC, which has local economic and social objectives. It is also starting to build relationships with BEN. This is shown in Figure 56.

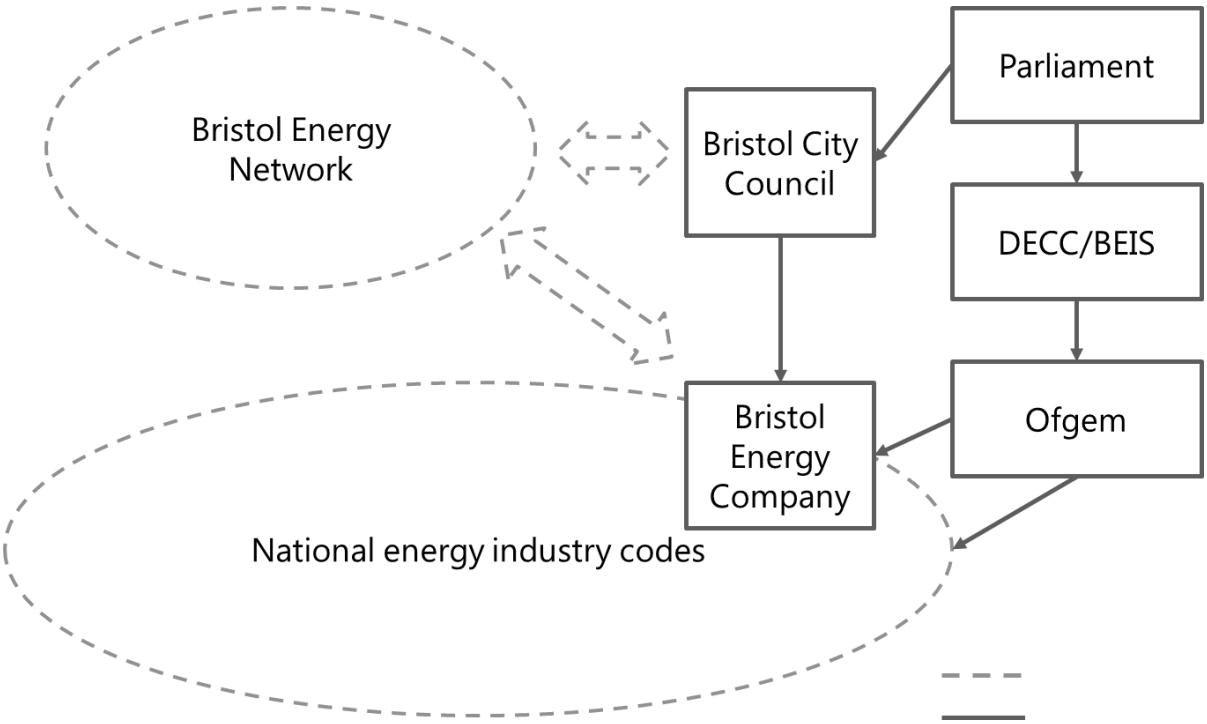

Figure 56: Polycentric and hierarchic actors in Bristol's energy transition, in relation to the national energy system

Additionally, the regional utility companies Western Power Distribution (electricity) and Wales and West Utilities (gas) are parties to the codes, and can build local relationships with the CE sector. These organisations are therefore well positioned to bridge between the local transition polycentric system and the national codes polycentric system, and overcome the deep structural fissures.

McGinnis describes tensions that exist in a mixed polycentric/non-polycentric system. He suggests that "it might be productive to consider the extent to which a polycentric system of order is, or is not, supported by similarly polycentric structures in the subsystems associated with economic, political, legal, scientific-technological, and social activities." (McGinnis, 2016, p. 18). Where subsystems are strongly connected with each other, they can provide checks and balances to each other, for example a market that becomes monopolised by one company might be challenged by a polycentric civil society. He also notes that when these links are not made, this results in the problem of deep structural fissures.

For the local polycentric energy system to fully function, BCC, Bristol Energy, WPD and WWU need to be an integral part of it. However, their roles as part of hierarchic and incumbent polycentric system may limit their ability to fully, openly participate. At the same time there is a tension between the polycentric systems and the hierarchic systems, which do not easily coexist, resulting in ambiguities such as the dilemma in how to allocate BCC roofs for solar discussed on p200. Reflecting this analysis back to key stakeholders could provide a framework that validates coordinating activity and supports the will to overcome the existing structural fissures.

7.5.6 Coordination failures

Inadequate coordination is one of the most frequent criticisms made of polycentric systems, as discussed at the start of this section. Pahl-Wostl and Knieper (2014) consider coordination to be part of the definition of polycentricity, categorising uncoordinated decentralised power as 'fragmented' rather than polycentric. McGinnis sees coordination itself as a collective good which needs to be provided through acts of leadership and public entrepreneurship. This is part of his argument that the order of a polycentric system is not

'spontaneous', as it requires active work. It is important to value the work of coordination, as discussed in relation to the CEI and Zero West case studies.

In a local energy system, there are many opportunities for coordination, for example, the 'boilers on prescription' study in Sunderland (Burns and Coxon, 2016) coordinated energy saving with health outcomes, where doctors are able to prescribe an energy efficient boiler to low-income households with pulmonary diseases, improving health and wellbeing and reducing healthcare costs, as well as improving energy efficiency of heating and reducing fuel bills. Achieving this involved understanding the metrics used by clinical commissioning groups in order to measure benefits. Similarly, the Centre for Sustainable Energy (2014) coordinated with healthcare professionals to identify households in fuel poverty with children who have respiratory illnesses such as asthma. They provide specialised energy advice to these households. This type of coordination can be very effective, but it is only possible if the work of coordinating is recognised and resourced.

The plan to roll out smart meters in GB through suppliers, rather than via geographically specific networks in local areas, misses an opportunity for local coordination with community groups and service providers who could support consumers to make best use of the new meters to manage their energy consumption (Centre for Sustainable Energy, 2015c).

7.5.7 Summary

Overall, McGinnis states that polycentric approaches to governance have some advantages and some disadvantages. On the downside, polycentric systems can have higher transaction costs, and less accountability, as it is less easy to see who is responsible for a decision. On the other hand, they can lead to greater satisfaction with the final outcomes, and enable people to contribute to public goods and services. They can also achieve scale economies by allowing different activities to be carried out at different scales.

The discussion of the persistent problems of polycentric governance in the GB energy system above takes a pragmatic approach of understanding the weaknesses of a polycentric system and considering ways to mitigate their impact, rather than taking a black and white comparative approach to evaluating polycentric governance. This can help us to see beyond simplistic market vs state debates. Many of these weaknesses are visible in the GB energy system, with the incremental bias and high complexity particularly well-documented in the energy industry codes by Lockwood et al. (2015). McGinnis' discussion of potential remedies to these perennial problems provides a framework for exploring solutions that retain the benefits of a polycentric system, as alternatives to solutions which make the system more monocentric.

Table 11: Persistent problems of polycentric governance in the GB electricity system

Persistent problems of polycentric governance	**GB electricity system**
Structural inequities	Fuel poverty, incumbent power, barriers to market entry
Incremental bias	Yes – well documented by Lockwood et al. in relation to energy industry codes
High complexity	10,000 pages of industry codes
Deep structural fissures	Climate and energy somewhat separate. Fissures between needs based and cost reflexive approach, and between energy and other domains e.g. health, transport

Coordination failures	Poor coordination across domains e.g. with healthcare. Poor coordination e.g. in roll out of smart meters by suppliers rather than DNOs with a spatial remit
Lack of normative clarity	Conflict between objectives of universal access, reducing demand, for-profit provision, competition, coordination, incumbent desire to retain power, technical efficiency, national economic competitiveness

7.6 Polycentric as paradigmatic

In addition to being descriptive and normative, the concept of polycentricity can be used paradigmatically. Different paradigms can be evaluated in terms of how well they explain reality. According to Thomas Kuhn's theory of paradigm shifts, if a new paradigm provides a 'map' that is closer to the 'territory', it supersedes the old one and a scientific revolution occurs. Science aims to create a map that is as close to the full detail of reality as possible.

However, the value of a paradigm can also be assessed based on the types of outcomes that seeing through that paradigm leads to. The most useful map for practical purposes is not the one with the most detail, but the one that highlights features which help the user to navigate the journey to their destination.

The first question, of how well the polycentric perspective fits reality, was explored in the analytic discussion of the extent to which the GB energy system is polycentric. The GB energy system has several features which make it somewhat, but imperfectly polycentric. It also experiences some of the pitfalls typical of a real-life non-ideal polycentric system. From this perspective, using a polycentric paradigm to consider the GB energy system is valuable.

Some of pitfalls of polycentric governance in the GB energy system have been identified by others who do not use the term 'polycentric', for example by Lockwood et al. (2015) or by Catney et al. (2013). However, not using the term 'polycentric' does not mean that a polycentric paradigm is not being used. During a reflective learning session at BHE following the CEI project, colleagues spoke about the importance of multiple decision-makers and dispersed agency. It was clear to me that they had a polycentric paradigm, although they were not using the theoretical language that I had become familiar with.

This research is concerned with practical policy outcomes, and considers how the use of a polycentric paradigm affects the way that energy system institutions are developed, and the outcomes that result from these institutional crafting activities. This is perhaps the type of paradigm shift that Donella Meadows is referring to when she argues that the second most powerful lever available for changing a system is "the mindset or paradigm out of which the system—its goals, structure, rules, delays, parameters—arises" (Meadows, 1999). Shifting what we see can open up new possibilities, and seeing polycentric governance rather than a regulated market may allow shifts to happen, just as Bollier and Gibson-Graham (Gibson-Graham, 2006; Bollier, 2014) argue that seeing a solution of commons rather than only seeing a problem of capitalism allows creative institutional crafting to develop. On the other hand, the regulated market is arguably a form of polycentric governance, and an implicit polycentric paradigm may already shape the thinking of many of those working in the sector. Developing explicit polycentric thinking may open up more options for the development of energy system governance without requiring a radical shift in perspective. The implicit polycentric thinking among BHE colleagues described above may be part of this.

Many people inspired by the Ostroms' work on polycentrism feel that it has a lot to offer (Taylor, no date; Wall, 2014; McGinnis, 2016). Goldthau (2012) sees polycentrism as a new paradigm for energy system research, as does Sovacool (2011). A polycentric paradigm allows the benefits of markets to be seen as not being exclusive to markets, and potentially to be nurtured in energy institutions without exclusively providing

support to business and profit making initiatives. This could include innovation funding being provided for the development of commons institutions as well as for the development of business models. It could include Bristol Energy seeing its role as a bridge between two fragmented polycentric governance systems working on energy, and working with the CE sector in Bristol and nationally to modify the energy industry codes such that they would provide a framework that enables a transition to a local and RE based system. It could enable Ofgem's remit to be changed so that climate change objectives are included. The polycentric paradigm can bring incumbent lobbying of government, which is well known, into the frame of how the market develops, and be discussed openly and critically as a part of the market system that is currently subject to structural inequalities that need to be addressed.

7.7 Conclusion

This chapter considers the GB energy system as a polycentric system, both at the national level in the energy industry codes, and locally in the Bristol case study. It shows that McGinnis' framework of characteristics and problems of polycentric governance is applicable to the GB energy system, and provides insights. It identifies ways in which the GB energy system exhibits all six of McGinnis' persistent problems of polycentric governance: structural inequalities, incremental bias, high complexity, deep structural fissures and coordination failures. These are summarised in Table 12 and Table 13, reproduced below.

Table 12: Fit of the GB electricity system with McGinnis' characteristics of polycentric governance

McGinnis' characteristics of polycentric governance		**GB electricity system fit**
Structure	Multiple centres of decision-making	Yes, but some are more powerful than others
	Overlapping jurisdiction	Yes, in some cases
Process	Mutual adjustment	Yes, but some actors more powerful than others so not fully mutual
	Dynamic institutional relationships	Yes, within the codes system, but slow-changing
Outcome	Emergent order	Order, but not very diverse or emergent
	Scale economies	Very restricted ability for local electricity development

Table 13: Persistent problems of polycentric governance in the GB electricity system

Persistent problems of polycentric governance	**GB electricity system**
Structural inequities	Fuel poverty, incumbent power, barriers to market entry
Incremental bias	Yes – well documented by Lockwood et al. in relation to energy industry codes
High complexity	10,000 pages of industry codes

Deep structural fissures	Climate and energy somewhat separate. Fissures between needs based and cost reflexive approach, and between energy and other domains e.g. health, transport
Coordination failures	Poor coordination across domains e.g. with healthcare. Poor coordination e.g. in roll out of smart meters by suppliers rather than DNOs with a spatial remit
Lack of normative clarity	Conflict between objectives of universal access, reducing demand, for-profit provision, competition, coordination, incumbent desire to retain power, technical efficiency, national economic competitiveness

Lockwood et al. (2016) propose that the GB energy system should "move away from self-authored regulation in a strategic way", "relocating code governance, including the proposing and development of modifications, out of the hands of industry and into a body within the public sphere". This could resolve many of the problems of polycentric governance identified above. However, depending on how it is implemented and fits in a wider system, it could also be seen as a move away from a polycentric system. This has parallels with the move towards centralisation in public administration which inspired the Ostroms' original research into polycentric governance in the 1970s.

An alternative to centralisation could be to find polycentric remedies to the problems highlighted above. Whilst there are moves towards centralisation, there are also moves towards greater diversity of scales, through the development of local energy markets in pilot projects (Centrica, 2017; Cornwall New Energy, 2017), the creation of local authority owned energy supply companies in Nottingham and Bristol, and the proposals for DNOs to become DSOs, taking on a greater balancing role at a regional level. The principles of polycentric governance would suggest that allowing diversity of institutional development at a local level could lead to greater and more rapid innovation. This would require coordination between sectors and scales to be valued and resourced in some way.

Lack of normative clarity could be addressed at each local level, allowing different priorities to emerge in different places. However, focusing on direct goals of access to energy, low carbon, and wellbeing may be more effective than rigidly sticking to indirect goals enshrined in EU energy directives, of competition, cost reflexivity and non-discrimination between commercial providers. The UK's departure from the EU may provide an opportunity to do this, as many of these rules come from the EU. On the other hand, remaining in the European energy market may require conforming to EU rules anyway.

Allowing local energy systems to develop in their own way would be a different approach to institutional innovation – rather than centralising to enable more rapid change in line with policy, new entrants would be allowed, not just to the market, but to regulatory and rule design itself. This may remedy the incremental bias. The ability to begin fresh systems, alongside existing systems, may allow low-complexity institutional systems to be compared with high-complexity systems, and reveal the level of complex rules that is actually required for the system to function. This could remedy the problem of excessive complexity.

Seen in this light, the polycentric paradigm reveals some exciting possibilities for energy system development. It will be interesting to see how those who already support this vision take things forward.

8 Preliminary design principles (DPs)

Sea coal, sea coal, hear the man call
Sea coal, sea coal, hear the man call

If we go buy a bag, we'll have nowt left at all
For we need our bit money to buy bread and meat
And if we must go hungry then at least we'll have heat

Sea coal, sea coal, hear the man call
Who'll buy, who'll buy, hear the man cry

It's just a few shillings for the finest of fuel
Come stoke up your fires now for the weather is cruel
It's a cold place in winter, is old Hartlepool

Sea coal, sea coal, hear the man call
See him, see him, see him at the end of the road

If we don't go buy quick then it all will be sold
I can see by his wagon that small is his load
And if we must go hungry then we needn't go cold

Sea coal, sea coal, hear the man call
Sea coal, sea coal, hear the man call

Graeme Miles (1950)

8.1 Introduction

This chapter proposes a set of four design principles (DPs) for a democratic, equitable and environmentally sustainable energy system for GB. A desirable future energy system would be designed in line with these principles. The term 'design principle' is taken from Ostrom's use of this term in relation to her principles for governance of common pool resources. They are a set of heuristic tools, which Hammersley (1992, p. 61) describes as "relying on tacit and always questionable assumptions in their application, these applications therefore being subject to potential debate', rather than being algorithmic, or "telling us what is and is not true with absolute and precise certainty".

The DPs emerge from the AR ethic of providing value to research participants, and to communicate research findings in a way that is immediately meaningful and succinct. I reflected on what I would say in a meeting with participants from the civic energy sector, to communicate what I had learned from my research, and came up with a list of four design principles. Appendix 4 includes the results of an extensive review of a number of other frameworks. This led to the development of a long list of about 30 different principles and mechanisms and values. However, this longer list was not fit for purpose as a succinct communication of my research findings for a lay audience. I returned to the original list of four principles and systematically analysed whether there was anything missing from that more extensive analysis that wasn't in some way captured in the principles, and was satisfied that the four design principles presented here had sufficient connection with the long list, whilst also being a more useful tool. These DPs could inform energy system development at all levels. They could be a framing used by CE groups to better understand their place in the

wider system, they could be used by local government in negotiating and implementing energy devolution, and they could also be used by Ofgem to conceptualise ways to create greater roles for the local, for renewable and distributed energy in the GB energy system. They could also be used by campaigners to identify strategic demands and situate these within a broader vision.

The development of the DPs was motivated by a desire to provide concrete recommendations which research participants and decision-makers at all levels in the GB energy system, including the civic energy sector, can act on. They are intended to be more immediately comprehensible and succinct than the careful theoretical analysis presented in chapters 5 to 7.

This is part of the action research process. The careful theoretical analysis presented in chapters 5 to 7 represents a first cycle in an action research reflective process. The initial DPs presented in this chapter represent the planning of a second cycle of action research. These initial DPs are tested against the case studies, as discussed in chapters 9-11, representing the second action research cycle, and culminating with a revised set of DPs. However, even the revised DPs are not positioned as 'the truth', but rather as a preparation for a third action research cycle, which would involve discussing and reviewing the principles with stakeholders and research participants. This third cycle falls outside the scope of this thesis. This process is illustrated in Figure 57

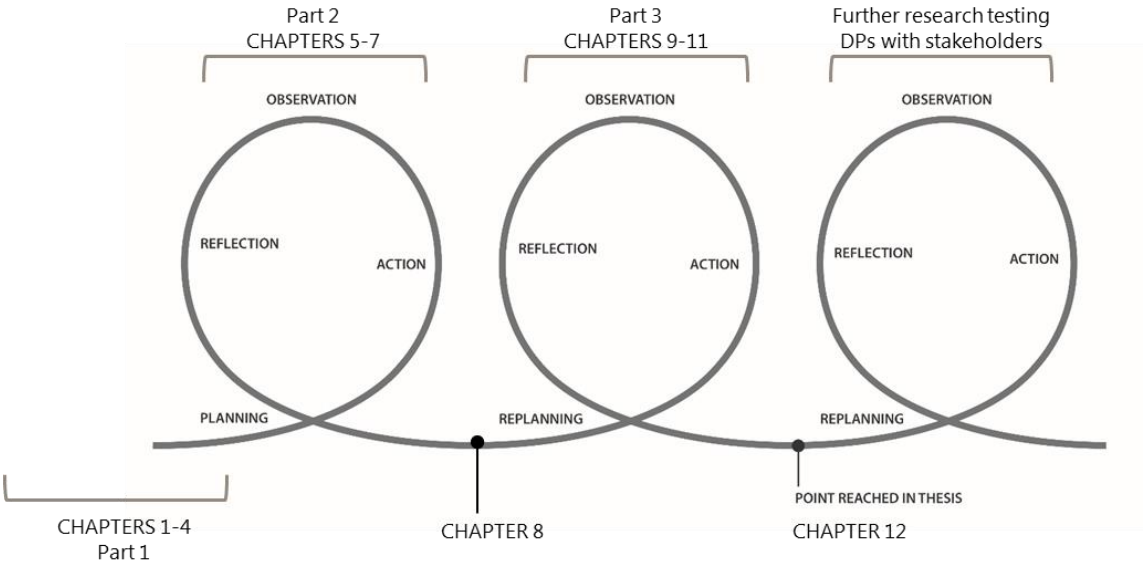

Figure 57: Development of design principles in action research cycle

IMAGE

The DPs do not represent the only way forward for a good energy system future. They are aimed towards a particular vision of how a sustainable energy system could be achieved, most closely aligned with the Thousand Flowers pathway of the Transition Pathways (Foxon, 2013) research programme. This is based in a worldview that prioritises deep democracy, equality of capabilities for participation in society, and responsibility; and that aims to reduce consumption in the global north and be resilient to economic degrowth, rather than rely on techno-optimism.

There are four initial DPs, as follows:

DP1 - mixed economy:	A thoughtful combination of commons, state-public, and market institutions and forms of ownership

DP2 - nested governance: Use of nested forms of governance at different spatial scales, as well as non-spatial governance

DP3 - equality and redistribution: National redistribution of value, sharing of risk, and sharing of learning

DP4 - responsibility and externalities: Responsibility and accountability for the full impact of actions, in particular those affecting environmental limits.

In contrast to Ostrom's DPs, these DPs are not derived from meta-analysis of hundreds of detailed case studies from around the world. They were developed through a process which included: detailed reflection on Ostrom's DPs for common pool resource management and their applicability to the GB energy system (chapter 6); analysis of ways in which the GB energy system matches the characteristics and common shortfalls of polycentric governance (chapter 7); engagement with developments in local energy systems in GB at a variety of spatial scales (chapter 4); and cross-checking with a number of other frameworks[41]. They have also benefited from Levitas' (2013) permission to imagine the future as different from the present, in the world of academic discourse as well as in the world of activism, entrepreneurship and innovation.

The initial DPs were then tested in detail against the evidence from the case studies by asking the following questions:

- To what extent are these principles already present or not present in current local energy activities and the GB energy system?
- To what extent does the absence or presence of these principles lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from these principles?
- Do these principles need to be modified or rejected in light of analysis of the case studies and if so how?

The conclusion of the thesis in chapter 12 then reflects on the final two questions:

- Supposing that a consolidated or modified set of principles is derived following detailed analysis of the case studies, what short, medium and long term actions (for research, policy, and local energy practice) would be recommended in order to follow this path, or explore it further?
- What are the implications of going towards these principles for commercial sustainability consultancies such as BHE?

This chapter discusses each of the four initial DPs in more detail.

8.2 DP1: Mixed economy

A thoughtful combination of commons, state-public, and market mechanisms for organising the production, distribution and consumption of energy in the GB.

This DP recognises the value of different forms of ownership and governance, and seeks to find roles for each that play to their strengths, and interactions between them that mitigate their weaknesses. In particular, it proposes that there should be a greater role for commons governance systems and property regimes

[41] These include permaculture ethics and design principles, Common Agenda values and principles developed by the New Economics Foundation, Donella Meadows' 12 levers for system change; Max-Neef's fundamental human needs; and concepts for a utopian ontology of human nature suggested by Levitas. See Appendix 4 for more details

within the GB energy system, whilst recognising that this does not operate in isolation from other forms of governance.

DP1 develops the three types of property regimes defined in chapter 5: commons as collective ownership and/or management of a resource by a group of people who both use and create a resource; state-public as ownership and management of a resource or service by the state, on behalf of or for the benefit of the citizens; and market-private as ownership of property by individuals or corporations.

Whilst there are many ways in which these roles could be structured, this section provides a sketch of the distinctive characteristics of commons, state and market parts of the energy system, in order to illustrate the roles that each of these modes of organisation could have, and their strengths and weaknesses. It is similar to the proposal by We Own It (2016), who suggest that national transmission should be owned by the national state, distribution owned by regional public bodies, and both generation and supply provided by mixed markets of state, community and private sector.

The commons, state and market logics are all present in different organisations in the GB energy system, and exist alongside each other in a mixed economy. The commons is characterised by smaller scale communities, reciprocity, relationships of trust, and mutual support. An ideal commons provides space for participation in decision-making, and broad-based shared ownership of resources, but not everyone wants to or has the capacity to participate all the time.

The state is conceived in various different ways, as having functions of protecting the national interest in relation to other nations, or of redistribution of wealth and provision of public services. An ideal state can manage natural monopolies in the public interest, both achieving economies of scale and avoiding rent-seeking behaviour.

The market is characterised by mechanisms of competition, choice, and one-off rather than repeat exchange between otherwise unrelated parties. An ideal market provides space for spontaneous participation in production activities through free entry and exit, leading to innovation and creativity. It also allows for dispersed expression of preferences and maximises economic efficiency.

The status quo for the GB energy system is dominated by the market, with little or no public discussion about what should be done through market mechanisms and what should be state or commons operated. This market bias has negative consequences: for democracy as it has limited arenas for voice; for equality of access to energy services as energy is available to those who have money to pay and is cheaper for bulk users; and for the environment as there is no limit on consumption and production. A more balanced system would provide a greater role for commons, a greater role for the state, and choice regarding which activities are to be carried out by the market and which through state or commons processes.

8.2.1 Commons

Commons based energy institutions could integrate consumption and production of energy within one place-based organisation, with a group size that is small enough to build trust and interpersonal relationships. This could involve local energy production that is made tangible by its nearness, so that remaining within consumption limits takes place within community institutions. In a decentralised energy system, distributed energy resources including generation, storage and smart control systems could enable community-based balancing of electricity supply and demand. Coordination of consumption and of distributed energy resources at the local level could lead to reduced demands on the national system, with associated efficiency benefits nationally. Commons institutions, using Ostrom's DPs, could be used to manage this. Initiatives and ideas such as flexible energy districts (Bristol Energy Network, 2017c), housing estate collective energy purchasing (Community Energy Scotland, 2016), pooling of RE generation behind a

meter (Energy Local, 2015), and community incentives for demand management (Centre for Sustainable Energy, 2015b) all take place in a community which makes arrangements for sharing of resources.

At the same time, particular locations are optimal for electricity generation and storage technologies. These are based on land, and are spatially specific. As demand for land for energy increases, (Ariza-montobbio *et al.*, 2014; Balta-Ozkan, Watson and Mocca, 2015; Moroni, Antoniucci and Bisello, 2016), there is a risk of rent-seeking behaviour in relation to land ownership pushing up the price of energy even as the construction cost of renewables falls, as discussed in section 6.1.3. Land reform, particularly in the context of food and housing, is being actively discussed by activists in England (Land Justice Network, 2017), and has been passed through legislation in Scotland (Scottish Parliament, 2016). A community right to own and provide energy, analogous to the localism act's 'community right to bid' (HM Government, 2011), or the Scottish 'community right to buy' (Scottish Parliament, 2016) could allow communities to organise themselves to own and operate local energy assets. This could enable community access to prime grid connection locations for storage and generation, and to provide energy to themselves as a commons.

Community based commons provide a space for participation in decision-making, and broad-based shared ownership of resources, often with provision of a safety-net of subsistence to all in times of hardship. Commons relationships of care, reciprocity and interdependence within a human community and beyond the human, as observed by Bresnihan (2015) are perhaps something we lack and long for, and part of the antidote to the 'loneliness epidemic' suffered in modern western societies (Bingham, 2014; Monbiot, 2014). On the other hand, commons arrangements could bring out the shadow side of community: social conformity, oppressive power dynamics within a community, and exclusion of outsiders. Additionally, not everyone wants to or has the capacity to participate all the time, particularly with modern work and family patterns. Participative deliberative processes can be slow, and communities can be risk-averse. This can support resilience, but may reduce levels of innovation and adaptability. These are all issues which can be addressed within community commons institutions, and which can be supported by other entities such as market and state actors.

DP1, mixed economy, sees a much greater role for commons-based institutions within the GB energy system, given their small role in the status quo.

8.2.2 State

The state can be an effective vehicle for ownership and management of large public infrastructure. Transmission and distribution networks are natural monopoly infrastructures, which are currently regulated monopolies. Hall (2016) has quantified substantial financial benefits from renationalisation of this infrastructure due to state access to cheap finance and not needing to pay dividends to shareholders.

Public ownership, and restructuring of the payment structure for this infrastructure so that the cost is socialised, may be a more effective way to address the challenge of lower utilisation rates of infrastructure. As was discussed in section 6.1.5, electricity transmission and distribution infrastructure is a congestible resource, which changes from being non-subtractible to subtractible as it reaches full capacity. As the generation of electricity becomes more distributed, the impact on the capacity is mixed: electricity is added to the grid in places it was not designed to be, leading to increased congestion, but with active management and flexibility assets it could be produced and consumed in one place, leading to reduced utilisation of the infrastructure. Consumers are still dependant on the grid to bring them electricity when the local generation is not available, but they may be transporting fewer units of electricity across the national grid. Currently, payment for the upkeep of infrastructure is crudely calculated per unit of electricity that is transported across that infrastructure. This means that if utilisation reduces (i.e. people are mostly using electricity from nearby), the payments could be insufficient for the upkeep of the infrastructure. One way of addressing this could be through changing from 'use' payments to 'availability' payments, where people are paying for the national

grid to be available to them. However, doing this through a market system may lead the national infrastructure to be undervalued. A public ownership alternative would be analogous to public funding of healthcare, as an insurance system that is available to everyone in time of need, rather than requiring people to individually pay for the healthcare services they use.

However, public ownership is criticised for being excessively bureaucratic and not challenging its employees to work to their full capacity, and for being risk-averse and lacking innovation. As with commons, these potential shortfalls can be mitigated within public sector ownership and governance, but can also be supported by the presence of other forms of governance within the wider system.

8.2.3 Market

Currently the market dominates the GB energy system, and so a more balanced mixed system with strong roles for commons and the state would see a reduced role for the market. However, market mechanisms do have benefits. Markets are seen as providing economic efficiency and innovation through competition; social sharing of the risks of failure of innovation through the institutions that support the market such as limited liability, spreading of investor risk through the stock market. They rely on market institutions including strongly enforced legal protection of contracts and a bias towards private property and profit, including intellectual property and commercial confidentiality, rather than shared ownership of assets and knowledge.

The benefits of markets are only achieved when there is competition. As discussed previously, in natural monopoly infrastructures the mechanism of competition does not function effectively. Additionally, whilst markets are claimed to lead to economic efficiency, this is an instrumental rather than an intrinsic goal. It has come to be strongly associated with prosperity and seen as an end in itself, and dominates policy evaluation criteria at the expense of intrinsic goals.

Intellectual property reduces the potential social value of knowledge both in terms of making it directly available to be used, and in terms of making it available for further development and innovation. Commercial confidentiality makes it more difficult for new entrants to replicate successful approaches and thus achieve wider social value, and also reduces the ability to hold firms accountable as they can hide the detail of their activities. Markets promise consumers individual choice between products and services, but the default use of markets for every type of activity withholds the freedom of collective choice of whether a market is an appropriate institution in a particular context.

However, in the right context, markets can provide efficient exchange, and an emergent order which can be much more rapidly responsive than deliberative processes. This leaves room for surprises, and individuals with a vision can freely enter the market to be creative and prove their concept works. In DP1 the market institutional form is thought suitable to aspects of the energy system where small scale, easy entry and exit is possible, and competition can function effectively. For example, production and development of technology, of smart systems, and new business models or services, including operation and maintenance, production of parts, training, energy generation and supply. Markets are better suited to Ostromian ‘production’ than to ‘provision’ (see p109).

The market, in this ‘utopian’ perspective should be a mechanism that can be used for a particular purpose, rather than the default institution for all economic relations. The choice of a market mechanism for a particular energy system function should be made actively, deliberatively and conditionally. The market provides goods and services to the state, to the commons, and directly to individuals. Where there are strong negative or positive externalities, or strong risk of monopoly rent-seeking due to large economies of scale, high barriers to entry, or land ownership, there is a process for bringing a market activity back into direct control by community commons or the state.

8.3 DP2: Nested governance

Use of nested forms of governance at different spatial scales, as well as non-spatial governance

The second DP discusses the ways in which different organisations interact with each other. It builds on the theories of polycentric governance discussed in chapter 7, which showed that polycentric governance can address some of the weaknesses of a purely commons based governance system by allowing innovation and diversity, and organisation at multiple spatial scales.

Polycentric governance systems have emergent characteristics of scale economies and emergent order. They can support institutional innovation through allowing multiple parallel institutional experiments to take place, combining diversity with interaction and sharing of learning. This is enabled by giving diverse elements some autonomy through the principle of subsidiarity, which gives sovereignty to the smallest unit that can manage it, thus supporting democracy.

DP2 therefore has three sub-principles:

a. The size of each spatial level of governance is congruent with the physical and technical boundary of the infrastructure being governed
b. Diversity of governance solutions in different localities, which promotes innovation, with sharing of learning between these
c. The relationship between different levels is organised according to the principles of subsidiarity

8.3.1 Spatial nesting and congruence of physical and institutional boundaries

Ostrom's eighth DP refers to nested forms of governance (Ostrom, 1990), and theories of fit suggest that congruence between the spatial boundaries of physical systems and the spatial boundaries of institutions is important for success (Cox, 2012). This can be a way of identifying the most appropriate scale for each activity, and thus achieving scale economies. This DP proposes a nested form of governance, with boundaries for the electricity system organised around substations or other infrastructural points.

The commons studied by Ostrom are primarily traditional commons of pasture, forest, fisheries and irrigation systems. Of these, the irrigation systems are the most obviously analogous to energy systems: they are infrastructure constructed by people, where there is a substantial work of maintenance and construction, as well as a question of allocation. Irrigation systems also typically have a branching pattern, with larger canals feeding smaller ones, finally going down to the level of the fields. This is analogous to the structure of electricity or gas network branching patterns.

In this context of irrigation Ostrom vividly describes nested layers of governance and subsidiarity, with farmers whose fields are irrigated from one sub-canal autonomously making decisions and carrying out work needed for their sub-canal. They may then be collectively responsible for conforming to the rules of the larger canal, and contributing to its maintenance. The success of this type of approach leads to a 'theory of fit', that the user boundaries and the resource system should be congruent.

Applying this to electricity systems, the users connected to each substation could act autonomously on matters affecting the performance within their substation, whilst participating with others in matters that relate across several substations.

8.3.2 Diversity, shared learning, and complex adaptive systems

Ostrom (1999) describes commons as 'complex adaptive systems'. She identifies the vast number of different rules that are available to commoners in managing their resource, and shows that it would be impossible to optimise the most effective rule-set. Rather, commoners are continually experimenting with rule

improvements, in ways that have a high probability of failure. When multiple autonomous local groups are free to try out different rules, and interact to share stories of their successes and failures, development of improved systems is enhanced. A nested model of electricity management, with local groups at the substation level free to organise the internal situation autonomously, and frequently meeting with others to coordinate impacts at a larger spatial scale, could achieve this type of 'redundant teams of designers' which is a benefit for "any design process that involves substantial probability of error" (Ostrom, 1999, p. 520). Ostrom describes the sharing of knowledge and freedom to innovate in irrigation systems as follows:

> "For example, many irrigation systems are divided into several tiers and multiple units at each tier. All of the farmers on a field channel are responsible for distributing the water to this small channel as well as keeping it in good repair. All farmers whose field channels are served by a branch canal may send a representative to a branch canal organization that focuses on the distribution of water among all branches and on the maintenance of the distribution canals. The branch canal organization may send a representative to a central committee that is responsible for the headworks that divert the water from a river into the system in the first place. The rules used on one branch canal or one field channel may be quite different from the rules used on others. There is no single center of authority for these systems that makes all relevant decisions on how to get water from the river to a farmer's field, but in many farmer-organized systems, the water is distributed in an organized fashion and all of the waterworks are maintained as a result of the aggregation of decisions and actions at multiple levels (see Yoder 1994; E Ostrom 1992; Coward 1979, 1985; Wade 1988)" (Ostrom, 1999, pp. 521–22)

Ostrom then goes on to discuss some of the limitations of small scale commons management, and the benefits of polycentric governance, where larger scale organisations that overlap in jurisdiction with the smaller ones provide a safety net. Being part of a polycentric system with larger scale entities can provide sharing of academic and technical knowledge e.g. from universities, availability of support from the larger system if the smaller system fails or vice versa, and protection of individuals from unhealthy local power dynamics. Achieving this requires sufficient authority for independent decision-making by the smaller units, and supportive relationships between scales. One way of achieving this is through the principle of subsidiarity.

8.3.3 Subsidiarity and mutual adjustment

The principle of subsidiarity is that "any particular task should be decentralized to the lowest level of governance with the capacity to conduct it satisfactorily" (Marshall, 2008, p. 80). Marshall (2008) describes this as originating in a moral belief that sovereignty should reside in the individual, rather than at the group level. However, the allocation of tasks to different levels is subject to interpretation, and there is a risk that governments will tend towards greater centralisation than is needed.

The concept of subsidiarity has a long intellectual history, with traces in classical Greek thought, Thomas Aquinas, medieval scholasticism, Johannes Althusius, Montesquieu, Locke, Tocqueville, Lincoln, and Proudhon (Carozza, 2003). It was promoted in Catholic social thought, in Pope Leo XIII's Rerum Novarum, in 1891. Carozza (2003) describes how this is founded on the belief that humans are inherently social and need to be part of communities to achieve our own flourishing, whilst also having intrinsic dignity as individuals, and just as individuals need communities, communities need bigger social groupings, leading to a nested system. The moral aim is always to serve the group that is closest to the individual.[42] I agree with this moral

[42] Carozza puts it as follows "One could say that the existence and end of the community (and this can mean a "community" as intimate as a single friendship) is to help the individual flourish, to help create the conditions for her to reach her ultimate fulfilment. The idea of subsidiarity extends that same model of fulfilment through relationship and

belief in the ultimate sovereignty of the individual, and the need for connectedness in order for that individual to flourish, and it resonates with the values of equal dignity of all and the belief that human nature is completed through social connection discussed in chapters 1 and 3.

Whilst the principle of subsidiarity can be applied in a 'bottom-up' context, where smaller units federate with each other voluntarily, or create organisations for collaboration where they identify a need for higher level coordination, it is often used in the context of top-down decentralisation, where national government is decentralising to give power to regional or local government. Hertig and Teufel (2016) describe three forms of decentralisation, in increasing order of sharing of power: deconcentration; delegation and devolution.

Marshall (2008) discusses case studies where governments talk about decentralisation, but micromanage the implementation of delegated tasks. He argues that this is often a political question of incumbents wanting to keep the power they have in the status quo, and control the extent to which local people are empowered to demand autonomy. This can also be a question of capacity of local units. If the starting point is a centralised system, it takes time for smaller units to build the capacity to be able to solve problems locally. This capacity cannot be developed without responsibility being shared with the local level, but governments can misunderstand the process by which this learning takes place, and expect it to be a faster and more linear process than it is. Genuine commitment to the principle of subsidiarity requires investment in the capacity building process, rather than restricting decentralisation to that which can already be carried out by lower level as it is now. "As observed by V. Ostrom et al. ([1961] 1999), it is a common mistake of governments and policy makers to underestimate the capacities of subunits at any level to self-organize governance arrangements to address problems for which they are currently 'too small'" (Marshall, 2008, p. 81)

Marshall also describes the cognitive hegemony of the ways of thinking familiar to actors at each level. He argues that the progressive model of governance "envisioned centralized definition of public policy objectives by politicians, with these objectives to be realised through centralized direct administration" pre WWI, and through "centralised manipulation of the 'market mechanism'" post WWII (Marshall, 2008, p. 85). This "mainstream-economic lens of agency theory … holds that it is feasible for any principal, including the state, to design centrally an incentive system that aligns to its own interests the interests of lower-level agents on which it depends" (Marshall, 2008, p. 91). The EU procurement rules discussed in relation to the case studies (p168, 171, 189) are perhaps an example of this idealistic top-down thinking. Marshall notes that the rhetoric of partnership is sometimes used for these relationships, but this does not always live up to the equal partnership that community agents are attracted to, with a risk of leading to cynicism, disengagement and obstruction.

