Community Low Carbon Energy Transitions in Irish Islands: A Transdisciplinary Approach

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Declaration

I hereby declare that this research is my own work and that it has not been previously submitted anywhere for any award. Where other sources of information have been used, they have been acknowledged.

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Abstract

The role of communities has been identified as significant in the future success of Ireland's transition towards a decarbonised energy system. At the community level, there are different understandings of, and attitudes to, sustainability and energy use. This is particularly evident in island communities where social interactions, activities and services are compositionally divergent from those in mainland communities. This thesis argues that current habits of categorising communities' energy needs by technology experts' standards creates an Irish energy planning environment oblivious to the distinctive energy needs of island communities. This classification of situated energy knowledges under the rational terms of experts' or policymakers' standards distorts and blurs the authenticity of community insights influencing the energy planning process in island communities. Demand and perceptions of energy are place-based, thus island situated energy knowledges and community knowledge networks differ epistemologically from the typically ubiquitous approaches of technology and policy. Within these peripheral communities, the conventional "one-size-fits-all" national approach to community engagement and public consultation has proved unsuccessful. This thesis argues that prevailing practices promoting and recognising expert knowledge over local knowledge fosters a community engagement process that is inattentive and indifferent to the distinctive and divergent needs of island communities. This research reports how predominant technical approaches to community energy planning are further marginalising periphery or island communities where, typically, local knowledge is highly valued. These findings are developed through an island-based case study analysis of Inis Oírr Island, in the Aran Islands, in the West of Ireland. Drawing on a social-constructivist perspective embedded in a post-normal science approach this research assesses how current generic approaches to community consultation can be redefined to be inclusive of all knowledge in the complex energy issue. This research further argues that the complex issue of community low carbon energy transitions requires investigation from multiples disciplinary perspectives. The innovative transdisciplinary methodology developed, applied and analysed in this research enabled a holistic investigation of the role of situated energy knowledges and community knowledge networks in successful community low carbon energy transitions. Three sensitising concepts were developed to guide the empirical investigations in this work - "knowledge", "governance" and "communication". Building on results from this empirical study with residents in Inis Oírr, this research identified three mechanisms where situated energy knowledges mould perceptions and understanding of energy that are not present in existing literature. First - the role of the case-study community's peripherality in shaping its daily energy practices. Second – their geographic and climate based experiences and household energy adaptations to account for them. And third – the case-study community's previous experiences of external energy governance structures and how this affects their levels of participation in energy planning processes. Finally, this research aims to create new knowledge of the role of situated energy knowledges and community knowledge networks through the application of a transdisciplinary methodology that combines social scientific and engineering techniques to create a holistic picture of appropriate low carbon energy transitions for Inis Oírr island. The transdisciplinary approach developed for this research enabled the participants and the researcher to engage in a co-creative energy planning process where all types of knowledge were given legitimacy and equal respect. This research contributes to a better understanding of pathways to achieving a more inclusive, holistic and co-creative community energy transition process that can better adapt to the atypical energy needs of island communities. The innovative methodological approach developed for this research revealed the participants' capacities to engage successfully in designing their own low carbon energy future.

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List of Acronyms

BER – Building Energy Rating

CER – Commission for Energy Regulation

CKN – Community Knowledge Networks

EC- European Commission

EEED – European Energy Efficiency Directive

EIA – Environmental Impact Assessment

EIS – Environmental Impact Statement

ELD - Energy Labelling Directive

EPBD – Energy Performance of Buildings Directive

ESB – Electricity Supply Board

HOMER - Hybrid Optimization of Multiple Energy Resources Software

IWEA – Irish Wind Energy Association

LULU – Locally Unwanted Land Use

NCT – National Car Test

NEEAP - National Energy Efficiency Action Plan

NESC - National Economic and Social Council

NHA – National Heritage Area

NIMBY – Not in my Back Yard

NPC – Net Present Cost

NPWS – National Parks and Wildlife Services

OECD - Organisation for Economic Co-operation and Development

PCI – Problem-Centred Interview

PV – Photovoltaic

SAC – Special Area of Conservation

SEAI – Sustainable Energy Authority of Ireland

STS – Science and Technology Studies

TSO – Transmission Service Operator

List of Publications

Journal Article:

Heaslip, E., Costello, G. J., Lohan, J. (2016) Assessing Good-practice Frameworks for the Development of Sustainable Energy Communities in Europe: Lessons from Denmark and Ireland, *Journal of Sustainable Development of Energy, Water and Environment Systems*, 4**,** 307-319.

Conference Papers:

Heaslip, E. (2016) Community Energy Knowledge Networks: Island Communities and Policy Processes, *American Association of Geographers Annual Meeting*, San Francisco, March 29-April 2.

Heaslip, E. (2016) Situated Knowledges: Island communities and Sustainable Energy Governance, *DEMAND Centre Conference,* Lancaster, 13-15 April.

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PART ONE: BACKGROUND AND THEORY

This thesis is comprised of three parts, **Part One** of which provides the background and theory to the project over three chapters. The part following this, **Part Two,** contains two chapters outlining the methodology developed and tested in this work and **Part Three** contains five chapters describing the results and discussion along with the conclusion chapter. This part of the thesis, Part One, is comprised of three chapters that introduce this research and its policy, academic and theoretical context. This chapter sets out the background to the thesis, the conceptual framework, the research questions, the research design and key strengths of this work. Chapter Two outlines policy responses to community low carbon energy transitions in Ireland and recent research in community low carbon energy transitions in Denmark and Ireland. The literature review chapter following this chapter explores theoretical approaches to community low carbon energy transitions, dividing them into three sensitising concepts developed from the literature: “knowledge”, “governance” and “communication”. Through these sensitising concepts the roles of situated energy knowledges and community knowledge networks in community low carbon energy transitions are considered.

Chapter One: Introduction to the Thesis

1.1 Background to this Study: The Policy Context

Energy, or the ability to do work, is integral to socio-spatial relations (Calvert, 2015). Energy can be considered at several levels, individual consumption, consumption at the household level, consumption at a community level and at a national scale (Reid et al., 2010). This thesis argues that all levels are equally important when considering transitions to low carbon energy sources. While demand for energy is improving infrastructures of energy provision there has been a subsequent rise in energy reliance (Devine-Wright et al., 2009). Since the oil crisis in the 1970s (Blanchard and Riggi, 2013) there has been a twofold increase in energy consumption globally (Dean et al., 2008, Dimas, 2008). Increasing dependence on technology in the workplace and home, coupled with the emergence of industrialised countries throughout Asia, has led to the significant and concerning rise in energy consumption worldwide (Dimas, 2008). The environmental consequences, along with energy security issues due to oil production becoming less efficient (Brandt et al., 2013), highlight a need for lower carbon methods of energy production and consumption. Since the 1970s, approaches to the energy resource issue have split, with technological advances in energy recovery driving two shifts in energy supply: one towards alternative fossil fuels, for example shale gas or oil sands (Farrell and Brandt, 2006, Greene et al., 2006), and another toward low carbon or renewable energy resources (Elliott, 2000). In the late 1980s, against the backdrop of a developing issue of resource depletion, the notion of sustainable development gained prominence. The Brundtland Commission's oft cited 1987 definition of sustainable development has been an influencing force on energy policy over the last three decades (Borowy, 2013). However, difficulties arise when defining acceptable consumption levels as the transformation from basic levels of usage to more lavish consumption levels is obscure (Doyle, 2013) and change with cultural norms (Shove et al., 2015).

In the policy arena, energy can be perceived in a multitude of ways, from individual and community energy consumption to low carbon energy production. The issue of low carbon energy transitions is conceptualised in an assortment of forms within academic circles, with it being lauded as the challenge of the 21st century by some (Bridge et al., 2013). The urgency of transitioning to low carbon energy is strengthened by impending shortages in energy resources (Armaroli and Balzani, 2007) along with societies' social, cultural, economic and political dependence on current energy structures and modes of energy provision (Shove et al., 2014). Arguments that society and human development is dependent on energy supply (Calvert, 2015) have revealed the threat of catastrophic consequences if there are energy shortages in the future. The importance of a global transition to low carbon living is clear, however, a lack of a consensus on what the end state should be (Bridge et al., 2013) stunts successful transitions.

Within energy studies, the term transition is used as an analytical assessment tool to assess and categorise considerable historical shifts in energy systems at national and global scales (Podobnik, 2006, Fouquet and Pearson, 1998). Low carbon energy transitions must be considered from the micro to the macro level of energy consumption and production. Rather than being defined as a conversion in terms of energy supply and use, low carbon energy transitions are more recently considered as a multi-faceted problem including both social and technical elements (Sovacool and Blyth, 2015, DoCEaNR, 2015). These concerns have led to the emergence of "energy geography" within the field of human geography, which argues that energy is spatially and socially constructed and thus human geography, which deals with people and place, is most suited to deal with its complexities (Calvert, 2015, Bridge et al., 2013). Transitions towards a low carbon energy system are characterised by universal access to energy services, coupled with secure and reliable supply from several low carbon energy sources (Bridge et al., 2013, Borowy, 2013). In the context of this research, energy use is understood as a set of practices that combine skills, material conditions and meanings which are embedded in wider social, institutional and political contexts (Shove and Walker, 2014). In addition, low carbon energy transitions are defined here as the process of decarbonising the energy system through the shift from fossil to low carbon energy sources coupled with a reduction of energy consumption (Bridge et al., 2013).

Traditionally, energy policy in Ireland has aimed to reduce reliance on fossil fuels through addressing the energy performance of buildings and energy supply (Byrne et al., 2016, DoCEaNR, 2012, DoCEaNR, 2009). This has been coupled with a focus on achieving cost effective, stable and secure methods of energy provision to reduce greenhouse gas emissions and meet EU climate policy targets (DoCCAE, 2016, FitzGerald and Valeri, 2014). At European level there are several key policy directives that guide the development of energy guidelines and initiatives in its member states. Key directives include the Energy Labelling Directive (ELD) and the Energy Performance of Buildings Directive (EPBD), which requires member states to employ building energy ratings and certification standards. In response to these directives and targets, the Irish government released it's first *"National Renewable Energy Action Plan"* in 2009 (DoCEaNR, 2012), which described Ireland's commitment to reach 40 per cent renewable electricity and 12 per cent renewable heating by 2020 (SEAI, 2010b). The Irish Wind Energy Association (IWEA) also published their updated *"Wind Energy Development Best Practice Guidelines"* in 2012 (Fehilly and Timony, 2012). These guidelines were intended to encourage responsible and sensitive wind farm development that acknowledges the concerns of local community groups and other stakeholder communities. In the following years, several more guidelines, frameworks and networks were developed throughout Europe to aid communities' transitions to low carbon energy societies. These included: The Sustainable Energy Authority of Ireland's (SEAI)*"Guidelines for a Sustainable Energy Community"* (O'Hora, 2010), the "*CONCERTO Guide to a Sustainable built Environment"*(EC, 2010a, SEAI, 2010a), the ICLEI – Local Governments for Sustainability (ICLEI, 2016) and the Covenant of Mayors (Energy Cities, 2016). The SEAI's *"Guidelines for a Sustainable Energy Community"* in 2010 (O'Hora, 2010) offer a framework for developing sustainable energy communities which includes five steps – commit to the project, identify what can be achieved, plan the project, take action and engage with the community and finally, review the project. Although these guidelines have recommended more community engagement in energy planning, this was not encouraged until late in the planning process. More recent renewable energy development guidelines released by the National Economic and Social Council (NESC) in Ireland have outlined the importance of meaningful consultation and community engagement in the development processes of low carbon energy projects (NESC, 2014) to ensure more successful outcomes. The most recent energy white paper; "*Ireland's Transition to a Low Carbon Energy Future"* in 2015 (DoCEaNR, 2015) placed more focus on the importance of communities in Ireland's low carbon energy transition promising increased support for community ownership and development of community energy projects. Although there are several policy documents and guidelines stating the need for meaningful community engagement to aid Ireland's low carbon energy transition, they lack depth and clarity on methods of achieving this. Currently, there is a gap between Irish energy policy, how Irish energy policy objectives are implemented and the needs of communities at local level. These top-down approaches have proven themselves to be ineffective in community low carbon energy transitions where, as this thesis argues, more situated approaches are needed which acknowledge the diversity of community configurations.

1.2 Background to this Study: The Academic Context

Contemporary concepts of community and low carbon energy transitions are divergent from those of the past. In the literature, community is conceptualised in a number of ways and there are many different types of communities (Parkhill et al., 2015). Rae and Bradley (2012) describe a community as a set of shared values between those who populate it, while others define community as a group that shares *"common needs and goals, a sense of the common good, shared lives, culture and views of the world, and collective action"* (Silk, 1999, p 95). Common across these descriptions of community is the idea that a shared vision is fundamental to the concept of community. These shared visions may create an able, strong, collaborative community or one that is combative and paralysed into inaction (Miller and Bentley, 2012). The notion of shared visions within the community context are often utilised to define the motivation for the emergence of any community group, however, these definitions of community are an over-simplification of how communities manifest. Multiple types of communities exist. Communities are not homogeneous and there can be multiple communities of practice within a spatial community (Mah et al., 2013).

A review of literature has revealed that research on low carbon energy transitions have been predominantly quantitative in nature (Lund, 2010, Connolly et al., 2016, Connolly et al., 2011). Contributions to community participation in community low carbon or renewable energy include; Burchell et al. (2016), Parkhill et al. (2015), Ellis et al. (2014) and O'Hora (2010). These contributions, which are discussed in more depth in Chapter Two, include assessments of existing community renewable energy projects, suggested methodologies and frameworks for community engagement and discussion of the barriers to effective community engagement. These works highlight the effect of the individual's placement within a community on their understandings and perceptions of low carbon energy transitions. These social-based and alternative perspectives can be identified as social constructivist perspectives where emphasis is placed on the social construction of ideas of low carbon energy transitions (Calvert, 2015, Letcher et al., 2007, Wüstenhagen et al., 2007).

Social construction is where any condition or entity is understood to have certain characteristics as a result of people socially acknowledging that it does (Robbins et al., 2011) and giving it meaning. A social constructivist perspective looks behind the social construction of entities and towards unspoken assumptions that are embedded within ideas of these entities (ibid.). Once we begin to critically assess perceptions of energy and energy practices in this way, we begin to see how individual natures, and natures of others within a community, and the community as a whole, are all social processes of beliefs, ideologies, culture and individual and collective history. This relatively new outlook has significantly altered and influenced community low carbon energy transition research in recent years and consequently, energy policy. Placing emphasis on the social construction of energy brings to light debates concerning human interactions with the environment, including the importance of environmental psychology (Schweizer-Ries, 2008, Devine-Wright, 2015), and the importance of emotion, identity, trust and place in low carbon community energy planning (Kalkbrenner and Roosen, 2016, Büscher and Sumpf, 2015, Raymond et al., 2010a, Cass and Walker, 2009).

Social scientists engaged in the area of sustainability research advocate transdisciplinary work to provide a holistic approach to complex issues which can address problems of economic development, environmental preservation and social equity simultaneously (Fahy and Rau, 2013). Much like sustainability research, successful research in the area of community low carbon energy transitions must acknowledge the role of social, economic and environmental influences on individual and community perceptions of energy. Social science research tends to argue that disciplinary boundaries can negatively affect the development of social scientific knowledge and that concepts of disciplines should be challenged (Lang et al., 2012, Jessop and Sum, 2001). These debates have been connected with debates around scientific practice and modes of knowledge production (Gibbons et al., 1994, Funtowicz and Ravetz, 1993). These debates evolved as a response to scientists' difficulties in dealing with "wicked"[1] sustainability challenges which revealed the limitation of conventional disciplinary approaches (Farrell, 2011). Social scientific approaches to sustainability research remain entrenched in disciplinary conventions prescribing which questions should be asked and the methods that should be used to investigate them (Fahy and Rau, 2013). Transdisciplinary approaches to sustainability research are gaining prominence in Europe and there are several research institutes paving the way in terms of transdisciplinary research, including: the Stockholm Environment Institute (SEI) in Sweden, the Potsdam Institute for Climate Change Research (PIK), the Wuppertal Institute for Climate, Environment and Energy in Germany and the Institute of Social Ecology in Vienna (Austria) (ibid.). The proliferation of these transdisciplinary institutes of sustainability research highlights the emerging trend for transdisciplinarity in the field of sustainability (and energy) research. This thesis argues that energy perceptions and practices are socially constructed and influenced by social, economic and environmental factors. This thesis employs a transdisciplinary post-normal science approach to investigate these pressures.

1.3 Researching Energy in Islands

The transdisciplinary methodology developed in this research requires a case study approach to enable a problem-centred merging of engineering and social scientific disciplines. A small offshore island[2] case study community was chosen as it offers a unique social and geographic landscape with delineated geographic and social boundaries. Many different types of communities exist, communities are not homogeneous and there can be multiple communities of practice within a spatial community (Mah et al., 2013). The term "community" is used in this thesis to designate a spatial community or a community of place. Small offshore islands offer an excellent community structure for investigation from both a social scientific and engineering

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[1] The term "wicked" is often used to describe issues with incomplete, contradictory, and changing requirements. These issues are often difficult to define and can have complex interdependent characteristics (Turnpenny et al., 2009).

[2] Offshore islands are defined in this work as small islands, which lie offshore of a much larger island or mainland (Royle, 1989).

perspective. These islands contain small populations with clearly defined community network boundaries, making in-depth qualitative studies feasible. From a technical energy planning perspective, energy consumption in small offshore islands is easily auditable due to their complete reliance on imported fuels. As a result of their geographic isolation islands have been misrepresented and misunderstood in the past leading to more insular community networks (Royle, 2002, Royle, 1989). This thesis argues that energy demand and perceptions are place-based, therefore island energy needs differ culturally from mainland approaches to energy demand and infrastructures. Small island communities, with their small self-contained communities, complete dependence on energy importation (O'Maoildhia, 2014, Denny and Keane, 2013, Cross and Nutley, 1999), and their local energy governance structures (CFOAE, 2013) offer an appropriate case study for transdisciplinary investigations in energy research. Social interactions, activities and services in island communities are compositionally divergent from those in mainland communities and can aid in highlighting the role of place in daily energy practices. In-depth transdisciplinary investigations are more achievable within island communities due to their small population and accessible energy data. Inis Oírr, the case study community, contains a population of 247 people (CSO, 2012), allowing for an in-depth investigation within this research. Remote islands offer unique insights into the effect of geographic remoteness and situated knowledge and energy knowledge development processes. Similarly, small, contained social networks within island communities offer opportunities to undertake in-depth analysis of knowledge networks within these unique communities and the processes involved in their operation. Inis Oírr's energy governance practices, along with international maritime regulations prohibiting unregulated transport of fuels across marine environments (IMDG, 2016) has resulted in concise records being maintained of all fuel that is imported onto the island and purchased by its residents. From a technical perspective, islands are commonly viewed as "microcosms" of larger communities while being more easily auditable from a technical perspective than larger communities due to their "Bioregionalism"[3] (Rae and Bradley, 2012). For this reason, islands have been given much consideration in engineering research due to the delineated

[3] Bioregionalism is a political, cultural, and ecological system based on naturally geographically defined areas called bioregions (Rae and Bradley, 2012).

boundaries around their technical and economic systems. However, little consideration has been afforded to the social consequences of this geographic isolation and its effect on community perceptions and understandings of energy. This thesis argues that the use of an island case study location offers opportunities for valuable in-depth transdisciplinary investigations of the situatedness of daily energy practices to provide valuable empirical evidence for policy and communities attempting to undertake low carbon energy transitions.

1.3.1 Energy Research and Engineering

Energy engineering is a broad field that deals with energy services, energy efficiency, facility management, environmental compliance, energy storage and alternative energy technologies. Energy efficiency can be viewed in two ways: that more work can be done for the same amount of energy or the same amount of work can be done for less energy (Battles et al., 1999). Since the early 1970s, energy efficiency research has focused on the basic problems of building physics and engineering design (Lutzenhiser and Shove, 1999). This approach to energy has facilitated great advances in societal and human development (Calvert, 2015). The dominant concerns have been the thermal performance of materials, the efficiency of heating and cooling systems, the challenges of integrated design and overcoming instability in renewable energy provision (Lutzenhiser and Shove, 1999). With notable progress within Europe in renewable energy policies such as feed-in tariffs and subsidies (Mendonça, 2009, Meyer, 2004), policymakers' attention is increasingly shifting towards reducing fossil fuel consumption and greenhouse gas emissions in buildings (Kitzing et al., 2012, Jones and Glachant, 2010). In the last decade, energy engineering research has begun to focus on integrated transitions to low carbon energy sources that include a holistic view of all modes of energy consumption: the built environment, heating and lighting, appliances and transport (Connolly et al., 2016, Lund, 2014). A recent shift in energy engineering is towards the assessment of integrated smart grid systems, where energy consumption and production are conceived as a single interconnected, inter-reliant system of energy demand and production (Eltigani and Masri, 2015, Verbong et al., 2013, Lund and Münster, 2006). This conceptualisation of energy as an integrative system has highlighted the importance of better understandings of human behaviours and energy consumption (Lund, 2014). Conceptualising energy systems in these terms has revealed the need for more integrated disciplinary approaches to energy, highlighting the importance of social scientific approaches to energy planning (Sovacool, 2014a, Sovacool, 2014b, Wüstenhagen et al., 2007).

1.3.2 Energy Research and the Social Sciences

Thirty years ago, Paul Stern (1986) argued that the strategy of improving energy research, by attempting to create more refined models of energy conversion and use, was not sufficient to deal with the complexity of energy demand. He argued that perspectives from physics, engineering and economics have dominated the energy research agenda for decades because of a “blind spot" in conventional policy thinking about sociotechnical systems (Stern, 1986). Sociologists Loren Lutzenhiser and Elizabeth Shove (1999) argue that the preoccupation with the “classic” paradigm of science, technology and economics in energy policy research overlooks the human aspects of energy technologies and their use. Since the 1970s, studies of energy consumption behaviours have been developed from a range of disciplinary perspectives (Lutzenhiser, 1993). These perspectives are varied and range from microeconomics to sociological theories. Research in microeconomics include the rational choice models (Wilson and Dowlatabadi, 2007) and the role of pricing and market structure on energy consumption (Hvelplund, 2006). Other perspectives include behavioural economics; technology adoption models; social and environmental psychology; and sociological theories (Stephenson et al., 2010). Energy engineering research and public policy in the field of energy has primarily focused on greater energy efficiency (Davies et al., 2014, Kitzing et al., 2012). However, these approaches do not consider the wider energy cultural influences on consumption which may negate these efforts as energy efficiency can, paradoxically, increase energy consumption (Sorrell, 2009). Individual energy consumption is socially constructed and influenced by societal norms and routines. Energy consumption is embedded in our everyday practices and these determine our ability and willingness to change those patterns (Maréchal and Holzemer, 2015). Without a comprehensive understanding of these energy cultures and the social construction of perspectives of energy, public policy initiatives targeting behavioural change to reduce consumption at the individual or household level are likely to fail.

Building on these statements, Community Energy Planning is defined in this research as the range of methods used to define the priorities of a community around energy provision and energy consumption with a view to improving efficiency, cutting emissions, and driving economic development (QUEST, 2016). These range from technical energy planning (where the technical energy demand profile is assessed and a technical design created) to in-depth qualitative data collection (assessing energy practices and cultural norms and values) (ibid.). This thesis argues that perceptions and understandings of energy are spatially and socially constructed and utilises the concept of situated energy knowledge to investigate this. The next section introduces the concept of situated knowledge and its application in this research.

1.4 The Concept of Situated Knowledge

Communities' energy knowledge development and perceptions and understandings of energy are complex and place-based phenomena (Fast and Mabee, 2015, Devine-Wright, 2012, Raymond et al., 2010a, Devine-Wright and Howes, 2010) that must be situated in cultural, social and political contexts (Shove et al., 2015, Calvert, 2015). This thesis argues that energy knowledge development in island communities is divergent from those of mainland communities due to their unique geographic landscape. The importance of situating the production of geographical knowledges has been a fundamental consideration of many discourses of feminist research methodologies in recent decades. Central to the notion of situated knowledges is the premise that there is not one truth to be uncovered (Nightingale, 2003) and thus all knowledge is tied to the environment that it was created in. The concept of situated knowledge was developed by Donna Haraway (1988) in response to feminist geographer Sandra Harding's *"The Science Question in Feminism"*(1986). The ambition of situated knowledge was to enable feminist philosophers to develop more expansive and inclusive interpretations of social relations (McDowell, 1993). The idea of situated knowledge has been incorporated into the field of environmental geography in an attempt to better understand the complexities of community understandings of the environment. Nygren (1999) integrated the concept into her environmental studies in Nicaragua to explore hybrid knowledges which transcend the usual dichotomy between universal and local or place-based knowledge. Nightingale (2003) argued that the triangulation of methods employed during her research in Nepal offered a good vantage point to examine the situated knowledges of the case study community. More recently Nightingale (2016) has addressed the problem of multiple epistemologies that exist in community development and planning processes arguing that all points of view are valid but that triangulating equally between them is extremely challenging. Ultimately, during the process of triangulation, expert views gain prominence and local knowledge is blurred losing its authenticity (Nygren, 1999). Conclusively it is less important to determine which type of knowledge is more relevant, but rather to recognise that differing cultural, political, social and place-based circumstances can be represented by varied types of knowledge (Morgan and Osborne, 2016, Nightingale, 2016).

This thesis argues that understanding context when researching energy knowledge, understandings and perceptions is fundamental to successful community low carbon energy transitions in islands. This research builds upon the premise that all knowledges in community low carbon energy transitions are valuable and that collaborative community transitions can only be achieved when situated energy knowledges are given more weight by policymakers and technical experts. This research adopts this position by acknowledging complexity and giving prominence to the place-specific and the contextually rich setting of local based experiences of energy.

1.5 The Concept of Community Knowledge Networks

Building on the concept of situated knowledges, the importance of knowledge networks within island communities needs consideration. Islands' geographic isolation often leads to internally uncontested knowledge development systems and social networks (Cross and Nutley, 1999). The importance of place in European debates on climate change policy began to emerge in the 1990s and this raised difficult challenges for governance (Healey, 1998). Healey (1998) argues that acknowledging the role of place in developing knowledge networks can aid in achieving more efficient ways of conflict management in governance. Catney et al. (2013) set out "community knowledge networks" (CKN) as an alternative approach to energy justice and they reject the "deficit view" of individuals as empty vessels devoid of information and therefore having no incentive to act (ibid.). It is important instead, to examine the processes of how individuals come to know about energy and how this knowledge is shared in their everyday lives. In using the term "knowledge networks" Catney et al. (2013) move away from the idea that "top-down" information provision is required for individuals to change their behaviours, and argue that individuals already possess tacit or local knowledge of their energy practices in everyday life. If energy knowledge is to be cultivated and made durable within communities, it must be done within the context of existing community networks and interpreted in the context of their existing relationships and cultural interactions (Moran, 2016, Moran, 2011, Gilchrist, 2009). The approach developed in this research offers an analytical framework for identifying the extent to which social interaction matters in structuring energy practices (Catney et al., 2013). The CKN model entails exploring, both theoretically and empirically, the role of knowledge networks and the practices within which they already engage. Similar to Catney et al. (2013), by using the concept of situated energy knowledge rather than top-down information provision, this research rejects the deficit view of individuals as empty vessels that will act if given information.

1.6 Conceptual Framework

This research is developed with the aim of critically assessing current community low carbon energy transition practices in Ireland and exploring the role of situated energy knowledges and CKNs in this area. The purpose of assessing island community low carbon energy transition processes in Ireland and comparing these to academic debates and international and European good-practice is to evaluate the level of public participation in current energy planning strategies in island communities. This process sets out to interpret these strategies and to provide theoretical and methodological knowledge of these strategies in order to inform recommendations for the improvement of low carbon energy transitions pathways in Irish islands. From both a theoretical and methodological standpoint, this is achieved through the adoption of a conceptual framework developed from key theoretical and methodological concepts. Key components of island community low carbon energy transitions identified in literature were embedded within this framework in order to develop an extensive critique of community low carbon energy transition policies and practice in Ireland. This conceptual framework questions the way in which traditional policy based perspectives have conceptualised community low carbon energy transitions and their traditionally positivist, technological approaches. The conceptual framework adopted within this thesis illustrates current influencing factors in community low carbon energy transitions to highlight how both similar and divergent concepts, perspectives and disciplines interact. Situated energy knowledges and CKNs are inserted within the wider debate and research focus of community low carbon energy transitions. Both concepts are used to reflect a series of practices and ideas around everyday energy practices and energy knowledge and their situated and social dynamics. The social constructivist approach reflects the concerns with the social, political, technical and industrial domains, but also a concern with energy knowledge development. The energy practice domains this conceptual framework assesses are divided into the community, family and individuals and how knowledge is constructed, how it provides meaning and how it produces specific types of representations which are often divergent (Nightingale, 2016, Stoutenborough and Vedlitz, 2016). The conceptual framework adopted within this thesis argues that all energy knowledges (whether rational, local, emotional or technical) are socially, spatially and politically constructed and are core components of community low carbon energy transitions. To various degrees, and through a myriad of ways, social domains and CKNs inform how low carbon energy transitions are navigated by island communities. This thesis argues that energy is a complex issue requiring the input of several disciplinary perspectives simultaneously (Farrell, 2011). The conceptual framework adopted within this methodological approach highlights the need for an iterative, holistic approach in order to fully integrate several perspectives simultaneously. The conceptual model aims to illustrate the multiple factors considered within the social constructivist perspective by linking community low carbon energy transitions to social based elements and considerations from multiple disciplinary standpoints.

1.7 Research Aims and Objectives

This research aims to respond to current needs and priorities within community energy policy and research. **The overall aim of this research is:**

> To design, apply and analyse a transdisciplinary methodological framework to facilitate the inclusion of situated energy knowledges into the energy planning process of community low carbon energy transitions.

It also aims to advance understandings of individual and community perspectives of low carbon energy transitions including how and why energy is understood and used, with the goal of generating policy-relevant data and data to inform communities when undertaking low carbon energy transitions. There are four key research questions guiding this research:

1. How is energy understood by people in island communities in their day-to-day practices?

2. What are the key processes that influence situated energy knowledge development and community knowledge network maintenance within island communities?

3. What role do situated energy knowledges and community knowledge networks play in island communities' transition pathways to sustainable, low carbon societies?

4. What new knowledge can be developed from applying a transdisciplinary approach to the analysis of situated energy knowledge development processes within the case study island community?

There are six key objectives guiding this research (spanning both social scientific and engineering disciplines) as follows:

1. Identification and analysis of relevant conceptual and theoretical perspectives on community involvement in energy policy

2. Undertaking of an in-depth review of existing community low carbon energy transition policy responses

3. Undertaking of an in-depth analysis of how island communities typically engage in energy policy today in one placed-based community in the West of Ireland

4. Development of a good-practice transdisciplinary methodological framework to enable the inclusion of situated energy knowledges into energy planning processes that complements existing Irish energy policies

5. Undertaking of a critical evaluation of the role of situated energy knowledges and community knowledge networks in island communities' transitions pathways to low carbon energy societies

6. Co-creation of a technical energy plan for the case study community developed from initial qualitative findings using technical energy plan simulation software.

The results garnered from this study cannot be assumed to be typical of any population. However, it is proposed that the themes identified could suggest possible explanations for trends identified in other community low carbon energy transitions and so have implications for future energy policy in Ireland.

1.8 Research Design

This study uses a social constructivist perspective embedded in a post-normal science approach to undertake an in-depth exploration of perceptions and understandings of energy within a case study island community in the West of Ireland. This entails exploring different elements of how daily energy practices are conceptualised and understood, with specific attention given to spatial and social-based elements of energy knowledge development. The post-normal science approach is appropriate as this research involves individuals' perspectives of the world around them (Funtowicz and Ravetz, 2003). Energy is defined as a complex issue, the investigation of which requires multiple perspectives (Castaneda et al., 2015). The case-study approach facilitates transdisciplinary problem-centred investigation within the social and spatial contexts of the case study community. This approach utilises a variety of data collection methods (both qualitative and quantitative) and analysis instruments to gain a contextually rich understanding of individual and community perspectives of energy and the participation mechanisms in community low carbon energy transitions. This research employed a problem-centred case study approach and utilised the Problem-centred Interview Technique (Witzel, 2000a) followed by thematic analysis of the empirical evidence. The fieldwork activities undertaken in this research were extensive and included surveys completed by 53 participants, focus groups with 20 participants, individual interviews with 29 participants, energy planning workshops with 12 participants and the exploration and analysis of secondary materials. The researcher first made contact with the gatekeeper in Inis Oírr in September 2013 and visited the island numerous times over the course of the three years of the research project. The most intensive phase of the data gathering spanned from June 2015 to September 2015, with the researcher visiting the island for three days a week. The research process involved the development of sensitising concepts for investigation prior to data gathering which are outlined in Chapter Three with further concepts emerging during the subsequent thematic analysis. Due to the requirement to develop reductionist techniques so that empirical data could inform the technical energy planning software, the need for reflexive techniques emerged, the reflections on which are contained in Chapter Ten. The island case study material provides rich context and place specific, energy related empirical evidence. Although there are limitations to the generalisability of the situated energy knowledge produced via this methodology, there are similarities across islands that suffer as a result of their geographic peripherality and isolation (Cross and Nutley, 1999) making the empirical evidence useful for these communities in the future. The critical analysis of current community energy planning techniques aims to challenge universal approaches to community low carbon energy transitions within island communities that are fundamentally situated and context specific.

1.9 Sensitising Concepts

Sensitising concepts are used in this research to provide a foundation for the development of lines of inquiry during the empirical investigations. Sensitising concepts provide a theoretical foundation for this study's development. They also give the researcher a general sense of reference and guidance in approaching empirical inquiry and suggest directions along which to look (Bowen, 2006). Sensitising concepts draw the researcher's attention to important aspects of social interaction and can be viewed as interpretive tools (ibid.). Sensitising concepts can also be used to examine substantive codes to aid in the development of thematic categories from the data (Bowen, 2006). Charmaz describes them as background ideas that inform the overall research problem and she explains *"they provide starting points for building analysis, not ending points for evading it. We may use sensitising concepts only as points of departure from which to study the data"* (2003: 259). Sensitising concepts can be tested, improved and refined throughout the process of research (Blumer, 1969). Although sensitising concepts might alert researchers to some important aspects of research situations, it is important to ensure that they do not direct attention away from other important aspects (Gilgun, 2004) and that subsequent themes are allowed to emerge. The survival of a sensitising concept until the last stage of the research *"depends on where the data take us; emergent concepts may supplement or displace them altogether"* (Padgett, 2004, p. 301). Sensitising concepts were used in this research to guide the direction of the empirical investigations and aid in the development of the innovative research design. (Charmaz, Glaser and Strauss, 1971)They provided specific analytic concepts that encompass the concepts of situated energy knowledges and CKNs.

The sensitising concepts that were developed for this work were "knowledge", "governance" and "communication". These sensitising concepts were influenced by findings from initial fieldwork studying successful community low carbon energy transitions (Heaslip et al., 2016) and the concept of CKNs (Catney et al., 2013) as being crucial to situated energy knowledge development. Catney et al. (2013) argue that we must no longer perceive people as being devoid of knowledge that, if given information, desired behavioural change will be the outcome. For this reason, situated energy knowledges and their social and spatial construction are a core theme of this research on community low carbon energy transitions. The sensitising concept of "knowledge" refers to participants' situated energy knowledges and how these relate to their day-to-day energy practices. This sensitising concept builds on the idea of CKNs and the argument that people already possess valuable forms of knowledge that must be acknowledged (Catney et al., 2013). The second sensitising concept guiding this research, "governance", applies the CKN approach to energy governance acknowledging the influence of existing governance structures (ibid.). This sensitising concept recognises that existing social and organisational networks, which communities' understand and trust, have significant influence on perceptions of universal governance techniques. The third sensitising concept, "communication", asserts that for knowledge to be made legitimate and permanent it must be shared through existing networks that communities trust (ibid.). This sensitising concept departs from the concept of "top-down" information provision to acknowledge existing modes of knowledge sharing (ibid.). The sensitising concept of communication is concerned with how people relate to energy information and public consultation processes.

1.10 Key Strengths and Importance of this Research

This study attempts an innovative, progressive and holistic approach to energy research that overcomes the individual shortcomings of the oft differing disciplines of engineering and social science. This study offers four advantages due to its merging of two traditionally divergent and opposing disciplines in the area of energy research. First, the application of a social constructivist perspective to community low carbon energy transitions offers insights into social, cultural and spatial influences on individuals' and communities' energy knowledge. Although energy is described as a pressing issue for policy and society, traditional theoretical approaches often omit or overlook the social, spatial and cultural dimensions of daily energy practices and perceptions. The development of new knowledge related to these factors is essential to increase our understanding of individuals' and communities' perceptions of energy and which factors influence pathways to low carbon energy transitions. Secondly, this research, through the use of several modes of qualitative data collection methods in both individual and groups dynamics, investigates both individual and community perceptions of energy and energy practices. This research investigates the impact of community dynamics, more particularly CKNs, on individual and community situated energy knowledges. Thirdly, this study combines the empirical evidence of a social scientific approach with the technical outputs of an engineering approach. This research endeavours to fuse these two disparate disciplines to create new knowledge through the employment of these techniques simultaneously. As the methodology developed in this research shifts from one discipline to another, new knowledge is developed as empirical and technical findings inform each other to develop a holistic picture of the most appropriate low carbon energy transition pathway for the case study community. Finally, the use of an in-depth, problem-centred case study design coupled with a technical approach provides a new lens with which to investigate community low carbon energy transitions in order to assess the social and technical interactions that spawn complexity in this process.

1.11 Thesis Outline

PART ONE: BACKGROUND AND THEORY

The current chapter locates island community low carbon energy transitions within wider policy and academic debates around energy. The need to develop a greater understanding of social and spatial factors influencing community low carbon energy transitions is also established. The chapter also outlines the research questions and objectives of the research, the expected key theoretical and methodological contributions and the key strengths of this work.

Chapter Two offers a critical review of policy responses to community low carbon energy transitions within Ireland. Current policy actions on low carbon energy transitions in Ireland are investigated and the emergence of situated energy knowledges and local knowledge as key components of the success of these pathways is discussed. Lessons from investigating relatively successful low carbon energy transitions of communities in Denmark and Ireland are then discussed, along with their implications for this research.

Chapter Three outlines the sensitising concepts guiding this research: “knowledge”, “governance” and “communication”. This chapter describes how the sensitising concept “knowledge” refers to the situated energy knowledges of the participants and how this relates to their day-to-day energy practices. “Governance” encompasses perceptions related to the public consultation process and mainland universal governance techniques. Finally, it explores how “communication” is concerned with how people relate to energy information and public consultation processes.

PART TWO: METHODOLOGY

Chapter Four begins by describing the current landscape of energy research in island communities, arguing that there is a lack of research related to the social implications of geographic remoteness on perceptions of energy within island communities. This chapter then continues to describe in detail the case study community along with the rationale for its selection. Next, this chapter argues the significance of a social constructivist approach to researching energy in islands. Finally, this chapter reveals the importance of a social epistemology in linking technical, political and community claims to knowledge on community low carbon energy transition pathways within island communities.

Chapter Five begins by describing the current literature and philosophical debates around transdisciplinary approaches to energy in communities. Then, this chapter continues to outline the research design, which is based principally on a transdisciplinary case study approach. The rationale behind the application of a transdisciplinary approach and the utilisation of a case study island community is described. This chapter also describes how the choice of a case study approach enables a range of detailed and situated accounts to emerge on the ways in which energy is understood at local level, while facilitating a transdisciplinary, post-normal scientific approach. This chapter justifies the use of the PCI Technique (Witzel, 2000a) as a mode of problem-centring the transdisciplinary case study approach developed for this work. Next, this chapter describes one of the key contributions of this research - the transdisciplinary methodological framework for the inclusion of situated energy knowledges into energy planning processes. Finally, this chapter details both the criteria for the design of the methodology along with the innovative methodological design itself.

