The Role of Social Enterprise in the Transition to a Low-Carbon Energy System

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Abstract

Socio-technical transitions have come to the forefront of academic debate on the challenges of developing a low-carbon economy. According to the transitions literature, addressing socio-ecological problems and underlying complexes of technologies and institutions requires novel approaches with a long-term orientation, as well as reflexive and adaptive policy design. Niche innovations play an important role in unearthing new solutions during the transition to a low-carbon energy system. In this context, the main aim of this investigation is to review the value of applying social enterprise in community owned energy schemes as a form of social innovation.

This thesis reports on original research undertaken on the Role of Social Enterprise in the Transition to a Low Carbon Energy System. Through an in-depth case study and policy analysis, extensive stakeholder engagement and interrogation of the characteristics of social enterprises across a range of contexts, the potential of social enterprise to act as local level social innovation niche is investigated. The research conducted provides insight into the holistic nature of energy focused social enterprises and explores the common barriers faced such as raising finance, project development and managing key stakeholders.

This investigation provides a business model perspective on the formulation of social enterprise within a socio-technical transitions conceptual framework. More broadly, the potential of social enterprises to act as 'transitions engines', by delivering a just community energy transition is investigated. The research has several important findings; 1) that social enterprises can increase democratisation in the energy system, 2) the premature withdrawal of protected space has hindered the growth of the community energy sector, and 3) the rapidly changing policy landscape has triggered innovation activity in the community energy sector. Social enterprises within a low carbon energy system are likely to remain at the niche level unless financially viable business models that can compete in the energy market can be identified and scaled-up.

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Chapter 1. Introduction

This thesis explores the role of social enterprises in the transition to a low-carbon energy regime. The research presented has been conducted across social enterprises in the UK. A pragmatist philosophical paradigm and mixed methods approach has been adopted. Three distinct but complimentary analyses are presented to address the main research question, presented in Section 1.4.

This project represents a key part of a wider research project on Sustainability Transitions by the Environmental Research Group at Liverpool John Moores University. The H2020 funded study titled ENTRUST investigates low-carbon transition processes and the human dimensions involved in the European energy systems. The ENTRUST project provides a comprehensive mapping of Europe's energy system (key actors and their intersections, technologies, markets, policies and innovations) and an in-depth understanding of how human behaviour around energy is shaped by both technological systems and socio-demographic factors (in particular gender, age and socio-economic status). New understandings of energy-related practices and an intersectional approach to the socio-demographic factors in energy use will be deployed to enhance stakeholder engagement in Europe's energy transition (ENTRUST, 2014). The research presented here is strongly influenced by a socio-technical transitions framework as a means of providing a more holistic approach to sustainable development.

1.1 Significance of the topic

The planetary boundaries relate to the ecological limits within which humanity is operating, they explicitly highlight that climate change is a major threat to the planet and any increase in temperature should be capped at 1.5°C to avoid irreversible and deleterious impacts (Rockström *et al.*, 2009; Steffen *et al.*, 2015). The main drivers for energy transition stem from the various global summits on climate change, the most recent and perhaps the most significant being COP21[1] which led to the Paris Agreement (United Nations, 2015a). The Paris Agreement makes global commitments to reduce carbon emissions in an attempt to avert runaway climate change and has been signed by 174 countries (UNCC, 2018). UK government data show that energy makes up 25% of UK carbon emissions, second only to transport at 26% (BEIS, 2018a). With pressing carbon reductions targets to be met, energy has become a key policy focus for the UK government to address (UNEP, 2017;BEIS, 2018a). The UK has a target to reduce CO_2 emissions 50% by 2025 and

[1] COP21 refers to the 2015 United Nations Conference on Climate Change

80% by 2050[2] (BEIS, 2018a). In addition to the UK's carbon reduction targets, the UN Sustainable Development Goals (SDGs) were developed in 2015 (United Nations, 2015b). The SDGs aim to address not only environmental concerns but also the growing levels of inequality which present a considerable challenge to sustainability goals (United Nations, 2015b).

Trying to incorporate political, environmental and social issues alongside the idea of economic growth creates complex problems. In relation to energy, these issues are often referred to as the energy trilemma. The energy trilemma frames energy issues, with a view to addressing the need for secure, affordable and renewable energy (Forman, 2017). Energy security relates to availability and access to natural resources for energy consumption (Forman, 2017). The evolution of the UK's energy system since 1700's has seen the rise and perpetuation of fossil fuels, the development of a centralised system and changes to key incumbents[3] (Dallamaggiore *et al.*, 2016; Kern and Rogge, 2016; Geels and Johnson, 2018). Throughout the UK's history there have been shifts in energy mix, flexibility and security of supply, renewable generation and emissions reduction targets (Dallamaggiore *et al.*, 2016)[4]. However, the UK has been dependent on imported fossil fuels in order for energy demands to be met (OFGEM, 2017). The reliance on other countries for imported fuel makes the UK vulnerable to insecure global supplies (BEIS, 2018b).

Affordability relates to the ability for householders and businesses to meet there energy costs (BEIS, 2018b). The renewable energy aspect of the energy trilemma relates to need to generate cleaner energy that supports the reduction of carbon emissions (BEIS, 2018b). Decentralised energy provides solutions to energy security that can be quickly deployed to help meet increasing energy demands (Tipper, 2013). Community energy, as a form of decentralised energy, is presented as a solution to affordability and renewable energy goals. Due to connections with the community and local knowledge, decentralised or local energy also has the potential benefits of 'greening' the energy system and tackling fuel poverty levels (Tipper, 2013; Regen SW, 2016). In a broad sense, decentralised energy refers to energy that is generated off the main grid and includes micro-renewables, heating and cooling systems (Regen SW, 2016). The UK government issued its community energy strategy in 2014, recognising the importance of decentralised solutions, one of them being community energy (DECC, 2014).

[2] Carbon emissions reductions are measured against a 1990 baseline
[3] Key incumbents in the energy system include; government, energy regulators, district network operators and dominant energy supply companies.
[4] A detailed profile of the UK's energy system can be found in Appendix 1.

When exploring the case of combined heat and power systems in Germany, Madlener & Schmid (2003) found that economic consideration alone did not explain the widespread diffusion of decentralised energy systems. Decentralised energy is considered as a way to liberalise the energy market through more democratic ownership and consideration of social justice issues (Madlener and Schmid, 2003).

Social justice issues concerning the energy system can relate to several issues. Social injustices that occur in relation to the energy systems include; regional inequalities, a lack of agency in decision making processes and the fuel poor being disproportionately disadvantaged by rising fuels costs creating more vulnerable household (Jenkins *et al.*, 2016). Prevalent energy justice issues in the UK include rising fuel costs, the growing number of households in fuel poverty and a top down system that creates energy consumers rather than energy citizens (Middlemiss, 2017). Communities that have no agency in the energy system are less likely to have their voices heard by policymakers (Newell and Mulvaney, 2013; Ottinger, 2013). However, bottom-up activism can play a crucial role in stimulating social and ecological change (Finley-Brook and Holloman, 2016).

Community Energy, as a method of decentralised energy generation, has the potential to address social justice and low-carbon energy issues as it utilises social enterprise business models (Seyfang and Haxeltine, 2012; Cieslik, 2016; Forman, 2017). A social enterprise by definition holds a more holistic position in relation to economic growth through the pursuit of economic, social and environmental objectives (Ridley-Duff and Bull, 2011). Managing these three different but interlinked objectives can be very challenging. Social enterprises lend themselves itself to more innovative approaches to solving complex problems such as those epitomised by the energy trilemma (van der Horst, 2008; Bull and Ridley-Duff, 2018; Ruggiero, Martiskainen and Onkila, 2018). To date there has been a dearth of research in to the business models behind community energy despite its prevalence in contemporary discussions on low-carbon energy transitions (discussed in more detail in Section 2.3).

1.2 Context of the research

The nature of the research topic highlights the need for an interdisciplinary approach. Therefore, several different bodies of academic literature have been considered to provide an adequate academic foundation for the thesis. This section taps in to the diverse bodies of literature reviewed to provide the conceptual background to the research project. The section is structured as follows; 1) sustainable development concepts, 2) community led sustainability, 3) socio-technical transitions and the energy system, 4) niche innovation and strategic niche management, 5) community energy

and, 6) the role of social enterprise. A comprehensive literature review provided in Chapter 2 provides deeper insights in to these specific subject areas.

Sustainable development concepts

Across the literature is it widely acknowledged that business as usual is not an option and current production and consumption patterns are unsustainable (United Nations, 1992; Jackson, 2007; Sen, 2013; Geels *et al.*, 2015). Sustainable development requires alternative business models that support economic, social and environmental outcomes (Solow, 1991; Elkington, 1999; Jackson, 2009). The Sustainable Development Goals (SDGs) highlight the need for more holistic approaches in order to achieve sustainability (United Nations, 2015b). The SDG's also recognise the need for local level solutions and raise the importance of communities in helping address sustainably problems (United Nations, 2015b). Sustainable development solutions are more socially desirable when at developed by communities instead of using top-down global interventions (Holden, Linnerud and Banister, 2014). According to Geels *et al.,* (2015) a whole systems approach to sustainable development and consumption is useful to understand the complex interactions that are at play during a transition to more sustainable regimes. These interactions need to be understood in order to overcome system 'lock-in' effectively (Geels *et al.*, 2015).

Community Led Sustainability

The importance of community led sustainability was a central message from local agenda 21, a key output of the Rio Earth Summit in 1992 (United Nations, 1992). According to Barrutia *et al.,* (2014) despite local agenda 21 helping raise awareness of local sustainable development solutions, a large implementation gap exists between what local councils want to achieve and what they have achieved (Douglas, 2014). Globally driven, community led sustainability initiatives have been adopted by local councils with mixed successes and often short-lived results (Barrutia *et al.*, 2014; Kveton *et al.*, 2014). It is thought that a lack of decision-making power and resource at a local level could be a reason for the varying degree of success (Stuart *et al.*, 2014).

The role of social capital is a key issue for community led sustainability initiatives (Damyanovic and Reinwald, 2014; Kveton *et al.*, 2014). Networking, autonomy versus collaboration and what constitutes a community are prevalent discussions pertaining to social capital in the community led initiative context (Franklin and Marsden, 2014; Kveton *et al.*, 2014; Stuart *et al.*, 2014). Networks are seen as valuable as they help to promote greater levels of stakeholder engagement (Damyanovic and Reinwald, 2014). From an interaction perspective, maintaining a balance between working with others whilst retaining a credible position is important (Franklin and Marsden, 2014). For example in the case of local activists, there is a dual need for them to remain autonomous from the state whilst

collaborating with them to effect change and reach consensus (Franklin and Marsden, 2014). The definition of what constitutes a community is often limited by the availability of funding. Funding for sustainability initiatives is often aimed at place-based communities as opposed to other types such as communities of interest or online (Aiken, 2014, 2015).

Research shows that more innovative strategies are developed when stakeholder engagement is employed (Peris *et al.*, 2013; Damyanovic and Reinwald, 2014). The notion that individuals and communities can provide solutions to global scale problems raises a key question; can individuals really take full responsibility for their own actions when they are locked in to a system (Maréchal, 2010)? Global progress towards sustainable development is still lacking (Martella and Smaczniak, 2013). By 2015 progress towards the millennium development goals, predecessor to the sustainable development goals, was uneven (United Nations, 2015c). Some countries were found to have achieved none of the goals set by the UN (2015c). The UN recognised the need for greater community involvement in the sustainable development goals (United Nations, 2015c). If community led development is to be an effective element of the sustainable development goals, better long-term planning and monitoring is required (Douglas, 2014).

Socio Technical Transitions and the Energy System

The framing of the energy system from a socio-technical transitions perspective highlights the complex nature of the energy system transition (Bulkeley, Castan Broto and Maassen, 2013; Healy and Barry, 2017; Geels *et al.*, 2018). The practicalities of the transitions are not as simple as just switching from one energy mix to another but involve a range of human interactions between technologies, markets, policies and innovations (Geels, 2002). There are many interconnected issues and a diverse range of stakeholders involved within the energy system that need to be considered (McLellan, Chapman and Aoki, 2016). According to Geels *et al,.* (2012; 2016) there is no single motivating factor that drives a transition.

Geels (2002) developed the multi-level perspective model as a framework for a whole systems approach (Figure 1.1). The MLP illustrates the role of and interactions between landscape, regime and niche level activities (Geels, 2002). It emphasises the importance of the niche-level, in particular niche-innovations, and the impact they have during a transition (Schot and Geels, 2008). Much analysis has been done utilising the MLP model which is broad in scope (Schot and Geels, 2008; Coenen, Benneworth and Truffer, 2012; Seyfang and Haxeltine, 2012; Whitmarsh, 2012; Crabbé *et al.*, 2013; Smith *et al.*, 2014; Slayton and Spinardi, 2016; Geels *et al.*, 2018).

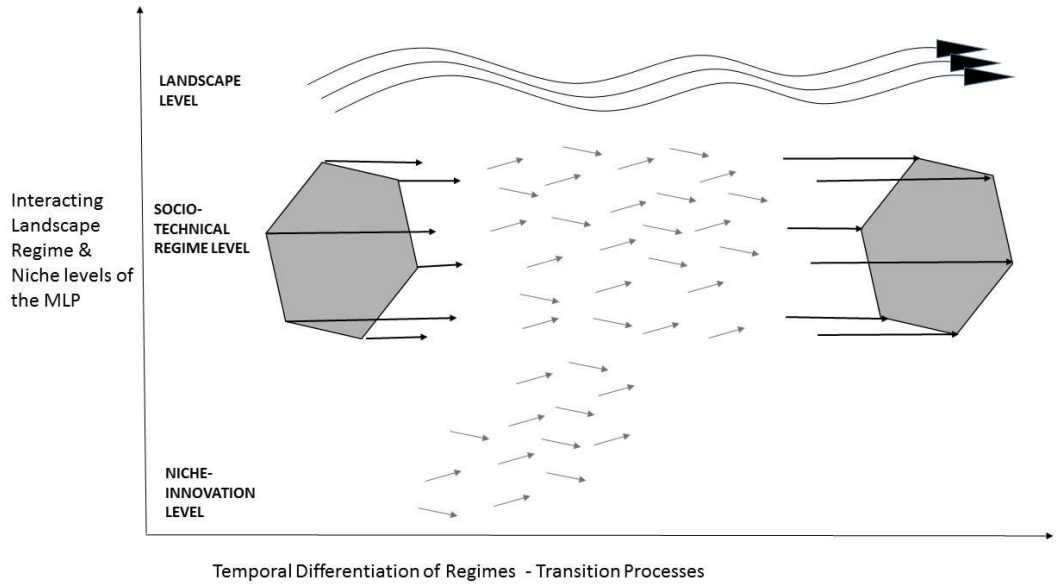


Figure 1.1: Geels Multi-Level Perspective Model (MLP)
(adapted from Schot & Geels, 2008)

Transition pathways and protected space for niche-innovation are elements of the MLP that are important to this research (Geels and Schot, 2007; Schot and Geels, 2008). The use of protected space literature allows focus to remain on the niche innovations during the investigation. Strategic Niche Management can provide policy implications to support the use of protected spaces, this is discussed in more detail later in the section (Truffer, Metzner and Hoogma, 2002). By also incorporating the transition pathways literature, the interactions between the niche level, regime actors and domains can be explored. These dynamics are vital as they can influence whether or not niche innovation can diffuse into the regime (Geels and Johnson, 2018). The exploration of transition pathways can also help to understand ways in which innovation diffusion in to the regime may occur (Geels and Schot, 2007).

Niche Innovation and Strategic Niche Management

The development of a niche-innovation is an important aspect which is underpinned by a key question posed by Schot & Geels (2008); is the niche sufficiently developed to exploit regime disruption? Geels & Kemp (2012) also highlight how innovations coming out of one sector can benefit other sectors. Despite these inroads in to the understanding on niche innovation, two key questions remain unanswered. How is new technology defined? How can communities and individuals engage with and accept new innovations?

The Strategic Niche Management (SNM) approach is rooted within the transitions literature (Schot and Geels, 2008). SNM is a framework focused on the development of niche-innovation through upscaling and diffusion (Mourik and Raven, 2006; Coenen, Raven and Verbong, 2010; Witkamp,

Raven and Royakkers, 2011; Ruggiero, Martiskainen and Onkila, 2018). Original thinking on SNM consisted of four key stages; 1) selection of experiment, 2) set-up of the experiment, 4) scaling up the experiment, and, 4) the breakdown of protection (Kemp, Schot and Hoogma, 1998). More recently three internal niche processes have been identified as playing a role within SNM; 1) voicing and shaping of expectations, 2) networking and, 3) learning (Mourik and Raven, 2006). In earlier literature SNM and niche-innovation were presented with a focus on technological innovations (Coenen, Raven and Verbong, 2010; Hermans *et al.*, 2013). More recently, attention has been brought to social innovation predominantly around community activism and grassroots movements (Seyfang and Longhurst, 2013).

The Role of Social Enterprise

In a broad sense, Ridley-Duff & Bull (2011) highlight three key characteristics related to social enterprises ; 1) ambition to create social innovations, 2) have a social mission, and 3) socialise ownership and control. Social enterprises often exist where there is a state failure to provide adequate welfare provision (Hopkins, 2010). Social enterprise offers an attractive win-win-win proposition which challenges business through offering a multiple-bottom line approach to enterprise (Elkington, 1999; Ridley-Duff and Bull, 2011). Despite this it should not be forgotten that sustainable consumption is the means and not the end goal (Sen, 2013). A global definition of social enterprise is lacking with a number of different variations existing in the UK alone (Thompson, 2008; Grassl, 2012; Birkhölzer, 2015; Brouard and Vieta, 2015). Throughout this research social enterprise will be considered as an organisation where most of the income is gained, or has the potential to be gained, through trade and which then uses the surplus to address a social or environmental need. The definition is based on the UK government definition (DTI, 2002) but includes the 'potential' element as an extension. Recognising the potential to become financial sustainable is an important extension as it allows for the differentiation between social enterprises and charitable organisations. It opens a new debate on the role of social enterprise and questions their role of purely sitting within the third sector. The issues in defining what a social enterprise is are discussed in more detail in Section 2.3.

Stakeholder engagement, social capital and networks are key topics across the literature on social enterprise (Coleman, 1990; Putnam, 2000; Sullivan, 2002; Porter and Kramer, 2011). Social enterprises often have a large amount of social capital through having well developed networks (Bull and Ridley-Duff, 2018). The social capital is often harnessed by sector specific networks to influence key policy and effect change (Phills and Denend, 2005; Thompson & Doherty, 2006). Social capital is a key aspect as it helps to create social cohesion and shared value, meaning that the work done by

social enterprises benefits both the social enterprise itself, through economic return, and the community which it serves through social and environmental impact (Porter and Kramer, 2011; OECD, 2012).

Social enterprise structures have been widely adopted across the community energy sector as they enable a more democratic approach (Abraham, 2017). Co-operatives are the most prevalent legal structure utilised by community energy organisations. Various forms of co-operative models have been adopted across a variety of countries (Yildiz *et al.*, 2015; Bauwens, Gotchev and Holstenkamp, 2016; Ruggiero, Martiskainen and Onkila, 2018). In the UK, community energy has shifted away from co-operative models to Community Benefit Societies following a change in regulatory body (Co-operatives UK, 2016). Community energy business models can vary, however across the literature the focus has been on community energy generation projects which will be discussed later in this section. This focus can be linked to a wider debate on decentralised energy and the democratisation of the energy system mentioned in Section 1.1.

Community Energy

Community energy can be applied as a broad term to describe community groups who are acting to solve both supply and demand side energy issues (Seyfang, Park and Smith, 2013). To date, a diverse range of fields and analytical frameworks have been applied to the context of community energy (Seyfang and Haxeltine, 2012; Hargreaves *et al.*, 2013; Hatzl *et al.*, 2016).

Stakeholder participation is a key element of community energy projects as it can support the development of low-carbon communities and foster community cohesion (Heiskanen *et al.*, 2010; Bauwens, Gotchev and Holstenkamp, 2016). In turn these links can potentially support behaviour change initiatives in relation to the reduction of energy consumption (Heiskanen *et al.*, 2010). Stakeholder participation has also been researched from the perspective of intermediaries in the community energy sector (Kivimaa, 2014; Seyfang *et al.*, 2014). The importance for collective action to effect change is reflected across the literature (Heiskanen *et al.*, 2010; Rogers *et al.*, 2012; Smith *et al.*, 2017).

Seyfang *et al.,* (2014) describe community energy as a social niche innovation through utilising strategic niche management principles. The principles used are the three SNM internal niche processes (Kemp *et al.,* 1998), and theory on the development phases of niche innovations (Geels and Deuten, 2006). Ruggiero, Martiskainen and Onkila (2018) have developed a typology of three types of community energy projects; cost reduction, technical expertise and system change. The typologies presented have been developed when exploring specific community energy projects as

opposed to the business models behind them. Exploring community energy as a niche innovation serves to understand how successful innovations may be scaled-up and diffused in to the regime. Across the literature on community energy there has been a prevalence of case studies that focus on individual projects or whole sector analysis (Seyfang, Park and Smith, 2013; Bauwens, Gotchev and Holstenkamp, 2016; Ruggiero, Martiskainen and Onkila, 2018). Few studies have placed the focused on the business models of community energy. The shift in focus to an organisational focus raises several new and underexplored questions; does our understanding of community energy change when organisations have multiple projects? Do existing definitions of community energy exclude more holistic approaches when renewable energy generation may not be a core aspect of the organisation, such as housing association generating renewable energy for its tenants? An organisational perspective can add value to existing frameworks on community energy and aid in the understanding of the phenomena. Understanding the business models utilised in the community energy sector is a central tenet of this research project.

1.3 Justification for the location of the study area

There are several reasons why it was preferable for this research to be conducted within the UK. Firstly, existing knowledge and connections in social enterprise sector with the UK was a key factor. The understanding of how social enterprises operate in the UK helped shape the research design. Secondly, there has been rapid growth in the community energy sector which resonated with the strategic niche management and niche innovations literature. Thirdly, during the early stages of the research project it became clear that UK community energy organisations were rapidly responding to national policy changes that posed a major threat to the future of the sector. The interaction between policy and the community energy sector resonated with the holistic, whole systems approach and the role of incumbents within the socio-technical transitions literature, in particularly the MLP model. The specific sampling strategies for each of the three studies have varied given the mixed-methods approach that has been employed. The different sampling techniques, boundaries and scope of the investigation and the individual studies are discussed in Section 3.2.

1.4 Research aim and questions

As discussed in Section 1.1, the main purpose of this thesis is to consider the role of social enterprise within the transition to a low-carbon energy system. The main aim of the research presented in this thesis is **to understand the potential for social enterprise to diffuse into a new low-carbon energy regime**. The research aim has been broken down in to three questions that will enable to the research aim to be met. The research questions that will be address through this thesis are;

1. Explore how community energy has responded to a rapidly changing energy system How has community energy responded to a rapidly changing energy system?

2. How viable is social enterprise as a business model within the energy sector in the UK?

3. Is it possible for social enterprise to become a niche innovation breakout and form part of the low-carbon energy regime in the UK?

The research questions stem from the literature review and are discussed in more detail on the theoretical framework presented in Section 2.4. The thesis is presented in the following structure;

Chapter 1 - Introduction provides the context and underlying rationale and aims for the research project.

Chapter 2 - A comprehensive literature review is presented. The literature review is then used to inform the theoretical framework and the four specific research questions to be addressed.

Chapter 3 – The philosophical position and methodological approach is discussed with this chapter. Specific details of the three studies conducted are given.

Chapters 4, 5 & 6 – The results for the three studies are presented in turn across these three chapters. A summary of the key findings is presented at the end of each of the chapters.

Chapter 7 – A syntheses and discussion of the results is presented. The synthesis is framed by the four specific research questions detailed in Chapter 2. The discussion centres on wider academic debate relevant to this research.

Chapter 8 – The conclusion provides a summary of the research project, the relevance within the literature and key areas for future research.

Chapter 2. Literature Review

In this literature review, firstly, an overview of the sustainability transitions literature will be presented with a specific focus on the energy sector. Secondly, focus will be placed on three key emerging themes that are relevant for this research; 1) niche innovation and strategic niche management, 2) community energy and business models, and 3) social justice and the role of social enterprise. These themes will then be applied to inform the development of the theoretical framework underpinning this research. The structure of the literature review is presented in Figure 2.1.

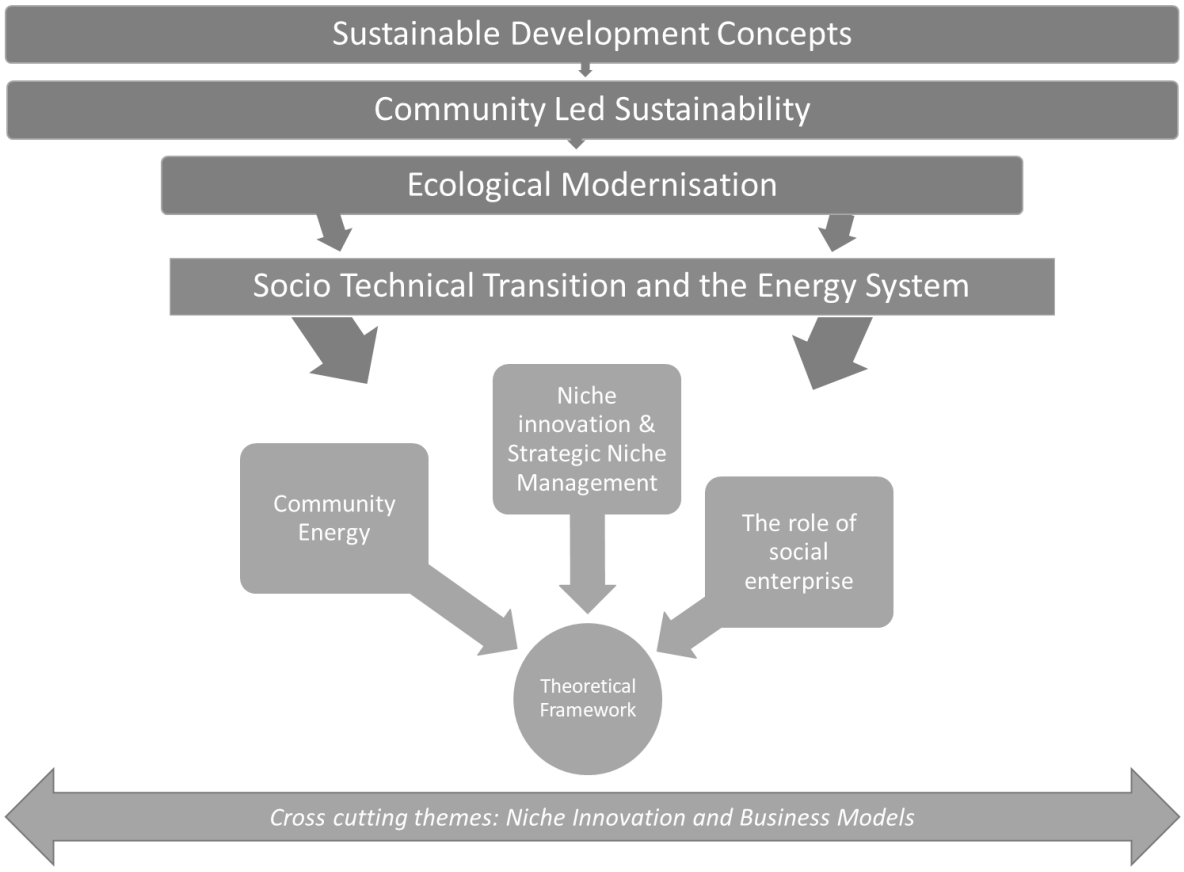


Figure 2.1: Literature review structure

The structure presented in Figure 2.1 has been developed following an extensive literature review of the social-technical transition literature and cognate fields. Although the discreet sections are presented here as distinct themes it should be noted that there are some cross-cutting ideas which are prevalent across the literature review such as niche level innovation, business models and social justice. This reflects both the interdisciplinary nature and more holistic approach to problem solving applied for this research, in keeping with contemporary multi-disciplinary and inter-disciplinary approaches in the social-technical transitions literature.

2.1 Sustainable Development Concepts

In order to provide context, it is important to understand what sustainability and sustainable development concepts are and how they differ. Sustainability can be framed as the balance between economic, social and environmental priorities to act in equal harmony (United Nations, 1992). Traditionally the focus of sustainability was on environmental issues but Faber *et al.* (2005) highlights that the emphasis of sustainability has shifted towards the inclusion of societal and economic perspectives. Sustainable development was defined in the Brundtland report by World Commission on Environment and Development (1987, p.43) as;

> *"Development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*

Despite this disagreement over the finer details, Brundtland's definition of sustainable development is still accepted and widely used today. Diesendorf (2000) considers that sustainable development is a pathway towards sustainability which in itself is the end point or the goal. Sachs (2015, p.12) frames the concept of sustainable development as;

> *"How we make the planet prosperous and fair as well as environmentally sustainable…there's the economic, social, political and environmental parts on this."*

This can be summed up through the idea of a 'good society', although the term itself is subjective it can be perceived as economic well-being, social inclusiveness, biodiversity, environmental sustainability and well-functioning governments (Sachs, 2015). The remainder of this section will explore the drivers for sustainable development, key issues around sustainable consumption and indicators of sustainable development. Community led and social sustainability and their interaction with economic and environmental goals will then be explored in more detail later in the chapter.

Steffen, Crutzen & McNeill (2007) found in their study that human activity is now the main driver for environmental change. Waters *et al.*, (2016) state that this period of human activity caused environmental change, more commonly referred to as the Anthropocene, started in the mid-20th century. The study presents an argument for 'the great acceleration' which started at the end of the Second World War and spanned a period which saw rapid growth in economies, the human population, industrialisation and urbanisation. Steffen *et al*., (2015a) highlight the rapid growth of the 'economic activity of the human enterprise' as a current socio-economic trend. Steffen, Crutzen & McNeill (2007) argue that over three quarters of CO_2 produced during this epoch has been since 1950 strengthening the case for the Anthropocene. Rockström *et al*., (2009) set out nine planetary

boundaries in an attempt to quantify the limits of planetary resources for continued human development. The planetary boundaries have since been updated by Steffen *et al.,* (2015b):

1. Climate change
2. Novel entities
3. Stratospheric ozone depletion
4. Atmospheric aerosol loading
5. Ocean Acidification
6. Biogeochemical flows: Nitrogen and Phosphorus
7. Freshwater use
8. Land-system change
9. Biodiversity integrity: Functional diversity and Genetic diversity

The limit identified for climate change would cap the associated global temperature rise at 2°C[5]. According to Rockström *et al.,* (2009) human related resource use has already exceeded planetary limits for climate change. In addition the limits for biogeochemical flows and biosphere integrity have been exceeded with the others not far behind (Steffen *et al.*, 2015b). The Living Planet Report by WWF (2014) states that unsustainable trends of consumption and a sole focus on economic growth has resulted in considerable damage to the planet, including impacts such as deforestation, water scarcity and food security. In the latest edition of this report WWF (2016) suggest that these issues are not only still prevalent but suggest they will be exacerbated by two current trends; firstly patterns of consumption and production remain unsustainable and secondly, economic and human population growth.

A foundational axiom of sustainable development is the idea of ecological carrying capacity, which is the maximum amount of a species that can be indefinitely sustained in a given environment (Arrow *et al.*, 1995). The Global Footprint Network (2015) highlights the problem of ecological overshoot by estimating that 'two planets' worth of resources, as measured by biocapacity[6], would be needed by 2030 to support humanity at its current levels of resource use. The primary message now forwarded by international organisations such as World Wide Fund for Nature (WWF), United Nations Environment Programme (UNEP) and the International Panel on Climate Change (IPCC) is that

[5] 2 degrees Celsius is the cap set out in the Copenhagen Accord at COP15. Although the more recent Paris Agreement from COP21 sets out that efforts to pursue a lower temperature increase of 1.5 degrees Celsius should be made

[6] Biocapacity measures the amount and productivity of cropland, grazing land, fishing grounds, forest and built-up land. Global hectares are utilised as a way to standardise the different types of land use and different biological productivity. For instance cropland is more biologically productive that pasture land (WWF, 2016)

business as usual is not an option. Elkington (1999) coined the term 'triple bottom line' as a way to highlight the need for businesses to shift away from a solely economic imperative and towards consideration for the depletion of natural resources and pressures on society. Solow (1991) emphasises the roles of economics within sustainable development through stating that environmental degradation should be thought of as an investment problem, in which we must use returns from the deployment of natural resources to create new opportunities of equal or greater value. For example, investing in renewable energy generation technology uses natural resources in the short-term but in the long-term those resources have long-term environmental benefits over fossil fuels.

Such a perspective raises important issues concerning economic markets and patterns of consumption which underpin the advanced economies of developed countries and increasingly the emerging economies of developing countries.

2.1.1 Differing perspectives on sustainable consumption and production

Local Agenda 21 addressed the needs to change unsustainable consumption and production and set out six activities to achieve this (United Nations, 1992); 1) encouraging greater efficiency in the use of energy and resources, 2) minimising the generation of wastes, 3) assisting individuals and households to make environmentally sound decisions, 4) exercising leadership through government purchasing, 5) moving towards environmentally sound pricing, and 6) reinforcing values that support sustainable consumption. Following the Oslo Roundtable for Sustainable Consumption and Production a working definition of sustainable consumption was produced (United Nations, 2015a, p.1);

> *"the use of goods and services that respond to basic needs and bring a better quality of life, while minimising the use of natural resources, toxic materials and emissions of waste pollutants over the life cycle, so as not to jeopardise the needs of future generations"*

Sustainable consumption and production play a key role within sustainable development. Sen (2013) argues that it is important to distinguish between sustainable development and sustainable consumption. The latter is a strategic concern around consumption habits and should supplement the former. Geels *et al*., (2015) states that traditionally there are two conflicting positions on sustainable consumption which are reformist and revolutionary. Reformist and revolutionary views can be mapped against "strong" or "weak" versions of sustainability respectively. A reformist view is where firms pursue eco-innovation or customers buy eco-efficient products and is closely aligned to the current western political and economic systems. A reformist view is rooted within the ideologies

of cost-benefit calculations and individuals as rational actors. The revolutionary approach critiques the mainstream and advocates the abolishment of capitalism. Geels *et al*., (2015) state that there are three strands to the revolutionary position; 1) structural changes to growth driven capitalist economies, 2) cultural shifts from conspicuous consumption to more 'meaningful' activities and 3) the refocus on grassroots innovation, decentralised production and local initiatives.

Jackson (2005), who holds a revolutionary position, highlights the important role of investment within the current economic system, to seek out novelty. He states that on an individual level tension exists between the need for novelty and the need for tradition whilst simultaneously, a second tension occurs between our needs for self-satisfying behaviour and altruistic behaviour. When these tensions are considered in conjunction with each other they can be used to represent key drivers of the current capitalist economic system, Figure 2.2.

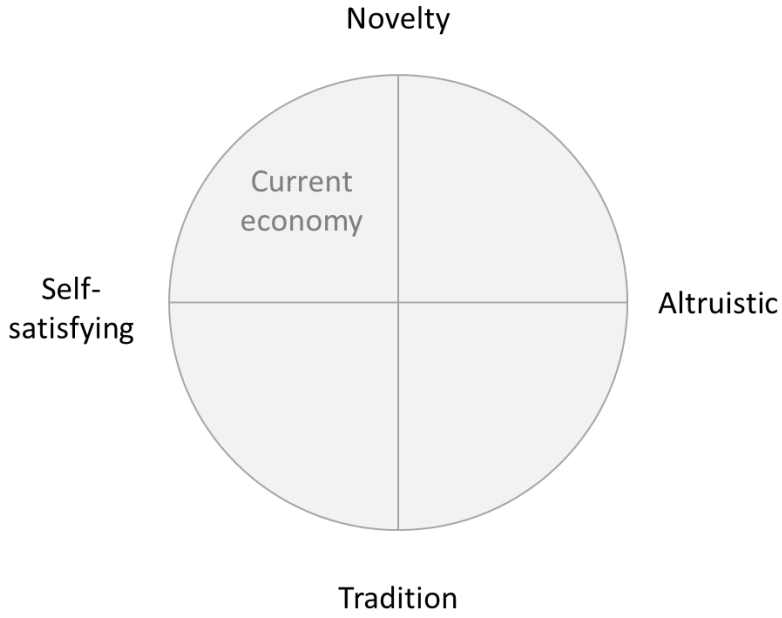


Figure 2.2: Jacksons view on individual's needs and behaviours
(developed from Jackson, 2009)

The model represents the idea that individuals need activity across all four quadrants to create meaning in their lives and demonstrates how the current economic system only satisfies one quadrant. Jackson (2009) states that for sustainable prosperity to occur the current economic model needs to be stretched to meet all four quadrants. Jackson suggests that a reorganising of firms will

be required and identifies social enterprises and B Corps[7] as a way to do this and achieve this concept of prosperity. These ideas will be further explored in Section 2.3.3 later in this chapter.

Geels *et al*., (2015) considers a third position in addition to diametrically opposing reformist and revolutionary views; this is reconfiguration. From this perspective, consumption and production are viewed from a socio-technical systems perspective which considers daily life practices and allows for the introduction of new conceptual frameworks. This new perspective refocuses the sustainable consumption and production debate on the idea that embedded rules, institutions, financial investments, policies and incumbent actors all work to stabilise the existing systems which make economic and consumption patterns difficult to change as they are locked in (Geels *et al.*, 2015). Despite their differing positions, Jackson (2009) demonstrates that the economy is held stable through economic growth which is stimulated through spending and borrowing rather than saving. This therefore converges with the reconfiguration view in relation to 'lock-in' that needs to be overcome were radical change to be realised. The socio-technical transitions literature and this 'lock-in' are important aspects of this research and will therefore be explored in Section 2.3 later in this chapter.

2.1.2 Measuring Sustainable Development

So far the idea of sustainable development presented has been relatively abstract and conceptual in relation to how it may actually be utilised for achieving sustainability (World Commission on Environment and Development, 1987; Faber *et al.*, 2005; Sen, 2013). Indicators are therefore key in order to monitor the progress and measure the success of sustainable development (Neumayer, 2004). There has been a shift in research agendas from theoretical to more applied sustainability studies (Meehan *et al*., 2006). Several practical approaches are evident in the literature. Holden, Linnerud & Banister (2014) suggest that in order for sustainability problems to be solved, countries should meet the threshold value for the following three dimensions; safeguarding long-term ecological sustainability, satisfying basic needs, promoting intra- and intergenerational equity. Pre-existing measures were suggested to benchmark progress towards the four dimensions. For example, the Gini coefficient which measures income distribution and inequality.

The Living Planet Report 2016 provides a practical approach to sustainability and breaks it down in to three key areas; ecosystems, healthy communities and food, water and energy (WWF, 2016). The report includes performance indicators, such as the living planet index and ecological and water

[7] B Corps are companies that trade for-profit and are certified by B Lab. In order to become certified the company has to meet rigorous standards in relation to social and environmental performance, accountability and transparency. Some well-known B Corps include; Ben & Jerry's, Etsy and Patagonia (B Lab, 2018).

footprints, designed to measure performance towards specific sustainability goals rather than shifts towards sustainability. These types of indicators are useful in determining how individuals, households or organisations can reduce their environmental impact. Strezov, Evans & Evans (2017) conducted a study on the effectiveness of nine commonly used sustainable development indices and found a key problem was that many indicators focused on one or two areas of sustainability. The study proposed a normalised average sustainability index (NASI) calculated as an average of all nine measures. The NASI scores were found to be more reflective of progress towards sustainable development when standardised against each other (Strezov, Evans and Evans, 2017).

The Report of the United Nations Conference on Sustainable Development[8] placed a new emphasis on the idea of transitioning to a green economy which is anticipated to provide a platform for sustainable development (United Nations, 2012). Since then the United Nations (2015b) have set out 17 'Sustainable Development Goals' (SDGs), shown in Figure 2.3, which specifically include affordable and clean energy and also communities. Some of the more holistic goals centre on the ideas of justice and equality.

Sustainable Development Goals	1. No Poverty	2. No Hunger	3. Good Health	4. Quality Education	5. Gender Equality
6. Clean Water and Sanitation	7. Renewable Energy	8. Good Jobs and Economic Growth	9. Innovation and Infrastructure	10. Reduced Inequalities	11. Sustainable Cities and Communities
12. Responsible Consumption	13. Climate Action	14. Life below Water	15. Life on Land	16. Peace and Justice	17. Partnerships for the Goals

Figure 2.3: United Nations Global Goals for Sustainable Development
(developed from United Nations, 2015)

The United Nations Development Programme (2017) issued a set of 232 indicators pertaining to the 17 development goals. The indicators were agreed upon by a working group made up of various UN departments and experts. In comparison to some of the indices mentioned earlier, it is important to highlight that the SGG indicators include reference to local and community dimensions (UNDP, 2017). According to Rourke (2017) the UK have collected initial data on 96 of the 232 indicators as of November 2017[9]. The practicalities of the sustainable development goals framework being adopted

[8] This was a key output from the Rio +20 summit
[9] This is 5 months since the formal adoption of the SDGs which was in July 2017

demonstrate that it will take some time before all the data will be collected and utilised as a benchmark for subsequent years. Given the recentness of these indicators it would be prudent to await developments within this field before commenting on their effectiveness. This is also an issue which goes beyond the scope of this research project.

2.1.3 Community Led Sustainability

Holden, Linnerud & Banister (2014) revisited the Brundtland report and stated that sustainable development has had more of an impact at a local or project level in enhancing the social desirability of solutions rather than at a global level. Therefore, this section will examine how community led sustainability has become increasingly prevalent and will review the most recent academic literature available to provide a description of current debate on the topic.

The narratives presented on community led sustainability are discussed from a starting point of the United Nations Conference on Environment and Development, also known as the Rio Summit, held in 1992. This was an unprecedented gathering of Governments who came together to discuss key environmental and development issues including; carbon emissions from transport and production, energy sources and use and water scarcity (United Nations, 1992).

Several documents came out of the Rio Summit. The most important one for the purpose of this discussion was entitled Agenda 21, which aimed to resolve global problems such as poverty, hunger, ill health and deteriorating ecosystems, and to create security for future generations (Martella & Smaczniak, 2013). More specifically Agenda 21 focused on combating poverty, the management and protection of natural resources and strengthening the role of major stakeholders such as NGO's, local authorities, communities, women and young people (Sitarz, 1993). In addition, it detailed the roles of international, nation and regional governing bodies in achieving sustainable development as agreed by the parties involved in the process (United Nations, 1992).

The part of Agenda 21 that is most relevant for this discussion is *'Chapter 28: Local Authorities' Initiative in Support of Agenda 21'.* This is now commonly referred to as Local Agenda 21 or LA21 (Brandt & Svendsen, 2013; Kveton *et al*., 2014; Peris *et al*., 2013; Wittmayer *et al*., 2015). Chapter 28 is relevant is because it was here that the parties involved in the Rio Summit recognised that many global environmental problems, such as increasing carbon emissions and pollution, originate at a local level and can also be solved at a local level. Therefore the United Nations (1992) set out 4 objectives for local councils;

- By 1993, the international community should have undertaken a consultative process aimed at increasing cooperation between local authorities
- By 1994, representatives of associations of cities and other local authorities should have increased levels of cooperation with a goal of exchanging information and expertise among local authorities
- By 1996, most local authorities in each country should have undertaken a consultative with populations and reached consensus on a Local Agenda 21 for the community
- All local authorities should be encouraged to implement and monitor programmes aimed at ensuring women and youth are represented in decision-making, planning and implementation

Following the Rio Summit, there was a greater global awareness of sustainable development and increased funding was made available to local projects. However, there remains an 'implementation gap' where little or no meaningful progress has been made towards the aims of Agenda 21. Although the Rio Summit had an impact, it has not been enough to create a change in overall global trends, including for example declining biocapacity (Martella & Smaczniak, 2013).

20 years following the Rio Summit, Rio +20 was held which reviewed Agenda 21 and acted as a basis to renew commitment towards the original goals set out in 1992. This has stimulated new research on the progress and effectiveness of initiatives since the Rio Summit. Barrutia *et al*. (2014) provided an analysis of the gap between the ideal LA21 models originally established and what had actually been achieved. Barrutia *et al*. (2014) found that local authorities now have a better understanding of sustainable development and of the means by which this should be implemented. Douglas (2014) agreed with this but also added that commitment to LA21 was linked to the attitude of local councils to sustainable development in the first instance. Even in cases when commitment to sustainable development is evident, impacts are frequently short-lived due to a lack of long-term planning and integrated thinking.

Barrutia *et al*. (2014) also found that LA21 stimulated activity in relation to stakeholder participation. However, they also found a lack of monitoring and long-term planning as well as limited stakeholder participation in decision making at local authority level. They concluded that this was caused by decreasing resources and a lack of decision-making powers at a local level. Stuart *et al*. (2014) found that a lack of power and performance indicators at a local level created limitations on what could be achieved. However, they also found that the use of an Integrated Sustainability Planning approach,

such as those applied in local government strategies in Canada, have successfully promoted community involvement, inclusive decision making and stewardship.

Kveton *et al*. (2014) conducted a study which compared areas where Local Agenda 21 had been implemented with those where it had not in the Czech Republic. They found that in municipalities that had created a local action plan under LA21, there were greater levels of stakeholder engagement and that the potential for creating social capital was much higher. In addition to this there was more focus on environmental concerns in strategic planning. Higher investment levels with well managed budgets were also evident (Kveton *et al*., 2014). As earlier highlighted, all these characteristics have an important role to play in sustainable development.

Damyanovic and Reinwald (2014) found that the level of social capital in an area directly contributes to the success or failure of sustainable development issues. Furthermore, networks that develop social capital are required at both micro and macro levels. When studying areas in Spain, Peris *et al.* (2013) discovered that utilising analytic network tools in the decision making process had a double impact in terms of stakeholder engagement; greater understanding of LA21 and its objectives and centralising stakeholder engagement are core to the planning of sustainable development initiatives. There is however some debate on local participation in sustainable development as Brandt and Svendsen (2013) found that the cost of consensus building with larger groups of stakeholders eventually starts to outweigh the benefits of stakeholder engagement in the first instance.

Franklin and Marsden (2014) looked at how community led initiatives could be better integrated within local government to strengthen social capital and create more innovative strategies for developing more 'sustainable places'. They found that there was a disconnect between what sustainability activists and local state actors were doing. Despite the disconnect creating potential issues, there is a need for community groups to retain the freedom of independence from local government (Franklin and Marsden, 2014). Activist groups need to be politically autonomous so they can challenge the existing systems and structures that they consider undemocratic. In this context, Franklin and Marsden (2014) state that a collaborative approach between activists and local government should be adopted. Douglas (2014) supports this idea of collaboration and suggests that multi-stakeholder advisory boards can be effective in problem solving on sustainability issues. Aiken (2014; 2015) found that localised sustainability is driven by the community however, funding often supports place-based communities. The Transitions Towns movement is an example of a community drive response to sustainability issues that is explored further.

2.1.4 Example of a community approach to sustainability – Transitions Towns

The Transition Towns movement started as a direct response to climate change, social justice and economic issues and aimed to help small local areas become more self-sufficient (Transition Network, 2016). The first initiative was based in Totnes in the UK and started in 2006. The founders of the movement created a set of principles, tools and values that underpin the work conducted. Since inception, The Transition Network has facilitated groups to establish in various locations and has spread internationally. The transitions network now consists of 26 national hubs and 929 registered initiatives (Transition Network, 2018). Some examples of initiatives that have come out of this grassroots movement are food growing, stimulating local business, local currencies and community energy. Stites (2013, p.19) provides an overview of the ideas behind Transition Towns and the scale of the movement in the following statement;

> *"Over the past decade, more than 1,000 municipalities in 43 countries have chosen to define themselves as "Transition Towns." Frustrated by the slow pace of change in response to challenges such as peak oil, climate change, and economic instability, people in these places have undertaken grassroots initiatives to build the resilience of their communities to survive sudden shortfalls of necessities such as food, oil, water, or money."*

Transition Towns is not without its critics through. Trainer (2015) acknowledges the movement's contributions to sustainability, but suggests that a large systematic change is required globally to develop sustainable communities. Trainer goes on to state that a localised approach to solve global issues is insufficient as many problems are linked to inherent features of Western culture, affluent lifestyles and the levels of consumption typical of North Americans and Europeans. The link between Local Agenda 21 and transitions is discussed by Wittmayer *et al.* (2015) who summarise that earlier efforts in sustainable development were focused on government but in recent years responsibility has been shifted to social entrepreneurs and citizens to solve these issues. This has been the case following the post-recession government cut backs and the austerity agenda across Northern and Western Europe (Wittmayer *et al.*, 2015). In contrast to Trainer (2015), Wittmayer *et al.,* (2015) argue that advancing the sustainable development agenda will come from individuals taking responsibility for their own actions across society. The question arises, can individuals meaningfully change their 'locked-in' behaviours within the current system. The perspective that Whittmayer *et al.* (2015) present is not universal. There is an increasing prevalence of arguments within the literature that a systematic societal change is required for any meaningful progress towards sustainability and that the responsibility of sustainable development does not belong to one group but to everyone.

There is a growing body of literature on the topic of behaviour change in the context of sustainability transitions which goes beyond the scope of this thesis (Shove & Walker, 2007; Shove & Walker, 2010; Steg & Vlek, 2009; Moloney *et al*., 2010; Lindén *et al*., 2006; Kok *et al*., 2011).

The development of community led sustainability has highlighted some interesting points that shall now be summarised. Since the Rio Summit in 1992 a global awareness of sustainable development along with the recognition that issues should be targeted at a local level. The creating of Agenda 21, and more specifically Local Agenda 21, has provided a useful tool for local governments and enabled a greater understanding of how to develop and implement action plans to work towards sustainable development goals. This can be seen in the widespread adoption of a holistic approach towards local action planning. Stakeholder engagement has also become more prevalent in decision-making at a local level which in some cases has had a double impact in terms of increasing understanding of sustainable development with stakeholders and creating more innovative strategies for addressing sustainability related issues.

2.2 Evolution of Sustainability – Ecological Modernisation

The concept of green growth and the need for economies to move towards recognising environmental imperatives can be linked to the ecological modernisation school of thought. Ecological modernisation underpins several prevalent ideologies that are utilised by policy makers and in practice such as corporate social responsibility, green growth and sustainable consumption (Geels *et al.*, 2015). These ideas have been addressed extensively by Jackson (2009) in the book 'Prosperity without growth' and by Elkington (1999) with the triple bottom line concept. These ideas are very much in line with the current sustainable development agenda and therefore are a central tenet to the philosophical persuasion of this thesis. This body of academic literature on ecological modernisation has gained much attention from scholars and policymakers over the last several decades. Gibbs (2017[10]) puts forward this definition of ecological modernisation (EM);

> *"An approach to addressing environmental problems that suggests ecological crisis can be resolved politically, economically, and technologically in the context of existing institutions and power structures and continued economic growth. Political institutions and processes can be modernized in order to change the direction of the economy toward environmental improvement."*

In EM, an emphasis is placed on the roles of technology, innovation, and market dynamics as drivers for change (Gibbs, 2017). Mol & Sonnenfeld (2000) also describe EM as an attempt to formulate

[10] Gibbs (2017) comes from an online encyclopaedia articles and therefore there is no page number attributed to this quote

general explanations of current transformations of environmental practices. EM is both a theory of, and a practical program for change. Mol & Sonnenfeld (2000) highlight the importance of EM in sustainability problem solving due to its more interdisciplinary, systems approach. EM was widely adopted by governments due to its unique aims to deliver a 'win-win' paradigm by creating economic growth and protecting the environment (Jänicke, 2008). Warner (2010) builds on the 'win-win' argument from a state perspective but states that EM supports more slow incremental changes as opposed to radical innovation. Hasan (2018) demonstrates the value of utilising EM alongside other theories in order to improve prospects for success application of solutions in addressing social changes at a global level. Despite incorporation into policies in several nation-states, EM has been criticized for its poor theorisation of the state and of power relations, as well as for its co-optation by vested interests.

EM has become a valuable frame of reference in analytical work surrounding society-environmental interaction. One main criticism of the approach is that the focus has remained on the role of the state and on organisations (Mol and Sonnenfeld, 2000). Blowers (1997) explores the differences between EM and risk society as opposing ideologies, the former focuses on transitioning to a new society whereas the latter towards more transformative change. The idea of a risk society was heavily informed by the work of Beck (1992) as a theory of social change. Beck (1992) highlights two central tenets of the risk society concept; 1) industrialisation has created irreversible ecological risks and progress can be made to mitigate these risks through the reorganisation of society, and 2) the reform of scientific and industrial[11] practices is required. The idea of a risk society is one where a society has organised itself in response to the risks that it faces (Giddens, 1999). EM and risk society are opposing concepts in how they suggest environmental problems are solved; either through distribution of the environmental and technological risk *(risk society)* or through correcting the environmental problems within current production and consumption models *(EM)* (Cohen, 1997).

Although in theory these two approaches are incompatible, in practice Thomas (1996) found that environmental organisations often utilise a combination of transformative and reformative approaches which can be categorised as; collaboration, confrontation, complementary and consciousness-raising. Cohen (1997) deepens this argument through the consideration that different society types may find themselves positioned as a risk society or transitioning through EM. Cohen (1997) also suggests that there may be a window of opportunity to move from a risk society to an EM one and vice versa. However, if this window of opportunity is missed then it could be very difficult for the pathway to be altered. There has been little advancement on the thinking around

[11] This notion is now more commonly referred to as reflexive modernisation

utilising EM and risk society in conjunction with each other since Cohen (1997). However, Hasan (2018) states there is still value in this work and posits a new perspective through the introduction of "double risk" societies. A double risk society is one which is exposed to all the risks of industrialisation before they have industrialised themselves, therefore it accounts for developing countries which have arguably been neglected in previous research (Hasan, 2018).

Adua, York and Schuelke-Leech (2016) studied state supported environmental innovations in the United States and found evidence of examples where firm and state supported innovations produced more CO_2 emissions than the technologies they were aiming to replace. However, evidence was also found to support the case that technological innovations can reduce environmental impact but the results of technological innovation alone were modest (Adua, York and Schuelke-Leech, 2016). This highlights the need for broadening the scope of EM to include more extensive consideration of human dimensions. Mol & Spaargaren (2000) identified five core themes across the various strands of research into EM at the time; the changing role of science and technology, the increasing importance of market dynamics and economic agents, transformations in the role of the nation-state, modifications in the position, role and ideology of social movements and changing discursive practices and emerging new ideologies. This is reiterated by Mol & Sonnenfeld (2000) who state that the debate on EM theory has been diverse and has developed over time with the focus shifting from technological innovation to the role of markets. Huber (2008) explored the global diffusion of environmental innovation and found that stringent regulation was the most important pre-condition that enabled innovation. A second key finding was that pioneering countries are more likely to lead the way on environmental innovation than global environmental regimes. This is due to the influence of technological innovation and environmental policy happening at a national scale and often within key domestic markets.

The recognition of the importance of human dimensions has led to a much broader perspective of EM recognising the importance of the state and more recently included studies on transformation of consumption and global processes (Cohen, 1997). The relationship between social capital and societal transformation is something that has also been acknowledged as requiring additional empirical attention (Cohen, 1997). Despite the emerging trends, EM as a concept prevalently focuses mainly on policy changes, organisational structure and industrial protection whilst neglecting to consider individual interactions within the system (Adua, York and Schuelke-Leech, 2016). In the case of the agri-food system in Brazil, Africa and China it was found that EM can significantly contribute to solving environmental issues within the agri-food regime if a more holistic approach is fostered including the participation of the farmers and consumers (Horlings and Marsden, 2011).

From a social sustainability perspective, historically there has been a dearth of research into social inequality and political landscapes relating to EM (Blowers, 1997). Jänicke (2008) highlights the limitations with EM. He suggests that due to its innovation-based nature, the use of this framework should be so supported by other literature such as transitions management or ecological structural policy. Hovardas (2016) also looked at EM as a paradox and stated that if a capitalist mode of production is utilised to address the ecological crisis then there will be demand for additional production which could in turn create a new ecological crisis. However, Hovardas' argument is primarily focused on state-led regulation alone to address the crisis. Lemprière (2016) explored the interaction between regulation and firms in the case of the zero-carbon homes agenda in the UK. The study found that the zero-carbon home policy was undermined by several factors; change in government, the 2008 financial crisis and the housing shortage coming on to the political agenda. Lemprière (2016) concludes that the economic framing of sustainability issues in this case meant that the zero-carbon homes agenda became a burden that shifted back and forth between the state and private sector organisations.

2.2.1 Ecological modernisation and renewable energy

In relation to renewable energy Toke (2011a) suggests that EM does not fit with the nature of the energy system and suggests that the future success of renewable technologies is dependent on bottom-up pressures or social movements. Toke calls this approach 'identity ecological modernisation'. This approach deviates from the more innovation-driven or environmental policy led variants of EM (Simonis, 2012). Toke (2011b) found that across Europe, grassroots movements have been influential in getting renewable technologies onto the agenda of key incumbents and policymakers.

When the focus is on capitalist values and scientific knowledge, the voice of citizens is often outweighed by the 'experts' according to (Rajkobal, 2014). Hillebrand (2013) explored this specifically in relation to Germany's EM policies which have largely centred on two main ambitions; 1) To address energy security and climate protection through the use of renewable energy and energy efficiency, 2) To phase out hard coal subsidies and nuclear power. However, a third critical goal is ensuring that the economic argument motivates companies which is where tension has occurred between organisations and the state due to the costs involved in such a radical transformation (Hillebrand, 2013).

Rajkobal (2014) looked specifically at the role of citizen engagement in EM and found that whilst some theorists promote engagement activity within the decision-making process others gave prominence to the state, science and technology. This disconnect within the academic discourse

makes EM difficult to be utilised as a framework in practice. Toke (2011a) sets out five characteristics of energy systems that can be utilised as a framework for analysis of energy programmes stemming from 'identity EM'; 1) idealism in the technological innovation process, 2) a dedicated financial support mechanism, 3) independent trade associations representing main technologies, 4) coalitions between renewable trade groups and environmentalists, and 5) deployment of renewables by companies that are independent of the main energy corporations.

A key finding of this literature review is that traditional approaches towards ecological modernisation have focused too much on incumbent led solutions to environmental issues. However, EM has served to increase understanding on the interaction between firms and the state along with highlighting the important role that innovation plays. A broadening of scope on what constitutes an innovation is evident, with the shift from purely technological innovations towards organisational structure and policy innovations. However, there is a need for EM to include social issues and for interactions to include the human dimensions in more meaningful ways. It has been suggested that a way of achieving this is through policymakers utilising EM alongside other approaches rather than in isolation. Within the renewable energy sector specifically the role of grassroots movement is of interest due to community participation and the success in bringing the attention to renewable energy at a regime level. In summary this review highlights the need for EM approaches on consumption and production to promote the role of the citizen and to have a multiple bottom line objective to address issues surrounding the energy trilemma effectively.

2.3 Socio-technical Transitions

Major technological transformations in societal functions, such as transportation, communication, housing and energy systems, can be categorised as socio-technical transitions (STT) (Geels, 2002). This approach towards sustainable development is broader than previous policy management efforts to shift the paradigm of economic and social systems (Geels, 2012). Korhonen (2007) suggests that previous attempts to shift the economic and social systems failed due to a lack of direction, vision and overall goal. The interdisciplinary nature of the transitions literature is noteworthy. Sovacool and Hess (2017) conducted an in-depth study and identified over 96 theories and conceptual approaches from across 22 different disciplines related to socio-technical transitions, with diverse and varied methodological approaches and frameworks. This methodological diversity is a defining feature and challenge of transitions approaches.

STT is a hybrid theoretical framework bridging science and technology studies and evolutionary economics, drawing extensively on institutional analysis as a middle ground spanning these traditions (Coenen *et al.*, 2012). The broader focus adopted within STT has demonstrated that social

and technological practice are linked rather than the focus being on one or the other (Smith *et al.*, 2005). Farla *et al.*(2012) state that a general feature of transitions is that sustainability is framed from a systems perspective. Also critical to the development of STT theory are the concepts of technical regimes and the idea of technological paradigms and technological trajectories (Dosi, 1982). Rip and Kemp (1998) developed these concepts of STT and looked at encouraging experimentation and innovation through the use of evolutionary niches.

Kern (2012) states that within the socio-technical transitions literature, scholars have explored ways through which relatively stable configurations of technologies, infrastructures, social practices, institutions and markets can change to provide societal functions such as energy provision, transport and nutritional supply in a more sustainable way. Since the late 1990's a significant body of literature has emerged, highlighting the need for a longer term approach to sustainability (Geels 2002; Kemp 1994; Schot & Geels, 2007). With these ideas in mind it is posited that an energy systems transition, the subject of this research, can be classed as a social-technical transition. Energy systems transition refers to a switch 'from an economic system dependent on one or a series of energy sources and technologies to another' (Crabbé *et al.*, 2013). In a real world context, it is commonly accepted that the current transition required is to a low-carbon energy system to address issues of climate change and rising human consumption rates (Meadowcroft, 2009; Solomon & Krishna, 2011). In relation to the current energy system transition Meadowcroft (2009, p.343) emphasises that;

> *"The irreducibly political character of governance for sustainable development, and suggests that the long-term transformation of energy systems will prove to be a messy, conflictual, and highly disjointed process"*

The switch to more sustainable energy systems is not only pressing as a direct response to climate change but also due to the rapid depletion of fossil fuels. Solomon & Krishna (2011) state that a global consensus is still lacking and is needed along with government support for R&D and mandates to transition to sustainable energy. The solution for a global sustainable energy supply consists of a combination of cleaner generation, demand reduction and system optimisation. These changes need to happen simultaneously in order to accelerate the transition (Solomon & Krishna, 2011).

Across the transitions literature, a range of approaches have emerged and Markard, Raven, & Truffer (2012) provide an overview of these, distinguishing between transition management, technological innovation systems, strategic niche management and the multi-level perspective (MLP). Further details on these and other transitions approaches can be found in the review paper by Lachman (2013).

Specifically of interest is the MLP which itself has become a frequently utilised model across transitions literature (Coenen *et al.*, 2012; Crabbé *et al.*, 2013; Kern, 2012a; Schot & Geels, 2008; Seyfang & Haxeltine, 2012). The MLP distinguishes three levels of heuristic, analytical concepts, which combine as a nested hierarchy to create a socio-technical system: landscape, regime, and niches (Crabbé *et al.*, 2013). A central tenet in MLP is the stabilising influence of a socio-technical regime, defined as "the coherent complex of scientific knowledge, engineering practices, production process technologies, product characteristics, skills and procedures, established user needs, regulatory requirements, institutions and infrastructures" (Geels, 2002).

The MLP acts as a whole systems approach to transitions as is shown in Figure 2.4. The MLP posits that transitions come about through interactions between processes at three levels: 1) niche-innovations afford space for new ideas to be tested and developed[12]; 2) changes at the landscape level create pressure on the regime; and 3) destabilisation of the regime creates windows of opportunity for niche innovations to emerge.

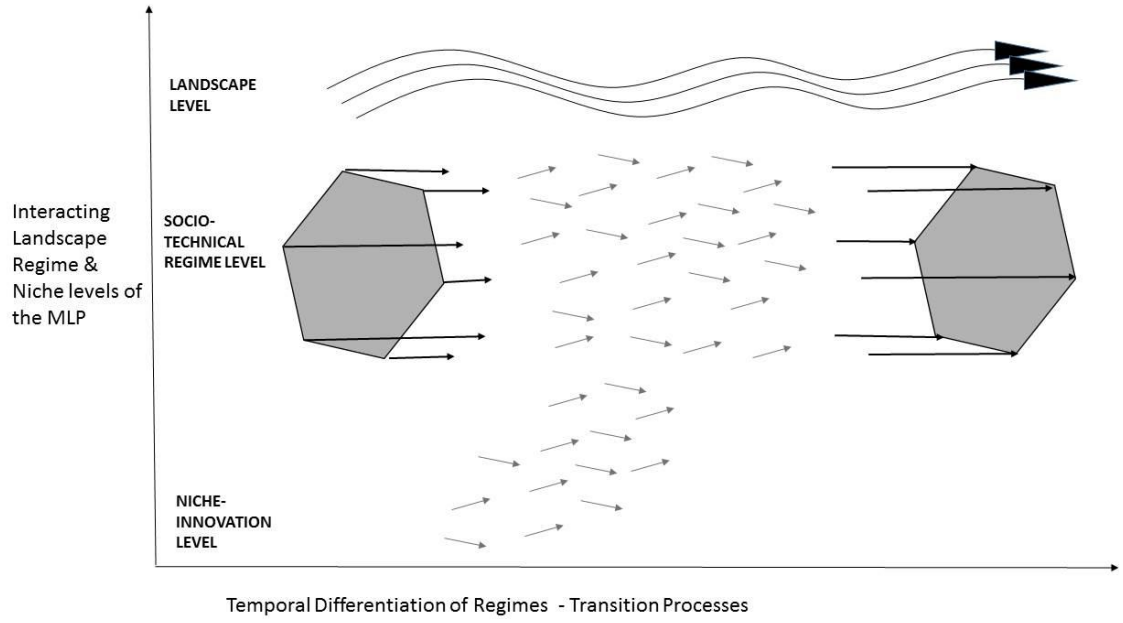


Figure 2.4: Geels Multi-Level Perspective Model (MLP)
(adapted from Schot & Geels, 2008)

According to Geels & Schot (2007), the niche level is particularly important, as this level provides a space for experimentation with new technologies, ideas and approaches that could potentially feed

[12] Niches of innovation offer opportunities to experiment with new practices, technologies and organizational models, with subsequent potential for wider social transformation, should these niche innovations be suitable for wider uptake and diffusion (Geels, 2002; Geels and Schot, 2007; Seyfang and Smith, 2007; Seyfang, 2010).

in to mainstream 'regime' level. At the niche level of the MLP Geels (2002) explores the idea of 'niche innovations' which are considered as radical forms of innovations with may challenge the existing regime. Early thinking on niche-innovations was restricted within the confines of a technological niche (Geels, 2002). However, over time the definition of niche innovations has evolved with many papers exploring the idea of social innovation (Witkamp, Raven and Royakkers, 2011; Seyfang and Haxeltine, 2012; Feola and Nunes, 2014; Van Der Schoor *et al.*, 2016). Schot (1998) stated that these radical innovations are protected from normal market conditions at the niche allowing for an 'incubation space'. Breakout of niches into the regime can then occur through 'niche-cumulation' (Geels, 2002). This idea of a niche-innovations and protected space is an issue that has been explored extensively throughout the STT literature and underpinned several new theoretical frameworks such as transitions management and strategic niche management (Truffer, Metzner and Hoogma, 2002; Schot and Geels, 2008; Raven, Bosch and Weterings, 2010; Witkamp, Raven and Royakkers, 2011; Kivimaa and Kern, 2016). Niches play a crucial role within this research and therefore more attention will be given to types of niches and niche management in Section 2.3.1.

The MLP can be further differentiated by distinguishing six patterns and mechanisms, which add depth to the model; these are transition pathways, add-on hybridisation pattern, knock-on effects and innovation cascades, fit-stretch patterns, hype disappointment cycles and niche-accumulation patterns (Geels, 2005), detailed in Table 2.1. Of particular interest is the idea of innovation cascades where innovations may happen because of a number of 'innovators' coming together and finding a configuration that works. Geels & Kemp (2012) also highlight how innovations coming out of one sector can benefit other sectors. Niche-accumulation patterns are also of relevance to this research as they relate to the 'up-scaling' or niche development through the creation of local niches and then global niches, which have shared visions, values and rules. The role of niche innovations has become a fundamental conceptual construct of STT theory as, depending on timing and quality of different niche-regime-landscape interactions across the system, transitions can evolve following different types of transition pathways (Geels, 2002; Kemp, 1994; Rip & Kemp, 1998).

Table 2.1: Multi-Level Perspective Patterns and Mechanisms

Mechanism/ Pattern	Description
Transition pathways	Sets out different patterns of change that can occur within the regime during a transition. This explores in more detail the relationships between the 3 levels; landscape, regime and niche (Geels and Schot, 2007).
Add-on and hybridisation pattern	The niche breakthrough to the regime occurs through innovations linking up with established technologies and create symbiosis. Rather than directly competing with then they often use this relationship to help solve development problems or reduce bottlenecks (Geels, 2005).
Knock-on effects and innovation cascades	Niche innovations are adopted by the regime for certain reasons. Following this learning processes and improvements trigger further adjustment within other system components (Geels, 2005).
Fit-stretch patterns	A pattern followed in the co-evolution between technical form and social function. In the early stages the technology will fit closely with the existing regime. The advancements made in the technology led to new user experience. Following the wide diffusion of this the regime adapts to the innovations new form (Geels, 2005).
Hype-disappointment cycles	This specifically relates to the diffusions of niche innovations where the hype influences the demand side. This hype can trigger the take-off of a niche innovation. However, disappointment can occur if expectations are hyped too much. For example, innovations can crash the market due to being over-produced and then innovations are sold below market price (Geels, 2005).
Niche-accumulation patterns	The pattern by which niche innovations can diffuse into the regime. This is where niche innovations can branch out or penetrate the regime in respect of a specific domain such as market or technology. The innovation is subsequently adopted by the other domains to become part of the regime. (Geels, 2005).

Transition pathways were explored by Geels (2005) who found that there are five main ways in which a regime can transition; reproduction process, transformation path, de-alignment and re-alignment path, technological substitution and reconfiguration. In addition to this Geels & Schot (2007) also argue that transition can happen in a sequential transition pathway whereby the pathway does not remain static over the period of the transition. This sequential pathway would occur in the following order; transformation, reconfiguration, then substitution or re-alignment. The transition pathway that occurs is linked to how well-developed niche innovations are, or, how well placed they are to take advantage of disruptions across the regime and provide an adequate

replacement or solution. Table 2.2 shows the potential pathways developed by Geels and Schot (2007) that demonstrate that pathway it determined by two factors; 1) the development stage of the niche innovation, and 2) the interactions between the landscape, regime and niche level.

Table 2.2: Transitions pathway possibilities

Pathway	Is the niche innovation	Nature of interaction between the 3 levels
Reproduction process	Niche innovations may or may not be	Landscape is stable and reinforces the regime
Transformation path	Not sufficiently developed	Moderate landscape pressure causing disruptive change to the regime
De-alignment and re-alignment path	Not sufficiently developed	Landscape change is divergent, large and sudden.
Technological substitution	Niche innovation is sufficiently developed	Landscape change is disruptive – this could be due to a 'specific shock' or 'avalanche' change
Reconfiguration	Niches are sufficiently developed	Niche innovations are symbiotic with the regime
Sequential transitions pathways*:* Transformation, Reconfiguration, then Substitution *or* Re-alignment	Niche innovations may or may not be sufficiently developed	Slow disruptive landscape change perceived by regime actors as moderate. The disruption increased over time as pressure on the regime increases.

Geels & Schot (2007) added two further scenarios; one being a control where there are no landscape pressures and therefore the regime remains stable and replicates itself. The final scenario, reconfiguration, represents a specific sequence where a transition starts on one pathway and shifts through the others. The transition pathway will be determined based on variations of two factors; 1) is the niche developed? 2) How does the niche interact with the landscape developments and the regime? In terms of the first factor, is the niche developed? Geels & Schot (2007) set out four proxies to assess the development of the niche;

- Learning processes have stabilised in a dominant design
- Powerful actors have joined the support network
- Price/performance improvements have improved and there are strong expectations of further improvement (e.g. learning curves)
- The innovation is used in market niches, which cumulatively amount to more than 5% market share.

The second factor is whether niche innovations and landscape developments have a disruptive or reinforcing effect on the regimes and the type of relationship the niche innovation has with the regime. Geels & Schot (2007) state that this can either be symbiotic or competitive.

The roles of a variety of different actors across the system have therefore started to emerge as a key theme in the literature with a number of studies conducted on users (Schot, Kanger and Verbong, 2016), incumbents (Geels and Kemp, 2012), government (Raven *et al.*, 2016) and more recently intermediaries (Kivimaa, 2014). The relationship level of collaboration between different actors plays a crucial role as to the pathway a transition will take. In particular in the case of government-affiliated intermediaries, findings suggest that this group have the potential to have either a reinforcing or a destabilising effect on the regime and incumbent actors (Kivimaa, 2014).

2.3.1 Niche Innovation & Strategic Niche Management

Innovation issues are often explored across the STT literature with a common theme being on the upscaling and diffusion of niche innovations to the regime (Coenen, Raven and Verbong, 2010; Naber *et al.*, 2017; Geels and Johnson, 2018). In their research Smith, Voß and Grin (2010, p.441) state;

> *"Niches that provided seeds for transition historically had to overcome the constraining influence of regimes, branch out, link up with wider change process, and drive transformations in those same regime structures over the long-term. Many niches are not successful at expanding, or even surviving for a long-time"*

Following on from this they pose the following two questions, 1) How do practices replicate, scale-up or translate into other contexts of application? 2) How does the niche perform as a political actor?

Niches can be defined as a series of ground up experiments, which emerge and develop in a protected space which affords given niches enough opportunity to develop. In terms of directing change, Raven *et al.* (2010) state that experimental niches are to be used to guide social change and to develop more forward thinking research and practical advice. Protected space allows emerging niches sufficient support so that they are able to compete with the status quo of the regime (Temmes *et al.*, 2013). The change induced by niche innovations breaking through into the regime can be trigged through several mechanisms, described in the transitions literature (Geels & Schot, 2007). Geels *et al.*, (2007, 2016) provides different scenarios in which transitions can happen, referred to as transition pathways as discussed earlier (transformation path, de-alignment and re-alignment path, technological substitution and reconfiguration). This is an important consideration when exploring niches as they have an impact in determining which transition pathway will occur.