This centralised approach may look 'simpler' than a polycentric one, but as Laloux notes in the context of organisations, the actual working relationships between people, even in a seemingly centralised system, are always much more complex and networked. Imposing a hierarchy onto this can mask that reality rather than making it simpler, as illustrated in Figure 58.

assistance to all levels of social interaction. It envisions that just as the individual realizes his fulfilment in community with others, so do smaller communities realize their purpose in interactions with other groups - a group of families as part of an educational community, for instance, or a group of workers as part of an economy of production and exchange. And, in turn, the "higher" groupings exist not just for their own sake but to assist the smaller, more limited associations in realizing their tasks, just as the community of a friendship or family is oriented toward providing the individual with the conditions enabling him to realize freely his own dignity." (Carozza, 2003, p. 43)

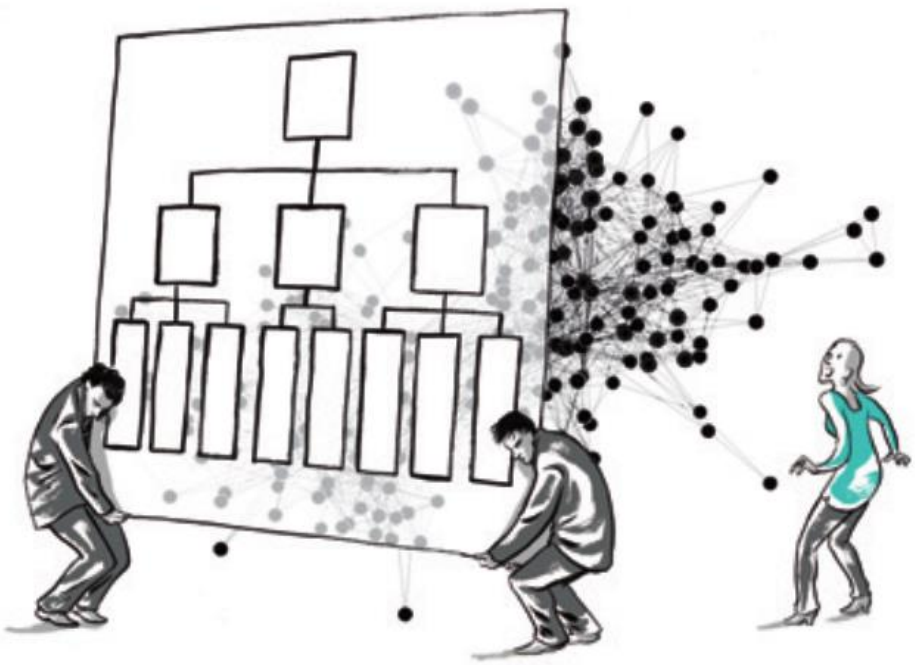

Figure 58: The hidden complexity behind seemingly simple hierarchical structures. Illustration by Etienne Appert, in Laloux (2016, p. 157)

This approach of subsidiarity contrasts with the polycentric governance approach of mutual adjustment discussed in section 7.4.4, where equality of relationships is emphasised. Giving greater voice to the smaller or less powerful unit through subsidiarity, however, may be necessary in order to avoid dominance by larger units.

8.3.4 Deliberative and democratic decision-making at the level of constitutional choice

Ostrom proposes three levels of decision-making: operational choice, collective choice, and constitutional choice, as discussed in chapter 5. The constitutional choice level decides which mechanism is used for collective-choice decisions – whether these are to be carried out by community groups, by centralised government policy, or by emergent market mechanisms.

The dominance of the market mechanism in mainstream policy thinking is characterised by McGinnis as a flawed polycentric system suffering from deep structural fissures. This was discussed in chapter 7. Typical economic analysis considers only the transactions taking place within the market, insufficiently acknowledging the institutional context within which the market operates. Not only is it important to recognise that the market is dependent on wider social structures, but it needs to be seen as one mechanism of organisation among many – a collective choice mechanism, not a constitutional choice mechanism.

8.3.5 Coproduction

Economic efficiency is not the only important metric for a successful energy system. However, coproduction is one of the ways in which a polycentric governance system can lead to economic efficiencies. In their study of police departments in Chicago in the 1960s, the Ostroms discovered that local populations were more willing to give information to locally run police departments than to centralised police departments. Commons approaches to the energy system may lead to what economists would perceive as increased 'transaction costs', but for the people involved, the day to day acts of reciprocity are creating community,

nurturing connection to place and land and a sense of belonging, which would support Scruton's (2017) 'oikophilia'. They are not necessarily 'costs'. Coproduction activities, where community members produce services in collaboration with technical experts, may simultaneously reduce the input required from professionals and create community bonds of reciprocity. This does raise questions about the way that different forms of labour are valued, whose work is paid for, and the way working hours leave little time for voluntary work for many people.

8.3.6 Summary

DP2 uses mechanisms of polycentric governance to connect the different forms of organisation and ownership outlined in DP1. This addresses some of the weaknesses of commons governance systems, in terms of coordinated action at larger scales, and supporting innovation. This comprises both ordered decentralisation of nested layers of governance, and more emergent coordination and mutual adjustment. The nested layers of governance are organised through the principle of subsidiarity. Where possible, interactions between parties are mutual, based on equal relationships, but where conflict arises sovereignty resides primarily in the smaller unit, closer to the individual. Collaboration is favoured over competition, and governance decisions at the constitutional choice level are inclusive and democratically accountable. Different localities are free to develop diverse governance solutions, and learning from their successes and failures is shared.

8.4 DP3: Equality and redistribution

National mechanism for redistribution of value, and sharing of risk associated with innovation in governance

The third DP aims to address the weakness of commons and polycentric governance in relation to equality. It proposes that there should be national mechanisms of redistribution, in order to avoid exacerbation of spatial inequalities.

One of the problems with commons approaches is that they risk exacerbating existing inequalities, both within and between communities, as discussed at the end of chapter 5. This includes problems of scapegoating, narrow requirements for social conformity, and abandoning of less successful or weaker elements.

Several scholars have discussed the risk that community based delivery of energy services could exacerbate inequalities between places. Communities with greater financial and social capital, land or housing assets, time available to spend on voluntary work, and professional skills, are more able to develop successful CE projects than those without such resources, e.g. in fuel poverty (Catney *et al.*, 2014; Johnson and Hall, 2014). Community approaches may be more participatory, and may provide more opportunities for making substantial reductions in energy needed in people's lives, but they may result in a higher unit price of energy. Making energy affordable, and making tariffs equal across the country, was one of the aims of the Electricity Act 1947, which nationalised the GB electricity system (Butler, 2001, p. 132), and it is important, given the egalitarian values promoted in this thesis, that any commons based system should not undermine this. However, the value of a commons based system is in the freedom of experimentation available to communities, including the freedom to make trade-offs between e.g. reliability, amounts of energy available, and costs of the system. In order for a polycentric system to function well as a whole, actors at all levels must take responsibility for the consequences of their actions.

This is one of the ways in which a nested system can provide benefits, with the national layer rebalancing wealth between different parts of the country, and intervening in cases where local systems are caught up in oppressive power dynamics. At the same time, national systems can share the risks of innovation, providing a

safety net when institutional innovations do not work well, and simultaneously sharing the learnings with other places.

Balancing these different considerations is a challenge. The potential benefit for innovation of diversity of institutions, and the role of larger scale entities in sharing knowledge gained through institutional experimentation and providing a safety net for experiments that go wrong has been discussed under DP2. This is a question of sharing risk, rather than one of redistribution. However, different communities have different starting levels of wealth, including different technical potential for RE generation. Questions of social privilege, of rural-urban relationships, and of land ownership become relevant here.

A nested system of organisations may not fulfil redistributive functions unless this is explicitly part of the remit. There is no particular reason why a national government would value equality more highly than a local commons does. Both are products of the prevailing culture and of power dynamics. There are many mechanisms in the current economic system which are reinforcing feedback loops, leading to concentration of wealth. In order to have a stable and equitable society, these need to be restricted, and also counterbalanced with negative feedback loops, which need to be at least as powerful[43].

There are a variety of mechanisms that could be used for redistribution of energy wealth. One is to ensure that individuals within commons-institutions have the option of purchasing their energy from market providers directly, or from a national energy supply company, if the community system is not working for them. The current energy supply market enables this for electricity and for gas. It is more difficult with district heating networks. Current regulatory mechanisms protect consumers through allowing them choice of supplier on a market, the mechanism of exit. Commons provide additional and alternative consumer protection, through the mechanism of voice, and through reframing the role of users of energy as one of energy citizens and prosumers (or commoners) rather than passive consumers.

Other mechanisms for redistribution include active support for capacity building at the local level, including skills and training, provision of expertise funded by national government through taxes or cross-subsidisation to support coproduction, and capital or income support for investment in energy infrastructure. Capacity building would also support the principle of subsidiarity of DP2. (1999)

8.5 DP4: Responsibility and externalities

Responsibility and accountability for the full impact of actions, in particular those affecting environmental limits.

The fourth DP aims to address the weakness of commons and polycentric governance in relation to environmental limits. It proposes that there should be feedback mechanisms to create accountability for spatial and temporal externalities (i.e. impacts taking place in a different place or time to the decision being made).

Remaining within environmental boundaries is something that can be but is not necessarily achieved in a commons. It is also not achieved adequately by the current market and state based institutions.

[43] Meadows (1999) considers that it is more effective to act on reducing the strength of reinforcing feedback loops (lever 7) than on creating counterbalancing feedback loops (lever 8).

The DP aims to go beyond the objective of remaining within environmental limits, to specify particular mechanisms of governance that could enable this.

One way of considering environmental limits is as negative externalities. This means negative impacts that happen outside of the frame of decision-making, whether they happen in a different place, to different people within the same place, or at a different time. One reason for decisions that negatively affect our environment is that the decision maker does not receive immediate feedback, affecting them personally, that this decision is harmful.

By brining energy governance within a local community inside a geographical boundary, and supporting democratic mechanisms for widespread participation in decisions, some feedback is brought back in, as a smaller proportion of the impacts happen in a different place, and those affected within a local area have a greater voice in the decision process, either by participating directly in the decision-making, or being heard by the decision-maker and holding them accountable. However, some externalities will always remain.

Mechanisms for artificially creating immediate impacts or feedbacks to the decision-maker, which represent longer term or further away impacts, can be useful in this context. This type of mechanisms would include carbon taxes, subsidies for RE generation, public health payments to interventions that improve air quality etc. These are the classic regulatory mechanisms of incentives and taxation.

8.6 Conclusion

This chapter has discussed each of the four proposed DPs, and explained the theoretical reasoning behind them. This concludes Part 2 of the thesis, the theoretical analysis. The following chapters 9, 10 and 11 analyse each of the DPs in relation to the case studies. They form Part 3 of the thesis, the empirical analysis.

Part 3: Testing the design principles

Part 3 of the thesis formally analyses the findings of the case studies in relation to the proposed DPs.

Chapter 8 discussed a set of four DPs for a commons-based polycentric energy system. These were developed from theoretical analysis discussed in Part 2, and initial reflection on the case studies introduced in chapter 4. Part 3 uncovers greater nuance and complexity as the DPs meet the messy reality.

Of each DP, it asks:

- To what extent is this principle already present or not present in current local energy activities and the national GB energy system?
- To what extent does the absence or presence of this principle lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from this principle?
- Does this principle need to be modified or rejected in light of analysis of the case studies and if so how?

This is split into three chapters: chapter 9 discussing DP 1, chapter 10 discussing DP 2, and chapter 11 discussing DPs 3 and 4 and summarising a set of revised DPs.

Following this, chapter 12 discusses the following questions, as part of the conclusions:

- Supposing that a consolidated or modified set of principles is derived following detailed analysis of the case studies, what short, medium and long term actions would be recommended in order to follow this path, or explore it further?
- What are the implications for commercial sustainability consultancy of going towards these principles?

9 DP1: Mixed economy with a greater role for commons

9.1 Testing the first design principle

DP1, mixed economy, proposes that there should be a thoughtful combination of commons, state-public and market mechanisms for organising the production, distribution and consumption of energy in GB. It sees the status quo as biased towards the market, and a need for a greater role for commons to enhance democracy.

This chapter discusses ways in which boundaries between commons, market and state institutions are more complex than implied by the initial DPs. It also identifies additional weaknesses of commoning: the risk of horizontal privacy loss, the challenge of dealing with conflict and the time required to participate.

It asks:

- To what extent is DP1 already present or not present in current local energy activities and the GB energy system?
- To what extent does the absence or presence of DP1 lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from DP1?
- Does DP1 need to be modified or rejected in light of analysis of the case studies and if so how?

Elements of several case studies are drawn on to test DP1. In the Bristol case study, activities of the CE sector and the LA, and the relationship between them, are used to highlight the different roles of 'commons' and 'state'. The LiM study is used to identify limitations of commoning, as it takes the concept of commoning further through hypothetical scenarios. The role of BHE in the CEI case study provides some insights into the role of the market, as do several elements of the Bristol case study.

9.2 Blurred boundaries of market, commons and state

Initial DP1, mixed economy, states that there should be a combination of commons, state-public, and market mechanisms for organising the production, distribution and consumption of energy in GB. We Own It depict this graphically (p129), with public ownership of transmission and distribution infrastructure, and a mixed economy of state, community and private ownership of generation and supply (retail). However, the analysis below shows that in practice the boundaries between commons, market and state are more nuanced. The CE sector at times acts through market logic, as does the LA. Private sector organisations make social and long term investments. Competitors collaborate with each other. At the same time, many individuals 'wear multiple hats': e.g. consumer of energy, employed in the private sector or by the local government, and bringing this experience to the CE sector as volunteers or in pro-bono support. The reality is more networked and complex than the simple image of a mixed economy initially proposed in DP1.

9.2.1 Bristol Energy as a publicly owned market entity

BCC launched a fully licensed energy supply company in late 2015. The decision to establish a fully licensed energy company was a *provision*[44] rather than a *production* activity, and was taken through democratic public sector decision-making processes. This is *a collective choice* decision, which took place within the established *constitutional* setup of BCC. The authoritative decision-making body was cabinet, which is made up of elected

[44] The terms production, provision, constitutional choice, collective choice and operational choice are used in the Ostromian sense, as discussed in chapter 5.

members of council who are chosen for this role by the elected Mayor. The decision made by cabinet was based on recommendations by officers (non-elected civil servants employed by BCC) in the Energy Services team (Bristol City Council, 2015c).

The objectives of BCC in relation to Bristol Energy included:

> "1. To create a licensed gas and electricity supply energy company offering customers the opportunity to purchase gas and electricity at a price that represents a fair deal to them.
>
> 2. To use Bristol Energy as a vehicle to route power from existing and planned Council- owned or community-owned low-carbon generation assets to local consumers.
>
> 3. To position Bristol Energy as the preferred choice for local low carbon electricity generators seeking offtake arrangements for their power.
>
> 4. To develop Bristol Energy such that it can scale up rapidly, in terms of customer numbers and additional services that may be offered to consumers, and dovetail with BCC's plans to distribute energy across locally built networks, and
>
> 5. For Bristol Energy to go-live during 2015 to coincide with Bristol's European Green Capital 2015 year."
>
> (Bristol City Council, 2015c, p. 5)

BCC chose to develop a fully licensed supply company, rather than pursuing other options which included: licence exempt supply; 'licence-lite' supply; 'sleeved' supply; and white-label supply. This option was recommended as most effective in providing a revenue stream for BCC. The company would be wholly owned by BCC, and be responsible for *operational choice* decisions within the objectives set by BCC. The Feb 2015 cabinet paper (Bristol City Council, 2015c) recommended allocating £1.575m cashflow to start the company.

As a fully licensed energy (electricity and gas) supply company, Bristol Energy must comply with licence conditions and energy market regulations. It is therefore a 'market' entity, although it is public sector owned. It is operationally separated from BCC, and must compete with other energy companies to supply energy to BCC. This competition protects the values of fairness among energy suppliers, and value for money for BCC's purchase of energy. This protects the energy system from corruption and monopoly advantages for state owned companies. At the same time, as BCC is a shareholder, and aims to use profits from the company to fund council services. Not being able to favour Bristol Energy as a supplier potentially reduces the income available to BCC.

Senior manager at Bristol Energy, Morgan[45], interviewed in 2016, approves of the mechanism of market competition, and mentions values that the market is expected to achieve: fairness, consumer choice, a service ethic within the company, and wisdom [emphasis added]:

> *Morgan: but we do have to be mindful that the council have to treat us as they would any other energy retailer. So for example the council will be looking to procure its energy as it bills for its own estate, and that's coming out I think in October. That will go out to tender. We will bid for it, as you would expect, but I'm sure a lot of other people including the current incumbents will bid for it as well. And that's...*

[45] All names of research participants are pseudonyms

Interviewer: and do you think it should be like that?

*Morgan: yes, I do. Because otherwise people like OVO, or whoever will say **hang on this isn't fair**. This is a competitive market, it's about **customer choice**, and I think it forces us to **focus on customer need**. And **run the busines wisely**.*

Interviewer: so everything that the council stands to gain financially through..

*Morgan: but that's true of any shareholder. That's exactly what they are. So we have a board of directors, the council put funds in, that has to pass the test of what an informed investor would do. So they're not buying into it being risk free or anything like that, they appreciate that it's a commercial venture and it is the job of myself and the executive to deliver according to the business plan. And I think that's right, I think the ability to focus the business on what it needed is very particularly for a startup. Otherwise you land yourself in the trap of 'there's loads of things we could do, what should we do' - we want to sell electricity and gas really **fairly**.*

The requirement for BCC to use competitive tender processes to purchase energy is enforced in part through EU procurement rules, intended to ensure international competition across the EU. The rules on state aid and public procurement also function to contain the economic power of the state. There is a great potential for economic dominance of the council - BCC owns or has an interest in nearly 40% of the land and buildings in the city boundary (Bristol City Council, 2017), although they may not have control over energy contracts for all of these properties.

The EU law makes an exception for semi-independent companies that are set up to specifically provide services to the public sector, called a Teckal exemption (Local Government Lawyer, 2013; Shafique, 2013; Bristol City Council, 2015c). Teckal companies are allowed to supply public sector bodies without going through a procurement process, but their actions are limited: any services that the company procures must go through public procurement, and Teckal companies must provide the majority of their services to the public sector, not the market (at least 90% of turnover (Local Government Lawyer, 2013)). As Bristol Energy supplies domestic households with energy, trading in the energy supply market, it cannot be a Teckal company.

Legal advice from within BCC in December 2014 advises that it would be possible to do both, through creation of two subsidiary companies:

> *"This advice informed the decision to propose a Council controlled holding company with two subsidiaries, one benefitting from the so called Teckal exception, i.e. enabling the Council to contract on certain matters without the need to tender, etc., the other a normal trading arm."* (Bristol City Council, 2015c, p. 12)

However, it is not clear what is included in 'certain matters', and whether this approach of setting up two companies was followed.

In practice, as of Feb 2017, the BCC contract for halfhourly electricity supply contract was won by Bristol Energy, but not non-halfhourly electricity, nor gas.

This enforcement of Bristol Energy as a market actor creates fragmentation by separating it from BCC. This separation is a key part of protecting the mechanism of 'competitive market', similar to the unbundling of vertically integrated companies. This division can be framed as preventing a 'conflict of interest' whereby BCC stands to gain financially by granting itself a contract, but also gains financially by selecting the lowest-cost supplier. At the same time, it is in the interest of BCC not to be seen to act unfairly – a question of reputation and a risk averse approach to compliance. It is not clear whether the use of a Teckal company could have avoided this requirement, and whether this was a strategic choice by BCC or a legal requirement.

Enforcing market logic in this way also creates fragmentation by distancing Bristol Energy from participating collaboratively and creatively in the emerging polycentric system of local sustainable energy transition described in chapter 7. A key function of an LA owned energy company such as Bristol Energy could be to add the crucial 'licensed energy supply company' role into that local sustainable energy transition polycentric system.

Bristol Energy has stated aims "To use Bristol Energy as a vehicle to route power from existing and planned council-owned or community-owned low-carbon generation assets to local consumers" and "To position Bristol Energy as the preferred choice for local low carbon electricity generators seeking offtake arrangements for their power" (Bristol City Council, 2015c, p. 5). One way to achieve this could be to make power purchase agreements with BEC and potentially to provide a white label supply to their members. However, BEC announced at their 2016 AGM that they were in discussion with Mongoose Energy, a spinout of CE co-operative BWCE, about setting up a white label energy supply, with Mongoose as the licensed supply partner. A BCC officer I spoke to at the event was not worried about this, as they felt that there was plenty of space for competition and that the BEC market is different to the Bristol Energy market.

As an observant participant engaged in a reflective practice, I had strong emotions in relation to this situation. I felt sad, frustrated, disappointed and concerned. I was disappointed because I felt that this was creating fragmentation; precluding the development of a fully polycentric local energy system; and missing an opportunity for Bristol Energy to play the key role that I had identified for it in this system. I felt frustrated because others were not seeing the importance of a collaborative, strongly connected polycentric system the way I did; and because I perceived that this situation had arisen due to insufficient open sharing between Bristol Energy and BEN members (an issue discussed further in chapter 8). I also felt concerned that not working in an integrated way with the CE sector would lead Bristol Energy to be unsuccessful as a company, at a time when I wanted it to succeed, and was aware that it is not an easy market to be in. I was disappointed that, for the BCC officer I spoke to, it was not important that Bristol Energy should seek collaborative and mutually supportive relationships with the participants in the local sustainable energy transition community. They had a market-competition-diversity perspective that I found painful.

The reflections above date from autumn 2016. Since that time, Bristol Energy has had more capacity for open conversations with CE groups. However, the details of these are outside the scope of this thesis.

These observations show the dominance of market logics in the current system, as well as the more complex interweaving of different logics and sectors than was imagined in the original formulation of DP1. The LA or state-public part of the local energy mixed economy does not purely behave according to state logics. By setting up a state-owned energy supply company, it is required to act as a market entity, and individuals involved actively value the market logic. At the same time, it has stated aims to support the commons, in the form of the CE sector, but this is secondary to market logic, even when market logic works against its own interests.

9.2.2 Local government as enforced rational consumer

Whilst Bristol Energy is legally separated from BCC, BCC also carries out energy activities directly. This is through the Energy Services team, which has been funded through the EU ELENA programme and thus has greater operational capacity than many LAs in the UK. The energy services team was responsible for four streams of work funded through ELENA: energy saving for social and private housing, energy efficiency of publicly owned buildings, solar PV on council and other public sector and commercial buildings, and district heating networks.

Procurement is important for the BCC energy services team, and is a major task. Riley, senior officer in BCC Energy Services team, talks about the scale of achievement of procuring two large contracts, for their retrofit

scheme, and for a Solar PV framework contract. Riley is proud of how quickly they have achieved this, but it has still taken a long time (interview September 2014).

> *Riley: Because we've worked really hard, we now have procured a number of contracts, large scale contracts, that will help us with delivery of schemes. And one contract that is really important for us is the 60 million contract with Climate Energy, and that was an EU compliant tender process. It usually takes 3-6 months to go through a tender process such as this, not including the planning, to actually start the process. So we've gone for that. OK, we are also announcing now in 2 weeks' time the solar PV contractors on our 47 million framework contract, that's taken us a year, and I think we're quicker than most local authorities in the country on this front and so I think there's real strength that we've got, because we've got these procurement framework contracts in place, because that should now help with speeding up the delivery. It's taken us a long time, and I think people have been saying 'why is the council not doing anything', but I think you will now see that we can make progress really quickly because all of that is in place.*

The two contracts mentioned here were very different with respect to the Ostromian concepts of provision and production. The first, contract, with Climate Energy, procured both production and some elements of provision, whilst the second, the solar framework contract, procured only production, with BCC taking responsibility for provision. In-house delivery would have meant that both provision and production were carried out directly by BCC.

McGinnis' guide to the Ostrom lexicon suggests that public sector bodies should keep provision activities in-house, but supports procurement of production activities through the market. In practice, Climate Energy, which was selected for delivery of the Warm up Bristol programme of energy efficient retrofit of homes, went into administration in 2015 (Macalister, 2015; Weisselberg, 2015), leaving BCC to pick up the pieces. Ultimately, BCC remained responsible for provision despite having contracted this out, and this is an example of privatising profit and socialising risk. The distinction between provision and production activities may be a useful way to discern what is appropriate to outsource and what should be kept in house. However, it is important to note that many other factors were involved, including government policy on FiT which was blamed for the collapse of Climate Energy.

In contrast, the solar PV framework contract selected multiple small contractors to be on the 'framework agreement' and thus eligible to be selected for installations. This approach enabled SMEs (Small and Medium Enterprises) to benefit from the public procurement, an approach which has since been more strongly supported in the 2014/2015 changes to EU public procurement rules (The European Parliament and the Council of the European Union, 2014; HM Government, 2015), which explicitly encourage public bodies to enable SMEs to bid for public tenders, including by breaking them down into smaller packages, or 'lots'. This effectively retains a BCC role in provision, whilst using market mechanisms for production. This is discussed further in the context of scale economies under DP2, p189.

As discussed previously, BCC is enforced to act as a 'rational consumer' when purchasing electricity, and cannot favour Bristol Energy as a supplier of energy. This is in contrast to domestic consumers, who are free to choose on whatever basis they wish, and 40% of whom never switch at all, resulting in them paying much more for their energy than those who do switch, see discussion of fuel poverty on p208.

The enforcement of BCC to act as a 'rational consumer' takes place in part through procurement rules at the EU level. This is based in "EU Treaty-based principles of non-discrimination, equal treatment, transparency, mutual recognition and proportionality" (United Kingdom Crown Commercial Service, 2016). These rules aim "to create a level playing field for all businesses across Europe" (Europa, 2014), i.e. the main purpose of EU procurement rules is to prevent states from favouring suppliers within their own borders, and to ensure that there is free competition across the EU. This is what is meant by 'non-discrimination'. This is debatably

motivated by the neoliberal and free market ideology of competition as a mechanism for achieving economic efficiency (Kunzlik, 2013; Sanchez-Graells, 2013). In practice, there is some scope for judgment and interpretation in the implementation of procurement rules, and this is done differently by different LAs, some of which are more risk-averse than others.

The need to be seen to be fair also resulted in a competitive process for the selection of a CE partner to install solar PV on the roofs of BCC owned buildings, discussed in more detail on p200. It took time to develop this process, partly due to the complexity of determining whether and how EU procurement rules would apply, and whether it was possible to reserve this role exclusively to CE groups, and partly due to the need to be clear on other legal and contractual issues.

BCC also needed to select a process for allocation of roofs to CE groups. Two approaches were suggested: either a nested approach, where BEN would be granted the right to decide which member group would install on which roof, or a direct process whereby BCC would select the group to carry out installations. The second option was ultimately selected. This is discussed in more detail under 'subsidiarity' in chapter 10.

It is interesting to note that although these EU procurement rules are enforcing market mechanisms, they are doing so through a top-down legislative process that is based in the logic of the state. This is one of the ways in which the market system is dependent on state-based legislation. It is also an example of mixing of market and state logics, supporting Bollier's (2014) point that market and state are 'joined at the hip', as discussed on p.101.

The time and effort involved in the procurement process resonates with Graeber's (2015) claim that contrary to popular belief, the market-based neoliberal economic system is more, rather than less bureaucratic than hierarchical decision-making systems. This calls into question the claim that market mechanisms are more efficient, a question that could be explored further in relation to the amount of resource committed to trading activities in the GB energy market. Further research could also explore whether LA officers perceive the work they do to complete procurement processes to be valuable and necessary due diligence, or whether they perceive it as unnecessary additional bureaucratic work that causes inefficiency.

This discussion shows that the local authority itself, not just its subsidiary company, acts as a market entity, because it is in a market context and bound by market rules. Additionally, part of the role of the state is to provide the market, both by creating market institutions and by modelling ideal market behaviour in its transactions.

9.2.3 Community energy in market

Similarly to Bristol Energy, CE groups often have a dual identity as market and non-market actors. This particularly applies to RE investment co-operatives, which have a clear commercial business model, but which differentiate themselves from commercial developers through their not-for profit social and environmental objectives and their democratic structure. They need to present as effective market actors, and to compete against commercial businesses in order to secure income and be financially viable. However, community groups are risk-averse investors, and are often at a disadvantage relative to commercial competitors as they move act slowly due to reliance on voluntary labour, crowdsourced capital and participatory processes.

The social benefits of community provision and the need for time for community organisations to build capacity and be in a position to compete with commercial organisations are recognised in the Localism Act 2011. This provides a Community Right to Bid through a register of Assets of Community Value (Part 5, chapters 2 and 3, HM Government, 2011). Local community groups can nominate buildings or land that are of social value to the community to be on the register. If they are accepted, the nominating group will be notified when the asset is to be sold, and if they state their intention to buy the asset, they then have six months to put together a proposal and raise the money to bid for it at market rates. In Scotland, the Land

Reform (Scotland) Act 2003 provides a similar but stronger policy of a Community Right to Buy, where the community has the right of first refusal to buy land at market price as determined by an independent valuation.

These rights do not currently apply to energy infrastructure, but the concept could be extended to allow community bodies to register sites of potential energy system value, such as land with high wind capacity or where storage would be of particular value to the network.

A commons framing sees the CE sector as a proto-commons that could fundamentally shift the role of users of energy into integrated collective self-provision rather than dependent consumers, organising the separate prosumers into a commoning organisation. Mechanisms such as a community right to buy energy assets, including rights to develop energy assets on land or buildings in the locality, could enable this potential future to emerge.

This discussion shows that community organisations must be 'market on the outside' (Bollier, 2014) even if they are 'commons on the inside', in order to survive in a market dominated economy, and to interface with the wider world.

9.2.4 BuroHappold Engineering making non-commercial investment

Where the discussion of the LA and CE sectors has shown that state and community organisations can interact through market mechanisms, whether voluntarily or because they are constrained to do so, the role of BHE in the CEI project shows ways that a commercial, ostensibly market organisation acts in non-market ways. BHE is a commercial, private sector entity, expected to behave in an economically self-interested way. The company self-funded the CEI project, as a long term investment with little tangible, directly attributable commercial gain relative to the substantial cost. Benefits are difficult to quantify: reputation; corporate identity; learning. For the individuals involved, there was the enjoyment of challenging work and learning, and the desire to do work that felt intrinsically valuable by contributing to Cornwall's sustainable energy development and developing an ongoing relationship and commitment to the Energy Island process.

One of the perennial questions raised within BHE by the CEI project was 'who would ever pay us to do this kind of work in the future?' The role played by BHE was felt to be valuable by many involved both within BHE and by participants to the workshop. It would also potentially be cheaper to provide this service in future, based on experience in Cornwall. However, the value is dispersed – many organisations benefit from coming together to create a common vision, but none is uniquely motivated to pay for it, a classic social dilemma of positive externality, or public good. LAs are naturally in a position to provide a public good in their local area, but are underfunded due to national policies of austerity during the study period. In a follow-up meeting with the Local Enterprise Partnership (LEP) and BHE colleagues, where we were exploring funding options to develop an energy strategy for Cornwall, the LEP suggested that a coalition of businesses might fund a CEI project going forward. We did not pursue this further, because as a consultancy we were not in the right role to develop a long term, Cornwall-based coordinating organisation and raise corporate sponsorship.

The Zero West project may be in a different position, as it is led by BEC, a locally committed, project development based organisation. The initiative has already received sponsorship from local law firms with business in RE, who would like to see a market for their services grow, and see the Zero West initiative as a way to support the RE sector.

However, the extent to which a commercial organisation can act in non-market ways is limited, as ultimately there needs to be a commercial business case for ongoing investment. Individuals within the organisation may play different roles in balancing this tension, with some who guard commercial viability and profit, protecting the financial homeostasis of the company, whilst others operate according to more intrinsic values and logics, and create temporary anomalous situations. This is a role I see myself as playing at times, for

better or worse. The balancing of market relative to social and environmental logics therefore takes place within as well as between organisations.

9.2.5 Multiple hats

Building on this consideration of the role of individuals, whilst the examples of BCC, Bristol Energy and the CE sector highlight the important role of market mechanisms as a logic of interface between organisations, direct human relationships are also an important way that organisations connect. One mechanism for this is cross-pollination by people involved in several different organisations.

Many people wear 'multiple hats' – they may be employed by one organisation, volunteer for another, have an official role such as director in another. At the same time, there is a community of values, interest and practice that includes most of the research participants in this case, and which I too am part of. We share a concern with climate change, a belief that we can act together at the local level, and a knowledge that there is a lot of work to be done in this space and so we need to work together.

Sometimes there is ambiguity as to which 'hat' to wear in a particular context: whether contribution to CE activities can be booked to work time or not, whether to organise an event through BEN or BEC, what organisation to put on a name badge at an event. Being able to select from and draw on resources from multiple roles allows people to enlist wider resources in the service of the CE sector – including informal or semi-formal 'in kind' contributions. As McGinnis puts it "each individual has valid interests in many different aspects of social life, each also belongs to multiple social groups" (McGinnis, 2016, p. 3), and "In reality, of course, individuals play multiple roles (like the Greenpeace activist who drives a sport utility vehicle)" (Unruh, 2002, p. 321). This belonging in multiple roles can contribute to cross-fertilisation and learning between organisations, and reduce the risk of fragmentation in a polycentric system, as discussed in more detail in chapter 7.

Having multiple roles and identities opened doors for me during the process of the research: I gained access to BCC as a researcher that I would not have had either as a BHE employee, or as a Bristol Energy Coop director or member. I commanded attention from CE practitioners in other places as a fellow CE practitioner, that I would not have had as a researcher. I contributed technical knowledge in CE settings which had greater weight because I spoke on behalf of an engineering consultancy. At the same time, I often hesitated when asked to introduce myself, feeling that I did not really belong anywhere.

Having a clear 'facilitator' role which is paid for may be more straightforward than making a pro-bono investment, as with BHE in CEI, or being an interested party within a setting, as with BEC in Zero West. Perhaps juggling multiple roles and interests is one of the skills that a consultant providing convening and partnership-building services needs to master.

9.2.6 Summary

This discussion shows that the boundaries between market, state and commons sectors are more complex and less clear than expected. The different 'logics' of institutions are dependent on each other. For Bollier, the state should have a role in the commons similar to that currently provided to businesses for innovation and development, which he suggests could include: legal support; setting basic parameters; and resources (Bollier, 2014, p. 163).

The analysis in this section has primarily focused on relationships between the market and commons, or market and the state, rather than the state and the commons, which is discussed more in relation to DP2 on nested governance. It has shown that organisations that are ostensibly 'state' or 'commons' sometimes operate in a market logic, and 'market' organisations sometimes operate in a 'commons' logic. It has also

shown that individuals move between and share between organisations based on their own values and individual motivations.

9.3 Additional concerns with commoning[46]

DP1, mixed economy, calls for a greater role for commoning. The discussion so far has shown that commoning has a subordinate role to markets and the state, and this thesis argues that the commons sector should grow in order to achieve balance. However, this does not mean an economy based only on commons. Not only is this potentially unfeasible, as commons may not provide enough connection for larger scale interaction and coordination, but it may not necessarily be desirable, as commoning has its own problems.

The theoretical discussion of commons in chapter 5 had identified weaknesses of commons including the risk of exacerbating inequalities within or between communities, and conservatism without space for innovation. The LiM interviews revealed three additional weaknesses of commons institutions: the risk of horizontal (peer to peer) privacy loss, the challenge of dealing with conflict and the time required to participate.

The LiM study explored the potential to design neighbourhood electricity management communities around Ostrom's DPs for management of CPRs. This particularly focused on community accountability mechanisms represented in Ostrom's DPs 4A, 5 and 6, as well as discussing the practicalities of community responsibility for local electricity infrastructure in a hypothetical scenario.

> 4A Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.
> 5 Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense)[47] by other appropriators, by officials accountable to the appropriators, or by both.
> 6 Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.

The interviews carried out in the LiM study showed that participants welcomed the chance to discuss energy consumption patterns with their neighbours in a mutually supportive way. Participants also engaged with the idea of community accountability and responsibility for infrastructure.

9.3.1 Positive and supportive information sharing

Before describing the wary responses to the more negative sides of commons, it is worth noting that respondents welcomed some aspects of community governance.

Several participants in the LiM study, including some who also had concerns about privacy, identified a number of positive aspects of sharing information about energy consumption within the community. These included making individual actions feel more worthwhile, social motivations of meeting others, and the potential for support through sharing tips and information.

Respondents expressed a sense of feeling more effective when acting with other people than individually, in the context of neighbourhood or CE demand reduction or peak shifting projects, e.g.

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[46] Much of this section adapts text published in (Melville *et al.*, 2017). Names of research participants are changed to pseudonyms, to preserve anonymity.
[47] The phrase 'assessed graduated sanctions' means that a smaller sanction is demanded of an individual who breaks a rule for the first time, or in time of need, whereas a repeat or casual offender will be more severely sanctioned.

> Clara: *sometimes it feels a bit futile if you don't think anyone else is doing it. So I think if you know that other people are doing it, it makes you feel you're having a bigger impact.* (with similar comments made by Gloria, Kelly and Josie).

This finding is supported by Burchell et al. (2016, p. 182), who report a respondent feeling that acting as part of the local area can make more of a difference than acting as an individual. Josie, Kelly, Beth, Gloria, Anna and Louise also mentioned being motivated by meeting people or doing things together, social cohesion and community involvement, or community activities.

LiM respondents were generally interested in having access to detailed information about their own electricity consumption, in order to learn how to adjust their behaviour: "being able to see your own usage and when your own peak times are and make adjustments" (Emma, with similar comments made by Kelly, Anna and Clara).

The idea of knowing how their energy consumption compared with others', particularly others who were similar to them in terms of number/age of children, type of heating system, house occupancy patterns etc., was discussed enthusiastically in the focus group. This is supported by VaasaETT (2011, p. 46): "If comparisons are to be made then it must be to households of a like description". Some level of sharing of information between participants would also be welcome for the purposes of enabling mutually supportive shared learning, sharing ideas and hints and tips. Several respondents expressed a desire for sharing learning (Frances, Louise, Kelly, Imogen), or observed that knowing what neighbours had done would be an inspiring demonstration of what is possible (Gloria, Anna). This idea of a learning community supports the development of 'energy know-how' discussed by Burchell et al. (2013), and the findings of Catney et al. (2013), on the value of "Community Knowledge Networks", which provide opportunities for peer learning about energy through discussion and sharing of tacit knowledge in a face to face interaction, 'making energy discussable' in an atmosphere of conviviality (RECCKN, 2013).

This suggests that bringing some level of commoning could be positive in supporting people's motivation to save energy.

9.3.2 Exposure and retribution

On the other hand, respondents also had concerns about the idea of community accountability beyond sharing information, including individual monitoring and consequences.

The idea of community monitoring of each other's energy consumption behaviour was framed through questions about whether people would want to see when their neighbours were consuming electricity, and whether they would want to know the names of who was and wasn't participating.

This touches on questions of privacy. Privacy can be conceptualised in terms of 'vertical' privacy of individuals relative to large organisations such as energy companies, data companies and the state, and 'horizontal' privacy of individuals relative to their peers (Naus, Vliet and Hendriksen, 2015). Privacy theorist Solove (2001) sees the imbalance of power between individuals and large corporations and government as problematic, particularly in an age of 'big data' where organisations can derive useful knowledge from large quantities of data.

Lack of horizontal privacy is also problematic. Solove (2002) describes two dimensions of privacy: not being seen, and not being interfered with. Whilst not being seen or interfered with by government or corporations is important, for many people not being seen or interfered with by neighbours, friends and family is more important. This conflicts with Ostrom's DPs which emphasise community accountability for actions, including an element of monitoring.