PART THREE: RESULTS AND DISCUSSION

Chapter Six describes the current landscape of energy in the case study community from a technical, energy planning perspective and provides insights related to Research Question One. This chapter begins with the development of the energy demand profile for the case study community, highlighting the divergences between island energy-demand profiles and profiles in mainland communities. This chapter also details the empirical findings from the investigation of the participants' understandings of energy in their daily lives and their situated energy knowledges.

Chapter Seven addresses Research Question Two and discusses the processes that influence the development of situated energy knowledges and CKNs within the case study community. The participants' understandings of energy knowledge are revealed and explored in this chapter as are the processes of their development. Following this, the participants' understandings of local knowledge and the role if this in community low carbon energy transitions are discussed. This chapter also describes the relationship between identity, place and proactivity in island communities and their effect on perceptions of energy. Next, this chapter further explores the influence of remoteness on island communities' adaptive capacities and the role this plays in their daily energy practices.

Chapter Eight deals with the governance and communication sensitising concepts of this research and reveals insights into findings related to Research Question Three. This chapter looks specifically at energy governance in island communities and how it is affected by geographic isolation. Following this, the participants' perceptions of external governance are discussed, as is its influence on perspectives of large energy infrastructure development in the case study community. This chapter finishes with discussion of the negative effect that past interactions with external governance has had on the case study community's participation in low carbon energy transition initiatives within their area.

Chapter Nine addresses Research Question Four and analyses the application of the innovative transdisciplinary methodology developed for this work. Building on the empirical findings from Chapters Six, Seven and Eight, this chapter reports on how the initial findings from the qualitative data are used to inform the design of the proposed technical energy plan. This chapter revealed the participants' capacities to engage in the design of the low carbon energy transition for their community. Following this, three technical energy scenarios were developed for the case study community using technical energy plan simulation software. Finally, the findings from the energy planning workshops are revealed and the participants' perspectives of the methodology itself are discussed.

Chapter Ten reconnects the literature with the empirical findings exposed in chapters Six, Seven, Eight, and Nine in order to refine and develop further conceptual ideas. The chapter provides the thesis's contributions to theory, policy and methodological approaches to investigating communities' capacities for engaging in energy planning for their communities. This chapter provides the opportunity for reflexive and critical evaluation of the methodological approach while assessing the policy implications and offering recommendations. The final sections of this chapter provide a consideration of how the research has contributed to a greater body of knowledge based on a conceptual and methodological approach which integrates both social scientific and engineering techniques in an iterative and holistic manner.

Chapter Two: Community Low Carbon Energy Transitions – Policy Responses

2.1 Introduction

The aim of this chapter is to examine policy responses and perspectives of community low carbon energy transitions in the Irish context. This chapter provides a comprehensive review of literature on community low carbon energy transitions and the varied way in which the concept is conceptualised within policy. It also describes the key challenges experienced in the transitioning process, the policy responses to date and the current landscape of community low carbon energy transitions in Ireland. Finally, this chapter describes recent research on the role of communities in low carbon energy transitions in Denmark and Ireland and culminates in a description of their implications for this research.

2.2 Community Low Carbon Energy Transitions in Ireland: Policy Actions

Traditionally, the goals of energy policy are to maintain a secure energy supply and deliver the required energy to consumers, all at a minimum cost (FitzGerald and Valeri, 2014). These policies are determined by governing bodies who set out the landscape of frameworks and the parameters within which communities' low carbon energy transitions take place. This landscape consists of regulatory, institutional and economic frameworks, which mould the regulatory environment within which all stakeholders of a community (public authorities, local authorities, individuals and businesses) operate. Governments hold a key role in framing energy consumption and household energy practices through their control of large-scale and individual level energy infrastructure planning (Ellis et al., 2010) and their creation and maintenance of energy structures. To date the Irish government has focused on energy performance of buildings and supply side issues to reduce the reliance on fossil fuels (DoCEaNR, 2012, DoCEaNR, 2009). Policy responses in Ireland have typically involved implementing home energy efficiency retrofitting programmes and the creation of more stringent energy efficiency standards (Byrne et al., 2016, Davies et al., 2014, DoCEaNR, 2014). Thus far the main thrust of Irish policy has focused on achieving cost effective methods of energy provision which is stable and secure, and reducing greenhouse gas emissions to achieve their targets in terms of international and EU climate policies (DoCCAE, 2016, FitzGerald and Valeri, 2014). In Europe, there are several key policy directives that guide the development of guidelines and initiatives on low carbon energy transitions in its member states. Key directives include the "Energy Labelling Directive" (ELD) and the "Energy Performance of Buildings Directive" (EPBD) which requires member states to set minimum energy standards for buildings to achieve a 'nearly zero-energy' building standard by 2020 and employ building energy ratings and certification standards (EC, 2002). Article 24 of the European Energy Efficiency Directive (EEED) requires each of its Member States to submit a National Energy Action Plan every three years (EC, 2012). In its efforts to comply with this directive, while transitioning towards a low carbon society, in 2009 the Irish government released it's first *"National Renewable Energy Action Plan"* (DoCEaNR, 2012) which described Ireland's commitment to reach 40 per cent renewable electricity and 12 per cent renewable heating by 2020 (SEAI, 2010b). Electricity generated from renewable energy reached 25.3 per cent of gross electricity consumption in 2015 (Holland and Howley, 2016) highlighting how Ireland is facing a considerable challenge to meet its energy targets by 2020. In 2014, Ireland imported 85 per cent of its energy requirements (Howley et al., 2015) leaving the country vulnerable to fluctuations and instabilities in the price of energy resources. Ireland's third, and most recent, NEEAP states that the public sector targets for energy consumption reduction is 33 per cent reduction of energy consumption relative to 1990 levels with considerable efforts needed to achieve this goal (DoCEaNR, 2014). Household consumption of energy in Europe accounts for approximately one quarter of its energy related greenhouse gas emissions (EEA, 2012a). In 2012, the most demanding end-use of energy within the EU-15 was for space heating and cooling at 68 per cent, water heating at 12 per cent and electricity for lighting, appliances and cooking at 16 per cent (EEA, 2012b). The residential sector accounted for 27 per cent of all primary energy used and carbon emissions in Ireland in 2011 and was the second largest energy-using sector (ibid.). The high level of residential energy use in Ireland is credited to inadequate insulation, especially in older housing stock which reportedly lose 20 to 30 per cent of their heat at present (Davies et al., 2014). These low levels of insulation, coupled with higher and more standardised internal temperatures have had a significant impact on energy use in the residential sector in Ireland.

Modern energy infrastructures have enabled heating and household energy consumption to become routine household based practices (Shove et al., 2015, Shove et al., 2014). Increased efficiencies in heating provisions and household appliances can, paradoxically, have a negative effect on the reduction of energy consumption (Sorrell, 2009). More effective heating leading to higher expectations of thermal comfort can greatly increase household energy consumption. Consequently, a 1ºC increase in settings for space heating can increase household energy consumption by 10 per cent (Sorrell, 2007). Recent energy awareness campaigns in Ireland have highlighted how, in the past, energy awareness campaigns have had little or no effect on energy consumption (Diffney et al., 2013) while a study from 2012 revealed that 53 per cent of the population had not attempted to cut down on their energy use in the month prior (Lavelle et al., 2012). Recently, scholars have argued that the social contexts of pro-environmental behaviours (and low carbon energy transitions) are more complex than existing literature would suggest (Castaneda et al., 2015). Castaneda et al. (2015) argue that interpersonal relationships influence low carbon energy transitions as consumers' immediate community allows them to develop environmental knowledge through social interactions (Catney et al., 2013). Castenada et al. (2015) argue that these networks of social ties exert pressure to undertake pro-environmental behaviour . Unfortunately, knowledge does not necessarily lead to pro-environmental behaviour (Castaneda et al., 2015) and information does not necessarily lead to action (Simcock et al., 2014, Catney et al., 2013). These trends are reflected in policy and several guidelines have been released in the last two decades containing community engagement frameworks for the development of low carbon energy projects (EC, 2015, Stöhr, 2010). In response to these, the Irish Wind Energy Association (IWEA) first published its *"Wind Energy Development Best Practice Guidelines"* in 1994, which was updated in 2008 and 2012 (Fehilly and Timony, 2012). The aim of these guidelines was to encourage responsible and sensitive wind farm development that is cognisant of the concerns of local community groups and other stakeholder communities. One of the earliest documents published on community owned energy in Ireland was entitled: "*To Catch the Wind*" and was released in 2004 (Comhar & TCD, 2011, WDC, 2004). This document outlined the opportunities for communities to engage in wind energy generation in their area (ibid.). In the following years, several more guidelines, frameworks and networks evolved throughout Europe to inform communities' transitions to low carbon energy societies. These included: The Sustainable

Energy Authority of Ireland's (SEAI) *"Guidelines for a Sustainable Energy Community"* (O'Hora, 2010), the "*CONCERTO Guide to a Sustainable built Environment"*(EC, 2010a, SEAI, 2010a), the ICLEI – Local Governments for Sustainability (ICLEI, 2016) and the Covenant of Mayors (Energy Cities, 2016). In a major move in Irish policy, the SEAI's *"Guidelines for a Sustainable Energy Community"* in 2010 (O'Hora, 2010) implied that a move from a fossil fuel based economy to an economy sustained by low carbon energy sources is a societal rather than a technological issue. These guidelines offer a framework for developing sustainable energy communities which includes five steps; 1) commit to the project, 2) identify opportunities for sustainable energy, 3) plan the project, 4) take action and consult the community and finally 5) review and report on the project's success (Figure 2.1).

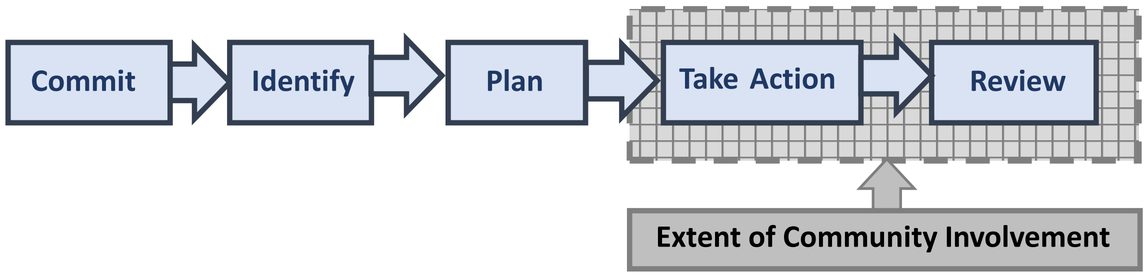

Figure 2.1: Illustration of "Guidelines for a Sustainable Energy Community" (O'Hora, 2010)

More recent renewable energy development guidelines released by the National Economic and Social Council (NESC) in Ireland have outlined the increasing need for meaningful consultation and community engagement in the development processes of low carbon energy projects (NESC, 2014) to ensure more successful outcomes. The NESC's guidelines on developing wind energy in Ireland outlined three components of social support: a process that guides society wide efforts to transform energy systems, an inclusive process of public participation and a process which enables organisations to initiate renewable energy developments (ibid.). Irish policymakers published the government white paper "*Ireland's Transition to a Low Carbon Energy Future"* in 2015 (DoCEaNR, 2015). On paper, this whitepaper placed more focus on the role of communities in Ireland's low carbon energy transition promising increased support for community ownership and development of community energy projects (ibid.). Although there are several guidelines illustrating pathways to low carbon energy transitions, these are predominantly utilising a "top-down" approach to community engagement and participation. These guidelines and frameworks outline the need for meaningful engagement but lack depth and clarity on methods of achieving this. At present, there is a gap between Irish energy policy, the implementation of Irish energy policy objectives and the needs of communities at local level in Ireland. This thesis argues that these guidelines cannot sufficiently aid in the effective implementation of Irish energy policy, as definitions of communities are not universal, nor are community structures and configurations. These top-down approaches have proven ineffective in community low carbon energy transitions where more individualised approaches are needed which acknowledge and engage with varied community configurations.

2.3 Critique of Policy Responses in Ireland

Irish and European policy has been concerned with communities' transitions to sustainable, low carbon societies in recent decades (Heaslip et al., 2016, DoCEaNR, 2015, SEAI, 2010b). To date, energy policy in Ireland has been predominantly technologically based (DoCEaNR, 2015, DoCEaNR, 2014, Connolly et al., 2011, DoCEaNR, 2009, DoCaMNR, 2007) and influenced by technology's generic approach in meeting communities' energy needs. Existing guidelines for the development of energy projects in Ireland acknowledge that meaningful community engagement is crucial, but do not give specific information on how to achieve this (O'Hora, 2010, Fehilly and Timony, 2012). This practice has resulted in a generic approach to community renewable energy engagement that often is not appropriate to communities' specific needs. Community configurations and organisations in Ireland are diverse and culturally distinct, revealing the complexity of low carbon energy transition pathways. At the community level, there are diverse interpretations and perceptions of energy. As a result, literature abounds illustrating that predominant universal approaches to community low carbon energy transitions have been unsuccessful and fostered ill-will in the energy planning process (Walker et al., 2010, Walker, 2008, Rogers et al., 2008, Wüstenhagen et al., 2007, Blake, 1999).

Traditionally, addressing the energy performance of buildings and energy supply has been a major focus of energy policy in Ireland (DoCEaNR, 2012, DoCEaNR, 2009). In tandem with the previously described policy instruments, policy responses in Ireland have typically involved implementing home energy efficiency retrofitting programmes and the creation of more stringent energy efficiency standards (Davies et al., 2014). The significance of social practices are argued as being disincentives to reduce energy consumption as the necessity to undertake daily activities in a certain manner outweigh concerns related to the environment (Shove et al., 2015). Current infrastructures shaping energy demand are designed around a fossil fuel rich economy and are not amenable to alterations in how energy is consumed (ibid.). Understanding energy consumption and pro-environmental behaviour is problematic as they are such complex phenomena that cannot be sufficiently described in a single framework (Kollmuss and Agyeman, 2002) making them difficult to quantify. There are several facets and "grips"[4] in daily energy consumption practices which are difficult to identify, define and dissolve which are crucial to behavioural change (Maréchal and Holzemer, 2015). Added to the difficulties inherent in defining energy consumption are complications related to varied stakeholder perceptions of what the energy planning system should be delivering (Ellis et al., 2010). Currently the Irish and UK public consultation processes assume a deficit in public knowledge which, if filled, will encourage community participation (Catney et al., 2013). Stemming from this assumption, insider/outsider[5] distinctions can develop during public consultation processes (Moran, 2016, Devine-Wright, 2012, Moran, 2007) negatively affecting the successful development of energy projects. Public consultation processes based on the "Information Deficit Model" (Catney et al., 2013) are generally structured in the form of a feedback loop creating a process that spans several differing knowledge epistemologies. Nightingale (2016) addresses this problem of multiple epistemologies that exist in the planning process and describes how the crude nature of feedback loops is unable to deal with the subtleties inherent in the interaction between local and expert knowledges. Nightingale (2016) reaffirms the argument that all points of view are valid but that triangulating equally between them is the most difficult part of the process.

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[4] Maréchal and Holzemer (2015) define "grips" as elements that have to be '(de-) activated' to support a targeted behavioural change. Identifying grips can inform consumption profiles and the design of innovative energy-saving tools.

[5] Insider/Outsider distinctions refers to those distinctions that develop between those within communities and those that are not from the community (Moran, 2007).

Ultimately, during the process of triangulation, the expert views gain prominence and local knowledge is blurred and no longer authentic knowledge (Nygren, 1999). Current practices involve an information-deficit and information-provision approach to energy practices, which does not nurture energy knowledge in all cases (Cass and Walker, 2009). One drawback of the information-deficit model approach to community engagement is that sufficient information is not given to communities to make informed decisions. These gaps in knowledge provision can lead to opposition to infrastructure projects within communities that are unable to determine the most relevant information for their specific situation (Walker et al., 2010, Devine-Wright, 2009). Studies in the UK have revealed that energy consumption is rising due to discrepancies between intention related to energy use and action related to energy use (Whitmarsh, 2009). Gaps in the divergences between what policymakers prescribed as suitable climate change actions (energy conservation) and what the public undertake as climate change actions (for example recycling) (ibid.) are partially responsible for this. Whitmarsh (2009) argues that these divergences reveal there are differences in perceptions in policymakers and the public's perceptions of climate change mitigation strategies. In terms of public incentives to engage in pro-environmental behaviour, climate change is rarely the primary incentive for undertaking climate change mitigation actions and financial incentives are generally deemed more powerful (ibid.). Building on these theories of behaviour change, the barriers to the adoption of the low carbon technologies themselves are also crucial to understanding the complexity of the energy issue. Snape et al. (2015) studied the UK's 2014 tariff based renewable heat incentive scheme which was introduced in 2014 coining the term "hassle factor". Findings revealed that the effort needed to implement low carbon energy alternatives are more prohibitive than previously considered (Snape et al., 2015). In engineering research in smart energy systems and smart grids[6], the complexity and importance of consumer participation is becoming more evident and trends to include consumers as participants are increasing (Verbong et al., 2013). Engineering research

[6] A smart grid is an electrical grid which includes operational and energy measures including smart meters, smart appliances, renewable energy resources, and energy efficiency resources. A smart grid is characterised by increased use of digital information and controls technology (Farhangi, 2010).

acknowledges that understanding the social dimension of smart grids is crucial to their long term success and integration into society (ibid.).

Energy policy design is critical to the success of low carbon energy transitions (Lipp, 2007). There can often be political or economic imbalances in the siting of large-scale renewable energy infrastructures (Cowell, 2010) further favouring large-scale energy supply developments rather than localised community-led development. Spatial plans are often based on the objective to preserve sites of national heritage while neglecting the heritage, needs and value-systems of local and often repeatedly marginalised, populations (ibid.). Additionally, sites that generally have a high potential for successful wind generation projects are generally ones that are remote, wild and have a special meaning to societies (Ellis et al., 2010). Meanings associated to landscape can lead to communities perceiving that negative local impacts from the project outweigh the local benefits that might be accrued in the long term from the project (Cass and Walker, 2009). Perceptions of the equity of the distribution of benefits within communities can also be understood as unbalanced with perceptions often being that only some of the community are receiving a financial benefit (ibid.). These feelings of unfairness in the distribution of prosperity, along with insensitive approaches to siting of large-scale projects often create another dimension to the planning process that is under-addressed in the Irish planning system: opposition based on emotion. Emotion is fundamental to any oppositional activism, is often the driving factor to oppositional groups and it characterised differently by several different stakeholder groups (Cass and Walker, 2009). In a case study of a community wind farm in Scotland, perceptions of emotions were used as tools to refute claims of opposing interest parties (ibid.) developers and policymakers dismissed the legitimacy of emotion in the planning process, while opposition parties used emotional issues that were still "valid planning issues" to pursue their arguments and garner support. Developers' and policymakers' current perceptions of the planning process as one that is devoid of emotion cannot be maintained due to the inclusion of Environmental Impact Assessment[7] (EIA) which acknowledges social implications and feelings about landscape (ibid.).

[7] Environmental Impact Assessment (EIA) is a process for anticipating the effects on the environment caused by a development. An Environmental Impact Statement (EIS) is the document produced as a result of that process (EPA, 2002).

Although considered unimportant by those deemed to have authority, objections posed by opposition parties can significantly slow the development process of energy related projects (ibid.). As a result, the planning system in the UK has become described as one that is overly onerous and a barrier to efficient development of large-scale energy projects like wind farms (Ellis et al., 2010) with the Irish planning system being conceived of in a similar manner. Although opposition may create delays, it is not always influential on ultimate outcomes, even though discourse around planning might describe it otherwise (ibid.). In the past, attitudes were considered as a good indicator of the expected success of any community transition to a low carbon energy source. However, it has been found more recently, that the concept of "attitude" has not been sufficiently defined in order to contribute effectively to knowledge of environmental behaviours (Dobson, 2007). Analysing attitudes cannot help to indicate whether attempts at encouraging pro-environmental behaviour (or reducing energy consumption) will be successful (ibid.) and more nuanced, in-depth approaches are needed. Building on these critiques of energy policy in Ireland, the following section describes how this research sought to investigate successful low carbon energy transitions in Europe and Ireland to develop new understandings of the role of community in these transitions.

2.4 Lessons from Community Energy Transitions in Denmark and Ireland

2.4.1 Introduction

While undertaking initial fieldwork for this research, Heaslip et al. (2016) investigated the low carbon energy transition processes employed by communities in Denmark and Ireland that relatively successfully transitioned to a low carbon society. Heaslip et al. (2016) assert that understanding communities' motivations for transitioning is crucial to successful low carbon energy transitions. Heaslip et al.'s (2016) study consisted of the analysis of two relatively successful low carbon energy transitions in two island communities in Denmark and one rural community in Ireland in order to determine their methodologies for successful low carbon energy transitions. The community transitions in Denmark were undertaken against a backdrop of innovative energy related policy (Mendonça et al., 2009, Meyer, 2004). The European Parliament's *"Energy 2020"* set Europe wide sustainable energy targets including: a 20 per cent reduction in greenhouse gases, a 20 per cent share of renewable energy and a 20 per cent reduction in primary energy consumption by 2020 (EC, 2010b). Many countries in Europe are actively trying to achieve these targets, Denmark is leading the way in the race to increase its share of energy obtained from renewables (Lund and Mathiesen, 2009). Historically, Denmark has been a pioneer in wind energy due to the co-operative nature of its wind energy provision (Meyer, 2004, Christensen and Lund, 1998). Denmark can provide useful lessons on the importance of financial incentives and ownership structures for community renewable energy ownership as well as the social, cultural and political aspects of successful community low carbon energy transitions (Hvelplund, 2006). Mendonça et al. (2009) describe how low carbon energy transitions in Denmark were originally driven from the “bottom-up”, beginning with enthusiasts influencing the political process. This forced the government to provide incentives to encourage development of the renewable energy sector (Meyer, 2004). As a result, a combined “top-down” and “bottom-up” approach, which is still favoured by the EU today (EC, 2010a), was created. A bottom-up process is defined by individual voluntary support and networking within the community in order to realise a certain energy project (Schweizer-Ries, 2008). In an attempt to continue their past successes, in 2012, the Danish government created very ambitious energy targets with the aim of reducing greenhouse gas emissions by 40 per cent by 2020 (The Danish Government, 2013). Denmark aims to have all their electricity and heating supply completely based on renewable energy by 2035 and have all energy consumption, including the transport sector, based on renewables by 2050 (ibid.).

In Heaslip et al.’s (2016) study, five themes emerged from the literature for the investigation of the role of communities in these successful low carbon energy transitions: the importance of local concept, participation, organisation of the project, economic and political aspects of the project and unexpected positives and negatives of a low carbon energy transition. Heaslip et al. (2016) undertook interviews with project managers from three communities that have achieved relative success in their low carbon energy transitions, two in Denmark and one in Ireland (Table 4.2). The interviewees who took part in the study were the renewable energy project managers from the following: Marstal Community in Aerø Island, Denmark, Samsø Island, Denmark and Cloughjordan Eco-village in Ireland.

Table 2.1 Profile of Low Carbon Energy Communities Investigated (Heaslip et al., 2016)			
	Marstal, Aerø Island, Denmark	**Samsø Island, Denmark**	**Cloughjordan Ecovillage, Ireland**
Population	6,669 inhabitants	3,806 inhabitants	140 inhabitants
Area	88 km²	114 km²	0.271 km²
Electricity	Over 80% self sufficient	100% wind power	From national grid
Heating	Over 80% self sufficient	75% from solar power + biomass energy	District Heating 100% biomass + solar power
Exporting	None	84 million kWh	None

2.4.2 Theme 1: Local Concept

Heaslip et al. (2016) argue that the driver for the transition to a low carbon society can often create prejudice or good will early in the development process. This research revealed that all participants perceived their projects as being financially motivated, giving the community a clearer understanding of the reasons for their low carbon energy transition (Table 2.2) (ibid.).

Table 2.2 Theme 1 Findings - Local concept (Heaslip et al., 2016)			
	Marstal, Aerø Island	**Samsø Island**	**Cloughjordan**
Driver and Local Concept	The high cost of oil in the 1970s	High level of unemployment and economic recovery was needed	The Eco-village community wished to create a sustainable village
Current/ Previous Situation	1970s: Completely dependent on imported energy	1990s: Completely dependent on imported energy & high unemployment	1990s: Existing village of Cloughjordan was in decline
Mission Statement	To convert from oil to renewable energy	To create a 100% renewable energy island	To create a sustainable/ eco-village community
Local Concept	Local concept was not an issue, it was important that the cost of heating was reduced	Community input to encourage revival of the local economy and employment kept local	Community input to ensure that the existing community accepted the new residents of the Eco-village

When questioning what community renewable energy means Rogers et al. (2008) analyse what stakeholders feel is distinctive about community renewable energy projects and state that the best type of project is one that is both for and by the people. In each of the communities studied the project managers perceived that the low carbon energy transition was being undertaken in order to bolster their local economy and to reduce their energy costs (Heaslip et al., 2016). The participants' narratives revealed their perceptions that this led to increased support and acceptance of the project in the long-term (ibid.).

2.4.3 Theme 2: Participation

Moran's (2011) highlighting of the problems experienced during expert-lay interactions indicates that communication methods used by those with expert knowledge and those used by members of the community are often incompatible. This often leads to feelings of resentment and a perceived lack of fairness. Heaslip et al. (2016) describe how the participants in their study discussed their perceptions that difficulties were experienced in the early stages of their projects as a result of expert-lay communication. The participants chronicled how public meetings were the solution used in all cases (Table 2.3) where the public can voice their concerns as a group to experts and developers.

Table 2.3 Theme 2 Findings – Participation (Heaslip et al., 2016)			
	Marstal, Aerø Island	**Samsø Island**	**Cloughjordan**
Participation	Public meetings, no survey of opinion, opinions voiced at meetings, existing school involved in communication	Public meetings, no survey of opinion, people voiced opinions at meetings	Public meetings, no survey of opinion, people voiced opinions at meetings, existing school was involved in communication

Lund (2014, 2010) describes how "Discourse Theory" perceives social reality as a linguistic construction and states that different organisations perceive and articulate things differently, leading to different ways of approaching the same problem. In this regard, academic institutions can play a lead role in the dissemination of information in an easily understood manner. Heaslip et al.'s (2016) study revealed how all participants had academic involvement during the development process and expressed the benefit of this experience in terms of community interaction.

2.4.4 Theme 3: Organisation

Heaslip et al.'s (2016) research revealed how participants perceived that both the Samsø and Cloughjordan project successfully used aspects of the bottom-up approach in the development of their low carbon energy projects (Table 2.3). Schweizer-Ries (2008) outlines how the bottom-up approach should be the basis for any long-term successful community renewable project. Schweizer-Ries (2008) concluded that taking social aspects into account increases successful realisation of sustainable energy supply and demand in the future. A key finding from this research was the importance of the "Key Influencer" in community low carbon energy transitions (Table 2.4) (Heaslip et al., 2016).

Table 2.4 Theme 3: Organisation (Heaslip et al., 2016)			
	Marstal, Aerø Island	**Samsø Island**	**Cloughjordan**
Organisational Structure	The organisational structure was already defined in the form of the district heating co-operative	The master-plan was sub-divided into different topics and these were dealt with by different sub-groups	Sustainable Developments Limited co-operative was set up and this company was used to organise the project
Key Influencer	Manager at Marstal District Heating	Director, Energy Co-operative	Project Manager of the Eco-village Project

The key influencers within a community are people who already have the attention of the community as a whole. In the case of low carbon energy transitions, the singling out of a single key influencer can often prove to be of benefit, and this was relatively successful in Samsø and Cloughjordan (ibid.). Cass and Walker (2009) state that, when dealing with emotion attached to place (as is very common in small communities), it is better to deal with individuals rather than a group. In this situation, it is often better to deal with a single representative for the group, the gatekeeper or the key influencer. Barriers exist as both individual (personal barriers) and external barriers (due to participating in a group dynamic) (Clark Ii and Eisenberg, 2008). The concept of the key influencer can be used to combat both individual and external barriers through allaying personal fears and challenging barriers suggested by opposing groups. As support for projects is generally more widespread than the wish to participate (Rogers et al., 2008) the importance of the key influencer as a project manager and instigator is clear.

2.4.5 Theme 4: Economic and Political Aspects of the Project

In all of the communities Heaslip et al. (2016) studied, the funding models were described as “mixed funding” with funding from the government, the community and bank loans (Table 2.5). Participants’ narratives revealed perceptions that this was a relatively successful funding method, as community investment led to more community action, participation and support for the development of the project (ibid.).

Table 2.5 Theme 4 – Economic and Political Aspects of the Project (Heaslip et al., 2016)			
	Marstal, Aerø Island	**Samsø Island**	**Cloughjordan**
Financing	20% seed funding from the Danish Ministry of Climate, Energy and Building, profits from existing district heating co-operative and a loan from Danish green bank (community gave guarantee for the loan)	20% seed funding from the Danish Ministry of Climate, Energy and Building, energy project set up on a co-operative basis and a loan from the Danish green bank (community gave guarantee for the loan)	The company was set up on a co-operative basis, received a loan from Clann Credo Ethical Bank and €700,000 from the EU through the SERVE[8] project
Policy and Planning	Given exemptions due to intervention by the ministry	Given exemptions due to intervention by the ministry	Submitted a proposal to the county council to zone the proposed site for sustainable development so there were less planning application refusals

Warren and McFadyen (2010) argue that mixed financing is the best model for a long-term successful low carbon energy transitions and this was evident in Heaslip et al.'s (2016) findings in this initial fieldwork study.

[8] The SERVE project is an EU funded project and aims to create a region in North Tipperary which is committed to being a leader in the implementation of sustainable energy actions (CONCERTO, 2016).

2.4.6 Theme 5: Unexpected Positives and Negatives

In both the Samsø and Cloughjordan projects (however not in the Aerø project), the participants stated that they were pleasantly surprised with the unexpected positives from the development of the renewable energy projects (Heaslip et al., 2016). They described how they both perceived that there had been a large increase in tourism and this led to the creation of education and enterprise centres in order to provide sustainable development education (Table 2.6).

Table 2.6 Theme 5: Unexpected positives and negatives (Heaslip et al., 2016)

	Marstal, Aerø Island	**Samsø Island**	**Cloughjordan**
Unexpected Positives	None cited	Increase in tourism, creation of an education centre, increased pride in the islanders and increased employment	Increase in tourism numbers, the creation of an enterprise centre and a better quality of life for the residents
Unexpected Drawbacks	Consumers of the heat are still not aware where energy comes from as the district heating company just delivers heat at the touch of a button	Complexity of the project, bitterness has evolved between some islanders in relation to certain aspects of the project	Privacy of the residents is compromised by the constant flow of visitors to the eco-village, the residents had to move from their original homes to the eco-village

Warren and McFadyen's (2010) research indicates that energy projects do not negatively affect tourism, as tourists in their study stated that the presence of community renewable energy projects did not affect whether they would return or not. The described positives that have resulted from these projects are contrary to communities' notions that a low carbon energy transition project may lead to minor benefits for the community in question while there is large local imposition (Cass and Walker, 2009). However, all communities cited negatives that occurred as a result of the projects including inter-community rivalries and a loss of privacy for the residents (Heaslip et al., 2016).

2.4.7 Implications for this study

Heaslip et al. (2016) concluded that although none of the communities studied in their research applied a framework for transitioning to low carbon energy communities, there were similarities across all methodological approaches which cannot be ignored. There were also similarities in the findings across all communities analysed and the key findings which influenced this thesis are outlined below:

- The participants' narratives revealed perceptions that the motivation and mission statement for the project needs to be shared with the community, and align itself with the wants and needs of the community involved
- The participants' narratives revealed perceptions that public meetings are the best method for communicating with communities
- The participants' narratives revealed perceptions that it is important to use any existing organisational structures or networks where possible
- The "Key influencer" was cited by the participants as being the most important person in the development process and a determined, proactive key influencer can mean the success or failure of a low carbon energy transition project
- Using mixed methods of financing for low carbon energy transition projects was cited by all participants as the most successful method of financing projects. These should involve funding from government, community investment and bank loans
- The participants stated that it is important to be aware that unexpected drawbacks to the project may occur and to make the community aware that these may happen as early in the project development as possible (Heaslip et al., 2016).

Heaslip et al.'s (2016) research highlighted the need for the inclusion of place-based and local energy knowledges early in the process of low carbon energy transitions. As described earlier in this chapter, the level of community involvement recommended in the SEAI's *"Guidelines for a Sustainable Energy Community"* (O'Hora, 2010)is significantly later in the low carbon energy transition development process than in the successful methodologies used by both Samsø and Cloughjordan communities (Figure 2.2).

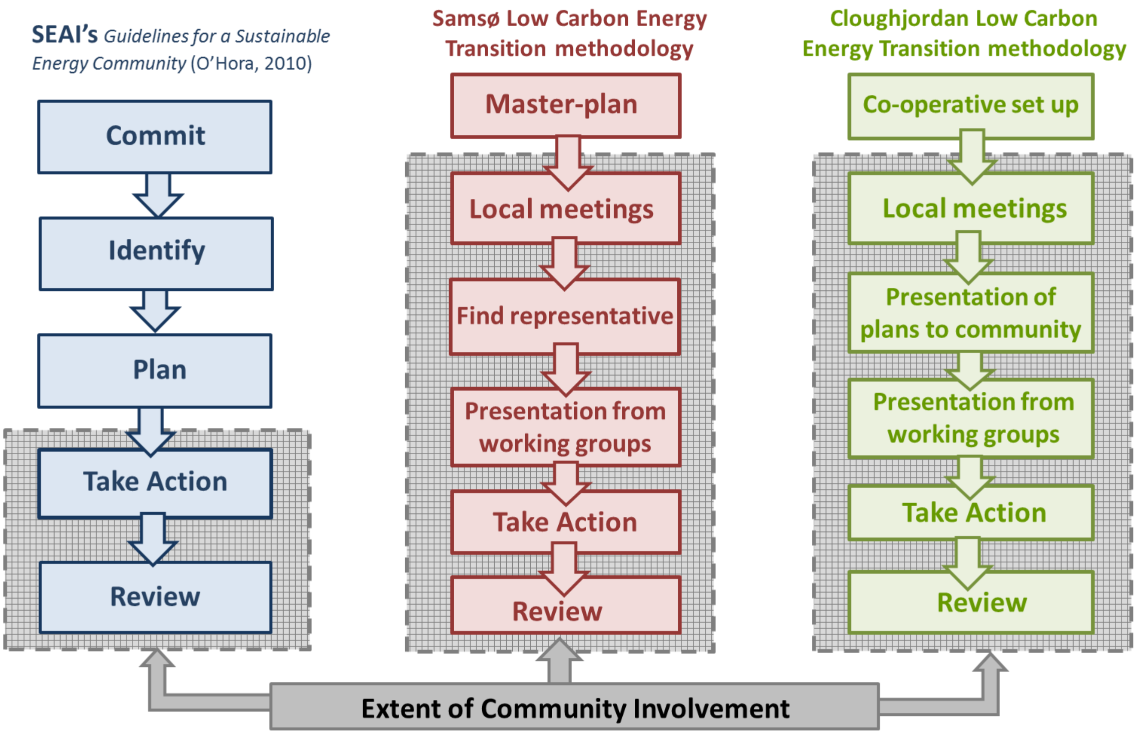

Figure 2.2. Comparison of SEAI's "Guidelines for a Sustainable Energy Community" against findings from (Heaslip et al., 2016)

Heaslip et al.s' (2016) findings influenced this research and led to initial themes being identified for use in the larger body of work of this research. Heaslip et al.'s (2016) study suggests that for a methodological framework for low carbon energy transition planning and implementation to be successful, situated energy knowledges and community involvement needs to play a larger role earlier in the process.

2.5 Conclusion

The aim of this chapter was to examine policy responses and perspectives of community low carbon energy transitions in the Irish context. This chapter provides a comprehensive review of how community low carbon energy transitions are conceptualised within policy and critiques energy policy approaches in Ireland. Analysing policy approaches in Ireland revealed the need for an extensive review of current policy approaches to be more inclusive of situated energy knowledges at community level. Finally, this chapter describes recent research on the role of communities in low carbon energy transitions in Denmark and Ireland. This research reveals the need to engage with communities earlier in the design and implementation of low carbon energy transitions (Heaslip et al., 2016). This research also highlights how, although communities might not employ low carbon energy transition frameworks in their community, the methodologies employed across communities that were relatively successful in their transition are often similar (ibid.). Finally, this chapter describes how literature on community low carbon energy transitions in Denmark and Ireland influenced sensitising concepts for investigation in this research. The following chapter describes the main body of literature influencing this research and the sensitising concepts guiding the subsequent investigations.

Chapter Three: Three Sensitising Concepts – Knowledge, Communication and Governance

3.1 Introduction

Several academics argue that the successful transition to low carbon societies is rooted in community acceptance and societal integration of low carbon energy technologies. These arguments highlight the need to investigate communities as focus of transitioning to low carbon societies. By focusing on "community" this research recognises the broader social contexts within which individuals and households use energy (Shove et al., 2015, Catney et al., 2013). While discussing models and incentives for community ownership of renewable energy projects in his study of community low carbon energy projects in the UK, Walker (2008) describes several barriers to the successful development of community energy that he observed during his investigations. These barriers include legal conditions, economic and technical viability of projects and finally the need for extensive liaison with communities. Blake's (1999) discussion of the value-action gap highlights several barriers to action including, but not limited to: individuality, responsibility, practicality and the involvement of public and expert knowledge in the development process. Büscher and Sumpf's (2015) work also highlights the importance of fostering trust between stakeholders in the development process in order to achieve a more collaborative community energy project. This research builds on previous studies analysing public perceptions and understandings of community energy projects (Rogers et al., 2008, Warren and McFadyen, 2010) and builds on these bodies of research in the context of situated energy knowledges, CKNs and community low carbon energy transitions. Although this research was a fundamental starting point from which to guide further analyses of low carbon energy transitions, more recent works have argued that community relationships with energy are perplexingly more complex (Bauwens, 2016, Burchell et al., 2014, Ellis et al., 2014). Interpersonal relationships, identity, trust, social capital[9] and daily practices have been argued to create an interwoven tapestry of influencing factors, which must be considered when facilitating any sort of low carbon energy transition (Castaneda et al., 2015, Büscher and Sumpf, 2015, Shove et al., 2015, Clayton et al., 2013, Walker et al., 2010, Devine-Wright, 2009).