The questions posited by Geels *et al.*, (2007) in relation to the niche involvement in a transitions pathway are based on variations of two factors; 1) Is the niche developed? 2) How does the niche interact with landscape developments and the regime?

The common consensus is that being sufficiently developed alone does not determine success for emerging niches. Other factors such as timing, the opportune emergence of openings for niches and key actor support are also of critical importance (Geels & Schot, 2007).

Strategic Niche Management is concerned with the development of niche innovation and therefore seeks to explore how niches are best supported and can develop enough to become an embedded part of the regime in transition (Temmes *et al.*, 2013). Schot, *et al.* (1996) define strategic niche management as learning about niches and developing the application rate of technologies through the creation, development and controlled phase out of protected spaces.

Kemp, *et al.* (1998) developed this further by stating that niches are formed through the following three steps; aligning expectations, learning through sharing information and lessons learnt and forming networks. With this in mind, SNM should be viewed as a tool for transition with the purpose of allowing experimentation of options as well as assisting niche innovations to become embedded within the regime (Kemp, Schot and Hoogma, 1998). For this, Kemp *et al.* (1998) describe 4 stages of SNM which distinguish this transitions approach as a tool specifically for regime transition rather than simply a strategy to introduce a new innovation to an existing market; 1) The selection of an experiment; 2) The set-up of the experiment, 3) Scaling up the experiment, 4) The breakdown of protection.

Consideration should also be given to the literature on alternative approaches to SNM. One such example of this is Transitions Management (TM) which according to Raven *et al*. (2010) traditionally centres on four main activity clusters; 1) Structuring the problem in question and establishing and organisation a multi-actor network, 2) Developing a sustainability vision, transition agenda and driving the necessary transition paths, 3) Mobilising actors and establishing and executing transition experiments and 4) Monitoring, evaluating and learning.

Raven *et al.* (2010) argue that Transitions Management is more of a strategy development tool for transitions and differs from SNM which is often very technical in nature. In contrast to TM, there is a greater need for SNM to be tested in a wider range of scenarios to develop the tool further (Raven, Bosch and Weterings, 2010). This need for testing of SNM on a wide range of scenarios is also mentioned by Truffer *et al*. (2002). The development of transitions tools such as TM and SNM across the literature has focused on the need for the growing body of knowledge on transitions theory to

be transposed to a form that can be utilised by practitioners (Raven *et al.* 2010; Mourik & Raven 2006). However, to date there has been a reliance on historical case studies across the literature (Smith, *et al*. 2014; Mourik & Raven 2006; Raven, *et al*. 2010), an overview is given in Table 2.3.

Table 2.3: Studies of Innovation Niches

Researchers	Studies of Innovation Niches	Type of innovation	Date of study
Laak, Raven & Verbong (2007)	3 case studies on biofuels in the Netherlands; Solar Oil Systems, Biofuel boats and vehicles in Friesland, OPEK	Technological artefacts	2002 – 2005, 1990's – 2003, 2003-2004
Hermans *et al.* (2013)	Agricultural networks in the Netherlands	Technological artefacts	1992 - 2010
Seyfang & Longhurst (2013)	Community currency developments over 30 - 40 years	Civil society and economical	1973 – 2007
Smith *et al.* (2014)	Solar photovoltaic in the UK	Technological artefact	1970's - 2010
Sushandoyo & Magnusson (2014)	The use of field testing in hybrid-electric vehicles	Technological artefact	2009 - 2010
Temmes *et al.* (2013)	Electric vehicles in Finland	Technological artefact	2009 - 2013

Mourik & Raven (2006) acknowledge that there is a need for more of a practitioner focus and set out three inter-related internal niche processes that contribute to the success or failure of a niche; the voicing and shaping of expectations, networking and learning. In their work, they also establish a plethora of research questions[13] which require further exploration to develop practitioner guidance through knowledge creation. This work has been continued by Raven *et al.* (2010) through the development of a strategic niche management toolkit, whereby three discreet competence layers enable practitioners to adopt a flexible approach in application of SNM; a practical layer, an illustrative layer and a theoretical layer.

Truffer, *et al.* (2002) investigate the testing of innovations and how to predict the means through which innovations may become embedded within the regime. Truffer, *et al.* suggest that societal embedding can be viewed as three interlinked processes; network management, infrastructure, matching and expectation building. This redefining of the original three SNM processes (expectation alignment, learning and networking) allows space for exploration of the means through which influences external to the niche and protected space can be incorporated within a SNM framework.

[13] Mourik & Raven (2006) present 46 research questions which cover several key aspects of the literature; Differentiating between projects and niches, the creation of niches, articulating and shaping expectations, dealing with networking and learning processes and niche protection.

Intermediaries are another external influence that are often discussed in the literature as an important aspect which can help to connect the niche with the regime and can help to empower niches (Bush, *et al*. 2017; Hermans, *et al*. 2013; Temmes, *et al*. 2013). Other external factors such as political changes and research projects can also play either nurturing and damaging influences on the testing of niche innovation (Smith, *et al*. 2014). The protected space, and therefore the niche, can be influenced by powerful actors and the conditions they set such as funding requirements, regulation or terms for collaboration (Hermans, *et al*. 2013).

The literature also examines the specifics of niche formation; managing expectations, learning and networking. Hermans, *et al*. (2013) investigated networks across niches in agriculture over a 15 year period and found that an erosion of trust can occur when there is a lack of consensus and the visions of the niche become fragmented. Another consideration is the credibility of actors across the network and how much influence they can have across the niche in terms of managing expectations. Key activities that increase credibility include advocacy and publicity work (Temmes, *et al*. 2013). The need for learning and developing new skills at an earlier stage of design is also required for sustainability focused technologies seeking a place within the regime. Ceschin (2014) suggests that fundamental skills[14] should be developed during the design phase to ensure that new products have a place within the regime in transition. Low rates of adoption of niche innovations to the main regimes may also be attributed to the lack of governance and operational frameworks as this can lead to false expectations and poor learning processes (Verbong, *et al*. 2008).

2.3.1.1 SNM and grassroots innovation

In discussing the case of community energy in the UK, Seyfang & Haxeltine (2012) highlight the need for social innovation coming from a grassroots level. Grassroots initiatives that stem from civil society are predominantly socially innovative (Smith, 2010). Using the three inter-related niche process as described by Raven *et al*., (2010) as a basis for analysis[15], Seyfang & Haxeltine (2012) found that SNM is relevant and important for social innovation as it helps innovations to become part of the new regime through replication, translation and by growing in scale. Analysis of the community energy sector in the UK also highlights the importance of considering the development phase of the niche from a local-level phase to a global phase niche (Geels and Deuten, 2006). The work on development phases distinguishes between many local-level niche practices that become

[14] Ceschin (2014) suggests 4 key skills that are required for socio-technical system design; 1) translating project visions in to transition strategy, 2) identifying and involving a broad range of actors, 3) facilitate the building up or shared project vision and transition path, and 4) managing the dynamic adaptation of the societal embedding process.

[15] Voicing and shaping of expectations, networking and learning

more connected and those that do not. Niches that sufficiently develop have the potential for successful regime breakthrough, those that are insufficiently developed are unlikely to breakthrough (Geels and Deuten, 2006). This work has more recently been followed up in the context of photovoltaics projects in Austria as a form of social innovation by (Hatzl *et al*., 2016) shown in Figure 2.5.

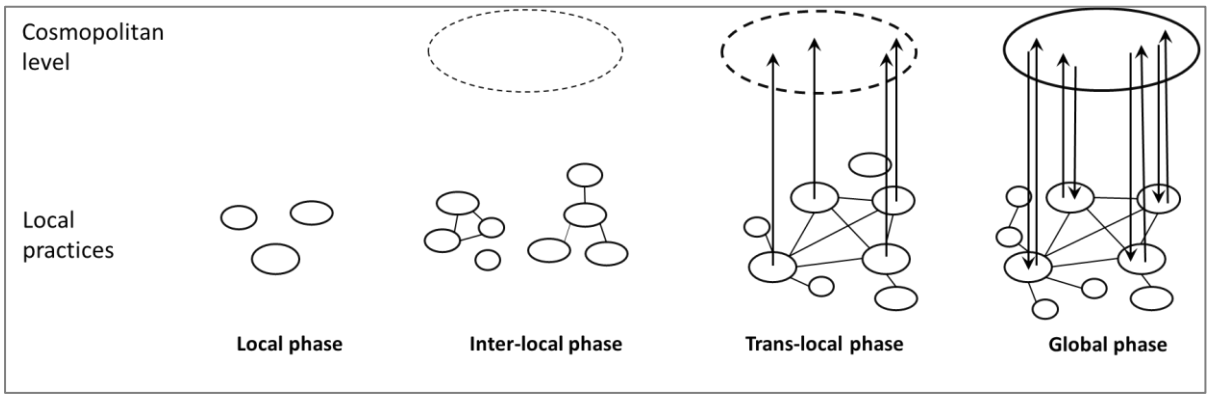


Figure 2.5: Development Phase of Niches
(Hatzl *et al.*, 2016)

When comparing grassroots projects with market-based initiatives, Hatzl *et al*. (2016) found that while both approaches were deemed capable of growing out of the niche and into the regime, there were significant differences in the types of actors and their network interactions - a key determining factor in their success or not. The grassroots movement explored by Hatzl *et al*. (2016) was a local tight-knit network whereas the market-based network were found to be much more heterogeneous. Similarly, Ruggiero *et al*., (2018) have applied the development phases framework to community energy projects in Finland and identified that actor networks patterns are not the same for all grassroots projects. As network building is a key aspect of SNM this highlights that solutions for niche development may not always follow a similar pattern. The lack of standardisation is supported by Bakker *et al*., (2015) who explored electric vehicle charging plugs in Japan, the US and Europe. They found that niches were prevented from aggregating to the point of a global phase were standards were not aligned. Bakker *et al*., (2015) suggested the lack of standardisation is due to practices being developed locally and therefore form around local needs rather than global needs. The application to social innovation in practice has been presented through scenarios research that demonstrates it is appropriate to use SNM theory in the context of radical social innovation (Witkamp, Raven & Royakkers, 2011). However, for the approaches to be successfully adopted, there is a need to rethink the framing of socio-technical regimes. Research in to regimes needs to include social as well as technical elements, and the technical elements should not just relate to technological artefacts (Witkamp, Raven and Royakkers, 2011).

Research into strategic niche management has highlighted important issues around diffusion (Longhurst, 2015; Geels and Johnson, 2018; Geels *et al.*, 2018). Geels & Kemp (2012) state that there is a need for collaboration between innovators and incumbents in order for upscaling and commercialisation to be possible for niche innovations. Geels & Kemp (2012, p67) also state that;

> *"Adoption and diffusion of new technologies requires domestication and social embedding"*

This statement raises two issues, on which there is a dearth of research across the literature; 1) how do we define new technology, and 2) how communities and individuals engage and accept new innovations?

Hargreaves *et al.,* (2013) suggest that there is a disconnect between existing growth-oriented SNM approaches and practical realities faced by grassroots organisations. There is a need for existing SNM approaches to be reformulated to reflect the diverse and conflicted realities that exist within niches. Seyfang & Smith (2007) state that issues faced by grassroots organisation can be categorised as intrinsic or diffusion challenges. The intrinsic challenges include how grassroots innovations are managed, what skills and resources are required and the vulnerability to wider shocks such as funding cuts, loss of key people or changes in policy priorities. Diffusion challenges are wider and external influences such as ideological commitments to differentiate from regime models, competition from mainstream models that have adopted similar principles to grassroots organisations or the risk aversion from policy makers when dealing with small-scale, often radical and relatively informal innovating organisations (Seyfang & Smith, 2007).

Intermediaries are an important source of support for niche innovations seeking to address intrinsic and diffusion challenges. Intermediaries are well placed to support the wider niche due to their ability to share lessons learns from failed innovations within the niche (Hargreaves *et al.,* 2013). Geels & Deuten (2006) suggest that intermediaries have three key roles in supporting niche innovations; 1) aggregating lessons from multiple local projects, 2) establishing an institutions infrastructure for the niche innovation and, 3) framing and coordinating action on the ground in local projects. Furthermore, intermediaries play a fourth role by brokering and coordinating partnerships with actors beyond the niche (Hargreaves *et al.,* 2013). SNM theory should be applied, and if necessary adapted, in a manner that is sensitive to the diversity and dynamism of the grassroots innovation (Hargreaves *et al*., 2013).

2.3.1.2 Policy Implications for SNM

Geels & Kemp (2012) suggest that niche innovation policy often focuses on the stimulation of niches rather the creating pressure on the existing regime, highlighting the importance of changing the type of support for the development of niches. SNM research also provides evidence which demonstrates the impact that external factors and quick changing policy decisions can have on the success or failure of niche testing within the protective space (Seyfang & Haxeltine, 2012; Smith *et al*., 2014; Temmes *et al*., 2013). SNM as a tool is starting to move towards a more action-based and practitioner led research approach (Raven *et al.*, 2010). SNM could be utilised more extensively as a tool by policy makers to make key decisions on determining potential areas for more extensive long-term government support.

More short-term policy support should be focused on ensuring that protected spaces and support are removed in a phased manner out rather than removed abruptly with little warning. There may also be a skills gap across practitioners in terms of the management of niche innovations. In addition to this, the scaling up and aggregating of innovations with other niches to the extent that these innovations move beyond the local level could be hindered by inappropriate standards (Witkamp *et al*., 2011). SNM therefore can provide substantial contributions on the diffusion of grassroots and organisational innovation into the regime during a transition (Seyfang & Longhurst, 2013).

2.3.2 Community Energy

Community energy refers to local community groups who have acted to challenge energy issues such as decarbonisation and fuel poverty (Seyfang, Park & Smith, 2013). This can be achieved through using collective action to reduce, purchase, manage or generate energy. The types of activity that often occur under the heading of community energy include community-owned renewable electricity installation; district heat networks, collective switching of energy supplier or energy efficiency projects. The idea of what community energy means was considered by Walker and Devine-Wright (2008) who identified that community energy should be open, participatory, local and collective. Community energy projects should be largely owned by communities and the community should collectively benefit from the outcomes of the project. This understanding was derived by looking at two fundamental questions; who is the project by and who is the project for? Seyfang *et al.,* (2013) added to this concept that community energy should include both demand and supply side energy initiatives.

2.3.2.1 Stakeholder participation

Some of the main attractions of a community-based approach is that groups understand the needs of the community and can bring people together with a common purpose. Across the academic

literature several themes are prevalent in relation to community energy such as stakeholder participation and barriers to community energy. It is evident that there has been a diverse range of fields and analytical approaches applied to this phenomena (Seyfang and Haxeltine, 2012; Hargreaves *et al.*, 2013; Hatzl *et al.*, 2016).

The roots of the community energy sector emerging from civil society is a critical factor which has typically ensured successful engagement with local communities (Seyfang, Park & Smith, 2013). This can be considered in terms of internal and external stakeholders. Internal stakeholders are the members of a cooperative organisation who hold some degree of ownership over a project or the external could be the communities who benefit from outputs of the project. In the case of UK renewable energy generation schemes, members are also the investors in a large amount of cases (Seyfang *et al.*, 2014). The motivation of people to invest in community energy was explored by Bauwens (2016) who found that norm driven values were linked to schemes set up within a place-based community. Such schemes had strong a strong community imperative rather than commercial one and had a more democratic organisational structure (Bauwens, 2016).

Heiskanen *et al.,* (2010) studied four different communities to investigate how building low-carbon communities can act as a support mechanism for individual behaviour change. It identifies some key areas which impede the effectiveness of achieving behaviour change by targeting individuals; these are social dilemmas, social conventions, lack of infrastructure, helplessness and specific features of communities which influence their capacity to facilitate a low-carbon lifestyle. The findings demonstrate that there is potential for low-carbon communities to alleviate the helplessness felt by individuals due to the scale of the climate change problem using collective action. Rogers *et al*., (2012) found a weak positive link between community energy projects and changes to energy consumption practices and also to individuals living more sustainable lifestyles. Rogers *et al*., (2012) stated this was due to the focus on local socio-economic sustainability issues. More recently Smith *et al.,* (2017) provided a case study on the Stories of Change project which utilised the method of storytelling to share positive visions of what the future might look like. This research highlighted that the stories themselves were not the key outcome but rather the process of challenging participant's own ideas on their engagement with energy processes.

The research on stakeholder participation isn't restricted to the communities themselves as Kivimaa (2014) highlights through exploring the role of government-affiliated intermediaries. Intermediaries have the ability to act as a translator between community groups and regime actors by articulating their visions, values and expectations, which serves to bridge the communication gap. In addition to this, Kivimaa (2014) also states that intermediaries are in the position to either contribute towards

the stability of, or challenge or destabilise the existing dominant regimes. Seyfang *et al*., (2014) also found that intermediaries were important for networking and learning but their role was not enough alone to ensure success within the community energy sector. Ruggiero *et al*., (2018) found that conflicting expectations were also an issue between different community groups in Finland, with no unified vision of what the sector could look like.

2.3.2.2 Community energy as a grassroots innovation

Smith (2010) considers civil society as a source of grassroot innovation activity that gives rise to diverse, hybrid and sustainable energy activities. Environmentally focused grassroots organisations can either demand something better or present alternative options that contest existing regimes and pathways (Smith, 2010). Community energy can be considered as a non-market innovation and when explored through this lens it is evident that external cultural factors can play an important role in the up-scaling of community efforts (Ruggiero, Martiskainen & Onkila, 2018). However, at a grassroots level there is not a universal desire to grow and diffuse niche innovation in to the regime level.

Seyfang & Smith (2007) highlight the difference in growth position through defining simple and strategic niches. Simple niches seek to offer mutual support for other grassroots initiative that are often poorly resourced. Strategic niches seek wider scale transformation through growth and diffusion. Seyfang *et al.*, (2014) frame community energy in the UK as a niche social innovation and describe it as an emerging niche which is neither strategic nor managed. Hargreaves *et al.*, (2013) found evidence of both simple and strategic niches in the community energy sector in the UK. Where strategic niches do exist, aggregating lessons from local projects is not always easily achieved. The challenge to aggregate lessons is due to the diverse range of issues which can be project and location specific (Hargreaves *et al.*, 2013). Co-ordinating local community energy projects is challenging given the variety of social and political contexts in which they operate (Hargreaves *et al.*, 2013). Replicability of localised community energy projects is identified as a limiting factor in the development of community energy sector (van der Horst, 2008).

Ruggiero, Martiskanien & Onkila (2018) reviewed community energy projects in Finland in relation to strategic niche management and identified three key types of community energy projects, Table 2.4. Table 2.4 indicates how community energy projects could be upscaled and can be utilsed to indentify commonalities between different contexts of community energy. Firstly, are these typologies applicable outside of Finland? Secondly, how could the typologies of community energy be utilsied on an organisational scale as opposed to a single project scale? The framework by Ruggiero, Mariskanine and Onkila (2018) advances the ealier work of Seyfang *et al*., (2014) who recognise the

plurality of the community energy sector but do not distingush between different types of community energy projects.

Table 2.4: Typologies of Community Energy

Type	Key Characteristics	Networking and Learning	Expectations
Cost reduction projects	- Support external to the niche is required - Aim is for low cost – not environmental reasons - Locally constrained - No aim to expand the project	- Closed networks - Learning comes from external support and/or suppliers - No networking or learning from other projects within the niche - Wider learning unnecessary and no aim to expand beyond the project	Lower cost of energy
Technical expertise projects	- Motivational factor was the expertise of the key actors - Environmental reasons prioritised or held at same value as community benefit - No aim to expand the project	- Existing knowledge mostly sufficient for project needs - Any learning that is needed comes predominantly from suppliers - Could be networking and learning from other projects	Environmental and low cost of energy
System change project	- Aim to develop new ways of generating energy for social change - Motivation was to increase the amount of renewable energy generation - Projects not necessarily restricted by location - Aim to expand	- Networking and learning are mostly based on key actors' knowledge - Aim to share information - Open and wide-reaching network not restricted by location - Learning across projects such as benchmarking	Specific aim to increase renewable generation

(Ruggiero, Martiskainen and Onkila, 2018)

Table 2.4 also highlights that the more scalable projects were system change projects which do not explicitly consider issues around energy justice. In Germany and Denmark, Mundaca, Busch & Schwer (2018) found that community energy projects mainly focused on procedural justice, such as consultation and decision-making. In regards to distributive justice, Mundaca, Busch & Schwer (2018) show that of tensions exist due to the unequal benefits towards certain groups or individuals. This is despite Germany and Demark being considered as successful case studies of localised energy project development (Bauwens, Gotchev and Holstenkamp, 2016; Geels *et al.*, 2016; Hermwille, 2016). The categorisation of community energy as a niche innovation challenges traditional approaches to innovations as technologies. This shift of focus towards more human dimensions and interaction with the regime may help to develop understanding of how community enery can be successful in developing and then diffusing in to the regime.

In the context of the UK, government policy on community energy has not included community ownership as a priority (Walker and Devine-Wright, 2008), in contrast to Germany where democratic ownership has been at the heart of the energy system long before the low-carbon transition (Abraham, 2017b). Policy efforts to support community energy in the UK include Scottish Community and Householder Renewables Initiative, Welsh Assembly's Community Scale Renewable Energy Programme, Rural Community Energy Fund, Urban Community Energy Fund and Feed-In Tariffs (Nolden, 2013; Seyfang *et al.*, 2014). In addition to this, community energy was made eligible under several tax relief schemes; Seed Enterprise Investment Scheme, Enterprise Investment Scheme, Social Investment Tax Relief. The tax relief schemes helped to make community energy in the UK an investable proposition to those wanting to own shares in projects. Since 2015 most of these policy mechanisms supporting community energy schemes have been withdrawn, some earlier than expected (Regen SW, 2016).

2.3.3 Sustainability & Social Enterprise

The discussions in Sections 2.1 and 2.3 regarding sustainable development and socio-technical transitions highlight that the ends do not necessarily justify the means and that systems are complex. Sen (2013) argues that sustainable consumption is the means and not the end goal. Sen (2013) acknowledges that sustainable consumption still has an important role informing strategic direction of organisations towards sustainability. Sustainable consumption is closely aligned with the concept of a triple bottom line as presented by Elkington (1999); businesses need to consider economic, social and environmental performance. The triple bottom line, which can represent a business or societal issue, represents a more holistic strategy through which to consider economic, social and environmental goals. Social enterprises fit well within a triple bottom line framing and have been adopted widely, in various forms, across the energy sector globally (van der Horst, 2008; Cieslik, 2016; Munro *et al.*, 2016).

This section introduces social enterprise and some of the key issues and challenges identified from across the academic literature. As a starting point, how to define social enterprise is mentioned in nearly all of the literature reviewed (Thompson, 2008; Grassl, 2012; Birkhölzer, 2015; Brouard & Vieta, 2015). In the UK, the government tried to address this issue and provided a definition which identifies social enterprises as those organisations which utilise surpluses generated within the business for social good rather than profit maximisation for shareholders (DTI, 2002). Grassl (2012) provides an in depth review of the literature in regards to defining social enterprise from a global perspective and finds that different countries or regions place emphasis on different aspects of the definition. For example, the United States focuses on social entrepreneurship and tends to discount

'philanthropic' activities, whereas European countries leave the idea of profit, funding and governance more open (DTI, 2002; Phills and Denend, 2005; Hopkins, 2010; Byerly, 2014).

While definitions vary, the common factor across all is that social enterprises trade to make most of their profits, in contrast to charities. The difference from traditional business approaches is that these profits are used to address social or environmental problems. The term business model is used to describe how organisations create economic value in existing markets. Osterwalder & Pigneur (2004, p66-67) define a business model as;

> *"a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams"*

Having a working definition helps organisations outline the structures, systems and processes that collectively make up the business model (Osterwalder and Pigneur, 2004). Business model design is key as it can reflect the strategic decisions made by an organisation (Porter and Kramer, 2006; Farla *et al.*, 2012). An organisation's chosen business model can impact the economic outcome of delivering innovations to market (Chesbrough, 2010). Table 2.5 highlights the different segments of the 'business model canvas', a framework developed by (Osterwalder and Pigneur, 2004) to detail components of an organisation's business model. The social enterprise business model canvas represents a variation on the BMC, tailored to the specific nature of social enterprise organisations (Qastharin, 2015).

Table 2.5: Business model canvas differences

Business Area	Business Model Canvas	Social Enterprise Business Model Canvas
Stakeholders	- Key partners	- Partners & key stakeholders
Operations	- Key resources - Key activities	- Key resources - Key activities
Marketing	- Value propositions - Channels - Segments - Customer relations	- Value propositions - Channels - Segments - Types of intervention
Finance	- Cost structure - Revenue	- Cost structure - Revenue - Surplus

(adapted from Osterwalder and Pigneur, 2004; Qastharin, 2015)

Table 2.5 demonstrates key differences between traditional and social enterprise business models; 1) social enterprises need to satisfy a wider range of stakeholders, 2) interventions are utilised to create social value, and 3) consideration needs to be given as to where the surplus profits will be

invested. In terms of this research, it is suggested that the existing definitions of social enterprise are extended to include any organisation which gains, or has the potential to gain, the majority of its income through trade and which then uses surplus to address a social need. This extension is an important factor as it captures organisations who have a reliance on grant funding at present, but who could viably move to a more trade-based strategy. It emphasises the need for social organisations to become more financially sustainable.

Social enterprise sits within the third sector of the economy and according to Hopkins (2010) such organisations primarily exist where there are market or governmental failures in social welfare. Social enterprise has increasingly become a key driver of social progress. This means that by their nature, social enterprises are often politically active and engage in activities such as lobbying government and creating public campaigns to create social change. High profiles examples include the Social Economy Alliance (Social Enterprise UK, 2015) or the Buy Social Campaign (Co-operative Heritage Trust, 2015). However, social enterprise type organisations are not a new concept and a notable historical example is the Rochdale Pioneers, a group of weavers who formed a co-operative in 1844 and later developed the Rochdale principles which provided a foundation for the co-operative movement (Co-operative Heritage Trust, 2015).

Another key issue identified from the literature is how social enterprises interact with government and policymakers (Phills and Denend, 2005; Thompson and Doherty, 2006). The autonomous nature of the social economy is appealing to political parties across the political spectrum as a viable model to help reduce state dependence and expenditure on social welfare. SE therefore has a strong political dimension, frequently motivated by a desire to provide a valid alternative to a neo-liberal economy, demonstrated trough social organisations trying to effect change through either collaboration or opposition (Phills and Denend, 2005; Thompson and Doherty, 2006).

The idea of working politically and collaboratively links directly to the idea of social capital which can be discussed from either left or right-wing political perspectives. Sullivan (2002) presents Bourdieu's idea of social capital which emphasises inequalities in social class and supports the idea of social justice and empowerment and challenging existing paradigms, typically aligned with left-wing thinking. However, Coleman (1990) describes social capital as the connections between individuals within the social structure, with Putnam (2000) adding that social capital is the reciprocity that arises from these networks. This approach is more concerned with groups of individuals supporting each other, in other words, family and community values which can be understood as a right-wing political framing.

Social capital also plays an important part in social cohesion, which is explained by the OECD (2012, p.3) as;

> *"A cohesive society works towards the well-being of all its members, fights exclusion and marginalisation, creates a sense of belonging, promotes trust, and offers its members the opportunity of upward mobility. This report looks at social cohesion through three different, but equally important lenses; social inclusion, social capital and social mobility."*

OECD (2012) go on further to state that social cohesion can assist and support long-term economic growth and should be a goal in terms of sustainable global development. In addition to this, research by Porter and Krammer (2011) argues for "creating shared value", showing that organisations that consider the social good will benefit economically. In addition to this, Byerly (2014) considers that this idea of shared value can also provide solutions for wider social issues. This provides an interesting platform for discussion on how social enterprises are well placed within society to facilitate social cohesion at a community level (Peattie and Morley, 2008; Markard, Raven and Truffer, 2012).

2.3.3.1 Social Enterprise and Low Carbon Transition

In order to identify current gaps in knowledge, it was important to review existing literature that discussed social enterprise and low carbon energy transitions. The review of literature in fact highlights that very little research on this topic exists. This is likely due to the fact that both of these areas are at present emerging in their own rights (Peattie and Morley, 2008; Markard, Raven and Truffer, 2012). However, what is noteworthy is the increase in literature discussing community energy responses with the focus being on the decentralisation of the energy system argument as opposed to community energy as an instrument to assist the transition process.

The literature which addresses social enterprise in relation to energy or carbon reduction has typically done so from different perspectives such as community governance (Aiken, 2015; Aylett, 2013; Parag *et al*., 2013) and carbon finance models (Lambe *et al*., 2015). Dan van der Horst (2012) looked specifically at the role social enterprises can play in the development of the renewable energy sector in the UK. He identified that certain social enterprise models can have a comparative advantage over private firms within this sector due to the mutual dependence between energy producers and consumers in renewable energy systems. This importantly demonstrates the link between utilising a socio-technical approach to problem solving the delivery of renewable energy projects and it is directly suggested that social enterprise provides the testing ground for social-technical innovations (van der Horst, 2008).

Since the publication of van der Horst's 2008 paper, there has been little advancement in knowledge on the topic of social enterprise within a low carbon transitions framework despite the on-going development of this sector. However, there are several papers which have emerged over recent years which have started to explore the community energy in relation to different areas of business (Heiskanen *et al.*, 2010; Rogers *et al.*, 2012; Becker *et al.*, 2017; Ruggiero *et al.*, 2018; Brummer, 2018). The aforementioned papers have explored specific aspects of community energy business models, such as behaviour-change, entrepreneurship, embeddedness or governance. One noteworthy study by Seetharaman *et al*. (2016) provides an enterprise framework for organisations looking to generate and deliver renewable energy.

Rogers *et al.,* (2012) explored community renewables through a social impact frame with a particular focus on participants in the scheme and other local stakeholders. Their findings suggest that there was only a weak positive association between involvement in the project and participants changing to a more sustainable lifestyle. However, the paper does suggest the need for more studies across a range of contexts, such as location and technology types would be useful to provide some triangulation for the data.

The literature also often tends to focus on energy co-operatives and generation models. Several different legal structures and alternative community energy business models are evident such as demand reduction, energy generation and tackling fuel poverty. Therefore, it is important to be clear on the scope and type of organisations being researched when considering community energy. The current body of literature is lacking in relation to the financial models adopted by community energy organisation as well as in depth exploration of practical aspects of business that are likely to lead to the success or failure of community owned energy businesses. More broadly, there is a new focus on applying social science to energy problems to obtain key insights into the barriers faced and to provide potential solutions for practitioners working within this context (van der Horst, 2012; Ottinger, 2013; Sweeney *et al.*, 2013; Heffron, McCauley and Sovacool, 2015b).

It is clear from the literature already presented that the use of social enterprise as an innovative way to address climate change through delivering community energy projects is not only an underdeveloped area of research, but that insights into this growing sector are needed in order to enhance understanding of the implications for SNM literature, more specifically grassroots innovation.

2.4 Theoretical Framework

The theoretical framework synthesises key insights from the literature review to demonstrate how these multiple bodies of literature will be brought together to address the research questions, thus meeting the research aim of the thesis;

To understand the potential for social enterprise to diffuse in to a new low-carbon energy regime

1. **How has community energy responded to a rapidly changing energy system?**
2. **How viable is social enterprise as a business model within the energy sector in the UK?**
3. **Is it possible for social enterprise to become a niche innovation breakout and form part of the low-carbon energy regime in the UK?**

The transition to a low-carbon energy system is a subjective and changing idea focused on the processes and mechanisms of the transitions. The UK energy system is already in transition to a low-carbon regime, but the structure of the new regime is still unclear. This point raises several key questions; Will the incumbents remain as incumbents in a variation on the status quo, if so, how will this effect workers and communities? What could a transition to a low-carbon energy system look like and how can social enterprise play a role within that? If social enterprises can't break through to the regime do they still have an important but lesser role to play, such as informing private firms on more sustainable working practices?

The answers to these questions partially lie within the further work of Geels *et al.*, (2007, 2016) who provides different scenarios for the ways in which transitions can happen. As discussed, four different transitions pathways are suggested by Geels, transformation path, de-alignment and re-alignment path, technological substitution and reconfiguration. The transition pathway will be determined based on variations of two factors; 1) Is the niche developed? 2) How does the niche interact with the landscape developments and the regime? The dynamics between niche innovations and the regimes help to provide the understanding of where social enterprise is currently operating with the system and what the potential of such organisations might be in a new regime. The use of a business models' perspective of community energy as a grassroots innovation will provide a novel understanding in to the development of niches.

The literature review has explored the current knowledge and explored where gaps exist in relation to specific bodies of literature. The literature on community energy and grassroots innovation has not focused on the relevance of business models in understanding the development of niches. The

purpose of this research is to advance theoretical knowledge on SNM and grassroots innovation literature whilst also raising awareness of issues relating to the community energy sector in the UK. Social enterprise as a business model will be considered as an engine for delivering niche innovation. This research will interrogate social enterprise as tool or mechanism to help achieve low-carbon transition will review the potential and limitations of social enterprise in practice, with reference to state-of-the-art insights from the academic literature.

Chapter 3. Philosophical approaches and Methodology

3.1 Philosophical approaches

The creation of knowledge is rooted and shaped by the application of a philosophical approach. Understanding how knowledge is created has been explored by philosophers and scholars who have posed two key questions; 1) what is reality? and 2) how do we come to know it? These questions are more commonly referred to respectively as ontology and epistemology (DePoy and Gitlin, 2016). A research paradigm refers to the way of thinking about the world and can relate to both ontology and epistemology (Gray, 2009; DePoy & Gitlin, 2016).

The ontology question relates to the perception of what reality actually is and whether or not there is a truth to be discovered. The ontological perspective of the research will dictate the epistemology of the research. This is because how the researcher views the nature of reality will determine the relationship they believe they should have with the research. Saunders, Lewis & Thornhill (2016) describe this relationship through the use of two key concepts; objectivism and subjectivism. Gray (2009) highlights that objectivism and subjectivism are not complete philosophical approaches but epistemological considerations. Objectivism describes the situation whereby the researcher remains independent to the data and therefore has no influence on the results (Bryman and Bell, 2011). Subjectivism holds that reality is socially constructed and therefore it is important to study the details of the situation in order to understand the reality that is happening behind the phenomena (Saunders, Lewis and Thornhill, 2016). An important aspect that relates to objectivity or subjectivity is the impact that the researcher's values can have on the research. Heron (1996) argues that is it important for the researcher to be honest about their values in order to allow for transparency and to increase the credibility of the research. This is referred to as the axiology of the research (Heron, 1996).

Epistemology focuses on not only how knowledge is created and obtained but also what is considered to be acceptable knowledge (Saunders, Lewis and Thornhill, 2016). Deductive, abductive and inductive can be considered as the three main approaches to theory development that are incorporated within the ontological and epistemological grounding of a study (Saunders, Lewis and Thornhill, 2016). DePoy & Gitlin (2016) state that until relatively recently there have been two key views relating to ontological and epistemological concerns; naturalistic inquiry and experimental. Traditionally the two competing philosophical perspectives were thought to be Positivism and Interpretivism (DePoy and Gitlin, 2016).

Positivism is based on the idea of deductive, experimental-type scientific enquiry. The researcher is on the outside of research seeking an objective measure to answer the research question (Bryman & Bell, 2011). Observations within a positivist perspective are likely to be collected to determine regularities or causal relationships within the data (Gill and Johnson, 2010). Interpretivism, by contrast, assumes that knowledge is maximised by increasing the proximity between the researcher and the researched.

Interpretivism is considered to be a naturalistic means of enquiry utilising more holistic and humanistic perspectives based on inductive or abductive reasoning (DePoy and Gitlin, 2016). There are several ways in which meaning can be interpreted to create knowledge within this perspective. Saunders, Lewis and Thornhill (2016) identified two key traditions which allow for the creation of acceptable knowledge. Firstly, phenomenology relates to participant's recollections and their own interpretation of their experiences. Symbolic interactionism emerges from interactions between people. The focus of symbolic interactionism is on the observation and analysis of social interaction (Griffin, 2006).

The competing approaches of Positivism *(scientific enquiry)* and Interpretivism *(naturalistic enquiry)* detailed above should be considered as opposing ends of the research spectrum. A broad range of approaches exist in between positivism and interpretivism. Saunders, Lewis & Thornhill (2016) represent this in the context of the 'research onion' (Figure 3.1).

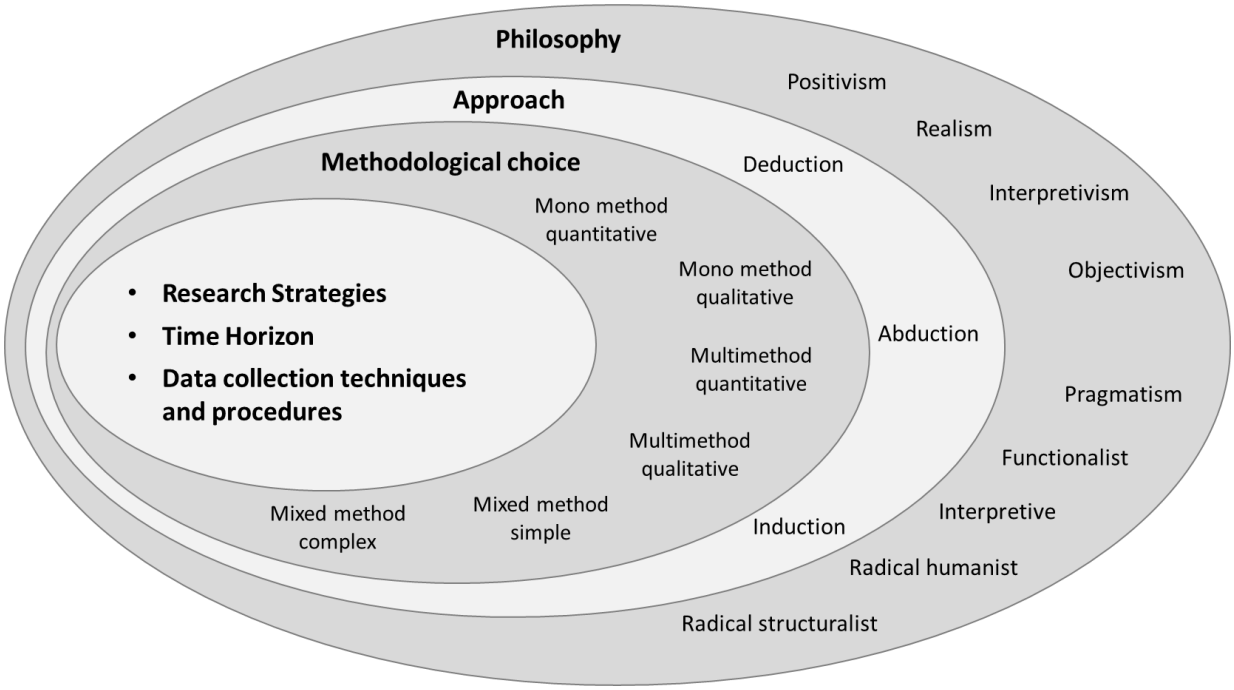


Figure 3.1: The research onion
(adapted from Bryman and Bell, 2011; Saunders, Lewis and Thornhill, 2016)

Bryman & Bell (2011) highlight 9 philosophical approaches; Positivism, Realism, Interpretivism, Objectivism, Pragmatism, Subjectivism, Functionalist, Interpretive, Radical Humanist and Radical Structuralist. Realism and Pragmatism which will be explored in particular in more detail through this methodology chapter (Saunders, Lewis and Thornhill, 2016). Figure 3.1 also demonstrates where the research philosophy is situated in relation to the different aspects of the research processes. Objectivism and subjectivism were flagged earlier in this section as epistemological considerations as opposed to complete research paradigms.

Burrell & Morgan (1979) coalesce functionalist, interpretive, radical humanist and radical structuralist approaches within a matrix to demonstrate the difference between them (Figure 3.2).

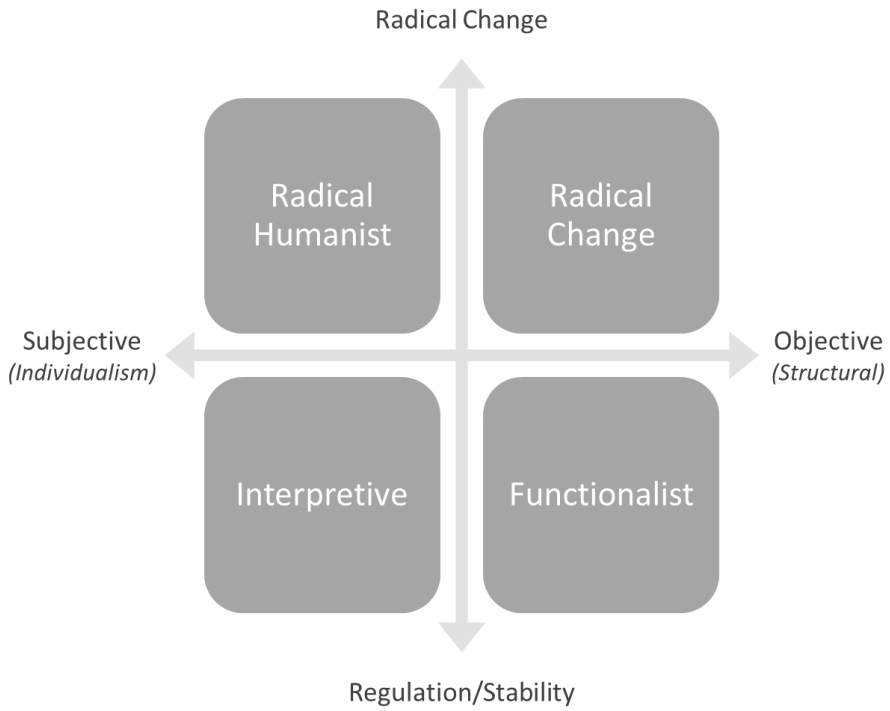


Figure 3.2: Burrell & Morgan's matrix of dominant sociological paradigms
(Burrell and Morgan, 1979)

The matrix is based on four key debates set out by Burrell & Morgan (1979); 1) Is reality given or a product of the mind? 2) Must an individual experience something to understand it? 3) Are humans determined by their environment or do they have free will? 4) Is scientific method or direct experience the best way to achieve understanding of a phenomena?

The functionalist paradigm is rooted in positivism. It is objective in nature and relies on hypothesis testing and scientific enquiry (Jones, 2014). A key assumption of a functionalist paradigm is that humans are rational actors that consciously make decisions regarding their behaviour (Pertti, Bickman & Brannen, 2008). It has primarily been used for organisational studies (Jones, 2014).

Interpretive relates to the stability of behaviour from the individual's viewpoint through observing ongoing processes. Some of the key philosophers who have informed this approach are Kant, Weber, Husserl and Schultz (Kaminski, 2006). Radical Humanist is concerned with social constraints that limit human potential (Stavraki, 2014). This approach suggests that individuals are prevented from being their "true selves" by dominant ideologies, such as consumerism and capitalism (Burrell and Morgan, 1979). This approach is often utilised to justify a desire for radical social change. The main philosophers who informed this approach are Kant, Hegel, Weber and Marx in his earlier work (Burrell and Morgan, 1979). Radical Structuralists believe that radical change is inherent within societal structures. Kavous (2009) states that the radical change is driven by structural conflicts such as political or economic crises. The main philosophers fundamental to radical structuralism are Marx, Engles and Lenin (Kavous, 2009). All four of these approaches demonstrate very specific positions which are not considered appropriate for the broad scope of objectives within this research.

The final two paradigms to be considered are realism and pragmatism. Realism is related to scientific enquiry and objectivism (Saunders, Lewis and Thornhill, 2016). Realist philosophy states that objects exist independent of the human mind, therefore, reality is independent of the mind (Crotty, 1998). There are two key different types of realism that can be considered, direct realism and critical realism. Direct realism refers to the notion that what we experience through our senses portrays the world accurately (Saunders, Lewis and Thornhill, 2016). Critical realism is different in the respect that it highlights that the senses can sometimes be unreliable and therefore the surroundings of things that exist within the world are also important (Saunders, Lewis and Thornhill, 2016).

Pragmatism is based on the idea that concepts are only relevant when they support action and therefore the research question determines the tools and techniques used (Saunders, Lewis and Thornhill, 2016). DePoy & Gitlin (2016) state that pragmatism transcends the incompatibility of the differing concepts allowing a mix of philosophical approaches to be utilised. Tashakkoria & Teddlie (2010) demonstrate that pragmatism provides a sound rationale for mixed-methods to be used should it be appropriate to answer the research question.

Four different philosophical approaches are summarised in Table 3.1 in relation to their ontology, epistemology, and axiology. The data collection techniques most often utilised within each paradigm are also considered within Table 3.1.

Table 3.1: Comparison of four key research philosophies in business and management research

<table>
<tr><th></th><th rowspan="2">Pragmatism</th><th rowspan="2">Positivism</th><th colspan="2">Realism</th><th rowspan="2">Interpretivism</th></tr>
<tr><th>Direct</th><th>Critical</th></tr>
<tr><td rowspan="2">Ontology
What is reality?</td><td rowspan="2">Researcher views reality as external, multiple and chosen based on best techniques to answer the research question</td><td rowspan="2">Reality is external, objective and independent of social actors.</td><td colspan="2">Reality is objective.</td><td rowspan="2">Reality is a social construction and subjective. It may change and multiple realities can exist.</td></tr>
<tr><td>Reality exists independently of human thought, beliefs or knowledge of their existence.</td><td>Same as realist but adds that reality is interpreted through social conditioning.</td></tr>
<tr><td rowspan="2">Epistemology

How do we come to create knowledge?</td><td rowspan="2">Though the use of observable phenomena and/or subjective meanings. Focus is on practical, applied research. Data can be interpreted by integrating different perspectives.</td><td rowspan="2">Knowledge can only be created using credible data or facts which are observed. Phenomena is reduced to its simplest element and the focus is on causality and generalisations.</td><td colspan="2">Facts and credible data are obtained through observing phenomena.</td><td rowspan="2">Knowledge is created by subjective meanings and social phenomena. The focus is upon the details of the situation and the reality behind these details. Subjective meanings act as a motivator for actions.</td></tr>
<tr><td>Insufficient data means inaccuracies in sensations.</td><td>Phenomena create sensations that are open to misinterpretation. The focus is on explaining within a context(s).</td></tr>
<tr><td>Axiology
What is the role of the researcher's values?</td><td>Values play a large role in interpreting results. Both subjective and objective points of view are adopted.</td><td>Values do not play a role in the research. An objective stance is maintained and is independent from the researcher.</td><td colspan="2">The research is value laden. Research bias by world views, cultural experience and upbringing impact on the research.</td><td>The research is value bound. The researcher and the research cannot be separated therefore the research is subjective.</td></tr>
<tr><td>Data collection techniques most often used</td><td>Mixed or multiple method designs – can be both quantitative and qualitative.</td><td>Large samples and highly structured. Mainly quantitative.</td><td colspan="2">Methods can be quantitative or qualitative. However, the methods chosen must fit the subject matter.</td><td>Small samples sizes and in-depth qualitative investigations.</td></tr>
</table>

(adapted from Saunders, Lewis and Thornhill, 2016)

The information provided in Table 3.1 gives a broad overview of the some of the potential approaches that are utilised across research and the characteristics of each of them. Table 3.1 is not presented as an exhaustive list of paradigms but rather to acknowledge the variety of philosophical perspectives that can be adopted.

This introduction provides a brief overview of the basic foundation of philosophical approaches underpinning this research thesis. However, a wide variety of approaches and considerations need to be addressed in relation to the application of this thesis. The philosophical approach provides the foundations for how the data throughout this research will collected, analysed and used. Therefore Section 3.1.1 will explore the ontological and epistemological concerns important to this thesis and state the philosophical approach that underpins it and the reasons why it was utilised.

3.1.1 Pragmatism in context

Pragmatism is often described as the 'what works' approach. It is based on the principle that there is no absolute truth and that the world is constantly changing and therefore nothing is definite (William, 1975). Pragmatists consider the truth as something that is defined by our ideas on the world and our own desires. Therefore, it can be derived that the truth is subjective and variable. The subjective and relative nature of pragmatism lends itself to the study of organisations as it can capture the changing nature and complexity of different micro and macro factors facing the organisations (Saunders, Lewis and Thornhill, 2016). This could include, but is not limited to, the industry or country in question or even issues such as the diversity of the workforce.

A fundamental part of the pragmatist paradigm is that people are primarily actors and secondarily knowledge seekers (DePoy and Gitlin, 2016). This is different to realists who will form knowledge from the point of humans being primarily knowledge seekers and then actors (Crotty, 1998). The foundations of pragmatism therefore lie in understanding that people solve problems through actions and then learn lessons from their successes and failures (Saunders, Lewis and Thornhill, 2016). This reflective and iterative process is what creates new knowledge (William, 1975). This research project has been developed on an iterative reflexive basis. A reflexive approach enabled emerging findings to be used to inform and develop subsequent research directions on an ongoing basis. The novelty of the research and the pairing of several bodies of literature means it is important to conduct the research in this way (Romm, 1998; Lowe & Phillipson, 2006). Pragmatism is particularly useful for exploratory research in new or under researched fields as is the case in this thesis.

One of the key values underpinning pragmatism is the importance of society and communities and the role of democracy. Dewey (1937) considers democracy as an equity justice issue rather than solely consisting of aspects such as law making and political democracy. Democracy is a key element of social enterprise and community energy, as highlighted within the literature presented in Section 2.4.

One criticism of the pragmatist approach is that findings can often not be generalised based on the research conducted (Koopman, 2015). This is because pragmatism is underpinned by the ideology that not everything works for everyone and not all scenarios will yield the same results (DePoy and Gitlin, 2016). This approach is also aligned with inductive reasoning. Results can be generalised but must be done so in a more tentative way and by acknowledging the possibility that findings could be subject to change (Saunders, Lewis and Thornhill, 2016). It is therefore important to highlight the limitations of the study by providing a clear context under which observations are carried out. The context may also change the amount of observations required in order to generalise the findings (Bryman, 2016).

Across the literature, a number of sustainability or environmental studies have been conducted utilising a pragmatic approach (Canard, 2011; McMeekin and Southerton, 2012; Popa, Guillermin and Dedeurwaerdere, 2015; Bull and Ridley-Duff, 2018). Pragmatism is particularly suited to sustainability transitions research as the aim is often to resolve complex problems that require complex solutions (Popa, Guillermin & Dedeurwaerdere, 2015). In their study on sustainability transitions and consumption patterns, McMeekin & Southerton (2012) highlight that the rational choice model is applied across many paradigms and this neglects the complexity required to understand sustainability transitions. Popa, Guillermin & Dedeurwaerdere (2015) suggest that there is a need with sustainability research for the reflexivity that pragmatism offers. In particular, the need for reflexivity is important when considering transdisciplinary research as social innovators or non-scientific experts are often forgotten in the research design process (Popa, Guillermin & Dedeurwaerdere, 2015).

Bull & Ridley-Duff (2018) explore the ethics behind social enterprise in the UK. The research highlights that social enterprises are not one specific type, driven by one specific set of values or ethics. Bull & Ridley-Duff (2018) demonstrate that a number different philosophical approaches underpin these organisations in practice; therefore, it is posited that the philosophical diversity should be replicated in research on these organisations. This ideology is shared by Canard (2011, pg 14) who states that pragmatism could indeed by used to solve environmental problems as;

"It should be viewed as a philosophy of action involving a reflection on both outcomes and the means."

3.1.2 Mixed methods

Mixed-method research uses both qualitative and quantitative methods (Bryman, 2016). This approach can be considered optimal for certain research questions as it enables a range of different data types and resultant perspectives to be developed. Across the transitions literature, the more typical approach has been to utilise quantitative methods (Markard, Raven & Truffer, 2012). There has more recently been a shift towards qualitative research (Seyfang and Haxeltine, 2012; Geels *et al.*, 2018; Ruggiero, Martiskainen and Onkila, 2018). Utilising mixed-methods within transitions research has the potential to bridge to gap between these differing approaches.

A mixed methods approach is applied in this thesis. There are many reasons for mixed methods research to be adopted; however, not all apply to all research (Teddlie and Tashakkori, 2010). The reasons for using mixed-methods within this research project are detailed in Table 3.2.

In particular, the use of social science methods has been applied in this research to investigate social enterprise organisations within a community energy context. The use of social science methods, including inductive qualitative work has been called for across the literature, such as by Devine-Wright *et al*., (2017). Similar approaches to those adopted by this research project align with recent published studies by Ruggiero Martiskainen & Onkila (2018) and Becker, Kunze & Vancea (2017). In adopting a social science approach, the authors are mindful of the argument of Sovacool *et al.*, (2015, p.95) that;

"realizing a future energy system that is low-carbon, safe, and reliable will require fuller and more meaningful collaboration between the physical and social sciences."

Table 3.2: Rationale for utilising mixed-methods approach

Reason	Description	Application to research project
Initiation	Mixed-methods can be used to provide context for the rest of the research and help define the scope and nature of the project.	The studies presented have been conducted utilising a reflexive approach. This reflexivity has enabled the studies to be informed by other elements of the study. For example, the questionnaire design in study 2 was influenced by the original interviews conducted for study 3.
Complementarity	Mixed-methods allows for elaboration and enhancement of findings from different phases.	Both the research field and published research are relatively new. Therefore, data is often incomplete. Mixed-methods allows for the use of available sources to be utilised to provide a comprehensive account of the community energy sector.
Interpretation	Mixed-methods enables the explanation of relationships between variables which have emerged from other elements of the research.	The studies have been presented within their own distinct results chapters. However, the data presented overlaps in places and helps explain phenomena. For example, the qualitative interviews for study 3 help add details to the background of the community energy sector in study 1.
Problem Solving	Mixed-methods allows for the collection of more data if results are unexplainable or there is insufficient data to confirm results.	This element has been critical within this research as part of the reflexive approach. The ability to explore new lines of enquiry where the findings have been incomplete due to the rapidly changing community energy sector in the UK. Secondary interviews were conducted as part of study 3 due to a large-scale policy change within the community energy sector during the time the research was being conducted.
Confidence	The findings can be affected by the method used, however, if the same findings are found across multiple methods then the confidence in the findings is greater.	A high level of detail, provided by the qualitative elements of this project, is required to explore some key issues in the community energy sector. However, the findings are based on small and subjective samples. Therefore, concurrences across studies and the utilisation of qualitative elements increase the confidence in the findings presented. This happens across all the three studies and is explored in more details within Chapter 7.

(reasoning for mixed-methods taken from Tashakkori and Teddlie, 2010)

3.1.3 Description of studies

The overall philosophical approach of this research is based around a pragmatist philosophical approach. DePoy & Gitlin (2016) states that pragmatism allows for a mixture of philosophical approaches to be used in order to address the objectives of the study. The different approaches utilised across this thesis are presented here. Three studies have been conducted to address the research questions, presented in Section 2.4. The following aims are addressed by this research; 1) to explore and understand the context of community energy 2) to do so in relation to both the energy sectors and the social enterprise sector, and 3) to link and advance theoretical knowledge in relation to, 4) what is happening in practice. To provide a basis for the studies and how they link to the wider academic discussion, an overview of how the research questions are addressed throughout this thesis is presented in Table 3.3.

Table 3.3: Addressing the research questions

Research Questions	How will the research question be addressed
What is the role of social enterprise in the transition to a low-carbon energy system?	
1. How has community energy responded to a rapidly changing energy system?	a) Profile the evolution of the community energy sector and detail current issues faced b) Evaluate the impact of policy from both micro-generation and social sustainability perspectives c) Identify innovative ways community energy has responded to the changing policy and regulatory landscape
2. How viable is social enterprise as a business model within the energy system in the UK?	a) Detail the business models within community energy b) Find out if these business models are still viable c) Explore the potential opportunities and threats that currently exist within the sector d) Explore approaches towards financial viability and financial sustainability and across community energy social enterprise.
3. Is it possible for social enterprise to become a niche innovation breakout and form part of the low-carbon energy regime in the UK?	a) Explored niche-regime dynamics between social enterprise within the community energy sector and the regime b) Explore the types of niche innovations that are happening within the community energy sector c) Identify niche innovations with the potential for growth and possibly diffusion within the energy regime d) Discuss the ways the niche innovations may diffused in to the energy regime and the implications for social enterprises in community energy sector

As there are multiple diverse research objectives it is important to select methods that embraces the diverse nature of the project (Davies, 2007). A variety of methods have been employed across the three studies and this section will describe these in turn. Following this, links between the studies and how each study individually and collectively addresses the research questions are considered.

The three studies that have been conducted are;

1. Community Energy in the UK – presents a background profile and policy analysis of the community energy sector in the UK
2. Social Enterprise in the UK – explores the similarities and differences between community energy organisations and other social enterprises
3. Community energy projects in detail – gain and in depth understanding the business models in the community energy sector and the potential for emerging innovations to breakout into the regime

The purpose of each of these studies along with details of objectives are described in Table 3.4. The research questions are also mapped against objectives to demonstrate how the different studies collectively address the research questions (Figure 3.3, p64).

Table 3.4: Objectives of studies to be completed

Studies	Objectives
1. Community Energy in the UK – a background and policy analysis	a) Build a profile of the community energy sector in the UK b) Evaluate the impact of the main policy implemented to support community energy and uncover the 'FIT crisis'
2. Social Enterprise in the UK – The difference with community energy	a) Provide a context for community energy by creating a profile of social enterprise in the UK b) Gain an insight into how social capital and income streams are utilised by social enterprises in the UK c) Identify distinct characteristics of social enterprises operating within the community energy sector
3. Community energy projects in detail	a) Provide a detailed account of the community energy sector in the context of the UK energy system b) Explore the emerging innovations within the community energy sector c) Determine the potential for community energy projects to diffuse in to the regime

3.1.3.1 Study 1 – Community Energy – Business Case and Policy Landscape

This study will detail the evolution of the community energy sector in the UK and the barriers that have been faced by the sector. This study will be of a descriptive nature and will attempt to provide insight into the evolution of the community energy sector in the UK and explore how changes in the policy landscape have affected the financial viability of the sector. The detailed case study and policy analysis will provide the macro context in which community energy organisations in the UK are operating. An overview of the methodological approach is presented in Table 3.5.

Table 3.5: Study 1 methodological overview

	Community Energy – Business Case and Policy Landscape
Methods applied	Case study with policy analysis
Rationale	Aim to create a case study of the UK community energy sector
Underlying philosophy	This study takes a pragmatic approach to the research questions and provides the basis for the research methods selected. Concepts of truth and reality are relative and purposive. A mixture of inductive and deductive reasoning has therefore been applied to obtain the necessary information to meet the objectives of this study.
Type of data	Secondary data from desk-based research. This included qualitative and quantitative data sources. Specific data sources are presented in section 3.2.1 of this chapter.
Application of data	The secondary data have been applied to the community energy context in the UK to create a profile of the energy sector, conduct a policy analysis on feed-in tariffs and identify the groups who are most likely to benefit from the policy.

3.1.3.2 Study 2 – Social Enterprise across sectors

This is a broad study of social enterprises across the UK. As there is a need to survey a large and diverse range of social enterprises, a structured approach will be taken to utilise existing network of social enterprise to profile and explore different aspects of social enterprise in the UK. The focus of the investigation will include barriers, networks and finance. As this will be more of a descriptive study seeking to establish where relationships exist between different variables, a quantitative method will be the most appropriate. An overview of the methodological approach is presented (Table 3.6).

Table 3.6: Study 2 methodological overview

	Social Enterprise in the UK – a community energy comparison
Methods applied	Survey with questionnaire instrument
Rationale	Aimed to collate data for >100 social enterprise organisations
Underlying philosophy	This study presented a more scientific, experiment-based enquiry. Knowledge has been created based on finding the truth through deductive reasoning.
Type of data	Questionnaire data were collected. The questions asked were predominately of a quantitative nature. More details of the list of questions asked in the survey will be presented in section 3.2.2 of this chapter.
Application of data	Data have been used to provide a comparison of the community energy sector against the wider social enterprise sector in the UK. Data provided evidence of barriers, income streams and networks and the relationships between them.

3.1.3.3 Study 3 – Social enterprise as a niche innovation breakout for low-carbon transition

This study will be focused on addressing knowledge gaps concerning community energy organisations and will also seek to evaluate how well these organisations are placed to breakthrough from the niche socio-technical level to become part of the regime. For this piece of the analysis, qualitative methods are the most appropriate as they allow for the flexibility to obtain additional data at the point of data collection should it be relevant to the study. The community energy sector has been subject to a rapid changing policy landscape and therefore this element of flexibility is important within this context. An overview of the methodological approach is presented in Table 3.7.

Table 3.7: Study 3 methodological overview

	Community energy in depth – practicalities and innovations
Methods applied	Semi-structured interviews and thematic analysis
Rationale	Aim to interview at least 5 community energy or support organisations and at the least 5 high level experts from the community energy or energy sector.
Underlying philosophy	This study leans more towards an interpretative philosophical approach given the subjective and inductive nature of the method utilised. There is an acknowledgement that multiple realities can exist within a given scenario.
Type of data	Qualitative data were collected from the semi-structured interviews. Two separate interviews were utilised and further details of the interview schedule used is presented in section 3.2.3 of this chapter.
Application of data	The data were applied to the context of socio-technical transitions and the strategic niche management in order to identify potential opportunities for niche growth and diffusion. The data also provided detailed accounts of key themes that are prevalent in praxis for the community energy sector

3.1.4 Scope of the thesis

The scope of the thesis sets out the boundaries of the research project and makes it clear what will not be addressed as part of the research. This thesis aims to create a representative and comprehensive picture of community energy within the UK. Therefore, the data collected relates to a UK context only. Countries outside of the UK have not been directly considered as part of the study. The research has been conducted over a three year period between September 2015 and August 2018. The data collection has been conducted over several separate phases, further details of this are provides in section 3.2 of this chapter. A working definition of social enterprise has been developed as a result of the literature reviews. This is important due to the multiple definitions used not only in the UK but also on a global scale. The definition is presented here to be clear about the types of organisations that are referred to. For the purposes of this research the term social enterprise is defined in Section 2.3.3 but restated here for the ease of the reader;

> *"Businesses with primarily social objectives whose surpluses are or have the potential to be generated through trade. Those surpluses are principally reinvested for that purpose in the business or in the community, rather than being driven by the need to maximise profit for shareholders and owners."*

Within this research project several issues are covered in relation to the central theme of the research. For example, fuel poverty and the energy trilemma are referred to in the results chapters and the discussion. However, more in-depth analysis of energy justice and social injustices related to fuel poverty and specific characteristics of the energy trilemma framework are beyond the scope of this project. The central focus is on social enterprise and more extensive analysis of secondary themes is beyond the scope of this work.

3.1.4.1 Practical limitations of study

The PhD project is part funded by a European Union Horizon 2020 project, ENTRUST. This means there are certain elements needed to be covered by the PhD for the research to be presented and utilised within the wider project. This included the focus on the human element in the energy system, business models and socio-technical transitions.

The community energy sector is rapidly changing and therefore the results presented should be taken in the context in which corresponding data were collected. For example, during the course of the PhD project one of the main policy instruments utilised by community energy projects changed drastically and therefore data captured reflects heavily on this period of change. This is a limitation to the study as certain aspects of the results presented relate to a business model that is no longer viable in the UK, or likely to be in the foreseeable future.

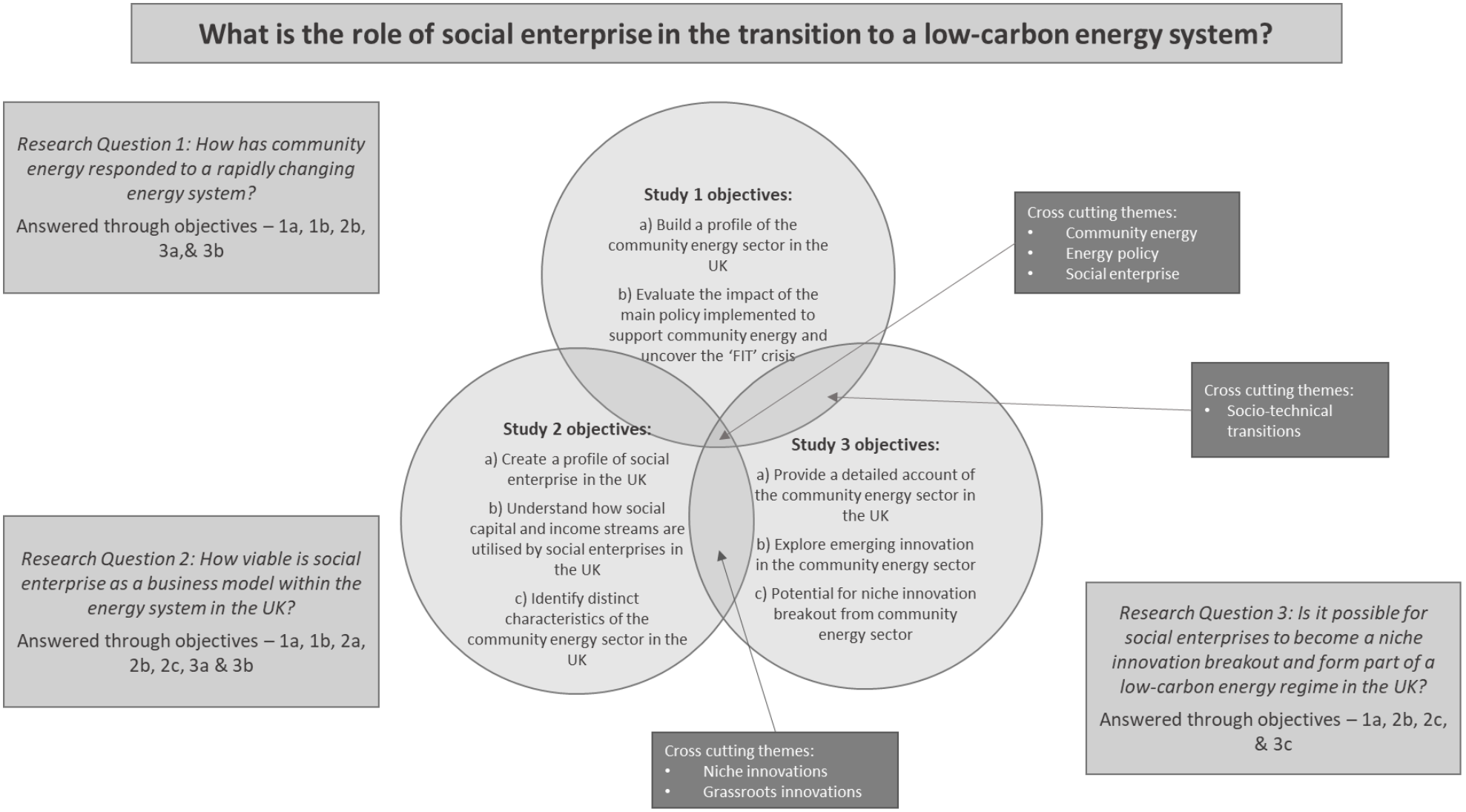


Figure 3.3: Research questions and study objectives

3.2 Data collection and analysis

This section explores the different methods by which data have been collected and analysed for this thesis. Firstly, an overview of the methods used is presented, this is followed by the practical detail of each of three studies introduced in Section 3.1.3. The three methods that have been used to collect data are; case study, survey and semi-structured interviews. The reasoning for the different choices are discussed in detail in Sections 3.2.1, 3.2.2 and 3.2.3. Several other options were considered in relation to this research to determine the most appropriate methods. According to Ventresca & Mohr (2002) archival research utilises primary or secondary data sources held as part of special collections, including documents and manuscripts and records. Therefore it can be a useful method to use when bringing a variety of different data sources together (Ventresca & Mohr, 2002). However, archival research is not appropriate due to the community energy sector being relatively new within the UK and a large amount of data being publicly available; this will be discussed in further detail in Section 3.2.1. Ethnography is a form of longitudinal study where several observations of the same participants are conducted over a period of time (Olsen, 2012). Ethnography may have been appropriate in relation to documenting the journey of the community energy organisations going through a period of change and adapting to that. However, at the start of the research project the rapid changes in the sector were not forecast, therefore it was unknown that this period of change would happen. At the point this had come to light it would have not been practical to start a longitudinal study due the time restrictions. The time horizon of this research is therefore cross-sectional where multiple participants are compared at a single point in time, creating a snapshot of a particular scenario or point in time (Saunders, Lewis and Thornhill, 2016). A benefit of cross-sectional studies is that such approaches allow for multiple variables to be considered without much additional work (Olsen, 2012).

3.2.1 Community Energy in the UK – Business Case & Policy Landscape

A case study has been utilised in order to present a full picture of the community energy sector in the UK. The case study also includes a policy analysis to review the effectiveness of the FIT policy. Case studies provide an in-depth examination of a particular person, group or situation over time (Olsen, 2012). Case studies are useful as they allow for integrating different types of data, such as qualitative and quantitative (Olsen, 2012). The use of mixed methods is not well suited to certain methods, for example narrative enquiry, which captures personal and human dimensions of experience over time through the use of qualitative data (Clandinin and Connelly, 2000). The data used can also be collected from several sources. Within the community energy context this has been beneficial as there are several government and non-governmental organisations considering community energy and who have produced reports relating to their specific interests in the sector.

This section details the techniques used to conduct a review of the feed-in tariff policy in relation to community energy. There are two main elements; firstly, to review the implementation of feed-in tariff led community energy projects in terms of location, size and technology type. Secondly analysis will explore where the feed-in tariff has had an impact in relation to the levels of deprivation across the UK through analysing the Index of Multiple Deprivation against registered feed-in tariff projects. The results chapter has been conducted as a desktop study utilising publicly available data. The objectives of the study and a summary of the methodological steps are shown in Box 3.1.

Box 3.1: Study 1 - Summary of methodological steps

Objectives of study:

a) Create a profile of the community energy sector in the UK
b) Evaluate the impact of the main policy implemented to support community energy and uncover the 'FIT crisis'

Summary of methodological steps:

1. Establish boundary
2. Identify and review literature and data sources from community energy sector to create background profile
3. Download datasets
4. Merge datasets where appropriate
5. Conduct statistical analysis to establish links

3.2.1.1 Datasets Utilised

This section will detail the different data sets utilised as a basis for analysis during the case study and policy analysis.

Central FIT register

The central FIT register is a database of renewable energy projects that are registered under the FIT scheme. The database is managed by OFGEM who manage the registration process for FITs. The data are available through a searchable database and give an overview of projects by category. The categories under which a FIT project can be registered as are domestic, non-domestic (commercial), non-domestic (industrial) and community. The search criteria available on the database are country, government office region, local authority, tariff code, technology type, accreditation type. In addition to this you can perform any search within specified date ranges.

In terms of outputs, the database provides a FIT summary report for the search criteria specified. The report contains the installed capacity and number of projects for each of the different

technology types. For ease of reference, the different technology types available under the FIT scheme are solar PV, wind, hydro, micro CHP and anaerobic digestion.

For the purposes of this study the data were interrogated to provide an overview of the performance of the FIT in terms of the different categories of project. Searches were then also carried out in relation to the key rate changes found when reviewing the feed-in tariff tables. This was done to identify any trends in relation to the installed capacity or the number of projects that are specifically linked to the rate changes.

FIT tariff tables

The FIT tariff tables hold information on all the rates paid since the launch of the scheme in April 2010. The data are hosted on the OFGEM website and are publicly available. A new rate table is issued anytime there is a change to the FIT rates. There rates are categorised by technology type and installed capacity. Therefore, each of the rate tables has approximately 24 separate rates to be considered. One of the key questions this thesis will seek to answer is the impact of policy on community energy in the UK. The purpose of utilising FIT tariff tables is to triangulate the data with the other studies conducted as part of this thesis to explore this theme further. Therefore, not all the FIT rates have been considered. Two key tariffs have been tracked and have been selected as they coincide with the types of projects that the key informants from semi-structured interviews had delivered. The rates reviewed were the following;

- Standard Solar photovoltaic receiving the higher rate with a total installed capacity of 10-50kW
- Hydro with a total installed capacity of 0-100kW

Since the introduction of the FITs there has been a slight change to the classification of the projects. Where two or more categories could have been selected the rates picked relate to the one which the community project would have registered to at that point in time.

Feed-In Tariff installation report

The FIT installation report provides a list of all the accredited FIT projects. It is published quarterly on the OFGEM website as a data table available for download. These data used the same classification of projects as the Central FIT register; domestic, community energy, non-domestic (commercial) and non-domestic (industrial). The report provides specific details of each registered project under the FIT scheme. The data are captured for each individual FIT registration and provide a much more in-depth dataset when compared to the Central FIT summary reports (Table 3.8).

Table 3.8: Data captured by the FIT installation report

Data collected	Description
Postcode district	Area where the installation site is located
Technology type	Solar, Hydro, Micro CHP, Anaerobic Digestion or Wind
Installed capacity	"The maximum capacity at which an Eligible Installation could be operated for a sustained period without causing damage to it (assuming the Eligible Low-carbon Energy Source was available to it without interruption), a declaration of which is submitted as part of the processes of ROO-FIT Accreditation and MCS certified Registration."
Declared net capacity	"The maximum capacity at which the installation can be operated for a sustained period without causing damage to it (assuming the source of power used by it to generate electricity was available to it without interruption) less the amount of electricity that is consumed by the plant."
Application date	Date the FIT application was submitted which dictates the applicable is pre-accreditation is accepted
Commissioned date	Date at which commissioning test are complete and installation is capable of operating to the declared net capacity
Export status type	This can either exported or not exported. Non-exported also included off grid connections and exported has several sub options; deemed, negotiated, standard tariff
Tariff code	Code which relates to rate for which the project is registered under, this will dictate the rate payable under the FIT
Installation type	Domestic, non-domestic (commercial), non-domestic (industrial) or community
Country	Country where the installation is
Local Authority	Local authority in which the installation sits
Government office region	Government area in which the installation sits
Accreditation code	Code assigned to the specific FIT project by OFGEM
Supply MPAN number	First two digits of the supply MPAN code which is the meter point administration number
Community/School	Noted if the installation on a community or school building
LLSOA code	Lower Layer Super Output area code

(OFGEM, 2017b)

The dataset utilised within this study relates to the September 2017 release of information as the most recent dataset available at the time the analysis was conducted. The data were also filtered to extract the community energy projects and exclude the domestic and non-domestic registrations. This was so that the effectiveness of the FITs in relation to the social enterprise triple bottom line. The funds generated by a community energy group are expected to be utilised within the community. Therefore, this analysis will provide insightful knowledge into whether deprived communities are likely to benefit more from the community energy projects.