Respondents' views on sharing individual energy consumption data with their neighbours were mostly negative (with some ambivalent or neutral), particularly if this was for the purposes of holding each other accountable. In particular there were negative feelings about identification of individual names. Participants used vivid and violent metaphors such as 'lynched', 'Hitler Youth', 'big brother' and 'witch-hunt' to express why they would not want individual energy users to be identified in the community:

> Interviewer: *If there was a blackout, would you want to know who did it?*
> Clara: *No, because if it had been us then I would be terrified of being* ***lynched****.*
>
> Interviewer: *And if it tells you the names of people?*
> Anna: *I think that'd be horrible. I'd hate that I wouldn't want to participate if that was how it was going on, it would be a bit like* ***Hitler Youth*** *or something wouldn't it.*
>
> Interviewer: *And if [a blackout] were to happen because a few people were just using huge amounts of power would you want to know who it was?*
> Frances: *Well, now that's kind of more like one* ***big brother*** *watching and it's also kind of scary like picking on one people, I mean … I don't know, I think that could go terribly wrong.*
>
> Interviewer**:** *And if [a blackout] did happen, because a few people were really maximising their power consumption, would you want to know who it was?*
> Louise: *Oh no, that's a local* ***witch-hunt****! We're far too nice round here!*

These metaphors evoke violent, unpredictable, unaccountable, arbitrary and irrational punishment for transgression, without any transparent process, with a threat of death. Violent punishment is pictured by respondents, although the question only referred to information about who has transgressed, with no mention of sanctioning or consequences. In contrast to the violent images evoked by respondents, Ostrom's fifth and sixth DPs refer to graduated sanctions and accessible conflict-resolution mechanisms. These are accountable, transparent and proportionate systems designed to maintain community trust rather than instil fear. However, Clara, Anna, Frances and Louise seemed not to perceive community accountability as calm, fair and rational.

Additionally, Ostrom's fifth DP of 'graduated sanctions' is based in a punitive justice paradigm. A restorative justice approach, which "brings those harmed by crime or conflict and those responsible for the harm into communication, enabling everyone affected by a particular incident to play a part in repairing the harm and finding a positive way forward" (Centre for Justice and Reconciliation, 2016), could be used instead, perhaps with greater benefits for developing stronger community relations.

A community DR approach is conceived as a way of trading off some horizontal privacy for the sake of protecting vertical privacy. In this context, it is interesting that metaphors used by Frances, Louise and Anna (big brother, witch hunt, Hitler Youth) originate in historic or literary situations where an oppressive force of the state, political party or church recruited local people or technology to spy on each other – a situation involving infringement of both vertical and horizontal privacy for the purposes of the control by totalitarian regimes. The unequal power relations of the individual to the large organisation are central here. However, these metaphors are being used by interview respondents in the context of horizontal privacy, rather than vertical privacy.

Whereas the terms such as 'big brother' discussed above related primarily to the aspect of privacy that is about freedom from coercion, respondents also had concerns about being seen, embarrassment, or their reputation, using words such as 'voyeuristic', 'too much information', 'singles people out', or simply expressing a general discomfort 'don't think I would want my name there', as shown in the following excerpts from three interviews.

Interviewer: *And if you could identify who the people were that were logging on, would you have felt more or less inclined to do it yourself?*
Clara: *I think I preferred the anonymity of it. I think if people were identified by house number it would be a bit, not* ***voyeuristic*** *but a bit* ***too much information*** *almost.*

Interviewer: *And what kind of information would you like to see if you wanted to know how many others were participating in the project?*
Frances: *I wouldn't want to know what houses were, because I feel like that* ***singles people out*** *and that's not the goal of it*

Interviewer: *And what if the website told you the names of people?*
Josie: *Don't think that's particularly a good, no I wouldn't really be bothered about that and* ***I don't think I would want my name there either****.*

The following excerpt, from the first interview with Clara, is more ambivalent. She thinks that having more information about neighbours' energy consumption would be 'interesting' and create a sense of 'something going on', and she also feels that energy saving is 'really, really important' and that she would 'take it seriously'. However, naming individuals could lead to 'embarrassment' and 'shame':

Interviewer: *What if it gave you the names of the people who were joining in?*

Clara: *I think I'd be quite* ***embarrassed*** *[laughter], I think it's quite, you wouldn't want it to be like a* ***name shame*** *thing but you'd have the house numbers but then again how personal does it get. Obviously it's all for awareness and not to* ***name and shame*** *but it's like I think it'd be quite* ***interesting****. If you do it by street that would be quite anonymous or at least let you* ***feel that there's something going on****, yeah.*

Interviewer: *And is there anything about the idea that other people that are participating about it being more fair that others are joining in and doing your bit…?*

Clara: *Okay so you mean say if my next door neighbours decided not to do it and I feel a bit aggrieved by it?*

Interviewer: *Yeah.*

Clara: *I don't think, I don't know if the word 'fair' would be more, you want to be quite* ***cohesive*** *don't you as a neighbour you want to* ***feel that you're working together*** *so if this kind of thing takes off and so it would be, yeah I don't think, and* ***obviously I'd take it seriously*** *but I wouldn't but not to the point that it clearly disrupting my* ***relationships*** *with my neighbours. I don't think it's not the first thing I would launch into talking to them about because it might seem a bit* ***mean*** *although* ***I do feel it's really, really important*** *and would be really good if whoever moves in on either side got involved. I'd be really happy to chat to them about it but it would be yeah I don't know if it would feel it's unfair, I'd just feel a bit like, "Oh that's a shame."*

Although Clara's understanding of the question about fairness is clear, her response is uncertain. She considers energy efficiency to be important, and wants her neighbours to participate, but feels that relationships with neighbours are more important.

Clara also mentions shame. Shame is a powerful mechanism of social control, but can also be destructive for those who are shamed. The question of whether it is possible to develop effective mechanisms of accountability which do not rely on shame is an important one for modern commons. For people who have experienced the benefits of individual freedom, liberation and privacy that an economic system based on anonymous market relations rather than social control, moving to shame-based social control is unpalatable.

The practices of restorative justice, discussed in more detail on p218, may provide some ways forward with this, and the intersection of shame and commons is an interesting area for further research.

The LiM study posed a hypothetical scenario to participants. However, the roll out of smart meters is a reality which touches on privacy, and primarily impacts vertical privacy rather than horizontal privacy, as the status-quo approach to smart metering will send information to energy supply companies, but not be visible to neighbours.

Morgan, senior manager at Bristol Energy, talks about the importance of framing smart meters in a way that elicits trust rather than suspicion:

> *And the other thing that the industry needs to get better at … is one of communication with the customer. It's not seen - what a shame that it's seen as the spy under the cupboard, when really the smart meter is the laser scanning till of our industry. Before laser scanning tills, Tesco and the like sold stuff. And they put in laser scanning tills to help them with stock control till queues shorter. And in touch… their clubcard. Which customers very much wanted to because they saw benefit - I got offers for cat food because I've got a cat. And … you know, not random stuff. That for me is about tailoring the offering of smart. And I think you're starting to see some very clever and innovative and… processes being developed.*

In contrast to Solove's concerns with 'big data' and vertical privacy risk, Morgan is comfortable with the idea of lack of vertical privacy, and has trust in the corporate institutions who use personal data for marketing purposes.

In conclusion, a community approach to accountability for energy use could lead to loss of horizontal privacy. This is a concern partly because of the potential for conflict that it creates, in particular in a contexts where people lack experience of effective restorative justice systems. In the UK, conflict between neighbours can become entrenched and problematic.

9.3.3 Community accountability and responsibility for infrastructure

Attitudes to mutual monitoring may be affected by the experience of responsibility for infrastructure. The discussion above shows that respondents saw mutual monitoring positively as an optional way of mutually supporting each other to choose ethical energy consumption behaviours. However, it was seen negatively in the context of enforced neighbourhood accountability. This ambivalent response challenges the applicability of community accountability in this neighbourhood electricity context. However, attitudes to community accountability may be different in a neighbourhood electricity commons where neighbourhoods have full responsibility for their infrastructure. This was explored through discussion of a scenario in focus groups.

In the LiM interviews, responsibility for infrastructure was a novel concept for most participants, introduced during the second interview and the focus group. Some respondents felt that the project had increased their personal sense of responsibility for local electricity infrastructure, talking about being more mindful and aware of their own impact. Others felt that it had not changed.

Imogen developed ideas of how a community based balancing system could be operated, in a way that would preserve privacy.

> Interviewer: *Yeah, and if it did kind of trip and cause a black-out because of a few households really putting everything on, would you want to know who it was?*
>
> Imogen: *Erm, not as such as in starting to get accusatory but I'd want to know that something was being done about it. So there wouldn't be my part to it, you know, you'd hope that there would be enough support and education going out. Then actually if that's doing that from one or two*

households, surely there should be some controls where you can stop it happening, so that household's limited. ***So that basically there's some trip switch on that house so it doesn't affect everyone else****. So it could be actually that you do have flashing lights that say you're getting close to your consumption max and switch off, switch on,* ***warning lights****. Then if you don't do that your supply is shut off.*

The system she describes, with a physical limit on the power that can be used by each house, and warning lights to let people know when the limit is being reached, has much in common with the CE system on the isle of Eigg described in section 2.11.

When prompted to think about the potential for community decision-making about local energy management, there was a mixed response, with some scepticism about whether people would have the time to participate locally, and an awareness that it may be difficult to get a sufficient percentage of the population interested. Two respondents referred to a local self-build community where they thought it could be easier to manage an energy commons.

Kelly saw the time needed to manage a CE system as requiring a paid position:

> Kelly: *Well it gives you more control but, again, you'd need people to do that and they'd cost. I don't think people have got enough voluntary time to do it, it would have to be paid, proper salaried posts to do all that*

Others commented that the decision-making itself would take time, with some feeling positive about meeting together, and others considering that it would be difficult to find the time to meet. Clara observes that energy companies provide value by making these kinds of decisions:

> Clara *If it's a decision-making process people might find that quite frustrating. So, for example, if we had to vote for particular items or aspects of the system then that might be quite problematic*
>
> Interviewer *And why do you say the decision-making process would be frustrating and problematic?*
>
> Clara *Maybe it's time consuming for people and slows the processes down. And I suppose when you …* ***I don't know if we partly pay certain companies like energy companies for making decisions that we don't have to think about.*** *And that's what people, that's maybe part of the premium.*
>
> Interviewer *Yeah. You think that's a good thing?*
>
> Clara *I think it makes our lives easier, I wouldn't say it was necessarily a good thing. If you look at, obviously, energy prices but there's lots of different variables within that I'm aware. I don't know if that's … I don't know about the transparency of the system and where the money goes, so …*

In practice, the day to day decisions involved may not be too onerous. For example, on Eigg, a maintenance team accountable to the residents takes most of the decisions (Leaver, 2016). However, the time involved in participating in a CE system is still a potential weakness to be taken into account.

9.4 Design principle 1, mixed economy, conclusion

Chapter 8 set out the following set of questions to be asked through the case study analysis of each DP:

- To what extent are these principles already present or not present in current local energy activities and the GB energy system?

- To what extent does the absence or presence of these principles lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from these principles?
- Do these principles need to be modified or rejected in light of analysis of the case studies, and if so how?

These are answered below drawing on both the case study analysis in this chapter and my experience working in the CE sector and at BHE for the last 7 years.

To what extent is DP1, mixed economy, present in the case studies discussed above?

DP1 stated that there should be a mix of state, market and commons organisations providing energy services. It was noted that market and private sector provision currently dominates, and that there should therefore be a greater role for commons and state provision.

Direct provision of energy services by BCC includes support for energy efficiency through the Warm up Bristol scheme, development of RE through direct investment in solar PV installations and collaboration with CE groups to invest in solar PV, as discussed in section 4.2. This represents state-public provision of energy services to the city of Bristol.

The decision to set up a BCC owned energy supply company increases the diversity of the energy supply sector, as proposed by We Own It, by adding a state-owned organisation in this role. However, it remains a market, and state or community owned supply licence holders must still act as market entities. It is possible to envisage non-market roles, such as the provision of social tariffs being explored by Bristol Energy, favourable power purchase agreements for locally generated RE, or direct self-supply of energy by the local authority. Some of these activities may require changes in national regulation or public sector procurement rules. This is therefore market-based provision, and state owned.

The electricity transmission and distribution sectors, which the analysis in chapter 6 identifies as being particularly suited to state ownership due to their natural monopoly status, are still privately owned as of August 2017. However, they are not organised through market mechanisms, but through price control regulations. This means that the mechanisms of interaction and pricing are primarily rule-based, with a top-down 'state' logic rather than market mechanisms. They are bureaucracy-based and privately owned.

Commons principles are present in the CE sector, with democratic decision-making and benefits to members. They are also perhaps implicitly present in the pro-bono work of BuroHappold in the CEI project. Additionally, commons principles of contributing collectively to create a collective good could be used to develop the Zero West initiative.

To what extent does the absence or presence of DP1, mixed economy, lead to strengths or weaknesses for developing a sustainable energy system?

The objectives for Bristol Energy set out by BCC are typical of other LA energy companies. The development of public ownership in the energy supply sector is a strength for the development of a sustainable energy system, as it brings publicly oriented core motivations into organisations with potentially large scale agency in the energy system. This also applies to the development of the CE sector, which shares many values with LAs, as part of the civic energy sector discussed in chapter 2.

The role of BHE collaborating with the Eden Project to develop the CEI is an example of non-market mechanisms being used in by a primarily market organisation, leading to greater momentum for the sustainable energy transition in Cornwall, and is a strength from the presence of DP1.

The presence of commons organisations, in the hypothetical scenario presented in the LiM study, could lead to problems with loss of horizontal privacy. This was envisaged by respondents as a source of potential violent conflict, as shown by their use of violent metaphors in response to the idea of community accountability. Scapegoating and violent retribution does take place in some communities, so these concerns are valid. However, it could be possible to use systems of restorative justice to deal with conflict without resorting to violence, and in a way that leads to strengthening of community relationships.

How does the current trajectory move towards or away from DP1 as evidenced by these case studies?

BCC and Nottingham City Council both set up fully licensed energy supply companies in 2015, indicating the presence of DP1, and several other local authorities including Cornwall, Manchester and the GLA are considering following this example. This is therefore a trend towards DP1. However, recently the GLA has been criticised for not pursuing the setting up of a London energy company (Laville, 2017), and, as of August 2017, Manchester Council has also been hesitant about going forward, so it is not clear how far this trajectory will hold.

The support for CE that was provided by the 2010 coalition government through the Community Energy Strategy, and indirectly through FiTs and ROCs that provided a reliable income stream for community renewable projects, has not been continued by the 2015 Conservative government. The CE sector is seeking new approaches to continue having viable business models. It is still extremely difficult to do this in the energy efficiency and retrofit sector, and the Green Deal has not delivered an effective market for retrofit. Some state support is required to create an effective market for retrofit, and arguably for renewables. At the same time, the development of commons economies, where appropriation and provision activities take place within the same organisation, is hindered by regulation that prevents small-scale supply of energy. Changing this regulation could allow true commons in CE to emerge and be experimented with.

Does DP1 need to be modified or rejected in light of the analysis of the case studies, and if so how?

DP1 discussed the separate roles of market, state and commons, and argued that all three should have a role, with commons and state needing a much greater role in order to achieve balance. The case studies have shown that there is not such a distinct separation between the three modes – CE renewable generation development and local government owned supply act through market mechanisms, and are market actors at the same time as being commons or state actors. The regulation around supply would need to be modified in order for true commons institutions to be established. Additionally, private sector organisations act in the public interest.

DP1 should be modified to differentiate between ownership models, core motives and mechanisms of interaction. It should recognise that an organisation may have state based ownership models, publicly oriented core motives, and use market mechanisms in operation. Interactions between organisations in these case studies appear to be dominated by market mechanisms. This may be due to legal and ideological biases in favour of markets and private property, or may be due to advantages of market mechanisms as a 'substrate' linking diverse organisational types. This would be an interesting topic to explore further.

10 DP2: Nested governance

10.1 Testing the second design principle

The second DP, relating to polycentric governance, proposes that there should be nested forms of governance, with multiple interconnected spatial scales. These should be connected through the principle of subsidiarity, with the size of each unit of governance selected to fit the infrastructure and the appropriate scale of the activity involved.

For reference, DP2 was phrased as follows:

> DP2: Use of nested forms of governance at different spatial scales, as well as non-spatial governance, with sub-principles:
>
> a. The size of each spatial level of governance is congruent with the physical and technical boundary of the infrastructure being governed
> b. Diversity of governance solutions in different localities, which promotes innovation, with sharing of learning between these
> c. The relationship between different levels is organised according to the principles of subsidiarity

The first sub-principle, spatial congruence, describes what nested governance means. The second, diversity, is one argument for use of spatial nesting. The third, subsidiarity, defines the ideal relationships between nested layers of governance.

This chapter uses all five case studies to explore the nested governance DP2 and its sub-principles, and asks the following questions:

- To what extent is DP2 principles already present or not present in current local energy activities and the GB energy system?
- To what extent does the absence or presence of DP2 principles lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from DP2?
- Does DP2 need to be modified or rejected in light of analysis of the case studies, and if so how?

10.2 Spatial nesting and congruence of physical and institutional boundaries

The first element of DP2 is to have spatially nested organisations, which are sized to fit the boundaries of the physical infrastructure. This is based on theories of fit discussed on p113, and on Ostrom's second DP regarding congruence.

This section uses the CEA, LIM and CEI case studies to consider the potential of local electricity balancing units which fit both the infrastructure layout and social boundaries; the Bristol case study to consider scale economies; and the CEI and Bristol case studies to consider decentralisation of power.

10.2.1 Technically congruent nesting of infrastructure at multiple spatial scales

Technically congruent nesting of infrastructure means that the governance of infrastructure is split into several spatial levels, which match the levels of the branch patterns of the infrastructure. This is particularly relevant to network infrastructures of electricity, gas and district heating.

Currently the GB electricity system has three levels of spatial nesting: the regional DNO level, the national National Grid level, and international interconnectors to France, Netherlands and Ireland.

Creation of additional local layers of nesting is being considered. The system operator role, which ensures balancing of supply and demand and maintenance of steady frequency and voltage, is currently only at national level. However, there is discussion about the potential to share this between the national and the regional levels, with DNO moving to DSO, as discussed on p51. This leads to potential opportunities for local engagement and contracting with the DSO, rather than with a national body, allowing for smaller scale and more spatially specific balancing and flexibility services provision.

The development of local energy markets could also be a mechanism for devolution of electricity supply and demand balancing, in the supply/generation part of the system rather than the distribution/transmission part of the system.

Several of the cases studies apply the theory of fit and nested governance to the electricity systems. The CEA, and the LiM project both explored creation of a local, neighbourhood level of responsibility for balancing supply and demand. This was matched to the branch pattern of the distribution network, with smaller and smaller units going down to the substation level.

The CEA project created a concept of neighbourhood smart electricity microgrids, units using generation, storage and responsive demand to balance locally as far as possible, aggregating their contribution to the national system through CEAs, with a potential 'community level 1' intermediate organisational level. This is shown in Figure 59.

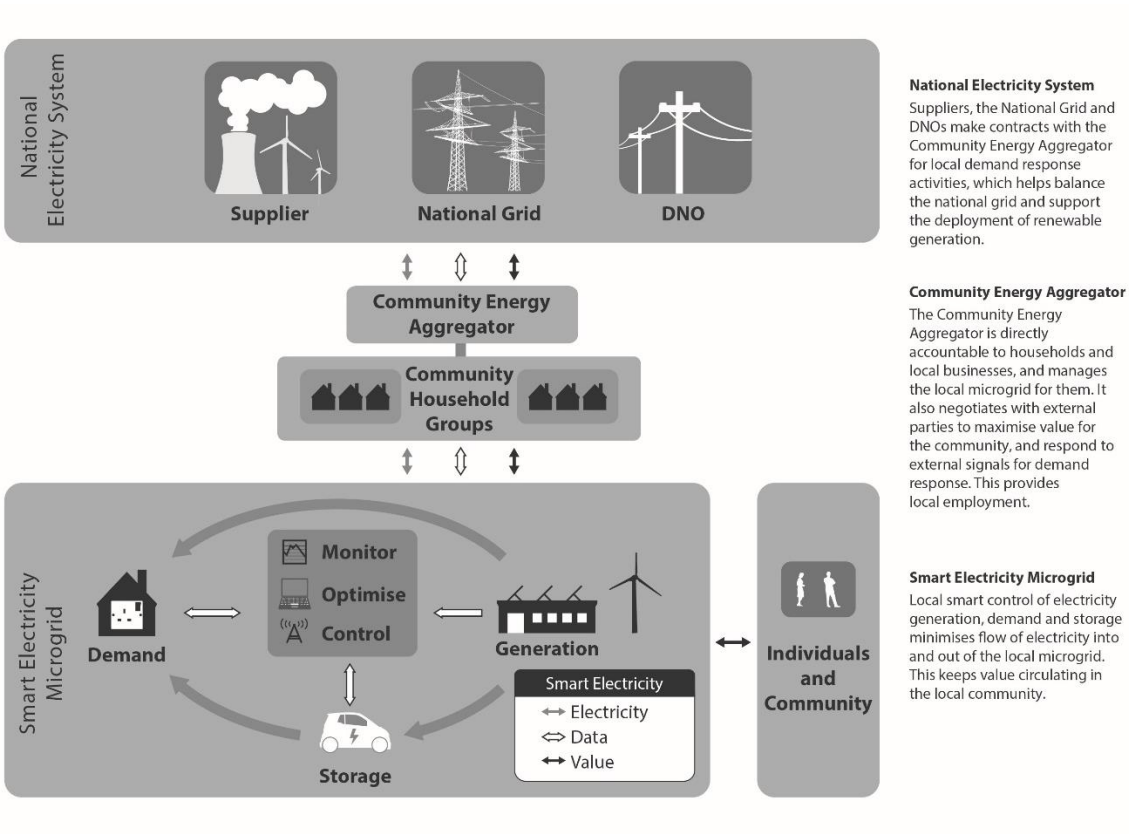

Figure 59: Smart electricity microgrids at a neighbourhood level, interacting with the national energy system through a Community Energy Aggregator (BuroHappold Engineering, 2013)

In the CEI project, this nested governance model was further developed as shown in Figure 60. This shows local units interacting with South West, South West interacting with the national, and then further with the international. Here, each unit attempts to balance electricity supply and demand as far as practicable within its own boundary, using storage, flexible demand and generation, but is able to use the wider system to enable greater reliability and efficiency[48].

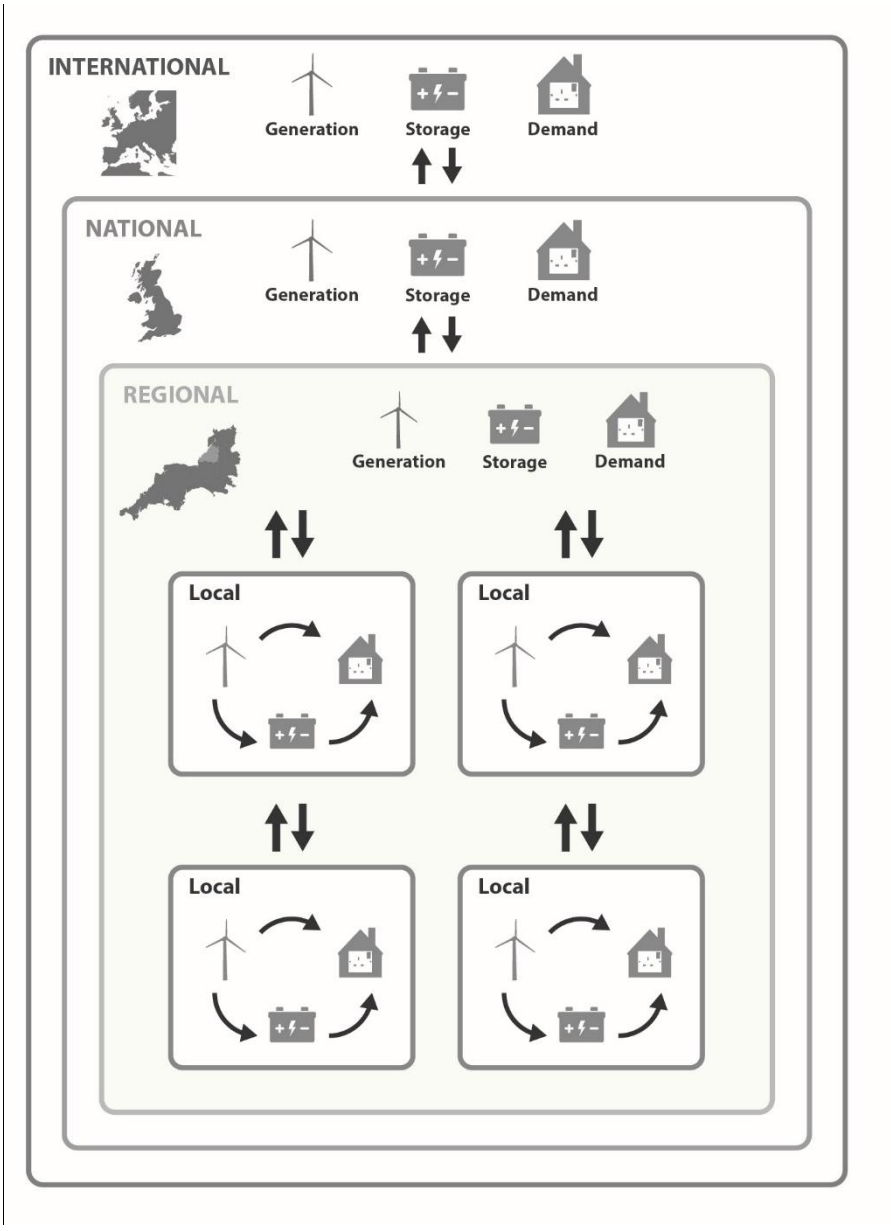

Figure 60: Spatially nested energy system (Melville, for CEI project, BuroHappold Engineering, 2015)

[48] Butler (2001, p. 131) describes the benefits of national and international interconnection as follows "interconnection can have a levelling effect on demand cycles, provide improved security and back- up for plant malfunction, maintenance and rapid changes in demand through linking stored hydro and standard steam generation. Interconnection also enabled a reduction in the amount of "spinning reserve" required as back-up, thus reducing system costs."

Further, the CEI proposed that Cornwall should aim for an economic benefit from 'arbitrage' – capturing value from the price difference in electricity at different times, providing a useful contribution to balancing the wider GB energy system. This requires 'importing' during off-peak demand times, and 'exporting' during peak demand times, as shown in Figure 61. Although such a strategy would provide economic benefit, it would require an active strategy to achieve this, as there is no particular reason why Cornwall would have demand at different times to other places, or generate at different times.

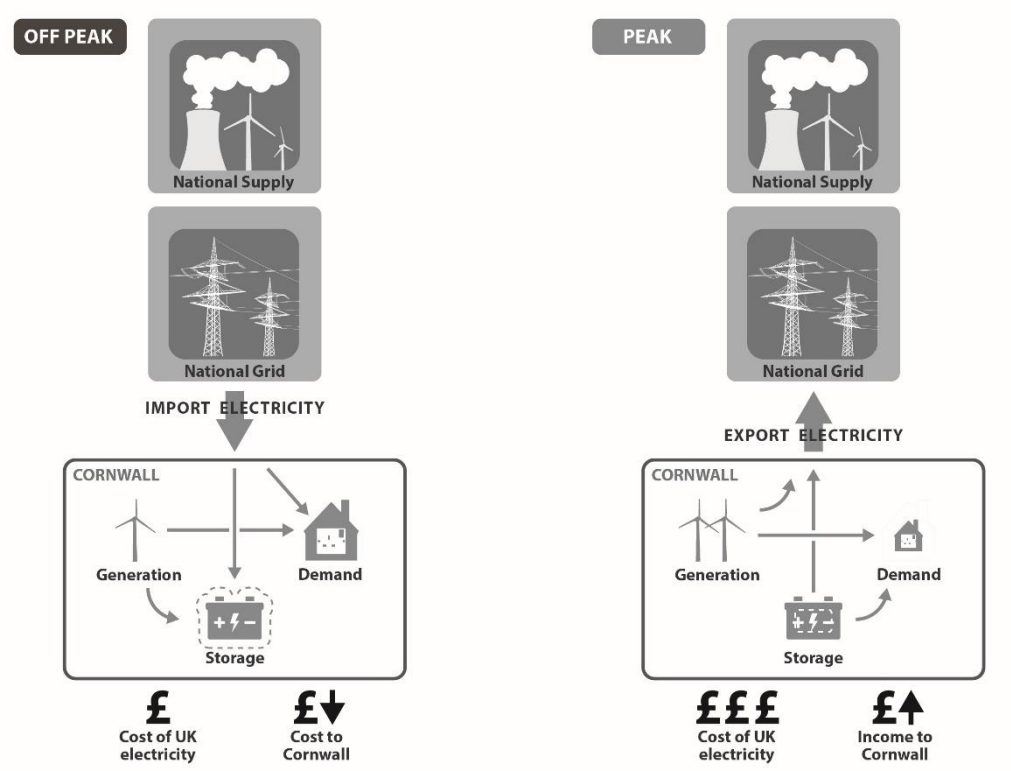

Figure 61: Economic benefit of arbitrage (Melville, for CEI project, BuroHappold Engineering, 2015)

In practice, defining the boundary of governance to fit the boundary of the resource or infrastructure is not necessarily straightforward. As with attempts to develop river basin governance structures across national boundaries, the houses served by one substation may not conform to natural communities of streets or neighbourhoods.

This became apparent in the LiM project, and the differing framings of WPD and CSE. For WPD, the focus was on responses that would make a reduction in peak energy consumption in a way that would be highly reliable, and at particular times, such that it would lead to actual reductions in the need to invest in new infrastructure. The choice of substation as a unit of 'community' reflects this perspective. For CSE, the priority was community engagement, which includes recognising the need for a sense of community that people socially identify with. Hoffman and High-Pippert (2009) find higher levels of community engagement when there is a strong sense of neighbourhood identity.

The LiM interviews carried out as part of this research show a strong sense of neighbourhood in the Greenbank/Easton area. One aspect of this included asking participants to draw a line around the area they felt was 'their neighbourhood', shown in Figure 62. This shows that different individuals drew the boundary in a similar location, and therefore had a clear sense of place and the spatial identity of the neighbourhood. The interview also included questions about social trust and participation in neighbourhood activities. I am also familiar with the neighbourhood as I have lived there for 7 years. The substation that was monitored in this

area had three feeders, also shown in Figure 62 for comparison. There was a strong line drawn around an area roughly 6 times the size of the studied substation, which did not align well with the substation boundary. It may or may not be possible to align with a wider set of substations. There was also a smaller 'immediate neighbourhood' line drawn by some participants which has a good fit with the substation area. However, this although this smaller 'immediate neighbourhood' area included one pub, it did not include many community hubs, such as the community centre which eventually received the community payment, and where the focus group sessions were held, nor fit with social media networking opportunities, such as neighbourhood facebook groups. This was also a problem in other neighbourhoods in the study.

Figure 62: Outline of their neighbourhood drawn by respondents during interview, and areas served by each substation feeder

Coxcoon (2014b, personal communication) felt that the LiM study suffered from a lack of community development expertise at the design stage and is "a classic-example of engineer-led design". The LiM study involved monitoring 10 separate substations dispersed around the WPD network area, none of which matched any genuine community boundary. She felt that the equipment would have been better deployed as part of an intensive study in a semi-rural village, which would involve all of the substations in the village. In this scenario, the mismatch between felt community and infrastructure boundary might have been overcome by having a larger level of governance where the two did fit. This project could have involved friendly competition between the different substations, and greater public visibility through an electronic notice board, at the village supermarket, showing live substation performance.

A new challenge might arise if this principle of nested forms of governance, with spatial fit to infrastructure, was applied to gas and water networks as well as electricity. It is likely that in many places, the boundaries of electricity substation groups, water branch and gas branch pipes are not coincident. Households might be part of one micro-community for their electricity, and another for their gas, and yet another for their water. Proponents of polycentric governance might see this as a positive creation of a dense network of

overlapping jurisdiction, with great opportunity for cross-fertilisation, as discussed in section 10.3 on diversity and innovation. However it could also be a recipe for huge complexity and excessive transaction costs, requiring people to spread their sense of belonging too thinly, and going against the 'oikophilia', or love of home advocated by Scruton (2017) as a core ingredient for sustainable prosperity.

10.2.2 Scale economies

Identifying the most effective scale for an economic activity is not straightforward, and depends partly on priorities and the wider economic system within which the activity is taking place, as well as on technical 'economies of scale'. Additionally, the 'best' scale for one party may not be the best scale for another.

One of the positive characteristics of a polycentric governance system is that of 'scale economies'. This means identifying the most economic scale for an activity, rather than assuming that bigger is always better. The selection of the appropriate scale for each activity is also part of the creation of a nested system, and part of the principle of subsidiarity, which requires the smallest effective scale (not necessarily the most economically efficient) to be selected. The identification of the smallest effective scale is usually open to discussion, and may be different from different standpoints. For the example of LA owned community investment in solar PV on the roofs of community buildings, from the CE perspective it may be desirable to have several smaller organisations involved, whereas from BCC's perspective it would be less administrative work to have a single, larger community organisation to deal with. This is also the case with obtaining finance for projects – commercial lenders are not interested in smaller projects, because the amount of due diligence they would need to do makes it not worth their while.

Another example of the optimal scale for an activity being different from different perspectives relates to the scale of public contracts. The 2014/2015 EU public procurement rules explicitly encourage public bodies to enable SMEs to bid for public tenders, including by breaking them down into smaller packages, or 'lots' (see section 9.2.2). SMEs tend to keep more money in the local economy, and employ large numbers of people. LAs, in their role in supporting a flourishing local economy, therefore have an interest in supporting SMEs through their contracts. However, they may also prefer larger contracts because of the overheads of the procurement process.

The BCC energy services team procured two large contracts (as discussed in section 9.2.2): a solar PV installation framework agreement, and an energy efficiency contract for the Warm up Bristol scheme. The framework agreement was designed to select up to 20 suppliers (five were actually selected), who would then be eligible to gradually bid for particular jobs over a period of time (Bristol City Council, 2014a). Solar PV installation works well at a small scale, as it is highly modular, and local PV installers in the Bristol area had recognised the barrier of being too small to win large contracts, and set up BASIC – Bristol Area Solar Installers Cooperative for that purpose.

The Warm up Bristol project, on the other hand, was tendered as one large contract, to a company which then employed subcontractors. Installation of home retrofit is modular like solar PV, and has low inherent benefits to large scale, but a 'Green Deal Provider' was needed to provide the funds through ECO. This large contract approach proved to be less resilient, however, as the chosen contractor went into administration in 2015 (Macalister, 2015; Weisselberg, 2015), and BCC had to step in to take up the existing contract with the subcontractors. Perhaps tendering smaller contracts to the subcontractors would have been more resilient. CSE has argued that government support should focus on "establish[ing] local schemes focusing initially on high quality work and local supply chain development rather than large scale and least cost. Such funding should be open to a wide range of potential local 'orchestrators' rather than just local authorities" (Centre for Sustainable Energy, 2015a).

Scale economies also come into question in the context of Bristol Energy as an actor in the energy supply market. As Morgan puts it:

> *the other thing about local energy business in the context of supply, is they need to be critical mass businesses, in the sense of if you think about the skills and the overhead needed in your* ***billing system your trading system your forecasting system****, your website you paying the terminals on your website,* ***you have to interface with the price comparison sites****, none of that comes cheap. And so the rather quaint notion that you can sort of energy retail to a few homes, just doesn't wash its face. [but do you think it ever could? Do you think that's a fundamental of how the energy system works, or do you think that's form excessive regulation?] I think in part, no, I* ***.. I think in part it's due to the nature of the risk in retail, and your ability to manage those risks.*** *[is that to do with the uncertainty of what the demand would be and when...] and price. and price. So for example ... this week um... we saw, well we, the market saw a 100% increase in day ahead electricity prices. It had been around £23/MWh .. day and it jumped to £47.48 in a couple of days. Couple of days ago it was pouring down, it was horrible, solar wasn't generating as it had been previously for obvious reasons, it wasn't particularly windy so wind was down, and I think the Dutch interconnector was out. And if your.... you get a big jump in price.*
>
> (emphasis added)

Morgan argues that large scale is needed to deal with the bureaucratic overheads of trading, forecasting, interface with price comparison sites, and ability to absorb the risks associated with the uncertainties of wholesale market price. All of these are costs that only exist because of the national market system. On the other hand, he also mentions the impact of weather conditions on renewable electricity generation, which will be a factor in any RE based system. Would a localised non-market system be more economically efficient? Fleming (2016) criticises the economic intensification of a complex economy, where more and more infrastructure services are needed, and additional work is created in the economy as a whole. This is perhaps an example of such intensification, where a smaller scale community economy would result in less input of labour and material resources to provide for the energy needs of each person. This may not be the same as greater 'economic efficiency'.

10.2.3 Devolution and decentralisation of power

Decentralisation has been on the political agenda in the UK in the years 2010 to 2017, with the Localism Act and various mechanisms for devolution. Discussing the overall impact of this legislation on the balance of power between local and central government is beyond the scope of this thesis. However, some of the case studies include implementation of some of these mechanisms.

The CEI event took place in March 2015, shortly before Cornwall Council announced a 'Devo Deal', or devolution deal with national government, in July 2015 (Cornwall Council *et al.*, 2015). The devolution deal includes specific mention of energy, including support for deep geothermal, a low carbon Enterprise Zone, energy efficiency in homes, addressing network constraints, developing smart grid infrastructure, support for CE and local ownership though local and neighbourhood plans and a community heat pilot, and targeting ERDF funding to low carbon, including local energy markets. There is also increased support for local transport through devolution of bus franchising powers to Cornwall by 2018. This devolution deal is supported by a 'case for Cornwall', published in March 2015 (Cornwall Council, 2015).

> "The Government has also agreed to support Cornwall's aim to create a low carbon Enterprise Zone and develop geothermal energy production, as well as working with partners to help address the current constraints on the national grid and to develop proposals to improve energy efficiency in homes. Cornwall is already taking steps towards a better energy future for its communities and residents with the Piclo trial." (Cornwall Council, 2017a)

In the Bristol case, the WoE Combined Authority was in the process of negotiating a devolution deal, which was subject to creating a directly elected mayor for a combined authority. Three of the four unitary authorities in the WoE have opted to join the combined authority, and a 'metro mayor' was elected in 2017.

Devolution of powers from central to local government supports the principle of subsidiarity. The Cornwall Council recognises the need for this to be nested, with a page on their web site describing devolution within Cornwall (Cornwall Council, 2017b), as well as one describing devolution to Cornwall (Cornwall Council, 2017a). Peter Capener sees a shift in the political lobbying emphasis of the CE sector from national to local government (Capener, 2017). This is potentially an opportunity for development of collaborative co-production relationships rather than antagonistic lobbying. However, the role of the CE sector in holding the LA accountable may require that some independence or ability to be critical and antagonistic is retained, as discussed on p203.

10.3 Diversity, shared learning and innovation

Diversity of institutions can promote learning, resilience and adaptation. A polycentric system can support the institutional innovation achieved by free entry and exit as provided in a market, addressing a weakness of centralised bureaucratic decision-making in both state and private sector, whilst also providing public goods, thus addressing a weakness of competitive markets. As discussed in section 8.3.2, Ostrom (1999) describes how a nested system of governance with autonomy for smaller units and coordination between them achieves rapid development of effective institutional forms, by combining simultaneous experimentation by multiple different units with sharing of learning between the units. This setup also provides resilience, as "when small systems fail, there are larger systems to call upon—and vice versa." (Ostrom, 1999, p. 528), and a safety-net against unhealthy local power dynamics, as larger units of governance can step in if 'local tyrannies and inappropriate discrimination' arise.

10.3.1 Diversity in the Bristol case study

In the Bristol case study, the diversity of CE groups allows many ideas to be trialled, and the umbrella structure of BEN allows learning from these groups to be shared. Whilst most of the groups and individuals share a vision of an energy transition, none has the capacity to tackle all of it in all places, and different groups have addressed different pieces of the puzzle. Some, such as the Easton Energy Group, or Ambition Lawrence Weston, have a strong geographical boundary in a neighbourhood. Others, such as BEC, Bristol Power Co-operative and the CHEESE project are city-wide, but have a focus on a particular activity, such as installation of renewables or thermal imaging.