Contributions to community acceptance and participation in community renewable energy include Clark Ii and Eisenberg (2008), O'Hora (2010) Rogers et al. (2008), Walker (2008), Walker and Devine-Wright (2008) and Warren and McFadyen (2010) in the form of assessment of existing community renewable energy projects and suggested methodologies for community engagement. These works highlight the effect of the individual's placement within a community on their perceptions of low carbon energy transitions. These more social-based and alternative outlooks can be identified as a social constructivist perspective where the emphasis is on the social construction of ideas of renewable energy projects in terms of subsequent participation in and acceptance of these projects (Raymond et al., 2010a, Middlemiss and Parrish, 2010, Letcher et al., 2007, Wüstenhagen et al., 2007). This relatively new outlook has significantly altered and influenced low carbon energy transition research in recent years and consequently, energy policy. This highlights how energy policy and devising adequate solutions for community engagement is paramount to successful low carbon energy transitions in Europe and Ireland (O'Hora, 2010, EC, 2010a). Finding a balance between the technological knowledge of the renewable energy systems needed for low carbon energy transitions, the key influencing factors within a community and the level of community participation in low carbon energy transitions can be problematic. Integrating differing perspectives and understandings of energy that utilise disparate epistemologies is a challenging task and is at the root of the success or failure of transitioning to low carbon energy societies. The chapter outlines the sensitising concepts that guide this research: "knowledge", "governance" and "communication". Although there are other ways of clustering concepts to guide this work, these sensitising concepts were used as modes of problem-centring the investigations. The development of these sensitising concepts were

[9] Social capital is a form of economic and cultural capital with social networks at the core. These networks involve relationships of mutual acquaintance, recognition and trust (Bourdieu, 2011).

influenced by Heaslip et al.s' (2016) study of successful community low carbon energy transitions and the concept of CKNs as being crucial to situated energy knowledge development and subsequently, successful low carbon energy transitions. Catney et al. (2013) argue that previous interventions of providing more information for people with the assumption that certain responses will occur, is not enough and this thesis argues that understanding knowledge and how it is developed is crucial. For this reason, situated energy knowledges and their social and spatial construction are a core concept of this research on community low carbon energy transitions. The sensitising concept "knowledge" refers to the situated energy knowledges of the participants and how this relates to their day-to-day energy practices. This research builds on Catney et al.'s (2013) concept of CKNs and their argument that people already possess valuable forms of knowledge that must be acknowledged. Moving away from the idea of "top-down" information provision, the second sensitising concept of this research "communication" asserts that for knowledge to be permanent, and understood as credible, it must be shared through existing networks that possess the community's trust (ibid.). The sensitising concept of communication is concerned with how people relate to energy information and public consultation processes. The third sensitising concept guiding this research, "governance", applies the CKN approach to energy governance and acknowledges that existing social and organisational networks, which communities understand and trust, have significant influence on perceptions of universal governance techniques. The following section details the literature that influenced the development of the "knowledge" sensitising concept, and the varied ways in which epistemologies affect perspectives of energy.

3.2 Knowledge

"To speak of sustainable knowledge is to begin to speak of the local and the general, the natural and the social"

(Murdoch and Clark, 1994: p130)

Due to the complex nature of perspectives of energy, when investigating low carbon energy transitions, several disciplinary perspectives and scales of energy consumption and production need to be considered. Developments that complemented established place values are more likely to gain acceptance arguing for greater place related values in decision making processes (de Groot and Bailey, 2016). Lang et al. (2012) assert that sustainability issues need to include knowledge from several communities along with goals, norms and visions. However, as described in Chapter Two, the Irish Energy planning system is heavily influenced by expert technical and scientific approaches to the energy provision problem and local knowledge has long been considered as lacking legitimacy in communities' transition to low carbon societies (Heaslip et al., 2016). Nygren (1999) argues that there is an epistemological difference between local and scientific knowledges, and that interactions between developers and locals are defined by those developers. She also argues that developers impose representations on local knowledges ignoring all other meanings (ibid.). In these practices there is little recognition of the fact that scientific knowledge is developed in the same way as local knowledge through trial and error (ibid.).

3.2.1 Defining Situated Knowledge

'Local knowledge' has a connotation that local people are only concerned with their immediate surroundings and subsequently, that their knowledge cannot have wider application (Nygren, 1999). 'Traditional knowledge' connotes a homogeneous, uncontested, system of thought, thus camouflaging the fact that knowledge is iterative and constantly updated (Maldonado et al., 2016). 'Indigenous knowledge' conceals the fact that all people, irrespective of whether they are indigenous to a given area, have developed complicated understandings of the world (Sillitoe, 2004, DeWalt, 1994). Community concerns and knowledges are greatly influenced by their day-to-day activities which vary per location (Glackin and Dionisio, 2016) which reaffirms their social and spatial construction. While investigating the social construction of knowledge, Nightingale (2003) established that triangulation across methods was crucial for validity when investigating situated knowledge. She argued that it was less important what methods were used than how these were used and what questions were asked (ibid.). Objectivity and neutrality in research methods are problematic as all knowledge is partial and situated (ibid.). Nygren (1999) writes that situated knowledges are simultaneously local and global. Nightingale (2003) argues for a new understanding of objectivity which recognises that there are different types of knowledge all of which are equally valid and that academic work is situated, partial and political. It is important to acknowledge that the positions of the supressed are not unaffected by critical re-examination as they are not pure and virtuous positions either (Nightingale, 2003). However, current policy does not acknowledge the situatedness of knowledge and perceptions and understandings of energy. Traditional interventions in behavioural change have comprised of providing the relevant information perceived to inspire change and assuming that individuals will respond accordingly (Dietz et al., 2009), however, knowledge development and behavioural change are not mutually exclusive (ibid.).

Fazey et al. (2006b) explain that expert and experiential knowledge can be separated into: explicit knowledge (easily articulated), implicit knowledge (can be articulated but has not been) and tacit knowledge (knowledge that cannot be articulated). The terms “representation” (Fourez, 1997) and “understanding” allow us to define effectively knowledge, perception and conception (Ingram et al., 2010) and enable discussions of the values that influence knowledge directly. They also help to acknowledge that all knowledge is situated (Haraway, 1988) especially local knowledge and local perspectives (Roberts et al., 2016). This situatedness of knowledge leads to divergent approaches to energy and thus the legitimising of certain knowledges over others as discussed in the next section. Situated Energy Knowledge is defined in this research as energy knowledge that is particular to a specific situation and is situated, partial and political.

3.2.2 Local versus Expert Knowledge

There are a range of knowledges described within literature, each represented alongside their binary opposite for example: tacit knowledge/scientific knowledge (Polanyi, 1958), folk knowledge/ universal knowledge (Hunn, 1982), indigenous knowledge/Western knowledge (Posey, 1983), and traditional knowledge/ modern knowledge (Huber and Pedersen, 1997). Local knowledge has been portrayed as part of a romantic past and as a major obstacle to development (Agrawal, 1995, Heyd, 1995). This romanticism of local knowledge is common in island communities where Irish culture is often preserved at the cost of modernisation (Royle, 2003). Nygren (1999) explains how in the past, local knowledge has been represented as something in opposition to modern knowledge. Characteristic of most of these dichotomies is the concept that local knowledge is spatially configured and rooted in place. Geertz (1983) argues that local knowledge is created based on immediacy of experience while Van der Ploeg (1993) describes local knowledge as being linked to spatially specific practices. It is also argued that local knowledge is a type of shared knowledge that is cultivated within a community (Cohen, 1993) implying that people living in rural or remote communities have unique and shared ways of knowing. Local knowledge is characterised by some as an internally uncontested system arising from a communal commitment to consensus (Browder, 1995, Heyd, 1995), however, others argue that this does not hold true in reality as members within communities all have politically fragmented and socially differentiated knowledges (Nygren, 1999). In her research Nygren (1999) argues that developers imposed representations upon local knowledges and ignored alternative interpretations. She explained that what constituted knowledge was defined by those that were considered to know, rendering other types of knowledge unimportant and voiceless (ibid.). Her study demonstrated how developers imposed particular representation on local knowledges and ignored all other alternative conceptualisations. She argued that local knowledge must be considered legitimate as it is created in the same way as scientific knowledge – through trial and error (ibid.).

Turnbull (1991) argues that it was important to give a voice to local knowledges without becoming overbearing with simplistic theories. Those that have to navigate ecological systems in their daily activities become "adaptive experts" which affects how they develop knowledge (Bransford et al., 2000) and have learnt flexibility in unanticipated events and dynamic social-ecological systems (Fazey et al., 2005). Leino and Peltomaa (2012) argue that legitimacy is only based on the specific context that knowledge is related to and that knowledge is interconnected with networks which associate knowledge with actions. Knowledge is iterative and constantly changing and the state of knowledge at any given time is only a moment in history to be built upon and updated through experience (ibid.).

Indigenous knowledge is knowledge that is held by people who live in a certain place, no matter how long they have lived there (Heyd, 1995) and is often used interchangeably with "traditional knowledge". In order to preserve the nature of indigenous knowledge, it is important that their social contexts are recognised and knowledge exchange in environmental management must be mindful of this (Reed et al., 2014). Innes and Booher

(2004) state that collaborative processes enable local actors to situate their knowledge in the context of what state actors know. The perceived rejection of local knowledge by others that are involved in environmental management can often result in epistemological anxiety (Innes and Booher, 2010). Wilensky (1997) defines epistemological anxiety as a feeling that one does not comprehend the meanings, purposes, source or legitimacy of concepts applied by other epistemic positions. To prevent these tensions in energy planning, Raymond et al. (2010b) argue that participants need to be more aware of others epistemic positions in order to successfully collaborate. While attitudes of scientists towards local knowledge are well documented in literature, the views of local and non-scientist actors assessing their own knowledge are less common (Taylor and de Loë, 2012). Taylor and de Loë (2012) found that participants defined local knowledge in a broad range of ways and although they supported their use in planning technical solutions, they were less inclined to support their use in the early planning of a project. Local knowledge must undergo critical assessment in the energy planning process and it cannot be assumed that all local knowledge is good and worthy of inclusion (Catney et al., 2014, Smith, 2011). According to Walker and Shove (2007) the ordering function of language and the cultural and political need to divide and define the world into legitimate and illegitimate knowledge makes the development of conflicts within development processes inevitable. These divides can result in people learning to sound like environmentalists because they feel the pressure of society to do so (van der Horst, 2007, Barr, 2004). Attempts to navigate these divergent epistemologies, although they can create tensions in energy planning processes, can result in new, hybrid forms of knowledges and transdisciplinary knowledges that are described further in the next section.

3.2.3 Transdisciplinary Knowledges

Movement of people between places results in hybrid knowledges that are comprised of experiential knowledge with multiple spatially defined influences (Clark and Murdoch, 1997). In everyday practice, the boundaries between knowledge systems may be vague and indefinable, but when interaction between the knowledge occurs (such as in community low carbon energy transition planning), these boundaries become more defined and cumbersome (ibid.). These hybrid knowledges and multiple perspectives of knowledge are best approached in an transdisciplinary manner which engages epistemological pluralism and conceptualises problems in several ways (Nightingale, 2016, Maclean and Cullen, 2009). Nightingale (2016) argues that epistemological pluralism is fundamental to investigating climate change (and energy planning) successfully. Research on local knowledge is, by its nature, an inter- or transdisciplinary venture (Smith, 2011) which should draw from social sciences and all other fields of science (Sillitoe, 2004). Glackin and Dionisio (2016) propose a new, transdisciplinary, methodology for engagement called deep-engagement which comprises a range of formal and colloquial actions to support community engagement in urban regeneration. Deep-engagement involves nurturing dependability among involved communities to better embed socio-cultural diversities and local know-how in the processes of urban regeneration (ibid.).

The drivers behind communities undertaking low carbon energy transitions can often have the most influence over a community's acceptance of the proposed energy project (Heaslip et al., 2016). These can regularly create resentment towards the project early in the development process (ibid.). Although the reduction of greenhouse gases is often cited by policymakers as a driver for transitioning to low carbon energy sources, this is not generally the case at grass-roots level (Middlemiss and Parrish, 2010, Blake, 1999). It is important for instigators of low carbon energy transitions to discuss with communities the positives of energy autonomy and energy security (Rae and Bradley, 2012) and ensure that the aims of the low carbon energy transition project are aligned with the needs and wants of the communities involved (Heaslip et al., 2016). The early identification of the type of community involved will affect the ease of development of the project and can be useful information when designing a development strategy. Schweizer-Ries (2008) identifies two types of communities: the "conscious community" (who still have to implement the realisation) and the "realising community" (who have a lack of public consciousness) stating that the methods used for the successful development of each community low carbon energy transition may be quite different. Determining the best method for dealing with different types of communities can lead to differing approaches during the early stages of a project. Rogers et al. (2008) outline the barriers to the acceptance of low carbon energy transition projects and reasons for the community member's reluctance to participate and support these projects in their areas. These include technical and economic factors and chiefly public opposition to wind farms (ibid.).

Research indicates that willingness to get involved in low carbon energy projects is often much lower than willingness to support it, possibly due to the “value-action gap” (Blake, 1999). Value action gaps are the difference between what people say and what people do and arise because of individuals’ attitudes and the social and institutional context for change (ibid.). Studies in England have shown that although the aim of community energy projects may be to involve locals, regularly they are reluctant to take control and look to outsiders for guidance and leadership (ibid.). This reluctance to engage can often create barriers to the successful development of low carbon energy transitions and foster an environment where opposition to projects can thrive. The negative phenomenon of NIMBYism[10] (Not In My Back Yard) and LULU[11] (Locally Unwanted Land Use) can easily be taken advantage of by opposition parties when participation of locals is not present. NIMBY is defined as the “*protectionist attitudes of and oppositional tactics adopted by community groups in relation to a development in their neighbourhood*” (Dear, 1992, p. 288). Unfortunately, opposition to renewable energy projects is quantitatively different from support for projects and not just its binary opposite (Moran, 2011) and comprises of a range of motivational factors. Ellis (2004) describes how “discourses of objection” are varied and wide ranging. He argues that there is a complexity of motivations behind discourses of objection and that, in-line with NIMBYism literature, the views of objectors should not be dismissed as illegitimate (ibid.). Ellis also illustrates the importance of context in understanding discourses of objection and that understanding how an objection is socially constructed may suggest why certain groups object (ibid.). Often in cases of opposition to low carbon energy projects, emotion is used by objectors to gain support while supporters challenge objections with facts (Cass and Walker, 2009). This frequently leads to developers dismissing the concerns of communities as emotional, even though some of those concerns highlighted, although emotionally driven, may still count as “valid planning issues” (ibid.). This thesis argues that social contexts, interpersonal relationships and the emotions that are attributed to these must be acknowledged and

[10] According to Cass and Walker (2009) the term NIMBYism is often used to describe the attitude of objectors to LULUs.

[11] A LULU is a land use that is useful to society, but the neighbours or community object to it (Cass and Walker, 2009).

engaged with to fully understand and investigate community perceptions of low carbon energy transitions. The insider/outsider distinctions inherent in small communities (Moran, 2011, Moran, 2016) often means that emotions involved in the planning process of a low carbon energy transition are more powerful than the logic that it is assumed is applied to the planning process. This section outlined the sensitising concepts developed for this research, along with the main concepts influencing the investigation of the sensitising concept of knowledge. Following this, the literature on situated energy knowledges and conflicts between local knowledge and expert knowledge in energy planning was discussed. This literature revealed the value of transdisciplinary knowledges as a method of enabling collaboration and epistemological pluralism in community low carbon energy planning. Building on the literature reviewed in this section which highlights how differing approaches and epistemic positions lead to tensions in energy governance the next sensitising concept, governance, is explored in the following section.

3.3 Governance

Building effective relationships between knowledge, science, policy, practice and action requires attention to governance (Wyborn, 2015). Governance can be defined as encompassing the various processes and structures shaping individual or collective action solidified through social norms (Cash et al., 2006, Young and Kante, 1992). Building on this, environmental governance brings questions of morals, values and societal commitment into the mix (Hajer, 1995). Co-productive governance focuses on how actors and institutions are embedded within relationships that affect the desired outcomes connecting knowledge with action (Wyborn, 2015). Governance is defined in this research as the structures and processes that determine how decisions are made, power is exercised and responsibilities allocated (Graham et al., 2003). Governance includes interactions among many actors in society beyond government (Kooiman et al., 2005) including individual and community communication. The nature and concept of communities and their ambiguities in creating shared visions, social action and social resilience (Parkhill et al., 2015) creates governance processes that are increasingly complex. These complex processes have detrimentally affected participation in low carbon energy transitions as outlined in the following section.

3.3.1 Defining Participation and Collaboration

Culturally appropriate participation strategies are extremely important in relation to successful integration of local and indigenous knowledge (Escott et al., 2015). Many studies have stressed the benefits, as well as the challenges, of stakeholder participation in environmental modelling and management (Voinov et al., 2016, Cosmi et al., 2003). Delvaux and Schoenaers (2012) explained that until the 1980s, the concept of participation was purely theoretical. After the 1980s, there was a shift to more participative policymaking known as the "New Public Governance" (Osborne, 2006). There is a certain amount of pragmatism on the part of policymakers in encouraging participation as *"a non-consulted public is often an angry one"* (Rowe and Frewer, 2004, p 514). Mielke et al. (2016) criticise stakeholder involvement on the premise that it can often be used in a negative manner to achieve economic or political aims. Stakeholder involvement can also be problematic for their obscuring of the purity of scientific aims, making defining problems more difficult (ibid.). Gerring et al. (2005) argue that the more a state is centralised the more difficult it is for them to create effective participation and empowerment at grassroots level. This is due to the gap between the state power and the grassroots power being so large that it is difficult to develop integrative mechanisms (ibid.).

Participative processes are often problematic in that the stakeholders are in a position of subordination and have no say in the process. Often, the form of knowledge that appears at the end of the process has no relation to their knowledge (Delvaux and Schoenaers, 2012). Public participation is *'a process where individuals, groups and organisations take an active role in making decisions that affect them'* (Reed, 2008, p. 2418). Public participation can be considered as the combination of expert assessments with problem framings of the lay public (Kasemir et al., 2000). Participation is defined in this research as any process including anyone contributing to governance (Paloniemi et al., 2015). This definition approaches procedural and distributive justice as being interactive (ibid.). For these participation processes to function effectively, a certain level of collaborative understanding between stakeholders is necessary. Flower (2003) argues that there were generally tacit barriers that must be accounted for when attempting to create collaborative understanding. Collaboration is typically conceptualised as a cyclical process and mutual trust has been found to be a critical factor (Watson, 2015). Gray (1985) defines a collaborative project as one where two or more stakeholders combine appreciations and resources in order to solve a set of problems which cannot be solved by individuals. Organisational histories and established power relations are important influences on the development and success of collaborative projects (Watson, 2015). Bauwens (2016) argue that there is a diversity of motivations behind community renewable energy as there are several categories of people with different motivations. In order to garner more volunteers to participate in energy projects, it is important to identify the different groups involved and those who have interests in its outcome (Stürmer and Kampmeier, 2003).

Historically, unequal power relationships have had a striking impact on equity in participation in consultation processes, poor governance of which can create resistance to the projects from locals (Baynes et al., 2016). Mendonça et al. (2009) argue that democracy which brings all of the actors into the decision-making process is crucial to a successful decision making process. Engaging stakeholders in the decision-making process means that stakeholders are less likely to shirk their responsibilities when they are involved in the rulemaking of the process (Tyler, 1994). However, these are not mutually exclusive and involvement at an early stage does not guarantee volunteering and participation later in the project. Kalkbrenner and Roosen (2016), in their studies in Germany, found that willingness to volunteer was greater than willingness to invest in the projects and both ownership and living in a rural area increased levels of participation. Often, although there may be widespread support for local generation of renewable energy, desire for active participation tends to be less (Rogers et al., 2008). Residents often perceive themselves as participating consultees rather than project leaders (ibid.).

Public consultation and participation models in Ireland operated on an information deficit model in the past that assume provision of information results in participation. Scholars argue that the Environmental Impact Assessment (EIA) process, currently used in planning in Ireland, clouds the ideal nature of the planning process as one devoid of emotion and operating solely on logic (Cass and Walker, 2009). The EIA process operates on an “information-deficit model” and regularly gives opposition parties a clear platform to highlight their emotional ideas of a lack of justice and fairness in the project development (ibid.). This emotional aspect often leads to what Janis (1997) described as

“Groupthink” whereby group norms that bolster (or harm) morale are created at the expense of critical thinking. One tool for overcoming NIMBYism due to LULU’s and the power of Groupthink, is to encourage communities to financially invest in part of the renewable energy project. Warren and McFadyen (2010) undertook a comparison of public attitudes towards a community-owned wind-farm on the Isle of Gigha with attitudes towards several developer-owned wind-farms on the adjacent Kintyre peninsula. Their findings revealed that the Gigha participants were consistently more positive about wind power than were the Kintyre residents due to community ownership. Although the Gigha residents were more positive it was a difference of degree of positivity and not completely opposing views (ibid). The authors suggest that this may be due to communities gaining positive experiences of a wind-farm situated locally. It has been shown that attitudes to wind-farms have a longitudinal dimension, following a U-shaped curve over time (ibid.). When questioned about wind-farms, communities generally have positive initial responses, but these are often replaced by more negative appraisals when a local wind-farm is proposed (ibid.). These negative appraisals are generally followed by a return to positive attitudes once the community has experienced the wind-farm (ibid.). This method of developing communities’ understanding of sustainable energy leads to more acceptance of renewable energy developments and better support for projects in the future. Rogers et al. (2008) conclude that a clearer framework and more standardised processes with demonstration of renewable energy technologies to raise awareness of community renewable projects are needed. Consideration of multiple perspectives and the social and spatial constructions of understandings of nature need to be considered in any framework or process related to low carbon energy transitions. These perspectives are based on a myriad of motivations, some of which are discussed in the following section.

3.3.2 Situated Energy Knowledges and the Governance of Community Low Carbon Energy Transitions

Situated knowledge is a concept applied across the domains of several different disciplines,but when applied to Science and Technology Studies (STS) this creates problems due to the application of multiple epistemological positions (Eglash, 2011). Eglash (2011) questions the application of social constructivism and situated knowledge to STS studies and asserts that the merging of the disparate concepts can be problematic. He questions how theories can be effectively critiqued if the overarching grounds (rationality, evidence, facts, nature etc.) that are used by scientists to analyse the theories are all socially constructed too (ibid.). Although problematic, the application of the social constructivist perspective portrays low carbon energy transitions in a real world context. The acknowledgement of these social constructions reflects the role of emotion in community energy planning.

Contributing to the issue of emotion within the planning process are the differing approaches to socially constructed issues. There are several different epistemologies of infrastructure planners and these can be described as predict and prevent (top-down processes) and participate and persevere (bottom-up processes) (Evans et al., 1999). Berkes (2002) argues that central agencies continue to rely on traditionally accepted scientific practices and do not have respect for alternative types of knowledge. Discounting local knowledge can lead to outcomes that are based on coerced community acceptance rather than collaboration (Berkes, 2009, Berkes, 2002, Kapoor, 2001). Walker and Devine-Wright (2008) identified two key dimensions to the thoughts of policymakers, the first being the "process dimension" which is concerned with who a project is developed by, run by and who has most influence. The second is the "outcome dimension" which is concerned with how the outcomes of a project are spatially and socially distributed and who the project is for. Several academics argue that bottom-up planning is most important along with regional motives amongst the relative stakeholders (Li et al., 2013).

Delvaux and Schoenaers (2012) argue that attempts to include local knowledge in development projects are divergent from the rhetoric that are used to describe them. These divergences can lead to a lack of trust in those in authority and spawning grassroots opposition groups to energy governance strategies (Morgan and Osborne, 2016). Energy governance is defined in this work as the "*collective action efforts undertaken to manage and distribute energy resources and provide energy services*" (Florini and Sovacool, 2009). High level governance typically employs a "one-size-fits-all" approach to transition strategies (Van der Heijden, 2016). These universal approaches often lead to communities feeling isolated and marginalised from the planning process. When people feel excluded from the decisions that affect them, suspicion and mistrust can often arise towards those decisions (Jobert et al., 2007, Gross and Thompson, 2007). Feelings of exclusion are detrimental to the positive development of interpersonal relationships and trust which are crucial to successful renewable energy development (Walker et al., 2010). Trust and fairness as issues in wind energy development have commonly appeared in studies on community wind energy development (Fast and Mabee, 2015, Ellis et al., 2014, Wüstenhagen et al., 2007). Büscher and Sumpf (2015) argue that trust is more important for consumers and communities than previously thought and must be considered as an alternative concept to acceptance. Trust is a method of complexity reduction and enables action without certainty about the future which is crucial to successful community low carbon energy transitions (ibid.). Trust can reveal new methods of engaging participants in collective action beyond the standard regulatory process (Lange and Gouldson, 2010). Trust based regulatory processes are ones that involve openness and co-operation with stakeholders outside of the policy arena (ibid.), much like transdisciplinary approaches to energy research. Fast and Mabee (2015) found that trust building was crucial to the success of wind energy projects in their case study in Canada. Place-making, or the attachment of meaning to the places we inhabit, was also a key influencing factor (Cresswell, 2014). Local host communities may determine whether a project is acceptable or not based on their trust in the siting process (Fast and Mabee, 2015). Mistrust tends to appear when a community cannot clearly identify any palpable benefits to an energy project in their locale (Cohen et al., 2014, Bronfman et al., 2012). Unfortunately, in recent decades trust in public institutions is declining within Europe and trust is fundamental to their effectiveness and successful operation (Marozzi, 2015, Pellizzone et al., 2015). Letcher et al.'s (2007) findings revealed that trust is a long-term process and a core component of community initiatives. More importantly, they found that trust is easily lost and is susceptible to several different factors including: withdrawal of funding, insufficient engagement techniques and changing government priorities (ibid.). Funding plays a key role in the success of community transitions to low carbon sources and, as outlined in the following section, can determine the level of engagement and participation within a community.

3.3.3 Funding Community Low Carbon Energy Transitions

Hammami and Triki (2016) argue that community acceptance stems from trust, benefit sharing with indigenous people and active participation of communities in the planning and management processes. Germany is a leader in low carbon energy transitions in Europe with economic instruments crucial to the success of their renewable electricity market (Agnolucci, 2006). Almost half of Germany's renewable energy capacity is owned by individuals and local or regional community groups and by the end of 2014 more than 900 energy co-operatives had been established (Yildiz et al., 2015, AEE, 2014). Lam and Law (2016) investigated how crowdfunding has been employed in renewable energy projects in eight international cases revealing how crowdfunding can play a crucial role at the start of the development of a renewable energy project. In a case study of public acceptance of renewable energy in Germany, Zoellner et al. (2008) argue that economic considerations were the strongest indicators of reported acceptance along with early and accurate information and the ability to participate in the planning process. Markantoni and Aitken (2015) describe the role that community benefits can play in low carbon governance in Scotland. They found that there were mixed feelings among the case study communities surveyed about the community benefit schemes (ibid.). There are several types of financial support mechanisms including: feed-in tariffs, tax incentives, and tradable green certificates (Abolhosseini and Heshmati, 2014). Funding within communities is crucial and local markets are key to success in community low carbon energy transitions (Hvelplund, 2006). Focus should be placed on the community levels as a mode for behaviour change (Heiskanen et al., 2010) and energy users should be engaged in the role of citizens, not consumers. Low carbon communities provide a new context for energy-use behaviour change (Middlemiss and Parrish, 2010, Middlemiss, 2008). In the 1970s there was a movement towards local, small scale and collective approach to sustainable energy generation (Smith, 2005) and this was mainly by activists. The rise of grassroots initiatives in renewable energy over the last decade reveals increased opportunities for community engagement (Mey et al., 2016). Much like the energy co-operatives and key influencer described by Heaslip et al., Letcher et al. (2007) found that "mission led" community organisations can make an impact in relation to encouraging behaviour change related to climate change, as can "wilful individuals" or community champions. However, without appropriate guidance and support, these can also have a negative impact and become barriers to progress (ibid.).

Koppenjan (2015) investigated whether co-operatives can be considered as a radical innovation in renewable energy and can contribute to low carbon energy transitions. Co-operatives had a positive impact on low carbon energy transitions in several communities in Europe highlighting their suitability as a funding structure within low carbon energy transitions (Koppenjan, 2015, Yildiz et al., 2015, Kunze and Becker, 2015, AEE, 2014, Viardot, 2013). However, this can be in part, due to different political structures in continental Europe from those in Ireland (Heaslip et al., 2016). One of the key characteristics of co-operatives in Germany is the close interaction of local governments and other local actors (AEE, 2014). Co-operatives in renewable energy production can come in many forms - they can be owned and managed by people who use the services (consumer co-operative), by the people who work there (worker co-operative) or by the people who live there (housing co-operative) (Viardot, 2013). Co-operatives are owned by their members and give everyone an equal voice regardless of their equity share and the board of directors is made up from elected co-operative members (Koppenjan, 2015, Viardot, 2013). However, these shared ownership models can also have drawbacks related to shared consensus and multiple perspectives. Bauwens (2016) argues that co-operative members are not a homogenous group and members can have differing incentives and values. He explained that people who enlisted early were interested in energy security, while people who enlisted later, were interested in the monetary benefits of being part of the co-operative (ibid.). These differing incentives can lead to delays in the decision making process in community low carbon energy transitions. When collectives become involved in renewable energy development, they tend to have a local focus rather than a political one, leading them to prioritise the wellbeing of the community (Islar and Busch, 2016) at the cost of integrative national energy planning. The ways in which these communities are communicated and engaged with, influence community initiatives and are crucial to low carbon energy transitions as discussed in the following section.

3.4 Communication

Leino and Peltomaa (2012) argue that to be successful environmental authorities have to implement the international and national policy norms with a style that receives local acceptance. Difficulties can arise when trying to include local knowledge when locals are interacted with using the discourses of developers, as locals tend to change their knowledge to align with what they understand the developers want (Nygren, 1999). Nygren (1999) found that an understanding of the powerful discourses controlling the predominant representations of knowledges and of the shifting and contested nature of knowledges is crucial to empowering local knowledges. However, eliciting knowledge in order for it to become explicit knowledge can mean that it loses its connection with the individuals deep tacit knowledge (Polanyi, 1958) whereby it loses its relationship with the context within which it is created (Barab and Plucker, 2002). Any individual or group of people will have certain biases that influence how they develop and articulate experiential knowledge (Fazey et al., 2006b) and these need to be extracted in order to be understood by others. Science- local relationships need to develop mutual dialogues (Bodorkós and Pataki, 2009) in order to activate local capabilities and networking across diverse local stakeholders.

Leino and Peltomaa (2012) argue that one must study the local actors and their informal and formal networks in order to understand their practices of governance and knowledge exchange. The importance of place in European debates on climate change policies has become clear and this raises difficult challenges for governance (Healey, 1998) including the establishment of mutual dialogues across relevant stakeholders. Achieving mutual dialogues is about trying to achieve more efficient ways of conflict management in governance as it is anticipated that stakeholders who think differently act differently (ibid.). Difficulties in achieving mutual dialogues reveals that planning is an interactive process and a governance activity shaped by economic and social activity (Healey, 2003). Catney et al. (2013) set out CKNs as an alternative approach to energy planning and justice in low carbon energy transition processes. Catney et al. (2013) rejected the "deficit view" of individuals as entities devoid of access to information, therefore having no incentive to act. It is important instead, to examine the processes of how individuals come to know about low carbon and renewable energy. In using the term "knowledge networks"

Catney et al. (2013) move away from the idea that top-down information provision is what is needed for individuals to change their behaviours, but more that individuals already possess tacit or local knowledge in relation to energy practices in everyday life. If knowledge is to be cultivated and made durable within communities, it must be done within the context of existing community networks and interpreted in the context of their existing relationships and cultural interactions (Morgan and Osborne, 2016, Gilchrist, 2009). Catney et al.'s (2013) approach offers an analytical framework to identifying the extent to which social interaction matters in structuring energy practices. In these CKNs, "nodes", much like the concept of the key influencer (Heaslip et al., 2016), are described as points where information is passed and knowledge is nurtured in these social contexts. Gilchrest describes these nodes as areas where "*connections are made either through individuals or organisational units*" (2009: p8). She continues to elaborate how some nodes are more critical that others and are influential persons for changing relationships and practices (Gilchrest , 2009). The assumptions underlying Catney et al.'s (2013) work is that institutions, individuals and sites are information provision "nodal points". The "Principal of Recognition" is central to the CKN approach as it seeks to recognise the knowledge that people already hold and the networks and practices within which they already engage (ibid.). The CKN approach involves a micro-geographic approach which connected people to the institutions and sites that acted as sources of knowledge (ibid.). When applied to this research, the CKN approach essentially examines the complex processes by which people come to learn about energy and argues that new knowledge development is going to be have to be *"done by the existing networks that they know and trust that are grounded in their own contexts and relationships"* (ibid.: p507). When assessing the existing knowledge networks within communities, it is crucial to determine the existing information distribution structures and modes of information provision that have garnered the trust of the community. The next section discusses these modes of information provision from the perspective of community low carbon energy transitions.

3.4.1 Information

In the past, governments have resorted to mass campaigns in an attempt to educate the public about energy but these have been considered largely unsuccessful (Simcock et al., 2014). Current practices involve an information-deficit and information-provision approach to energy practices, which does not nurture energy knowledge in all cases. However, Stoutenborough and Vedlitz (2016) argue that more scientific knowledge is needed within the public to ensure accurate risk assessment and to encourage behavioural change. There is a presumption that public apathy to the democratic system can be overcome by delivering positive messages related to the benefits of democracy (Burgess et al., 1998). There exists ideas of an information-deficit in the public in relation to energy practices and environmental issues and that filling this gap with expert knowledge will lead to individuals accepting their responsibilities and changing their lifestyles (ibid.). The present "downloaded responsibility" form of individual action where the state provides information to already active citizens to help them take action in their everyday lives (Catney et al., 2013) has proven to be unsuccessful, as only the already active participate. The CKN approach is based on the theory that some communities are better equipped than others to meet energy challenges and transition effectively to low carbon lifestyles due to their organisational structures and social structures (ibid.).

The EIA is the predominant mode of information provision in the process of energy infrastructure development. Within this process, the most important mechanism in public consultation is the public meeting. However, these are criticised for their lack of meaningful participation (Crow et al., 2016). This is partially due to the control of "sensitive information" by local authorities which is a challenging area of information management (Sheppard et al., 2015). Sheppard et al. (2015) argue that there needs to be more transparency in informing the public about what information is sensitive and what is not. The inherent uncertainty in the EIA process is often worsened by the lack of transparency in relation to information provided and the vocabulary that is used to convey it. Masden et al. (2015) define several types of uncertainty- random uncertainty (natural variability) and systematic uncertainty (related to human understanding) which can be overcome by standardising the vocabulary used in the conveying of EIA results. In recent years, it is not only the information that is falling under scrutiny, but the trustworthiness of the authority is also in question (Sheppard et al., 2015). People tend to trust information from what they perceive to be a credible sources and do not tend to make independent evaluations of the information (De Fine Licht, 2014). Trust therefore is linked to transparency as third parties need to have confidence in the planning officers and that they have made appropriate use of the information provided to them (Sheppard et al., 2015). Increasing meaningful participation means ensuring access to information to the greatest extent possible.

Delvaux and Schoenaers (2012) argue that if an actor's knowledge modifies the representations of another actor, the "new" knowledge is modified to the criteria of what the target actor (or the policy sphere in this case) considers valid. In the past, when politicians wished to deal with a particular problem they often consulted a specialist in the problem being considered (Horlick-Jones et al., 2001). The transfer of knowledge between actors and processes of translation or transformation are heavily influenced the representations held by various actors (Freeman, 2009). To date, standard practice has been to determine attitudes to projects, similar to the work of Warren and McFadyen, (2010). Specifically, Warren and McFadyen (2010) assessed the influences of different development models on attitudes to windfarms by comparing public attitudes towards a community-owned windfarm on the Isle of Gigha with attitudes towards several developer-owned windfarms on the adjacent Kintyre peninsula. However, the differences were differences of degree rather than diametrically opposing viewpoints (ibid.) highlighting how assessment of attitudes is a crude method of determining the varied perspectives within a community. In their case study of a wind farm proposal in Northern Ireland, Ellis et al. (2007) describe how, even though the Northern Ireland population has been quoted as the most supportive of wind farm projects in the UK, objections still arise. Ellis et al. argue that a multiplicity of factors shape and influence public attitudes to wind energy and the complexity of the problem cannot be defined with precise and quantifiable answers, as they are moulded by deep values (Ellis et al., 2007). These values can be affected by situated and social factors and the CKNs that individuals are embedded in, both locally and globally. Communities across Europe support the use of a mix of traditional and modern communication techniques to communicate low carbon energy transition proposals (Wilker et al., 2016). The inclusion of modern information technologies has resulted in the media now having a significant impact on situational legitimacy[12] and situated energy knowledges within communities (Leino and Peltomaa,

[12] Situated legitimacy argues that meanings are given by actors in specific contexts and these meanings are continuously constructed through discursive processes. This argues that the situating of legitimacy itself plays a reciprocal, highly political role in shaping those processes (Connelly et al., 2006).

2012). As the number of sources of media in our daily lives grow and citizens take more part in distribution and reporting of media making reconstructing events, questioning the authority of policymakers easier (Hajer, 2009). The following section summarises the key literature and sensitising concepts their impact on this research.

3.5 Conclusion

This chapter describes the sensitising concepts that guide this research: “knowledge”, “governance” and “communication”. The chapter begins with discussing the sensitising concept of knowledge and argues that knowledge is situated, socially constructed and never static. This chapter also argues the importance of acknowledging the different epistemological positions in community low carbon energy transitions and the value of local knowledge in development processes. Knowledge plays a key role in communities’ participation in community low carbon energy transitions. Understanding the importance of existing community processes is crucial to the success of communities’ transitions to low carbon energy societies. This section describes the concept of CKNs and their key role in situated energy knowledge development. Following this, communication norms that are employed in the public consultation process in Ireland are critiqued. This chapter argues that more consideration must be given to CKNs (particularly in island communities) as these are central in the development of situated energy knowledges and thus, successful transitions to low carbon energy societies. The final section of this chapter outlines the current public consultation process in Ireland, critiquing its lack of inclusion of local knowledge. This chapter also argues that more collaborative and participative approaches can lead to increased integration of local knowledge for more successful project development. Next, this chapter explores existing governance at national, local and island level, arguing that the universal approach currently employed does not sufficiently deal with situated energy knowledges. Finally, this chapter argues that funding structures at European, national and local level significantly affects governance structures and their effectiveness. This chapter marks the end of Part One of the Thesis, discussing the background and context of this research. The next chapter begins the second part of this research, Part Two – Methodology, which contains two chapters outlining the methodology applied in this research. The first chapter in Part Two, Chapter Four, describes the current landscape of energy research within island communities, arguing that more focus needs to be placed on the social and spatial construction of energy knowledge. This chapter then continues to describe in detail the case study community, the rationale for its selection and current literature and philosophical debates around social constructivist approaches to energy in communities. Finally, the significance of a constructivist approach to researching energy in islands is discussed and the importance of a social epistemology in linking technical, political and community claims to knowledge on community low carbon energy transitions pathways within island communities.

PART TWO: METHODOLOGY

This part of the thesis presents the methodology developed and tested in the study and explains how the literature was drawn upon in making fundamental methodological decisions. These decisions included the application of a social constructivist perspective embedded in a transdisciplinary post-normal science approach. This part of the thesis contains two chapters - Chapters Four and Five and introduces the hybrid social scientific and engineering methodology developed in order to approach the topic from differing disciplinary perspectives. Chapter Four outlines current perspectives and approaches to energy research in island communities and their influence on the research design developed for this study. This chapter also describes the case study location, the rationale for its selection and the rationale for the use of a social constructivist perspective to investigate this topic. Chapter Five is devoted to introducing the transdisciplinary methodological design as this study adopts a relatively innovative approach, requiring justification. One key aspect of the methodological approach is reflexivity and reflection on this method forms part of the contribution of this study. This chapter explains "step-by-step" how and why certain tools and techniques were employed at each stage of the research process, and evaluates their effectiveness.

