From command and control to local democracy?

A survival analysis approach to community-led renewable energy in Scotland

Submitted by Anna Line Harnmeijer to Wageningen University as a dissertation towards the degree of Master of Science in Environmental Sciences

August 2012

Those resisting change have an advantage: everything is designed for last century.

- Energy network actor (2011)

Key words: Event history analysis, social movement theory, community renewable energy

Name: Anna Line Harnmeijer
Course code: ENP-80436
Student number: 830928307040
Thesis supervisors: Dr. ir. Bas van Vliet, Dr. Ivo van der Lans
Study supervisor: Judith van Leeuwen
Contact: anna.harnmeijer@gmail.com
Cover: A church powered by a wind turbine on the island of Westray, Orkney
Photograph: Mike Roper/PR

Acknowledgements

I am indebted to all community survey participants who made this study possible. The SCENE Connect project on which this study is based would not have been realized without the support of the Edinburgh Centre for Carbon Innovation, as well as the UK Energy Research Centre. A special thanks goes out to Nicola McEwen and Elizabeth Bomberg for their wisdom and the opportunity to build on the UKERC Scotland Engage project. I am grateful to Bas van Vliet and Ivo van der Lans for their consistent counsel and advice, and to Niccolò Meriggi, my respite and pillar of support through thick and thin. Finally I would like to thank the SCENE team and Rebecca Reeve in particular for her diligence and patience.

Abstract

This study places barriers to community renewable energy deployment in a broader framework of Social Movement theory, in which community renewables deployment is conceptualised as a form of associative democracy. Drawing on qualitative and anecdotal accounts, interviews and summary reviews, key determinants for successful implementation of community energy initiatives are identified and operationalised. Based on a Scotland-wide survey of community-led renewable energy projects, a competing risk regression is used to estimate the cumulative probability of project completion conditional on technical, organisational and socio-political covariates. While a UK-wide analysis would be necessary to substantiate the findings, the initial results suggest that regional education levels, technology type and organisational land assets significantly influence the likelihood of project completion. No evidence is found for the influence of socio-political variables such as social cohesion or the levels of social integration into the wider energy network. The results support the notion that communities may not have equal opportunities to develop renewable energy or access public support schemes. Specifically, land access constraints and access to local expertise are key to any policy reforms aimed at facilitating effective participation by place-based social enterprises in the renewable energy sector.

List of Figures

List of Tables

List of Appendices

1 Introduction

1.1 Roles and rhetoric of 'the community' in the Scottish energy transition

In May 2011 the Scottish government put in place Europe's most ambitious statutory targets for carbon dioxide emission reduction as well as renewable energy, with a 100% target of Scottish gross annual electricity consumption to be renewable by 2020. Scottish potential capacity and investor demand for renewable energy is high by global standards, and the Scottish Government aims to exploit the rapid evolution of the renewable energy market to become a lead exporter of renewable power, technical expertise and products[1].

The Scottish government's ambitions are no doubt influenced by global environmental and national economic and energy security concerns, including the ongoing decline in North Sea oil and gas production, the closure of all current major nuclear and coal power stations by 2025, and prospects of future dependency on energy imports[2]. However, the Scottish government's renewable energy policy is often presented as an answer to domestic and local issues: the need to invigorate the manufacturing sector, provide employment and revitalize rural areas[3]. This is especially relevant for wind energy, because wind developments often occur in precisely those areas with economic development challenges; in sparsely populated areas with smaller communities and adequate wind resources[4,5]. On community engagement, the Scottish Government writes: "Effective engagement with the public can lead to better plans, better decisions and more satisfactory outcomes and can prevent delays in the planning process"[6]. The SG clearly sees place-based community engagement as a means to circumvent public opposition to wind energy development - and thus key to reaching 2020 targets. Beyond government circles, community-led, owned and controlled renewable energy (RE) initiatives are variably conceptualized as opportunities to provide not only energy and financial benefits, but community cohesion, empowerment and skills development, enabling environmental awareness, resource independence and democratization of energy governance[7,8]. In addition, small- scale community RE initiatives are thought to be able to make a significant cumulative contribution to the RE mix by feeding into local distribution networks and selling off excess capacity to the grid, thereby enhancing supply resilience[9].

In contrast to the discourse employed by the government to relate renewable energy to regional development, sociological literature on the whole suggests that the relationship between socio-economic inequity and regional development objectives on the one hand and renewable energy projects on the other is not clear cut. Given largely instrumental motivations for providing community-based RE support by the UK government, the question to what extent communities retain financial benefits, skills development, local employment, local economic generation from RE projects, and how this relates to organisational structures, legal and regulatory frameworks is essential to the credibility of the UK and

Scottish governments' renewable energy policy. In addition, it is becoming increasingly apparent that communities have highly variable capacity to engage in and lead complex projects of this nature, caused by a range of social, cultural, political, material, economic, institutional, infrastructural and human resource factors – many of which have been extensively treated in academic literature and policy support documents. Community-led, owned and controlled RE initiatives in the UK are hindered by issues ranging from social, administrative opposition[10], complex and costly planning and feasibility requirements[4], lack of leadership[11] and volunteer capacity, difficulty in finding investors willing to finance such projects[12], continuity and short-term nature of available finance[13], vulnerability to electricity price changes and uncertain profitability, as well as operational difficulties in getting smaller power generators connected to the grid network[14]. A number of these constraints are remnants of a historical legacy in which UK electricity production and provision was - and still is- highly centralized, hierarchical, disengaged from the public and designed to provide metropolitan areas with fossil-fuel based power[15]. In addition, the rise of wind energy development has coincided with land reforms aimed to redress the historical inequities of Scottish land ownership and remove land-based barriers to rural development[16]. Land access currently plays a significant role in determining whether community organisations are able to secure access to suitable wind development sites and business loans.

While community-led renewable generation has been developing rapidly in Scotland and the UK, it constitutes a mere ~0.5% of current and consented commercial and private RE deployment (**Figure 1**). The notion that powerful vested interests are tending towards a new centralized form of renewable energy production appears to be central to current social justice debates surrounding the transition of the energy sector in the UK. There is evidence that the UK may be shifting away from small-scale RE projects towards medium to large-scale commercial projects, as was observed by Carossio (2011) in the Italian biogas sector[17]. In the past decade, adoption support schemes have attracted a rush of well-established private sector developers that has "overloaded UK planning and control authorities and in some cases lead to suboptimal enforcement of social and environmental assessment criteria of plant proposals"[2]. The concern that Feed-In-Tariffs are increasingly flowing towards large private sector parties instead of to intended household or small-scale entrepreneur beneficiaries frequently comes up in both Scottish media and policy documents[18,19]. Van der Horst (2008) shows empirically that commercial wind farm development in England has taken place largely in more deprived areas, and suggests that these communities do not have equal political influence as richer communities to engage in effective protest against wind power projects[20]. Furthermore, Warren and Birnie (2009) describe the critiques of the distribution of financial revenues of commercial projects throughout the UK and the disappointment over resulting socio-economic outcomes[2]. Toke (2005) and Casse, Walker and Devine-Wright (2010), Munday *et al* all suggest that current 'community benefit' fund provisions issued by developers are more strategic elements in negotiations around planning consent, serving to guard the public image of the sector, to compensate for adverse effects, and win the hearts and minds of communities, rather than serious mechanisms for local rural development[4]. Unlike Spanish or Danish case studies then, commercial RE schemes in the UK have by and large not resulted in significant local employment or increased local business rates[2'21]. The lack of specific skills required in parts manufacture and installation has resulted in limited opportunities for genuine local purchasing of goods and services in local authority areas surrounding wind energy sites[4]. In summary, there has been significant attention given to the lack of positive socio-economic impacts and local protest against commercial wind development.

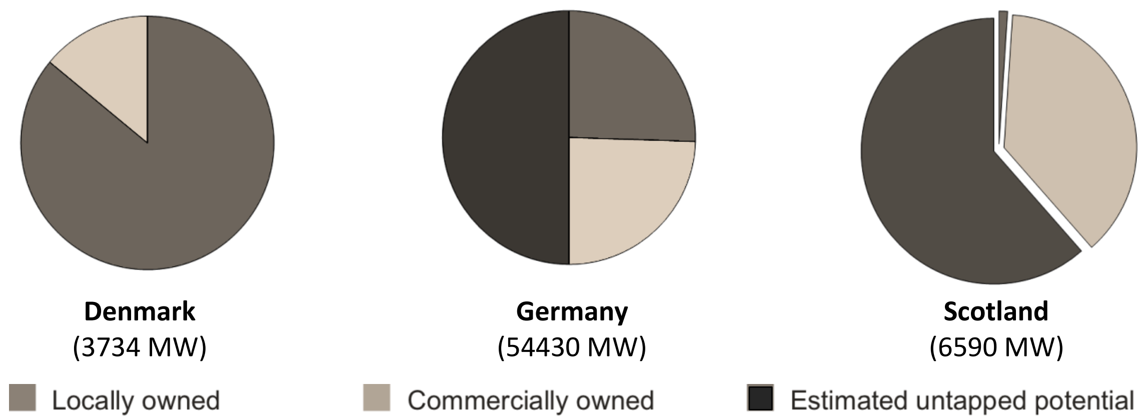

Figure 1: *Danish, German and Scottish ownership of wind energy (Source: adapted from EEA 2011, BWEA 2011, and SCENE 2012)*

The nature and publicity of and surrounding commercial wind development in the UK has to some degree rekindled instrumental, rhetorical and normative motivations for community-led RE deployment. At a practical level, government support for smaller scale community initiatives was instigated and made possible thanks to its greenhouse gas emissions targets and RE targets and associated national programmes, networks and funds. For instance, community body charity status has allowed the government to "stimulate and support the market for renewable energy technologies without contravening European rules on state aid"[14]. There are instrumental motivations to engage communities, since it is now widely recognized that communities that are directly involved and benefit from wind farms are more likely to support them[10'22]. Finally, small-scale projects can avoid some of the problems posed by large-scale renewables[23], by matching the existing load in an area, deferring expensive upgrades and extensions of the network by creating islands of security during grid outages, and contributing to voltage stability[9'24]. In addition, Walker *et al* (2007) find numerous normative motivations for government support of community RE deployment; motivated by principles and ethical positions as to how environmental and renewable energy projects should be developed, emphasizing localism, social cohesion and collaboration, or co-operative ownership and financing, or environmental awareness and responsibility[14].

Communities themselves appear to be variably motivated by a number of instrumental and/or normative reasons to pursue a lead role in RE projects[25]. Instrumental motivations include local control over aspects including scale, siting and orientation of turbines on wind farms, local income and employment and reduced cost and increased reliability of electricity for community buildings in rural areas[24]. In addition, a number of factors appear to make normative drivers- that is, ethical and environmental commitment to locally owned, sustainable energy generation - resonate particularly strongly with communities in parts of Scotland. Warren and McKee (2011) describe how historical land clearances have instilled a "sense of indebtedness, a you-owe-me spirit"[16]. A concentrated pattern of land ownership persists today, and the authors point to i) social injustice, ii) the control of local environment or iii) the belief that community ownership allows greater local socio-economic sustainability as being key drivers in the explosion of interest in community land ownership since 1992[16]. In summary, Scotland's troubled land ownership history appears to have played a large part in constructing strong conceptions of 'community', particularly in the Highlands. As will become clear towards the end of this chapter, such conceptions of 'community' fit comfortably in the neo-communitarian environmental discourses of local participation and empowerment that is thought to have contributed to the growth of interest in community-based power generation since the late 1990's[14,9,26]. Like land then, renewable energy assets are now playing into this value-laden concept of 'community', either as an opportunity for local socio-economic benefits to be reaped, or as a local resource that needs to be protected from exploitation by outsiders.

The prevalence of normative motivations for individuals, government and non-government organisations to engage in community-led RE development suggests that the current development of commercial and centralized renewable energy regime is at odds with distributed, decentralised and locally organised energy regime that many associate with the transition to a 'sustainable economy'. These conceptions are rooted in theories of associative democracy, social economy or Lovins' 'soft energy paths', which provide arguments underlying most normative motivations for community-led renewable energy development. Lovins' 'soft energy paths' provides environmental arguments for a localised energy regime, emphasizing efficient energy use, diverse, distributed renewable energy production in which scale and quality of energy generation is matched to task[27]. These arguments correspond with those of communities hoping to achieve self-sufficiency in preparation for a fossil-fuel scarce world. In contrast, 'associative democracy' provides social justice arguments for a localized energy regime. Hirst (2001) posits that current hierarchical governance frameworks in both public and private spheres are responsible for large democratic deficits in present society, providing citizens with too few opportunities for consent[28] - and *de facto* responsible for an era of decline in civic engagement. Following on from Lovins, he suggests that the most important arena for democratic reform is at the level of organisations, calling for the devolution of as many social services as possible to democratically self-governing voluntary organisations[29]. Finally, the main argument for a localized energy regime provided by Smith and Teasdale's conceptualization of a 'social economy' are the local benefits of economic activity that is primarily focussed on "generating mutual, communal or general interests"[30].

However, from the viewpoint of a societal transition to Lovins' 'soft energy path', there are considerable difficulties in getting communities - whether geographically defined, interest-based or work-place based- to 'plug into' complex supra-local socio-technical systems of energy provision, which are governed by corporate actors and policy arrangements operating at larger spatial scales[31]. Janicke and Jacob state that "a decrease of an industry in its core technologies creating losers and [for instance] regional unemployment problems requires huge political endeavour and is therefore possible only exceptionally"[32]. While there is little comparative research there appears to be large international variation in the role of community-based power, which may provide some clues as to effective institutional reform. In contrast to RE development in Denmark and Germany[33,34,35], community –owned wind energy schemes in Scotland remain a negligible fraction of total wind capacity (see **Figure 1**). These are thought to be predominantly well- defined, well organized and more privileged communities in rural North of Scotland, while community-led RE initiatives are still rare in low income communities and urban areas[22]. The need for innovation of social organisation parallel to technological niches and the danger of dissolution of niches into dominant regimes because of political reasons has been observed elsewhere[32,36,37]. In this context, current policy decisions on incentive schemes and support for decentralized micro-generation are likely to have lasting impacts on the nature of energy production in the UK, determining whether regime change of the energy sector will involve fundamentally different governance configurations, or be captured to a large extent by the same social organisation, institutional structures and market systems governing the current regime. There is no explicit vision or strategic objective in UK energy policy working towards replacing the current energy production regime with one which is distributed, decentralised, locally organised and community owned[27]. While there is support for community energy, it remains "a junior partner to the incumbent model of energy production - which shows all signs of remaining centralised, big and substantially nuclear rather than renewable"[15]. The question therefore arises to what degree community energy networks can operate autonomously from government support- a question raised by Lovins as far back as 1977. As will become clear in this work, the nature and extent of government support for community-led renewable energy has enormous implications for the degree to which the future energy sector as a socio-technological system will feature concepts such as 'distributed generation', 'smart grids' and 'energy citizens'. Serving as a counter-hegemony in an era of declining civic engagement, it is perhaps precisely the lack of an explicit government vision of locally organized, community owned renewable electricity generation that makes community-led RE politically contentious, allowing us to frame and understand community-led RE action as a social movement (this argument will be outlined in more detail in Chapter 3 of this work).

This research hopes to explain successful implementation of community renewable energy. By revealing which factors are influential in determining the variable progress and success of community-led renewable energy projects in Scotland, it hopes to contribute to the design of effective public support schemes. Identifying enabling and constraining factors to project implementation based on theory and literature, this study is the first of its kind in drawing on a cross-sectional dataset on community power, and to my knowledge the first attempt to place community-led renewable energy initiatives in a quantitative framework. The data and results described here are a first step towards a rigorous treatment of the potential for growth in the community RE sector, as well as the question of equal opportunities to develop renewable energy and access public support schemes.

1.2 Structure and objectives of this thesis

Given piecemeal and anecdotal evidence of barriers in the development of community-led renewable energy initiatives, the objective of this research is to operationalise the constraining and enabling factors and statistically investigate their relationship with project success. The added value of such an approach lies in that it allows identification of structural determinants of success that hold true across the complete population of community projects, based on anecdotal evidence and 'hunches' of determinants of successful project development. Secondly, it allows approximate prediction of success within the sample and can therefore contribute to our understanding of the capacity and growth of community-led RE development, *ceteris paribus*. While the assumption *ceteris paribus* is unlikely to hold, given constant changes in economic, political landscapes, it is hoped that the results would at least reveal structural patterns in factors that may be constraining further community-led RE development in Scotland and that may require policy intervention.

The research questions following from this are as follows:

I. *How can we define community-led RE initiatives and distinguish them from both private and commercial RE initiatives, based on literature?*

II. *How are community RE schemes negotiated in the field; what are the i) organisational structures, ii) funding sources, iii) existing policy mechanisms for generating public and private investment in community-led sustainable energy projects, iv) existing options for joint ventures and partnerships between developers and community groups as they set up renewable energy initiatives?*

III. *What is the current status of community-led RE in Scotland? Specifically;*
   - *What is the extent of the community energy sector?*
   - *What are the predominant business models enabling community ownership?*
   - *What are the driving motivations behind community engagement in the renewable energy sector?*
   - *What are the organisational, socio-economic characteristics of these organisations and the wider communities in which they are located?*

IV. *What are the key determinants of successful project implementation and what are the implications for the capacity, growth and potential of community-led RE production?*

Based on the literature review of opportunities and barriers to community-led RE we can define several postulates that we may expect to hold true and that can be explored by means of the described statistical approach to identify key determinants of successful community-led renewable energy development. They are:

- ❖ *Community-led RE initiatives are more likely to succeed given greater human and material resources, and in less deprived regions than more deprived regions.*
- ❖ *Community-led RE initiatives are more likely to succeed in regions with high degrees of social cohesion.*
- ❖ *Communities that are less integrated into the established energy network are less likely to be successful.*

This document will proceed as follows. Building on the Introduction in this chapter, Chapter 2 describes what is known on the current status of community energy in Scotland and further outlines the institutional context which community organisations must navigate in order to successfully deploy renewable energy installations. Specifically, it describes the process of community-led wind development and the political and historical context of localized energy regimes in UK energy policy, providing detailed accounts of current price support mechanisms, planning policies and grid connection issues. Chapter 3 outlines the theoretical framework that contributed to the framing and formulation of barriers to community-led RE deployment, drawing on Resource Mobilisation and Political Process theories. The methodological approach is described in Chapter 4, which defines 'community' projects and by extension the statistical population under investigation. It also describes the method used to develop constraining and enabling factors and indicators, data collection (including data sources and survey design) and model specification. Describing the analysis, Chapter 5 begins by outlining the constraining and enabling factors and indicators generated from the content analysis, and proceeds with an overview of community RE projects and model results. Chapter 6 concludes with an interpretation results, revisits Social Movement theory, and discusses the methodological limitations of this research. The final Chapter places results in a broader perspective, outlining the implications of this work for policy reforms as well as for future research.

2 The institutional landscape of community energy in Scotland

2.1 The current state of community energy in Scotland

According to Gubbins (2010), Scotland touts 800 known community-led renewable energy initiatives, in which a range of different types of community engagement can be distinguished[38]. **Table 1** demonstrates how a number of communities have simply received benefit funds, as a form of compensation from large commercial wind farm developers ('4 Community benefit'). Alternatively, local farmers, industries, and citizens may form a co-operative in which local community members are given the opportunity to buy shares in a wind project, thereby contributing upfront capital to the project ('1 For profit'). Thirdly, in a few cases communities have approached ongoing commercial developments to invest in a share of a wind farm, essentially becoming an equity partner ('2 Profit and non-profit distributing'). Finally, a growing number of community groups co-ordinate, source funding and develop RE projects entirely on their own initiative, simply paying turn-key contractors for the services they provide ('3 Non-profit distributing', from here on 'community-led' projects). The latter category of community engagement typically involves social enterprises with local development objectives, including 'facilities' projects in which a project provides heat or power to a community building. Whether these four broad categories of community engagement exist for other Feed-In-Tariff (FIT) eligible technologies is not clear, but the phenomenon of community benefit funds is unique to onshore and offshore wind projects. None of these types of community engagement existed in early 2000's and the nature of community engagement has clearly diversified in the last decade. The number of complex large community-led RE projects (small wind farms consisting of 1-3 turbines and hydro-electric schemes below 100kW) have been on the rise, with respective community groups building technical, project management and governance expertise[38].

A closer look at the process of community-led wind turbine development suggests that community-led wind development is a daunting, costly and complex process, necessarily involving collaboration with service providers, utility and grid companies, advice networks, local, national and UK authorities, legal and environmental experts, as well as the wider community. Community-led wind turbine development in Scotland typically involves the following steps:

1) *A group of individuals establishes a tradable legal entity, enabling business ventures with private sector parties and land lease or purchase.*

Community organisations in Scotland are predominantly Development Trusts in the form of companies limited by guarantee with charitable status, but in some cases community organisations have established bona fide co-operatives, community benefit societies, companies limited by shares, community interested companies, or limited liability partnerships[39]. Depending on the structure and legal status of choice, they establish a governance structure, recruit staff and members. The legal status predicates to some degree the financial structure of the RE project, determining the nature of financial engagement of members in the project vis- à- vis developers[40], the distribution of financial revenues vis-à-vis the wider community[23], as well as its ability to receive grants[41]. For instance, investment through share ownership brings benefits only to those able and willing to invest, while community trusts or charities may to varying degrees act in the collective interest of everyone in a defined area (see Walker, 2008)[43].

Table 1: *Classification of Scottish community energy projects. Taken from Gubbins N. (2010)*

Model	1 For Profit	2 Profit and non-profit distributing	3 Non-profit distributing	4 Community benefit
Description	local developments providing opportunities for local private investors and 'small' investors nationally	joint venture arrangements between private and non-profit distributing companies	developments by non-profit distributing bodies on behalf of all people in a community	'community benefit' arrangements with private commercial developers
Developer	E.g.: co-ops, farmers, other rural businesses	E.g.: private landowners and local development trusts	E.g.: local development trusts, community interest co-ops	E.g.: wind farm community benefit payments
Ownership	Individuals, profit distributing companies and co-ops	Special purpose vehicles (joint) or Two separate companies, private and community	Community group	Developer
Legal basis	Companies ltd by shares; Industrial and Provident Society with profit distribution	Companies ltd by shares with both partners owning shares; or separate companies ltd by shares, one owned by community group	Typically company limited by guarantee with trading subsidiary limited by shares	Payments usually to an existing community trust or one established for purpose
Main beneficiaries	Private individuals	Both private individuals and community groups	Community groups and wider community	Wider community

2) *The community body tenders amongst RE developers or consultancies to undertake a feasibility assessment.*

In some cases, communities have had academics and engineering students do an initial desk feasibility study to narrow the options at low cost, before committing to a full feasibility assessment- which requires planning permission for the erection of wind mast(s) and at least 6 month worth of wind speed data. The assessor then identifies a number of suitable sites for development, accounting for road access, average wind speeds, landscape values and environmental designations, suitable geomorphology, bird and radio constraints, archaeological interests, noise, shadow flicker, health and safety, proximity and capacity to the high voltage electricity grid, rates of return, cash-flows as well as respective local and national policies that are relevant to each site when obtaining planning permission (see point 5 below). Feasibility studies often include identification of potential hydro, tidal, tidal-stream, off/near shore wave power, or offshore wind sites in addition to onshore wind sites.

3) *The community body then secures a suitable site* (as per defined by the feasibility study) either through lease or ownership.

4) *Depending on grid connection costs, communities may or may not apply for grid connection*, enabling them to receive FIT's once the turbine is installed.
Grid connection is not required for Renewable Obligation Certificates. Grid connection involves application to the distribution network, which makes a formal offer based on full cost recovery of connecting lines and any required capacity extensions.

5) *While applying for grid connection, the community body applies for planning consent, or may hire a consultant to help them in planning consent application*.

For wind schemes up to 50MW planning consent is obtained from the local authority but may not be required for micro-installations (<50kW) depending on the location and surroundings of the proposed site[42]. For wind schemes greater than 50MW, planning consent is obtained from the Scottish Executive. For wind power developments of 2 turbines or more, or with hub heights of 15m or more, which covers any wind development over about 20kW[43], the planning application process typically involves an environmental impact assessment, and submission to the planning authority in the Local Area Authority for approval on technical grounds. The process can take up to six years, and costs 150-300,000£ for a typical wind farm under 50MW, with an additional 200,000£ if rejected by local planning authorities and appealed with the central Government[44].

6) *The community body purchases the turbine(s) and hires the developer to install them, as well as making provisions for day-to-day operations and management.* Upon landing, the turbine is tested and connected to the grid.

7) *The community body registers the plant as an eligible installation with the respective energy supplier operating in its region, negotiating a 'power purchase' contract* that outlines the conditions under which the generator will have access to the grid and receive FIT payments.

Demonstrating why communities must engage with multiple levels of public authorities and with private sector bodies throughout the process of RE development, the following sections outline the multi-level governance framework that both engenders and regulates community RE development in Scotland.

2.2 Localism and UK energy policy throughout history

Prior to devolution of Scotland under the Scotland Act (1998), the UK retained constitutional and legislatory powers over all energy and environment related issues. Since privatization of state-controlled energy companies in the late 1980's, UK energy policy is itself limited to influencing the operation of the energy market; gas and electricity market regulation is carried out by the Office of Gas and Electricity Market (Ofgem). Unlike Denmark and Austria, UK energy policy did not include co-operative localized models for energy development until the late 1990's, with energy infrastructure and technology being centrally planned, large-scale with largely no social or environmental objectives or stakeholder involvement[15'45]. Walker (1997) shows that until this time, co-operative localized models of power generation analogous to Lovins 'soft energy path'[46] were only pursued outside of the mainstream energy supply system without government backing in the form of demonstration projects[47]. UK renewable energy policy arose in the early 1990's but was highly private-sector oriented. Community renewable energy development first emerged in UK policy discourse in 2000 and appeared to be motivated by a range of normative, instrumental and rhetorical reasons[15] already discussed in the Introduction (see Chapter 1.1).

Post devolution, Scottish energy and climate change policy is still embedded in and to some degree constrained by both UK energy policy, as well as the European Union Climate Change Strategy[48]. According to the Scotland Act (1998), the UK retains constitutional powers over energy generation, distribution, transmission and supply of electricity, oil, gas and nuclear energy, regulation of the energy industry and the energy market, aspects of road, rail and marine transport, as well as foreign relations. This leaves legislatory powers related to forestry, agriculture, waste, resource efficiency, housing and promotion of renewable energy in the hands of the Scottish Government (SG). While this gives the SG sufficient autonomy to set targets for renewable electricity that exceed both EU and UK targets, it also significantly constrains Scotland's political autonomy with respect to making structural changes in the energy sector[100]. Firstly, SG energy and climate legislation can cover policy areas devolved to Scotland only. The SG does not have direct control over energy sourced on its own territory, grid capacity and connection, or structure and levels of price support, but does have direct control over planning permission and land use. By extension, the SG has limited direct control over several of the barriers facing community-based renewable energy development, such as grid connection policy (see 1.1). Secondly, the SG has no right to representation at EU decision-making forums defining EU GHG reduction targets or climate policy. Scottish local governments - where policies with regards to housing, sustainable development are implemented - therefore need to influence intergovernmental platforms to be indirectly represented at EU level.

Over the past seven years a diversity of national programmes and networks have emerged to support and fund community renewable energy action, both in Scotland as elsewhere in the UK[15]. Community Energy Scotland, a government organisation conceived with the sole purpose of providing support to communities pursuing RE projects, has "continually had a pipeline of projects that are waiting for their advice due to overwhelming demand for their services" but still "does not have enough exposure with certain communities"[49]. With a 500MW community-led and owned RE target by 2020, the SG appears to be committed to localized renewable power generation[50]. However, these targets are unambitious compared to commercial sector targets- they comprise less than 0.001% of additional (total new and consented) 2020 renewable electricity generation targets[¿,51]. Best summarized by Walker (2007), "total committed budgets for funding and support programs [for community RE] are still very small and short term compared to other energy investments and strikingly unambitious given the large potential and demand that exists"[94]. Reportedly, the SG's unambitious community RE targets stem from the lack of overview over the current capacity, growth and potential of community or household renewable energy production[52]. In addition, while SG enjoys the freedom of employing alternative monetary incentives to stimulate community-led RE's, EU State Aid requirements have recently eliminated the ability of the SG to provide grants for community RE, since it forbids receipt of both subsidy and price support[53]. As a consequence SG support policy has recently shifted from community grants to community loans, in which communities are required to invest 10% to demonstrate commitment[54]. New community entrants to price support schemes are essentially treated equal to any commercial body. Since 2010 then, community groups have to forge new partnerships with private investors and financial intermediaries in order to finance the high-risk, pre-planning consent stages of renewable energy initiatives and to benefit in the long term from FIT's. This has left communities in the pre-planning phase enraged and re- ignited the debate over access and distribution of benefits[55]. For communities, the implication of this complex and dynamic multi-level governance framework that regulates renewable energy development is that there is significant uncertainty around the stability of policies, and that they must draw on resources and policy arrangements at different local, national and UK authorities, as well as private sector bodies, at each step of RE project development.

The remainder of this chapter describes two policy frameworks that are key to driving and shaping community RE development: price support mechanisms (regulated at UK level), and planning and land use policy (regulated by both national and local Scottish governments).

¿ 2020 renewable electricity targets were set at 100% of electricity demand, estimated at 43TwH. Excluding the 17.3 TwH of existing hydropower, this implies 25.8 TwH of alternative new and consented renewable electricity generation by 2020.

2.3 Price support mechanisms and community renewables

With the exception perhaps of micro 'community facility' projects (typically <10kW), the cost of renewable energy installations place them well outside the scope of autonomous funding by communities. Instead, the various phases of RE development may be funded by one or more of diverse charities, business loans and in rare cases, private equity. There are two key price support mechanisms that have thus far played a substantial role in community RE project finance[*]. The following paragraphs provide an overall overview of these mechanisms, briefly discuss each mechanism in turn and show that while these support mechanisms make community RE initiatives financially viable, they leave some key issues in community RE project finance unresolved.

Once communities have installed hydro-electric, wind, solar photovoltaic, anaerobic digestion technologies (up to 5 MW) and fossil-fuel derived Heat and Power (CHP) (up to 2kW), they are eligible for price support in the form of Renewables Obligations (for maximum capacity 50kW- 5 MW) or Feed-In-Tariffs (< 5MW), where 5MW represents the annual electricity requirements for approximately 1- 2 Scottish domestic homes. Tidal and wave, geothermal, biomass, landfill and sewage gas technologies are excluded from the FIT scheme because they are not yet deployed at scale and uncertainties over cost and performance make setting FIT tariffs difficult[56]. However, they are included in the Renewables Obligation's scheme. Both are market-based instruments aimed at compensating RE generators for the gap between grid power price and the cost of producing renewable electricity per kilowatt hour, thereby providing incentives for RE production despite high initial investment costs and generally otherwise non-profitable returns[57].

Feed-In-Tariffs were introduced in 2009 with the specific aim to provide small-scale low-carbon energy generators (including wind, photovoltaic, hydro, anaerobic digestion and micro-combined heat and power plants) with a retail-price-index pegged price for generation for 20-25 years, in addition to a fixed minimum export price[56]. Electricity suppliers register eligible installations, set up power purchase contracts with community generators specifying the conditions under which a renewable electricity generator has access to the grid[§] and make FIT payments. Ofgem (Office of Gas and Electricity Markets) is responsible for monitoring and compliance. While minimum export tariffs are fixed and

[*] A third most recent price support mechanism, the Renewable Heat Incentive, was introduced in November of 2011, targeting large-scale industrial heating, public sector initiatives, small business schemes and not-for-profit community heating projects built from July 2009 onwards across Scotland, England and Wales. Renewable heat generators including solar thermal systems, ground/water/air source heat pumps and woodfuel-based district heating systems are eligible for a fixed payment per kWh of heat produced for the period of 20 years, while anaerobic digesters and CHP units are eligible for both RHI and FIT remuneration.

[§] Turbines may be switched off from the grid under off-peak overcapacity conditions, and power purchase agreements specify the order in which RE installations are switched off, and whether installations are compensated for being switched off.

technology- blind, FIT generation tariffs are cost and technology- dependent[56]. As a technology becomes mainstream and its technology costs decrease, the UK Department of Energy and Climate Change (DECC) will reduce FIT generation tariffs for new installations[56]. FIT's have been subject to amendment based on rates of technology uptake. For instance, in response to the surge in private sector interest in large-scale projects, DECC has issued a fast track review of FIT's for small-scale low carbon electricity initiatives[58], and announced that tariffs for solar and anaerobic digestion will be adjusted to encourage micro-generation over larger installations[59]. Further downwards adjustments for onshore wind and solar generation are under review, also driven by rapid uptake[60].

Generators with a capacity of 50kW- 5MW have the one -off choice of applying under the FIT or the Renewables Obligation Scotland (ROS) [56]. On top of a bilaterally agreed upon base electricity price, accredited generators under ROS are given one Renewable Obligation Certification per MW renewable electricity generated. ROC's are essentially 'green certificates' and are sold to suppliers to meet their quota renewable electricity obligations[65]. Supplier quota's increase annually in order to enhance renewable electricity generation, and payments are made to a buy-out fund wherever suppliers do not meet targets at a rate that is pegged to the Retail Price Index[61]. The buy- out fund is annually redistributed amongst suppliers according to the number of Renewable Obligations submitted[65], thereby rewarding ROC acquisition below supplier obligation levels, and essentially reducing the cost to consumers of those supply companies who submit relatively large numbers of ROC's. Because ROC's are traded at market price, their value fluctuates annually depending on quota levels in relation to the number of ROC's available on the market. Since 2009 ROC's are banded in order to provide additional support to emerging technologies[62]. From a community perspective, ROC's provide more administrative burden[63] and less predictable revenues over time as compared to FIT's. Because ROC's were historically available to large generators only[†], only a small number of community groups- typically the large off-grid island projects- receive ROC's, especially since the introduction of FIT's in 2009. However, given that the annual RO targets set by the Scottish Executive are ambitious, the value of ROC's is likely to remain high until at least 2015[64].