On the other hand, the demographic diversity of the CE sector is relatively limited, with an overrepresentation of middle-class white men. This limits the breadth of learning and reach of the CE sector. It is also problematic in relation to inclusivity and equality, discussed in more detail in chapter 11 in relation to DP3.

Learning in the CE sector also takes place at national and regional or sub-regional levels. BEN and BCC learned from the co-operation agreement developed in neighbouring BWCE and B&NES (discussed in more detail on p200), although ultimately this was not transferable to the Bristol context. B&NES council learned from the diverse approaches to energy governance of other LAs by commissioning BHE to interview officers in five other LAs. The CE sector, including BEN, also learn from other nationally and regionally through membership organisation Community Energy England, and through intermediaries (Hargreaves, Hielscher and Smith, 2012; Bird and Barnes, 2014) such as RegenSW and CSE.

Riley, senior officer in BCC Energy Services team, recognises the value of diversity of approaches in different places (interview transcript, 22/09/2014, emphasis added):

Interviewer: and what about the way in which there are some local authorities where there is no leadership coming from the community, and the local authority has actually created the community group, for example Plymouth have done that...

Riley: well I think there's different models, and I think we should allow for ***all sorts of different models****, I think it will only do the whole energy agenda good if we accept that there's a* ***variety of models****, and I think in each locality you have to decide a little bit on what's best, so I think we have to* ***be careful not to be prescriptive****, in terms of what works, so when we developed our approach to community energy we looked at* ***a lot of models****, we actually had a questionnaire, we looked at what is actually possible, and I think that's quite important. Because* ***it really depends*** *you know if you only have one local authority officer then what do you focus on? If you have more people like we have then you have more options, and* ***I would think that it's quite important that it stays quite open, and different models are explored and also delivered****.*

Diversity can support both resilience and progress, through adaptability to change contexts and innovation in discovering better ways of doing things. Ostrom (1999) notes that changes in ecosystems can be much slower than changes in the human institutions that interact with them, leading to a risk of lag between changes in human practices and ecosystem feedback. This results in new human practices potentially damaging ecosystems before humans notice the impact of this damage. Ostrom proposes that traditions, potentially including superstition and social sanction for non-conformity, play a useful role of slowing institutional innovation to reduce this dangerous lag in feedback from ecosystems.

Guhyapati (2016) talks about 'innovation vs conservation' as one of the four dimensions to be balanced in a group. This is closely aligned with the dimension of 'diversity vs commonality', where greater diversity leads to greater innovation, and greater commonality leads to greater conservation. Diversity of strategic approach or priorities can be productive. For example, disagreement over strategy within a group could lead to robust discussion of options and ultimately an improved strategy. However, this relies on those discussing having sufficiently shared goals which they are aiming towards. In a discussion of the renewal of the Bristol Community Strategy for Energy, some voices were keen to prioritise 'getting to scale', 'action', and speed. Others felt that embedding democratic processes, inclusion and diversity of demographics was key, feeling that 'if you want to go far, go together'. This diversity of opinion could potentially lead to a strategy that achieves both speed and democracy. This tension is also discussed in more detail on p213 in relation to equality and DP3.

10.3.2 Deliberation and autonomy in institutional innovation in Bristol

Another dimension of balance identified by Guhyapati (2016) is between 'autonomy' and 'cooperation'. Attempts to consolidate and coordinate energy initiatives in Bristol as discussed below show a balance between the group dynamics of autonomy and cooperation. This took place through attempting deliberative discussion, and using autonomy where this proved to be needed.

The large number of CE groups in Bristol is in some ways fragmented and confusing. In June 2014, there were discussions among some of the members of BEN about the potential for consolidation of CE groups within the WoE. Formal consolidation through a deliberative process did not take place at this time, as there were differing perspectives on whether it was a good idea. However, the Zero West initiative which emerged in 2016 was in part a continuation of the effort to coordinate the fragmented local energy sector. The fact that this could be initiated without waiting for deliberative agreement from all parties who might be involved shows that autonomy, or the freedom to create new institutions, is valuable within a polycentric system.

The process of developing the Zero West initiative took place in collaboration and discussion with others without waiting for consensus. This is a decision process perhaps analogous to Laloux's (2016) 'advice process' (see p141).

The approaches of autonomous organisation or deliberative co-operation have parallels with Hirschman's concepts of 'exit' and 'voice' (see p111). Exit is the ability to leave an unsatisfactory situation, and can be coupled with 'entry', the ability to autonomously set up a new institution or business (e.g. 'market entry'). Voice is the ability to change a situation through a deliberative process. In the market paradigm, entry and exit are privileged over voice, and assumed to take place through competitive processes. Voice is seen to be easily dominated by conflict. In contrast, a polycentric governance paradigm values both entry/exit and voice, and sees each as operating through both competitive and collaborative relationships. This is represented in Figure 63.

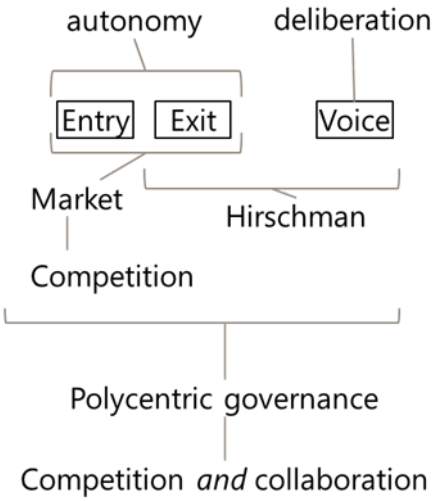

Figure 63: Entry, exit and voice in market and polycentric paradigms

The development of the Zero West initiative through autonomous action following an inconclusive discussion about consolidation shows that progress can be made by combining exit and voice in a collaborative emergent process with neither competition nor conflict dominating. Some existing organisations in Bristol may feel threatened by the development of a new convening body, seeing this as their role, but the approach of Zero West has been to invite representatives of these organisations into the steering group, and identify gaps and approaches to partnership.

In another example from the Bristol case study, CE groups were explicitly asked about competition[49]. Bristol Energy Coop describes a polycentric system with overlap of jurisdiction, with deliberative mutual adjustment rather than competition:

> *As the groups above expand there is likely to be overlap between the type of projects we are developing and the potential sites we are assessing, e.g., solar farms. The groups have had an initial meeting to discuss a process for managing such scenarios, and a follow-up meeting will shortly be convened. However, it is important to note that the potential for community energy is so large that there is no a priori reason for groups to compete; we are a long way from there being a shortage of opportunities!*

Whilst deliberative discussions of this sort may be helpful and support ongoing relationships, in practice there may still be an element of competition. The response from Bristol Power states that CE groups do

[49] This was through a questionnaire sent by BCC to community groups wanting to install solar on their roofs, to which I added a question about competition.

compete, but frames this competition as a mechanism for institutional innovation at the service of a common purpose, and with greater emphasis on co-operation and collaboration than on competition:

> *We compete to figure out what would be the best integrated energy offer to the community. This involves a lot of co-operation and collaboration, e.g. on a Community Strategy for Energy. We'd expect partnerships to emerge that lead to consolidation and co-operation.*

Autonomy does not need to be accompanied by competition. Whilst the free market paradigm equates autonomy with competition, Guhyapati (2016) puts autonomy and cooperation as poles in group dynamics that need to be balanced with each other, and does not discuss competition. This case shows that autonomy can be carried out in a manner that emphasises co-operation above competition

10.3.3 Shared Vision

Whilst diversity is important, there is also a need for some commonality for a community to function effectively. This fits with theories of agonistic democracy discussed in section 1.3.2, which welcome diversity of opinion, but acknowledge that there is a need for some foundation of shared values. McGinnis (2016) recognises this by naming 'lack of normative clarity' as a potential problem in polycentric governance systems, discussed in section 7.5.2.

Many of the people working for a sustainable energy future in GB have some degree of shared vision. This creates community between the individuals working in different localities or organisations, and fosters trust between potential competitors or those operating under different logics of public, civic, profit, non-profit. As one person put it at the February 2017 Zero West event, 'this is my family'. The shared vision is implicit: 'we all know the direction of travel', as another said at the same event, arguing against spending too much time calculating the targets to set.

10.3.3.1 Shared vision in Bristol

The local energy system in Bristol has a strong shared vision. This was elaborated and made explicit by BEN through the collaborative process of writing the Bristol Community Strategy for Energy, and summarised in the 'wheel' shown in Figure 64.

Figure 64: Bristol Community Strategy for Energy – wheel (Bristol Energy Network, 2013a)

The Community Strategy for Energy builds on a longer history of visioning work at the local level, such as the Bristol Peak Oil report published by the Bristol Green Capital Partnership (Osborn, 2009), BCC's Framework for Climate Change and Energy Security (Bristol City Council, 2015d), and at the national level, such as the Zero Carbon Britain report published by the Centre for Alternative Technology (Helweg-Larsen and Bull, 2007; Centre for Alternative Technology, 2013). This process is continued in the Zero West initiative.

This vision of the future energy system agreed in the Community Strategy for Energy is broadly renewable, with reduced demand, reduced fuel poverty, and greater local control. However, from several years' participation in the BEN community, I am aware that there is also diversity of opinion regarding vision for the future energy system. Differences include the role of nuclear power, biomass and energy from waste, the importance of democracy and local self-sufficiency, the extent of demand reduction and lifestyle change, and the level of optimism about future technological development.

10.3.3.2 Shared vision as a theory of change in CEI and Zero West

Theories of utopia, such as Levitas' (2013), put shared vision at the centre of their theory of change. This means action is inspired and directed by a collective understanding 'of how we want things to be', in contrast

to scenario planning approaches which create diverse images of what could happen, or conservatism which begins with what is, and values existing practices that have evolved over time. Both the CEI project and the Zero West initiative are based on the use of ambitious visions for the future as a way of creating a community of action.

The CEI project started with an implicit theory of change based on the idea that an ambitious narrative can bring people together and lead to heroic levels of action.

Hugh Montgomery referenced the Apollo programme in his speech at the CEI event:

- *"We have no time left for inaction. … The level of ambition needs to be that of the Apollo mission. Once NASA had announced there was going to be a man on the moon in a decade everyone had to deliver. … And if it can't be done in Cornwall, it can't be done anywhere. Cornwall should be a real world innovator whose reach can be far from just local. Cornwall can solve the problem for the UK and the rest of the world"* (BuroHappold Engineering, 2016a, p. 59, Hugh Montgomery)

BHE's partner in the CEI project, the Eden Project, was founded by Tim Smit, who is familiar with the 'tell them you will build it and you can achieve the (nearly) impossible' approach. It was by articulating a dream and following it tenaciously that he created the Eden Project and the lost gardens of Heligan. It is perhaps Smit's influence that put vision and narrative at the heart of the CEI project, even if this was not clear to all of us from the outset.

The first of the 'key actions' identified in the CEI white paper is to "create a powerful shared vision". This was derived from comments made by workshop participants in the Energy Island event. The bullet points in Figure 65 reflect the comments made by workshop participants and captured on post-it notes which were later transcribed and coded as 'vision'.

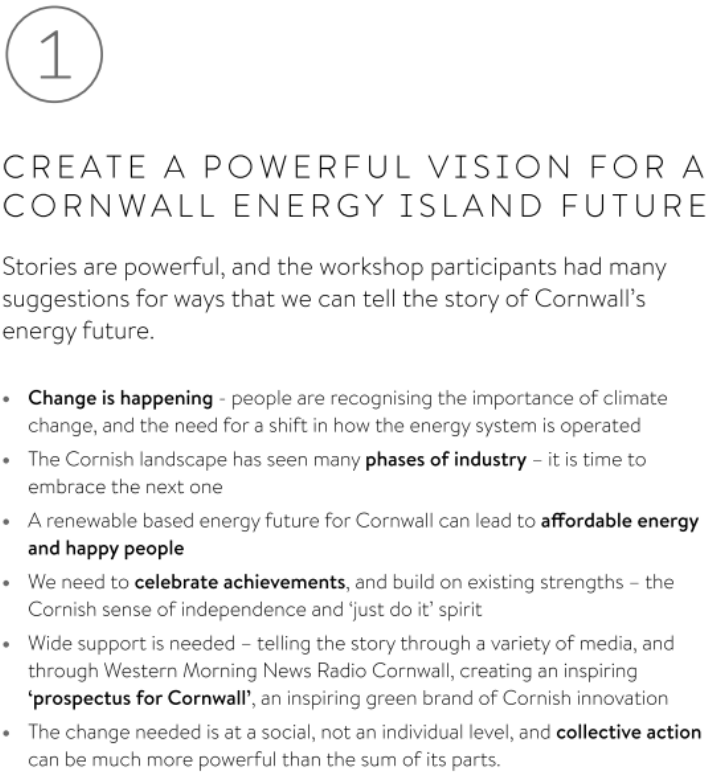

Figure 65: Key Action 1, identified in the CEI white paper (BuroHappold Engineering, 2016a, p. 69)

The Zero West initiative is similar to the CEI initiative, in that the starting point is an ambitious target based on what is seen to be needed, without waiting to rigorously analyse what is possible. The 'zero carbon' target is much more ambitious than the Bristol Community Strategy for Energy. However, it is in keeping with the commitment made by Bristol Mayor George Ferguson at the climate talks in Paris in 2015, that Bristol would be carbon neutral by 2050 (Bristol City Council, 2015a). It builds on a history of 'Zero Carbon Bristol', described in section 4.3.2. The present initiative has built momentum in late 2016-early 2017 with two workshops, asking for commitment from individuals, setting the context, and with a desire to create a narrative target or direction of travel towards zero carbon, potentially with specific calculated targets.

Whilst zero carbon is not synonymous with RE, RE forms an important part of the vision. The International Renewable Energy Agency (IRENA) describes a spectrum of RE targets in terms of how SMART (Specific, Measurable, Achievable, Realistic and Time-bound) they are, as shown in Figure 66 (IRENA, 2015). The 'energy island', and the 'zero carbon' WoE targets, as well as the '100% carbon neutral' declaration for Bristol, would be categorised at level 1 – political announcements and vision statements, variously in terms of carbon and in terms of energy.

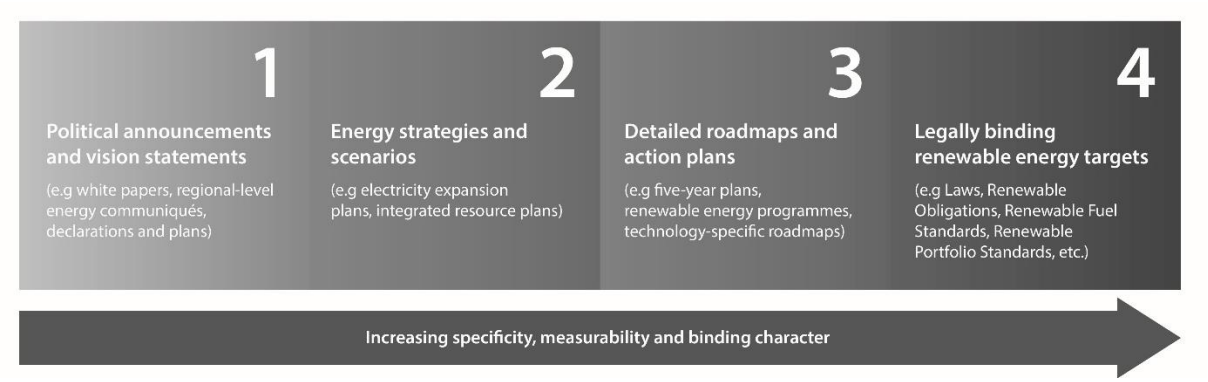

Figure 66: Spectrum of RE targets, from (IRENA, 2015, p. 24).

This has some parallels with Meadows' (1999) twelve levers of system change introduced on p72, where the IRENA first category, 'political announcements and vision statements' corresponds with Meadows' level 3, 'the goals of the system', and the IRENA levels 2, 3 and 4 correspond with Meadows' level 5, 'the rules of the system'. The implication of IRENA's framework is that the higher numbers are more powerful, the inverse of Meadows' perspective. Both of these arguments make sense in different ways, as discussed below in relation to Zero West.

Participants in the Zero West initiative are so far ambivalent about 'getting bogged down' in calculations, when the community of committed people with a shared vision already know the direction of travel, effectively an argument for jumping straight from level 1 on the spectrum proposed by IRENA to concrete action, supporting Meadows' perspective. However, if political support is to be enlisted from organisations such as the WoE LEP, the four unitary authorities, and the Metro Mayor for the devolved area, having a strong evidence base to support a credible vision may be necessary, and some stakeholders see rigorous data analysis as one of the main tasks of Zero West. There is already an evidence base for RE in the WoE (BuroHappold Engineering, 2012), and this formed a basis for an energy game workshop with WoE LA and CE stakeholders (BuroHappold Engineering, 2015). The latter produced scenarios where 50% to 70% of demand was provided from local energy, including offshore wind and tidal, assuming an average of 50% reduction in demand. This would already be extremely ambitious, but does not achieve 100% RE.

As the Zero West initiative progresses, it will be interesting to see whether quantified targets are required in order for the vision to be widely credible, and achieve the broad buy-in that would create an effective community of action.

Shared vision provides commonality in a group or network. This needs to be balanced with diversity in order to remain innovative and adaptive for progress and resilience, and inclusion in order to fulfil the values of equality. Theories of commons and of polycentric governance can provide a framework for understanding the functions of both diversity and commonality, and discussing whether they are appropriately balanced in a particular setting.

10.3.4 Summary

Diversity can be important both within groups, and between groups that are linked through a polycentric system. In BEN, there are a diversity of approaches, and a diversity of spatial jurisdictions. There are also very different approaches taken in different LA areas around the country. Freedom of entry and exit can be achieved in ways which are not reliant on competition, but instead allow cooperative autonomy as well as deliberative agreement. Diversity can lead to adaptation required for resilience, and innovation to create positive gains, or progress. However, some shared vision is needed to create coherence in a diverse group.

10.4 Subsidiarity

Subsidiarity is defined as decisions or actions being carried out by the smallest unit of decision-making that can implement them or is affected by them. The principle of subsidiarity is both claimed to be instrumentally effective, (Marshall, 2008), and of intrinsic moral value due to the intrinsic sovereignty of the individual combined with their interdependence with other people (Carozza, 2003), as discussed in section 8.3.3.

10.4.1 Subsidiarity in BEN, BCC and the relationship between the two

In the Bristol case study, there is subsidiarity in the governance structure of BEN, which has a democratic accountability to member groups, or 'voting members', who elect the directors. Sovereignty therefore resides primarily in the lower level of governance. BEN member groups are also autonomous in their activities. Individuals can also be members, but do not have voting rights (Bristol Energy Network, 2015b). This structure is partially inspired by the history of secondary co-operatives in housing (Alcock and Bird, 2012).

BCC, in contrast, is broadly a hierarchical organisation. There are two roles in BCC: a legislature, made up of 'elected members', local councillors elected in each of the wards of the city, usually with an affiliation to a national political party, the directly elected Mayor, and a cabinet; and an executive of 'officers', civil servants employed by BCC who must implement the decisions of the legislature. The elected members operate through a democratic process of voting, whereas the officers operate in a bureaucratic hierarchy. On the other hand day to day decisions in BEN are taken by the directors, and BCC is accountable to the electorate, so in some ways the two organisations are not all that different.

Whilst neither BCC nor BEN use the term subsidiarity explicitly, there is some recognition of the principle in relation between BCC and individuals or community groups. Riley, senior officer in BCC Energy Services team, talks about the importance of individual agency in making decisions about energy saving, which could be interpreted as an instrumental valuing of subsidiarity or recognition of individual sovereignty:

> *We are not the ones who can teach people what to do. So being quite careful... I think there was one section on our website about energy saving tips, but I'm almost inclined to take that off. We're not the ones teaching people, it needs to come from people, they need to, I thought it would be much better if it was something that they felt that they needed to do, rather than us saying you should do this and this and this, and that's what I'd like to see in Bristol, and that's what I'm trying in this scheme in particular.*
>
> ...
>
> *So, it's actually working with people on this rather than teaching them what they have to do.*

An active CE group member considers that the CE groups are morally entitled to some degree of democratic participation, which could be seen as valuing individual sovereignty:

> From my field notes, April 2015:
>
> *The person I spoke to felt that the council still think that they are doing community energy groups a favour by letting them do stuff, and they haven't yet realised that the community groups have a right to participate, to be consulted etc.*

There is a general frustration from community groups with BCC, for not including them as equal partners, particularly around the issue of openness with information (see section 10.4.2). At the same time, people within BCC are frustrated that central government do not treat LAs as an 'equal partners' and include them in early discussions of policies that will need to be delivered at a local level, such as energy efficient retrofit.

When I was invited to attend a meeting at DECC with officers from BCC, I travelled by train with them from Bristol. During the train journey, I was speaking to them about how people in BEN are frustrated that BCC

was not being open with strategic discussions of energy, and collaborating seriously. Later, in the meeting with DECC, one of the BCC officers made almost exactly the same point in relation to DECC, complaining that DECC didn't take LAs seriously as equal partners. I found the irony of this very funny, but I don't know if they understood what it was I was laughing about.

This perspective was also noted by Riley during the formal interview:

> *But I'd like to see it recognised a little bit more, locally and nationally, that local authorities can play a crucial role in this.*

This frustration with hierarchy is perhaps a useful motivating force in overcoming some of the fragmentation between emergent local polycentric parts of the energy system, and the incumbent and hierarchic parts of the system, which were discussed on p147, on polycentricity and the wider energy system context.

The question of subsidiarity appeared in the development of the process for selection of community groups to install solar panels on the roofs of BCC owned buildings. Two options were considered: one whereby BCC would select the community group directly, through a competitive process, and the second whereby BCC would agree to make roofs available to BEN, and allow an autonomous selection process to take place within BEN. The latter option would have represented stronger subsidiarity, where BEN, a smaller unit, would make the decision, and build the capacity to be able to do so if they did not have it already. This would be a way towards developing a multi-layered nested approach.

BCC sent a questionnaire to community groups regarding 'Community Investment in Renewables'. It received three responses, in September 2014, including from Bristol Power (BP) and BEC. Both BP and BEC considered that a nested process with BEN members making decisions autonomously would be the best approach:

Bristol Power

> *The best model would appear to be that of Bath and West Community Energy (BWCE), where there is a co-operation agreement between the council and the community – then let (e.g.) BEN and its members allocate work – the way BASIC (Bristol Area Solar Installer Co-op) shares work.*

BEC

> *We suggest the Council signs a co-operation agreement with the Bristol Energy Network (BEN) along the same lines as the one that Bath and North East Somerset Council signed with Bath and West Community Energy (BWCE). This allowed BWCE to roll out a large number of projects at speed, plan properly and raise the corresponding project finance. BEN members would then be able to organise and finance the projects internally, while providing a single point of contact for the council.*

The Co-operation agreement between BCC and BEN, which was being drafted in late October 2014, had a similar approach:

> *3.3 BEN will decide whether it wishes to take Projects forward and invite its Community Group members to bid for Projects internally*
>
> *3.4 BEN will select from interested member groups based on a set of criteria drawn up by BCC*
>
> *3.5 The successful Community Group will, at its own cost, prepare a budget and work plan to be submitted for consideration by BEN*

However, the 7th October Cabinet Report, which resulted in agreement from the decision-making body of the BCC legislature to make BCC owned roofs available to the community, set out a process whereby community groups would tender competitively:

> *Community groups in the city will be invited to tender for a package of pre-assessed council owned community buildings and/or land. It is proposed that a competition document will be established in order to fairly select a suitable community group, on the basis of transparent criteria*

The same individuals were responsible for both documents. The contradiction between them indicates that both options were given serious consideration by BCC, by the same individuals. I do not have detailed information about exactly what the decision-making process was after this, but BEC was selected as the provider, and I believe this was through a competitive tender process rather than a delegation or decentralisation of authority to BEN.

This implies that although a decentralisation of power compatible with the principle of subsidiarity was favoured by BP and BEC in their questionnaire responses to BCC, and by BCC and BEN in their drafting of a co-operation agreement, in the end BCC chose a process where decision-making power remained in BCC rather than being delegated to BEN.

Whilst DP2, nested governance, favours decentralisation, there are good reasons for BCC to have chosen the approach of directly selecting the community group. They may have considered that BEN did not have the capacity to make the decision effectively. Additionally, the interest in selecting a reliable community partner was much stronger for BCC than for BEN, as BCC assets and legal commitments were involved. It may also be that had BEN made the decision internally, this could have led to unnecessary interpersonal conflict and upset by the party(ies) not selected. It is likely that BEN would have chosen to share the roofs between several of their members, resulting in a more diverse set of owners of installations. This may be a positive in terms of building capacity and diversity in the CE sector, but may lead to a greater bureaucratic overhead for BCC, a question of different 'scale economies' for different parties in a transaction.

10.4.2 Privileged access to information as a source of frustration

Related to the theme of subsidiarity is the theme of openness and information, which has already been mentioned. There is a common theme of people feeling annoyed when strategic decisions are made without their input. Frustration with hierarchy described above manifested particularly in the lack of sharing of information – people in both the CE sector and in BCC found it frustrating when they were not included in early discussions:

> Email from Sam, 15/06/2014: *Alex has been trying to encourage the council to open up what it is planning / thinking for the last few months. It's like trying to get water from a stone sometimes. The project that he has been working on with them, the Green Deal and Communities Scheme, has been incredibly frustrating when they only tell us half the story and then say we can't discuss even that much with ANYONE*

Other members of BEN resonated with this and felt similarly frustrated with BCC not sharing information as openly as potential collaborators would have wanted.

This is something that is also experienced in the engineering design industry. Engineers designing energy efficient buildings often desire to be involved in the early, high-level strategic decisions about a development. Often their ability to make a building use less energy is constrained by decisions made by architects earlier in the process before the engineers are engaged.

10.4.3 Trust and transparency

On the other hand, complete transparency and openness is not necessarily desirable. Trust is needed in order to share important information, and in practice there can be a need for some level of 'cliqueiness', of trust-based in-group discussions or private conversations, in order for effective collective action to take place.

Riley, senior officer in BCC Energy Services team identified lack trust as a weakness of Bristol's energy scene when asked to do a SWOT analysis during the interview:

> *OK, weaknesses, what are the weaknesses, let me think about that a little bit. I think a bit of a joined up a joined up approach across the city, in terms of energy, I see that as a bit of a weakness. I think that will develop, it's just something that needs to just grow. I think a bit of trust, overall, and in terms, all levels. Trust from the residents that we are going to come up with a good offer for them, but you know trust as well from our side that for example some of the stakeholders we're working with are really going to deliver this. OK, um, you know, you name it, I mean community groups you really have to trust them, and it's quite a difficult thing to do when you're used to quite a rigorous process to suddenly have to let things go a bit. OK, and um I think that trust needs to develop between all parties, I think*

Fleming (2016, pp. 41–43) distinguishes between trust and transparency. He argues that transparency is not needed when there is a relationship of trust, as trust means believing that the other person will do the right thing, and has made the best choice, even if you do not have access to seeing this. However, a practice of open and honest sharing of information can be a powerful ingredient to build trust, and this is perhaps something that has been lacking between BCC and BEN. This understanding may be part of why I felt frustrated in situations where I had limited access to privileged information, and was not allowed to share it with others – a similar frustration to that expressed by Sam above "incredibly frustrating when they only tell us half the story and *then say we can't discuss even that much with ANYONE*" – the fact of not being able to share information within his own trusted community was a key part of his frustration.

It is tricky to judge where to draw the line between the public face of an organisation and private discussions, when to respect confidentiality and trust, and when to demand transparency and openness. I found the question of confidentiality tricky to negotiate myself: as a researcher; as a recipient of trusted information from different people; as someone associated with a company with commercial interests; as a nosy person who didn't have access to all the all the conversations, and found that challenging in the context of navigating insider-outsider roles.

There was a strong sense from some CE groups that BCC was being less open with information than they should have been. However, it may be that the CE sector, myself included, had a misplaced sense of entitlement to be treated as equal partners rather than as a 'special interest group' whose concerns should not be given undue weight relative to ordinary citizens. There is evidence that over time trust has built between the CE sector and BCC, as the sector has grown its capacity and worked with BCC on delivery of a number of projects. The period of these observations in summer/autumn 2014 may have been a time of high 'confidentiality' from BCC, as they were engaging in commercial procurement for large contracts at the time. Perhaps the level of openness would have been different if services had been delivered in-house by BCC rather than having to follow specific procedures of competitive tenders, with high levels of transparency over sharing of information. Lambeth Council, from the outside, appears to have a very different attitude (Lambeth Council, 2012; Blume and Randle, 2013), but it may not be so different from an insider perspective.

From Fleming's perspective, transparency is needed when there is a lack of trust. However, in large scale bureaucratic systems, and in the logic of the competitive free market, transparency of information is essential for trust to be established.

Morgan (interview transcript, 12/05/2016) talks about the importance of transparency for building consumer trust in the context of the Bristol Energy:

> *and I think whatever you do, you have to be very transparent in your offer. [yep] oh, I didn't realise that the charity was going to get a kickback because I'd signed up with... how does that make you feel?*

Well I really trusted that charity, and now I feel a bit... [yep], whereas if you say 'brilliant, the charity can now do so much more because it's got this money, and all I've done is changed energy supplier and I've saved money myself, well all's to like

I think the trick is to make a larger business seem very local. [right]. And I don't mean that in terms of hoodwinking people - smoke and mirrors - but I genuinely mean it as it feels local, you can ring them up, they relate to you as a customer, they understand the community that you live in

This emphasis on transparency in relation to consumers, in 2016 after Bristol Energy started serving its first customers, contrasts with the very strong emphasis on 'commercial confidentiality' as Bristol Energy was being set up, and leaves me wondering whether commercial confidentiality really is compatible with the ideal competitive free market, which is based on an assumption of free access to information.

This question of trust also raises a core question of the role of the community group in relation to the power of BCC. One function of the CE sector may be to act as an adversarial challenge to power. This may conflict with the process of building a relationship of trust with BCC, as there is a risk of being co-opted. The ability to retain a critical voice, and 'speak truth to power' is an important role, given the tendency for those in positions of power not to receive honest feedback, making power a 'disability' (Chambers, 1997) . Perhaps part of the answer to this dilemma lies in the work of ensuring BEN is accountable to a broad section of the population of Bristol, including those with little voice. This is discussed in more detail in section 11.2.2.

10.4.4 Summary of subsidiarity

The principle of subsidiarity can address the challenges of complexity and rigidity in a polycentric governance system – the 'incremental bias' and 'high complexity' problems identified by McGinnis, by allowing smaller scale actors the autonomy to get on with things, whilst also supporting collaboration. The development of the Zero Carbon West initiative by BEC, despite a doubtful response from other local organisations, is an example of avoiding ossification through excessive requirements for consensus.

Subsidiarity reverses usual power roles, bringing into question who has power, and who is able to exercise their full capacities and develop them. The approach to selecting a CE group for installing on BCC owned roofs missed an opportunity for building the capacity of BEN to make collective decisions, and of building the capacity of other community renewable groups other than BEC. On the other hand, everyone making decisions all the time may not be efficient, and collective decision-making skills may not be the capacities that everyone wants to develop.

Within the definition of subsidiarity there is an implication that the right scale can be identified, but this is not always obvious. Perhaps choosing one community group for the BCC owned roof solar PV installations, and retaining control over this decision within BCC, was the right scale. This question also arises in relation to public procurement contracts, which tend to favour large providers. EU procurement rules attempt to mitigate the bias against SMEs by providing mechanisms to make contracts available to them. The Framework Agreement for solar PV installations by BCC did contract to SME installers. However, the Green Deal Warm up Bristol contract was awarded to a single large provider, Climate Energy. The fact that Climate Energy had subcontracted to a number of local SMEs is evidence that a smaller scale was also a 'right scale' to deliver the work on the ground. This ultimately provided some resilience when the main contractor went into administration, as BCC could continue with these contracts.

Subsidiarity can provide for universal access to participation, including through deliberative decision-making, and through the freedom to develop projects and innovate new institutions. Frustration with hierarchy, seen at many levels in hierarchical relationships, has a positive side as a motivating force to increase open communication and develop mutual relationships. This is not necessarily a smooth process, but can be positive.

10.5 Design principle 2 conclusion

Chapter 8 set out the following set of questions to be asked through the case study analysis of each DP:

- To what extent are these principles already present or not present in current local energy activities and the GB energy system?
- To what extent does the absence or presence of these principles lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from these principles?
- Do these principles need to be modified or rejected in light of analysis of the case studies and if so how?

For reference, DP2 was phrased as follows:

> DP2: Use of nested forms of governance at different spatial scales, as well as non-spatial governance, with sub-principles:
>
> a. The size of each spatial level of governance is congruent with the physical and technical boundary of the infrastructure being governed
> b. Diversity of governance solutions in different localities, which promotes innovation, with sharing of learning between these
> c. The relationship between different levels is organised according to the principles of subsidiarity

These are answered below drawing on both the case study analysis in this chapter and my experience working in the CE sector and at BHE for the last 7 years.

To what extent is DP2 already present or not present in current local energy activities and the GB energy system?

There is already spatial nesting in the GB electricity system with layers of national high voltage and regional low voltage grids. This is spatially congruent with the infrastructure, but does not operate according to the principle of subsidiarity, as decisions are made either top-down by central government or the regulator, or consensually as part of the energy industry codes process in which national and regional elements participate together. DNOs at the regional level must follow the same licence conditions and codes across the country, so diversity between localities is limited. However, innovation is supported through the Low Carbon Networks Fund, and sharing of learning is mandated and facilitated through publications and an annual conference.

There is currently no local nor neighbourhood level of grid infrastructure management, other than exceptional private wire situations.

Energy supply companies operate nationally, although different companies may dominate in different parts of the country. The LA fully licensed and white label supply companies aim to serve their local geographical area, and some have tariffs that are only available locally.

The electricity generation sector is dominated by ten large companies which own power stations around the country. There is no spatial nesting involved, as individual power stations feed directly into the national grid or distribution network.

The CE sector is a small component of the energy system. However, CE organisations tend to have geographically specific remits. In Bristol, the CE sector does operate in a nested manner, with a Bristol-wide

energy network that has membership of many CE groups at both the neighbourhood and city-wide scales. The Bristol Energy Network in turn is a member of Community Energy England, a national network and advocacy body for the CE sector. This sector therefore does operate according to the principle of subsidiarity.

The BCC energy services team operates at a local level. However, it is dependent on funding from the EU and from national UK government. In these situations, policy and decisions are made by the larger unit, rather than by the LA, which is not a case of subsidiarity. There is also no specific relationship of subsidiarity between the LA and the CE sector. There are diverse approaches taken by different LAs around the country. Learning between them may take place informally, and to some extent through national networks such as Association of Public Service Excellence (e.g. APSE Energy, 2013). BCC had intended to host an LA energy conference as part of their Green Deal for Communities funding from DECC, but this had been postponed from the original date, and may or may not have taken place since.

To what extent does the absence or presence of DP2 lead to strengths or weaknesses in observed GB energy system activities?

The absence of spatial nesting and linkages between the CE sector and the energy industry codes is perhaps problematic. Currently the regulatory system does not allow local energy commons to develop, as there is a restriction on local supply at a small scale. The causal relationship is not clear, but it may be that the lack of power of the CE sector in the development of licence conditions and codes is one reason why regulation does not support holistic small-scale CE systems.

The development of renewable electricity generation has been partly mandated through EU directives and national UK regulation. This would appear to be a strength in GB's energy transition created by an absence of DP2's principle of subsidiarity. However, in the USA, the autonomy of states and municipalities has allowed them to pursue actions in support of the Paris climate change agreement, a strength arising from the presence of the principle of subsidiarity in the USA federal structure. In the current GB context, with a national government that is unsupportive of RE and the Brexit process under way, lack of autonomy of local governments may be a weakness.

Where there is shared learning between the different approaches of LAs, this is a strength. This is particularly the case for LAs considering setting up new initiatives, who are able to learn from the varied approaches taken by those who have developed initiatives before them.

In the Bristol CE sector, there is diversity and autonomy of individual groups. This may be a weakness in the sense that it can be confusing to outsiders. However, the Bristol Energy Network is effective in building relationships between the individuals involved and sharing learning and resources. The individual groups do not appear to limit each other's capacity. The diversity also allows specialisation, with small organisations addressing different areas of work, e.g. house retrofit, education, RE investment. It is not clear whether this is a positive or a negative.

How does the current trajectory move towards or away from DP2?

The current trajectory includes some moves towards devolution. The move from DNO to DSO would mean that balancing and network management responsibilities, which are currently only at the national level, would become spatially nested to the regional level. The process of devolution from national to local government moves towards DP2, but the inclusion of energy within that is varied.

The advocacy and exploration of local energy markets, of community pooling of electricity generation behind a 'virtual meter' such as is being explored in the EnergyLocal project (Energy Local, 2015). Substation level community-based demand management is being explored by WPD, through the LiM project. However, this

study did not produce very clear positive outcomes in terms of the metrics that WPD were pursuing, so it is not clear whether this will be followed up.

Does DP2 need to be modified or rejected in light of analysis of the case studies?

DP2 does not need to be rejected, and requires little modification other than by adding a sub-principle relating to open sharing of information, as in the discussion of subsidiarity it was clear that one source of frustration for the smaller units of governance, in a context where the larger have greater sovereignty, was the lack of open sharing of information.

Additionally, whilst diversity allows experimentation, there is a lack of ongoing strategic support for those experiments that prove to be successful. The lack of ongoing funding for the highly successful Bristol Green Doors project is an example of this. Consistency and stability is needed in addition to innovation and diversity.

11 Design principles 3 and 4 and design principles revisited

This chapter discusses DPs 3 and 4, and finally revisits all four DPs following analysis of case studies.

11.1 Testing the third and fourth design principles

The third and fourth DPs aim to address the weaknesses of commons and polycentric governance in relation to equality and in relation to environmental limits. These are both important core values of the thesis, but are not areas that were explored in depth through the case studies. There is therefore less detailed analysis for these two design principles and thus they fit in one chapter together.

The third DP proposes that there should be national mechanisms of redistribution, in order to avoid exacerbation of spatial inequalities.

The fourth DP proposes that there should be feedback mechanisms to create accountability for spatial and temporal externalities (i.e. impacts taking place in a different place or time to the decision being made).

This chapter discusses each of these final two DPs in turn. The same questions are asked of each of these DPs as were asked of DP1 and DP2:

- To what extent is the DP already present or not present in current local energy activities and the GB energy system?
- To what extent does the absence or presence of the DP lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from the DP?
- Does the DP need to be modified or rejected in light of analysis of the case studies?

11.2 DP3: National mechanism for redistribution of value, and sharing of risk associated with innovation in governance[50]

Commons management systems, which would have a greater role than they do currently in the GB energy system under DP1, do not necessarily safeguard equality. Neither do polycentric governance systems or nested governance as promoted under DP2. Chapter 5 identified three risks to equality in communities: boundaries leading to the risk of exclusion, community accountability leading to the risk of scapegoating, and fiscal equivalence leading to the risk of abandoning the weak.

DP3 is concerned both with existing inequalities in the GB energy system as it is, and with inequalities which would remain or risk being exacerbated by moving to a more localised and commons-based energy system as proposed by DP1 and DP2.

This section uses a framework of distributional, procedural and recognition equalities, introduced in section 1.3.1, to identify equality-enhancing and reducing processes, drawing on evidence from the Bristol, CEI and LiM case studies.

[50] This section draws on text produced for (Melville, no date).