Chapter Four: Researching Energy in Inis Oírr – A Social Constructivist Approach

4.1 Introduction

Initial fieldwork for this research revealed the opportunities that islands offer for undertaking in-depth analyses of low carbon energy transitions (Heaslip et al., 2016). Islands provide a unique social and geographic landscape for investigating the role of communities in low carbon energy transitions, while their geographic isolation make them easily auditable from an energy demand perspective (ibid.). Their unique geography has caused them to be understood in inconsistent and erroneous ways in the past resulting in their isolation and strengthening linkages within their self-contained communities (Royle, 1989). Demand and perceptions of energy are place-based, thus island energy needs differ culturally from mainland approaches to energy demand and infrastructures. Small offshore islands[13] are heavily dependent on external linkages and product importation (Cross and Nutley, 1999). These islands are more likely to exhibit problems of economic viability, social isolation and external dependency generally in adverse proportion to their size and population (ibid.). Small islands which lie offshore of a much larger island (mainland) are particularly liable to demonstrate economic and political dependence (Royle, 1989). This insular status subsequently creates peripheral isolated communities in both the geographic, economic, political, energy and social sense. This peripherality often translates into economic marginality and neglect by the central power (Cross and Nutley, 1999). This marginality also spans into the domain of energy and energy provision. Often, peripheral communities' services are not in-line with those in mainland communities, creating animosity towards mainland energy policies and governance structures (ibid.). As a result, social interactions, activities and services in island communities are compositionally divergent from those in mainland communities.

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[13] Offshore islands are defined in this work as small islands which lie offshore of a much larger island or mainland (Royle, 1989).

Public participation in the development of community energy projects is lacking in island communities (Horlings and Kanemasu, 2015, Cross and Nutley, 1999). This thesis argues that this is due, in part, to predominant universal-policy approaches to community consultation which further marginalise periphery or island communities where, typically, local knowledge is highly valued (Royle, 2002, Cross and Nutley, 1999). This gives more meaning and significance to the economic and social pressure of energy resource dependency than in mainland communities. Offshore island communities are generally one hundred percent dependent on imported energy and thus, are facing an increasing cost of living due to rises in the cost of energy (Denny and Keane, 2013).

This chapter describes the consequences of geographic remoteness of life in islands while discussing the current state of energy research in island communities. Following this, the rationale behind the use of an island case study and their unique situated knowledges and strong CKNs are explored. This chapter then continues to describe the rationale for choosing Inis Oírr as a case study and the particular energy related structures on the island. The final section of the chapter discusses current literature on social constructions of community low carbon energy transitions. This chapter concludes by arguing that a social constructivist approach is most appropriate for effective investigation of the role of situated energy knowledges and CKNs in community low carbon energy transitions. The following section introduces discussion of the influence of geographic peripherality and isolation on daily energy practices in island communities.

4.2 Geographic Remoteness and Island Life

Isolation is difficult to define as it deals with geographic isolation and poor external linkages, but also has a defining impact on a community's values and expectations (Cross and Nutley, 1999, Nutley, 1980). In their study of Gola Island in Cork, Ireland, Aalen and Brody (1969) attributed population losses to the islands being made more geographically accessible to the external markets. The same problems have been persistent in Irish island communities throughout history with the burgeoning depopulation from the 1840s to the 1970s and the subsequent increase in population in the 1990s, which has been proven to be delicate (Walsh and Bradley, 1991). During the 1950s and 1960s depopulation threatened islands and those that could not increase capacity fell victim to evacuation, for example the evacuation of the Great Blasket Island in 1953 (Mac Conghail, 1987) and

Gola Island in the end of the 1960s (Aalen and Brody, 1969). Although other islands might not be considered as depopulated, many of them are populated during the summer months only (ibid.). Tory almost fell victim to evacuation in the late 1970s and early 1980s, despite maintaining a population of over 200 people (Péicín and Nolan, 1997). Isolation has not only contributed to islands depopulation, but has also led to Irish islands being depicted in a myriad of ways in Irish literature (McIntyre, 2009, Feehan et al., 1994, Robinson, 1986, Synge, 1934). For Joyce and his contemporaries, the Aran Islands were associated with a brand of Ireland from the past (McIntyre, 2009). The islands became representative of an entity that was still whole while the rest of Ireland was crumbling under British rule (ibid.). Synge repeatedly describes the Aran Islands as being primitive (Synge, 1934) and those that live there as charming primitives (Leder, 1990, Synge, 1934). These images have led to heritage in Irish islands being preserved at the cost of modernisation. Royle (2003) defines 'heritage' as something from the past that has a positive attribute and a commercial attribute.

There have been many studies in the past in relation to technical energy solutions for island communities and the economic viabilities of these solutions (Denny and Keane, 2013, Chen et al., 2007, Mitra, 2006, Duić and da Graça Carvalho, 2004, Weisser, 2004). Although much consideration has been given to islands due to their unique isolation in terms of technical and economic systems, the social consequences of this isolation has not been sufficiently explored. This thesis argues that proposals for island community energy transitions must be considered within their place-based contexts and the situated energy knowledges of island communities to ensure a more collaborative and participative process. Several academics have argued that "energy islands" play a key role at the European scale and the Baltic states are seen as experiencing severe energy isolation that needs to be dealt with by interconnection and co-operation (Bridge et al., 2013). Energy autonomy in islands is seen as a key instrument in the UK's transitions to a low carbon society (Rae and Bradley, 2012). High costs of grid connections offer opportunities for energy autonomy that are rarely available in mainland communities. However, this autonomy can also be troublesome, with the need for several modes of energy provision in order to account for stability in the grid due to intermittency in renewable energy provision (Kuang et al., 2016). Although geographic isolation offers up possibilities for completely decarbonised energy systems, the close-knit uncontested knowledge systems that evolve as a result can have negative impacts on participation in island communities (Cross and Nutley, 1999). The following section of the thesis details the current state of participation within island communities in Ireland and its complex relationship to attachment to place and place-related identities, specifically within island communities.

4.2.1 Islands and Energy Planning Processes

In their study of place-attachment in Tenerife in the Canary Islands, (Hernández et al., 2007) found that the bonds of attachment and identity with the island were stronger than bonds with the neighbourhood their participants lived in. This highlights the strength of place-attachment within island communities and how identity is bound up in island living (ibid.). Place-attachment is a complex phenomenon comprising of an emotional bond between individuals or groups and the locations they inhabit (Low and Altman, 1992). Place-identity refers to those dimensions of self, that define who we are, such as symbolic connections to place and the feelings associated with that place (Proshansky et al., 1983). Raymond et al. (2010a) found that there was a significant relationship between place-identity and attachment and willingness to undertake pro-environmental behaviour and place-protective actions (Devine-Wright and Howes, 2010). Hay (1998) argued that ancestral and cultural connections are important in the development of place-belongingness as is a very strong bond to home and it's environment. Devine-Wright and Howes (2010) propose an alternative view to NIMBYism called disruption to place-attachment and the theory of social representations in their case study of a wind project in Wales. The results illustrated the important role of place-attachment in shaping so-called NIMBY responses along with the critical role of trust (ibid.). Place-identity can be described as a personal identity where one describes oneself as belonging to a place (Hernández et al., 2007) or as the link that people have to specific settings (Hidalgo and Hernandez, 2001). Although Devine-Wright and Howes (2010) acknowledged that there is a link between place-attachment and opposition, their findings suggest that the strength of the attachment to place does not directly lead to opposition. They found that opposition depends on how the proposed change is being interpreted by people, and how much trust these individuals have in the authorities or organisations involved, both of which are socially constructed (ibid.).

Identity is a complex concept which can be defined as a way of describing or conceptualising the self which may include membership in certain groups and connections to geographical locations (Devine-Wright and Clayton, 2010). It includes descriptions that one makes internally as well as descriptions that are made by others (ibid.). This desire to cultivate identities that are interpreted by others can have both positive and negative effects on community low carbon energy transitions. Devine-Wright (2011) in their study of a tidal wave energy project in Northern Ireland found that support for the project was bolstered by community beliefs that the project would bring positive worldwide attention to the locality. Building on these discussions of place-attachment, identities and unique energy practices in islands, the following section describes the selection of the case study community. The rationale for the selection an island community is discussed and the concept of social constructivism is described.

4.4 Case Study Community – Inis Oírr Island

4.4.1 Introduction

Leder (1990) describes the Aran Islands as having a unique character that embodies a balance between traditional and modern lifestyles. Inis Oírr is described as exuding a calm sincerity, peaceful and dominated by a hill overlooking a white beach (Feehan et al., 1994). Inis Oírr is one of the three Aran Islands which are renowned for their culture, language and archaeological heritage which aids them in maintaining a successful tourism industry and garnering significant state funded support (Robinson, 1986). Cross and Nutley (1999) argue that this state support is the main reason as to why Inis Oírr is able to maintain its population even though there have been several enterprise failures in the past. Royle (2003) describes how traditionally, the Aran islanders farmed, fished, sealed, took kelp (seaweed, for iodine production), took material from the beaches, smuggled and made illicit spirits. Residents of the Aran Islands create their identity around the concept of the island saying that "*we call ourselves islanders*," (Hyman, 2003). Islands can conjure up images of despair and memories of a lost past (Klaus and Stephen, 2003). This unique way of life creates an uncommon landscape of energy practices revealing the spatial and social construction of understandings of energy and energy practices. The next section describes the mechanics of conducting case study research and the unique transdisciplinary approach developed and applied in this study. This section also describes the suitability of islands as communities for investigating the role of situated energy knowledges and CKNs in low carbon energy transitions from a transdisciplinary perspective.

4.4.2 Rationale for Selection of the Case Study Location

The boundaries between communities can often be difficult to determine. Energy and information flows across neighbouring communities can often dilute the reliability of community-based studies. Rae and Bradley (2012) describe the notion of “Bioregionalism” as a method of delineation between communities in terms of case-study research. Bioregionalism is nowhere more evident than in an island community. Energy to island communities has to be imported and most of this is by sea, making them easily auditable energy communities from a technical perspective (Cross and Nutley, 1999). This was a key factor in the selection of Inis Oírr Island in the West of Ireland as a suitable case-study community. Inis Oírr’s remoteness from mainland Ireland gives it a uniquely suitable position as an easily auditable community in terms of energy consumption. Inis Oírr is one of the Aran Islands, which consists of Inis Mór, Inis Meáin and Inis Oírr and is situated approximately 8 km off the west coast of Ireland in Galway Bay with a total land mass of approximately 5,254 hectares (Figures 4.1 and 4.2). Most of the buildings in Inis Oírr are positioned to the north of the island (Figure 4.3) and there are two hotels, a convenience store, a campsite, a sports field, a primary and secondary level school a co-operative office, a health centre and a graveyard on the island (Figures 4.4 and 4.5).

Figure 4.1: Location of the Aran Islands in Ireland (adapted from (GCC, 2016))

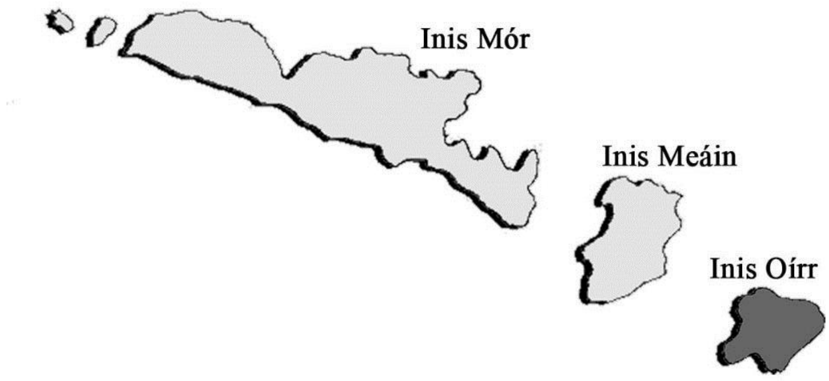

Figure 4.2: Location of Inis Oírr in the Aran Islands in Ireland (adapted from (GCC, 2016))

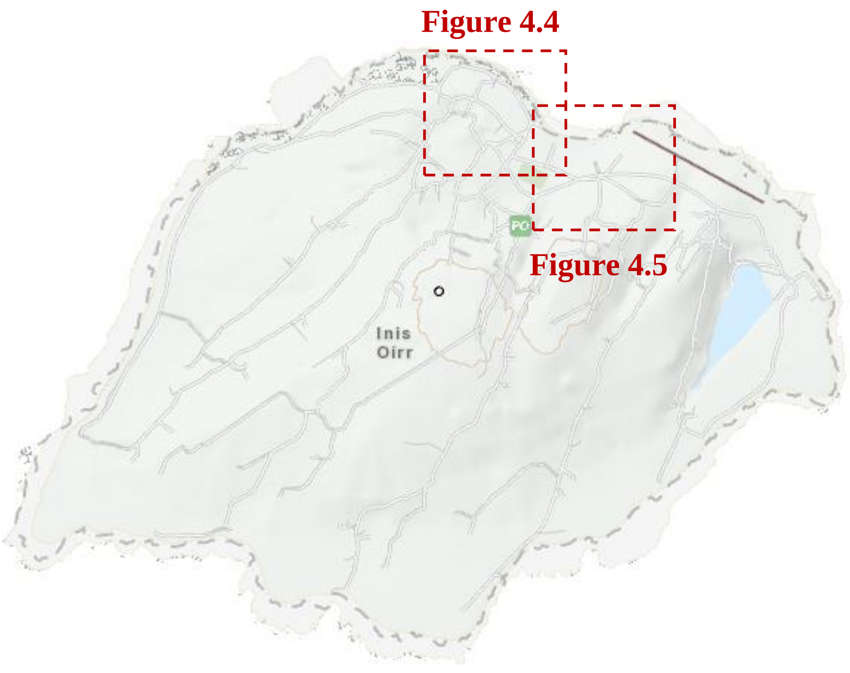

Figure 4.3: Map of Inis Oírr (Source: (GCC, 2016))

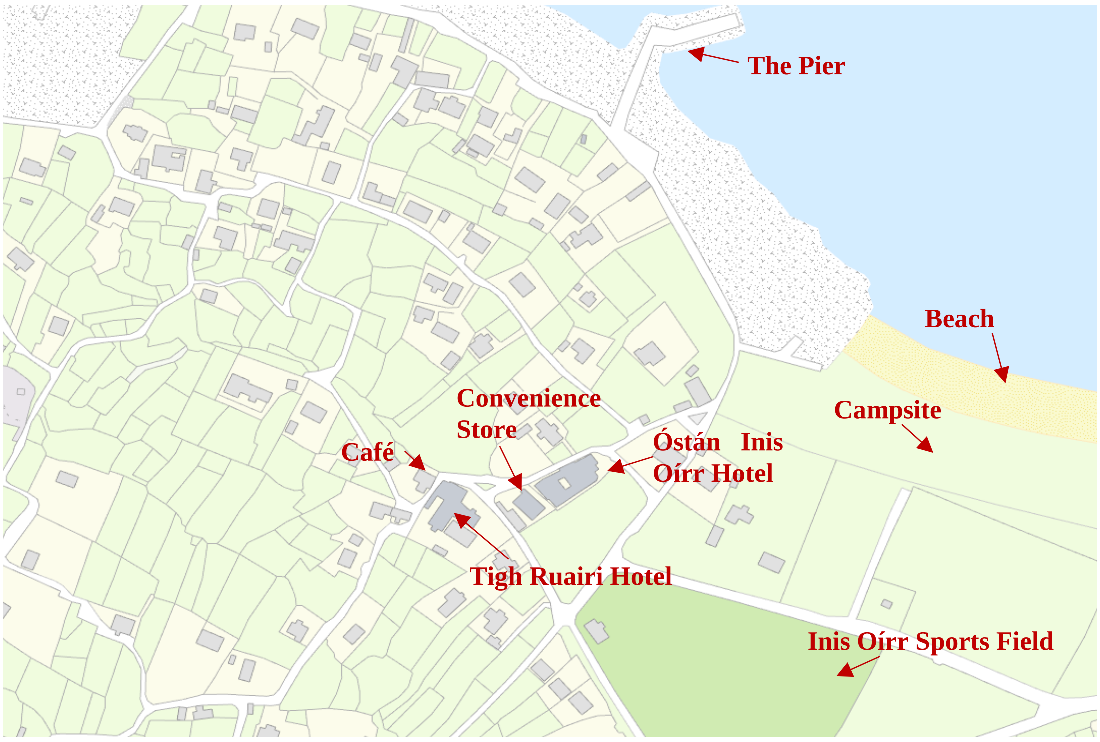

Figure 4.4: Detailed Map 1 of Inis Oírr (Source: (GCC, 2016))

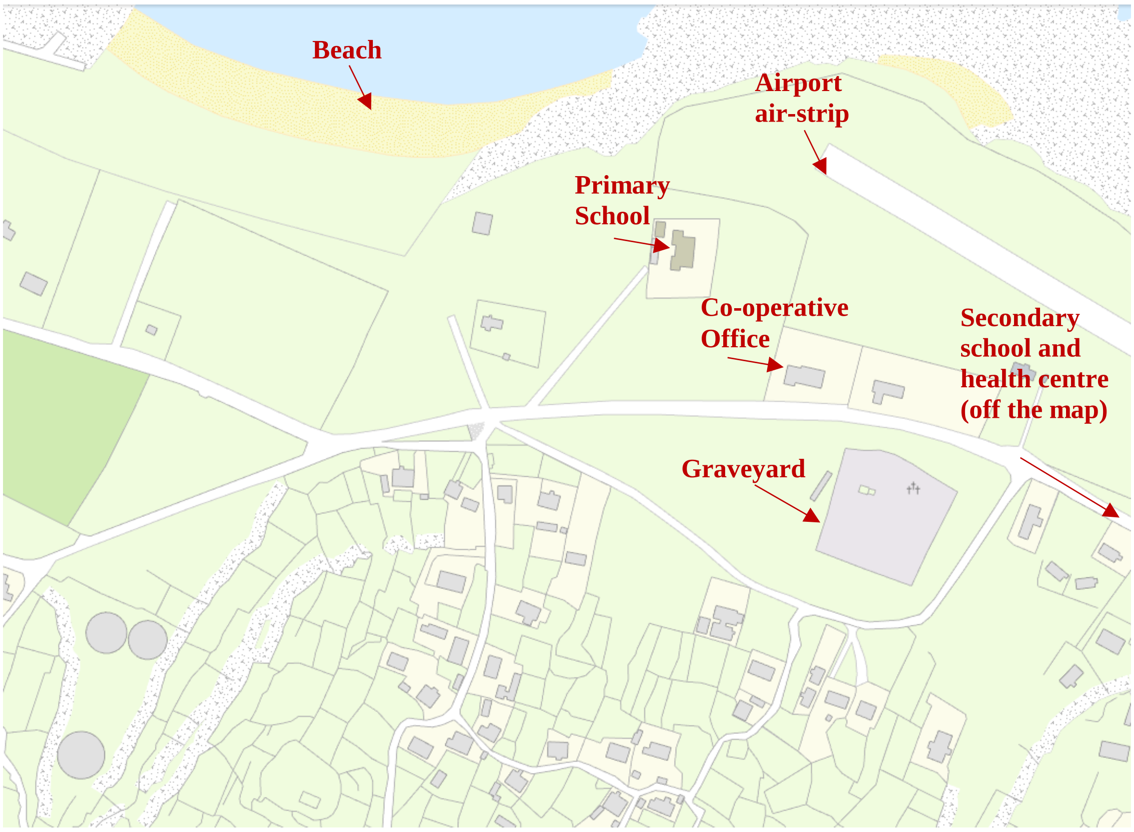

Figure 4.5: Detailed Map 2 of Inis Oírr (Source: (GCC, 2016))

Inis Oírr is the smallest of the three Islands (BIM, 2012) and the islands are separated by the North and South Sounds (narrow sea or ocean channels between two bodies of land) from the counties of Clare and Galway respectively. Inis Oírr has a population of approximately 249 people (CSO, 2012). Inis Oírr's population is concentrated in the north of the island and is spread across four villages named according to their geographical position; high, low, castle and terrace with natural ravines or rift valleys dividing the villages. During the 2011 census the population of the island was recorded as 131 men and 115 women with a range of ages, with 1 person not present (CSO, 2012) (Table 4.1).

Table 4.1: Population of Inis Oírr by Sex (CSO, 2012)		
Age	**Male**	**Female**
< 18	25	30
19 - 24	1	1
25 - 34	20	12
35 - 44	13	11
45 - 60	40	27
60 - 70	18	12
> 70	14	22
Total	**131**	**115**

Inis Oírr is in the Gaeltacht region in the West of Ireland and Irish is the spoken language. Since the foundation of the Irish Free State in 1922 and the designation of the Gaeltacht area, it has been seen as the living repository of the Gaelic tradition that could eventually spread itself throughout Ireland (Denvir, 2002). The Gaeltacht areas in Ireland are situated in remote coastal or island regions mainly along the coast of Ireland (ibid.). Their enduring traditional Irish culture attracts tourists by their authenticity however, after the 1950's, the process of modernization and the shift from the Irish language to English, began to emerge in the Gaeltacht, similar to the rest of the country (ibid.). During this time, the Gaeltacht moved from traditional agriculture, fishing and simple lifestyles to a tourism-led industrial, commercial, and service economy (ibid). Percentages of Irish speakers in true Gaeltacht areas have remained stable over time (between 70–80) (ibid.) percent, however, the absolute number of native Irish speakers has been steadily declining [14].

[14] The official Gaeltacht was defined by the Gaeltacht Act of 1956 (eISB, 2017). The term "fíor Ghaeltacht"(true Gaeltacht) has come to denote areas where Irish is still the dominant community language.

The level of Irish speakers in Inis Oírr remains relatively high at 98%. During the 2011 census, 233 persons in Inis Oírr stated that they had to ability to speak Irish (Table 4.2).

Table 4.2: Inis Oírr Population aged 3 or over by ability to speak Irish (CSO, 2012)

Ability	Persons
Yes	233
No	4
Not stated	1
Total	**238**

The Aran islands market their heritage, culture and landscape which is based on their unusual drystone walled fields and Iron Age stone forts (Royle, 2014). Income from tourism has been a core source of income for the islanders for many decades and has afforded many islanders to inhabit modern, comfortable bungalows which are of a different vernacular to the traditional whitewashed thatched cottages which tourists photograph (ibid.).

Inis Oírr has the Áras Éanna Teo heritage centre and locals with horse drawn horse and carts greet tourists off the plane and the ferries in the hope of getting hired to take them on a tour of the island (ibid.). There are several opportunities for the tourists to purchase keepsakes of their visit to the island with Aran sweaters, a traditional garment adapted in the early twentieth century into a more easily manufactured product by enterprising local women looking to supply visitors with souvenirs (ibid.), available in An Ceard Siopa, the local craft shop.

Due to the touristic nature of Inis Oírr, there are several seasonal summer houses on the island, which are used normally inhabited from March/ April to September/ October. During the 2011 census, the total housing stock was recorded as 174, of which vacant households (or seasonal summer homes) numbered 63 (CSO, 2012). The housing stock on the island is varied in size and ranges from 1 person house households to 4 person households (Table 4.3).

Table 4.3: Private households in Inis Oírr by size (CSO, 2012)

Size of family	Households	Persons
1 person	33	33
2 persons	27	54
3 persons	14	42
4 persons	15	60
5 persons	13	65
6 persons	2	12
7 persons	0	0
8 or more persons	0	0
Total	**104**	**266**

The island that the tourists see when they visit Inis Oírr during the summer has little relevance to that lives of the islander's, aside from the fact that tourism provides many of them with a living (Royle, 2003). Traditionally, islanders engaged in a wide range of activities to make ends meet, from laboriously producing artificial soil on the island to grazing cattle (Royle, 2014). Along with heritage tourism, language tourism is also a source of revenue for the islanders. The Irish College, which organizes residential summer courses in the Gaeltacht for second level students aged 12–18 years, have been a fundamental part of the cultural, linguistic and educational life of Inis Oírr, and Ireland, for many generations (Denvir, 2002). Much of the income generated from Irish Colleges goes directly to Irish-speaking homes (and normally to women) in areas where there is high unemployment, little infrastructural development, and much outmigration (ibid.). A high number of inhabitants of Inis Oírr are trained tradesmen, but tend to work in the tourism industry. In terms of employment, the inhabitants of Inis Oírr are employed in varied professions ranging from managers to sales professionals and customer services personnel (Table 4.4).

Table 4.4: Persons at work or unemployed by occupation and sex (CSO, 2012)			
Occupation	**Males**	**Females**	**Total**
Managers Directors and Senior Officials	8	4	12
Professional Occupations	8	15	23
Associate Professional and Technical Occupations	7	2	9
Administrative and Secretarial Occupations	3	10	13
Skilled Trades Occupations	27	4	31
Caring Leisure and Other Service Occupations	2	7	9
Sales and Customer Service Occupations	1	0	1
Process Plant and Machine Operatives	7	1	8
Elementary Occupations	6	3	9
Not stated	13	4	17
Total	**82**	**50**	**132**

In their daily activities and modes of employment, English is the normal language of interaction with a stranger in Gaeltacht areas, particularly during the summer tourist season. Islanders who would normally speak Irish unselfconsciously among themselves, would address a stranger whom they identify as a tourist in English, unless it is suggested to them otherwise (Denvir, 2002). Irish is still dominant in the pubs however, restaurants and hotels would differ with a significant number of English speaking seasonal workers in tourist-related businesses (ibid.).

The large area of the island designated as National Heritage Areas[15] and Special Areas of Conservation[16] inhibit new developments on the island apart from these settled areas (BIM, 2012). Inis Oírr is a small island with over 80 per cent of the island listed as protected in the National Parks and Wildlife Services (NPWS) map database (ESRI,

[15] Natural Heritage Area (NHA) is an area considered important for the habitats present or which holds species of plants and animals whose habitat needs protection (NPWS, 2010).

[16] These are prime wildlife conservation areas in the country, considered to be important on a European as well as Irish level (NPWS, 2010b).

2016) as being protected. The Aran Islands are known for their unique landscape features and are considered to be an extension of the Burren region, while also being part of the Gaeltacht (Irish speaking) area in County Galway (Feehan et al., 1994). Galway city is the closest major urban centre and the offices of the County Council are located there. Inis Oírr is currently completely dependent upon energy imported from mainland Ireland and is dealing with higher energy costs as a result, with islanders paying approximately 28 per cent more for their energy than mainlanders in 2014 (O'Maoildhia, 2014). With approximately 100,000 visitors per year to the Aran Islands, the inhabitants of the neighbouring island, Inis Mór, created an energy co-operative with the vision of converting the three Aran Islands to 100 per cent renewable energy (FailteIreland, 2016, O'Maoildhia, 2014). The energy co-operative membership was open to all three islands and the aim of energy independence was to increase the island’s attractiveness for tourism (ibid.). Making the move to a 100 per cent sustainable island will also continue the islands history of self-sustainability that is part of its heritage and culture (Royle, 2002).

Cross and Nutley (1999) also argue that due to the small size of the island, only low-order and small services are likely to survive, while the need to access medium and high-order services makes dependence on external linkages acceptable. Water and electricity infrastructures were installed on the islands in the 1970s (ibid.). During their work in the late 1990s, Cross and Nutley (1999) described the irrelevance of car ownership, stating that the islands are so small that all places are within walking distances for able-bodied adults. They also found that five per cent of the respondents kept a car on the mainland at the ferry port, and these were primarily for those that had to commute frequently to the mainland (ibid.). In order to achieve better services for the islands, an umbrella group, Comhar na hOileáin[17], was formed in the mid-1980s to give Ireland's islands a collective voice (Royle, 1986). On most of the islands the original electricity supply was achieved with the installation of a diesel generator (Cross, 1996). This improved the life of islanders significantly due to the ability to maintain food long term in freezers and allowed them to develop a burgeoning tourism industry (ibid.). Laroe (1996) argues that

[17] The Comhar na hOileáin is an integrated Local Development Company with responsibility for the offshore islands of Ireland (CnOT, 2016).

the Aran Islands are tied by tradition to the sea and as a result they face a turbulent future. In Laroe's study, participants are quoted as saying "*It's change or die*" describing this change as embracing the vast numbers of visitors that come to the islands (ibid.). She also describes how these visitors come to experience the beauty and solitude of the islands, but their visiting the island *en masse* might compromise both (ibid.). Due to the complex place-based nature of energy demand in island communities, a transdisciplinary approach (which is outlined in detail in Chapter Five) was required for effective analysis of the role of situated energy knowledges in island communities' low carbon energy transitions.

There were a number of contentious issues in Inis Oírr during the timescale of this research in relation to the provision of services to the island. The researcher first met with Philip, the gatekeeper and manager of the island co-operative in Galway city in September 2013 and this meeting was followed-up with a visit to the island a month later. The researcher visited the island numerous times over the course of the three years of the research project. The most intensive phase of the data gathering, where the focus groups and interviews were undertaken, spanned from June 2015 to September 2015, with the researcher visiting the island for up to four days a week. The final phase of the research process, the technical energy planning workshops, were undertaken in early February 2016. During the summer of 2015, while the intensive qualitative data collection for this research was underway, information on proposals to renegotiate the contract for the air service was emerging (Fitzgerald, 2016). The airplane service had previously been provided by the Aer Arann airline company for over four decades, but the service contract went out to tender and was awarded to Galway-based helicopter company Executive Helicopters instead (ibid.). The decision was opposed by the residents of the Aran Islands as the service was proposed to be moved to Galway Airport in Carnmore, rather than its current location beside the ferry port in Ros a Mhíl (ibid.). Carnmore in approximately 15 kilometres outside of the city of Galway and Ros a Mhíl is approximately 40 kilometres outside of the city. The residents of the Aran Islands requested that the base for the air service be maintained close to Ros a Mhíl and the current ferry service, so that during times of bad weather, it is possible to choose either service. The residents of the Aran Islands argued that if the air service is near the ferry port when there are no flights due to inclement weather it is still possible for travellers to take the ferry. There were several protests outside the Taoiseach's[18] office in Castlebar, in the neighbouring County of Mayo, over the summer of 2015 with several hundred people from the islands and mainland Ireland in attendance (Griffin, 2015). Responding to pressure from residents of the Aran Islands and the surrounding area, the Department of the Arts, Heritage, Regional, Rural and Gaeltacht Affairs[19] extended the contract with Aer Arann for one year, at a cost of €1.62 million (Healy, 2016).

For decades, the residents of Inis Oírr have petitioned to have the current pier extended to make it safer during the winter months so that the island can be accessible by boat throughout the year. Currently, during inclement weather, the ferry service cannot dock in Inis Oírr due to unsafe conditions and the ferry service is often cancelled for days at a time, leaving the island without external transport linkages. In January 2016 the Minister for transport confirmed the allocation of €8 million under the Capital Investment Plan 2016 – 2021 for the redevelopment of Inis Oírr pier (DoHPCLG, 2016). In 2013, hundreds of islanders and others from the mainland marched through Eyre Square in Galway city to protest at a proposal to locate a deep-sea salmon farm off Inis Oírr island (NiFhlatharta, 2013). The Environmental Impact Statement (EIS) (BIM, 2012) for this project was the main point of contention to the proposal with the validity of some of the scientific arguments coming into question (O'Sullivan, 2014). After over a year of public consultation the plans for the project were withdrawn due to the number of objections (Crawford, 2015). The community's ability to effectively petition and protest the government in order to achieve improved services highlights their unique and effective landscape of CKNs. This thesis argues that understanding these knowledge networks and the social construction of energy knowledge is crucial to effectively facilitate low carbon energy transitions. This thesis argues that understandings and perceptions of energy are socially constructed and the following section discusses and describes existing social constructions of low carbon energy transitions.

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[18] The Taoiseach is the head of government in Ireland.

[19] The Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs oversees the protection and presentation of Ireland's heritage and cultural assets and promotes long-term sustainable economic and social progress across rural Ireland (DoAHRRGA, 2016).

4.5 Social Constructions of Community Low Carbon Energy Transitions

Communities' perceptions and understandings of energy are complex and place-based (Devine-Wright, 2012, Raymond et al., 2010a, Devine-Wright and Howes, 2010), they are situated in cultural and political contexts and are socially constructed. This section discusses ontologically and epistemologically the concepts of social constructivism within the context of community low carbon energy transitions. In particular, this section aims to assess the implications of social constructivism in low carbon energy transitions which is essential in explaining the range of subtleties and policy responses to issues related to energy. Literature describes two separate approaches to the concept of social constructivism. These are often conflicting as they take different ontological positions in relation to the concept.

Social construction can be defined as *"a set of meanings that become attributed to the characteristics and identities of people and places by common, social or cultural usage"* (Cloke et al., 2005: p10). Proponents of social constructivism argue that the traditional Marxist perception of "Nature" is problematic and that Nature (both first and second[20]) should be conceptualised as a socially constructed entity (Mariyani-Squire, 1999). Rosewarne (1997) posited an argument that easily represented the ideals of social constructivism. He argued that Marxists criticise environmentalists for having idealised concepts of Nature (and social constructivism is one of these idealistic approaches) (ibid.). He also claimed that the traditional Marxist approach to Nature is materialist, and that this, in itself is still a conceptualisation of Nature (ibid.). Building on this, scientific conceptualisations of Nature are socially constructed and thus are idealist. Rosewarne's (1997) argument claims that a purely realist or materialist understanding of Nature is "inauthentic" and that an "authentic" understanding of nature is a non-materialist one. He argued that the concept of "First Nature" is a human construct as these areas are preserved

[20] Karl Marx stated that "first nature" is composed of basic material processes associated with land and animals and devoid of human influence, whereas "second nature" referred to the environment that is designed, transformed or constructed by humans (Smith & O'Keefe. 1980)

through human created legislation for biodiversity and other such legislation (ibid.). Suchting (1992) claimed that social constructivism was developed from Kantian philosophical foundations. Kant argued that there is absolutely no knowledge of an object unless there is thought with which abstract concepts are applied (ibid.). Essentially, Kant argues that the form of knowledge is the product of the human mind. Concepts that are applied are chosen by humans, and are not unique to particular individuals or groups, but are universally held concepts that are obtained, *a priori*, by all human minds (ibid). The result of the combination of the object to be known and our concepts is the phenomenal dimension, meaning the world that humans experience in their everyday lives (ibid.). However, social constructivism differs from this Kantian philosophy in that it rejects the universality of human concepts and claims that different individuals or groups possess different concepts (ibid.). Therefore, one's understanding of "Nature" is relative to one's individual or group concepts, meaning that if the concepts of "Nature" differ between individuals or groups, thusly so will "Nature" itself.

Another version of social constructivism is based on Hegel (Vogel, 1999) who argues that any claim to knowledge must be assessed through comparing it with its own criteria. However, he argues that progress in thought is not made solely through this comparison, but must also have "the dialectic" component (ibid.). Steven Vogel (1999) claims that the "Truth" is comprised of the social subjects self-conscious reflection of the Object and the fact that Truth is our individual creation (Mariyani-Squire, 1999). Mariyani-Squire (1999) argues that what makes social constructivism both Kantian and Hegelian is the fact that "social" is the concept generating mechanism. How an individual perceives and conceptualises Nature is significantly influenced by their social interactions with their communities and the societies that they live in. Both means and medium are public and thus imply social relations (ibid.). These social relations then condition the concepts that are upheld by an individual or group and thus the entities that exist for that individual or group. One of the benefits of social constructivism is that it enables the inclusion of several perspectives simultaneously and concludes that all perspectives are social constructions. This results in all perspectives being conceived as equally valid which is crucial to the inclusion of communities in successful energy planning processes. Social constructivism also offers the opportunity for more effective integration of policy, science and technology in line with the greater public good (Mariyani-Squire, 1999). Social constructivists argue that theoretically, because Nature is socially constructed, and all perspectives are deemed valid, injustices can be avoided (ibid.). Subsequently, if a social constructivist perspective is employed in energy planning processes, where all perspectives are deemed valid, a more inclusive, more conscientious and equitable planning environment could be the outcome. Although there are many benefits to the use of social constructivism in assessing community low carbon energy transitions, there are also limitations to its use. Section 4.5.1 critiques social constructivism and how this work drew on it as an underlining conceptual framework.

4.5.1 Criticisms of Social Constructivism

The first criticism of social constructivism is founded upon unjustified abstract reasoning (Mariyani-Squire, 1999). The second criticism is the self-refutation of the relativism argument. In order to maintain its authenticity, social constructivism must argue that it is not merely a conceptual scheme that is only real relative to the social structures within which it exists. Social constructivism contradicts itself when the social system constructs a materialist perspective which no longer supports such a concept. This is evident in relation to energy planning where the social construction of the field hails the technical and rational modes of the energy planning process to be the most authoritative form of knowledge. There are three main criticisms of the use of social constructivism in investigating community low carbon energy transitions as follows:

Incommensurability – social constructivism must acknowledge that at times, it might not be possible to compare two sets of social constructions against each other because the social structures within which the conceptual schemes are developed might be so different that the resultant entities (such as Nature) might also be completely different. This could result in no genuine communication between two social systems and thus no disagreement between these two social constructions about anything of relevance. Where two disparate epistemologies converse during an energy planning process, each using conflicting discourses that defy comparison, how can a solution that is perceived as equitable and just by both be achieved effectively?

External Constraints – If all phenomena come under human control humans are unrestricted and all powerful. According to the Kantian version of social constructivism, there must be some external constraints placed upon what can be constructed within a social context (Mariyani-Squire, 1999). If one cannot effectively define the external restraints related to the social construction of energy planning, how can the scale of the problem be sufficiently assessed and described?

Policy Implications – Another shortcoming of social constructivism is that, in rejecting positivist approaches, it can often pertain to a dictatorial and judgemental standpoint which creates an elitist political-intellectual lead. Mariyani-Squire (1999) argues that there is nothing necessarily liberating about entities being socially constructed and that there is no political advantage to thinking of Nature as socially constructed if those that are in politics are trapped within the system they operate within. When discussing "valid" planning issues related to energy planning, planning processes and institutions must be comparable across cases to ensure compliance with national planning regulations. Thus, the social constructions of specific cases may add little to the energy planning processes if the institutional settings do not account for their validity.

4.5.2 Post-normal Science and Community Low Carbon Energy Transitions

The current chapter illustrates how this thesis aims to highlight how the nature of community transitions to low carbon energy sources are socially constructed. The argument of the social construction of all creates a problem where all theories are both refutable and non-refutable. Eglash (2011) argues that social construction requires that research must prove that "it could have been otherwise" and that no one perspective is right. However, traditional positivist and objective approaches have enshrined society into believing that there is only ever "one right answer" whereas subjective approaches open the possibility of multiple right answers (ibid.). From a social constructivist perspective, community low carbon energy transitions are both epistemologically and ontologically subjective as consumption and perspectives of energy are both socially constructed (Castaneda et al., 2015, Shove et al., 2015). Through the 1980s and into the 1990s, the social constructivist movement became a central theory for the emerging field of science and technology studies (Lynch, 2016). Some further argue that the technical practices of science have constructed the problem of global warming (Demeritt, 2001), however, the same construction cannot be applied to community energy transitions due to the situated nature of the concept. Understanding this is done by scrutinising the many ways in which social and place relations shape existing perceptions, understandings and demands of energy within communities (Devine-Wright, 2015, Castaneda et al., 2015, Shove et al., 2015). There is opportunity for a more holistic approach to the use of social constructivist inquiry in the analysis of perceptions of sustainable energy that relates to the cultural and socially constructed understandings of nature and its practical and place-based comprehensions (Lynch, 2016, Berger and Luckmann, 1991). The social constructivist approach assesses differing forms of meaning and influencing factors and attributes these to either socially constructed or discursively influenced elements. This research is concerned with the social based processes that construct low carbon energy transitions while also assessing them within their spatially constructed influences. In order to effectively place this phenomenon within its social context, this research adopts the post-normal science approach (Funtowicz and Ravetz, 1993, Funtowicz and Ravetz, 2003). Post-normal science represents a novel approach for the use of science within complex, socially constructed issues where facts are uncertain, values are in dispute, stakes are high and decisions are urgent (ibid.). It focuses on aspects of problem solving often neglected in traditional scientific practice. Post-normal science is useful where the facts of an issue are under debate due to different norms, values or social constructions such as community low carbon energy transitions as illustrated in Figure 4.4.