3.2.1.2 Policy Analysis

This section details the analysis methods utilised in relation to the datasets utilised for study one. There are three distinct elements to the analysis that have been conducted in relation to the Central FIT register, FIT tariff tables, FIT installation reports and the IMD data. The three analyses conducted are to; 1) review of community energy projects in relation to other types of FIT eligible projects and, 2) compare the central FIT register data on installation numbers and capacity against FIT rate changes. These two approaches are presented here in more detail.

Review of community energy projects in relation to other categories

The summary data from the Central FIT register have been utilised to provide a review of the performance of different technologies and the four different categories of project; domestic, non-domestic (commercial), non-domestic (industrial) and community. These data have been presented in order to provide some initial findings from the secondary research and provide a context for the remainder of the policy analysis.

Integrating central FIT register info and rate changes

The data from Central FIT register were analysed against the significant rate changes identified from the collection of the FIT tariff table data. Anywhere where that was a change of greater than 10% signalled a key change in terms of rate changes. The significant rate change dates were then utilised to identify key trends in terms of the number of projects and installed capacity at different times. The analysis was carried out for data from April 2010 until June 2017.

3.2.2 Social Enterprise across the Sectors - Questionnaire

Surveys provide a method of gathering information from a sample of a specific population. Fowler (2002) states surveys have three key characteristics; 1) they are designed to collect quantitative data relating to specific aspects of the study population, 2) data are mainly collected through asking questions, and 3) information is normally collected from a sample of the population rather than every member of the population. Moser & Kalton (1993) highlight several instruments available that

enable a survey to be conducted; documents and observations, interviewing and questionnaires. The instrument that has been utilised within this research are questionnaires. This is because they allow for dissemination of the survey to cover a large geographical scale and takes in to account the resource restraints (Fowler, 2002). Questionnaires provide a large data set which allow for some descriptive statistics and cross tabulation of data to identify significances (Berg and Lune, 2012). An online questionnaire was developed using the Qualtrics software which enabled quick and easy dissemination and includes tools for downloading data and basic statistical analysis. Online questionnaires tend to have a lower response rate, therefore strategies to ensure a satisfactory response rate can be required (Gill and Johnson, 2010). Response rates are discussed in more detail in section 3.2.2 of this chapter.

This study was conducted to provide an overview of the social enterprise sector in the UK and provide a basis for comparison against the activities of the social enterprises within the community energy sector. The study has been designed to explore commonalities and differences between community energy social enterprises and social enterprises operating in other sectors. The objectives of the study and a summary of the methodological steps are shown in Box 3.2.

Box 3.2: Study 2 - Summary of methodological steps

Objectives of study:

a) Provide a context for community energy by creating a profile of social enterprise in the UK
b) Gain an insight into how social capital and income streams are utilised by social enterprises in the UK
c) Identify distinct characteristics of social enterprises operating within the community energy sector

Summary of methodological steps:

1. Establish boundary
2. Create sample database of organisations to form the sample frame
3. Create questionnaire
4. Develop contact strategy
5. Send out questionnaires
6. Conduct descriptive and chi-square statistical analysis
7. Run post-hoc tests on significant chi-square results

A full copy of the survey is presented in Appendix 2, the main sections of the survey and the data collected were as follows;

- Background info – *Gives profiling data on the organisations within the sample such as time in operation, location, sector, legal structure and number of employees*
- Networking info – *Identifies how well connects across different networks are and where the see the important networks to be*
- Income Streams – *Provides a breakdown of how social enterprises obtain funding and questions around financial sustainability*
- Barriers – E*xplores the barriers organisations have faced in the past and ones they suspect they will need to face in the future*

3.2.2.1 Selecting Social Enterprises

A database of social enterprises in the UK was developed between October and November 2016. The database contains information on 863 organisations deemed relevant to the research questions. The database was collated to ensure the widest representation of social enterprises possible. The purpose of the database was to create a sampling frame to be utilised for the distribution of the questionnaire. Once the database was created it was filtered by organisations who had provided contact details. At this stage of database collation, some organisations were removed due to an assessment of ineligibility (i.e. they did not fit social enterprise organisational criteria[16]). Several organisations also had ceased to operate in the time between the original creation of the database, November 2016, and the distribution of the survey, February 2017. The total number of eligible and active organisations included in final survey was 682.

The database was created through a google search of social enterprises in the UK and through utilising public access social enterprise databases held on networking organisations such as Social Enterprise UK and SEN Together.

In February 2017, the organisations in the database were filtered to remove 181 organisations that did not meet the following criteria;

- UK based
- Social enterprise set up under a recognised legal entity (such as co-operative, community interest company)

[16] The classification for a social enterprise organisation is discussed within the literature review of this thesis and the working definition is presented with section 0 of this chapter.

- Ltd. company who also operate with a social or environmental purpose and who identify as a social enterprise
- Still trading/operating as a social enterprise
- Contact details are unable to be obtained so unable to invite to take part in survey

3.2.2.2 Distribution Strategy

A link to the on-line survey form was distributed via e-mail and was live from the 2nd February 2017 to the 31st March 2017. Figure 3.4 shows the contact strategy adopted to distribute the survey effectively. The timeline for the distribution of the surveys was as follows;

- Week 1 (Feb 2017) – Contacted social enterprises from the database to obtain e-mail addresses, set up the mail merge and created personalised links
- Week 2 – E-mail sent out with the survey links sent out in five stages over the course of the week
- Week 3 – Check responses received and marked off companies who have completed the survey
- Week 4 – Chase e-mail sent out to participants along with survey close date
- Week 6 – Final reminder sent out
- Week 8 (April 2017) – Survey closed, database updated with participants and thank you e-mails sent to participants

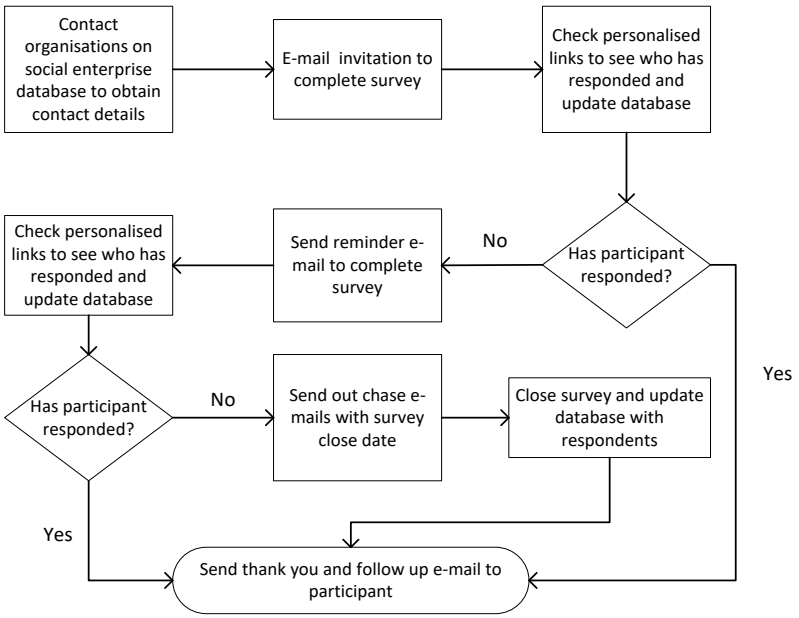


Figure 3.4: Survey Contact Strategy

3.2.2.3 Completion and Response Rates

The database discussed in section 3.2.2.1 of this chapter details the social enterprises that were invited to take part in the survey. Table 3.9 shows the response and completion rates for the survey in relation to the database.

Table 3.9: Survey response data

Number in database	863
Organisations filtered out	181
Surveys distributed	682
Snowball survey responses	9
Respondents who opened the survey	176
Surveys competed	126
Partial completion	24

Completion Rate	72%
(Completed surveys/respondents entered survey)	
Response Rates:	
not including partial completions	18%
including partial completions	22%

During the planning and distribution of the survey several strategies were employed to maximise the response rate. These included the following:

- Personalised e-mails were sent – The use of mail merge was selected as it enabled the personalisation of the e-mail including the company name or contact at the organisations.
- Personalised links - The use of Qualtrics to design the survey allowed the use of trackable links. Despite considerable set-up time, this allowed a record to be kept of those contacted organisations who had and had not responded to the survey request. This ensured that all future correspondence could be tailored to the individual organisations and prevented unnecessary e-mail traffic which could be considered a nuisance.
- Changing the date the survey went out – Originally it had been planned that the survey would go out in the final quarter of 2016. However due to the proximity to the Christmas period following the completion of the database, the distribution was moved to February in order to maximise engagement with the survey.
- Survey was left open longer than originally planned - The original intent was for the survey to be open for a period of one calendar month. However, at the end of week three this was reviewed due to high interest in the survey and offers of organisations to distribute the survey in monthly newsletters. Therefore, to allow time for this and for publication of newsletters the survey remained open for 2 calendar months.

- Chase e-mails – This strategy was one of the more useful techniques employed in improving the response rate as it acted as a reminder for those who had intended to complete the survey but had perhaps forgotten or not yet had the opportunity to respond.

3.2.2.4 Chi-Square Analysis and Post-Hoc Tests

The questionnaire utilised had several questions that produced categorical data. Chi-square tests were conducted on the dataset as it tests for relationships between categorical variables (Davies, 2007). Chi-square analysis is a test for independence of variables. Therefore, the null hypothesis states that no relationship exists between two variables. A rejection of the hypothesis indicates that a relationship does exist. A null hypothesis is rejected when the chi-square tests returns a p value result of less than 0.05. Within this study the chi-square analysis was conducted by utilising SPSS statistical software. However, there are several assumptions that should be considered when utilising chi-square;

- The total number of participants should be at least 20
- Each participant must only contribute to one category
- Each observation must be independent of all others

Contingency tables larger that 2x2 chi-square distribution can only be utilised where less than 20% of the expected counts are less than 5 (Yates, Moore and McCabe, 1999). This means that chi-square is highly sensitive to sample size. If more than 20% of the expected sample size are less than 5 this can lead to a type 1 error. A type one error refers to the incorrect rejection of a null hypothesis, or a false positive report. This criterion was compromised across several the chi-square analysis conducted on the data generated from the questionnaire. Where results were compromised due to low sample sizes post-hoc testing effectively produces a new chi-square result for each of the independent category levels (Beasley and Schumacker, 1995; García-Pérez and Núñez-Antón, 2003). The method utilised the Bonferroni corrected p-value, which acts as a control for the type 1 error (MacDonald and Gardner, 2000). The post-hoc testing allows for more robust statistical analysis and provides richer data as it enables identification of where the significant relationships exist within the contingency tables. The context and steps involved within the post-hoc test are given in Box 3.3.

Box 3.3: Steps for conducting post-hoc testing on significant chi-square results

Step by step guide to conducting post-hoc chi-square tests within SPSS

This test is appropriate for comparing two variables measured on a nominal scale. When the frequency data is generated on the different variables a test can be conducted to test for a relationship between them. Within SPSS this is done by creating a cross-tab and instructing the software to also run the chi-square analysis. The chi-square tells you if one or more of the variables has a value which is greater or lower than expected values based on the null hypothesis. At this stage this is just a standard chi-square result. Where the result is significant (p value of less than 0.05) the null hypothesis of no association is rejected. When the result is significant it tells you that somewhere across the contingency table that there one or more cells have a disproportionately high frequency compared to the expected result. This demonstrates that somewhere within the table there is something deviant between the observed and the expected cell frequencies. Post-hoc testing can be conducted by isolating individual categories in 2x2 tables, however, this method utilises SPSS to conduct the post-hoc analysis. The method applied here has developed from three key studies on post-hoc testing (Beasley and Schumacker, 1995; MacDonald and Gardner, 2000; García-Pérez and Núñez-Antón, 2003). The steps are provided below;

1. Generate a cross-tab within SPSS ensuring that adjusted standardised residuals[17] will be included within the table along with the row percentages.
2. The adjusted standardised residual scores will be utilised to identify if any other specific categories are deviant. In order to check if these results are significant, they must be compared to the p-values and the type 1 error controlled.
3. The Bonferroni corrected p-value is calculated by dividing the original p-value (0.05) by the number of adjusted residual values there are[18]. This Bonferroni corrected p-value is the value at which the post-hoc test will be considered as statistically significant.
4. The adjusted standardised residual scores are then put in to a separate column within SPSS. The variable then needs to be multiplied by itself in order to create a new variable which is the chi-square of each of the adjusted standardised residuals.
5. The p-values for each of the new chi-square values are now calculated[19] within SPSS. The p-values can be compared against the Bonferroni corrected p-value to identify where any significant relationships existing within the data.

[17] Within this method the adjusted standardised residuals are in effect the z-scores, therefore they are statistically significant when over 1.96

[18] This is because it is the number of analyses conducted, e.g. if a frequency table is 5x5 then 25 separate analyses have been conducted.

[19] 1 degree of freedom is utilised within the chi-square calculation as details in the study by MacDonald & Gardener (2000)

3.2.3 Social enterprise as a niche innovation breakout for low-carbon transition – Sector Interviews

Primary data were collated through a series of semi-structured interviews, framed in an open ended format (Hay, 2000; Harding, 2013). Semi-structured interviews are an appropriate method to utilise where investigation is required but there is some prior knowledge about the topic under investigation (Wilson, 2014). The flexible approach that semi-structured interviews enable allows for the exploration of points arising during the course of the interview whilst maintaining a consistent approach across all interviews (Harding, 2013). Dierckx de Casterle *et al*., (2012) recognised that the use of semi-structured interviews enables differing individual experiences, tone and involvement to be considered. In the case of community energy this is useful due to the different context specific issues organisations have faced.

A reflexive approach to the research design has been adopted and the first step of this was to carry out a small pilot study to establish the link between low carbon transition and social enterprise. The objectives of the study and a summary of the methodological steps are shown in Box 3.4.

Box 3.4: Study 3 - Summary of methodological steps

Objectives of study:

a) Provide a detailed account of the community energy sector in the context of the UK energy system

b) Provide a detailed account of the community energy sector in the context of the UK energy system

c) Determine the potential for community energy projects to diffuse in to the regime

Summary of methodological steps:

1. Create interview schedule
2. Identify and contact potential key informants
3. Conduct interviews
4. Transcribe interviews
5. Analyse data utilising thematic analysis

The study utilised the qualitative method of semi-structured interviews which were selected due to their flexible nature. Semi-structure interviews provide a method to explore ideas in more detail and gain richer data. This approach allows for explanation of key ideas, whilst maintaining a consistent approach.

The key informants were selected strategically and purposefully based on their roles as prominent stakeholders within the social enterprise energy sector across the Liverpool City Region. Table 3.10 shows a summary of the key informants consulted between February and October 2016. The interviews were transcribed to facilitate the analysis process, checked for error and then sent out to the interviewees for comment or correction in accordance with the approach reported by Harding (2013). In order to ensure rich data collection, an overview framework with indicative questions was developed which followed the methods of Faherty & Morrissey (2014). The reason for this is discussed by Dierckx de Casterle *et al.*, (2012) who state that the use of strictly organised questioning can prevent considerable insights by excluding data.

Table 3.10: Proof of concept study - Key Informants

Key Informant	Professional Role	Organisation	Interview schedule	Date of Interview
Key Informant 1	Company Director	Social enterprise (energy generation)	1	9th February 2016
Key Informant 2	Chief Executive Officer	Social enterprise (energy use reduction)	1	22nd February 2016
Key Informant 3	Research Officer	Business support for social enterprise	1	22nd February 2016
Key Informant 4	Project Manager	Public-Private Partnership	1	23rd February 2016
Key Informant 5	Company Director	Social enterprise (energy generation)	1	21st October 2016
Key Informant 6	Company Director	Social enterprise (energy generation)	1	26th October 2016
Key Informant 7	Company Director	Social enterprise (energy generation)	1	28th October 2016
Key Informant 8	Communications Officer	National Community Energy NGO	2	15th February 2018
Key Informant 9	Department Head	Government department	2	28th February 2018
Key Informant 10	Company Director and Consultant	Community energy generation and consultancy	2	8th March 2018
Key Informant 11	Community Energy Manager	District Network Operator	2	9th March 2018
Key Informant 12	Director of Strategy	National Climate Change NGO	2	19th March 2018

Opened ended questions were used within the interviews to enable a flow to discussion. The interview themes are presented below in Table 3.11 and Table 3.12. The interview schedules are presented in Appendices 3 & 4. Indicative questions were adapted to reflect the role of the respective interviewee and questioning changed in response to emerging discussion points[20].

[20] A similar approach is applied by Friedl & Reichl (2016)

Table 3.11: Interview schedule for the first round of interviews

Interview theme	Indicative Questions
Organisation	• Introduction to organisation? • Role within organisation?
Sustainability / Climate change	• Perception of sustainability issues? • Role of Social Enterprise in greener economy?
Business Structure	• Legal structures? • Operation structure of organisation?
Income Streams	• Types of income? • Financial sustainability of sector?
Barriers within Sector	• Barriers encountered to date? • Policy implications?
Future considerations	• Impact of your work? • Future issues in medium/long term?

Table 3.12: Interview schedule for second round of interviews

Indicative Themes	Indicative Questions
Post-FIT climate	• Thinking specifically about the period since summer 2016 and now, what has happened within the community energy sector? • What is the current state of the sector?
Community Energy Innovations	• Thinking about the current issues within community energy can you tell me what innovations have either come out of or are being worked on by the sector in response? • Which stakeholder groups have been involved in driving the innovations you have discussed, and do you think the sectors has the capacity to innovate given financial, personnel constraints etc.?
The future of community energy	• Thinking about the innovations you have just discussed which ones do you think will have the most potential and why? • When you think forward 10 years how do you view the energy system in the UK and what role will community energy play within that?

3.2.3.1 Thematic Analysis

There are several different approaches that can be taken towards the analysis of qualitative data. Four key patterned-based approaches are considered in relation to this research project. An overview of the four methods is presented in Table 3.13. The chosen approach within this study is thematic analysis and the reason for this will be discussed in more detail later in this section.

Table 3.13: Type of qualitative analysis methods

Overarching analysis method	Description	Varieties available
Thematic analysis (TA)	Uses to identify themes in relation to the research question. Can also identify patterns of meaning across a dataset.	Inductive, Theoretical, Experiential and Constructionist

Interpretative Phenomenological Analysis (IPA)	Uses to understand how people make sense of lived experience. Can be used across a small groups of participants to analyse individual cases or themes.	Interpretative Phenomenological Analysis
Grounded Theory (GT)	Builds theory from the data with an emphasis on understanding social processes. Analysed around categories.	GT- Lite, (Full) GT, Positivist GT, Contextualist (Constructivist) GT and (radical) Constructionist GT
Pattern-based discourse analysis (DA)	Concerned with patterns in language to understand the how accounts of objects and events are socially constructed in different ways.	Thematic discourse analysis (DA lite), Poststructuralist DA, Interpretative repertoires, Critical discursive psychology

(adapted from Braun and Clarke, 2013)

Across the four different types of analytical methods four varieties were identified as potential options for use within this research; Inductive thematic analysis, Interpretative Phenomenological Analysis, Grounded Theory Lite and Contextualist Grounded Theory (Table 3.14). Given the fit to the aims of the study an inductive approach to thematic analysis was selected.

Table 3.14: Pattern-based analytical methods considered

Variety	Description	Fit with the aims of the study
Thematic Analysis: **Inductive**	Analysis is shaped from the bottom-up rather than using the theory as a starting point. Research is always shaped by researcher's standpoint, epistemology and disciplinary knowledge.	Analysis fits well the aims of the study as allows for research experience to guide the analysis. It also offers a flexible approach to the analysis which is important within this exploratory study.
Interpretative Phenomenological Analysis: **IPA**	Appropriate for identifying themes across small groups. Interpreted by the research and therefore influenced by the researcher's knowledge. Focus is on how people perceived their lived experience rather than exploring the phenomena itself.	Fits well in terms of the sample size and researcher knowledge. However, the focus on how scenarios are perceived doesn't fit with aspects of the aims. Some aims need to be viewed more critically such as identifying promising innovations.
Grounded Theory: **GT-lite**	Provides a classification of data that can be used to identify relationships between concepts and relate them back to the research question. Outcome of GT-lite is not necessarily focussed on theory building but categories that fit together in various ways. Does not acknowledge the role of the researcher.	This approach fits better than full GT as there is no need to try and build theory and the data guides the analysis. As role of the research is not acknowledged this could present problems with the reflexive nature of this research project.
Grounded Theory: **Contextualist GT**	Acknowledges the role of the researcher in shaping the analysis. Argues is it not possible to state a singular truth from the data as meaning is contextual. Focus is on theory building from the data.	This approach fits well as the researcher can shape the analysis. However, the focus on theory building is not suitable for the aims which are more practically driven.

(descriptions taken from Braun and Clarke, 2013)

A thematic approach was applied which went through several iterative stages of analysis to highlight the primary themes from the interviews. An overview of this process is shown in Figure 3.5. This approach follows methods reported in Saldana (2013), Berg & Lune (2012) and Faherty & Morrissey (2014). Content analysis generated a short-list of common and critical themes, similar to the approaches reported in Shay *et al.,* (2016) and Friedl & Reichl (2016). The outputs from the analysis provided a comprehensive characterisation of energy focused social enterprise which addressed internal and external barriers to social enterprise operating within the energy sector (discussed in Chapter 6).

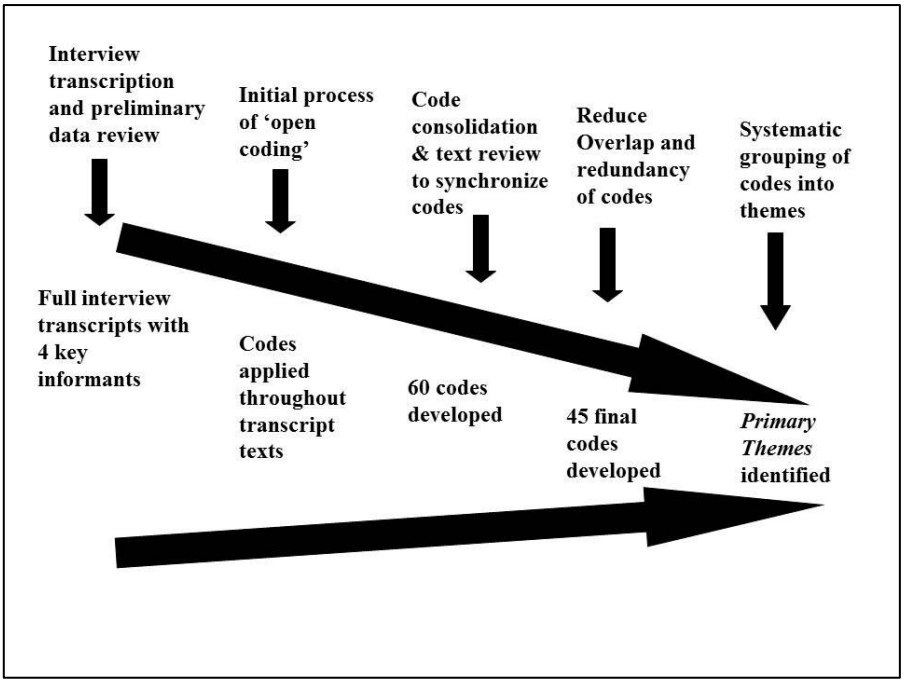


Figure 3.5: Thematic analysis approach

Chapter 4. Community Energy – Business Case and Policy Landscape

An overview of the methods used within this results chapter are presented due to mixed methods approach and the complexity with the various datasets utilised (Table 4.1). Full details on the methodological approaches applied and datasets utilised are detailed in Chapter.

Table 4.1: Summary of methods for study 1

	Community Energy – Business Case and Policy Landscape
Methods applied	Case study with policy analysis
Rationale	To create a case study of the UK community energy sector
Datasets utilised	• Various reports generated by the government, regulator and community sector organisations in the UK • Central FIT register • FIT tariff tables • FIT Installation Report • Index of Multiple Deprivation (IMD)
Analysis overview	<u>Section 1 and 2 – Sector Profile and Characteristics</u> • Document review of existing UK specific grey literature from across the community energy sector <u>Section 3 – Policy analysis on FITs</u> • Review of community energy projects against different types of projects also eligible for the FIT • Descriptive statistics used on the data set <u>Section 4 – Impact analysis on FITs</u> • Integration of the Central FIT Register and the tariff rate changes • Integration of the IMD data and the FIT installation report[21] • Descriptive statistics used on both data sets to evaluate how the rate changes have affected the community energy sector

[21] The IMD and FIT dataset is presented in Appendix 5

4.1 Profile of Community Energy Sector (UK)

4.1.1 Defining Community Energy

Community energy refers to local community groups who have organised to address energy issues (Seyfang, Park & Smith, 2013). The term community energy encapsulates a wide number of different types of project such as energy generation, energy efficiency programs and collective purchasing of energy. A key characteristic of community energy from the definition provided by Seyfang, Park & Smith (2013) is that projects are based in the community and are run for the benefit of the community. Becker, Kunze and Vancea (2017, pg 25) explored social entrepreneurship across Europe and defined social enterprises within the community energy sector as;

> *"Collectively owned organisations that combine renewable energy production with more overarching goals of environmental and social transformation, and a specific quest for civic participation"*

However, this is not a universal definition. When comparing the UK to the US Hoffman *et al.* (2013) focus their definition of community energy around the production of decentralised energy and state that production decisions should be made close to the source of consumption. Community energy promises the potential to provide solutions that address economic, social and environmental issues particularly through models such as social enterprise. Becker *et al*. (2017) suggest that these organisations have the potential to transcend the local scale. Many types of community energy projects have been researched globally and include various forms of energy cooperatives across Europe and Australia (Nolden, 2013; Becker, Kunze and Vancea, 2017; Forman, 2017, Coalitition for Community Energy, 2017), Community Energy Solar Power Plants in India (Jain *et al.*, 2010) and Energy Kiosks in Sierra Leone (Munro *et al.*, 2016).

German and UK community energy projects have often been compared to each other in the literature. The ability for German community energy groups to sell their energy directly to a third party is one key distinguishing feature between the community energy sectors in both countries. This enables German community energy groups to sell their energy within the community rather than selling it back to the grid. The sale of energy is not prohibited for supplying energy to a single user in the UK when arranged through a power purchase agreement. The financial, technical and regulatory barriers mean that the supply of energy to multiple consumers is not financially viable on the current scale of projects which is explored in Section 7.1.2. In the UK, an over-reliance on the feed-in tariff paid for energy exported to the national grid has limited overall growth and development of the sector as discussed during Chapter 6. Two key issues for community energy in

the UK therefore centre around the removal feed-in tariffs (*the protective niche space set up by the government in 2010*) and energy regulation.

Community energy in the UK has to date been portrayed as a story of an industry both created and also halted by the fast changing policies on feed-in tariffs (Good Energy, 2016; Regen SW, 2016; Community Energy England, 2017). However, the story is a little more complex than this as discussed by Seyfang, Park & Smith (2013). This chapter explores the impact of policy changes made to the FITs in the UK and then considers the wider context in which community energy operates. The data presented include an overview of the characteristics of the community energy sector in the UK, barriers faced by the community energy sector and a policy analysis of the feed-in tariffs. The desktop-based review of the community energy sector includes analysis of data from current industry research augmented by original policy analysis.

4.1.2 Policy context

The UK's energy system has a complex history including a past reliance on fossil fuels and imported energy, defined by eras of industrialisation, nationalism, privatisation of the sector and more recently the low-carbon transition (Geels *et al.*, 2016). A review of UK energy policy over the past 30 years shows that one of the consistent focus areas of policy has been a concentration on large-scale supply infrastructures (Pearson & Watson, 2012). Despite some policy support for small scale renewable projects, the UK's low-carbon transition plan has largely been dominated by centralised, top down action. In such a context, the introduction of bottom-up initiatives has ultimately created tensions (Pearson & Watson, 2012). Grass-root innovations have the potential to challenge the existing, highly centralised and carbon dependent regime through questioning existing practices and offering alternative solutions (Seyfang and Haxeltine, 2012). In the case of community energy, this niche offers potential for innovative business models and practices to influence policies, institutions and market-rules (Seyfang and Haxeltine, 2012; Seyfang, Park and Smith, 2013; Seyfang *et al.*, 2014).

The UK Department for Energy and Climate Change (2014) published the UK government's first strategy for community energy and recognised the significant potential for growth within the community energy sector. The strategy report details four ways in which community groups can get involved; generating energy, reducing energy use, balancing supply and demand and purchasing energy. The strategy also sets out an ambition to ensure that every community that wishes to set up a community project would be able to do so and lists the benefits of community energy projects (DECC, 2014).

"Community-led action can often tackle challenges more effectively than government alone, developing solutions to meet local needs and involving local people" - (DECC, 2014, pg4)

Against this background, the community energy sector in the UK has grown from less than 10MW capacity to over 120MW capacity since the feed-in tariffs have been introduced (Community Energy England, 2017). It is estimated that there are over 550 active community groups in the UK.

One defining feature of community energy in the UK has been the use of the feed-in tariff, a government subsidy supporting micro-generation projects (OFGEM, 2017c). In April 2010, the UK government introduced feed-in tariffs to promote the uptake of renewable technologies (OFGEM, 2017c). The scheme works under the general principle of a subsidy, whereby extra financial assistance is provided to help an industry or an organisation. In this case, the feed-in tariffs are extra payments that small-scale renewable energy generators receive on top of an export tariff obtained for energy input to the national grid (DECC, 2014). Feed-in tariff payments are not given on energy used or sold on site, rather, the energy needs to be fed directly to the national grid as explored further in Chapter 6.

4.2 Sector characteristics

Good Energy (2016) reports that across the UK there are just under 550 active community energy groups. Since 2010 there has been just under £50 million worth of private investment in the sector and £7.4 million of FIT payments (Good Energy, 2016). Community energy has generated nearly £23 million of community benefit funds and has been supported by 155,000 hours of volunteer time (Good Energy, 2016). Based on a full-time working week of 37.5 hours, this figure equates to 80 people working full time for over a year on a voluntary basis.

Table 4.2 shows the different types of community energy projects that are currently operating in the UK. A brief description and the benefit of each type of energy is provided in this table (Good Energy, 2016), together with a description of whether the project focuses on solving security, affordability or decarbonisation[22] of energy.

[22] This is the terminology is more commonly referred to as the 'energy trilemma'. The energy trilemma related to the needs for governments to address issues within the energy system relating to; security of supply, ensuring it is low-carbon and to reduce the number of people living in fuel poverty.

Table 4.2: Types of community energy project as defined by Good Energy

Project Type	Description	Benefits to local communities	Focus of Project
Local renewable generation	Where groups are generating renewable electricity locally. Predominantly made up from small to medium size solar and wind	Generate revenue for investment within the community, reducing carbon emissions and reducing the price of electricity used on site	Security, decarbonisation and affordability
Community heat	Community hot water, seasonal thermal energy storage and district heating.	Reduce carbon emissions and energy bills	Decarbonisation and affordability
Energy efficiency	Projects to improve energy efficiency within local housing. The focus has been on those households in fuel poverty	Delivers positive economic, social, health and wellbeing outcomes	Decarbonisation and affordability
Collective purchasing	Communities coming together to negotiate a better deal on their gas, electricity and other heating fuel supplier	Reduction in the price of fuel, assisting those in fuel poverty	Affordability
Local tariffs and community benefit funds	Suppliers offering community funds, local tariffs and windfall payments. Often given on a £ per MW basis	Helps existing community energy generators to generate more funds locally for community benefit	Security, decarbonisation and affordability
Biodiversity enhancements	Biodiversity hotspots created on generation sites. This could include planting wildflowers, grasses and trees	Enhances the local environment and wellbeing. This can also be providing space for grazing animals	Decarbonisation
Other initiatives	Covers any other initiatives. Examples include, communal washing lines and pilot projects to match supply with demand	Save money on energy bills and help with knowledge of complex energy system problems	Decarbonisation and affordability

(Adapted from Good Energy, 2016)

Table 4.2 shows that different types of community energy projects do not always address all three aspects of the energy trilemma discussed in Chapter 1. Table 4.2 also highlights the tensions that occur between decarbonisation and affordability agendas, particularly in relation to whether governments should intervene or not (Bosman *et al.*, 2014). Often projects concerned with affordability aim to mitigate a household's level of fuel poverty. For example, collective purchasing projects focus on providing the cheapest energy for both individuals and the community through collective purchasing power (Table 4.2). The focus on price means that decarbonisation would only be considered when it can compete on a financial basis with carbon intensive fuels. The outcomes of projects are often driven by funders, therefore the initial motivation of a project needs to line up with the financial support available (Ruggiero, Martiskainen and Onkila, 2018).

4.2.1 Installed Capacity

Cumulatively, community energy groups in the UK have seen large levels of growth both in terms of number of projects and installed capacity. Community Energy England (2017) report that the operational generation capacity across community energy is approximately 121MW and in addition to this, 67MW of generation capacity has been identified in Scotland. During 2010-2014, installed capacity of renewable energy went from 7% to 19% of all energy capacity according to Vaughan-Morris (2015). The same report also stated that by 2014, 0.25% of renewable energy in the UK came from community energy. Good Energy (2016) predicted that by 2020, community energy could help the UK to meet its energy targets on decarbonisation, energy security and affordability. The Good Energy 2016 Progress Report states that community energy has the potential to reduce the UK's annual CO_2 emissions by 1 million tonnes, reduce the UK's coal imports for electricity generation by 9% and deliver economic benefits to communities by retaining money in local economies (Good Energy, 2016). This potential confirms community energy as a niche innovation as the reduction in CO_2 emissions would equate to less than 0.5% of the government's 34% emissions reduction target for 2020. Based on renewable generation alone, the CO_2 emission reductions from community generation are presented as 110,000 tonnes to date (Community Energy England, 2017). For the community energy sector, the reduction is expected to be higher due to organisation's focus on energy efficiency as a core or secondary activity.

4.2.2 Funding and legal structure

One of the key motivations for setting up community energy schemes comes from the principle of a democratic ownership of energy. This ideological approach highlights the need to consider two key points in relation to community owned energy schemes; 1) The finance models used and 2) The appropriate legal structure (Brown, 2011; Vaughan-Morris, 2015).

There are several different types of legal structures available that community energy organisations could adopt as detailed in Table 4.3.

Table 4.3: Possible legal structures for community energy

Legal Structures	Description	Corporation Tax Obligation
Registered Society: Community Benefit Society (BenComms)	A group of more than three members registered under the Financial Conduct Authority (FCA) that operate for non-profit, and trade to benefit the boarder community, governed by charity law.	Yes
Registered Society: Cooperative	A group of more than three members registered under FCA that operate for non-profit and run for the mutual benefit of their members that use its services.	Yes
Community Interest Company (CICs)	A form of limited company that is governed by the Companies Act 2004 and is designed for social enterprises.	Yes
Private Company Limited by shares (CLSs) if wholly owned by registered charity	Private limited company, where shareholders' liability is limited to the capital originally invested, with shares not listed on a stock exchange.	Yes
Private Company Limited by guarantee (CLGs) if wholly owned by registered charity	A limited company registered with Companies House and governed by Company Law, with a limited liability status with shareholders guaranteeing to pay £1 - £10 if insolvency occurs.	Yes
Charitable Trust	An irrevocable trust established for charitable purposes.	No
Charitable incorporated organisation (CIO)	An organisation with charitable aims that meets the public benefit test, is incorporated without being a company, and is registered with the Charity Commission.	No

(Vauhan-Morris, 2015)

Community Energy England (2017) produced a report on 222 community energy groups across the UK. They found that there were three prevalent types of legal structure which have been adopted by community energy projects within the UK as show in Table 4.4.

Table 4.4: Legal Structure of Community Energy Organisations in the UK

Community Energy Legal Structure	Percentage surveyed
Community Benefit Societies (BenComms)	44%
Cooperatives (co-ops)	22%
Community Interest Companies (CICs)	11%
Other charitable entities	23%

(Community Energy England, 2017)

Throughout this research the focus will be on community generation projects, as opposed to projects where the primary aims are energy demand reduction or behaviour change. In the UK, community energy projects have largely been dominated by solar generation in the south of England while the rest of the country has experienced a more diverse range of projects and technology types (Community Energy England, 2017).

Social enterprises operating within the energy sector have innovated through utilising share offers, further elaborated on in Chapter 5 and 6. There are four different types of community share offers

that can be utilised; membership, pioneer, time-bound and open (Brown, 2011). Figure 4.1 is adapted from the Practitioner's Guide to Community Shares and details the stages where different types of share offer may be useful to an organisation.

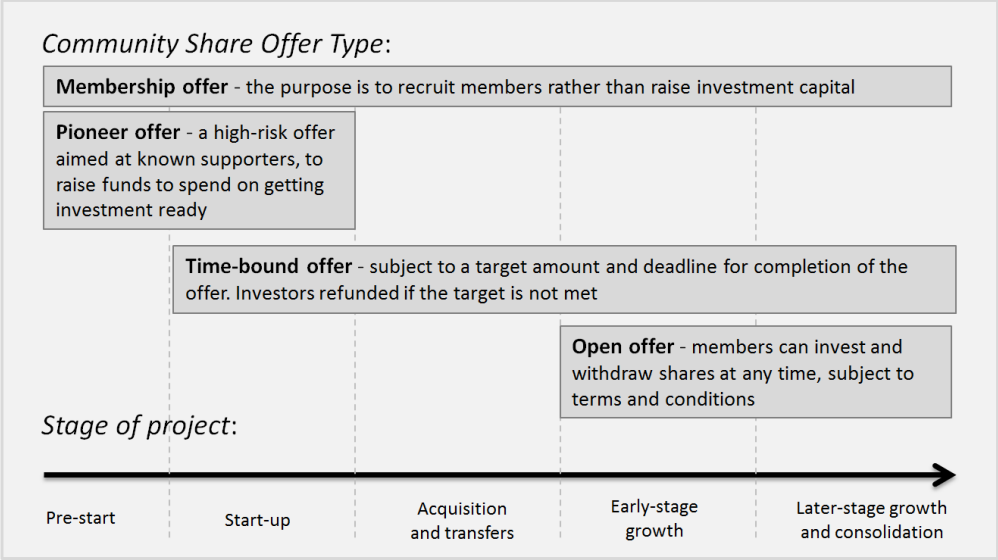


Figure 4.1: Community share types in relation to project stage
(Brown, 2011)

It is important to note here that a community share offer is something that is exclusively used for co-operatives or community benefit societies. Therefore, the prevalent use of this method of financing across the community energy sector goes hand in hand with the most commonly adopted form of legal structure, Community Benefit Society. This type of structure falls under a category of structures called Industrial & Providence Societies (IPS), which are regulated by the Financial Conduct Authority (FCA, 2016).

Originally, across the community energy movement in the UK, the most typically adopted legal structure was the co-operative model, a finding explored further in Chapter 6. The use of the co-operative model changed in April 2013 when the organisations already operating had to transfer to a community benefit model (Co-operatives UK, 2016). This sweeping change was triggered when the FCA was set up following the disbandment of the Financial Services Authority (FSA). The reason for the change was that co-operatives are only able to act for the benefit of their members whereas community benefit societies can act for the benefit of the local community (FCA, 2016). In the case of community energy, the members are the shareholders of the organisation. As the members are the shareholders and the community benefit goes to the wider community rather than the members, then the co-operative model is not appropriate (Co-operatives UK, 2016). The requirement for co-operatives to act in the interest of their members was an existing rule under the

FSA. However this was not enforced in the case of community energy under the previous regulator (FCA, 2016). The FCA introduced remedial action to transfer community energy organisations to BenComms after this error was identified (Co-operatives UK, 2016). This highlights two key points; the copy and paste approach to the business model typically applied in community energy projects and the lack of business knowledge within the sector. This confusion was reflected in the semi-structured interviews that are presented in Chapter 6. Figure 4.2 synthesises the key elements from Table 4.2, Table 4.3, Table 4.4 and Figure 4.1 to provide a summary of the prevalent project types, legal structures and share offer types used within the community energy sector in the UK.

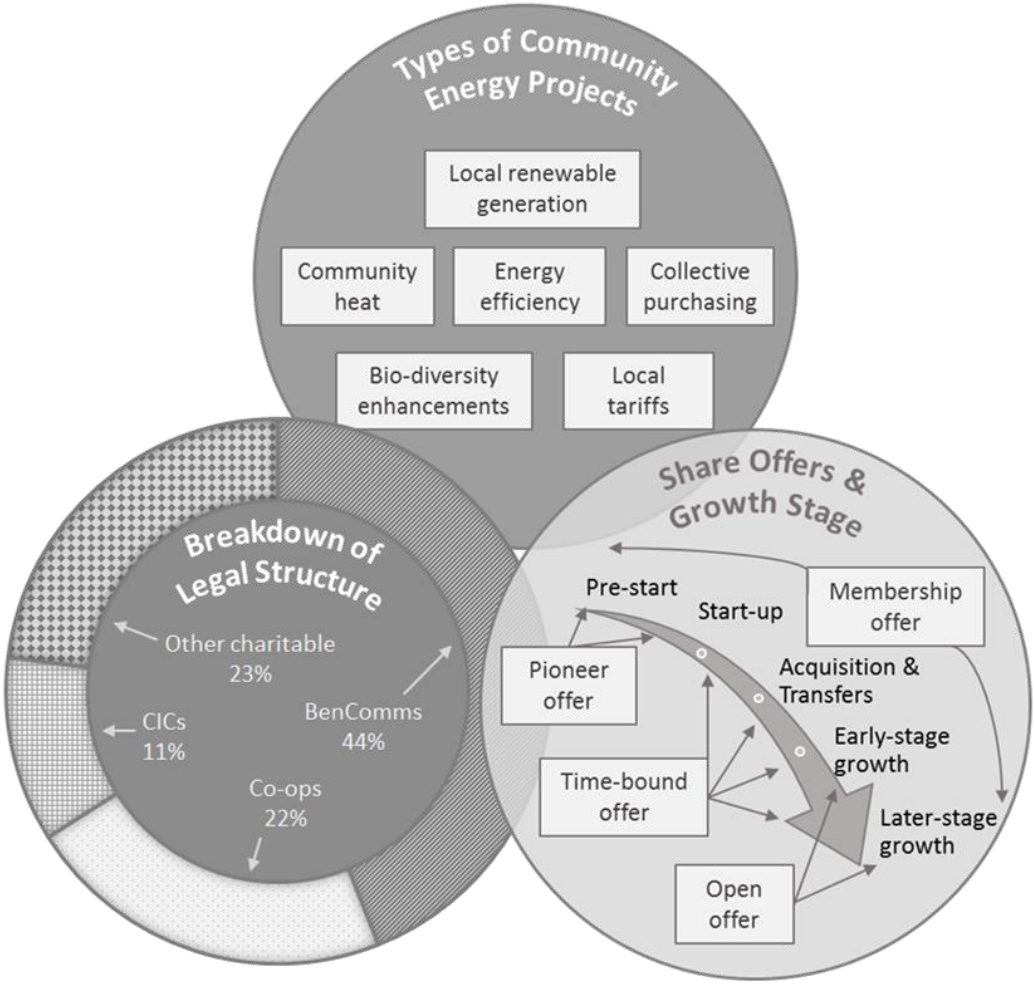


Figure 4.2: Community energy in the UK; project types, legal structures and financing options

The BenComm legal is the most commonly used legal structure across community energy (Figure 4.2). This legal structure allows for the raising of shares through community share offers and protects them by making them members. Community benefit funds are then developed from any surplus once the shareholders have been paid at the agreed rate of return.

For community energy groups which have members as shareholders, the ownership model is comparable to that of an ordinary business which is owned by its shareholders (FCA, 2016). According to Brown (2011) the democratic ownership model is protected by the nature of the investment and people who are likely to invest in community energy. The democratic principle is also protected through the use of the one member/one vote system rather than voting rights being based on the percentage of shares held (Brown, 2011). Across IPS's there is more of a tendency for models of democracy where people are engaged in activities within the organisation such as the members being employees, customers or tenants (FCA, 2016). The democratic ownership model across the community energy sectors is something which is valued deeply in the sector (Ottinger, 2013; Seyfang, Park & Smith, 2013; Van Der Schoor *et al.*, 2016; Kooij *et al.*, 2018). Although ownership models are not something that are explored in great depth in this thesis, the discussion highlights an interesting point for further research around democratic ownership across social enterprises and what configuration of ownership model would be the most effective.

Table 4.5 shows an overview of the different types of income streams that are used by community energy organisations.

Table 4.5: Income streams utilised by community energy projects

Income Type	Description	Stage of Project utilised
UCEF or RCEF grant	Government grant to help cover project development costs such as feasibility studies	Development phase
Share offer	Shares issues to raise capital required to purchase and install the technology	Development phase
Electricity sales	Sale of electricity to the site the installation is on or nearby consumer.	Post-installation
Export tariff	Price paid for energy that is generated and exported back in to the national grid.	Post-installation
Feed-In Tariff	Government subsidy which is paid in addition to the export tariff for any electricity exported to the national grid.	Post-installation *(currently paid for a period of 20 years)*

(Good Energy, 2016; Regen SW, 2016; Community Energy England, 2017)

The export tariff and feed-in tariff go hand in hand with FIT registered projects as they are both paid in relation to the amount of energy exported to the grid (OFGEM, 2017c). Electricity sales are usually handled through a power purchase agreement (PPA) which is a contract directly agreed between the energy generator and the energy user (Good Energy, 2018). PPA transactions are considered to be 'off-grid' and the price paid will tend to be linked to the retail price of energy rather than the export price (Brown, 2017). This is like a wholesale vs. retail price in business terms. Therefore, it is in the interest of the community group for energy to be sold to the end user rather than exporting it to the grid as it will generate more income, discussed further in Chapter 6. However, it is unlikely that all

the energy generated would be used on site, so a large proportion of organisations rely on a combination of electricity sales, export tariffs and feed-in tariffs. In more recent years, FITs have dropped significantly, for example the FIT for solar has dropped by 88% since the scheme started in 2010 (Ofgem, 2016). Some of the cuts have been drastic and unexpected, with solar projects finally becoming financially unsustainable under the current FIT reliant business model in March 2015 as discussed in Chapter 6.

Within the community energy sector there are two distinct types of finance capital that need to be raised; development funding and project finance costs (Regen SW, 2016). Chapter 6 discusses the difference between development and finance costs in more detail, however, some examples are given here. The development costs can cover many activities from feasibility studies through to planning or license applications. Project finance covers the capital costs associated with implementing the project such as purchasing the technology and installing it on-site. The FIT's were also supported by two project development grants, the Urban Community Energy Fund (UCEF) and the Rural Community Energy Fund (RCEF) (Community Energy England, 2017). The FITs and development grants were flagged as part of the government's community energy strategy set out by Department for Climate Change (2014). The UCEF was worth £10 million and the RCEF £15 million (Department for Energy & Climate Change, 2013; Department for Business Energy & Industrial Strategy, 2014).

The UCEF and RCEF provided grants of up to £20,000 for early stage renewable energy project development (DECC, 2014). Both funds offered the option for community energy groups to take out a loan to help cover the project costs, however this was not mandatory if community groups could source the funding from elsewhere (DECC, 2014). Findings suggest that 88% of groups who are generating energy locally utilised the FIT subsidy (Community Energy England, 2017). Community Energy England (2017) found that out of organisations who had required development funding for projects that over 63% of them had utilised UCEF and RECF. Therefore the discontinuation of the UCEF in July 2015 has created a large barrier to entry for urban community energy organisations wanting to install renewable technology (Good Energy, 2016).

Community Energy England (2017) reported that over £190m worth of investment has been generated by across the 108 community projects surveyed. The difference sources of investment are shown in Figure 4.3.

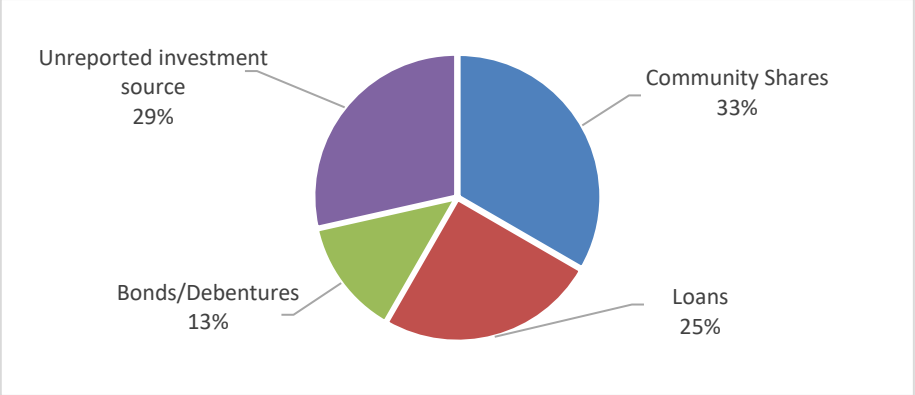


Figure 4.3: Community Energy Capital Investment
(Community Energy England, 2017)

These data demonstrate the prevalence of community shares across the sector. The second most common source of funding is from loans.

4.2.3 Community Benefit

One of the key pull factors that attracts people to the social enterprise model is that it enables communities to provide interventions which they believe are needed within their own community (Good Energy, 2016; Community Energy England, 2017). A community benefit fund is the money that is generated by a social enterprise to be used to better the communities in which they operate (Ridley-Duff and Bull, 2011). A secondary social impact comes from the autonomy over the use of income generated. This autonomy helps to empower communities to solve the problems that they deem to be significant (Ridley-Duff and Bull, 2011).

Figure 4.4 highlights the variety of community benefits that can be funded with the profits generated from the community energy sector. The circles in the figure are proportionally representative of the amount of community benefit distributed to different types of activity. The data shown highlight the number of community energy organisations who create each specific type of community benefit.

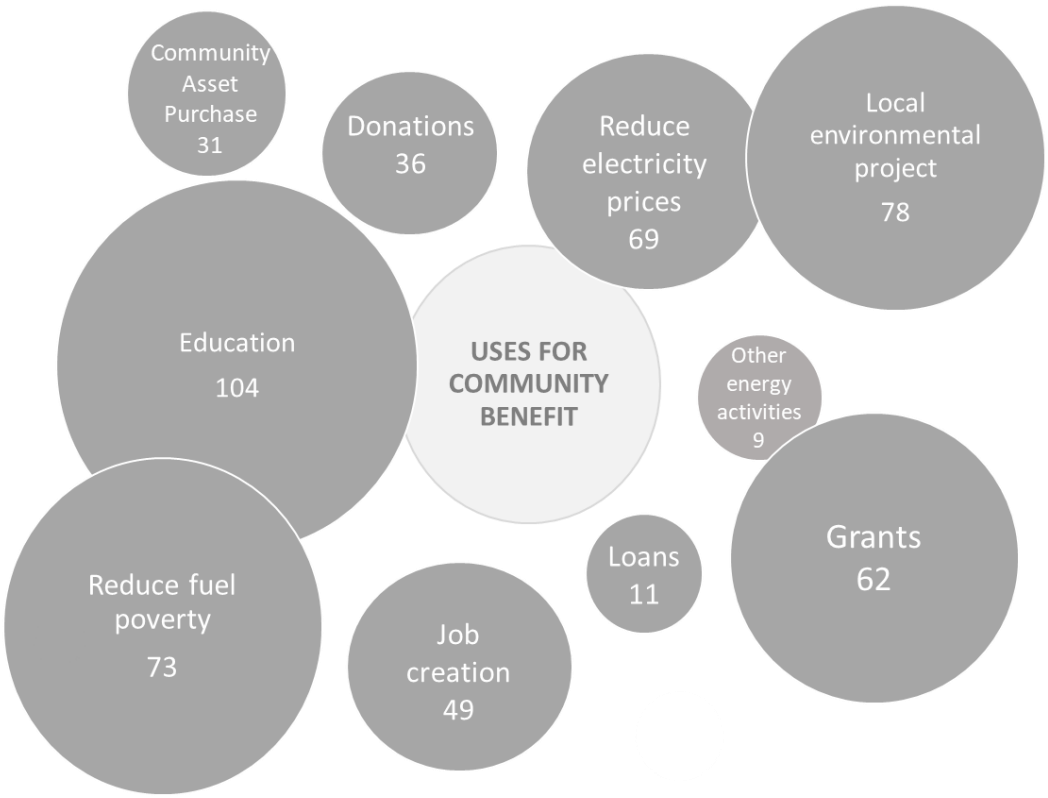


Figure 4.4: Distribution of community benefits of the Community Energy Sector
(developed from Community Energy England, 2017)

Figure 4.4 illustrates the 12 different potential uses for community benefit funds as highlighted by the State of the Sector Report by Community Energy England (2017). The top three were education around how community projects and the energy system work, reducing fuel poverty in the local area and local environmental projects. Job creation was also a high priority along with reducing energy prices. Given that the survey conducted by Community Energy England had 222 respondents, Figure 4.4 also highlights that individual organisations are likely to create community benefit in multiple ways.

3.2.4 Community energy social business model

Based on the key finding from this section Figure 4.5 details the dominant business model that has been utilised across the community energy sector in the UK. The overview is presented using the social business model canvas designed by Qastharin (2015). The canvas is previously discussed in Section 2.3.3 and illustrates the key stakeholders, operations, marketing and finance structures. A central tenant of this thesis is that a 'copy and paste' model has been adopted by community energy groups around the UK.

<table>
<tr>
<td rowspan="2">Key resources
• Finance for development costs (UCEF and RCEF grants) and project costs (community shares)
• Volunteer time

Partners & Key Stakeholders
• Site owners
• Building occupiers
• Energy suppliers
• Energy regulator
• District network operators</td>
<td rowspan="2">Key Activities
• Developing community based energy projects
• Raising finance to fund renewable energy projects
• Installing and managing renewable energy equipment
• Renewable energy generation</td>
<td>Type of Intervention
• Product – renewable energy
• Service – sale and export of renewable energy</td>
<td>Segments
Beneficiary
• Sites where the energy is generated
• Energy suppliers purchasing the energy
• Wider local community</td>
<td rowspan="2">Value Proposition
User value proposition
• Cheaper energy prices
• Using cleaner energy
• Funding available for local projects

Impact measures
• Amount of energy generated
• Cost savings for energy generation sites
• Amount of community benefit fund
• Review of community benefit interventions

Customer value proposition
• Cheaper energy
• Cleaner energy</td>
</tr>
<tr>
<td>Channels
• Using networks to obtain access to schools or other public buildings with the potential space for renewable energy generation
• Targeting and approaching organisations directly</td>
<td>Customers
• Sites that use the energy generated
• Energy supplier purchasing the energy at wholesale rate</td>
</tr>
<tr>
<td colspan="2">Cost Structure
Current
• Development costs and capital costs of projects, operation and maintenance of equipment, outsourcing costs of ongoing management
Scaling-up
• Staffing costs</td>
<td>Surplus
• Community benefit fund spend on local projects such as reducing energy prices, education and fuel poverty
• Funding development of more projects</td>
<td colspan="2">Revenue
• Sale of energy to site (approximately 50%*)
• Export of energy and the FIT subsidy (approximately 50%*)

*The 50% is an average based on half the energy being used on site and half being exported. The split will vary depending on the energy use of each site and the generating capacity of the installation.</td>
</tr>
</table>

Figure 4.5: Social Business Model Canvas for Community Energy

4.2.4 Barriers faced by community energy projects/groups

The community energy sector in the UK has been hindered by a number of issues that have limited the growth of the sector, primarily around how to finance the projects (DECC, 2015; Vaughan-Morris, 2015). This section explores the barriers that have been experienced by community energy organisations under the traditional generate and export models stimulated by the FITs. Figure 4.6 shows the most common barrier faced has been the cuts to the feed-in tariffs. Other significant issues identified relate to raising project delivery costs and navigating planning processes. A lack of expertise and local opposition to the projects were less common barriers.

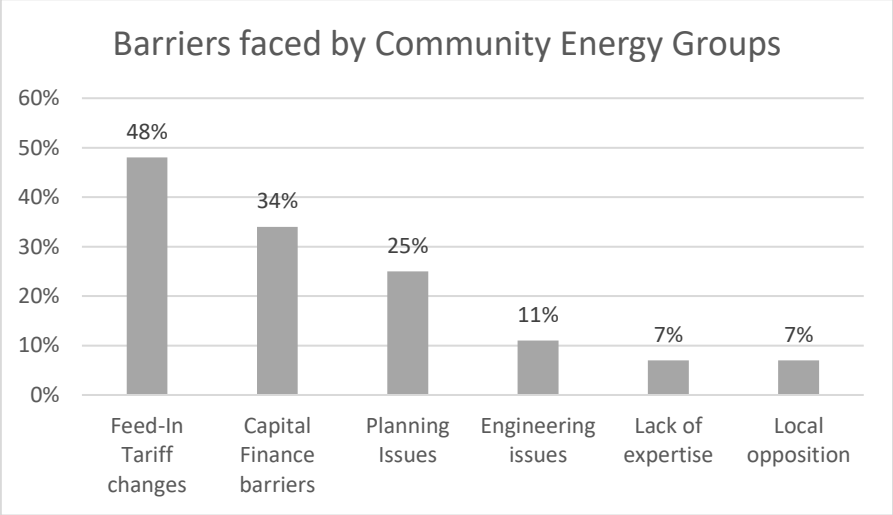


Figure 4.6: Barriers faced by the Community Energy Sector
(Community Energy England, 2017)

Table 4.6 shows some of the finding from a community energy review from 2015. It details the specific constraints that led to cost and financing problems that are only found in community or shared ownership renewable energy projects.

Table 4.6: Constraints and related cost/financing implications that only apply to community-led/or shared ownership projects

Code	Constraint
CE1	The lack of clear governance processes for community groups
CE2	Communities are risk averse
CE3	Communities have very few financial resources
CE4	The perceived riskiness of community-led shared ownership projects has deterred some financiers, such as banks
CE5	Community groups are not able to raise finance quickly
CE6	Average development phases are slightly longer
CE7	Developers are likely to have several projects under consideration, learning how to structure projects, whilst communities will often be developing only one project
CE8	Undertaking renewable projects of any size requires an understanding of many issues with communities, until recently, lacking guidelines on how to solve each challenge
CE9	A legal agreement must be made in the case of shared ownership and the legal fees can run into the many £10,000's

(adapted from Vaughan-Morris, 2015)

This research shows that community groups often face issues with finances. Some of the issues presented relate to raising finances and the development of projects. In terms of raising finances, risk is a key factor. Community organisations are more risk averse and community energy projects themselves can be perceived as too high risk by potential investors. In terms of developing community energy projects, Community Energy England (2017) found that across 222 organisations surveyed the total number of distinct projects is 269. This low number highlights that community groups often take on a limited number of projects. Therefore, communities as individual groups do not have the benefit of learning from several projects. The projects also take longer to execute and are costlier as they are not benefitting from any economies of scale on either expertise or equipment as discussed more in Chapter 6.

4.2.4.1 Regulatory issues

Regulation has been slow to evolve and as a result, community energy groups have had to come up with innovative solutions to enable them to operate within existing regulatory frameworks. One issue is that generators of community energy are not registered as suppliers. Therefore, in order for a community group to generate energy and sell it on site, they use a contract called a power purchase agreement (PPA) (Good Energy, 2018). The contract is formed between two parties where one side generates the energy and the other uses the energy. This method is commonly utilised to enable community energy groups to sell energy directly to the site it is generated on (Coalition for Community Energy, 2017). Where the energy is not to be sold on site, a private connection is also commonly used in conjunction with a PPA (TLT, 2016). The means that physical infrastructure is installed to transmit the energy from the generation site to the end user. This approach is often only carried out in areas where a 'soft dig'[23] is possible and within a short distance otherwise the costs become too high to make the projects financially viable as discussed in Chapter 6.

Private wire installations are not favoured by the District Network Operators (DNO's) as they result in the supply being 'off grid' (Miller, 2007). DNO's have a responsibility to balance supply and demand of energy and off-grid systems make this difficult to do. Private wire is infrastructure is outside of their network meaning they are unable to monitor generation and use (Electricity North West, 2017). DNO's are unlikely to be able to identify when people who are off-grid may need to draw from the grid when their own systems are not generating energy. The DNO's are therefore unable to balance this part of the supply (Miller, 2007). Since the demise of the FIT's, the DNO's have been exploring future options available for collaboration with community groups such as being able

[23] A soft dig refers to a method of removing terrain in order to install new utility lines. Typically the terrain type would be sand, mud, dirt, clay, rocks (ARUP, 2011). A soft dig would have minimal environmental impact and be more cost effective for community energy than alternative solutions.

to sell to a specific user but using the existing infrastructure (Electricity North West, 2017). This method would require community energy groups to go through a registered supplier and then effectively pay for the use of the grid but at a heavily discounted rate. This system may still not be financially viable; however, it demonstrates ways in which community energy has prompted more innovative thinking across the energy system.

4.3 Policy Analysis – A Review of Feed-In Tariffs in the UK

4.3.1 Feed-In Tariffs, Background

This section presents a summary of community energy installations registered for FIT. The projects referred to here are based on the actual number of installations that are registered for FITs, based on specific sites (OFGEM, 2017c). A community energy organisation may have one or several installations. Likewise, the community group may not be registered for the FIT at all, although the findings from Community Energy England (2017) suggest that the numbers for this are low. The aim of the analysis presented is to interrogate data on the uptake of the FIT and to investigate how the changes to the FIT rates have affected the number of new projects and installed capacity.

FIT's were announced in 2008 and made available from April 2010 (OFGEM, 2017c). Projects which were registered after the 15th July 2009 were eligible for the full FIT. Early adopters who already had technologies prior to this date were able to claim the FIT at a lower rate (OFGEM, 2017c). The FIT does not only cover community energy but it is also available for domestic, non-domestic commercial and non-domestic industrial projects (Ofgem, 2016). The eligibility criteria for the FIT is as follows (OFGEM, 2017c):

- The technology must be one of the following;
    - Solar Photovoltaic (Solar PV)
    - Wind
    - Micro combined heat and power (CHP)
    - Hydro
    - Anaerobic digestion
- Installation must be located in Great Britain
- Installations must be registered through either the Microgeneration Certification Scheme (MCS) or the ROO-FIT scheme

The scheme the projects are registered to depends on the type and size of the installation as detailed by OFGEM (2017c). Details are shown in Table 4.7.

Table 4.7: Registration Scheme to obtain Feed-In Tariffs

Technology	Microgeneration Certification Scheme (MCS)	ROO-FIT
Solar Photovoltaic (PV)	DNC* of 50kW or less	DNC* of more than 50kW and TIC** up to 5MW
Wind	DNC* of more than 50kW and TIC** up to 5MW	DNC* of more than 50kW and TIC** up to 5MW
Micro CHP	All	Not applicable
Hydro	Not applicable	All up to and including 5MW
Anaerobic Digestion	Not applicable	All up to and including 5MW

*DNC – Declared Net Capacity, ** TIC – Total Installed Capacity

(OFGEM, 2017c)

Table 4.7 shows the different types of projects and the type of scheme they are classified as. The size of an installation is often dictated by factors other than the type of scheme alone. However, there are implications for applying under the MCS or ROO-FIT. The application process for ROO-FIT is more time consuming and requires review and approval from the regulator, OFGEM. MCS projects simply require the submission of an application form along with supporting documents in order to start claiming FIT payments (OFGEM, 2017c).

FITs are payable for a period of 20 years, however, the FIT is granted in relation to the specific technology installed on a specific site (OFGEM, 2017c). This means that if the technology is relocated then the existing FIT agreement will no longer be paid. Therefore, registered FIT projects are site and technology specific and cannot be changed retrospectively. Since the FIT's were first introduced there here have been significant cuts to the FIT's scheme through a combination of small incremental and large drastic reductions (Ofgem, 2016).

4.3.2 Overview of FIT installed capacity installed in the UK

The central FIT register published by OFGEM (2017d) has been used to produce a series of graphs. The graphs identify who has utilised the FITs and what types of technology have prevailed. The data presented were up to date at time of analysis and are therefore accurate as of October 2017. Full details of the dataset utilised can be found in Section 3.2.1.

The first thing to note is the four different types of generators categorised by OFGEM (2017c); domestic, commercial, industrial and community groups. Figure 4.7 shows the total installed capacity of projects that have been installed under the FIT scheme.

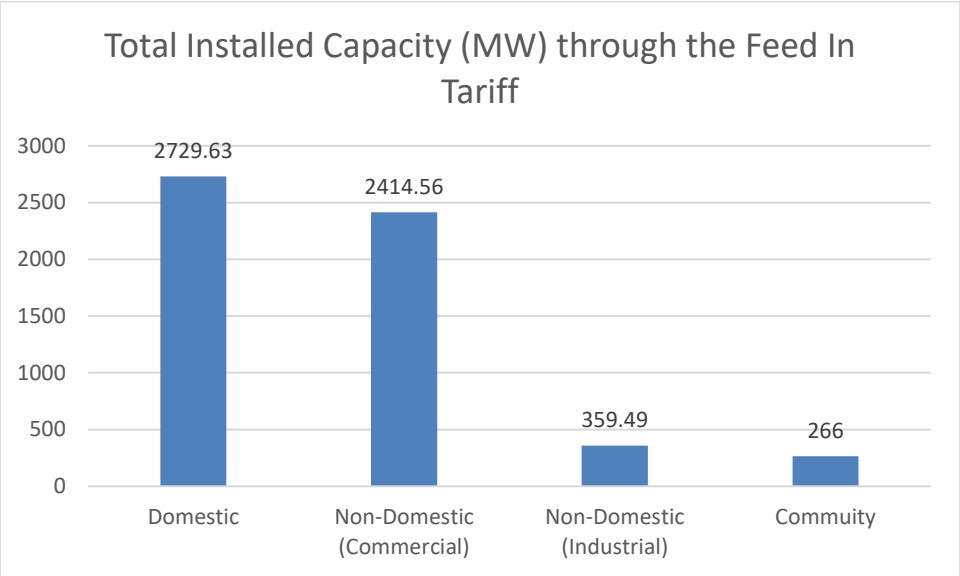


Figure 4.7: Total installed capacity of projects that have utilised the FITs as of June 2017

The installed capacity of community energy is 266MW. Figure 4.7 shows that community energy makes up 4.6% of the overall installed capacity. This is the smallest percentage of all four categories. It suggests that in capacity terms, community energy has been the least responsive in terms of uptake of the FIT. The types of technology to be utilised under the FIT is also an important consideration. A breakdown the different types of technologies utilised under the FIT scheme is shown in Figure 4.8.

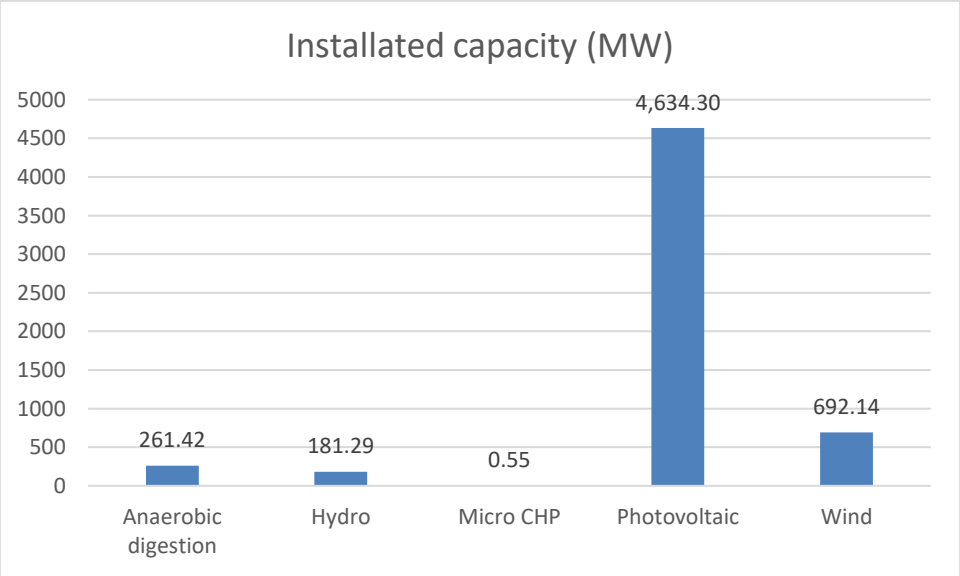


Figure 4.8: Installed capacity in the UK based on Technology Type

From the five different types of energy that have been registered under the FIT scheme, it is evident that solar photovoltaic is by far the dominant form of technology. It accounts for 80.32% of renewable capacity installed under the FIT. The reason why solar has been so popular could be

linked to the lower financial risk of solar projects identified in the interviews presented in Chapter 6. This steer towards solar PV is also in line with current a current global trend. Gul, Kotak and Muneer (2016) state that the trend towards solar PV due to the affordability and scalability of the technology. Figure 4.9 presents an overview of project type and installed capacity by technology type.

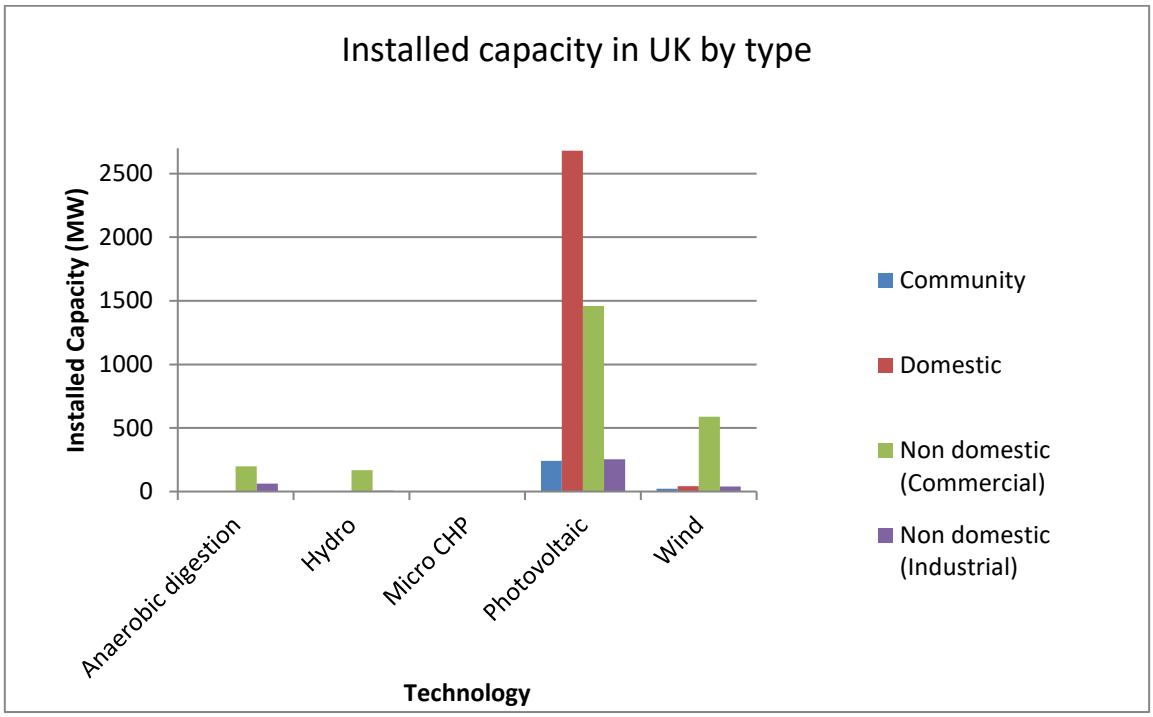


Figure 4.9: Installed capacity in the UK based on technology and type of project as of June 2017

Figure 4.9 shows photovoltaics being the most installed in terms of capacity did not change depending on project type. Alternative types of technology were more frequently explored by non-domestic (commercial) level energy organisations. Community energy showed less variance in this respect with a large proportion of the projects being solar PV.

Figure 4.10 shows the number of active generators in relation to each of the four project types. There are 510,169 domestic projects, 19,283 non-domestic commercial, and 1,357 non-domestic industrial and 2001 community projects.