It identifies the following equality-enhancing mechanisms in the Bristol case study: proactive attempts to increase diversity and challenge unconscious bias; the development of a community fund that targets disadvantaged community groups; recognition of fuel poverty; and attempts to include the voices of people in fuel poverty. On the other hand, some of the inequality exacerbating mechanisms that exist in wider society are repeated in the CE sector. These include a return on investment in community RE investment, and reproduction of participation dominated by white, middle-class men.

11.2.1 Distributional equality

The first aspect of inequality addressed is that of distribution. This pertains to material access to resources, and is most obviously the target of DP3 as it was initially formulated. Current distributional issues in the Bristol case study include fuel poverty, climate change and overconsumption of energy, and distribution of wealth from RE.

CE groups risk reproducing existing inequalities in society, and may not be as effective as government agencies at shifting distributional inequalities, as the latter have access to tax income and a role of providing general benefit to the population.

This analysis identifies inequalities and mechanisms of redistribution. This includes values or goals based in concern about distributional equality issues, as motivation to address equality is a starting point for developing effective institutional mechanisms.

11.2.1.1 Fuel poverty

Fuel poverty is a distributional injustice in the amount of energy that people are able to consume. This derives from wider societal distributional injustices of income and wealth. Fuel poverty is defined by the UK government using a Low Income High Costs indicator.

> "A household is considered to be fuel poor if:
>
> - they have required fuel costs that are above average (the national median level)
> - were they to spend that amount, they would be left with a residual income below the official poverty line" (HM Government, 2017)

According to this measure, 11% of households in England were deemed to be in fuel poverty in 2015 (BEIS, 2017). As a result, some people cannot afford to heat their homes whilst others overconsume.

Fuel poverty is a concern of many of the Bristol study stakeholders. CSE, a national energy charity based in Bristol and a key player in local energy development, has tackling fuel poverty at the core of its mission. The Easton Energy Group has a strong focus on fuel poverty, which they address by helping people reduce their energy demand through draught-proofing, insulation and behaviour change. They partnered with BCC on their Warm Up Bristol energy efficiency scheme, which is partly aimed at reducing fuel poverty. Fuel poverty is one of the five BEN strategy themes. Directors of BEN include representatives of organisations supporting people who have financial difficulties with energy bills.

A senior manager interviewed at Bristol Energy recognises that energy is a basic need, and the importance of fuel poverty:

> *"We sell stuff that heats your home and cooks your food and so particularly in the context of the residential, the domestic customer, you cannot ignore the social angle to it. And you cannot ignore that there are tens of thousands of people who cannot afford to heat their home properly. Who are ... in fuel poverty."*

In GB, high energy prices are charged to the 40% of people who do not regularly switch supplier, including many in fuel poverty. Fair prices are a priority for Bristol Energy. Additionally, they are trialling a social tariff called 'Warm Homes Plus' (Bristol Energy, 2017a), which would be available to those in need by referral from partner organisations. Bristol Energy is also one of the first companies to voluntarily offer the Warm Home Discount scheme, which larger energy companies are obliged to provide (Bristol Energy, 2016b).

The prevalence of fuel poverty shows that there are distributional inequalities in access to energy. The widespread concern leads to institutional mechanisms to mitigate fuel poverty, but at present the overall impact of these actions appears to be insufficient.

11.2.1.2 Climate change and overconsumption of energy

Whilst a focus on fuel poverty is important from a social justice perspective, mitigating climate change also has distributional justice implications. These include both immediate and more distant international and intergenerational implications. A RE based mitigation of climate change is likely to require substantial overall reduction in energy consumption, as discussed in chapter 2.

People experiencing fuel poverty may need to consume more, rather than less energy to keep their homes warm. Making space for this requires those who currently overconsume energy to reduce their consumption. Focusing on energy efficiency can address both fuel poverty and climate change at once, but it is also important to target those who are overconsuming energy. Whilst participation and support for high users of energy may seem not to be the most obvious focus for social justice, helping them to reduce their consumption supports fairer sharing of the energy resource and 'climate space', and recognises the needs and vulnerabilities of those who are using a lot, as per the 'recognition that we are all vulnerable' emphasised by Levitas (2013).

This means that redistribution should not just address financial distribution, but should also consider redistribution of actual consumption of energy. In a context where total sustainable energy consumption levels are limited, some limits to individual consumption should be considered.

11.2.1.3 Income from renewable energy

The flow of income from RE is an important aspect of distribution. Ostrom's commons governance principle DP2b calls for the benefits of appropriation and provision inputs to be proportionate, or that the benefits received by each person should be proportionate to their contribution. This is similar to the concept of 'fiscal equivalence', defined by McGinnis as "the extent to which the beneficiaries of a public good or service are expected to contribute towards its production" (McGinnis, 2013, p. 15). BEC distributes the financial benefit of RE generation to its member investors proportionately to the amount of money invested, with a return on investment of 5%. This effectively means that those who invest more are entitled to more gain, in a way that is numerically proportionate. This is a typical example of community RE investment cooperatives, where return on investment for ranges from about 3% to 7%. It is also a framework that is so much standard investment practice in capitalist economies that it probably would not occur to many people to question it.

However, this way of structuring return on investment participates in the capitalist logic whereby those with greater financial wealth to begin with obtain a greater increase in their wealth than those who started with less. This is an example of the reinforcing feedback mechanism of income from wealth that will lead to growing inequality if it is not counterbalanced by a strong enough distributive negative feedback loop. It is a 'regressive' financial setup, although potentially less regressive than the alternative of private sector commercial investment, as membership is widely available, and BEC also provides money to a community benefit fund, an equality-enhancing process of sharing beyond the members.

Conversely, investment in RE by local government is progressive. Capital for this is likely to come from the Public Works Loan Board at low interest. Profit made from the RE installation is spent on general public services within the LA, which go primarily to those who need them most, contributing towards redressing inequalities.

This means that the LA may have an important role in ensuring that income from RE is distributed in a progressive way. LA investment in RE which provides an income that is directed into public service provision is generally more redistributive than community investment. However, there is not necessarily a conflict between these two sources of investment, as both can be combined. For example, in their solar farm share offer BEC combined investment from community shares with a bridging loan from BCC, and there was still a need for bank loans.

Spatial issues in distributional equality

In addition to inequality within a locality, moving to a localised energy system risks exacerbating or creating spatial inequalities between places. Technical potential for RE is not equally distributed. When BHE created an 'energy game' for WoE (BuroHappold Engineering, 2015), they found that it was almost impossible for the 'bioregion' to be self-sufficient in energy, even with a 50% reduction in demand, whereas under similar conditions in Cornwall workshop participants created scenarios with 30% export of energy from Cornwall (BuroHappold Engineering, 2016a). This is primarily due to the higher population density of the WoE area. This difference highlights the importance of differences between urban and rural areas.

In a commons, greater local technical potential for RE could lead to greater energy access. However, in the current energy market, direct benefit from local resources is limited. The exacerbation of local inequalities is more likely to be due to unequal financial resources, commercial knowledge and social capital (Catney *et al.*, 2014). Additionally, ownership of land is highly concentrated in the UK and the benefits of owning land with RE technical potential are not shared as a commons.

Cornwall is rich in RE, but much of it is owned or financed from outside Cornwall. The financial value flows out as shown in Figure 67. According to Burnyeat's analysis, "the income leaving Cornwall, of £74m, is that generated by commercial developer-owned solar parks and wind farms", whereas "the income retained locally, of £11m, is that generated by the farmer-owned wind turbines and solar parks, and building-scale PV". This means that of a total of £105m revenue, only £21m remains in Cornwall. This high level analysis does not include analysis of where the commercial investment originates, and whether any of this has beneficial ownership based in Cornwall, but it is a good starting point. This analysis can be used to justify greater local ownership of RE, rather than commercial developer ownership.

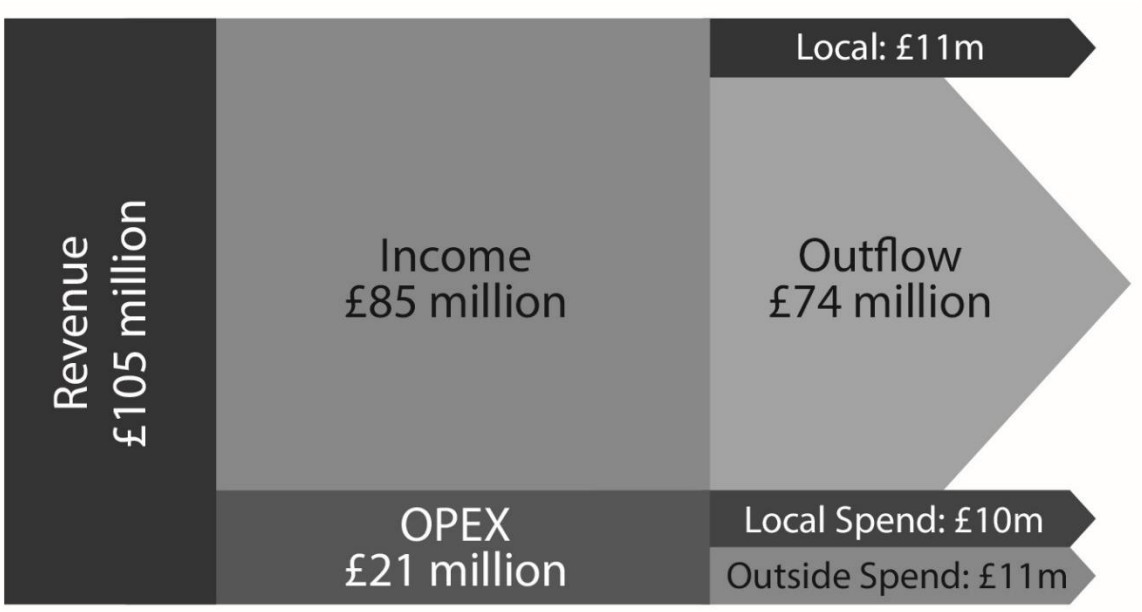

Figure 67: Flow of revenue from renewable energy capacity in Cornwall (Burnyeat, 2013, p. 8)

However, Bristol, as an urban area, has limited RE potential within its territorial boundary. The LA and CE sector are therefore considering developing RE elsewhere. BEC attempted to develop a wind farm just outside of Bristol, in a village in South Gloucestershire (Bristol Energy Cooperative, 2015). This was a situation where a developer had already put in a planning application, and BEC directors negotiated an option for community buy-in. However, the local community in the village saw BEC as outsiders, and claims of being 'local' and 'community' were seen as spurious.

Coxcoon (2014b, personal communication) would frame the rural-urban relationship differently, arguing that CE projects instigated by communities living in rural settlements outside of cities should consider the value they secure from their spatial relationship with nearby urban centres and consider providing much more than their village's energy needs, in order to contribute to the needs of the city where they work, shop, go to the theatre, find employment etc.

There are implicit questions here about who is entitled to 'belong' to what size of territory. The concept of a 'bioregion', also mentioned by Scruton (2017), may provide a way forward, but the fragmented structure of the four unitary authorities of the WoE makes it difficult to take a bioregional approach.

BCC has also considered developing energy resources outside their territorial boundary. Riley, senior officer in BCC Energy Services team, talks about the use of energy resources from outside the city.

> *The energy comes from various sources, would like to see localised energy production as much as possible. How much? Difficult, but would like to see Council using its assets a lot more to help with that, we own 40% of city's land and properties, good position to make good use of that, in terms of electricity generation, heat production via district heating systems...*
>
> *Energy not from the city - from a variety of resources, variety of sources, (have to be careful politically.) [bit where both talking at once] Yeah. And is there any sense for you of where geographically it comes from? Is that part of the story or not? (it should be local if possible, but I think that it's ... flexibility... in ... it's not just about solar panels, because that wouldn't provide us with enough electricity to fulfil our energy demand, I think it needs to be wider, but I also want to say that that's not been tried yet properly in the UK. I know from Germany for example that Local Authorities have a much wider approach to that - so local energy if possible, but if an opportunity arises for local authorities to facilitate offshore wind for example then we*

would be interested in getting involved. From our point of view. But some of this needs to be explored really in the context of UK legislation and you know so far local authorities haven't done this type of thing, so it depends really on what's going to happen on that front. But I know it's possible in the rest of Europe, so I think we will have a look at that as we go forward.

The spatial inequalities in RE assets may seem difficult to address when treated simply as a question of which territory has the greatest technical potential. However, on closer inspection it is clear that the picture is more complex, and that in fact financial capital, technical experience and a variety of other factors affect who benefits financially from RE. Redistribution between territorial boundaries may become necessary if resources are allocated within territorial boundaries, but this is far from being the case currently.

11.2.2 Procedural equality: Boundaries of inclusion and exclusion in the CE sector

The CE sector has potential for high procedural equality, as it is founded on a belief that citizens are entitled to participate in the creation of the energy system. This is captured in the concept of 'energy democracy' (Sweeney, 2012; Angel, 2016a). This strong ethic of participation contrasts with the bureaucratic and hierarchical structures of the LA. On the other hand, the LA is more broadly inclusive, as councillors are elected by the whole population rather than a self-selected group.

However, promotion of equality is not inherent in any particular form of governance, but particular mechanisms can promote it within local or national systems, and in state and community organisations. Commons management and polycentric governance with a mechanism of subsidiarity, has the greatest potential for procedural justice, as they actively supports the active participation of everyone in matters that concern them. However, this relies on the people involved valuing this.

11.2.2.1 Participation and privilege

Whilst the CE sector provides an avenue for direct participation, the demographics of those participating are not representative of the wider population. The CE sector in Bristol has been criticised for being white, middle class and male, in a diverse city. This is a problem for equality. Members of BEN are aware of this problem, and have pro-actively attempted to make BEN more inclusive.

A first step has been to recognise the lack of diversity in the CE sector. An event in 2015 which acknowledged this problem was framed as follows:

> *"Why are Bristol community energy groups mostly from a narrow section of a diverse community? Why is it so hard to get others involved?*
>
> *…. The communities most affected by fuel poverty are often not involved in discussions about energy equality, or have much to do with the groups working in this area. Many energy groups try to reach out and involve others but often with limited success. But with these important voices missing, how can we create a sustainable, inclusive energy system that works for us all?"*

This event aimed for procedural equality by inviting the voices of those currently not participating. It also provided recognition of the dignity of disadvantaged groups – "representatives of communities of African and Asian heritage, Eastern European migrants, older people, disabled people, LGBTQI people and those from lower income households talking", and recognition of the particular needs of people experiencing fuel poverty. However, from a starting point of a mainly white, middle class, male, well-educated set of participants, it is challenging to increase the diversity and appeal to those outside of this privileged demographic. The event had some success in attracting more diverse participants, but was primarily attended by people already involved in BEN.

BEN has also taken active steps to broaden participation. In collaboration with BCC, it has set up a Community Energy Fund aiming to support 'non-energy' community groups to work with energy groups. Funding has supported internships for young people, solar panels on a 'sensory bus', double glazing on youth centres, and digital energy advice for low income, digitally excluded people, amongst other projects. BEN has actively sought diversity in the grant-making panel, and successfully included representatives of ethnic minorities, and a majority of women (Bristol Community Energy Fund, 2016).

BEN has also actively worked to bring diversity to its board of directors, a matter of both procedural and recognition justice, and has held training events on diversity and inclusivity for its members.

However, whilst equality and inclusion is a priority for some members of BEN, for others making large scale and rapid progress with the deployment of low carbon energy technology is more urgent. This perspective is similar to that of the Greenpeace activist cited by Agyeman:

> *"I asked a Greenpeace staffer if she felt that her organization's employees reflected multicultural Britain. She replied calmly, 'No, but it's not an issue for us. We're here to save the world.'"* (Agyeman, 2008b, p. 751)

Frustration with this perspective is clear in this excerpt from an email sent by a member of BEN for whom equality is a high priority:

> *Attempting to charge ahead with a project when it has only successfully engaged such a narrow segment of a very diverse city is not only an ineffective strategy but also unjust. At the root of many of our problems in society is the fact that a small, unrepresentative group of people have determined the policies, systems etc that we all have to live by; the result being that those policies and systems are often ineffective at meeting the needs of people different to those who wrote them in the first place. Don't we want to be different? Yes, including other people can mean a longer process, but it doesn't have to be 'paralysing'. As the saying goes: If you want to go fast, go alone. If you want to go far, go together.*

Another member argued for the importance of having a material impact as well as being inclusive:

> *To paraphrase your "Attempting to charge ahead with a project when it has only successfully engaged such a narrow segment of a very diverse city is not only an ineffective strategy but also unjust." We say that "attempting to engage with a wide segment of the public while having no resources to deliver beneficial change is just as ineffective and unjust". It's only when we have both that it makes sense.*

The idea that it makes more sense to engage with people when there is something concrete to offer them is compelling. However, this is also a question of choice, and procedural justice interacts with distributional justice as those who are disadvantaged can advocate for their own needs. Perhaps to move forward, participation needs to be reframed as an enabler of effective delivery of projects.

The CE sector in Bristol contrasts with the Brixton Energy Co-operative project in London. Diversity, inclusion and participation are fully integrated through grant funding that enabled door-knocking in the council housing blocks where solar panels were installed, training local young people to carry out draught proofing within their own communities, and funding internships for local youth which led to job opportunities.

Additionally, the question of who is in the room is linked to the dynamics that take place 'within the room'. One of the manifestations of privilege is that those with more privilege tend to have more voice within a group. Often this is an unconscious process. The training organisation New Economy Organisers Network (NEON) prompts reflection with the following questions:

> *"When you speak in a group situation, are you listened to? Do you create space to listen to others?*

When you propose a new idea, is it explored? If someone else offers you a new idea, do you give it room to be heard?

When people say something you disagree with, do you listen and does the way you address it result in change? When you say something others disagree with, is it heard and does it result in change?" (NEON, 2015, p. 4)

So long as there is not a critical mass of people committed to inclusion and equality, people from different backgrounds may not feel fully welcome in participating.

BEC still has further to go in terms of procedural equality and representation. In 2016 the board of nine directors was all white, and included one woman; all have professional backgrounds. The promotional film made in 2015 featured only white people. As of 2017, of the three employees, only one was a woman, and she was in an administrative role.

Inequalities in who participates are partly due to economic factors, such as the greater freedom and time for volunteering available to those with greater financial resources. However, they are partly due to informal boundaries of membership, as people feel more comfortable with those similar to them. The work of identifying unconscious biases and dismantling privilege attempts to remove boundaries that reinforce societal inequalities.

These observations show that redistribution should not just be limited to material wealth and access to energy services, but should also include redistribution of power.

11.2.3 Equality in recognition[51]

Equality of recognition is related to some of the issues discussed previously. Addressing fuel poverty not only supports distributional equality, but also recognises the distinct needs and situation of people living in fuel poverty. Considering privilege and noticing who is missing from a conversation involves recognising the different experiences and resources available to different people, and recognising the equal rights of different people.

However, commons governance systems can make use of mechanisms that pose risks to equality of recognition. If DP1, including a greater role for commons, is to be implemented, this is a concern. For example, community accountability could lead to scapegoating of the 'other' within a group, if there is lack of recognition of the rights of different people within a community.

The idea of community monitoring led participants in the LiM project to think of repressive social punishments, using words such as 'witch hunt', 'lynching' and 'big brother'. This shows the link in the interview respondents' minds between community accountability and harsh punishment of those within a social group who do not conform to norms, as discussed in 9.3.2.

In contrast to these strong fears, however, respondents were understanding of the different energy needs of families with young children or the elderly. Bureaucratic decision-making processes such as the centrally administrated system of billing and metering currently in place can block creative and human responses to individual needs (Solove, 1999).

Respondents were accepting of the diverse needs and capabilities of individuals in their community, in relation to the flexibility of their energy consumption:

[51] This section draws on text from (Melville *et al.*, 2017).

Imogen: *I think if **someone can only do a tiny bit** but they've actually done that tiny bit, it's all part of the bigger picture isn't it*

Frances: *It's also really hard because **you don't know the situation** of the people in the house. Like you don't know **ability** wise, you don't know anything about these people. So just to switch off, pick and choose to switch off someone's electricity it's like yeah … I know that we could make do and we'd be fine. We might be a bit cranky but we'll be fine. But there are **other houses maybe they couldn't** or maybe there's **something about them that we don't know on multiple levels**.*

This acceptance of the diversity of the population supports the idea that community groups could develop their own sense of fairness and be compassionately responsive to individual needs. The comments express a compassion that contradicts the fear of mob violence expressed in the 'big brother' discourse. On the other hand, it may be easier to be compassionate towards those seen as 'deserving', e.g. people with young children or particular medical needs, and less compassionate towards people who are stigmatised by community norms.

Frances also pragmatically recognises that "there's always going to be people that don't participate", a finding supported by Burchell et al. (2016), who note a 'pyramid of participation', in their project. This acceptance of free-riding, and potentially willingness to compensate for those who do not contribute, might be different in a context where the community provided the only mechanism of accountability, rather than an additional layer alongside the contractual relationship of buying energy. Although 'witch hunt' and 'lynched' seem to be dramatic exaggerations, vigilante justice systems do develop in human societies (Weisburd, 1988). The outcomes of a community based justice system may not necessarily be desirable.

The question of diverse needs also relates to horizontal privacy – judging whether individuals should be entitled to favourable energy access would involve access to detailed information about personal matters. The comment by Frances above implies an awareness of the privacy associated with different people's needs "you don't know the situation" "something about them that we don't know on multiple levels".

It is also possible that respondents' attitudes to different people's needs may be gendered, or subject to self-selection bias, with more socially minded people choosing to respond to research interviews. Levels of social trust of respondents were moderate to high, with the greatest social trust for colleagues, people working in local food shops, and people in the neighbourhood, and the lowest for the local councillor and local council. There was a stronger association between trust in people in the neighbourhood and motivation to save energy if others were doing so than between general social trust and community motivation. This high level of social trust may be related to respondents' accepting attitudes to the diverse energy needs within the neighbourhood. Attitudes may be different in another neighbourhood or with different demographics.

Community accountability mechanisms may provide opportunity for participation and self-representation, a potential improvement in procedural justice relative to decisions being made by remote elites, and for recognition of the specific needs of known individuals within a community. However, it also carries the risk of injustice in recognition of the worth of diverse people within the community.

11.2.4 Design principle 3 conclusion

Chapter 8 set out the following set of questions to be asked through the case study analysis of each DP:

- To what extent are these principles already present or not present in current local energy activities and the GB energy system?
- To what extent does the absence or presence of these principles lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from these principles?

- Do these principles need to be modified or rejected in light of analysis of the case studies and if so how?

For reference, DP3 was phrased as follows:

> National mechanism for redistribution of value, and sharing of risk of innovation in governance

These are answered below drawing on both the case study analysis in this chapter and my experience working in the CE sector and at BHE for the last 7 years.

To what extent is DP3 already present or not present in current local energy activities and the GB energy system?

There are currently standard tariffs that are the same across the country, but this does not protect people who are most at risk of fuel poverty, as the 40% of consumers who never switch supplier are on higher tariffs, as are those who are on prepayment meters. LA energy companies in Bristol and Nottingham specifically aim to provide fair tariffs to all, including the 'standard variable tariff' for those who do not switch. This is more equitable than the status quo, without being a national redistributive mechanism.

There is no coordinated system of redistribution of wealth from renewable-energy rich to renewable-energy poor geographical areas. However, as those areas with high RE capacity have limited ability to retain financial benefit from that, in practice the wealth of RE resources flows to those who have the financial capital to invest in generation projects. Redistribution would therefore potentially be needed from those with financial capital to those with less, or some regulation to retain wealth from renewables within the geographical area where it was generated, before redistribution of this sort would become relevant.

To what extent does the absence or presence of DP3 lead to strengths or weaknesses in observed GB energy system activities?

The redistribution that takes place through general taxation, which benefits people who are at risk from fuel poverty, is a strength in terms of supporting equity. It is also generally supported by the population and media.

Redistribution that takes place as a cross-subsidy within the energy system, such as FiT and ROC, has enabled the development of the RE industry, but as this is taken from people's bills rather than from general taxation, there are media stories which accuse the financial support for green and social policies of increasing people's bills. This is debated, with analysis by DECC in 20143 concluding that long term bills will be lower in 2020 due to green policies (Vidal, 2013). In addition, there are currently hidden subsidies for fossil fuel energy systems.

There is some capacity-building redistributive funding available from national government in the form of the Rural Community Energy Fund (RCEF) and the Urban Community Energy Fund (UCEF). However, the urban fund was closed to new applicants in July 2016 (Centre for Sustainable Energy, 2016). These funds were aimed at supporting communities with development funding and loan finance for ultimately financially viable energy projects. Intermediary organisations such as CSE were available to help communities with the application process. This does enable communities to develop RE, and supports communities that do not have sufficient financial or other resources to develop CE projects independently. The support of intermediary organisations helps make this available beyond the communities who are able to engage with the application process without support. These funds are therefore a strength, although the reduction in general support for RE has meant that it is more difficult for communities to find financially viable projects.

DP3 was partly intended as a safeguard for the hypothetical situation where commons management systems provide primary energy services to communities. This is not how the GB energy system is currently configured, so some of the spatial redistribution proposed in DP3 is not currently relevant.

How does the current trajectory move towards or away from DP3?

The current trajectory is moving away from DP3, with reductions in grant funding and other financial support for those in fuel poverty, debate about the continuation of winter fuel payments, reduction in support for RE, and ending of the UCEF fund.

Does DP3 need to be modified or rejected in light of analysis of the case studies?

The discussion of DP1 highlighted a number of additional challenges with commons based systems, in particular regarding the need for privacy and the need to address conflict effectively. The issue of privacy is relevant to equality, because one of the risks it creates is in relation to protection of people who are perceived as 'other' within a community. In addition to redistributive policies, it is important to retain existing legislation that protects the 'other', currently in the UK Equalities Act (HM Government, 2010) . This is at risk in the context of Brexit, as the 2015 government has announced plans to leave EU human rights legislation. National legislation that protects the equal rights of all people in a community, and which has sovereignty that is allowed to override any local rules, would provide some important protections. This is a good case for making exception to the rule of subsidiarity.

For the sake of integrity, it is worth acknowledging that this human rights legislation is anthropocentric, as it does not afford the same rights to non-human animals.

11.3 DP4: Responsibility and accountability for the full impact of actions

The fourth DP aims to achieve the objective of remaining within environmental limits, one of the core values of this thesis. Taking responsibility for the full impact of actions is seen as a potential way to achieve this goal in practice, as the abstract objective of remaining within environmental limits is not necessarily a useful governance mechanism in itself.

This DP is discussed briefly and at a more theoretical level than the others, as environmental limits, responsibility and accountability were not explored in detail within this study. However, as remaining within environmental limits is a foundational value, it is important to have a DP relating to this. The testing of the DP in relation to the GB energy system and observations from the case studies is addressed in response to the research questions at the end of this section.

Important issues for remaining within environmental limits include: creating strong enough and timely feedback about the impact of decisions; selecting between voluntary agreements to remain within limits, and coercive enforced rules; and approaches to dealing with conflict. These are discussed in more detail below.

Remaining within environmental limits is a goal, or a target, but is not something that can easily be implemented directly. The DPs, on the other hand, aim to provide mechanisms for organisations that can be implemented in practice. Responsibility and accountability mechanisms have been identified as an approach to implementation of remaining within environmental limits.

The abstract objective of remaining within environmental limits is not necessarily a useful governance mechanism. In case studies of how commons fisheries remain within environmental limits, Ostrom observed that fishers rarely used quotas regulating quantities of fish that could be caught, but rather used rules regarding when or where they could fish, what technology could be used, or what size, sex or species of fish

could be caught (Ostrom, 1999). Abstract limits, which require extensive analysis of ecosystem behaviour, are not good rules as they are not easily implementable.

In relation to sustainable energy consumption, limits regarding the number and type of electrical appliances that are permitted, and the time at which they can be used, or alternatively limits on power consumption such as the 5kW limit on the island of Eigg, can lead to concrete operational choice decisions.

Remaining within limits involves internalising externalities, or taking responsibility for externalities. This requires effective and timely feedback processes (Meadows, 1999). When there is a delay within a system, it is more difficult to ensure that the system remains stable. For example, the impacts of climate change on food systems do not immediately affect someone who is deciding whether to travel by bicycle or by car.

Remaining within limits is not easy, particularly in a culture where we have been encouraged to consume without limits. Easy access to credit allows people to consume beyond their immediate financial means, thus sustaining economic growth even when wages are limited. However, at the other extreme, living within limits imposed by the state, such as the rationing in Britain during and following WW2, is not a popular policy. Potentially, mutually agreed limits to consumption – i.e. rules governing 'appropriation' in a commons management system - could be more desirable and politically feasible.

This involves taking responsibility at a local level, within a community, without relying on a supposedly benevolent state to impose limits. Conflicts are likely to arise in this process, for example between the desire for comfort and the amount of electricity that can be generated locally; or between the desire for convenience in the present, and the impacts of climate change on future generations. Shared dependence on a resource, community, and conflict are three elements that arise together. Community involves learning how to 'fight gracefully' (Peck, 1990).

Ostrom identifies effective strategies for dealing with conflict as an essential aspect of successful management of commons. This is central to her 6th DP: 'easy access to low cost conflict resolution mechanisms'. At the same time, fear of violent and disproportionate punishment in a community accountability situation is one of the issues that emerged in the LiM study. This is an issue that is related to how conflict is dealt with in a community. Ostrom's 5th DP, 'graduated sanctions' involves proportionate rather than excessive punishment for transgression of community rules.

Ostrom's DP does not give detail of how conflict is to be addressed, but implies a punitive justice system. Restorative justice systems may be more effective than punitive justice systems, in terms of long term sustainable community relationships. "Restorative justice sees wrongdoing in terms of harms to relationships, and aims to restore relationships … between people and communities: doing justice means healing and putting right wrongs" (Robins, 2009, p. 62) . This means that where a rule is broken within a community, a restorative justice process might lead to the perpetrator understanding the harm they have done and being re-integrated in community, and the victim receiving an apology and potentially forgiving the wrongdoing, rather than the perpetrator being imprisoned, punished or excluded from society. Restorative justice was part of many traditional justice systems displaced by colonial punitive justice systems, for example in Uganda (Robins, 2009) .

Responsibility and accountability mechanisms also support self-reliance and the full dignity of people involved, and provide opportunities for learning and maturity. This is in contrast to welfare-state approaches, which can lead to dependency. Whilst care, and solidarity for individuals experiencing difficult circumstances are important, dependency fails to provide full opportunities for creativity, challenge, wonder, learning and dignity. This is one of the ways in which the polycentric and commons based governance system attempts to find a humanistic alternative to both centralised-state socialism, and rapacious capitalism, an objective similar

to that of the Catholic church in their promotion of the principle of subsidiarity, as discussed by Carozza (2003).

This discussion proposes some areas for further research which may be useful for energy governance systems that remain within environmental limits. These include timely feedback of impacts both within and outside of a governance unit, taking responsibility for those impacts, and having effective mechanisms for resolving the conflict that is likely to arise from that process of taking responsibility. Whilst such mechanisms do not directly address environmental limits, they may be implementable mechanisms within an institution that can support sustainable living, when underpinned with a strong shared value of remaining within environmental limits.

11.3.1 Design principle 4 conclusion

Chapter 8 set out the following set of questions to be asked through the case study analysis of each DP:

- To what extent are these principles already present or not present in current local energy activities and the GB energy system?
- To what extent does the absence or presence of these principles lead to strengths or weaknesses in observed GB energy system activities?
- How does the current trajectory move towards or away from these principles?
- Do these principles need to be modified or rejected in light of analysis of the case studies and if so how?

For reference, DP4 was phrased as follows:

> Responsibility and accountability for the full impact of actions, in particular those affecting environmental limits.

These are answered below drawing on both the case study analysis in this chapter and my experience working in the CE sector and at BHE for the last 7 years.

Whilst the discussion of the DP was quite general, the answers to the questions are more specific to the GB energy system, drawing on my experience and understanding gained through case studies generally.

To what extent is DP4 already present or not present in current local energy activities and the GB energy system?

There is a lack of accountability for the impacts of climate change, at many levels within the current GB energy system. At a national level, there are commitments to address climate change, including through the Climate Act 2008, European commitments, and the Paris Agreement. However, these are not integrated into every relevant level of decision-making. For example, when BCC refused planning permission for a biomass power station in Avonmouth, it was not allowed to mention climate change as a 'material concern', as non-local issues are not allowed to be considered in local planning decisions. This type of policy goes against the principle of taking responsibility for the impacts of decisions, even if those impacts are far away in time and place.

Similarly, Ofgem, the regulator for the energy markets, does not have climate change in its remit. Additionally, the government department responsible for energy is no longer the Department of Energy and Climate Change, but now the department for Business, Energy and Industrial Strategy. The remit for climate change has been separated from energy.

This thesis makes an assumption that there is a need to reduce consumption of energy in order to become sustainable, particularly to remain within the RE that can be produced in the GB (Centre for Alternative

Technology, 2013). Supposing this is the case, there should be some accountability for levels of consumption. Instead, government policy assumes that demand will continue to rise, that lifestyle change is politically unfeasible, and that the role of the energy system is to meet any level of demand.

To what extent does the absence or presence of DP4 lead to strengths or weaknesses in observed GB energy system activities?

The GB energy system is not ecologically sustainable, in terms of GHG emissions. This is partly due to the absence of strong enough mechanisms for taking responsibility for the impacts of actions. On the other hand, where mechanisms of responsibility do exist and are turned into policy, there is a positive impact. For example, the FiT and ROC schemes were originally policies designed to enable GB to meet its commitments as part of the EU RE directive, and have been effective in encouraging large scale installation of RE generation, contributing to drops in prices at a global level.

How does the current trajectory move towards or away from DP4?

The current trajectory is moving away from DP4. However, campaign groups such as 10:10 are campaigning for renewed support for RE, and attempts to develop fracking in the UK are being resisted both locally and nationally.

Does DP4 need to be modified or rejected in light of analysis of the case studies?

The aims of DP4 are still valid. However, the LiM case study highlighted the importance of addressing conflict effectively in a community. This is part of taking responsibility for actions, and conflict may well arise as part of the process of taking responsibility, whether internal conflict faced by individuals, or conflict within a community, or in national policy. DP4 is proposed to be modified as following:

> Responsibility and accountability for the full impact of actions, and effective strategies for resolving conflict.

11.4 Design principles revisited

The insights about the mechanisms of commons and of polycentric governance, and their limitations, were used to develop a set of DPs for an energy system that maximises democracy, promotes equality, remains within environmental limits, and promotes innovation and learning.

Chapter 8 proposed a set of four initial DPs, inspired by Ostrom's set of DPs for common pool resource management. These were tested against the case studies, in chapters 9, 10, and 11. This led to identification of modifications to the DPs. The initial DPs, conclusions from the analysis, and new modified DPs are listed below. There are several more nuanced DPs listed under each of the initial DPs.

DP1: mixed economy

Initial DP:

> A thoughtful combination of commons, state-public, and market institutions and forms of ownership

Recommendation from analysis:

> DP1 should be modified to differentiate between ownership models, core motives and mechanisms of interaction. It should recognise that an organisation may have state based ownership models, publicly oriented core motives, and use market mechanisms in operation.

Updated DP:

- Mix of state-public, private and community-commons ownership and governance, with a greater role for commons, and a lesser role for markets than there is currently
- Differentiation of ownership models, core motives and mechanisms of interaction.

DP2: nested governance

Initial DP:

Use of nested forms of governance at different spatial scales, as well as non-spatial governance

Recommendation from analysis:

DP2 should be modified to add a sub-principle relating to open sharing of information.

Updated DP:

- Nested system organised according to principle of subsidiarity
- The size of each spatial level of governance is congruent with the physical and technical boundary of the infrastructure being governed
- Diversity of institutions and sharing of learning between them; with sharing of risk of failure
- Shared vision, with values of human wellbeing, equality, democracy and environmental limits

DP3: equality and redistribution

Initial DP:

National redistribution of value, sharing of risk, and sharing of learning

Recommendation from analysis:

DP3 should be modified to include protection of the rights of individuals, in particular the protected characteristics listed in the Equalities Act 2010, in addition to the redistribution of wealth.

Updated DP:

- Mechanisms of redistribution of power and wealth, including through capacity building
- Protection of the equal worth and rights of all humans, including those potentially seen as 'other' within or outside a community

DP4: Responsibility and externalities

Initial DP:

Responsibility and accountability for the full impact of actions, and effective strategies for conflict.

Recommendation from analysis:

DP4 should be modified to include mention of effective approaches to dealing with conflict, as part of taking responsibility for the impacts of actions.

Updated DP:

- Responsibility for the impacts of actions, including externalities, in particular impacts relating to environmental limits

- Effective mechanisms for addressing conflict, based in restorative justice systems.

These DPs could inform energy system development at all levels. They could be a framing used by CE groups to better understand their place in the wider system, by local government in negotiating and implementing energy devolution, and by Ofgem to conceptualise ways to create a greater role for the local, for renewable and distributed energy in the GB energy system. They could also be drawn on by campaigners to identify strategic demands and situate these within a broader vision.

These DPs are expected to achieve the **desired outcomes** of:

- Maximising democracy: this includes balancing autonomy and responsibility with care and solidarity, and providing multiple approaches to participation
- Promoting innovation and learning: by allowing multiple experiments in sustainable energy culture and institutions to take place simultaneously, and supporting shared learning from each other's successes and failures
- Remaining within environmental limits, by developing energy cultures that integrate appropriation and provision, and finding ways to live well within the limits of the energy available in a geographical area
- Promoting equality, including compassionate human responsiveness to the diverse needs in a community, backed up by bureaucratic means tested support for those that a community fails to support through reciprocity.

The most detailed work in this thesis has been in the research leading to DP1 and DP2. This is where the original contribution to knowledge is situated. DP3 and DP4 could be seen as **necessary safeguards**, to ensure that the core values of equality and remaining within environmental limits are prioritised, responding to weaknesses identified in commons and polycentric governance theories, rather than as DPs in their own right.

The first two DPs are revised to a more nuanced form, taking into account the complex realities observed in the case studies. This has led to a number of sub-principles being identified.

This chapter therefore proposes two categories of principles: **design principles**, and **necessary safeguards**.

The final **design principles** are proposed as follows:

A Mix of state-public, private and community-commons ownership and governance, with a greater role for commons, and a lesser role for markets than there is currently.

B Differentiation of ownership models, core motives and mechanisms of interaction.

C Nested system organised according to principle of subsidiarity.

D The size of each spatial level of governance is congruent with the physical and technical boundary of the infrastructure being governed.

E Diversity of institutions and sharing of learning between them; with sharing of risk of failure.

F Shared vision, with values of human wellbeing, equality, democracy and environmental limits.

With **necessary safeguards:**

A Mechanisms of redistribution of power and wealth, including through capacity building.

B Protection of the equal worth and rights of all humans, including those potentially seen as 'other' within or outside a community.

C Responsibility for the impacts of actions, including externalities, in particular impacts relating to environmental limits.

D Effective mechanisms for addressing conflict, based in restorative justice systems.

12 Conclusions and implications

12.1 Conclusions

The GB energy system must be radically transformed in order to reduce its impact on climate change. It is undergoing a major transition due to the reduced cost of renewables, and development of energy storage and digital technologies. Commons and polycentric governance theory can potentially be of value for understanding and governing this transition, and for ensuring that its benefits go to the common good rather than being captured by elite and incumbent interests.

Commons and polycentric governance frameworks have proved to be a valuable lens for exploring the roles of communities and local government in GB's sustainable energy transition. This analysis has enabled contributions to be made to the commons literature, and to the literature on empirical application of polycentric governance, both through the theoretical analysis and through the case studies. This has implications for the local CE and LA energy sectors, for energy policy, and for organisations such as BHE.

A set of 'design principles' (DPs) for a polycentric, commons-based energy system have been developed. These DPs are expected to be transferable to a broad range of other contexts. They can also shape the way that BuroHappold and similar organisations engage with multi-stakeholder projects and complex situations where a collaborative outcome will be greater than the sum of its parts.