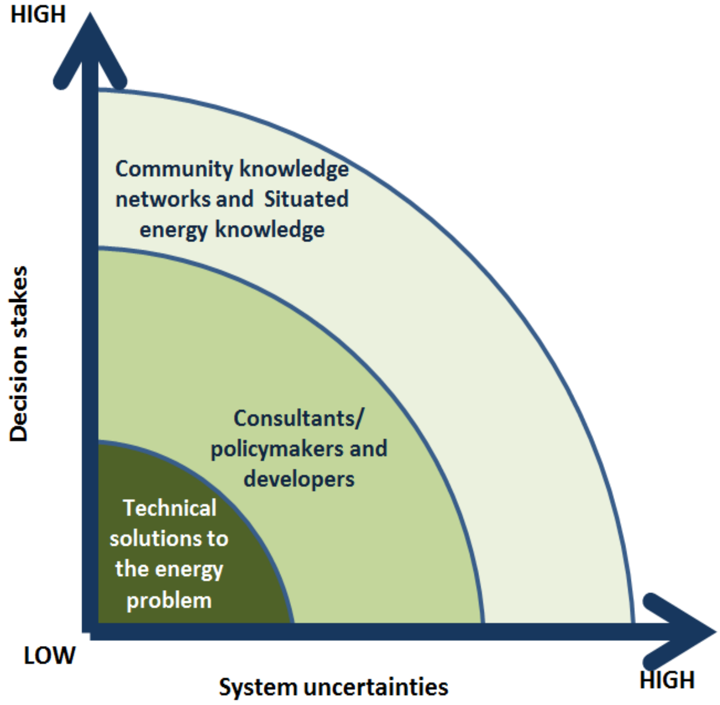

Figure 4.4: Post-Normal Science and This Research (adapted from (Funtowicz and Ravetz, 2003))

Energy planning and energy policy implementation is an uncertain, long-term process where stakes are high. The extended peer community involved in the development and implementation of energy planning and policy increases the complexity of the development process. When applied to this research the post-normal science approach involves analysing the connection between individuals' current situated energy knowledges, their history and their interaction with the local CKN within which information has been shared.

4.6 Conclusion

This chapter describes the core assumptions and purpose of this thesis. To achieve this it identifies the guiding principles influencing the research process and the rationale behind the selection of the case study community. Following this, Inis Oírr, the case study community itself is described, along with its unique social and geographic landscape.

This chapter then discusses the rationale behind employing a social constructivist perspective, arguing that the nature of community transitions to low carbon energy sources is socially constructed. Following this, this chapter explores and critically assesses the theoretical perspectives on social constructivist approaches and their suitability for investigation of community low carbon energy transitions. Finally, this chapter describes the rationale behind the application of a post-normal science approach to this research and its suitability for the investigation of complex problems, such as community low carbon energy transitions. Building on this theoretical basis, the next chapter, Chapter Five, describes the research design developed for this thesis and the processes involved in its implementation.

Chapter Five: Designing and Undertaking Transdisciplinary Energy Research in Inis Oírr

5.1 Introduction

The purpose of this chapter is to provide an outline and rationale for the transdisciplinary methodology developed and tested in this thesis. Chapters One, Two and Three highlight some important gaps in our understanding of the role of situated energy knowledges and CKNs in Irish island communities' transitions to low carbon energy societies. This chapter outlines the transdisciplinary methodological approach developed in order to fill these gaps in knowledge. The purpose of this chapter is to provide the rationale and structure of the transdisciplinary methodology developed. The key aim of this chapter is to reveal a detailed outline of the transdisciplinary methodological design and to illustrate how it facilitates the analysis of situated energy knowledges and CKNs in transitions to low carbon energy sources. The methodology is a novel one, based on a transdisciplinary approach involving a case study methodology employing qualitative data collection and the PCI technique (Witzel, 2000a), but also utilising technical engineering techniques as a tool for further qualitative investigation. As described in Chapters Two and Three, an in-depth literature review and analysis of documents, such as guidelines and policies, was undertaken to critically assess the context for island low carbon energy transitions in Ireland. This chapter begins by discussing the differing disciplinary approaches to community low carbon energy transitions and argues that transdisciplinary approaches are the most appropriate method of analysing these in a holistic manner. Due to the innovative research technique, special consideration is paid in Section 5.2 of this chapter to describing current thinking around the suitability of transdisciplinary approaches when researching complex, real world problems such as community transitions to low carbon energy sources. This section also describes the assumptions, advantages and disadvantages associated with transdisciplinary approaches in energy research. The concept of community low carbon energy transitions as being an iterative process is assessed and linked to the need for a transdisciplinary methodological approach that combines differing disciplines simultaneously. This section also suggests that the concept of the "Transdisciplinary Individual" is important in energy research and describes how it can enable the integration of several epistemologies into community low carbon energy transition processes. Following this, the research design developed for this research is described and the rationale behind the selection of each of the processes involved. Next, the design of the case study approach, the qualitative investigations and the rationale for the use of the PCI Technique (Witzel, 2000a) are described and how the sensitising concepts developed in Chapter Three influenced these. Next, the methods of thematic analysis employed in this research are discussed, as is the rationale for their use. Finally, the engineering techniques that are utilised to create a holistic methodology are described in detail, along with how they are influenced by lessons from the application of a social constructivist perspective to community low carbon energy transitions. This chapter concludes with an overview of the research design and presents the transdisciplinary methodological framework developed for this work.

The next section details the case-study design and the rationale behind its utilisation. It also describes the PCI technique (ibid) and how it is employed in this research. The latter part of the next section describes the analysis employed in this research along with the process utilised to develop the technical energy plans for Inis Oírr.

5.2 Transdisciplinary Approaches to Researching Energy in Inis Oírr

5.2.1 Introduction

Situated knowledges and place are defined as cross-disciplinary entities, however, there is little cross-boundary interest between the disciplines in investigating local attachments (Devine-Wright, 2015). Transdisciplinarity is fundamental to sustainability research and environmental concerns spawned its emergence as a concept. Many authors (Klein and Coffey, 2016, Jahn, 2008, Klein, 2004) have heralded the Organisation for Economic Co-operation and Development's (OECD) "*Interdisciplinarity: Problems of Teaching and Research in Universities*" as the beginning of the myriad of discourses around transdisciplinarity. The contribution of Erich Jantsch (1970, 1972) is often cited as the precursor to current conversation around the topic of transdisciplinarity. However, others (Miller et al., 2008) trace the origins of attempts to categorise transdisciplinarity as far back as the 1950s where conversation about the need for cross-disciplinary approaches to social-ecological issues began. It is now widely acknowledged that the popularity of transdisciplinarity gained prominence when Funtowitz and Ravetz (1990) published their work on post-normal science. Transdisciplinarity experienced a further resurgence in interest when Gibbons et al. (1994) explored the concept of a new mode of knowledge production. The development of the concept of Mode 2 of knowledge production was considered as functioning more generally within a context of application where problems are not set within a disciplinary framework (Gibbons et al., 1994). Concepts such as Post-normal science and Mode 2 of knowledge production began to emerge at a time when climate change and ideas of sustainability were being grappled with by those in policy, practice and academia alike. Klein et al. (2001) describe how the 2000 Zürich conference "*Transdisciplinarity: Joint Problem Solving among Science, Technology and Society*" highlighted the universal experience of "real-world problems" (ibid.) such as sustainable development. In 2004, the journal "Futures" devoted a special issue to discussing transdisciplinary research (Augsburg, 2014). After this, in 2010, "*The Oxford Handbook of Interdisciplinarity*" was published with part of the book dealing with knowledge and transdisciplinarity (Frodeman et al., 2010). "*The Charter of Transdisciplinarity*" (de Freitas et al., 1994) described several characteristics of a transdisciplinary attitude including: a recognition of the differing perceptions of reality, an openness towards other types of knowledge, a respect for collective understandings and perceptions, rigor in argument, openness and acceptance of the unknown and tolerance of opposing ideas. Building on discussion of these concepts of transdisciplinarity, the next section outlines how transdisciplinarity is defined in this research.

5.2.2 Defining Transdisciplinarity

The struggle to fully describe the concept of transdisciplinarity has been approached in many varied ways by academics in the past. Generally, ideas of "interdisciplinarity" and the "participation" of non-scientific actors were key components in definitions of transdisciplinarity (Darbellay, 2015, Jahn et al., 2012, Aeberhard and Rist, 2009, Hadorn et al., 2008, Klein, 2004). Due to difficulties experienced by previous scholars in creating a concrete definition for transdisciplinarity that involved a new paradigm of science, these concepts began to grow in popularity (Max-Neef, 2005, Jantsch, 1970). Today, defining transdisciplinarity remains problematic and it has maintained its status as an ambiguous concept while discourses around its elusiveness have continued to evolve (Jahn et al., 2012, Klein, 2008). Jahn et al. (2012) describe how, although there is widespread consensus on the differences between disciplinary, multi-disciplinary, and interdisciplinary forms of research (Kessel and Rosenfield, 2008, Miller et al., 2008, Russell et al., 2008), agreement on how transdisciplinary research differs is lacking clarity. Jahn et al. (2012) argue that the primary differences are in relation to the level of co-operation involved in each. They argue that transdisciplinarity differs from interdisciplinarity in that it involves collaboration between "non-scientists" (or "practitioners") and researchers. Mobjörk (2010) suggests that both are equal with respect to their motivations and the level of integration of disciplines that they undertake as integration is deemed critical in both. However, other scholars have argued that transdisciplinarity does not necessarily require "explicit engagement with society" (Miller et al., 2008). Russell et al. (2008: p460) stress that interdisciplinarity still relies on the borders around disciplines, their delineation and their "areas of overlap". In contrast transdisciplinarity "transcends or transgresses" the boundaries between disciplines creating a more fluid integration of knowledge (ibid.). In its transcendence, transdisciplinarity facilitates the creation of "shared conceptual frameworks" across disciplines (Stokols et al., 2008: p79). Transdiciplinarity also offers the "*potential to produce transcendent theoretical approaches"* (Klein, 2008: p117). Transdisciplinarity "*transcends entrenched categories to formulate problems in new ways*" (Miller et al., 2008: p3). Epistemology is our systematic inquiry into, and theory of human knowledge generation and acquisition. A "transdisciplinary epistemology" should be seen fundamentally as a relational epistemology, as one of knowledge co-production (Regeer and Bunders, 2009). "Transdisciplinary methodology" refers to the integrative reasoning, logic or principles for guiding the collaborative research process of knowledge co-production (Wickson et al., 2006). Collaboration is often cited as being a fundamental part of transdisciplinarity (ibid.).

5.2.3 Transdisciplinarity and the Disciplines

Current literature conceives transdisciplinarity as being problem-centred (Lawrence, 2015, Popa et al., 2015, Darbellay, 2015, Lyall et al., 2015, Polk, 2014, Hadorn et al., 2008) making it most appropriate for complex issues such as low carbon energy transitions. Robinson (2008) asserts that a problem-based focus is the defining characteristic of transdisciplinarity and not solely its theoretical or epistemological claims. He also describes how issues that require transdisciplinary approaches tend to start from the real world and move from there into the scholarly arena and that they are reaching across disciplines for a particular purpose (ibid.). Polk (2014) argues that the aim of transdisciplinary research is to capture and address the complexity of societal problems and solve them in a more contextual way. Polk also argues that a *"high level of participation presumes the integration of knowledge, values, expertise and perspectives of the respective participants in the project formulation, design and execution"* (2014: p72). In 2010 a group of international scientists argued that a science that relies on reinforcing disciplinarily will not have the tools necessary to comprehensively understand the complexity of the how technology interacts with the interconnected systems we depend on (Vasbinder et al., 2010). Jahn et al. (2012) argue that the reason for this polarisation in the disciplines is due to a lack of clarity about what exactly transdisciplinarity really is. Although the conversation around transdisciplinarity has been ongoing for over 40 years, there is still no consensus on what transdisciplinarity is or how it might be manifested and undertaken successfully. Consequently, guidance and standards around transdisciplinary methodologies are severely lacking, leading to reluctance on the part of researchers to partake in transdisciplinary research. Successful integration of disciplines is often hindered by the requirements of disparate disciplines and the different disciplinary constructions of the world (Baumgärtner et al., 2008). However, Mobjörk (2010) cautions that over emphasis on achieving integration may result in "separating methodologies from epistemologies". Zierhofer and Burger (2007) distinguish three types of discipline specific knowledge integration: thematic integration, problem-oriented integration and social integration of knowledge.

Although transdisciplinarity is unique, this does not mean that there is no longer a need for the disciplines. Klein (2004) for example argues that transdisciplinary work is based on disciplinary practice and although it transcends standard boundaries, it must be complimentary to standard disciplinary practice (Max-Neef, 2005, Lawrence and Després, 2004). Jahn et al. (2012) state that the true purpose of transdisciplinarity should be to service the existing disciplines in order to broaden disciplinary horizons. Transdisciplinary practices should challenge the scope of their respective knowledge, methods, and theories (ibid.). They further ascertain that transdisciplinary collaboration may function *"as a driver for disciplinary innovation by questioning and eventually* *reshaping internal borders"* (ibid.: p3). Transdisciplinarity was not presented as an alternative form of research, but as one that could complement existing modes of research practice and their respective disciplines and which involves actors outside of academia (Häberli et al., 2001). Ramadier (2004) argues that environmental problems exemplify complexity and comprise several problems that fall into the domains of different disciplines. Jahn et al. (2012) argue that "mutual learning" within transdisciplinary teams of scientists and external stakeholders in processes of joint problem solving[21] is closely related to successful and valid transdisciplinarity. The concept of mutual learning can only be relevant when applied with an egalitarian ambition which is often stunted by unbalanced power relations between actors in transdisciplinary processes (Nowotny et al., 2001). Mobjörk discusses how "consulting" and "participatory transdisciplinarity" (ibid.) may be differentiated. Consulting involves participants answering and reacting to the research, the latter considers them to be partners in a joint egalitarian research process. In this process, their knowledge is "equally valuable to scientific knowledge" (ibid.).

In unpacking their notion of "epistemological pluralism", Miller et al. (2008) argue that "internal reflexivity" (ibid.: p4) on the part of the researcher is fundamental to successful transdisciplinary research. Jahn et al. (2012) argue that the inclusion of reflexivity into the process of knowledge production in transdisciplinary research is the primary purpose of the practice itself. Their research pointed towards "transdisciplinary epistemic communities"[22] as a hybrid phenomenon related to individual transdisciplinarity and building socio-epistemic relationships between science and social actors (ibid.). Giri (2002) regarded transdisciplinarity as the individual's practice of "interperspectivity" arguing that transdisciplinarity is a field of relationship. Transdisciplinarity can better enable the integration of other research into the policy sphere by softening the boundaries

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[21] Farrell (2011), when discussing "problem solving" reflects a classically modernist and industrial problem solving mind-set. This does not pay heed to the fact that *"wicked problems are, by definition, unsolvable conundrums for the modern planet"* (ibid.: p75). Jahn et al. (2012: p3) also shared this view considering the relationship between the transient nature of *"solutions to societal problems as being one of the prime task of transdisciplinary research"*. This work shares this critical argument with the iterative process required for dealing with issues around sustainable energy and communities being the motivation for the transdisciplinary approach applied in this research.

[22] Transdisciplinary epistemic communities are related to the concept of the transdisciplinary individual and the socio-epistemic relationships that are developed across disciplines (van Breda et al. 2016).

around the policy arena and the disciplines that contribute to it (Tress et al., 2001, Hadorn et al., 2008, Van Kerkhoff and Lebel, 2006). Transdisciplinarity can contribute to policy decision making for complex problems (Lang et al., 2012). Having discussed the suitability of a transdisciplinary approach for this research, the next section outlines the characteristics of transdisciplinary research itself.

5.2.4 Characteristics of Transdisciplinarity

Integrative communication is also of primary importance in successful transdisciplinarity and Strang (2009) argues that achieving forms of communication that bridge between disparate disciplines and translate findings into widely accessible forms is the major challenge of transdisciplinarity. Benham and Daniell (2016) using the works of (Russell et al., 2008) and (Lang et al., 2012) described transdisciplinary research processes as:

1. Addressing a "real world problem"

2. Iteration and reflection

3. Collaboration and integration of stakeholder concerns.

In order for transdisciplinary research to achieve its potential some scholars argue that it is paramount that stakeholders *"acknowledge the power relations between various actors, their possibilities to be active participants, and the role they play in relation to researchers"* (Mobjörk, 2010: p870). Montuori (2008) wrote that the integration of the inquirer into the process of inquiry is central to transdisciplinarity. While undertaking individual transdisciplinary research van Breda et al. (2016) entered their research process working with "static" issues with "fixed" problem statements, research questions and "pre-determined" methods. While using transdisciplinary methodologies they were continuously challenged with changes in the way the issues were approached and conceptualised, depending on who and what disciplines were participating (ibid.). Importantly, transdisciplinary frameworks emphasise the importance of iterative research practice and how transdisciplinary research approaches are practical in nature (Benham and Daniell, 2016). In participatory research projects, such as the one developed for this research, the researcher shares power with other stakeholders during the research process (ibid). Building on these descriptions of the characteristics of transdisciplinary research and its suitability to this thesis, the next section outlines the shortcomings of employing transdisciplinary research methodologies.

5.2.5 Difficulties of Transdisciplinary Research

Zscheischler and Rogga (2015) argue that without a theoretical framework, transdisciplinary topics will continue to lack the production of integrated, cumulative knowledge on specific topics. Polk (2014) also found that for transdisciplinary approaches to be successful and achieve collaboration, they needed to create a sovereign meeting place where all stakeholders are entitled to take equal responsibility for the co-production of knowledge. Hollaender et al. (2008) described the paradox between the difficulties in transdisciplinarity's inherent heterogeneity and how it is both fundamental to its nature and a barrier to its success calling it the "Transdisciplinary Paradox". Transdisciplinary work does have some negatives; the fundamental characteristic of needing to be competent in several disciplines can lead to a lack of depth in any (Augsburg, 2014). Augsburg (2014) do not paint becoming a transdisciplinary individual as an easy task, and describe it as an identity that takes its toll on the transdisciplinary researcher. The need to approach problems from multiple perspectives is time consuming and requires dedication and perseverance. Although there are a number of studies that summarise the current status of transdisciplinarity, (Lawrence, 2015, Frodeman et al., 2010, Hadorn et al., 2008, Wickson et al., 2006, Lawrence and Després, 2004), there are limited attempts to synthesise the myriad of discourses around transdisciplinarity into one ubiquitous concept. There are even fewer attempts at applying or developing a concept for the transdisciplinary individual. Jahn et al. (2008, 2012) attempted this synthesis of existing discourses through the undertaking of a comprehensive study of existing conversations around transdisciplinarity with the intention of creating a framework and single definition as guidance for transdisciplinarity. The concept of the transdisciplinary individual is even more elusive than that of transdisciplinary research itself. The discourse around this can be traced back to a colloquium on transdisciplinarity held at the L'Abbaye de Royaumont in France in 1998 (Somerville and Rapport, 2000). The aim of the colloquium was to advance the discourse around transdisciplinarianists, with most in attendance confirming that they were "unconscious transdisciplinarianists" (Klein, 2002). Many at the meeting felt that they were both talking about transdisciplinarity and doing it (Somerville and Rapport, 2000). Building on these bodies of literature, this research seeks to create new knowledge through the development and application of a transdisciplinary methodological approach to the investigation of situated energy knowledges and CKNs in community low carbon energy transitions. This research attempts to develop understandings of the processes involved in undertaking successful transdisciplinary research and how individual transdisciplinary research might be developed. The "ideal qualities" needed for transdisciplinary researchers have been described as; a curiosity about, and willingness to learn from other disciplines, good communication and listening skills, the capacity to absorb information and the ability to work in a team successfully (Bruce et al., 2004: p464). Bruce et al.'s (2004) research revealed that respondents perceived that personality and attitudes are as important as disciplinary knowledge for the successful undertaking of inter- (or trans-) disciplinary research. Godemann (2008) identified skills such as the ability to delve beyond one's own disciplinary boundaries, the ability to be self-reflexive, the ability to reflect on the knowledge interaction processes that one is undertaking and the ability to work with new ideas easily. Discourses around successful transdisciplinarity (and co-operation) is the assertion that personality and openness is as important to the process as the discipline that one hails from (Bruce et al., 2004). Jacobs and Nienaber (2011) investigated the concept of the "transdisciplinary individual" in their work on water governance in South Africa and attempted to advance discourses around transdisciplinarity beyond the "team" model to that of the individual. They examined the internalisation of a transdisciplinary mind set beyond collective models and posited the question of how can a researcher become transdisciplinary and is this something that can effectively be learned (ibid.). Building on these discussions of the varied discourses around transdisciplinarity, the next section describes the innovative research design developed for this research.

5.3 Research Design

As described in Chapter One, it was established early in the research project that a transdisciplinary problem-centred approach was the most appropriate methodology for analysing situated energy knowledges and CKNs in community low carbon energy transitions. Effective transdisciplinary research dealing with societal problems can facilitate the development of new research questions that may have been overlooked following the standard logic of disciplinary processes. In line with a transdisciplinary approach, a case study methodology employing the PCI Technique (Witzel, 2000b) coupled with technical energy planning techniques was deemed most appropriate to fully investigate both the social and technical aspects of energy. The analysis of current discourses of transdisciplinarity revealed several transdisciplinary issues to be deliberated when designing the methodological approach for this research. The methodology outlined in this chapter is influenced by the work of Jahn et al. (2012) and the criteria for selection of the methodological tools are built upon this foundation and other key literature outlined at the beginning of this chapter and in Chapter Three. In this section, six key criteria for the transdisciplinary methodology are catalogued and described based on the earlier review of existing literature; - a problem-centred approach, - an approach that transcends disciplinary boundaries, - a holistic, place-based approach, - an in-depth, collaborative and experienced based approach, - an integrative approach and an iterative and reflexive approach. These requirements guided the decision making process for the selection of the methodological approach which follows and are outlined below:

1. Problem-centred Approach

Chapter Two describes community transitions to low carbon energy societies as complex, multi-faceted and problem oriented phenomena. Building on this, the beginning of this chapter reveals that current literature defines transdisciplinarity as being problem-centred (Lawrence, 2015, Popa et al., 2015, Darbellay, 2015, Lyall et al., 2015, Polk, 2014, Hadorn et al., 2008) revealing it as a suitable approach when studying low carbon energy transitions. The core concept behind the act of transdisciplinary research is that boundaries between disciplines are overcome in order to achieve a specific purpose in solving a particular problem. Energy planning within the community context is a difficult undertaking and requires the use of several modes of data collection in order to fully analyse the complex issues surrounding community low carbon energy transitions (Büscher and Sumpf, 2015, Warren and McFadyen, 2010, O'Hora, 2010, Walker and Devine-Wright, 2008). Thus a problem-centred focus involves the merging of different disciplines with the goal of assessing a particularly complex energy planning issue through the problem-centring of the social scientific data collection. The case study and PCI technique was most suitable for this research, as combining the social scientific and engineering techniques required specific energy-focused, qualitative outcomes in order to inform the engineering approach.

2. An Approach that Transcends Disciplinary Boundaries

As discussed in Chapter Two, community low carbon energy transitions are a complex issue that must be viewed through several different lenses to be fully comprehended (Büscher and Sumpf, 2015, Warren and McFadyen, 2010, O'Hora, 2010, Walker and Devine-Wright, 2008). As described in Chapter One, this research involves not just a range of disciplines but also the application of a shared theoretical approach which transcends disciplinary boundaries and approaches the energy issue with a single theoretical approach applicable to all. As described in Section 5.2.2, the transdisciplinarity approach facilitates the production of transcendent theoretical approaches (Klein, 2008) and aids in formulating problems in new ways (Miller et al., 2008). For this reason, several disciplines are employed when undertaking this research as follows:

- Social scientific techniques are the primary method of analysis
- A knowledge of planning and policy is utilised
- A knowledge of the built environment is included
- A knowledge of energy systems and energy systems planning along with energy modelling tools is employed
- The ability to interpret and communicate effectively across several different disciplines and with several different community actors is also important.

The employment of each of these disciplines during the course of this research was crucial to the successful assessment of the various facets of community perceptions of community low carbon energy transitions.

3. A Holistic, Place-based Approach

As described in Chapter Three, situated energy knowledges suggests that understandings and perceptions of energy are place-based, contain many different entities and their relationship to each other is as important as considering each individually. Moreover, researchers in the fields of both social science and engineering concur that energy demand and consumption are multidimensional and affected by many physical and social variables. This chapter began by illustrating how transdisciplinarity literature focuses on place-based approaches as a means to undertake problem-centred research so that the problem can be explored through the lens of several disciplines. Applying a case study approach and utilising the PCI technique means that both individual and community perspectives can be analysed within the same study and can validate and build upon each other. The combination of case-study approach with the PCI technique within this study is useful as a reflexive, cyclical methodological design. This technique was chosen as it enables the analysis of perspectives at the individual, group/ community level simultaneously and within their community contexts, in a holistic manner.

4. An In-depth, Collaborative and Experienced Based Approach

The review of literature on community low carbon energy transitions suggests that a large proportion of previous research took a broad, quantitative approach to the analysis and description of the factors affecting their successful development (Heaslip et al., 2016, Lund, 2010, Cass and Walker, 2009, Rogers et al., 2008, Blake, 1999). However, in order to address certain gaps in research outlined in Chapter Three, a more in-depth, focused approach is needed which combines individual experiences, community needs and individual and group perceptions around energy. Current literature also suggests that research needs to move beyond simplistic socio-technical models of deductive descriptions of pathways to low carbon energy sources. Insights gleaned from literature suggest that the methods developed for this study should be built upon a foundation that is based on participants' perceptions and community dynamics rather than pre-conceived socio-technical frameworks. A review of the literature supports this argument with several authors describing the shortcomings in current socio-technical transition frameworks (Nightingale, 2016, Klein and Coffey, 2016, Swapan, 2016, Büscher and Sumpf, 2015). For this reason, a multi-level analysis was developed, where investigations could be undertaken at the individual and community level in order to fully determine the role of situated energy knowledges and their development in community transitions to low carbon futures. Several modes of analysis were used in this research as follows:

1. Focus groups are employed in order to assess perceptions when embedded within community dynamics
2. Individual interviews are employed to engage with individual, experienced based perceptions around low carbon energy transitions
3. Energy planning workshops were undertaken to create a co-creative research environment that facilitates mutual learning.

5. An Integrative Approach

Fundamental to transdisciplinarity is the integration of the inquirer into the process of inquiry (Montuori, 2008) in order to fully engage with the complexity of the issue in question. Montuori argues that transdisciplinarity emerges out of a need to go beyond some of the limitations of more traditional disciplinary academic approaches (ibid.). Integration can be defined as *"the cognitive process of critically evaluating disciplinary insights and creating common ground among them to construct a more comprehensive understanding"* (Jahn et al., 2012: citing Repko, 2012: p263) . As outlined at the beginning of this chapter, transdisciplinarity differs from interdisciplinarity in that it involves collaboration between "non-scientists" (or "practitioners") and researchers. However, successful integration of disciplines is often hindered by the requirements of these disparate disciplines and *"the different disciplinary basic constructions of the world"* (Baumgärtner et al., 2008: p8). For this reason, a shared theoretical approach is employed in this research (outlined in Chapter One), with the discipline of social science being the dominant, while integrating other technical disciplines into the research process though the PCI technique (Witzel, 2000a).

The decision to base this research on the case study of an island community enabled integration of the gathering of in-depth social scientific data and quantitative engineering data in a valid format. As described in Section 4.4, small offshore island communities are often easily auditable communities in terms of energy use while small communities allow qualitative researchers to gather in-depth data with a large proportion of the population. The choice to study an island community was influenced by the ease of access to data on energy importation and the opportunity to catalogue the success of the community's transition towards low carbon energy in the long term. The ease of analysis and energy auditing of island communities highlights the significance of spatially defined peripheral communities as ones that can satisfy the needs of both the social scientific and the engineering approach simultaneously.

6. An Iterative and Reflexive Approach

The literature review in Chapters Two and Three highlight another unresolved issue in the community energy literature; the need to understand situated energy knowledge development as an iterative, ever-changing process. Several studies have focused on present perceptions and understandings of energy as passive and unchangeable, not affected by the CKNs they are embedded in (Burchell et al., 2014, Warren and McFadyen, 2010). However, although some literature investigated the current state of perceptions of energy, Cass and Walker's (2009) study of community acceptance of wind farms highlights how the level of acceptance operates on a bell curve which alters over time which prompted the design of a phased, iterative and reflexive research process for this work.

As illustrated in Figure 5.1 following, the transdisciplinary methodology developed to meet these criteria included: an initial survey, focus group discussions, individual interviews, the use of technical energy simulation software to develop draft technical energy plan scenarios, energy planning workshops and finally the preparation of a report for the community and peer-reviewed publications.

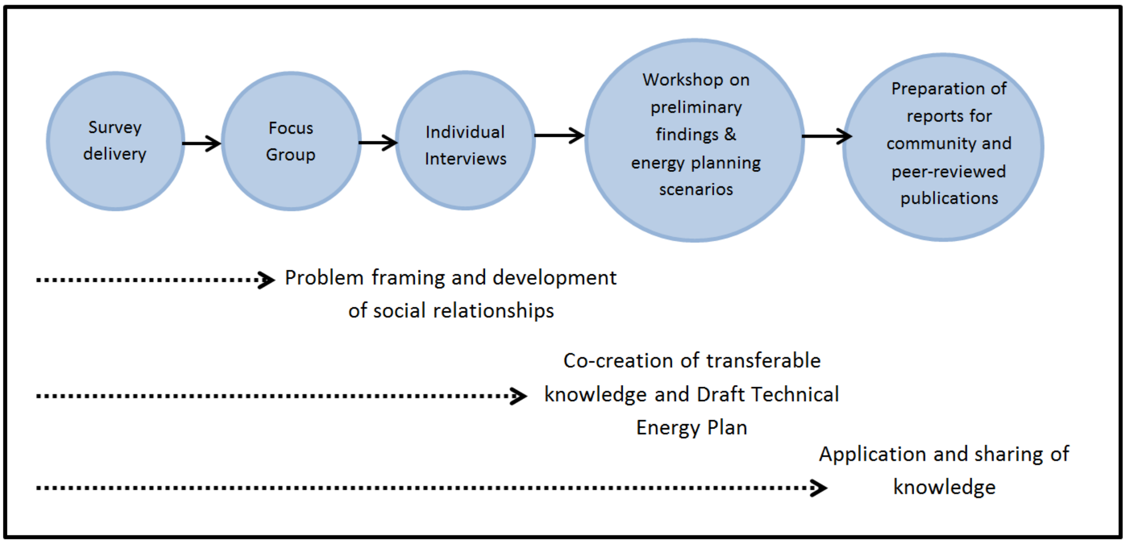

Figure 5.1: Preliminary outline of the Proposed Transdisciplinary Methodology Developed for this Research (source: Author)

Each of these methodologies were selected to enable the development of a transdisciplinary methodology for the investigation of the role of situated energy knowledges and CKNs in community low carbon energy transitions. The application of this innovative transdisciplinary methodology and the use of the case study approach, along with the selected case study location are described in the following section.

5.4 The Case Study Approach

5.4.1 Rationale for a Case Study Approach

Case studies are *"an empirical inquiry about a contemporary phenomenon (e.g., a "case"), set within its real-world context especially when the boundaries between phenomenon and context are not clearly evident"* (Yin, 2009a, p. 18). The case study approach is an appropriate research methodology when "when", "how" or "why" questions are being posed by the investigator and when they have very little control over events (Yin, 2013). In line with the transdisciplinary approach, a case study is useful when the research focus *"is on a contemporary phenomenon with some real-life context"* (Yin, 2013: p1). Although the case study method allows a transdisciplinary multi-method approach, they are often criticised due to their time and resource intensive nature (Yin, 2013) and what is often perceived as their poor generalisability (Stoecker, 1991). Nonetheless, case study research, although more time and resource intensive, can yield more in-depth, rich data than less intensive research strategies can generate (Flannery, 2011). Several different case study designs can be employed, including: the single case study; the single embedded case study; multiple case studies; and multiple embedded case studies. An embedded case study contains more than one sub-unit of analysis (Yin, 2013).

In the past, case study approaches have contributed in important ways to both methodological and theoretical advancements in qualitative research (Soy, 2015, Yin, 2013, Flyvbjerg, 2006, Bennett and Elman, 2006). Case studies have been used extensively in community low carbon energy transition research, especially with regard to local based knowledge and perceptions of energy (Islar and Busch, 2016, Walker et al., 2010, Warren and McFadyen, 2010, Mendonça et al., 2009, Walker, 2008, Schweizer-Ries, 2008, Devine-Wright, 2007). A case study approach is an excellent methodology for studying complex social based questions (Flyvbjerg, 2006) and enables direct engagement with the research problem (Yin, 2013). The case study method also provides flexibility in the approach and an opportunity to employ a range of techniques simultaneously while enabling the researcher to undertake an in-depth and detailed study (Bennett and Elman, 2006). This makes the case study approach suitable for the methodological requirements of this study and provides the opportunity to employ a transdisciplinary research approach to the problem.

A place-based approach was undertaken in this research as it gives opportunities to explore many different variables in community low carbon energy transitions; practical, political and social. The case study approach provides a suitable methodology for combining several different methods of data collection and interpretation (Yin, 2013). This research investigates the issues of individual energy perspectives, but also addresses the phenomenon of community low carbon energy transitions as socially constructed and rooted in place. This case study approach seeks to develop an in-depth understanding of community perceptions of sustainable energy by recognising and engaging with the social complexities and place-based context within which these occur. This involves exploring the range of meanings and understandings that individuals share within these bounded constraints. In line with the social constructivist perspective, the case study approach allows the researcher to assess the research problem within its social and cultural contexts.

The case study is a mixed-method approach that requires the collection of data through a variety of methods and at several levels of investigation (Yin, 2013) making it suitable for the problem-centred transdisciplinary approach. The emphasis of this research is an in-depth, place-based study of the role of situated energy knowledges and CKNs in the successful transition to low carbon energy societies. This involves assessing the influence of not only policy, but also how situated energy knowledges are socially constructed and the processes involved in the development and maintenance of the CKNs within which they are constructed through social action and the impact of physical location. The task of collecting data in a variety of methods, and over time, can give a voice to community experiences and feelings around low carbon energy transitions, while giving equal consideration to the viewpoints of different stakeholders. The varied research methodologies that the case study approach employs is deemed most suitable to this research project as it offers the opportunity for transdisciplinary methods to be combined successfully (van Breda et al., 2016, Krohn, 2010). When discussing idiographic and nomothetic knowledge[23], Krohn (2010) asserts that the case study lies somewhere between the two. He further argues that the concept of *"real world cases"* is only meaningful if it can be contrasted with what he terms *"the ideal state of something"* (ibid.: p32). *"Every scientific experiment makes things simpler than they are and theory imagines the world yet simpler"* (Krohn, 2010: p32). When discussing the concepts of the transdisciplinary individual van Breda et al. (2016) further emphasise the importance of the case study approach by describing three transdisciplinary projects that were completed by individual researchers. These researchers developed and pursued very different research strategies of working with and building informal individual epistemic

[23] Nomothetic and idiographic are terms used by Kantian philosopher Wilhelm Windelband to describe two distinct approaches to knowledge. Nomothetic knowledge is based on what Kant described as a tendency to generalise, and is generally employed in the natural sciences. Idiographic knowledge is based on what Kant described as a tendency to specify, and is typical for the humanities and social sciences. It describes the effort to understand and attribute meaning to unique, and often socially constructed, cultural or subjective phenomena (Thomae, 1999).

relationships[24] with the social actors immediately available to them in order to successfully integrate each of the disciplines they were utilising. These types of epistemic relationships are only possible through the use of a case study and in-depth qualitative techniques which allow interpersonal relationships to flourish.

A single embedded case study is employed in this research to develop comprehensive understandings of the role of situated energy knowledges and CKNs in community low carbon energy transitions. The case study community examined in this research was selected in order to achieve two interdependent objectives; to conduct in-depth evaluations of individuals situated energy knowledges within the context of community dynamics and to learn lessons that can reveal policy relevant findings for the Irish energy policy arena.

To establish the range of meanings and understandings behind situated energy knowledges with particular bounded contexts of the case study location several methods of data collection are employed. Data collection is achieved through a range of methods including:

- Secondary materials
- Initial Surveys
- Problem-centred focus group sessions
- Problem-centred semi-structured interviews
- Quantitative engineering data collection
- Reflexive energy planning workshops.

Having defined and described the case study approach, the following section describes the Problem-centred Interview Technique and how it is employed in this research.

[24] The terms epistemic relationship is used in this context to describe the concept of the co-production of knowledge across epistemic positions through the nurturing of interpersonal relationships.

5.3.2 The Problem-centred Interview Technique

"We can presuppose that humans have interviewed each other in some form or other for as long as they have mastered the use of language"

(Kvale and Brinkmann, 2009: p471).

Although the act of the interview is a natural human process, literature describes a myriad of ways of doing so. Having established that both qualitative and quantitative methods were appropriate for this study, it is still necessary to determine a specific methodological approach that could easily meet the requirements of both. This section outlines why the Problem-centred Interview (PCI) technique (Witzel, 2000a) was utilised in order to meet these criteria. It discusses the PCI technique, and its advantages, before turning to discuss the collection of the qualitative data needed for this research which enabled the development of quantitative outputs for the technical tools employed in this research. Finally, it discusses the merits of using the PCI as a transdisciplinary interviewing approach in community low carbon energy transition research.

1. Rationale for the Problem-centred Interview Technique

The premise of the PCI technique is that the basic aim of interviewing is to collect and subsequently construct knowledge. Witzel (2000b) argues that the sole function of the interview is to gain and communicate knowledge through language. Interviewing is the most basic form of knowledge collection and understanding based on the ancient human habit of asking and answering questions (ibid.). Interview methodologies have taken many forms over the years, including the *miner-interviewer methodology* and the *traveller interviewer methodology* (Kvale and Brinkmann, 2009). The *miner –interviewer* is one that has a targeted and specific interest in information they consider valuable whereas the traveller interviewer is openly curious without predisposed questions (ibid.). In the case of the *traveller interviewer*, the knowledge is co-constructed by the interviewer and the participants (ibid.). Both of these methods, although useful, have drawbacks. Approaching the interview searching for key information may lead to other crucial findings being missed, while a lack of focus during the interviewing phase can also lead to a meandering study which finds difficulty in reaching a final conclusion (Witzel, 2000a, Scheibelhofer, 2005). The PCI technique merges these two methodologies and involves participants in the process of knowledge construction. In the situation of the PCI:

"Interviewers take the role and attitude of a well-informed traveller: they have certain priorities and expectations and start the journey on the basis of background information obtained beforehand" (Witzel, 2000b: p2).

Although the interviewer approaches the interview well-informed, the journey through the interview is not pre-determined and it can take any form, depending on the participants input. This leads to a more focused but adaptive interview technique that meets the research design criteria of facilitating a collaborative, holistic, iterative and reflexive research approach required for this study. Prior research gives a better vantage point from which to interact with the participant. The PCI technique is a "*qualitative, discursive-dialogic method of reconstructing knowledge about relevant problems"* (Witzel, 2000a: p4). The involvement of the interviewer's knowledge enables a dialogue with participants and their individual perspectives, while the problem-centring allows the qualitative data collection phase of this research to produce focused energy related data that can transcend the disciplinary boundary between social science and engineering. The PCI is especially useful when looking at situated energy knowledges as PCI involves an "exchange between real people" in their own "social, cultural, and physical context" (ibid.: p4). PCI focuses on meanings and behaviour, which the researcher tries to understand through the eyes and lived experience of the people (Scheibelhofer, 2005), allowing for better understandings of community perceptions of low carbon energy transitions in their place-based contexts.