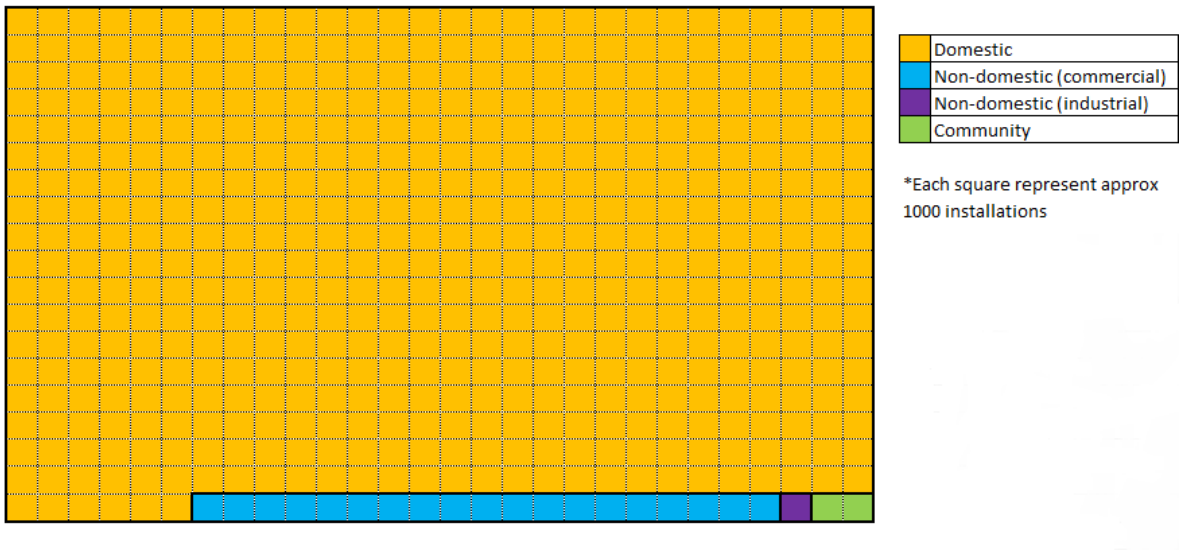


Figure 4.10: Number of generators registered for FITs as of June 2017

It is clear to see that domestic installations are the largest proportion in relation to the number of projects. This is unsurprising as the installed capacity for domestic projects was the highest. This demonstrates that individuals wishing to generate energy at home have taken the most advantage of the FIT's. The industrial group has the lowest number of generators, accounting for 0.27%. Community energy is only slightly more than this at 0.39%. This demonstrates that the uptake levels of the FIT for community energy have been similar to the industrial projects. Figure 4.11 shows the average capacity per generator for each technology type based on data from OFGEM (2017d).

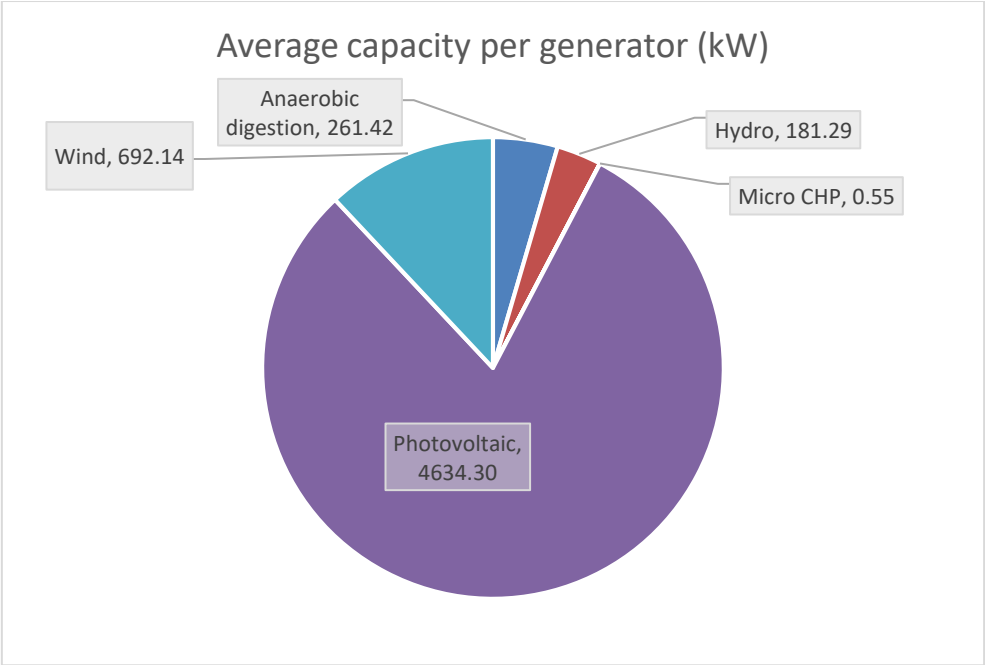


Figure 4.11: Average installed capacity by technology as of June 2017

The average installed capacity per generator analysis demonstrates that photovoltaic projects have the largest average. Photovoltaics have almost 7 times the generation capacity when compared to wind projects. However, data from Figure 4.10 and Figure 4.11 suggest that there is a large variance in the size of solar projects.

According to OFGEM (2017c), domestic installations of renewable energy technology are relatively small at approximately 4kW. However, they account for over 95% of the number of projects installed. These data demonstrate that there is a large variation in the size of solar projects across the UK. Figure 4.12 shows that the average size of a solar project varies depending on the type of project, that is, whether community, domestic, commercial or industrial.

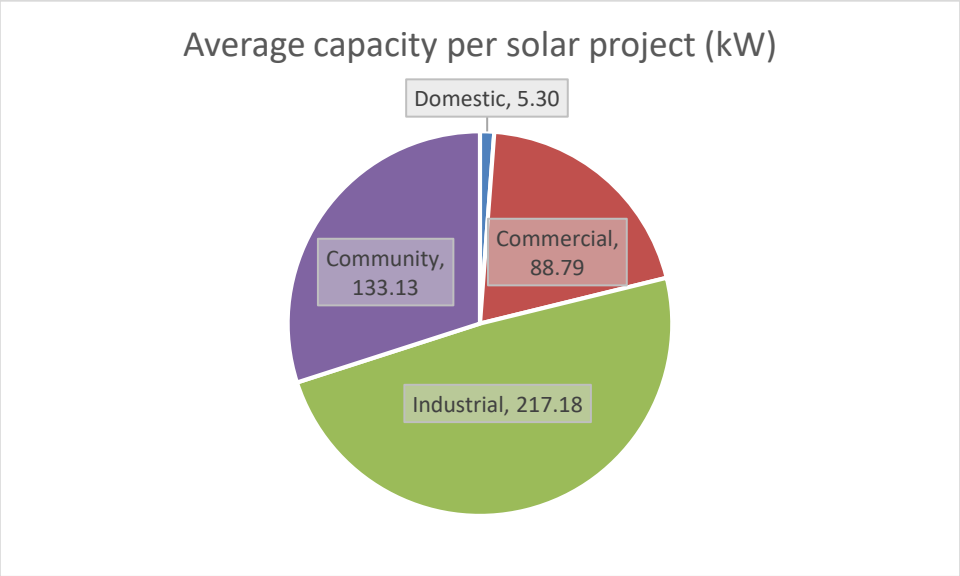


Figure 4.12: Average size of solar project by sector as of June 2017

The domestic sector is the smallest with an average capacity of 5.3kW. Industrial PV projects have an average of 217.18kW and constitute the largest sector. Community energy solar projects have an average capacity of 133.13kW, this situates them in between a commercial and industrial scale.

The average capacity of projects has been charted against the percentage of generators in each of the categories (Figure 4.13). The graph provides a basis for comparison of community energy against the different classifications of projects; domestic, community energy, non-domestic (commercial), non-domestic (industrial). It highlights the similarities between the community energy sector and the other sectors analysed.

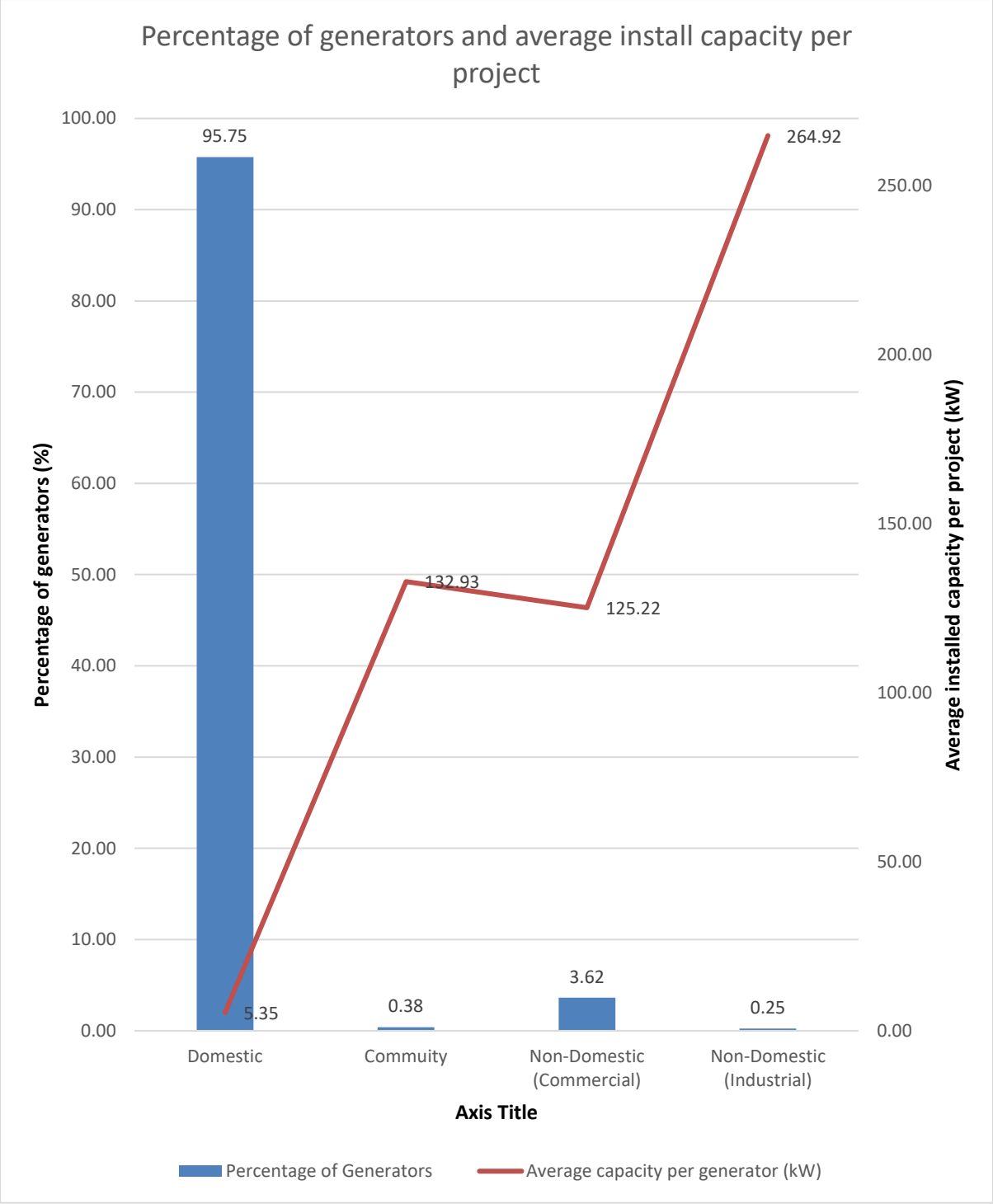


Figure 4.13: Percentage of FIT registered generators and average install capacity

Figure 4.13 shows that despite 95.75% of generators being in the domestic category, their generation average is the lowest. The pattern shows that on average community energy projects generate more energy than commercial projects; however, there are significantly less numbers of commercial projects. The dominant technology that has emerged from the FIT data is solar PV. However, to gain a better understanding of what is happening with the different technologies solar has been excluded to see if any insights can be gained. Figure 4.14 shows that anaerobic digestion

has the largest average capacity but the lowest number of projects. Wind has the largest number of projects, however the second lowest average capacity (when solar PV is excluded).

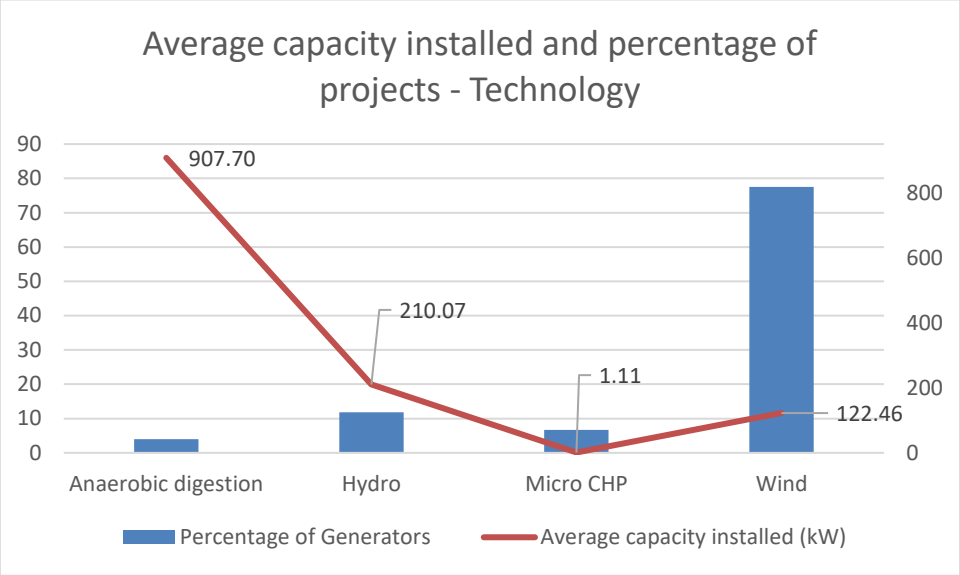


Figure 4.14: Average installed capacity plotted against percentage of projects for all technologies

For the purposes of this analysis it should be noted that at the time the data were collected there were no registered anaerobic digestion projects and only 1 Micro CHP project in the UK. Therefore, these have been excluded from the results and the graph from Figure 4.14 was reproduced, showing in Figure 4.15 to provide a more accurate representation.

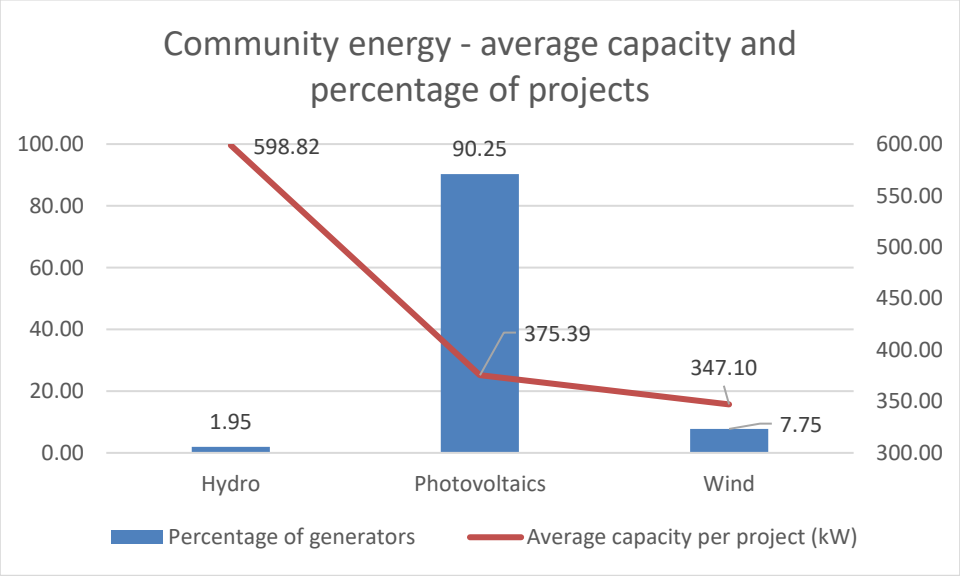


Figure 4.15: Community energy - average capacity and percentage of projects

Figure 4.15 shows that within community energy FIT registrations, 90.25% of the projects are for solar photovoltaics and the highest average install capacity is for hydro schemes at 598.82kW. This finding shows that the solar photovoltaics have been a dominant form of technology across the

community energy sector and the generation capacity average for solar PV is higher than for wind projects. This raises an important question as to why solar has become a dominant technology in the UK considering the British climate is more suited for wind generation than solar.

4.4 Impact of the Feed-In-Tariff for Community Energy

This section of the results explores the changing FIT rates in relation to the number of projects installed and the installed capacity of community energy projects in the UK. Table 4.8 lists all of the FIT rate changes in relation to photovoltaic and hydro schemes (Ofgem, 2016). The rates used are reflective of the typical installation capacity of community energy organisations. Hydro has been chosen as it has the largest install capacity and photovoltaic as it has the largest number of projects. These two will provide a basis for comparison. The table also logs the duration of each of the tariff periods. This is reflective of when new FIT rates were issued by OFGEM (2016) in relation to the different technologies and types.

Table 4.8: FIT rates between April 2010 and June 2017 for PV and Hydro

			Rate per technology (p/kWh)		Percentage Change (from previous tariff period)	
Tariff period	**Date**	**Duration (days)**	Solar PV*	Hydro*	Solar PV*	Hydro*
1	1st Apr 2010 to 31st Mar 2011	365	38.5	21.87		
2	1st Apr 2011 to 31st Jul 2011	122	38.5	21.87	0.00	0.00
3	1st Aug 2011 to 29th Sept 2011	60	38.5	21.87	0.00	0.00
4	30th Sept 2011 to 2nd Mar 2012	155	38.5	21.87	0.00	0.00
5	3rd Mar 2012 to 31st Mar 2012	29	16.96	21.87	-55.95	0.00
6	1st Apr 2012 to 31st Jul 2012	122	16.96	21.87	0.00	0.00
7	1st Aug 2012 to 31st Oct 2012	92	15.07	21.87	-11.14	0.00
8	1st Nov 2012 to 30th Nov 2012	30	14.09	21.87	-6.50	0.00
9	1st Dec 2012 to 14 Mar 2013	104	14.09	21.87	0.00	0.00
10	15th Mar 2013 to 31st Mar 2013	17	14.09	21.87	0.00	0.00
11	1st Apr 2013 to 30th Apr 2013	30	14.09	21.87	0.00	0.00
12	1st May 2013 to 30th Sept 2013	153	14.09	21.87	0.00	0.00
13	1st Oct 2013 to 31st Dec 2013	92	13.61	21.87	-3.41	0.00
14	1st Jan 2014 to 31st Mar 2014	90	13.24	21.87	-2.72	0.00
15	1st Apr 2014 to 30th Jun 2014	91	12.78	20.79	-3.47	-4.94
16	1st Jul 2014 to 30th Sept 2014	92	12.78	20.79	0.00	0.00
17	1st Oct 2014 to 31st Dec 2014	92	12.78	18.71	0.00	-10.00
18	1st Jan 2015 to 31st Mar 2015	90	12.15	18.71	-4.93	0.00
19	1st Apr 2015 to 30th Jun 2015	91	12.15	16.63	0.00	-11.12
20	1st Jul 2015 to 30th Sept 2015	92	12.15	16.63	0.00	0.00
21	1st Oct 2015 to 31st Dec 2015	92	11.73	14.97	-3.46	-9.98
22	1st Jan 2016 to 14th Jan 2016	14	11.17	14.97	-4.77	0.00
23	15th Jan 2016 to 31st Mar 2016	77	4.7	8.75	-57.92	-41.55
24	1st Apr 2016 to 30th Jun 2016	91	4.64	7.87	-1.28	-10.06
25	1st Jul 2016 to 30th Sept 2016	92	4.57	7.85	-1.51	-0.25
26	1st Oct 2016 to 31st Dec 2016	92	4.5	7.84	-1.53	-0.13
27	1st Jan 2017 to 31st Mar 2017	90	4.32	7.63	-4.00	-2.68
28	1st Apr 2017 to 30th Jun 2017	91	4.36	7.8	0.93	2.23
	**The rates used are reflective of the organisations consulted within this research. Please note the classifications for different size and types of installations have changed several times over the course of the scheme. All rate taken from OFGEM* (2017b).					

The highlighted cells show times when the FIT rate changed. On all occasions, apart from the FIT rates from 1st April 2017[24], the tariffs reduced. This is graphically presented in Figure 4.16 which demonstrates the changes to the FITs from April 2010 until June 2017.

[24] The reason for this exception is unknown, however, since the original data was collected there trend has been for the FIT rates to continue to decrease (Ofgem, 2018).

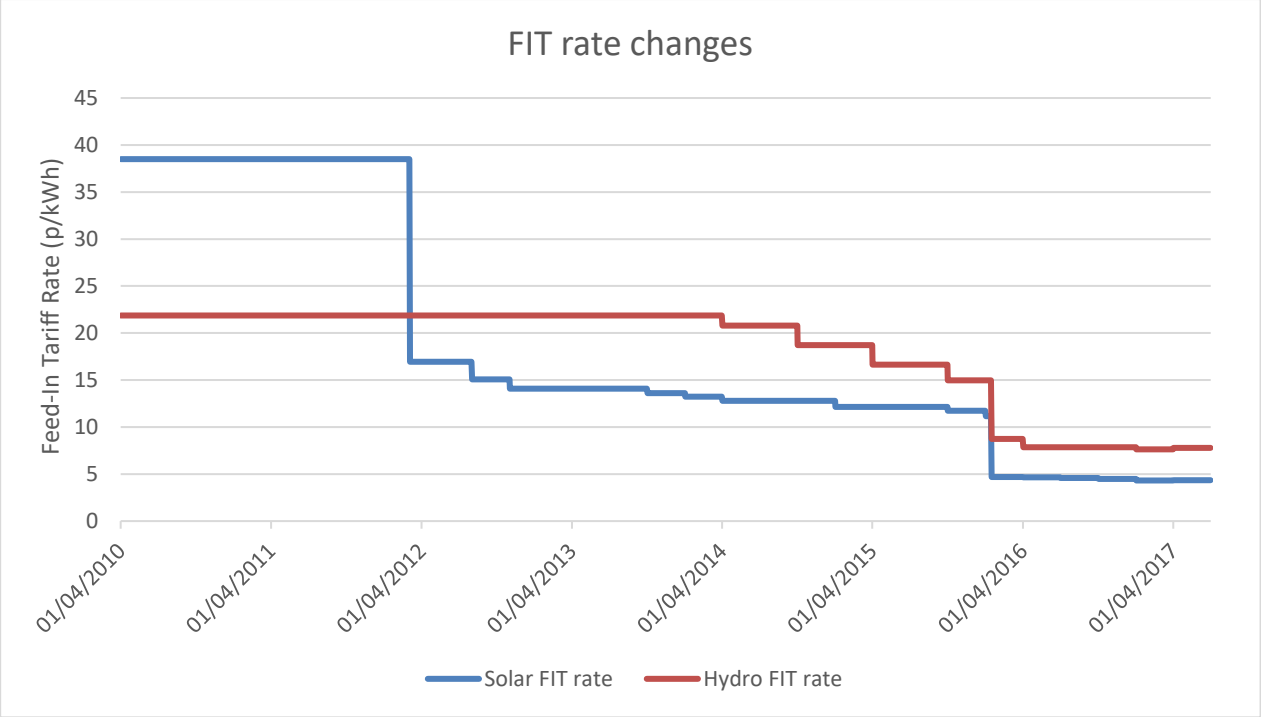


Figure 4.16: FIT rate changes for hydro and solar projects likely to affect community energy since start of the scheme

For solar, it is evident that there were two main points at which the FIT rate dropped substantially, in March 2012 and January 2016. Hydro remained relatively more stable until April 2014 where incremental reductions took place until January 2016 when there was a significant drop. In addition to this, Table 4.9 shows all the drops for solar PV and hydro where the decrease was greater than 10%. The solar PV significant drops are identified as a 55.95% reduction in March 2012 and a 57.92% reduction in January 2016. The hydro FIT rate dropped by 41.55% in Jan 2016. The sporadic and unpredictable nature of the drops in feed-in tariffs demonstrates the uncertainty faced by the community energy organisations who had established original business models on basis of the FITs. The sporadic nature of changes will be explored further by reviewing specific periods in time where drops to the tariff were over 10% have been identified and are shown in Table 4.9.

Table 4.9: FIT changes showing the dates where the FIT's dropped more than 10%

	Rate per technology (p/kWh)		Change from previous period	
Date of change	Photovoltaic*	Hydro*	Photovoltaic*	Hydro*
1st April 2010	38.5	21.87		
3rd March 2012	16.96	21.87	-55.95%	0.00%
1st August 2012	15.07	21.87	-11.14%	0.00%
1st October 2014	12.78	18.71	0.00%	-10.00%
1st April 2015	12.15	16.63	0.00%	-11.12%
15th January 2016	4.7	8.75	-57.92%	-41.55%
1st April 2016	4.64	7.87	-1.28%	-10.06%
1st April 2017	4.36	7.8	0.93%	2.23%

**The rates used are reflective of the organisations consulted within this research. Please note the classifications for different size and types of installations have changed several times over the duration of the scheme*

(Ofgem, 2017b)

The most significant drop occurred in January 2016 which was followed by another significant drop just three months later in April 2016. The information from Table 4.9 has been used to compare against additional data on the number and capacity of projects from the Central FIT register held by OFGEM (2017d), Table 4.10. The data presented in Table 4.10 have been standardised by calculating the average number of installations per day and the average installed capacity per day. The number of solar PV projects installed per day was at its peak during the period of March 2012 – July 2012 at 2.87 projects per day despite this being the period which suffered a large drop in the feed-in tariff. Since 2012 the average number of new projects per day for solar has been less than one project per day with the trend going down. However, the installed capacity per day between Jan 2016 and June 2017 was 0.374MW which is significantly above the average of 0.087MW per day[25]. This indicates that although less projects are being installed, the projects that are installed tend to be larger in size. This concurs with the findings in the interviews presented in Chapter 6 that larger projects are necessary to remain financially viable.

[25] Average capacity installed per day calculated based on the Central FIT database data presented within this chapter. The average calculation is based on data from the introduction on the FIT in April 2010 until the June 2017 when the data was collected.

Table 4.10: Changes to the number of registered community installations following periods where significant drops to FITs occurred

Photovoltaics

Period				Totals		Average (per day)	
Start date	End Date	No. of days	FIT change	Installations	Installed capacity (MW)	Installations	Installed capacity (MW)
01/04/2010	02/03/2012	702	0%	814	5.80	1.160	0.008
03/03/2012	31/07/2012	151	-55.95%	436	5.77	2.887	0.038
01/08/2012	14/01/2016	1262	-33.14%	1145	23.43	0.907	0.019
15/01/2016	20/06/2017	523	-60.97%	367	195.55	0.702	0.374
	Totals:	2638	-88.68%	2762	230.55	1.047	0.087

Hydro

Period				Totals		Average (per day)	
Start date	End Date	No. of days	FIT change	Installations	Installed capacity (MW)	Installations	Installed capacity (MW)
01/04/2010	30/09/2014	1644	0.00%	19	0.52	0.012	0.0003
01/10/2014	31/03/2015	182	-14.45%	3	0.49	0.016	0.0027
01/04/2015	14/01/2016	289	-37.31%	8	0.88	0.028	0.0030
15/01/2016	31/03/2016	77	-25.40%	2	0.12	0.026	0.0016
01/04/2016	20/06/2017	446	-10.86%	11	1.27	0.025	0.0028
	Totals:	2638	-64.33%	43	3.28	0.016	0.0012

Benchmark data

All registered renewable technologies over whole period (anaerobic digestion, hydro, micro CHP, photovoltaic and wind)

All renewable technologies totals:	2971	256.12	1.126	0.097

(OFGEM, 2017d)

Figure 4.17 explores solar PV in more detail by presenting the changes in FIT rates, average capacity per day installed and average number of installations.

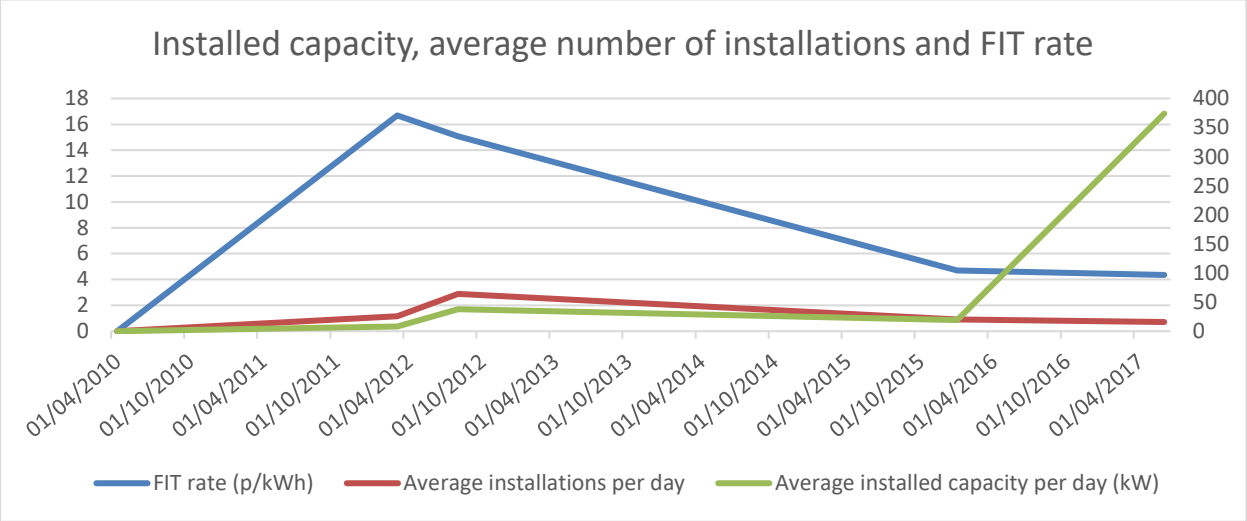


Figure 4.17: Plots installed average capacity against average number of installations and the FIT rates for solar

Figure 4.17 highlights the significant growth in capacity being installed per day since April 2016 when there was a large reduction in the feed-in tariff. This change was not matched by an increase in the number of projects. Prior to April 2016 there was a fall in the FIT rates, the average capacity and the number of projects installed per day. This demonstrates that since April 2016 there has been a shift in the size of solar projects that are now being considered by community energy in the UK.

4.5 Summary of Chapter 4 results and points for discussion

The rationale behind this chapter was to provide a case study of the community energy sector in the UK. Three key objectives of the study outlined in Section 3.2.1 were; 1a) build a profile of the community energy sector in the UK, and 1b) evaluate the impact of the feed-in tariff. An overview of the key findings linked to each of these aims is presented. Box 4.1 provides a summary of the key findings. Overall the findings demonstrate that a dominant business model for community energy emerged in the early 2010s. The use of the social business model canvas has helped to map this business models that was widely adopted across community energy groups. The 'copy and paste' nature of the business model has led to limited diversity and innovation across the community energy sector.

Box 4.1: Summary of results - Study 1

Profiling the community energy sector in the UK

- The feed-in tariff stimulated the development of the community energy sector in the UK
- There was evidence of approximately 550 active community energy groups in the UK. The sector had been supported by over 155,000 hours of volunteer time
- The dominant finance model utilised in community energy sector was the combined use of FITs, government development grants and community share offer. The dominate legal structure is Community Benefit Societies

Impact of the feed-in tariff

- The overall energy generation capacity of the community energy sector is unknown, but is thought to have grown from 10MW to several hundred MW between 2010 and 2017
- Solar has been the dominant technology registered under the FIT scheme. There was a large variance in size of solar projects. The average installed capacity of solar was larger than wind
- 88% of community energy organisation had at least one FIT registered generation site. The number and capacity of community energy projects was comparable to commercial installations
- Drops to the FIT's were found to be sporadic and unpredictable. No pattern was established between the scale and timing of the cuts

Profiling the community energy sector in the UK– *Objective 1a*

The evolution of the community energy sector in the UK is a cornerstone of this thesis. The results presented underpin the findings for research questions 1, 2 & 3, as discussed in Chapter 3. It is evident from the results presented that the use of renewable energy technology has increased, and that community energy has contributed to this. Community energy projects within England, Northern Ireland and Wales have been dominated by solar PV and much of the installed capacity is

based in the South of England. The sector has also been largely supported through volunteers setting up and delivering projects. Community benefit funds have also been established to provide benefits, the most common being education, reducing poverty and reducing energy bills locally.

The FIT data presented suggest that community energy have a combined total installed capacity of 266MW. This figure is different to the 188MW reported by Community Energy England as the total number of community energy projects. It is unclear why there is a disparity between the two dataset and both measurements have limitations. It was also reported by Community Energy England that 12% of community groups did not have FIT registered projects meaning that the difference in the datasets is likely to be even larger. The data show that the FITs created a fertile ground for community groups starting projects and brought many new projects into being. Evidence demonstrated that the business model for generating community energy was based around the feed-in tariff as it made exporting energy to the grid a financially viable business model. Many organisations have utilised the government UCEF and RCEF grants to aid with the development cost of projects. Finance is then often raised using share issue rather than the loan options attached to the UCEF and RCEF grants. Three main legal structures utilised across community energy were; Community Benefit Societies, Co-operatives and Community Interest Companies. Community energy groups face several barriers which have hindered progress against other sectors. These include longer project development times, issues raising capital finance, planning and the costs involved in hiring experts such as legal teams or engineers. However, the most prevalent issue which currently community groups are currently facing is that the business model which relied heavily on the FITs is no longer financially viable.

Impact of the feed-in tariff – *Objective 1b*

The impact of policy on the community energy sector is important for addressing research questions 1 & 2, as discussed in Chapter 3. The reduction in the feed-in tariffs between April 2010 and June 2017 was explored during this results chapter. This period was significant as it spans from the introduction of the FITs to the time when community energy projects became financially unviable under the FIT scheme. The FIT analysis shows that, following the introduction of this policy instrument, the number of community energy organisations rose rapidly in subsequent years. 88% of community energy groups had at least one project register under the FIT scheme. The more recent data show that despite a fall in the number of projects following the reduction in the feed-in tariff, there has been an increase in the capacity installed per project. Evidence presented also shows scale and timing inconsistencies in the reduction in the feed-in tariffs. The inconsistencies relate to both the amount of the reduction and the periods of time in between significant rates changes.

The solar PV and hydro FIT rate changes from April 2010 to June 2017 were analysed. The findings show that both small and incremental reductions in FIT occurred in addition to two large reductions for solar (Mar 2012 and Jan 2016) and one for hydro (Jan 2016). All the FIT changes reviewed showed reductions, apart for the most recent change which showed a small increase of several pence. The longest time in between FIT reduction was nearly 2 years (702 days) for solar and 4 years for hydro (1,461 days). The shortest period in between reductions for solar was 14 days and 77 days for hydro. In terms of the total reduction, the solar FIT reduced by 88.7% whereas the hydro FIT has been reduced by 64.3%.

Community energy accounts for 4.6% of the capacity installed that benefit from the FITs. The dominant form of technology that utilises the FIT is solar PV both in terms of capacity installed and number of projects. The clear majority of installed capacity for community energy is in the south of England. Across all the FIT registered projects there was a lot of variation between the capacities installed. This variation is due to the broad range of project types eligible for the subsidy; domestic through to industrial scale. In terms of capacity the projects that are set up by community energy have similar average capacity to the projects installed by commercial entities. This finding demonstrates the capacity that community energy is currently operating at.

Chapter 5. Social Enterprise in the UK

An overview of the methods used in this results chapter are presented due to the mixed methods approach using within this thesis (Table 5.1). Full details on the methodological approaches applied and datasets utilised are detailed in Chapter 3.

Table 5.1: Summary of methods for study 2

	Social Enterprise in the UK
Methods applied	Survey with questionnaire instrument
Rationale	Collate data for >100 social enterprise organisations
Datasets utilised	Questionnaire Overview The questionnaire was made up of the following sections; • Background and organisational profile information • Organisational networks • Income streams and opportunities to trade • Organisational barriers The survey data collected is presented exclusively within this chapter, the complete dataset can be found in Appendix 6.
Analysis overview	• Descriptive statistics were used to provide an overview of the data collected • Chi-square analysis[26] was then utilised to identify any relationships between the different variables for the whole of the sample • Post-hoc testing[27] on significant chi-square results to explore validity of results and identify where specific relationships exist

[26] Summary tables are presented in the chapter for ease of the reader. Full chi-square findings are presented in Appendix 7.

[27] The post-hoc testing used provides richer data on the where specifically significant relationships exist. It also corrects for a type 1 statistical error created by the small sample sizes for some of the grouping used. Full details of the methodology used for the post-hoc testing is provided in Section 3.2.2.4. The post-hoc tests from SPSS and the overview of significant findings are presented in Appendices 8 and 9.

5.1 Background Information and Organisational Characteristics

The results presented here make use of descriptive statistics and present the key findings from the survey of social enterprise organisations. Cross-tab and chi-square analysis techniques have been applied to add an extra level of depth to the analysis and to identify key relationships across organisational parameters.

To provide context to the results, is it important to give some background information on the characteristics of the surveyed organisations. Several questions were asked to establish key background information on the surveyed organisations;

- *Where is your organisation based?*
- *How long has the organisation been in operation?*
- *How many people does the organisation employ?*
- *In which sector does your organisation operate?*
- *What is the legal structure of your business?*

The rationale for asking these questions was to provide a basis for analysis. The demographic data help to determine whether factors such as location, business size or legal structure have any influence on the findings. Where reference is made to Environmental and Energy social enterprise, it should be made clear that the environmental group is a subset of the whole dataset and that the energy group is a further subset of the environmental group subset as shown in Figure 5.1.

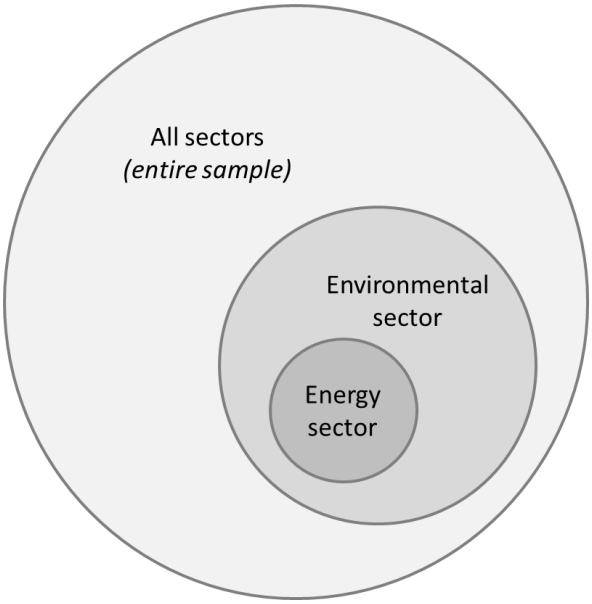


Figure 5.1: Dataset subgroups presented within the chapter

The rationale behind these groupings is to allow for the comparison of the energy sector organisations against the whole social enterprise sector. As only 8 energy organisations completed the survey the environmental group was also utilised to give a second basis for comparison. Findings unique to energy focused organisations and those common to social enterprise organisations in general are elucidated. The all sectors, environmental and energy grouping scheme has been designed to provide a basis for discussion and will be used later within the chapter to highlight the implications of results for social enterprises operating in the energy sector. Table 5.2 provides a summary overview of characteristics of the surveyed organisations for the entire sample and the environmental and energy subgroups. Table 5.2 shows that the most common legal structures of social enterprises across the sample are Community Interest Companies (CIC) and Ltd Companies. This pattern is reflected in the environmental grouping. The energy group demonstrates a different trend as Community Benefit Societies were reported as the most common legal structure adopted.

During the analysis no statistical significance[28] was found between the length of time in operation and legal structure. This finding demonstrates that the type of legal structure selected by social enterprises is not necessarily dependent on when the social enterprise was set up or dictated by current trends.

[28] A Chi-squared test was used to determine whether there was a relationship between the length of time in operation and legal structure. The results showed that these parameters were not independent of each other ($\chi_1{}^2$=56.103, p=0.0047). Further post-hoc testing was applied and outcomes demonstrate that there was no significant relationship between time in operation and the legal structure selected.

Table 5.2: Characteristics of Social Enterprises Surveyed

	All		*Environment*		*Energy*	
	N	***%***	***N***	***%***	***N***	***%***
Time in Operation *(N=150):*						
Less than 1 year	8	5.3%	0	0%	0	0%
1-2 years	29	19.3%	1	9%	1	12.5%
2-4 years	40	26.7%	5	45.5%	5	62.5%
4-10 years	40	26.7%	2	18.2%	2	25%
10+ years	33	22.0%	3	27.3%	0	0%
Size (by employee/volunteer) *(N = 149):*						
Small (less than 50)	129	86.6%	22	91.6%	7	87.5%
Medium (50 - 249)	9	6.0%	1	4.2%	1	12.5%
Large (250+)	11	7.4%	1	4.2%	0	0%
Legal Structure *(N = 149):*						
Multiple	12	8.1%	4	16.6%	2	25%
Community Benefit Society	6	4.0%	5	20.8%	5	62.5%
Co-operative	2	1.3%	0	0%	0	0%
Community Interest Company	59	39.6%	7	29.2%	1	12.5%
Sole Trader	3	2.0%	0	0%	0	0%
Limited Company	55	36.9%	8	33.3%	0	0%
Partnership	4	2.7%	0	0%	0	0%
Public Limited Company	4	2.7%	0	0%	0	0%
Registered Charity	1	0.7%	0	0%	0	0%
Charitable Incorporated Organisation	3	2.0%	0	0%	0	0%
Sector *(N=175):*						
Advocacy & Campaigning	2	1.1%	n/a		n/a	
Business Support Services	35	20.0%	n/a		n/a	
Community Development & Regeneration	8	4.6%	n/a		n/a	
Cross sector	17	9.7%	n/a		n/a	
Education & Training	13	7.4%	n/a		n/a	
Environment	28	16.0%	28	16%	8	4.6%
Health & Social care	29	16.6%	n/a		n/a	
Hospitality, Leisure & Tourism	7	4.0%	n/a		n/a	
Housing & Construction	3	1.7%	n/a		n/a	
Legal and Financial Services	4	2.3%	n/a		n/a	
Public Services	8	4.6%	n/a		n/a	
Retail	14	8.0%	n/a		n/a	

Figure 5.2 illustrates the length of time the respondent organisations have been in operation.

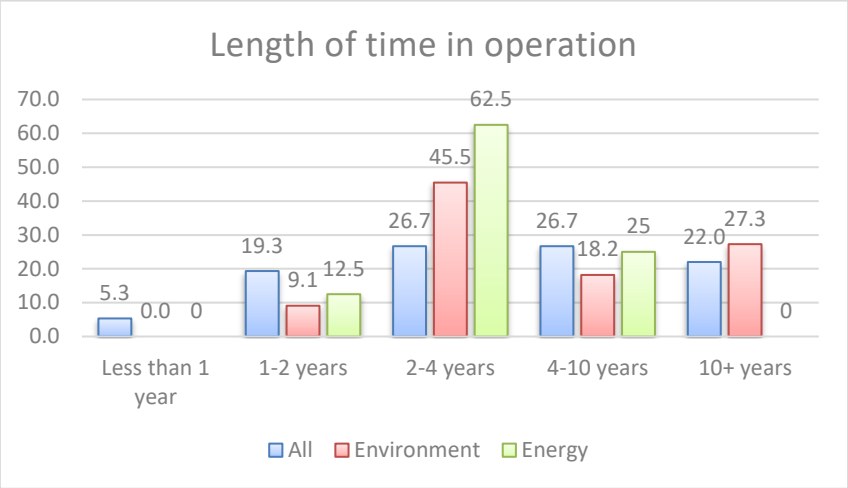


Figure 5.2: Length of time in operation by category

Figure 5.2 highlights that social enterprises under 1 year old made up 5% of the organisations surveyed across all participants. However, none of these belong to the energy subgroup. There is a clear peak in environment and energy organisations that have been in operation for 2-4 years, particularly regarding the energy sector. The organisations that have been in operation for 2-4 years would have been set up between early 2013 and early 2015 (as the data were collected during February and March 2017). The lack of new entrants was an expected but prevalent finding in relation to the energy sector when considering the trajectory of development of community energy in the UK, discussed in Chapter 4.

The data show that 86.6% of all surveyed social enterprises are classified as micro or small businesses[29]. Micro business, with fewer than 10 employees, make up 58.4% of the sample. Table 5.3 shows the organisational sizes of the sample categorised by the number of employees.

Table 5.3: Organisational labour averages

	Mean	Median	Mode	Range	*Total*
All (149)	125	7	2	9009	*18473*
Environment (25)	375	5	5	9009	*9376*
Energy (8)	14	5	5	52	*115*

Little variation was evident when comparing the environmental and energy subgroups within which micro or small organisations make up 91.6% and 87.5% of surveyed organisations respectively. Table

[29] Based on part of the European Commission (2018) classification for business; micro (0-9) small (10-49), medium (50-249) and large (250+)

5.3 shows that the mode of employees and volunteers for all respondents is 2 employees. However, this increased to 5 employees for both the environmental and energy sub groups.

The survey collected data in relation to the sector of operation of all surveyed organisations. The sectors were self-selected, and the data were processed and grouped to facilitate analysis. A breakdown of responses on sector is shown in Figure 5.3.

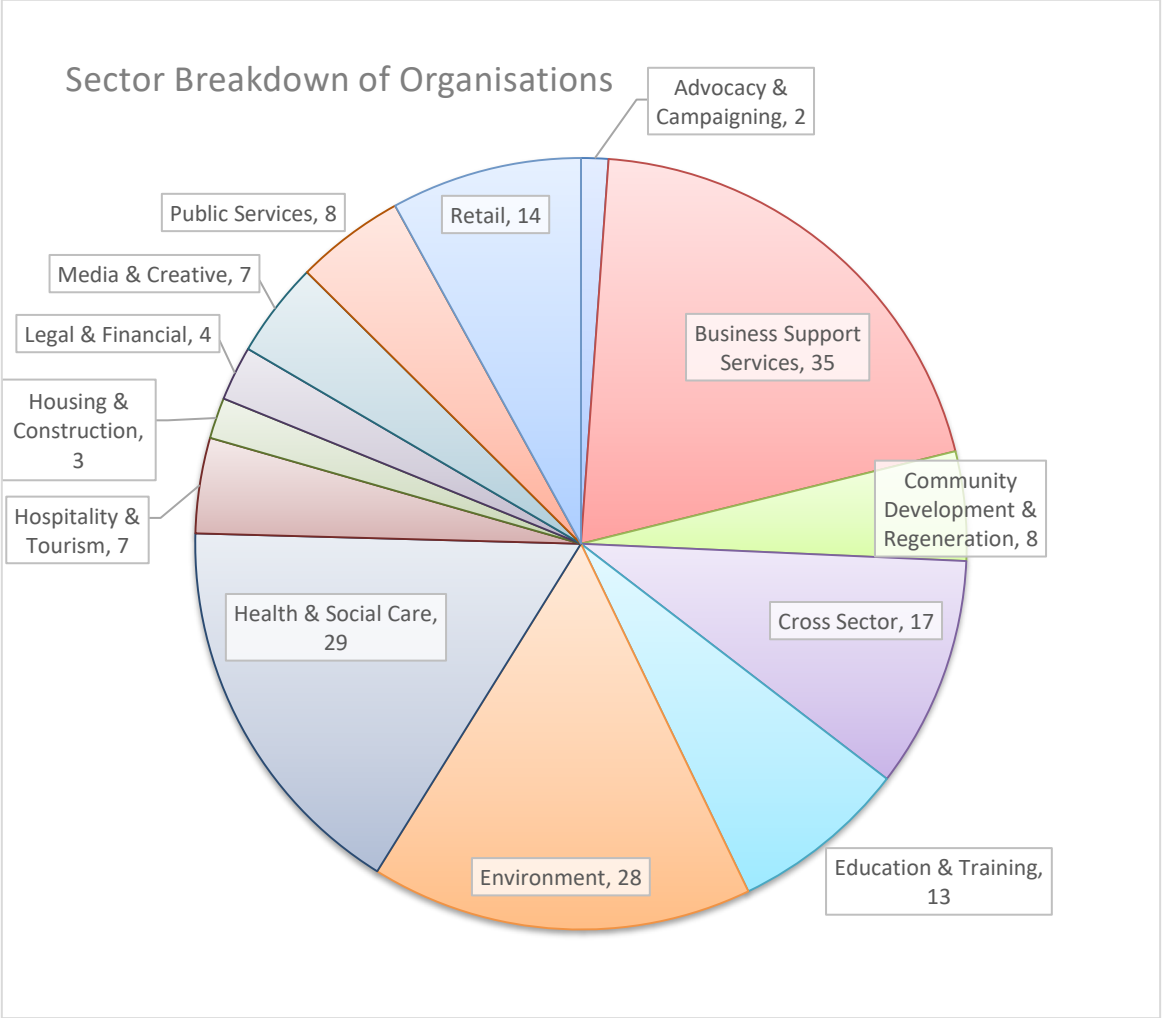


Figure 5.3: Sector breakdown of organisations surveyed

Figure 5.3 depicts the key sectors in which social enterprises operate. The three largest sectors were reported as business support services (20%), health and social care (16.6%) and the environment (16%). Collectively these three sectors accounted for 52.6% of all organisations surveyed out of a possible 13 sectors identified.

5.2 Organisational Networks

The questionnaire asked participants how well connected they felt in relation to different stakeholder groups, how important such connection was for the future success of their organisation and how important being connected to the same stakeholder group was for the future success of their organisation. This was achieved using two questions;

- *How well connected is your organisations in terms of the following networks*[30]*?*
- *In relation to the same networks, how important are these networks in relation to assisting you to achieve your organisational goals?*

The questions were used to elicit a response on how well-connected organisations are and to establish if any links exist between various stakeholder groups. The organisational networks questions also enabled analysis to be conducted on how important those same connections might be in the future. The analysis enabled a deeper understanding of the importance of different stakeholders in two ways; 1) Identifying where significant relationships exist between organisations and their networks, and 2) Understanding how the importance of the same networks may change over time. Figure 5.4 provides an initial overview of the reported networks and the networks that are considered as important for future success to some extent.

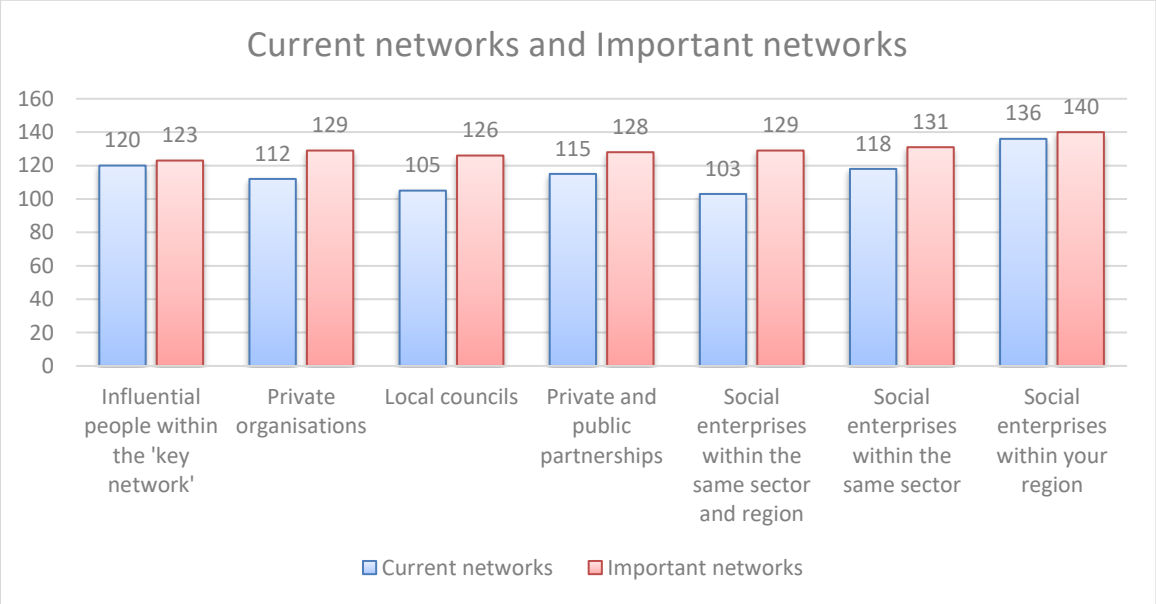


Figure 5.4: Reported instances of current networks and future importance

[30] The different networks presented were; other social enterprises within the same region, other social enterprises within the same sector, other social enterprises within the same sector and region, private and public partnerships, local councils, private organisations, influential people in the 'key' network

Figure 5.4 illustrates differences between the various stakeholder groups across 141 respondents. Social enterprises in the same region were reported as the most common networks as 96.4% of respondents reported having current connections and 99.2% reported these groups as important for the future. Social enterprise within the same sector were reported as the second most common networks with 83.7% stating they are connected to other organisations in their sector. At least 73% of respondents reported being connected to some extent to all the different stakeholder groups, demonstrating the potential for a large amount of social capital. The remainder of this section will explore these findings in more detail by exploring the relationships between networks and organisational profile data.

5.2.1 Relationships between networks and organisational profile data

A context for the results presented in this section has been formed by reviewing organisational profile data from the questionnaire provided. The relationships between networks and organisational profile data collected for the surveyed organisations were considered to identity differences across sectors, legal structures, size and length of time in operation. A summary of identified network connections[31] is presented in Table 5.4.

.Table 5.4 illustrates the diverse range of networks that different types of organisations reported having engaged with. In general, respondents who have been operating between 4 and 10 years reported more instances of strong networks across all stakeholder groups than the other time in operation categories. Small organisations reported less instances of strong network connections than medium and large organisations. It is noteworthy that the sample sizes for the medium and large organisations were significantly smaller that their small organisation counterparts, making the large and medium groups particularly sensitive to changes in reported instances. In terms of legal structures, two groups with comparable sample size are considered, CICs and limited companies. CIC's reported more instances of strong connections with influential people, public and private partnerships, private organisations and local councils. This finding suggests that CIC's are likely to look outside of the social enterprise sector which may be indicative of wider collaboration efforts. In comparison, limited companies are more likely to engage with organisations that are either in the same region or the same sector. The larger peer networks for limited companies may be more indicative of support or building capacity for the region or sector type relationships.

[31] Strong network connections refers to respondents who advised they are extremely or very well connected to the network in question.

Table 5.4: Cross tabulation of the strong network connections networks by organisational profile data

		Influential people	Private orgs.	Local councils	Private and public partners	Same region/ sector SE's	Same sector SE's	Same region SE's
Time in Operation*:*		% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
n=7	Less than 1 year	28.6% (2)	14.3% (1)	14.3% (1)	0% (0)	14.3% (1)	14.3% (1)	14.3% (1)
n=28	1-2 years	32.1% (9)	21.4% (6)	14.3% (4)	10.7% (3)	14.3% (4)	21.4% (6)	35.7% (10)
n=38	2-4 years	23.7% (9)	26.3% (10)	26.3% (10)	23.7% (9)	34.2% (13)	26.3% (10)	31.6% (12)
n=40	4-10 years	42.5% (17)	42.5% (17)	42.5% (17)	37.5% (15)	37.5% (15)	30.0% (12)	47.5% (19)
n=28	10+ years	35.7% (10)	39.3% (11)	37.5% (9)	25.0% (7)	32.1% (9)	28.6% (8)	53.6% (15)
Size (by staff size)*:*								
n=123	Small (less than 50)	30.1% (37)	27.6% (34)	25.2% (31)	22.8% (28)	26.8% (33)	25.2% (31)	38.2% (47)
n=8	Medium (50 - 249)	62.5% (5)	62.5% (5)	62.5% (5)	37.5% (3)	62.5% (5)	37.5% (3)	50.0% (4)
n=10	Large (250+)	50.0% (5)	60.0% (6)	50.0% (5)	30.0% (3)	40.0% (4)	30.0% (3)	60.0% (6)
Legal Structure:								
n=12	Multiple	25.0% (3)	25.0% (3)	33.3% (4)	16.7% (2)	41.7% (5)	33.3% (4)	41.7% (5)
n=6	Community Benefit Society	33.3% (2)	50.0% (3)	50.0% (3)	0.0% (0)	0.0% (0)	0.0% (0)	50.0% (3)
n=2	Co-operative	50.0% (1)	50.0% (1)	50.0% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
n=58	Community Interest Company	41.4% (24)	36.2% (21)	31.0% (18)	27.6% (0)	36.2% (21)	20.7% (12)	39.7% (23)
n=2	Sole Trader	0.0% (0)	0.0% (0)	0.0% (0)	50.0% (16)	0.0% (1)	50.0% (1)	50.0% (1)
n=52	Limited Company	25.0% (13)	26.9% (14)	23.1% (12)	25.0% (13)	23.1% (12)	32.7% (17)	42.3% (22)
n=3	Partnership	66.7% (2)	33.3% (1)	33.3% (1)	33.3% (1)	33.3% (1)	33.3% (1)	66.7% (2)
n=3	Public Limited Company	0.0% (0)	33.3% (1)	33.3% (1)	0.0% (0)	33.3% (1)	66.7% (2)	33.3% (1)
n=1	Registered Charity	100% (1)	100% (1)	100% (1)	100% (1)	0% (0)	0% (0)	0% (0)
n=2	Charitable Incorporated Org.	50.0% (1)	0% (0)	0% (0)	0% (0)	100% (2)	0% (0)	0% (0)
Sector:								
n=29	Business Support Services	44.8% (13)	34.5% (10)	31.0% (9)	34.5% (10)	34.5% (10)	41.4% (12)	58.6% (17)
n=4	Community Development & Regeneration	25.0% (1)	25.0% (1)	25.0% (1)	0.0% (0)	0.0% (0)	25.0% (1)	0.0% (0)
n=13	Cross sector	23.1% (3)	23.1% (3)	30.8% (4)	30.8% (4)	38.5% (5)	30.8% (4)	38.5% (5)
n=12	Education & Training	25.0% (3)	16.7% (2)	0.0% (0)	41.7% (5)	16.7% (2)	33.3% (4)	25.0% (3)
n=24	Environment	33.3% (8)	54.2% (13)	54.2% (13)	20.8% (5)	33.3% (8)	16.7% (4)	37.5% (9)
n=25	Health & Social care	28.0% (7)	32.0% (8)	24.0% (6)	24.0% (6)	36.0% (9)	20.0% (5)	56.0% (14)
n=3	Hospitality, Leisure & Tourism	66.7% (2)	0.0% (0)	0.0% (0)	0.0% (0)	33.3% (1)	0.0% (0)	33.3% (1)
n=3	Housing & Construction	66.7% (2)	66.7% (2)	66.7% (2)	33.3% (1)	33.3% (1)	0.0% (0)	0.0% (0)
n=3	Legal and Financial Services	33.3% (1)	33.3% (1)	33.3% (1)	33.3% (1)	33.3% (1)	33.3% (1)	33.3% (1)
n=7	Media and Creative	42.9% (3)	28.6% (2)	28.6% (2)	0.0% (0)	14.3% (1)	0.0% (0)	28.6% (2)
n=7	Public Services	42.9% (3)	28.6% (2)	28.6% (2)	14.3% (1)	28.6% (2)	28.6% (2)	28.6% (2)
n=11	Retail	9.1% (1)	9.1% (1)	9.1% (1)	9.1% (1)	18.2% (2)	36.4% (4)	27.3% (3)

Table 5.5: Cross tabulation of important networks by organisational profile data

		Influential people	Private orgs.	Local councils	Private and public partners	Same region and sector SE's	Same sector SE's	Same region SE's
Time in Operation*:*		% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
n=7	Less than 1 year	28.6% (2)	14.3% (1)	28.5% (2)	71% (5)	42.9% (3)	71.4% (5)	85.7% (6)
n=28	1-2 years	17.9% (5)	35.7% (10)	28.6% (8)	42.9% (12)	50.0% (14)	60.7% (17)	78.6% (22)
n=38	2-4 years	26.3% (10)	28.9% (11)	36.8% (14)	52.6% (20)	65.8% (25)	39.5% (15)	84.2% (32)
n=40	4-10 years	30.0% (12)	35.0% (14)	42.5% (17)	52.5% (21)	70.0% (28)	42.5% (17)	75.0% (30)
n=28	10+ years	35.7% (10)	28.6% (8)	28.6% (8)	53.6% (15)	53.6% (15)	39.3% (11)	67.9% (19)
Size (by staff size)*:*								
n=123	Small (less than 50)	26.0% (32)	27.6% (34)	30.9% (38)	51.2% (63)	58.5% (72)	48.0% (59)	76.4% (94)
n=8	Medium (50 - 249)	50.0% (4)	50.0% (4)	50.0% (4)	50.0% (4)	75.0% (6)	25.0% (2)	75.0% (6)
n=10	Large (250+)	30.0% (3)	60.0% (6)	70.0% (7)	60.0% (6)	70.0% (7)	40.0% (4)	90.0% (9)
Legal Structure:								
n=12	Multiple	16.7% (2)	25.0% (3)	25.0% (3)	25.0% (3)	41.7% (5)	41.7% (5)	58.3% (7)
n=6	Community Benefit Society	0.0% (0)	16.7% (1)	16.7% (1)	50.0% (3)	50.0% (3)	16.7% (1)	83.3% (5)
n=2	Co-operative	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)	50.0% (1)	0.0% (0)	50.0% (1)
n=58	Community Interest Company	36.2% (21)	44.8% (26)	50.0% (29)	60.3% (35)	70.7% (41)	43.1% (25)	81.0% (47)
n=2	Sole Trader	0.0% (0)	0.0% (0)	0.0% (0)	50.0% (0)	0.0% (0)	50.0% (1)	50.0% (1)
n=52	Limited Company	26.9% (14)	23.1% (12)	25.0% (13)	51.9% (27)	55.8% (29)	59.6% (31)	78.8% (41)
n=3	Partnership	66.7% (2)	33.3% (1)	33.3% (1)	33.3% (1)	66.7% (2)	0.0% (0)	66.7% (2)
n=3	Public Limited Company	0.0% (0)	33.3% (1)	33.3% (1)	66.7% (2)	66.7% (2)	66.7% (2)	100.0% (3)
n=1	Registered Charity	0.0% (0)	0.0% (0)	100% (1)	0.0% (0)	0.0% (0)	0.0% (0)	0.0% (0)
n=2	Charitable Incorporated Org.	0.0% (0)	0.0% (0)	0.0% (0)	50% (1)	100% (2)	0.0% (0)	100% (2)
Sector:								
n=29	Business Support Services	44.8% (13)	31.0% (9)	37.9% (11)	58.6% (17)	51.7% (15)	58.6% (17)	79.3% (23)
n=4	Community Development & Regeneration	25.0% (1)	75.0% (3)	50.0% (2)	100.0% (4)	75.0% (3)	100.0% (4)	100.0% (4)
n=13	Cross sector	23.1% (3)	38.5% (5)	38.5% (5)	61.5% (8)	84.6% (11)	61.5% (8)	69.2% (9)
n=12	Education & Training	16.7% (2)	16.7% (2)	16.7% (2)	66.7% (8)	50.0% (6)	33.3% (4)	58.3% (7)
n=24	Environment	25.0% (6)	33.3% (8)	41.7% (10)	45.8% (11)	75.0% (18)	29.2% (7)	66.7% (16)
n=25	Health & Social care	12.0% (3)	36.0% (9)	36.0% (9)	40.0% (10)	60.0% (15)	28.0% (7)	92.0% (23)
n=3	Hospitality, Leisure & Tourism	0.0% (0)	0.0% (0)	0.0% (0)	66.7% (2)	100.0% (3)	33.3% (1)	100.0% (3)
n=3	Housing & Construction	33.3% (1)	0.0% (0)	33.3% (1)	0.0% (0)	66.7% (2)	33.3% (1)	33.3% (1)
n=3	Legal and Financial Services	33.3% (1)	33.3% (1)	33.3% (1)	33.3% (1)	66.7% (2)	33.3% (1)	66.7% (2)
n=7	Media and Creative	42.9% (3)	14.3% (1)	28.6% (2)	71.4% (5)	42.9% (3)	42.9% (3)	85.7% (6)
n=7	Public Services	42.9% (3)	57.1% (4)	57.1% (4)	57.1% (4)	57.1% (4)	71.4% (5)	85.7% (6)
n=11	Retail	27.3% (3)	18.2% (2)	18.2% (2)	27.3% (3)	36.4% (4)	63.6% (7)	81.8% (9)

Table 5.5 displays the number of reported instances of networks being considered as important[32] to the organisation's future success.

Table 5.5 shows that in general organisations reported networks were more important for the future when compared to their current network connections. This finding indicates that there may be a disconnect between how well networked respondents are in comparison to the networks they need to establish in the future. Across 19 out of the 30 organisational profile groups, over 75% reported that same region social enterprises are important for networks for the future. This finding suggests that local social enterprise specific support is likely to be peer led.

Further tests were conducted to the test the validity of the initial findings presented on networking and organisational profile data. The relationships between profile data variables and the data on both current and important networks were explored through chi-square testing. Chi-square tests were conducted on each of the following variables; sector, legal structure, size of organisation and time in operation groupings against each of the different network groups. The data utilised in the chi-square testing relate to all responses in the questionnaire, not only those reporting strong connections or important for the future. The significant results are shown in Table 5.6.

Table 5.6: Significant chi-square results for networks and profiling data

Variable A	Variable B	Chi-Square	p-value	Chi-Square Sig. *(p < 0.05)*	Post-hoc significance *(yes or no)*
Test: Sector and Current networks					
Sector	Influential people within the network	62.667	(0.034)	Yes	No
Test: Legal structure and Important networks					
Legal Structure	Private and public partnerships	52.61	(0.036)	Yes	No

Table 5.6 shows that only two of the statistical tests came back as statistically significant. However, further post-hoc testing for both results demonstrated that no relationship exists. The results highlight that there are no relationships between networks and organisational profile data. This means that networks are not more or less important depending on sector, legal structure, size or time in operation.

5.2.2 Links between current networks

This section utilises the data from the first of the two questions posed in the networks section of the questionnaire; *How well connected is your organisation?* The participants were asked to rank how well connected their organisation was on a 5-point Likert scale from extremely well connected to not

[32]Important networks are considered as those reported as either extremely or very important by the respondents during the questionnaire.

connected at all. The initial findings that detail how well-connected social enterprises are to current networks is presented in Figure 5.5.

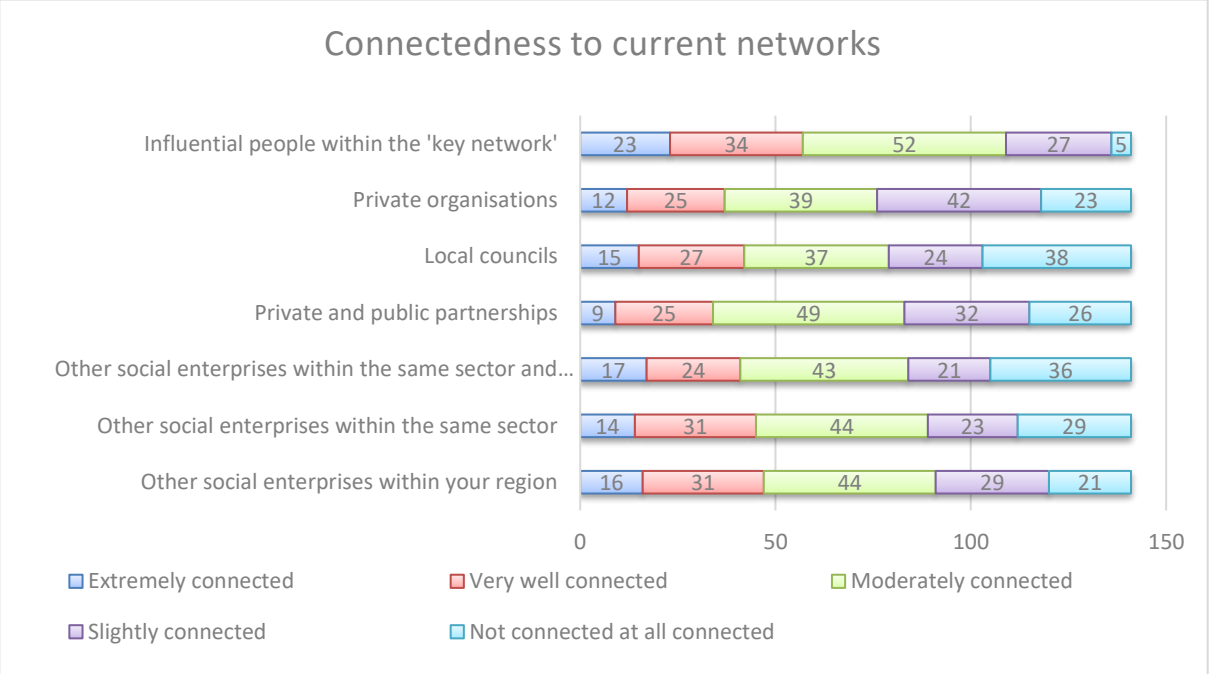


Figure 5.5: Connectedness to existing networks

The data show that at least 50% of all the surveyed organisations reported being at least moderately connected across all the different types of networks. The diversity of stakeholders is indicative of the important role that social capital plays for social enterprise. When different network types were compared, influential people were highlighted as a key network group. Only 3.5% of organisation's state that they were not at all connected to influential people within their sector. The participants were less likely to have good connections with local councils and private organisations.

To identify any links between the current networks, chi-square tests were used to identify any relationships between different networks. For example, if an organisation is well connected with influential people are they likely to also be connected with the local council. The chi square tests were conducted systematically by comparing each network in relation to all other networks. 17 significant chi-square results were obtained indicating that several relationships may exist, a summary of which are presented in Table 5.7.

Table 5.7: Significant Chi-Square for relationships between current networks

Variable A	Variable B	Chi-Square	p-value	Chi-Square Sig. *(p < 0.05)*	Post-hoc significance *(yes or no)*
Same region social enterprise	Same sector social enterprise	146.163	(0.000)	Yes	Yes
	Same region & sector social enterprise	146.163	(0.000)	Yes	Yes
	Private and public partnerships	41.909	(0.000)	Yes	Yes
	Local councils	27.969	(0.032)	Yes	No
	Influential people within network	45.882	(0.000)	Yes	Yes
Same sector social enterprise	Same region & sector social enterprise	240.364	(0.000)	Yes	Yes
	Private and public partnerships	39.87	(0.001)	Yes	Yes
	Local councils	47.285	(0.000)	Yes	Yes
	Private organisations	27.975	(0.032)	Yes	Yes
	Influential people within network	44.374	(0.000)	Yes	Yes
Same region and sector social enterprise	Private and public partnerships	37.211	(0.002)	Yes	No
	Local councils	32.093	(0.010)	Yes	No
	Influential people within network	36.912	(0.002)	Yes	Yes
Influential people within key network	Private and public partnerships	48.494	(0.000)	Yes	Yes
	Private organisations	82.222	(0.000)	Yes	Yes
Local councils	Private and public partnerships	44.334	(0.000)	Yes	Yes
Private and public partnerships	Private organisations	65.546	(0.000)	Yes	Yes

Table 5.7 highlights several significant results following the post-hoc testing. From the 16 chi-square tests that initially showed statistical significance, 14 were confirmed as having statistical significance following post-hoc testing. Some findings from the post-hoc tests will be discussed here. Other social enterprises and influential people from across the network account for 12 of the 14 chi-square tests that showed statistical significance following post-hoc testing. A relationship exists between organisations that have strong network connections with social enterprises in the region or sector and having strong connections with influential people in the network. This relationship may be indicative that influential people are actively involved with social enterprise organisations in some capacity. Post-hoc testing shows that a relationship exists where organisations were extremely well connected to same sector social enterprise and extremely well connected to private and public partnerships, private organisations and local councils. All the statistically significant relationships found during post-hoc testing suggested that organisations are likely to have strong networks across several different networks than just one type. This significance suggests that social enterprises are likely to effectively build networks over a wide range of stakeholders rather than strategically linking up with one or two key groups.

5.2.3 Shifts in importance of networks

This section uses the data from the second of the two questions posed in the networks section of the questionnaire; *How important are the same networks in achieving your organisational goals?* The participants were asked to rank the network from the first question in relation to their importance. The ranking was indicated on a 5-point Likert scale from extremely important to not important at all. Initial findings detail the importance of different networks and are presented in Figure 5.6.

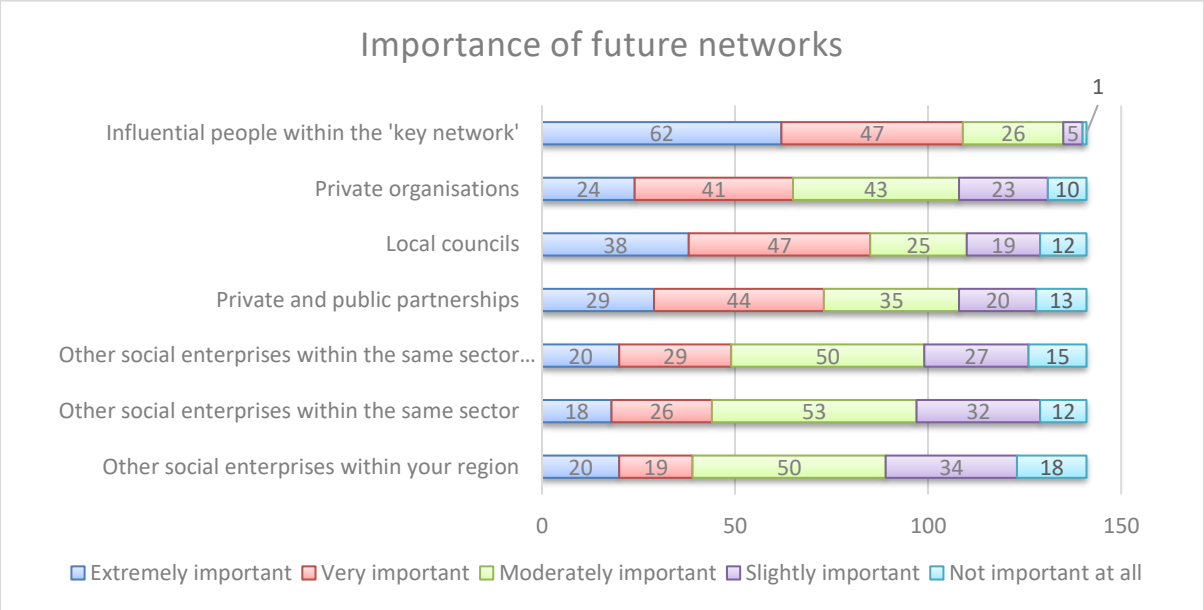


Figure 5.6: Importance of future networks

The data on future importance of networks show a greater variance than the current networks presented in Section 5.2.2. Figure 5.6 shows a trend of all networks being reported as important for organisational success, evidencing the value placed on social capital by respondents. In the networks that were considered important in terms of future success influential people were prevalent. Influential people were reported as the most important with 77.3% of respondents stating they will be either extremely or very important to their organisation in the future (Figure 5.6). The least important network report for future success was other social enterprise within the same region, 12.7% of respondents stated they were not important at all.