12.1.1 Personal reflections

As I come to the end of this process, I am reflecting on what I have learned. Writing a thesis is a very solitary process. It has forced me to think deeply about the ground I stand on, to take responsibility for my own position. Whilst I have at many times resisted this, and wanted to take my cues from others – my supervisors, friends, CE colleagues, climate activists, my perception of acceptable thinking in a commercial context – finding my own ground has been a huge gift.

I write in the introduction to my thesis, when describing my positionality, about feeling 'pulled in different directions' by my position with a foot in each of several worlds. In the midst of the tension of that plurality, I felt at times like a messenger or ambassador, bringing the voice of another paradigm into each setting I found myself in. This became confusing and painful, as I kept shifting who I was and my position, and trying to hold multiple conflicting views. I feel less of that pain now. The EngD, with its solitary nature requiring me to fully own the position I take, has brought me to be clearer in who I am and where I stand, and enabled me to more consistently bring myself to varied contexts as myself, rather than attempting to channel other worlds I am familiar with and thus losing my ability to confidently and humbly stand where I am and listen.

Donella Meadows proposes twelve levers for changing a system. Whilst all of them are important, for me this research process has been a dance between the two most powerful ones: the mindset or paradigm out of which the system arises, and the power to transcend paradigms.

The GB energy system is operated in a market paradigm. This means that it is conceptualised as a market, and that the main utopian vision of what it should be is a market. By engaging with commons theory I have attempted to construct an alternative paradigm, both for seeing what is already happening and for imagining a desired future. This has involved going deeply into that alternative paradigm, beyond market or state, and advocating for it.

At the same time, Meadows' first most powerful lever, of transcending paradigms, has a pull. I argue from a pro-commons position, but also reflect on the shortfalls of commoning in terms of conformity, risk to equality, traditionalism. I reflect on what is good in the market, in terms of innovation and individual

freedom. Holding both, and also the state, in my vision of utopia and in how I see the world as it is, requires the power to transcend paradigms.

Perhaps accessing this 'power to transcend paradigms' is only possible in moments of experiencing oneness, such as spiritual experiences of enlightenment or visions of God. Most of the time, perhaps the best we can do is to move between and see the value in different paradigms, and not take ourselves or our worldview too seriously. To have a sense of humour. Laughter is a moment of presence in what really is, of stepping outside of the story – perhaps as much enlightenment as spiritual experiences of oneness achieved through meditation.

Returning to work as a consultant at BuroHappold during the final part of writing my thesis has given me the opportunity to reflect on how the learnings from this thesis can be applied in a BHE context, through working on projects, re-learning the language of built environment work, and having discussions with colleagues.

It has also allowed me to reflect on what I have learned and how I have changed, and to experience the dissonance between the facilitator role of a consultant and the need to commit to an argument and position as a utopian academic. BHE too takes a position and has a bias, but one which follows the money, and serves the interests of our clients, rather than our personal individual integrity. Being explicit, conscious and clear about our own individual and organisational positions and biases can be a gift, and can potentially be a starting point for finding pragmatic ways to work with integrity.

I am loving returning to working with other people, working as a consultant with an emphasis on workshop facilitation, and re-engaging with the CE sector. The role of the consultant as facilitator/convenor is one that BHE has been moving towards over the past few years. One of the challenges of good facilitation is to learn to take a position that transcends paradigms, to hold a neutral space for others to share their perspectives and understand each other. This is difficult to do, and perhaps more difficult for someone who hasn't understood and reflected on their own position, and become conscious of their own biases. By deeply exploring the paradigm of commons, and understanding the contingent basis on which I choose to commit to this vision of utopia, I hope to be both conscious of where I stand, and be open to other perspectives.

12.1.2 The Design Principles

The final part of this thesis proposes a set of design principles (DPs) for a commons-based, polycentric energy system. The DPs are derived from detailed study of theories of commons and polycentric governance, and are expected to be applicable in a range of context beyond the energy system. They are accompanied by a set of necessary safeguards which protect the values of equality and environmental protection, which are not necessarily adequately addressed by commons and polycentric governance.

The final design principles are proposed as follows:

A Mix of state-public, private and community-commons ownership and governance, with a greater role for commons, and a lesser role for markets than there is currently.

B Differentiation of ownership models, core motives and mechanisms of interaction.

C Nested system organised according to principle of subsidiarity.

D The size of each spatial level of governance is congruent with the physical and technical boundary of the infrastructure being governed.

E Diversity of institutions and sharing of learning between them; with sharing of risk of failure.

F Shared vision, with values of human wellbeing, equality, democracy and environmental limits.

With necessary safeguards:

A Mechanisms of redistribution of power and wealth, including through capacity building.

B Protection of the equal worth and rights of all humans, including those potentially seen as 'other' within or outside a community.

C Responsibility for the impacts of actions, including externalities, in particular impacts relating to environmental limits.

D Effective mechanisms for addressing conflict, based in restorative justice systems.

These DPs are expected to achieve the desired outcomes of:

- Maximising democracy: this includes balancing autonomy and responsibility with care and solidarity, and providing multiple approaches to participation
- Promoting innovation and learning: by allowing multiple experiments in sustainable energy culture and institutions to take place simultaneously, and supporting shared learning from each other's successes and failures
- Remaining within environmental limits, by developing energy cultures that integrate appropriation and provision, and find ways to live well within the limits of the energy available in a geographical area
- Promoting equality, including compassionate human responsiveness to the diverse needs in a community, backed up by bureaucratic means tested support for those that a community fails to support through reciprocity.

These DPs do not represent the only way forward for a good energy system future. They are based in a worldview that prioritises deep democracy, equality of capabilities for participation in society, and responsibility; and that aims to reduce consumption in the global north and be resilient to economic degrowth, rather than rely on techno-optimism. Following these DPs could also support other forms of sustainable prosperity. If these desired outcomes are valued, then it is recommended to consider following these DPs, and to understand the thinking behind them.

These DPs could inform energy system development at all levels. They could be a framing used by CE groups to better understand their place in the wider system, by local government in negotiating and implementing energy devolution, and by Ofgem to conceptualise ways to create a greater role for the local, for renewable and distributed energy in the GB energy system. They could also be drawn on by campaigners to identify strategic demands and situate these within a broader vision.

12.1.3 Transferability

The conclusions of this thesis can be transferred to other contexts. A similar theoretical analytic process could be applied to other industrial and infrastructural resources. Additionally, the political aspects of commons are generally applicable. The analysis of energy as a commons differentiates between aspects of the energy industry, such as infrastructure, access, and environmental impacts. These conclusions could be transferred to other similar industries, for example the water industry where universal access is a basic need and has positive social externalities and with network infrastructure that is a natural monopoly.

The analysis of polycentric governance was specific to the GB energy system. The general conclusion that considering the governance system through McGinnis' polycentric lens yields interesting insights is likely to be transferrable to the energy industries in other countries, and to other infrastructure systems. However, understanding the transferability of any specific insights would require an extensive comparative study. For example, the model of two separate polycentric energy systems identified in Bristol, and the potential role of

Bristol Energy Company in bridging this gap, is an insight specific to Bristol. It may be transferable to other contexts where there is a strong civic and community energy sector and a municipal energy company, but there may not be many such contexts.

Beyond consideration of different infrastructure systems in isolation, insights from commons and polycentric governance theory could provide insights for multi-utility governance, for example through 'MUSCos', or multi-utility service companies as researched in the Land of the MUSCos research project (Leeds, 2014).

The DPs are stated at a general level, and could be applicable to many different contexts. However, their robustness should first be tested further, both within GB's energy system and in other contexts, and it may be that they require further modification in practice.

12.1.4 Assumptions and limitations

This thesis is based on a set of normative assumptions. The conclusions are therefore valid in the context of these assumptions. These include:

- That social systems can be changed, through collective action
- That individual autonomy, responsibility, skills, and interdependence and community with relationships of reciprocity are valued intrinsically as part of a good life.
- That there is a need to reduce consumption in order to live within environmental limits. Much of current consumption in the UK is unnecessary, or necessary because of a high-consumption social context. It would be possible to live a good life much more simply, but this requires collective change.

The research context of the EngD has provided a richness of grounded experience in projects. However, it has also led to a non-linear research process, with planned research being modified in order to adapt to the project opportunities in BHE. The research in Bristol in particular has provided rich information through experience and immersion, but it was not possible in this context to pursue a more complete action research cycle or to carry out as many formal interviews as planned. It has been challenging to know how to draw on the rich observational data in the context of an academic thesis, given that this is not an ethnography.

12.1.5 Commons and energy

Chapters 5 and 6 analysed energy as a commons. It brought together analytic Ostromian literature with more political pro-commons literature to define commons governance as collective ownership and/or management of a resource by a group of people who both use and create it. The choice of governance system relates to the physical characteristics of a resource and to other factors. This has been explored in depth in relation to energy, which has not received extensive attention in the commons literature.

There are a number of reasons for considering energy as a commons or public good, based on widely accepted legal and economic perspectives. There are strong positive externalities of universal access to energy services, and strong negative externalities associated with the energy system such as global climate change and local air quality problems caused by burning fossil fuels. Energy network infrastructures are natural monopolies and so at risk of rent-seeking behaviour, and many energy resources are based on land, also a resource at risk of rent-seeking behaviour. For these reasons, there are benefits to governing energy as a commons or public good.

Commons governance of energy could have benefits for democracy beyond energy. However, achieving good outcomes for equality and the environment through commons-based governance may be reliant on wider public ownership and/or policy. Commons governance mechanisms are already active within the civic energy system. However, they have limited visibility and could play a greater role than they currently do. The

commons theory developed in this thesis could be used to improve the visibility and articulate the potentially greater role a commons-based civic energy system could play within the wider GB energy transition.

The first DP relates to commons, and states that there should be a:

A Mix of state-public, private and community-commons ownership and governance, with a greater role for commons, and a lesser role for markets than there is currently.

This means recognising that different forms of governance, which are characterised as market, state and commons archetypes in this study, exist alongside each other and are mutually interdependent. All three have their strengths and weaknesses, and there should be a greater role for commons, both in terms of the way that governance is structured and in terms of how the existing governance systems are perceived and framed.

The second design principle:

B Differentiation of ownership models, core motives and mechanisms of interaction.

Shows the complexity of mixed-modes of governance in real institutions. An organisation might be owned as a commons, but interact through market mechanisms, and be motivated by broad public good. A simplified vision that puts an organisation purely into one box is likely to misrepresent the reality.

12.1.6 Polycentric governance and the GB energy system

Chapter 7, on polycentric governance, situates commons governance within a wider system of energy governance. It uses McGinnis' (2016) framework of characteristics and common problems of polycentric governance systems to analyse the GB energy industry codes. The use of polycentric governance theory in empirical settings is at an exploratory research stage, and was discussed in several sessions at the 2017 IASC conference (International Association for the Study of the Commons, 2017). This research therefore contributes to the literature developing empirical applications of polycentric theory.

The energy industry codes self-governance exhibits many of the problems of polycentric governance identified by McGinnis: *structural inequalities* of domination by incumbents, which are difficult to overcome partly due to the *high complexity* and *incremental bias*, and *deep structural fissures* of some separation of the energy industry rules from climate change mitigation.

Lockwood et al. (2015) propose that the GB energy system should move away from self-governance by private industry and towards a 'body within the public sphere'. This may be a move towards centralisation which could risk forfeiting some of the benefits of polycentric governance such as local autonomy to solve problems in innovative ways and to tailor solutions using local knowledge. On the other hand, a central rule-making body in the public sphere could create a framework within which local diversity can flourish more than it does currently.

At a local level, the emergence of a polycentric civic energy sector in Bristol was identified. This can potentially be linked to the polycentric system of the energy industry codes through the Bristol Energy Company, which is a party to the codes. It is important that as such a system evolves it retains norms of equality and citizenship, and builds in sufficient broad-based democratic accountability at all levels to avoid persistent *structural inequalities* and *lack of normative clarity*.

DPs C, D, E and F, relate to polycentric governance.

C Nested system organised according to principle of subsidiarity.

D The size of each spatial level of governance is congruent with the physical and technical boundary of the infrastructure being governed.

E Diversity of institutions and sharing of learning between them; with sharing of risk of failure.

F Shared vision, with values of human wellbeing, equality, democracy and environmental limits.

The injunction to organise a nested system according to the principle of subsidiarity is difficult to achieve. However, the ultimate sovereignty of the individual at the heart of subsidiarity is a key ingredient of democracy, and a follow on from the equal dignity of each person, and so this principle is important to the core values underpinning this thesis.

Congruence of governance with physical and technical boundaries of infrastructure can be valuable for effective governance. At the same time, congruence with community boundaries is also important, as seen in the LiM case study.

The sharing of learning and of risk between organisations is one of the greatest strengths of polycentric governance. Shared vision is required in order to keep a polycentric governance system from becoming too fragmented.

12.2 Implications

12.2.1 Paradigm, framing and narrative

The conclusions of this thesis could have implications on many levels. Thinking in terms of commons is a different paradigm to the dominant paradigm of market-based governance of energy.

Shifting to a commons paradigm would change what is observed in the current context and how these narratives are framed. For example, free market ideology claims that innovation takes place through competition, and motivation is based on financial reward. However, even in a commercial environment such as BHE, there are many examples of commoning taking place as part of daily life, through interactions based on reciprocity and cooperation. Making tea for each other. Helping out team-mates without expecting official individual recognition. Being aware of the different skills and approaches different people bring to the team. Holding each other accountable for working effectively, and creating conditions in which each person can bring all of what they have to offer and be motivated.

A commons paradigm also has the potential to change the vision of utopia which guides policy development and the development of prefigurative initiatives. Using a utopian methodology allows the conceptual space to be much wider, and allows an escape from hegemonic thinking, but in practice no imagined world is perfect, and utopias are not free of conflict, as illustrated in the vignette in the preface and epilogue of the thesis.

Policy narratives can be shifted from a market paradigm to a commons paradigm as shown in Table 14, both in relation to energy and in relation to the economic system more broadly. For example, mainstream energy policy has a strong narrative of protecting market competitiveness and mitigating the rent-seeking impact of monopolies. This could be shifted to a narrative of fostering diversity without requiring this to be competitive, and supporting broader innovation beyond technology and business models. The structure of this table is inspired by Ostrom's (1972) sets of 'propositions derived from two traditions', and Helfrich's (2012b) table comparing a for-profit and commons paradigm.

Table 14: Reframing of policy narratives

	Market paradigm	Commons paradigm alternative
Innovation and performance	**Competition**: competition for survival in the market is seen as the main motivation of innovation and good performance.	**Diversity and autonomy:** many different organisations exist and are free to innovate, but they do not necessarily compete. It is autonomy, rather than competition, that is needed for innovation.
Pricing	**Cost reflectiveness:** the cost of production is reflected in the cost passed on to consumers.	**Socialising of costs:** the cost of production is shared across society, e.g. paid for by tax, rather than passed on proportionately to consumers.
Economic objectives	**Growth:** economic growth is a central objective for the economy as a whole.	**Prosperity:** rather than growth, a broader understanding of prosperity is seen as an economic goal.
Redundancy and slack	**Efficiency:** economic efficiency, achieving the greatest material output per financial input, is seen as a primary goal.	**Resilience:** the ability to continue following shocks or changes is valued. Redundancies and inefficiencies are valuable 'slack' that can be drawn on when needed, rather than a waste.
Interactions and transactions	**Transaction cost:** time spent in transaction with others is seen as a cost.	**Relationship building:** time spent in transaction with others is seen as a benefit of enjoying and nurturing relationships.
Worth of people	**Meritocracy:** people are valued differently based on their ability to contribute (to financially measured economic efficiency).	**Equality:** all people are valued equally and given equal dignity.
Access to a resource	**Access based on ability to pay:** this is tied to cost-reflectiveness. Only those who can pay the price can access a resource.	**Access based on need:** a basic access to a resource is available to all, regardless of their ability to pay financially. This is enabled by socialising the cost.
Limits	**Supply must meet unlimited demand:** Although efficiency measures aim to reduce demand, it is not limited other than by ability to pay or through other price mechanisms. The 'system' is	**Limits to consumption:** consumption is limited, by agreements, rules or physical limits other than the ability to pay.

	designed to meet anticipated demand.	
Consumer role	**Demand:** consumers of a resource can make demands on the system, and are entitled to have these demands met if they can pay. Lifestyles are not negotiable.	**Use/consumption:** avoiding the language of 'demand', and using the more neutral words 'use' or 'consumption' to refer to units of energy consumed, which are often referred to as 'demand' when quantified.
Public role	**Customer:** end users of service and the general population are increasingly referred to as customers, which narrows the frame to a particular relationship within a market exchange.	**User/citizen:** a more neutral word, 'user', is favoured for those who consume a resource, which allows diverse contractual or property relationships to be imagined. The general population are citizens with rights and responsibilities rather than customers paying for a service.
Role of market	**Market as default:** there is a lack of freedom to choose the rules of collective action, freedom only within market – freedom of Hirschman's 'exit'.	**Voice in choosing rules of collective action:** market as an option, freedom to choose alternatives such as commons or public ownership, and voice in shaping rules of market.
Exchange vs reciprocity	**Exchange:** transactions are based on exchange, usually of a commodity for money. These can be one-off, and rely on trust in the monetary system.	**Reciprocity:** transactions are based on relationships and expectation of repeated interactions and give and take. This builds trust between people.

12.2.2 Implications for industry (BuroHappold Engineering)

BHE can benefit in many ways from the learning in this thesis. This includes both the codified knowledge that is written in this thesis and passed on to others formally, and through the tacit knowledge that I have personally gained and can share through working with colleagues whilst drawing on this knowledge.

Sharing knowledge effectively requires starting from the learner's experience and language, and going beyond this (Freire and Horton, 1990). This will involve a period of listening, of working with colleagues in many parts of BHE, not just the familiar sustainability team, and listening to the perspectives of clients, wider design teams and BHE partners. From this starting point it will become easier to share outcomes of this research effectively with immediate colleagues.

BHE has a number of avenues for making use of knowledge from this thesis. This includes having evidence and expertise when dealing with complex, multi-stakeholder projects. Being able to credibly design collaboration at various scales will enhance our ability to convene. This can help us to position ourselves competitively in projects that require stakeholder engagement, too provide greater value to our clients, and to develop thought leadership in areas relating to current global challenges.

The first DP aims for a greater role for commons within a mixed economy. BHE can promote this by proposing commons governance approaches as an alternative to 'business as usual' ownership and procurement approaches. Having the confidence to propose a commons approach can be supported by understanding their success factors, weaknesses, and the mechanisms to put in place for commons governance to work well. At the same time, BHE can highlight the commons and collaboration already ongoing in processes of 'business as usual', and the existing interdependences between commons, market and state approaches.

The study of commons has provided an understanding of the contexts where commons organisation is of value, and the rules, incentive structures and practices that make them work well. Commons work well where participants are strongly motivated to work together. This means not only identifying situations where collaboration will achieve outcomes that are more than the sum of their parts, but also creating a shared vision and engaging stories to communicate the gain that can be achieved by co-operating, and the risk of not cooperating. Commons also work well when there is repeated interaction and trust, which can be built through good, open, face to face relationships. Commons work well when they follow Ostrom's DPs, which broadly requires: fairness, where people feel that they are getting something back from what they are contributing; good conflict resolution processes; clear membership and system boundary; enough agency for the 'commons' within the wider system, and clarity of the role of the 'commons' within the wider system; democratic decision-making within the commons; feedback of information on impact and performance.

The study of polycentric governance has provided a deeper insight the role of a commons within a wider system. It also provides insight into the characteristics of polycentric governance systems, and the problems that need to be addressed and strengths that can be built on. It has shown that the existence of a diversity of organisations in a space can achieve innovation and progress in a complex situation. However, co-ordination and open communication is needed for the system as a whole to function well. Additionally checks and balances are required to avoid concentration of power.

12.2.3 Policy implications

Applying a commons and polycentric governance framing, and implementing the DPs in the GB energy system would require changes in policy and regulation.

Policy changes that would support the emergence of a GB energy system based on the DPs could include the following, as discussed below.

DP A and B call for a greater role for commons within the energy system. This requires enabling experimentation with the creation and development of energy commons, including testing appropriate scale and interface with the wider energy system. It also requires greater legal recognition and definition. Policy that would support this includes:

1. A community right to provide energy, including selling energy within a local community. This is already being lobbied for as a 'community right to supply', and being explored in practice through virtual metering and similar arrangements such as the innovative EnergyLocal and TowerPower projects.
2. Local financial institutions that support the development of local energy systems. The existence of regional development banks is a key success factor for the CE sector in Germany (Hall et al., 2015). There is no equivalent in the UK, although private initiatives such as Bristol and Bath Regional Capital could begin to play a role.
3. A community right to own energy assets in the community, and to develop sites that are suitable for storage or generation facilities for local benefit rather than for external developers. This could be implemented through and extension of the existing 'register of community assets' mechanism to allow viable energy development sites to be registered.

4. The above would require a sound legal definition of community energy or commons energy. This should include: ownership and control of assets and management by the end users, democratic accountability to all users in a group, and provision for protection of the more vulnerable. This adds more detail to the 'local ownership' already included in the government definition of CE.
5. Regulatory space for innovation, such as Ofgem's 'regulatory sandbox' (Ofgem, 2017), should be provided specifically to community energy, as legally defined.

DP A also calls for greater public ownership of energy infrastructure, particularly networks. Achieving this in GB is challenging, as there is no end of franchise/renewal date for transmission and distribution companies as there is in Germany, or in GB rail. In the meantime, much can already be achieved through regulation and working with the existing ownership structure.

6. Develop a strategy for bringing energy network infrastructure in gas and electricity into not-for-profit public ownership, at appropriate spatial scales.
7. Continue to develop positive collaborative relationships between infrastructure operators and local energy transition initiatives, such as the collaboration between Wales and West Utilities and Zero West
8. Target existing network innovation funds towards projects that collaborate with the community energy sector and develop multi-stakeholder local energy transition. This could be achieved through some modification to the criteria for allocation of funding.

DPs C, D, E and F call for a nested system and polycentric governance.

Specific policy changes that would support the development of a nested system, as per DP C and D include:

9. Allowing LAs to specify local economic benefit in procurement processes. This is partly affected by EU procurement regulation, and may be slightly different following brexit.
10. Developing local balancing units for electricity, as discussed by Cornwall Energy (2015).
11. Increased devolution to local government, allowing income to be taken from provision of energy services, and providing a budget for non-income generating activities.
12. Addition of a local system operator role as well as pursuing the change from the regional DNO to DSO (Distribution System Operator).

Polycentric governance with shared vision and shared learning, as per DP E and F can be supported by organisations such as Zero West, which form a 'glue' for different organisations with a role to play in energy transition. Key characteristics of such organisations include: the development of shared vision; an open and collaborative process; being oriented towards action. A framing of organisations such as Bristol Energy Company seeing themselves in a strategic role within a local energy ecosystem can also contribute to this.

The safeguards A and B protect equality. These are 'negative feedback loops' to counteract tendencies towards concentration of wealth and power.

13. Providing funding for capacity-building in communities in order to contribute to mitigating inequalities.
14. Progressive taxation in order to redistribute wealth. This can be used to provide capacity building and other funds.
15. Strong protection of the equal rights of different people, through local accountability processes implementing the spirit of the Equalities Act and respecting individuals' dignity. This needs to be constantly embedded into practices and cultures, enforced and taken further.

Safeguard D, for restorative justice and mechanisms for addressing conflict, could be part of the capacity building for communities.

16. Best practice approaches to governance, including protection of equality and restorative justice, could be included in mechanisms for building capacity.

Safeguard C refers to taking responsibility for the impacts of actions, particularly environmental impacts. This is particularly difficult to achieve when impacts are at a global level and actions are local, for example with climate change. Policies that help with this include:

17. Taking into account externalities, for example the impact on global climate change, in local authority planning decisions, rather than excluding these from material considerations. This is being implemented through the planning process in many localities.
18. Policies that create local incentives for action that supports global benefit. The Feed in Tariff is a good example of this.

Some of these policy changes are already being recommended or lobbied for by organisations involved in the CE sector, campaigning on climate change, and political parties.

For example, the Labour Party statement on energy and environment (Corbyn, 2016), includes the following statements, which resonate with items 1 and 2 in the list above:

> "Promote the growth of over 200 'local energy companies' within the next parliament; giving towns, cities and localities the powers they need to drive a UK clean energy revolution; and making public, not-for-profit companies and co-ops the centrepiece of a new energy economics."
> "Support the development of 1,000 community energy co-operatives, with rights to sell energy directly to the localities they serve, with regional development bank assistance for grid connection costs. We will introduce a 'right to supply'."

The Regen response to the BEIS and Ofgem call for evidence on "A Smart, Flexible Energy System" includes the following recommendations:

> "Recommendation: provide support and funding for local groups to work with vulnerable customers on smart meters and appliances." (RegenSW, 2017, p. 2)

> "Recommendation: the role of local energy markets and the link to non-traditional supply models should be clearly recognised by BEIS and Ofgem. A core principle of the design of DSO market platforms for flexibility or development of local balancing units should be enabling a wide variety of market participants to participate, including those with less expertise in the energy market." (RegenSW, 2017, p. 7)

The first of these resonates with the necessary safeguard A, "mechanisms of redistribution of power and wealth, including through capacity building".

The second resonates with creating a greater role for commons and community institutions, and increasing the diversity of the sector.

Others are talking about local energy governance and energy democracy. The Labour Energy Forum held a day-long discussion at the labour party conference 2017 (Labour Energy Forum, 2017). Islington council have launched 'Angelic energy' (Angelic Energy, 2017), a white-label with Robin Hood energy, Nottingham's municipal energy company, and Nicola Sturgeon has made recent statements about setting up a Scotland state owned energy company (BBC, 2017). However, it is important to note that whilst municipally owned energy supply companies are an opportunity for developing capacity in local government, the benefits of public ownership of distribution and transmission could be greater. However, these are not accessible to local government, due to the monopoly nature of these industries, whereas the supply market allows new entrants.

12.2.4 Implications for the civic energy sector

There are a number of implications from this thesis for the civic energy sector. These can act on the first five of Meadows' levers for system change.

Meadows' fifth lever refers to the structure of information flows. This thesis has shown that open sharing of information within the civic energy sector, between CE groups and LAs, is essential to building trust and effective working relationships. This is a positive feedback loop, as trusted relationships increase willingness to share information openly. Face to face public meetings, such as those hosted by BEN, Bristol Green Capital Partnership, and Zero West, are valuable arenas for forming such relationships. They can also be arenas for education and sharing technical knowledge, increasing the understanding of how the energy system works. Information flows are also implicated in the development of smart metering, which can lead to much greater availability of data models and visualisation. This can support energy literacy as well as distributed decision-making. However, this raises issues of horizontal and vertical privacy which need to be addressed.

Meadows' fourth lever refers to the rules and incentives of the system. This thesis suggests that rules of subsidiarity, collaboration, protection of equality, and bringing remote consequences of actions to local decision makers are desirable. This provides a framework for assessing existing rules and incentives and developing new ones.

Meadows' third lever refers to the goals of the system. Theories of agonistic democracy and polycentric governance agree that there needs to be some basic shared goal in order for a system to function effectively. It is important that this shared vision should be developed collaboratively by those involved. The CEI project and Zero West show the power of uniting around a strong shared vision.

Meadows second lever refers to changing paradigms. The paradigms of commons and polycentric governance can shift the ways that consumer protection is understood, attitudes to the role of the market, and the role of efficiency and resilience, amongst other things, as shown in Table 14.

Finally, the most powerful first lever is that of transcending paradigms. An attitude of transcending paradigms can be fostered by being open to diverse perspectives, and understanding that many different pathways will develop simultaneously. Zero West should remain as open as possible to diverse sectors and political perspectives. Promoting a commons and polycentric paradigm should be seen in the context of market and state solutions being part of the mixed future.

As described in the methodology, this thesis takes an action research approach, but only the first steps of action research are within the scope of the thesis. Deeper understanding of the implications for the civic energy sector can be developed by taking forward a more participatory and action-observation approach following the completion of this thesis.

12.2.5 Further research

This thesis has identified a number of opportunities for further research. The main conclusions of the thesis could be taken forward by discussing them with practitioners and exploring their resonance in real life contexts. This process could involve written dissemination, one-to-one conversations and workshops.

Additionally, there were a number of more specific avenues for further research identified in the course of this study:

- Widen the demographic of those interviewed in the LiM study, which was primarily female and white and in a narrow (25-55) age range. It would be difficult to replicate the study conditions, but the research questions could be explored in other ways.
- Explore the intersection of restorative justice, shame-based social control and commons in relation to people's attitudes to community accountability.
- Measure the resource that is committed to trading activities in the GB energy market relative to technical work, in order to compare the economic efficiency of technical optimisation relative to market mechanisms for electricity system operation.
- Explore whether LA officers perceive the work they do to complete a procurement process to be valuable and necessary due diligence, or whether they perceive it as unnecessary additional bureaucratic work that causes inefficiency.
- Further investigation of mechanisms of accountability and responsibility for externalities as a way to govern so as to remain within environmental limits. This was not explored in detail in this thesis, although there is a large literature in environmental governance which deals with these questions.
- There is potential for commons approaches to limiting consumption could support sustainability through generating an 'abundance' mindset rather than the creation of artificial scarcity that is part of capitalism. Exploring this is beyond the scope of this research, but would be an interesting area for further research.
- Carry out research with innovative projects such as Energy Local and Tower Power, using a commons and polycentric governance framing and the DPs developed in this thesis.
- Set up an action-reflection group within the Zero West project, to develop a participatory action research process as the next step of this research.
- Discuss policy recommendations from this thesis with existing campaign and lobby groups, as a first step in a policy implementation action research process.
- Investigate applicability of the findings of this thesis to other sectors, e.g. the digital economy.

These are just some of the potential areas of further research identified within this thesis. They range from specific methodological issues to broader philosophical questions. However, every study must be finite, and this is the end of this thesis, which I hope has made an interesting contribution. I now leave you with an epilogue, revisiting Bristol in 2040.

Epilogue

Bristol, 2040

Amy, energy manager

I wish I knew what was causing this fault – this is the third time this winter that we've exceeded our import allowance and caused a fault at the substation. Luckily all of the houses and businesses in the neighbourhood have 'essential' and 'non-essential' circuits, so they don't always notice when something goes wrong, but it's costing us to keep having to call out the Bristol network operator to reconnect us. I suspect that there's someone who's doing something naughty – heating their house to 30 degrees, or making fancy meals whilst washing and drying their laundry and heating water for a shower. Though if a house was over the limit that should automatically cut off the house, not trip the entire substation area. Maybe someone's bypassed the meter in their house. I'm not sure why they would do that – if there was a special need for extra energy allowances, everyone knows they can put in a request to the energy council, and when there's a real need we always try to accommodate it.

Mattie, resident

It's sunny and windy today – a good day for laundry. Funny how the same energy that directly dries laundry hanging outside, as it has since laundry was first invented, also powers the washing machine that saves so much labour.

I was with grandma last night, and talking to her makes me think about how much has changed. It's obvious to me that when it's been windy for a few days the car batteries will be full, and it's a good time to drive somewhere, or heat the whole house with the windows open to air it, since there's surplus in the grid. We just know these things, automatically. In her day, people thought they would need apps on their phones to tell them whether it was windy or sunny, or what the weather had been for the past few days. Just look out the window! Of course, prediction in future weather has become much more accurate now, and we really need that to know when we should make a big roast dinner, or when it's best to microwave leftovers or let something defrost. There's something satisfying about living with the rhythms of the seasons.

I particularly love the days when it's blowing a hooley and we power the massive sound system and dance. Not that the sound system really uses that much energy, but it's a kind of celebration of abundance. Gathering for a dance is good on those cold, still cloudy winter days too, when you don't really want to heat the whole house all evening.

I can see that the energy light post in the street is green today – that means that the car batteries are all fully charged, and the neighbourhood battery too. Maybe I'll go for a drive, if I can book a car – go and see some countryside for the day. I love driving anyway, it's such a treat.

Richard, Bristol City Council

The meeting with the national energy board was challenging yesterday. They want us to make a bigger contribution to the national energy system, because we are invested in the offshore wind in the Bristol Channel, but we need that energy for our own city. There's only so much that we can supply from solar on city roofs and our few urban wind turbines. Our industry is nationally important, and if we had to pay national energy price rates for a greater percentage of our energy, that would affect businesses' viability. We invested in that generation, and in large levels of storage, because we had the foresight to understand the need to power ourselves locally, long before most of the local governments could see what was coming. We have one of the strongest and most affordable local energy tariffs in the country, and that's part of our

success as a city. I guess that's why they want to put a stronger burden on us, so that those places where they only acted late can get more affordable energy too.

At least we have really good relationships with the other authorities in the WoE – the reciprocal energy agreements that we made back in 2025 have really worked to enable each authority to make the most of its RE resources, and share with the others. It's good that they're flexible and we've learned from trial and error.

It started with the community energy sector, to be honest – the Bristol Energy Co-operative got the support of communities in villages in North Somerset for installing wind turbines by guaranteeing that the price of electricity from the wind farm for locals would be 90% of the price they charge in Bristol. And our wholly owned energy company, Bristol Energy, enabled that to happen by providing the energy supply licence so they could sell to customers. Of course, the cheaper price overall was only possible because they installed large battery storage capacity at the wind farm, and made use of smart meters in members' homes to measure exactly how much of the consumption was from local generation, and how much of it should be charged at the national price.

Different approaches were trialled in other places –BWCE worked with EnergyLocal to set up virtual private wire arrangements in Bath, using electricity generated from their solar farms as if it was 'behind the meter' in homes in the city. The Bristol Energy Company provided the supply licence for that as well. And Ambition Lawrence Weston managed to provide free electricity to their members during the national surplus generation hours, through a deal with a national aggregator company based on national wholesale market prices.

It all seemed a bit messy at the time, but now looking back it's clear that we wouldn't have developed such a functional system without all of that experimentation by different people.

Chris, Bristol Energy Networks

I've been talking with Amy today, she's really frustrated with this repeated fault on their neighbourhood substation. I don't really know what's up. From our end, it's good to know that people will still have power in their 'essential' circuits even if we don't get to the substation to fully reconnect it for a couple of days. That makes the cost of reconnection cheaper for them – without reducing their motivation to sort it out, as everyone gets pretty annoyed to be limited to essential energy uses for 3 days!

We're still in the process of developing substation agreements in the last few neighbourhoods of the city. It's been a long process – some neighbourhoods took a while to see that they would benefit from organised energy management, and that their network availability cost would be much lower if they made a substation agreement with us. And then there was the whole process of capacity building and training, with input from the already-organised neighbourhoods, and getting to grips with the different approaches taken by each area, understanding what would and wouldn't work for them, and trying to involve everyone in the discussions. It's quite complex stuff to get everyone to understand. Luckily we have some really good facilitators who are good at explaining alternative models to people in ways that they can understand. And the energy coordinators in existing organised neighbourhoods are always glad of an opportunity to tell their stories – it's like a kind of therapy session for them, they get to vent their frustration at everything that doesn't work, and also appreciate what does work.

We've been able to offer a much better service since we joined together the gas and electricity network operation. It means we think about energy in an integrated way, and use the gas network to deal with big peaks in demand, and know when to kick in the hybrid heating systems. The hydrogen and biogas system works a treat. Although there are still shortfalls at times.

It's also ultimately worked well to be owned by the local government. That means that any cost savings we make through neighbourhood energy agreements get passed on to everyone in the city, which helps with motivating the neighbourhood coordinators to support each other! And the income we get pays for really good healthcare available to everyone. I've benefitted from that myself, when I had pneumonia last winter. OK, back to work – need to sort out Amy's neighbourhood system fault.

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Appendix 1: Extract from Community Energy Aggregator report

This reproduces text from Appendix C of the Community Energy Aggregator report to the TSB, discussing the analysis of the current and potential energy system based on Ostrom's design principles for common pool resource management.

Introduction

In the development of a community system for managing resources, we have used the design principles for management of common pool resources developed by Elinor Ostrom. These were developed initially in the context of community scale management of resources, but has since been generalised to a variety of other institutional contexts. The design principles have been applied to the current UK electricity system, as a framework for critiquing what is not working with it, and has also been used to design an innovative community management institution.

The IAD framework

The design principles proposed by Ostrom are listed below. These were derived from analysis of a large number of case studies.

Note on terminology

The term 'appropriation' denotes use of a resource by 'users' or 'appropriators'. The terms 'user' and 'appropriator' are used interchangeably.

The term 'provision' refers to activity that provides, creates or maintains a resource. This could include demand response behaviours, providing capital for the installation of renewable energy, or making available the battery of an electric car to the local microgrid system.

Design Principles

1A User boundaries: Boundaries between users and non-users must be clearly defined

1B Resource boundaries: Clear boundaries are present that define a resource system and separate it from the larger biophysical environment.

2A Congruence with local conditions: Appropriation and provision rules are congruent with local social and environmental conditions.

2B Appropriation and provision: The benefits obtained by users from a common-pool resource (CPR), as determined by appropriation rules, are proportional to the amount of inputs required in the form of labour, material, or money, as determined by provision rules.

3 Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.

4A Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.

4B Monitoring the resource: Monitors who are accountable to the users monitor the condition of the resource.

5 Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense) by other appropriators, by officials accountable to the appropriators, or by both.

6 Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.

7 Minimal recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

8 Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

Analysis of the current UK electricity system

The deisgn principles have been applied to the current UK electricity system, as a framework for a critical review.

1A Clearly defined user boundaries

The people who have access to electricity are metered. It is difficult to steal electricity from the grid through illegal connections.

1B Clear boundaries of resource system

As a human-made system, the electricity system is clearly defined. However, it is connected with other resource and environmental systems, such as fossil fuel extraction, and the climate. One could draw the system boundary to include the fossil fuel supply chain, or the fossil fuels after they have arrived at a power station, or only electricity once it has been generated.

2A Congruence with local conditions: Appropriation and provision rules are congruent with local social and environmental conditions.

The current national electricity system is the same around the country, and does not vary according to local energy generation potential conditions (e.g. very windy areas), or specific local needs (e.g. greater need for energy in colder microclimates, different levels of affordability for different people). However, the system has been in place for a long time, and local social conditions are adapted to it.

In some places, provision rules are not congruent with local environments. For example, in the Scottish islands there is very high potential for generation of wind power, but generation is restricted due to lack of capacity in national grid transmission infrastructure.

2B Benefits of appropriation and provision inputs are proportionate

People pay money to purchase electricity. Tariffs are generally lower for those who buy large quantities (e.g. commercial electricity costs are lower than households), households generally pay a standing charge that does not relate to the amount they consume, people on pre-payment meters pay higher rates, and generally the first few units of electricity consumed are more expensive than the next few. This may have some reflection on billing and distribution costs, but does not provide for basic needs to be met affordably, and does not incentivise behaviour which would reduce overall system costs, e.g. keeping peaks low.

3 Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.

Individuals have almost no say in modifying the rules of the system. There are numerous protests regarding aspects of the electricity system, from fuel price and anti fuel poverty campaigns, to campaigns against the use of shale gas and climate change. Consumer interests are protected by regulation of the market through Ofgem, which is accountable to policy, which is accountable through the democratic process of the country, but there is very little potential for users of electricity to change the rules.

4A Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.

The monitoring of usage of electricity takes place through metering, which is controlled by electricity supply companies. These are not accountable to the users of the electricity, but to their shareholders, although they are regulated by Ofgem.

4B Monitoring the resource: Monitors who are accountable to the users monitor the condition of the resource.