Although PCIs have more structure than narrative interviews, they are not necessarily centred on the conventional notions of "problems". The "Problemzentriertes Interview" (Problem-centred Interview) was developed in Germany in 1982 by Andreas Witzel (2000a). The German term *Problemstellung* refers to a *specific research question* and not necessarily a problematic issue, thus, the PCI technique works well with thematic analysis. It was introduced at the time as a mixed methods approach combining interviews with case-analysis, group discussions and biographical elements (Witzel, 2000b). At the time, the very popular qualitative interview was the norm while open interviewing was prominent and very influential in social science research. Yet the development of a systematic methodology for undertaking interviewing was largely neglected and considered unsuitable and unsophisticated (Witzel, 2000a). As a result of their lack of systemisation, the information garnered from these qualitative approaches were only suitable to enrich, illustrate and accompany the existing quantitative analysis and could not be used as a method independently on their own. They provided illustrative quotes to add colour and imagery to accompany the standard quantitative approach. As a result of its lack of clarity, the open approach was deemed too time consuming by some at the time (Witzel, 2000a). As discussed in Section 5.1, transdisciplinary research is one that is time-consuming for those that undertake it, and a focused, efficient method of data collection is crucial for successful transdisciplinary analysis of perceptions of community low carbon energy transitions.

Although qualitative methods are oft deemed to be elusive and ambiguous, the PCI approach implements and pushes the importance of the uniformity of interviewing whilst acknowledging that social science deals with people who are varied and unpredictable. Uniformity of interview techniques is necessary when crossing disciplinary boundaries in the realm of community low carbon energy transition research. Although the social scientific aspects of this research allows and encourages diversity, the engineering approach employed requires homogenous, systematic data to be undertaken effectively. PCI is also popular in studies that deal with complex, social based problems (such as community energy transitions), as it allows for greater integration of several methods (Greene and Rau, 2016, Santini et al., 2016, Sander et al., 2006, Lewis and Kattmann, 2004). This method is suitable for investigating actions and experiences and their justification and evaluation. Moreover, *"its underlying image of humanity (Menschenbild) considers people as self-reflective and capable of acting and communicating"* (Witzel, 2000b: p8). Self-reflexivity on the part of the particpants is crucial to effective eliciting of situated energy knowledges and the processes involved in their development. PCI must be treated as an agent of listening whereby the interviewer has prior knowledge of the problem but is guided by the respondent and their experiences. It is important that PCIs deal with real, practical knowledge and a research question that corresponds to an everyday problem, which can aid revealing the participants own experiential energy knowledge during this research. The research focused on perspectives of practical energy knowledge in the participants' daily lives that they can easily discuss and are also interested in discussing. The PCI offers a solution to the problem outlined in Chapter Three about the categorisation of local knowledge under the terms of experts (Nightingale, 2016, Taylor and de Loë, 2012, Raymond et al., 2010b, Nygren, 1999). Problem centring means that the participants are encouraged to reconstruct their own practical energy related problems to reveal their situated energy knowledges.

Another incentive for the creation of the PCI was to create a more reflective tool for the collection of qualitative knowledge than the semi-structured interview, *"which is hardly more than a query tool without theoretical foundation"* (Mey and Mruck, 2010: p423). In this regard, the PCI can facilitate the use of multiple methods of analysis across several disciplines that is required for the complex problem of community low carbon energy transitions. The benefit of the PCI is that it contributes to improving understandings of social realities by combining and integrating methods and methodologies of various traditions. Moreover, PCI is so designed that the researcher's prior energy knowledge developed while defining the research questions and structuring the research approach contributes to the interview discussion. In this way the researchers prior knowledge enters into conversation with the participants' practical everyday knowledge to enable a more considered, informed and structured interview discussion. This also facilitates more structured outcomes which is also useful when specific types of data are required, such as energy demand data. The PCI approach also allows the inductive moment of fully considering subjective perspectives that complement the deductive moment of building upon prior knowledge from research preparation to allow the data to question the previous knowledge in an abductive way. The structured management and suspension of prior knowledge by the guiding of the interview by the participant allows and enables further findings by way of abductive inference.

The PCI is one of many interview techniques developed for the qualitative research domain, see Flick (2006) for a comparative overview of methodologies. The PCI technique bears similarities to the *active interview* (Holstein and Gubrium, 1995). The PCI, like the active interview, is concerned with the "how" (process) and the "what" (substance) of meaning-making that the active interview emphasises, but more than this, the PCI has an interest in the "why" (reasons) there are certain meanings, actions and opinions. In the PCI process, the subject and knowledge behind the interviewer is as important as the subject and knowledge behind the respondent. The narrative interview designed by Schütze (1983) idealises the subjective perspective with paradoxical consequences. The narrative, which has a strong foundation in narrative theory, follows a strict process and series of steps. The opening question is followed by an uninterrupted period where the main narration is undisturbed. When this phase is concluded, follow-up questions allow the opportunity to delve deeper into any issues of relevance. Further so-called "Examinant questions" introducing additional topics can be used in conjunction with the rest of the interview, but they must stand alone (Bauer and Jovchelovitch, 2000). The narrative interview relies on drawing meanings and interpretations from the narration itself. In this instance, the burden of maintaining the interview and addressing the research issues falls mainly on the participant. Interviewers are required to abstain from interruptions or interventions in order to guide the interview and as a result the outcomes from the interaction are very heavily dependent on the communicative capabilities of the participant. PCI interviewers have much more flexibility in interrupting or intervening in order to ensure that the interview is problem-centred throughout. As a result, ad-hoc questions, specific probing and even confrontations can easily blend into the PCI process in order to ensure this. The PCI uses narratives differently, in a more focused and reflective way and utilises narration as a way of further probing the problem. This can be done through the use of an interview guide, or a topical guide, but essentially the crux of the problem unfolds throughout the interaction with the participant. Unlike the narrative interview, the PCI does not suggest a strict adherence to each stage of the process in order. The benefit of the PCI is that the meaningful knowledge about one's experience and actions can be established and understood through interaction with others. The process of interpretation can, of course, be understood by the interviewers after the interview when there is no interaction with the participants. It is useful for the interviewer to develop a topical guide for undertaking the interview that has been developed from theories and concepts that are developed from the researcher's prior knowledge.

2. The Epistemological Challenge of the PCI in this Research

"The thought objects constructed by the social scientist, in order to grasp this social reality, have to be founded upon the thought objects constructed by the common-sense thinking of men living their daily life within their social world"

(Schutz, 1962: 72).

Social science knowledge, unlike everyday knowledge, is characterised by remoteness as it is made of scientific constructs. Unfortunately, even if we take the approach of the interactive-inductive approach, the knowledge, experience and perceptions of the participants are never fully accessible. It is important to approach the PCI with the "principle of openness", meaning that it is best to refrain from having a hypothesis when entering into the PCI process. When assessing situated energy knowledges and CKNs in community low carbon energy transitions, it is important to assess their roles and to do so without a hypothesis when entering into the investigative process. This is much in the vein of other interpretive researchers who start the process without a hypothesis so as not to delineate the boundaries of the possible insights that arise from the study (Glaser and Strauss, 1971, Blumer, 1969). The presence of the interviewer's prior energy knowledge and their leadership in undertaking the interview can never be overlooked. This needs to be acknowledged and organised in such a way that it becomes a collaborative, co-creative interaction which can provide better access the participants "stubborn world" (Blumer, 1969). This is done through the development of a sensitising framework illustrated in Figure 5.2 and the development of the sensitising concepts described in Chapter Three and summarised in the topical guide in Section 5.3.4 in following section.

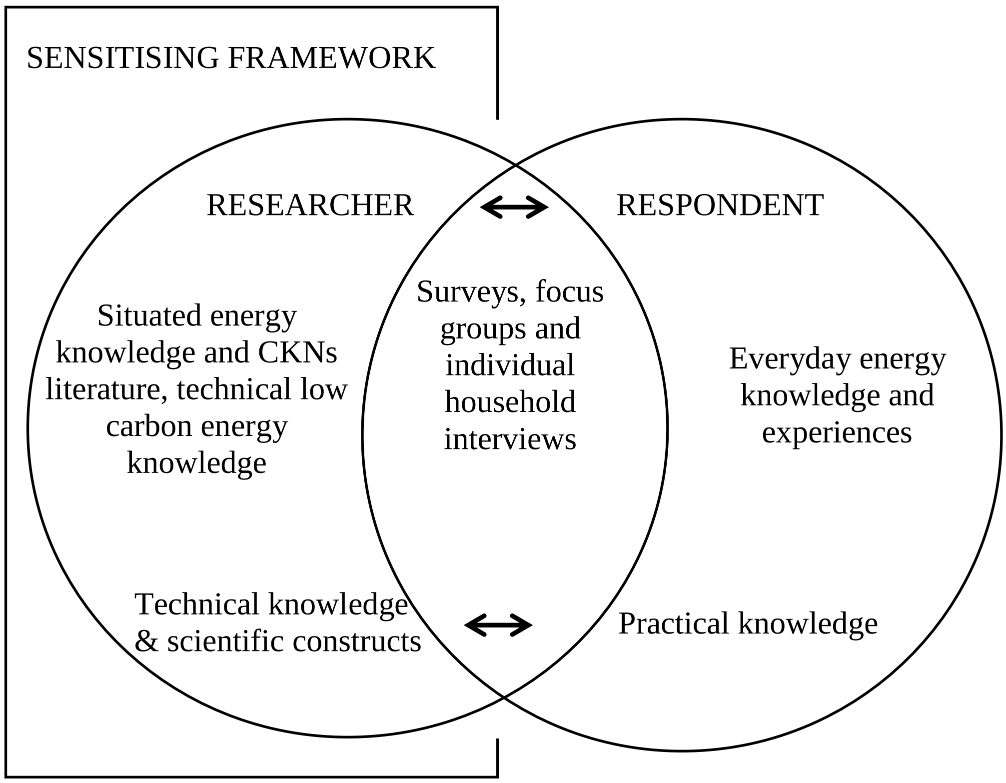

Figure 5.2: Epistemological challenge of PCI in this work (adapted from (Witzel, 2000a))

In this research, the PCI welcomes the participants to co-construct and reconstruct problems together with the interviewer in an interactive and interpretive process of data collection. Another facet of the PCI technique is *"pre-interpretation"* (which is done during the interview) (Witzel, 2000a). This is distinct from the systematic interpretation during the dedicated analysis phase of the research described in Section 5.5. This is innovative as it recognises the achievement of the researcher as interviewer when they keep interpretations open, assess prospective leads and meanings and even provoke further investigation in certain topics. This is extremely useful when discussing energy related topics as it allows the researcher to delve further into specific energy related queries that might have been ignored with more rigid interview techniques. This method reflects the everyday activities of discussion and interaction and is a very natural investigative method which can help to better elicit information related to every energy experiences. Having described the epistemological challenge of the PCI technique in this work, the following section details the how PCI's were prepared in this research.

5.3.3 Preparing Problem-centred Interviews

Research designs make visible what steps and procedures are necessary to gather the relevant data needed. Compared to quantitative research design, qualitative research design is more flexible and allows for more adaptive interaction of the various elements than with a rigid linear process. Qualitative research design is *"an ongoing process that involves "tacking" back and forth between the different components of the design, assessing the implications of goals, theories, research questions, methods, and validity threats for one another"* (Maxwell, 2012: p3). Research designs are not prescribed modes of questioning, but rather *"plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis"* (Creswell, 2009: p4). As plans, research designs illustrate the steps in the research process that are necessary and how these are interconnected with the decisions required (Witzel, 2000a). A flowchart was developed for this research to make visible key steps and decisions throughout the data gathering process, and as a method of guiding the researcher through the process as illustrated in Figure 5.3.

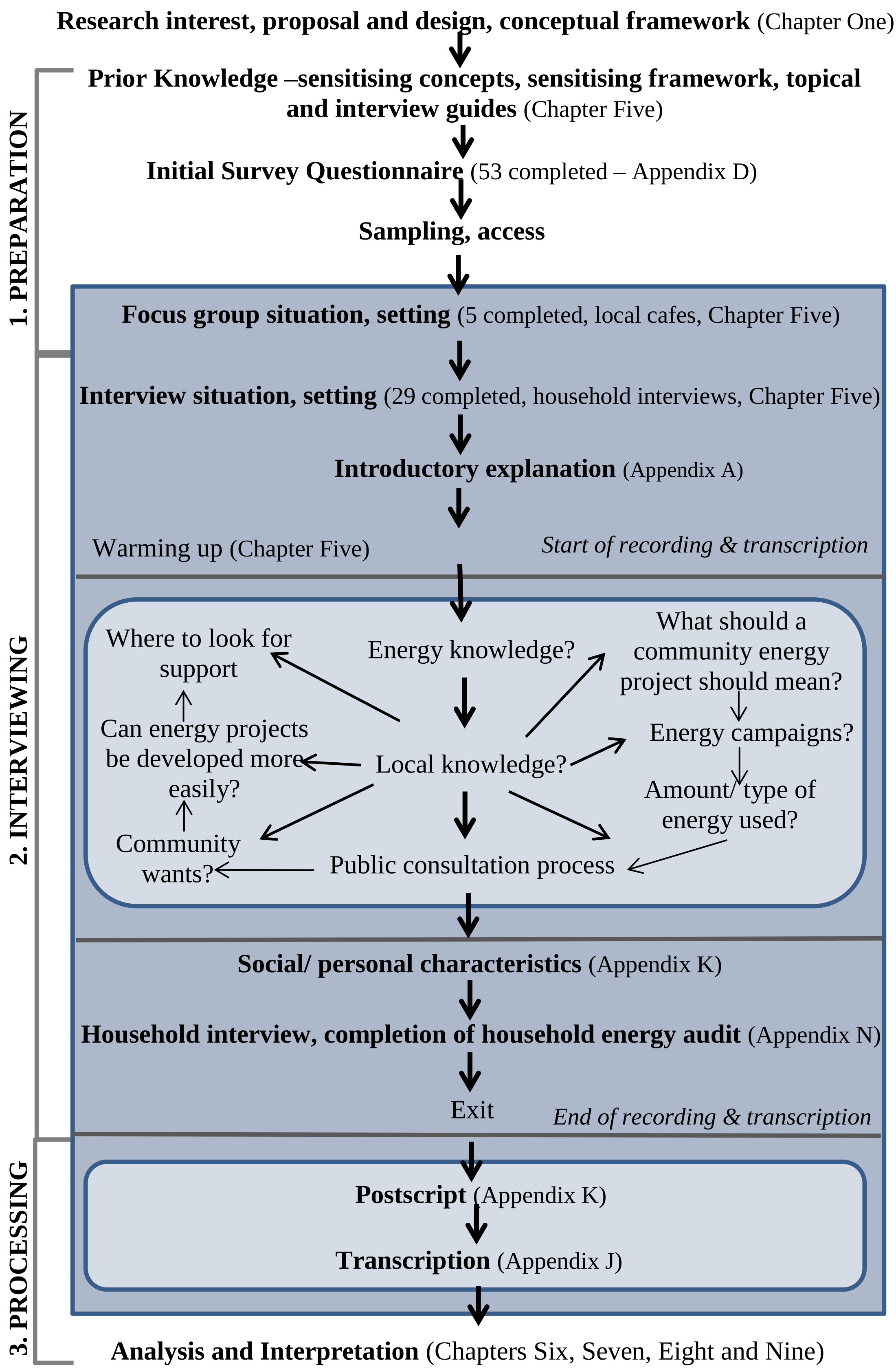

Figure 5.3: Flowchart of PCI methodology employed in this work (adapted from (Witzel, 2000a))

Qualitative research is an iterative, ongoing process that involves going back and forward though different elements of the research design through the journey (Maxwell, 2012) especially when integrated into a transdisciplinary approach. Developing prior knowledge of the researcher involves four types of knowledge: everyday, contextual, research and sensitising knowledge (Scheibelhofer, 2005, Witzel, 2000a). Every-knowledge is knowledge that is garnered during the everyday-life of the researcher and their personal experiences and is fundamental the successful transdisciplinary energy research. In the case of this transdisciplinary work, this includes synthetic or processed knowledge (Strauss and Corbin, 1990) in the form of technical and non-technical energy knowledge. Although the addition of this synthetic knowledge creates a gap between the researcher and the participant, it is necessary in this research in order to gather focused energy specific data. Contextual knowledge is the minimum requirement of the prior knowledge needed for undertaking PCI effectively and is of the utmost importance when undertaking research in small island communities. This includes knowledge of the living conditions of participants, the history of policy reforms and legislation, and the relevant issues outlined in Chapter Three that are within the scope of the participants' lives in Inis Oírr. This gathering of contextual information allows the interviewer to appear more competent to the interviewees and to garner trust from the participants while developing relationships needed for successful transdisciplinary research. Sensitising prior knowledge is distinguished by its twofold quality. On the one hand it is of general interest to the energy problem and can include more abstract concepts, on the other, the sensitising quality of prior knowledge depends on how it is used in a sensitising way. The prior knowledge garnered for this research was utilised in a non-authoritative capacity so as not to impede the participants chance to enter dialogic reconstruction of the problem. The sensitising concepts employed in this research are useful as they suggest directions along which the researcher should look throughout this PCI process (Witzel, 2000a). Figure 5.4 illustrates the sensitising prior knowledge developed for this research which guides the process of investigation.

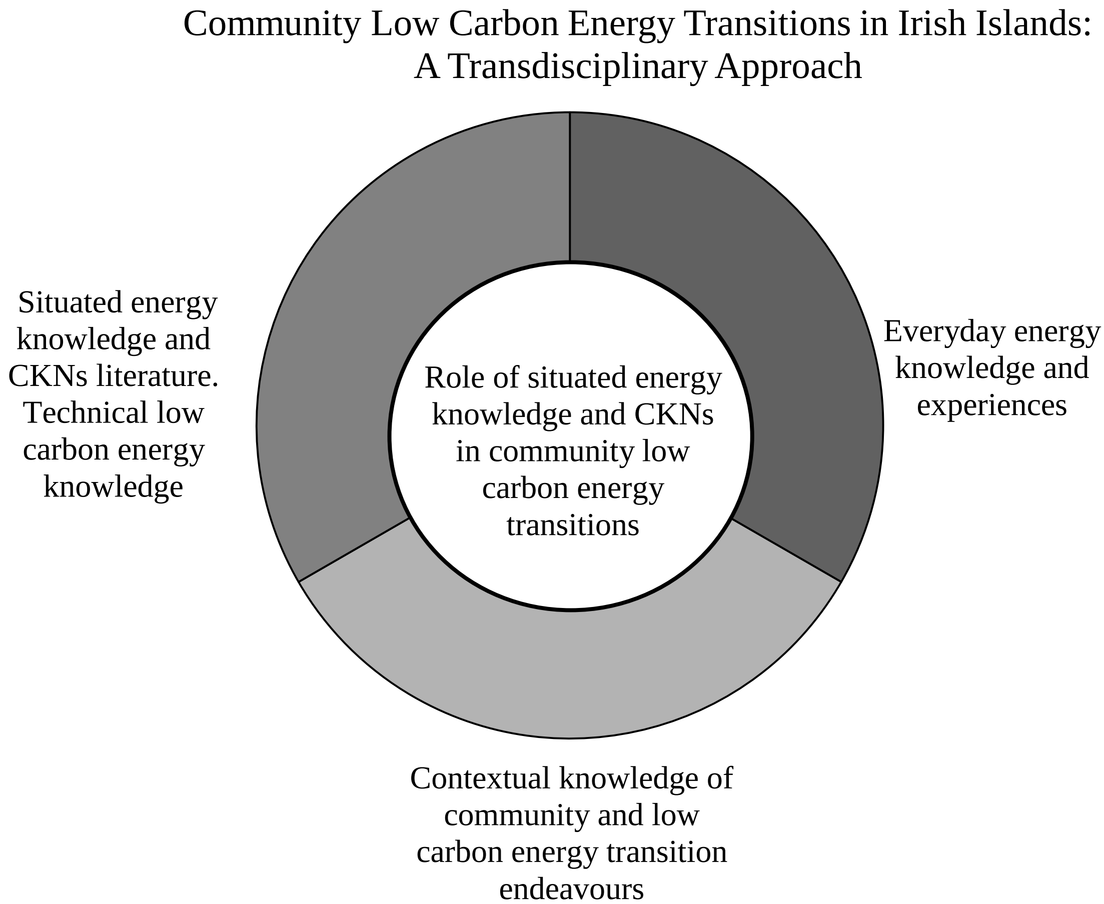

Figure 5.4: Sensitising prior knowledge for this research (adapted from (Witzel, 2000a))

The aim of this prior sensitising knowledge is to have impartial expertise when undertaking the PCI process. Prior knowledge is used here in an attitude of theoretical sensitivity as it is done in grounded theory (Strauss and Corbin, 1990). A "sensitising framework" (Witzel, 2000a) was developed for this research as a method of organising prior knowledge within the PCI process. The sensitising framework is, in essence, a preliminary roadmap for the issues being investigated during the PCI process employed in this research. The use of the theoretical framework outlined in Chapter One is appropriate for projects that contain a cultural theme and are utilising a transdisciplinary approach (Creswell, 2009) such as are present in this research. Along with defining a sensitising framework, in order to ensure that the boundary around the scope of this research is delineated, a scope of analysis was defined prior to undertaking this research and is illustrated in Figure 5.5.

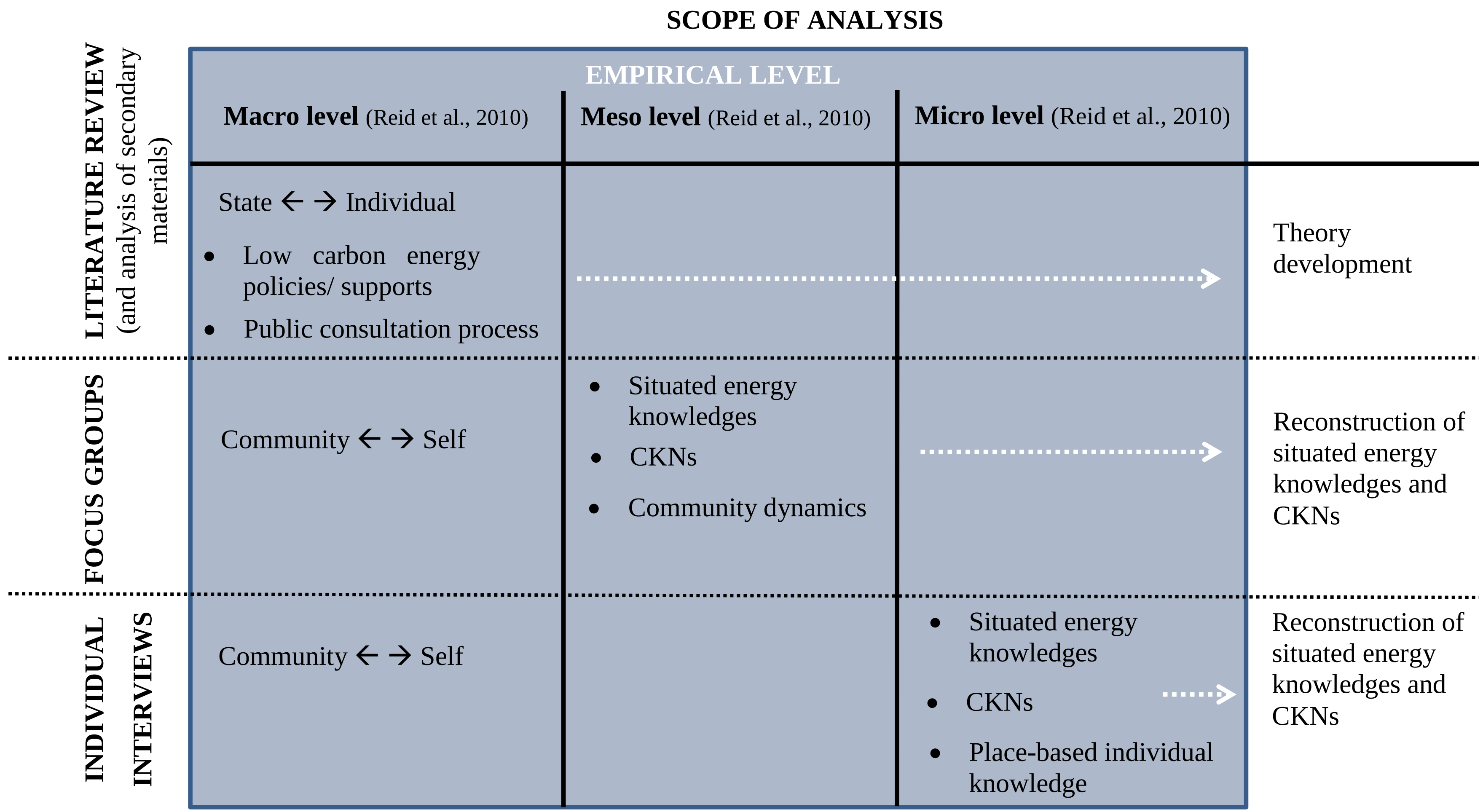

Figure 5.5: Scope of analysis of this work (adapted from (Witzel, 2000a))

This is extremely useful for the transdisciplinary nature of this research and ensures that all phases of the research process have the potential to create compatible data outputs. The scope of work outlined in Figure 5.5 describes how perceptions and daily experiences of energy were analysed at the individual, household and community level simultaneously. This research gathered data across experiential levels and disciplines simultaneously, creating the need for a defined scope early in the research design, so that the process maintained its problem-centring throughout. In order to achieve this effectively, this research looked at the macro level (national/community), the meso level (household) and the micro level (individual) as crucibles of energy behaviour (Reid et al., 2010) and cross-disciplinary analysis. The first phase of the research, the literature review, investigated the macro level of energy practice and existing policy on low carbon energy transitions and current energy planning and public consultation processes. The second level of analysis, the focus group, attempts to reconstruct situated energy knowledges and CKNs within the group dynamic. Finally, the third level of investigation, the individual problem-centred interview, attempts to reconstruct situated energy knowledge networks and CKNs from the individual perspective. Building on the PCI approach coupled with lessons drawn from the literature review outlined in Chapters Two the sensitising concepts described in Chapter Three and the GMIT Research Ethics Policy (GMIT, 2010), a set of criteria were developed for this research which are outlined in Table 5.1.

Table 5.1: Ethical and Evaluative Criteria for this research	
1.	<u>*The promotion of honesty, openness and fairness*</u> Respect for the participants must be maintained by being open about the research and their role and the implications of their taking part in the study. Feedback must be invited from the participant throughout the interview and sensitivity must be maintained about the potential impacts on the participants. The aim of this research is to invite the participants to become active collaborators and co-creators of the draft technical energy plans. Critical subjectivity must be maintained by being honest and transparent about researcher positionality and the influence this may have on the research. **Table 5.1 continued on next page**

Table 5.1: Ethical and Evaluative Criteria for this research (contd.)	
2.	*Informed consent* This research must not involve persons under 18 years of age. Consent must be ascertained on the doorstep and subjects must enter the research process voluntarily and willingly through informed consent. An information sheet and consent form detailing their rights as participants in the study must be sent to the participants prior to undertaking the study (Appendix A). This includes procedures for withdrawing from the study at any time and an agreement about the conditions of use of data for research material.
3.	*Transparency of data* The tapes and transcripts of the interview post interview must be retained. Transcripts must be carefully numbered and stored.
4.	*Transparency of method and participant sampling* Discussions of methodological decisions and their limitations, sources of bias and other possible difficulties must be recorded. It is important that the participant sampling is purposive and theoretically justified.
5.	*Confidentiality and privacy* When undertaking fieldwork the research will take place face-to-face and verbal assurance will be given that all information will be private and confidential. When undertaking PCI research, participants are narrating everyday life experiences, which often contain private and intimate material. This research will therefore employ the use of pseudonyms in order to protect participants' anonymity. The research will also be relayed in the participants' own words. At the end of the study tapes will be stored for the duration of up to a year, and destroyed after this time has elapsed. The data for this study will be held on a computer and personal data will be stored in cases where householders have given the research permission to undertake further studies in their household. Files will have administrator passwords and only the researcher and project supervisors will have access to these files. **Table 5.1 coninued on next page**

Table 5.1: Ethical and Evaluative Criteria for this research (contd.)	
6.	*Proper acknowledgement of the role of all involved in the research* Where other researchers contribute to this research, they will be acknowledged in publications related to their work. Acknowledgement will also be given to the participants in the study.
7.	*Transparency and clarity of conclusions* How the conclusions have evolved and been developed and how they are deeply grounded in data must be clearly explained at completion of the research (Chapter Ten).
8.	*Quality and usefulness of conclusions* Conclusion should be theme driven and tie in easily with the technical energy plan as output. It is important that these conclusions are also deeply grounded within the context of the research project (Chapters Six, Seven, Eight, Nine and Ten).
9.	*Participant evaluation* The participants must be invited to give their feedback to evaluate the quality of the results and the draft technical energy plans. The results should be in line with the participants' experiences and everyday lives and have beneficial implications for the case study community (Chapters Four and Nine).
10.	*Triangulation with literature* Sensitising concepts must be developed for research from relevant literature. Results must be compared to existing literature and undertake discussion based on their uniformity and their divergence (Chapters Six, Seven, Eight, Nine and Ten).
11.	*Benefit of research should be maximised and possible harms should be minimised* In keeping with the transparent nature of this research, the results are to be disseminated within the case study community so that they can learn from its findings. Findings will be communicated using pseudonyms and without detailing life-history so as to ensure that the identities of those involved are not revealed. **Table 5.1 coninued on next page**

Table 5.1: Ethical and Evaluative Criteria for this research (contd.)	
12.	*Merging of qualitative and quantitative methodologies* The Research Design must enable the movement between and integration of both quantitative and qualitative data in the research methodology (Chapters Four and Five).
13.	*Respect and consideration of the broader social and cultural implications of research and participant wellbeing* When research involves people and their lives, distressing or unpredictable events can happen. This is especially true when undertaking biographical research in the context of peoples' homes and their families. Although the topic of this research is not highly sensitive, when discussing people's daily lives, difficulties that they have experienced can cause distress. For this reason the researcher will prepare a set of guidelines in advance of how they would respond to such a situation (Appendix B).
14	*Ethical Approval* The researcher must obtain ethical approval from the awarding institution. Ethical approval was obtained from Galway-Mayo Institute of Technology in the summer of 2015.

Then next section details the implementation of the PCI and the process involved in each research phase. The section begins with a brief explanation of the application of the sensitising concepts to this research, the topical guides that were developed, and the process involved in their development. Following this, the initial survey is detailed along with the purpose of its use. Following this, the implementation of the focus group phase of the research is described, with the final part of this section discussing the design and implementation of the individual problem-centred interviews.

5.3.4 Topical guide

As soon as the direction of the research was consolidated, research questions were clear, the sensitising concepts developed and PCI identified as the mode of data collection, the applied part of the research process began. Based on current literature in the area of community low carbon energy transitions outlined in Chapter Two, the sensitising concepts outlined in Chapter Three, and to facilitate proceeding with the applied part of the research process, a topical guide was developed. To attempt to answer the research questions outlined in Chapter One, the three key sensitising concepts outlined in Chapter Three are investigated in this research; knowledge, governance and communication in island communities. Figure 5.6 illustrates the topical guide developed from literature for the knowledge sensitising concept. The topical guides created for the governance and communication sensitising concepts are contained in Appendix C. The first sensitising concept centres on the concept of situated knowledge and argues that all knowledge must be considered and placed within its context (Nightingale, 2016, Nightingale, 2003). This research considers the different types of knowledges involved in the process of community energy transitions; those that are considered “authentic” and those that are considered “synthetic” (Nygren, 1999). Tensions between these two dichotomies of knowledge epistemologies creates a conspiratorial environment of “them” (experts) versus “us” (communities) (Haraway, 1988).

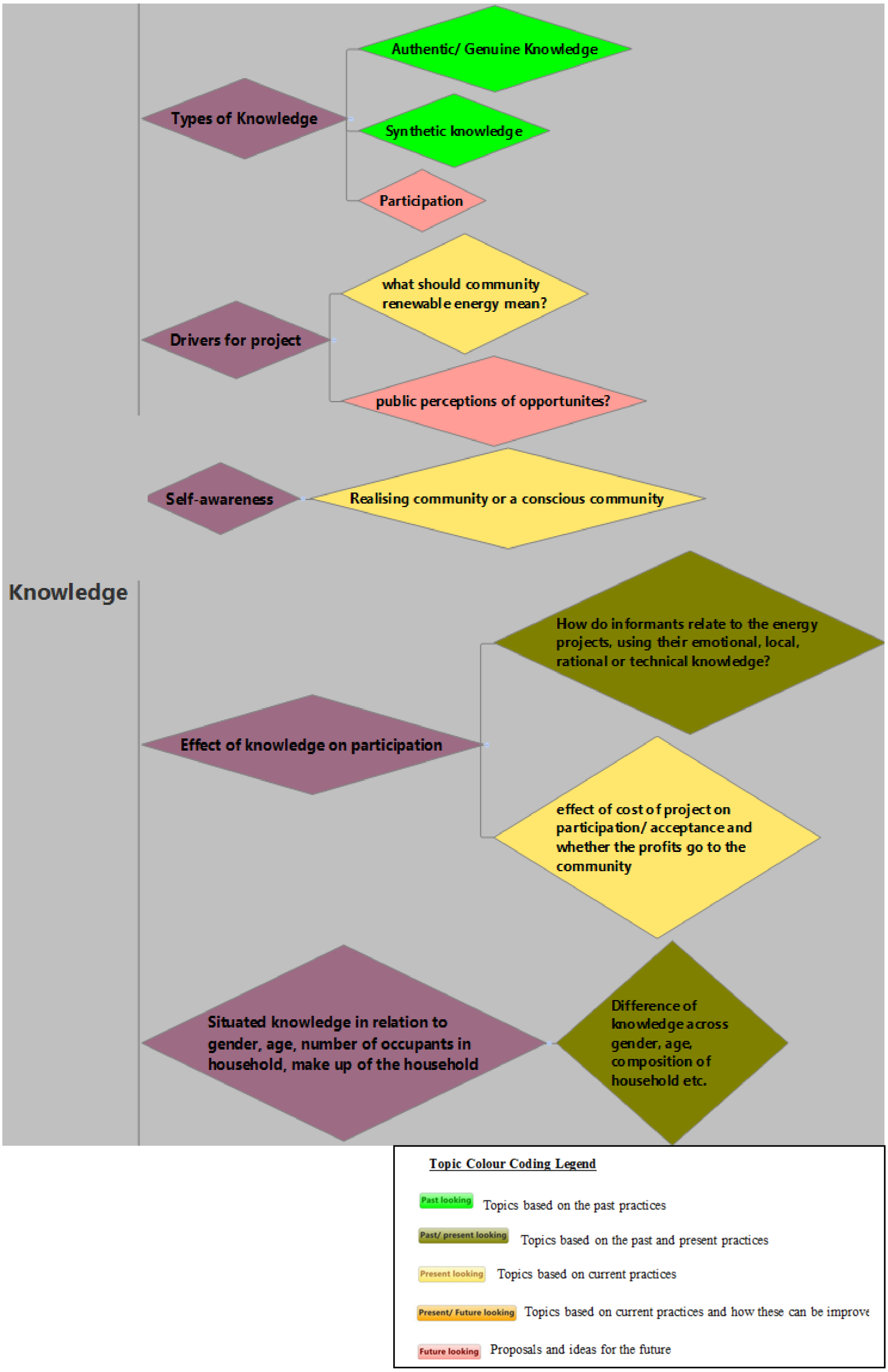

Figure 5.6: Topical Guide Developed from Literature (source: Author)

The knowledge topical guide is divided into five headings within which the themes from literature are placed and the discussion topics for the focus group developed. These are as follows:

1. Types of knowledge
2. Drivers for community low carbon energy transitions
3. Self-awareness of participants in the transitioning process
4. Effect of knowledge on participation in low carbon energy transitions
5. Situated knowledges

These concepts created the foundation upon which knowledge was investigated within this research. Several types of knowledge were explored (local, emotional, rational, technical, political and economic) within the contexts of the participants' daily lives. The second sensitising concept investigated in this research is the concept of communication, primarily the prominent information-deficit model of community consultation (Catney et al., 2013, Burgess et al., 1998) used to date which is outlined in Chapter Three. CKNs were also assessed (Catney et al., 2013) including the importance of existing relationships within these networks (Gilchrist, 2009). The topical guides for the sensitising concepts of governance and communication are contained in Appendix C. Also investigated is the effect of current public consultation processes' assumption of a deficit in public knowledge which, if filled, will encourage community participation (Devine-Wright, 2007, Burgess et al., 1998). Insider/outsider distinctions that develop during public consultation processes (Devine-Wright, 2012, Moran, 2007) were explored with a view to understanding their role in energy governance in island communities. The existing role of government, including the existing institutional barriers to community energy development, was also probed to gain insights into current deficits in Irish island energy governance structures. Following the development of the topical guides, the initial survey was created to undertake theoretical sampling and to enable the development of interpersonal relationships with members of Inis Oírr community. The design and content of the initial survey is outlined in the following section.

5.3.5 Initial Survey

Prior to the undertaking of the focus group phase of the research, initial surveys were distributed within the community. These surveys contained questions related to the participants' demographics in order to enable the researcher to undertake theoretical sampling. The survey was distributed in both Irish and English and is contained in Appendices D and E. The survey contained questions related to the participants' perceived level of individual and community energy actions as follows:

- The level of individual action they undertake aimed at deliberately reducing their energy use
- The types of individual energy action they take in order to reduce their energy use
- The level of group energy action they undertake aimed at deliberately reducing their energy use
- Examples of the group energy action initiatives that they partake in
- They were asked to rate the opportunities for improvement in their level of energy use in their normal daily activities
- They were asked what factors they thought influenced their level of energy use most
- They were asked to estimate their total average monthly household energy spend.

These surveys are also a method of gaining access to participants for the study and encouraging participants to sign up to the study, while developing interpersonal relationships needed for transdisciplinary research. An initial list of possible participants' names was obtained through the Inis Oírr Co-operative. In his role as the gatekeeper Philip, the manager of the co-operative, attempted to distribute the initial survey. However, due to resource constraints on his part, there was a low level of survey completion and the researcher had to enlist the majority of the participants

through the use of snowball sampling[25] and through the interpersonal connections that the researcher developed through several visits to the island. The surveys were distributed by

[25] A snowball sample is a technique that is appropriate to use in research when the members of a population (such as a small island location) are difficult to locate. In this instance the researcher collects data on the

walking around Inis Oírr Island and employing the snowball sampling technique to garner contacts and introductions to enlist more participants in the study. 53 surveys were completed for this study and the final number of participants chosen for the second (focus groups) and third (individual interviews) phases of the research was 29. Following the distribution of the surveys, the focus groups were undertaken and these are outlined in more detail in the next section.

5.3.6 Focus Group Design

The design of the focus group comprised of four stages; deciding on the unit of analysis, the use of multi-category design, the location for the focus groups and the development of the focus group topic guide and these are outlined further in the following sections.