5.2.3.1 How importance of networks is likely to change

The datasets were compared to identify any differences between how well connected organisations were with the various stakeholder groups and how important the same groups are likely to be in the future. This analysis was completed by collating the data for both the current connectedness and future importance for all the networks. The comparison highlights where social enterprise think they may need to improve networks in the future to succeed. Therefore, the data presented in this

section relates to the organisational responses from the *extremely well* and *very well* categories[33]. Figure 5.7, Figure 5.8 and Figure 5.9 show the differences between current connectedness and future importance of networks across the three groups presented in Section 5.1 respectively; all respondents, the environmental subgroup and the energy subgroup. The series of graphs indicate the number of respondents who reported being *extremely* or *very well* connected to a network in comparison to the number of respondents who reported the importance of the same network being extremely important or very important in the future. The finding from each of these figures is now explored starting with all respondents, Figure 5.7.

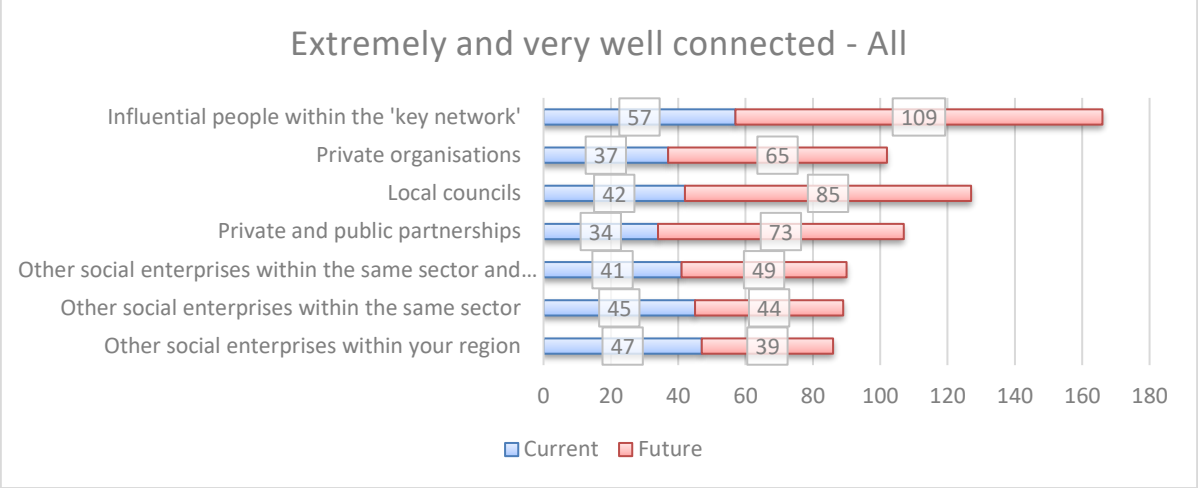


Figure 5.7: All instances of current connectedness and future importance

Figure 5.7 displays the data for the all the respondents, n=141, and indicates a disconnect between current connections and important connections. The biggest differences between current and important networks were for the following groups; influential people (52), private and public partnerships (39), local councils (43) and private organisations (28). The increases in respondents demonstrated these four networks will be important in the future compared to the number of respondents who have strong connection to them already. Responses for all other social enterprise groups stayed around the same for both current networks and future importance. The similarity noted here may be explained by the earlier finding in this section that 96.4% of respondents are already connected in some capacity to other social enterprises locally. Next the findings of the environmental subgroup analysis are discussed (Figure 5.8).

[33] The data was also analysed for the moderate, slightly and not at all categories. However, the findings confirmed those presented here but did not provide any further insights. Therefore, those results are not presented within this chapter.

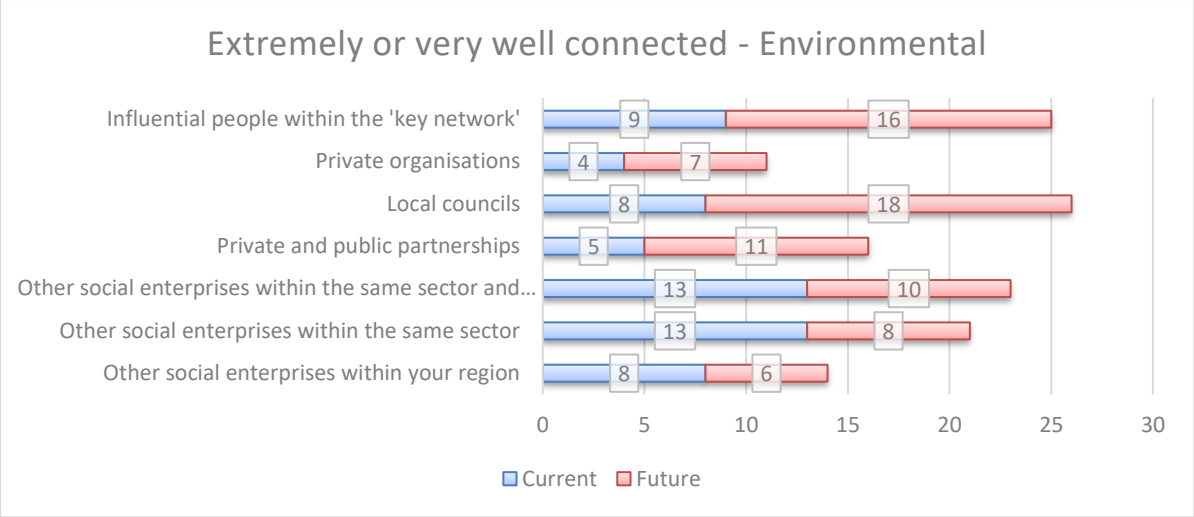


Figure 5.8: Instances of current connectedness and future importance - Environmental subgroup

Figure 5.8 displays the data for the environmental subgroup, n=28, and indicates a disconnect between current connections and important connections. The biggest difference highlighted is between respondents was being currently connected to the local council (28.6%) and local council being important in the future (64.2%). Relationships with influential people from the sector and public and private partnerships were perceived as being more important in the future. Despite being strongly connected with other social enterprises, the responses show that this peer support will be less important in terms of future success. Finally, the findings from energy subgroups are presented in Figure 5.9.

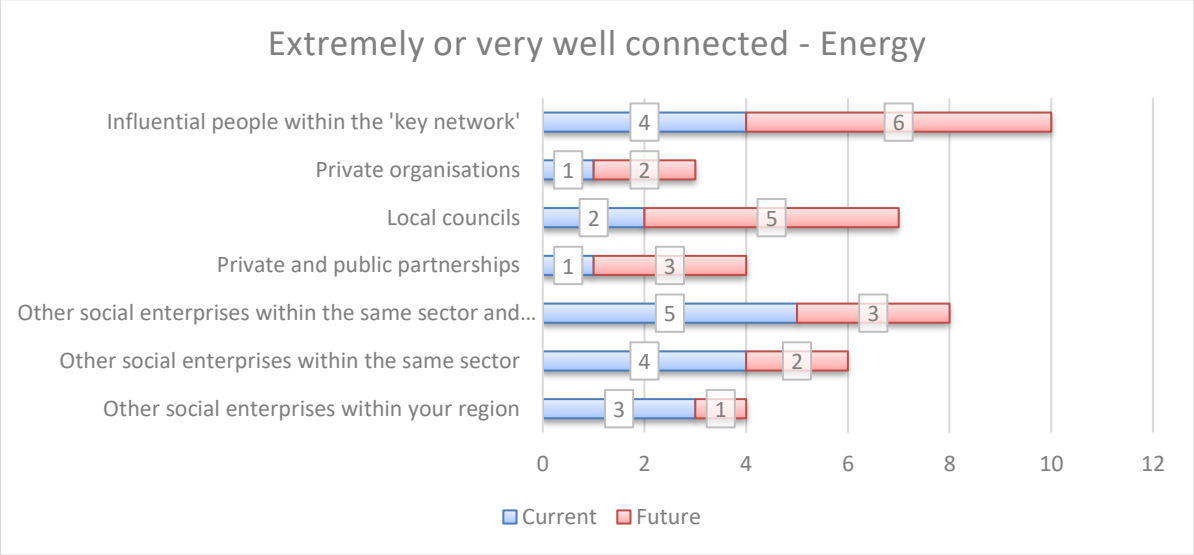


Figure 5.9: Instances of current connectedness and future importance - Energy subgroup

Figure 5.9 displays the data for the energy subgroup, n=7, and indicates a disconnect between current connections and important connections. Key differences between current connections and

important connections were evident for local councils and public and private partnerships. Results show that energy organisations reported strong connections to other social enterprises in the same sector and region. However, less respondents stated that other social enterprises are likely to be very important in the future. This finding is also reflected in the results for the environmental sector. Due to the sample size being small the findings presented can only be indicative, however, networks in the community energy sector is explored more extensively in Chapter 6.

5.2.3.2 Relationships between current networks and future importance

The relationships between current connectedness and future importance of networks were analysed across several variables using chi-square testing. Table 5.8 shows the significant chi-square results obtained, together with the outcome of the associated post-hoc tests.

Table 5.8: Significant Chi-Square testing for current networks and future networks

Variable A	Variable B	Chi-Square	p-value	Chi-Square sig. *(p < 0.05)*	Post-hoc significant (yes or no)
Influential people within network	Private organisations	47.615	(0.000)	Yes	Yes
	Influential people within network	45.996	(0.000)	Yes	Yes
Local councils	Local councils	71.15	(0.000)	Yes	Yes
Private and public partnerships	Same region social enterprise	29.614	(0.020)	Yes	No
	Same sector social enterprise	28.973	(0.024)	Yes	No
	Same region & sector social enterprise	29.662	(0.020)	Yes	No
	Private and public partnerships	92.112	(0.000)	Yes	Yes
	Local councils	33.016	(0.007)	Yes	No
	Private organisations	46.571	(0.000)	Yes	Yes
Private organisations	Private and public partnerships	30.054	(0.018)	Yes	No
	Private organisations	66.142	(0.000)	Yes	Yes
Same region social enterprise	Same region social enterprise	64.544	(0.000)	Yes	Yes
	Same sector social enterprise	33.287	(0.007)	Yes	No
	Same region & sector social enterprise	43.178	(0.000)	Yes	Yes
Same region & sector social enterprise	Same region social enterprise	57.628	(0.000)	Yes	Yes
	Same sector social enterprise	45.631	(0.000)	Yes	No
	Same region & sector social enterprise	61.701	(0.000)	Yes	Yes
Same sector social enterprise	Same region social enterprise	58.222	(0.000)	Yes	Yes
	Same sector social enterprise	57.519	(0.000)	Yes	Yes
	Same region & sector social enterprise	58.152	(0.000)	Yes	No

Table 5.8 highlights several significant results following the post-hoc testing. From the 22 chi-square tests that initial showed statistical significance, 12 were confirmed as having statistical significance following post-hoc testing. Some findings from the post-hoc tests will be discussed here. Other social enterprises and influential people from across the network account for 8 of the 12 chi-square tests that showed statistical significance following post-hoc testing. In general, the post-hoc testing demonstrated that where strong connections currently exist organisations were more likely to report that those same networks will be important the future. This relationship pattern was found

across the post-hoc testing for influential people, local councils, private organisations and other social enterprises in the same region and sector. Respondents that reported public and private partnerships were not part of their network were also more likely to report that they would be of no importance in the future. Where organisations reported limited connections to influential people, they were more likely to report that private organisations will not be important for future success. Box 5.1 highlights the key points from the findings on networks presented in this section.

Box 5.1: Summary findings on networks

Key findings on networks across the social enterprise sector

- Social enterprises were likely to establish networks with a wide range of stakeholders.
- Networks do not vary depending on sector, legal structure or organisation size.
- Local councils and public and private partnership were predicted to be important connections for social enterprises in the future.

5.3 Income Streams and opportunities to Trade

This section of the survey asked about the breakdown of the different types of income each organisation received. The questions asked within this section were;

- *Please allocate an approximate percentage to each of the different income streams*[34] *in relation to your organisation*
- *Do you consider your sector to be one in which social enterprise can raise more than 50%*[35] *of its annual income through trade? Organisations were also asked to provide a reason for their answer on this question.*

The survey asked responding organisations to provide an approximate percentage for the different types of income they receive. The question on income was designed to enable analysis of the use of different types of income across organisations. The analysis will provide an understanding of the complexity of funding streams within the social enterprise sector and help identify how these funding streams differ to social enterprises within the energy sector. The second question was designed to elicit responses regarding the financial sustainability of specific sectors. This question was purposefully worded to try and capture where the tradable opportunities were rather than to solely find out if organisations were currently financially sustainable or not.

[34] The income streams options available were; share issue, donations, trade income, membership fees, loans, government grants or contracts, private grants or contracts. Organisations were also given the option to provide more information on additional income streams not included within the list

[35] 50% was selected in line with the requirements of financial sustainability detailed within the Social Enterprise Mark

5.3.1 Breakdown of different types of income

These data have been analysed in two ways. Firstly, the income streams for each of the social enterprises were ranked from primary income to quaternary income, presented in Table 5.9. This was done to identify the key sources of income and to explore the diversity of funding within social enterprises. Secondly, averages were taken for the whole dataset and for the environmental and energy subgroups, presented in Table 5.10. This was done to identify any differences across the respective groups.

Table 5.9: Breakdown of Types of Income

Income Type	Primary Income (N,%)		Secondary income (N,%)		Tertiary Income (N,%)		Quaternary Income* (N,%)	
Donations	5	3.73%	7	7.22%	9	18.37%	7	43.75%
Gov. grants or contracts	17	12.69%	23	23.71%	15	30.61%	1	6.25%
Loans	5	3.73%	9	9.28%	3	6.12%	2	12.50%
Membership fees	5	3.73%	2	2.06%	2	4.08%	2	12.50%
Private grants or contracts	19	14.18%	28	28.87%	11	22.45%	2	12.50%
Share Issue	3	2.24%	4	4.12%	2	4.08%	0	0%
Trade Income	70	52.24%	22	22.68%	5	10.20%	1	6.25%
Other	10	7.46%	2	2.06%	2	4.08%	1	0
Total	***134***		***97***		***49***		***16***	

**There were only 2 organisations who exceed 4 types of income so 5th, 6th, 7th and 8th income streams left off. One covered all 8 types and the other had a 5th income stream.*

Table 5.9 illustrates the breakdown of income types and shows that over half of the organisations surveyed generate their primary income through trade. The most common type of secondary income is generated through private grants or contracts, followed closely by government grants or contracts and then trade income. The most significant type of income at tertiary level consists of government grants and contracts followed by private grants or contracts. A change is observed for the quaternary income source where the most common type is donations, with 43.75% of organisations declaring this. The three most prevalent types of income across the top three income streams are trade income, grants and contracts (both government and private). In relation to the diversity of income types, 72.3% of organisations receive secondary income and 36.5% receive tertiary income. Table 5.10 highlights the average percentage of different sources of income for the entire sample and the pre-defined subgroups, environment and energy.

Table 5.10: Income stream averages

	All				Environment				Energy			
Income Type:	Mean	Median	Mode	Range	Mean	Median	Mode	Range	Mean	Median	Mode	Range
Share issue	2.1%	0%	0%	90%	11.0%	0%	0%	90%	43.3%	37.5%	0%	90%
Donations	4.8%	0%	0%	100%	9.1%	0%	0%	100%	8.8%	0%	0%	50%
Trade income	49.1%	40%	0%	100%	28.6%	7.5%	0%	100%	5.1%	0%	0%	29%
Membership fees	4.2%	0%	0%	100%	1.4%	0%	0%	25%	0.1%	0%	0%	1%
Loans	4.0%	0%	0%	95%	9.1%	0%	0%	60%	15.6%	0%	0%	60%
Gov. grants or contracts	14.5%	0%	0%	100%	17.6%	10%	0%	60%	14.6%	12%	10%	27%
Private grants or contracts	15.9%	0%	0%	100%	15.4%	0%	0%	90%	12.3%	0%	0%	60%
Other	6.4%	0%	0%	100%	7.8%	0%	0%	82%	0.1%	0%	0%	0.5%

Table 5.10 shows that the primary form of income for all social enterprises was trade with an average of 49.1%. This decreased to 28.6% for social enterprises in the environmental sub-group and 5.1% for social enterprises in the energy sub-group. In contrast, the primary form of revenue received by energy social enterprises came from share issues, where the average was 43.3%. In contrast, this proportion was 11% for the environmental sub-group social enterprises and 2.1% for all. The mean values across all funding types across all and environmental social enterprises shows that organisations have a diverse range of funding and that there is not a common singular type of funding (Table 5.10). The only exception to this was in relation to government grants or contracts within the energy subsector. This is reflective of the government led UCEF grant[36] for project development costs of community energy projects that was available for organisations.

The mean values for government grants and private contract are similar across all three groups, between 12% and 17%. These figures suggest that government grants and private contracts are implemented as supplementary income streams across all sectors.

5.3.2 Income stream relationships

The different levels of income stream were explored for relationships between other levels of income streams, organisational profile data and financial sustainability. The significant chi-square results are shown in Table 5.11.

[36] The UCEF grant refers to the Urban Community Energy Fund. It is a grant from central government to support the development of community energy projects. UCEF grants are detailed in Section 4.2.2.

Table 5.11: Significant Chi-Square results relating to income

Variable A	Variable B	Chi-Square	p-value	Chi-Square sig. *(p < 0.05)*	Post-hoc significance *(yes or no)*
Test: Financial sustainability and Income level					
Financial sustainability	Primary Income	35.280	(0.001)	Yes	Yes
Test: Primary income stream and Other income streams					
Primary Income	Secondary income	102.55	0.000	Yes	Yes
Test: Primary Income and legal structure					
Primary Income	Legal structure	106.361	(0.001)	Yes	Yes

Table 5.11 highlights the statistical significance found through the chi-square and post-hoc testing on primary and secondary income, financial sustainability and legal structure. All three of the tests that were found to be statistically significant at chi-square stage were confirmed as statistically significant through post-hoc testing. The post-hoc highlights that a relationship exists between using loans as primary income and share issue as secondary income. This relationship means that where organisations use loans as a main source of income, they are also likely to raised finance through a share offer. A relationship between private grants or contracts as primary income and trade income as a secondary income was also observed. This means that where private grants and contracts are the main source of income organisations are also likely to trade. A relationship was identified between share issues as a primary income source and community benefit societies. It is worth noting the earlier finding that community benefit society was the most common legal structure of the energy organisations surveyed. Finally, a relationship was found between organisations who believe that financial sustainability is achievable and those who have private grant or contracts as their primary source of incomes.

5.3.3 Perceptions on financial sustainability

The second part of the income section on the questionnaire was analysed to develop an understanding of perceptions on the possibility of becoming financially sustainable by obtaining at least 50% of the respondent organisation's income through trade. Table 5.12 shows how this perception varies over the whole group and across the subgroups of environmental and then energy.

Table 5.12: Perceptions on financial sustainability

Is it possible for social enterprises in your sector to raise more than 50% of income through trade?	All	Environment	Energy
I believe it is currently possible	105 *(78.4%)*	18 *(75%)*	4 *(50%)*
Not currently, but possibly in the future	25 *(18.7%)*	5 *(20.8%)*	3 *(37.5%)*
I can't see a way this would be possible	4 *(2.9%)*	1 *(4.2%)*	1 *(12.5%)*
Totals:	134	24	8

The results in Table 5.12 show that there is a good deal of optimism across social enterprises that financial sustainability is achievable. However, when analysing the open-ended comments relating to this question, many organisations were either already earning more than 50% of their income through trade or knew of other similar organisations who had achieved this. This is noteworthy as it highlights the enterprise aspect of social enterprise though increased trading. A more market-based approach supports the 'potential to trade' extension to the social enterprise definition presented in Chapter 1. This key finding helps to support a central tenant of this thesis that differentiates social enterprises from charitable or 'not-for-profit' organisations. Box 5.2 the key points from the findings on income and financial sustainability presented in this section.

Box 5.2: Summary findings on income and financial sustainability

Key findings on income streams financial sustainability across the social enterprise sector

- Trade was the most common source of primary income across the social enterprise sector as a whole
- Share issues were not utilised widely across the entire social enterprise sector but were commonly a primary income source for energy sector social enterprises.
- In general, social enterprise are more optimistic about the ability be become financially sustainable that energy sector social enterprises.

5.4 Barriers

This section of the questionnaire aimed to gather information on different categories of barriers that the respondent's organisations may have faced and sought to determine what level of impact they had on surveyed organisations. Participants were asked to evaluate the impact on their organisations in relation to several various barriers through the following questions;

- *Please state how much each of the barriers*[37] *effected your organisation since being in operation*
- *For the same barriers, please state how much they are likely to affect your organisation in the future*

A 5-point Likert scale was used to consider the level of impact of each barrier; *1) not a barrier at all, 2) created minor disruptions for a short period of time, 3) triggered changes to working practices, 4) influenced strategy, or, 5) change the strategic direction*. The questions in this section of the questionnaire were asked so that any relationships between the different types of barriers could be

[37] Barriers presented were; industry regulation, local government policy, national government policy, direct competitors, staffing difficulties, location, finding adequate funding, grants or subsidies being cut, lack of strategy, cash flow issues, lack of business knowledge, lack of knowledge of the sector.

identified. The understanding of what type of barriers are faced and how they are interlinked helps identify and better characterise the complex issues faced by social enterprises. The second question in the section builds on this by adding a future dimension; it asked organisations to evaluate the impact the same barriers were likely to have in the future. The comparison between the previous and expected barriers has been used to identify where organisational learning may have taken place and provides data to explore ideas around the resilience of social enterprise.

Figure 5.10 provides an initial overview of the responses that show where barriers have affected organisations in the past and highlights those barriers that are likely to affect the organisation in the future.

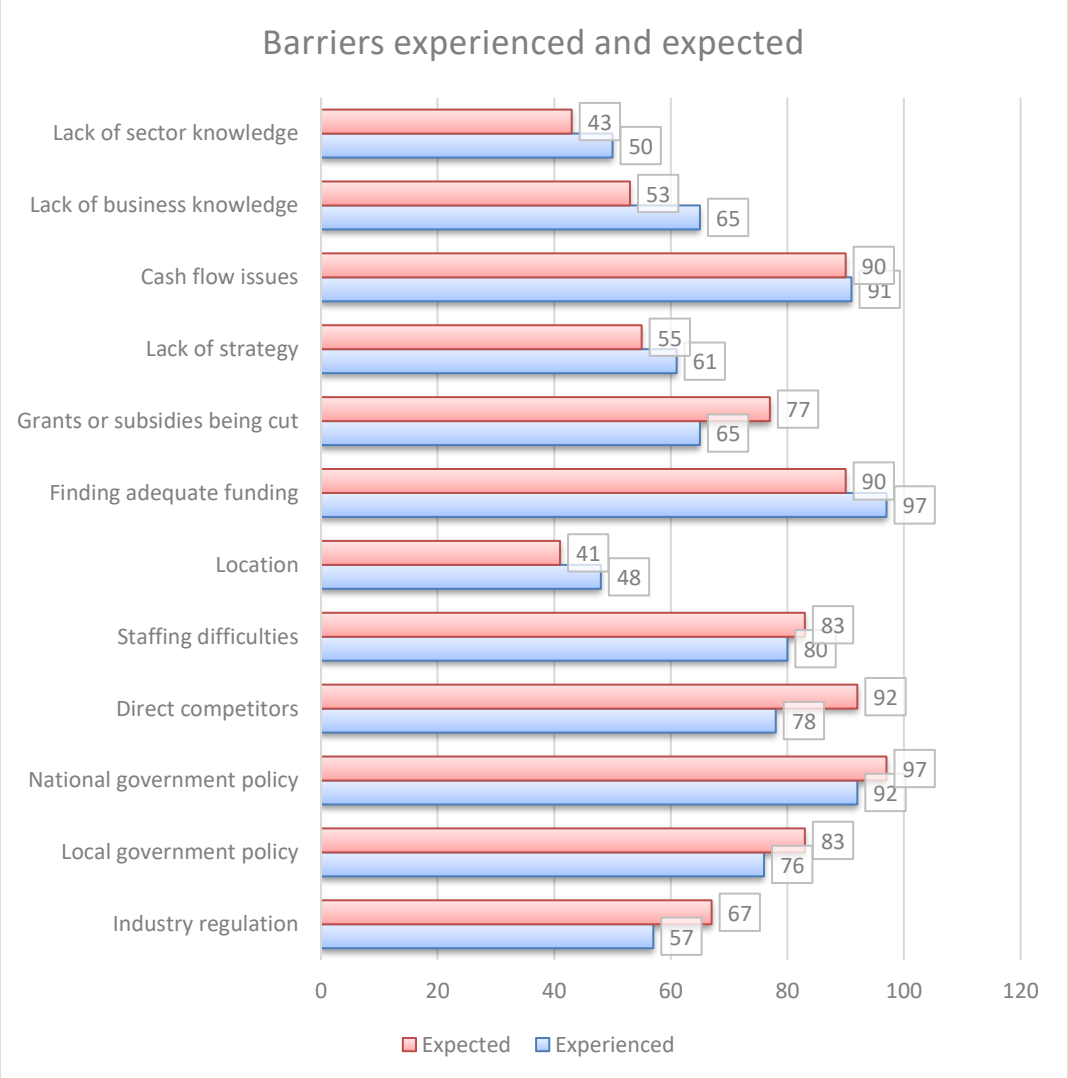


Figure 5.10: Overview of barriers faced and predicted

Figure 5.10 depicts the number of organisations who had experienced and predicted the different barriers across the 126 respondents. The most commonly reported barriers organisations

experienced were national government policy (73%), finding adequate funding (76%) and cash flow issues (72%). The same three issues were identified as the most common causes for concern for the future. The least common barriers reported were location (38%) and lack of sector knowledge (39%). Predicted barriers were largely reported at a similar level to the barriers experienced. The largest difference found was for direct competitors where an increase from 78 to 92 respondents was observed for the predicted barriers. The remainder of this section will examine these key findings in more detail by exploring the relationship between barriers and organisational profile data, as well as analysis other barriers experienced and the predicted impact of barriers in the future.

5.4.1 Relationships between barriers and organisational profile data

Organisational profile data were reviewed to provide a context for the results presented in this section. The relationship between the barriers faced and the organisational profile data collected for the surveyed organisations was considered to identify differences across length of time in operation, size, sector and legal structure. A summary of the barriers that the respondent organisations have faced in the past are presented in Table 5.13, Table 5.14 and Table 5.15.

Table 5.13 details the number and proportion of respondents reporting that they had been affected by the barriers. These data are broken down by the length of time the organisation had been in operation.

Table 5.13: Cross-tabulation of barriers that have impacted the business by time in operation

	<1 year n=6	**1-2 years n=25**	**2-4 years n=34**	**4-10 years n=36**	**10+ years n=25**
Barrier;	% (n)	% (n)	% (n)	% (n)	% (n)
Industry regulation	16.7% (1)	52.0% (13)	44.1% (15)	47.2% (17)	44.0% (11)
Local government policy	50.0% (3)	52.0% (13)	64.7% (22)	61.1% (22)	64.0% (16)
National government policy	50.0% (3)	68.0% (17)	70.6% (24)	75.0% (27)	80.0% (20)
Direct competitors	0.0% (0)	68.0% (17)	55.9% (19)	63.9% (23)	76.0% (19)
Staffing difficulties	50.0% (3)	56.0% (14)	70.6% (24)	58.3% (21)	72.0% (18)
Location	33.3% (2)	36.0% (9)	44.1% (15)	36.1% (13)	36.0% (9)
Finding adequate funding	83.3% (5)	80.0% (20)	88.2% (30)	72.2% (26)	64.0% (16)
Grants or subsidies being cut	50.0% (3)	40.0% (10)	61.8% (21)	55.6% (20)	44.0% (11)
Lack of strategy	50.0% (3)	48.0% (12)	50.0% (17)	41.7% (15)	56.0% (14)
Cash flow issues	66.7% (4)	84.0% (21)	79.4% (27)	66.7% (24)	60.0% (15)
Lack of business knowledge	66.7% (4)	60.0% (15)	50.0% (17)	52.8% (19)	40.0% (10)
Lack of sector knowledge	33.3% (2)	36.0% (9)	61.8% (21)	22.2% (8)	40.0% (10)

Table 5.13 highlights differences between barriers experienced depending on how long the organisation has been in operation. Cash flow issues affected 84% of respondents in their second year of operation which is a higher proportion than all other groups. Finding adequate funding is

reported as a barrier for a smaller percentage of the organisations in operation for over 10 years (64%) than for those who have been in operation for less time (80%). Industry regulation affected a lower proportion of organisations in the first year of operation (16%) than it did for those in operation for longer (46%). Table 5.14 details the number of respondents reporting that they had been affected by the barriers broken down by the size of organisation.

Table 5.14: Cross-tabulation of barriers that have impacted the business by organisational size

	Small n=111	Medium n=7	Large n=8
Barrier;	% (n)	% (n)	% (n)
Industry regulation	44.1% (49)	14.3% (1)	87.5% (7)
Local government policy	57.7% (64)	85.7% (6)	75.0% (6)
National government policy	71.2% (79)	85.7% (6)	87.5% (7)
Direct competitors	59.5% (66)	85.7% (6)	75.0% (6)
Staffing difficulties	59.5% (66)	85.7% (6)	100.0% (8)
Location	38.7% (43)	28.6% (2)	37.5% (3)
Finding adequate funding	75.7% (84)	100.0% (7)	75.0% (6)
Grants or subsidies being cut	49.5% (55)	71.4% (5)	62.5% (5)
Lack of strategy	46.8% (52)	57.1% (4)	62.5% (5)
Cash flow issues	74.8% (83)	71.4% (5)	37.5% (3)
Lack of business knowledge	52.3% (58)	42.9% (3)	50.0% (4)
Lack of sector knowledge	42.3% (47)	14.3% (1)	25.0% (2)

Table 5.14 illustrates the different barriers facing different size organisations. Cash flow is reported as a key issue for the small (74.8%) and medium sized (71.4%) respondents. Finding adequate funding is a prevalent barrier across small (75.7%), medium (100%) and large (75%) organisations. The most common barriers for medium and large organisation were reported as local and national government policy, direct competitors and staffing difficulties. For small organisations the most common barriers were national policy, cash flow issues and finding adequate funding. This difference highlights the financial sensitivities that new organisations are likely to face.

Table 5.15 details the number of respondents that reported they had been affected by various barriers, broken down by the size of organisation. In terms of legal structure, two similar sized groups are CICs and limited companies. Limited companies reported more instances of experiencing problems with national (74.5%) and local (61.7%) government policy and direct competitors (68.1%). CIC's more commonly reported issues with a lack of strategy (55.8%), grants or subsidies beings cut (53.8%) and cash flow (80.8%). Community benefit societies reported regulation, national and local government policy, finding adequate funding and grants or subsidies being cut. 73.9% of environmental sector organisations reported industry regulation issues which was larger than all other sectors.

Table 5.15: Cross tabulation of barriers that have impacted the business by legal structure and sector

		Industry Regulation	Local gov. policy	National gov. policy	Direct competitor	Staffing difficulties	Location	Finding adequate funding	Grants or subsidies being cut	Lack of strategy	Cash flow issues	Lack of business knowledge	Lack of sector knowledge
Legal Structure:		% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
n=10	Multiple	70.0% (7)	60.0% (6)	60.0% (6)	60.0% (6)	70.0% (7)	40.0% (4)	90.0% (9)	70.0% (7)	40.0% ($)	50.0% (5)	40.0% (4)	30.0% (3)
n=6	Community Benefit Society	83.3% (5)	83.3% (5)	83.3% (5)	33.3% (2)	50.0% (3)	50.0% (3)	100.0% (6)	83.3% (5)	33.3% (2)	33.3% (2)	50.0% (3)	66.7% (4)
n=2	Co-operative	50.0% (1)	50.0% (1)	100.0% (2)	100.0% (2)	50.0% (1)	0.0% (0)	50.0% (1)	50.0% (1)	50.0% (1)	50.0% (1)	100.0% (2)	0.0% (0)
n=52	Community Interest Company	40.4% (21)	59.6% (31)	71.2% (37)	57.7% (30)	65.4% (34)	44.2% (23)	71.2% (37)	53.8% (28)	55.8% (29)	80.8% (42)	57.7% (30)	38.5% (20)
n=2	Sole Trader	50.0% (1)	50.0% (1)	100.0% (2)	0.0% (0)	50.0% (1)	50.0% (1)	100.0% (2)	50.0% (1)	50.0% (1)	50.0% (1)	50.0% (1)	50.0% (1)
n=47	Limited Company	38.3% (18)	61.7% (29)	74.5% (35)	68.1% (32)	61.7% (29)	31.9% (15)	78.7% (37)	42.6% (20)	44.7% (21)	74.5% (35)	44.7% (21)	42.6% (20)
n=2	Partnership	0.0% (0)	0.0% (0)	100.0% (2)	100.0% (2)	50.0% (1)	50.0% (1)	50.0% (1)	50.0% (1)	50.0% (1)	50.0% (1)	0.0% (0)	0.0% (0)
n=3	Public Limited Company	66.7% (2)	33.3% (1)	33.3% (1)	66.7% (2)	66.7% (2)	0.0% (0)	66.7% (2)	0.0% (0)	33.3% (1)	66.7% (2)	66.7% (2)	0.0% (0)
n=1	Registered Charity	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)
n=1	Charitable Incorporated Organisation	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	100.0% (1)	0.0% (0)	100.0% (1)	100.0% (1)	0.0% (0)	100.0% (1)	100.0% (1)	100.0% (1)
Sector:													
n=27	Business Support Services	37.0% (10)	59.3% (16)	77.8% (21)	70.4% (19)	70.4% (19)	40.7% (11)	51.9% (14)	48.1% (13)	48.1% (13)	77.8% (21)	29.6% (8)	37.0% (10)
n=3	Community Development & Regeneration	33.3% (1)	0.0% (0)	33.3% (1)	33.3% (1)	100.0% (3)	0.0% (0)	66.7% (2)	33.3% (1)	66.7% (2)	100.0% (3)	66.7% (2)	66.7% (2)
n=11	Cross sector	9.1% (1)	27.3% (3)	63.6% (7)	72.7% (8)	54.5% (6)	27.3% (3)	90.9% (10)	36.4% (4)	9.1% (1)	72.7% (8)	45.5% (5)	27.3% (3)
n=11	Education & Training	45.5% (5)	63.6% (7)	63.6% (7)	45.5% (5)	36.4% (4)	45.5% (5)	100% (11)	45.5% (5)	45.5% (5)	81.8% (9)	45.5% (5)	27.3% (3)
n=23	Environment	73.9% (17)	78.3% (18)	73.9% (17)	43.5% (10)	65.2% (15)	39.1% (9)	82.6% (19)	56.5% (13)	47.8% (11)	56.5% (13)	60.9% (14)	52.2% (12)
n=23	Health & Social care	56.5% (13)	78.3% (18)	87.0% (20)	65.2% (15)	60.9% (14)	34.8% (8)	73.9% (17)	65.2% (15)	60.9% (14)	65.2% (15)	60.9% (14)	30.4% (7)
n=2	Hospitality, Leisure & Tourism	50.0% (1)	50.0% (1)	50.0% (1)	50.0% (1)	100.0% (2)	0.0% (0)	100.0% (2)	100.0% (2)	0.0% (0)	100.0% (2)	50.0% (1)	50.0% (1)
n=3	Housing & Construction	66.7% (2)	66.7% (2)	66.7% (2)	33.3% (1)	66.7% (2)	33.3% (1)	66.7% (2)	33.3% (1)	33.3% (1)	66.7% (2)	66.7% (2)	33.3% (1)
n=3	Legal & Financial Services	66.7% (2)	33.3% (1)	33.3% (1)	66.7% (2)	33.3% (1)	33.3% (1)	66.7% (2)	33.3% (1)	33.3% (1)	33.3% (1)	33.3% (1)	33.3% (1)
n=6	Media and Creative	16.7% (1)	33.3% (2)	66.7% (4)	66.7% (4)	50.0% (3)	33.3% (2)	83.3% (5)	50.0% (3)	66.7% (4)	66.7% (4)	33.3% (2)	33.3% (2)
n=6	Public Services	33.3% (2)	83.3% (5)	83.3% (5)	66.7% (4)	83.3% (5)	83.3% (5)	100.0% (6)	83.3% (5)	66.7% (4)	100.0% (6)	66.7% (4)	33.3% (2)
n=9	Retail	22.2% (2)	33.3% (3)	66.7% (6)	88.9% (8)	66.7% (6)	33.3% (3)	77.8% (7)	133% (12)	55.6% (5)	77.8% (7)	77.8% (7)	66.7% (6)

Further analysis was conducted to test the validity of the initial findings on barriers and organisational profile data. The relationships between profile data variables and information on both impact experienced and impact expected across the different barriers were explored through chi-square testing. Chi-square tests were conducted on each of the sector, legal structure, size of organisation and time in operation groupings against each of the different barriers presented. The data utilised in the chi-square testing relates to all responses in the questionnaire. The significant results are provided Table 5.16.

Table 5.16: Significant chi-square results for barriers and organisational profile data

Variable A	Variable B	Chi-Square	p-value	Chi-Square Sig. *(p < 0.05)*	Post-hoc significance *(yes or no)*
Test: Sector and Barriers faced					
Sector	Finding adequate funding	62.885	(0.032)	Yes	No
Test: Legal structure and Barriers faced					
Legal structure	Industry regulation	51.642	(0.044)	Yes	Yes
Legal structure	National government policy	69.972	(0.001)	Yes	Yes
Test: Time in operation and Barriers faced					
Time in operation	Direct competitors	28.489	(0.028)	Yes	No
Time in operation	Lack of knowledge of the sector	23.258	(0.026)	Yes	No
Test: Time in operation and Predicted barriers					
Time in operation	Finding adequate funding	29.22	(0.022)	Yes	No
Time in operation	Grants or subsidies being cut	50.559	(0.000)	Yes	No

Table 5.16 highlights several significant results following the post-hoc testing. From the 7 chi-square tests that initial showed statistical significance, 2 were confirmed as having statistical significance following post-hoc testing. Both significant statistical results relate to legal structure. The first relationship found was between legal structure and industry regulation. Organisations that operated under multiple legal structures were more like to report that industry regulation had changed the strategic direction of their organisation. The second relationship found was between legal structure and national government policy. Both community benefit societies and organisations who operate under multiple legal structures were more likely to report that national government policy has changed the strategic direction of their organisations. The findings from this chi-square analysis are significant as they highlight that large impact that legal structure can have on the direction of the organisation. In the context of community energy this is explored in more detail in Chapter 6.

5.4.2 Links between barriers experienced

This section explores data from the first question posed in the barriers section of the questionnaire; *How has each barrier affected your organisation?* Participant organisations were asked to rank the impact of different barriers on a 5-point Likert scale, ranging from *this was not a barrier for the*

organisation to t*he barrier changed the strategic direction of the organisation*. The initial findings detailing the barriers faced by the respondents are presented in Figure 5.11.

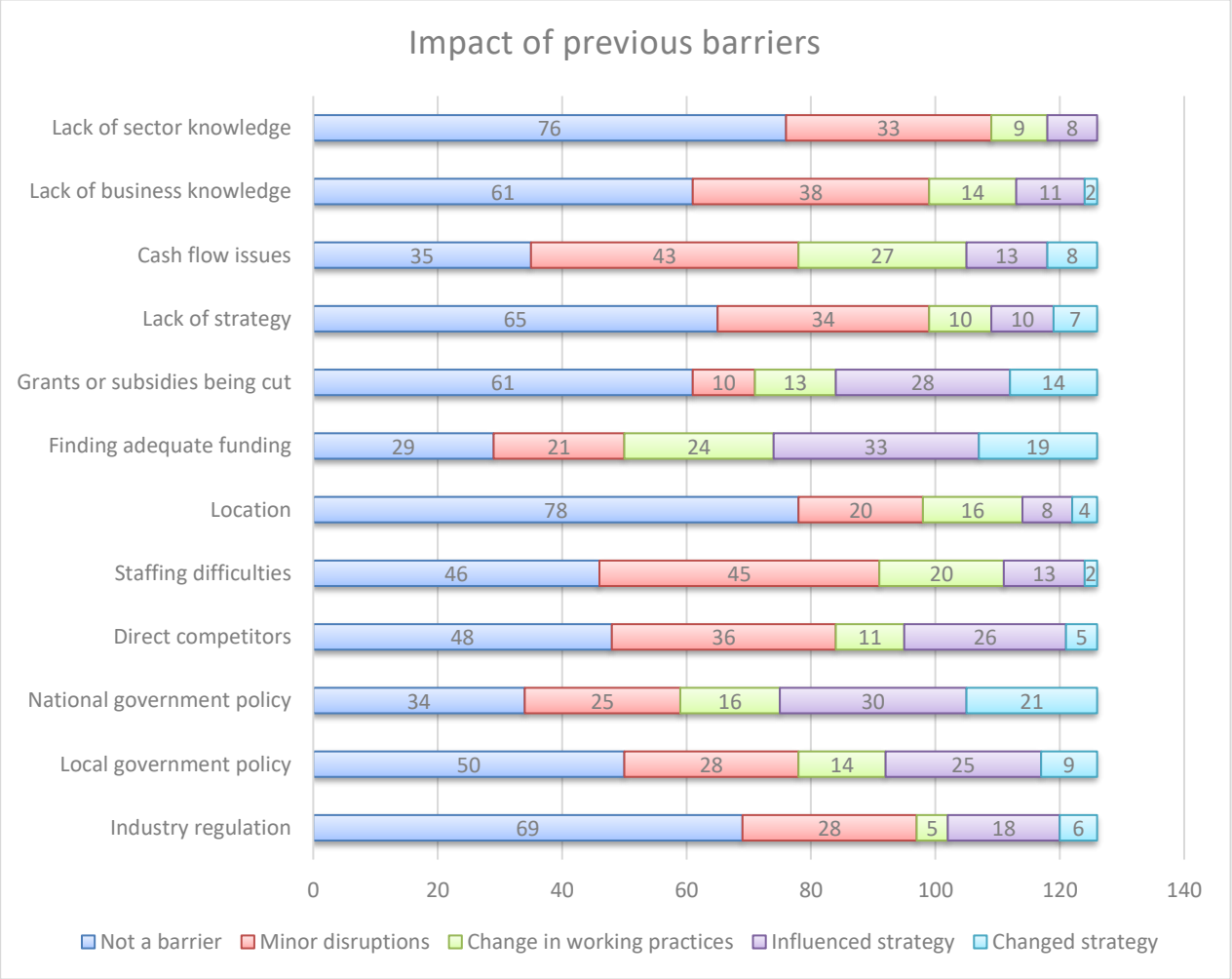


Figure 5.11: Impact of barriers on organisations

Figure 5.11 illustrates the level of impact experienced due to the various barriers across 126 respondents. The least common barrier reported was location, 78 of respondents stated that this was not a barrier and a further 20 reporting only minor disruptions. Finding adequate funding is the most commonly reported barrier with 76.9% of respondents reporting this as a barrier. 41.2% of respondents also reported that finding adequate funding had strategic implications. Cash flow issues affected 72.2% of respondents, however the impact of cash flow issues was more likely to create minor disruptions (34.1%) or changes to working practices (21.4%).

To identify any links between the experienced barriers chi-square tests were used to highlight any relationships between different barrier types. For example, if an organisation has experienced cash flow issues they are also likely to have experienced staffing difficulties. The chi square tests were conducted systematically by comparing each barrier in relation to all other barriers. 23 significant

chi-square results were obtained indicating that several relationships may exist, a summary of which are presented in Table 5.17. Post-hoc tests were also conducted, and the results are also provided within the same table.

Table 5.17: Significant Chi-Square for current barriers

Variable A	Variable B	Chi-Square	p-value	Chi- square sig *(p < 0.05)*	Post-hoc significance *(yes or no)*
Cash flow issues	Local government policy	27.906	(0.032)	Yes	Yes
	National government policy	29.729	(0.019)	Yes	Yes
	Finding adequate funding	34.146	(0.005)	Yes	Yes
	Grants or subsidies being cut	28.777	(0.025)	Yes	No
	Lack of strategy	32.52	(0.009)	Yes	No
	Lack of business knowledge	29.992	(0.018)	Yes	No
Direct competitors	Location	31.648	(0.011)	Yes	Yes
Finding adequate funding	Staffing difficulties	29.321	(0.022)	Yes	No
	Grants or subsidies being cut	69.377	(0.000)	Yes	Yes
	Lack of business knowledge	28.184	(0.030)	Yes	Yes
Grants or subsidies being cut	Industry regulation	26.507	(0.047)	Yes	Yes
	National government policy	27.008	(0.041)	Yes	Yes
Industry Regulation	National government policy	43.951	(0.000)	Yes	Yes
	Location	29.182	(0.023)	Yes	Yes
Lack of business knowledge	Staffing difficulties	40.293	(0.001)	Yes	Yes
	Location	34.891	(0.004)	Yes	Yes
	Lack of strategy	71.74	(0.000)	Yes	Yes
	Lack of knowledge of sector	61.696	(0.000)	Yes	Yes
Lack of knowledge of sector	Location	27.768	(0.006)	Yes	Yes
	Lack of strategy	29.438	(0.003)	Yes	Yes
Lack of strategy	National government policy	30.759	(0.014)	Yes	No
Local government policy	National government policy	124.518	(0.000)	Yes	Yes
Location	Staffing difficulties	28.41	(0.028)	Yes	No

Table 5.17 highlights that out of the 23 significant chi-square results, 17 were confirmed as statistically significant through post-hoc testing. Funding issues were a key theme across the post-hoc testing that was explored further. Where finding adequate funding had not been a barrier the organisations were likely to report that cash flow issues had triggered changes to working practices. This suggests that cash flow issues were related to ongoing organisational issue rather than due to a lack of funding. Organisations were their strategy has been affected by local or national policy were likely to report that cash flow did not cause problems in their organisation. Finding adequate funding and grants or subsidies being cut showed relationships at the extreme ends of the scale. Organisations who reported finding adequate funding had influenced their strategy were more likely to report that grants or subsidies being cut has also influenced their strategy. This finding shows that social enterprises were more likely to report that they struggle to find funding when they are

utilising grants or subsides. These three key findings together build up evidence to suggest that cash flow issues are more likely to occur due when social enterprise are operating through more market-based business models.

5.4.3 Shifts in expected effects of barriers

This section reports on data from the second question posed in the barriers section of the questionnaire; *How will the barriers impact the organisation in the future?* The participants were asked to rank the same barriers from the first question in relation to their importance. The ranking was applied on a 5-point Likert scale from *it won't be a barrier* to *it will change the strategy of the organisation*. Initial findings on the predicted impact of different barriers are presented in Figure 5.12.

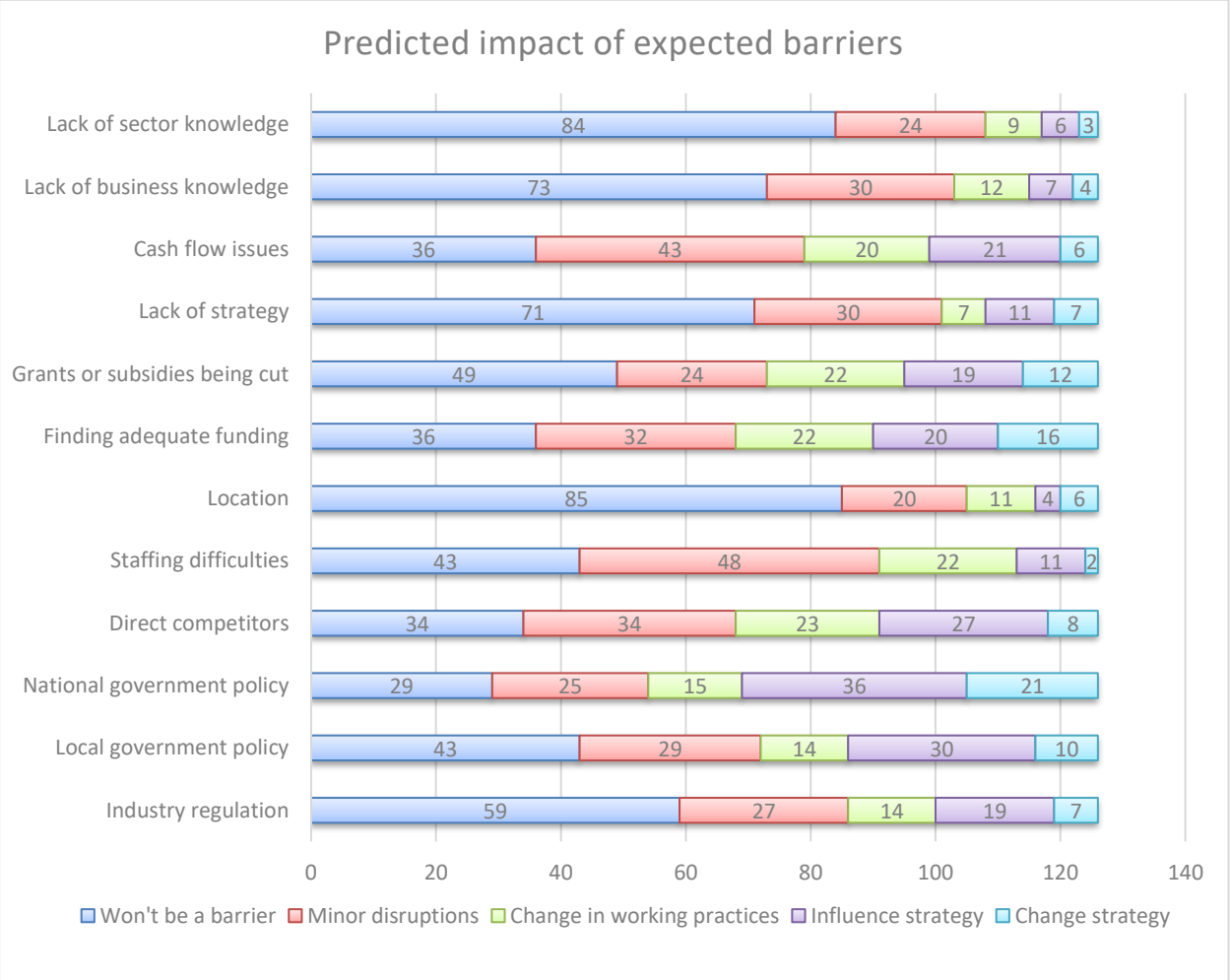


Figure 5.12: Predicted impact of barriers

Figure 5.12 illustrates the level of impact predicted due to the various barriers across 126 respondents. Cash flow issues and finding adequate funding are expected to be prevalent issues which is similar the barriers experienced data in Section 5.4.2. However, it is expected that the

severity of the impact will decrease for finding adequate funding in the future. Two barriers that are expected to become more common in the future are direct competitors and national government policy. 73% of respondents are expecting disruptions due to direct competitors, suggesting a movement towards more market-based business models. National government policy is expected to cause issues for 76.9%, with 45.2% of respondents expecting it to impact their organisations strategy.

5.4.3.1 How is the impact of barriers expected to change?

The datasets were compared to identify any difference between the impact of barriers that have been previously experienced and barriers that may arise in the future, for surveyed organisations. The comparison has been conducted by collating the data on both the barriers experienced and barriers predicted for each of the different issues. This comparison highlights which barriers are likely to have strategic impact[38] on the organisation in the future. Therefore, the data presented in this section relate to the organisational responses, *barrier is likely to influence strategic direction* and *barrier is likely to change the strategy* categories. Figure 5.13, Figure 5.14 and Figure 5.15 show the differences between barriers that have previously impacted strategy and barriers that are expected to impact strategy across the three groups presented in Section 5.1 respectively; all respondents, the environmental subgroup and the energy subgroup. The series of graphs report the number of respondents who reported their strategy being influenced or changed due to the barrier presented. Respondents were also asked the same question in relation to barriers they expected in the future. The findings from the three groups are explored starting with all respondents, Figure 5.13.

[38]Impacted strategy refers to respondents who advised they had to change the strategy as a direct result of the barrier or the barrier influenced the strategic direction of the organisation.

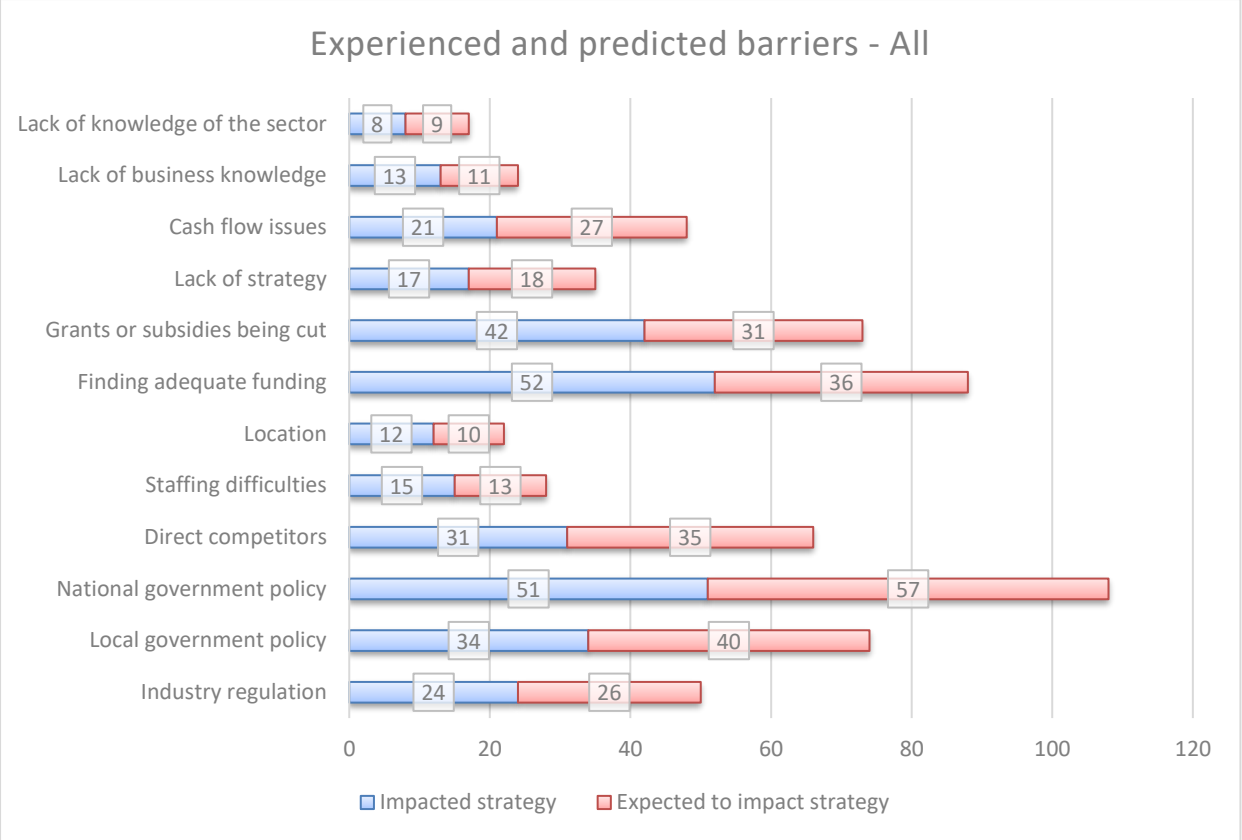


Figure 5.13: Strategic impact from barriers experienced and expected - All respondents

Figure 5.13 illustrates the number of organisations that have experienced or expected barrier to impact on strategy out of the all 126 respondents. The data highlights the shifts in perception in comparison to previous experiences. Both local and national government policy are more likely to have a strategic impact in the future. Finding adequate funding was is expected to have a strategic impact for few organisations in the future. A key finding is that all the barriers presented are expected to have an impact on strategy in the future across the entire dataset. The barriers that have been reported as impacting strategy for the environmental subgroup are presented in Figure 5.14.

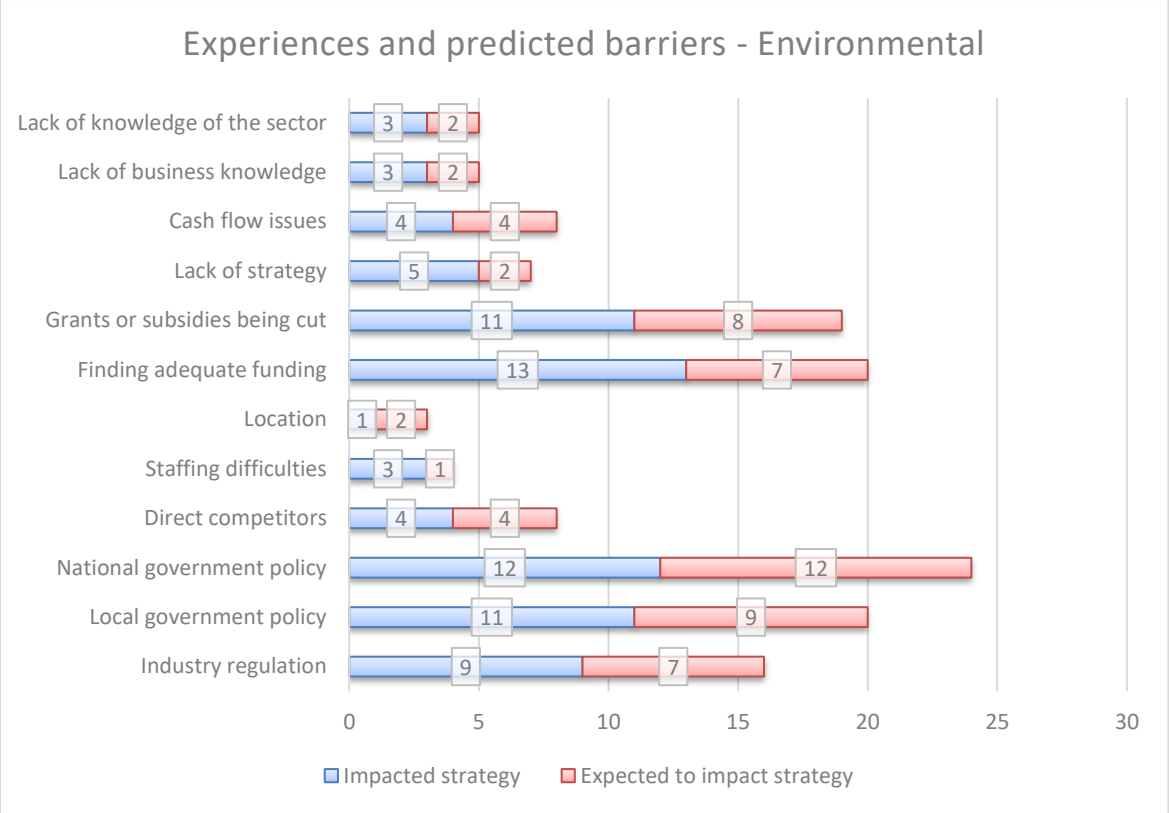


Figure 5.14: Strategic impact from barriers experienced and expected - Environmental respondents

Figure 5.14 shows the number of organisations that have experienced or expected barrier to impact on strategy out of the environmental subgroup of respondents, n=23. In the environmental sample, less variance between experienced and expected barriers is observed in comparison the entire dataset (Figure 5.13). The environmental group shows that all the different barriers have and are expected to have strategic impact. The number of respondents stating that finding adequate funding would have a strategic impact has decreased from 13 to 7, suggesting that finding adequate funding is less likely to be a strategic barrier in the future.

The barriers that have been reported as impacting strategy for the energy subgroup are presented in Figure 5.15.

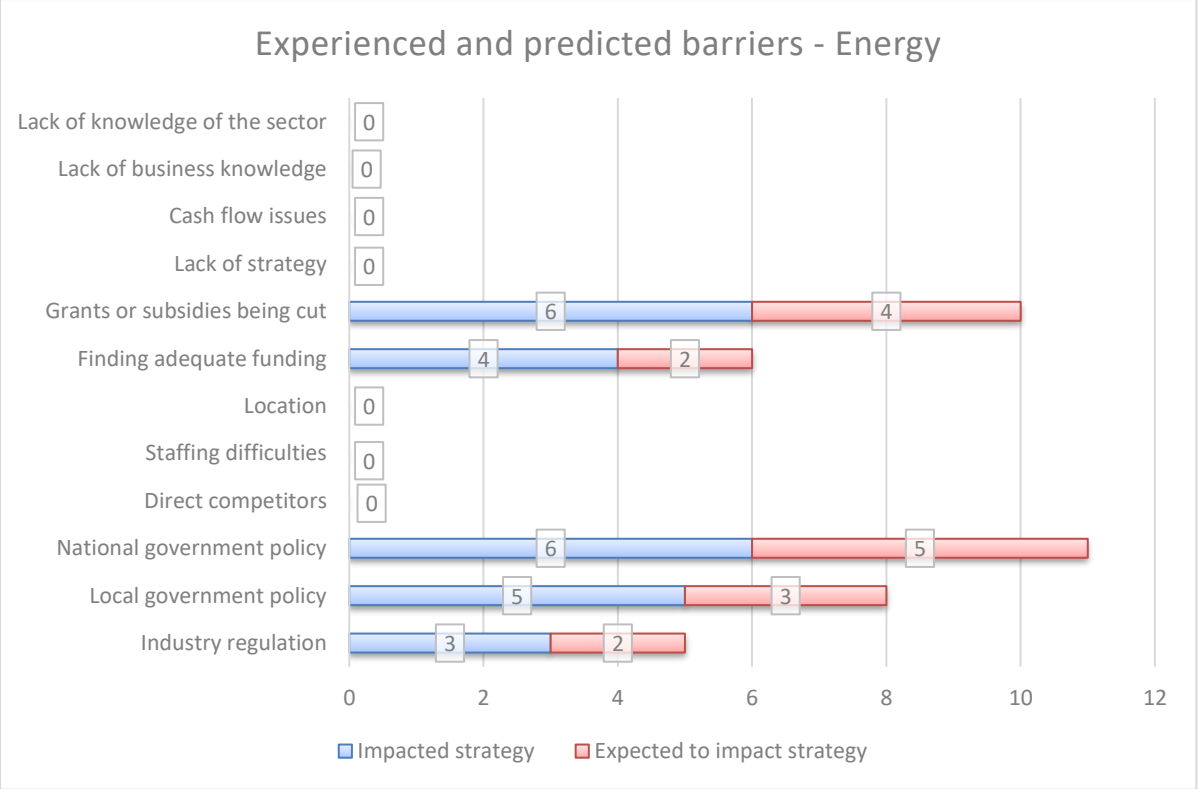


Figure 5.15: Strategic impact from barriers experienced and expected - Energy respondents

Figure 5.15 shows the number of organisations that have experienced or expected barriers to impact on strategy out of the energy subgroup of respondents, n=7. The small sample size here means the findings cannot be generalised. However, some indicative findings can provide insight in to prevalent issues within the energy social enterprises to be explored in more detail in Chapter 6. Within the energy subgroup only 5 of the 12 barriers are reported to impact strategy; grants or subsidies being cut, finding adequate funding, national government policy, local government policy and industry regulation. Across the 5 barriers there is less expectation from respondents that they will have strategic impact in the future. The reduction in impact could be related to two ideas explored across Chapters 4 and 6; 1) that organisational learning may have taken place to reduce the impact of the barriers in future, or 2) that not significant changes to policy, regulation or the funding climate are expected in the foreseeable future. The two reasons presented both have different implications for the community energy sector.

5.4.3.2 Relationships between previous barriers and predicted barriers

A series of chi-square tests were conducted to identify if any relationships existed between barriers that have been experienced in the past and barriers expected in the future. Table 5.18 provides the significant chi-square results exploring the relationship between experienced and predicted barriers.

Table 5.18: Significant chi-square testing for current barriers and predicted barriers

Variable A	Variable B	Chi-Square	p-value	Chi-Square Sig. *(p < 0.05)*	Post-hoc significance *(yes or no)*
Cash flow issues	National government policy	30.932	(0.014)	Yes	Yes
	Direct competitors	28.198	(0.030)	Yes	No
	Finding adequate funding	39.313	(0.001)	Yes	No
	Grants or subsidies being cut	26.699	(0.045)	Yes	No
	Lack of strategy	29.137	(0.023)	Yes	No
	Cash flow issues	106.256	(0.000)	Yes	Yes
	Lack of business knowledge	38.226	(0.001)	Yes	Yes
	Lack of knowledge of sector	31.311	(0.012)	Yes	Yes
Direct competitors	Direct competitors	94.601	(0.000)	Yes	Yes
Finding adequate funding	Finding adequate funding	100.909	(0.000)	Yes	Yes
	Grants or subsidies being cut	40.052	(0.001)	Yes	Yes
	Cash flow issues	27.84	(0.033)	Yes	No
Grants/subsidies being cut	Grants/subsidies being cut	72.701	(0.000)	Yes	Yes
Industry Regulation	Industry Regulation	139.263	(0.000)	Yes	Yes
	Local government policy	45.984	(0.000)	Yes	Yes
	National government policy	31.092	(0.013)	Yes	No
Lack of business knowledge	Location	45.962	(0.000)	Yes	Yes
	Lack of strategy	42.634	(0.000)	Yes	Yes
	Cash flow issues	37.384	(0.002)	Yes	No
	Lack of knowledge of sector	47.401	(0.000)	Yes	Yes
Lack of knowledge of sector	Industry Regulation	22.719	(0.030)	Yes	Yes
	Direct competitors	25.291	(0.014)	Yes	No
	Staffing difficulties	22.077	(0.037)	Yes	No
	Location	31.76	(0.002)	Yes	No
	Lack of strategy	38.626	(0.000)	Yes	Yes
	Cash flow issues	23.081	(0.027)	Yes	No
	Lack of business knowledge	38.232	(0.000)	Yes	No
Lack of strategy	Local government policy	27.189	(0.039)	Yes	No
	National government policy	38.062	(0.001)	Yes	No
	Cash flow issues	28.499	(0.028)	Yes	No
	Lack of business knowledge	36.006	(0.003)	Yes	Yes
Local gov. policy	Industry regulation	47.774	(0.000)	Yes	Yes
	National government policy	70.478	(0.000)	Yes	Yes
	Grants or subsidies being cut	29.621	(0.020)	Yes	No
	Lack of strategy	27.146	(0.040)	Yes	No
Location	Industry regulation	42.265	(0.000)	Yes	Yes
	Direct competitors	39.48	(0.001)	Yes	Yes
	Staffing difficulties	34.121	(0.005)	Yes	Yes
	Finding adequate funding	32.51	(0.009)	Yes	Yes
	Grants or subsidies being cut	27.941	(0.032)	Yes	No
	Cash flow issues	26.775	(0.044)	Yes	No
	Lack of business knowledge	49.078	(0.000)	Yes	Yes
	Lack of knowledge of the sector	42.493	(0.000)	Yes	Yes
National gov. policy	Industry regulation policy	32.442	(0.009)	Yes	No
	Local government policy	83.105	(0.000)	Yes	Yes
Staffing difficulties	Location	32.278	(0.009)	Yes	Yes

Table 5.18 highlights that out of the 53 significant chi-square results, 33 were confirmed as statistically significant through post-hoc testing. A general finding from across the post-hoc testing was that organisations that had experienced cash flow or lack of knowledge barriers have changed the strategy of their organisation. These organisations were more likely to expect a wider range of barriers in the future. This finding suggests that where cash flow or a lack of knowledge has caused problems in the past, a more cautious approach is adopted by the organisation in predicting future issues. Organisations who reported that cash flow issues had changed the strategic direction of the organisations were more likely to report that national government policy may trigger long-term changes in working practices in the future. Earlier in this section cash flow issues were linked to more market-based business models. The link between case flow issues and national policy found here suggests that market interventions are expected. Participants were given the options to expand or add open comments on any issues throughout the questionnaire and a key barrier identified that is expected to cause issues in the future is the political and economic uncertainty surrounding Brexit. A lack of clarity over the impact of Brexit may explain why more market-based social enterprises are concerned about national government policy. Box 5.3 the key points from the findings on network presented in this section.

Box 5.3: Summary findings on barriers

Key findings on barriers across the social enterprise sector:

- National government policy was found to be a key barrier to social enterprises
- Direct competitors were expected to create more disruption in the future
- Finance related barrier have and will continue to pose problems for social enterprises

5.5 Relationships between networks, income streams and barriers

This section will explore the relationships between the three different sections of the questionnaire; networks, income and barriers. Chi-square and post-hoc analysis were utilised to identify where any relationships exist between the different key elements of the questionnaire. The analysis presented here has been conducted in two ways. Firstly, the relationships between existing networks, income stream and barriers are explored. Secondly, the relationships between important networks and predictions on financial sustainability and barriers are examined.

5.5.1 Relationships between current networks, income streams and barriers

The section explores the relationships between existing networks, current income streams and barriers faced. Chi-square analysis was used to explore the any relationships between each of these

variables. The significant results from those tests, along with the result of the post-hoc testing, is provided in Table 5.19.

Table 5.19: Rest of the significant chi-square results for networks, income and barriers based on previous experience

Variable A	Variable B	Chi-Square	p-value	Chi-Square Sig. *(p < 0.05)*	Post-hoc significance *(yes or no)*
Test: Current networks and Barriers faced					
Influential people within the key network	Direct competitors	36.158	(0.003)	Yes	Yes
	Local government policy	27.062	(0.041)	Yes	No
Local councils	Grants or subsidies being cut	28.132	(0.030)	Yes	No
	Lack of knowledge of sector	21.396	(0.045)	Yes	No
Private organisations	Finding adequate funding	28.948	(0.024)	Yes	Yes
Same region social enterprises	Lack of knowledge of sector	24.493	(0.017)	Yes	No
Test: Level of income stream and Barriers faced					
Primary Income	Finding adequate funding	46.822	(0.014)	Yes	No
	Grants or subsidies being cut	45.701	(0.019)	Yes	No
Tertiary Income	Lack of business knowledge	45.071	(0.022)	Yes	Yes

Table 5.19 shows that out of the 9 chi-square tests that highlighted statistical significance, 3 were confirmed as having statistical significance through post-hoc testing. A relationship was identified between organisations who reported not being well connected to influential people across the network were more likely to report that they had to change the strategic direction of their organisation. A significant relationship was also found between organisations not being very well connected to private organisations and having to change the strategic direction of the organisation due to not being able to find adequate funding. This means that organisations who did not connect with private organisations were more likely to report they struggled to find funding. The final significant relationship identified was between income and lack of business knowledge. There was a relationship between a lack of business knowledge changing the strategic direction of the organisation and those who reported using shares as a tertiary income. As details in Section 5.3.1 of this chapter, share issues are commonly utilised in by energy based social enterprises but not very often in other sectors. The implication of financial models in the community energy sector will be discussed more in Chapter 7.

5.5.2 Relationships to forecast future networks, financial sustainability and barriers

The section explores the relationships between organisations predictions on the importance of networks to overall success, the likelihood of becoming financially sustainable in the future and either barriers experienced or predicted. Chi-square analysis was used to explore the any relationships between each of these variables. The significant results from those tests, along with the results of the post-hoc testing are presented in Table 5.20.

Table 5.20: Significant chi-square results for forecasting networks, financial sustainability and barriers

Variable A	Variable B	Chi-Square	p-value	Chi-Square Sig. *(p < 0.05)*	Post-hoc significance *(yes or no)*
Test: Current networks and Predicted barriers					
Local councils	Local government policy	36.757	(0.002)	Yes	No
Private and public partnerships	Staffing difficulties	27.519	(0.036)	Yes	No
Same sector social enterprises	Local government policy	27.918	(0.032)	Yes	No
	Lack of business knowledge	36.721	(0.002)	Yes	Yes
	Local government policy	27.542	(0.036)	Yes	No
Test: Future networks and Predicted barriers					
Local councils	Local government policy	33.94	(0.006)	Yes	No
Private organisations	Location	26.72	(0.045)	Yes	No
Same region & sector social enterprise	National government policy	28.88	(0.025)	Yes	No
Same sector social enterprises	Local government policy	27.238	(0.039)	Yes	No
	National government policy	35.291	(0.004)	Yes	Yes
Test: Financial sustainability and current networks					
Financial sustainability	Private and public partnerships	62.667	(0.034)	Yes	Yes
Test: Financial sustainability and barriers faced					
Financial sustainability	Industry regulation	17.04	(0.030)	Yes	Yes
Test: Financial sustainability and predicted barriers					
Financial sustainability	Lack of strategy	24.682	(0.002)	Yes	No
	Cash flow issues	15.884	(0.044)	Yes	No

Table 5.20 shows that out of the 14 chi-square tests that highlighted statistical significance, 4 were confirmed as having statistical significance through post-hoc testing. The key findings from the post-hoc tests relate to peer interactions and financial sustainability. Respondents who reported they were not well connected to other social enterprises in the same region expect they will need to change their strategy in the future due to a lack of business knowledge. The strategic impact suggests the organisations with a lack of business knowledge are more likely to miss out on the peer support benefit of networking with local social enterprises. A relationship was found between those who reported financial sustainability as unachievable for them and those who are extremely well connected with private and public partnerships. This relationship highlights that some social enterprises may rely on such collaborations to perform economically and remain in operation. Finally, a relationship exists between organisations who believe financial sustainably could be possible in the future and those who reported having to change long-term practices due to industry regulation. This finding could indicate that regulation changes are expected to influence the business models in the future, this is a key to the community energy sector and is explored in more detail in Chapter 7.