As incentive mechanisms, none of the price support instruments directly provides the initial start-up capital required for RE development, but all three mechanisms contribute substantially to revenue flows upon installation. Once a community has obtained planning consent, been granted grid connection and obtained a power purchase agreement, price support revenues can be used as debt security, allowing a project to become bankable and communities to obtain a bank loan to finance turbine purchase and installation. However, while FIT's do provide some risk reduction, FIT export and generation revenues remain subject to wind speeds and turbulence, turbine performance and down time, and the

[†] Before 2004, ROC's were only available to generators providing more than 0.5mWhour/month. Since 2004, generators can claim ROC's on the basis of annual generation (Hain J. *et al,* 2005).

dynamics of grid demand, supply and access. Furthermore, FIT's do not alleviate the problem that annual cash-flows realized from a wind-power scheme are highly sensitive to the nature of funding and associated debt interest rates, payment periods, or return on equity, as well as unforeseen events such as prolonged planning processes, land disputes or the price of baseline electricity at the time of establishing a power purchase contract[44].

Price support mechanisms have provided a number of community organisations annual revenues ranging between to 60,000£ to 500,000£ per annum[11]. A closer look at price support mechanisms however reveals that, for any given installation, establishing and negotiating a more profitable cash-flow requires considerable financial expertise (in the form of accounting skills, cash-flow calculations and knowledge of alternative financial models), a good understanding of the electricity and/or ROC markets, as well as favourable market conditions. Skarza and Bluhdorn (2006) suggest that price support mechanisms in the UK are more market-oriented than elsewhere in Europe, in that they require investors to make higher up-front costs at greater uncertainty, de facto favouring large wind developers with access to finance, resources and a lower cost base[µ,34]. Smaller-scale community projects are often doubly disadvantaged in that sites are far from the grid, with connection costs increasing disproportionately with distance[65]. In addition, initial capital investment costs do not decrease parallel to plant size as compared to yields from electricity generation. More importantly, price support mechanisms do not allow communities to overcome the obstacle of financing the pre-planning consent phases of RE development, such that additional financing frameworks are required. Finally, while cost compensation mechanisms such as the RO and FIT internalize health and environmental values of renewable energy production[60], they do not distinguish between community projects vis- à- vis pure commercial projects. In other words, they do not recognize any socio-economic values generated by community-led RE projects. This is reflected in the following quote in a published report from an interview with a community member: *“A lot of our behaviour change work, the stuff that is crucial in our communities, can’t ever make money and it is quite difficult to show what the actual return is”*[14].

2.4 Planning and land use policy

While price support policies are not in the hands of the Scottish Executive, land use planning and policy was devolved to Scotland in 1998, and all proposals for renewable energy developments are subject to a formal approval process either through the Electricity Act (>50MW), or through the Town and Country Planning Acts (<50MW)[‡]. The latter provides a statutory requirement for local authorities to provide development plans outlining planning criteria for landscape and visual impact, natural heritage and historic environment, aviation,

[µ] A low cost base implies a low cost per kWh produced

[‡] SG planning policy is laid out in the National Planning Framework, and the Planning Scotland Act 2006, superseded in 2010 by the Scottish Planning Policy.

telecommunication, noise flicker, cumulative impacts and socio-economic impacts. In the context of community projects (which are typically <50MW), specific regulations and planning decisions for generators are ultimately sit with local councils. However, council legislation is transposed from SG policy on nationally important land use and planning matters, such as the Scottish Historic Environment Policy (2011). Scottish EIA Regulations are transposed from the European Council Directive 97/11/EC on environmental impact assessment, to ensure that where relevant, additional information on environmental effects are taken up in planning decisions and inform choice of project alternatives and design[66]. For instance, while the Scottish Executive has set criteria for wind and hydro installations requiring an Environmental Impact Assessment[§ 67,68], councils have the ultimate authority over the identification of 'sensitive areas' and the decision of whether an EIA is required. Apart from Scottish Planning Policies and Regulations, the SG has influenced council planning legislation and protocol by means of planning guidelines, including PAN45: Renewable Energy, PAN60: Planning for Natural Heritage, PAN 2/2011: Planning and archaeology, PAN 1/2011: Planning and noise, PAN73: Rural Diversification. Together, these guidelines encourage local authorities to have prepared policies that support wind farm development in an environmentally acceptable way, in anticipation that planning policies for other large-scale renewable technologies will soon follow suit[69]. In a similar way, national park-specific planning legislation is also material consideration in planning authority decisions[70,71].

The SG states that: "Decision making in the planning system should contribute to the reduction of greenhouse gas emissions in line with the commitment to reduce emissions by 42% by 2020 and 80% by 2050, contribute to reducing energy consumption and to the development of renewable energy generation opportunities"[72]. SG energy and GHG targets are widely quoted in planning permission applications related to renewable energy. However, planning legislation is considered by some as the primary bottleneck for (community) renewable energy deployment, with planning policy frequently being at odds with renewable energy policy at council level, as well as inconsistent across councils, opaque and highly political[78]. Wind planning applications receive highly variable treatment in different planning authorities across Scotland; for instance Planning Committee members with strong anti-wind sentiments have been known to wield their power to veto wind planning applications[15], or to impose newly conjured and unlegislated turbine height restrictions[73].

Scottish planning legislation for renewable energy is led by and furthest evolved for onshore wind development, for which councils are increasingly publishing 'prospective development zones'. Planning criteria for other renewable energy developments are broadly similar to criteria for wind developments (including criteria such as amenity, landscape, visual, natural

[§]The Scottish Government Environmental Impact Regulations (1999) define installations that must undergo an Environmental Impact Assessment as any dammed hydroelectric scheme with a water holdback facility exceeding 10 million cubic metres, or any thermal power stations and other combustion installations with a heat output of 300 megawatts or more (a 'Section 1' development). Installations that may need an EIA subject to local authority assessments are wind installations consisting of more than two turbines over 15m hub height or located in a 'sensitive area', and hydro installations above 500kW ('Section 2' developments).

heritage, scientific, historic or archaeological, safety and electromagnetic interference impacts). However, compared to wind planning regulations, other renewable energy installations are currently not subject to equally specific planning restrictions, instead tending to consist of looser requirements to 'demonstrate no significant effect'. This is likely to reflect the fact that other renewable technologies such as biomass, energy from waste, landfill gas and marine renewables are simply not yet deployed at the same frequency and scale, and are also less subject to perceived adverse landscape impacts.
Hydro-electric development is an exception, being a mature sector with relatively little scope for significant further large-scale deployment. Planning rejection for hydro-electric sites is rare and less critical to project outcomes, because hydro-electric developments are subject to rigorous assessment by Scottish Natural Heritage (SNH) and Scottish Environmental Protection Agency (SEPA) at pre-application stages. Depending on the head (short versus long) and scale of the development as well as its proximity to designated areas, this involves initial assessment of the relevant scope of environmental assessment by Scottish Natural Heritage and SEPA, undertaking water vole, bryophyte, otter and fish surveys, and obtaining an abstraction licence from SEPA[74].
Finally, there are few planning guidelines and restrictions for micro-renewables (<50kW), for which planning is generally only refused on grounds of protection of the historic environment (such as conservation areas and listed buildings).

Aside from planning permission, access to suitable sites is remains problematic. Land in Scotland remains predominantly in the hands of private estate owners (46%) and public ownership (12%)[75]. However since 2003, the Land Reform Act, part 2 gives communities pre-emptive right to buy land with which they have a connection in rural Scotland by giving communities 'right of first refusal' should the landowner decide to sell[76]. While community uptake of Community Right to Buy (CRB) has up to now been limited[**,77], these reforms have contributed to community-led renewable energy development in several ways. Firstly, in several cases the CRB application process has been a vehicle for community groups to self-organize, register as tradable legal entities, formalize membership, community representation and governance structures, and gain experience in public consultations and asset trading. Secondly, the CRB specifies that community objectives and specific plans for the land need be consistent with sustainable development, making renewable energy an obvious and attractive revenue-generating alternative for communities drawing on the Scottish Land Reform Act. Thirdly, while community land ownership does not remove the possibility of planning permission rejection, it tremendously reduces it. Community benefit and buy-in into planning applications are thought to be the single most important factor in determining whether planning applications are granted[78].

[**] Community land buy-outs are few and far in between. According to Macleod and Braun-Holtz-Speight (2010), this is due to the lack of land being put on the market, land being withdrawn from the market post-application, and rejection of applications. More generally, there is a temporal mismatch between the speed of land sales and the initiation, development and processing of community interest applications (Macleod and Braun-Holtz-Speight, 2010).

In summary, planning consent for small to medium-scale installations (>50kW) can be a costly and risky process, requiring public consultations and detailed planning applications, which may or may not require an environmental impact assessment depending on the project scale and site. There are no (formal) special provisions for community projects in the planning process. The CRB has in several cases provided windows of opportunity for communities to secure land, assets and organisational capacity required for renewable energy development. However, the additional upfront cost and complexities of purchasing appropriate land forces most communities to rent land, frequently leading to lengthy and arduous negotiation processes with land owners who want 'a piece of the pie'.

The final section of this chapter briefly outlines a common technical constraint to RE development, but one which is poorly documented in the community RE literature, namely: difficulties in accessing grid connections and limitations in grid capacity.

2.5 Grid connection, access and capacity

The UK electricity grid is composed of 'the Great Britain transmission' system, a UK-wide high-voltage AC and DC transmission system that delivers bulk electricity to 14 licenced lower voltage distribution networks via grid supply transformers at what are called 'grid supply points'[79]. While large power stations are usually directly connected to the Great Britain Transmission system[††], the majority of small to medium power stations are embedded within distribution networks of variable transfer capabilities and transmission capacities. With exception of the larger (>5MW) joint venture projects in this study then, the installations in this study supply electricity to distributed networks and are consequently treated as 'negative demand' on the national transmission system[79].

SHETL and SPT are the two distribution network owners and operators (DNO's) in the Scotland and are responsible for local distribution of electricity and maintenance[‡‡]. In both distribution networks, embedded generation has increased to a level where distributed networks supply electricity exports to the transmission system[79]. Wherever an organisation sites a new generator in a network area where the amount of generation already exceeds the demand, the maximum power flow will increase. If the maximum power flow exceeds the transmission capacity of the existing system, the new station cannot be connected to the grid before transmission capacity is reinforced. For instance, in some parts of the SHETL and SPT network, substations transforming high to higher voltage are reaching capacity with limited room for additional generators[80]. Additionally, in some areas of the SHETL and SPT

[††] Large generators are defined as power stations of 100MW or more in NG network (England & Wales), 30MW or more in SPTL's network and 5MW or more in SHETL's area (The National Grid, 2005).

[‡‡]Both SHETL and SPL are subsidiaries of corporations that also electricity suppliers and generators, owning power plants, purchasing electricity from generators and selling electricity to commercial, industrial and domestic customers.

network the transmission network is already full for generation, in which case SHETL and SPT must issue a statement of works process with the National Grid to assess and plan for the impact of a new generator[80]. This has resulted in delays and cost impacts on a number of (community) renewable energy installations, and has in certain circumstances singularly made projects financially unviable (see for instance Swider *et al*, 2008[81] ; Lüthi and Prassler, 2011[82]).

Having sketched the institutional context surrounding community renewables, the following chapter provides a theoretical foundation for this study, which assesses community renewable deployment in terms of its ability to enable a socio-technical regime change in the energy sector, and subsequently provides a framework from which to specify the model for analysis.

3 Conceptual and theoretical foundations: Social Movement theory

As described in the introduction, the starting point of this thesis is that community-based renewables deployment (whether geographically defined, work-place based or interest-based communities) is key to a socio-technical regime shift featuring distributed networks, renewable energy and regeneration of rural or urban deprived regions. Given a context in which segmentary, polycentric and networked community organisations are challenging and influencing the existing energy network, one can view community-led renewable energy deployment as a grass-roots based social movement, where social movements are defined by Diani (1992) as "networks of informal interactions between a plurality of individuals, groups and/or organisations, engaged in political or cultural conflicts, on the basis of shared collective identities"[83]. While the nature and degree of political contention differ from that of revolutions or civil rights groups on which Social Movement theory is based, the demand of inclusion into the existing UK energy policy network is most certainly an arena of political contention. Namely, in the process of overcoming social, financial and technical problems during the development of renewable energy schemes, communities instigate social, political and infrastructure change, for example by engaging in cross-community support networks, creating new institutions, collaborating with landowners or the private sector, instigating regulatory change at the level of local authorities, driving change in grid infrastructure, and challenging UK energy policy. The political contention associated with the latter is evidenced by the nature of the public consultations used by the UK government to adjust the technologies, requirements, and banding rates of public support schemes[84]. Public consultation responses clearly reflect the colliding interests of different stakeholders in the sector, in which conflicting social, environmental and economic values at local, national and global scales are brought to the fore.

The community activities described above correspond with concepts and processes of 'protest' and 'recruitment' integral to Diani's synthesis definition of social movements. Diani definition of social movements bears five key characteristics: i) networks of informal interaction, ii) shared beliefs and solidarity, iii) collective action, and iv) action which displays largely outside of the institutional sphere and the routine procedures of social life[71]. Community organisations engaging in RE schemes are often necessarily formal and institutionalized structures. However, Diani emphasizes informality and looseness to be properties of the overall system of interaction, rather than of each single unit of the system[71]. Given the emphasis on diverse, segmentary, polycentric, and networked organisations that are able to adapt to the task of challenging and changing society and culture[85], such single units are expected to take on a diversity of structures and degrees of formality. With respect to shared beliefs and solidarity, Chapter 1.1 of this text has already argued that the Scottish context of community RE action is one in which communities are frequently (at least partially) motivated by normative and therefore political motivations to engage in renewable energy generation, such as empowerment, self-sufficiency, and the right to benefit from local natural resources, perhaps reflected in that “regional policy and regional policy communities are more firmly embedded than elsewhere in the UK”[100]. In conclusion, this work assumes from here on that community renewable energy development in Scotland corresponds with definitions of 'a social movement' as per recent integrated approaches to Social Movement theory, in the hope that such an analytical approach may increase our understanding of the conditions under which such a social mobilisation comes to successful fruition.

Social Movement theory (SMT) has been used to analyse collective action ranging from the rise and decline of the black protest movement in the United States[86], to 'bottom-up' improvement of performance of national health organisations[87]. SMT encapsulates several analytical approaches attempting to understand the form and consequence of social mobilisation, as well as how it manifests (or not). These theories appear to be variably applied depending on the nature of a social movement (routine versus non-routine[88], largely oppositional versus 'generative' action)[ø], as well as the research questions motivating a given study. Two such analytical approaches, the 'Resource Mobilisation' and 'Political Process' theories, have been extensively used to identify the material, institutional and socio-political conditions in which social mobilisation processes occur. Entities engaging in social mobilisation are defined as ‘social movement organisations’ (SMO’s). Both RMT and Political Process theory view SMO’s as rational and strategically oriented reform actors, rather than political pressure groups, and therefore seem apt to frame our understanding of the factors that enable community renewable energy action. A third approach, 'New Social Movement Theory' (NMST), was put forward to investigate how framing processes and shared meanings associated with the need to overcome a 'cultural domination' can instigate social mobilisation. In other words, NMST focusses on the formation of shared perceptions about societal control and dominant relations of production over peoples spiritual, social and economic values that can motivate the formation of collective counter-hegemony[89,90]. Application of NMST to community-led RE initiatives would therefore enable an understanding of which communities are more likely to adopt renewable energy and which not, and is relevant to our understanding of current development and future growth and capacity of community-led renewable energy generation. It is excluded here due to the fact that this study has access to only those communities who have already initiated in RE initiatives. A broader analysis tackling community adoption versus non-adoption would require data sampled from a random selection of non-implementing communities, which is problematic. Note however that this work does include social, cultural factors and community objectives of renewable energy projects, in so far as they affect successful

[ø] Social movement theory identifies two constitutive elements within social movements: i) action directed to a common cause allowing “appropriation and orientation of social values and resources“, or that articulates and develops technology alternatives (generative action) and ii) “behaviour which transgresses the norms that have been institutionalized in social roles, which go beyond the rules of the political system and/or which attack the structure of a society’s class relations” (oppositional action)'.

collective action of social movement organisations. NSMT will not be discussed here in further detail.

Social Movement theory has been sporadically applied to renewable energy development and environmental action. It has been used to analyse the statistical co-evolution of social movements with institutions, entrepreneurship and wind power industries[91,92]. There are also descriptive accounts of the role of social movement action in facilitating commercial wind development[93] and in legitimating wind technologies[94], with an emphasis on the USA. Together they suggest that social movements influence the nature of institutions that emerge as well as the subsequent growth and visibility of the RE industry, but that social movement organisations in turn are also transformed by the establishment and growth of the RE industry. At a more general level, Hess (2007), van Poel (2010) and Smith (2004) explore the consequences of both oppositional and generative social movement action in terms of how they contribute to politicizing consumption, changing markets, industries and regulations in their ultimate aim to provide alternative institutions to diffuse technologies and products[95,96,97]. Without exception then, these studies focus on the wider consequences of social movement action, and their role in driving societal and/or commercial development in sustainable technologies[*]. While this thesis likewise sits at the interface between Social Movement theory and Organisational theory, it differs from these studies in that it distinguishes between community-led versus commercial RE development. As such, the 'model of change' investigated here is not a transition to renewable-energy based society in the broader sense, but one corresponding to a distributed, decentralized, and renewable energy production.

Finally, a separate class of literature focusses on social movements or activism in the form of climate change action and its relationship to 'cognitive praxis'; the coupling of ideologies and worldviews, existing cultural and traditional knowledge to particular forms of action[98]. The sparse literature drawing on SMT to analyse the barriers facilitating and constraining the advancement of (community-based) renewable energy projects likewise focusses on cultural and social barriers, drawing on New Social Movement theory, and show how leadership aspects, communication between leaders and community members and conflicting values can deter project completion[99]. The following paragraphs will outline the two SM theories deemed relevant for this work and apply them to community-led RE development in the Scottish context.

3.1 Resource Mobilisation theory

Resource Mobilisation theory focusses on rational, purposeful and technical aspects of social movement behaviour[100]. Instead of asking 'Why do people want social change?' it asks

[*] Hess (2007) considers normative motivations based on poverty and democracy and suggests that generative action often manifests as a form of localism.

'What conditions and resources allow a set of beliefs representing preferences for change in society to be translated into action?'[71]. In this framework, community bodies represent 'out-polity groups' or 'social movement organisations' (SMO's) which organize themselves to seek inclusion into the polity, and gain regular routine low-cost access to societal resources, such as access and control over electricity and price support. The community body acts as a repository for accumulation and concentration of resources, as well as a forum for leadership potential and articulation of group goals[88]. The human resources relevant to RE development are diverse, ranging from accounting skills and project management skills to environmental and technical expertise and construction, as well as political, leadership and communication skills. As outlined by McCarthy and Zald (2001), the intensity of commitment to change and the number of people who demand change is affected by 'issue entrepreneurs' who, by defining issues for general and specific audiences, "enlarge and intensify the sentiment pool"[101]. This supports Walker *et al* (2010) observations and literature elsewhere on the key role of community leaders in RE development[41]. Other internal factors that may affect sustained collective action according to RMT are the degree of internal organisation and group size[102]. In our case, these factors are reflected in the difficulties community bodies face in generating internal consensus, recruiting sufficient volunteers and sustaining member participation. SMO's develop to manage the interdependencies of adherents to the movement, and may be informal or formal, small or large[89]. Applied to community-led RE, we can envision a range of formalities ranging from informal neighbourhood eco-clubs to community development trusts or companies limited by shares which enjoy a formal governance structures and legal status. The larger SMO's may link adherents in different locales and countries[89], as is reflected in the interconnectivity of community bodies engaged in RE development. While practice suggests that community interconnectivity and knowledge exchange is perceived by community members as insufficient, it does occur by means of informal social networks, meeting forums organized by third (academic or NGO) parties, as well as an official government body (Community Energy Scotland) that regularly brings its members together for knowledge exchange and training.

Resource Mobilisation theory stresses that a preference for change does not automatically translate to action; instead action occurs in the context of the life situation of SMO members which includes competing commitments (work, family, educational goals), social costs and benefits of participation, resources available (skills, money, time, facilities, status) and the extent to which resources are put in service of the movement[89]. From this viewpoint, with respect to resources, we can therefore expect community members with higher income, more free time, and higher education levels to be relatively more engaged in community-led RE development. With respect to personal gain of participation, we can expect benefits of status and prestige to be highest in locales with a majority of Green Party voters, for instance. In addition, we might expect benefits of status, prestige and leadership to be highest where there is much social capital, since individuals will be more socially accountable for their actions. While less resourceful SMO's have historically been known to be able to organize on their own and accumulate the necessary resources to sustain an organisational network [103,104], most authors agree that SMO's with low access to discretionary resources depend economically and politically on the dominant polity. This is especially true for community energy action, because it is characterised by substantial upfront investment, extensive legislatory requirements and dependence on external parties for technology manufacture and installation. Community-led RE thus remains far from autonomous of the political sphere and from electricity and technology markets.

According to McArthy and Zald (2001), resources may be supplied by members of the movement, institutional channels such as church bodies, philanthropic foundations or government programs, or 'conscience constituencies' who do not benefit directly from the changes advocated, and SMO's both combine and compete for resources in their attempt to accomplish social change[89]. Indeed there is stark competition between community bodies for limited government Climate Challenge Funds, and CARES grants (now CARES loans), or Big Lottery Funds, but there is also free and voluntary bilateral information exchange and a sense of collective ambition. As SMO's increase in size and resources, professionalization may occur such that careers in a 'social movement industry' may develop[89]. Professionalisation of community RE development in Scotland has involved the establishment of several 'broker' companies, consisting of community leaders who have built significant experience in pioneering community-led RE development and who have started capitalising on this experience by providing services to start-up communities, such as mediation with developers on behalf of the community, planning, training and RE finance. However, given that communities struggle to finance project expenses there is a lack of funding and support for such peer-to-peer mentoring[105]. As the sentiment pool expands, resources available for mobilisation increase and SMO's differentiate in ideological disposition and functional niche, with different tactics and programs[89]. As government support for community-based RE development has increased since the 1990's, the community-led RE sector clearly reflects this diversity in objectives, with some communities aiming primarily to reduce community GHG emissions, while others simply aim to cut domestic energy bills, eliminate dependency on centralised energy supply or to finance other community social objectives. In addition, communities have clearly taken different approaches to realizing RE schemes, both with respect to technology as the social arrangements through which technology is used. Walker(2007) shows how different forms of alliance or partnerships between public, private and voluntary sector groups, models of responsibility for ongoing operation, and forms of technology ownership allow communities to develop renewable technology appropriate to particular needs, objectives and local contexts[106]. These differences are also apparent from the four categories of community engagement outlined in **Table 1**. For instance, many successful communities appear to build on a history of community-based asset management to exploit currently attractive renewable energy markets, in order to secure their organisational survival and to fund broader social or environmental programmes in the locality. These well-established community bodies are more likely to have both human resources and facilities to enable RE development. Others have fewer (land, resource, community-owned capital) assets and are less able to self-fund start-up capital, relying on more extensive external fund-raising. While some communities channel resources to household-based renewable energy production, others focus on electricity production and distribution at community level. Finally, communities may produce energy for the grid and/or consume it locally.

In summary, Resource Mobilisation theory suggests that the following broad categories of enabling and constraining factors are relevant to our understanding of the development of community-led RE as a social movement. First, we identify a number of organisational features; skills and expertise, leadership, the degree of internal organisation and manpower. These are all indicators of organisational capacity and depend on the number and nature of its members, as well as the degree of commitment and resources they are able and willing to invest in the organisation. Commitment and resource investment of members hinges on the one hand on shared collective ambition but on the other hand on a number of local or regional characteristics that are exogenous to the organisation itself. The latter includes the degree of social cohesion that exists within the wider community, as well as the time, expertise and wealth that organisation members have available. In bland terms, we may find more single income earner households in wealthy neighbourhoods such that more time may be available for voluntary contributions to community organisations.
Other exogenous factors that may affect the success of a social movement according to RMT is the degree of interconnectivity and knowledge exchange between SMO's, as well as the number of SMO's in relation to the support mechanisms available. In this respect older, more experienced community organisations are likely to be less dependent on external financial or project management support, because they are more likely to own assets and capital reserves and have developed experience and expertise in asset trade and development.

Aside from the human and financial resources available to a community organisation, the success of a community organisation also depends on how it can influence the wider socio-political landscape in which it resides. The following section draws on Political Process theory to delve in more detail into whether we can identify specific attributes of the socio-political landscape that may aid or detriment community-led RE initiatives.

3.2 Political Process theory

While RMT focusses on internal material and human resources, the Political Process school is concerned with political opportunities and constraints confronting a social movement in its attempt to access an established polity[71'107.] Tarrow (1998) defines political opportunity as "consistent—but not necessarily formal or permanent—dimensions of the political environment that provide incentives for collective action by affecting people's expectations for success or failure"[108]. Literature reveals two aspects that affect the degree of political opportunity an SMO may have. Firstly, *an SMO that is well aligned to its political environment is more likely to be successful*[90]. For instance, applied to the national level, we may see Feed-In-Tariffs and the availability of community grants as a favourable alignment of government and community agenda's. At a regional level, a communities' ability to develop a RE scheme is highly dependent on the perception on and support for renewable energy of authority figures in its community or Local Area Authority. This is evidenced by several cases in which individuals within Planning Committees or councilors have singularly blocked consent for planning of RE schemes[109], as well as cases in which high levels of intra-community opposition to the project has effectively blocked the scheme (by leading to planning rejections). The degree of public opposition has been called the single most important factor in determining the outcome of wind developments[22]. Although there is no literature systematically investigating different factors underlying the degree of public opposition, the extent of local ownership comes up consistently in literature from the UK as well as elsewhere as a key underlying factor[10,110]. To conclude, political alignment with the wider community appears to hinge firstly on the degree to which an organisation represents the wider community and secondly on the perceived distribution of benefits over adverse effects of the development. The relevance of the distribution of benefits vis-à-vis the distribution of adverse effects is exemplified by recent policy developments in Scotland's' Highlands council, which distributes community benefit funds on the basis of adverse visual effects of wind developments[111].

A second argument arising from political opportunity theory is essentially the advantage of political power in an organisations' ability to realize social change. Specifically, Melucci states that *an SMO that is able to restructure existing power relationships in order to exert political leverage is more likely to realize social change*[90]. Applied to community RE development, this would suggest that the larger the number and strength of community ('out-polity') groups, the greater the extent of external sympathizers, and the better a communities social connections in the existing energy network, the easier this process of restructuring of power relations. Little is known about the extent and the means by which community bodies engage in politics to gain leverage within the wider energy social network in order to affect change or recruit adherents. Anecdotal evidence suggests that communities vary in the degree to which they reach out to key authority figures or are politically active at local authority or national level. For instance, outreach for the majority of organisations is limited to membership to a national umbrella organisation (Community Energy Scotland), which is by virtue of being 100% publicly funded not an ideal platform for political activism. However, a number of community power practitioners have taken an alternative route and 'joined voices' under an independent umbrella group to lobby on matters ranging from planning approval to grid capacity and connection[112].

In summary, Political Process theory suggests the following factors are relevant to the success of a social movement. Firstly, there is more likely to be support for a project if it is implemented by an organisation that is perceived to be highly representative of the wider community, which enjoys high levels of support and membership in the area (visually or otherwise) affected by a project. Secondly, an organisation with strong ties to key authority figures is more likely to have the political leverage with its local authority to ensure backing for its projects and its mission. For instance, a personal acquaintance on the council planning committee represents a window of opportunity to persuade the committee of the socio-economic and environmental benefits of community-led RE projects. Organisations with ties in the wider energy network will also have the information that allows them to align themselves in politically favourable positions and to respond to any political opportunities that may further their wider cause.

Having placed community RE in a framework of Social Movement theory, the following Chapter describes how this study went about more systematically identifying constraining and enabling factors of Scottish community-led RE initiatives. It also describes how these factors were subsequently measured and modeled in a survival analytical framework.

4 Methodology

The following paragraphs outline the methodology followed in chronological sequence. Because of the inherent difficulties in placing socio-political phenomena in a quantitative framework, we begin by outlining the conceptual approach with regards to choice of factors and development of indicators by which these factors were measured across Scottish community organisations. Section 4.2 outlines the process by which constraining and enabling factors were systematically identified ('content analysis') and in Section 4.3 we detail the definition of 'community organisations' adopted in this study. Finally, we describe how the data corresponding to the factors identified were collected, explain the development of composite indicators and outline the model used for analysis.

4.1 Methodological approach: subjectivism in choice of constraining and enabling factors and indicators

Previous studies on community engagement in renewable energy have shown that actors in this field have emphasized different constraining and enabling factors to the deployment of community-led wind power generation[16]. From a theoretical view, conflicting views on key barriers to community-led RE initiatives arises first from incomplete oversight of data, for instance due to the set of experiences and knowledge an individual is exposed to. Secondly, conflicting views arise from the uncertainties and subjective partiality inherent to existing knowledge. From a constructivist perspective, claims for different relationships and causal mechanisms are most likely part of wider discourse(s) in that they are produced, used strategically and work to construct any given author's subjective view of reality ('discourses'). This is especially relevant for constraining and enabling factors that embody multiple dimensions, are ambiguously defined and difficult to measure, such as 'leadership skills', 'environmental orientation', 'network integration' and 'social cohesion'. The objective of this research is however not to analyse the strategic choice of language used by different actor groups surrounding renewable energy in order to exert power effects, nor to reproduce or realize their version of an out-there reality. Instead the aim is to match and compare postulates implicit in different discourses with a more complete oversight of empirical data. As such, this study samples constraining and enabling factors from across the range of different viewpoints. Respondents are not, in as far as possible, asked to provide measures of such 'fuzzy' factors, and 'fuzzy' factors will be replaced instead by proxies abstracted from external data sources.

According to strict constructivist notions, the inherent selection and representation of empirical data, such as the searching, interpretation and formulating indicators for constraining or enabling factors is also subjective. The methodology in this study is borrowed from a small field at the interface between entrepreneurial studies and institutional theory, which uses statistics to distil structural correlations between the emergence of (sustainable) industries and social, economic, institutional environments (see for instance Russo, 2003[113] and Sine, David and Mitsuhashi, 2007[114]). Inherent to this method is the view that, while empirical data is (inevitably) subject to social construction, we can minimize the influence of social constructs through systematic data collection, choosing indicators that are less amenable to variable interpretation, validating survey data with secondary external data sources, and aligning findings with conceptual frameworks and case studies generated by researchers elsewhere.

4.2 Identification of constraining and enabling factors and development of indicators

Content analysis was used for systematic identification of key factors enabling or constraining the successful completion of Scottish community-led renewable energy initiatives. Literature included anecdotal findings, summary reviews and previous work outlining expert opinions. Factors were coded according to 'resource' and 'political opportunity' factors arising from the application of SMT as outlined in Section 3.1 and 3.2, with additional codes emerging throughout the coding process. Care was taken to sample literature originating from different corners of the sector, urban and rural case studies, and RE technologies other than onshore wind. Some literature focussed on UK in general, while other literature focussed on Scotland specifically. Literature on domestic micro-generation was excluded on the basis that the nature of barriers to domestic micro-generation are likely to diverge from community-scale generation projects (domestic initiatives were also not included in the sample). Key sources used for content analysis and formulation of indicators were Pepper and Caldwell (2010)[13], Walker (2008)[23], Walker (2007)[106], Hogget (2010)[115], Rogers *et al* (2011)[116] and IPPR Report (2010)[117] , Barnes (2011)[15] and Walker *et al* (2010)[39]. Indicators were chosen for the constraining or enabling factors identified based on available data and where possible by measurement approaches taken in previous studies as described in the following two sections.

Survey-based indicators were adjusted to field realities after pilot survey interviews. Indicators had to match the knowledge and vocabulary of project development officers who were the primary contact persons for interviews. Given that for some factors it was difficult to predict the range of variability in the population of community projects, and that some factors were subject to a degree of subjective interpretation, factors were chosen conservatively (more rather than fewer) and where possible validated with external data. Indicators were chosen to be least subjectively interpretable as possible, such that answers were not dependent on the choice of interviewee and therefore representative for the unit of analysis (the community body).

4.3 Defining 'community' projects

Returning to the four types of community engagement outlined in Section 2.1, the definition of community RE project adopted by this study included community-led projects as well as joint ventures with a community stake. Case studies from both categories were sourced from the following directories and resources:

1. UKERC ENGAGE directory (2011); The UKERC Engage directory was collated in 2011 by the Institute of Governance at Edinburgh University and includes any "non-governmental, non-professional groups engaged in community-focused and often policy-orientated energy action"[25] across Scotland, thereby excluding interest-based groups such as housing associations, schools, libraries. Of the 135 grass-roots energy action groups in the directory, this study selected only those generating renewable energy through any or several of wind, biomass, solar, CHP or hydro-electric sources (83).
2. The University of Lancashire's UK community energy projects database (2004); The UK community energy projects database was constructed by at the end of 2004 and contains 103 Scottish then ongoing or completed projects supported by programmes or initiatives with the word 'community' in their title and/or their rationale, a small proportion of which involve community-owned renewable energy technologies. Projects by local authorities and by local entrepreneurs and organisations that were not strictly grass-roots social enterprises were excluded.
3. Any remaining case studies described in Community Energy Scotland's web portal.

In case of non-charitable organisations or where non-profit rationale was in doubt, articles of association were used to assess the presence of motivations over and beyond company profit. Where the main business activity was based on an alternative economic activity, such as housing, charitable status was a prerequisite for inclusion. For instance, for - profit housing associations with independent charitable arms with a social/environmental mandate were also included in the sample.

Based on the literature, the resulting sample of community projects corresponds well with stakeholder understanding of what constitutes a 'community project', since it captures both the participatory nature (process) and collective benefits (outcome). These two dimensions were observed to be the main characteristics that stakeholders used to distinguish a 'community project' from other types of projects in the UK[118].

4.4 Data collection & survey design

Having identified indicators for the range of factors affecting successful implementation of community-led renewable energy projects, this data was sampled from 301 community projects. All technologies eligible for public support schemes were included, such that the sample included solar (thermal or electric), hydro-electric, wind, combined heat and power, or anaerobic digestion, and wood-fuel based district heating installations. Wherever possible, data was collected from existing literature, government resources and the directories described above (**Appendix I** shows the external data sources used to populate respective factors). All other factors were populated by means of digital surveys using Qualtrics, embedding data in Qualtrics panels as to personalize and shorten the survey for respondents (see survey in **Appendix VI**). Given that renewable energy installations were taken to be the unit of analysis, wherever community organisations had multiple installations, each installation was given a separate entry in the database. For a given installation, both the sites that were rejected for planning and alternative sites were recorded, but only the most recent candidate development site was used in the analysis.