Unit of Analysis

Case study research offers the opportunity to undertake several levels of analysis simultaneously, at the macro, meso and micro levels of energy practice. One can easily look at both individual and group theories within the same study (Yin, 2013). This research considers individual theories around the individual, their situated energy knowledges and their relationship to their CKNs. It also analyses group theories and group dynamics in the form of their family functioning, their interpersonal relationships and the processes involved in CKN development and maintenance. Although community dynamics are a key concept within this research, the individual was chosen as the unit of analysis. The concept of "household energy managers" was applied to the individual in order to assess family and community dynamics within the study. The term *"household energy manager"* developed for this research is used to define the person within a household who is responsible for the supervision and management of energy consumption within the household. The household energy manager was the individual within the family that had an in-depth knowledge of, or were responsible for the energy management within their home. As a result, each participant represented a household on the island.

few members of the target population that can be located, then asks those individuals to provide information to contact and locate other participants for the study (Cohen and Arieli, 2011).

The number of households in Inis Oírr is approximately 120, therefore, the participants involved in this study represented over 25 per cent of the island's population.

Multiple Category Design

A variation of the traditional design is to conduct groups with several types of participants, either sequentially or simultaneously (Kreuger and Casey, 2009). This allows the researcher to make comparisons from one group to another within a category (younger to older) and from one category to another category (Witzel, 2000b). The structure of the focus groups involved between four and five participants across five focus groups, with one consisting of two people. Each focus group lasted between one and two hours. The types of participants varied across age, gender, types of energy knowledge and comprised of household energy managers as illustrated in Figure 5.7.

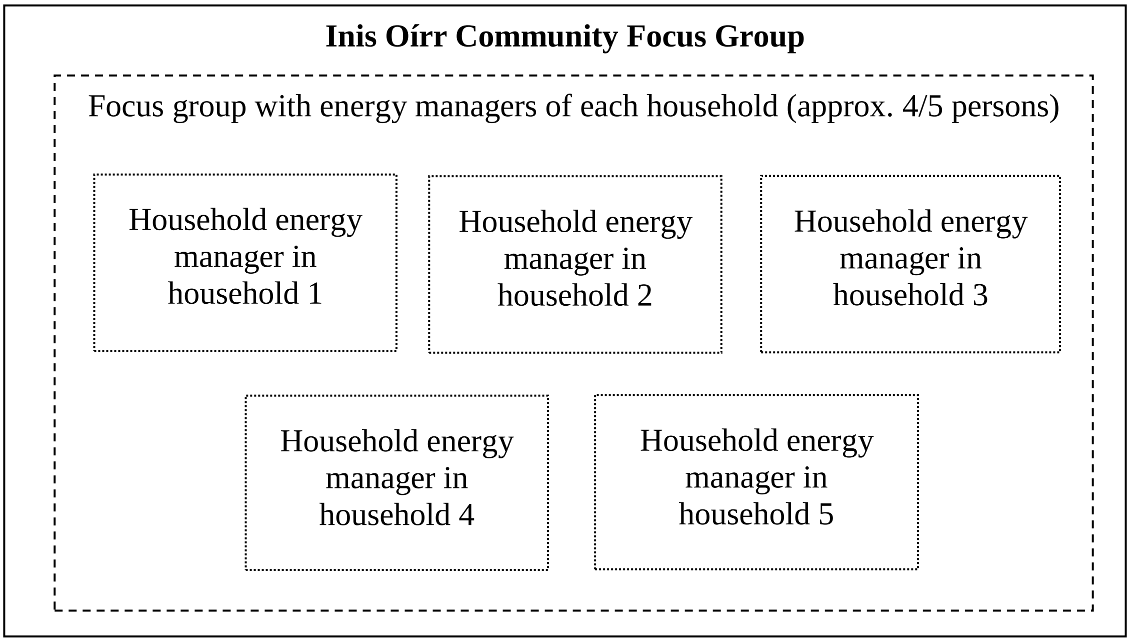

Figure 5.7: Focus Group Multi-Category Design (adapted from Yin, 2013))

In order to account for the possibility of existing power relationships within the community (Witzel, 2000a, Yin, 2013), each of the focus groups were structured around participants' perceived level of community energy action in order to avoid power dynamics within the focus group discussion. This enabled open discussion around the topic of the participants' situated energy knowledges, CKNs and Inis Oírr's low carbon energy transition. These open discussions were intended to encourage participants to partake in later stages of the research process. For example, focus group one was comprised of participants that rated themselves as eight or higher in terms of their perceived level of community energy activity (where one is extremely low and ten is extremely high) as illustrated in Table 5.2. This meant that the majority of the group were involved in community organisations or were quite active in the community energy groups with a high level of confidence in their abilities, leading to a focus group discussion that was focused on the topic of community energy governance. So as to be mindful of any tensions within the community (Witzel, 2000a) members of the island co-operative were consulted on the grouping of individuals within each of the focus groups prior to contacting the participants about the focus group arrangements.

Table 5.2: Example of Theoretical Sampling of Focus Group One Based on Level of Energy Action

Focus Group 1 (Group Energy action rating of ≥ 8)					
	Pseudonym	**Occupation**	**Level of Group energy action**	**Age group**	**Gender**
1	**Martha**	Community development officer	10	> 65	Female
2	**Philip**	Manager of Inis Oírr Co-operative	9	45 - 64	Male
3	**Maeve**	Office worker	8	45 - 64	Female
4	**Evan**	Working in FÁS[26]	10	45 - 64	Male
5	**Tadhg**	Hotelier	9	25 - 44	Male

The focus groups were undertaken in neutral locations, two in local cafes and three in local restaurants. Refreshments were provided to the participants during the focus groups in order to make them feel more comfortable. The focus groups were also held during the peak tourism season, so many of the participants had limited free time. In order to limit

[26] FAS is Ireland’s employment authority which promotes job opportunities and training courses for school leavers, post graduates and professionals.

the intrusion of the focus groups into their personal time, lunch was served so the participants could take part in the study during their lunch breaks.

Focus Group guide

The next phase in the research process involved the development of the focus group guide which serves as a preliminary guide for undertaking the focus group itself and aids the researcher in ensuring that the focus group remains problem-centred. The focus guide covers all aspects of energy related discussions to be undertaken, how the problem is to be addressed and the anticipated outcomes from the data collection. The focus group guide is structured around ten main questions that are outlined in Table 5.3.

Table 5.3: Focus Group Topic Guide

	Key words/ cues	**Narrative/ question**
SENSITISING CONCEPT 1: KNOWLEDGE	- aim is to have a definition at the end - examples of what you think energy knowledge is? - conserving/ creating energy?	*Question 1: Opening question* Different people have different definitions of what energy knowledge means. What do you think it is?
	- aim is to have a definition at the end - examples of what you think local knowledge is? - living in Inis Oírr/ small island affects energy use?	*Question 2: Transition Question* Different people have different definitions of what local knowledge means. What do you think it is?
	- aim is to have a definition at the end - What type of knowledge do you think is more important - Do you use energy differently at home than in your workplace/ school? - What are the reasons for this? - Opportunities? - Drawbacks?	*Question 3:* What do you think that a community energy project should mean? *Question 4:* What things are most important to you in relation to the amount of energy you use or the type of energy you use?

Table 5.3 continued on next page

Table 5.3 Focus Group Topic Guide (Contd.)		
	Key words/ cues	**Narrative/ question**
SENSITISING CONCEPT 2: COMMUNICATION	- through the efforts of government/ community members? - How community approach new energy projects? - What opportunities are there for you and your community to make changes at community level? - political barriers / institutional barriers role to play for community representatives?	*Question 5: Key question* How can community energy projects be developed more easily? How can energy use within your community be easily, and most effectively altered?
	- existing support networks? - Does your community get sufficient support from government?	*Question 6: Closing question* Where does your community look for support in developing community projects?
SENSITISING CONCEPT 3: GOVERNANCE	- thoughts on these campaigns? - European and Irish energy targets - Aran Islands Energy Independence targets - What are your thoughts on these?	*Question 7: Opening question* Are you aware of any past or current energy campaigns?
	- thoughts on this process? - Does this process involve and communicate with you effectively? - Where do you get most of your information on how much energy you should use	*Question 8: Transition question* Are you aware of the <u>public consultation process</u> currently used in the development of projects today?

Table 5.3 continued on next page

Table 5.3 Focus Group Topic Guide (Contd.)		
	Key words/ cues	**Narrative/ question**
GOVERNANCE (contd.)	- most important reasons for your community to develop a community energy project?	*Question 9: Key question* What differences do you think there are between what your community wants from the community energy project and what the government wants?
		Question 10: Ending Question: Is there any other topic that you feel is important to discuss today?

5.3.7 Individual Interview

Interview guide

The interview guide serves as a preliminary guide for undertaking the interviews themselves. The interview guide covers all aspects of the interview to be undertaken and how the problem is to be addressed. This takes the form of thematic fields that are further divided by keywords or categories that have been devloped based on the initial findings from the focus groups. The interview guide contained a structured layout which was the same across all interviews as illustrated in Figure 5.8.

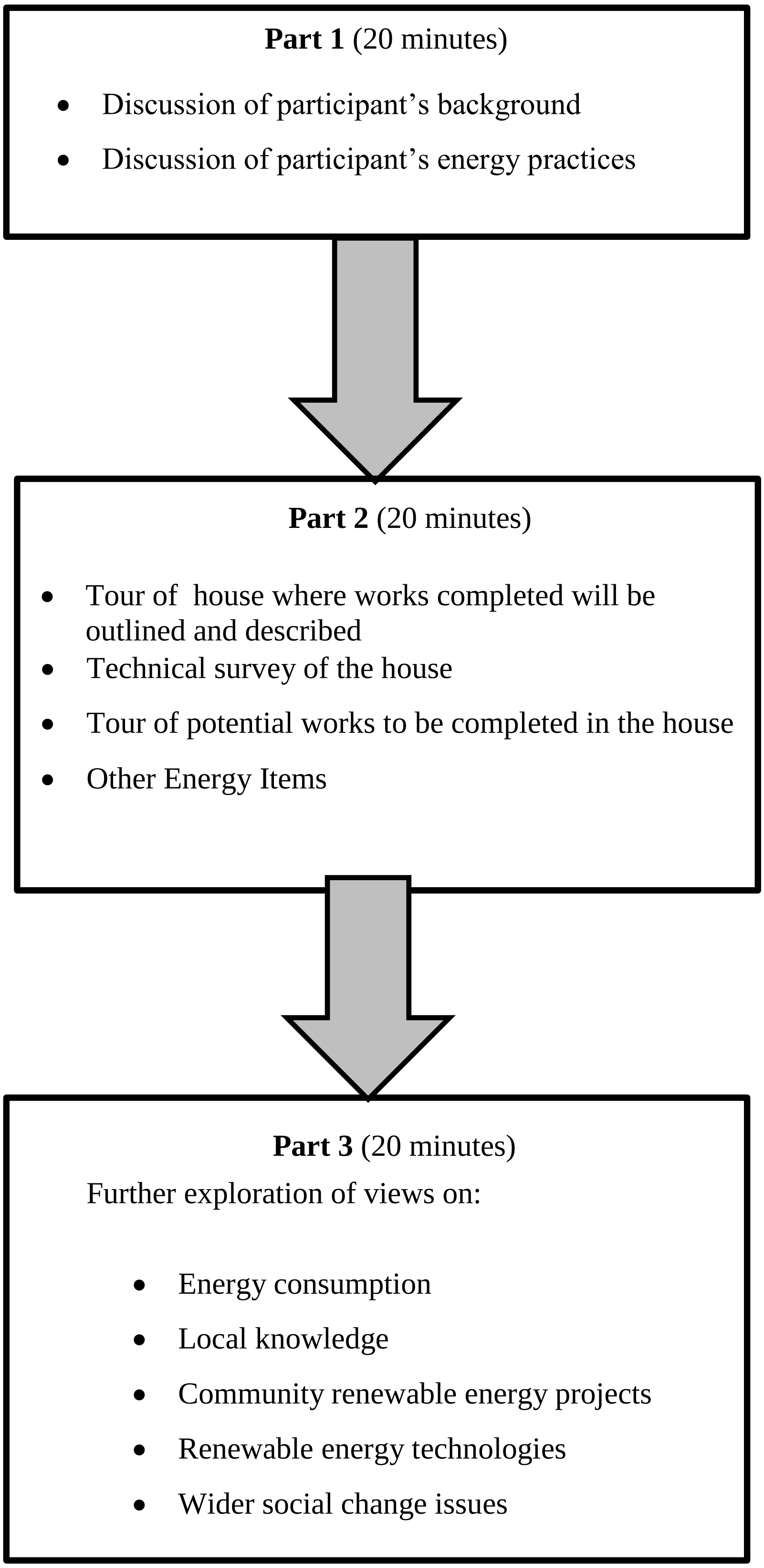

Figure 5.8: Basic Interview Guide for all Individual Interviews (source: Author)

The topic guide was defined by the participant and the thread suggested by them. The pressure to decide whether to follow up and introduce new topics while the conversation is still evolving was avoided through the creation of this topic guide in an effort to reduce interview mistakes. Flexibility was maintained in the interview guide so that leads could be followed and insights outside of the initial topic guide found. Twenty One of the 29 participants that were interviewed individually took part in the focus groups as well. In order to further delve into certain issues that came up in the focus group and to continue the problem-centring of the research, the interview guide in Figure 5.9 was built upon based on the initial findings from each of the focus groups (where the participants had taken part in the focus groups prior) and these are contained in Appendix H. For example, Philip took part in the first focus group which involved participants that rated themselves as between an eight and ten in terms of their perceived level of energy action (with one being extremely low and ten being extremely high). The focus group comprised of four participants that worked in community organisations and one who was a local business owner, but very active in reducing his energy consumption. The majority of the focus of the discussion centred around the governance stuctures on the island and on mainland Ireland and also the difficulties they experienced due the islands' geographic remoteness. The topic guide in Figure 5.9 was overlaid with the key themes from the focus group in order to better guide the researcher and to further reinforce the interpersonal relationship that evolved in earlier parts of the research process.

The location and setting of the interview were carefully considered in order to preserve the trust that had developed during the focus groups and to nurture the development of trust with those participants that had not taken part in the focus groups previously. The details of the location of the individual interviews and the format of the interview are outlined in the following section.

5.4 Location and Format of the Interview

Interview location, setting and format

The locations of the interviews were chosen to contribute to open and intensive dialogue as part of establishing a research relationship within which reconstruction of the problem could best unfold (Witzel, 2000a). Ethical issues involving managing the visability of the research were considered as was the comfort of the participants. As a result, the individual interviews were held in both the participants' homes and otherwise in the local café, restaurant or the offices of the co-operative if they were uncomfortable the researcher visiting their home. As described in Section 4.4, Inis Oírr is in the Gaeltacht Region of Ireland and is an Irish speaking island. Gibb and Danero Iglesias (2016) assert that ethnographic research is often multilingual requiring researchers to work in two languages and they argue that levels of fluency in a second or additional language can affect the research. They state that one must learn to identify subtle differences in dialect, understand colloquialisms, acquire slang terminology, and learn when and how to use a polite or a casual tone (ibid.). However, although the participants spoke Irish during their day-to-day activities, they were all fluent in English and spoke to visitors to the island in English. As the researcher is also Irish, colloquialisms, slang terminology and understanding when to employ certain tones were not an issue. Although the research was undertaken in English, in order to make the participants more comfortable with the focus group and interview process, and to acknowledge the value of their knoweldge, culture and language, the researcher learned a basic level of Irish. The researcher introduced the focus group in Irish so as to ease the participants into the research process and practiced Irish with the participants during social interactions.

Format of the Interview

The format of the interview involved six phases in order to ease the participants into the interview process without losing the problem-centring of the process. The first phase involves the warming up at the start of the interview, followed by the opening question with the opening account in response then the main body of the interview (which was outlined in the previous section) and then finally the exit and debriefing at the end of the interview. It is standard practice to create a postscript at the end of the PCI and this is contained in Appendix K.

1. Warming up at the start of the interview

This part of the interview involves building trust in the research relationship, breaking the ice and easing the participant into the interviewing process (Witzel, 2000a). It was important that the researcher and participant get familiar with each other and that a comfortable rapport is developed. The researcher introduced herself in Irish and gave a brief overview of the research in Irish. During this phase, the researcher either recapped on the themes that developed during the focus group the participant attended or, if they had not attended the focus group, discussed some general themes that were common across all focus groups.

2. Opening question

The aim of the interview was to have a narrative conversational structure and a relaxed research relationship that was not combative. The opening question was a general and open question which was also non-directive. This was in order to create a discussive pause or space that could be (and was encouraged to be) filled by a narrative discussion on the part of the participant. Merton et al. (1990) have written about "unstructured questions" that have a problem-centred frame of reference meaning that the participant should be free to "indicate the foci of attention". As a rule of thumb, an initial narrative question combined with a "receptive strategy" (Wengraf, 2001) to respond to leads is most appropriate when the participant is very communicative and open. A more "assertive strategy" is more appropriate throughout the interview when attempting to activate and access the participant's knowledge base if they are quieter and less expressive (ibid.). In this research, each of these strategies were applied depending on the confidence, comfort and openess of the participant and these were assessed through the development of interpersonal relationships with the participants.

3. Opening account

This is the narrative phase on the part of the participant that followed the opening question. It provided the substantive base (the pool of topics and different reasons for following up and different leads). Unlike the biographical–narrative approach, the PCI is not interested in analysing the narrative itself. In this case, narrative accounts are important ways of generating knowledge about situated energy knowedges and CKNs doing so within the realm of the participant's everyday life. In epistemological terms the participants' everyday-day knowledge takes precedence. Questions that are obvious and natural were used which gave communicative legitimisation to the process. Following the opening account, the interview guide was used as a model for the researcher to adhere to.

The opening account was then followed by some probing questions which initiated a dialogue between the researcher and the participant. The discussion centred on the key themes developed from the initial findings of the focus groups (described further in Chapter Eight). One incentive to follow-up on the themes which evolved from the focus group was in order examine whether polarisation occurred (Lamm and Myers, 1978), where individuals, when separated from the group dynamic, had different perceptions of the topics discussed. Following the opening account, the main body of the interview was guided by the topic guide outlined in Section 5.3.4. The main body of the interview was followed by the exit and debriefing after the interview to ensure that the participants had shared all that they deemed relevant during the interview process.

4. Exit and debriefing after the Interview

The transition of the communication from that of an interview back to everyday conversation had several purposes (Witzel, 2000a) during this research process. This exit framed a very unusual and intensive social interaction and gave the participants the opportunity to share other aspects of their situated energy knowledges prior to the completion of the interview. In order to facilitate reflexive research, this phase was also used to ask the participants for their feedback on the interview itself. In order to nurture trust and interpersonal relationships, the participants were also given the opportunity to ask any outstanding questions in relation to the research project. For many of the participants, during the undertaking of the focus group and interview, they developed an interest in the project and wanted to know more about both the researcher and the research project background.

5. Postscript

While the previous step involved the debriefing of the participants, it was also important for the researcher to undergo a debriefing. The postscript is a useful tool for facilitating the debriefing of the researcher (Witzel, 2000a) and was used in this study to describe the nature of the interview itself. The postscript is important as the PCI technique considers the researcher to be part of the research and it acts as a post-communication description. The postscripts for the research were written without delay after the interviews and described the location and researcher’s general impression of the interview itself. The postscripts included information before the interview (moments before the interview), information during the interview (non-verbal aspects) and information after the interview (concluding discussion). Appendix K contains an example of a postscript from this research. Following the social scientific phase of the research, a technical energy planning workshop was undertaken. The initial findings from these phases are used to inform the technical energy planning scenarios and the analytical method used to analyse these are detailed further in the following section.

5.5 Thematic Analysis

Prior to the development of the technical energy plan, initial findings were developed. This section details how these initial findings were created along the overall analytical process used. The first part of the process was the transcription of all of the focus groups and individual interviews. After this was completed, the data was inspected and distilled into themes that related to the three sensitising concepts described in Chapter Three: knowledge, governance and communication. Firstly, the surveys were analysed in Excel software in order to gather enough data to inform the theoretical sampling technique applied. After the completion of each of the focus groups, analysis began with recollecting research notes and observations from the focus group discussions. Following this, the audio files for each focus group were transcribed into Microsoft word in order to make them suitable for repeated analysis. The transcription process was conducted in two steps, firstly the entire audio file was transcribed and initial notes and findings were developed. Following this initial phase, the audio was listened to again in order to determine mistakes and discrepancies in the transcribed material and to establish the validity of the initial findings. These initial findings were then used to inform the individual interviews which followed. Following this, the transcripts were read several times in order for the researcher to become familiar with their content before the in-depth coding process began. The format of this coding process is discussed in the results section of this research in Chapter Six. The inclusion of content within codes were determined partly based on Ryan and Bernard's (2003) and Kreuger's (2009) guidelines for processing focus group data, which suggest that attention is paid to the following particulars of data content:

- Indigenous typologies or categories (culture and content)

- Transitions between topics (and the relevance of this)
- The words (what was said/ meant)
- The context (what triggered the response)
- Internal consistency (opinions shifts/ polarisation)
- Repetitions and intensity of comments
- Basis upon which comments are made (continuation of previous comments).

The search for data to place into the relevant themes involved taking a small chunk of the text as line by line of the data was coded (a screenshot of this is in Appendix J). Key phrases were then marked and those that could be placed under one of the predefined themes were placed within these identified concepts or "codes" (Strauss and Corbin, 1990). Those that did not match the criteria for the predefined codes were placed within separate codes to be reassessed during the second phase of coding to determine emergent themes. The NVivo qualitative software was used to aid in organisation of the data and to organise the content into each of the codes. NVivo enables one to overlay multiple coding layers and themes with multiple sub-themes that were elaborated throughout the analysis process (Bazeley and Jackson, 2013). The first phase of coding sought to loosely divide the data into the three sensitising concepts previously described: knowledge, governance and communication with a new category created for those that did not fit into any these three. Following this phase, the patterns, categories and themes of the analysis were allowed to emerge from the data in a process of inductive analysis (Patton, 1990). The parent (or highest level) codes consisted of five themes: knowledge, communication, governance, characteristics of the technical energy plan and the background of the participants as illustrated in Figure 5.9. The complete set of codes developed for this work are contained in Appendix I.

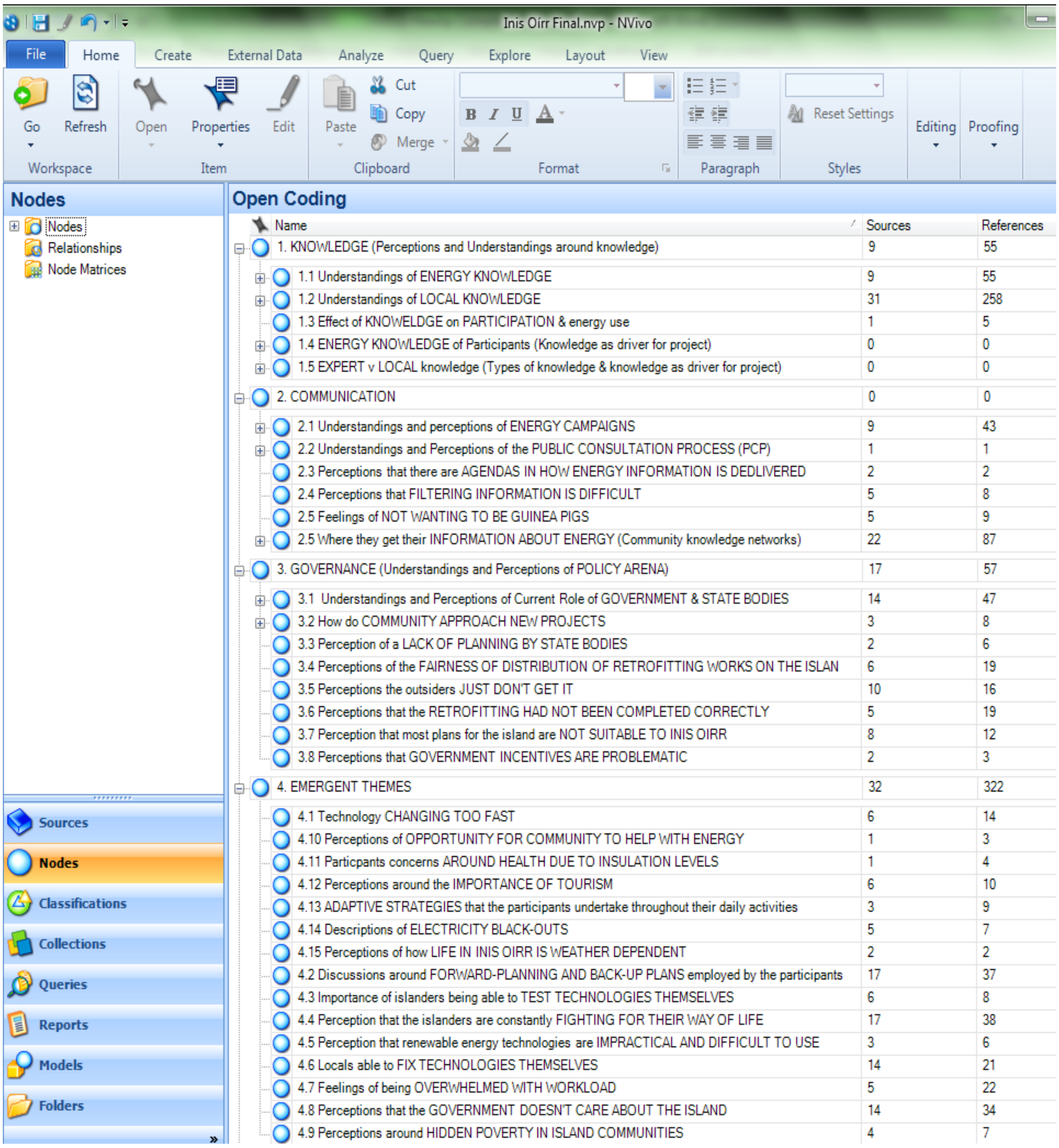

Figure 5.9: NVivo Screenshot of Knowledge, Communication and Governance themes (source: Author)

As described in Chapter Three, the sensitising concept "knowledge" refers to the situated energy knowledges of the participants and how this relates to their day-to-day energy practices. "Governance" is concerned with perceptions related to the public consultation process and mainland universal governance techniques. "Communication" is concerned with how people relate to energy information and public consultation processes. New themes also emerged during the data collection and these are varied and particularly related to island life. The task was an iterative and reflexive process that was influenced by the researcher's knowledge and familiarity with the relevant literature and their prior knowledge. The aim of this analysis process was the reduction of the complexity of the data in order to find meaning from the descriptive data generated on the participants' understandings of energy in their daily lives and community low carbon energy transitions. Having described the qualitative aspects of the research design developed for this thesis, the next section critiques these methodologies and the posssible shortcomings of their use.

5.6 Criticisms of the Qualitative Aspects of the Research Design

Qualitative research has been the focus of a great deal of criticism over the years - for its research strategy, its epistemological and ontological foundations and its specific methods and research designs. Critics often argue that qualitative research is too subjective and relies too heavily on the researcher's views on what data is significant (Bryman, 2015). As argued in Section 5.2.2, interpersonal or social relationships are crucial to effective transdisciplinary research and in-depth qualitative investigations. However, these relationships can often lead to one area being investigated over another depending on their nature, with little evidence as to why (ibid.). Qualitative research is also difficult to replicate, and the importance of developing relationships means that although methodologies might be replicable, the study itself is not (Maxwell, 2012). It is also argued that the scope of the findings from qualitative research is restricted and that using a small sample size makes it difficult to generalise the data to other settings (Bryman, 2015). In-depth qualitative research can improve understandings of a particular case, but not necessarily increase understandings of the general population. The people who are selected for inclusion in a case study investigation are not meant to be representative of a population, but data gathered can contribute to the formulation of theories rather than generalising to populations (ibid.).

This thesis argues that perceptions and understandings of energy are socially constructed and moulded by the CKNs within which they are developed. Focus groups have potential to give insights into research questions where meaning is argued to be jointly constructed or group dynamics are being investigated (Bryman, 2015). Focus groups reveal participants' perspectives in ways that individual interviews cannot. However, in some cases, the researchers can have less control over the direction of the discussion leading to it meandering away from the topic of the research (ibid.). In some cases, open-ended conversational focus group dynamics are appropriate and the level of control that a researcher maintains over the focus group is subject to the research questions themselves and the type of analysis to be undertaken afterwards. The amount of data gathered from a focus group can be large, leading to difficulties in its analysis (ibid.). Recordings of focus groups are more difficult to transcribe than those of individual interviews because of variations in the voices of participants, with one hour of focus group audio taking up to eight hours to transcribe (Bloor, 2001). There are also possible problems with group effects and with participants that spend too much time talking (Kreuger and Casey, 2009). Participants in a focus group might be more prone to expressing views that are expected within the group dynamic, which would have been different if discussed during an individual interview (Bryman, 2015, Morgan, 2008). Another recognised limitation of focus groups and interviews is that they rely on 'self-reported' data, values and actions and as a result may not provide as accurate, complete picture as direct observation or other modes of data collection (Flowerdew and Martin, 1997). (Morgan, 2008, Kreuger and Casey, 2009)

Due to the large amount of data gathered during this study, NVivo software was used to aid in the organisation of the data. In recent years, computer software such as NVivo have become more popular as a tool for organising qualitative data. This software essentially allows the researcher to code and theme their data and enables them to easily retrieve the specific codes later (Bazeley and Jackson, 2013). NVivo takes over the physical act of writing and highlighting codes and allows the researcher to cut out chunks of text that are not coded (ibid.). Although NVivo allows the researcher to easily organise their data, it does not help with the decision-making process of what data is important. Computer software such as NVivo are not universally accepted and some argue that the ease of importing coded data into quantitative software packages will increase the application of reliability and validity criteria to qualitative research (Hesse-Biber, 2004). Others are concerned with the use of NVivo as a code and retrieve tool, leading to fragmented textual materials (Weaver and Atkinson, 1994). This code and retrieve function had been argued to be inappropriate for focus group data as it tends to result in a loss of the communication process (Catterall and Maclaran, 1997) and the effect of the group dynamic. However, others have also discussed the virtues of NVivo, arguing that it speeds up the process of coding, making qualitative data gathering faster and more efficient (Bryman, 2015). It has also been suggested that the use of software like NVivo enhances the transparency of the process and it is easier to make the way in which the qualitative data was analysed clear in the reporting of the findings (ibid.). NVivo also offers the researcher the opportunity to easily count the frequency with which a form of behaviour occurred or a topic was discussed (ibid.).

As described in Section 5.5, thematic analysis was used to guide the researcher in the analysis of the data while allowing emergent themes to evolve. A criticism aimed at thematic analysis is that it is lacking sophistication and merely aims to cite, described or summarise the data (Braun et al., 2014). Thematic analysis also lacks a clearly defined process for its implementation, making it an unidentifiable approach (Bryman, 2015) leading to difficulty in clarifying the process in the reporting of the data. Having described the qualitative aspects of the research design, the next section details the development of the draft technical energy plan scenarios, how the initial findings from the qualitative data were integrated into this phase and the energy planning workshops that were undertaken.

5.6 Technical Energy Plan Simulation Software

Following the social scientific phase of this research, and in order to undertake an integrative, and holistic transdisciplinary research process, initial findings from the social scientific phase of this research were used to inform the development of three draft technical energy plan scenarios for Inis Oírr. The overall methodology applied in this case study and each of the phases involved is outlined in Figure 5.12. This section outlines the methodology used in the technical energy planning scenario phase in more detail as illustrated in Figure 5.10. The outputs of the technical energy planning scenario phase were used as a communication tool in the later parts of the research which is further explored in Chapter Nine.

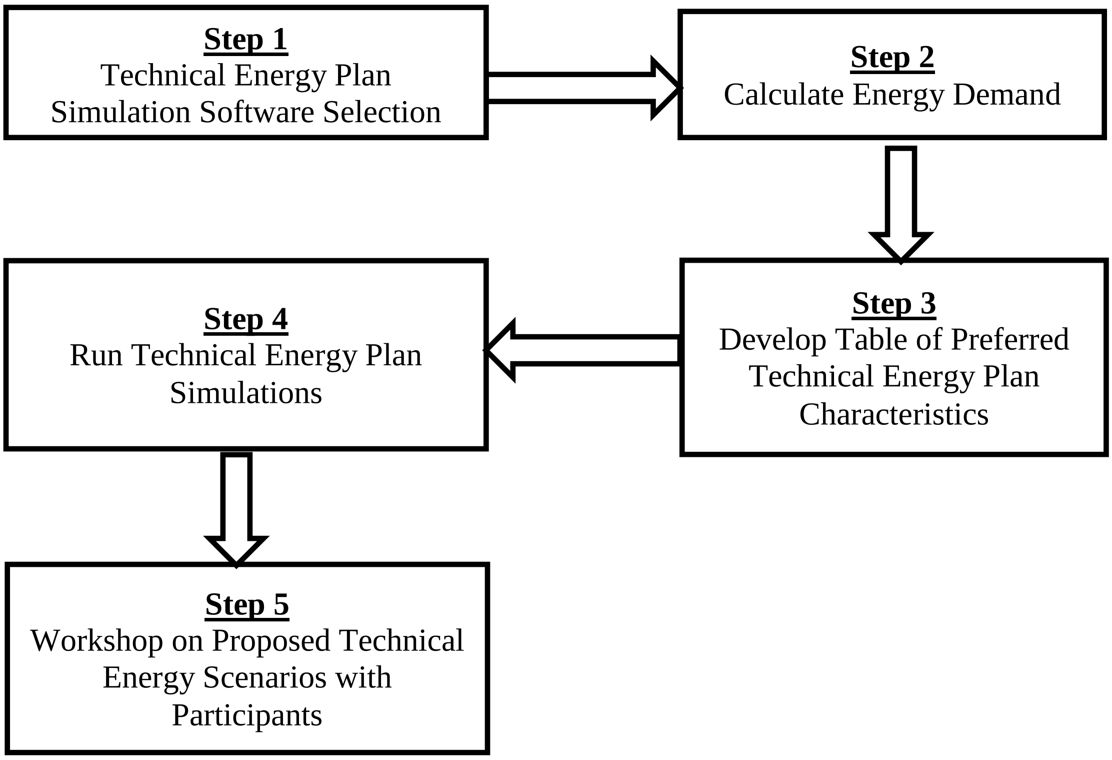

Figure 5.10: Methodology developed for the creation of the Draft Technical Energy Plan Scenarios (source: Author)

As is outlined in Figure 5.10, the energy planning phase of this research involves five stages, each stage building upon the findings of the previous stage and the initial findings from the surveys, individual interviews and focus groups. Step 1 involved choosing the technical energy plan simulation software to be used in this research while concurrently assessing the physical aspects of the landscape, the empirical characteristics of the island and the economic activity within the community. Step 2 involved the gathering of data in order to calculate the energy demand profile of Inis Oírr. The table of required characteristics based on the findings garnered from the initial phases of data gathering was developed in Step 3. Step 4 involved running three technical energy scenario simulations that would meet the energy demands of Inis Oírr. Finally, in Step 5, the proposed scenarios were presented to the study participants during an energy planning workshop exercise in order to facilitate open dialogue, integrative and reflexive research and to enable feedback on the consultation process and the proposed scenarios themselves.

The software required for undertaking this research was one that must be able to undertake assessments on isolated micro-grids[27] (which can simulate the isolated nature of an island community). HOMER (Hybrid Optimisation of Multiple Energy Resources) software can aid in the selection and optimisation of a micro-grid energy system. This software requires the user to input information on component and required system size and outputs a list of micro-grid systems ranked in order of optimal performance. Each of the results can also give details on the system components including: the rated output of the system, the cost of energy, and a cost analysis of the entire system. The cost analysis is ranked by the net present costs[28] (NPC), which include the sum of the present value of all costs over the period of interest, including residual values such as negative costs (Shahinzadeh et al., 2015). Although HOMER is capable of selecting the most suitable technology for a specific energy demand in a specific location, due to the limited data available for this project, the HOMER tool was used to create several technical energy scenarios based on the initial findings from the qualitative phase of the data gathering. A costing analysis was not undertaken in this research and the scenarios were designed based on the participants' perceptions of their energy requirements. HOMER was used less as an optimisation tool and more as a method of designing technical energy scenarios that could sufficiently supply the energy needs of the island.

When selecting the most appropriate technical energy planning tool to use in this research, there were several to choose from, each providing different aspects of energy planning. Literature provided ample evidence for the vast array of technical optimisation tools to choose from (Sinha and Chandel, 2014, Mendes et al., 2011, Connolly et al., 2010).

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[27] A micro-grid is a local energy grid with independent control capability, meaning it can disconnect from the national grid and operate autonomously. This was chosen for this work so that scenarios could be developed that were independent of the national grid and could create and isolated, independent energy system.

[28] The total net present cost condenses all the costs and revenues that occur within the project lifetime into a single lump sum, with future cash flows discounted back to year zero using the discount rate. Costs may include capital costs, replacement costs, operating and maintenance costs, fuel costs, electricity costs, and miscellaneous costs (Shahinzadeh et al., 2015).

HOMER was chosen as the optimisation tool for this research as it is the most widely used software, is very user friendly and is possible to use free for a limited period (Sinha and Chandel, 2014). The software was most appropriate as it can carry out feasibility studies of several different system configurations very quickly. It can also combine several different system components such as wind turbines, PV arrays, run-of-river hydro turbines, biomass power, internal combustion engine generators, micro-turbines, fuel cells batteries, and hydro storage (Connolly et al., 2010). This ability gives more scope for experimentation when designing the technical energy plan. The benefit of HOMER is that it can serve both electric and thermal loads and can consider a one-year time-period. The National Renewable Energy Laboratory (NREL) in the USA developed HOMER in 1993 for the analysis of both on-grid and off-grid systems meaning that the draft scenarios could be designed to do both (Shahinzadeh et al., 2015). HOMER requires inputs such as various technology options, component options, component costs and information on the availability of resources to simulate several system configurations to generate a list of simulated system configurations ranked in order of increasing net present cost. HOMER is useful in that it can simulate a system hourly over the year, making it possible to use electricity data from Ireland's electricity Transmission Service Operator[29] (TSO).

What makes HOMER so useful in this instance is that it can generate graphic displays of the simulation results and a variety of tables, making it useful as a technical energy planning communication tool for use in the energy planning workshops. These graphs and tables helped to reveal the merits of each of the scenarios and created a platform for further discussion of the energy planning process with the participants in a collaborative way. HOMER has been used extensively in literature for the design and assessment of hybrid renewable energy systems in various case studies and is becoming ever more popular among academics (Amutha and Rajini, 2016, Gheiratmand et al., 2016, Shahinzadeh et al., 2015, Givler and Lilienthal, 2005). HOMER can successfully undertake energy-system optimisation analysis at the local or community level, making it most appropriate for the rural island case study location. The latest HOMER version of

[29] A transmission system operator (TSO) is an entity entrusted with transporting energy on a national or regional level, using fixed infrastructure.

the software is version 3.6 (in 2016) and can be downloaded from the HOMER website (NREL, 2016). HOMER requires the inputting of several different datasets in relation to demand, resources, information on components and constraints and outputs its data based on the optimisation of these inputs as illustrated in Figure 5.11.