5.6 Summary of Chapter 5 results and points for discussion

The aim of this chapter was to provide an analysis of currently operating organisations in the social enterprise sector in the UK. Three key objectives of the study, outlined in Section 3.2.2, were; 2a) to provide a context for community energy by creating a profile of social enterprises operating in the UK, 2b) gain an insight into how social capital and income streams are utilised by social enterprises in the UK and, 2c) identify distinct characteristics of social enterprises operating within the community energy sector. An overview of the key findings linked to each of these aims is presented. Box 5.4 provides a summary of the key findings.

Box 5.4: Summary of results - Study 2

Profile of social enterprises operating in the UK

- Most common legal structure across the social enterprise sector was Community Interest Companies and Limited Companies
- Environmental, Health and Social Care and Business Support Services were the three largest sectors, accounting for 52% of the sample
- A large proportion of social enterprise were found to be small organisations, 86.6%.

Social capital, income streams and barriers across the social enterprise sector

- Social enterprises were found to be likely to establish networks with a wide range of stakeholders. Local councils and public and private partnership were predicted to be important connections for social enterprises in the future
- Share issues were not utilised widely across social enterprise. In the cases where shared were used, they were more likely to be a secondary income after loans. Overall, there was optimism that social enterprises could become financially sustainable in the future
- National government policy was found to be a key barrier to social enterprises. Direct competitors were expected to create more disruption in the future than they currently do
- Peer support from other social enterprises and collaboration with private organisations and public and private partnerships were key for financial sustainability.

Distinct characteristics of the community energy sector

- There was peak in new energy sector social enterprises being set up between 2013 and 2015
- The business model in community energy differs from the general findings for social enterprises in that it utilises the community benefit model and generate a larger proportion of income through share issue

- Only five barriers were predicted to have an impact on community energy; industry regulation, government policy (national and local), grants or subsidies being cut and finding adequate funding

Profile social enterprises operating in the UK – *Objective 2a*

Profiling social enterprises in the UK helps to address research question 2, discussed in Chapter 3. Most organisations were classed as small organisations in terms of employee numbers. This is also reflective of businesses across the UK where 99.9%[39] of businesses are classified as small to medium size enterprises (SME's). The most common number of employees for social enterprises to have was 2. In total 13 separate sectors were represented across the data. Environmental, Health & Social Care and Business Support Services were found to be the three prevalent sectors accounting for over half of the organisations surveyed.

The most common forms of social enterprise legal structure that was found across the surveyed organisations were Community Interest Companies or Limited Companies. No relationship was established with legal structure and the length of time the organisation has been in operation. This shows that there has not been a shift over time to different legal forms. The data show that the number of new start-up of social enterprises was lower in recent years.

Identify social capital, income streams and barriers across the social enterprise sector – *Objective 2b*

The findings from this aim are key to all 3 research questions as discussed in Chapter 3. Social enterprises were likely to report developing networks with a wider range of stakeholders. This key finding demonstrates diversity within networks is considered an important success factor for social enterprises. Peer support from other social enterprise is something that was perceived as being important now and in the future. The sector the peers operating in was found to be less important than social enterprises being in the same region. Gaining more business knowledge through peer support was found as a key benefit of networking with other social enterprise in the same region. Influential people were found to be the most commonly reported network connection across the data. The data highlighted a disconnect between how connected social enterprises were to several stakeholders and their future importance. In the case of private organisations, local councils and private and public partnerships the data suggest that relationships need to be better established in the future.

[39] Stats for SME's in the UK from Nov 2017 policy briefing: 99.9% SME's (less than 250 employees, 96% micro, 4% small. 1% medium and 0.1% large) (Rhodes, 2017)

Trade income was highlighted as an important income stream for social enterprise with 73.14% of respondents stating they engage in trade activities and 52.24% stating it is their primary form of income. However, 72.38% of organisations stated that they had more than one income stream. Secondary income streams were found to be more diverse than primary income streams. The top three types of secondary income were private grants or contracts (28.87%), government grants or contracts (23.71%) and trade income (22.68%). Statistically significant relationships were found between primary and secondary income streams. Organisations with a primary income of loans were mostly likely to use shares as a secondary income. Shares were found to make up an average of 2.1% of income where utilised. Perception on ability to become financially sustainable was high with 78.4% stating that they believed it was currently possible. This stems from numerous comments from organisations who state they are already achieving this.

The most common barriers faced by social enterprise was cash flow issues, finding adequate funding and national government policy. Community benefit societies were more likely to report that they had implemented strategic changes as a direct result of national government policy. National policy was predicted to be a problem in the future. The role of national policy is particularly pertinent for theory as it highlights that social enterprises are particularly dependent on the state. A shift for more organisations to move towards market-based business models was evidence through the expectation that direct competitors would cause disruptions for organisations in the future. A noteworthy point here is that no significant relationships were found between the size of organisations and any of the barriers that had either been face or were expected to be faced in the future. Organisations that did not connect to private organisations were more likely to struggle to find funding in the future. Social enterprises who connected to private and public partnerships may rely on those collaborations to maintain financially viable business models.

Identify distinct characteristics of the community energy sector – *Objective 2c*

The findings presented show that the community energy social enterprise model appears to be different from more widely used models across other sector social enterprises. The key differences highlighted are the use of the community benefit society legal structure, the issuing of shared and the lack of income though trade. The characteristics of the community energy sector are importing to research questions 2 & 3, as discussed in Chapter 3. Several differences were found between the structure of businesses in the energy sector and the social enterprise findings. The community benefit society legal structure was used exclusively in the energy sector. On average the organisational size for the energy sector was larger at 5 employees or volunteers found as the most common size. The primary income for the energy sector was share issue and them most common

secondary income was government grants or contracts. The chi-square tests showed a significant relationship between community benefit societies and share issues as a primary income source. Energy sector organisations were much less optimistic that financial sustainability would be possible, at 50%. On average only 5.1% of income in the energy sector was found to come from trade. None of the energy sector organisations had started up within the 12 months prior to the survey, (February/March 2016).

The most important areas for networking in the future were private and public partnerships and with the local council. Peer support was not considered particularly important despite energy organisations being well currently well connected. There are 5 key barriers that have strategically impacted energy organisations and are likely to do so in the future are; industry regulation, government policy (national and local), grants or subsidies being cut and funding adequate funding. Cuts to grants and subsidies were expected to trigger long-term changes to working practices rather than strategic problems for community energy.

Chapter 6. Social Enterprise as a niche innovation breakout for low-carbon transition

An overview of the methods used within this results chapter are presented due to the mixed methods approach utilised within the thesis (Table 5.1). Full details on the methodological approaches applied and datasets utilised are detailed in Chapter 3.

Table 6.1: Summary of methods for study 2

	Social Enterprise in the UK
Methods applied	Semi-structured interviews
Rationale	Conduct in-depth interviews with 12 key informants
Datasets utilised	Round 1 interviews Transcripts were used from interviews with 7 community energy or business support organisations. The interview schedule covered the following key themes; Sustainability and climate change • Business structure • Income streams • Barriers within the sector • Future consideration Round 2 interviews Transcripts were used from interviews with 5 community energy sector experts. The interview schedule covered the following key themes; • Post-FIT environment • Community energy innovations • The future of community energy
Analysis overview	• Interviews conducted and transcribed verbatim • Interview transcripts coded using NVivo software • Thematic analysis techniques applied to identify key themes from the data

6.1 Overview of key themes from interviews and thematic analysis

This chapter explores the findings from two stages of interviews that were conducted during this PhD. The first round of interviews was conducted during February and October 2016 and focused on broad ideas of sustainability and the business models associated with the community energy sector. The second round of interviews were held during February and March 2018 and aimed to investigate

developments within the community energy sector, focusing specifically on innovation. The second round of interviews were conducted in recognition of the rapidly changing nature of the community energy sector. All interviews were targeted at key players with an interest in the community energy sector including key regime actors.

The thematic analysis of the first round of sector interviews highlighted five key themes; business strategy, business structure, energy projects, external factors and innovation. Table 6.2 provides an overview of these themes by highlighting the sub-themes and all the categories that make up that theme, following from the in-depth thematic analysis.

Table 6.2: Overview of themes and sub-categories following thematic analysis of first round interviews

Theme	Sub-theme	All categories within theme
Business Strategy (13) *Total number of codes in theme: 31*	Energy Market (5) Entrepreneurship (6) Organisational learning (7)	Business strategy, organisational learning, entrepreneurship, consumption, energy generation, export price
Business Structure (28) *Total number of codes in theme: 388*	Business Operations (144) Economic Development (160) Legal Structure (56)	Business structure, business operations, business costs, insurance, individual roles, gender, personal values, skills, suppliers and volunteers, economic development, financial sustainability, generating income, grant income and interest rates, legal structure, governance and members
Energy Projects (76) *Total number of codes in theme: 250*	Barriers for community energy (108) Benefit of community energy (6) Local council (24) Project development (27) Retrofit (1) Uncertainty (8)	Energy projects, barriers for community energy, business support, consumer costs, future of community energy legal barriers, benefit of community energy, awards, local council, risk, project development, retrofit and uncertainty
External factors (0) *Total number of codes in theme: 403*	Brexit (1) Collaboration (24) Green growth (3) Legal requirements (10) Local currency (1) Ownership (7) Political landscape (85) Power (1) Regulation (15) Stakeholders (144) Sustainability (112)	Brexit, collaboration, gatekeepers, private and social business, green growth, legal requirements, local currency, ownership, political landscape, economy failures, feed-in tariffs, power, regulation, stakeholders, communication, community, stakeholder, engagement, networks, sustainability, sustainability initiatives, sustainability perceptions, sustainability targets awareness raising, education, social impact, empowerment
Innovation (12) *Total of codes in theme: 28*	Forecasting (5) Market driven innovation (2) Product testing (1) Protected space (1) Scale (7)	Innovation, forecasting, different technologies, market driven innovation, product testing, protected space, scale

Table 6.2 shows the diverse nature of the discussions held with the key informants. A key but underdeveloped theme from this set of interviews is innovation. Due to the timing and rapidly changing funding landscape in the sector, a second round of interviews was conducted in early 2018 to identify how the sector had dealt with the challenging landscape. The second round of interviews considered emerging innovations. Table 6.3 provides a breakdown of the themes by highlighting the sub-themes and all the categories that make up that theme, following the in-depth thematic analysis. The themes from the second set of interviews were reflective of a more targeted interview schedule developed towards sector experts.

Table 6.3: Overview of themes and sub-categories following thematic analysis of second round interviews

Theme	Sub-theme	All categories within theme
Actors (1) *Total number of codes in theme: 25*	Attitudes & Beliefs (9) Stakeholder Interactions (32)	Caution, opportunity, pessimism, resistance towards renewable energy, gatekeepers, human interaction, leadership, local authorities, ownership, partnerships, people focused, public partnerships, reward
Emerging Innovation (2) *Total number of codes in theme: 61*	Disruptive Innovation (2) Evolution (1) Business models (48) Protected Space (15) Scale (32)	Experimental, financing, financial sustainability, financial viability, PPA business model, uncertainty, innovation activities, innovation funding, innovation trials, multiple solutions, new platforms, down-scaling, niche scale up
Energy Market (2) *Total number of codes in theme: 250*	Competition (2) Selling vs Exporting (1) Supply (5) Demand (3) Energy Transition (5) Community Energy (77) Decentralised Energy (8) Disengagement Energy Market (6)	Balancing supply, demand reduction, capacity, growth rate, paid staff. Community benefit, links to communities, new project development, acceptance of projects, feasibility, heat projects, holistic projects, risk, non-social business impact, sector changes, barriers to community energy, regional differences, energy management, local supply, fuel poverty
Regime (1) *Total number of codes in theme: 35*	Future regime (13) Regime Domains (43) Tension against the regime (8)	Future, vision, politics, FITs lobbying, policy decisions, political transition, regulation, regulator problems, regulatory conflict, technological, retroactive storage systems, storage, system constraints, work around solutions

The key sub-themes identified during the coding process were actors, emerging innovation, energy markets and the regime. A significant cross cutting theme of energy transitions was also identified during the analysis process. The significant findings following these interviews are; 1) role of the community energy sector within the energy market, 2) the relationship between different key actors and attitudes towards the sector, 3) emerging innovation coming directly out of the sector and their externalities and, 4) the transitioning regimes and tensions which are occurring.

The thematic analysis of the interview data succeeded in highlighting the key themes and insights. The three key aims were introduced in Section 3.1.3. During this chapter the key aims of this study will be met by exploring the key themes from the interviews in relation to the objectives of the study (Table 6.4). Full interview transcriptions are provided in Appendices 10 & 11.

Table 6.4: Themes utilised to meet the objectives

	Themes utilised	
Objective	Round 1 interviews	Round 2 interviews
Provide a detailed account of the community energy sector and project specifics	- Business Strategy - Business Structure - Energy Projects - External Factors	- Actors - Emerging Innovation - Energy Market
Evaluate the role of innovation in the community energy sector and identify where community energy groups are innovating	- Business Strategy - Business Structure - Energy Projects - External Factors	- Actors - Emerging Innovation - Energy Market - Regime
Determine the potential for community energy projects to diffuse in to the regime	- External Factors - Innovation	- Actors - Emerging Innovation - Energy Market - Regime

6.2 The UK energy sector and the emergence of community energy business models

This section provides a detailed account of the changing energy system has enabled the emergence of community energy in the UK. Key Informants describe the need for diversification of energy sector business models, how community energy can add value to the energy sector, prevalent business model in community energy and the challenged faced when delivering community energy projects.

Energy sector in the UK

A key driver of this PhD is that the energy sector in the UK is currently going to through a period of transition as discussed in Chapter 1. The transition to a low-carbon energy system is a pressing agenda for several key stakeholders in the energy system; energy companies, government, regulatory bodies and communities. A vast amount of power in the energy market in the UK is held by fossil fuel companies, government and regulatory bodies. The power to influence the energy system is largely protected through the powers of the regulators, legislative powers of government and the economic power of the fossil fuel companies. The influential nature of the key incumbents in the energy system was highlighted in the interviews as an important factor to recognise in the context of instigating meaningful change in the energy market;

> *"The energy market is a heavily regulated market with some big players in it, and it's a global market and we rely on energy systems often without thinking about them. If you want to change that system, again it comes back to your reasons for doing so. You might want to think about protecting local jobs, training people up and not to make revenue but for a circular economy argument." (Key Informant 4)*

The quote draws attention to two key points. Firstly, that systems are often complex, and dependent on several factors and therefore difficult to change. Secondly, the motivation for transition is key as it can affect how the 'new' system will be structured. Key Informant 10 acknowledged that there was a disconnect between the normative and utilitarian ideologies of the future energy system;

> *"There's what would I like to see happen and what do I think will happen. I would really like to see far greater local ownership, which include local public sector and community. I really think that local authorities should be investing in renewable energy." (Key Informant 10)*

Within the wider low-carbon transition debate there is an argument for decentralised systems to help meet carbon reduction targets (Madlener and Schmid, 2003; Tipper, 2013; Becker, Kunze and Vancea, 2017). A key benefit of decentralised energy presented was that democratisation can be incorporated in the energy system to make it more equitable;

> *"I mean all of the sort of things are really interesting disruptive ways of restructuring the market to get more democratisation in. And if we can sell it as a democratisation of energy because we can show that it is genuine" (Key Informant 9)*

Decentralisation through disruptive innovation and more democratic markets was perceived as an important normative goal for future energy system. Practical benefits to local, more democratic energy mean that economic benefits can be retained locally and communities can become more engaged with the energy system. During the interviews, social enterprises were recognised as a key tool to support the delivery of democratic business models in the energy system. Interviewees were generally optimistic about the potential for social enterprise in the transition to a low carbon energy system;

> *"It is more democratic because the members are more involved, it is one shareholder one vote whatever their shareholding." (Key Informant 5)*

> *"The intention is to set up a business which is a self-funding, sustainable business but has very much a values-based approach to what we do and has a clear intention to democratise the energy system as we move in to a post carbon energy system." (Key Informant 1)*

The democratic and entrepreneurial elements of quotes presented supports an underlying theme of this thesis, that it is important to differentiate social enterprises from charitable organisations. The interviews support the notion of social enterprise as a tool, or engine, for the delivery of decentralised energy solutions.

The value of community energy

The benefits of transitioning to a democratic energy system were explored during the interviews. Community energy is posited as a way to democratise the energy system in the UK. Several key ways that community energy can add value to the energy system were highlighted during the interviews; local ownership, secondary impacts and community engagement.

Local ownership is presented as a key element of social enterprise models in community energy as it represents a power shift in the system. The shift in power from private corporations and government to a local level was discussed during the interview;

> *"That's one of the really nice things about community energy as well is that you start to take back control of, in this case electricity supply, into the hands of local people and that the benefits and the profit from those activities come back to the local community." (Key Information 7)*

Community energy allows communities to take control of their energy systems. The control benefits the community through the retention of economic benefits delivered by community energy projects. Key informant 4 discussed the importance of retaining profits within the local economy;

> *"So that would mean that you've got an income stream coming in to do some stuff with locally rather given the profit to shareholders the profits can be used to start funding retrofitting homes or even perhaps a local feed in tariff for example." (Key Informant 7)*

Income staying in the community was discussed through profits being split more equitably across the community, rather the being directed to shareholders. The potential for different types of social and environmental impacts through community-led activities was evident. Community-led solutions were reported to be preferential as local solutions could be implemented based on the specific needs of the community;

> *"The industry just sells what the legislation requires, and the householder has to go with it… We therefore need to empower people to make their own decisions and then invest in it and that to me is going to come through community and through engagement. But it will cost money and government programs are fine but unless they're going to legislate." (Key Informant 2)*

Community-led solutions are more likely to come when individuals feel more empowered. The interviewees suggested that community engagement is a key part empowering people to act and make their own decisions. The sentiment that individuals should feel empowered to act rather than feeling disenfranchised with the energy system was reflected by many of the interviews;

> *"Energy is something we all rely on and some of that when you put infrastructure locally should be rewarding the locals." (Key Informant 4)*

Local communities being rewarded by the economic benefits of local energy generation, ownership and management was presented as an important element of community engagement. One of the key informant's organisations had installed projects on schools purposefully, so they had the added benefit of direct access to the community;

> *"So, this clearly is the direct impact of being able to produce green renewable energy which is great, also for the schools to save money which is great and then we're working on the educational bits of engaging with schools on how we can support them to maximise the educational benefits for the kids." (Key Informant 7)*

Multiple benefits coming from singular community energy projects were demonstrated. The benefits included; lower energy bills for the school, reducing carbon emissions and conducting behaviour change initiatives with the children and their families. The benefit of communities being involved or aware of community energy projects was discussed further by key informant 7;

> *"But then you've suddenly got more control locally of something happening locally and through that engagement people become much more aware and engaged in things like where energy comes from and why it matters." (Key Informant 7)*

The need for energy demand reduction was presented in Chapter 1 as an important part of the government's carbon-reduction plan. Therefore, engaging individuals and communities with the energy system is key due to the multiplier impact that it can have on other aspects of everyday life such as travel, food and waste reduction. From the interviews, it was evident that the potential benefits of community energy were much deeper and more holistic than just installing renewable energy systems or making buildings more energy efficient.

> *"The excitement is about that type of arrangement where you've got a holistic local energy solution and local people are benefiting from the renewables directly...by various types of contractual relationships supporting local decentralized renewables" (Key Informant 12)*

Community energy business models

The following types of community energy business models were described by key informants; energy generation, energy demand reduction and organisations that support community energy in some capacity. The diversity of the different forms that organisations in the community energy sector can take were discussed by all the interviewees. As discussed in Section 4.2.3, energy reduction programmes are often utilised by community energy to alleviate fuel poverty rather than with the sole intention of decarbonisation. This finding was reflected by key informant 2;

> *"But there's also the other equally important aspects and its link currently to fuel poverty, but ultimately it will be linked to climate change as well and that's health and well-being. So, the warm and healthy homes programme is a grant to engage with residents whose health will be affected by cold and damp homes or inability for fuel that sort of thing." (Key Informant 2)*

The focus on affordability for those in fuel poverty is an important aspect of the energy trilemma, discussed in Chapter 1. However, in the context of this thesis affordability poses a difficult paradox whereby affordability incentives may increase energy consumption for those most disadvantaged in the system. Stockton & Campbell (2011) state that tensions exist between affordability and decarbonisation policies. When social and environmental tensions occur individuals may prioritise their immediate living environment over a seemingly abstract global issue (Stockton and Campbell, 2011).

A key finding from Section 4.3 was that energy generation business models make up the largest proportion of the community energy sector. Energy generation business models were a main theme across the interviews. The prevalent business model for community energy was found to rely heavily on the use of the FIT[40] subsidy scheme offered by the UK government. When the FITs were introduced there was optimism in the growing community energy sector that the government subsidy would lead to economic growth;

> *"The other one obviously is PV and FITs. Community organisations, community groups, and we're linked into some where the FITs would have created an annual income for community groups or community organisations to then look to snowball into big funding." (Key Informant 2)*

The FIT's and UCEF grants enabled community organisations to enter the energy markets by allowing energy generation to become financially viable on a small scale. The necessity to utilise government subsidies created a vulnerability in the community energy sector that was exposed starkly when the

[40] FITs refer to the feed-in tariff government subsidy that are explained in Section 4.3.

FIT subsidies were reduced. The unexpected and rapid reduction to FIT rates is discussed by key informant 6;

> *"Amber Rudd became Environmental Minister after the May election last year and the bonfire of subsidies began" (Key Informant 6)*

Community energy was severely affected by the austerity measures from central government. The removal of the FIT's created a financial deficit in this business model of community energy generation. Many organisations did not have enough projects to become financially self-sustaining enterprises. The interview data suggest that community organisations needed to diversify from projects focusing on single technologies to exploring new options;

> *"Now, not so much with solar but say biomass, there's still a subsidy for biomass which would offer the same returns as solar was doing before the tariff cut so there's still potential there for a similar business model. And the sectors changing so much so there's a lot of stuff coming down the pipe to do with storage which is going to be the next big thing." (Key Informant 1)*

Biomass and battery storage were considered as two potential alternative business models being explored by community energy in the post-FIT era. The interviews highlighted that there was still activity in the community energy sector, despite the FITs being removed. Local supply was considered during the interviews as a potential for locally delivered energy. Local supply is where local authorities act as energy suppliers to their constituents;

> *"Other opportunities you might argue, we could sell gas and electricity. It's like Greatplaces and Bristol Community Energy, they're selling gas and electricity. That might be something too big for us individually, but we could get involved in that sort of arena." (Key Informant 2)*

Local supply was found to be costly to set up and therefore was recognised as having potential for large or public-sector organisations, such as local councils. At a community level scale local supply would not present a financially viable opportunity, however, potential was identified for social enterprise to be involved in a collaborative way. The potential for collaborative business models with public utility providers was also identified in the interviews;

> *"Water utilities are very good client, just in the same way railways are easier because you don't need it you don't need any new special kit. But basically, they are sites with extremely dependable electricity demand and owners and operators that are in a position to sign a 25-year PPA." (Key Informant 12)*

The main reason that public utility suppliers were reported as a key potential collaborator is that such organisations would be able to use all of energy generated without any surplus being exported

to the national grid. The interviews confirmed that the optimal business model is when all the electricity generated is sold directly to an end user through a power purchase agreement (PPA). This different approach indicates that the community energy sector has showed signs of innovation through diversification of business models. The old FIT model that relied on the income earned from exported energy was found to be no longer viable. Instead, viability was considered as likely to come from projects where energy is supplied directly to the end user. The mood across the community energy sector was presented as cautious rather than optimistic;

> *"So I think there is a real, for me that we're almost back at 2010 when there are three or four groups that are really bold in England looking to do really exciting things and others are sort of sitting back watching and waiting to see how it pans out." (Key Informant 9)*

Many community groups were managing current portfolios whilst waiting to see how successful the innovation trials were. Waiting for others to innovate was an expected finding as the interviews were conducted at a time when there was an absence of many viable business models in the community energy sector. The interviews show that the community energy sector was in a period of reflection and transition away from the original FIT business model. Despite this, the interviewees predicted that community energy will still have a role in the new low-carbon regime;

> *"I see it being a part of it. I don't know how much of a part of it because I think it aligns with other things that are changing in society, moving away from large companies and trying to do more for your local area." (Key Informant 11)*

The uncertainty as to what that role is likely be was a consistent view across all the interviews. Given that this research has already highlighted that in the UK a 'copy and paste' approach was utilised by many organisations under the FIT this was an expected finding. Innovation in the community energy sector therefore may not only be valuable to the low-carbon regime but essential for the development of the community energy sector;

> *"What they're going to have to innovate in is in funding streams, partnerships, business models and where the flow of money from energy and the flow of benefits from energy comes." (Key Informant 9)*

The community energy sector has been dealt a severe blow through the removal of the FIT's. For the sector to maintain credibility and continue to grow alternative solutions are required. Innovations coming out of the sector are explored further in Section 6.3.

Delivering community energy projects

The removal of the FITs played an important role in the evolution of community energy. However, several other factors that affected the delivery of energy generation projects were also discussed during the interviews. The three key factors reported were; 1) regulatory issues, 2) time and cost in developing projects, and 3) managing multiple stakeholders.

The energy industry has already been discussed as a highly regulated one in Section 4.2.4.1. A key regulation found to affect the business models in community energy is that selling energy directly to the public is restricted without a supply license as set out by the Electricity Act 1989. Regulation was reported as a hindrance to developing new business models as community energy organisations are restricted by who they can sell the energy they generate to. It was reported that if community energy organisations could sell their energy to the local communities they are based in then more revenue would be earned;

> *"It would be nice if we could sell energy to them, if we can sell them their own locally produced energy that would be quite a nice thing to do and obviously that's more revenue for us." (Key Informant 7)*

Selling energy directly to local communities would enable organisations to charge more for the energy they produce than they currently get from export tariffs and FITs. The ability to generate and supply energy locally offers a more promising approach for community energy. The use of PPAs reported earlier in this section are restricted to an individual end user and do not cover the general sale of electricity.

EU state aid regulations were reported as a barrier for one key informant. The regulatory barrier was encountered whilst negotiating a peppercorn rent[41] with the local council for the lease of council owned land;

> *"But the level was €200,000, you know it didn't come close cause giving us as a peppercorn rent if we were paying £5k a year over 20 years what does that come out to, well it wouldn't have been that." (Key Informant 6)*

The EU state aid regulation viewed the peppercorn rent as the council subsidising a commercial enterprise. A breach in regulation would have occurred if the rent was over £5,000 per year. Key informant 6 confirmed that this was not the case. In this instance the regulatory issue had already

[41] Peppercorn rent refers to a very low or nominal rent paid in comparison to actual market rental value or the property or land being let.

stalled the project for almost 12 months and had not yet been resolved[42]. The delays happened despite the local authority being supportive of the project.

Time consuming and expensive

Renewable energy projects were reported as being expensive and time-consuming. The length of time involved in developing an energy generation project, from the initial planning through to the install of the renewable technology on a site emerged as a key issue;

> *"I mean I've been going round talking to people about community energy now for a long time and we haven't actually got that far, we're not producing anything" (Key Informant 1)*

Large legal costs were also reported as well as the challenges encountered in navigation of regulatory issues. The start-up costs of financing community energy projects were reported as high as they involve not only large outlays for the technologies, but also adequate due diligence is required to be carried out before contracts can be agreed. Such due diligence involved the generation of structural reports, environmental surveys and land registry searches. Legal issues require specialist knowledge and professional expertise to avoid breaking any laws or leaving the organisations exposed to legal risks. One legal problem that was prevalent in the community energy sector was leasing land or buildings to install renewable technology;

> *"It's been a kind of rollercoaster ride and down to the wire as well the lease negotiations took absolutely ages as well, things popped up there and it just took a long time, so we were cutting it fine but it all worked out in the end and installations went smoothly." (Key Informant 7)*

> *"There were only two things left, one was the lease and the lease has been like the albatross around neck for a whole number of reasons" (Key Informant 6)*

Significant delays were found due to arranging the finer details in the lease agreements. The delays in lease agreements were indicative of the length of time the legal teams had put into negotiating the terms. Although the exact legal costs were undisclosed, the quote from key information 6 indicates substantial costs are typically involved in obtaining legal assistance;

> *"We've got £20,000 pro bono legal support from a major company" (Key Informant 6)*

Development funding was reported as a crucial element of funding that needs to be sourced in order to get projects off the ground. Renewable generation projects were reported across the interviews

[42] This was at the time the interviews were conducted in October 2016

as being technically complex. Technical issues, involving either the technology itself or preparatory work required at the install site were reported as having the potential to delay projects while being addressed;

> *"The other big stumbling block with the environment agency because the weir is next to a gauging station and the environment agency is a classic silo-based organisation because of its large number of responsibilities." (Key Informant 6)*

The navigation of different governmental agencies posed a challenge not only in time and cost but also in stakeholder management. Navigating all the key stakeholders that needed to be contacted regarding the projects was reported as causing significant project delays. Two key reasons for stakeholder delays were found; 1) trying to link up stakeholders from across multiple organisations, and 2) the specific nature of involvement of each stakeholder. One key informant disclosed that a project officer needed to be appointed by the local council to link up all stakeholders from across multiple organisations;

> *"They had to appoint a project officer to bring them together to discuss our project. I mean I don't tell it as a hard luck story but as an indication of the challenges that a social enterprise…can meet in terms of trying to address compliance issues and legislative barriers which I think is not irrelevant." (Key Informant 6)*

Bringing together the necessary stakeholders from across multiple organisations was considered to be a time consuming but important task. Stakeholders often had very specific roles to play in the wider project, however, evidence from the interview data suggests that these roles and responsibilities were often interlinked. The levels of engagement and communication with the local authority were reported as a key reason behind long project delays;

> *"So that initial engagement with local authorities took quite a bit of time to start with, it was quite slow moving with local authorities and getting decisions was quite hard so that was a little bit tricky" (Key Informant 7)*

> *"Partly it was the council in that there is one part of the council, people who look after school is basically, we'd giving all the information quiet early on in the project and that had not really engaged with it. So, when it was getting towards the end when the lease needed finalising somebody came along and said we can't do that because having a lease in place it'll stop us rebuilding the school if we wanted to." (Key Informant 7)*

The data show two key reasons why dealing with local authorities was time consuming; 1) the segregated nature of internal departments means decision making processes can be long and complex, and 2) the level of cautiousness from local authority officers when engaging with new

types of projects, such community energy. Stakeholder management issues were reported across all interviews as causing considerable delays during the project development stage.

6.3 Post FIT business models and reliance on the regime

Across the interviews several reports were made that the community energy sector has always stimulated innovation;

> *"the community energy sector which has been nothing but a hotbed of innovation since its inception." (Key Informant 8)*

The community energy sector was perceived as a space where innovative solutions to assist the energy transition process have been explored. The transition potential for community energy projects is explored in Section 6.4. This section explores how community energy organisations were considered to be acting as innovators by the interviewees. Innovations from across community energy sector are explored by reflecting on what types of innovation have occurred and which other actors have been involved in the innovation process. Looking at innovation through this lens enables a discussion on the future role of community energy.

During the interviews it was evident that the community energy sector had experienced a rapid period of growth due to the replication of the FIT business model. Following the period of rapid growth, organisations reported being in a constant state of flux;

> *"Sure, so there's undeniably been a step backwards and a period of reflection and contemplation about next steps. From us and from the sector in general." (Key Informant 8)*

Key informants reported that organisations were working hard to find a way forward in a period of uncertainty. The unexpected feed-in tariff reduction had triggered a crisis that the sector is keen to overcome. A key finding was that innovation in the community energy sector is currently focused on the financial viability of projects. New business and finance models were prevalent across the conversations on innovation. The more nuanced details and difference between some of those business models were explored. Three key types of business model innovation activity were identified during the interviews; evolutionary, embedded and disruptive.

Types of innovation in the community energy sector

Evolutionary types of innovation focus on making small changes to the existing strategies through stricter site selection criteria, larger projects and new finance models. Evolutionary business models consist of small changes to the original FIT business model. Small changes to the existing FIT business

model were the most common type of innovation discussed during the interview. In some instances, this was not strictly seen as innovation but more a process of evolution;

> *"They're both adapting and evolving and looking for new ways to make their business cases work." (Key Informant 11)*

The evolution of existing business models implies that organisations were looking for ways to tweak existing business approaches rather than coming up with an entirely new approach. One business model identified was to match the demands of the site to the capacity installed when finding appropriate sites for installation;

> *"We are looking at only schemes where you can sell all of the electricity or the majority of it. At the moment it doesn't work without that." (Key Informant 10)*

> *"The only stuff that actually we know works and it works today is just relying on, forgetting grid export, and relying on direct sales of energy to an end user. You know to a large-scale end user." (Key Informant 12)*

Matching the generation capacity and demand means that all the energy generated will be utilised on site through a PPA. Selling all the electricity directly to site generates a higher income than selling some to the site and exporting the surplus to national grid. Many projects installed prior to the reduction in FIT rates were specified to generate more energy that the sites would ever be able to use. The interviews suggested the over specification had been done to create financially viable projects on sites where all the energy would never be used, such as schools. The new, more stringent approach to site finding suggested that it was important to provide a proposition for a project that can satisfy the needs of funders without deviating too far from the original business model.

Adding battery storage to the system was reported as a potential strategy to capture the surplus energy and therefore overcome the drop in the FIT rates. The energy generated on site could be stored and used at a different time when either demand increased, or when the system was not generating. Plymouth energy had generated a tool to identify where projects would be more financially viable with battery storage added to the system;

> *"Plymouth Energy Community, Regen worked with them to develop a ready reckoner for assessing whether…specifications for storage to be added to existing generating sites. So, co-locating storage back on…where the system was over spec'd…now the reality is Jo, the price of storage is still so high that it doesn't make sense. It wouldn't improve the economics of any site." (Key Informant 12)*

The case of Plymouth Energy provided a good indication that the cost of battery storage remains too expensive to be financially viable at a small scale. The current trend that renewable technology, including the price of battery storage, is coming down was identified by several key informants. The interviews suggested that in the future, battery storage is likely to become a critical part of financially viable projects.

Working on collaborative projects utilising existing national infrastructure such as public utility or railway providers was discussed in Section 6.2. Collaborative projects such as these adapt the existing business model to create financial viability whilst maintaining the long-term security of the existing business model;

> *"the thing I'm most excited about is solar railways because we're the first movers…water utilities are very good client, just in the same way railways are, only easier because you don't need any new special kit…basically they are sites with extremely dependable electricity demand and owners/operators that are in a position to sign a 25-year PPA." (Key Informant 12)*

It was suggested that larger organisations such as rail networks or water utility companies were more stable and in a stronger position to commit to the long-term deals needed to create economically viable projects. There could be a shift from small scale generation sites to large scale private sector deals in the future. Financial viability was also considered through exploring alternative financial models that would be more appropriate for larger scale projects;

> *"The other thing that's changing is the finance model or the funding mechanism. Getting projects built with some sort of loan finance and going out to community share later." (Key Informant 10)*

Under government support mechanisms the traditional model was heavily grant and subsidy dependant in relation to both development and running costs. Capital costs were often funded through community share issue and less frequently bank loans. The shift toward bank loans to finance community energy projects was evident. Key informant 10 stated that this enables community energy groups to engage the community at a later stage in the project, under a less risky investment proposal. Despite the business models remaining similar, larger projects represented a shift away from community energy as small-scale grassroots organisations. There is a diversification of strategy away from generating energy in the community to be used by the community.

Innovation through embedding community energy within wider socially orientated projects as a method towards sustainable development was evident. Embedded innovation was the least common type of innovation discussed during the interviews; the evidence suggested that several

advantages exist to this approach. Diversification of business models through more holistic approaches was a way to maintain financial viability whilst maintaining the community level, grassroots feel of projects.

> *"I think there's a couple of new build schemes of housing estates that are looking at doing community energy from scratch across a whole site. They're potentially exciting because they encompass everything, so you could put in there solar PVs, heat pumps, PV panels, storage, potentially a local supply" (Key Informant 11)*

> *"Yes, so Burneside Community Energy will be the energy supplier for the new homes in the village. Which we can do on a private wire." (Key Informant 10)*

The use of housing developments demonstrate that larger scale projects can be taken on and developed in a more holistic way to create financial viability. Generating and supplying energy to several households rather than on a single site creates a proposition that maintains more of the elements of community benefit than large scale private sector deals. However, such arrangements may create less community benefit funding.

The final type of innovation discussed during the interviews was disruptive market-based innovations. Although there were not as many examples of disruptive innovations as evolutionary, they were well known across all the interviewees. Due to them being high profile in nature, disruptive innovations were discussed with mixed opinions about their scalability; this is discussed further in Section 6.4. Two disruptive types of market-based innovations being explored by the community energy sector were evident in the interviews. Firstly, the evolution of local tariffs and peer to peer trading;

> *"some of the things that Pixie energy are looking at around local tariffs and peer to peer trading." (Key Informant 9)*

Secondly, how balancing supply and other demand reduction services can be incorporated;

> *"in the future if there's a local balancing market it could be things like operating aggregated service demand, like demand side reduction services" (Key Informant 11)*

Market-based interventions were highlighted as more complex and service sector based, a shift away from the traditional models of installing renewable generation technologies. Peer to peer trading would connect local generators and supply companies looking to purchase more renewable energy for resale. They would operate on a more business to business approach rather than direct sale to consumers or just exporting to the grid. Local tariffs and balancing programmes engage end users with their energy consumption by highlighting when local energy is being generated. The

impact of this is that consumers benefit from a lower price when the system is generating surplus and higher rates when energy is scarce. Local tariffs and local balancing have been implemented by Wadebridge Renewable Energy Network and Bethesda Energy Club. However, both projects were at viable FIT rates so the idea of replication and scaling up the number of projects needs to be considered. A more detailed discussion on scaling up of projects is presented in Section 6.4.

The evidence presented in this section highlights that the community energy sector has faced several crises. Despite the infancy and uncertainty facing the sector, several innovative solutions continue to be explored. The innovations found have been categories as evolutionary, embedded and disruptive. Overall the community energy sector is still recovering from the FIT reductions, however, this section underlines that the motives for community energy go much deeper than an economic imperative alone. Solutions being presented to move beyond the replication of one business model, suggesting that the community energy sector has evolved to a more entrepreneurial one placing new value on diverse business models.

Harnessing social capital – Relationship building or regime reliance?

One of the key features across the three types of innovation discussed is the need for community energy organisations to leverage their social capital to gain support. The support required often requires the involvement of various regime actors to develop the innovation sufficiently. The interview data highlights several different relationships that may be harnessed by social enterprises operating in the community energy sector.

A key element of social capital is that transactions are conducted with trust, reciprocity and cooperation (Porter & Krammer, 2011; Putnam, 2000; OECD, 2012). These three values align with the values of social enterprises; therefore, it is unsurprising that the community energy organisations interviewed considered social networks to be important. Data from interviews reinforces that social capital was an important factor for growth in community energy organisations;

> *"We basically asked around because obviously there's quite a few people doing something similar in different parts of the country" (Key Informant 7)*

> *"So, did a lot of face-to-face discussions and tapping on people you already know. Working the contacts that you've made throughout the years" (Key Informant 7)*

The data presented demonstrate the value of peer support and networking. The community energy sector has been working to achieve a common goal of local, green energy generation for the benefit of the community. Therefore, the importance of peer support and networks finding was

unsurprising. Two key themes that came out of the network discussions during the interviews were collaboration and competition;

> *"I look to expand either through partnership or collaboration rather than look to displace existing well-placed providers if that makes sense." (Key Informant 2)*

The tone of the interviews suggested that the common good was more important than economic success and that in some cases collaboration was necessary to remain viable as an organisation. When discussing collaboration, two different stakeholder collaboration types were prevalent across the interviews; private sector organisations and local authorities.

Evidence suggested that social enterprises collaborating with private organisations had the potential to act as role models. There was optimism that some of the social values from social enterprises would be adopted by the private companies to shift businesses from a solely economic imperative to a triple bottom line approach;

> *"If you can inject into the DNA of a private business that there's more to running an organisation that the bottom line then I think you're on your way to an improved situation." (Key Informant 3)*

However, the view that social enterprise can have a positive influence on private organisations was not shared by all key informants. Scepticism towards the motives of private organisations was more commonly reported by the key informants. The data suggest that collaboration was more beneficial for the private organisations rather than the social enterprise or the common good;

> *".. this relationship between business and community and third sector charities and social enterprises, the danger that smaller organisations are taken advantage of or seen as a means to make a sale." (Key Informant 2)*

> *"Private companies tend to fund social enterprises and charities out of their CSR budgets and it can be viewed, by some at least, as a way of giving a kind of whitewash to activities that are peripheral to the central mission almost as an organisation." (Key Informant 3)*

The caution shown by key informants towards private organisations was linked by key informants to either negative past experiences of collaborating with private organisations or their world views on large corporations. A view that private organisations may also not see the value in working alongside a social enterprise was also evident;

> *"On the other hand, I think that there are limited opportunities because I think the power of the corporate sector is so great in that respect" (Key Informant 6)*

The view that private organisations may not want to work with community energy in the future was not shared across the key informants, such as public utilities and railways as discussed earlier in this section.

Local authorities were discussed by all key informants and several suggested there was a need for community energy organisations to collaborate with them;

> *"We're seeing and recommending and working out how partnerships can deliver more projects. How much of a stake or buy in a local authority has for instance? That's how we think we're going to start to see an upward trajectory of new projects." (Key Informant 8)*

The need for community energy and local authority collaboration stems from the increase in local authorities working to delivering local solutions to energy trilemma issues. A common finding across the interviews was that projects need to be delivered on larger scales to be financially viable; community energy collaborations with local authorities was presented as way to deliver projects at a municipal scale.

The necessity for community energy to be involved in local authority agendas on local energy ownership was considered during the interviews. A concern was raised that community energy organisations may be overshadowed by the municipal scale projects within the local area if they are not involved;

> *"There's what would I like to see happen and what do I think will happen. I would really like to see far greater local ownership, which include local public sector and community…This is where local authority owned energy could do it but community is unlikely to." (Key Informant 10)*

Local authorities were considered as having more of the required resources needed to deliver projects than community energy groups. Rather than trying to compete with local authorities, partnerships were considered as more favourable as they were more conducive towards reduction of carbon targets and energy justice issues. Concerns were raised regarding the motivation and dedication of political leaders to drive the local and community energy agenda forward;

> *"I'm not convinced that we have enough strong committed leaders who will actually push this sort of thing through and ignore all of the naysayers they will come across within their own administrations as much as anything else." (Key Informant 10)*

The lack of political buy-in was viewed as a significant barrier that could hinder the adoption of the localised energy agenda and the development of the community energy sector. There was evidence

to suggest that where local authority and community energy collaboration had occurred in the past that it had been successful;

> *"But we got a really good rapport with the Salford especially one of the officers where he worked very closely with us and the mayor, the Salford collective mayor, bought it straight away which was great, and we signed a co-operation agreement to say that we'd support each other which was great." (Key Informant 7)*

Experiences dealing with government at a local level had been more fruitful than that of working with private organisations to date for many of the key informants. However, there was a clear distinction in the tone towards local authorities depending on where the key informant was based. Regional differences in local authority attitudes to community energy as a potential solution were evident.

The ability for social enterprise to compete with private companies was discussed during the interviews. The main theme across the conversations related to the competitive advantages that social enterprises have. Firstly, that social enterprises were able to create financially viable projects at a lower rate of return;

> *"I know that commercial investment is still going ahead, and they want rates of return of 20%. If community groups only want a return 4% interest…you think that they'd have more room to manoeuvre."(Key Informant 4)*

The lower rate of return needed means community energy organisations can consider projects that private sector organisations may reject due to a small return. Social enterprises were found to be able to accept lower rates of return. Social enterprises were found to have access to the social investment funds which private organisations do not. Secondly, in relation to competing for large scale private or public-sector contracts, social enterprises were considered less likely to win them;

> *"There are fewer social enterprises winning larger contracts than would be accounted for by the percentage of the business economy that social enterprises make up" (Key Informant 3)*

The reason for losing out on contracts was due to their ability to compete on a commercial basis. A perception that private organisations were more credible and legitimate was evident. The points raised here on competition can be linked to income streams. Most community energy organisations are gaining income through share offer in order to create tradable opportunities. Public and private contracts were not identified as a key income stream for community energy as discussed in Section 5.3.

This section the exploration of emerging post-FIT business models and the relationships needed to sustain them. The evidence highlights the need for social enterprise operating in the community sector to engage with the regime in order to find viable business models. The need for regime engagement with niches demonstrates that dependency have shifts from a subsidy model to exploring collaboration and public and private partnerships. The level of success achieved through these innovations will be determined by the desire for regime actors to engage with the community energy sector.

6.4 The potential for community energy projects to be diffused into the regime

Opportunities for an innovation breakthrough

The uncertainty found in the community energy sector has been mirrored across the energy system. The transition to a low-carbon energy system has created disruption in the energy system, a key element that allows for the breakthrough of niche innovations. A socio-technical transitions lens was utilised to explore the disruption in the energy regime and consider the opportunities and threats for community energy. Finally, the potential for community energy to breakthrough to the regime was considered. The multi-level perspective model (MLP) was reintroduced here to demonstrate the interactions between the different levels of a socio-technical system; landscape, regime and niche (Figure 2.4). A full discussion on the MLP is presented in Section 2.3.

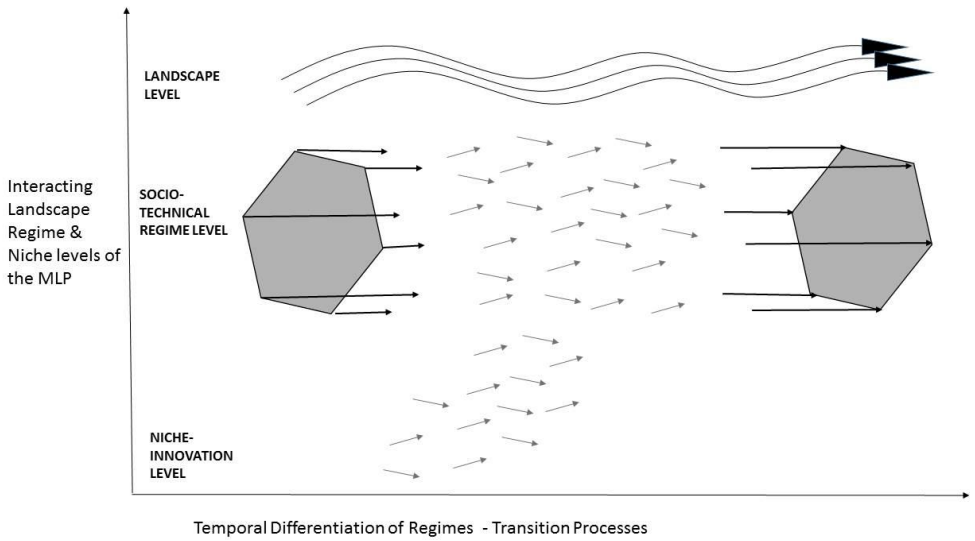


Figure 6.1: Geels Multi-Level Perspective Model (MLP)
(adapted from Schot & Geels, 2008)

A key element of the MLP is the interactions between the different levels of the system. Schot & Geels (2008) stated that for a niche innovation to breakthrough and become part of the regime there must be sufficient disruption in the system. Schot & Geels (2008) referred to this disruption as

a window of opportunity. The interviews highlighted that a large amount of uncertainty exists over what the new low- carbon energy regime in the UK will look like;

> *"So, the entire energy system is in flux and there are some big strategic decisions to make around...Where does the energy come from? What are those business models?" (Key Informant 9)*

Several key questions presented here were; what sort of energy will be generated, who will be involved in that process, and which businesses will play a part in that? The incumbents that currently exist in the energy regime make it difficult for new players to energy the market. However, the interview data demonstrate that there has been a shift in the energy market away from the big six energy companies to a larger number of smaller supply companies;

> *"I mean it's a difficult world to play in, you know you've now got 60 supply companies out there. You've got DNOs changing to DSOs and looking to get more involved in the demand side of it. You've got local authorities running programs, so London, Bristol, Manchester now all have community energy support programs that are run out of the council." (Key Informant 9)*

The evidence identified that several incumbents have changed roles and that new players were entering the energy system. The energy system has high barriers to entry due to the high start-up capital needed and the regulatory and commercial constraints on accessing the national grid infrastructure. The disruption presented demonstrates a potential window of opportunity for disruptive niches to breakthrough to the regime. Several MLP regime domains were identified as key in relation to the transition; political, regulatory and technological. Primarily, the national grid in the UK may not be able to meet the energy needs of the future;

> *"Well I think the UK generally is at a crossroads. We have a market structure that was designed for a top down delivery system. We know that that is probably not sustainable going through to significant electrification of vehicles, electrification of heat" (Key Informant 9)*

The demand for electricity is expected to increase as low-carbon innovations move towards electrification of technologies such as vehicles and heating systems. The top-down pressure for the UK to decarbonise the energy system has created waves of disruption across interlinking regimes;

> *"We'd like to see more support for that and perhaps for there to be less red tape in the way for these trials to happen. We are currently formulating our specific policy asks…the DNO's absolutely have to take a lead on innovation because they're going to be, their resources, their tangible copper resources are already stretched for want of a better term" (Key Informant 8)*

Key informant 8 evidenced how innovation has started to occur, not only within the community energy sector but with incumbents too. Evidence of conflict between protected space for innovation and various aspects of the system was found. Two types of conflicts were found during the interviews; 1) between the different domains in the existing regime, and 2) between the regime and the niche level.

The conflict between different domains was discussed during the interview in specific relation to OFGEM, the regulator of the energy system in the UK. The first point made about the regulator is that they have been slow to react to changes;

> *"OFGEM have a problem which is that they are not able to keep up in regulatory terms with the pace of change in the energy system" (Key Informant 12)*

The evidence suggested that the transition process is happening faster than the regulator can respond to. Another point of view presented in the interview is that the regulator is disengaged with the low-carbon transition;

> *"they don't have any formal duties with respect to decarbonisation they're able to just go right we're going to change these rules in such a way that, you know, that we regard it as fairer. But, the impact on the ground will be to further destroy the business case for decentralised renewables." (Key Informant 12)*

The interviews suggested that the regulator has no obligations towards the decarbonisation of the energy system. The lack of formal requirements to reduce carbon means that the regulator may not always be acting with this interest in mind, despite the political and market shifts towards low-carbon.

Tensions between the regime and the niche level were discussed during the interviews. The key tensions found were between the community energy sector and two key stakeholders; policymakers and the regulator. Evidence of the top-down conflict between the community energy and policy makers in relation to the FITs was found;

> *"the really good work that was being done around community switching, community energy efficiency programs, community buying club all of that got lost in the noise of community groups going give us more handouts because we're socially better than commercial companies. Which hasn't really done the sector that many favours." (Key Informant 9)*

The over-reliance from the outset on the FITs has potentially damaged the reputation of the community energy sector with policy makers. This tension strengthens the case for community energy organisations to reduce their reliance of government subsides. Bottom-up tension towards government was also found during the interviews;

> *"I think there's quite a lot of people in the sector who are not going to let the system beat us, that will carry on fighting. It feels like we've fought all the way since I started in this 6 years ago" (Key Informant 10)*

The tensions between community energy and national government were felt across all the interviews. The need to overcome this tension may explain some of the inclination to work more on collaborations either with local authorities, in the light of devolution, or with private sector organisations. Collaborating with key players would help to create more legitimacy for community energy organisations in the future. The view of the 'system' also referred to the regulator as well as government. Tensions were also present in the attitudes from the community energy sector towards the regulator;

> *"right now, in the absence of subsidies and in the face of grid constraints, behind the meter generation is the only thing you can make work. Well OFGEM are planning to fuck the economics of that so that a big chunk of the business case for doing behind the meter generation is taken away." (Key Informant 12)*

The evidence suggests that a perception exists the regulator will remove more of the business model opportunities that exist in the community energy sector. The frustration of the challenges that community energy organisations have faced was evident. In the perspective of some respondents, the regulator was unsupportive of the community energy sector. In the absence of government funding, new business models and finance mechanisms are being explored. However, finding ways around regulatory barriers was found to be extremely challenging. This was considered to be particularly difficult when the formal requirements of the regulator did not reflect those of the policymakers, incumbents and community energy sector.

Niche development potential from the community energy sector

Evidence of innovative business models and financing was found during the interviews. Despite innovation being present, the community energy sector was found to be operating in a period of uncertainty. The potential for community energy innovation to breakthrough to the regime is considered by looking at the purchase of energy generation assets. One of the innovative business models introduced in Section 6.3 was to buy solar farms that are already installed and generating. The shift to larger scale projects is demonstrated by several community energy organisations buying existing energy generation infrastructure;

> *"There might be less small projects and more big projects. We've also seen more leaning to this kind of project which has taken private generation assets in to community hands." (Key Informant 8)*

The strategy of buying existing infrastructure was explained as private assets that were taken in to community ownership and used to generate income. As lower development costs were needed, buying installed generation equipment overcomes one of the start-up barriers and removes some of the initial at-risk outlay. Buying installed generation equipment means the groups can save time on developing the projects themselves and can start generating income relatively quickly in comparison to installing the equipment themselves. The advantage of having economies of scale through a larger portfolio of projects is reported as having the added benefit of being able to develop more projects or support other groups to develop their own. However, there was divergent opinions on this approach;

> *"I mean even their model of buying solar farms on the secondary market. You know the secondary market for solar farms in the UK is going to dry up within five years." (Key Informant 12)*

It was suggested that purchasing existing commercial or private sector projects will only have a big impact in the short-term. This business strategy is unlikely to revolutionise the market due to the lack of opportunities that were likely to be available to buy existing infrastructure. The interviews suggested that the community energy sector was likely to remain a niche part of the energy system. The idea that many niche innovations will be unsuccessful was presented;

> *"I think the failure rate is going to be enormously high…there is potentially huge opportunity, but I see it as being incredibly fragile…fragile little seedlings which were watered for a while and then a big storm came along and flooded them all out."(Key informant 6)*

A key part of the MLP is that niches must be developed enough to be able to take advantage of the window of opportunity. The prediction that the failure rate of niche innovations will be high suggested that the niche is not sufficiently developed. Further evidence of the lack of a niche innovation that developed enough to break through the regime was presented by the national community energy NGO;

> *"this state of uncertainty certainly remains, and I think that's healthy for anyone to think that their innovation is what's going to saves the sector" (Key Informant 8)*

The phased 'save the sector' provided evidence to suggest that the community energy sector is an underdeveloped niche. An underdeveloped niche may be able to play a secondary role in the regime, this is explored further in Section 7.1.3.

The importance of initial support or protected space for promising innovations that are in the development phases is a key element of the MLP. The need for better protected space to support niche development was discussed during the interviews. The cost of setting up the community energy organisation was considered as relatively inexpensive;

> *"The costs to entry and the costs to setting up in that sort of structure are very, very low…It could be that were on the verge of a precipice where actually it just needs a little bit more of a push and you do achieve the sort of take-off speed that they need." (Key Informant 3)*

As discussed in Section 6.2, the development costs of projects were a bigger barrier to be overcome than setting up the organisation itself. From a scale point of view, there was recognition that social enterprises were very much operating in a niche environment, and that considerable challenges existed in bridging the gap to the mainstream regime;

> *"You have maybe three or four people in an office in a provincial city in the north of England working to promote the green economy. Whereas there maybe 300,000 to 400,000 people across the country who are working for big multinational energy corporations that don't have this on their radar." (Key Informant 3)*

The difference in scale between energy sector organisations and social enterprise operating in the same space is evident. The evidence suggested that the key regime actors may not even be aware of community energy as an opportunity or a threat. Evidence of the advantages of operating at a small, niche scale was recognised. The interviews suggest that smaller firms can take more risks;

> *"So, they can take more risks and if they're smaller they can be more flexible and more nimble and they and just say things that bigger businesses can't say, they can put messages out and do things that maybe big businesses or other businesses can't quite do." (Key Informant 1)*

Key informant 1 highlighted that smaller organisations are often more flexible than bigger organisations. The ability to take more risk enables community energy organisations to adapt quickly when the macro environment changes. The interviews also demonstrated that community energy organisations can operate without the same degree of commercial pressures as private organisations;

> *"But if its community we don't need to make money, we just need to pay back the money that was invested. We don't need to be making 10% off the top so the figures would surely stack up for us on that basis." (Key Informant 1)*

The ability to reduce the commercial pressure of the organisation makes it easier to develop the triple bottom line approach as discussed in Section 2.2.

Diffusion to the regime

The exploration of the innovation potential of community energy raised several key points that link to the research question; can community energy diffuse in to the regime? Three important factors that link to niche development and diffusion identified were; 1) protected space for innovation trials, 2) capacity to innovate, and 3) scalability of innovation. The three issues have been explored in more detail.

During the interviews protected space for innovation was discussed primarily in relation to funding. Protected space in the form of funding came from both the government and regulator. Government funding was provided through the FITs, development grants and tax relief for investors. It was recognised across the interviews that the initial government-led protected space for innovation has been significantly withdrawn;

> *"you know a lot of the innovation that has happened up to now, let's be frank, has been funded by a variety of state institutional mechanisms which don't exist anymore and that includes stuff trickling down from EU money which is also going to disappear." (Key Informant 12)*

The evidence suggested that some funding sources from the EU were expected to be removed. The removal of the government protected space was explored in further detail in Chapter 4. The regulatory funding that has offered a second protected space was found through the UK energy market regulator OFGEM;

> *"I was supportive of OFGEM's ability to create sandbox trials which foster innovation, can be financially supportive toward innovation and we know that communities are the best place to be the centre of these sandbox trials." (Key Informant 8)*

The funding provided by the regulator was specifically aimed at supporting innovation trials. This finding highlights the regulator sees the benefit of involving community led approaches in the new energy system. There is pressure on OFGEM to solve some of the key network capacity challenges that the UK is currently faced with. It was considered that decentralised solutions can help with capacity challenges;

> *"So, there's been the groups that have well you know and their credentials and the appetite have been part partnering with other support institutions on*

innovation trials via the network innovation competition, network innovation allowance stuff from OFGEM." (Key Informant 12)

The regulatory protected space offered by the regulator benefits the community energy sector organisations through giving them the means to experiment. It also gives the regulator direct access to innovative approaches that may help alleviate the national grid capacity constraints. Several informants showed scepticism towards OFGEM's motives and their commitment to the community energy sector;

"they sort of claim to be supportive and there's this regulatory sandbox thing which you're supposed to be able to play in with innovation but basically OFGEMs view is that those types of schemes… are all about avoiding contributing fairly to the system costs which is network costs and policy costs…OFGEM are actually moving to shut down that avenue and models that are basically evading those contributions OFGEM's not going to support with more derogations and stuff" (Key Informant 12)

Evidence is presented that OFGEM have used innovation trials to find solutions to the problems they are trying to address as opposed to supporting the development of the community energy sector. The ideas presented here demonstrate that the regulator working with community energy creates a conflict of interest. Community energy essentially is seeking ways to innovate the energy sector, however, due to their scale and the off-grid approach they avoid paying the same regulatory costs as larger organisations operating in the sector pay. If community energy innovations were to take off this could potentially remove income from the regulator. Therefore, it was the view during the interviews that it was not in the regulators interests to support community energy led innovation trials past the experimental stage;

"it is difficult to get past the innovation trial stage for these network things…it out will be so disruptive to the business models of the people who are in the system today that that's it, it doesn't get past the trial stage." (Key Informant 12)

It was suggested here that tensions exist between community energy and key market actors who want to prevent the upscale of niche innovation as it could disrupt the business as usual approach. Tensions between the niches and key actors are evident and present a barrier to community energy organisations wishing to develop beyond the protected space.

Capacity to innovate was the second key issue discussed in relation to the development of niche innovation. Chapters 4 & 5 illustrated the community energy sector is reliant on volunteers and along with a lack of development funding for projects, capacity issues were raised. Does the community energy sector have capacity to deliver energy system innovations?

In terms of experience there was a consensus that the community energy sector has built up momentum and gained the valuable experience needed to deliver innovation;

> *"But there is enough motivation and experience from the community energy sector" (Key Informant 8)*

The evidence suggested that there was still optimism across the community energy sector. Technical learning around regulation, installation, project management and raising finance through shares had taken place. Both points suggest that the relevant experience and knowledge was available from within the sector. A concern was presented that the lack of opportunities currently available in the community energy sector deter people from being involved;

> *"So, I worry that people will get weary and just give up doing it" (Key Informant 10)*

As projects are reliant on the input from volunteers this quote evidenced that people have limited time as want to use it where they feel they can be most effective. There was evidence that further capacity through charitable support organisations is being withdrawn for the same reason;

> *"We're losing capacity, that's what I think is going to happen. Certainly, from where I'm sitting at 10:10. Like I say we're moving away from this and you know we're losing some capacity ourselves in terms of some core funding that has let us do innovation projects." (Key Informant 12)*

It was evident that following the removal of the FIT's there was pressure on charitable support organisations to work where they can have maximum impact. This finding provided evidence that the community energy sector was losing capacity. The loss of capacity was not universal though, key informant 10 detailed how they are still committed to making project happen, despite the lack of funding;

> *"But what it means is that for us with the business we're having to spend time at risk rather than being paid… I think we wouldn't have been in position to do this a few years ago, it's only because we've build up the capacity to do it and some of the skills that we can do that." (Key Informant 10)*

The main difference between these two positions, which may explain the different approaches, was that the first one is an externally funding national NGO and therefore were under pressure to carefully select the sectors they were working in. The second organisation was a small privately owned consultancy prepared to risk their own time, as they did not have to keep funders happy they had more freedom to do this.

The third development issue related to the up-scaling of niche innovations. Up-scaling was recognised as an important aspect of the niche development process. Niches need to be able to deliver at scale through growth the number or size of projects. A key finding was that community energy projects had potential to up-scale if they could be replicated. Evidence was found of innovations that were starting to scale up, such as a balancing local supply project based in Wales;

> *"The trial in North Wales has been very successful under its terms and the Welsh government is very enthusiastic about this model and supporting its rollout in Wales and so there are another half a dozen site lined up for Welsh rollout." (Key Informant 12)*

The upscale of this innovation trial was enabled by the support of the Welsh government, evidencing the need for collaborative efforts to bring projects to fruition. The replication of the trial at multiple sites was a key factor in the upscale of the innovative project. The project in Bethesda in Wales has two elements; energy generation and balancing of supply. The community were able to check online when the hydro scheme is generating energy and were then able to adapt their energy use accordingly. The Bethesda Energy Club is a co-operative where the members are the energy users. Therefore, it was found that it is in their interests to ensure the maximum use of energy from the hydro as it benefitted the local community. However, concern was evident in respect of this project and how it could work in different areas;

> *"I think some of the stuff that is happening at Bethesda and around local energy, although I'm not sure the scale quite works" (Key Informant 9)*

There was scepticism as to whether this business model would work in different areas due to differences in generation technology and regulatory constraints. The Bethesda project presents evidence of the reflective and cautious approach that many stakeholders involved in the sector have adopted.

6.5 Summary of Chapter 6 results and points for discussion

The purpose of this chapter was to present the findings from 12 semi-structured interviews with key informants involved in the community energy sector. Three key objectives of the study were outlined in Section 3.2.3. The objectives of the study were; 3a) to provide in depth investigation to community energy business models in the context of the UK energy system, 3b) explore the potential of emerging innovations in the community energy sector and, 3c) evaluate the potential for niche innovation breakout from the community energy sector. The findings from this chapter provide more in-depth knowledge on the nature of the FIT business model and the challenged that social enterprises face in managing and developing community energy projects. The finding

demonstrate evidence that new business models are emerging in response to the FIT crisis. An overview of the key findings linked to each of these aims is presented.

Box 6.1 provides a summary of the key findings.

Box 6.1: Summary of results - Study 3

Community energy business models in the context of the UK energy system

- Community energy existed within the niche level of the energy system
- The benefits of community energy have gone beyond an economic imperative and add social and environmental value to the energy system
- Changes in government policy have affected the financial viability of the original business model adopted by community energy. Legal costs, regulation and stakeholder management were also barriers for community energy

The potential of emerging innovations in the community energy sector

- Community energy sector has started to show signs of innovation following the FIT crisis
- Innovation has focused on evolutionary, embedded and disruptive business models. The types of innovation evident seek to overcome market and regulatory barriers to achieve financial viability
- Efforts centred around creating financial viability rather than long-term financial sustainability
- Reliance of the regime for innovative business models remains a key component of emerging business models. Collaboration with local authorities and public utility companies was perceived as an important aspect for the future development of the community energy sector

Niche innovation breakout from the community energy sector

- The energy system is in a period of uncertainty and evidence of a window of opportunity was presented
- Community energy as a niche was not developed enough to breakthrough to the regime. There was agreeance that community energy would have a role to play in the low-carbon transition
- Three key points explain the development potential of community energy; 1) protected space has diminished, 2) capacity to innovate has increased in terms of knowledge but decreased in people power, and 3) scalability of innovations relied on the replicability of projects and outside support or collaborations

Community energy business models in the context of the UK energy system – *Objective 3a*

Understanding the practicalities of community energy organisations helps to address research questions 1 & 2, as discussed in Chapter 3. Multiple benefits of community energy projects were evident. Evidence was presented that showed that the benefits of community energy go beyond adding economic value to the energy system. Efforts to create various forms of social value in

addition to commitment to the decarbonisation of the grid were evident. Community energy is well situated to play a role in the energy transition given the energy trilemma problems that incumbents across the energy system face. The progress towards the low carbon energy transition in the UK has been heavily influenced by several powerful incumbents; policy makers, private energy corporations and the regulator.

Community energy was found to be placed in the niche level of the energy system. Changes in government policy have made it difficult for community energy business models to sustain financial viably in the future. The removal of the FIT's and development cost grants have meant that new projects are financially unviable. The lack of viable energy projects means that the community energy sector is reliant on volunteers. Three barriers in addition to government policy were found to stall the growth of the community energy sector; legal costs, complex and outdated regulation and stakeholder management. These issues must be overcome if community energy is to grow as a sector.

The potential of emerging innovations in the community energy sector– *Objective 3b*

Exploring the innovations coming from the community energy sectors helps to address research questions 1 & 2, as discussed in Chapter 3. Business model related innovation activity was found to occur in three different ways. Evolution of existing business models, embedding community energy as part of a more holistic approach and disruptive market-based innovation. Evolutionary methods focus on tweaks to the existing strategies through stricter site selection criteria, larger projects and new finance models. Embedding community energy as part of a more holistic approach to sustainable development was evident. This included incorporating local generation as part of housing development or on vehicle charging points. Disruptive market-based innovations included the use of local tariffs, local balancing projects and peer-to-peer trading. The economics of community energy are vital in taking projects forward to a development phase. Innovation that was evident was being driven the by decarbonisation agenda and the view that some other social benefits could come from the projects. A key finding is that the motivation in the community energy sector matches with the triple bottom line values; economic, environmental and social.

The innovation has primarily been aimed at engagement with other organisations and business models. The engagement has been through competition or collaboration. Local authorities and public utility companies appear to be important collaborations for the future. The need to collaborate with regime actors to create financially viable business models demonstrates the reliance of the regime has merely shifted from central government to other key actors. Emerging

innovations in community energy organisations are dependent of the desire of regime actors to engage with the niche.

Niche innovation breakout from the community energy sector – *Objective 3c*

Contextualising community energy as a social niche innovation helps to address research question 3, as discussed in Chapter 3. Pressures on the UK to decarbonise the energy system are evident due to the reliance on fossil fuels and the expected increase in demand for electricity. The UK is already in transition towards a low carbon energy system, however, uncertainty exists around the composition of the new energy system. The disruption in the system could present a window of opportunity for a sufficiently developed niche to breakthrough. Conflict both within the regime and between the niche level and regime. OFGEM were recognised as having no formal agreements towards decarbonisation of the national grid. This conflict highlights the tensions between the regulator, national government and corporate agendas. The reputation of the community energy sector may have been damaged due to the reliance on FITs. Evidence of negative attitudes from policy makers towards community energy were evident. Conflict was evident between community energy organisations and the regulator. The off-grid nature of community energy projects means that the regulator does not benefit from the income of community energy in the same way it does with larger organisations. It was not found to be in the interests of the regulator to support community energy.

Community energy operates at the niche level of the energy system and the interviews suggest that it is not developed enough to breakthrough to the regime. Across all the interviews there was a view that community energy will have an important role to play in the transitions. However, it was unclear as to what this role might be. The potential for niche innovation development was explored from three different by interlinking themes; protected space, capacity to innovate and scalability of innovations. The regulator has largely been unsupportive of niche innovation development past the trial stage. Policy changes have withdrawn much of the funding available from central government to support community energy. Therefore, a key finding was that much of the protected space has been removed from the community energy sector to experiment with innovations.

Knowledge of the energy sector and experience of delivering renewable generation projects had been gained by the community energy sector. However, support capacity was starting to be withdrawn from NGO's and there was a concern volunteer capacity would decrease. A key finding in relation to capacity to innovate was that there is a danger that the knowledge and experience gained could reduce significantly if viable projects cannot be found. Delivering community energy on scale hinged on two key factors, relevant support behind the project and replicability. The support did not necessarily need to be financial but having a key stakeholder supporting the project helped

to build the profile. Replicability is important due to the community nature of projects. Projects need to be done in multiple communities rather than scaling up to a regional/national scale. The evidence suggested that a regional umbrella organisation to help facilitate and connect individual community projects would be useful to gain economies of scale and better deals on energy prices.

Chapter 7. Synthesis of Results & Discussion

7.1 Discussion of Results

This chapter explores the implications of the three distinct results chapters in the context of the research questions. Firstly, the results will be discussed in the context of the original research questions posed in Chapter 2. Secondly, the wider implications of the findings for both practice and theory will be considered. Finally, any limitations of the study and areas for future research are considered.

The research questions, as presented in Chapter 2 of this thesis are;

1. How has community energy responded to a rapidly changing energy system?
2. How viable is social enterprise as a business model within the energy sector in the UK?
3. Is it possible for social enterprise to become a niche innovation breakout and form part of the low-carbon energy regime in the UK?

Figure 7.1 provides the overview of the research questions and how they will be addressed, introduced in Section 3.1.3, along with the specific research aims of the three different studies. The figure maps out how the different research aims contribute to answer the three research questions. Collectively these research questions give a guide to addressing the overarching research agenda; to understand what role social enterprise can have within the transition to a low carbon energy system.

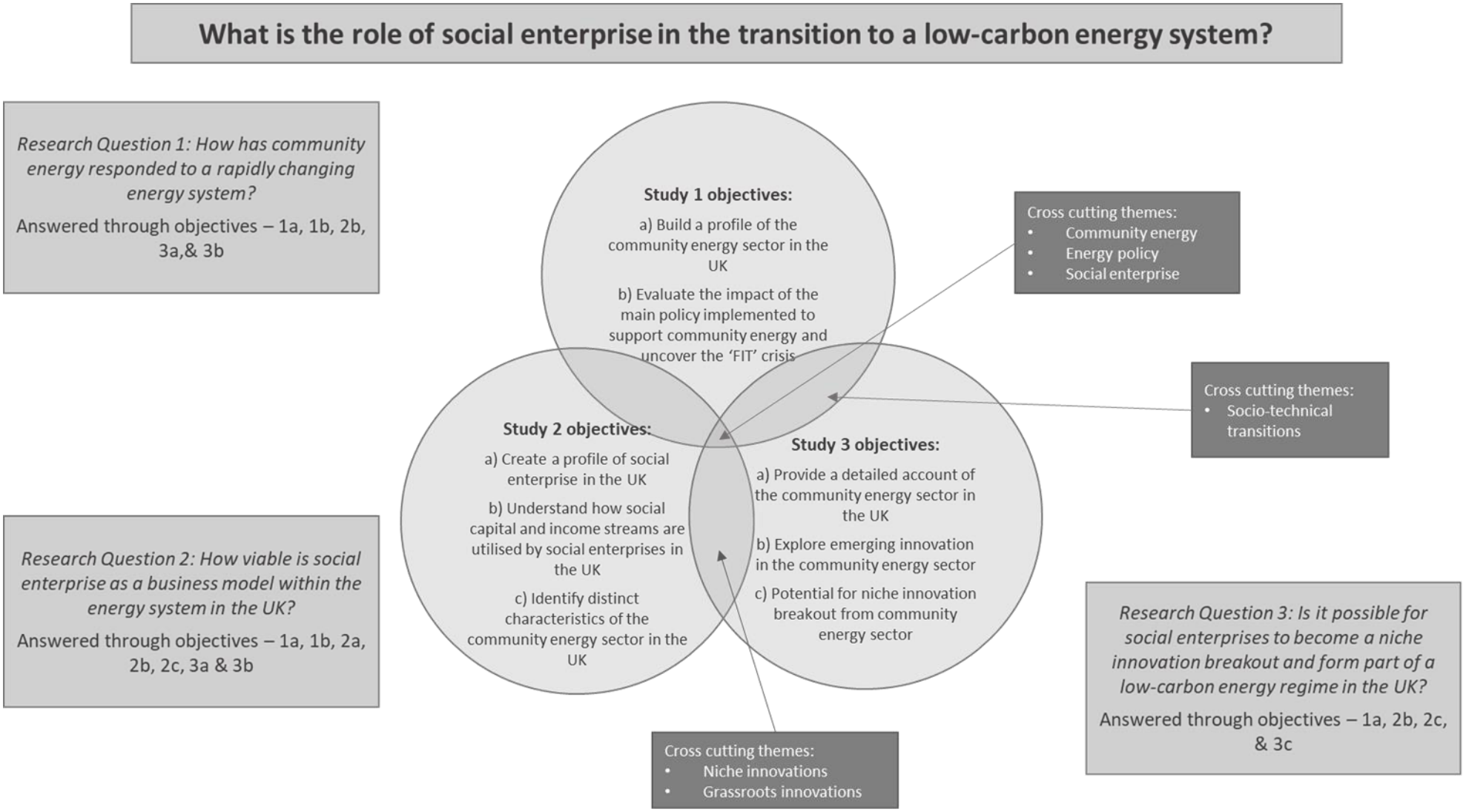


Figure 7.1: Research questions and study objectives

Table 7.1: How the research questions have been addressed

Research Questions	How will the research question be addressed
What is the role of social enterprise in the transition to a low-carbon energy system?	
1. How has community energy responded to a rapidly changing energy system?	a) Provided an overview of the community energy sector and the barriers faced. b) Evaluated the impact of policy a micro-generation perspective. c) Identified where the changing energy system has triggered innovation within the community energy sector.
2. How viable is social enterprise as a business model within the energy system in the UK?	a) Detailed the primary business model within community energy sector. b) Provide evidence to explain why the business model was previously viable and is no longer viable. c) Explored the potential opportunities and threats that currently exist within the sector. d) Explored approaches towards financial viability and financial sustainability and across community energy social enterprise.
3. Is it possible for social enterprise to become a niche innovation breakout and form part of the low-carbon energy regime in the UK?	a) Explored the concept of community energy as a niche innovation. b) Explored niche-regime dynamics between social enterprise within the community energy sector and the regime. c) Identified niche innovations potential for growth and possibly diffusion within the wider energy regime. d) Discussed the ways the niche innovations may diffused in to the energy regime and the implications for social enterprises in community energy sector.