Finally, non-survey data included a range of spatial, grid capacity and planning data compiled from a number of sources (a detailed list of sources is provided in **Appendix I**). These data are described in the following subsections. Where relevant, the development of composite indicators is described.

Spatial data

Data on local wealth, education and social cohesion was obtained from Scottish Neighbourhood Statistics. QGIS was used to join this data defined at level of datazones (the smallest possible geographic unit at which this data is collected, representing populations of between 500-1000 individuals) to individual community organisations by postcode. The 'Income domain 2009+2 rate' provided by the Scottish Index for Multiple Deprivation (2009) was used as an indicator for local wealth, and represents the percentage of the data zone population who are in receipt of, or dependant on someone in receipt of, Income based Employment and Support Allowance, Income Support, Job Seekers Allowance, Guaranteed Pension Credits and Child and Working Tax Credits[§§]. Local education levels were approximated with 2008 data on the proportion of working age people with no qualifications (2008)[§§]. The Scottish Rural-Urban Classification (2010) was used as a proxy of social cohesion; this classification assigns localities to one of eight categories based on based on settlement size and drive times[***].

The degree to which community organisation represented the wider community in which it resided (from here on 'representability') was approximated by means of survey data, as well as spatial data on settlements and datazones as obtained from the Scottish Index for Multiple Deprivation (2009) and the General Register Office of Scotland[†††]. Community

[§§] Scottish Index of Multiple Deprivation Income and Education Domains, [available online at:] http://www.scotland.gov.uk/Topics/Statistics/SIMD
[***] 2009-2010 Urban Rural Classification, [available online at:] http://www.scotland.gov.uk/Publications/2010/08/2010UR
[†††] Scottish Settlements Urban and Rural Areas in Scotland, [available online at:] http://www.gro-scotland.gov.uk/statistics/geography/scosett/index.html. A postcode is 'urban' if either the density of residential addresses per hectare exceeds 2.1 or the density of non-residential addresses per hectare exceeds 0.1.

organisation representability was calculated as follows:

$$\frac{Number\ of\ members\ in\ the\ organization}{Total\ number\ of\ people\ living\ in\ the\ community}$$

where ‘total number of people living in the community’ is defined as the population of the respective settlement (2001 data). The settlements of Scotland have been defined by the General Register Office as an area of more than 210 postcodes above a threshold population density††[†]. A small number of community organisations are not located within ‘a settlement’ (%). Here the total number of people living in the community is defined as:

$$\frac{\text{Average area of a settlement } (233154.8m^2)}{\text{Area of the data zone}} \times Data\ zone\ population$$

Council planning policies for renewable energy

Council planning policies for renewable energy developments were analysed by means of a comparative review of local development plans. In addition, planning rejection rates for wind were calculated based on data on planning outcomes obtained from the online planning registers for each council represented in the total sample. The nature of variations across council policies made it difficult to rank per council planning legislation on the basis of restriction levels. For the purposes of this study then, annual planning rejection rates (as obtained from online planning registers) were chosen as an indicator for council (community) renewables policy and support. Given that key planning documents make a distinction between <50kW (micro)-installations, ‘large wind developments’ above 20MW, and >50MW developments, wind planning rejection rates were calculated following these broad categories. An additional category was added for 50kW-2MW to distinguish between medium and large-scale developments. Rate of planning rejection for all non-wind installations was taken to be 1%, reflecting minimal planning rejection rates.

Regional grid capacity

Transmission capacity is strictly defined as the thermal limit or rating of an individual transmission component, but in an interconnected network, the ability of a single transmission line transfer additional power is in fact a function of: i) the physical relationship of that line to other elements in the transmission network (such as switch gear elements with lower current ratings, as well as thermal headroom of substations and grid supply points); in other words the *thermal capacity of the system*, ii) generation levels, demand levels and transmission system conditions (temperature and wind affects the thermal conditions of conductors) assumed during the period analysed (these affect *the voltage and* *stability of the system*)[119,‡‡‡].

This study therefore approximates local grid capacity as follows:
For installations of any technology above 50kW for which wider network capacity issues apply, grid capacity (GC) will be estimated as:

$$GC = \frac{D\ (m)}{\min(SS(MVA), GSP(MVA)}$$

where D= Distance between installation site and nearest primary substation (km)
SS= Thermal headroom of nearest primary substation (MVA)
GSP= Thermal headroom of nearest grid supply point (MVA)

Distance is placed in the enumerator to account for the fact that remote off-grid locations may too far from the nearest substation to connect there. For installations of any technology below 50kW that can connect to the local network or any installations that only connect to a private network for private consumption,

$$GC = 0$$

For projects above 5MW we assume direct connection to the transmission grid and estimate GC as:

$$GC = \frac{D\ (m)}{GSP(MVA)}$$

Data on thermal headroom of transformers at substations and of grid supply points were obtained from the SHETL and SPD websites as pdf tables or maps, processed and imported into QGIS[§§§,****]. In order to derive the spatial coordinates of substation and supply points, this data was merged with vector data for settlements, localities and Ordinance Survey Boundary Line data [††††](see **Figure 2**).

[‡‡‡] There are three dimensions to transmission capacity; these are the factors that constrain the ability to add additional power export on a distribution grid: thermal capability, voltage and stability;
1. Thermal Capability is the maximum amount of power that can be transferred across a boundary on the system without exceeding the thermal rating of any one of the individual circuits; it depends to a large degree on the way in which the power transfer is shared between them.
2. Voltage, because it is sometimes necessary to restrict power transfers to a level lower than the firm thermal capability to ensure satisfactory voltage levels in the importing area.
3. Stability, because the power transfer between two areas or between a major generating station and the system can also be limited by considerations of electro-mechanical stability.
[§§§] SP Energy Networks, [online, last accessed 31/07/2012 at:] http://www.spenergynetworks.co.uk/dgis/connection_opportunities.asp
[****] Scottish and Southern Energy Power distribution, [online, last accessed 31/07/2012 at:] http://www.ssepd.co.uk/uploadedFiles/Controls/Lists/Connections/Generation_connections/DG_information_strategy/SHEPD_GenerationHeadroom.pdf
[††††]OS Boundary Line, [online, last accessed 31/07/2012 at:] http://www.ordnancesurvey.co.uk/oswebsite/products/boundary-line/index.html

The following and final section of this chapter specifies the statistical model chosen to analyse the constraining and enabling factors to community-led RE initiatives. Given that there are a large number of modelling alternatives that all fall under the broad class of survival models, it also attempts to justify choices made in model specification by taking a closer look at the properties of the data at hand and by returning to the research questions as originally outlined in Section 1.2.

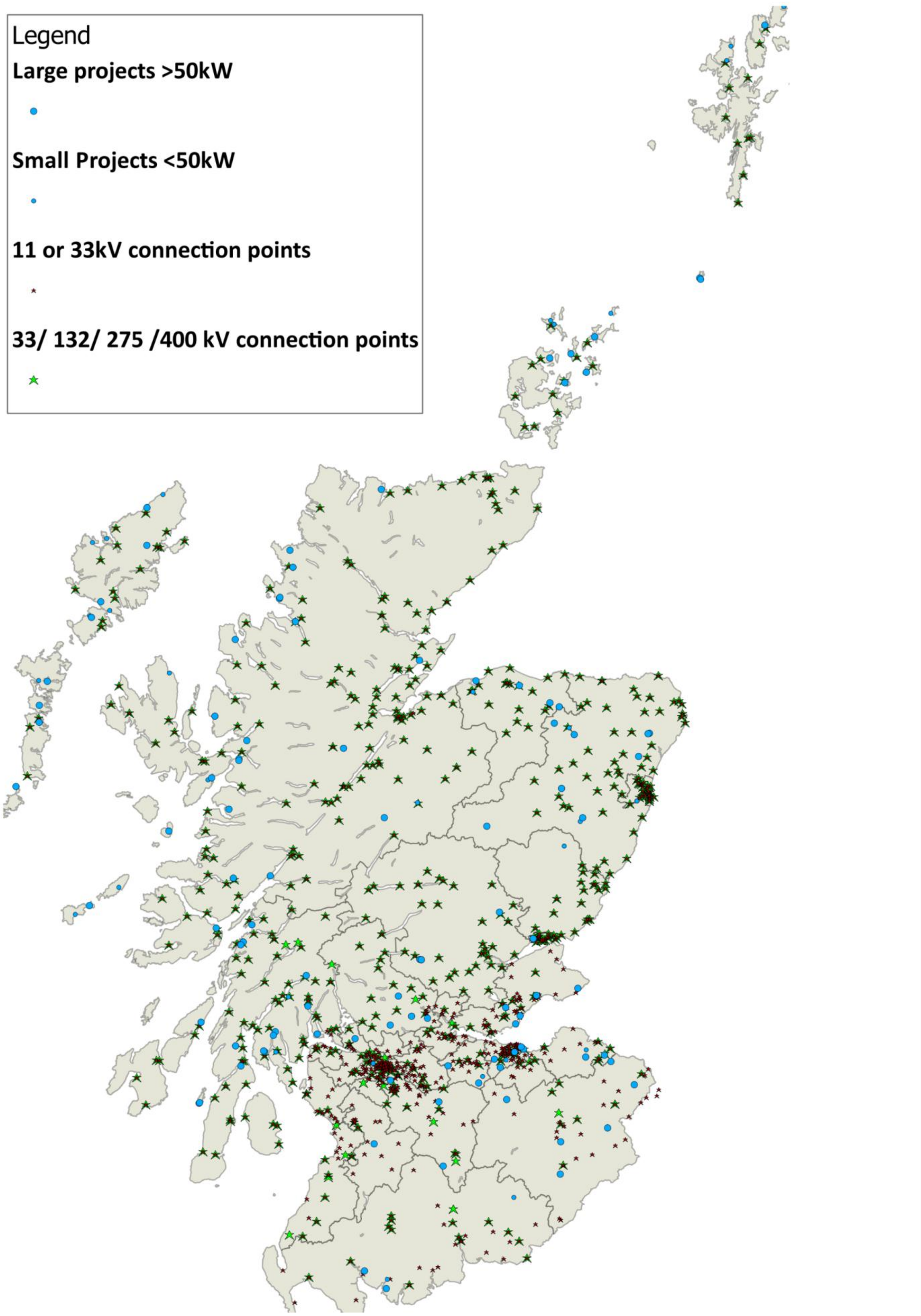

Figure 2: *Map of project locations in relation to grid connection locations*

4.5 Model specification

Survival analysis (SA) models are typically used when one wants to understand the factors affecting the (duration until) occurrence of an event. The event in question in this case is the completion of a renewable energy project, defined here as the month upon which it is commissioned and operational. SA models are appropriate when the dependent variable represents the occurrence of a discrete event in time, when there is a possibility that a unit of analysis never experiences the event ('censoring'), and when one has a longitudinal record of the timing of the occurrence of the event available[120]. This class of models has been widely used to explain the emergence of (sustainable) industries quantitatively[98'99], as well as for instance the length of civil wars, coalition durability, work careers, and health and development-related issues[121].

There are a range of non-parametric, semi-parametric and parametric survival models available that are more or less appropriate given what is known about the nature and distribution of the data. In this case:

- Covariates are assumed to have an effect on the event, not on the timescale until the event occurs (the event being the operationalization of a renewable technology);
- We distinguish two types of events. One event is defined as project completion, the month at which the installation is commissioned and functional. The second event is defined by project failure, the month in which the organisation chooses to stop pursuing a project. Organisations exits from one and only one cause;
- Our data set is cross-sectional and we do not specify time-varying covariates. However, projects enter and exit the time frame at different times;
- Censored cases (non-events) are defined as projects that have not completed or failed at time of interview;
- Our sample for analysis consists of 150 projects over 107 organisations, in which covariates are either unique to projects or to organisations.

Figure 3 demonstrates the three project types distinguished in the analysis. A distinction between project completion and failure is necessary because if failed projects were treated as censored projects (non-events), this category of cases would be selectively withdrawn from the sample and result in biased estimates. This is because failed projects are likely to exhibit properties that make them less likely to experience project success. Failed projects are therefore likely to demonstrate dependence on covariates, violating the assumption that parameters of the distribution of censored data are independent of parameters of the distribution of duration data[122]. By excluding failed projects from the censored subsample, we can assume that remaining censored cases are randomly drawn from the population and that censoring is not informative in predictions of hazard rate.

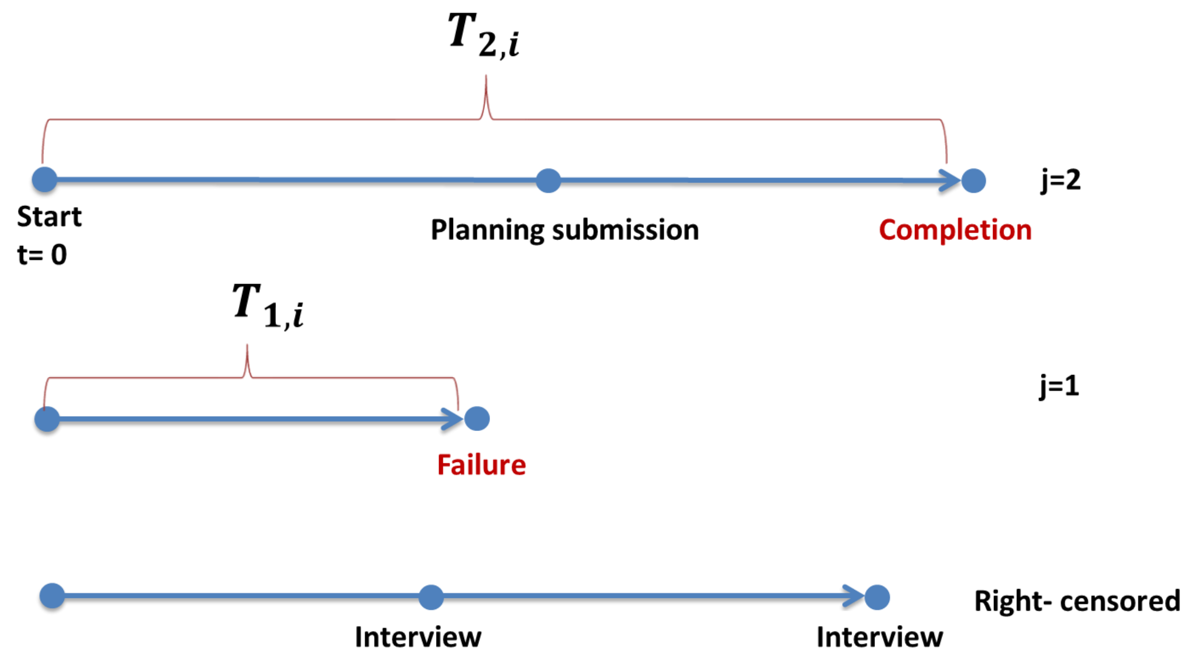

Figure 3: *The three project categories distinguished in the competing risk model*

Another advantage of including failed projects in the model as a separate category of 'event' is that it allows us to meet the assumption of a zero limiting survival probability; that all projects are ongoing at t=0 and all projects experience an event (whether failed or completed) at t=∞. In other words, we can assume that S (0) =1 and S (∞) = 0 which prevents us from having to account for a surviving fraction S (∞)> 0.

Following Kalbfleisch and Prentice (2002)[123], the following paragraphs outline a semi-parametric competing risks model in which we account for disproportionate hazards by splitting the time axis. Splitting the time to event data into two episodes and incorporating a discrete variable for 'episode' into the model is a standard approach to meeting the proportional hazards assumption which states that the effect of a change in covariates on event occurrence is the same at any point in the time frame of analysis[123]. As long as the hazard function for the two episodes have the same baseline hazard function, this approach is more favourable to stratifying the model by episode. In addition, stratification assumes that coefficients of remaining covariates are constant across strata[124], which is not the case here.

For each episode we define:
Y= duration until the project is successfully completed, defined as the point at which the installation is commissioned
Z = duration until installation is censored, at which the project is still ongoing (or has dropped out prior to completion)
$T = min\ (Y, Z)$
C= 0 if the project is ongoing (censored), C = 1 if it is not
j = 1 if project has failed, and j = 2 if project has completed

Since project completion and project failure are mutually exclusive, this enables the independent estimation of hazard rates of the two events, in which exit by failure removes a project from the risk of completion and vice versa. In the context of competing risks, the cause specific hazard function (also called the subhazard function) defines the instantaneous conditional probability that an organisation with covariates x completes a project ($j = 2$) or fails a project ($j = 1$) in a small time interval, given that the project has not completed or failed up until t:

$$\lambda_j(t, x) = \lim_{\Delta t \to 0} \frac{P(\mathrm{t} \leq T \leq \mathrm{t} + \Delta \mathrm{t}, \mathrm{J} = \mathrm{j} \,¦\, \mathrm{T} \geq t, x)}{\Delta t}$$

The probability of project success ($j = 2$) from time zero until time t is known as its cumulative incidence (Λ_2). In the context of censored (ongoing) projects, Λ (t) is estimated based on the ratio of the number of completed projects to the number of projects awaiting completion with some adjustment for censoring for each time interval t=1…g. In the presence of the competing risk of project failure, the unconditional cumulative incidence of project completion ($j = 2$) becomes dependent on the cause-specific hazard of project failure ($j = 1$):

$$\Lambda_2(t) \equiv \Pr(\mathrm{T} \leq \mathrm{t}, \mathrm{j} = 2) = \int_0^t \lambda_2(u) \exp\left\{- \int_0^u \lambda_1 \,(w) dw\, du\right\} du, \mathrm{j} = 1{,}2$$

The cause- specific hazard function is then defined for each ‘event’ type by specifying covariates as linear on a log-logistic transformed cumulative incidence function. The baseline hazard function is left unspecified as normal:

$$\lambda_j(t; x) = \lambda_{j0}(t) e^{\beta_j{}' x_j}, j = 1{,}2$$

This dual approach of accounting for competing risks in the presence of a split time axis removes the assertion that projects prior to planning submission and projects post planning submission face the same risk of failure or of completion over time.

5 Results & Analysis

Having laid out the methodological steps taken in this study, the chapter at hand provides an overview of results. Section 5.1 describes the constraining and enabling factors generated from the content analysis, and ends with a summary list of factors and indicators used for further analysis. Section 5.2 provides an overview of survey results and provides an overview of any external data collected. The final section provides the model results arising from fitting the competing risk regression to the data collected.

5.1 From literature to factors and indicators

Content analysis revealed several material, organisational, human resource and political opportunity constraints to community RE development in addition to those specified in the theoretical treatment outlined in Chapter 3 of this work. Throughout the coding process, ambiguous composite factors such as 'level of network integration' had to be split into composite codes in order to be able to describe the most elementary causal factors and develop concrete indicators. That aside, coded factors closely matched those arising from Social Movement theory, and the majority of codes were observed across the range of literature sampled, with no discernible differences in codes found in Scottish versus UK-wide literature (See **Appendix II** for detailed results of the content analysis). **Table 3** provides a full summary of constraining and enabling factors arising from both theoretical and content analytical approaches.

'Integration of community bodies into the energy network' could be further composed into four sub-elements, which could each be clearly delineated in the literature. The first element was the desire of groups to 'do it all ourselves' and 'learn from the process', versus their tendency to look for solutions outside of the community or community body (see **Appendix II** under 'level of network integration-internal versus external orientation groups'). As illustrated in the following interview excerpt, this tendency was determined by the perceived degree of dependency on authorities, but also community perceptions about local authorities' attitude towards renewable technologies and competence at providing guidance and support:

'[The planning officer] seems to have lots of misconceptions about the renewable technologies and energy saving measures on older buildings in particular […] Some of the council employees are so supportive and want to help you but couldn't. Then the other ones were like "It's not my job, I'm not employed to help with biomass boilers, it's nothing to do with me". It's almost like it's not, "How can I help you?" It's more like, "How can I avoid having anything to do with you?"'

Interview with Community leader, IPPR Report (2010)

The second factor contributing to the level of network integration was the ability of community bodies to access, communicate and influence key actors in the energy network. The presence of such a social network was shown in several instances as an important means to wield power and influence in their favour (see **Appendix II**- 'Wielding power and influence'). The third category under network integration was the variable degree and quality of communication between local authorities and community groups due to council specific legislatory and procedural requirements (see 'Institutionally embedded network communication associated with procedural or legislatory requirements' under **Appendix II**). Finally, a degree of network integration occurred as result of community groups hiring or acquiring network advice, ranging from consultants to private or public social enterprise programmes (see 'Dependence on external knowledge, resources and expert advice' in **Appendix II**).

The literature pointed overwhelmingly to major difficulties for community groups in securing capital, further complicated by the fact that these constraints clearly differ at different phases in project development. The reason behind the existence of different funding mechanisms at different phases of project development is variable risk, where high risk phases require higher levels of return for private investors[125], and where risk pre-planning consent is generally too high to enable private investment. This was clearly reflected in the content analysis, where funding constraints could be sub-categorized into problems related to securing start-up capital, versus longer-term more continuous funding (see **Appendix II**).
There is virtually no peer-reviewed literature on the variable ability of communities to secure start-up or continuous capital, but Hogget (2010)[115], Barnes (2010)[21], Walker *et al* (2010)[39] and Gubbins (2010)[38] do provide some clarity. Hogget (2010) provides evidence that most communities, and in particular the less established communities, fund high-risk pre-planning consent stages by means of grants. It is only the more established community groups who are already engaging in revenue-generating activities that can fund early project phases by means of existing capital reserves. Clearly, Gubbins' (2010) categorization of community groups is important in understanding the variable constraints community groups may face in securing start-up capital (see Chapter 2, **Table 1**). Long-term funding is generally secured by means of a business loan, and occasionally through equity funding. Variable access to long-term funding can therefore be ascribed to the financial expertise within a community group that enables them to access such funding (internal) and factors that affect external risk assessments of the project (external). **Table 2** summarizes internal and external factors that could be identified in the content analysis.

Table 2: *Factors determining the variable ability of community organisations to acquire longer-term continuous funding based on Hogget (2010), Walker et al (2010), and Barnes (2010).*

Financial expertise	An awareness of the different sorts of finance available on both the debt and equity side, which have different needs and requirements
	Skills and capacity to market a project to candidate investors
Factors that affect investor risk assessment	Project viability
	Credibility of the community organisation, including history of asset management
	Capital available to the community organisation to underwrite equity investors
	Project size
	The presence of planning consent, price support, grid connection, and a construction site

Across the literature content analysis revealed the importance of leadership, a variable for which accurate measurement is notoriously difficult and would require a detailed survey on its own. Given the absence of a sufficiently accurate and parsimonious method to assess leadership at the level of community, leadership was excluded from the survival analysis. Other factors excluded on the basis of a lack of data included the environmental orientation of statutory consultees (such as the Civil Aviation Authority) and the institutionally embedded levels and quality of communication associated with procedural or legislatory requirements by local authorities. **Table 3** summarizes the constraining and enabling factors and respective indicators chosen to represent factors included in this study, adjusted according to pre-survey data variability, data availability and pilot interviews.

Table 3: *Factors and indicators based on content analysis (Detailed composition of indicators and data sources are provided in* ***Appendix I****)*

Domain	Variable	Indicator
TECHNOLOGY	Technology	7 categories
	Capacity	Installation size
FINANCIAL	Project Viability	Net Present Value
	Land acquisition	- Cost of securing land - Difficulty in negotiating lease - Land site ownership
	Cost of pre-installation construction	Cost of transport, road access, foundation construction, site preparation, erection and commissioning
	Cost of feasibility study	Cost of feasibility study
	Existing assets owned by the community body	Value of existing assets
	Cost of planning consent	Cost of planning application
	Price support	Feed-In-Tariffs, Renewables Obligations, Renewable Heat Incentive, or none
	Cost of technology	Cost of technology
	Cost of electrical infrastructure	Cost of electrical infrastructure
	Access to grid connection	- Grid capacity - Distance to connection - Grid connection cost
	Funding source and amount	5 categories distinguished
SOCIAL	Group objective	7 categories distinguished
	Social cohesion	Urban Rural Classification based on settlement size and

		drive times
	History of collective agency/solidarity	Years of active engagement in community oriented activities
ORGANISATIONAL	Degree of internal organisation	i) System for community consultation ii) Self- evaluation and iii) Pro-active financial management/regular financial risk assessment, iv) Adequate facilities to meet and carry out its activities
	Peer-to-peer mentoring	Access to 1 or more people in other communities with previous experience in setting up similar projects
	Experience in running trading, commercial or revenue-generating projects	Years of community group experience in running trading, commercial or revenue-generating projects, years
	Legal capacity to trade and handle assets	Legal status of community body
HUMAN RESOURCES	In – house technical expertise	Contribution of engineers, electricians or other technical experts from within the community in the project
	In – house project management skills	Contribution of community member(s) with experience in running similar size projects to the project
	In – house financial skills	Contribution of community member(s) with professional experience in accounting, financial planning, and/or managing cash-flows to this project
	In-house legal expertise	Contribution of community member(s) with professional legal expertise contributing to the project
	Manpower	- Total number of active volunteers ('those who regularly take part in group activities') - Total number of paid (full time or part time) staff in the community organisation
	Community Income levels	Level of income deprivation in the datazone
	Community education levels	Level of education in the datazone
POLITICAL OPPORTUNITY	Support for renewable energy of wider community / Level of consensus, buy-in	Degree of resistance to the project from within the community
	Community representability	No. of members/ total number of people living in the community
	Council and planning office (community) renewables policy and support	- Existence of a clear policy or strategy with regards to community-led renewable energy projects - Quality of council community support - Support/ interest of local council/community council in project process, with categories - Number of approved renewable energy installations/ Total number of planning requests for RE installations
	National or local utility companies support	Quality of utility company support
	Commercial developer support	Quality of commercial developer support
	Internal versus external orientation	Community inclination to seek support
	Wielding power and influence	Presence of external parties sitting in the management body or board
	Dependence on external resources and expert advice	External acquisition of technical, legal, project management or financial management support

5.2 An overview: the current state of community energy

5.2.1. Organisational features

Telephone and online surveys provided completed responses from 99 community organisations ('the respondent sample'), and 202 non- respondents for whom only limited web-based data was known ('the total sample'). The summed community-owned renewable energy capacity of the total sample (respondents and non-respondents) currently in operation was 20.2MW. This closely matches recent estimates for community-owned renewable energy capacity by the Energy Saving Trust (19.11MW), suggesting that the total sample is highly representative for the total population of community RE projects in Scotland[126]. The respondent sample therefore represents approximately 33% of the total (known) population of community projects.

With an estimated 180 MW currently at various stages of the planning process, the total sample suggests that community ownership is gaining ground. The respondent sample represents a total of £35m investment into Scottish community-owned renewables since 2004, including £7m by communities themselves in the form of either community shares or capital reserves.

Community renewables deployment continues to be centred in northwest Scotland (**Figure 4**), with just over 50% of projects occurring in the Highlands and Islands. Confirming Gubbins (2010), community RE is still dominated by wind and hydro-electric installations (**Figure 5**)[38]. Integrated installations are dominated by solar photovoltaic, ground source heat pump, or micro-wind installations in combination with solar thermal panels in community 'facility' projects (9 projects). Less common integrated installations included wind-hydrogen fuel cell systems (1 project) and integrated grid systems, such as the island grid developed by Eigg Electric. Biomass installations consisted exclusively of wood-fuel boilers based on logs, wood-chips or pellets.

Business Models and Ownership

Across the total sample, a wide variety of business and ownership models are employed towards renewable energy development (**Figure 6**). Community-led ventures comprise 87% of all projects in the total sample, and have to a large extent been enabled through financial and project management support from Community Energy Scotland and the Scottish Government.

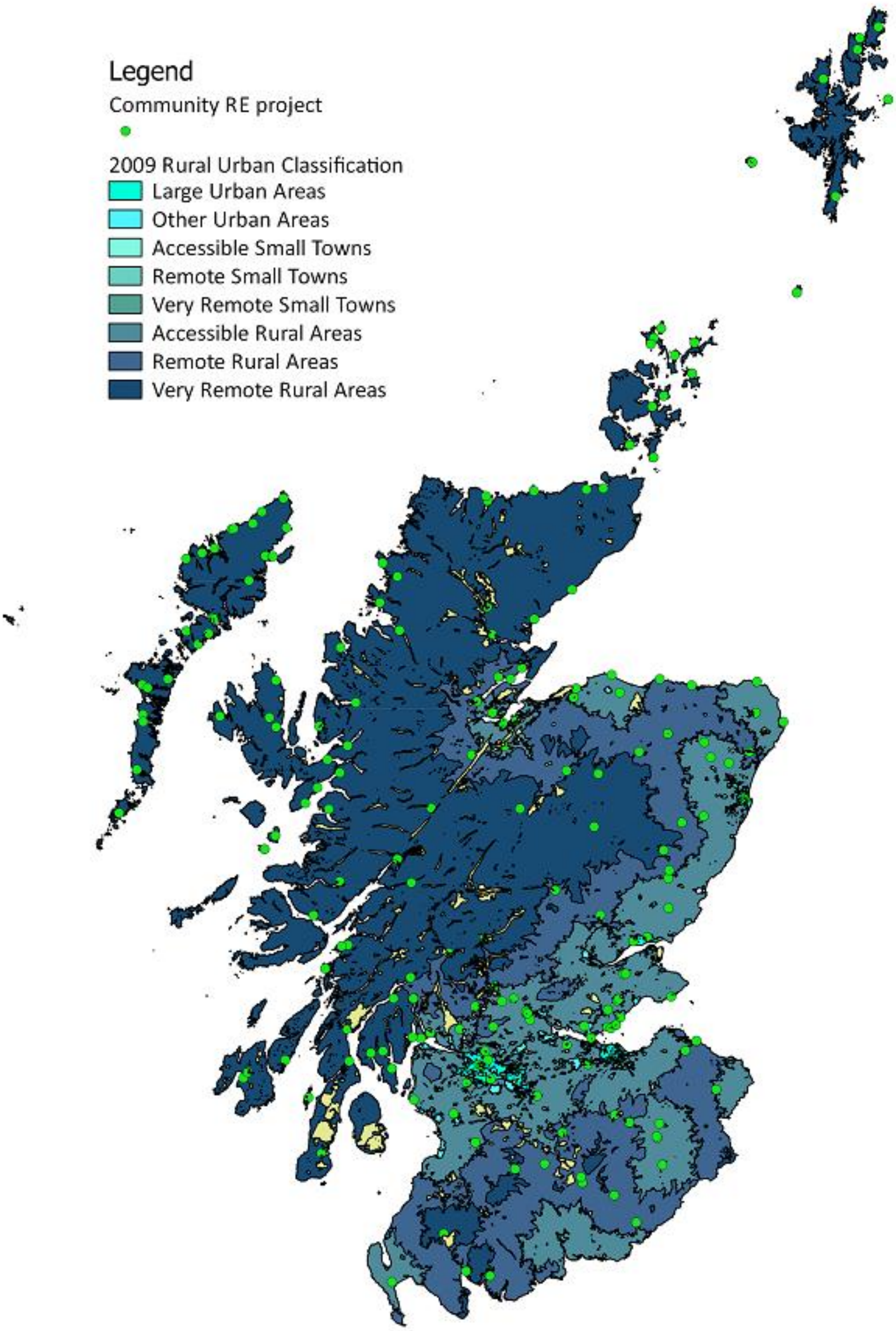

Figure 4: *Regional distribution of community renewable energy projects in the total sample*

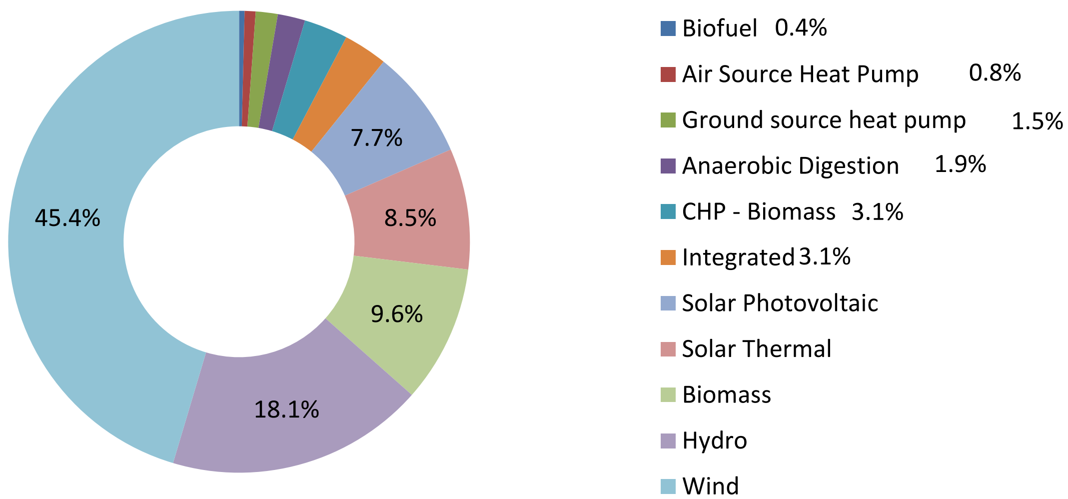

Figure 5: *Frequency of renewable technology types deployed by community organisations*

Community-led ventures are generally relatively small, with an average capacity of 65 kW, currently accounting for a total of 9.4 MW of generation capacity. A smaller fraction of projects (9.5%, currently delivering 10.8 MW of community-owned capacity) consist of joint ventures between place-based social enterprises and commercial parties. These can be divided into two types, on the basis of investment and ownership. One type sees community ownership in the form of co-operative shares (2.5% of projects, with an average community-owned capacity of 502 kW), while the other type involves various forms of equity investment (7% of projects, with an average community-owned capacity of 463 kW).