The condition of the electricity system is monitored by the national grid, which must maintain the frequency and voltage within certain boundaries. This is highly regulated, and must be kept stable, in order to avoid a blackout. Users do not participate in the monitoring. Monitoring of the wider resource (e.g. renewable energy, fossil fuels) is not included in the system, and there is no feedback from the availability of fossil fuels to users other than through price signals. Price of electricity, however, is made up of a complex variety of factors, and does not provide information in a way that allows preventative action by users.

5 Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense) by other appropriators, by officials accountable to the appropriators, or by both.

It is very difficult for appropriators to violate operational rules, as there are no limits to how much any user can consume, as long as they pay for it. Users who get into debt can be cut off their electricity supply.

6 Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.

Any conflict resolution takes place through the legal system. Electricity supply companies have much greater power than users/appropriators.

7 Minimal recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

There are high barriers to developing local electricity institutions. Users of electricity are not able to sell directly to each other, as selling and buying electricity requires an electricity supply licence, which is onerous and expensive. The distribution and transmission networks are controlled by large companies which can refuse connection. This is partly due to infrastructural and technical issues, such as the cost of reinforcement of local and national grids, but is also due to the institutional, commercial and regulatory arrangements. Household users are treated as individuals, and a 'community' is not recognised as a unit, so it is not possible to bulk buy electricity to achieve economies of scale.

8 Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

There are no layers of nesting, as household consumers purchase electricity directly from national electricity suppliers, on a competitive market, and are not able to organise into consumer groups to bulk buy. The distribution system is somewhat nested, with the national transmission grid as a separate entity to the regional distribution network operators.

Development of a Community Smart Grid

The design principles were then used to develop an institutional design for a community smart grid. This institutional design is to be tested through the proposed pilot project.

1A Clearly defined user boundaries

The users of the system would need to actively choose to participate, and become members of the system. This would involve some form of contractual agreement.

User boundaries may also be defined geographically (e.g. households attached to one substation), through communities of interest (e.g. members of existing community groups).

1B Clear boundaries of resource system

The resource system includes all electricity consumption/demand, storage and generation assets owned or managed by individual members, or the community institution. These may be geographically collocated, or associated through a 'virtual' aggregation system.

The local microgrid resource system is linked to the external national electricity system, and there are flows of electricity and data between the local and the national system, mediated by the Community Energy Aggregator (CEA) institution.

2A Congruence with local conditions: Appropriation and provision rules are congruent with local social and environmental conditions.

Tariffs, incentives, and allocation of benefits and costs can be set to achieve local objectives, including reducing fuel poverty or raising money for local projects.

Provision of electricity is aligned to local resources, e.g. insolation, windspeed, biomass space for storage of batteries or locating of CHP or other electricity plant. It also takes into account the local distribution and transmission constraints, but aims to find ways around these constraints where possible.

Rules build on local culture, social capital, and levels of energy literacy, and seek to develop these.

Local value is maximised, but the microgrid is connected to the wider system. e.g. obtaining investment from outside the community where required, exporting electricity from areas with high renewable potential.

2B Congruence between provision and appropriation rules

Electricity generated by local renewables, and the storage capacity of batteries in buildings or electric vehicles, use of fuel cells or hydrogen for storage, are pooled in a local system. The owners of these assets receive value proportional to what they have provided to the community system.

Activities such as demand response behaviour and making appliances available to automated switching are rewarded proportionately to individual participation.

Investment in the community enterprise is rewarded through a return on investment.

The coordination, analysis, contract negotiation, maintenance and appliance control work is carried out by paid staff of the community energy aggregator, creating local jobs.

3 Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.

Individuals and households can make decisions within the Community Level One (CL1) groups for matters affecting that group (e.g. visibility of information, aggregation of data, whether they can see individual household energy use, allocation of value for assets and activities within the group, allocation of value to community benefits).

The community level one groups send a representative to the CEA, to make decisions on matters that affect all the level one groups, e.g. allocation of value between the groups, negotiation with external sources of value (e.g. National Grid, DNOs, supply companies), and lobbying of national government and provision of evidence for regulatory development.

4A Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.

Smart metering is used to monitor electricity usage, generation and utilisation of storage. This sends data to a processing unit run by the CEA, which is accountable to the users through the CL1 groups.

CL1 groups can decide how much detailed information is provided to individuals, e.g. showing each household's consumption data to all other members of the CL1 group, or showing only averages. The processing unit uses algorithms agreed by the members to allocate value to individuals and households, based on their monitored appropriation and provision levels.

4B Monitoring the resource: Monitors who are accountable to the users monitor the condition of the resource.

The condition of the assets in the system is monitored by employees of the CEA. This includes monitoring for general maintenance, and day to day monitoring for the purposes of optimisation of the system, e.g. charge level of batteries, instantaneous power output from renewable generators, and demand level of buildings, as well as availability of demand response.

The processing unit also receives external input, with information about the condition of the external resource, i.e. the national electricity system. This provides signals regarding the value of exporting electricity from the microgrid to the national grid, or importing from the national grid to the microgrid for local storage.

5 Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense) by other appropriators, by officials accountable to the appropriators, or by both.

Cost effective mechanisms for graduated sanctions for any violations of rules will be developed by the CL1 groups, bearing in mind the need for sanctions to consider the seriousness and context of any offense. The CEA will provide support, advice and a forum for discussion and mediation in the process of developing these sanction mechanisms.

6 Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.

Building of trust and relationships between members of the CL1 groups and CEA are expected to develop over time. Conflict resolution support from expert facilitators and community conflict resolution organisations will be made available during the pilot stages, and skills in conflict resolution built in to the

CEA as it develops. In the longer term, a budget for calling in these services will be reserved within the running costs of the CEA.

7 Minimal recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

This system requires support and cooperation from a number of external authorities, including:

Ofgem: giving permission, and developing the regulatory framework to enable community electricity management

DNOs: providing payments for the value of avoided grid reinforcement achieved by local microgrids, supporting the infrastructural development of the microgrid, and providing external services in connecting microgrids to each other, and to the national network. It is likely that the DNO will continue to own and maintain the wires within the microgrid, at least in the early stages, so their collaboration will be important.

National Grid: the CEA will manage the importing of electricity from the national grid in such a way as to respond to national grid balancing services requirements, and also to the capacity market, when this becomes operational.

National Government, in particular through the Department of Energy and Climate Change: to provide policy support for any regulatory changes required.

Local Government: many local authorities have plans to develop their own energy services companies, or other energy related activities. Their endorsement of a community managed and owned electricity microgrid will therefore be crucial to its success. There could also be significant benefits in collaborative working or partnership between a local authority owned energy company and a community owned microgrid company.

8 Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

To build trust, a sense of personal connection and community will be important. This requires members to be part of groups of a size that enables personal relationships with the majority of members of that group. For this reason, Community Level One groups of approximately 50 households will form the primary unit of governance, and be brought together in the Community Energy Aggregator which will provide economies of scale and expert services, as well as carrying out the negotiation with third parties. In the longer term, further higher levels of aggregation could be developed, e.g. a city wide or regional or national network of community energy aggregators, but this is not required in the initial stages.

Appendix 2: Interview and focus group guides for Less is More

Interview Protocol for LiM interview 1

Carry out interviews in the home of the interviewee (likely to be in evenings).

Interview number:

Date and time:

Introduction:

- Brief introduction to Less is More project, based on information provided in participant information sheet.
- Introduce myself as a PhD student.
- This interview will involve questions about your neighbourhood and about how you use electricity
- Explain interview schedule and incentives: £15 today, another interview in October/November also £15, a focus group for some people in November/December, also £15, a follow up interview a year later, prize draw of £200, with 1 in 20 chance of winning. Are you willing to participate in more research for this project? Would it be OK to contact you about further interviews and focus groups nearer the time?
- I would like to make an audio recording of our conversation, so that I can listen to it again afterwards and use it for research. Is it OK to record it? The interview will be anonymous, and details which would identify you will be kept separately from the recording. Please read this consent form, which says more about who I am and what the recording will be used for, and if you're happy with it please sign it at the bottom.

Introductory questions

- How long have you lived in this area?
- How long do you expect to live in the area in the future?
- How many people live in this house?
- Do you have any children?

Neighbourhood

The first few questions are about your neighbourhood where you live.

1. Here are some maps of the area where you live. Could you please draw a line around the area which you consider to be your neighbourhood, on the map which fits it best? Please talk me through it as you draw.
2. Tell me about your neighbourhood
    - [prompts, if needed
        - what you like
        - what you don't like
        - how you feel about living there?]
3. Tell me about the people in your neighbourhood
    - [prompts, if needed
        - what kinds of interactions you have

        - would you be up for drawing red dots on the houses where you know someone by name, and yellow dots on the houses where you would recognise someone in the street?]
4. Overall, how satisfied are you with the way you interact with your neighbours?
    - what would you like to be different?
    - what do you like about it?
5. I'd like to ask some questions about community participation and actions. How likely would you be to join in with the following neighbourhood activities, and why? [use
    - litter pick
    - signing a petition about local issues
    - attending a street party
    - organising a street party
    - neighbourhood watch
    - taking care of local green spaces (gardening, e.g. on cycle path)
    - if you have children, taking your child to play out on the street with other children
    - going back into the house whilst your child plays on the street, supervised by other children's parents?
    - are there any other neighbourhood activities you would do?
6. How many of your neighbours (the 200 people living nearest to you) do you think would join in with the following neighbourhood activities? [if you're not sure, just give me your best guess of a number of people]
    - litter pick
    - signing a petition about local issues
    - attending a street party
    - organising a street party
    - neighbourhood watch
    - taking care of local green spaces (gardening, e.g. on cycle path)
    - taking their child to play out on the street with other children
    - going back into the house whilst their child plays on the street, supervised by other children's parents?
    - are there any other neighbourhood activities that people do?
7. Would you be more likely to do these things if the people in your neighbourhood we discussed just now were doing it?
    - What is it about other people doing things that would motivate you?
    - [prompts, if needed
        - is it because that would be more fair?
        - is it because that would make it a normal thing to do?
        - is it because it would be more fun with more people?
        - please rank the three above in order of importance]
8. Next, I'd like to ask a more general question about how you view people. Generally speaking, would you say that most people can be trusted or that you can't be too careful in dealing with people?
    - on a scale of 1 to 5, where 1 is you can't be too careful, and 5 is most people can be trusted.
9. Next, I'd like to know how much you trust people you come into contact with in different ways. Generally speaking, would you say that you can trust them a lot, some, only a little, or not at all? on a scale of 1 to 5, where 1 is you can't be too careful, and 5 is most people can be trusted.
    - people in your neighbourhood?
    - people who you work with?
    - people who work in the shops where you buy food?
    - your local councillor?

- the city council?

Energy using practices

10. the Less is More project is providing a £5000 prize to your community if you change when you use electricity and reduce your overall consumption.
    - do you have any suggestions as to what this money should be spent on in your neighbourhood?
        - would this specific goal be more or less motivating than the cash incentive?
    - does this prize make you more likely to reduce your energy use in peak times?
    - do you think it will make your neighbours more likely to reduce their energy use in peak times?
    - how many of your neighbours (the 200 households living nearest you) do you think will make efforts to change the way they use energy in the home because of the project?
        - do you think this is a lot or a little?
11. Would you be more or less likely to make an effort to change when you use electricity and reduce consumption if you knew your neighbours were also making this effort?
    - What kind of information would you want to see, in order to know others were actively participating in the Less is More challenge?
    - [prompts, if needed
        - word of mouth
        - stickers/sign in windows
        - website or other communication telling you the number of people
        - website or other communication telling you the names of people]
    - What is it about other people doing things that would motivate you to make an effort to reduce/ shift your energy consumption in the less is more challenge?
    - [prompts, if needed
        - is it because that would be more fair?
        - is it because that would make it a normal thing to do?
        - is it because it would be more fun with more people?
        - please rank the three above in order of importance]
12. Some daily activities use more energy than others. I'd like to ask you a bit about some of these.

	Regular pattern?	Flexible?	Constrained?
Laundry			
Kettle			
Cooking hot meals			
TV			
Computer			

	Comments What influences when you use it? What motivates you to use it/not use it/have that pattern?

Laundry	
Kettle	
Cooking hot meals	
TV	
Computer	

13. Aside from the less is more project, do you do anything to try to save energy?
    - if so, what are your main reasons for doing this?
        - probing questions for this to elicit values, financial concerns, or other reasons for this.
    - do you think that others in your neighbourhood try to save energy?
    - if so, what do you think their main reasons are for doing this?

Thank you, that's all that I want to ask today.

As I mentioned at the start, we will be carrying out further interviews and a focus group in the autumn, and in a year's time. Would you be willing to participate in these? Would it be OK to contact you about further interviews and focus groups nearer the time? If you continue to participate in all three interviews, you will be entered into a prize draw for £200.

Do you have any questions for me, about my research, or about the Less is More project?

Interview Protocol for LiM interview 2

Use of the GEM

- What do you think of the GEM?
- Where in the house do you keep it?
- How easy was it to understand the interface? Could you talk me through the various signals and things it does?
    - What does the red light mean? What does the green light mean?
- How frequently did it give a signal?
    - How frequently did you notice this?
- How many times have you responded?
    - What did you do in response?
- How many other people also responded when you did?
- How many other people responded when you didn't?
- Did you sometimes take action in response to a request, but not press the 'play' button?
- Did you sometimes press the 'play' button and not do anything?
    - How did you feel about that?

        - Possible prompts: Did you feel dishonest? Letting down the community?
- Do you suspect that other people are pressing the button and not doing anything?
    - How does that feel?
- If you could identify who the people were pressing the button, would you have felt more or less inclined to press the button?
- Did you look at the data available on the website, which showed the amount of energy being used?
- Could you see the impact of your actions?
    - How did that make you feel?
    - Did it make you more or less likely to do things again?
- Are there any improvements you would suggest to the GEM, or to the project as a whole?
- Would you like to continue to keep the GEM for the longer term?
- How many people have you discussed the GEM with, or the less is more project with? How many of these were your neighbours?

Substation and local infrastructure

- Do you know where the substation is? Do you know what it looks like?
- What does the substation mean to you?
- If everyone in every house switched everything on at the same time, it could blow the 'fuse' in the substation. Are you aware of this?
- If the substation did trip, because a few people were using maximum power, would you want to know who did it?
- Has the project changed your relationship to the electricity infrastructure?
    - Do you feel any more responsibility for the infrastructure than you did before?
    - If so, how do you feel about that?
        - Is it irritating?
        - Do you welcome it?
- Some people are considering the idea of local microgrids, where people using a very local bit of infrastructure have some responsibility for the way their use of it affects it, and the cost of maintaining it, and get to make decisions about trade-offs of its performance, cost and environmental impact. What do you think of this idea?
- The wider national context for this project is that UK electricity infrastructure is under stress, and there is some risk of brownouts, as you may have seen in the media recently. There are various options for dealing with this, e.g.
    - Big infrastructure investment, which consumers or taxpayers eventually pay for
    - Devolving responsibility to the very local level, as we just discussed
    - Devolving responsibility to the individual, such as the system in some parts of Italy where there is a limit on how much electricity any particular house can draw at one time, or by charging high prices at peak times.
    - Brownouts that you can't control.
- Do you have a preference for any of these options?
- How do you think that these decisions should be made?

Demographics

I would like to collect some demographic information about the people participating in this study. This part is optional, but I would appreciate it if you were up for filling in this short demographic questionnaire, to the extent that you want to.

Focus groups

Finally, I will be organising a focus group for people who have used a GEM. This will be in early January, and is likely to take 2 hours on a weekday evening or at a weekend. I will try to organise a date for this that suits as many research participants as possible. This is likely to be at the Easton Community Centre.

Are there any times that you cannot make from the following dates:

- Evenings 5-9 Dec (not thurs)
- Weekend 10-11 Jan
- Evenings 12-16 Jan (not thurs)
- Weekend 17-18 Jan
- Evenings 19-23rd Jan
- Weekend 24-25.

Scenario provided to focus group participants for discussion

Community network management scenario part 1:

More and more people in Greenbank want to install solar panels on their roofs, and drive electric cars, which they charge at home. This is causing problems at the local substation, which is becoming overloaded. It would be very expensive to upgrade the substation enough to deal with all the possible peaks in electricity generation and supply. Western Power Distribution have decided that rather than stopping people from installing more solar panels, or from installing electric car charging points, they would give the neighbourhood the option of managing their peak electricity demand within the neighbourhood, and people would be allowed to install new solar panels and electric cars as long as the neighbourhood remained within a certain capped peak demand.

This would mean that if the neighbourhood goes over the peak demand, electricity is cut off for everyone for 24 hours. It is up to the neighbourhood to decide how to manage things internally.

The Easton Energy Group, who was involved with the Less is More project, have offered to help facilitate a public discussion process to decide how to respond to this offer.

Q1: What do you understand from the scenario outlined? Does it make sense to you? Is there anything you would like clarification on? What would you want to ask the Easton Energy Group about the options?

Appendix 3: Paper under review: Equality in local energy commons

Title: Equality in local energy commons: a UK case study of community and municipal energy

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Paper under review

Abstract

This paper considers the intersection of institutional mechanisms for creating and maintaining commons with mechanisms that increase or decrease inequalities in wealth, power and dignity. This is explored in the context of the development of local energy systems, based on a case study in a UK city. It explores different conceptions of fairness and equality among those working towards a local sustainable energy transition, and how this affects the way that inequality manifests, is perpetuated, and is challenged. The paper explores the inclusion and exclusion of participants in the community energy sector, which has been criticised for being mainly white, middle class and male; the distribution of financial benefit from renewable energy through community investment or municipal ownership; and the focus on people in fuel poverty relative to people who overconsume energy. It concludes that although a commons approach to local energy can risk exacerbating inequalities, it also provides opportunities for increasing equality, of wealth, power and individual dignity. These require commitment, and need to be designed into evolving local institutions.

Keywords

Energy commons
Equality
Local energy transition
Ostrom
Community energy

Introduction

Commons institutions can have a role in reducing inequalities, but they can also exacerbate inequalities. This paper explores the intersection of institutional mechanisms for creating and maintaining commons with mechanisms that increase or decrease inequalities in wealth, power and dignity. This is explored in the context of the development of local energy systems, based on a case study of initiatives in a UK city. The paper contributes to the discussion in this issue of the problem-field of 'the commons and the local'.

Proponents of local energy initiatives in the UK see these as part of a transition to a sustainable energy system. Local initiatives include collective investment in renewable energy generation, energy efficiency initiatives, and motivating demand reduction. They can provide avenues for participation, community bonds, love of place and a sense of belonging, which can be powerful in motivating care for the environment and long-term thinking, as well as supporting non-material satisfaction of human needs. These local energy initiatives can be framed as commons.

However, the mechanisms through which commons governance systems are created and maintained can exacerbate inequalities. The need for clear boundaries of the users of a resource, identified as Ostrom's (1990) first DP for common pool resource management (DP), can lead to disadvantage for and hostility towards those excluded. Mechanisms of reciprocity risk not meeting the needs of those seen as not contributing, such as disabled people. Systems based on tradition may accept historic and structural inequalities. Mechanisms of community accountability, identified in Ostrom's fourth, fifth and sixth DPs, risk prejudicial judgement against 'outsiders' within the commons, punitive justice systems, and scapegoating.

This paper draws on case study of local authority (LA) and community energy (CE) initiatives in a UK city, over a period of three years. It explores the extent to which the commons-like characteristics of local and CE initiatives in the UK help or hinder progress towards greater equality.

Background to equality and commons governance

Equality

This paper considers the impact of the commons governance mechanisms in the energy transition case study on equality. Wealth and income inequalities are growing, both within and between nations (Keister and Moller, 2000; Stiglitz, 2012). Whilst many people are willing to accept some inequalities in wealth and income, consistent growth in inequality is unacceptable. Equality is of instrumental value. It is associated with increased wellbeing (Wilkinson and Pickett, 2009), and remaining within environmental limits whilst meeting basic human needs is much easier if resources are equally distributed. This paper additionally sees equality as being of intrinsic value, taking the position that one person is not worth more than another, as emphasised by Nussbaum, who promotes an ethic in which "everything is provisional and up for grabs except the notion that some are less valued than others" (Preskill, 2014).

The position of valuing all people equally, which Miller (1997) discusses as social equality, is not universally agreed. There are many possible philosophical approaches to equality (Miller, 1997; Gosepath, 2011), and to the relationship of equality to the more universal value of justice. S*ocial equality* is one approach to justice. Other approaches to justice include *meritocracy*, the idea that those with greater personal effort and talent deserve greater reward, and *reciprocity*, where resources are allocated to people on the basis of their contribution.

The concept of meritocracy, originally a satirical work (Young, 1958), has become a positive social system in mainstream UK political discourse, with normative and descriptive elements. The normative element asserts that each person should receive what they deserve, and that those who are more determined, hard-working or clever deserve more than others. This is perhaps fairer than systems based on rigidly stratified social

classes, but it does not support the idea that each person is intrinsically of equal worth and dignity promoted by Levitas (2013).

The descriptive element of meritocracy sees the outcomes for each person as their personal responsibility, neglecting the social context which enables some to have or achieve more than others. In practice, however, the system of 'meritocracy' does not function as well as its proponents claim. Social class is still largely determined through inheritance rather than through individual achievement.

The norm of *reciprocity*, or reciprocal fairness, is identified by Bowles and Gintis (1997) as a universal human concern, based on game theory and experimental psychology. Focusing on the 'sustainability' of any redistribution (i.e. will it last, or will social processes overturn it), they argue that programmes of redistribution that do not resonate with 'fundamental notions of reciprocal fairness' will not last. Reciprocal fairness involves generosity to strangers, contributing to public goods, not free riding and punishing free riders. There is a greater obligation to share luck than gains from effort, and reciprocity is more important if there is strong social connection. Reciprocal fairness is similar to the concept of 'fiscal equivalence', or "the extent to which the beneficiaries of a public good or service are expected to contribute towards its production" (McGinnis, 2013). The sense of reciprocal fairness is tapped into newspaper headlines attacking 'scroungers' and 'welfare fraud' (Ellicott, 2011; Castella, 2012) , which take advantage of people's tendency to resent those perceived as not contributing in times of perceived and experienced scarcity.

In contrast to the emphasis on reciprocity or merit, this study values full equality between people. This is the position taken by Levitas (2013), who argues for a utopian vision of equal dignity and worth of every individual, and by capabilities theorist Nussbaum (Preskill, 2014). This firm belief in the fundamental equal worth of all people creates space for a society based on mutuality and care, echoing the communist vision of 'from each according to their need, to each according to their ability'. This is considered to be a basis for integrity, although this is an anthropocentric view that does not grant this dignity to non-human life.

At the same time, Bowles and Gintis' (1997) concern for the 'sustainability' of redistribution processes is important. The mechanism of reciprocal fairness can be a useful pragmatic approach to distribution, provided that unearned advantages and disadvantages are recognised and challenged, and that the expectation of contribution is calibrated to people's abilities. This mechanism is often part of commons governance.

Whilst the intrinsic valuing of equality is a valid moral position, the question of how to implement this in practice remains. A simplistic rationing approach could give each person the same material resources. However, individual people are different, and need different amounts of resources to achieve the same level of personal flourishing. Human difference can arise for many reasons, whether inherent to our physical bodies from birth, due to the position we are born into, or as a result of events, chosen or otherwise, which take place throughout our lives.

The 'capabilities' approach, which is founded on a belief in the intrinsic value of equality, is Sen's answer to the question 'equality of what?' (Sen, 1979). Sen recognises the individual differences between people as a core part of considering equality (Robeyns, 2003), and argues that different individuals should receive the resources that they need to flourish, even if this means that different people receive different amounts of resources. As illustrated in Figure 1. The first image shows that to have an equal outcome, different individuals (e.g. shorter/taller people) need differing levels of support. The second emphasises that it is not necessarily the individual characteristics (e.g. height) of people that are different, but that they also face different structural barriers (e.g. ground level, fence height).

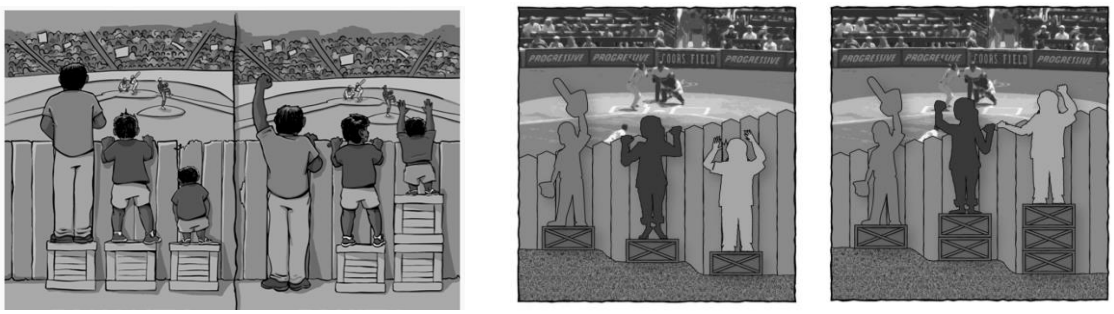

Figure 1: Illustration of the different resources needed by different people, depending on their starting points (Maguire, 2016 adapted from Craig Froehle 2012), and (Kultner, 2016)

The capabilities framework is multi-dimensional and complex, and more specific conceptual tools are needed to implement reductions in inequality in practice.

One such tool is to use a heuristic of three dimensions of justice: distributional, recognition and procedural. These relate to material wealth, dignity and respect for all, and voice or power in decision-making processes respectively. Although framed in terms of justice, these three dimensions can also be applied to equality. Walker and Day (2012) discuss these three forms of justice in relation to fuel poverty.

Another powerful tool, which responds particularly to the recognition element of justice or equality but also touches on distributional and procedural equality, is the discourse of power and privilege. This challenges the myth of meritocracy which believes that success comes purely from effort and talent, by showing that people do well in society because they have 'unearned advantages', due to structural and historic inequalities, or personal differences. Facing privilege is an uncomfortable process, partly because people with privilege want to feel like we are good people, and because it is easy to hear 'you have privilege' as 'you have had an easy life' (Kashtan, 2016). In fact, everyone is vulnerable (Levitas, 2013) and faces challenges in life. The concept of intersectionality coined by Kimberlé Crenshaw (Adewunmi, 2014), recognises that everyone has ways in which they are, and are not, privileged. Considering privilege involves a personal reflexive process, illustrated in McIntosh's (1988) process of 'unpacking the invisible knapsack'. She identifies unearned advantages she has as a white person, including seeing members of one's race represented in the history taught at school, not being followed or harassed by security guards in a shop, or being able to arrange activities so as to never experience feelings of rejection because of one's race. Another example is Brydon-Miller's (2004) reflection on her experiences of power and powerlessness in different contexts as part of her action research practice.

Commons

This paper considers the role of commons governance mechanisms in promoting or reducing equality. Bollier (2014, p. 15), defines a commons as "a resource + a community + a set of social protocols". This definition brings together the physical characteristics of a resource with the social relations governing the resource. In particular, the social relationship of property rights is important for commons. Commons property regimes are contrasted with state-public and private-market property regimes.

Whilst economists sometimes use the physical characteristics of 'rivalrousness' and 'excludability' of a resource to determine whether it should be governed as a common pool, private, public or 'club' good, (Helfrich, 2012a), the selection of governance regime is a social choice. Other socio-physical reasons for choosing a commons or public good governance regime include: the need for universal access to a resource to satisfy basic needs; natural monopolies that have a risk of rent-seeking behaviour; or the presence of large negative or positive externalities.

Many of these characteristics apply to modern energy resources in the UK, and so this paper argues that energy *should* be governed as a public good or a commons, although it is not currently. In the UK in the 21st

century, access to modern forms of energy such as electricity and gas is an important satisfier of basic needs for subsistence and participation in society. There are strong positive externalities of social and economic benefits from universal access to affordable energy. Energy infrastructure has large economies of scale and is therefore at risk of monopoly rent-seeking. At the same time, production of energy from fossil fuels has large negative externalities on a global level, in terms of climate change, and locally, in terms of air quality.

This paper explores the emergent ways in which some aspects of the UK energy system are governed as a commons, and how these commons governance mechanisms impact on equality. Currently UK energy system is primarily governed through market mechanisms and private corporate ownership, with strong state regulation. In electricity, generation and supply (retail) are markets, whilst the transmission and distribution infrastructures are regulated privately owned monopolies. However, a local energy sector has grown over the years 2009-2016, including participation of both local authorities (LAs) and community energy groups.

Energy initiatives from LAs and the CE sector are both included in the concept of the 'civic energy sector' (Hall, Foxon and Bolton, 2015). Whilst LAs are part of the state, they are more local entities than the national state, and potentially have a more commons-like role. This paper will use a case study in a UK city to identify commons governance mechanisms in the civic energy sector, and to understand their impacts on equalities.

Design Principles for successful management of common pool resources

In order to analyse the impact of commons mechanisms in the civic energy sector on equality, it is necessary to have a framework for identifying commons governance mechanisms. Ostrom (1990) developed a set of eight design principles (DPs) for successful management of common pool resources. These are practices that people 'do' to manage commons, and although not intended as a definition of commons, the practice of 'commoning' is considered by some, including Linebaugh (2008), to be a more important focus than the material resource of commons as an object. Ostrom's DPs are therefore used in this paper as an indicator of governance mechanisms used in commons. These DPs are listed below.

DPs for successful groups as updated by Cox et al, (2010), developed from those originally published in (Ostrom, 1990):

1A Clearly defined user boundaries: Individuals or households who have rights to withdraw resource units from the common-pool resource (CPR) must be clearly defined.

1B Clear boundaries of resource system: The boundaries of the CPR must be well defined.

2A Congruence with local conditions: Appropriation and provision rules are congruent with local social and environmental conditions.

2B Benefits of appropriation and provision inputs are proportionate

3 Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.

4A Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.

4B Monitoring the resource: Monitors who are accountable to the users monitor the condition of the resource.

5 Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense)[52] *by other appropriators, by officials accountable to the appropriators, or by both.*

6 Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.

[52] The phrase 'assessed graduated sanctions' means that a smaller sanction is demanded of an individual who breaks a rule for the first time, or in time of need, whereas a repeat or casual offender will be more severely sanctioned.

7 Minimal recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.

8 Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

The first DP concerns boundaries and exclusion. The second, in particular 2B can be seen as a principle of reciprocity, regarding proportionality of contribution and benefit. The third is about procedures and participation. DPs 4, 5 and 6 are mechanisms for community accountability. DPs 7 and 8 concern the relationship of the commons institution to other institutions, which may be commons, state or market systems.

Commons risks to equality

Commons management systems can in theory provide benefits relative to pure market and commodity systems, and may support more sustainable levels of consumption. They can also provide more human and reciprocity based equity, whilst market systems are widely seen as a good approximation of a meritocracy. However, Ostrom's DPs for common pool resource management raise some concerns for equality, including the risk of exclusion, the risk of scapegoating, and the risk of abandoning of the weak. It is therefore important not to romanticise the commons as there are negative sides to community and commons governance

Boundaries – the risk of exclusion

Whilst Ostrom's first DP advises having clear boundaries of users, a mechanism which can have the unwanted side effect of violence and hostility towards outsiders. Fleming (2016), in his description of a potentially commons-like post-market economy, argues that multiculturalism is unhelpful, and that separate, homogeneous cultural groups will be more successful. Scruton (2017) argues for 'oikophilia' or love of home as a key mechanism for achieving sustainable prosperity, arguing that this can create greater respect for 'absent generations', the unborn and the dead, through an ethic of stewardship. However, as Anderson (2017) states, "although love of home can be entirely positive, it can also easily shade into antagonism towards others who either are outside of 'home' or located inside but not seen as belonging." Hostility towards outsiders is particularly poignant with the rise of nationalistic and socially regressive (racist, sexist, anti-LGBT) politics in the UK, the USA, and many countries in Europe in 2016-2017. Moving towards commons mechanisms, with strong boundaries of membership could risk exacerbating these exclusive political dynamics.

Community accountability – the risk of scapegoating

The reliance on tradition and social sanction, or community accountability as identified in Ostrom's fourth, fifth and sixth DPs, can lead to a social conservatism that is hostile to the 'other' within – those who do not conform to norms of gender presentation, sexual orientation, skin colour, or religion, as well as those who are 'other' in a multitude of ways. Sanctioning can involve punitive justice systems, which can take the form of exclusion or other forms of violent retribution, and can lead to scapegoating. The risk of scapegoating could potentially be mitigated through the development of restorative justice systems which aim to resolve conflict in ways that build rather than destroy community relationships.

Fiscal equivalence – the risk of abandoning the weak

Commons governance systems often rely on mechanisms of reciprocity, which can risk abandoning those who are less able to contribute, such as disabled people. Cox et al's (2010) wording of Ostrom's second DP states 'benefits of appropriation and provision inputs are proportionate', an emphasis on 'fiscal equivalence' rather than equality of access to resources. This is a stronger stance for reciprocity than Ostrom's original formulation "congruence between appropriation and provision rules and local conditions".

In addition to those unable to contribute, a stance of fiscal equivalence may not acknowledge historic and structural inequalities which affect people's starting positions. For example, in the irrigation communities described by Hunt (1992), water is distributed according to the amount of land owned. Unequal land distribution leads to unequal access to water. This does not fit with the stance of social equality taken in this paper, but the rules in place fit local perceptions of fairness, where conflict is caused by a person taking more water than they are entitled to, rather than a sense that the entitlement is unfair.

A stable traditional commons institution, which distributes water equally to the land but not equally to the people, may have value, but does not support the type of equality proposed by this paper.

Rather than either dismissing or romanticising the commons, this paper seeks to understand specific ways in which commons mechanisms do and do not support equality.

Methodology

This paper presents the outcomes of a three year longitudinal case study of the civic energy sector in the UK city of Bristol (2014-2017), taking an insider-outsider participant observation approach.

Four organisations are discussed in this paper: Bristol City Council (BCC), which has an active energy team; Bristol Energy Co-operative (BEC), a renewable energy investment co-operative; Bristol Energy Network (BEN), an umbrella network for the CE sector in Bristol, and Bristol Energy Company (Bristol Energy), a fully licensed energy supply company which is wholly owned by BCC.

BCC is a pro-active council which received EU funding for energy initiatives. This includes development of renewable energy generation, district heating network, a domestic retrofit scheme, and setting up Bristol Energy which started trading in 2015. BEC is an investment co-operative that is similar to others around the UK. Individuals can become members by investing in the co-operative, which uses these funds to develop renewable energy generation. Income from selling the electricity generated and subsidies is returned to members with interest, and also provided to a 'community benefit fund'. Members each have one vote in democratic decisions within the cooperative. BEN is an umbrella organisation for city-wide and neighbourhood focused CE groups, which have varying levels of formality. It has over 30 member groups (Bristol Energy Network, 2017b). Bristol Energy is a fully licensed energy supply company, selling electricity and gas to domestic and non-domestic customers (Bristol Energy, 2017b), and purchasing this mostly on the wholesale markets. It started trading in 2015, and is a wholly owned subsidiary of BCC, with all profits going to BCC.

This study takes a reflexive stance, recognising my positionality as a researcher, and prioritising rich participant observation over generalisability. As such, first person description is used where appropriate. I am an insider in the CE sector in Bristol, having been involved in setting up BEC from 2011 to 2013. During the research I have stepped back somewhat, but could be seen more as an observant participant than an external observer. I have unearned advantages due to my privileged position as a white, middle-class cis-woman.

Analysis

In order to answer the research question concerning the extent to which the commons-like characteristics of local and CE initiatives in the UK help or hinder moving towards greater equality, the analysis has three steps. First it identifies commons-like and non commons-like characteristics of the local energy initiatives in the case study. Secondly, it identifies equality-promoting and non equality-promoting characteristics. Finally, the paper discusses the ways in which these interact with each other.

Commons and non commons-like characteristics of the local or CE initiatives.

The first part of the analysis seeks to identify commons-like and non commons-like characteristics of the civic energy sector in the case study. It draws partly but not rigidly on Ostrom's DPs for this identification, considering DPs 1, 2 and 3 separately, then 4, 5 and 6 together, and 7 and 8 together.

Design principle 1

Ostrom's first DP calls for clear boundaries of the resource and of the members, which are important for effective governance, but create a risk of exclusion. Clear boundaries of membership are therefore taken to be a commons-like characteristic. In BEC, there are clear boundaries of membership. There is a formal process for becoming a member, which involves buying shares in the co-operative, and a clear list of who the members are. Members can be located anywhere, and do not have to be resident of Bristol. There is only one category of membership.

BCC also has clear boundaries, with a jurisdiction that extends to a defined territorial boundary. BCC has duties to provide services to all residents in that jurisdiction, and is accountable to all who are on the electoral register.

BEN has more open boundaries of membership. There is a defined list of member groups, and a process for groups to become members. On the other hand, participation in the network as an individual is open, and individuals can be part of the BEN community without necessarily having an official affiliation to any member group.

Bristol Energy has customers who can be anywhere in the UK, employees, and a board and governance structure.

All four focal organisations therefore have some degree of defined boundaries to membership, and thus have this commons-like characteristic.

Design principle 2

Ostrom's second DP has two parts. The first regards the congruence of the commons institution with local conditions. All four of the case study organisations fit with local conditions as they are legal and functional in the present. The second part requires proportionate allocation of benefits of appropriation and inputs to provision, effectively a principle of reciprocity. In BEC, members receive interest[53] on their investment proportionate to the total amount of investment made, with an option to waive a part of their interest for reinvestment or to the community benefit fund. This is commons-like. However, the community benefit fund represents a financial benefit beyond the membership, to community groups working on energy or sustainability projects (Bristol Energy Cooperative, 2017). This is not commons-like.

The structure of benefits to members in the CE sector, in particular for renewable generation investment co-operatives with business models similar to BEC's, has been a matter of regulatory controversy. There are two legal structures that such organisations can use: the 'bona fide co-operative', and the 'community benefit society' (FCA, 2015). BEC has the latter legal structure, which has an emphasis on benefit for the wider community, not just the members. The community benefit fund is therefore congruent with this legal structure. However, some similar organisations have a 'bona fide co-operative' structure, which focuses on benefits to members. The FCA, the regulatory organisation responsible for registering co-operatives, ruled that renewable energy investment co-operatives could not be bona fide co-operatives, because they

[53] Payment to members is called 'interest' rather than 'dividend' for legal reasons relating to community share offers, the mechanism by which BEC raises funds.

provided insufficient direct benefit to members (Vaughan, 2014). The only benefit they provide to members is financial return on their investment. If they supplied energy directly to their members, e.g. through selling them electricity generated from the renewable power they owned, this would be a direct benefit to members. However, the rules of the UK energy system make it impossible for a small scale community organisation to domestic consumers, as the terms of the licence conditions are too onerous. Overall, BEC does have proportionality of benefits to members and input from members, and thus broadly fits Ostrom's second DP.

BCC has a taxation-based income, primarily from central government, and provides public services to all. It is therefore redistributive rather than reciprocal. BEN does not require any financial contribution from member groups, and has been funded by BCC. Bristol Energy has market transactions with its customers, who do not contribute to provision. Therefore, in relation to DP 2A, only BEC has this commons-characteristic.

Design principle 3

Ostrom's third DP calls for most group members to be eligible for participation in decision-making. In the day-to-day, BEC is run by a board and by three employees. However, all members are eligible to vote for the board and to vote on key decisions at the AGM (Annual General Meeting). All members have one vote, regardless of their level of financial investment.

BCC is a large bureaucratic institution. Many decisions are made by civil servants. Major decisions are made by the council or cabinet. Councillors and the mayor are elected by all residents of Bristol. In many ways, this structure is not so different to that of BEC, but at a much larger scale, and with much more complex decisions, so the residents are more removed from the decisions.

BEN member groups have an equal say in decisions at members meetings, including election of the board of directors at AGMs. Individuals do not have formal decision-making entitlements, but can participate in discussions that inform decisions.