7.1.1 How has community energy responded to a rapidly changing energy system?

a) Overview of the community energy sector and the barriers faced

The community energy sector in the UK sits at the niche level of the energy system. The sector has experienced significant growth and subsequent decline because of the rapidly changing policy landscape. Several different types of business models that operate in the community energy sector have been identified by Good Energy (2016); local energy generation, demand reduction (*energy efficiency and behaviour change*), local tariffs and biodiversity projects (as discussed in Chapter 4) . The findings concur with Seyfang, Park & Smith (2013) who emphasise community energy should include supply and demand side initiatives. Section 4.1 highlights a dominance of energy generations projects across the community energy sector in the UK. The increase and decline in the number of local energy generation projects was directly linked to the introduction and reduction of the feed-in tariffs. Local generation projects form the basis for the discussion presented.

Policy changes explain the growth of the community energy sector; however, they do not provide the full story of the difficulties in the development of the sector. Five key barriers were self-reported by the community energy sector; 1) industry regulation, 2) national government policy, 3) local government policy, 4) grants or subsidies being cut and 5) finding adequate funding. The five barriers help to broaden the understanding of why the community energy sector has stalled. Policy maker decisions and slow to respond regulators were found to have decreased the tradable opportunities and therefore the financial viability of community energy organisations. The interview data presented in Section 6.2 highlight that financial sustainability in the community energy sector would

have been achievable if community energy groups had installed more projects under the higher rate FITs. Financial sustainability would have been meet where organisations had installed 5 or 6 micro generation projects. However, many organisations were only able to install one project prior to the early 2015 FIT reductions. Bauwens *et al.,* (2016) found that community energy organisations across Demark, Germany, Belgium and the UK managed to adapt quickly to changes policy changes. The 2015 FIT reductions had a significant impact on project viability as following this period individual community energy projects became financially unviable. The small number of projects community energy organisations in the UK developed under the FIT business model may be explained by the length of time it takes for projects to come to fruition. Seyfang, Park & Smith (2013) found three key barriers to community energy projects; project management, access to finance and policy changes. Two key issues that affected the community energy sector in 2015 were evident across Chapters 4, 5 and 6; 1) government subsidy cuts and, 2) project development delays. The implications for the FIT reductions are discussed in terms of the community energy sector later in this section and business model viability in section 7.1.2.

The FIT reductions were not the only issue discussed in relation to grants and subsidies being cut. Project development grants were previously available to support the investigatory work that is required as part of renewable energy project installations (Good Energy, 2016). The costs can relate to things such as structural surveys and various public register searches such as land registry or environmental agency. Chapters 4 and 5 showed the most common grants received were UCEF and RCEF. The UCEF and RCEF grants are no longer available. Results in Chapters 4, 5, 6 highlighted that cuts to grants and subsidies and finding adequate funding represent the main barriers experienced by community energy practitioners. Grants were the most common secondary income in the energy sector, most typically used to cover development costs. The removal of the grant support for project development leaves a potential £20,000 shortfall in the finances for community energy. The development grants became a key component of the community energy generation business model. Organisations that managed to establish several installations prior to the FIT reductions may have been able to cover this shortfall through the community benefit funds. The surplus funds could potentially be utilised to fund further projects which is emergent in the Australian community energy sector (Coalition for Community Energy, 2017). Results demonstrated that many projects struggle for financial viability due to the large development costs of projects. The development costs are considered as sunk costs as the community energy organisations need to pay them even if the project does not go ahead. Therefore, the sunk costs involved in community energy projects pose a significant financial risk for small social organisations. As there is no guarantee that any project will go ahead, the sunk costs may never be recovered (Bondarenko, 2018). Public registry searches may

present something that prevents the project or the site owner could change their minds before a contract is signed.

Project development is a key theme that has come out of all three of the studies. Project development refers specifically to the delays and barriers experienced in getting projects to an installation stage. The long delivery timescales of community energy projects were reported as a common barrier because of several key issues; raising finances, volunteer capacity, technical delays and stakeholder engagement. Capital finance for the technology installation and finance to cover the development costs of the project are both required in project development (Seyfang, Park & Smith, 2013; Good Energy, 2016; Regen SW, 2016). Contradictory evidence was found on raising finance. Chapter 4 highlighted that raising capital costs were a common delay factor across community energy projects. However, the organisations interviewed for Chapter 6 had successfully managed to raise capital through various community share offers, often before the project development aims had been met. The key informants stated two reasons for them being able to raise community shares relatively easily; 1) community energy projects currently offer better returns than interest rates on savings in the UK, and 2) there is an increasing trend for investments in social projects and renewable energy. The key informants state that they were more likely to get held up by other factors such as technical hitches or 'bureaucratic processes' preventing the final sign off. The reliance on small numbers of volunteers was evidenced across all three studies. The reliance on voluntary directors to deliver highly technical, time consuming projects was another contributing factor towards significant delays. Most of the key informants from the interviews were in full-time employment in addition to delivering the community energy projects. One of the organisations interviewed did manage to hire a project manager and managed to deliver three projects over a relatively short space of time. The literature highlights that a lack of team cohesion due to conflicting visions can create additional issues to already limited capacity (Nolden, 2013; Seyfang, Park and Smith, 2013; Ruggiero, Martiskainen and Onkila, 2018).

b) Impact of policy from a micro-generation perspective

The relationship between social enterprise and public policy can be described as uncertain at best. Evidence was found that radical policy changes can have a detrimental impact on the viability of social enterprise as a legitimate business rather than as just a charitable entity. According to Mikami (2014), the failure to define the social economy in an unambiguous way causes confusion in the system of domestic laws that regulates the social sector. The interview data show that such problems are exacerbated by uncertainty across the environmental and energy policy landscape, as has been the case in the UK for the past number of years. Such uncertainty is exacerbated by a

reliance on top-down funding, and, on grants and subsidies as an integral component of the social enterprise's revenue stream. More generally, social enterprises broadly remain closely tied to the public sector and to public sector support. Support through public policies has to date, and still remains, a key channel for the diffusion of various models of social enterprise throughout Europe, for instance (Defourny and Nyssens, 2010).[43]

A policy analysis of the feed-in tariffs was presented in Section 4.3. The data demonstrated that community energy projects have widely adopted the FIT and installed 266MW of capacity between 2010 and 2017. Community energy projects were found to be of a similar size to commercial projects in terms of average capacity per project. In comparison to community energy, commercially registered projects have installed 2414MW of capacity in the same period. Commercial classification is more likely attributed to organisations electing to install energy generation to reduce their own energy bills or green their energy use (Good Energy, 2018). The adoption of renewable technologies by commercial business could have been accelerated by the organisations utilising existing resources. For example, commercial organisations may absorb the costs of capital and staff time to ensure that projects were up and running quickly (Andrews and Johnson, 2016). Organisational motives may also be to future proof their energy prices by investing in their own generation systems (Andrews and Johnson, 2016).

The FIT analysis shows the rate change reductions were inconsistent, both in timing and in amounts of rate reduction. The interviews evidenced that there was an expectation that the FITs would decrease over time. However, many of the reductions were unexpected and larger than anticipated. The findings suggest that FITs enabled new players to enter the energy market by reducing some of the financial barriers to entry. The evidence shows that the FITs influenced community groups to set up local energy generation organisations. Questionnaire generated data showed that most of the social enterprises surveyed from the energy sector started up between 2010 and 2014. The interview data showed a similar pattern as all interviewed energy generation organisations started between 2011 and 2014. The FITs supporting the rapid development of the community energy sectors is acknowledged in the literature (Nolden, 2013; Seyfang, Park and Smith, 2013). Of the organisations included in this study, no evidence was found that any new community energy organisations had started since 2014. The timing is significant as the financially unviable FIT rates were announced during the Autumn Statement of 2014 (HM Treasury, 2014). The lack of new community energy organisations since 2014 highlights the absence of viable business opportunities

[43] The discussion presented in the first paragraph is drawn from the published journal article based on this research (Hillman, Axon & Morrissey, 2018). A copy of the paper can be found in Appendix 12.

to make local energy generation work at a community level in the UK. Brummer (2018) found that the FIT schemes were complex, confusing and rapidly changing which has hindered the community energy sector in the UK. The key informants interviewed suggested that community energy was in a period of reflection and observation whilst several community groups were undertaking innovation trials. The 'copy and paste' business model that had been developed based on FIT and replicated by numerous organisations has enabled growth, initially, but also hindered development of the community energy sector in the medium term. Seyfang *et al.,* (2014) highlight that the higher FIT rates paid a higher than market-rate for the surplus energy generated by community energy groups. Since the reduction of the FIT, organisations were forced to revisit the replicated business model to create new financially viable opportunities. The FIT business models are explored in further detail in Section 7.1.2.

c) Innovation within the community energy sector

A clear finding of Chapter 6 was that innovation has become a key element of the community energy sector. The innovations from the community energy sector were not only linked to the development of the energy sector but could also support the wider social enterprise sector. This section explores how the community energy sector has shown signs of innovation from inception through to establishment of the predominant finance model. One key finding was the use of community share offers in the energy sector. Questionnaire data show that the use of share issue is disproportionally high across community energy in relation to other social enterprises (Share issues are also discussed in Chapter 4). Sunley and Pinch (2012) suggest that social enterprise finance models are reliant on habit and on the previous experience of individuals involved, rather than utilising more complex market-instruments, such as loan and equity finance. Questionnaire data show that share offers were not often utilised in social enterprises outside of the energy sector. The use of share offers is not a new phenomenon, such instruments are utilised across private sector organisations who rely on trade (Sunley and Pinch, 2012). Section 5.3 highlighted that while trade was a primary or secondary income source for many social enterprises, the use of share issue and loans was low, in general terms. The low uptake of loans and shares represents a key sign that organisations have relatively low capital costs and may not have the desire to grow the organisation beyond their current levels. However, where a social enterprise does have a desire to grow, the exploration of innovative finance models could bridge some of the gaps and funding issues found in Section 6.3. The use of community shares can deepen the roots of social enterprises in local communities (Brown, 2011). The exploration of in depth finance models goes beyond the scope of this PhD research, however, it does raise an interesting question on the attitudes towards growth across the social enterprise sector (Ridley-Duff, 2008; Wiklund, Davidsson and Delmar, 2008).

The interviews highlighted an advantage to being a niche organisation as that they can be flexible and therefore quick to act or respond to market or policy changes. The flexibility allowed small organisations to deviate from strategy and take more risks by testing innovations, especially when government contracts and subsidies are withdrawn (Germak and Singh, 2010). Despite the complex problems faced and the setbacks seen in relation to FIT reliant business models in 2015, evidence of numerous innovations going on across the community energy sector is clear. Some of the business model options currently being explored are virtual supply, balancing supply locally and municipal energy companies which are discussed in more detail Section 7.1.2.

7.1.2 How viable is social enterprise as a business model within the energy system in the UK?

a) Business models within the community energy sector

Previous studies into the community energy sector in the UK have explored the weaknesses and barriers for community energy but have neglected to understand the business models behind the organisations (Hielscher, 2011; Seyfang, Park and Smith, 2013; Brummer, 2018). Findings from Chapters 4 and 6 have shown that social enterprise by their nature have intrinsic social imperative that add social value to business models operating in the energy sector. The value was largely added through the triple-bottom line ethos that simultaneously aims to meet economic, social and environmental goals. Distinct eras in community energy were evident in Chapter 6; FIT and post-FIT. Therefore, to answer this question, the two will be considered separately. Firstly, by reviewing the dominant FIT model and its current viability. Secondly, by looking at the new emerging business models coming out of the sector.

The dominant FIT business model from the energy sector is applied by community energy organisations that generate energy locally. Operating surplus is then fed back into the community through a community benefit fund. The original FIT business model for community energy is no longer financially viable as discussed in Chapters 4 and 6. The implication of the FITs on the community energy sector were explored in Section 7.1.1. This section will explore the FIT business model in more details to demonstrate why community energy projects are economically unviable under the FIT model. The reduction of the FITs, removal of development grants and regulatory restrictions have collectively limited the market opportunities available to the community energy sector. The data from the interviews show that the energy sector had more pessimism towards financial sustainability than the whole social enterprise sector. The interview data demonstrate that the community energy sector was in a transition period of its own. The results from Chapter 6 show

that there has been a distinct shift away from the ready-made business model based on FITs towards more innovative business models.

b) Changing business model viability

Prior to the reduction of the FITs, a clear and viable business model was available to community energy organisations. The detail of the FIT business model is presented to provide context to the discussion on new innovative business models later in this section. Once the community energy projects had been developed and installed, income was generated in two ways; 1) selling energy close to the generation site, and 2) exporting surplus energy to the national grid. Energy can be sold to the generation site to a single user through a power purchase agreement enabling energy to be sold at retail energy price. Exporting energy to the national grid yields an export tariff which is substantially lower. The FIT income supplemented the export tariffs income. The current FITs were guaranteed for a period of 20 years; however, organisational registration for the FIT was linked to a specific project (OFGEM, 2017b). As the FIT is registered to a specific installation site, it cannot be transferred elsewhere should the lease cease prior to the end of the 20 years. This means that community energy organisations must get the site owner to agree to a 20-year lease on the site. The interview data show that there is added complexity if the site owner is not the same as the energy user as both parties must agree to the arrangement. As the FIT rates were guaranteed for 20 years, they provided longevity to the business models, providing that a lease agreement and power purchase agreement for that length of time could be negotiated (DECC, 2015).

The reduction of the FITs triggered a major shift in the community energy sector which has threatened the potential for financial sustainability for many social enterprises. The removal of project development funding leaves the current business model financially unsustainable, even if the FIT were to be increased again. Regulatory restrictions on how energy can be sold and who it can be sold by limits the solutions available to achieve financial viability (DECC, 2014). The cost of registering as an energy supplier would be out of reach for any individual organisation at a local scale (Boait, 2009). The FIT business model was well suited to tenants and premises that were able to commit to long-term agreements, such as churches, schools and potentially community buildings as discussed in Chapter 6. However, the energy use requirement for the buildings in question does not always match the times of generation and amount of energy being generated on site. The interviews highlight the mismatch in production and demand at a school where solar PV had been installed, for instance. The peak generation time is during the summer months when the schools are on summer break. FIT business models inherently relied upon the FIT as a main income stream to boost energy prices rather than a complimentary one (Seyfang *et al.*, 2014). The uncertainty caused by the steep

reduction of FITs caused significant problems for the many of the energy generation projects studied across all three studies.

Evidence of where opportunities were being explored and adjustments being made to community energy business models emerged during the interviews. Strategic changes may be necessary to create financially viable business models. Porter (1985) states that competitive advantage can be gained by using either differentiation or cost leadership strategy. Two fundamental principles determine whether FIT business model could be made financially viable again, 1) more of the energy is sold at retail price, and 2) the development and capital costs of generating energy go down. More energy could be sold at retail price if the installations were matched to the energy demand of the potential energy user. The current trend was that energy prices were rising and therefore, more income could be generated as the price increased. The cost of installing renewable generation technologies is expected to reduce (Community Energy England, 2017). However, the interview data highlighted that many solar panels are currently imported from Europe. The fluctuation in the currency exchange rates since the Brexit referendum has diminished the advantage of importing equipment at lower costs (Finn, 2018). The interview data show that if the trends for lower cost generation equipment and funding for development costs can be found then the existing business model may be financially viable without the FITs. However, adopting an approach like this is very reactionary and is therefore unlikely to create much growth in the community energy sector. Community energy groups would also need to raise the development costs upfront before issuing shares as discussed in Section 7.1.1.

More innovative approaches to community energy have been observed in Australia. The Coalition for Community Energy (2017) document ten approaches to community energy which are currently viable in the Australian context[44]. Several investment and collaborations options that enable the uptake of community energy organisations were identified such as, sector led development funding and local authority partnerships. The energy sector in the UK is a notoriously heavily regulated industry to operate in. The rise of community led generation and then the uncertainty that the reductions to the FITs has introduced has impeded the growth of the community energy sector, explored in Section 7.1.1, and affected business model viability. There are now many community groups working on different projects that have gained a vast amount of knowledge on the energy markets and how to operate within these markets. The organisational and individual learning that

[44] Three key points that differentiate Australian business models from the UK are; 1) more targeted social and environmental impact, 2) viability has been found in partnerships with the local authorities, and 3) shorter project life-spans, average between 5-10 years rather than 20 years in the UK.

has taken place is also increasingly being shared and advanced throughout the sector by key influential stakeholders (Hargreaves *et al.*, 2013; Seyfang, Park and Smith, 2013).

c) Potential opportunities and threats within the sector

Evidence of community energy organisations trialling various innovative business models was found during the interviews. The approaches to business model innovation varied across the sector. Three key types of innovation activity were discovered; 1) evolutionary, 2) embedding, and 3) disruptive innovation. These innovation types are different from existing organisational literature which tend to focus on innovation of services, products and processes rather than business models as a whole (Read, 2000; Salavou, Baltas and Lioukas, 2004).

Evolutionary innovation was the least risky of the innovation types as this involves making small adjustments to the existing FIT business model to create financial viability. One way to make a project financially viable is to revisit the original criteria set. The original criteria often allowed for large proportions of the generated energy to be exported to the grid without losing too much income. However, if site generation and demand were better matched, then retail price can be earned on more of the generated energy through the power purchase agreement. Selecting sites that are more likely to use all the energy generated would mean that there is a bigger return from the generated energy and would negate the need for the FIT. Chapter 4 showed that approximately 12% of community energy organisations did not have their project's FIT registered suggesting that they may already be following this business model.

Embedding innovation refers to integrating community energy generation alongside other projects to create a more holistic approach. For example, installing generation equipment as part of a housing project or local vehicle charging point as discussed in Chapter 6. The advantage of holistic projects is that the community benefit is likely to benefit a larger proportion of the community. Community energy projects are often explored across the literature from the individual project perspective and little evidence of embedding community owned energy within wider projects was found across the literature (Walker, 2008; Holstenkamp and Kahla, 2016; Ruggiero, Martiskainen and Onkila, 2018). The interview data highlights that projects may be more financially viable when set up in collaboration with local authorities or private organisations due to the shared development costs. For community energy organisations, collaboration outside of the social enterprise sector can reduce some of the financial burden and overall risk of project development (Austin, 2000).

Disruptive innovation refers to the innovations identified in Chapter 6 that challenge the existing energy market, such as local tariffs, balancing supply and peer to peer trading. The disruptive

innovation trials were found to be in early stages of development at the time the data were collected. Despite several promising trials, issues with scalability and capacity to deliver innovations at scale were found. Ruggiero, Martiskainen & Onkila (2018) found that scaling-up community energy in Finland was prevented by three key issues; 1) lack of a shared vision across key stakeholders, 2) a lack intermediaries who can aggregate knowledge, and 3) lack of niche empowerment. The issues with scaling-up community energy as a niche innovation are explored in more detail in Section 7.1.3. A pertinent issue across all three type emerging innovations is that the business models are reliant on regime engaging with them. Therefore, the success of niche development is likely to be linked to the desire from regime actors to collaborate with community energy organisations.

An immediate threat to the community energy sector is the reliance on volunteers to deliver projects, evidenced in Chapters 4 and 6. Chapter 5 explores this further, showing that on average the number of individuals needed for project operation is higher in the energy sector than across the wider social enterprise sector. The interviews highlight that the community energy sector is losing capacity in terms of the number of people involved with the sector. The volunteers in the community energy sector are mainly present in senior positions, for instance the directors of community energy organisations. The directors were found to be responsible for delivering projects and adhering to the legal and compliance issues of running a social enterprise. A key sub-theme of the interviews was that organisational learning had taken place across the community energy sector. Directors have gained a lot of knowledge and experience delivering projects, so if they leave, the sector loses knowledge capacity which may not easily be replaced. Capacity in the community energy sector is discussed in more detail in Section 7.1.3.

Some of the business model options being explored need to be considered carefully as they need to match the overall ethos of social enterprise and ensure that social or community investors still want to engage with the proposition. For instance, generating energy on a school roof was easier to justify to potential investors than generating energy on the roof of a corporate data centre. Raising capital finance was not found to be an issue faced by organisations interviewed; however, the interviews suggested that alternative finance models need to be considered for larger projects with higher development costs and capital requirements. If the nature of the community energy propositions changes then it may attract different types of investors. More commercially minded investors would need to deliver a more financially attractive proposition to obtain adequate investment. If community energy organisations become too large or closely aligned with existing mainstream

models' individuals may not see the value of engaging with community energy over incumbent energy firms (Johanisova, Crabtree & Fra, 2013; Hillman, Axon & Morrissey, 2018).

Different legal structures have different implications in terms of organisations accessing grant funding or having restrictions on trading. It is considered best practice for social entrepreneurs to decide what and how they are trying to achieve before picking a legal structure (Ridley-Duff, 2009; Brown, 2011; Lyon and Fernandez, 2012). An inappropriate legal structure could end up acting as a barrier preventing income being generated in certain ways. For example, registered charities are prohibited from trading but they do benefit from larger tax relief than other social enterprise legal structures (Social Enterprise UK, 2017). Although newly created legal forms may prove to be important tools in some countries, most social enterprises across Europe still adopt legal forms that have existed for a long time. The most prevalent legal structures across Europe are association, co-operative, company limited by guarantee or by share and Industrial and Provident Societies (IPS) (Defourny and Nyssens, 2010). The current legal structure utilised by most of the community energy organisations is the Community Benefit Society (Bencomm), a form of IPS. The most common type of IPS is a co-operative. Co-operatives and Bencomms are similar structures as they both operate under democratic principles. Being owned by their members and utilising a one-member-one-vote system, IPS are democratically owned. There is a distinct difference between co-operatives and Bencomms in relation to who the organisation benefits. Co-operatives must be run for the benefit of their members, however, Bencomms can be run for the benefit of the community they operate in.

Members of an IPS can be freely defined by the organisation and this is often changed to suit the purpose of the organisation (FCA, 2016). Members could be the customers, employees, tenants or even shareholders. In the case of community energy, the members were found to be the shareholders. Therefore, the owners of the organisation are the investors. The methods community energy organisations could use to raise shares is impacted by having investors as members (Brown, 2011). Community ownership is a fundamental element of community energy; therefore, organisational shares need to be raised without diluting the community aspect (Seyfang and Haxeltine, 2012; Ruggiero, Martiskainen and Onkila, 2018). Apart from the one-member-one-vote system and decision-making processes, having investors as member's makes community energy organisations legally like a private sector company. The legal form selected can affect the legitimacy of organisations using the label of social enterprise (Ridley-Duff and Bull, 2011). The implications of social enterprise legal structures are discussed further in Section 7.2.

d) Financial viability vs financial sustainability

An emergent theme across Chapters 4, 5 and 6 is the need for community energy groups to find financially viable projects. A key finding from Chapter 6 was that emerging community energy business models are still reliant on the regime, albeit different incumbents, to engage with them. The reliance on the willingness of regime actors makes achieving financial sustainability difficult aspiration.

Findings from the interviews suggest that social enterprises need to generate more of their income through trade to become more financial sustainable. The need for social enterprises to become financially sustainable resonates with evidence from the literature (Phills and Denend, 2005; Byerly, 2014; Bull and Ridley-Duff, 2018). Social enterprises are generally viewed as organisations characterised by a significant level of economic risk. Moreover, to be successful in bearing such risks over the medium and long-term, economic sustainability is a prerequisite (Defourny and Nyssens, 2010). The social enterprise's mission is only attainable if the social enterprise itself has a sustainable operation (Sodhi and Tang, 2011). In practice, many social enterprise managers continuously make trade-offs between increasing productivity for financial gain versus increasing productivity for social benefits (Zainon *et al.*, 2014).

Green growth is underpinned by ideals of ecological modernisation which were explored in Section 2. Green growth refers to the concept that a green economy would help to meet sustainable development goals (Jackson, 2009).The idea of green growth was not well received by several of the interviewed organisations as it was perceived as an oxymoron. The interview data show that green growth was not embraced as a strategic decision, but as more of a necessary evil in order to effect positive environmental change. A key example of the negative perception towards capitalist business models was discussed during the interviews in relation to the community benefit fund. The community benefit fund was a key component of the community benefit society legal structure and reflects the surplus income generated. There were many ways in which the community benefit fund can be utilised, for example reducing fuel poverty, supporting local environmental projects or delivering educational programmes on energy. These are explored in detail in Section 4.2.3. Examples provided during the interviews included providing grants to support fuel poverty or retrofit activities locally or to set up local community hubs to work alongside local schools. However, for those organisations generating a surplus it was not considered appropriate to utilise this money to pay for a member of staff in the organisation despite the reliance on volunteers. This attitude was not reflected across all the interviews. One key informant argues that hiring staff could potentially have a bigger social impact in terms of providing employment, engaging in community outreach and

working on developing new projects. Lyon & Fernandez (2012) suggest that organisational growth is key for social enterprises seeking to scale up their social impact.

The negative attitudes towards capitalism were not reflected across all social enterprises. The results in Chapter 5 highlight the main type of income was revenue earned through trade and that financial sustainably could be achieved across most sectors. The interview data show the specific language differences used by energy organisations when discussing finances. Financial viability was often discussed as opposed to financial sustainability. There is an important difference here as it was portrayed that the goals in the community energy sector are primarily focused on getting projects installed. The interview data suggest that a shorter-term outlook was due to the rapidly changing policy landscape. However, focusing on financial viability rather than financial sustainability is likely hinder growth of social enterprises due to the short-term outlook (Lyon and Fernandez, 2012). The use of the 'viability' term was reflected in both sets of interviews conducted both in 2016 and 2018. This focus on 'sector survival' rather than on future growth was reflective of the growth crisis explored in Section 6.3. The focus on financial viability rather than financial sustainability over a prolonged period means that the community energy sector may transition away from the 'enterprise' aspect of a social enterprise to more charitable models (Bell, Massola and Zimmerman, 2010).

One prevalent difference found between the community energy sector and the social enterprise sector more broadly was the primary means of generating income. The disparity between the income models was the primary use of share offers and lack of trade income in the community energy sector. The results presented in Chapter 5 show that trade was the most common form of primary income when considering all social enterprises. Ridley-Duff (2009) investigated access to finance and found that where social enterprise do issue shares, they are given to members to promote community ownership rather than being utilised to raise capital costs. The use of shares is discussed earlier in this section; however, the questionnaire data show that shares were rarely used outside of the energy sector. Shares are predominately a market-based instrument used to raise capital finance (Sloman, 2007). The wide spread use of shares in the community energy sector is contradictory to the anti-capitalist sentiment disclosed by several key informants. Therefore, there is potential for the community energy sector to influence the social enterprise sector to issue shares to raise capital finance. The ability for social enterprises to trade their way to financial sustainability is an important cornerstone of social enterprises. The definition of social enterprise applied in this research highlights the important distinction between social enterprise and charitable not-for profit organisations. Membership fees were an underutilised source of income in the energy sector. This is

unexpected as membership fees are a common income stream in industrial and provident societies due to organisations being owned and led by members (Ridley-Duff, 2009).

The attitudes towards finance models in the community energy sector were found to be conflicting and in some cases contradictory. Ruggiero, Martiskainen and Onkila (2018) found that in a Finish context, community energy projects are influenced by the director's expectations. In some instances the expectations were to reduce the cost of energy, however, in others they were to increase the amount of renewable energy generated (Ruggiero, Martiskainen and Onkila, 2018). Results from Ruggiero *et al.*'s study could be indicative of a social enterprise operating with an environmental focus being different from social enterprises with a primary focus on social issues. Traditionally, social enterprises have been established to address social issues, primarily due to a lack of social welfare provision (Hopkins, 2010). The data collected does not specifically explore the claim that environmentally focused social enterprises are more in conflict with the notion of capitalist economies than socially focused ones. Despite being beyond the scope of this investigation, the difference between socially and environmentally focused social enterprises poses a key area for further research.

7.1.3 Is it possible for social enterprise to become a niche innovation breakout and form part of the low-carbon energy regime in the UK?

a) The transitioning UK energy system

Section 7.1.2 explored a range of different innovations happening in the community energy sector. This section explores community energy as a niche innovation in the context of the energy system in the UK. The energy system in the UK is centralised and shaped by the foundations laid by major energy corporations and underpinned by complex regulation. The use of decentralised renewable energy has implications in the energy transition as it deviates from existing infrastructure, markets and regulation (Electricity North West, 2017). To successfully incorporate decentralised energy in to the energy regime in the UK, a system alteration from its current linear design to a more adaptable one is required. This can be demonstrated through thinking about the ways in which electricity is currently generated and sold in the UK. There are three key processes in the current electricity infrastructure system as described by McAlinden (2014); generation, transmission and distribution. Firstly, electricity is *generated* in large power plants. Secondly, energy is *transmitted* long-distance over the energy system to local substations. Finally, energy is *distributed* from the substation to energy customers. Generation, transmission and supply are connected through the national grid infrastructure (McAlinden, 2014).

Local energy generation challenges the current energy system in two ways; 1) energy is used at point of generation, reducing the need for transmission and distribution processes, and 2) surplus energy can be fed back in to the national grid infrastructure. Feeding energy in to the national grid from the end user creates technical issues as the system was originally designed to handle a one-way flow of energy (Electricity North West, 2017). The practicalities of the technical issues are illustrated by considering user-generators where surplus energy is fed in to the national grid. Metering problems can be encountered as the user-generator creates a two-way flow of electricity in and out of the national grid (OFGEM, 2018b). In these circumstances, it becomes difficult for individuals to check their bills or to know how much electricity they have generated or even used. Market structures make billing more complicated as often energy taken from the grid is not always handled by the same organisation handling the surplus energy being exported (Good Energy, 2016). The energy infrastructure and market system in the UK is complicated and local generation creates additional complexity (Carson *et al.*, 2008). Solutions for energy system transformation need to be considered from a holistic perspective due to distinct but overlapping roles and responsibilities of the different incumbents in the energy system (Carson *et al.*, 2008).

Micro local generation is categorised through the FIT scheme as domestic, commercial, industrial and community as discussed in Section 4.3. Community energy is the only category from the four types of micro generation that has inherent social benefit; for example, the community benefit fund as evidenced in Section 4.2.3. The analysis of community energy in Chapters 4, 5 and 6 has highlighted some key issues with the current energy system that may hinder the transition to a low-carbon energy system. The potential for community energy to develop enough to become a key constituent part of a new low-carbon energy system is explored here.

b) Niche-regime dynamics

The use of the MLP model in Chapter 6 enabled the exploration of the niche-regime dynamics in the energy sector in the UK. Evidence of two different tensions in the energy transition were found; 1) tensions in the existing regime, and 2) tensions between the niche and the regime. The data from the interviews suggest that there was a window of opportunity for niche-innovation break-through that occurred after the introduction of the FIT but before the cuts to this scheme. The tensions are briefly considered to give context for discussion in this section (and explored in more detail in Chapter 6); does social enterprise in the energy sector have the potential to become part of the low-carbon regime? .

Tensions were found across the different domains of the low-carbon regime. The key tension that was evidenced is the relationship between the energy regulator and energy companies and national

government. There is pressure on government and energy companies to decarbonise the energy system. However, the regulators mission is to 'make a positive difference for energy customers' (OFGEM, 2018a). The regulator has a responsibility to explore how future demands on the energy system can be met. The regulator has no official mandate or obligations to decarbonise the energy system (OFGEM, 2018a). As a powerful incumbent, the regulator can act as a barrier not only to community energy but also towards the decarbonisation agenda. The implications of this for community energy are explored later in this section.

The interview data highlight that tensions exist between the community energy niche and the regime. The relationship between social enterprise and the mainstream 'regime' was found to be an uneasy one. There was evidence to suggest that the reputation of the community energy sector has been damaged among policymakers. The interview data show that some policy-makers thought that community energy had an over-reliance on FITs. The community energy sector has been branded by some as a 'cap in hand sector' and an expensive way to build green energy generation capacity. There was evidence in the interviews that the district network operators (DNO's)[45] have started to work with community energy groups. The DNO's have encountered challenges in monitoring supply and demand where projects are developed 'off-grid'. The relationship between the DNO's and the community energy sector presented evidence of the bottom up pressure being created by community energy on the regime. Many community energy projects had been developed off-grid to overcome regulatory barriers. Hannon & Bolton (2015) suggested that local authorities pursuing decentralised energy opportunities at a municipal level is contingent on favourable regulation. Future government support towards the community energy sector in the UK is unlikely without financial sustainability being central to new business models. To date, changing environmental policies and interactions with private sector energy companies and regulators has presented significant challenges for social enterprise operations. Policy changes have had a disruptive and unsettling impact on the community energy sector. The changing environmental policy environment was discussed in Section 7.1.1.

c) Niche Innovation breakout potential

Niches are only able to take advantage of windows of opportunities if they are sufficiently developed (Geels and Schot, 2007). This section will explore how developed the community energy niche innovation currently is. The development phases of niche innovations were introduced in Section 2.4.1. The breakout potential of community energy was explored in Section 6.4. The results

[45] District Networks Operators (DNO's) are responsible for maintaining regional sections of the national grid infrastructure and balancing energy supply and demand.

presented were framed around the lens of protected space, capacity to innovate and scalability which are core elements of niche development (Hossain, 2016).

Protected spaces for innovation to occur in the energy system transitions have largely focused on technological innovations as discussed in Section 2.3.1. During this research community energy was framed as a social innovation following on from research in the transitions field (Hatzl *et al*., 2016; Raven *et al.,* 2010; Seyfang & Haxeltine, 2012). Evidence of protected space for community energy in the UK was found in various forms; FITs, development grants, tax relief for investors and innovation trial grants. The data collected for all three studies highlighted that protected space for community energy in the UK is being withdrawn. As protected space is intended to support innovation trials that are underdeveloped a key point was raised; was the protected space for community energy withdrawn prematurely or because the innovation has failed to deliver?

Protective space for niche innovations is typically required to support the niche through its infancy (Smith and Raven, 2012). The results presented in Chapter 4 show that the scale of the withdrawal of policy support was unpredicted. However, the interviews with key informants 9 and 12 highlighted that community energy was an expensive way to generate kWh of energy. Intrinsic benefits of delivering community energy were often of a local nature; such as democratisation, building additional energy system capacity and community benefit funds. The FIT analysis illustrated that community energy had not delivered projects at the same capacity as their commercial sector counterparts. Austin, Stevenson & Wei-Skillern (2006) state that a key difference between social and commercial enterprises is that social enterprise experience more difficulties in resource mobilisation. The community energy sector experienced rapid growth between 2010 and 2014 based on a 'copy and paste' business model in many cases. The interview data showed a potential reason for the dominant model was that community energy groups could become financially sustainable after installing a relatively small number of projects under original FIT rates. The copy and paste business model was key in enabling the sector to experience growth. Most community energy groups in the UK did not get to the point of financial sustainability prior to the FIT rate cuts. The evidence from the interviews highlighted the long-time scales of developing projects due to their reliance on volunteers and technical issues, such as negotiating leases and satisfying multiple government agencies. Social enterprise organisations often face more difficulties than their private sector counterparts. However, social enterprises are characterised by innovation as they exist as a direct challenge to traditional business models (Austin, Stevenson & Wei-Skillern, 2006). From the data collected during this research it cannot be stated definitively if the sector would have

developed beyond the copy and paste business model to create new market-based innovations had the FIT rates not been cut.

Capacity to innovate was explored from two different aspects; knowledge and numbers. Across the community energy sector, a vast amount of knowledge and experience has been gained in developing and delivering renewable energy generation projects (Walker and Devine-Wright, 2008; Seyfang *et al.*, 2014; Kooij *et al.*, 2018; Ruggiero, Martiskainen and Onkila, 2018). The interview data show that knowledge sharing was common across community energy organisations with many free courses offered and templates of key documents being shared. The network has built capacity and attempted to streamline processes by community energy organisations working together to benefit for economies of scale, as discussed in Chapter 6. In-depth knowledge of energy and industrial and provident society regulation was found during the interviews with community energy organisations. The questionnaire data highlight a lack of new entrants into the energy sector since 2014 and the interview data suggested that support capacity in the sector is being withdrawn. There is a danger that if viable solutions are not found then the sector will lose some of its volunteer capacity. The impact would be doubled due to the loss of experience and knowledge that would exit if voluntary capacity diminishes.

Scalability in the community energy sector relates directly to increasing the amount of community owned renewable energy generation capacity. Two different approaches to scale were found; either increase the number of projects or encourage community energy groups to install larger projects. Larger projects were considered as financially favourable during the interviews due to economy of scale benefits. Reproducing community energy at scale was found to be a balancing act between maintaining community roots while finding projects which represented a viable business proposition.

Replicability of projects was found to be a key factor in terms of scaling up projects. The FIT business model was successfully replicated by numerous groups across the UK. This phenomenon worked in a similar way to a franchise arrangement without the oversite of an umbrella organisation or driving ‘brand’. Thus, the community energy sector was scaled-up but without the economy of scale that a franchisee would normally benefit from. Although community energy projects were distinct, and issues varied from project to project, common issues and processes were evident. Raising finance, arranging leases, dealing with public bodies and external stakeholders and the installation of the renewable technologies were evidenced across all projects. There is evidence of some structured knowledge sharing across the sector through national organisations championing community energy. Much of the support tends to be happening on a more informal and localised basis. A close

network of community energy and the use of social capital across the community energy sector was prevalent across the three studies. However, it was evident that links with private organisations and local councils were found to be necessary in the scaling-up process. The data from the interviews and the questionnaire highlighted the need for collaborations with organisations outside of the community energy sector. Section 5.2.3 highlights that having a wide range of network connections is likely to be important for community energy organisations in the future, particularly influential people in the network, local councils and private and organisations.

Protected spaces have been removed from the community energy sector over a relatively short period. Removal of protected space has impacted the support coming from other third sectors organisations seeking to support community energy. The withdrawal of support is likely to impact the community energy sectors ability to develop past a local inter-local phase (Hatzl *et al.*, 2016). Capacity to innovate has been built in terms of knowledge and experience. There could be an ongoing issue in retaining that knowledge in the sector in the absence of viable business opportunities (Mourik & Raven, 2006; Coenen, Raven & Verbong, 2010; Feola & Nunes, 2014). The community energy sector was experiencing a growth crisis and found to be at pivotal moment. If new business models can demonstrate financial sustainability and not only financial viability then there is potential for sector to grow (Bell, Massola & Zimmerman, 2010; Munro *et al.*, 2016). However, growth will be difficult without support from regulators and central government due to the power they hold in the system. Collaborations with private sector organisations and local government may also be critical in the short-term in the absence of a more formal protective space (Smith and Raven, 2012).

d) Innovation diffusion pathways

The discussion has shown that although there was a window of opportunity for community energy, the sector was not developed enough to take advantage of it. The MLP model and SNM literature suggests that not all niches become developed enough to break through to the regime. A key finding from the interviews was that community energy did have a role to play in the new energy system transition. The MLP transitions pathways literature has been utilised to explore further what that role of social enterprises in a low-carbon energy system might be. Table 7.2 presents the pathways framework developed by Geels & Schot (2007). This framework is applied to identify the potential role social enterprise can play in the future.

Table 7.2: Niche-innovation pathways and links to social enterprise

Pathway	Is the niche innovation developed?	Nature of interaction between 3 levels	Possible role of social enterprise in the future
Reproduction process	Niche innovations may or may not be sufficiently developed	Landscape is stable and reinforces the regime	Even if social enterprise is considered developed, there is little chance of it breaking through to the regime without landscape pressures to destabilise the regime
Transformation path	Not sufficiently developed	Moderate landscape pressure causing disruptive change to the regime	Social enterprise is not developed enough to take advantage of the disruption to the regime. Therefore, regime actors will respond by modifying innovation activities.
De-alignment and re-alignment path	Not sufficiently developed	Landscape change is divergent, large and sudden.	Regime actors lose faith in the landscape and regime eroded. Therefore, social enterprise would co-exist with other niche innovations as there is no clear substitute. Eventually one will become dominant re-aligning the regime.
Technological substitution	Niche innovation is sufficiently developed	Landscape change is disruptive – this could be due to a 'specific shock' or 'avalanche' change.	Social enterprise could have been operating successfully for some time as a niche, however the regime has remained stable. Disruption to the regime allows social enterprise as a radical developed innovation to replace the regime.
Reconfiguration	Niches are sufficiently developed	Niche innovations are symbiotic with the regime	Social enterprises are adopted to solve local regime problems and elements of social organizations may be adopted by other regime actors. This could make it difficult for social enterprises to differentiate in a regime market when competing with private firms.
Sequential transitions pathways*:* Transformation, Reconfiguration, then Substitution *or* Re-alignment	Niche innovations may or may not be sufficiently developed	Slow disruptive landscape change perceived by regime actors as moderate. The disruption increased over time as pressure on the regime increases.	Regime actors will initially seek to resolve problems. They may then look to incorporate social enterprise in to the regime. If this alters the regime but landscape pressures increase, developed social enterprises can take advantage of the disruption and move in to the regime. If undeveloped, social enterprise will coexist with other niche-innovations until one becomes dominant.

The application of the pathways theory to the community energy context in the UK gives an overall indication of the potential future of social enterprise in the transition to a low-carbon regime. Based upon the findings of this research it is suggested that the mostly likely pathways would be reproduction or reconfiguration transitions pathway. According to Geels & Schot (2007) there are

four proxies[46] to determine whether or not a niche is developed (as introduced in Section 2.3). Community energy in the UK is not sufficiently developed for several reasons; 1) there is no stable dominant design, 2) the absence of financially viable business models demonstrates there have not been continual improvements in the price/performance patterns, and 3) community energy accounts for less than a 5% market share of the energy market. Community energy as a niche innovation has not sufficiently developed and therefore several pathway ways are not considered possible (Table 7.2). The analysis demonstrates that the likely outcome for community energy is that it will remain as a niche level innovation if the sector cannot develop beyond its current state. If the community energy sector manages to develop through collaboration with regime actors, a mutual relationship between regime actors and the niche innovation may occur. Therefore, the relationship between community energy and the regime may become symbiotic rather than competitive (Geels and Schot, 2007). Within the findings of this thesis community energy was not found to be a disruptive niche innovation in its current state. Should community energy develop sufficiently, a reconfiguration process would be likely to take place.

Table 7.2 identified that during the reconfiguration pathway regime, actors may adopt social enterprise to innovate and then adopt their core values and approaches. Evidence of the regulator engaging with community energy to take part in innovation trials but not supporting scaling up was explored in Section 6.4. Social enterprises need to ensure that maintain their position and competitive advantage over existing regime actors who may support innovation and then seek to deploy successful one's themselves under more market-driven business models. The findings from Chapter 6 suggest it will be difficult for community energy organisations to have a competitive advantage over regime actors due to business models being reliant on the regime.

7.2 Implications of research in theory and practice

Transition implications

The value of whole system approaches has been considered in the context of low-carbon energy transition in the UK. The niche-regime dynamics explored during Section 7.1.3 highlight the complexity involved in niche development. The research has demonstrated that pressures from the landscape and niche levels have created disruption in the UK's energy system. A window of opportunity for developed niches to take advantage of had been created due to the uncertainty of the structure of the new low-carbon energy regime.

[46] 1) Learning processes have stabilised in a dominant design, 2) Powerful actors have joined the support network, 3) Price/performance improvements have demonstrated an improvement curve, and 4) Market share of the niche innovation cumulatively amount to more than 5% market-share.

Community energy is presented as social niche innovation which supports other literature from the SNM field (Seyfang and Haxeltine, 2012; Seyfang, Park and Smith, 2013; Ruggiero, Martiskainen and Onkila, 2018). The tensions found between the niche innovations and the regime were prevalent in understanding why community energy in the UK is underdeveloped as a niche innovation. During the period of the research, 2015-2018, the community energy sector was going through a transition towards more financially viable business models with mixed success. Understanding why niches fail supports future research on how niche innovations can be supported during development phases and gain a deeper insight in to the role of the protected space. The thesis has captured the implications of prematurely removing protected space for the community energy sector in the UK, (discussed in Section 7.1.1 and 7.1.2).

Incumbents in the energy system have created protected space for innovation trials across communities in the UK. Innovation trials are an important way to find solutions for key issues in transitioning to a low-carbon energy system. Social enterprises are not restricted by economic imperatives and social entrepreneurs often must find creative solutions to compete with non-social enterprises (Ilac, 2018; Sinclair *et al.*, 2018). Financial support for innovation trials is often aimed at the actors or social enterprises, who are financially vulnerable, rather than corporate organisations who are more financially resilient. Niche level organisations are at risk of being taken advantage for their ability to innovate despite not being resilient enough to withstand the removal of protected space (Seyfang, Park & Smith, 2013). Existing literature states that protected space should be phased out gradually (Geels & Kemp, 2012; Seyfang & Haxeltine, 2012; Smith *et al.*, 2014). The FITs provided protected space to develop micro generation renewable energy projects in the UK. Domestic, commercial, community and industrial projects range from small solar installations on domestic roofs to 5MW solar farms. Therefore, the development times and support needs vary depending on the types and size of installation. The thesis posits that the removal of protected space is complex and the implications of this should be considered when designing and implementing policy that and phase out plans. The appropriate phasing out of policy support is key in developing protected spaced that adequately support innovations during testing phases.

Niche development is vital for niche innovations to breakthrough to the regime (Hatzl *et al.*, 2016). The discussion in Section 7.1.3 demonstrated that the community energy sector in the UK is currently underdeveloped. The diversity of networks in market-based niche interventions were found to be heterogeneous in the community energy sector in the UK, supporting the findings of Hatzl *et al.,* (2016). Stakeholder engagement and networking are vital for social enterprises. Collaboration and peer support enable community energy organisations to reduce their risk and

learn from other organisations experiences. The need for niche innovators to engage with regime stakeholders is important for the niche development. Seyfang & Longhurst (2016) suggest that policy to nurture support of niche-level intermediary organisations could assist the diffusion of grassroots innovation.

Community energy implications

Community energy is posited as a solution for sustainable development in the energy system. Community led initiatives have benefits that can help break barriers and create meaning at a community level to abstract global issues (Aiken, 2015). In the UK communities have engaged with the energy system through local balancing projects and investing in community energy projects.

The lack of viable business models threatens the future growth of the community energy sector in the UK. In the short-term collaborative projects are likely to play a key role in the growth of the community energy sector. Collaboration is needed due to the absence of financial assistance in supporting the development of the community energy sector. In contrast to traditional commercially focused organisations, social enterprises are more collaborative than competitive (Leadbeater, 2007). Therefore, social enterprises are well placed to act as facilitators for innovation exploration that brings key stakeholders together. Several key innovations can be attributed to the community energy sector, such as local balancing and peer-to-peer energy trading. However, the innovations with greatest potential are projects that collaborate with or are supported by incumbents in the regime. In long-term, approaches to developing innovative business models in the community energy sector need to focus on financial sustainability rather than financial viability and reduce their reliance on the regime.

Community energy projects are more holistic than other types of micro generation projects. However, they lack in delivering social justice elements of the energy trilemma. Democratic ownership is a key way of creating a more equitable energy system. Democratic values are at the heart of the community sector in the UK. However, the democracy is shaped by the finance models and regulatory restrictions on the supply of energy such as; those on lower incomes who cannot afford to buy shares in community energy or community energy organisations not being able to supply the energy generated to the wider community. The democratic values of community energy in the UK differs from values evident across European counterparts. The difference between the types of democracy should be considered when comparing community energy operating in different contexts (Brummer, 2018).

Social enterprise implications

The research has demonstrated the possibility of triple bottom line imperatives being delivered through community benefit. However, the effectiveness and level of impact is dependent on the ways community benefit funds are deployed and the ability to upscale localised projects to wider areas (Community Energy England, 2017; Ruggiero, Martiskainen and Onkila, 2018). Social enterprise has the potential to deliver niche innovations; however, two key questions should be considered; 1) can social enterprise deliver at scale to compete in existing markets without external support, and 2) can social enterprises maintain links to the community at scale?

The social enterprise sector needs to foster legitimacy and credibility through their business models (Dart, 2004; Zainon *et al.*, 2014). The ability to demonstrate that social enterprises can create economic value and financially sustainable business models in existing regimes is vital. Many social enterprises reported that financial sustainability is possible as they are currently achieving it. Where social enterprises are financially sustainable through trade, they can act as 'positive role models' and put pressure on traditional business models. Competing with non-social enterprises challenges the existing economic regime and creates new consumer expectations (Wattanakamolchai *et al.*, 2016). As markets move towards more triple bottom line focused business models, social enterprises may lose their competitive advantage if sustainability becomes a standard requirement for all market players (Porter and Kramer, 2006; Bull and Ridley-Duff, 2018). The potential for innovation transfer from community energy social enterprises to the wider social enterprise sector is evidenced in Section 7.1.2. The community energy sector has utilised innovative finance models in comparison to other types of social enterprises. The use of community shares across different types of social enterprise that are financially sustainable in competitive markets would help support the legitimacy of social enterprise business models in the UK (Ridley-Duff, 2009; Sunley & Pinch, 2012; Hiteva & Sovacool, 2017). Whether or not this is achievable requires further investigation across different sectors where social enterprise models are already competing in the market.

Social enterprise as an 'engine' for sustainable innovations provides certain protections for organisations seeking to realise multiple bottom line objectives (Hillman, Axon & Morrissey, 2018). Social enterprises are well placed to deliver social sustainability and challenge conventional bottom line imperatives as they are often based at the community level (van der Horst, 2008). A conflict exists between the growth of social enterprise and maintaining connections with local communities. The small scale at which many social enterprises operate builds trust and reciprocity within local communities (Bull and Ridley-Duff, 2018; Ruggiero, Martiskainen and Onkila, 2018). The trust between communities and organisations differentiates social enterprise from private sector

organisations (Ridley-Duff and Bull, 2011). However, social or environmental development often need to happen at larger scales to achieve wide-spread impact (Geels *et al.*, 2018; Heffron *et al.*, 2015; Sovacool *et al.*, 2017). Growth in the social enterprise may be more beneficial through replicability across sectors rather than individual organisational growth. Seyfang & Longhurst (2016) found that in the case of community currency diffusion was most common through replicability.

The potential for social enterprise in a low-carbon energy system

The exploration of the business models behind community energy demonstrated that there is a need for an element of cohesion with the current economic regime in order to create financially viable opportunities that can compete in the energy market. Competing in the energy market enables community energy organisations to create a customer expectation for new industry standards that are rooted with social justice and environmental values. Community energy organisations that can create successful business models to compete in energy markets are likely to act as influencers for the whole community energy sector. However, attitudes towards green growth and economic development in the community energy sector may limit the number of organisations that successfully end up operating beyond a niche level. If community energy organisations can find economically viable business models, it is likely the sector will adopt these models relatively quickly and have the potential to pressure on the regime (Sunley & Pinch, 2012; Hatzl *et al.*, 2016; Hillman, Axon & Morrissey, 2018). However, the evidence presented across this thesis has demonstrated that the emerging business models being at the fore of the community energy sector are still reliant on regime actors being willing to engage with the niche. The withdrawal of government support and negative attitudes from policymakers towards community energy in the UK make it unlikely that another window of opportunity will emerge in the short-medium term (Geels & Schot, 2007, 2008).

There is a role for intermediaries as they can act as key links between the community energy sector and regime actors (Hargreaves *et al.*, 2013; Kivimaa, 2014; Bush *et al.*, 2017). Regional umbrella organisations in the community energy context could help to create local economies of scale and shared resources for the community energy sector. Although there is evidence of intermediary and networking organisations in the community energy sector, more practical support is required (Good Energy, 2016; Regen SW, 2016; Community Energy England, 2017). Key support functions missing in the community energy sector where intermediaries could fill the gap include; the creation development funds, procuring capital finance at more favourable rates or lowering development costs through scale by collectively working with multiple community energy groups. Working with overarching intermediaries would give community energy a stronger voice and more legitimacy in the regime whilst allowing local groups to maintain their links with the local community.

From a macro perspective, policy interventions need to be more stable so that community energy organisations can plan for withdraw of protected space (Brummer, 2018). The implications of withdrawing protected space should be considered during the design of policy interventions. Support for innovation trials should also be designed with a focus on scaling-up projects following a successful trial. To date, diffusion support has been lacking in the community energy sector. Policy should be more favourable towards projects that can demonstrate their economic, environmental and social impact.

7.3 Limitations of the thesis

This thesis has several limitations that should be considered due to the implications on the findings presented. A key limitation of the questionnaire is linked to the sample size. Despite the sample size for the social enterprise questionnaire being large, only a small number of energy organisations participated. Where this effect the finding presented this has been clearly indicated throughout the thesis. To validate the findings on energy sector organisation data from the survey the results have been triangulated with other studies and with existing literature.

The availability of consistent data on the energy sector is a limitation of the research. Data utilised, particularly in Chapter 4, comes from a wide variety of sources as there is a lack of standardised data on the energy system. For example, there was a disconnect between the data from OFGEM and the Community Energy England data on the installed capacity for community energy in the UK. The datasets are discussed further in Chapter 3.

Chapter 8. Conclusions

This thesis aimed to explore the role of social enterprises in the transition to a low-carbon energy regime. The research presented has been conducted on social enterprises in the UK. A pragmatist philosophical paradigm and mixed methods approach has been adopted. Three studies were conducted to meet the research aims of this investigation. The overall research aim and research questions were as follows;

To understand the potential for social enterprise to diffuse into a new low-carbon energy regime;

1. Explore how community energy has responded to a rapidly changing energy system How has community energy responded to a rapidly changing energy system?

2. How viable is social enterprise as a business model within the energy sector in the UK?

3. Is it possible for social enterprise to become a niche innovation breakout and form part of the low-carbon energy regime in the UK?

The research questions were discussed in detail in Chapter 7. This chapter summarises the findings of the research questions in relation to the main fields of academic literature reviewed in Chapter 2; sustainable development concepts, community led sustainability, social sustainability, socio-technical transitions and the energy system, niche innovation and strategic niche management. Following this summary, the contributions to knowledge, practical implications and possibilities for further research are presented.

8.1 Community energy and its response to a rapidly changing energy system

The consideration of decentralised energy systems at government level led to the introduction of the FITs. The FITs created an opportunity to increase community participation and ownership of energy issues through community energy business models. Community energy has been used as a broad term to describe community groups who are acting to solve both supply and demand side energy issues. Community energy is primarily composed of grassroots movements that present a more holistic view to solving sustainability problems in the energy system. Community energy projects can support the development of low-carbon communities and foster community cohesion. The importance of stakeholders and collective action has become central to community energy. Community energy groups can engage communities with the abstract global issue of climate change and help create understanding of the importance of the energy system.

In the context of this thesis, the focus was on community energy as energy generators due to the prevalence of this type of group in the UK. The findings show that community energy is a useful tool for exploring solutions to low-carbon energy that might be considered as radical by regime actors. In the community energy sector, the democratic possibilities of social enterprise are recognised as a way to increase democracy in the transitioning energy system. The FITs supported the rapid development of the community energy sector in the UK. However, the reductions to the FITs have been unpredictable and left community energy organisations unable to prepare for the rapid succession of rate changes between 2012 and 2016. Since early 2015 community energy organisations have struggled to find financially viable business models following the extent of the FIT reductions. Several barriers for community energy were evident during this investigation including project development costs, the cut of government grants and subsidies, and, regulatory restrictions. Community generation projects were found to have long development times because of the reliance on volunteers and a lack of technical expertise. A key finding of this thesis is that at this current time community energy organisations are unlikely to create transformative change in the energy system.

From an ideology perspective, social enterprise organisations were found to act as innovators that seek to challenge mainstream economic models through application of a triple bottom line imperative. For example, community energy groups are not driven by economic imperatives but primarily environmental objectives. There are social benefits that can also be linked to community energy such as reduction of fuel poverty, provision of educational programmes and provision of grants to other social organisations. The community energy sector has shown signs of innovation that relate to both energy and social enterprise sectors. The community energy sector has utilised innovative finance models that were not evidenced across the other sector social enterprises.

Innovative projects that have stemmed from the community energy sector include virtual supply, balancing local supply and municipal energy companies. The shift to an organisational focus raises several new and underexplored questions; does our understanding of community energy change when organisations have multiple projects? Do existing definitions of community energy exclude more holistic approaches when renewable energy generation may not be a core aspect of the organisation, such as housing association generating renewable energy for its tenants?

8.2 The viability of business models in the energy sector in the UK

The definition of social enterprise, presented in Chapter 1, was an organisation where most of the income is gained, or has the potential to be gained, through trade. The surplus generated by the organisation is then used to address a social or environmental need. The 'potential' element was added as an extension to the existing definition set out by the UK government. Recognising the potential to become financially sustainable allows for the differentiation between social enterprises and charitable organisations. It opens a new debate on the role of social enterprise and questions their present status of purely operating within the third sector. The social enterprise sector appears to fit with the definition of trading organisations that can become financially sustainable. The FITs in the UK created business models that were reliant on government subsidies to develop the community energy sector.

Currently, the community energy sector is experiencing a growth crisis and therefore focus remains on the financial viability of energy generation projects. There needs to be more focus on long-term financially sustainable business models if the community energy sector can scale-up to have long lasting and meaningful impact towards sustainable development goals. During times of austerity and a lack of government support there has been a clear shift away from business models that rely on subsides and grants to models that can compete in existing markets. Evidence of mixed opinions on social enterprise as a more holistic and socially conscious way to do business were presented. Across the surveyed organisations there was evidence that some social enterprises posit themselves as charitable alternatives rather than an alternative to traditional business. Opinion differed depending on the organisational directors' personal attitudes towards ideas of capitalism and green growth. Community energy leaders may need to be more open to competing in existing markets and exploring tradable opportunities for the community energy sector. The over-reliance on volunteers and reluctance from some organisations to consider hiring paid employees will act as a barrier to community energy organisations seeking legitimacy in the regime.

Social enterprises were found to have a wide range of diverse networks and recognised the importance of these networks for their organisational success. The diverse range of networks that

social enterprises have developed make them well placed to understand both the need of incumbents in the energy system and the needs of local communities. Stakeholder engagement helps to promote innovation strategies for sustainable development. Social capital and social networks play a key role in promoting stakeholder engagement; however, this needs to be balanced with community groups maintaining credibility through remaining autonomous from local government bodies.

Despite the challenges facing the community energy sector in the UK, there are pockets of innovation activity evident. The innovations from the sector has focused on the development of new business models, some radical and some incremental. Three different types of innovation were presented to describe the activities taking place; evolutionary, embedding and disruptive. Despite the evidence of innovation activity, a key challenge for the community energy sector is the reliance on regime in order to create viable business models. Further exploration of the different types of innovation activity would help to understand the contexts in which community energy organisations operate.

8.3 The potential niche innovation breakout in to the low-carbon regime in the UK

The framing of socio-technical transitions highlights the complex nature of energy system transitions. The whole systems approach of the MLP deepens understanding by considering interactions at three levels; landscape, regime and niche. Socio-technical transition concepts provide a framing to explore the interactions between technologies, markets, policy and innovation. The investigations of the thesis have demonstrated that a number of barriers exist which in the medium-long term may limit the potential of social enterprises to deliver regime transformation, or to act as 'transitions engines'. Chief amongst these is a lack of clarity or certainty on the policy and regulatory landscape in which they operate. Tensions between social enterprises in the community energy sector and both the energy and environmental policy landscape and the regulatory landscape were evident. *Ad hoc* and reactionary policy change in the UK has acted as a major challenge to energy focused social enterprises.

Niche innovations are important in the transitions process and their potential for breaking through to transitioning regimes can be explored using transition pathways literature. Social enterprises are already playing an important role in the energy sector. However, there is considerable scope for this role to be scaled-up, potentially with minimal grant or subsidy support. However, support for the 'take-off' stage was identified as being particularly important. What is also clear is that the social enterprise model could in principle deliver a regime transformation in part, however this is unlikely

at the current juncture. The evidence suggests community energy would need to deliver self-sustaining business models in tandem with other concurrent transformative innovation across the regime, including for example, associated changes in practices of consumer behaviour and expectation, and in wider consumer value considerations.

Exploring community energy from a business model perspective links closely with the literature exploring social niche innovations, discussed in Chapter 2. Exploring community energy as a niche innovation serves to understand how successful innovations may be scaled-up and diffused in to the regime. The SNM literature highlighted the importance of a protected incubation space so that niches can become developed enough to break through to the regime. Within the context of community energy in the UK, the incubation space provided by the government through the FITs had been reduced before initially expected. However, the findings show that post FIT, organisations were innovating their business models to shift away from subsidy-based models in favour of becoming financially sustainable.

Community energy social enterprise operations were explored in respect of the three internal processes of SNM; 1) voicing and shaping of expectations, 2) networking and, 3) learning (Mourik and Raven, 2006). The role of networking and learning were found to be particularly important in Chapter 7. Networking has been conductive to the momentum behind innovative collaborations and information sharing across the community energy sector. The discussion on barriers faced by niche innovations helps to advance the SNM and transitions fields by understanding how niches interact with the regime. Focusing on social enterprise issues has created a more holistic approach to understanding how niches can develop. The research highlights the risks of deploying financially unsustainable business models prematurely.

The transition pathways discussion in Section 7.1.3 highlights that despite community energy being underdeveloped as a niche innovation, there is potential for community energy social enterprises to influence regime actors. However, the likelihood is that regime actors will adopt and modify community energy concepts and community energy will continue to co-exist alongside other niche-innovations until one becomes dominant. The presence of alternative niche innovations and the interaction of community energy with other low-carbon innovations has not been explored during this investigation. However, competition between different innovations could prove a fruitful strand of research to explore whether niche-innovations can affect the development rate of other innovations. To summarise the investigation the contributions to knowledge from the thesis are presented in Box 8.1.

Box 8.1: Contribution to knowledge

Contributions to knowledge

1. Provided a detailed account of how niches interact with the regime. By using a business models' perspective, insights have been gained into the difficulties niches face when trying to diffuse in to the regime. The exploration of social enterprise as a community energy business model has demonstrated that the community energy sector is highly dependent on the regime for provision on income and protected space.

2. Captures the community energy sector in the UK at a critical phase in the niche development and provides better understanding of how niches react to the withdrawal of protected space. The investigation during this period enabled valuable insight into a transitioning sector. Specifically, this research has provided a detailed insight in to why niches fail

3. Explored the innovation activity that has happened in the community energy sector in the UK following the withdrawal of the FITs. Three types of business model innovation that have occurred in the community energy sectors have been characterised; evolutionary, embedding and disruptive innovation.

8.4 Practical Implications

Several practical implications for the community energy sector have been alluded to throughout the thesis. The key implications discussed in this investigation are;

- The lack of viable business model threatens the future growth potential of the community energy sector.

- Collaborative projects with local government and private sector organisations can help social enterprises in the community energy sector in the UK grow in the short-term.

- Niche innovations require a greater level of support from political leaders committed to holistic approaches to low-carbon transitions at both local and national levels.

- Understanding why niches fail can help support and inform future policy design and implementation.

8.5 Possibilities for further research

This thesis has established some key findings, but significant gaps exist that would advance knowledge, understanding and practice. Three key areas for further research are presented; 1) the implications of withdrawing protected space, 2) social enterprise organisations as activists, and 3) social capital and network interaction between the niche level and the regime.

The research has highlighted that implications of withdrawing protected space utilised for developing niche innovations. Investigation in to the withdrawal of protected space and the how niches respond to the withdrawal may lead to further niche innovation rather than niche failure as found in the case of community energy in the UK. Future research should seek to understand why niche innovations fail. Understanding what happens to niches once protected space is removed can inform effective design of policy interventions and would help to develop the SNM research agenda.

In the context of the low-carbon transition in the UK energy system, social enterprises and community energy has created disruption in the existing regime. Social enterprises have developed niche innovations and solutions to transition issues that are deemed as radial by incumbents in the regime. Further research should explore where social enterprise can intentionally and purposefully create a dichotomy in other contexts.

The role of networks and social capital has been an underlying theme across much of this thesis. Tensions between the niche level and regime have been explored throughout this investigation. However, there is a need to understand networks from a collaboration perspective and the types of positive interaction that exist between the niche level and the regime. For example, to understand how social enterprises at a niche level interact with the regime and how this differs from other niche level organisations. Further research should explore the role of networks and social capital from a whole systems perspective.

References

Abraham, J. (2017) 'Just transitions for the miners: Labor environmentalism in the Ruhr and Appalachian coalfields', *New Political Science*. Routledge, 39(2), pp. 218–240. doi: 10.1080/07393148.2017.1301313.

Adua, L., York, R. and Schuelke-Leech, B. A. (2016) 'The human dimensions of climate change: A micro-level assessment of views from the ecological modernization, political economy and human ecology perspectives', *Social Science Research*. Elsevier Ltd, 56, pp. 26–43. doi: 10.1016/j.ssresearch.2015.10.003.

Aiken, G. (2014) 'Common Sense Community? The Climate Challenge Fund's Official and Tacit Community Construction', *Scottish Geographical Journal*, 130(3), pp. 207–221. doi: 10.1080/14702541.2014.921322.

Aiken, G. (2015) '(Local-) community for global challenges: carbon conversations, transition towns and governmental elisions', *Local Environment*, 20(7), pp. 764–781. doi: 10.1080/13549839.2013.870142.

Andrews, R. N. L. and Johnson, E. (2016) 'Energy use, behavioral change, and business organizations: Reviewing recent findings and proposing a future research agenda', *Energy Research & Social Science*. Elsevier Ltd, 11, pp. 195–208. doi: 10.1016/j.erss.2015.09.001.

Arrow, K. *et al,* (1995) 'Economic growth, carrying capacity, and the environment 1', *Ecological Economics*, 15, pp. 91–95. doi: 10.1016/0921-8009(95)00059-3.

ARUP (2011) 'Decentralised Energy Masterplanning', p. 69. Available at: http://www.chpa.co.uk/medialibrary/2012/01/05/46ccc22e/DENet_manual_lo_v1%5Cn0.pdf.

Austin, J. E. (2000) 'Strategic Collaboration Between Nonprofits and Businesses', *Nonprofit and Voluntary Sector Quarterly*, 29(1), pp. 69–97. doi: 10.1177/089976400773746346.

Austin, J., Stevenson, H. and Wei-Skillern, J. (2006) 'Social and commercial entrepreneurship: Same, different, or both?', *Entrepreneurship: Theory and Practice*, 30(1), pp. 1–22. doi: 10.1111/j.1540-6520.2006.00107.x.

Aylett, A. (2013) 'Networked urban climate governance: Neighborhood-scale residential solar energy systems and the example of Solarize Portland', *Environment and Planning C: Government and Policy*, 31(5), pp. 858–875. doi: 10.1068/c11304.

B Lab (2018) *What are B Corps*, *B Corporation*. Available at: https://www.bcorporation.net/what-are-b-corps.

Bakker, S., Leguijt, P. and Lente, H. Van (2015) 'Niche accumulation and standardization e the case of electric vehicle recharging plugs', *Journal of Cleaner Production*. Elsevier Ltd, 94, pp. 155–164. doi: 10.1016/j.jclepro.2015.01.069.

Bakker, S., Maat, K. and van Wee, B. (2014) 'Stakeholders interests, expectations, and strategies regarding the development and implementation of electric vehicles: The case of the Netherlands', *Transportation Research Part A: Policy and Practice*. Elsevier Ltd, 66(1), pp. 52–64. doi: 10.1016/j.tra.2014.04.018.

Barrutia, J. M. *et al,* (2014) 'From Rio to Rio+20: twenty years of participatory, long term oriented and monitored local planning?', *Journal of Cleaner Production*. Elsevier Ltd, 106, pp. 594–607. doi: 10.1016/j.jclepro.2014.12.085.

Bauwens, T. (2016) 'Explaining the diversity of motivations behind community renewable energy', *Energy Policy*. Elsevier, 93, pp. 278–290. doi: 10.1016/j.enpol.2016.03.017.

Bauwens, T., Gotchev, B. and Holstenkamp, L. (2016) 'What drives the development of community energy in Europe? the case of wind power cooperatives', *Energy Research and Social Science*. Elsevier Ltd, 13, pp. 136–147. doi: 10.1016/j.erss.2015.12.016.

Beasley, T. M. and Schumacker, R. E. (1995) 'Multiple Regression Approach to Analyzing Contingency Tables: Post Hoc and Planned Comparison Procedures', *The Journal of Experimental Education*, 64(1), pp. 79–93. doi: 10.1080/00220973.1995.9943797.

Beck, U. (1992) *Risk Society: Towards a New Modernity*, *Risk Society: Towards a New Modernity*. London: Sage Publications Ltd. doi: 10.2307/2579937.

Becker, S., Kunze, C. and Vancea, M. (2017) 'Community energy and social entrepreneurship: Addressing purpose, organisation and embeddedness of renewable energy projects', *Journal of* Cleaner Production, 147, pp. 25–36. doi: 10.1016/j.jclepro.2017.01.048.

BEIS (2018a) 2016 UK Greenhouse Gas Emissions, Office for National Statistics. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/679334/2016_Final_Emissions_Statistics_one_page_summary.pdf (Accessed: 18 May 2018).

BEIS (2018b) UK Energy Security, Gov.uk.

BEIS (2014) Urban Community Energy Fund - Detailed guidance, Gov.uk. Available at: https://www.gov.uk/guidance/urban-community-energy-fund.

Bell, J., Massola, J. and Zimmerman, S. (2010) *Nonprofit Sustainability: Making Strategic Decisions for Financial Viability*. New Jersey: John Wiley & Sons.

Berg, B. and Lune, H. (2012) Qualitative Research Methods for the Social Science. 8th edn. Edinburgh: Pearson Education Limited.

Birkhölzer, K. (2015) Social Enterprise in Germany : A Typology of Models. 15. Liege.

Blowers, A. (1997) 'Environmental Policy: Ecological Modernization or the Risk Society?', Urban Studies, 34(5–6), pp. 845–871. doi: 10.1080/0042098975853.

Boait, P. (2009) 'Energy Services and ESCos – their benefits and implications for regulation and the consumer', (October), pp. 1–29. Available at: https://www.ofgem.gov.uk/ofgem-publications/52028/ofgem-rpi-x20-esco-paper-final.pdf.

Bondarenko, P. (2018) 'Sunk Cost', *Encycolpeadia Britannica*. Britannica Online Academic Edition.

Bosman, R. *et al*. (2014) 'Discursive regime dynamics in the Dutch energy transition', Environmental Innovation and Societal Transitions. Elsevier B.V., 13, pp. 45–59. doi: 10.1016/j.eist.2014.07.003.

Brandt, U. S. and Svendsen, G. T. (2013) 'Is local participation always optimal for sustainable action? The costs of consensus-building in Local Agenda 21', Journal of Environmental Management. Elsevier Ltd, 129, pp. 266–273. doi: 10.1016/j.jenvman.2013.07.020.

Braun, V. and Clarke, V. (2013) Successful Qualitative Research: a practical guide for beginners. London: Sage Publications Ltd.

Brouard, F. and Vieta, M. (2015) 'Social Enterprise Models in Canada — Ontario', 6(1), pp. 63–82.

Brown, J. (2011) The practitioners' guide to community shares, Co-operatives UK. Manchester. Available at: http://www.bakerbrown.co.uk/practitioners_guide_to_community_shares.pdf.

Brown, J. (2017) 'What does a good PPA look like - CEC 2017 - Josh Brown', in Community Energy Conference. Manchester: Co-op Energy.

Brummer, V. (2018) 'Community energy - benefits and barriers: A comparative literature review of Community Energy in the UK, Germany and the USA, the benefits it provides for society and the barriers it faces', *Renewable and Sustainable Energy Reviews*, 94, pp. 187–196.

Bryman, A. (2016) Social Research Methods. Edited by 5th. Oxford: Oxford University Press.

Bryman, A. and Bell, E. (2011) Business Research Methods. 3rd edn. Oxford: Oxford University Press.

Bulkeley, H., Castan Broto, V. and Maassen, a. (2013) 'Low-carbon Transitions and the Reconfiguration of Urban Infrastructure', Urban Studies, 51(7), pp. 1471–1486. doi: 10.1177/0042098013500089.