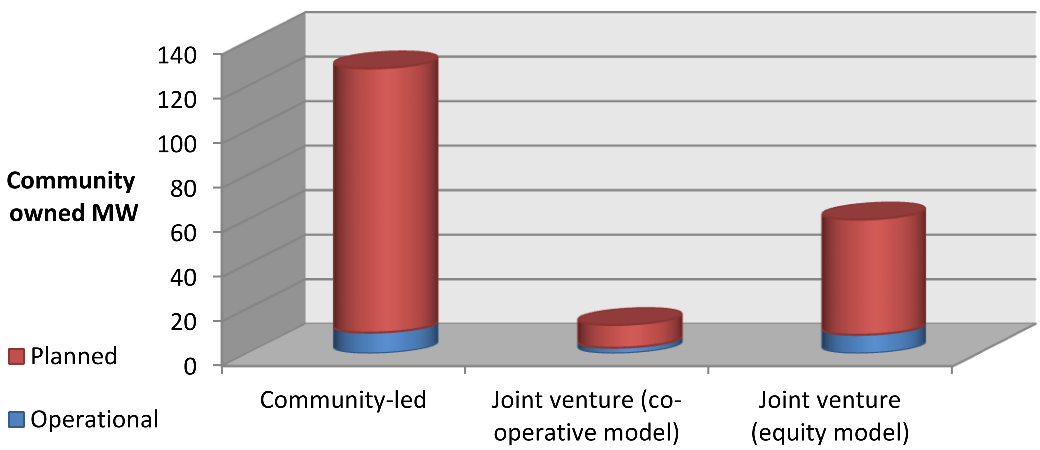

Figure 6*: Planned and operational community energy by business model*

For all three ownership models, there are a number of significantly larger projects in development. If realized, these would raise average community-owned capacity to 1011 kW, 3165 kW, and 2541 kW for community-led, community shares and equity-based models respectively. The joint ventures currently under negotiation or in development are therefore significantly larger than most community-led ventures. Joint ventures under consideration include a number of large (total capacity > 50 MW) commercial wind farms on Forestry Commission (FC) land, driven by obligatory offers of sizable (up to 49%) community stakes. Examples are projects involving Tweed Green and the Kirknewton Development Trust. However, no agreements, contracts or finance have yet been secured for a community stake in any of these projects.

Community-led ventures under development also boast a growing number of significantly larger outliers, exemplified by projects led by the Catrine Community Trust, Selkirk Regeneration Company, Stòras Uibhuist, Point and Sandwick Development Trust, Kirkmichael and Tomintoul Community Association Ltd, and the Rosneath Pensinsula West Community Development Trust.

In contrast to England, Denmark and Germany, the co-operative model is not central to Scottish community energy, representing only 12% (2.5 MW) of current community capacity. Despite their reputation elsewhere, existing community energy co-operatives in Scotland are almost exclusively joint ventures in large commercial developments that currently provide community organisations with lower ownership (ranging from 0.3% - 6% ownership, with an average of 2.1%) than equity partnership arrangements (which range from to 8% - 80% ownership with an average of 41%) (**Figure 7**). The 'Energy4all model' driving joint venture co-operatives in Scotland has suffered from a lack of commercial projects willing to make provisions for community ownership[127]. Our interviews suggested that the choice between sourcing finance from community share investors versus seeking commercial or public finance on behalf of an organisation representing the community is determined primarily by knowledge and advice frameworks available to grassroots organisations in Scotland. This supports other findings, such as those of Bolinger (2004) and Birchall (2009), which suggest that Danish and Finnish citizens are historically better acquainted with co-operative ownership of energy generation infrastructure and other utilities[128,129]. Other factors affecting this choice are perceptions about the availability of local finance, and views on who should control and benefit from project revenues.

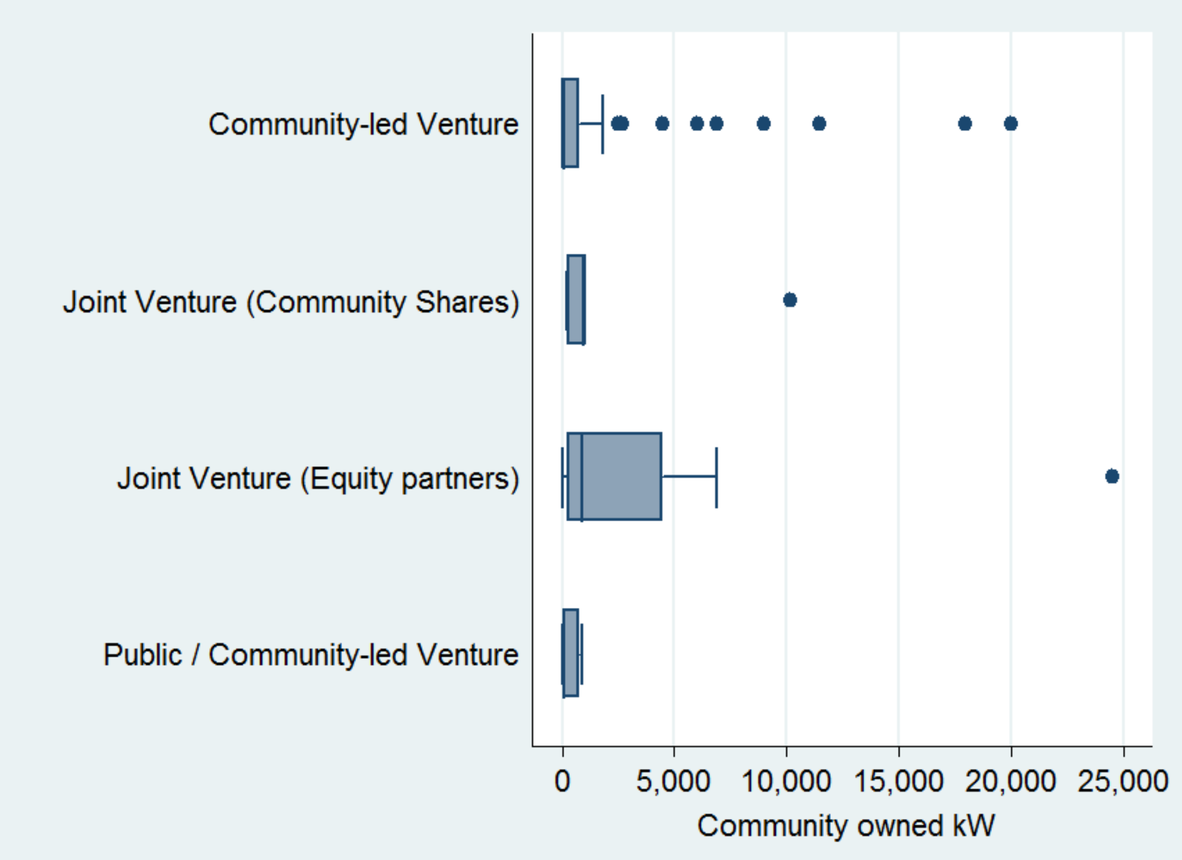

Figure 7: *Size of community-led ventures (kW) in relation to community shares of private or public joint ventures. Box plots show median, lower and upper quartiles, minima and maxima, and outliers*

Organisational Types and Motivation

The Scottish community energy sector is dominated by charitable companies with a mandate for local development and regeneration. Other organisations engaged in the community energy sector include village hall committees, energy co-operatives, environmental organisations with a local focus, charitable (local or regional) housing associations - and partnerships between organisations such as these (**Figure 8**). With regards to legal capacity to trade and handle assets then, a small percentage of organisations (7%) are unincorporated.

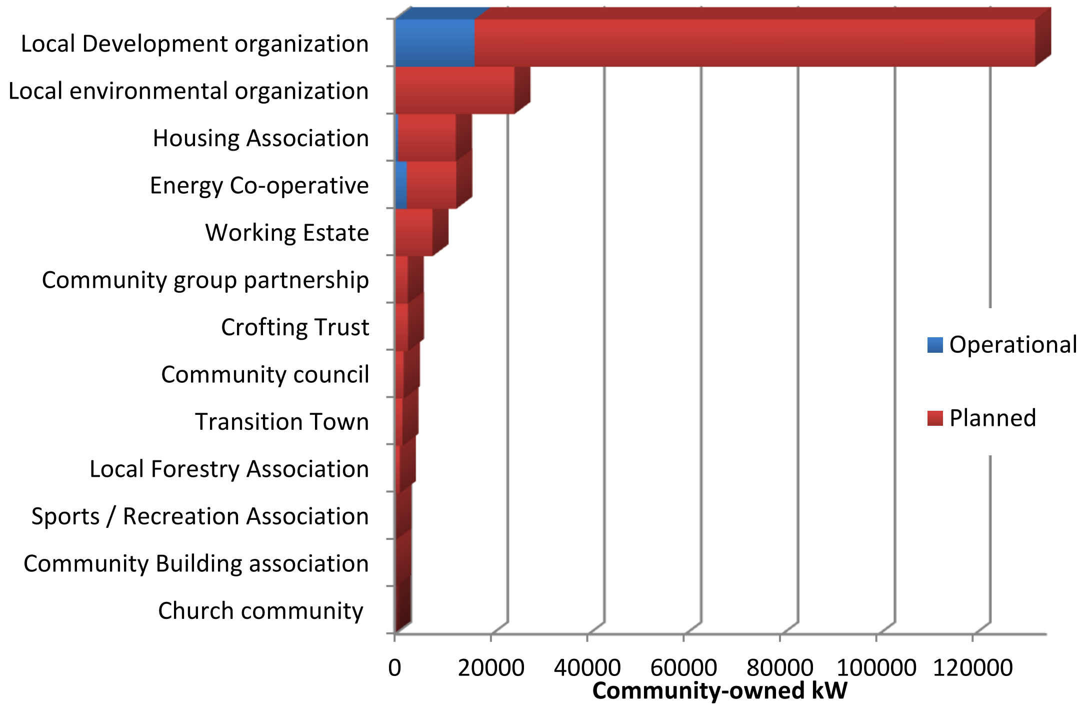

Figure 8: *Planned and operational community energy held by different organisation types*

Communities engage in renewable energy for a diverse number of reasons. The most common primary motivation for engaging in renewable energy that we encountered was 'to generate local income and strengthen the local economy'. A wide range of other motivations were also encountered, reflecting the diversity of organisations in this sector (**Figure 9**). As expected, off-grid communities are motivated primarily by increasing their access to reliable electricity provision (92%), while community building projects are pursued primarily to generate local income (30%) and lower the cost of energy (27%). Interestingly, even on-grid communities with standalone installations are sometimes motivated primarily by lower energy costs (16%), even though electricity generated may not contribute directly to alleviating household energy expenditure.

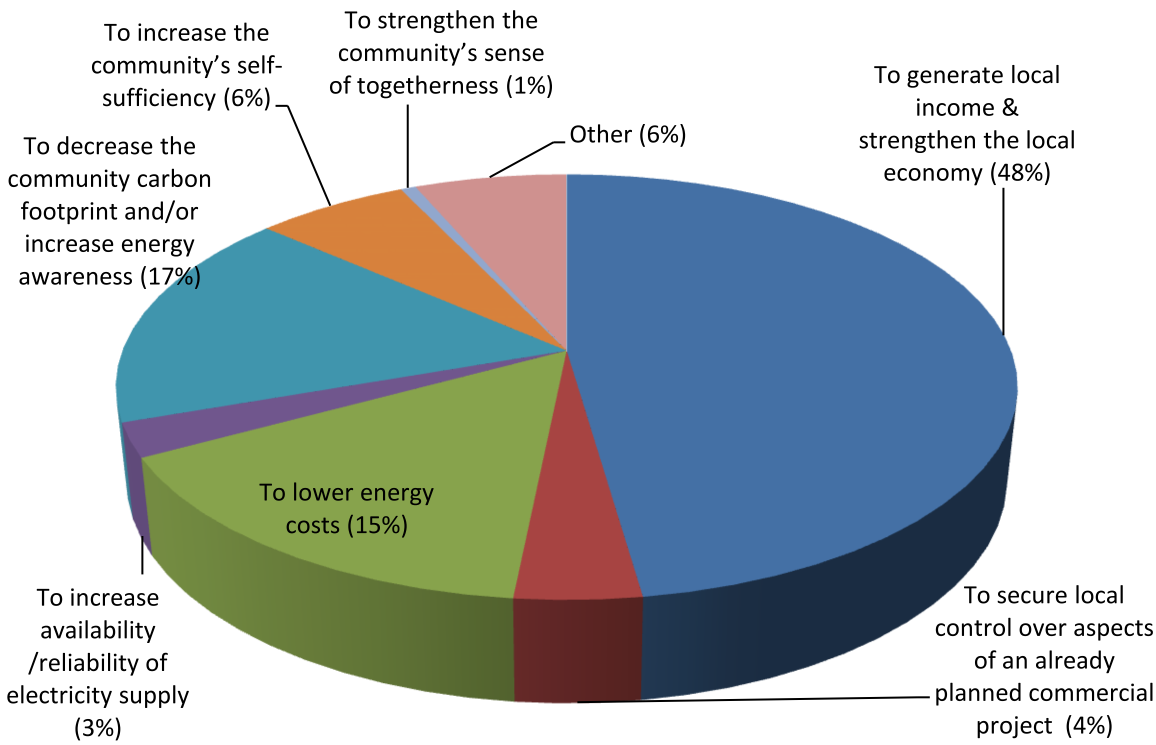

***Figure 9:** Primary reasons Scottish communities give for engaging in renewable energy*

Environmental grass-roots organisations were motivated primarily 'to decrease the community carbon footprint and/or increase energy awareness' (50%), followed by the need 'to increase the community's self-sufficiency' (17%). Joint ventures through community shares are pursued exclusively with the aim of 'securing local control over aspects of an already planned commercial project (such as partial ownership, siting, scale or orientation of wind turbines)', while joint ventures through equity shares are pursued primarily 'to generate local income and strengthen the local economy' (57%). Outside of the motivations shown in **Figure 9**, other reasons given included tips from external parties regarding resource availability or project opportunities, local regulations with regards to consideration of renewables in planning developments, the need for more effective heating installations, the availability of waste heat and the desire to raise revenues for community land buy-outs.

Organisational Capacity

Organisations varied in size, ranging from 0 to 1500 members. Organisations had on average 11 years of community activity behind them, but experience with local community oriented activities ranged from 0 to 60 years. 26% of community organisations engaging in renewable energy projects do not have any full or part-time staff, relying fully on volunteers, while 33% of projects rely on temporary programme-funded staff. The remaining 40% have at least one or more part- or full-time permanent staff (**Figure 10**).

One third of organisations do not carry out regular financial risk assessments and reports finances to members, and 65% did not have a policy for accumulating appropriate levels of reserves on the balance sheet. However, most organisations reported having adequate facilities to meet and organize activities (81%). 53% stated that they had effective monitoring and evaluation systems in place for reviewing and improving performance in relation to organisation objectives.

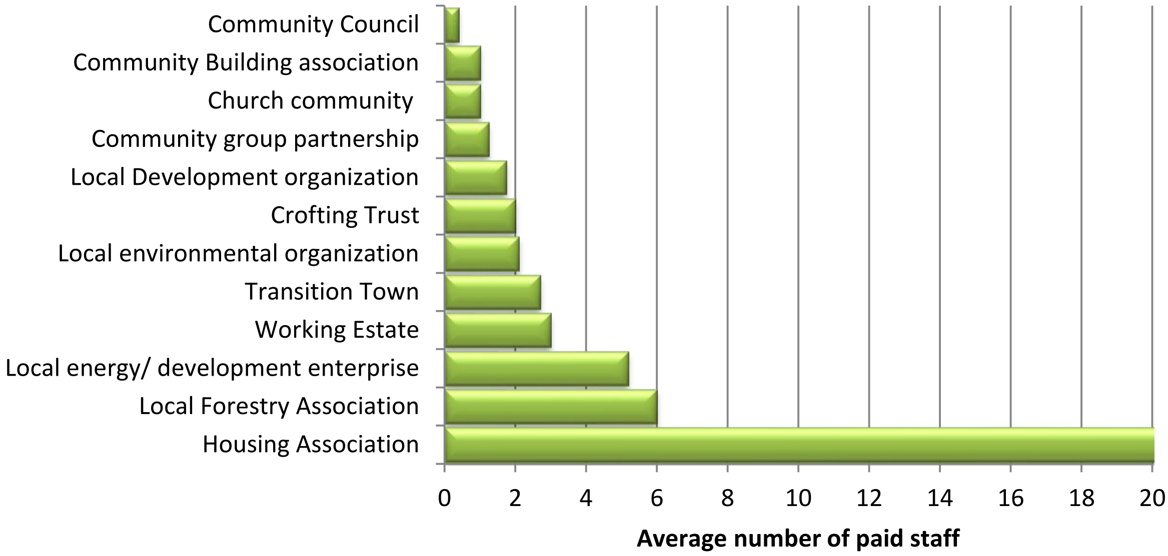

Figure 10: *Average number of paid staff across organisation types*

The major areas of expertise lacking in community organisations were legal expertise (absent in 74% of projects) and project management experience (absent in 33% of projects). On a more positive note, only 26% of respondents stated that their organisation lacked individuals with professional experience in accounting, financial planning, and/or managing cash-flows. 72% of organisations had access to members, volunteers or staff who were engineers, electricians or other technical experts.

Social network integration and autonomy

More than a third of organisations did not have any external stakeholders on their board or project committee (40%) (**Figure 11**). Community councillors were best represented in boards (43%), and in several occasions played a key role in recognizing and introducing project opportunities to key local organisations. Other external agencies on boards included project management support organisations (such as Community Energy Scotland, Highlands and Islands Enterprise and Changeworks), local environmental groups, the Chamber of Commerce, joint venture brokers such as Energy4all, sponsoring foundations such as the John Muir Trust, local businesses, tenants and residents associations, city mayors and university staff. The majority of organisations reach out 'occasionally' or 'frequently' to local authorities for help and advice (83%), while 15% have never done this. Close to half of the respondent sample had regular access to 1 or more community groups with previous experience at all phases of project development (44%), while only 10% had no access to such groups at all.

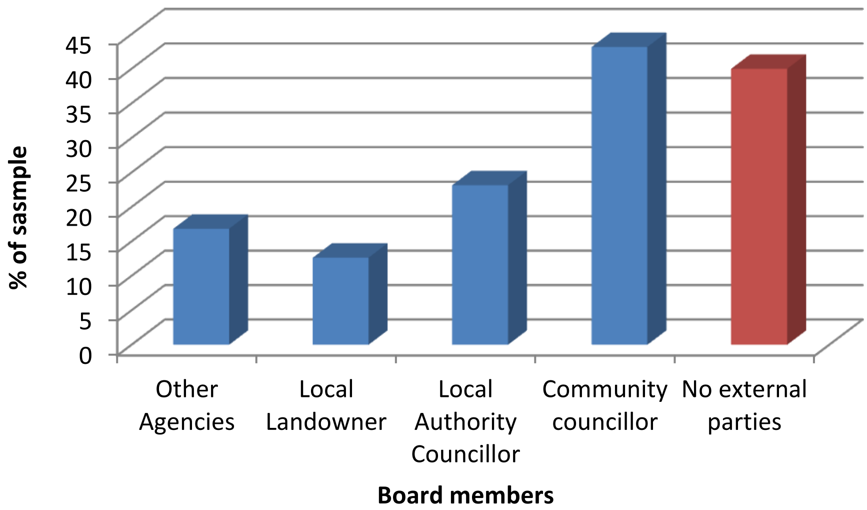

Figure 11: *External stakeholders in organisation boards or project committees*

In terms of collaboration between public and corporate stakeholders and communities, the majority of community organisations found their local councils, utilities and their commercial developers to be supportive and knowledgeable in their dealings with them (68%, 67% and 88% respectively). However, utilities were also classified as being unsupportive but knowledgeable (29%).

Financing

Initial estimates of unit costs (total cost per kW) suggest community-led wind costs on average £4609/kW as compared to £2466/kW for joint ventures. This disparity is likely to reflect economies of scale, as well as factors such as the increased cost of debt finance and lengthier periods of project development faced by community organisations. The time-scale from conception to completion of community-led ventures exceeding 50 kW ranged from 1 to 8 years, averaging at just slightly over 4 years.

As expected, projects that are currently operational have been heavily dependent on grant funding, which has contributed an average of 33% of total project costs (**Figure 12**). However, there is a prominent shift away from charitable funding, with projects currently at early feasibility stages turning to CARES loans and/or community shares to source seed capital. This follows a reduction in the availability of grant funding and new regulations on the incompatibility of FIT's and public funding of capital costs.

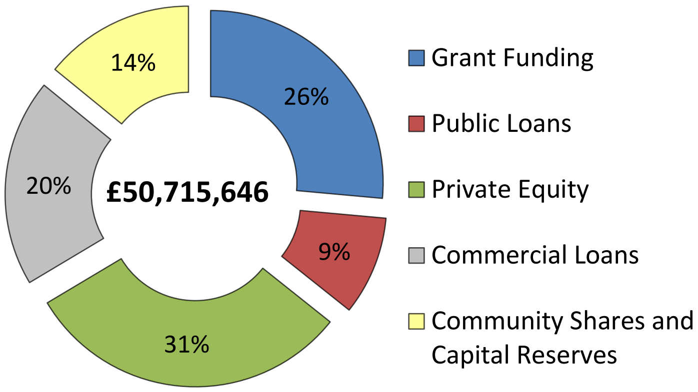

Figure 12: *Sources of finance for community stakes*

Commercial loans were provided by just three banks; the Co-operative Bank, Triodos Bank, the Royal Bank of Scotland. Other debt sources were Social Investment Scotland, and commercial wind developers themselves. Commercial loans average £760,000. At least two wind and three hydro projects were identified as being on hold after securing planning consent due to the inability to secure commercial loans, the latter awaiting release of Feed-in Tariff reviews. The potential for asset-based loans was variable; the stated value of assets owned by respondent organisations ranged from £0 to £54m, where 58% of respondent organisations stated they did not own any assets. However, a large proportion of organisations own land which they may not be willing to put up as collateral for debt finance (**Figure 13**).

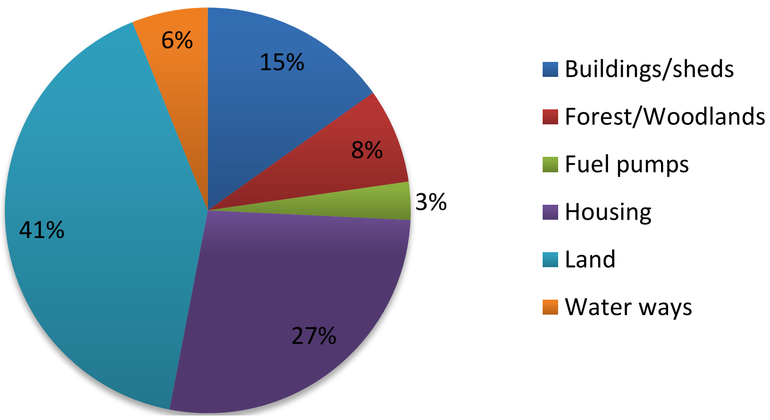

Figure 13: *Types of assets owned by community organisations*

The respondent sample identified 33 operational or on-going joint ventures. Within this group of joint ventures, equity partners currently engaging with community organisations range from developers (13 projects, see **Table 6**), housing associations (3 projects), Community Energy Scotland (1 project), landowners (5 projects), NGOs (2 projects), councils (2 projects) and local businesses (2 projects). Of these 33 projects, community organisations hope to finance equity shares predominantly through one or more of community shares (45%), followed by commercial loans (27%), community benefit funds (18%) or other capital reserves (16%) - and in a single occasion from revenues of an existing wind turbine.

Table 4: *Joint ventures (ongoing) between commercial wind developers and community organisations in Scotland*

Developer	**Community Organisation(s)**
Falck Renewables	Kilbraur Wind Energy Co-operative Boyndie Wind Farm Co-operative Great Glen Energy Co-operative Isle of Skye Renewables Co-operative Clyde Valley Energy Co-operative Dunbeath Community Wind Co-operative Fintry Development Trust (Fintry Renewable Energy Enterprise)
West Coast Energy	Huntly Development Trust
Lomond Energy	Kilmaronock Community Development Trust
European Forest Resources Group (Louis Dreyfrus Group)	Kirknewton Community Development Trust (Kirknewton Community Renewables)
Future Spectrum	Torrance Farm Community Wind Co-operative
Partnerships for Renewables	Tweed Green
Carbon Free Developments	Neilston Development Trust (Neilston Community Wind Farm)

Relative to commercial projects, the distribution of costs on community-led wind projects in the respondent sample are slightly skewed towards grid connection and pre-planning expenses (**Table 5**). This is likely to reflect the difficulties faced by community organisations to secure debt or equity investment at pre-planning stages, and bears testimony to a disadvantage that communities face relative to commercial developers.

Table 5: *Cost distribution for community-led wind projects as compared to BWEA figures for a commercial 5MW wind farm. Source: BWEA (2011)*[130]

	% cost feasibility	*% cost planning*	*% cost grid connection*	*% cost electrical infrastructure*	*% cost technology*	*% cost preinstallation*
Community-led ventures	1.3	3.7	12.0	5.6	57.4	16.8
Commercial 5 MW wind farm	1	2	8	8	61	14

To summarize, Scotland's community involvement in renewable energy is by and large lead by local development organisations with a mandate for revitalization of their locales that sometimes go on to set up local power generation companies. Maximum community ownership of renewable energy is currently taking place through joint ventures in which community organisations are equity partners, although there are a number of exceptions in the form of large community-led wind installations. The largest proportion of projects has yet to be completed (62%), and 36% of projects are at very early feasibility stages, that is, at stages in which planning application have not yet been submitted, characterized by ongoing negotiations over land acquisition, community consultations and technical assessments of resource availability and suitable sites in the locality.

Key constraints and reasons for failure

The respondent sample included 21 projects that had been discontinued (10.2% of the total projects sampled). All stalled projects were sampled through telephone interviews. Altogether these interviews suggested respondents were less likely to respond to surveys in the context of stalled or problematic projects. A bias away from stalled projects is therefore likely.

Of the stalled projects in the respondent sample, the most common reason for discontinuation was a lack of capital and/or lack of project financial viability (6 projects), followed closely by planning rejection (5 projects). For at least one project, financial non-viability was attributed to planning restrictions and grid connection costs. Three projects were discontinued as a result of being turned down for grant funding. Remaining reasons for discontinuation included lack of time/human resource capacity, land site issues and delays, downgrading of project importance, disputes/lack of consensus within the community, lack of natural resource availability, as well as the dismantling of implementing organisations.

Across the respondent sample (99 community organisations), 34% of organisations reported to have had difficulties, disputes or delays in negotiating the land lease. Projects overwhelmingly received local support, with two thirds of projects facing 'no objections from within their communities' (**Figure 14**).

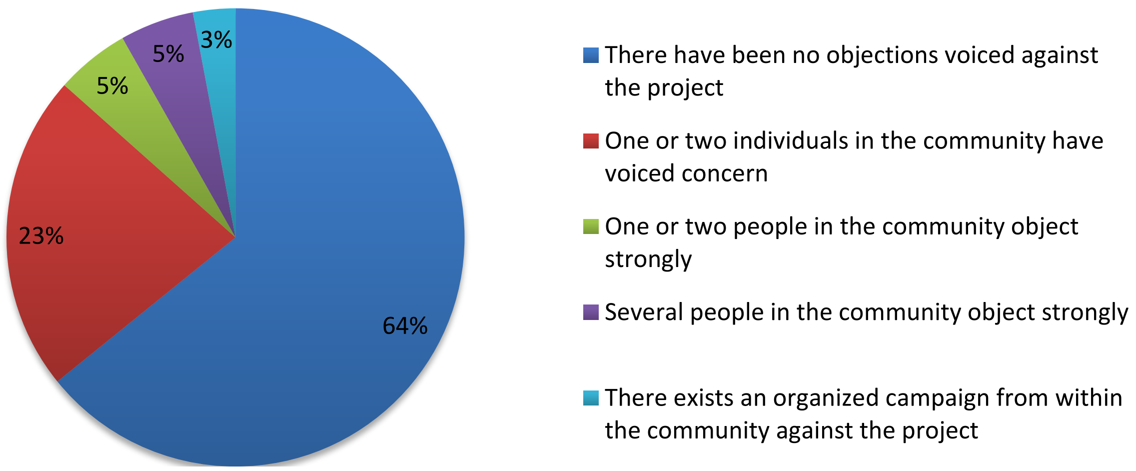

Figure 14: *Opposition encountered to community renewable energy projects*

5.2.2. Local and regional characteristics of sample community organisations

Remoteness and social cohesion

The majority of community organisations engaging in RE are situated in remote Scotland, in 'areas with a population of less than 3,000 people, and with a drive time of over 60 minutes to a settlement of 10,000 or more'. The data suggests that the more urban the location, the fewer community renewable energy projects are currently taking place (**Figure 13**). In so far as the rural-urban indicator distinguishes between commuter towns and small rural communities where relationships are more likely to be long-term, they may distinguish between places where there is a lesser or greater sense of a collective community identity. To that end, the pattern observed in **Figure 15** may be in part a reflection of a relationship between social ties and collective energy action. Other factors that may underlie this pattern include larger spatial and planning constraints in urban areas.

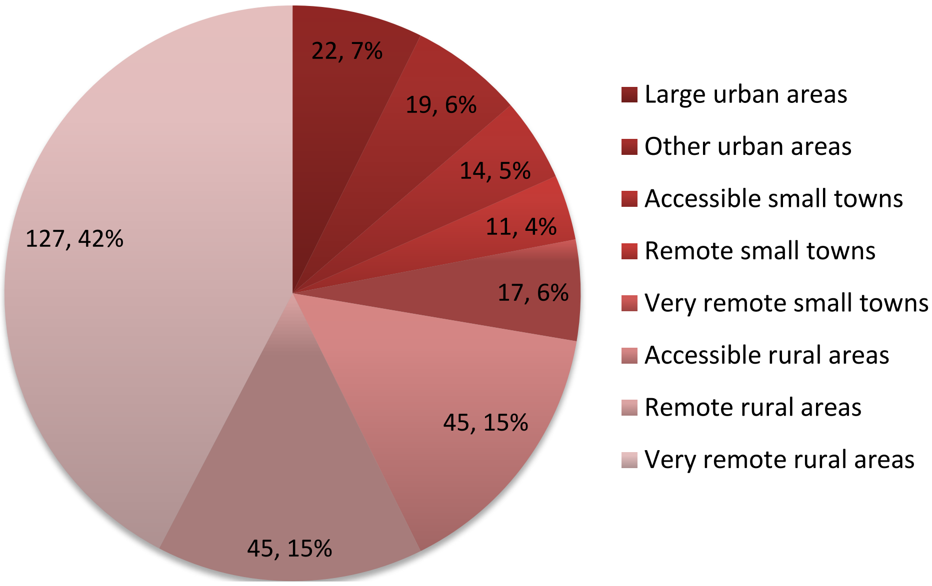

Figure 15: *Rural-urban class of community organisations, as per Scottish Government 8 fold Urban Rural Classification (2009-2010)*

Wealth and education

A visual assessment of income deprivation at datazone level[‡‡‡‡] suggests median wealth of regions with communities engaging in RE projects does not differ from national median wealth (**Figure 16**). The 'income deprivation' figures given here represent the percentage of adults and their dependants in receipt of Income Support, Job Seekers Allowance, Guaranteed Pension Credits and Child and Working Tax Credits. However, community RE projects are not taking place in datazones with highest income deprivation (**Figure 16**). A t-test comparing average national income deprivation rates with income deprivation rates of the total sample suggests that the average income deprivation levels in the total sample is significantly smaller than average national income deprivation levels, where $H_{O:}$ $\mu = 16.52$, $T = -4.07$, $p < 0.001$ with df=218.

Educational data at datazone level provides a similar pattern, with medians for the rate of

[‡‡‡‡] The data zone geographic unit is Scotland's key small-area geography which covers the whole of Scotland, have a regular shape and have between 500-1000 residents. Data zone delineation respects physical boundaries, natural communities and in as far as possible contain households with similar social characteristics (see Scottish Neighbourhood Statistics Guide).

'Working age people with no qualifications' and 'Proportion of 17- 21 year olds entering higher education' being similar in the total sample as compared to Scottish national distributions. Here again, community RE projects are not taking place in datazones with lowest workforce qualifications and university enrolment. In conclusion, income and education levels may be a relevant factor in the ability or desire to engage in community RE projects.

Figure 16: *Medians, upper and lower quartiles of income deprivation rates across the total sample of community projects as compared to that of Scotland, as per the Scottish Index of Multiple Deprivation (2009)*

Council planning and renewable energy policy

Scotland counts 32 unitary authorities, of which 28 are represented in the dataset. A comparative review of per council regulations on wind development (as defined by local development plans with regards to criteria for landscape and visual impact, natural heritage and historic environment, aviation, telecommunication, noise flicker, cumulative impacts and socio-economic impacts) suggests that the major variations across council policies appear to centre not so much on the *level* or *nature* of planning restrictions but the *degree of specification* of planning restrictions. For instance, while some councils have followed SPP6 recommendations and imposed standardized height, distance and zonation restrictions, councils such as Angus Council insist restrictions should be imposed on impact directly and assessed on a case by case basis[131]. Some councils have implemented detailed and high-resolution suitability zoning for wind installations, while others have no or very crude zoning indications. Underlying this heterogeneity of planning legislation across councils is a considerable degree of leeway for councils to interpret and legislate Scottish Planning Policy 6 Renewable Energy (from here on SPP6) differently. Case by case assessment of impact is likely to result in more tenuous application processes and may increase the risks of planning rejection, but on the other hand allows for more accurate consideration of cumulative visual, landscape or species/habitat impacts (which depend on every nearby applications in process). Standardized absolute restrictions are easier to enforce and increase transparency but risk imposing arbitrary and unnecessary restrictions on wind development.

Annual rejection rates for wind developments were calculated for 18 councils, data for remaining councils being unavailable. Councils have similar profiles, in that the number of <50kW applications processed increases sharply along with <50kW rejection rates over the period 2005-2011 (rising from 6% averaged over 2005-2008 to 16% averaged over 2009-2011). There is a less pronounced rise of both number of applications and rejections for 50kW to 2MW and 2-20MW projects over the period 2005-2011. However, annual rejection rates are limited to zero because of low (frequently zero) application numbers, suggesting the observed increase in rejection rates may be due to the increase in applications rather than an increase in planning restrictions. For purposes of the event history analysis then, application and rejection numbers were summed over 2005-2011 to calculate rejection rates over the period of 2005-2011 (shown in **Figure 17**). **Figure 17** suggests variation in rejection rates between councils is sufficient for inclusion in a regression model. Planning rejection for non-wind developments were minimal and taken to be 1%, representing average rejection rates of <50kW projects.