Bristol Energy customers do not participate in decisions – they can only decide whether to be a customer or not, and select between the different available tariffs. The company is run by employees, in a hierarchical management structure, with a board of directors and ultimate accountability to BCC, as the sole shareholder. BEC, BEN and BCC are therefore commons-like with respect to DP 3, but Bristol Energy is not.

Community accountability

Ostrom's fourth, fifth and sixth DPs relate to community accountability. This is particularly relevant in the context of a commons where appropriation is governed. The integration of appropriation and provision activities within one organisations was also part of the definition of commons given at the start of this paper. None of the organisations in the case study limits levels of consumption of energy. So in one sense, appropriation is not monitored. BEC is engaged in production of energy, but the rules regarding supply of energy to households, discussed above, are a barrier to also managing appropriation. Thus it is not possible for BEC to become a true commons under current energy market regulations.

Several member groups of BEN are engaged with energy efficiency and demand reduction projects, but this is without community accountability for levels of consumption. Similarly, BCC has energy efficiency programmes, and has set targets for energy demand reduction in the city (Bristol City Council, 2015d). It monitors overall energy consumption through city-wide statistics, and has plans to control consumption in its own buildings, but does not create accountability for levels of consumption or monitoring of individuals or households. Bristol Energy monitors the amount of energy consumed by its customers, through metering, but this is used for billing rather than for setting limits. In its role as an energy supply company, Bristol Energy must purchase the same amount of energy that it sells. Relative to other organisations in this study, it is well-placed to link production with consumption of energy, and could potentially collaborate with other organisations such as BEC to play this role.

Community accountability is not an obvious feature of any of the four organisations in the case study, primarily because none of them regulates consumption (appropriation). .

Design principles 7 and 8

Finally, Ostrom's seventh and eighth DPs concern the relationship of a commons institution with the outside world. DP7calls for 'minimal recognition of the right to organise', and DP8 calls for 'nested forms of governance'.

All four of the case study organisations exist legally in the current system, and therefore have some minimal recognition. However, the regulation to supply of energy to households prevents BEC from becoming a true commons by organising both provision and appropriation. There is a lack of recognition of the right to provide energy to members. This is a right that is being lobbied for, as a 'community right to supply' (Corbyn, 2016).

BEN is organised in a nested structure, with member groups, including BEC, having autonomy to operate their own activities, but coming together as the network. However, this nesting is not in a territorially neighbouring structure, but rather a structure of overlapping jurisdictions, one of the characteristics of polycentric governance identified by McGinnis (2016). For example, some BEN member groups have a city-wide remit, whilst others are specific to a particular neighbourhood. They also overlap in function, with several groups engaged with energy efficiency, and several group developing renewable energy assets. More widely, the civic energy sector in Bristol, including BCC and Bristol Energy, could be seen as a polycentric system.

Several of the organisations in the case study have multiple roles. BCC has a broad remit for the general wellbeing of the city, which goes beyond energy. Income it receives from Bristol Energy's profits do not necessarily go just to energy-related work, but to public service provision. This more holistic approach could be seen as commons-like. At the same time, BEC is highly commons-like on the inside, but acts as a renewable energy developer in a market context, and so could be seen as 'commons on the inside, market on the outside' (Bollier, 2014).

Summary

The presence of commons governance mechanisms in the four case study organisations is summarised in

Table 1.

Table 1: Summary of case study organisations in relation to Ostrom's DPs.

Ostrom's DP		BEC	BCC	BEN	Bristol Energy
1	boundaries	yes	yes	yes	yes
2A	local conditions	yes	yes	yes	yes
2B	reciprocity	yes	no	no	no
3	participation	yes	yes	yes	no
4,5,6	community accountability	no	no	no	no

7	recognition of commons	some	yes	yes	yes
8	nestedness	no	no	yes	no

Equality promoting and not equality-promoting aspects of local or CE initiatives

This section uses a framework of distributional, procedural and recognition equality to identify characteristics of the organisations in the case study that do and do not promote equality.

Distributional equality

This section discusses distributional issues in the civic energy sector in the case study, including concern with fuel poverty, concern climate change and overconsumption of energy, and distribution of wealth from renewable energy.

Fuel poverty

Fuel poverty, is a major issue in the UK (Department of Energy and Climate Change, 2013). It is caused in part by inequality of wealth and income, and results in unequal access to energy as some people cannot afford to heat their homes whilst others have plenty. All four case study organisations are concerned with fuel poverty. BCC's energy efficiency scheme, Warm Up Bristol, is partly aimed at reducing fuel poverty. Fuel poverty is one of the five BEN strategy themes. Directors of BEN include organisations supporting people who have financial difficulties with energy bills.

A senior manager interviewed at Bristol Energy, recognises that energy is a basic need, and the importance of fuel poverty:

> *"we sell stuff that heats your home and cooks your food and so particularly in the context of the residential, the domestic customer, you cannot ignore the social angle to it. And you cannot ignore that there are tens of thousands of people who cannot afford to heat their home properly. Who are ... in fuel poverty."*

In the UK, high energy prices are charged to the 40% of people who do not regularly switch supplier, including many in fuel poverty. Fair prices are a priority for Bristol Energy. Additionally, they are trialling a social tariff called 'Warm Homes Plus' (Bristol Energy, 2017a), which would be available to those in need by referral from partner organisations. They are also one of the first companies to voluntarily offer the Warm Home Discount scheme, which larger energy companies are obliged to provide (Bristol Energy, 2016b).

Concern with fuel poverty is a way of 'not abandoning the weak' discussed as a risk in relation to the commons mechanism of reciprocity.

Climate change and overconsumption ***of energy***

Climate change is also a shared concern of the case study organisations. This has international and intergenerational distributional justice implications, which are more challenging to engage with than concern for fuel poverty nearby. A renewable energy based mitigation of climate change is likely to require a substantial reduction in energy consumption (Centre for Alternative Technology, 2013). As discussed in relation to community accountability, none of the four case study organisations limits consumption of energy.

People experiencing fuel poverty generally need to consume more, rather than less energy. Making space for this requires those who currently overconsume energy to reduce their consumption. Energy efficiency and demand reduction support provided to overconsumers by some member groups of BEN therefore also has a positive impact on equality of access to energy, despite providing support to people who are relatively wealthy.

Income from renewable energy

The flow of income from renewable energy is an important question for distribution. Commons principle DP2b calls for reciprocity, a conception of fairness that does little to redress existing inequalities. As discussed in relation to DP2b, BEC provides interest to members based on their level of investment, at 5% return. Whilst the financial circumstances of members may not correlate with their level of investment, this mechanism of return on investment enables those with greater financial wealth to obtain gain more financially than those with less. It could lead to widening wealth gaps if it is not counterbalanced by a strong enough distributive mechanism. BEC also provides money to a community benefit fund, non commons-like equality-enhancing process of sharing beyond the members.

Investment in renewable energy by local government is more progressive. Profit is spent on general public services within the local authority, which go primarily to those who need them most, contributing towards redressing inequalities.

Spatial issues in distributional equality

In addition to inequality within a locality, moving to a localised energy system risks exacerbating or creating spatial inequalities between places. Technical potential for renewable energy is not equally distributed. In a commons, greater local technical potential for renewable energy could lead to greater energy access. However, in the current energy market, direct benefit from local resources is limited. The exacerbation of local inequalities is more likely to be due to unequal financial resources, commercial knowledge and social capital (Catney *et al.*, 2014).

Cornwall is rich in renewable energy, but much of the it is owned or financed from outside Cornwall. The financial value flows out. According to Burnyeat's (2013) analysis, £74m of the £85m income from renewable energy leaves Cornwall, whilst more than half the £21m opex spend also leave Cornwall. This means that of a total of £105m revenue, only £21m remains in Cornwall. This analysis can be used to justify greater local ownership of renewable energy, rather than commercial developer ownership.

However, Bristol, as an urban area, has limited renewable energy potential within its territorial boundary. The LA and CE sector are therefore considering developing renewable energy elsewhere.

In 2013 BEC attempted to develop a wind farm just outside of Bristol, in a village in South Gloucestershire (Bristol Energy Cooperative, 2015). The local community in the village saw BEC as outsiders, despite the fact that many villagers rely on Bristol for work, cultural activities, shopping etc. Rural areas have always provided the material needs of cities, and Coxcoon (2014a) recognises the importance of local communities making a contribution to "meeting national sustainable energy targets" rather than just providing for their own village.

BCC has also considered developing energy resources outside their territorial boundary. A BCC employee interviewed considered that energy for the city should be "local if possible", but "[solar panels] wouldn't provide us with enough electricity to fulfil our energy demand" and "if the opportunity arises for local authorities to facilitate offshore wind for example then we would be interested in getting involved".

Procedural equality

The CE sector has potential for high procedural equality, as it is founded on a belief that citizens are entitled to participate in the creation of the energy system. This is captured in the concept of 'energy democracy'

(Sweeney, 2012; Angel, 2016a). This strong ethic of participation contrasts with the bureaucratic and hierarchical structures of the LA. On the other hand, the LA is more broadly inclusive, as councillors are elected by the whole population rather than a self-selected group.

Participation and privilege

Whilst the CE sector provides an avenue for direct participation, the demographics of those participating are not representative of the wider population. The CE sector in Bristol has been criticised for being white, middle class and male, in a diverse city. This is a problem for equality. Members of BEN are aware of this problem, and have pro-actively attempted to make BEN more inclusive.

A first step was to recognise the lack of diversity. An event in 2015 which acknowledged this problem was framed as follows:

> "Why are Bristol community energy groups mostly from a narrow section of a diverse community? Why is it so hard to get others involved?
>
> …. The communities most affected by fuel poverty are often not involved in discussions about energy equality, or have much to do with the groups working in this area. Many energy groups try to reach out and involve others but often with limited success. But with these important voices missing, how can we create a sustainable, inclusive energy system that works for us all?"

This event aimed for procedural equality by inviting the voices of those currently not participating. It also provided recognition of the dignity of disadvantaged groups – "communities of African and Asian heritage, Eastern European migrants, older people, disabled people, LGBTQI people and those from lower income households", and recognition of the needs of people experiencing fuel poverty. However, from a starting point of mainly white, middle class, male, university-educated participants, it is challenging to include those outside this privileged demographic. The event had some success in attracting more diverse participants, but was primarily attended by people already involved in BEN.

BEN has also taken active steps to broaden participation. It has actively worked to bring diversity to its board of directors, a matter of both procedural and recognition justice, and has held training events on diversity and inclusivity for its members. In collaboration with BCC, it has set up a Community Energy Fund aiming to support 'non-energy' community groups to work with energy groups. Funding has supported, for example, internships for young people, solar panels on a 'sensory bus', double glazing on youth centres, and digital energy advice for low income people. BEN has actively sought diversity in the grant-making panel, and which has representatives of ethnic minorities and a majority of women (Bristol Community Energy Fund, 2016).

However, whilst equality and inclusion is a priority for some members of BEN, for others making large scale and rapid progress with the deployment of low carbon energy technology is more urgent. This perspective echoes the Greenpeace activist cited by Agyeman:

> "I asked a Greenpeace staffer if she felt that her organization's employees reflected multicultural Britain. She replied calmly, 'No, but it's not an issue for us. We're here to save the world.'" (Agyeman, 2008b, p. 751)

Frustration with this perspective is clear in this excerpt from an email sent by a member of BEN for whom equality is a high priority:

> *Attempting to charge ahead with a project when it has only successfully engaged such a narrow segment of a very diverse city is not only an ineffective strategy but also unjust. At the root of many of our problems in society is the fact that a small, unrepresentative group of people have determined the policies, systems etc. that we all have to live by; the result being that those policies and systems are often ineffective at*

meeting the needs of people different to those who wrote them in the first place. Don't we want to be different? Yes, including other people can mean a longer process, but it doesn't have to be 'paralysing'. As the saying goes: If you want to go fast, go alone. If you want to go far, go together.

Another member argued for the importance of having a material impact as well as being inclusive:

To paraphrase your "Attempting to charge ahead with a project when it has only successfully engaged such a narrow segment of a very diverse city is not only an ineffective strategy but also unjust." We say that "attempting to engage with a wide segment of the public while having no resources to deliver beneficial change is just as ineffective and unjust". It's only when we have both that it makes sense.

The idea that it makes more sense to engage with people when there is something concrete to offer them is compelling. However, this is also a question of choice, and procedural justice interacts with distributional justice as those who are disadvantaged can advocate for their own needs. Perhaps to move forward, participation needs to be reframed as an enabler of effective delivery of projects.

The CE sector in Bristol contrasts with the Brixton Energy Co-operative project in London. Diversity and inclusion and participation are fully integrated through grant funding that enabled door-knocking in the council housing blocks where solar panels were installed, training local young people to carry out draft proofing within their own communities, and funding internships for local youth which led to job opportunities.

The BEC still has further to go in terms of procedural equality and representation. The board of nine directors is all white, and includes one woman, all of whom have professional backgrounds. The promotional film made in 2015 featured only white people. Of the three employees, only one is a woman, and she is in an administrative role.

Inequalities in who participates are partly due to economic factors, such as the greater freedom and time for volunteering available to those with greater financial resources. However, they are partly due to informal boundaries of membership, relating to Ostrom's DP1, as people feel more comfortable with those similar to them. The work of identifying unconscious biases and dismantling privilege attempts to remove boundaries that reinforce societal inequalities.

Equality in recognition

Equality of recognition is related to some of the issues discussed previously. Addressing fuel poverty not only supports distributional equality, but also recognises the distinct needs and situation of people living in fuel poverty. Considering privilege and noticing who is missing from a conversation involves recognising the different experiences and resources available to different people. Lack of recognition of the rights of different people within a community can lead to scapegoating of the 'other' within. The risk of scapegoating can potentially be mitigated by directly engaging with and attempting to dismantle privilege, as discussed above.

Discussion

The commons and non-commons, and equality and inequality promoting aspects of the case studies are collated in Table 2.

Table 2: Comparison of equality impact and commons design principles

Equality?		Commons mechanisms?	
Equality promoting	Inequality promoting	DP present	DP absent

Concern about fuel poverty;			
demand reduction for overconsumers – concern about climate change			
	lack of limits to consumption		lack of 4,5,6 community accountability
	return on investment	2B - reciprocity	
BEC CE fund			lack of 2B – reciprocity
LA reinvestment of profit to public services			lack of 2B – reciprocity
	financial benefit from renewables goes to places with financial capital	2B - reciprocity	
	Informal boundaries of 'like-minded' others in group	1 boundaries	
Active discussion of privilege		3 participation	
active dismantling of privilege		3 participation	
	fear of scapegoating	idea of 4,5,6 community accountability	
recognition of diverse needs		idea of 4,5,6 community accountability	

This shows that in some cases the presence of commons mechanisms was associated with inequality promoting mechanisms, in particular the presence of boundaries and the mechanism of reciprocity. On the other hand, the principle of wide participation was associated with increasing equality. Community accountability had was more ambivalent in relation to equality.

These observations are consistent with the theoretical discussion of equality risks from commoning, and these associations are partly based in this theoretical analysis rather than being purely empirical.

The case study evidence does bring a number of new insights, however. It shows that each organisation has both commons-like and non commons-like and equality-promoting and non equality-promoting

characteristics. The impact on equality is partly a question of objectives and values (e.g. concern about fuel poverty and climate change), and partly a response to the wider context (the need to attract investment and be financially viable in the national economic system), as well as being structured by the internal logic of a 'commons-like' organisation. The case studies also show that some of the equalities risks of commoning could be mitigated, e.g. through attention to power and privilege, social tariffs and provision of grants.

Conclusions

In conclusion, equality promoting is not inherent to state or commons governance, but depends on the detail of how each organisation is governed. Commons management supports procedural equality, when promoting the active participation of members. CE groups may not be as effective as LAs at shifting distributional inequalities due to their relatively elite membership. However, achieving greater equality is partly dependent on a commitment and pro-active approach to equality.

This paper has identified a number of equality enhancing mechanisms: proactive attempts to increase diversity and challenge unconscious bias; development of a community fund that targets disadvantaged community groups; recognition of fuel poverty and inclusion of the voices of people in fuel poverty. On the other hand, some of the mechanisms that exacerbate inequalities in wider society are repeated in the CE sector. These include a return on investment in community renewable energy investment, and participation dominated by the privileged.

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Appendix 4: Development of design principles

The DPs were developed after engagement with the case studies, and so insights from these have in some ways informed their development, but they were primarily developed from the theoretical frameworks of polycentric governance, as defined by McGinnis, and from Ostrom's DPs for common pool resource management. These principles have also been checked against a number of frameworks which share the core values of equality, democracy and living in environmental limits, and a systems perspective. This led to a more full and complex list of DPs than those ultimately used in the thesis. The longer list was condensed into a selection of those DPs that were most fully explored theoretically and empirically in this thesis. The reference frameworks and full long list of DPs are included below for reference. Figure 1 shows the mind map used as part of the development of the DPs.

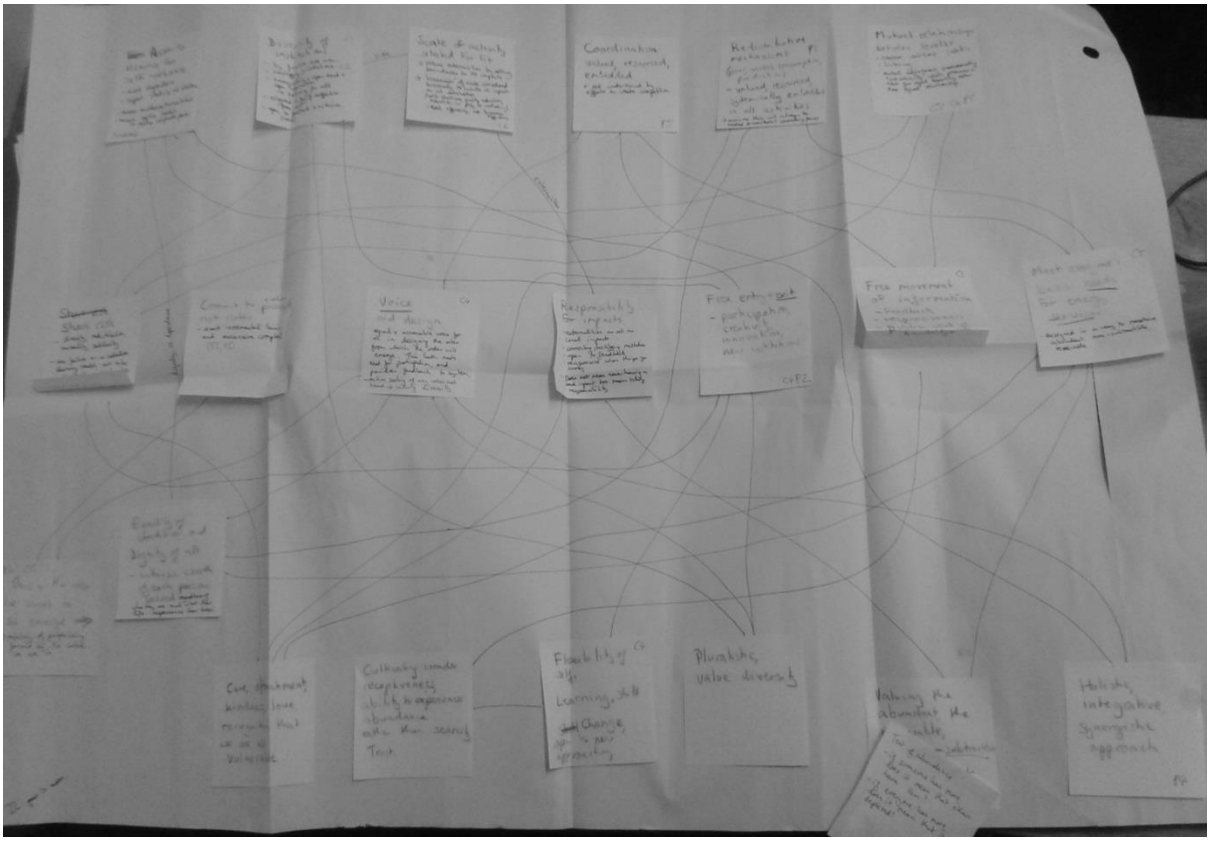


Figure 1: Mind map for developing DPs

Proposed design principles

Three levels of principles were initially developed, with values, as a foundation, followed by objectives, followed by principles. This was then condensed into the shorter list of DPs shown in chapter 8.

Values

1. Equality and care
    a. Equality of condition and dignity for all
    b. Meet everyone's basic needs for energy services
    c. Care, attachment, kindness, love, recognition that we are all vulnerable
2. Wonder and learning

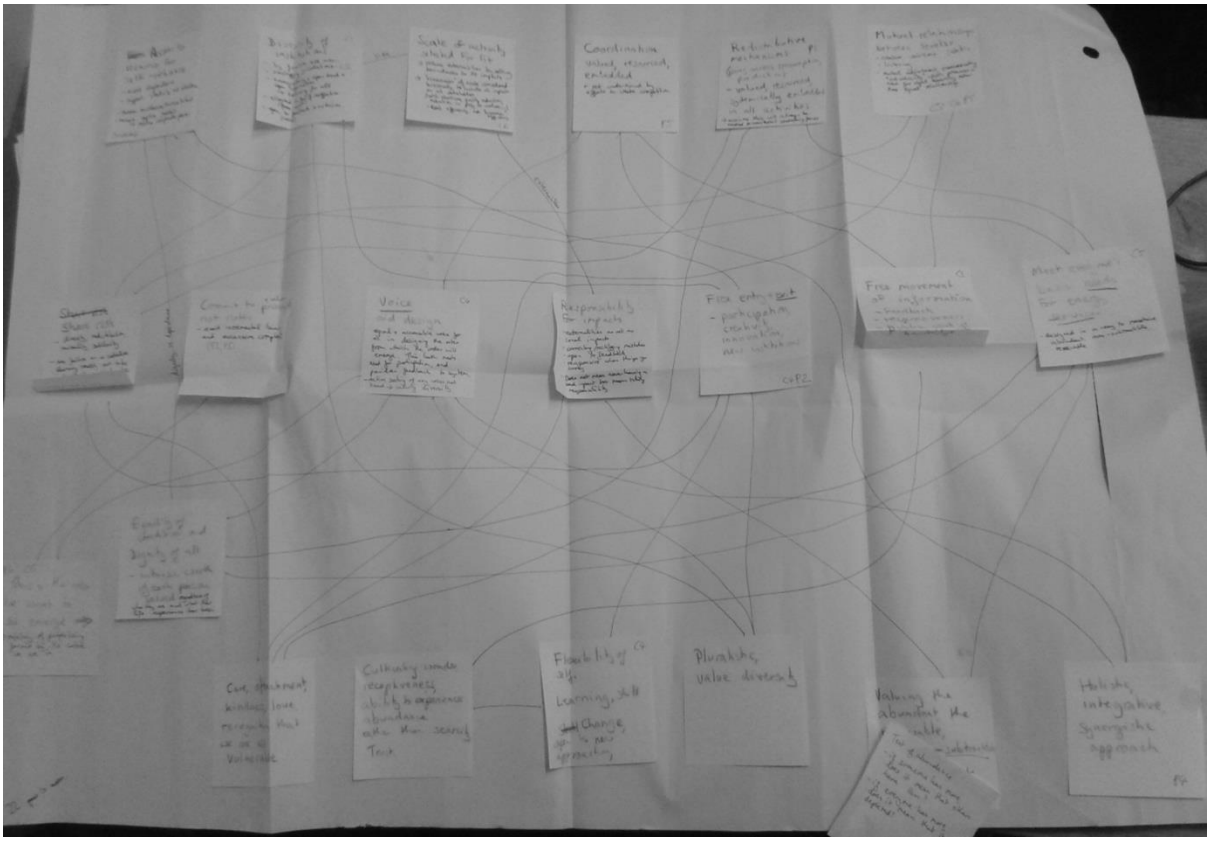
    a. Cultivating wonder, receptiveness, ability to experience abundance rather than scarcity, trust
    b. Flexibility of self, learning, skill, change, open to new approaches
3. Environment
    a. Respect for the environment, for its own sake, as well as ours
4. Systems thinking
    a. Pluralistic – value diversity

Objectives

1. Environmental limits
    a. Remain within environmental limits
    b. Value the abundant, the renewable, the non-subtractible
2. Systemic thinking
    a. Holistic, integrative, synergistic approach
    b. Commit to values and principles rather than rules
    c. Diversity of institutions
3. Solidarity
    a. Share risk
4. Responsibility
    a. Clarity of roles and responsibilities, accountability and enforcement
    b. Access to resources for self-reliance

Principles

1. Externalities
    a. Responsibility for the impacts of actions, deal with the consequences, near and far
    b. Mutual relationships between levels and scales
1. Exit and voice
    a. Everyone has access to voice in decisions for active design of rules of the system
    b. Low barriers to entry and exit to develop new institutions, or to stop providing, producing or consuming, accessible to all
2. Public goods and commons
    a. Free movement of information – no intellectual property or commercial confidentiality. Transparency, responsiveness, feedback
3. Scale and boundaries
    a. Scale of activity selected for fit, and
    b. scale of group size selected for accountability and relationships
    c. Clear boundary of who is in and who is out of which group, in terms of access to resources and responsibilities
4. Coordination and leadership
    a. Coordination valued, resourced, embedded, with clarity of roles and development of leadership skills
5. Equality and dignity
    a. Redistributive mechanisms, to redistribute power, access, consumption, production
    b. Valuing unpaid as well as paid work, allowing time for both



Reference lists of principles

Main sources – McGinnis' characteristics and problems of polycentric governance, Ostrom's DPs for common pool resources

Polycentric governance - McGinnis

McGinnis' discussion of the characteristics and persistent problems of polycentric governance is discussed in detail in relation to the UK energy system in Chapter 4.

Characteristics of polycentric governance

1. Multiple Centres of decision-making
2. Overlapping jurisdictions
3. Mutual adjustment
4. Dynamic institutional relationships
5. Emergent order
6. Scale economies.

Problems of polycentric governance

1. Structural inequities
2. Incremental bias
3. High complexity
4. Deep structural fissures
5. Coordination failure
6. Lack of normative clarity

Ostrom's DPs for common pool resources

Ostrom's DPs for common pool resources are discussed in Chapter XX, as is the application of commons theory to the UK energy system. The principles are as listed below:

1A Clearly defined user boundaries: Individuals or households who have rights to withdraw resource units from the common-pool resource (CPR) must be clearly defined.
1B Clear boundaries of resource system: The boundaries of the CPR must be well defined.
2A Congruence with local conditions: Appropriation and provision rules are congruent with local social and environmental conditions.
2B Benefits of appropriation and provision inputs are proportionate
3 Collective-choice arrangements: Most individuals affected by the operational rules can participate in modifying the operational rules.
4A Monitoring users: Monitors who are accountable to the users monitor the appropriation and provision levels of the users.
4B Monitoring the resource: Monitors who are accountable to the users monitor the condition of the resource.
5 Graduated sanctions: Appropriators who violate operational rules are likely to be assessed graduated sanctions (depending on the seriousness and the context of the offense) by other appropriators, by officials accountable to the appropriators, or by both.
6 Conflict-resolution mechanisms: Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials.
7 Minimal recognition of rights to organize: The rights of appropriators to devise their own institutions are not challenged by external governmental authorities.
8 Nested enterprises: Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises.

Secondary sources – system thinking

Whilst this thesis has a particular focus on the theories of polycentric governance and commons developed by the Ostrom workshop, it is based in an ontology and epistemology of complexity and systems thinking. Donella Meadows' twelve levers of places to intervene in a system are seen as a useful heuristic for system thinking. Permaculture was developed as an approach to living sustainably and working with nature rather than against it, and has been used for several decades in practical settings.

Donnella Meadows 12 levers for changing a system

Meadows proposes twelve levers for changing a system, which are listed in increasing order of effectiveness, with 1, the power to transcend paradigms as the most effective. These can also be taken in a less hierarchical way. Jed Picksley suggests that (2016) different people are working on different levels, and that to have widespread resonance it is valuable to touch on all twelve levels in describing a systemic approach. Working at all levels is important, as intervening effectively at levels 1 and 2 requires an in depth understanding of the system which can only be gained through working at levels 12 and 11. One needs both the big picture and attention to detail.

Places to Intervene in a System (in increasing order of effectiveness) (Meadows, 1999)

12. Constants, parameters, numbers (such as subsidies, taxes, standards)
11. The sizes of buffers and other stabilizing stocks, relative to their flows.
10. The structure of material stocks and flows (such as transport networks, population age structures)

9. The lengths of delays, relative to the rate of system change
8. The strength of negative feedback loops, relative to the impacts they are trying to correct against
7. The gain around driving positive feedback loops
6. The structure of information flows (who does and does not have access to what kinds of information)
5. The rules of the system (such as incentives, punishments, constraints)
4. The power to add, change, evolve, or self- organize system structure
3. The goals of the system
2. The mindset or paradigm out of which the system—its goals, structure, rules, delays, parameters—arises
1. The power to transcend paradigms

Permaculture

Permaculture is a way of thinking that learns from ecosystems, and considers human activity as having a place within an ecosystem. This type of thinking is highly relevant to the concept of polycentric governance, as an ecosystem has all of the characteristics of polycentric governance described by McGinnis, e.g. multiple centres of decision-making (different organisms), overlapping jurisdictions (species that occupy the same niche)… permaculture also offers a set of DPs, and so is quite a useful reference point in relation to developing DPs.

Permaculture ethics

1. earth care
2. people care
3. return the surplus/fair shares

ontology of each person or community as a small part of a bigger system- humans as part of an ecosystem. This is a complexity based ontology which leads to emergent outcomes.

Permaculture DPs

1. observe and interact
2. catch and store energy
3. obtain a yield
4. apply self-regulation and accept feedback
5. use and value renewable resources and services
6. produce no waste
7. design from pattern to detail
8. integrate rather than segregate
9. use small and slow solutions
10. use and value diversity
11. use the edges and value the marginal
12. creatively use and respond to change

Secondary sources – humanistic and egalitarian

In addition to attempting to transcend the different rationalities of human approaches to culture and governance systems, this thesis is grounded in the egalitarian rationality, and challenges the prevailing neoliberal paradigm, which is identified with the individualist rationality. Levitas' considers a utopian ontology of humanity, based on the belief that how we are as humans is culturally contingent. The Common

Agenda principles were developed by members of the New Economy Organisers' network, which brings together individuals who are working to challenge the neoliberal hegemony. Max-Neef identifies nine fundamental human needs, which are seen as being universal for all people, regardless of their belief system or cultural situation. This approach is echoed in the writings of Sen and Nussbaum.

Levitas' utopia as ontology

The following aspects of human nature would be nurtured and supported in a utopian society as envisioned by Levitas:

1. Recognition that we are all vulnerable
2. Centrality of dignity
3. The emotion of hope
4. The importance of care and attachment
5. Flexibility of the self – people as becoming as well as being
6. Love, kindness
7. Equality to underpin relations of dignity
8. Some kind of path towards self-actualisation, grace
9. Wonder, as an attitude and receptiveness, rather than a response

New Economics Foundation: Common Agenda

"We all know that it's easier to agree on what we're against than what we're for." (Berry, 2015)

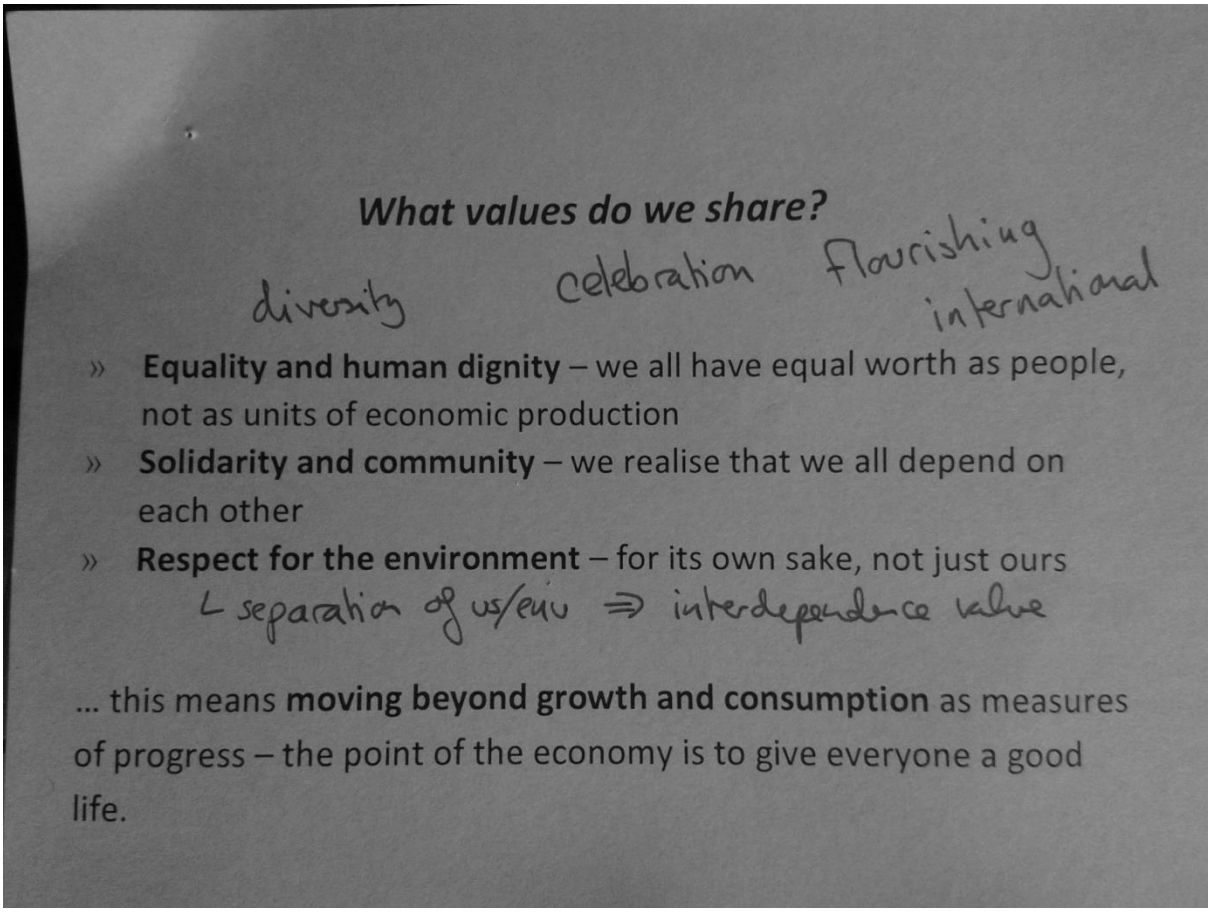
The New Economy Organisers Network (NEON), a part of the New Economics Foundation, worked to develop principles for a common agenda, through a broad collaborative discussion between the members of NEON. Christine Berry facilitated this research process, which led to a set of values, and a set of principles for 'how to change the rule of the game'. Christine facilitated a workshop in Bristol on 23rd July 2015, which included discussion of the principles developed to that point. These are listed below.

What values do we share?

The Common agenda process identified the following values:

1. Equality and human dignity – we all have equal worth as people, not as units of economic production
2. Solidarity and community – we realise that we all depend on each other
3. Respect for the environment – for its own sake, not just ours

… this means moving beyond growth and consumption as measures of progress – the point of the economy is to give everyone a good life

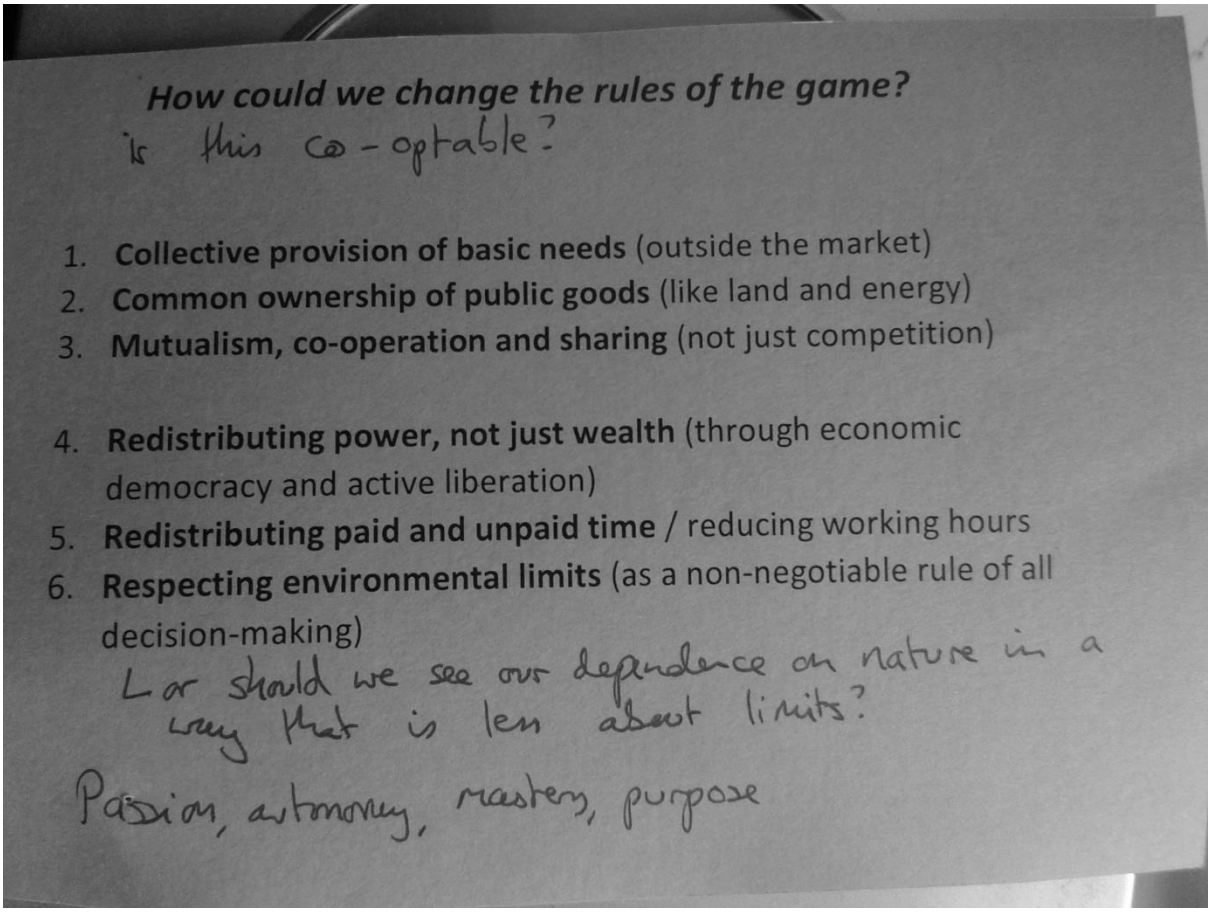


The workshop in Bristol additionally identified diversity, celebration, flourishing and international connection as values, and suggested reframing the value of respect for the environment to see humans as part of the environment, rather than separate, and to value our interdependence with other life forms.

How could we change the rules of the game?

The Common Agenda process identified the following ways of changing the 'rules of the game' in terms of how our economic system works:

1. Collective provision of basic needs (outside the market)
2. Common ownership of public goods (like land and energy)
3. Mutualism, cooperation and sharing (not just competition)
4. Redistributing power, not just wealth (through economic democracy and active liberation)
5. Redistributing paid and unpaid time /reducing working hours
6. Respecting environmental limits (as a non-negotiable rule of all decision-making)



The workshop in Bristol asked whether these 'rules' were framed in a way that was co-optable, whether we could see our dependence on nature in a way that was not framed in terms of limits, and addition of aims towards passion, autonomy, mastery and purpose.

Max-Neef's fundamental human needs

Max-Neef's fundamental human needs are a good reference point for what humans need.

1. Subsistence
2. Protection
3. Affection
4. Understanding
5. Participation
6. Leisure
7. Creation
8. Identity
9. Freedom