Bull, M. and Ridley-Duff, R. (2018) 'Towards an Appreciation of Ethics in Social Enterprise Business Models', Journal of Business Ethics. Springer Netherlands, (0123456789), pp. 1–16. doi: 10.1007/s10551-018-3794-5.

Burrell, G. and Morgan, G. (1979) Sociological Parasigms and Organisational Analysis. New Hampshire: Heinemann.

Bush, R. E. *et al,* (2017) 'The role of intermediaries in low carbon transitions e Empowering innovations to unlock district heating in the UK', *Journal of Cleaner Production*. Elsevier Ltd, 148(April 2013), pp. 137–147. doi: 10.1016/j.jclepro.2017.01.129.

Byerly, R. T. (2014) 'The social contract, social enterprise, and business model innovation', *Social Business*, 4(4), pp. 325–343.

Canard, F. (2011) 'W. E. Deming, Pragmatism and sustainability', in 17th Annual International Deming Research Seminar. New York, pp. 1–17.

Carson, N. *et al.* (2008) *Decentralised Energy: Business Opportunity in Resource Efficiency and Carbon Management*. Available at: https://www.cisl.cam.ac.uk/publications/publication-pdfs/decentralised-energy.pdf.

Ceschin, F. (2014) 'How the Design of Socio-technical Experiments Can Enable Radical Changes for Sustainability', 8(3), pp. 1–22.

Chesbrough, H. (2010) 'Business model innovation: Opportunities and barriers', *Long Range Planning*. Elsevier Ltd, 43(2–3), pp. 354–363. doi: 10.1016/j.lrp.2009.07.010.

Cieslik, K. (2016) 'Moral Economy Meets Social Enterprise Community-Based Green Energy Project in Rural Burundi', *World Development*. Elsevier Ltd, 83, pp. 12–26. doi: 10.1016/j.worlddev.2016.03.009.

Clandinin, J. and Connelly, M. (2000) Narrative inquiry: Experience and story in qualitative research. San Fransisco: Jossey-Bass Publishers.

Co-operative Heritage Trust (2015) *Rochdale Pioneers*. Available at: http://www.rochdalepioneersmuseum.coop/ (Accessed: 6 October 2015).

Co-operatives UK (2016) Community Energy, Co-operatives UK. Available at: https://www.uk.coop/promoting-co-ops/influencing-policy/energy-co-ops (Accessed: 25 April 2018).

Coalition for Community Energy (2017) Small-Scale Community Soalr Guide. Sydney. Available at: http://c4ce.net.au/wp-content/uploads/2017/09/C4CE-Small-Scale-Community-Solar-Guide-v2.pdf.

Coenen, L., Benneworth, P. and Truffer, B. (2012) 'Toward a spatial perspective on sustainability transitions', *Research Policy*. Elsevier B.V., 41(6), pp. 968–979. doi: 10.1016/j.respol.2012.02.014.

Coenen, L., Raven, R. and Verbong, G. (2010) 'Local niche experimentation in energy transitions: A theoretical and empirical exploration of proximity advantages and disadvantages', *Technology in Society*. Elsevier Ltd, 32(4), pp. 295–302. doi: 10.1016/j.techsoc.2010.10.006.

Cohen, M. J. (1997) 'RISK SOCIETY AND Alternative', *Futures*, 29(2), pp. 105–119.

Coleman, J. (1990) *Foundations of Social Theory*. Cambridge: Harvard University Press.

Community Energy England (2017) Community Energy State of the sector: A study 2017 of community energy in England, Wales and Northern Ireland. Sheffield. Available at: https://communityenergyengland.org/files/document/51/1499247266_CommunityEnergy-StateoftheSectorReport.pdf.

Crabbé, A. *et al,* (2013) 'Transition towards sustainable material innovation: Evidence and evaluation of the Flemish case', *Journal of Cleaner Production*. Elsevier Ltd, 56, pp. 63–72. doi: 10.1016/j.jclepro.2012.01.023.

Cresswell, J. (2015) A concise introduction to mixed methods research. London: Sage.

Crotty, M. (1998) The Foundations of Social Research. London: Sage.

Dallamaggiore Eve *et al*. (2016) Energy System Stakeholder Characterisation: Deliverable D2.1 of the ENTRUST H2020 Project, ENTRUST H2020 Project. Cork.

Damyanovic, D. and Reinwald, F. (2014) 'The "Comprehensive village renewal programme in Burgenland" as a means a strengthening the social capital in rural areas', *European Countryside*, 1, pp. 18–35. doi: 10.2478/euco-2014-0003.

Dart, R. (2004) 'The legitimacy of social enterprise', *Nonprofit and Voluntary Sector Quarterly*, 14(4), pp. 411–424. doi: 10.1002/nml.43.

Davies, M. (2007) Doing a successful research project: Using qualitative or quantitative methods. London: Palgrave MacMillan.

DECC (2015) 'Consultation on a review of the Feed - in Tariffs scheme 27', (August).

DECC (2014) DECC Community Energy Strategy : People Powering Change. London. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/275164/20140126_Community_Energy_Strategy_summary.pdf.

DECC (2013) £15m fund for rural energy projects opens to applications, Economic Growth in rural areas. Available at: https://www.gov.uk/government/news/15m-fund-for-rural-energy-projects-opens-to-applications.

Defourny, J. and Nyssens, M. (2010) 'Social enterprise in Europe: At the crossroads of market , public policies and third sector', *Policy and Society*. Policy and Society Associates Ltd Partnership, 29, pp. 231–242. doi: 10.1016/j.polsoc.2010.07.002.

DePoy, E. and Gitlin, L. (2016) Introduction to Research: Understanding and applying multiple strategies. St. Louis: Elsevier.

Devine-Wright, P. *et al,* (2017) 'A conceptual framwork for understanding the social acceptance of energy infrastructure: Insights from energy storage', Energy Policy2, 107(c), pp. 27–31.

Dewey, J. (1937) 'Democracy and educational administration', School and Society, 47(April), pp. 457–467.

Dierckx de Casterle, B. *et al,* (2012) 'QUAGOL : A guide for qualitative data analysis', International Journal of Nursing Studies, 49, pp. 360–371. doi: 10.1016/j.ijnurstu.2011.09.012.

Diesendorf, M. (2000) 'Sustainability and Sustainable Development', in *Sustainability: The corporate challenge of the 21st centuary*. Sydney: Allen & Unwin, pp. 19–37. doi: 10.1007/978-3-642-28036-8_662.

Dosi, G. (1982) 'Technological paradigms and technological trajectories', *Research Policy*, 11(3), pp. 147–162. doi: 10.1016/0048-7333(93)90041-F.

Douglas, I. (2014) 'The political filter in the local implementation of initiatives relating to urban ecology', *Landscape and Urban Planning*. Elsevier B.V., 125, pp. 312–319. doi: 10.1016/j.landurbplan.2014.02.008.

DTI (2002) *A Strategy for Social Enterprise*. London.

van Eijck, J. and Romijn, H. (2008) 'Prospects for Jatropha biofuels in Tanzania: An analysis with Strategic Niche Management', Energy Policy, 36(1), pp. 311–325. doi: 10.1016/j.enpol.2007.09.016.

Electricity North West (2017) Community Energy Partnerships, Energy Storage, Local Generation and Distribution - Transforming Energy in Cumbria. Available at: https://www.enwl.co.uk/globalassets/innovation/innovation-documents/transforming-energy-in-cumbria.pdf (Accessed: 9 November 2017).

Elkington, J. (1999) *Cannibals with forks: the triple bottom line of 21st century business*. Oxford: Capstone Publishing.

ENTRUST (2014) Energy System Transition Through Stakeholder Activation, Education and Skills Development: The Project. Available at: http://www.entrust-h2020.eu/the-project/ (Accessed: 12 July 2016).

European Commission (2018) What is an SME?, Growth. Available at: http://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en (Accessed: 10 May 2018).

Faber, N., Jorna, R. and Van Engelen, J. (2005) 'The sustainability of "sustainability"', *Journal of Environmental Assessment Policy and Management*, 7(1), pp. 1–33.

Faherty, T. R. and Morrissey, J. E. (2014) 'Challenges to active transport in a car-dependent urban environment : a case study of Auckland , New Zealand', International Journal of Environmental Science & Technology, 11(8), pp. 2369–2386. doi: 10.1007/s13762-014-0563-6.

Farla, J. *et al,* (2012) 'Sustainability transitions in the making: A closer look at actors, strategies and resources', *Technological Forecasting and Social Change*. Elsevier Inc., 79(6), pp. 991–998. doi: 10.1016/j.techfore.2012.02.001.

Feola, G. and Nunes, R. (2014) 'Success and failure of grassroots innovations for addressing climate change: The case of the transition movement', *Global Environmental Change*. Elsevier Ltd, 24(1), pp. 232–250. doi: 10.1016/j.gloenvcha.2013.11.011.

Finley-Brook, M. and Holloman, E. L. (2016) 'Empowering energy justice', *International Journal of Environmental Research and Public Health*, 13(9). doi: 10.3390/ijerph13090926.

Finn, T. (2018) 'Pound sterling sufferes worst quarter since Brexit vote', *The Independent*, July.

Forman, A. (2017) 'Energy justice at the end of the wire: Enacting community energy and equity in Wales', Energy Policy. Elsevier Ltd, 107(May), pp. 649–657. doi: 10.1016/j.enpol.2017.05.006.

Fowler, F. J. (2002) Survey Research Methods. Edited by 3rd. London: Sage Publications Ltd.

Franklin, A. and Marsden, T. (2014) '(Dis)connected communities and sustainable place-making', *Local Environment*, 0(May), pp. 1–17. doi: 10.1080/13549839.2013.879852.

Friedl, C. and Reichl, J. (2016) 'Realizing energy infrastructure projects – A qualitative empirical analysis of local practices to address social acceptance', Energy Policy. Elsevier, 89, pp. 184–193. doi: 10.1016/j.enpol.2015.11.027.

García-Pérez, M. A. and Núñez-Antón, V. V. (2003) 'Cellwise Residual Analysis in Two-Way Contingency Tables', Educational and Psychological Measurement, 63(5), pp. 825–839. doi: 10.1177/0013164403251280.

Geels, F. and Deuten, J. J. (2006) 'Local and global dynamics in technological development: a socio-cognitive perspective on knowledge flows and lesons from reinforced concrete', *Science and Public Poicy*, 33(4), pp. 265–275.

Geels, F. W. (2002) 'Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study', *Research Policy*, 31, pp. 1257–1274. doi: 10.1016/S0048-7333(02)00062-8.

Geels, F. W. (2005) 'Processes and patterns in transitions and system innovations: Refining the co-evolutionary multi-level perspective', *Technological Forecasting and Social Change*, 72(6 SPEC. ISS.), pp. 681–696. doi: 10.1016/j.techfore.2004.08.014.

Geels, F. W. (2012) 'A socio-technical analysis of low-carbon transitions: introducing the multi-level perspective into transport studies', *Journal of Transport Geography*. Elsevier Ltd, 24, pp. 471–482. doi: 10.1016/j.jtrangeo.2012.01.021.

Geels, F. W. *et al,* (2015) 'A critical appraisal of Sustainable Consumption and Production research: The reformist, revolutionary and reconfiguration positions', *Global Environmental Change*. Elsevier Ltd, 34, pp. 1–12. doi: 10.1016/j.gloenvcha.2015.04.013.

Geels, F. W. *et al,* (2016) 'The enactment of socio-technical transition pathways: A reformulated typology and a comparative multi-level analysis of the German and UK low-carbon electricity transitions (1990-2014)', *Research Policy*. Elsevier B.V., 45(4), pp. 896–913. doi: 10.1016/j.respol.2016.01.015.

Geels, F. W. *et al,* (2018) 'Reducing energy demand through low carbon innovation: A sociotechnical transitions perspective and thirteen research debates', *Energy Research and Social Science*. Elsevier, 40(June), pp. 23–35. doi: 10.1016/j.erss.2017.11.003.

Geels, F. W. and Johnson, V. (2018) 'Towards a modular and temporal understanding of system diffusion: Adoption models and socio-technical theories applied to Austrian biomass district-heating (1979–2013)', *Energy Research and Social Science*. Elsevier, 38(April), pp. 138–153. doi: 10.1016/j.erss.2018.02.010.

Geels, F. W. and Kemp, R. (2012) 'The multi-level perspective as a new perspective for studying socio-technical transtions', in *Automobility in Transition? A Socio-Technical Analysis of Sustainable Transport*. Oxon: Routledge, pp. 49–79.

Geels, F. W. and Schot, J. (2007) 'Typology of sociotechnical transition pathways', *Research Policy*, 36(3), pp. 399–417. doi: 10.1016/j.respol.2007.01.003.

Germak, A. J. and Singh, K. K. (2010) 'Social entrepreneurship: Changing the way social workers do business', *Administration in Social Work*, 34(1), pp. 79–95. doi: 10.1080/03643100903432974.

Gibbs, D. (2017) 'Ecological Modernization', *The International Encyclopedia of Geography: People, the earth, environmnet and technology*. Available at: https://onlinelibrary.wiley.com/doi/full/10.1002/9781118786352.wbieg0434.

Giddens, A. (1999) 'Modern law review', *The Modern Law Review*, 62(1), pp. 1–10. doi: 10.1111/j.1468-2230.2008.00711.x.

Gill, J. and Johnson, P. (2010) Research Methods for Managers. 4th edn. London: Sage.

Global Footprint Network (2015) *World Footprint - Do we fit he planet?* Available at: http://www.footprintnetwork.org/en/index.php/GFN/page/world_footprint/ (Accessed: 12 January 2016).

Good Energy (2016) Good Energy Community Energy. London.

Good Energy (2018) Power Purchase Agreements, Good Energy. Available at: https://www.goodenergy.co.uk/business/our-generators/power-purchase-agreements-ppas/ (Accessed: 25 April 2018).

Grassl, W. (2012) 'Business Models of Social Enterprise : A Design Approach', 1(1), pp. 37–60.

Gray, D. (2009) Doing research in the real world. 2nd edn. London: Sage.

Griffin, E. (2006) A First Look at Communication Theory. Boston: McGraw Hill.

Gul, M., Kotak, Y. and Muneer, T. (2016) Review on recent trend of solar photovoltaic technology, Energy Exploration & Exploitation. doi: 10.1177/0144598716650552.

Hannon, M. J. and Bolton, R. (2015) 'UK Local Authority engagement with the Energy Service Company (ESCo) model: Key characteristics, benefits, limitations and considerations', *Energy Policy*. Elsevier, 78, pp. 198–212. doi: 10.1016/j.enpol.2014.11.016.

Harding, J. (2013) 'Usability of geographic information e Factors identi fi ed from qualitative analysis of task-focused user interviews', Applied Ergonomics. Elsevier Ltd, 44(6), pp. 940–947. doi: 10.1016/j.apergo.2012.11.013.

Hargreaves, T. *et al,* (2013) 'Grassroots innovations in community energy : The role of intermediaries in niche development', *Global Environmental Change*. Elsevier Ltd, 23(5), pp. 868–880. doi: 10.1016/j.gloenvcha.2013.02.008.

Hasan, M. N. (2018) 'Techno-environmental risks and ecological modernisation in "double-risk" societies: reconceptualising Ulrich Beck's risk society thesis', *Local Environment*. Taylor & Francis, 23(3), pp. 258–275. doi: 10.1080/13549839.2017.1413541.

Hatzl, S. *et al,* (2016) 'Market-based vs. grassroots citizen participation initiatives in photovoltaics: A qualitative comparison of niche development', *Futures*. Elsevier Ltd, 78–79, pp. 57–70. doi: 10.1016/j.futures.2016.03.022.

Hay, I. (2000) Qualitative Research Methods in Human Geography. Oxford: Oxford University Press.

Healy, N. and Barry, J. (2017) 'Politicizing energy justice and energy system transitions: Fossil fuel divestment and a "just transition"', *Energy Policy*. Elsevier Ltd, 108(November 2016), pp. 451–459. doi: 10.1016/j.enpol.2017.06.014.

Heffron, R. J., McCauley, D. and Sovacool, B. K. (2015) 'Resolving society's energy trilemma through the Energy Justice Metric', *Energy Policy*. Elsevier, 87, pp. 168–176. doi: 10.1016/j.enpol.2015.08.033.

Heiskanen, E. *et al,* (2010) 'Low-carbon communities as a context for individual behavioural change', *Energy Policy*. Elsevier, 38(12), pp. 7586–7595. doi: 10.1016/j.enpol.2009.07.002.

Hermans, F. *et al,* (2013) 'Niches and networks : Explaining network evolution through niche formation processes', *Research Policy*. Elsevier B.V., 42(3), pp. 613–623. doi: 10.1016/j.respol.2012.10.004.

Hermwille, L. (2016) 'The role of narratives in socio-technical transitions - Fukushima and the energy regimes of Japan, Germany, and the United Kingdom', *Energy Research and Social Science*. Elsevier Ltd, 11, pp. 237–246. doi: 10.1016/j.erss.2015.11.001.

Heron, J. (1996) Co-operative Inquiry: Research into the Human Condition. London: Sage.

Hielscher, S. (2011) 'Community Energy in the UK A Review of the Research Literature', p. 63. Available at: www.grassrootsinnovations.org!

Hillebrand, R. (2013) 'Climate protection, energy security, and Germany's policy of ecological modernisation', *Environmental Politics*. Routledge, 22(4), pp. 664–682. doi: 10.1080/09644016.2013.806627.

Hillman, J., Axon, S. and Morrissey, J. (2018) 'Social enterprise as a potential niche innovation breakout for low carbon transition'. *Energy Policy*. Elsevier, 117, pp. 445-456. doi: 10.1016/j.enpol.2018.03.038.

Hiteva, R. and Sovacool, B. (2017) 'Harnessing social innovation for energy justice: A business model perspective', *Energy Policy*. Elsevier Ltd, 107(November 2016), pp. 631–639. doi: 10.1016/j.enpol.2017.03.056.

HM Treasury (2014) *Autumn Statement 2014*, *Cm 8961*.

Hoffman, S. M. *et al.* (2013) 'Public values and community energy: Lessons from the US and UK', Sustainability (Switzerland), 5(4), pp. 1747–1763. doi: 10.3390/su5041747.

Holden, E., Linnerud, K. and Banister, D. (2014) 'Sustainable development: Our Common Future revisited', *Global Environmental Change*. Elsevier Ltd, 26(1), pp. 130–139. doi: 10.1016/j.gloenvcha.2014.04.006.

Holstenkamp, L. and Kahla, F. (2016) 'What are community energy companies trying to accomplish? An empirical investigation of investment motives in the German case', *Energy Policy*. Elsevier, 97, pp. 112–122. doi: 10.1016/j.enpol.2016.07.010.

Hopkins, L. (2010) *Mapping the Third Sector : A context for social leadership A report prepared for Clore Social Leadership Programme*.

Horlings, L. G. and Marsden, T. K. (2011) 'Towards the real green revolution? Exploring the conceptual dimensions of a new ecological modernisation of agriculture that could "feed the world"', *Global Environmental Change*. Elsevier Ltd, 21(2), pp. 441–452. doi: 10.1016/j.gloenvcha.2011.01.004.

van der Horst, D. (2008) 'Social enterprise and renewable energy: emerging initiatives and communities of practice', *Social Enterprise Journal*, 4(3), pp. 171–185.

van der Horst, D. (2012) 'Energy Issues and Social Sciences .', in *Energy Issues and Social Sciences. Theories and Applications*. Milano: McGraw-Hill, pp. 71–79.

Hossain, M. (2016) 'Hossain 2016 grassroots innovation', *Journal of Cleaner Production*, 137, pp. 973–981.

Hovardas, T. (2016) 'Two paradoxes with one stone: A critical reading of ecological modernization', *Ecological Economics*. Elsevier B.V., 130, pp. 1–7. doi: 10.1016/j.ecolecon.2016.06.023.

Huber, J. (2008) 'Pioneer countries and the global diffusion of environmental innovations: Theses from the viewpoint of ecological modernisation theory', *Global Environmental Change*, 18(3), pp. 360–367. doi: 10.1016/j.gloenvcha.2008.03.004.

Ilac, E. (2018) 'Exploring social enterprise leadership development through phenomenological analysis', *Social Enterprise Journal*, 14(1), pp. 71–91. doi: http://dx.doi.org/10.1108/MRR-09-2015-0216.

Jackson, T. (2005) 'Live better by consuming less? Is there a "double dividend" in sustainable consumption?', *Journal of Industrial Ecology*, 9(1–2), pp. 19–36. doi: 10.1162/1088198054084734.

Jackson, T. (2007) 'Sustainable consumption', in Handbook of sustainable development. Edward Elgar Publishing, p. 254.

Jackson, T. (2009) *Prosperity without growth? The transition to a sustainable economy*. London: Routledge.

Jain, A. *et al*. (2010) 'Sustainable energy plan for an Indian village', 2010 International Conference on Power System Technology, pp. 1–8. doi: 10.1109/POWERCON.2010.5666618.

Jänicke, M. (2008) 'Ecological modernisation: new perspectives', *Journal of Cleaner Production*, 16(5), pp. 557–565. doi: 10.1016/j.jclepro.2007.02.011.

Jenkins, K. *et al,* (2016) 'Energy Research & Social Science Energy justice : A conceptual review'. Elsevier Ltd, 11, pp. 174–182. doi: dx.doi.org/10.1016/j.erss.2015.10.004.

Johanisova, N., Crabtree, T. and Fra, E. (2013) 'Social enterprises and non-market capitals : a path to degrowth ?', 38, pp. 7–16. doi: 10.1016/j.jclepro.2012.01.004.

Jones, M. (2014) The practice of organisational fieldwork. London: Sage.

Kaminski, J. (2006) 'Beyond capitalism: A critique of Max Weber's general understanding of Islamic discourse', Intellectual Discourse, 24(1), pp. 35–58.

Kavous, A. (2009) 'Globalization and culture: four paradigmatic views', International Journal of Social Economics, 36(5), pp. 513–534.

Kemp, R. (1994) 'Technology and the transition to environmental sustainability', *Futures*, 26(10), pp. 1023–1046. doi: 10.1016/0016-3287(94)90071-X.

Kemp, R., Schot, J. and Hoogma, R. (1998) 'Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management', *Technology Analysis & Strategic Management*, 10(2), pp. 175–198. doi: 10.1080/09537329808524310.

Kern, F. (2012) 'Using the multi-level perspective on socio-technical transitions to assess innovation policy', *Technological Forecasting and Social Change*. Elsevier Inc., 79(2), pp. 298–310. doi: 10.1016/j.techfore.2011.07.004.

Kern, F. and Rogge, K. S. (2016) 'The pace of governed energy transitions: Agency, international dynamics and the global Paris agreement accelerating decarbonisation processes?', Energy Research and Social Science. Elsevier Ltd, 22, pp. 13–17. doi: 10.1016/j.erss.2016.08.016.

Kivimaa, P. (2014) 'Government-affiliated intermediary organisations as actors in system-level transitions', *Research Policy*. Elsevier B.V., 43(8), pp. 1370–1380. doi: 10.1016/j.respol.2014.02.007.

Kivimaa, P. and Kern, F. (2016) 'Creative destruction or mere niche support ? Innovation policy mixes for sustainability transitions', *Research Policy*. Elsevier B.V., 45(1), pp. 205–217. doi: 10.1016/j.respol.2015.09.008.

Kok, G. *et al,* (2011) 'Changing energy-related behavior: An Intervention Mapping approach', *Energy Policy*. Elsevier, 39(9), pp. 5280–5286. doi: 10.1016/j.enpol.2011.05.036.

Kooij, H. J. *et al*. (2018) 'Between grassroots and treetops: Community power and institutional dependence in the renewable energy sector in Denmark, Sweden and the Netherlands', Energy Research and Social Science. Elsevier, 37(September 2017), pp. 52–64. doi: 10.1016/j.erss.2017.09.019.

Koopman, C. (2015) Pragmatism as Transition: Historicity and Hope in James, Dewey and Rorty. West Sussex: Columbia University Press.

Korhonen, J. (2007) 'Special issue of the Journal of Cleaner Production, "From Material Flow Analysis to Material Flow Management". strategic sustainability management on a principle level', *Journal of Cleaner Production*, 15(17), pp. 1585–1595. doi: 10.1016/j.jclepro.2006.08.005.

Kveton, V. *et al,* (2014) 'Contribution of Local Agenda 21 to Practical Implementation of Sustainable Development: The Case of the Czech Republic', *European Planning Studies*, 22(March 2015), pp. 515–536. doi: 10.1080/09654313.2012.753994.

Van der Laak, W., Raven, R.P.J.M. and Verbong, G.P.J. (2007) 'Strategic niche management for biofuels: analysing past experiments for developing new biofuel policies', Energy Policy, Vol. 35, pp.3213–3225.

Lachman, D. a. (2013) 'A survey and review of approaches to study transitions', *Energy Policy*. Elsevier, 58, pp. 269–276. doi: 10.1016/j.enpol.2013.03.013.

Lambe, F. *et al,* (2015) 'Energy Research & Social Science Can carbon finance transform household energy markets ? A review of cookstove projects and programs in Kenya', *Energy Research & Social Science*. Elsevier Ltd, 5, pp. 55–66. doi: 10.1016/j.erss.2014.12.012.

Leadbeater, C. (2007) *Social enterprise and social innovation: Strategies for the next ten years*, *Office of Third Sector*. Available at: http://community-wealth.org/_pdfs/articles-publications/outside-us/paper-leadbeater.pdf.

Lemprière, M. (2016) 'Using ecological modernisation theory to account for the evolution of the zero-carbon homes agenda in England', *Environmental Politics*. Taylor & Francis, 25(4), pp. 690–708. doi: 10.1080/09644016.2016.1156107.

Lindén, A. L., Carlsson-Kanyama, A. and Eriksson, B. (2006) 'Efficient and inefficient aspects of residential energy behaviour: What are the policy instruments for change?', *Energy Policy*, 34(14), pp. 1918–1927. doi: 10.1016/j.enpol.2005.01.015.

Longhurst, N. (2015) 'Towards an "alternative" geography of innovation: Alternative milieu, socio-cognitive protection and sustainability experimentation', *Environmental Innovation and Societal Transitions*, 17, pp. 183–198. doi: 10.1016/j.eist.2014.12.001.

Lowe, P. and Phillipson, J. (2006) 'Reflexive Interdisciplinary Research: The Making of a Research Programme on the Rural Economy and Land Use', *Journal of Agricultural Economics*, 57(2), pp. 165–184.

Lyon, F. and Fernandez, H. (2012) 'Strategies for scaling up social enterprise: lessons from early years providers', *Social Enterprise Journal*, 8(1), pp. 63–77. doi: http://dx.doi.org/10.1108/MRR-09-2015-0216.

MacDonald, P. and Gardner, R. (2000) 'Type 1 error rate comparisions of post hoc procedures for 1 j Chi-Square tables', Educational and Psychological Measurement, 60(5), pp. 735–754.

Madlener, R. and Schmid, C. (2003) 'Adoption and Diffusion of Decentralised Energy Conversion Technologies: The Success of Engine Co-Generation in Germany', Energy & Environment, 14(5), pp. 627–662. doi: 10.1260/095830503322663384.

Markard, J., Raven, R. and Truffer, B. (2012) 'Sustainability transitions: An emerging field of research and its prospects', *Research Policy*. Elsevier B.V., 41(6), pp. 955–967. doi: 10.1016/j.respol.2012.02.013.

Maréchal, K. (2010) 'Not irrational but habitual: The importance of "behavioural lock-in" in energy consumption', Ecological Economics. Elsevier B.V., 69(5), pp. 1104–1114. doi: 10.1016/j.ecolecon.2009.12.004.

Martella, R. and Smaczniak, K. (2013) 'Introduction to Rio+ 20: A Reflection on Progress Since the First Earth Summit and the Opportunities that Lie Ahead', *Sustainable Development Law & Policy*, 12(3), pp. 4–7. Available at: http://digitalcommons.wcl.american.edu/cgi/viewcontent.cgi?article=1531&context=sdlp.

McAlinden, B. (2014) *A General Description of Electricity Networks in Great Britain*, *Institute of Civil Engineers*. Available at: https://www.ice.org.uk/knowledge-and-resources/briefing-sheet/electricity-transmission-and-distribution (Accessed: 18 May 2018).

McLellan, B. C., Chapman, A. J. and Aoki, K. (2016) 'Geography, urbanization and lock-in – considerations for sustainable transitions to decentralized energy systems', Journal of Cleaner Production. Elsevier Ltd, 128, pp. 77–96. doi: 10.1016/j.jclepro.2015.12.092.

Meadowcroft, J. (2009) 'What about the politics? Sustainable development, transition management, and long term energy transitions', *Policy Sciences*, 42(4), pp. 323–340. doi: 10.1007/s11077-009-9097-z.

Meehan, J., Meehan, K. and Richards, A. (2006) 'Corporate social responsibility: the 3c-SR model', *International Journal of Social Economics*, 33(5), pp. 386–398.

McMeekin, A. and Southerton, D. (2012) 'Sustainability transitions and final consumption: Practices and socio-technical systems', Technology Analysis and Strategic Management, 24(4), pp. 345–361. doi: 10.1080/09537325.2012.663960.

Middlemiss, L. (2017) 'A critical analysis of the new politics of fuel poverty in England', Critical Social Policy, 37(3), pp. 425–443.

Mikami, K. (2014). An alternative framework for the analysis of social enterprises. Journal of Co-Operative Organization and Management, 2(2), 92–97. https://doi.org/10.1016/j.jcom.2014.03.005

Miller, D. (2007) Virtual Private Networks. Available at: https://www.ofgem.gov.uk/ofgem-publications/43856/ce-electrics-paper-virtual-private-networks.pdf.

Mol, A. P. J. and Spaargaren, G. (2000) 'Ecological Modernisation Theory in Debate: A Review', *Environmental Politics*, 9(1), pp. 17–49. doi: 10.1080/09644010008414511.

Mol, A. and Sonnenfeld, D. a. (2000) 'Ecological modernisation around the world: an introduction', *Environmental politics*, 9(February 2015), pp. 3–16. doi: 10.1080/09644010008414510.

Moloney, S., Horne, R. E. and Fien, J. (2010) 'Transitioning to low carbon communities-from behaviour change to systemic change: Lessons from Australia', *Energy Policy*. Elsevier, 38(12), pp. 7614–7623. doi: 10.1016/j.enpol.2009.06.058.

Moser, C. A. and Kalton, G. (1993) Survey Methods in Social Investigation. Aldershot: Dartmouth Publishing Company Limited.

Mourik, R and Raven, R. (2006) *A practioner ' s view on Strategic Niche Management Towards a future research outline*. Available at: https://www.ecn.nl/docs/library/report/2006/e06039.pdf.

Mundaca, L., Busch, H. and Schwer, S. (2018) '"Successful" low-carbon energy transitions at the community level? An energy justice perspective', *Applied Energy*. Elsevier, 218(February), pp. 292–303. doi: 10.1016/j.apenergy.2018.02.146.

Munro, P. *et al,* (2016) 'Social enterprise development and renewable energy dissemination in Africa: The experience of the community charging station model in Sierra Leone', *Progress in Development Studies*, 16(1), pp. 24–38. doi: 10.1177/1464993415608080.

Naber, R. *et al,* (2017) 'Scaling up sustainable energy innovations', *Energy Policy*. Elsevier Ltd, 110(August 2017), pp. 342–354. doi: 10.1016/j.enpol.2017.07.056.

Neumayer, E. (2004) 'Indicators of Sustainability', in Tietenberg, T. and Folmer, H. (eds) *The International Yearbook of Environmental and Resource Economics 2004/2005*. Cheltenham: Edward Elgar.

Newell, P. and Mulvaney, D. (2013) 'The political economy of the "just transition"', *Geographical Journal*, 179(2), pp. 132–140. doi: 10.1111/geoj.12008.

Nolden, C. (2013) 'Governing community energy-Feed-in tariffs and the development of community wind energy schemes in the United Kingdom and Germany', *Energy Policy*. Elsevier, 63, pp. 543–552. doi: 10.1016/j.enpol.2013.08.050.

OECD (2012) *Perspectives on Global Development 2012 : Social Cohesion in a Shifting World Shifting wealth brings opportunities for social cohesion*. Paris.

Ofgem (2016) FIT tariff rates. Available at: https://www.ofgem.gov.uk/environmental-programmes/fit/fit-tariff-rates?page=2#block-views-publications-and-updates-block (Accessed: 9 December 2016).

OFGEM (2017a) Electricity generation mix by quarter and fuel source (GB), Elecricity - Wholesale Markets.

OFGEM (2017b) Installation Reports, Environmental Programmes. Available at: https://www.ofgem.gov.uk/environmental-programmes/fit/contacts-guidance-and-resources/public-reports-and-data-fit/installation-reports (Accessed: 1 October 2017).

OFGEM (2017c) Applicants, Feed-In Tariffs. Available at: https://www.ofgem.gov.uk/environmental-programmes/fit/applicants (Accessed: 6 November 2017).

OFGEM (2017d) Report - FIT summary, Central FIT Register. Available at: https://cfr.ofgem.gov.uk/#/reports/fitSummary (Accessed: 7 November 2017).

OFGEM (2018a) *How we work*. Available at: https://www.ofgem.gov.uk/about-us/how-we-work (Accessed: 10 August 2018).

OFGEM (2018b) *Onsite generation and metering*, *Ofgem*. Available at: https://www.ofgem.gov.uk/consumers/household-gas-and-electricity-guide/understand-smart-prepayment-and-other-energy-meters/onsite-generation-and-metering (Accessed: 8 August 2018).

Olsen, W. (2012) Data collection: Key debates and methods in social research. London: Sage Publications Ltd.

Osterwalder, A. and Pigneur, Y. (2004) 'An Ontology for E-Business Models', *Value Creation from E-Business Models*, pp. 65–97. doi: 10.1016/B978-075066140-9/50006-0.

Ottinger, G. (2013) 'The Winds of Change: Environmental Justice in Energy Transitions', *Science as Culture*, 22(2), pp. 222–229. doi: 10.1080/09505431.2013.786996.

Parag, Y. *et al,* (2013) 'Network approach for local and community governance of energy : The case of Oxfordshire $', *Energy Policy*. Elsevier, 62, pp. 1064–1077. doi: 10.1016/j.enpol.2013.06.027.

Pearson, P. and Watson, J. (2012) UK Energy Policy 1980-2010, A history and lessons to be learnt, Energy Policy. Sussex: Parliamentary Group for Energy Studies.

Peattie, K. and Morley, A. (2008) 'Eight paradoxes of the social enterprise research agenda', *Social Enterprise Journal*, 4(2), pp. 91–107.

Peris, J. *et al,* (2013) 'Prioritizing Local Agenda 21 Programmes using Analytic Network Process: A Spanish Case Study', *Sustainable Development*, 21(March 2011), pp. 338–352. doi: 10.1002/sd.514.

Pertti, A., Bickman, L. and Brannen, J. (2008) The Sage Handbook of Social Research Methods. London: Sage.

Phills, J. and Denend, L. (2005) *Social Entrepreneurs: Correcting Market Failures*. Watertown.

Popa, F., Guillermin, M. and Dedeurwaerdere, T. (2015) 'A pragmatist approach to transdisciplinarity in sustainability research: From complex systems theory to reflexive science', Futures. Elsevier Ltd, 65, pp. 45–56. doi: 10.1016/j.futures.2014.02.002.

Porter, M. E. (1985) *Advantage, Competitive*. New Yorkq: Free Press.

Porter, M. E. and Kramer, M. R. (2011) 'Creating Shared Value', *Harvard Business Review*, 89(1/2), pp. 62–77. doi: 10.1108/09600039410055963.

Porter, M. and Kramer, M. (2006) 'Strategy and Society: The link between competitive advantage and corportate social responsibility', *Harvard Business Review*, 84(December), pp. 78–92. doi: 10.1287/mnsc.1090.1070.

Putnam, R. D. (2000) *Bowling Alone: The collapse and revival of American community*. New York: Simon and Schuster.

Qastharin, A. (2015) 'Business Model Canvas for Social Enterprise', in *The 7th Indonesia International Conference on Innovation, Entrepreneurship and Small Business*. Bandung.

Rajkobal, P. (2014) 'Ecological modernisation and citizen engagement', *International Journal of Sociology and Social Policy*, 34(5/6), pp. 302–316. doi: 10.1108/IJSSP-02-2013-0023.

Raven, R. *et al,* (2016) 'The politics of innovation spaces for low-carbon energy: Introduction to the special issue', *Environmental Innovation and Societal Transitions*, 18, pp. 101–110. doi: 10.1016/j.eist.2015.06.008.

Raven, R., Bosch, S. Van den and Weterings, R. (2010) 'Transitions and strategic niche management: towards a competence kit for practitioners', *International Journal of Technology Management*, 51(1), pp. 57–74. doi: 10.1504/IJTM.2010.033128.

Read, A. (2000) 'Determinants of successful organisational innovation: a review of current research', *Journal of Management Practice*, 3(1), pp. 95–119.

Regen SW (2016) *Renewable energy: A local progress report for England*. London.

Rhodes, C. (2017) *Business statistics*, *House of Commons Library*. Available at: http://researchbriefings.files.parliament.uk/documents/SN06152/SN06152.pdf.

Ridley-Duff, R. (2008) 'Social enterprise as a socially rational business', *International Journal of Entrepreneurial Behavior & Research*, 14(5), pp. 291–312. doi: http://dx.doi.org/10.1108/MRR-09-2015-0216.

Ridley-Duff, R. (2009) 'Co-operative social enterprieses: company rules, access to finance and management practice', *Social Enterprise Journal*, 5(1), pp. 50–68. doi: http://dx.doi.org/10.1108/MRR-09-2015-0216.

Ridley-Duff, R. and Bull, M. (2011) Understanding Social Enterprise. London: Sage Publications Ltd.

Rip, A. and Kemp, R. (1998) 'Technological Change', in *Human choice and climate change*. Volume 4. Michigan: Battelle Press, pp. 327–399.

Rockström, J. *et al,* (2009) 'Planetary boundaries: Exploring the safe operating space for humanity', *Ecology and Society*, 14(2). doi: 10.5751/ES-03180-140232.

Rogers, J. C. *et al,* (2012) 'Social impacts of community renewable energy projects : findings from a woodfuel case study', *Energy Policy*. Elsevier, 42, pp. 239–247. doi: 10.1016/j.enpol.2011.11.081.

Romm, N. (1998) 'Interdisciplinary Practice as Reflexivity', *Systemic Practice and Action Research*, 11(1), pp. 63–77.

Rourke, E. (2017) *Sustainable Development Goals: progress and possibilities: November 2017*, *Office for National Statistics*. Available at: https://www.ons.gov.uk/economy/environmentalaccounts/articles/sustainabledevelopmentgoalstakingstockprogressandpossibilities/november2017.

Ruggiero, S., Martiskainen, M. and Onkila, T. (2018) 'Understanding the scaling-up of community energy niches through strategic niche management theory: Insights from Finland', *Journal of Cleaner Production*. Elsevier Ltd, 170, pp. 581–590. doi: 10.1016/j.jclepro.2017.09.144.

Sachs. I (1999) 'Socail Sustainability and whole development', in *Sustainability and the Social Sciences*. New York: Zed Books, pp. 25–36.

Sachs, J. (2015) *The Age of Sustainable Development*. New York: Columbia University Press.

Salavou, H., Baltas, G. and Lioukas, S. (2004) 'Article Information ':, *European Journal of Marketing*, 38(9/10), pp. 1091–1112. doi: 10.1108/EL-01-2014-0022.

Saldana, J. (2013) The Coding Manual for Qualitative Researchers. 2nd edn. London: Sage Publications Ltd.

Saunders, M., Lewis, P. and Thornhill, A. (2016) Research methods for business students. 6th edn. Harlow: Pearson Education Limited.

Van Der Schoor, T. *et al,* (2016) 'Challenging obduracy: How local communities transform the energy system', *Energy Research and Social Science*. Elsevier Ltd, 13, pp. 94–105. doi: 10.1016/j.erss.2015.12.009.

Schot, J. (1998) 'The usefulness of evolutionary models for explaining innovation. The case of the Netherlands in the nineteenth century', *History and Technology*, 14(3), pp. 173–200. doi: 10.1080/07341519808581928.

Schot, J. and Geels, F. W. (2007) 'Niches in evolutionary theories of technical change: A critical survey of the literature', *Journal of Evolutionary Economics*, 17(5), pp. 605–622. doi: 10.1007/s00191-007-0057-5.

Schot, J. and Geels, F. W. (2008) 'Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy', *Technology Analysis and Strategic Management*, 20(5), pp. 537–554. doi: 10.1080/09537320802292651.

Schot, J., Kanger, L. and Verbong, G. (2016) 'The roles of users in shaping transitions to new energy systems', *Nature Energy*, 54, pp. 1–7.

Schot, J., Slob, A. and Hoogma, R. (1996) 'De invoering van duurzame technologie : Strategisch Niche Management als beleidsinstrument', in *Programma DTO, Delft University of Technology, Delft, The Netherlands*.

Seetharaman, A. *et al,* (2016) 'Enterprise framework for renewable energy', *Renewable and Sustainable Energy Reviews*, 54, pp. 1368–1381.

Sen, A. (2013) 'The Ends and Means of Sustainability', *Journal of Human Development and Capabilities*, 14(1), pp. 6–20. doi: 10.1080/19452829.2012.747492.

Seyfang, G. *et al,* (2014) 'A grassroots sustainable energy niche? Reflections on community energy in the UK', *Environmental Innovation and Societal Transitions*. Elsevier B.V., 13, pp. 21–44. doi: 10.1016/j.eist.2014.04.004.

Seyfang, G. and Haxeltine, A. (2012) 'Growing grassroots innovations: Exploring the role of community-based initiatives in governing sustainable energy transitions', *Environment and Planning C: Government and Policy*, 30(3), pp. 381–400. doi: 10.1068/c10222.

Seyfang, G. and Longhurst, N. (2013) 'Desperately seeking niches : Grassroots innovations and niche development in the community currency field', *Global Environmental Change*. Elsevier Ltd, 23(5), pp. 881–891. doi: 10.1016/j.gloenvcha.2013.02.007.

Seyfang, G., Park, J. J. and Smith, A. (2013) 'A thousand flowers blooming? An examination of community energy in the UK', *Energy Policy*. Elsevier, 61, pp. 977–989. doi: 10.1016/j.enpol.2013.06.030.

Seyfang, G. and Smith, A., (2007) 'Grassroots innovations for sustainable development: towards a new research and policy agenda', Environmental Politics, 16(4), pp. 584-603.

Shay, E. et al, (2016) 'Identifying transportation disadvantage : Mixed-methods analysis combining GIS mapping with qualitative data', Transport Policy. Elsevier, 48, pp. 129–138. doi: 10.1016/j.tranpol.2016.03.002.

Shove, E. and Walker, G. (2007) 'CAUTION! Transitions ahead: Politics, practice, and sustainable transition management', *Environment and Planning A*, 39(4), pp. 763–770. doi: 10.1068/a39310.

Shove, E. and Walker, G. (2010) 'Governing transitions in the sustainability of everyday life', *Research*

Policy. Elsevier B.V., 39(4), pp. 471–476. doi: 10.1016/j.respol.2010.01.019.

Simonis, U. E. (2012). Ecological modernisation and renewable energy. Environmental Politics, 21(2), 346–348. https://doi.org/10.1080/09644016.2012.651915

Sinclair, S. *et al.* (2018) 'Social innovation, social enterprise, and local public services: Undertaking transformation?', *Social Policy & Administration*, pp. 1–15. doi: 10.1111/spol.12389.

Sitarz, D. (1993) *Agenda 21: The Earth Summit Strategy to Save Our Planet*. Boulder: Earth Press.

Slayton, R. and Spinardi, G. (2016) 'Radical innovation in scaling up: Boeing's Dreamliner and the challenge of socio-technical transitions', Technovation. Elsevier, 47, pp. 47–58. doi: 10.1016/j.technovation.2015.08.004.

Sloman, J. (2007) *Essentials of Economics*. 4th edn. Essex: Pearson Education Limited.

Smith. A., (2010) 'Civil Society in Sustainable Energy Transitions', in Governing the Energy Transition: reality, illusion *or necessity. New York: Routledge*

Smith, A. et al, (2014) 'Technological Forecasting & Social Change Spaces for sustainable innovation : Solar photovoltaic electricity in the UK', *Technological Forecasting & Social Change*. Elsevier Inc., 81(March 2012), pp. 115–130. doi: 10.1016/j.techfore.2013.02.001.

Smith, A. and Raven, R. (2012) 'What is protective space? Reconsidering niches in transitions to sustainability', *Research Policy*. Elsevier B.V., 41(6), pp. 1025–1036. doi: 10.1016/j.respol.2011.12.012.

Smith, A., Stirling, A. and Berkhout, F. (2005) 'The governance of sustainable socio-technical transitions', *Research Policy*, 34(10), pp. 1491–1510. doi: 10.1016/j.respol.2005.07.005.

Smith, A., Voß, J. P. and Grin, J. (2010) 'Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges', *Research Policy*, 39(4), pp. 435–448. doi: 10.1016/j.respol.2010.01.023.

Smith, D. A. and Seyfang, G. (2007) 'Grassroots Innovations for Sustainable Consumption', *Environmental Politics*, 16(1), pp. 584–603. doi: 10.1080/09644010701419121.

Smith, J. *et al,* (2017) 'Gathering around stories: Interdisciplinary experiments in support of energy system transitions', *Energy Research and Social Science*. Elsevier, 31(July), pp. 284–294. doi: 10.1016/j.erss.2017.06.026.

Social Economy Alliance (2015) *Who are we?* Available at: http://www.socialenterprise.org.uk/social-economy-alliance/who-are-we (Accessed: 6 October 2015).

Social Enterprise UK (2015) *Buy Social*. Available at: http://www.socialenterprise.org.uk/policy-campaigns/latest-campaigns/buy-social (Accessed: 6 October 2015).

Social Enterprise UK (2017) *Start Your Social Enterprise: The Social Enterprise Guide*. Available at: https://www.socialenterprise.org.uk/Handlers/Download.ashx?IDMF=b5514bc0-5a3b-4c4e-afe1-d8aaec3ebb19.

Sodhi, M. S. and Tang, C. S. (2011) 'Social enterprises as supply-chain enablers for the poor', *Socio-Economic Planning Sciences*. Elsevier Ltd, 45, pp. 146–153. doi: 10.1016/j.seps.2011.04.001.

Solomon, B. D. and Krishna, K. (2011) 'The coming sustainable energy transition: History, strategies, and outlook', *Energy Policy*. Elsevier, 39(11), pp. 7422–7431. doi: 10.1016/j.enpol.2011.09.009.

Solow, R. M. (1991) 'Sustainability: An Economist's Perspective', *Economics of the environment Selected readings*, 3, pp. 179–187.

Sovacool, B. K. *et al,* (2015) 'Integrating social science in energy research', Energy Research and Social Science. Elsevier Ltd, 6, pp. 95–99. doi: 10.1016/j.erss.2014.12.005.

Sovacool, B. K. *et al,* (2017) 'New frontiers and conceptual frameworks for energy justice', *Energy Policy*. Elsevier Ltd, 105(January), pp. 677–691. doi: 10.1016/j.enpol.2017.03.005.

Sovacool, B. K., & Hess, D. J. (2017). Ordering theories: Typologies and conceptual frameworks for sociotechnical change. Social Studies of Science, 47(5), 703–750. https://doi.org/10.1177/0306312717709363

Stavraki, G. (2014) Going Reflective: Making sense of the Process of Designing a Case Study under the Interpretive paradigm. London: Sage.

Steffen, W., Richardson, K., *et al,* (2015a) 'Sustainability. Planetary boundaries: guiding human development on a changing planet.', *Science (New York, N.Y.)*, 347(6223), p. 1259855. doi: 10.1126/science.1259855.

Steffen, W., Broadgate, W., *et al,* (2015b) 'The trajectory of the anthropocene: The great acceleration', *Anthropocene Review*, 2(1), pp. 81–98. doi: 10.1177/2053019614564785.

Steffen, W., Crutzen, P. J. and McNeill, J. R. (2007) 'The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature', *AMBIO: A Journal of the Human Environment*, 36(8), pp. 614–621. doi: 10.1579/0044-7447(2007)36[614:TAAHNO]2.0.CO;2.

Steg, L. and Vlek, C. (2009) 'Encouraging pro-environmental behaviour: An integrative review and research agenda', *Journal of Environmental Psychology*. Elsevier Ltd, 29(3), pp. 309–317. doi: 10.1016/j.jenvp.2008.10.004.

Stites, J. (2013) 'Is Your Town in Transition ?', *In These Times*, 14(1), pp. 19–27.

Stockton, H. and Campbell, R. (2011) 'Time to reconsider UK energy and fuel poverty policies?', p. 20. Available at: http://www.jrf.org.uk/publications/time-reconsider-uk-energy-and-fuel-policies.

Strezov, V., Evans, A. and Evans, T. J. (2017) 'Assessment of the Economic, Social and Environmental Dimensions of the Indicators for Sustainable Development', *Sustainable Development*, 25(3), pp. 242–253. doi: 10.1002/sd.1649.

Stuart, J. *et al,* (2014) 'Embracing sustainability: the incorporation of sustainability principles in municipal planning and policy in four mid-sized municipalities in Ontario, Canada', *Local Environment*, 9839(January 2015), pp. 1–22. doi: 10.1080/13549839.2014.936844.

Sullivan, A. (2002) 'TIreNetherlands 'Journal of Social Sciences - Volume 38 - 110. 2 - 2002', *The Netherlands'Toumal of Social Sciences*, 38(2), pp. 144–166.

Sunley, P. and Pinch, S. (2012) 'Financing social enterprise: social bricolage or evolutionary entrepreneurialism', *Social Enterprise Journal*, 8(2), pp. 108–122. doi: http://dx.doi.org/10.1108/MRR-09-2015-0216.

Sushandoyo, D., & Magnusson, T. (2014). Strategic niche management from a business perspective : taking cleaner vehicle technologies from prototype to series production. Journal of Cleaner Production, 74, 17–26. https://doi.org/10.1016/j.jclepro.2014.02.059

Sweeney, J. C. *et al,* (2013) 'Energy saving behaviours: Development of a practice-based model', *Energy Policy*. Elsevier, 61, pp. 371–381. doi: 10.1016/j.enpol.2013.06.121.

Tashakkori, A. and Teddlie, C. (2010) Handbook of mixed-methods in social & behavioural research. 2nd edn. Calif: Sage.

Teddlie, C. and Tashakkori, A. (2010) Foundations of mixed methods research: Integrating quantitative approaches in the social and behavioural sciences. London: Sage.

Temmes, A. *et al,* (2013) 'The Emergence of Niche Protection through Policies : The Case of Electric Vehicles Field in Finland', 26(3), pp. 37–62.

Thomas, A. (1996) 'What is development management_ - Thomas - 1996 - Journal of International Development - Wiley Online Library', *Journal of International Development*, 8(1), pp. 95–110.

Thompson, J. and Doherty, B. (2006) 'The diverse world of social enterprise', *International Journal of Social Economics*, 33(5/6), pp. 361–375.

Thompson, J. (2008) 'Social enterprise and social entrepreneurship: where have we reached?: A summary of issues and discussion points', *Social Enterprise Journal*, 4(2), pp. 149–161.

Tipper, H. (2013) Decentralised energy: powering a sustainable future, Carbon Trust.

TLT (2016) Private wire PPAs - why the focus now?, TLT. Available at: https://www.tltsolicitors.com/insights-and-events/insight/private-wire-ppas---why-the-focus-now/ (Accessed: 25 April 2018).

Toke, D. (2011a) 'Ecological modernisation, social movements and renewable energy', *Environmental Politics*, 20(1), pp. 60–77. doi: 10.1080/09644016.2011.538166.

Toke, D. (2011b) 'Revising Ecological Modernisation Theory', in *Ecological Modernisation and Renewable Energy*, pp. 7–40.

Trainer, T. (2015) 'Transition Townspeople : We need to think about transition (Just Doing Stuff is Far From Enough !)', *Social Alternatives*, 34(1), pp. 64–70.

Transition Network (2016) *Principles*, *Transition network.Org*. Available at: https://transitionnetwork.org/about-the-movement/what-is-transition/principles-2/ (Accessed: 11 April 2018).

Transition Network (2018) *Transition Near Me*, *Transition network.Org*. Available at: https://transitionnetwork.org/transition-near-me/ (Accessed: 11 April 2018).

Truffer, B., Metzner, a and Hoogma, R. (2002) 'The Coupling of Viewing and Doing. Strategic Niche Management and the electrification of individual transport', *Greener Management International*, pp. 111–124.

UNCC (2018) The Paris Agreement, United Nations Conference on Environmental & Development. Available at: https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement (Accessed: 18 May 2018).

UNDP (2017) 'Annex: Global Indicator Framework for the Sustainable Development Goals and Targets of the 2030 Agenda for Sustainable Development', *Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development*, pp. 1–21. Available at: https://unstats.un.org/sdgs/indicators/Global Indicator Framework_A.RES.71.313 Annex.pdf.

UNEP (2017) The Emissions Gap Report 2017 - A UN Environment Synthesis Report, United Nations Environment Programme (UNEP). Nairobi: United Nations Environmental Programme. doi: ISBN 978-92-9253-062-4.

United Nations (1992) *Agenda 21*, *United Nations Conference on Environmental & Development*. Rio de Janerio. doi: 10.1007/s11671-008-9208-3.

United Nations (2012) 'Report of the United Nations Conference on Sustainable Development', (June), pp. 1–126.

United Nations (2015a) *Sustainable Consumption and Production*, *Sustainable Development Knowledge Platform*. Available at: https://sustainabledevelopment.un.org/topics/sustainableconsumptionandproduction.

United Nations (2015b) *Sustainable Development Goals*, *UN.org*. Available at: https://www.un.org/sustainabledevelopment/sustainable-development-goals/ (Accessed: 11 April 2018).

United Nations (2015c) 'Transitioning from the MDGs to the SDGs : accountability for the post-2015 era', (25).

Vaughan-Morris, G. (2015) Cost and financing aspects of community renewable energy projects. Didcot. Available at: http://iea-retd.org/wp-content/uploads/2016/08/Cost-and-Financing-Community-Renewables-Volume-I-Main-Report.pdf.

Ventresca, M. and Mohr, J. (2002) 'Archival Research Methods', in Baum, J. (ed.) The Blackwell Companion to Organizations. Oxford: Wiley-Blackwell.

Verbong, G., Geels, F. W., & Raven, R. (2008). Multi-niche analysis of dynamics and policies in Dutch renewable energy innovation journeys (1970-2006): Hype-cycles, closed networks and technology-focused learning. Technology Analysis and Strategic Management, 20(5), 555–573. https://doi.org/10.1080/09537320802292719

Walker, G. (2012) *Environmental Justice: Concepts, Evidence and Politics*. Oxon: Routledge.

Walker, G. (2008) 'What are the barriers and incentives for community-owned means of energy production and use?', *Energy Policy*, 36(12), pp. 4401–4405. doi: 10.1016/j.enpol.2008.09.032.

Walker, G. and Devine-Wright, P. (2008) 'Community renewable energy: What should it mean?', *Energy Policy*, 36(2), pp. 497–500. doi: 10.1016/j.enpol.2007.10.019.

Warner, R. (2010) 'Ecological modernisation theory: Towards a critical ecopolitics of change?', *Environmental Politics*, 19(4), pp. 538–556. doi: 10.1080/09644016.2010.489710.

Waters, C. N. *et al*, (2016) 'The Anthropocene is functionally and stratigraphically distinct from the Holocene', Science, 351(6269). doi: 10.1126/science.aad2622.

Wattanakamolchai, S., Singal, M. and Murrmann, S. K. (2016) 'Socially Responsible Customers and the Evaluation of Service Quality', *Journal of Hospitality & Tourism Research*, 40(6), pp. 715–738. doi: 10.1177/1096348014525635.

Whitmarsh, L. (2012) 'How useful is the Multi-Level Perspective for transport and sustainability research?', Journal of Transport Geography. Elsevier Ltd, 24, pp. 483–487. doi: 10.1016/j.jtrangeo.2012.01.022.

Wiklund, J., Davidsson, P. and Delmar, F. (2008) 'What do they think and feel about growth? An Expectancy-Value approach to Small Business Managers' Attitudes Toward Growth', *Entrepreneurship Theory and Practice*, 27(3), pp. 247–270.

William, J. (1975) Pragmatism. Cambridge: Harvard University Press.

Wilson, C. (2014) 'CHAPTER 2 - Semi-Structured Interviews', in Interview Techniques for UX Practitioners. Waltham, MA, USA: Morgan Kauffmann. doi: 10.1016/B978-0-12-410393-1.00002-8.

Witkamp, M. J., Raven, R. P. J. M. and Royakkers, L. M. M. (2011) 'Strategic niche management of social innovations: the case of social entrepreneurship', *Technology Analysis & Strategic Management*, 23(6), pp. 667–681. doi: 10.1080/09537325.2011.585035.

Wittmayer, J. M. *et al,* (2015) 'Governing sustainability: a dialogue between Local Agenda 21 and transition management', *Local Environment*, 9839(October), pp. 1–17. doi: 10.1080/13549839.2015.1050658.

World Commission on Environment and Development (1987) *Report of the World Commission on Environment and Development: Our Common Future (The Brundtland Report)*. doi: 10.1080/07488008808408783.

WWF (2014) *The Living planet Report, 2014*. Washington: WWF International. doi: /.

WWF (2016) *Living Planet report: risk and resilience in a new era*, *WWF International*. doi: 978-2-940529-40-7.

Yates, D., Moore, D. and McCabe, G. (1999) The Practice of Statistics. New York: Freeman.

Yildiz, Ö. *et al.* (2015) 'Renewable energy cooperatives as gatekeepers or facilitators? Recent developments in Germany and a multidisciplinary research agenda', Energy Research and Social Science. Elsevier Ltd, 6, pp. 59–73. doi: 10.1016/j.erss.2014.12.001.

Zainon, S. *et al.* (2014) 'Legitimacy and sustainability of social enterprise: governance and accountability', *Procedia - Social and Behavioral Sciences*. Elsevier B.V., 145, pp. 152–157. doi: 10.1016/j.sbspro.2014.06.022.

Appendices

Appendix 1: The energy system in the UK

The UK's energy mix has changed drastically since the 18th century when Britain's main source of energy came from burning wood and charcoal. Since then several transitions are evident within the energy system in the UK. The timeline below sets out several pivotal points in history relating to the UK use of gas and coal (Dallamaggiore Eve *et al*, 2016);

- Early 1700's – Wood and charcoal
- Late 1800's – Gas used for street lights
- 1813 – First public gas works
- 1851 – Great exhibition
- Post 1851 – Gas becomes popular for cooking and heating but coal still prevalent.
- 1956 – Clean Air Act restricted the use of solid fuel in urban areas
- Post 1956 – Developments in gas production meant that gas could travel further
- 1960s – Small gas work factories closed in favour of the cheaper imported natural gas
- 1965 – Natural gas discovered on the coast of Yorkshire
- 1972 – Miner's strike
- 1973 – Oil crisis
- 1980's – Government privatised British Gas
- 1994 – Coal industry privatised

The timeline gives an interesting insight in to the rise and perpetuation fossil fuels in the UK. Significant turning points in the evolution of the UK energy system occurred at the industrial revolution, post-industrialisation and neo-liberal energy system (Geels *et al.*, 2016). Several characteristics are noteworthy about these distinct periods. Firstly, the time for a transition to a new energy system has historically spanned over multiple decades and are far more complex than substituting one technology for another involving a wide range of actors and the state (Kern and Rogge, 2016; Geels and Johnson, 2018). Secondly, the UK has a dependant relationship on fossil fuels (Geels *et al.*, 2016). Finally, and more recently, the privatisation of the energy sector saw the introduction of a regulatory body. Regulators are often seen within free-markets as a way to protect customers when a monopoly or oligopoly's exist (Levi-Faur, 2003).

From 1948 until 2008 coal was the dominant fuel used for electricity generation in the UK. The use of oil peaked in the 1970's which aligns with the peak oil crisis in 1973. The prevalence of gas and nuclear power then emerged over the following decades (OFGEM, 2017a). There are five types of energy that are prevalent within the energy mix; coal, oil, nuclear and more recently renewables. However, a clear

pattern of dependency on the use of fossil fuels is evident (OFGEM, 2017a). A transition to a more diversified energy mix and the reduction in the reliance on coal was evident between 2006 and 2017, however, natural gas then became the dominant fuel source during this period (OFGEM, 2017b). In terms of renewable energy, the most prevalent renewable sources were wind, solar and bioenergy (OFGEM, 2017b).

In terms of energy consumption in the UK, the general trend has seen energy use decrease since the 1970's (Department for Business Energy & Industrial Strategy, 2017a). Further insight can be gained from considering the four key sectors that make up the energy system; transport, domestic, industry and service (Department for Business Energy & Industrial Strategy, 2017a). Between 1970 and 2016 industry is the only sector that has decreased in energy use, this was mainly due to increasing energy efficiencies in production processes and a shift in the type of industry in the UK. In the domestic sector there has been an increase in energy use, BEIS (2017a) reports that this was due to the a 48% rise in the number of homes in the UK since the 1970s. BEIS (2017a) also report that the number of appliances owned by a household has increased, particularly across consumer electronics and home computing. A recent decrease in consumption from appliances is thought to be due to the improved efficiencies particularly across cold appliances and lighting. However, there will be a limit to how much energy efficiencies can solve the problem if the number of appliances owns per household continues to rise. The effect of electricity consumption in the transport sector is predicted to rise due to the transition towards electric vehicles (Bakker, S., *et al.,* 2014, Temmes, A. *et al.,* 2013). Energy security and the ability for the national grid to cope with increasing demand is a key challenge facing the UK government and the energy regulator (OFGEM, 2018a).

Appendix 2: Social Enterprise Questionnaire

LIVERPOOL JOHN MOORES UNIVERSITY

Social Enterprise Questionnaire

Welcome to this survey regarding social enterprises operating across Europe. This questionnaire relates to my PhD research into the role of social enterprise within a low-carbon economy. The survey consists of 5 sections and should take no longer than 10 minutes to complete.

By completing this survey you are consenting to be part of this research and for your data to be used as described in the information sheet provided.

Do you confirm that you have read the information above and in the participant information sheet and are still happy to participate?

- ❍ Yes
- ❍ No

Section 1 - Background information on your organisation

Q1.1 Where is your organisation based? Please provide town/city and country

Q1.2 How long has the organisation been in operation?

- ❍ Less than 1 year
- ❍ 1-2 years
- ❍ 2-4 years
- ❍ 4-10 years
- ❍ 10+ years

Q1.3 How many employees does your organisation have? (Volunteers may be included for the purposes of this survey)

Q1.4 In which sector does your organisation operate in?

Q1.5 What is the legal structure of your business?

Section 2 - Networks accessed by your organisation

Q2.1 How well connected is your organisation in terms of the following categories?

	Extremely well	Very well	Moderately well	Slightly well	Not well at all
Other social enterprises within your region	❍	❍	❍	❍	❍
Other social enterprises within the same sector	❍	❍	❍	❍	❍
Other social enterprises within the same sector and region	❍	❍	❍	❍	❍
Private and public partnerships	❍	❍	❍	❍	❍
Local councils	❍	❍	❍	❍	❍
Private organisations	❍	❍	❍	❍	❍
Influential people within the 'key network'	❍	❍	❍	❍	❍

Q2.2 In relation to the same networks, how important are these networks in relation to assisting you to achieve your organisational goals?

	Extremely important	Very important	Moderately important	Slightly important	Not at all important
Other social enterprises within your region	❍	❍	❍	❍	❍
Other social enterprises within the same sector	❍	❍	❍	❍	❍
Other social enterprises within the same sector and region	❍	❍	❍	❍	❍
Private and public partnerships	❍	❍	❍	❍	❍
Local councils	❍	❍	❍	❍	❍
Private organisations	❍	❍	❍	❍	❍
Influential people within the 'key network'	❍	❍	❍	❍	❍

Section 3 - Income streams and opportunities to trade

Q3.1 Below are a number of different income streams.
Please allocate an approximate percentage to each of these in relation to your organisation.

_____ Share issue
_____ Donations
_____ Trade income
_____ Membership fees
_____ Loans
_____ Government grants or contracts
_____ Private grants or contracts
_____ Other (*please give descriptor*)

Q3.2 Do you consider your sector to be one in which social enterprise can raise more than 50% of its annual turnover through trade?

- ❍ I believe it is currently possible
- ❍ Not currently, but possibly in the future
- ❍ I can't see a way this would be possible

Q.3.3 Please provide reasons for your response to the previous question (Q3.2)

Section 4 - Barriers encountered or expected in the future

Q4.1 For each of the options below, please state how much the following barriers effected your organisation since being in operation
(Where there are multiple occurrences please evaluate consider the one which had the greatest)

	This was not a barrier for my organisation	Barrier created minor disruptions for a limited time	Barriers triggered a long term change in working practices	Influenced the strategic direction of the organisation	Changed the strategic direction of the organisation
Industry regulation	❍	❍	❍	❍	❍
Local government policy	❍	❍	❍	❍	❍
National government policy	❍	❍	❍	❍	❍
Direct competitors	❍	❍	❍	❍	❍
Staffing difficulties	❍	❍	❍	❍	❍
Location	❍	❍	❍	❍	❍
Finding adequate funding	❍	❍	❍	❍	❍
Grants or subsidies being cut	❍	❍	❍	❍	❍
Lack of strategy	❍	❍	❍	❍	❍
Cash flow issues	❍	❍	❍	❍	❍
Lack of business knowledge	❍	❍	❍	❍	❍
Lack of knowledge of the sector	❍	❍	❍	❍	❍

Q4.2 For the same barriers detailed in the previous question, please state how much they are likely to affect your organisation in the future

	This was not a barrier for my organisation	Barrier created minor disruptions for a limited time	Barriers triggered a long term change in working practices	Influenced the strategic direction of the organisation	Changed the strategic direction of the organisation
Industry regulation	❍	❍	❍	❍	❍
Local government policy	❍	❍	❍	❍	❍
National government policy	❍	❍	❍	❍	❍
Direct competitors	❍	❍	❍	❍	❍
Staffing difficulties	❍	❍	❍	❍	❍
Location	❍	❍	❍	❍	❍
Finding adequate funding	❍	❍	❍	❍	❍
Grants or subsidies being cut	❍	❍	❍	❍	❍
Lack of strategy	❍	❍	❍	❍	❍
Cash flow issues	❍	❍	❍	❍	❍
Lack of business knowledge	❍	❍	❍	❍	❍
Lack of knowledge of the sector	❍	❍	❍	❍	❍

Q4.3 Please provide details of any other barriers faced that are not included in the options above

Section 5 Final comments and invitation for further study

Q5.1 Please provide any further comments or information that you feel is relevant to this survey

Q5.2 This survey will provide initial data towards this research. Would you like to participate in future stages of this study?

- ❍ Yes please - invite me to participate in workshops and/or interviews
- ❍ No thanks - but please send me a copy of the final report of the study
- ❍ No thanks
- ❍ I would like to know more, please send me some additional information

If you have requested to participate further, a copy of the report or further information please provide your contact information below;

Q5.3 Name and organisation

Q5.4 E-mail address

Q5.6 Telephone number

Thank you for completing this survey.

If you have any questions or concerns regarding the use of the data collected please contact me via e-mail - j.s.hillman@2012.ljmu.ac.uk

Appendix 3: Interview schedule - February to October 2016 interviews

Social Enterprise Interviews

Interview Time

Approximately 1 hour

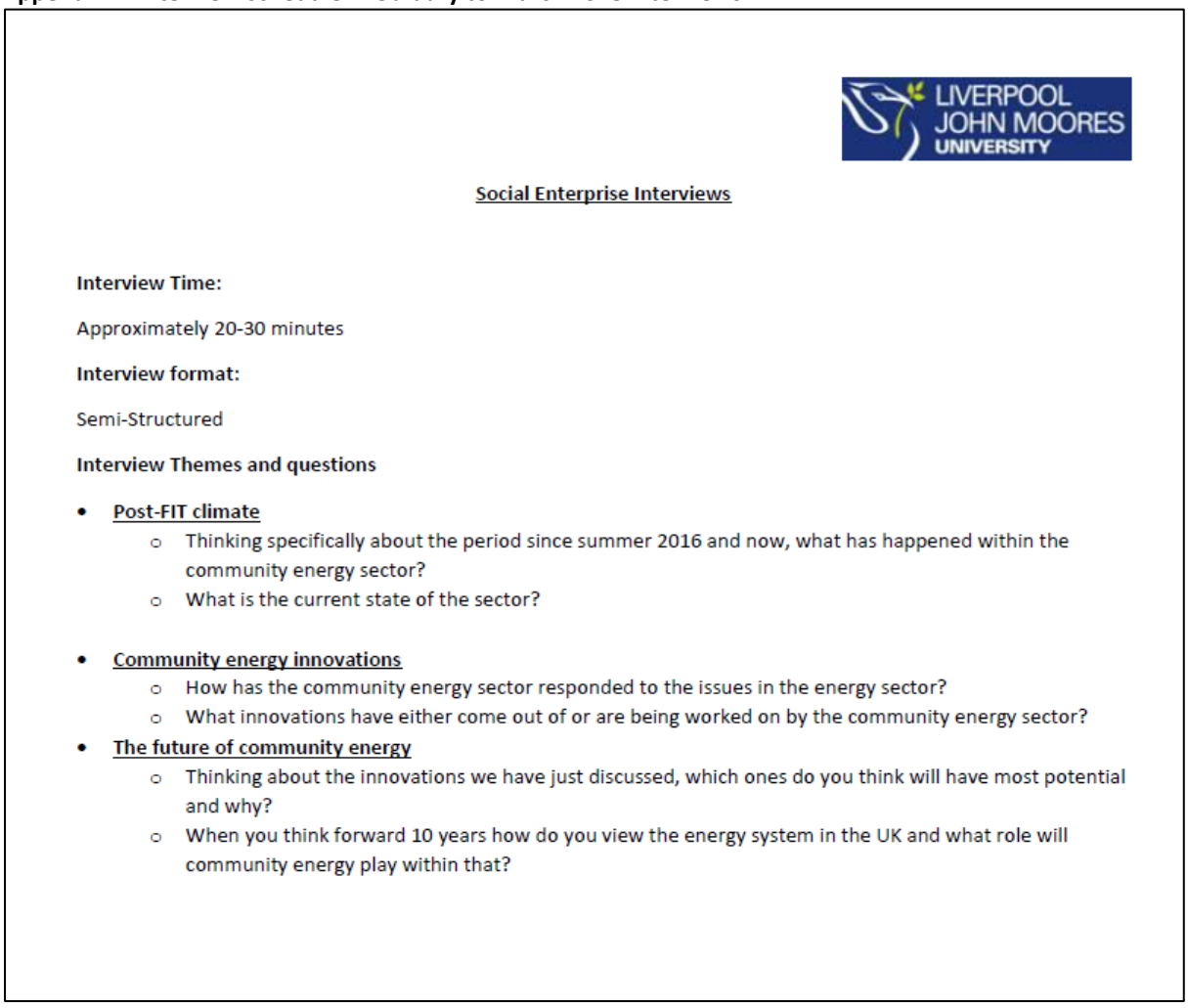
Interview format

Semi-Structured

Interview Themes and questions

- **Introduction**
  - Tell me a little bit about your organisation?
  - Tell me about your role within the organisations?
- **Sustainability and climate change**
  - From your perspective can you tell me how you perceive the issues around sustainability, in particular climate change?
  - In your opinion, what role does social enterprise have to play in creating a greener economy?
- **Business structure**
  - Tell me more about the legal structures used for energy based social enterprise and why this organisation is set up under this one?
  - Give me some information on the operational structure of the business?
- **Income streams**
  - Tell me more about the different types of income that you receive in to the business?
  - Do you believe it is possible to become financial sustainable within this sector?
- **Barriers within the sector**
  - Tell me about any barriers that you have faced in setting up/working with/working for energy focuses social enterprises?
  - Are there any implications of policy that you have already had to address or will need to address in the near future?
- **Future considerations**
  - What is the impact of the work that you do?
  - What are the future problems that you foresee in the medium and long-term?

Appendix 4: Interview schedule - February to March 2018 interviews



LIVERPOOL JOHN MOORES UNIVERSITY

Social Enterprise Interviews

Interview Time:

Approximately 20-30 minutes

Interview format:

Semi-Structured

Interview Themes and questions

- **Post-FIT climate**
  - Thinking specifically about the period since summer 2016 and now, what has happened within the community energy sector?
  - What is the current state of the sector?
- **Community energy innovations**
  - How has the community energy sector responded to the issues in the energy sector?
  - What innovations have either come out of or are being worked on by the community energy sector?
- **The future of community energy**
  - Thinking about the innovations we have just discussed, which ones do you think will have most potential and why?
  - When you think forward 10 years how do you view the energy system in the UK and what role will community energy play within that?

Appendix 5: IMD and FIT integrated dataset
Appendix 5 has been included on the USB drive submitted with the thesis

Appendix 6: Questionnaire data
Appendix 6 has been included on the USB drive submitted with the thesis

Appendix 7: Chi-square results
Appendix 7 has been included on the USB drive submitted with the thesis

Appendix 8: SPSS post-hoc test data
Appendix 8 has been included on the USB drive submitted with the thesis

Appendix 9: Significant post-hoc testing results
Appendix 9 has been included on the USB drive submitted with the thesis

Appendix 10: Interview transcripts from February to October 2016 interviews
Appendix 10 has been included on the USB drive submitted with the thesis

Appendix 11: Interview transcripts from February to March 2018 interviews
Appendix 11 has been included on the USB drive submitted with the thesis

Appendix 12: Journal article published from this research
Appendix 12 has been included on the USB drive submitted with the thesis