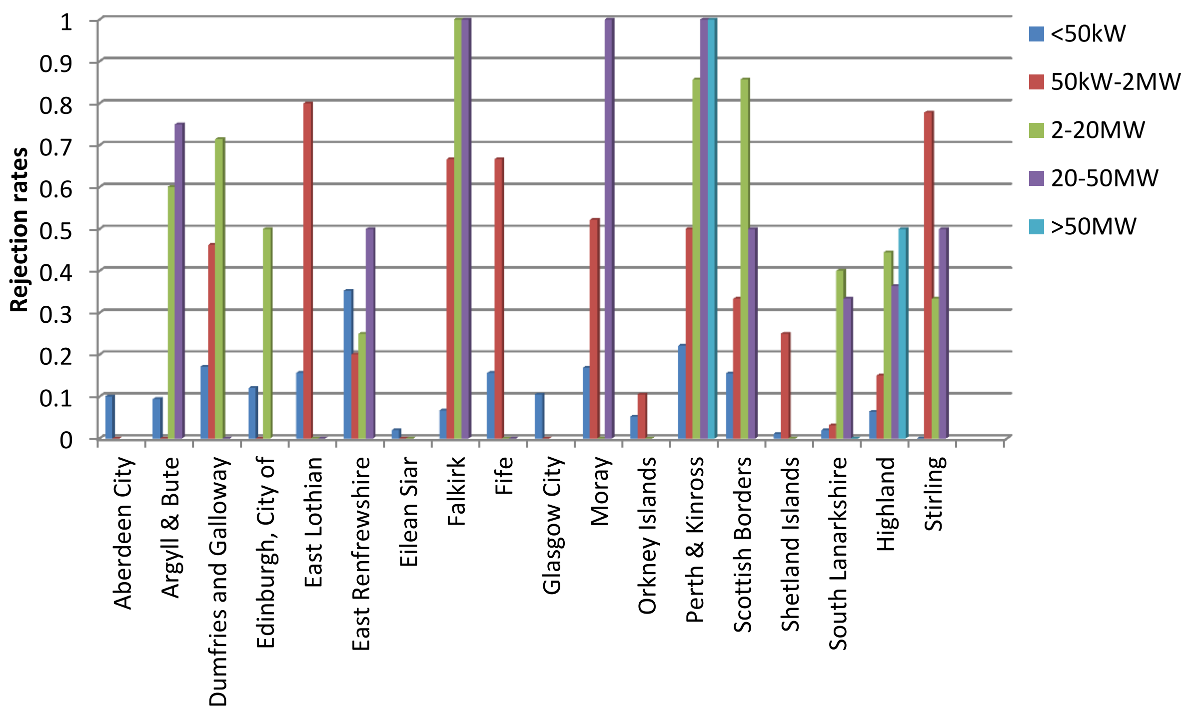

***Figure 17:** Planning rejection rates for wind developments over the period 2005-2011*

5.3 Results from the survival analysis

The sample used for analysis totalled 150 projects, consisting of 47 completed projects, with an average total project duration of 34 months. A total of 85 out of 150 project entries (57% of the sample) were right censored due to having as of yet uncompleted projects at the time of interview (**Appendix III-a**). For about 30% of the sample, organisations were at early feasibility stages of project development meaning that explanatory variables were also poorly populated (this data did not yet exist). The sample included 18 failed projects, which for reasons already mentioned are not thought to be fully representative of the total project population.

It is widely known that early project stages bear highest risks so there is good reason to believe that failed projects are more likely to drop out in earlier rather than later project phases. This was confirmed by the cause- specific unconditional cumulative hazard functions, which show the ratio of completed or failed projects over ongoing projects at any time t (**Figure 18**). **Figure 18** suggests project failure largely occurs in the first 30 months of a project. Most projects have been completed at month 60 upon which completion occurs more sporadically up until about month 100. It is therefore unlikely that there is proportionality between hazard rates for failure and completion. The Kaplan - Meier curve (**Figure 19)** shows the number of yet ongoing projects at risk of either completion or failure less the number of censored projects at any time t. **Figure 19** suggests that we can safely assume that all projects are ongoing at t=0 and all projects reach termination (either completion or failure) at t=∞. With respect to the shape of the cumulative hazard curves, the Nelson - Aalen cumulative hazard estimate suggests an increasing and non-linear hazard rate for both failure and completion, conform to a log-logistic distribution. Failure rates display a steeper gradient than completion rates. Again, this corresponds to what we know with regards to project risk distributions.

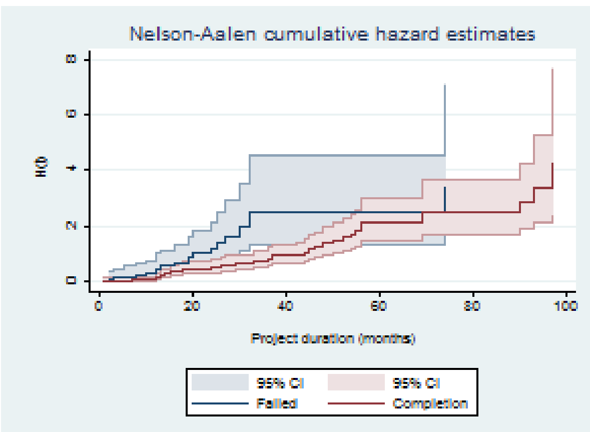

Figure 18: Cause specific Nelson-Aalen Cumulative Hazard Function (with 95% c.i.s), showing the unconditional cumulative likelihood of project success

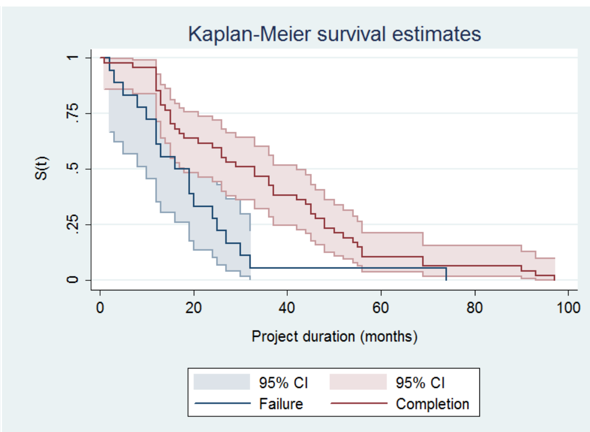

Figure 19: Cause specific Kaplan- Meier Survival Function

Splitting the project duration into episodes before and after the submission of a planning application goes some way to eliminate the disproportionate hazards problem (**Figure 17**). Planning submission is an activity that applies to all projects once technical assessments are completed, the project is deemed financially viable and agreements with landowners are in place. The comparison between **Figure 20** and **21** shows that failures are closely associated with the pre-submission episode while completions are associated with the post-submission episode. Splitting the data into projects that exit prior to planning submission and projects that exit post planning submission is therefore approximate to distinguishing between on the one hand small projects that are completed over short time periods and failed projects and on the other hand larger more complex projects that succeed.

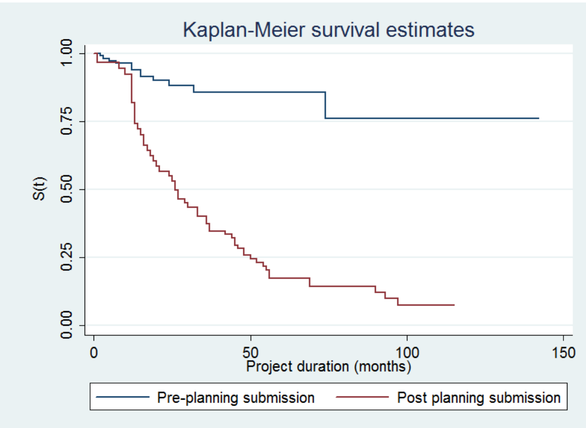

Figure 20: Unconditional Kaplan-Meier estimate events (aggregated across both completion and failures) by episode, where pre-planning represents events occurring before planning submission and post-planning represent events occurring after planning submission.

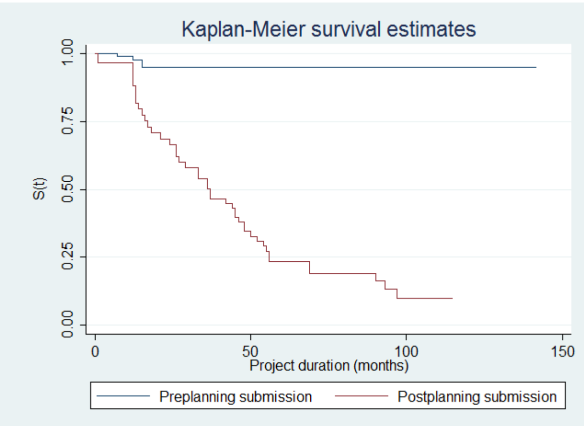

Figure 21: Unconditional Kaplan-Meier estimate of events (completion events only) by episode, where project failures are censored

Choice of predictors: univariate analyses

To gain initial insight into the relationship between categorical variables and project completion, univariate Kaplan- Meier (KM) curves and log rank tests were used to assess visual and statistical evidence for the statistical non-equivalence of survival rates of different factor levels respectively. Steep drops in KM curves suggested that certain treatment groups within variables defining business models and in house expertise were poorly populated, which was confirmed by factor level tabulations (see for instance **Figure 23**). KM curves for land acquisition, access to peers, and business model suggested disproportional hazard rates of treatment groups along the time axis; in other words for these covariates hazard rates appear to depend on time (**Figure 22**). This makes sense conceptually as covariates represent risk factors that apply to different project stages. For instance, land acquisition negotiations typically present project delays in development stages of a project, while report with local government and community is more likely to influence planning outcomes and be relevant post planning submission. **Figure 24** and **25** suggest that splitting the time axis in two episodes following the approach outlined above goes some way to remediate disproportionate hazards.

Of the categorical variables outlined in **Table 8**, stratified log rank tests suggested that land acquisition, technology type, access to peers and network integration had predictive power (H_0: HR = 1, where HR = $h_1(t) / h_2(t)$ for all t, $p<0.2$). However, for technology type, expertise and business model variables, the number of events observed in some categories were so low that any definitive conclusions on predictive power were ruled out (see for instance **Appendix IV-a**). Land acquisition affected survival rates in the expected direction, demonstrating higher survival rates for projects pursuing land purchase and lease than projects building on self - owned or gifted land. In contradiction to the expected effect of access to peers with project experience, better access to peers was associated with higher survival rates (slower project progress) (**Figure 22**). It is unclear whether this reflects noise or underlies some other effect, such as for instance a distinction between organisations that want to engage personally and learn from all aspects of the project, versus those that outsource technical, project management and financial aspects to outside experts (consultants) in as far as possible. This phenomenon has been observed and described by Ison (2010) in her comparative analysis of two community renewable projects in the UK[132].

Table 6: *Log rank tests for equality of survivor functions*

Variable	Significance (p-values) pre-planning	Significant(p-values) post-planning submission	χ^2 over total	Significant values over total	Number of observations (n)
Land acquisition (ordinal)	**<0.001**	**<0.05**	**16.13**	**0.0029**	**141**
Technology (Wind=1, other=0)	**0.2670**	**0.2397**	**2.12**	**0.1453**	**150**
Business model (Joint venture=1; other=0)	**0.5430**	**0.2239**	**0.1811**	**0.1811**	**150**
In house expertise (aggregated, ordinal)	0.3624	0.1874	8.30	0.0813	142
Access to peers, (ordinal)	**0.0923**	**0.112**	**10.39**	**0.0155**	**147**
Log of Network integration (ordinal)	**0.0832**	**0.0222**	**10.53**	**0.0052**	**149**

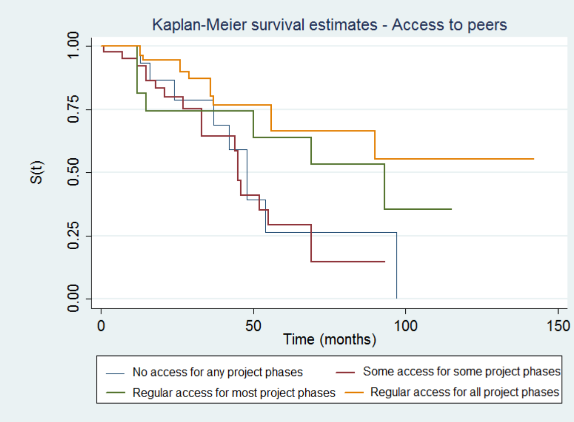

Figure 22: Univariate Kaplan-Meier estimate for access to peers, showing disproportionate hazards

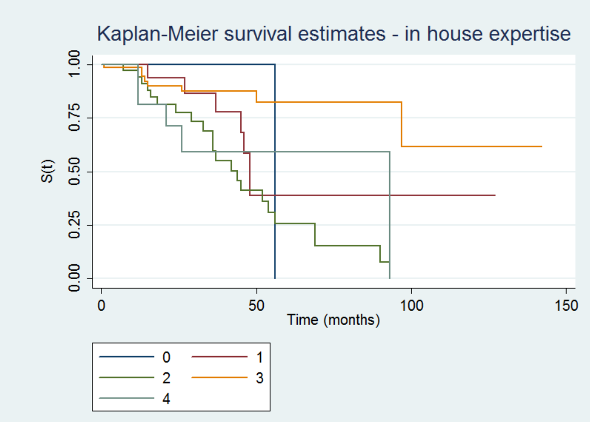

***Figure 23*: ** Univariate Kaplan-Meier estimate for in house expertise, showing poorly populated treatment levels

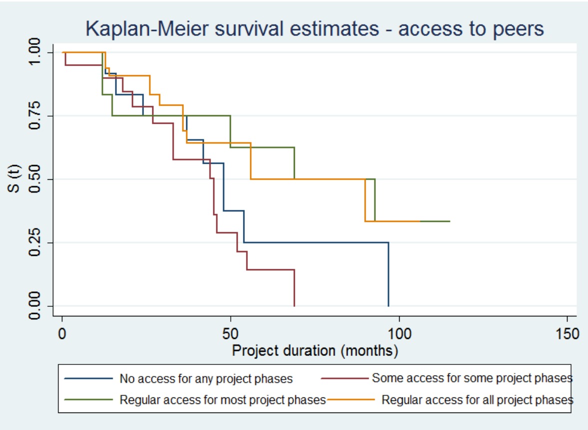

Figure 24: Kaplan- Meier estimates of access to peers post-planning submission

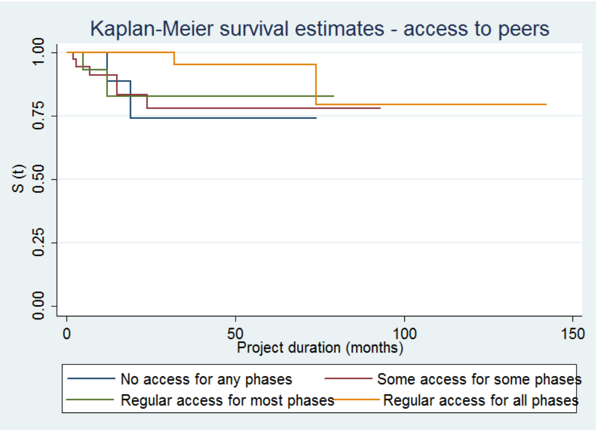

Figure 25: Kaplan- Meier estimates of access to peers pre- planning submission

To gain initial insight into the relationship between continuous variables and project completion univariate cox proportional hazard regressions were fitted for each continuous predictor (**Table 9**). Following Fox (2002), continuous variables were categorized into equal intervals to increase the size of coefficients and make them more easily interpretable[124]. This changed coefficients marginally but had no effect on the significance of any coefficients. Results shown in **Table 7** suggested that the grid capacity indicators based on remaining thermal headroom did not significantly contribute to explaining project completion (p=0.7). The likely reason for this is that thermal headroom data are cross-sectional snapshots of grid capacity in 2011 and 2012, and do not reflect remaining capacity at the date at which projects sought connection to the grid; in other words, time-dependent data is required because current thermal headroom constraints are not representative of past thermal headroom constraints. Alternatively, thermal headroom may not be representative of the factors that cause grid connection delays, which can be affected by other dimensions of grid capacity (network demand and supply) or administrative hurdles (see Chapter 4.2 for a detailed description of grid connection in relation to access and capacity). Finally, power tests based on effect sizes generated from univariate Cox proportional hazard tests suggested that the sample size is insufficient to demonstrate effects for both distance and thermal capacity variables (power <<0.8 at given number of observations, see **Appendix IV-b**). The interpretation of these results would therefore benefit from a more extensive analysis of grid connection constraints in terms of distance and capacity.

Of the significant variables, installation capacity, working age people with no qualifications and total project cost correlated negatively with project completion as expected. The measure of collective agency; the number of years of community oriented activity, was positively correlated with project completion (p<0.05).

Table 7: *Cox PH regressions using the Efron method for ties and accounting for episodes*

Continuous variable	B_x	P>|z|	e^{β}	Number of observations (n)
Capacity (kW)	**-0.245**	**<0.001**	**0.783**	**137**
Total cost (£)	**-0.274**	**<0.001**	**0.760**	**115**
Manpower	-0.002	0.967		147
Years community oriented activity	**0.096**	**0.038**	**1.101**	**150**
Working age people with no qualifications in the datazone (SIMD 2009)	**-0.116**	**0.029**	**0.890**	**150**
Income rate (SIMD 2009)	-0.0314	0.500	1.649	150
Community representability	-0.0574	0.232	1.261	145
Urban-rural classification	-0.0121	0.836	2.307	150
Planning rejection rate	0.0314	0.758	2.134	130
Distance from project to nearest substation	0.0003	0.832	1.000	127
Thermal headroom at near-est substation	-0.0186	0.340	0.982	127

Multivariate competing risk regression

Following Cleves (2008), a preliminary model was fit by including all 'candidate' predictors with p-values less than 0.2 in univariate analyses[133]. Parameters displayed signs of multicollinearity (unstable with high standard errors) and correlation coefficients and VIF estimates confirmed collinearity between total cost and capacity (r=0.88). Years of community oriented activity, access to peers and business models were not collinear with any variables but remained insignificant irrespective of the combination of covariates included in the model. For business models, insignificant effects are likely to be result of selection bias towards community-led projects: the community-led category dominated the data set (94%) and the sample of joint ventures did not contain the same number of events. A closer look at years of community oriented activity revealed a heavily positively skewed data distribution, derived from the fact that the majority of organisations are fairly new. However, a log transformation did not improve regression estimates. A power test suggested that insignificant effects were a direct result of missing values (sample size) and resulting consequences on statistical power (power<< 0.8 at given effect size and sample size, see **Appendix IV-c**).

Eliminating total cost, community oriented activity, access to peers, integration into social networks and business models, the final model contained four explanatory variables with an overall model fit of Wald $\chi^2 = 125.14$, $p<0.001$. Inclusion of any remaining candidate variables did not improve overall model fit. The results are shown in **Table 10**, where the parameter estimates under the SHR column represent subhazard ratios and measure the effects of covariates on the cumulative incidence of project completion. The subhazard of completion for an increase in capacity by 1MW ceteris paribus was 79% ($p<0.001$). In other words, an increase in project size by 1MW reduces likelihood of completion by ~20%. Owning land versus renting or purchasing land decreases likelihood of project completion by 50% ($p<0.001$) (**Figure 27**). An increase in the number of working age people with no qualifications by 20 decreases likelihood of project completion by 10% ($p<0.001$). Finally, wind projects were 2.5 times more likely to succeed compared to all other technologies (**Figure 26**). Tabulation of event rates by technology suggests that the latter result was not an artifact of biased sample selection, but stemmed from the relatively high failure rates of non-wind technologies, which were absorbed in the estimation of the cause-specific cumulative hazard function (**Appendix V-a** to **V-c**). As such, this may simply demonstrate the comparatively attractive returns of wind investments as compared to the other renewable technologies included in the sample.

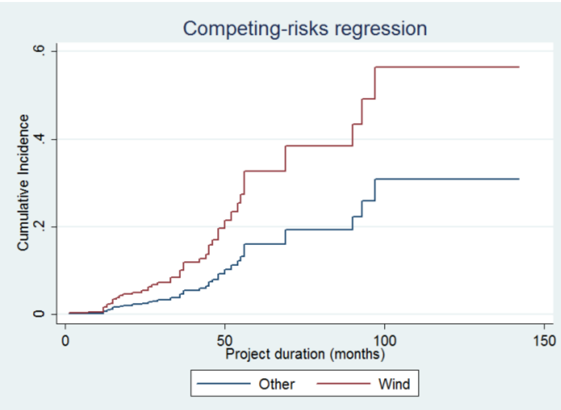

Figure 26: Estimated cumulative incidence of completion for wind turbines as compared to all other technologies

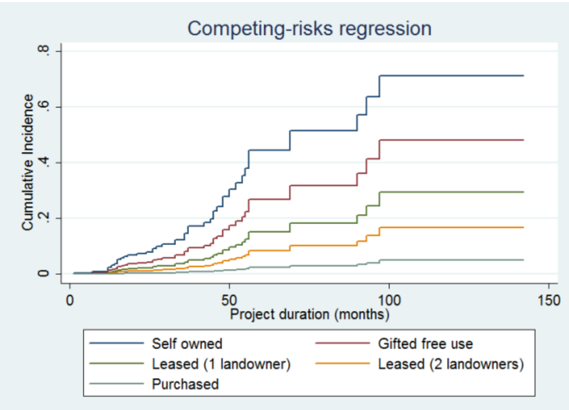

Figure 27: Estimated cumulative incidence of completion for different forms of land acquisition

Given that the final model contained only one variable that is unique to organisations (rather than projects), the model was run on the entire sample and any random effects arising from dependence among projects within single organisations were accommodated by clustering on organisations. As expected, this improved the p-value for adult educational qualifications (this data was sampled at datazone level and was therefore unique to organisations). Of the five remaining variables, no interactions were significant (and neither do we have any prior knowledge of specific interactions). Elimination of potential outliers in covariate data had no effect on the significance or direction of coefficients.

Given that proportional hazard rates are a key assumption for unbiased competing risk estimates, the proportional hazards assumption was tested using the Grambsch and Therneau likelihood ratio test and by plotting Schoenfeld residuals over time[134]. As expected including a discrete variable for episodes arising from the split time axis in the model substantially reduced χ^2 values and there was no evidence that the specification violates the proportional hazard assumption. Schoenfeld residual graphs demonstrated a zero slope for all explanatory variables.

The same procedure towards specifying a competing risk regression was attempted for project failures but the sample size was too small for any meaningful results. Clearly any effects this may have had on sub-hazard rate estimates for project failure are likely to have ramifications for the competing risk analysis on project completion.

Table 8: *Multivariate competing risk regression*

Variable	**Subhazard ratio (SHR)**	**Robust Standard Error**	**z**	**P>| z |**
Capacity (kW)	0.791	0.050	-3.71	0.000
Site acquisition type	0.515	0.078	-4.39	0.000
Education	0.882	0.049	-2.26	0.024
Technology	2.508	0.774	2.98	0.003

The final chapters of this work will attempt to interpret the results outlined here in the context of the research questions originally outlined in Section 1.2. Chapter 6 deduces any implications of this work for Social Movement theory, compares and contrasts findings to current literature in the field of community RE and discusses potential future directions for research in this field. A closer look at the limitations of this study and this approach to the subject more generally enables formulation of specific recommendations for further research. The final chapter provides the reader with a succinct summary of this study and draws attention to key conclusions and implications emerging from this work.

6 Discussion

6.1 Findings and implications

While there is much controversy surrounding the definition of 'community', this study demonstrates that it is relatively easy to define and distinguish 'community-like' entities on a purely functional basis. The definition of a community as a place-based social enterprise with a mandate for local social and/or environmental improvements was workable for the purposes of this analysis. This definition includes for-profit organisations with charitable arms, such as housing associations with a mandate for local social and/or environmental improvements. It excludes 'interest-based' communities such as schools, universities and sport clubs, partly because these are likely to bring in heterogeneity in key characteristics relating to resource access and political processes, such as membership and financing. Given that resource access and political processes are the two pillars of the theoretical foundation of this work, the model outlined in this study benefits from homogeneity in both dimensions.

Having defined 'community', the additional criterion for definition of 'community project' was 'active participation in a renewable energy project' following Walker and Devine-Wright (2008)[118]. The degree of active participation in RE projects was sometimes difficult to ascertain. For purposes of this analysis, RE projects exhibiting any proportion of ownership by a community organisation were included in the sample. While small percentages of community ownership are not likely to meet more conservative definitions of a 'community project', the first objective of this study was to establish the full extent and forms of community engagement currently occurring throughout Scotland. In doing so, the results show that small percentage community ownership of large joint venture projects are set to provide community organisations with relatively larger extent of self-owned generation capacity than most community-led projects currently taking place in Scotland. This is an important discovery, because it suggests that the (more conservative) definitions of community projects frequently favoured in current literature and practice may be underestimating the potential benefits of joint ventures to communities. This finding has direct implications for current proposals by the UK Department for Energy and Climate Change for a formal and institutionalised definition of 'community projects'[135]. Specifically, this finding implies that joint ventures with community organisations should be classified as 'community projects' on the basis of an absolute rather than a proportional threshold of community-owned capacity.

Returning to the original postulates outlined in Section 2.1, we find no evidence that community-led RE schemes are more likely to succeed in less income deprived data zones than more income deprived data zones. While this removes some of the social justice concerns with respect to equal access to public support funds, the survival analysis results do provide evidence of other physical and human resource constraints on project completion. Land ownership vis- à- vis lease or purchase has significant effects on project outcomes, confirming that community organisations with access to suitable sites have a significant advantage over organisations that do not have such access. In contrast to income effects, the number of adults without qualifications at data zone level has significant negative effects on project success. This suggests that the size of the pool of qualified adults available to community organisations has an influence on project outcomes that works separately from any effects education may have on shaping of environmental attitudes and instigating renewable energy projects in the first place.

To my knowledge, this study is the first to attempt to operationalise and estimate the effect of socio-political and grid capacity barriers to community power in the context of a statistical model. However, indicators for social cohesion based on population density and driving times or history of collective agency fail to predict cumulative incidence of project success. These results suggest that the age of a community organisation and the size and isolation of the wider community in which it resides has no discernible implications on the success of a project, ceteris paribus. We also find no evidence that communities with formal ties to local authorities, businesses and landowners have significantly higher cumulative incidence of project success than communities that have no such ties. In other words, contrary to much of the anecdotal literature on this subject (Pepper and Caldwell, 2010)[13], the survival analysis outlined here suggests that social integration into the wider energy network does not affect project success.

Taken together the results generated from the competing risk regression specified in this study broadly provide evidence that local conditions and resources have an effect on the outcome of community-led renewable energy projects. The role of education and land access confirms findings by Pepper and Caldwell (2010)[13] and Barnes (2011)[15]. Revisiting Social Movement theory then, the observed effects of local educational levels and access to land assets on project success support the relevance of Resource Mobility theory to community RE development. In contrast to the consistency of results with respect to Resource Mobility theory, the findings of this analysis are broadly inconsistent with Political Process theory. While there is abundant anecdotal evidence for the relevance of concepts such as political alignment and political leverage to community RE (see for instance Walker, 2007[106]; Walker *et al*, 2008[23]; Walker *et al*, 2010[39], IPPR Report, 2010[117] and Barnes, 2011[15]), we do not observe these effects in the context of the survival analytical approach taken in this study. This inconsistency is not likely to be an issue of inappropriate application of this theory, because factors arising from content analysis expanded on and compellingly confirm the added value of framing community RE in terms of Social Movement theory. In an attempt to shed light on this inconsistency, we turn to the limitations of this research. The following section identifies the basis of any inconclusive results and proposes solutions for improvement of this analysis.

6.2 Limitations and steps for further research

A number of organisational, socio-political and technical factors were found to have no discernible effect on project outcome. These factors were manpower, in-house expertise, the type of business model adopted, the degree of access to peer organisations, local income levels, local population density and isolation levels, planning rejection rates and grid capacity indicators. Other than the possibility that these factors simply do not contribute significantly to project outcome, there are a number of technical limitations relating to the statistical distribution of the data and the quality of the data that may have contributed to their non-significance. These limitations will be discussed here in turn.

With respect to the quality of survey data, the surveying process demonstrated that cost-related data and data relating to local politics were perceived as sensitive information and difficult to obtain from respondents. Consequently the analysis lacked a variable for project financial viability (a proxy based on total cost was used instead). Given that project viability has been a key variable in approaches to estimate RE project risk elsewhere[113,114], a more accurate estimate of project viability based on FIT rates at time of commissioning, location -specific wind speeds and installation capacity is likely to improve the overall accuracy of this model. A number of ordinal questions were inconsistently answered by different respondents from the same organisation, suggesting there were also instances of recall error and left censoring where subjects no longer remembered details of a project. Overall use of proxy indicators such as 'categories of stakeholders represented in a board' were less vulnerable to such inconsistencies than 'Never – Often' or 'Yes-No' questions. For purposes of analysis, binary answers were generally not effective, suggesting that for data such as 'in-house expertise', it may be better to ask for 'the number of engineers' working on the project from within staff or members, rather than 'Yes-No' to 'having engineers, electricians or other technical experts' (see Survey in **Appendix VI**). Another factor that suffered from potential inaccuracy was 'manpower'. Results suggest that there are no significant effects of manpower on probability of project success, where the indicator used for analysis was based on the number of staff and volunteers. However, due to the variation in commitment of volunteers, any definitive conclusions would require taking account of the more precise extent of volunteer time to which organisations have access.

For several reasons a number of variables based on externally acquired data were inaccurate and may be able to contribute to the analysis upon improvement. With regards to 'community representability', the estimate for 'number of people living in a community' was accurate for postcodes within settlements and localities but problematic and inconsistent for postcodes outside of these areas. This is because the size of geographic unit boundaries (Scottish Neighbourhood Statistics 'output areas' and 'postcode sectors') used to represent 'number of people living in a community' were themselves chosen based on population size and therefore not necessarily accurate representations of local population counts. To improve estimates for community representability, we require a more accurate estimate for local population that can be applied to addresses outside of urban areas. Furthermore, substantial inaccuracies for grid distance data may have arisen from the need to import and georeference pdf maps of substation locations. Thermal headroom data was of variable quality; accurate and comprehensive for the North of Scotland but characterised by missing and broad interval data for the South of Scotland. More comprehensive, time-varying and continuous data for thermal headroom at connection points would enable rigorous treatment of grid capacity constraints. An even superior treatment of grid connection constraints would address administrative processing times and grid connection policies (in addition to thermal headroom and distance constraints). Finally, some data may have been collected at an inappropriate level of resolution. For instance, while local income levels were insignificant, the significant effect of the type of land acquisition on project outcome suggests that an analysis based more directly on the value of organisation-owned assets and capital reserves may shed further light on the relationship between organisational material and capital resources and project success.

Given that survival inferences are drawn from the number of events, rather than the number of subjects, the issue of statistical power governed most decisions made in this analysis and was also crucial for interpretation of any results. In particular, this analysis would have benefitted from a higher (more representative) number of project failures, as well as project completions. Sample size restrictions arose firstly due to low response rates (~10%), despite a tremendous surveying effort. ~90% of the respondents who started the survey also finished the survey, suggesting that responses were not hampered by the length or nature of the survey itself. The observed response rate is not unlike survey response rates experienced by the Development Trust Association Scotland and appears to be inherent to the nature of community organisations; by and large, they are understaffed and dependent on the time of volunteers. The survey approach taken here brought forward some specific lessons. While embedding data substantially shortened response time for respondents, it confused respondents in several cases where embedded data was incorrect, due to for instance outdated information on websites.

Aside from low response rates, a second factor resulting in sample size restrictions was simply the lack of the existence of certain data. An adequate representation of joint venture projects was not possible given that joint ventures are still rare in Scotland, resulting in compromised data distributions for the 'business model' covariate used for analysis. In addition, the majority of projects are at early feasibility stages, where respondents were unable to provide answers for most project-specific data. This model is therefore likely to be substantially improved upon following the sample at hand for a longer period of time, or alternatively by sampling data from other countries in the UK. One drawback is likely to remain: while targeted telephone interviews may go some way to addressing sample bias away from failed projects, the issue of missing data for failed and early censored projects seems unavoidable.

Technologies were amalgamated within a single model because of sample size limitations. Throughout the process of operationalisation of constraints, it became more and more apparent that this technology-wide approach would come at the cost of excluding a number of technology- specific constraints. For instance, a closer comparison of council renewable energy policies revealed that wind turbines are currently the only technology facing set constraints with respect to visibility, position with respect to special environmental designations or natural heritage sites, defence radar constraints and buffer zones around domestic dwellings. These factors were not addressed in this analysis yet may be crucial to the outcome of wind projects.

In summary, a larger sample and a technology- specific model following the recommendations described here would enable more definitive answers to the postulates outlined in Section 1.2. This is because the technology-blind model at hand appears to be dominated by more fundamental differences in hazard rates between technologies and project sizes, which overshadow any ‘higher resolution’ effects on project outcomes. Given the sensitivity of the analysis to the distribution of the data, definitive conclusions on the effect of business models, access to peers, collective agency, grid capacity and distance, may require a better thought-out definition of treatment levels that enable every treatment level to be more equally represented in the dataset. A technology- specific model would narrow the number of causal relationships and also enable more distinct formulation of treatment levels, and is likely to increase the 'signal to noise’ ratio. Altogether, the (relatively low) statistical power of this model and the lack of demonstrable significance any other complex relationships between social and political factors and project outcomes make the observed effects of land ownership and local education levels are all the more noteworthy.

Having interpreted the results and discussed their limitations the following chapter details concluding statements emerging from this work, including the implications of this work for both the current and potential role of community power in Scotland’s energy sector.

7 Summary and conclusions

This dissertation describes what is to my knowledge the first attempt to place community-led RE initiatives in a quantitative framework, operationalising and estimating the effect of constraining and enabling factors derived from two branches of Social Movement theory: Resource Mobility and Political Process theories. Given the lack of an explicit vision of locally organized, community owned renewable electricity generation at the level of Scottish or UK Governments, this study frames community-led RE as a politically contentious activity that challenges incumbent social, institutional and regulatory frameworks governing energy production and consumption. Viewed through the lens of Social Movement theory, content analysis applied to the existing literature on community RE confirms the relevance of a range of (physical, technical, financial and human) resources and socio-political factors to the outcome of community RE projects.

Drawing on a survival analytical approach that allows distinction between project failure and completion, we estimate the effect of these constraining and enabling factors on project outcome. Results suggest that community RE projects benefit significantly from large pools of qualified adults at local level. Communities also benefit significantly from owning suitable sites for development, as opposed to leasing or purchasing sites. Finally, wind projects have much larger probability of success relative to all other FIT-eligible RE technologies, indicative of the comparatively attractive returns provided by wind projects. The results described here are therefore broadly supportive of Resource Mobility theory, which ascertains that social movement organisations may be variably exposed to the conditions and resources that allow a set of beliefs representing preferences for change in society to be translated into action. The findings suggest that while community projects are currently not exclusive to wealthy neighbourhoods, communities may not have equal opportunities to develop renewable energy or access public support schemes. In addition, the results imply that land access constraints and access to local expertise are likely to be key to any policy reforms aimed at facilitating effective participation by place-based social enterprises in the renewable energy sector. While there is also abundant anecdotal evidence for the relevance of concepts such as political alignment and political leverage as derived from the application of Political Process theory described here, the jury is still out on whether these factors affect project outcomes empirically (and statistically). An expanded analysis at UK scale is proposed to enable establishment of conclusive results with regards to the effect of socio-political constraints.

The survey generated in this study provides results that conform to recent estimates of total community RE capacity by the Energy Saving Trust[126]. The Scottish community renewable energy sector is small in comparison to Germany and Denmark, currently presenting 0.4% of Scotland's total renewable energy capacity. It remains dominated by hydro-electric and wind technologies. However, the number, size and technological diversity of projects are growing and the sector enjoys high levels of public support. The results obtained here clearly suggest that the sector adopts an increasingly colourful array of organisational structures, legal and project finance models, making creative use of institutional options, capital sources and tax regulations. The most recent type of engagement is in the form of joint ventures, which is set to provide communities with substantial self-owned generation capacities and revenue streams. Given public sentiment surrounding commercial wind projects, the wind sector is likely to experience further growth in joint ventures with community organisations in years to come.

Finally, the analysis outlined in this dissertation has a number of imaginable practical applications that justify the need for further and expanded research along the lines of the approach taken here. For instance, it represents a first step to a workable risk assessment tool that could provide (private, public) investors with a means to distinguish between credit-worthy and (politically, socially or financially) unviable community RE projects. Given that investor risk perceptions have thus far been a major hurdle to enabling community RE finance, such a tool has the potential to contribute to increased community uptake of renewable energy in Scotland and beyond.

Endnotes

[1] Scottish Government (2011a). 2*020 routemap for renewable energy in Scotland,* [online, last accessed 03-06-12:] http://www.scotland.gov.uk/Publications/2011/08/04110353/0
[2] Warren C., Birnie R. (2009). *Re-powering Scotland: Wind farms and the 'Energy or Environment' debate,* Scottish Geographical Journal 125(2): 97-126.
[3] Scottish Government (2010b). *Securing the benefits of Scotland's next energy revolution-Consultation on proposals to ensure Scotland and its local communities benefit from renewable and low carbon energy developments,* November 2010.
[4] Munday M., Bristol G., Cowell R. (2011). *How far do community benefits from wind farms represent a local development opportunity,* Journal of Rural Studies 27:1-12.
[5] Hanley, N., Nevin, C. (1999). *Appraising renewable energy developments in remote communities: the case of the North Assynt Estate, Scotland*. Energy Policy 27: 527-547.
[6] Scottish Government (2010c). *Scottish Planning Policy,* p.5 paragraph 31. [online, last accessed: 15-11-2011:] http://www.scotland.gov.uk/Publications/2010/02/03132605/12
[7] Scottish Government (2011d). *Renewable energy,* [online, last accessed 03-06-2011:]http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Communities
[8] DTI (2006). *Our Energy Challenge: Power from the People.* London: Department of Trade and Industry.
[9] Hain J. *et al* (2005). *Additional renewable energy growth through small-scale community orientated energy policies,* Energy Policy 22: 1199-1212.
[10] Warren C., McFayden M. (2010). *Does community ownership affect public attitudes to wind energy? A case study from south-west Scotland,* Land Use Policy 27:204–213.
[11] Rogers J. *et al* (2008). *Public perceptions of opportunities for community-based renewable energy projects,* Energy Policy 36: 4217-4226.
[12] House of Commons Environmental Audit Committee (2008). *Eighth Report of Session 2007-2008: Climate change and local, regional and devolved Government.* [online, last accessed 02-06-2011:] http://www.publications.parliament.uk/pa/cm200708/cmselect/cmenvaud/225/225.pdf
[13] Pepper S., Caldwell A. (2010). *A Framework for Community Action on Climate Change*, Report on behalf of Keep Scotland Beautiful, [online, last accessed 02-06-2011:] http://www.c5570320.myzen.co.uk
[14] Walker G. *et al* (2007). *Harnessing Community Energies: Explaining and Evaluating Community-Based Localism in Renewable Energy Policy in the UK*, Global Environmental Politics 7(2):64-82.
[15] Barnes D. (2011). Interview with Scottish and Southern Energy, In: *Does Scottish Government Policy Maximise the Benefits from Community Ownership of Onshore Wind?,* MSc Thesis with the University of Edinburgh.
[16] Warren C., McKee A. (2011). *The Scottish Revolution? Evaluating the Impacts of Post-Devolution Land reform,* Scottish Geographical Journal 127(1):17-39.
[17] Carrosio G. (2011). *Energy production from biogas in the Italian countryside: policies and organisational models,* Conference Proceedings for the RenErGo Workshop on the Governance and Socio-Economics of Biogas in Rural Areas, Wageningen 2011.
[18] Monbiot G. (2010), *Are we really going to let ourselves be duped into a solar panel rip-off?* The Guardian, 1 March 2010.
[19] Scottish Government (2010b). *Securing the benefits of Scotland's next energy revolution-Consultation on proposals to ensure Scotland and its local communities benefit from renewable and low carbon energy developments,* November 2010 [online, last accessed 10-09-11:] http://www.scotland.gov.uk/Publications/2010/11/26094907/0
[20] van der Horst D., Toke D. (2010). *Exploring landscape of wind farm developments: local area characteristics and planning process outcomes in rural England,* Land Use Policy (27): 214-221.
[21] Barnes D. (2011). Interview with Community Energy Scotland, In: *Does Scottish Government Policy Maximise the Benefits from Community Ownership of Onshore Wind?,* MSc Thesis with the University of Edinburgh.

[22] Toke D., Breukers S., Wolsink M.(2008).*Wind power deployment outcomes: How can we account for the differences? ,* Renewable and Sustainable Energy Reviews 12: 1129–1147.
[23] Walker G. (2008). *What are the barriers and incentives for community-owned means of energy production and use?* Energy Policy 36: 4401–4405.
[24] Strbac G., Jenkins N., Green T. (2006). *Future network technologies*, Report to DTI to support the Energy Review, April 2006.
[25] McEwen N., Bomberg E. (unpublished). *Grassroots Action and the Politics of Energy Governance*, UKERC ENGAGE project brief, [online, accessed 01-10-2011:] http://www.ukerc.ac.uk/support/tikiindex.php?page=EnGAGE+Scotland:+Grassroots+Action+and+te+Politics+of+Energy+Governance+in+Scotland
[26] Stevenson R., Richardson T. (2005). *Policy integration for sustainable development: exploring barriers to renewable energy development in post-devolution Wales,* Journal of Environmental Policy and Planning 5:95-118.
[27] Lovins A. (1977). *Soft Energy Paths: Towards a Durable Peace,* Friends of the Earth International, San Francisco.
[28] Hirst P. (2001). *Associative democracy: the real third way,* Frank Cass Publishers, London.
[29] Ison N.(2010). *From command and control to local democracy: the governance of community energy projects*, Proceedings of the Berlin Conferences on Human Dimensions of Global Environmental Change, [online last accessed 21/08/2012:] http://edocs.fuberlin.de/docs/receive/FUDOCS_document_000000006940
[30]Smith G., Teasdale S. (2011). *Associative democracy and the social economy: exploring the regulatory challenge,* PSA.
[31] Marvin S., Guy S. (1997). *Creating myths rather than sustainability: the transition fallacy of the new localism,* Local Environment 2(3):311-318.
[32] Jänicke M., Jacob K. (2005). *Ecological Modernisation and the Creation of Lead Markets,* pp. 175-194 in: Towards Environmental Innovation Systems. M. Weber and J. Hemmelskamp (Eds), Berlin Heidelberg New York, Springer.
[33] Breukers S., Wolsink, M.(2007). *Wind power implementation in changing institutional landscapes: an international comparison*, Energy Policy 35: 2737-2750.
[34] Szarka J., Bluhdorn, I. (2006). *Wind Power in Britain and Germany: Explaining Contrasting Development Paths*, A report for DEFRA, London, UK.
[35] Szarka J. (2007). *Wind Power in Europe: Politics, Business and Society*, Palgrave Macmillan, Basingstoke.
[36] Hegger D., van Vliet B., van Vliet J. (2007). *Niche Management and its Contribution to Regime Change: The Case of Innovation in Sanitation*, Technology Analysis & Strategic Management, 19 (6): 729-746.
[37] Smith A., Stirling A.(2006). *Inside or Out? Open or Closed? Positioning the Governance of Sustainable Technology,* SPRU Electronic Working Paper Series No. 148. Brighton, SPRU**:** 49p.
[38] Gubbins N. (2010).*The role of community energy schemes in supporting community resilience,* JRF briefing paper: Community Assets, November 2010.
[39] Walker A. *et al* (2010). *A guide for community groups on investing for community benefit,* The Pool in Scotland.
[40] TLT Solicitors (2007). *Bankable Models which Enable Local Community Wind Farm Ownership: A report for the Renewables Advisory Board and DTI,* Department for Business Innovation and Skills, [online, last accessed 25-10-2011:] http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/energy/sources/renewables/policy/renewables-advisory-board/community-involvment-wind/page43643.html
[41] Scottish Government (2009). *Community Renewable Energy Toolkit, Section 9: Funding and Financing your Project,* [online, last accessed 25-10-2011:] http://www.communityenergyscotland.org.uk
[42] Scottish Executive Development Department (2006). *Planning for micro-renewables: Annex to Pan 45 Renewable Energy technologies,* [online, last accessed 25-10-2011:]

http://scotland.gov.uk/Publications/2006/10/03093936/0

43 Scottish Government (2007). *The Environmental Impact Scotland Regulations (1999) Circular*, [online, last accessed 25-10-2011:] http://www.scotland.gov.uk/Resource/Doc/205337/0054660.pdf

44 Centre for Sustainable Energy (2007). *Delivering Community Benefits from Wind Energy Development: A Toolkit- Report for the Renewables Advisory Board and DTI,* [online, last accessed 25-10-2011:]http://www.cse.org.uk/pdf/pub1078.pdf

45 Smith A. (2007). *Emerging in between: The multi-level governance of renewable energy in the English regions,* Energy Policy 35: 6266–6280.

46 Morrison D., Lodwick D. (1981).*The Social Impacts of Soft and Hard Energy Systems: The Lovins' Claims as a Social Science Challenge*, Annual Review of Energy 6: 357-378.

47 Walker G. (1997). *Renewable Energy in the UK: The Cinderella Sector Transformed?,* Geography 82 (1): 59–74.

48 Bomberg E., McEwen N. (2008). *Intergovernmental politics and climate change: Scotland, UK, EU,* Paper prepared for presentation at the UACES conference, Edinburgh, 1-3 September 2008.

49 Barnes D. (2011). Interview with CES and with Scottish and Southern Energy, In: *Does Scottish Government Policy Maximise the Benefits from Community Ownership of Onshore Wind?,* MSc Thesis with the University of Edinburgh.

50 Scottish Government (2011c). *Renewable Energy for Communities,* [online, last accessed 25-10-2011:] http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Communities

51 University of Edinburgh (2006). *Matching renewable electricity generation with demand-Full Report,* Commissioned by the Scottish Executive, http://www.viewsofscotland.org/library/docs/MREWD.pdf

52 Nicola McEwen (2011). *Personal communication*, Institute of Governance (Co-Director), August 2011.

53 Ofgem (2011a). *Feed-in- Tariffs: Guidance for renewable installations V2,* 18 October 2011.

54 Scottish Government (2010a). *Scottish government community and renewable energy loan scheme: guidance,* [online, last accessed 25-10-2011:] http://www.communityenergyscotland.org.uk/userfiles/file/CARES/CARES%20Loan%20Fund%20Guidance.pdf

55 Phillip Bruner (2011). *Personal communication*, Sustainable Community Energy Network (Director), July 2011.

56 Department of Energy and Climate Change (2010). *Feed-In-Tariffs: Government Response to the summer 2009 Consultation,* [online, last accessed 31/01/2011:]http://www.decc.gov.uk

57 Dinica V. (2003). *Sustained diffusion of renewable energy,* PhD thesis, [online, last accessed 23-07-2011:]http://www.tup.utwente.nl/catalogue/book/index.jsp?isbn=9036519217

58 Department of Energy and Climate Change (2011a). *Consultation on fast-track review of Feed-in Tariffs for small scale low carbon electricity,* [online, last accessed 03-06-2011:] http://www.decc.gov.uk/en/content/cms/consultations/fit_review/fit_review.aspx

59 Department of Energy and Climate Change (2011b). *Feed in Tariff Scheme: Summary of responses to the Fast Track Consultation and Government Response,* [online, last accessed 11-07-2011:] http://www.decc.gov.uk/assets/decc/Consultations/fits-review/fits-fast-track-government-response---final.pdf

60 Financial Times (2011). *Shadow falls over solar subsidies,* October 20, 2011.

61 Ofgem (2011b). *Renewables Obligation: Guidance for licensed electricity suppliers (GB and NI),* [online, last accessed 25-10-2011:] http://www.ofgem.gov.uk/Sustainability/Environment/RenewablObl/Documents1/Supplier%20Guidance%20Document%202011.pdf.

62 Scottish Government (2009). Part 15 in: *Community Renewable Energy Toolkit*, [online, last accessed 25-10-2011:] http://www.scotland.gov.uk/Publications/2009/03/20155542/15.

63 Scottish Government (2009). *Generating and Selling Electricity- Community Ownership,* Section 6 in Community Renewable Energy Toolkit*,* [online, last accessed 25-10-2011:]

http://www.communityenergyscotland.org.uk/userfiles/file%5CCommunity%20Renewable%20Energy%20Toolkit%5CCommunity%20Renewable%20Energy%20Toolkit.pdf
[64] IPA Energy Consulting (2003). *Final Report to Comhairle Nan Eilean Siar and The Highland Council- An Evaluation of Alternative/Renewable Energy Schemes* , [online, last accessed 20-10-2011:]http://www.cnesiar.gov.uk/renewable/documents/areschemesevaluation.pdf.
[65] Wood Mackenzie (2009). *Scotland's Generation Advantage – A report to the Scottish Government* [online, last accessed 25/08/2011:]http://www.scotland.gov.uk/Resource/Doc/295424/0091448.pdf.
[66] Scottish Executive (1999). *Planning Advice Note 58: Environmental Impact Assessment,* [online 25/08/2011:]http://www.scotland.gov.uk/Publications/1999/10/pan58-root/pan58.
[67] Northern Ireland Assembly (2010). *The principles of planning sequencing in relation to wind energy,* Research Paper 05/10, [online, last accessed 25/08/2011:] http://archive.niassembly.gov.uk/researchandlibrary/2010/0510.pdf
[68] Scottish Government (1999).*The Environmental Impact Assessment (Scotland) Regulations 1999 – Schedule 2 descriptions of development and applicable thresholds and criteria for the purposes of "schedule 2 development"*, [online last accessed 25/06/2012:] http://www.legislation.gov.uk/ssi/1999/1/schedule/2/made
[69] Scottish Government (2008). Planning Advice Note 45: Renewable Energy, Annex 2: *Spatial frameworks and supplementary guidance for wind farms*, [online last accessed 05/08/2012:] http://www.scotland.gov.uk/Resource/Doc/244403/0068333.pdf
[70] Cairngorms National Park Authority (2007). *Cairngorms National Park Plan,* [online last accessed 05/08/2012:]http://www.cairngorms.co.uk/park-authority/planning/local-plan/.
[71] Scottish Government (1997). *Section 264A, Town and Country Planning (Scotland) Act 1997,* [online last accessed 25/08/2011:]http://www.legislation.gov.uk/ukpga/1997/8/contents.
[72] Scottish Government (2010c). *Scottish Planning Policy*, [online last accessed 11/01/2012:] http://www.scotland.gov.uk/Publications/2010/02/03132605/0
[73] Boyd D. (2012). *Personal communication*, Huntley Development Trust (Director), May 2012.
[74] Scottish Natural Heritage (2010). *Guidance: Hydroelectric schemes and the natural heritage,* [online last accessed 26/08/2012:] http://www.snh.gov.uk/docs/C278964.pdf
[75] Higgins, P., Wightman, A., MacMillan, D. (2002). *Sporting Estates and recreational land use in the Highlands and Islands of Scotland*, Swindon: Economic and Social Research Council, p.22.
[76] Pillai A. (2010). *Sustainable rural communities? A legal perspective on the community right to buy,* Land Use Policy 27: 898–905.
[77] Macleod C., Braunholtz-Speight T. (2010). *Community right to buy in practice,* JRF briefing paper: Community Asset, October 2010.
[78] Toke D. (2005). *Explaining wind power planning outcomes: Some findings from a study in England and Wales,* Energy Policy 33: 1527–1539.
[79] The National Grid (2005). *System Overview: The GB Transmission System,* In: 2005 Seven Year Statement, [online last accessed 28/06/12 at:] http://www.nationalgrid.com/uk/library/documents/sys05/default.asp?action=mnch6_2.htm&Node=SYS&Snode=6_2&Exp=Y#The_Gb_Transmission_System
[80] SSE Power Distribution (2012). *Network capacity,* [online, last accessed 28/06/2012 at:] http://www.ssepd.co.uk/GenerationConnections/ConnectingGenerationToOurNetwork/
[81] Swider D. *et al* (2008). *Conditions and costs for renewables electricity grid connection: Examples in Europe,* Renewable Energy 33(8):1832-1842.
[82] Lüthi S., Prässler T. (2011). *Analyzing policy support instruments and regulatory risk factors for wind energy deployment—A developers' perspective*, Energy Policy 39:4876–4892.
[83] Diani M. (1992). *The concept of social movement,* The Sociological Review, 40:1: 1–25.
[84] Scottish Government (2011b). *FIT fast-track review of consultation responses,* Consultation on fast-track review of Feed-in Tariffs for small scale low carbon electricity [online last accessed 04/11/2011:] http://www.decc.gov.uk/en/content/cms/consultations/fit_review/fit_review.aspx.

[85] Gerlach P. (1999). *The structure of social movements: environmental activism and its opponents,* Chapter 9 in: Networks and Netwars: The Future of Terror, Crime, and Militancy, Eds. Arquilla J. and Ronfeldt D.
[86] McAdam D. (1999). *Political process and the development of Black insurgency: 1930-1970,* University of Chicago Press.
[87] Bate B., Bevan H., Robert G. (2004). *Towards a million change agents: a review of the social movements literature: implications for large scale change in the NHS,* Report for the NHS Modernisation Agency.
[88] Useem B. (1998). *Breakdown theories of collective action,* Annual Review of Sociology, 24:215-38.
[89] Touraine A. (1985). *An Introduction to the Study of Social Movements*, Social Research, 52 (4):751-785.
[90] Melucci, A. (1980). *The new social movements: A theoretical approach,* Social Science Information, 19 (2):199-227.
[91] Pacheco D., York J., Hargrave T. (unpublished). *The co-evolution of industries, social movements, and institutions: the case of wind power,* ARCS 3rd Annual Conference , October 2011.
[92] Sine W., Lee B (2009). *Tilting at windmills? The environmental movement and the emergence of the U.S.A wind energy sector,* Administrative Science Quarterly, 54: 123–155.
[93] Toke D. (2011). *Ecological modernisation, social movements and renewable energy,* Environmental Politics 20:(1)60–77.
[94] Doblinger C., Soppe B. (2011). T*he role of social movements in legitimating new technologies: evidence from the electric utility industry,* Paper presented at the Dime-Druid Academy Winter Conference 2011*,* Aalborg, Denmark, January 2011.
[95] Hess D. (2007). *Alternative Pathways in Science and Industry: Activism, Innovation, and the Environment in an Era of Globalization,* The MIT Press.
[96] van Poel I. (2000). *On the Role of Outsiders in Technical Development,* Technology Analysis & Strategic Management, 12 (3): 383-397.
[97] Smith A. (2004). *Alternative technology niches and sustainable development,* Innovation: management, policy & practice, 6: 220–235.
[98] Jamison A. (2010). *Climate change knowledge and social movement theory,* Wiley Interdisciplinary Reviews: Climate Change, 1: 811-823.
[99] Hardy J. (2009). *Renewable energy development in rural Saskatchewan: a critical study of a new social movement,* Msc thesis at the University of Saskatchewan, Saskatoon.
[100] Waterman H. (1981). *Reasons and reason: Collective political activity in comparative and historical perspective,* World Politics 32:554-589.
[101] McCarthy J., Zald M. (2001). *The Enduring Vitality of the Resource Mobilisation Theory of Social Movements,* pp.533-565, Chapter 25 In: Handbook of Sociological Theory. J. H. Turner (Ed.), Springer US**.**
[102] Pichardo N.(1988). *Resource mobilisation: an analysis of conflicting theoretical variations,* Sociological Quarterly, 29(1):97.
[103] McAdam A. (1982). *Political process and the development of the black insurgency, 1930-1970,* Chicago, University of Chicago Press.
[104] Morris A. (1981). *Black Southern sit in movement: an analysis of an internal organisation,* American Sociological Review 46:744-767.
[105] Barnes D. (2011). Interview with Udny (2011), p. 33. In: *Does Scottish Government Policy Maximise the Benefits from Community Ownership of Onshore Wind?,* MSc Thesis with the University of Edinburgh.
[106] Walker G. (2007). *Community Energy Initiatives: Embedding Sustainable Technology at a Local Level: Full Research Report,* ESRC End of Award Report, RES-338-25-0010-A, Swindon: ESRC.
[107] McAdam D., McCarthy J., Zald M. (1996). *Introduction: Opportunities, mobilizing structures, and framing processes—toward a synthetic, comparative perspective on social movements,* In: Comparative perspectives on social movements, Cambridge University Press.

[108] Tarrow S., Meyer D.(1998). *The social movement society: contentious politics for a new century,* Rowman & Littlefield, pp.76–77.
[109] Barnes D. (2011). Interview Scottish and Southern Energy, p.49 In: *Does Scottish Government Policy Maximise the Benefits from Community Ownership of Onshore Wind?,* MSc Thesis with the University of Edinburgh.
[110] Mussall F., Kuik O.(2011). *Local acceptance of renewable energy—A case study from southeast Germany*, Energy Policy 39(6): 3252–3260.
[111] Highland Council (2012). *Community Benefit Policy,* [online, last accessed 27/08/2012:] http://www.highland.gov.uk/livinghere/communityplanning/communitybenefit/
[112] Hebrides News (2011). *Community energy companies demand Pairc buyout approval,* [online, last accessed 27/07/2012:] http://www.hebrides-news.com/pairc_buyout_demand_11110.html
[113] Russo M. (2003). *The emergence of sustainable industries: building on natural capital,* Strategic Management Journal 24:317-331.
[114] Sine W., David R., Mitsuhashi H.(2007). *From plan to Plant: Effects of Certification on Operational start up in the emergent Independent Power Sector,* Organisation Science 18(4): 578-594.
[115] Hogget R. (2010). *The opportunities and barriers for communities to secure at-risk finance for the development of revenue-generating renewable energy projects,* MSc thesis September 2010 to Exeter University.
[116] Rogers J. *et al* (2011). *What factors enable community-leadership of renewable energy projects? Lessons from a woodfuel heating initiative,* Paper submitted to the 9th Rural Entrepreneurship Conference, 23-24 June 2011, Nottingham.
[117] IPPR Report (2010). *Barriers to Community energy projects,* Ch. 4 In: Green streets, strong communities: What communities can do for emissions reductions and what emissions reductions can do for communities.
[118] Walker G., Devine-Wright P. (2008). *Community renewable energy: What should it mean?* Energy Policy 36(2): 497-500.
[119] North American Electric Reliability Council (1996). *Available Transfer Capability Definitions and Determination: A framework for determining available transfer capabilities of the interconnected transmission networks for a commercially viable electricity market,* [online, last accessed 28/06/2012 at:] http://www.westgov.org/wieb/wind/06-96NERCatc.pdf
[120] Steele F. (2005). *Event History Analysis - A National Centre for Research Methods Briefing Paper ,* NCRM Methods Review Papers 004, [online, last accessed 05/11/2011:] http://eprints.ncrm.ac.uk/88/1/MethodsReviewPaperNCRM-004.pdf
[121] Box-Steffensmeier J., Zorn C. (2001). *Duration models and proportional hazards in political science,* American Journal of Political Science 45(4): 972-988.
[122] Cameron C., Trivedi P.(2005). *Transition Data: Survival Analysis,* Chapter 17 In: Microeconometrics: methods and applications, Cambridge University Press, USA.
[123] Kalbfleisch, J., Prentice, R.(2002). *Competing Risks and Multistate Models*, Chapter 8 in: *The Statistical Analysis of Failure Time Data,* Wiley Series in Probability and Statistics.
[124] Fox J. (2008). *Cox Proportional-Hazards Regression for Survival Data,* In: An R and S-PLUS Companion to Applied Regression, Sage Publications.
[125] Justice S. (2009). *Private Financing of Renewable Energy – A Guide for Policymakers*, Chatham House.
[126] Energy Saving Trust (2012). *Community and locally owned renewable energy in Scotland*, [online last accessed 21/05/2012:] http://www.energysavingtrust.org.uk/scotland/Publications2/Communities/Community-and-locally-owned-renewable-energy-PDF.
[127] Energy4all (2011). *Community Ownership- Energy Prospects*, [online last accessed 21/05/2012:] http://www.energy4all.co.uk/community.asp?ID=SCPRF&catID=2.
[128] Bolinger M. (2004). *Community Wind Power Ownership Schemes in Europe and their Relevance to the United States*, Lawrence Berkeley National Laboratory, [online last accessed 21/05/2012:] http://eetd.lbl.gov/EA/EMP/.

[129] Birchall J. (2009). *A comparative analysis of co-operative sectors in Scotland, Finland, Sweden and Switzerland*, Co-operative Development Scotland.
[130] BWEA (2010). *The economics of wind energy,* online last accessed 18/09/2012:] http://www.bwea.com/ref/econ.html
[131] Angus Council (2012). *Implementation Guide for Renewable Energy Proposals- Policies ER34 Renewable Energy Developments & ER35 Wind Energy Development,* [online last accessed 22/06/2012:] http://www.angus.gov.uk/renewableenergy/
[132] Ison N.(2010).*From command and control to local democracy: the governance of community energy projects,* Proceedings of the Berlin Conferences on Human Dimensions of Global Environmental Change, [online last accessed 21/08/2012:] http://edocs.fuberlin.de/docs/receive/FUDOCS_document_000000006940
[133] Cleves M. *et al* (2008). *An introduction to Survival Analysis Using Stata,* Stata Press, USA.
[134] Grambsch P., Thernaeau T. (1994). *Proportional hazards tests and diagnostics based on weighted residuals,* Biometrika 81:515-516.
[135] Department of Energy and Climate Change (2011c). *Feed-in tariffs scheme: Consultation on Comprehensive Review Phase 1 – tariffs for solar PV,* [online last accessed 21/09/2012:] https://econsultation.decc.gov.uk/office-for-renewable-energy-deployment-ored/comprehensive-review-part-1

Bibliography

Angus Council (2012). *Implementation Guide for Renewable Energy Proposals- Policies ER34 Renewable Energy Developments & ER35 Wind Energy Development*, [online last accessed 22/06/2012:] http://www.angus.gov.uk/renewableenergy/

Barnes D. (2011). *Does Scottish Government Policy Maximise the Benefits from Community Ownership of Onshore Wind?,* MSc Thesis with the University of Edinburgh.

Bate B., Bevan H., Robert G. (2004). *Towards a million change agents: a review of the social movements literature: implications for large scale change in the NHS*, Report for the NHS Modernisation Agency.

Birchall J. (2009). *A comparative analysis of co-operative sectors in Scotland, Finland, Sweden and Switzerland*, Co-operative Development Scotland.

Bolinger M. (2004). *Community Wind Power Ownership Schemes in Europe and their Relevance to the United States*, Lawrence Berkeley National Laboratory, [online last accessed 21/05/2012:] http://eetd.lbl.gov/EA/EMP/

Bomberg E., McEwen N. (2008). *Intergovernmental politics and climate change: Scotland, UK, EU*, Paper prepared for presentation at the UACES conference, Edinburgh, 1-3 September 2008.

Box-Steffensmeier J., Zorn C. (2001). *Duration models and proportional hazards in political science*, American Journal of Political Science 45(4): 972-988.

Boyd D. (2012). Personal communication, Huntley Development Trust (Director), May 2012.

Breukers S., Wolsink, M.(2007). *Wind power implementation in changing institutional landscapes: an international comparison*, Energy Policy 35: 2737-2750.

BWEA (2010). *The economics of wind energy*, online last accessed 18/09/2012:] http://www.bwea.com/ref/econ.html

Cairngorms National Park Authority (2007). *Cairngorms National Park Plan*, [online last accessed 05/08/2012:] http://www.cairngorms.co.uk/park-authority/planning/local-plan/

Cameron C., Trivedi P.(2005). *Transition Data: Survival Analysis,* Chapter 17 in: Microeconometrics: methods and applications, Cambridge University Press, USA.

Carrosio G. (2011). *Energy production from biogas in the Italian countryside: policies and organisational models*, Conference Proceedings for the RenErGo Workshop on the Governance and Socio-Economics of Biogas in Rural Areas, Wageningen 2011.

Centre for Sustainable Energy (2007). *Delivering Community Benefits from Wind Energy Development: A Toolkit- Report for the Renewables Advisory Board and DTI*, [online, last accessed 25-10-2011:] http://www.cse.org.uk/pdf/pub1078.pdf

Cleves M. *et al* (2008). *An introduction to Survival Analysis Using Stata*, Stata Press, USA.

Department of Energy and Climate Change (2010). *Feed-In-Tariffs: Government Response to the summer 2009 Consultation*, [online, last accessed 31/01/2011:] http://www.decc.gov.uk

Department of Energy and Climate Change (2011a). *Consultation on fast-track review of Feed-in*

Tariffs for small scale low carbon electricity, [online, last accessed 03-06-2011:] http://www.decc.gov.uk/en/content/cms/consultations/fit_review/fit_review.aspx

Department of Energy and Climate Change (2011b). *Feed in Tariff Scheme: Summary of responses to the Fast Track Consultation and Government Response*, [online, last accessed 11-07-2011:] http://www.decc.gov.uk/assets/decc/Consultations/fits-review/fits-fast-track-government-response---final.pdf

Department of Energy and Climate Change (2011c). *Feed-in tariffs scheme: Consultation on Comprehensive Review Phase 1 – tariffs for solar PV*, [online last accessed 21/09/2012:] https://econsultation.decc.gov.uk/office-for-renewable-energy-deployment-ored/comprehensive-review-part-1

Diani M. (1992). *The concept of social movement*, The Sociological Review, 40:1: 1–25.

Dinica V. (2003). *Sustained diffusion of renewable energy*, PhD thesis, [online, last accessed 23-07-2011:] http://www.tup.utwente.nl/catalogue/book/index.jsp?isbn=9036519217

Doblinger C., Soppe B. (2011). *The role of social movements in legitimating new technologies: evidence from the electric utility industry*, Paper presented at the Dime-Druid Academy Winter Conference 2011, Aalborg, Denmark, January 2011.

DTI (2006). *Our Energy Challenge: Power from the People*. London: Department of Trade and Industry.

Energy Saving Trust (2012). *Community and locally owned renewable energy in Scotland*, [online last accessed 21/05/2012:] http://www.energysavingtrust.org.uk/scotland/Publications2/Communities/Community-and-locally-owned-renewable-energy-PDF

Energy4all (2011). *Community Ownership- Energy Prospects*, [online last accessed 21/05/2012:] http://www.energy4all.co.uk/community.asp?ID=SCPRF&catID=2

Evans B. (2006). *UKERC Energising Communalities*, UKERC Meeting Place Workshop Report 12th June 2006, Oxford.

Financial Times (2011). *Shadow falls over solar subsidies*, October 20, 2011.

Fox J. (2008). *Cox Proportional-Hazards Regression for Survival Data*, In: An R and S-PLUS Companion to Applied Regression, Sage Publications.

Gerlach P. (1999). *The structure of social movements: environmental activism and its opponents*, Chapter 9 in: Networks and Netwars: The Future of Terror, Crime, and Militancy, Eds. Arquilla J. and Ronfeldt D., Rand Corporation, [online last accessed 21/05/2012:] http://www.rand.org/pubs/monograph_reports/MR1382.html

Grambsch P., Thernaeau T. (1994). *Proportional hazards tests and diagnostics based on weighted residuals*, Biometrika 81:515-516.

Gubbins N. (2010). *The role of community energy schemes in supporting community resilience*, JRF briefing paper: Community Assets, November 2010.

Hain J. *et al* (2005). *Additional renewable energy growth through small-scale community orientated energy policies*, Energy Policy 22: 1199-1212.

Hanley N., Nevin C. (1999). *Appraising renewable energy developments in remote communities: the case of the North Assynt Estate, Scotland*, Energy Policy 27: 527-547.

Hardy J. (2009). *Renewable energy development in rural Saskatchewan: a critical study of a new social movement*, Msc thesis at the University of Saskatchewan, Saskatoon, [online, last accessed 21/08/2011:] http://library.usask.ca/theses/available/etd-04152009-085302/unrestricted/ThesisHardy.pdf

Hebrides News (2011). *Community energy companies demand Pairc buyout approval*, [online, last accessed 27/07/2012:] http://www.hebrides-news.com/pairc_buyout_demand_11110.html

Hegger D., van Vliet B., van Vliet J. (2007). *Niche Management and its Contribution to Regime Change: The Case of Innovation in Sanitation, Technology Analysis & Strategic Management*, 19 (6): 729-746.

Hess D. (2007). *Alternative Pathways in Science and Industry: Activism, Innovation, and the* Environment in an Era of Globalization, The MIT Press.

Higgins P., Wightman A., MacMillan D. (2002). *Sporting Estates and recreational land use in the Highlands and Islands of Scotland*, Swindon: Economic and Social Research Council, p.22.

Highland Council (2012). *Community Benefit Policy*, [online, last accessed 27/05/2012:] http://www.highland.gov.uk/livinghere/communityplanning/communitybenefit/

Hirst P. (2001). *Associative democracy: the real third way*, Frank Cass Publishers, London.

Hogget R. (2010). *The opportunities and barriers for communities to secure at-risk finance for the development of revenue-generating renewable energy projects*, MSc thesis September 2010 to Exeter University, [online, last accessed 27/05/2012:] http://www.communitypowercornwall.coop/downloads/at_risk_finance_for_community_renewables.pdf

House of Commons Environmental Audit Committee (2008). *Eighth Report of Session 2007-2008: Climate change and local, regional and devolved Government*, [online, last accessed 02-06-2011:] http://www.publications.parliament.uk/pa/cm200708/cmselect/cmenvaud/225/225.pdf

IPA Energy Consulting (2003). *Final Report to Comhairle Nan Eilean Siar and The Highland Council-An Evaluation of Alternative/Renewable Energy Schemes*, [online, last accessed 20-10-2011:] http://www.cnesiar.gov.uk/renewable/documents/areschemesevaluation.pdf

IPPR Report (2010). *Barriers to Community energy projects*, Ch. 4 In: Green streets, strong communities: What communities can do for emissions reductions and what emissions reductions can do for communities, [online, last accessed 20-10-2011:] http://www.communityplanning.net/pub-film/pdf/GreenStreetsStrongCommunities.pdf

Ison N.(2010). *From command and control to local democracy: the governance of community energy projects*, Proceedings of the Berlin Conferences on Human Dimensions of Global Environmental Change, [online last accessed 21/08/2012:] http://edocs.fuberlin.de/docs/receive/FUDOCS_document_000000006940

Jamison A. (2010). *Climate change knowledge and social movement theory*, Wiley Interdisciplinary Reviews: Climate Change, 1: 811-823.

Jänicke M., Jacob K. (2005). *Ecological Modernisation and the Creation of Lead Markets*, pp. 175-194 in: Towards Environmental Innovation Systems. M. Weber and J. Hemmelskamp (Eds), Berlin Heidelberg New York, Springer.

Justice S. (2009). *Private Financing of Renewable Energy – A Guide for Policymakers*, Chatham House.

Kalbfleisch J., Prentice R.(2002). *Competing Risks and Multistate Models*, Chapter 8 in: The Statistical Analysis of Failure Time Data, Wiley Series in Probability and Statistics.

Letcher M. *et al* (2007). *Mobilising individual behaviour change through community initiatives: lessons for climate change*, Report by the Centre for Sustainable Energy and Community Development Xchange, [online, last accessed 21/04/2012:] http://www.cse.org.uk/pdf/pub1073.pdf

Lovins A. (1977). *Soft Energy Paths: Towards a Durable Peace*, Friends of the Earth International, San Francisco.

Lüthi S., Prässler T. (2011). *Analyzing policy support instruments and regulatory risk factors for wind energy deployment—A developers' perspective*, Energy Policy 39: 4876–4892.

Macleod C., Braunholtz-Speight T. (2010). *Community right to buy in practice*, JRF briefing paper: Community Asset, October 2010.

Maritskainen M., Watson J. (2009). *Energy and the Citizen*, In: Energy for the Future. Palgrave MacMillan, pp. 165-182.

Marvin S., Guy S. (1997). *Creating myths rather than sustainability: the transition fallacy of the new localism*, Local Environment 2(3):311-318.

McAdam A. (1999). *Political process and the development of the black insurgency, 1930-1970*, Chicago, University of Chicago Press.

McAdam D., McCarthy J., Zald M. (1996). *Introduction: Opportunities, mobilizing structures, and framing processes—toward a synthetic, comparative perspective on social movements*, In: Comparative perspectives on social movements, Cambridge University Press.

McCarthy J., Zald M. (2001). *The Enduring Vitality of the Resource Mobilisation Theory of Social Movements*, pp.533-565, Chapter 25 In: Handbook of Sociological Theory. J. H. Turner (Ed.), Springer US.

McEwen N., Bomberg E. (unpublished). *Grassroots Action and the Politics of Energy Governance*, UKERC ENGAGE project brief, [online, accessed 01-10-2011:] http://www.ukerc.ac.uk/support/tikiindex.php?page=EnGAGE+Scotland:+Grassroots+Action+and+te+Politics+of+Energy+Governance+in+Scotland

Melucci, A. (1980). *The new social movements: A theoretical approach*, Social Science Information, 19 (2):199-227.

Monbiot G. (2010). *Are we really going to let ourselves be duped into a solar panel rip-off?,* The Guardian, 1 March 2010.

Morris A. (1981). *Black Southern sit in movement: an analysis of an internal organisation*, American Sociological Review 46:744-767.

Morrison D., Lodwick D. (1981).*The Social Impacts of Soft and Hard Energy Systems: The Lovins' Claims as a Social Science Challenge*, Annual Review of Energy 6: 357-378.

Munday M., Bristol G., Cowell R. (2011). *How far do community benefits from wind farms represent a local development opportunity?*, Journal of Rural Studies 27:1-12.

Mussall F., Kuik O.(2011). *Local acceptance of renewable energy—A case study from southeast Germany*, Energy Policy 39(6): 3252–3260.

Nicola McEwen (2011). *Personal communication*, Institute of Governance (Co-Director), August 2011.

North American Electric Reliability Council (1996). *Available Transfer Capability Definitions and Determination: A framework for determining available transfer capabilities of the interconnected transmission networks for a commercially viable electricity market*, [online, last accessed 28/06/2012 at:] http://www.westgov.org/wieb/wind/06-96NERCatc.pdf

Northern Ireland Assembly (2010). *The principles of planning sequencing in relation to wind energy*, Research Paper 05/10, [online, last accessed 25/08/2011:] http://archive.niassembly.gov.uk/researchandlibrary/2010/0510.pdf

Ofgem (2011a). *Feed-in- Tariffs: Guidance for renewable installations V2*, 18 October 2011.

Ofgem (2011b). *Renewables Obligation: Guidance for licensed electricity suppliers* (GB and NI), [online, last accessed 25-10-2011:] http://www.ofgem.gov.uk/Sustainability/Environment/RenewablObl/Documents1/Supplier%20Guidance%20Document%202011.pdf

Pacheco D., York J., Hargrave T. (unpublished). *The co-evolution of industries, social movements, and institutions: the case of wind power*, ARCS 3rd Annual Conference , October 2011.

Pepper S., Caldwell A. (2010). *A Framework for Community Action on Climate Change*, Report on behalf of Keep Scotland Beautiful, [online, last accessed 02-06-2011:] http://www.c5570320.myzen.co.uk

Phillip Bruner (2011). *Personal communication*, Sustainable Community Energy Network (Director), July 2011.

Pichardo N.(1988). *Resource mobilisation: an analysis of conflicting theoretical variations*, Sociological Quarterly, 29(1):97.

Pillai A. (2010). *Sustainable rural communities? A legal perspective on the community right to buy*, Land Use Policy 27: 898–905.

Rogers J. *et al* (2008). *Public perceptions of opportunities for community-based renewable energy projects*, Energy Policy 36: 4217-4226.

Rogers J. *et al* (2011). *What factors enable community-leadership of renewable energy projects? Lessons from a woodfuel heating initiative*, Paper submitted to the 9th Rural Entrepreneurship Conference, 23-24 June 2011, Nottingham.

Russo M. (2003). *The emergence of sustainable industries: building on natural capital,* Strategic Management Journal 24:317-331.

Scottish Executive (1999). *Planning Advice Note 58: Environmental Impact Assessment*, [online 25/08/2011:]http://www.scotland.gov.uk/Publications/1999/10/pan58-root/pan58

Scottish Executive Development Department (2006). *Planning for micro-renewables*: *Annex to Pan 45 Renewable Energy technologies,* [online, last accessed 25-10-2011:]http://scotland.gov.uk/Publications/2006/10/03093936/0

Scottish Government (1997). *Section 264A, Town and Country Planning (Scotland) Act 1997*, [online last accessed 25/08/2011:]http://www.legislation.gov.uk/ukpga/1997/8/contents

Scottish Government (1999).*The Environmental Impact Assessment (Scotland) Regulations 1999 – Schedule 2 descriptions of development and applicable thresholds and criteria for the purposes of "schedule 2 development",* [online last accessed 25/06/2012:] http://www.legislation.gov.uk/ssi/1999/1/schedule/2/made

Scottish Government (2007). *The Environmental Impact Scotland Regulations (1999) Circular*, [online, last accessed 25-10-2011:] http://www.scotland.gov.uk/Resource/Doc/205337/0054660.pdf

Scottish Government (2008). *Planning Advice Note 45: Renewable Energy, Annex 2: Spatial frameworks and supplementary guidance for wind farms*, [online last accessed 05/08/2012:] http://www.scotland.gov.uk/Resource/Doc/244403/0068333.pdf

Scottish Government (2009). Community Renewable Energy Toolkit, [online, last accessed 25-10-2011:] http://www.communityenergyscotland.org.uk

Scottish Government (2010a). *Scottish government community and renewable energy loan scheme: guidance*, [online, last accessed 25-10-2011:] http://www.communityenergyscotland.org.uk/userfiles/file/CARES/CARES%20Loan%20Fund%20Guidance.pdf

Scottish Government (2010b). *Securing the benefits of Scotland's next energy revolution- Consultation on proposals to ensure Scotland and its local communities benefit from renewable and low carbon energy developments*, November 2010 [online, last accessed 10-09-11:] http://www.scotland.gov.uk/Publications/2010/11/26094907/0

Scottish Government (2010c). *Scottish Planning Policy*, [online, last accessed: 15-11-2011:] http://www.scotland.gov.uk/Publications/2010/02/03132605/12

Scottish Government (2011a). *2020 routemap for renewable energy in Scotland*, [online, last accessed 03-06-12:] http://www.scotland.gov.uk/Publications/2011/08/04110353/0

Scottish Government (2011b). *FIT fast-track review of consultation responses*, Consultation on fast-track review of Feed-in Tariffs for small scale low carbon electricity [online last accessed 04/11/2011:] http://www.decc.gov.uk/en/content/cms/consultations/fit_review/fit_review.aspx

Scottish Government (2011c). *Renewable Energy for Communities*, [online, last accessed 25-10-2011:] http://www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Communities

Scottish Government (2011d). *Renewable energy*, [online, last accessed 03-06-2011:] http:// www.scotland.gov.uk/Topics/Business-Industry/Energy/Energy-sources/19185/Communities

Scottish Natural Heritage (2010). *Guidance: Hydroelectric schemes and the natural heritage*, [online last accessed 26/08/2012:] http://www.snh.gov.uk/docs/C278964.pdf

Sine W., David R., Mitsuhashi H.(2007). *From plan to Plant: Effects of Certification on Operational start up in the emergent Independent Power Sector*, Organisation Science 18(4): 578-594.

Sine W., Lee B (2009). *Tilting at windmills? The environmental movement and the* emergence of the U.S.A wind energy sector, Administrative Science Quarterly, 54: 123–155.

Smith A. (2004). *Alternative technology niches and sustainable development*, Innovation: management, policy & practice, 6: 220–235.

Smith A. (2007). *Emerging in between: The multi-level governance of renewable energy in the English regions*, Energy Policy 35: 6266–6280.

Smith A., Stirling A.(2006). *Inside or Out? Open or Closed? Positioning the Governance of Sustainable Technology*, SPRU Electronic Working Paper Series No. 148. Brighton, SPRU: 49p.

Smith G., Teasdale S. (2011). *Associative democracy and the social economy: exploring* the regulatory challenge, PSA.

SSE Power Distribution (2012). *Network capacity*, [online, last accessed 28/06/2012 at:] http://www.ssepd.co.uk/GenerationConnections/ConnectingGenerationToOurNetwork/

Steele F. (2005). *Event History Analysis - A National Centre for Research Methods Briefing Paper* , NCRM Methods Review Papers 004, [online, last accessed 05/11/2011:] http://eprints.ncrm.ac.uk/88/1/MethodsReviewPaperNCRM-004.pdf

Stevenson R., Richardson T. (2005). *Policy integration for sustainable development: exploring barriers to renewable energy development in post-devolution Wales*, Journal of Environmental Policy and Planning 5:95-118.

Strbac G., Jenkins N., Green T. (2006). *Future network technologies*, Report to DTI to support the Energy Review, April 2006.

Swider D. *et al* (2008). *Conditions and costs for renewables electricity grid connection: Examples in Europe*, Renewable Energy 33(8):1832-1842.

Szarka J. (2007). *Wind Power in Europe: Politics, Business and Society*, Palgrave Macmillan, Basingstoke.

Szarka J., Bluhdorn, I. (2006). *Wind Power in Britain and Germany: Explaining Contrasting Development Paths*, A report for DEFRA, London, UK.

Tarrow S., Meyer D.(1998). *The social movement society: contentious politics for a new century*, Rowman & Littlefield, pp.76–77.

The National Grid (2005). *System Overview: The GB Transmission System*, In: 2005 Seven Year Statement, [online last accessed 28/06/12 at:] http://www.nationalgrid.com/uk/library/documents/sys05/default.asp?action=mnch6_2.htm&Node=SYS&Snode=6_2&Exp=Y#The_Gb_Transmission_System

TLT Solicitors (2007). *Bankable Models which Enable Local Community Wind Farm Ownership: A report for the Renewables Advisory Board and DTI*, Department for Business Innovation and Skills, [online, last accessed 25-10-2011:] http://webarchive.nationalarchives.gov.uk/+/http://www.berr.gov.uk/energy/sources/renewables/policy/renewables-advisory-board/community-involvment-wind/page43643.html

Toke D. (2005). *Explaining wind power planning outcomes: Some findings from a study in England and Wales,* Energy Policy 33: 1527–1539.

Toke D. (2011). *Ecological modernisation, social movements and renewable energy*, Environmental Politics 20:(1)60–77.

Toke D., Breukers S., Wolsink M.(2008).*Wind power deployment outcomes: How can we account for the differences?,* Renewable and Sustainable Energy Reviews 12: 1129–1147.

Touraine A. (1985). *An Introduction to the Study of Social Movements*, Social Research, 52 (4):751-785.

University of Edinburgh (2006). *Matching renewable electricity generation with demand*, Commissioned by the Scottish Executive, [online, last accessed 03-06-2011:] http://www.viewsofscotland.org/library/docs/MREWD.pdf

Useem B. (1998). *Breakdown theories of collective action*, Annual Review of Sociology, 24:215-38.

van der Horst, Toke D (2010). *Exploring landscape of wind farm developments: local area characteristics and planning process outcomes in rural England*, Land Use Policy (27): 214-221.

van Poel I. (2000). *On the Role of Outsiders in Technical Developm*ent, Technology Analysis & Strategic Management, 12 (3): 383-397.

Walker A. *et al* (2010). *A guide for community groups on investing for community benefit*, The Pool in Scotland.

Walker G. (1997). *Renewable Energy in the UK: The Cinderella Sector Transformed?,* Geography 82 (1): 59–74.

Walker G. (2007). *Community Energy Initiatives: Embedding Sustainable Technology at a Local Level*, ESRC End of Award Report, RES-338-25-0010-A, Swindon: ESRC.

Walker G. (2008). *What are the barriers and incentives for community-owned means of energy production and use?,* Energy Policy 36: 4401–4405.

Walker G. *et al* (2007). *Harnessing Community Energies: Explaining and Evaluating Community-Based Localism in Renewable Energy Policy in the UK*, Global Environmental Politics 7(2):64-82.

Walker G., Devine-Wright P. (2008). *Community renewable energy: What should it mean?* , Energy Policy 36(2): 497-500.

Warren C., Birnie R. (2009). *Re-powering Scotland: Wind farms and the 'Energy or Environment' debate*, Scottish Geographical Journal 125(2): 97-126.

Warren C., McFayden M. (2010). *Does community ownership affect public attitudes to wind energy?,* A case study from south-west Scotland, Land Use Policy 27:204–213.

Warren C., McKee A. (2011). *The Scottish Revolution? Evaluating the Impacts of Post-Devolution Land reform*, Scottish Geographical Journal 127(1): 17-39.

Waterman H. (1981). *Reasons and reason: Collective political activity in comparative and historical perspective*, World Politics 32:554-589.

Wood Mackenzie (2009). *Scotland's Generation Advantage – A report to the Scottish Government* [online, last accessed 25/08/2011:]
http://www.scotland.gov.uk/Resource/Doc/295424/0091448.pdf

Appendices

I Indicators and data sources for variables

Variable (data type)	Indicator(s)	Source, Year
Capacity (continuous)	Installation size, kW	Survey, 2011/12
Collective agency	Years of active engagement in community oriented activities, years	Survey, 2011/12
Commercial developer support (ordinal)	Quality of commercial developer support, with categories; • Unsupportive and unknowledgeable • Supportive but unknowledgeable • Unsupportive but knowledgeable • Supportive and knowledgeable	Survey, 2011/12
Community representability (continuous)	– (Legal status of community body) – No. of members/ total number of people living in the community Where total number of people living in the community is defined as: $\frac{Number\ of\ members\ in\ the\ organization}{Total\ number\ of\ people\ living\ in\ the\ community}$	General Register Office, 2001
Cost of electrical infrastructure (continuous)	Cost of electrical infrastructure, £	Survey, 2011/12
Cost of feasibility study (continuous)	Cost of feasibility study, £	Survey, 2011/12
Cost of planning consent (continuous)	Cost of planning consent, £	Survey, 2011/12
Cost of pre-installation construction (transport, road access, foundation construction, site preparation, erection and commissioning) (continuous)	Cost of pre-installation construction, £	Survey, 2011/12
Cost of technology (continuous)	Cost of technology, £	Survey, 2011/12
Council and planning office renewables policy and support (continuous)	Number of approved renewable energy installations / Total number of planning requests for RE installations	Per council online planning registers
Degree of internal organisation (ordinal)	Ordinal rank for: i) system for community consultation ii) self- evaluation and iii) pro-active financial management/regular financial risk assessment, iv) adequate facilities to meet and carry out its activities	Survey, 2011/12
Dependence on external resources and expert advice (ordinal)	External acquisition of technical, legal, project management or financial management support with categories: • Technical support • Legal support • Financial support • Project management support • None of the above	Survey, 2011/12
Education levels of community (continuous)	Working age people with no qualifications	Scottish Neighbourhood Statistics (2009), Office for National Statistics
Environmental orientation of wider community / Level of	Degree of resistance from within the community, with categories: • There have been no objections (0)	Survey, 2011/12

consensus, buy-in (ordinal)	• 1 or 2 individuals have voiced concern (1) • 1 or 2 individuals strongly object (2) • Several people strongly object (3) • There is an organized campaign against the project (4)	
Existing assets owned by the community body	Value of existing assets, £	Survey, 2011/12
Experience in running trading, commercial or revenue-generating projects	Years since tradable legal entity established, years	Company Check
Funding source and amount	5 categories: - Self-funded - Grant - Bank/commercial loan - Public loan eg CARES loan - Equity partnership/joint venture	Survey, 2011/12
Grid access (continuous)	Distance to nearest connection point Thermal headroom at nearest connection point Grid connection cost, £	Scottish and Southern Energy/ Scottish Power, 2011-2012
Organisation motivation	7 categories distinguished: - To generate local income/strengthen the local economy - To increase community's self-sufficiency - To secure local control over aspects of an already planned commercial project eg partial ownership, siting, scale or orientation of wind turbines - To lower energy costs - To increase reliability of electricity supply - To decrease the community's carbon footprint and/or increase energy awareness - To strengthen the community's sense of togetherness - Other, namely:	Survey, 2011/12
In – house financial skills (ordinal)	Contribution of community member(s) with professional experience in accounting, financial planning, and/or managing cash-flows to this project, binary	Survey, 2011/12
In – house project management skills (ordinal)	Contribution of community member(s) with experience in running similar size projects to the project, binary	Survey, 2011/12
In – house technical expertise (ordinal)	Contribution of engineers, electricians or other technical experts from within the community in the project, binary	Survey, 2011/12
Income levels of community (continuous)	Weighted proportion of income and employment deprived individuals in the output or ward area	Scottish Neighbourhood Statistics, 2009
In-house legal expertise (ordinal)	Contribution of community member(s) with professional legal expertise contributing to the project, binary	Survey, 2011/12
Internal versus external orientation (ordinal)	Community inclination to seek support, with categories: • No, never (0) • Yes, occasionally (1) • Yes, frequently (2)	Survey, 2011/12
Land acquisition (ordinal)	- Cost of securing land (purchase, rent, year of purchase or rent), £ - Difficulty in negotiating lease (ordinal, rank)	Survey, 2011/12

	with categories: No difficulties, some difficulties, significant difficulties - Land site ownership (Categories: privately owned/local council/community council/ other community organisation/other public organisation eg. Forestry Commission/we don't know yet)	
Legal capacity to trade and handle assets	Legal status of community body; one of: • Club/ unincorporated Organisation • Charitable Incorporated organisation • Trust • Bona-fide co-operative • Community benefit society • Company limited by shares • Company limited by guarantee • Community interested company • Limited liability partnership	Survey, 2011/12, Company Check, various
Manpower (continuous)	- Total number of active volunteers ('those who regularly take part in group activities') plus paid (full time or part time) staff in the community organisation - Total number of volunteers and (full/part time) staff working on the RE project	Survey, 2011/12
National or local utility companies support (ordinal)	Quality of utility company support, with categories; • Unsupportive and unknowledgeable • Supportive but unknowledgeable • Unsupportive but knowledgeable • Supportive and knowledgeable	Survey, 2011/12
Peer-to-peer mentoring (ordinal)	Access to 1 or more people in other communities with previous experience in setting up similar projects, ordinal rank (1-4)	Survey, 2011/12
Price support (categorical)	Feed-In-Tariffs, Renewables Obligations, Renewable Heat Incentive, or none	Survey, 2011/12
Project Viability (continuous)	Net Present Value, £	Survey, 2011/12
Social cohesion (continuous)	2009-2010 Urban Rural Classification based on settlement size and drive times	Scottish Neighbourhood Statistics, 2009-2010
Technology (categorical)	Technology type; one or more of: • On-shore wind • Solar photovoltaic • Solar thermal • Anaerobic Digestion • Biomass- Woodfuel Heating System • Combined Heat and Power • Other, namely:	Survey, 2011/12
Network integration (ordinal)	Presence of external parties sitting in the management body, (0-5) with categories: • Community councillor • Local authority councillor • Local landowners • Other agencies, namely: • None of the above	Survey, 2011/12

II Content analysis

BARRIERS AND OPPORTUNITIES TO COMMUNITY RE DEVELOPMENT			
AUTHORS	**VARIABLE**	**QUOTE**	**PAGE**
Pepper and Caldwell (2010)	Availability of continuous, long term funding - internal : **awareness**	“What can we do when CCF runs out?”, “Most of the obvious funding sources are so short term and project specific.”	11
Hogget (2010)	Availability of continuous, long term funding - external : **credibility**	"By far the biggest issue identified was the lack of availability of this sort of money. This was linked to the funders themselves, which are perceived to be generally risk adverse and conservative in nature, as one person put it “getting finance is a challenge for new enterprises approaches [because] financers like established businesses and models” (P5:20)." "As one interviewee put it, in relation to banks: “at the point when they would make a decision, they might be concerned by [the] fact it’s a community approach, complicated non-profit, surplus distributing type thing – questioning people’s ability to oversee the management of [the project]. Raises concerns, rather than reduce it”. (P15:62)."	39
Hogget (2010)	Availability of continuous, long term funding -internal : **knowledge, skills and capacity**	"It was often mentioned that sources of at-risk finance were hard to find out about and that this would be a new requirement for many communities that are used to the process of applying for grants." "Most projects to date had been supported by public sector sources and it was commonly perceived that accessing this sort of money was likely to become harder, increasing the difficulty of securing finance" " “People really have no idea about what sources of capital are available to them and how to market themselves to those sources, not just within community renewables” (P7:44). It was felt there was a lack of understanding within three main areas, which would all have an impact on the ability of a community to raise money: · How risk is viewed – in terms of both the organisation delivering a project (with communities perceived as a risk) and the project itself; and how this impacts the type of finance that might be available and what this may mean in terms of giving up aspects of ownership or control. · The nature of commercial finance – the fact that there are lots of different sorts of finance available on both the debt and equity side, which have different needs and requirements; often within organisations that share very different values to those held by the community. · Issues for accessing it – that support would be needed to help communities understand what is available."	41
IPPR Report (2010)	Availability of start-up funding/ Availability of continuous, long term funding	[Given the high-risk costs of feasibility, planning consent and technologies] Private sector grants are, therefore, an ideal source of capital for community projects, yet there is little incentive for them to be provided and no formal mechanism for doing so.	38
Walker *et al* (2010)	Availability of start-up funding	“In most of the case studies examined the combination of an early stage package of support that enabled **the purchase of an important asset** was a crucial aspect of the organisation's development.“ “although grants or other subsides can be crucial at an early stage, in some cases they may hinder growth because the organisation spends too much time grant-chasing rather than investing.”	20

Walker (2007)	Community engagement and representation	Institutional aspects such as whether the project is led by an organisation representing the community or by certain individuals [are likely to be important for local acceptance]	7
Walker *et al* (2008)	Community engagement and representation	Community projects can also become controversial locally, particularly if the extent of real community involvement and benefit becomes an issue	4403
Walker *et al* (2010)	Community engagement and representation	"It is vital that structures are robust, transparent and invite wider engagement by the community and other partners. "	18
IPPR Report (2010)	Community engagement and representation	Some of the community groups appeared to have encountered resistance from local people to engage with their project because the legitimacy of the group in representing the community's interests was questioned.	36
Walker *et al* (2010)	Community experience in asset management	"[Relatively unestablished] community bodies may need to rely more on the support of intermediary agencies early on, especially regarding appropriate structures and ways to take the community with them. Such an approach may emphasise a portfolio of investments including mainstream financial instruments (such as bank deposits, unit trusts, bonds and so on) until such time as they feel at ease with more complex projects"	19, 20
Walker *et al* (2010)	Competing council RE projects	There are examples of local councils attempting to act as the conduit for income from wind farm sites in order to benefit the entire community in their areas as well as those in the immediate vicinity. This provides funds for wider benefit but may dilute the potential benefit to those who are most affected by the project's impact. Muaitheabhal wind farm project for example, based on the Eishken estate in the Lochs district of Lewis, will provide benefits to both. However, the bargaining power and other expertise provided by a council may well obtain greater local benefits than might otherwise have been the case, whilst also providing funds for wider benefit.	22
IPPR Report (2010)	Cost of feasibility assessment and planning permission	The costs for gaining planning permission can be problematic. Such costs may cover the completion of land surveys and technology feasibility studies, as well as submitting the application to the planning authority. They are borne at a high risk, as permission may not be granted. This put several of the community groups and participating community buildings off submitting planning applications. Ham and Petersham encountered such barriers when several schools were unwilling to pay £1,000 to submit their proposed solar PV projects for planning permission.	38
IPPR Report (2010)	Cost of technology	The capital costs of technologies are also a major barrier	38
Walker *et al* (2010)	Council community renewables policy and support	Local authorities may also play a role in supporting community organisations. This can be advantageous to communities in that it reduces the time and effort required to actively engage with a developer.	22
IPPR Report (2010)	Council community renewables policy and support	'[The planning officer] seems to have lots of misconceptions about the renewable technologies and energy saving measures on older buildings in particular […] Some of the council employees are so supportive and want to help you but couldn't. Then the other ones were like "It's not my job, I'm not employed to help with biomass boilers, it's nothing to do with me.". It's almost like it's not, "How can I help you?" It's more like, "How can I avoid having anything to do with you?"'	37

Barnes (2011)	Degree of internal organization	In SSE's experience [..] it was difficult to engage with communities. The communities may have organised into a Development Trust but were not organised into a tradable legal entity and the large number of members meant contradicting views and opinions. [..] SSE have yet to be approached by an organised community that has put together a comprehensive and considered proposal for community involvement in a wind farm (SSE, 2011c).	44
Barnes (2011)	Environmental orientation of local council	SSE (2011a) claim the lack of consistency between LPAs is vast. Once a proposal is submitted it is assessed by the planning office before approval is gained from the local council. Some councils refuse applications that their own planning office has approved, whilst others approve those recommended for refusal. CES (2011) agree that a lot of room exists within the approval process for councils to delay projects if they are opposed to onshore wind in general.	56
Hogget (2010)	Environmental orientation of local planning authority	This local process [of planning consent] can [..] be highly political. [This] creates inconsistencies for gaining consent, reflecting both the local planning authority's attitude to different technologies and whether they take account of the wider benefits such schemes could in meeting national targets for energy and climate change (Woodman 2008; Roberts 2009a).	
IPPR Report (2010)	Environmental orientation of local planning authority	The lack of consistency [in granting planning permission] across locations creates great uncertainty for community groups and developers but, as we can see, it does fall both ways – both expediting and blocking renewables deployment. The attitudes of the planning authorities towards renewables were described as very different. Some community leaders believed the planning authority in their area was inherently supportive of renewables; in others, it was the opposite. Several of the community leaders and project managers suggested a lack of awareness or understanding about renewable technology by planning officers and councillors was a strong inhibiting factor. 'On the planning committee itself there are people who have conservation interests and there was no way of getting around that. There was one councillor who was from a strong conservation background and that did make it difficult for us to count on them as objective judges.'	39
Pepper and Caldwell (2010)	Environmental orientation of wider community	"We have bumped into barriers to our progress with land owners who don't want to co-operate and anti-carbon reduction views within our community.	9
Walker (2007)	Environmental orientation of wider community	This diversity [amongst projects in local acceptance] indicates that 'place' matters in understanding pscyhological aspects of environmental beliefs	8
IPPR Report (2010)	Environmental orientation of wider community	Barriers to two of the community scale installations came from other people within their community. One objection related to an installation of a solar array on a church; the other, a proposal for a wind turbine on Eilean Eisdeal, resulted in a highly charged standoff.	42
Barnes (2011)	Environmental orientation statutary consultees	Integration and commitment of statutory consultees is also an issue. Udny (2011) was almost delayed when they were unable to access the Civil Aviation Authority for their response. It was only through having a contact on the council that they became aware that their application had been recommended for refusal and were able to convince the Civil Aviation Authority to retract their refusal before the council Meeting.	56
Barnes (2011)	Existing community-owned assets	Without a tangible asset, such as a consented site, lending institutions will not provide debt to community organisations because there is no guarantee of cash flow can be generated (Triodos, 2011).	55

Walker *et al* (2010)	Existing community-owned assets	"Community ownership of assets can contribute to a wide range of innovative, bottom-up solutions developed to address local needs and: Generate long term sustainable revenue streams for community organisations making them more sustainable; instill a heightened sense of civic pride and responsibility; provide local people with a meaningful stake in the future development of the place in which they live and/or work; contribute to more effective and more intensive use of local resources; be used as leverage to draw in new finance and expand the level of community activity; improve the quality of the relationship between the citizen, the community and the local state; provide new opportunities for local learning and community capacity building. "	
Wood Mackenzie (2009)	Grid access/ connection costs	Community projects are subjected to costs disproportionate to their size and costs quickly escalate with distance	56
Barnes (2011)	Grid access/ connection costs	In general renewable energy projects in rural areas are poorly supported by the current grid network. The network was designed for supply from fossil fuels near cities and, *"is the exact inverse of what it should be today"* (SSE, 2011a). Rural regions are serviced by low capacity cables and are further from the central grid which makes connection more expensive, furthermore, the smaller the project the shorter the distance from the grid before it becomes uneconomical (SSE, 2011a). Horshader (2009) project costs were increased by 30% due to the need to install equipment to link the local grid with the national grid whilst Udny (2011) were charged £54,000 for their deposit alone.	57
Hogget (2010)	Grid access/ connection costs	In relation to grid connections, issues include the cost and technical detail needed before requesting a connection and in some areas, including much of Scotland, there are also grid capacity issues meaning it can take a long time to get connected	
Walker *et al* (2010)	Group objective	"Successful community organisations are usually those that identify a clear mission at a very early stage and avoid the temptation to become distracted from the key social aims that originally informed them. Successful organisations need also to be flexible and dynamic, but a recurring theme is the creation of systems and structures to ensure the core aims remain at the centre and that the growing scale and nature of new projects do not become the end, rather than the means."	
Walker *et al* (2010)	History of collective agency/ solidarity	Communities benefiting, or hoping to benefit from significant renewable energy-based income streams may face more unusual transition issues such as the need to establish themselves and act quickly rather than grow incrementally. In some cases this may exacerbate the tension between early-stage individual flair and the need to engage with and involve the community at large. As a result, such community bodies may need to rely more on the support of intermediary agencies early on, especially regarding appropriate structures and ways to take the community with them. Such an approach may emphasise a portfolio of investments including mainstream financial instruments (such as bank deposits, unit trusts, bonds and so on) until such time as they feel at ease with more complex projects.	
Barnes (2011)	In- house technical expertise	Udny (2011) who claim that their project was only successful as they could call on a retired BT project manager, a rural economist, an architect, a geo-chemist and a semi-retired oilman from within their community. "In fact, we're lucky because every time we get a task we seem to have someone that enjoys doing that task so it's much easier to do a good job." (Udny, 2011). [..] this rich background of applicable skills has not necessarily existed in other communities	44

Walker *et al* (2010)	In- house financial expertise	It is important for an organisation to have access to the skills that can enable it to select and assess proposed investments and investment objectives (types of project to invest in, return sought, time period of investment, form of investment vehicle, use of investment returns etc.) [and] to manage and monitor the investments.	19
Martiskainen and Watson (2009)	In-house leadership and communication skills	This requirement for a range of skills and capacity can act as a barrier to development of these projects, often requiring key individuals or entrepreneurs, and trusted local champions.	
IPPR Report (2010)	In-house leadership and communication skills	The capacity to lead emerged as key. Some individuals displayed confidence and entrepreneurial skills, proactively building relationships across their community, engaging different stakeholders and inspiring people to take part in their projects. Diplomatic skills were also reported as important. The following description was given of one community leader by a colleague: '[Our community leader] has got an incredible amount of drive, energy and passion and he takes people with him, and you do need that in anything to make it successful.'	35
Evans (2006)	In-house leadership and communication skills	When there is no single or ambitious steering group in place, projects are more likely to fail	
Pepper and Caldwell (2010)	In-house leadership and communication skills	[Good leaders] have the confidence and skills to set direction, inspire, take risks, engage others, listen, adapt, and drive change. They also understand the context within which they work, and how to relate to those who exercise power and influence.	17
Walker *et al* (2008)	In-house leadership and communication skills	Experience has shown that key committed individuals or entrepreneurs can be essential to success	4403
Walker *et al* (2010)	In-house leadership and communication skills	"In common with most organisations, community bodies are often founded by a key entrepreneur or enterprising groups of individuals. Strong leadership with imagination, adaptability and entrepreneurial flair are key ingredients of early success." "Successful community organisations often instinctively understand appropriate ways to engage with their community. This is not just a question of having marketing and communication skills, it usually also involves an element of genuine empathy and a recognition that 'community' means different things to different people."	18,20
Walker *et al* (2010)	In- house legal expertise	"From the outset board members need to grasp the implications of the differences between personal/collective action and operating from within a legal entity, usually with limited liability. This legal protection that enables individuals to separate their personal finances from their business interests comes with conditions. Guidance should be sought as to the various forms available and the different responsibilities and opportunities they provide."	18
Barnes (2011)	In- house legal expertise	If [communities favour] joint-ownership, CES needs to provide an advisory service on setting up legal structures for communities, a service it does not currently provide.	46
Pepper and Caldwell (2010)	In-house facilities	There is a need to mobilise the existing infrastructure for supporting communities, encouraging relevant organisations to use their good offices, not only to support new groups but to encourage the thousands of existing community groups, [...]to consider	15
Pepper and Caldwell	In-house project management skills	"We took a long time figuring out how to go about organising a project."	9

(2010)			
Walker (2007)	In-house project management skills	Some communities can largely 'do it for themselves', with local people taking the initiative, organising and managing projects, and drawing on skills and collective enthusiasm. Such cases are not typical though and most need more assistance, hand-holding and guidance. This is particularly true where projects are more complex, larger scale or risky and where local skills and experience are limited.	6
Pepper and Caldwell (2010)	In-house technical expertise	"We have found it really difficult to access sound technical advice on reducing carbon emissions and developing project ideas."	9
Barnes (2011)	Income levels of community	"The introduction of the FIT and a loan scheme for pre-development costs has benefited more privileged communities where the additional revenue is needed least." "Well organised, relatively privileged generally rural communities will continue to receive disproportionate benefits from renewables." (CLEAR, 2011).	2
IPPR Report (2010)	Income levels of community	Recent research suggests that skills and resources [..] are unevenly distributed across communities (Coote 2010, IPPR and PWC 2010). While communities at all socioeconomic levels will struggle to mobilise these resources, in general, the barriers for more disadvantaged communities are greater. That being said, some economically deprived neighbourhoods do have active and vibrant voluntary organisations, and strong and successful community leaders, with The Meadow and MOZES being an excellent example of this.	36
Barnes (2011)	Income levels of community / Existing community-owned assets	The charitable bodies are in agreement that less organised or wealthy communities might not be able to access the loan because the government requires at least 10% be invested by the community to demonstrate commitment.	55
Pepper and Caldwell (2010)	Integration into the wider energy network	"We are too small to have any clout." "We feel disconnected from the big strategy." "We are doing our bit, but local business, agencies and others don't seem to be doing theirs. Aren't we all in this together?" "It took us ages to work out what we could e	13
Pepper and Caldwell (2010)	Knowledge exchange with existing community projects/ 'peer-to-peer mentoring'	"Getting help from partners is time consuming and frustrating." "Contact with other groups is both therapeutic and stimulating". "We needed help navigating issues which we later found others had explored before."	13
Walker *et al* (2008)	Knowledge exchange with existing community projects/ 'peer-to-peer mentoring'	It is essential to have expert advice and support and to learn from previous experience	4402
Barnes (2011)	Knowledge exchange with existing community projects/ 'peer-to-peer	Communities agree that a bottom up approach of communities educating communities would be beneficial but that successful communities **do** not necessarily have the time or money to properly engage in the role. Funding and support is needed to facilitate people with experience to promote ownership to others	40

	mentoring'		
Walker *et al* (2010)	Knowledge exchange with existing community projects/ 'peer-to-peer mentoring'	"There is now a substantial history of successful community-based organisations and networking with and seeking out best practice from these movements is likely to pay long-term dividends."	
Letcher *et al* (2007)	Knowledge exchange with existing community projects/ 'peer-to-peer mentoring'	"Access to trusted and expert support is needed to help co-ordinate and direct a project"	
IPPR Report (2010)	Knowledge exchange with existing community projects/ 'peer-to-peer mentoring'	There are great opportunities to be found in peer-to-peer learning between communities. Many of the community group leaders wished they had received a greater opportunity to share experiences with each other and also with other groups beyond Green Streets. 'The most useful thing we could have had was a storyboard or something that says "these are the things that are going to happen" so actually learning from someone else's experiences.'	
Barnes (2011)	Land ownership	"Developers suggest that communities who approach them do not have access to land and can run into difficulties when attempting to lease land." "Interviews with communities supported the idea that they lack available land. Helensburgh Community Trust had their project delayed by 19 months whilst they negotiated with the landowner who owns over 40 000 acres of the surrounding land." "SEAS (2011) claim that their project is unlikely to progress because landowners want to secure the benefits for themselves. Interviews with charities, however, contradict this and claim land leasing for onshore wind is a common occurrence (CES, 2011)." "onsented land with a grid connection has considerable tangible value that allows communities to access debt finance to solve this problem."	44
Mackie (2011)	Land ownership	Mackie (2011) claims that landowners, farmers and land managers have the upper hand as generating revenue from the land is their vista.	
Walker *et al* (2010)	Legal capacity to trade and handle assets	"There are a number of options and new community organisations need to adopt the appropriate legal and business model and evolve a structure and systems that are fit for purpose and which enable them to engage in the required activity to implement their strategy, or respond to any opportunities that arise."	18
IPPR Report (2010)	Legal capacity to trade and handle assets	The constitutional status of the community groups was also a barrier to managing finances. While some of the community groups had set up as a legal structure capable of managing long-term income streams from FIT payments, others had been dissuaded by the challenges they saw in doing so.	
Walker (2007)	Level of consensus/community buy-in	[..] the previous history of social relations in the locality [are likely to be important for local acceptance]	9
Walker *et al* (2010)	Level of internal organization	"Managing the transition from an early phase, which often involves bold, decisive action into a more mature state of affairs involving group consensus, clear procedures and policies etc. is also crucial."	18

IPPR Report (*2010)*	Level of internal organization	It was often stated, across the interviews, that large committee structures were ineffective for making decisions. Governance arrangements with clear lines of responsibility were perceived to work better. Clear guidelines on effective models of governance would have been a useful resource for many of the groups.	36
Walker *et al* (2010)	Level of network integration - dependence on external resources and expert advice	"The numerous small communities already benefiting, or about to benefit from windfalls from onshore wind farms may well need to seek advice from organisations qualified to assist them, [such as the Scottish Community Foundation, Community Development Finance Institutions, public social enterprise programmes]" For larger or better resourced community organisations, councils may be one of several potential funding and advisory partners. Their input and guidance is likely to be a crucial factor in any plans brought forward, for both renewable schemes and later investments they fund."	23
Walker *et al* (2010)	Level of network integration – to win power and influence	"For smaller communities, local authorities may be very valuable partners in negotiating benefits from renewable projects.	
IPPR Report (2010)	Level of network integration - dependence on external resources and expert advice	"All of the community groups required information and advice on their projects, in particular on technical aspects, which for the most part was provided by British Gas. For example, the original technology solutions proposed by some of the community groups were altered following the identification of a more cost and/or energy efficient option in the energy assessments and feasibility studies". t.	37, 41
IPPR Report (2010)	Level of network integration – degree of internal versus external orientation of the community body	"The communities that had the most successful relationships with their planning authorities believed it important to generate and maintain an excellent relationship with them from the outset of an energy project"	
IPPR Report (2010)	Level of network integration- institutionally embedded communication associated with procedural or legislatory requirements	Informational requirements and the quality of communication also varied between locations, and is one area in which greater consistency should be achievable.	
IPPR Report (2010)	Level of network integration – wielding power and influence	In several instances, influential individuals, in particular local councillors, were reported as having affected the outcome of planning decisions." 'What I think happened is that behind the scenes our local councillor got involved and I think that was probably more influential than anything that our architect did. She went above the planner who was dealing with our application's head.' Anonymous	

IPPR Report (2010)	Manpower	"Those few community groups that included paid employees or people who were able to work full-time on their project unpaid were at a considerable advantage. Wide pools of volunteers supported the delivery of many of the projects. For example, Beccles Lido community leaders claimed that in summer 2010 they had several hundred people helping in one month, contributing an estimated 2,500 volunteer hours." "People are absolutely at their limit if not beyond of what they can do ... It's absolutely not sustainable at this level of input.'"	35
Walker *et al* (2010)	Organizational incentive structures	"At a later stage in a commercial organisation's growth the drive for shareholder value often keeps things moving. In a community enterprise this may be lacking. Boards and stakeholders should therefore be on the lookout for evidence of complacency or stagnation"	18
Barnes (2011)	Period of existence of the community body / History of collective agency/solidarity	Communities in the North have more of a history of community developments and the necessary skills (CES, 2011).	44
IPPR Report (2010)	Period of existence of the community body / History of collective agency/solidarity	The length of time the groups had been established was partly a factor here, with community leaders of groups who had been established for longer periods believing they had developed high levels of trust, which worked to their advantage.	36
Barnes (2011)	Price support	Both the RO and the FIT are acceptable for lending institutions but the FIT allows for communities to leverage considerably more debt because it provides a higher cash flow (Triodos, 2011).	61
Barnes (2011)	Social cohesion	Communities that are more easily defined, such as island communities or crofting communities in the North, are more likely to be organised and in a position to lease land. They are also more likely to have local land owners with a vested interest in the community.	49
Pepper and Caldwell (2010)	Degree of internal organization	"Carbon metrics are a nightmare. Everyone gives different advice, and we can't compare with other groups who are using different metrics".	16
Walker *et al* (2010)	Degree of internal organization	"As the organisation grows, an effective system of appraisal of local need and some means of reviewing and measuring impact is likely to be a key aspect of a truly successful community anchor. There are a variety of methods used to describe and measure these social impacts such as referring to the 'triple-bottom line', social auditing etc. "	18

III-a Descriptive statistics for time-to-event data

```
      150  obs. remaining, representing 150  subjects
       65  failures in single failure-per-subject data
     5151  total analysis time at risk, at risk from t =         0
                                 earliest observed entry t =         0
                                      last observed exit t =       142
```

Category	total	mean	min	median	max
		per subject			
no. of subjects	150				
no. of records	150	1	1	1	1
(first) entry time		0	0	0	0
(final) exit time		34.34	1	26	142
subjects with gap	0				
time on gap if gap	0	.	.	.	.
time at risk	5151	34.34	1	26	142
failures	65	.4333333	0	0	1

III-b Nelson Aalen estimator of cumulative hazard for project completion

Time	Beg. Total	Fail	Net Lost	Nelson-Aalen Cum. Haz.	Std. Error	[95% Conf.	Int.]
1	237	1	1	0.0042	0.0042	0.0006	0.0300
2	235	0	3	0.0042	0.0042	0.0006	0.0300
3	232	0	2	0.0042	0.0042	0.0006	0.0300
4	230	0	3	0.0042	0.0042	0.0006	0.0300
5	227	0	5	0.0042	0.0042	0.0006	0.0300
6	222	0	4	0.0042	0.0042	0.0006	0.0300
7	218	1	12	0.0088	0.0062	0.0022	0.0353
8	205	0	3	0.0088	0.0062	0.0022	0.0353
9	202	0	5	0.0088	0.0062	0.0022	0.0353
10	197	0	3	0.0088	0.0062	0.0022	0.0353
11	194	2	7	0.0191	0.0096	0.0072	0.0511
12	185	5	5	0.0461	0.0154	0.0240	0.0889
13	175	3	1	0.0633	0.0183	0.0359	0.1117
14	171	1	3	0.0691	0.0192	0.0401	0.1193
15	167	3	8	0.0871	0.0219	0.0533	0.1424
16	156	1	8	0.0935	0.0228	0.0580	0.1507
17	147	2	0	0.1071	0.0247	0.0681	0.1684
18	145	1	2	0.1140	0.0257	0.0733	0.1773
19	142	0	7	0.1140	0.0257	0.0733	0.1773
20	135	0	6	0.1140	0.0257	0.0733	0.1773
21	129	1	1	0.1218	0.0268	0.0791	0.1875
23	127	0	3	0.1218	0.0268	0.0791	0.1875
24	124	2	6	0.1379	0.0291	0.0911	0.2087
25	116	0	5	0.1379	0.0291	0.0911	0.2087
26	111	2	4	0.1559	0.0318	0.1045	0.2325
27	105	1	3	0.1654	0.0332	0.1116	0.2452
28	101	0	6	0.1654	0.0332	0.1116	0.2452
29	95	1	1	0.1760	0.0348	0.1194	0.2594
30	93	0	3	0.1760	0.0348	0.1194	0.2594
31	90	0	4	0.1760	0.0348	0.1194	0.2594
32	86	0	4	0.1760	0.0348	0.1194	0.2594
33	82	2	4	0.2003	0.0389	0.1370	0.2930
34	76	0	1	0.2003	0.0389	0.1370	0.2930
35	75	0	2	0.2003	0.0389	0.1370	0.2930
36	73	2	0	0.2277	0.0434	0.1567	0.3309
37	71	2	0	0.2559	0.0478	0.1775	0.3690
38	69	0	2	0.2559	0.0478	0.1775	0.3690
40	67	1	1	0.2708	0.0501	0.1885	0.3891
42	65	1	0	0.2862	0.0524	0.2000	0.4097
43	64	0	4	0.2862	0.0524	0.2000	0.4097
44	60	1	0	0.3029	0.0550	0.2123	0.4322
45	59	2	0	0.3368	0.0600	0.2376	0.4774
46	57	1	2	0.3543	0.0625	0.2508	0.5006
47	54	0	1	0.3543	0.0625	0.2508	0.5006
48	53	2	2	0.3921	0.0679	0.2792	0.5506
49	49	0	1	0.3921	0.0679	0.2792	0.5506
50	48	1	1	0.4129	0.0710	0.2947	0.5785
52	46	1	0	0.4346	0.0743	0.3109	0.6076
54	45	1	0	0.4569	0.0776	0.3276	0.6372
55	44	1	4	0.4796	0.0808	0.3447	0.6673
56	39	2	0	0.5309	0.0886	0.3828	0.7362
57	37	0	1	0.5309	0.0886	0.3828	0.7362
59	36	0	3	0.5309	0.0886	0.3828	0.7362
60	33	0	1	0.5309	0.0886	0.3828	0.7362
67	32	0	2	0.5309	0.0886	0.3828	0.7362
69	30	2	0	0.5975	0.1003	0.4300	0.8304
70	28	1	0	0.6333	0.1065	0.4554	0.8805
71	27	2	0	0.7073	0.1187	0.5091	0.9828
72	25	0	1	0.7073	0.1187	0.5091	0.9828
74	24	0	3	0.7073	0.1187	0.5091	0.9828
75	21	0	1	0.7073	0.1187	0.5091	0.9828
78	20	0	1	0.7073	0.1187	0.5091	0.9828
79	19	0	2	0.7073	0.1187	0.5091	0.9828
80	17	0	1	0.7073	0.1187	0.5091	0.9828
84	16	0	1	0.7073	0.1187	0.5091	0.9828
90	15	1	0	0.7740	0.1361	0.5483	1.0926
91	14	0	3	0.7740	0.1361	0.5483	1.0926
93	11	1	1	0.8649	0.1637	0.5969	1.2533
97	9	1	0	0.9760	0.1978	0.6560	1.4521
101	8	0	2	0.9760	0.1978	0.6560	1.4521
103	6	0	1	0.9760	0.1978	0.6560	1.4521
106	5	0	1	0.9760	0.1978	0.6560	1.4521
108	4	0	1	0.9760	0.1978	0.6560	1.4521
115	3	0	1	0.9760	0.1978	0.6560	1.4521
127	2	0	1	0.9760	0.1978	0.6560	1.4521
142	1	0	1	0.9760	0.1978	0.6560	1.4521

III-c Nelson Aalen estimator of cumulative hazard for project failure

Time	Beg. Total	Fail	Net Lost	Nelson-Aalen Cum. Haz.	Std. Error	[95% Conf.	Int.]
1	237	0	2	0.0000	0.0000	.	.
2	235	1	2	0.0043	0.0043	0.0006	0.0302
3	232	1	1	0.0086	0.0061	0.0021	0.0343
4	230	0	3	0.0086	0.0061	0.0021	0.0343
5	227	1	4	0.0130	0.0075	0.0042	0.0402
6	222	0	4	0.0130	0.0075	0.0042	0.0402
7	218	0	13	0.0130	0.0075	0.0042	0.0402
8	205	1	2	0.0178	0.0089	0.0067	0.0476
9	202	0	5	0.0178	0.0089	0.0067	0.0476
10	197	1	2	0.0229	0.0103	0.0095	0.0552
11	194	1	8	0.0281	0.0115	0.0126	0.0627
12	185	2	8	0.0389	0.0138	0.0194	0.0780
13	175	1	3	0.0446	0.0149	0.0231	0.0860
14	171	0	4	0.0446	0.0149	0.0231	0.0860
15	167	0	11	0.0446	0.0149	0.0231	0.0860
16	156	2	7	0.0574	0.0175	0.0316	0.1043
17	147	0	2	0.0574	0.0175	0.0316	0.1043
18	145	0	3	0.0574	0.0175	0.0316	0.1043
19	142	2	5	0.0715	0.0201	0.0412	0.1241
20	135	1	5	0.0789	0.0214	0.0463	0.1344
21	129	0	2	0.0789	0.0214	0.0463	0.1344
23	127	0	3	0.0789	0.0214	0.0463	0.1344
24	124	1	7	0.0870	0.0229	0.0519	0.1457
25	116	1	4	0.0956	0.0245	0.0579	0.1579
26	111	0	6	0.0956	0.0245	0.0579	0.1579
27	105	1	3	0.1051	0.0263	0.0644	0.1715
28	101	0	6	0.1051	0.0263	0.0644	0.1715
29	95	0	2	0.1051	0.0263	0.0644	0.1715
30	93	1	2	0.1159	0.0284	0.0717	0.1873
31	90	0	4	0.1159	0.0284	0.0717	0.1873
32	86	1	3	0.1275	0.0307	0.0796	0.2043
33	82	0	6	0.1275	0.0307	0.0796	0.2043
34	76	0	1	0.1275	0.0307	0.0796	0.2043
35	75	0	2	0.1275	0.0307	0.0796	0.2043
							…
40	67	0	2	0.1275	0.0307	0.0796	0.2043
42	65	0	1	0.1275	0.0307	0.0796	0.2043
43	64	0	4	0.1275	0.0307	0.0796	0.2043
44	60	0	1	0.1275	0.0307	0.0796	0.2043
45	59	0	2	0.1275	0.0307	0.0796	0.2043
46	57	0	3	0.1275	0.0307	0.0796	0.2043
47	54	0	1	0.1275	0.0307	0.0796	0.2043
48	53	0	4	0.1275	0.0307	0.0796	0.2043
49	49	0	1	0.1275	0.0307	0.0796	0.2043
50	48	0	2	0.1275	0.0307	0.0796	0.2043
52	46	0	1	0.1275	0.0307	0.0796	0.2043
54	45	0	1	0.1275	0.0307	0.0796	0.2043
55	44	0	5	0.1275	0.0307	0.0796	0.2043
56	39	0	2	0.1275	0.0307	0.0796	0.2043
57	37	0	1	0.1275	0.0307	0.0796	0.2043
59	36	0	3	0.1275	0.0307	0.0796	0.2043
60	33	0	1	0.1275	0.0307	0.0796	0.2043
67	32	0	2	0.1275	0.0307	0.0796	0.2043
69	30	0	2	0.1275	0.0307	0.0796	0.2043
70	28	0	1	0.1275	0.0307	0.0796	0.2043
71	27	0	2	0.1275	0.0307	0.0796	0.2043
72	25	0	1	0.1275	0.0307	0.0796	0.2043
74	24	1	2	0.1692	0.0517	0.0929	0.3081
75	21	0	1	0.1692	0.0517	0.0929	0.3081
78	20	0	1	0.1692	0.0517	0.0929	0.3081
79	19	0	2	0.1692	0.0517	0.0929	0.3081
80	17	0	1	0.1692	0.0517	0.0929	0.3081
84	16	0	1	0.1692	0.0517	0.0929	0.3081
90	15	0	1	0.1692	0.0517	0.0929	0.3081
91	14	0	3	0.1692	0.0517	0.0929	0.3081
93	11	0	2	0.1692	0.0517	0.0929	0.3081
97	9	0	1	0.1692	0.0517	0.0929	0.3081
101	8	0	2	0.1692	0.0517	0.0929	0.3081
103	6	0	1	0.1692	0.0517	0.0929	0.3081
106	5	0	1	0.1692	0.0517	0.0929	0.3081
108	4	0	1	0.1692	0.0517	0.0929	0.3081
115	3	0	1	0.1692	0.0517	0.0929	0.3081
127	2	0	1	0.1692	0.0517	0.0929	0.3081
142	1	0	1	0.1692	0.0517	0.0929	0.3081

IV-a Univariate test for in-house expertise

```
Log-rank test for equality of survivor functions
             |   Events         Events
X_IH_exper~r |  observed       expected
-------------+-------------------------
0            |         1           0.92
1            |         4           4.74
2            |        15           7.54
3            |         4          12.78
4            |         5           3.02
-------------+-------------------------
Total        |        29          29.00
                   chi2(4) =      15.34
                   Pr>chi2 =     0.0041
```

IV-b Univariate Cox and power tests for distance to connection points

```
Cox regression -- Efron method for ties
No. of subjects =          178                     Number of obs   =       178
No. of failures =           41
Time at risk    =         5563
                                                  LR chi2(2)      =     33.50
Log likelihood  =   -148.37519                     Prob > chi2     =    0.0000
------------------------------------------------------------------------------
          _t |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
x_DistanceCon|   .0022247    .001228     1.81   0.070    -.0001821    .0046315
    postplan |   2.626952   .7277728     3.61   0.000     1.200543     4.05336
------------------------------------------------------------------------------

One-sided power test (Wald test) for Cox PH regression with n(178)
Ho: [b1, b2, ..., bp] = [0, b2, ..., bp]
Input parameters:
         alpha =    0.0500  (one sided)
            b1 =    0.0022
            sd =    0.5000
             N =       178
Estimated number of events and power:
             E =       178
         power =    0.0515
```

IV-c Univariate Cox and power tests for history of collective agency

```
Cox regression -- Efron method for ties
No. of subjects =           83                     Number of obs   =        83
No. of failures =           43
Time at risk    =         3226
                                                   LR chi2(1)      =      4.79
Log likelihood  =   -150.07197                     Prob > chi2     =    0.0286
------------------------------------------------------------------------------
          _t |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
NET_years_~t |   .0259477   .0108258     2.40   0.017     .0047295     .047166
------------------------------------------------------------------------------

One-sided power test (Wald test) for Cox PH regression with n(83)
Estimated power for Cox PH regression
Wald test, log-hazard metric
Ho: [b1, b2, ..., bp] = [0, b2, ..., bp]
Input parameters:
         alpha =    0.0500  (one sided)
            b1 =    0.0259
            sd =    0.5000
             N =       83
Estimated number of events and power:
             E =        83
         power =    0.0634
```

V-a Failure rates of different technologies compared

Estimated rates and lower/upper bounds of 95% confidence intervals
(208 records included in the analysis)

Tech	D	Y	Rate	Lower	Upper
1	5	3.6e+03	0.0013702	0.0005703	0.0032920
2	5	1.3e+03	0.0037879	0.0015766	0.0091005
3	1	336.0000	0.0029762	0.0004192	0.0211282
4	1	158.0000	0.0063291	0.0008915	0.0449308
5	2	756.0000	0.0026455	0.0006616	0.0105779
6	1	93.0000	0.0107527	0.0015147	0.0763341
7	0	19.0000	0.0e+00	.	.
8	2	94.0000	0.0212766	0.0053212	0.0850732
9	1	74.0000	0.0135135	0.0019036	0.0959334
10	0	87.0000	0.0e+00	.	.

V-b Success rates of different technologies compared

Estimated rates and lower/upper bounds of 95% confidence intervals
(208 records included in the analysis)

Tech	D	Y	Rate	Lower	Upper
1	21	3.6e+03	0.0057550	0.0037523	0.0088266
2	4	1.3e+03	0.0030303	0.0011373	0.0080740
3	7	336.0000	0.0208333	0.0099320	0.0437001
4	7	158.0000	0.0443038	0.0211211	0.0929319
5	6	756.0000	0.0079365	0.0035656	0.0176657
6	0	93.0000	0.0e+00	.	.
7	1	19.0000	0.0526316	0.0074139	0.3736353
8	0	94.0000	0.0e+00	.	.
9	0	74.0000	0.0e+00	.	.
10	2	87.0000	0.0229885	0.0057494	0.0919181

V-c Success rates used in competing risk analysis

0= Other technology
1= Wind
Estimated rates and lower/upper bounds of 95% confidence intervals
(237 records included in the analysis)

x_Tech~y	D	Y	Rate	Lower	Upper
0	32	3.5e+03	0.0092272	0.0065253	0.0130480
1	23	4.1e+03	0.0056084	0.0037269	0.0084397

6. Survey (Anonymous version)

Q1.1 *This survey will ask you about details of your community renewable energy installations. The survey is part of a project called SCENE Connect, supported by the Edinburgh Centre for Carbon Innovation and Wageningen University. If you have any questions about this survey or the knowledge exchange platform contact jelteh@scenetwork.co.uk or telephone: 075 81015628. You are not obliged to respond to any of the questions, but we guarantee that your response will be kept confidential, meaning that no one beyond our team will be able to connect your responses with your name or organization.*

ID no:______________________________Date taken:_________________________________

Your name (or name of your project manager) (1)______________________________________

Name of your organization (2)____

Postcode of your organization (3)____

Your/ your organization email address (4)____________________________________

Website (5)____

Telephone (6)____

Q2.2 Please tell us which renewable energy technologies your organization is developing by marking the appropriate boxes. Please exclude renewable energy schemes for single domestic residences and include any discontinued projects. If you are developing the same technology at two different sites, please describe the second site location under the second column.

	Yes, we	First installation	Second installation
	have/ are developing this technology! (1)	Installation 1 is sited at: (1)	Installation 2 is sited at: (1)
Wind installation(s) (1)	❑		
Solar photovoltaic scheme(s) - (solar electricity) (2)	❑		
Solar thermal scheme(s) - (solar heating) (3)	❑		
Hydro-electric scheme(s) (4)	❑		
Anaerobic Digestion scheme(s) (5)	❑		
Woodfuel Biomass (Heat) (6)	❑		
Combined Heat and Power (Biomass) (9)	❑		
Energy Efficiency measures and/or advice (10)	❑		
Other, namely: (8)	❑		

Q3.1 When did your organization first engage in community oriented activities? (Please type the year e.g., 2009)

Q3.2 How many volunteers, staff and members does your community organisation currently have? (Please write number in the appropriate box below)

	No. of individuals
Active volunteers (those who regularly take part in group activities) (1)	____________
Permanent paid staff (full time and part time) (2)	____________
Members (3)	_____________
I don’t know! Ask. Eg. Judith.hall@btconnet.org	____________

Q3.3 The following lists a number of motivations for community groups to get involved in renewable energy projects. Which of the following motivations is the MOST relevant to your organization? Please mark your most important motivation by ticking the box

- ❍ To generate local income/strengthen the local economy (1)
- ❍ To secure local control over aspects of an already planned commercial project eg. partial ownership, siting, scale or orientation of wind turbines (2)
- ❍ To lower energy costs (3)
- ❍ To increase availability or reliability of electricity supply (4)
- ❍ To decrease the community’s carbon footprint and/or increase energy awareness (5)
- ❍ To increase the community's self-sufficiency (6)
- ❍ To strengthen the community’s sense of togetherness (7)
- ❍ Other, namely: (8) ____________________

Q3.4 Does your organization have one or more members, volunteers or staff with the following expertise working on/contributing to your renewable energy projects? (Please mark yes or no as appropriate)

	YES (1)	NO (2)
Engineers, electricians or other technical experts (1)	❍	❍
Individuals with experience in running a project of similar size (2)	❍	❍
Individuals with professional experience in accounting, financial planning, and/or managing cash-flows (3)	❍	❍
Individuals with professional legal expertise (4)	❍	❍

Q3.5 Does or did your organization benefit from access to knowledge or experience from other community groups engaged in community renewables? *Please mark the answer that best applies to your situation.*

We have:

- ❍ **No regular access** to people from **other community groups with previous experience** to help us with **any aspects** of our project (1)
- ❍ Access **to 1 or more groups with previous experience**, who help us **with some aspects** of the project (2)
- ❍ **Regular access to 1 or more group**s with previous experience, who can help us with **most aspects** of the project (3)
- ❍ **Regular access to 1 or more groups** with previous experience at **all phases of project** development (4)

Q3.6 Do you have individuals from external parties on the board or management body of your organization, or in the project steering committee? External parties on your board, management or steering committee include: (Please mark the answer that applies to your situation)

Community councillor(s) (1)

Local authority councillor(s) (2)

Local landowner(s) (3)

Local business(es) (7)

Other agencies, namely: (4) ____________________

None of the above (5)

Q3.7 Did your local area authority **inform you about the opportunities of renewable energy development, support, or take interest in the project process?** Example: making you aware of suitable land. *Please mark the answer that best applies to your situation*

No never (1)

Yes, occasionally (2)

Yes, frequently (3)

Q3.8 How did you find the following organizations in dealings with your organization? *Please mark the answer that best applies to your situation:*

	Staff have been				
	Knowledgeable always (1)	Mostly knowledgeable (2)	Mostly unknowledgeable (3)	Unknowledgeable always (4)	We have not approached them yet (5)
Your **local Council** (1)	❍	❍	❍	❍	❍
Your **electric utility company** (eg the National Grid) (2)	❍	❍	❍	❍	❍
Your **commercial developer or installer** (Example: Airtricity, Renewable Energy Systems, West Coast Energy) (3)	❍	❍	❍	❍	❍

Q3.9 How did you find the following organizations in dealings with your organization? Please mark the answer that best applies to your situation:

	Staff have been				
	Entirely Supportive (1)	Mostly supportive (2)	Mostly unsupportive (3)	Entirely unsupportive (4)	We have not approached them yet (5)
Your **local Council** has been (1)	❍	❍	❍	❍	❍
Your **electric utility company** has been (e.g. National Grid) (2)	❍	❍	❍	❍	❍
Your **commercial developer or installer** has been (Example:	❍	❍	❍	❍	❍

Airtricity, Renewable Energy Systems, West Coast Energy) (3)					

INSTALLATION 1

Technology:______________________________
Site:___________________

Q4.1 The following questions apply to your [wind] installation When did your [wind] project start? Example: the date on which your organization first met to discuss why and how to pursue this project. Please enter an approximate month/year as follows: 01/2009

Q4.2 What is the (planned) total capacity of the installation in kW or MW? Please write down the value next to the relevant units below
in kW: (1)_____________
or in MW: (2)__________
I don't know, ask: e.g. judith.hall@btconnect.org (3): _______________

Q5.1 Where are you currently at in this wind project? *Please tick the boxes of all project phases you have completed as appropriate*

	Yes this applies to us!	No Not yet	This is not relevant to our project
	(mark box) (1)	(mark box) (1)	(mark box) (1)
Our wind turbine(s) **are functional and operating** (10)	❑	❑	❑
This wind project was **discontinued** before completion (11)	❑	❑	❑
Grid connection was granted (4)	❑	❑	❑
Full planning consent was granted (5)	❑	❑	❑
Provisional planning consent was granted (18)	❑	❑	❑
Planning consent was rejected (9)	❑	❑	❑
Planning application was submitted (6)	❑	❑	❑
Site was secured (ie. we settled on a contract for lease or purchase of land) (7)	❑	❑	❑
Technical Feasibility assessment completed (8)	❑	❑	❑

Q5.2 Feel free to describe which project phase you are in now, if not captured by the above Example: We haven't gotten to any of these stages OR We have completed a detailed feasibility assessment, but have met with problems securing the initial development site, and are now negotiating another site, for which provisional planning consent was granted

Q6.1 How did or will your organization **secure land** for the wind installation? The site is: (Please mark at least one answer)

❑ Owned by your organization (1)
❑ Owned by your partner organization in this project (2)
❑ Leased from one landowner (3)
❑ Leased from two different landowners (4)
❑ Gifted or under free use agreement (5)
❑ Purchased (6)

- ❑ We do not know how we will secure land yet (7)
- ❑ Other, namely: (8) ____________________
- ❑ Not applicable (9)

IF LAND LEASED OR PURCHASED:

Q6.2 Did you **experience difficulties, disputes or delays in negotiating the land lease or purchase**?
Please mark the answer that best applies to your situation

- ❍ No difficulties (1)
- ❍ Some minor difficulties (2)
- ❍ Significant difficulties (3)

Q6.3 We would be grateful if you could break down the project costs involved in your wind project as follows. *Please enter a number in pounds - a rough estimate is okay!*

	Cost of project phase	We haven't gotten here yet!
	£ (1)	/ I would rather not say (1)
Total (projected) project cost (7)	______________	❑
Cost of planning and development (technical feasibility assessment and planning application) (8)	_____________	❑

Q6.4 So far, how is your wind project being funded? Please mark YES for funding sources that apply to you and provide names of your partner organization where possible.

	Does this funding source apply to you?		Name of charity, bank, investor
	YES (1)	MAYBE (2)	or lending institution (optional) (1)
Grant or charity-funded (1)	❍	❍	
Public loan eg. CARES loan (2)	❍	❍	
Equity partnership / joint venture with another organization, namely: (3)	❍	❍	
Self-funded from our reserves (4)	❍	❍	
Self-funded from community shares (6)	❍	❍	
Bank or commercial loan (5)	❍	❍	

Q6.5 Has your wind project **experienced any resistance from within the community**? Please mark the answer that best applies to your situation

- ❍ There have been **no objections** voiced against the project (1)
- ❍ **One or two individuals** in the community **have voiced concern** (2)
- ❍ **One or two people** in the community **object strongly** (3)
- ❍ **Several people** in the community **object strongly** (4)
- ❍ There **exists an organized campaign from within the community against the project** (5)

Q6.6 Have you or will you be applying for Feed-In-Tariffs or Renewables Obligations Certificates for this project? Please mark the appropriate answer

- ❍ Feed-In-Tariffs (1)
- ❍ Renewables Obligations Certificates (2)
- ❍ None (3)