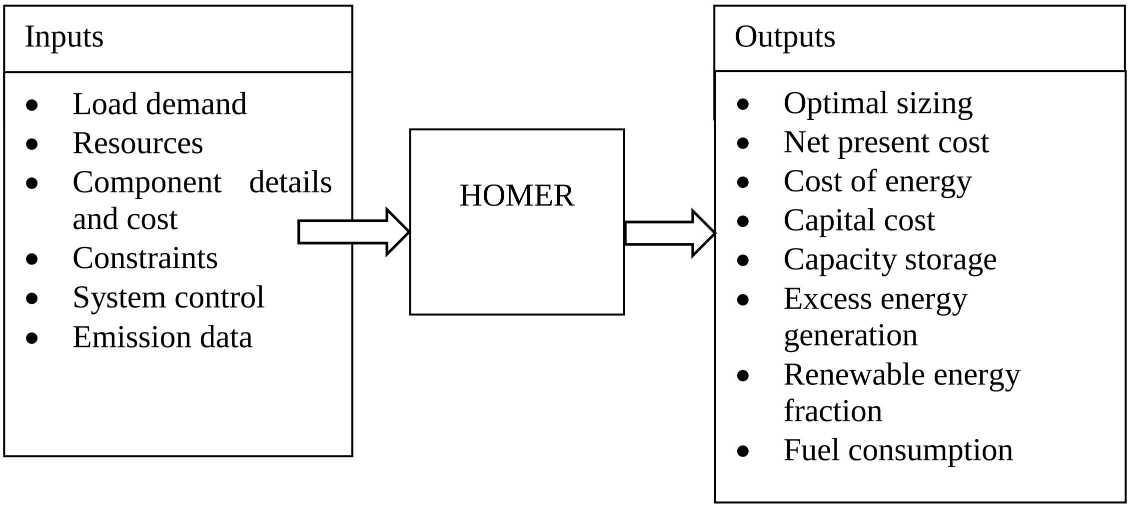

Figure 5.11: Schematic Representation of HOMER (Sinha and Chandel, 2014)

Although HOMER was deemed the most suitable software for this research, it is not without limitations and these are as follows:

1. HOMER only allows single objective function for minimising NPC. As a result, the multi-objective problems cannot be formulated meaning HOMER ranks the system configurations on NPC only and not on other cost analysis for energy. In the case of this research, this is not of concern as the software is being utilised for a feasibility study and a cost analysis was not being undertaken (Sinha and Chandel, 2014). In order to enable informed discussion, details on the approximate pricing of the proposed scenarios were gathered prior to the energy planning workshops.

2. HOMER also does not take into account the depth of discharge of a battery bank (which can affect both the life and size of the battery) (Sinha and Chandel, 2014). This means that the optimisation of the hybrid system might not be fully accurate. Again, this was not of concern in this study as HOMER software was being used for a preliminary feasibility study and was only

required to design a system that could meet the estimated energy demand needs of the community in Inis Oírr.

3. HOMER also does not consider intra-hour variability, for example, there may be variations in energy demand across the hour, however, HOMER software will not measure this (Sinha and Chandel, 2014). These intra-hour variabilities can cause power variability with adverse effects on power systems, especially their reliability and the economic viability of installing and running them. However, this short-coming was of little concern in this research as the proxy electricity demand data obtained from the TSO was in hourly intervals and could not be subdivided into smaller time increments.

During this initial phase, the physical characteristics of the island and its geographic characteristics were assessed in order to determine the physical constraints in the case study location. The next section details the methods employed in gathering the data to input into the HOMER software. All of the data was based on 2014 energy demand profiles as, at the time of simulation, a complete set of 2015 energy data was not available. Following the simulation of the technical energy plan scenarios, an energy planning workshop was facilitated to engage the participants in critical assessment of the proposed technical energy plan scenarios and these are presented in the next section.

5.7 Technical Energy Planning Workshop

Following completion of the surveys, the individual interviews, the focus groups and developing the three technical energy plan scenarios, two technical energy planning workshops with the participants of the study were facilitated. Two workshops were held in the Inis Oírr co-operative offices in February 2016, one was held in the evening and another was held at lunch the next day. All of the participants were contacted and invited to the workshop, however, several were not on the island at the time as it was no longer peak tourism season. 12 participants were available to attend, five on Tuesday and seven on Wednesday. Having gathered all of the quantitative data for the inputs into HOMER and gathered the qualitative data to inform the design of the technical energy plans, the next step was to run the HOMER simulations and present them at the energy planning workshop. Three different scenarios were simulated – one scenario was designed which was deemed to be most efficient from a technical perspective, but did not take into account any of the qualitative data or the list of characteristics developed from initial findings (outlined further in Chapter Eight). The second scenario was designed based on the list of characteristics and built upon the qualitative phase of the data collection. The third scenario was influenced by the list of characteristics, the initial findings from the qualitative data and was also shaped by other themes developed from the findings garnered from the participants' narratives during the focus groups and individual interviews. At the energy planning workshops, an overview of the study was presented to the participants along with the rationale, methodology and some of the initial findings. A small portion of the initial findings from the qualitative data was also presented and discussion and feedback on these were encouraged. The initial findings from the participants' narratives were presented and the process of integrating these findings into a technical energy plan were explained. During this workshop, the list of characteristics for the development of the technical energy plan was presented and the background on how they were developed was chronicled. Following the presentation of the three proposed technical energy scenarios a round table discussion was facilitated to encourage discussion of the scenarios and the process of their design. An evaluative sheet was also distributed in order to gather data on the participants' perception of the study itself and the research processes that were employed (Appendix M). The findings from both the round table discussion energy planning workshop and the evaluative sheet are discussed later in Chapter Eight. The innovative transdisciplinary approach developed and tested in this thesis, although holistic, is not without its limitations and these are discussed in the next section.

5.8 Limitations of the Methodological Design

While the limitations of the study in its entirety will be critically considered in Chapter Ten, the following section provides an overview of some of the specific issues which were considered when developing the research design. Although the research design aims to facilitate a holistic approach to the investigation of community low carbon energy transitions in Inis Oírr, there are still challenges in the implementation of this innovative transdisciplinary approach. The use of one case study community provides situated individual and group understandings and perceptions of energy within the island community. However, not all of the findings revealed in this research will be representative of perceptions and understandings of islands elsewhere in Ireland. As described in Section 5.2.4, the development of interpersonal relationships are crucial to successful transdisciplinary research and these require extensive time in the field interacting with the participants. This increases the workload of the researcher, but also creates a more collaborative research exchange leading to richer empirical data. To facilitate effective merging of the two disciplines, reductionist techniques were applied to analyse the empirical results in order to create data that can inform the technical phase of this research. The facilitation of the technical energy planning workshops aimed to account for the application of these reductionist techniques, and the effect of the researcher's positionality on the data developed for the technical energy planning phase of this research. The focus of these energy planning workshops was to determine whether the participants felt that their narratives had been interpreted effectively. Several scenarios were proposed in an effort to allow participants to engage in the energy planning process to account for data being misrepresented during the researcher's interpretation of the data.

Access to electricity and heating demand profiles are crucial to the development of the technical energy plans. However, difficulties arose in accessing data for the electricity demand profile for Inis Oírr and proxy electricity demand data had to be developed as described in Section 5.6. The use of the snowballing sampling method when enlisting participants for the study created a risk that only those that were interested in community energy would volunteer to take part in the project. Several participants recommended others that they felt were interested in energy and would be willing to take part in the project. The inclusion of those enlisted through this method of snowball sampling may create a picture of the situated energy knowledges of Inis Oírr that is not representative of the community as a whole. However, with a sample size large enough to represent 25% of the households in the island, it can be assumed that it is representative of the population of Inis Oírr as a quarter of the population is represented.

As described in Section 4.4, Inis Oírr is an Irish-speaking island. However, the research was being undertaken in English, as the researcher is not a fluent Irish speaker. As described in Section 5.4, the researcher learned a basic level of Irish in order to undertake initial conversations with the participants and develop relationships. However, the researcher's dialect was different from the dialect that the participants spoke, so the researcher could not understand some of the more advanced conversations. Several of the participants made comments to each other in Irish during the focus groups and the researcher could not understand some of these comments, although the participants may have intended them to be private.

5.9 Conclusion

This Chapter marks the end of the second part of this research, the methodology. This Chapter outlined the depth and complexity of the transdisciplinary methodology developed for this research and the rationale behind its design. The research design was concerned with developing a transdisciplinary methodological approach that could sufficiently deal with the varied aspects of island community low carbon energy transitions while addressing the theoretical approaches outlined in Chapter One. The social constructivist perspective embedded in a post-normal science approach informed the development of the research questions and sensitising concepts and consequently the methodological approach required. A transdisciplinary approach was crucial for investigating the complex issue of community low carbon energy transitions as described in Section 5.1. The first chapter in this section detailed the rationale behind the application of a social constructivist perspective embedded in a post-normal science approach when investigating community low carbon energy transitions in island communities. Following this, the case study community and the rationale for its selection were described in detail. Finally, social constructivism itself was discussed and critiqued and its application to this research was detailed.

The second chapter in this part of the thesis began by arguing the suitability of the transdisciplinary approach to the complex issue of low carbon energy transitions. Building on this critical assessment of transdisciplinary research, the second part of this chapter outlines six criteria for the development of the research design based on the literature review and research questions. Next, this chapter continued to argue that the case study approach is ideal as it allows for problem-focused research that can reach across disciplines while investigating the place-based context of the phenomenon.

Following this, the rationale for the use of the PCI technique and its applicability to transdisciplinary research is considered.

The development of topical guides for the qualitative investigations in this research and the rationale for the use of thematic analysis as a mode of problem-centring were also described. Finally, the design of the processes involved in the development of the draft technical energy plan scenarios for the case study community were discussed along with the reflexive energy planning workshops. The fieldwork activities undertaken in this research were extensive and included surveys completed by 53 participants, focus groups with 20 participants, individual interviews with 29 participants, energy planning workshops with 12 participants and the exploration and analysis of secondary materials. This extensive data gathering resulted in a total of approximately 50 hours of recorded audio and approximately 129,200 words of dialogue transcribed. The technical aspects of this methodology involved the co-creation of three technical energy plan scenarios for the case study community, using technical energy plan simulation software described in detail in this chapter. The mix of social scientific and engineering techniques created findings that were both qualitative and quantitative in nature, creating a holistic methodological approach, which gives greater meaning and context to the material gathered and explored.

The focus group and interview techniques were chosen as they enabled the analysis of perspectives at the individual, household and community level simultaneously. The research design developed for this research is reflexive and iterative in nature with each phase informing the next. The findings from the initial surveys guided the selection of participants and the composition of the focus groups. The initial findings from the focus groups informed the themes for investigation in the individual interviews and facilitated reflection on the focus group methodology with the participants. Following this, the empirical findings from the focus groups and individual interviews informed the development of the technical energy planning scenarios for Inis Oírr. Finally, the energy planning workshops were facilitated for several purposes – to present the draft energy plans to the community, to facilitate the co-creation of a feasible technical energy plan for Inis Oírr, to facilitate mutual learning between the researcher and the participants and to reveal the participants' capacity to engage in planning their low carbon energy future.

An overview of the transdisciplinary methodological design for this research was illustrated in Figure 5.1, however, through the application of the research design, it became evident that undertaking transdisciplinary research is much more complex than illustrated in this diagram. In this innovative transdisciplinary methodological design, initial findings from each of the research processes experience a cyclical process of analysis by feeding into future phases of the research process, creating an iterative, adaptive and reflexive process as illustrated in Figure 5.12 on the following page.

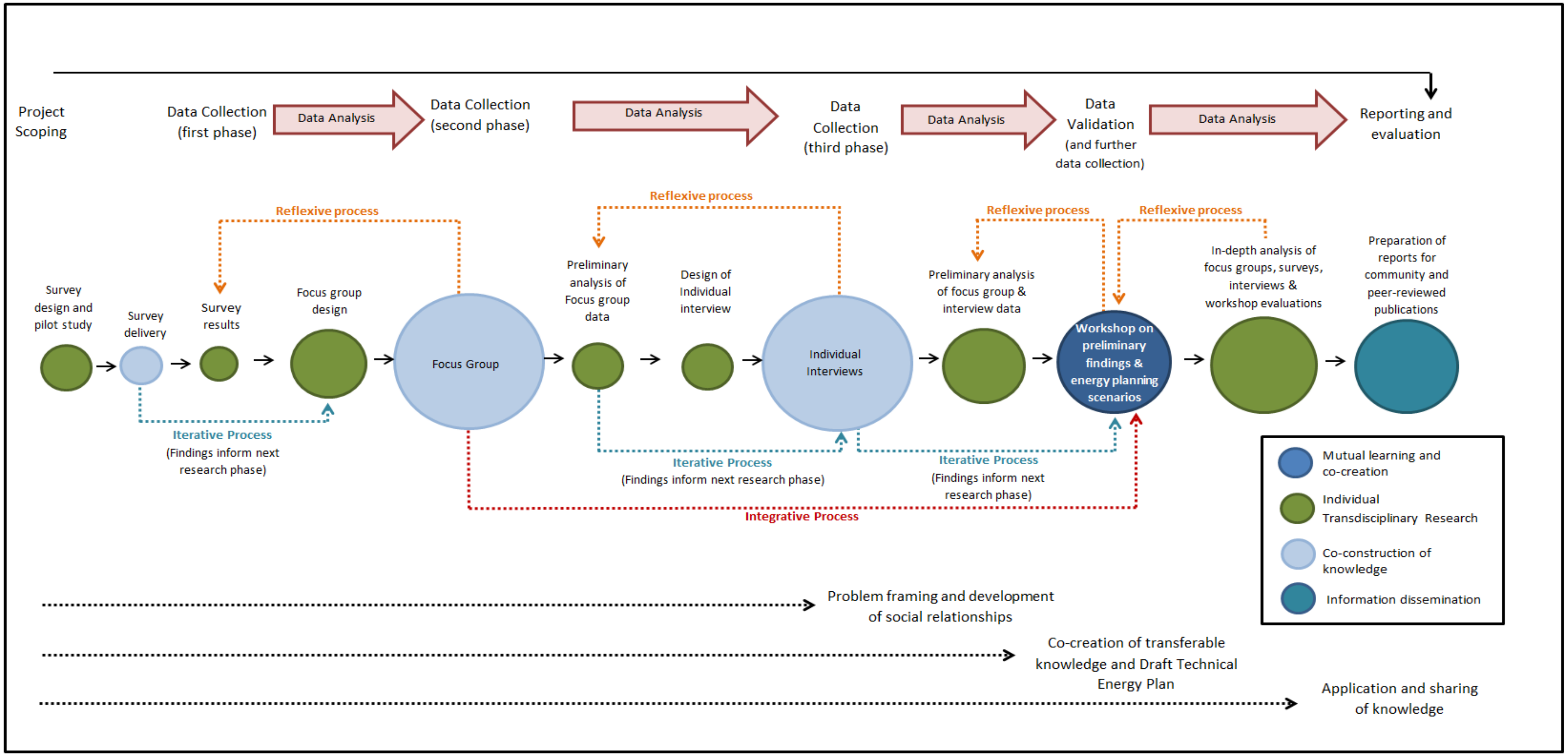

Figure 5.12: The Research Process Developed for this Research (Source: Author)

The purpose of the focus groups and the individual interviews is to facilitate the researcher's and participants' co-construction of the participants' situated energy knowledges. Co-construction of knowledge is undertaken through the application of the PCI technique where the participants co-construct and reconstruct problems together with the researcher in an interactive and interpretive process of data collection (Witzel, 2000a). During the analysis of each of the stages of data collection, the researcher undertakes transdisciplinary analysis in order to create empirical and technical findings for use in later stages of the research. The final part of the research design, the energy planning workshop, is intended to facilitate mutual learning between the researcher and the participants through the discussion and co-creation of draft technical energy plans for Inis Oírr. Mutual learning is defined as a process of information exchange where knowledge is shared from science to society and vice versa (Scholz, 2000). Mutual learning can be considered as the adaptation process inherent in interaction and joint problem solving between science and society (ibid.). In the context of this research design, co-creation can be understood as any act of collective creativity that is shared by two or more people (Sanders and Stappers, 2008). Having described the transdisciplinary methodological design developed for this work, and its application, the next chapter marks the beginning of the third part of the thesis, Part Three: Results and Discussion.

PART THREE: RESULTS AND DISCUSSION

This is the final part of this research, the purpose of which is to present the findings and discuss their implications for policy and research. The following chapters highlight key findings of the research, their contribution to theory and policy and evaluate the methodological findings of the study. First, Chapter Six addresses Research Question One, concerning the ways in which energy is understood by people in their day-to-day practices. Secondly, Chapter Seven deals with Research Question Two, assessing the processes involved in the development of situated energy knowledges and CKNs in Inis Oírr. Chapter Eight seeks to address Research Question Three and assesses how existing situated energy knowledges and CKNs affect island communities' governance of transitions to sustainable, low carbon societies. Finally, Chapter Nine investigates the application of the innovative methodology itself and the range of empirical findings developed from the application of both a social scientific and engineering approach. Chapter Ten contains the conclusions developed from the thesis, evaluates the study and discusses its implications for academics and policy audiences. This section attempts to reveal the participants' capacities to engage in planning their path to becoming a low carbon energy community. In order to attempt to answer these questions, three key sensitising concepts are used to guide this research; knowledge, governance and communication in island communities. The first chapter in this section investigates how energy is understood by the participants in their daily lives, beginning with the description of the current energy landscape in Inis Oírr. The purpose of this chapter is to lay the foundation for describing current energy practices and perceptions within Inis Oírr community.

Chapter Six: Understanding the Energy Landscape of Inis Oírr

6.1 Introduction

This Chapter argues that understandings of energy are situated and socially constructed and, within island communities, are influenced by geographic isolation. This Chapter also asserts that pathways for island community low carbon energy transitions must be considered within their place-based contexts. This chapter concentrates specifically on Research Question One:

1. How is energy understood by people within island communities in their day-to-day practices?

The following section describes the current energy demand profile of Inis Oírr and reports on the response of the study participants around a range of questions relating to energy and their daily lives in Inis Oírr. These questions established the situated energy issues that were of particular importance to the participants. Several key themes emerged in the data and these are explored in the following sections. As described in Chapter Three, for the purposes of this research, results relating to the three previously outlined sensitising concepts; knowledge, governance and communication are presented here. “Knowledge” refers to situated energy knowledges of the participants and how this relates to their day-to-day energy practices. “Governance” explores perceptions related to the public consultation process and mainland universal governance techniques. “Communication” is concerned with how people relate to information and consultation processes. Several themes also emerged during the data collection phase and their relationship to each of these sensitising concepts are explored in the following sections. This chapter illustrates themes related to knowledge which emerged from the research including: the effect of geographic peripherality on energy needs within the community and the participants’ situated and technical understandings of energy. The next section details the development of the current energy demand profile for Inis Oírr to inform the discussion of the empirical results that follow.

6.2 Developing the Energy Demand Profile for Inis Oírr

This section outlines the process utilised in the development of the energy demand profiles for Inis Oírr using HOMER technical energy plan simulation software. One of the major challenges with using a technical energy system optimisation tool such as HOMER, is gathering the exact data to input into the modelling software. This section details the different types of data that were required for the model, the level of success that was achieved in attaining them and the results from inputting them into the HOMER simulation software. As discussed in Chapter Five, the HOMER software is being utilised as a communication tool, and thus exact information for the development of the plan was not paramount. The outputs from this research involved a series of three draft technical energy plan scenarios, which were used as a focal point for discussion of the energy planning process itself. The processes involved in the gathering of the data and the inputting it into the energy plan simulation software are detailed in the following sections.

6.2.1 Electric Load Data for Inis Oírr

The first hurdle encountered in gathering data for the project was in obtaining data on hourly electricity demand from Ireland‘s Transmission Service Operator (TSO) – the Electricity Supply Board (ESB). The ESB is a state owned (95%) electricity company that operates as a commercial semi-state concern (ESB, 2016). The ESB was contacted on several occasions over the space of two years and, unfortunately, the data was not forthcoming. It transpired that data on hourly electricity demand profiles for Inis Oírr was not being recorded by the TSO, but was being recorded for Inis Mór, the neighbouring island. In order to develop a relatively realistic proxy dataset to input into the model, the hourly electricity demand profile for Inis Mór was used (and altered) to account for Inis Oírr’s smaller population, the calculations of which are contained Appendix N. The rationale behind the use of the Inis Mór electricity demand profile to develop a proxy profile for Inis Oírr is that its demand profile is similar to that of Inis Oírr. Inis Mór’s demand profile, much like Inis Oírr’s, experiences huge spikes in demand in the summertime due to the influx of large numbers of tourists. This information was input into HOMER software which created graphic displays of the yearly electricity demand profile for Inis Oírr, as illustrated in Figure 6.1, which could then be exported and used for communication purposes.

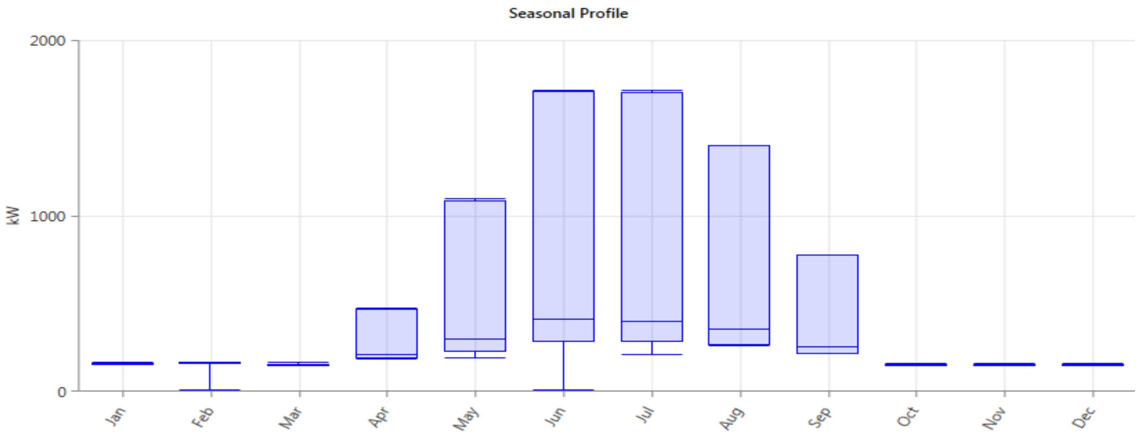

Figure 6.1: Proxy Estimated Yearly Electricity Demand Profile for Inis Oírr in 2014 from HOMER Software (source: Author)

As can be seen in Figure 6.1, the proxy yearly electricity demand profile for Inis Oírr experiences a very large spike in electricity demand during the months of June, July and August, which is its busiest tourism season. A key aim of the technical energy scenario simulations was to ensure that the solutions proposed could meet the huge peaks in summertime demand related to the tourism industry in Inis Oírr. In this way, the data from the hourly electrical demand profile in Inis Mór provided the relevant information to account for the large influx of tourists in the summer months. These results indicate that a proposed energy plan for Inis Oírr needs to be designed to accommodate for the relatively low demand profile during the winter months and the significantly greater level of electricity demand during the summer months. The unique way of life in Inis Oírr has led to their daily electricity demand profile being divergent from those in mainland Ireland. Using the electricity demand profile for Inis Mór, a proxy daily electricity demand profile for Inis Oírr was created from the HOMER software (Figure 6.2). As can be seen in Figure 6.2, this demand profile is relatively flat throughout the day and is divergent from the daily electricity demand profile for the rest of Ireland, which is contained in Figure 6.3.

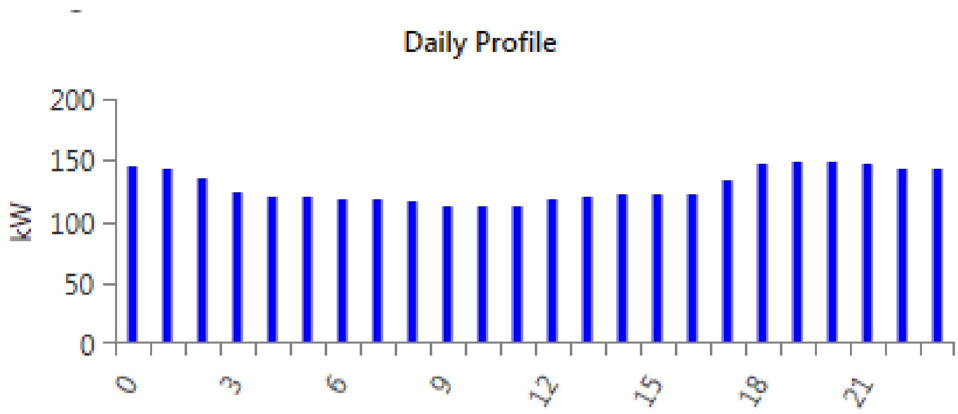

Figure 6.2: Proxy Average Daily Electricity Demand Profile for Inis Oírr in 2014 from HOMER Software (source: Author)

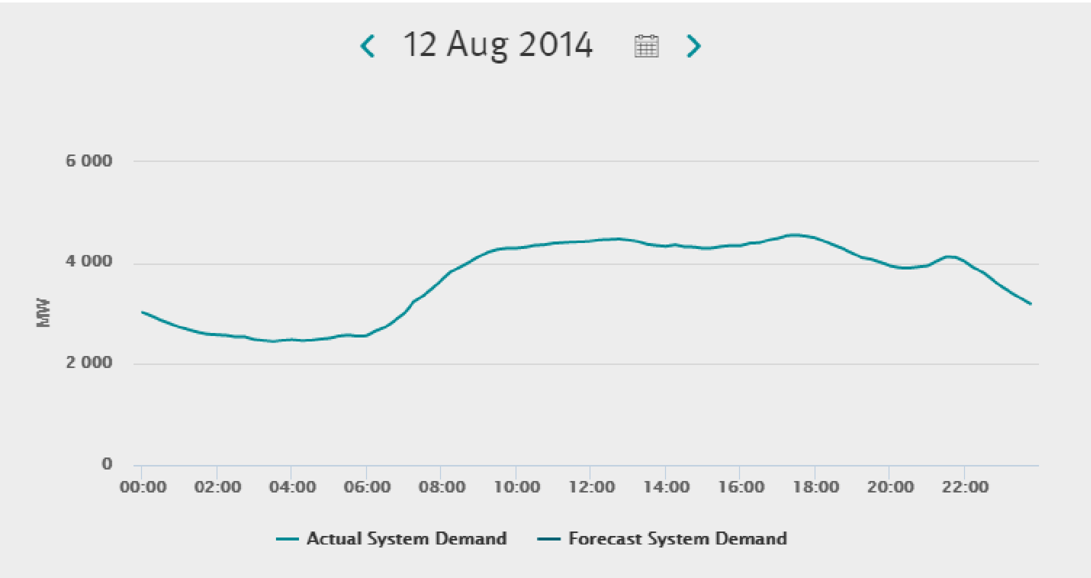

Figure 6.3: Screenshot of a Daily Electricity Demand Profile for Ireland in 2014 (source: (EirGrid, 2014))

The proxy daily electricity demand profile for Inis Oírr is constant throughout the day in comparison with the sharp peaks and troughs that are experienced throughout the rest of

Ireland and Northern Ireland (Figure 6.3). There are many possible reasons for this, including, as described in Chapter Four, the fact that most of the employment in Inis Oírr is in the tourism industry. These divergent work practices create a relatively flat daily electricity demand profile in contrast to the spikes in electricity demand in the evening on mainland Ireland as a result of standard office hours of nine in the morning to five in the evening.

6.2.2 Geography of Inis Oírr

The latitude and longitude of Inis Oírr are easily available on Google Maps and the time zone for Ireland was available with the software itself. This was entered into the home screen of the software along with the project details which can be seen in Figure 6.4.

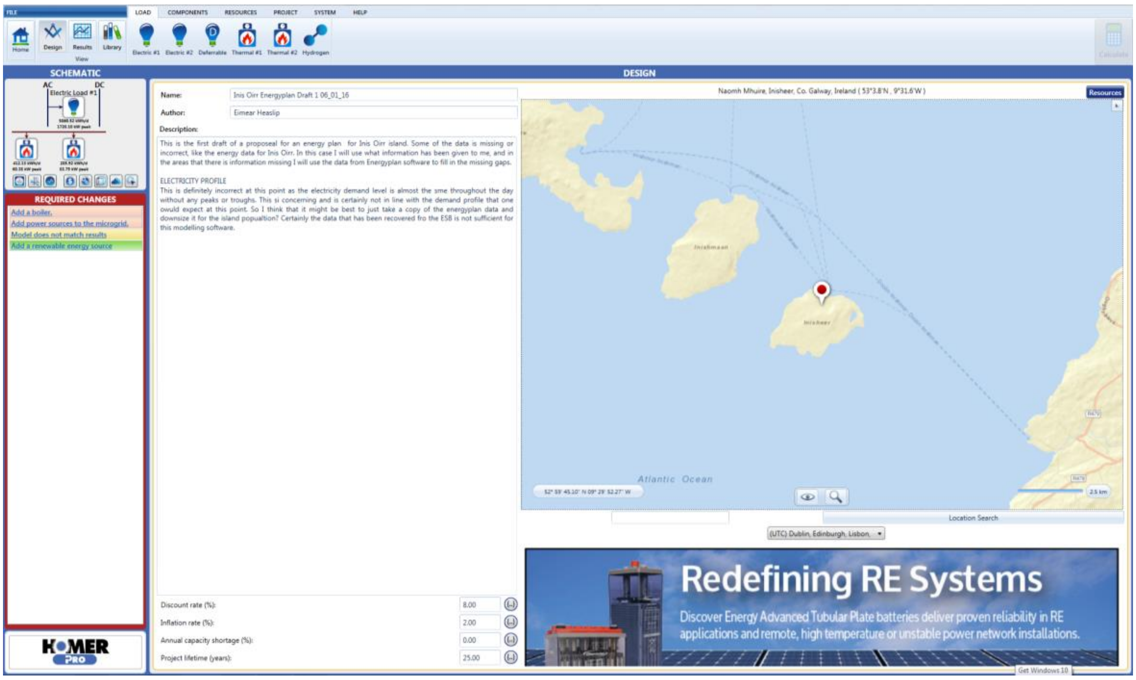

Figure 6.4: Screenshot of HOMER Home Screen with Latitude and Longitude of Inis Oírr (source: Author)

6.2.3 Solar Radiation Data for Inis Oírr

The solar radiation data for Inis Oírr was available on the Photovoltaic Geographical Information System, the Interactive Maps website provided by the European Commission's Centre for Joint Research for Energy and Transport (CMSAF, 2016). The

Average Daily Solar Irradiance data throughout the year in Inis Oírr was downloaded at 15-minute intervals and had to be adjusted to be input into the HOMER software and can be seen Figure 6.5.

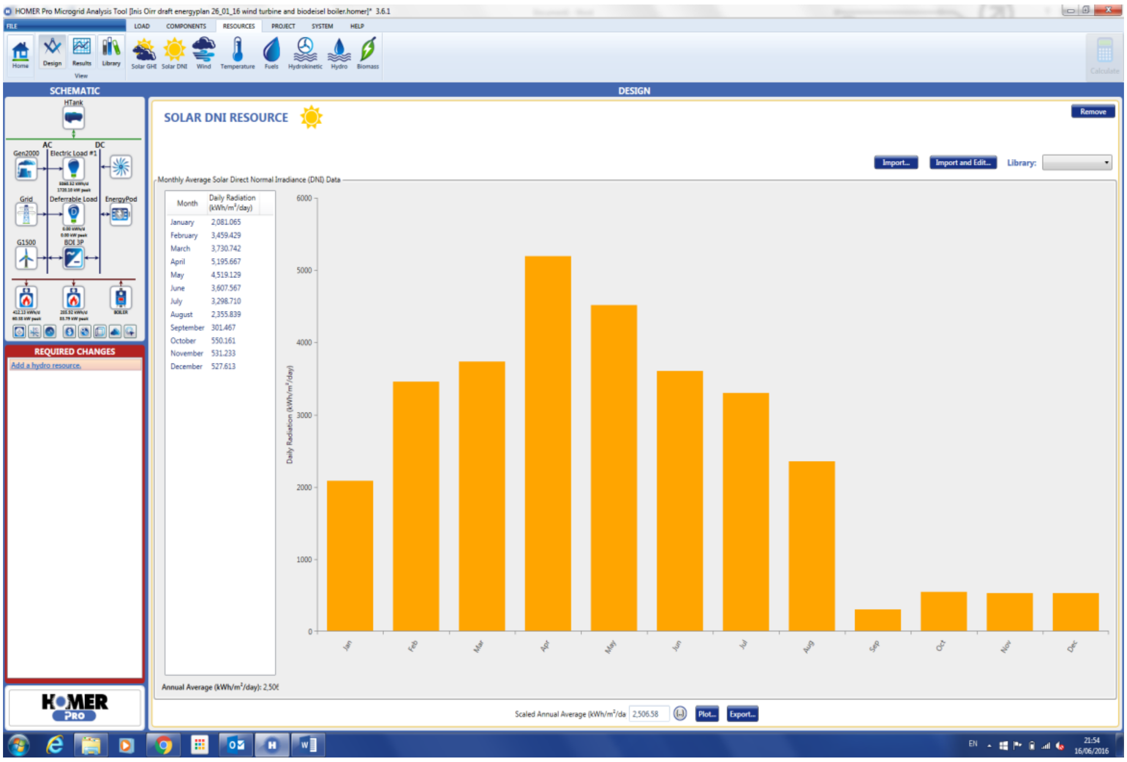

Figure 6.5: Screenshot of Solar Radiation Data for Inis Oírr Entered into HOMER Software (source: Author)

Each of the four 15 minute intervals for the solar irradiance data were combined in order to change the dataset into an hourly time-step series.

<u>6.2.4 Wind Speed Data for Inis Oírr</u>

The wind speed data for Ireland is freely available on the SEAI's website where an interactive wind map is available (SEAI, 2016). The wind speeds were downloaded in hourly time step intervals and the notepad file was then imported into HOMER. The average yearly wind speed data for Inis Oírr can be seen in Figure 6.6 following.

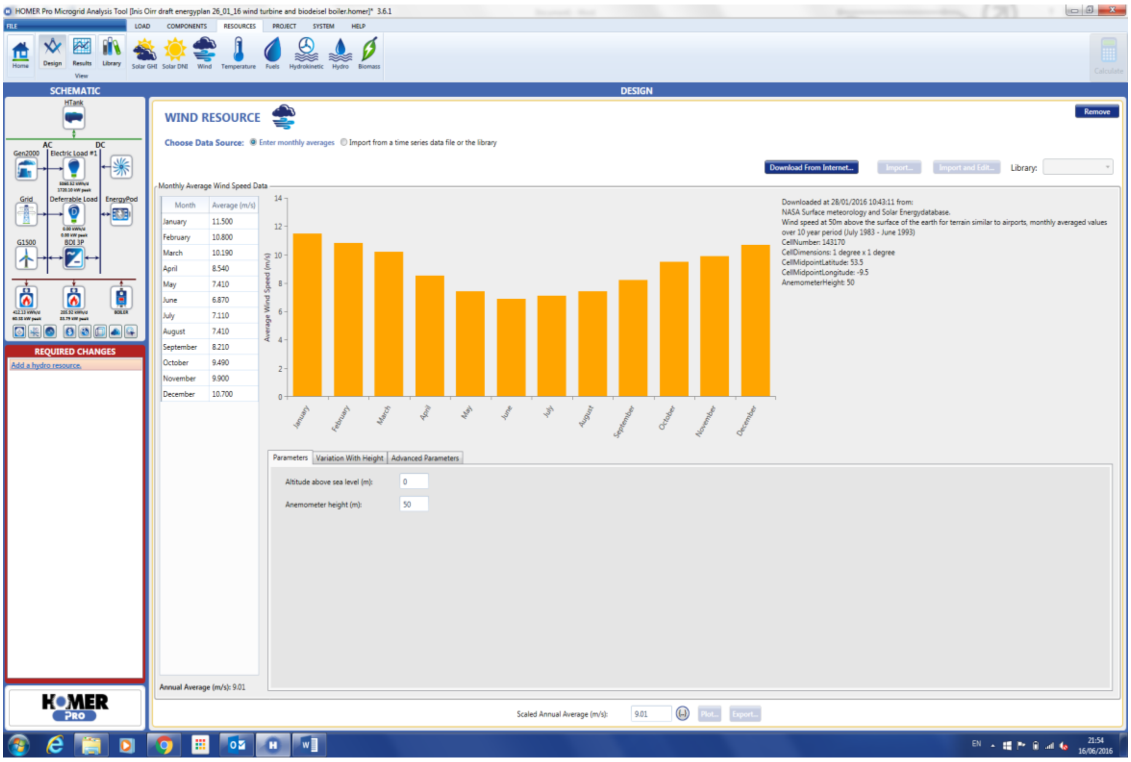

Figure 6.6: Screenshot of Average Yearly Wind Speed Data for Inis Oírr Entered into HOMER (source: Author)

6.2.5 Heating and Hot Water Demand for Inis Oírr

As described in Chapter Five, HOMER software is a micro-grid optimisation software and thus, can only simulate heating demands if they are met by a single boiler. Information on the heating demand in Inis Oírr was gathered through the co-operative's accounts as all coal and oil imported into Inis Oírr is done so through the co-operative. Unfortunately, it was difficult to determine the exact yearly heating demand profile, but an exact record of the amount of fuel being imported into Inis Oírr was available. Information on the yearly heating demand in Inis Oírr was gathered through the co-operative's financial accounts, as all coal and oil imported into Inis Oírr is purchased through the co-operative. A measure of the amount of oil, coal and peat that are imported every quarter was obtained and these were converted into kWh's using standard conversion values for each of the fuels and the calculations of the heating demand profile for Inis Oírr is contained in Appendix N. The yearly space heating demand profile for

Inis Oírr was approximated using the degree-day[30] data for 2014 and this is also contained in Appendix N and Figure 6.7.

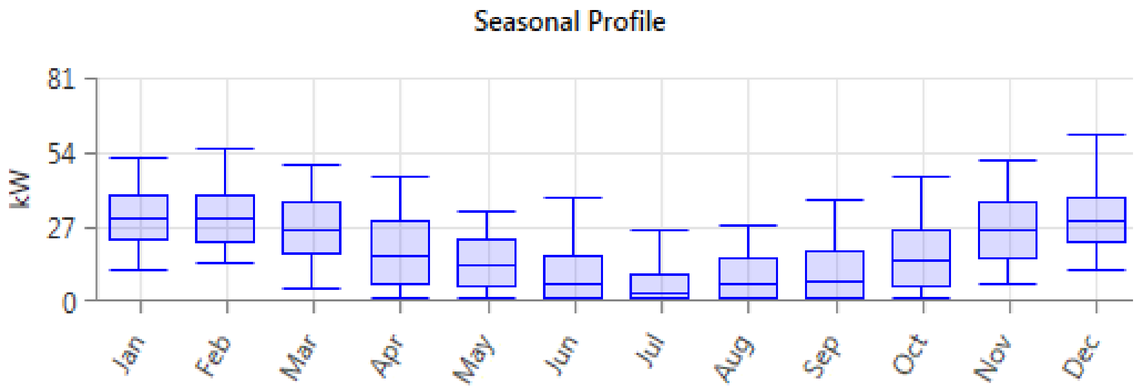

Figure 6.7: Yearly Space Heating Demand in Inis Oírr Developed from HOMER Software (source: Author)

The remainder of the imported fuels were then assumed to have been used to meet the hot water demand in Inis Oírr. In order to determine the profile of the yearly hot water demand for Inis Oírr, as per average water consumption in Ireland, the hot water usage was determined at 120 litres per person based on a 2014 report on water consumption in Ireland (Morgenroth, 2014). It was calculated that 6 kWh of energy is required to heat the water use of each person in Inis Oírr per day (Widén et al., 2009). The calculations for this part of the technical energy-scenario building are also contained in Appendix N, which illustrates how the results were developed, based on approximated hot water demand related to high visitor numbers during the summer months. The approximated yearly hot water demand profile for Inis Oírr is contained in Figure 6.8, which illustrates the large peak in hot water demand during the summer months.

[30] Degree-days are the number of degrees that a day's average temperature is below 18° Celsius which is the temperature below which buildings need to be heated.

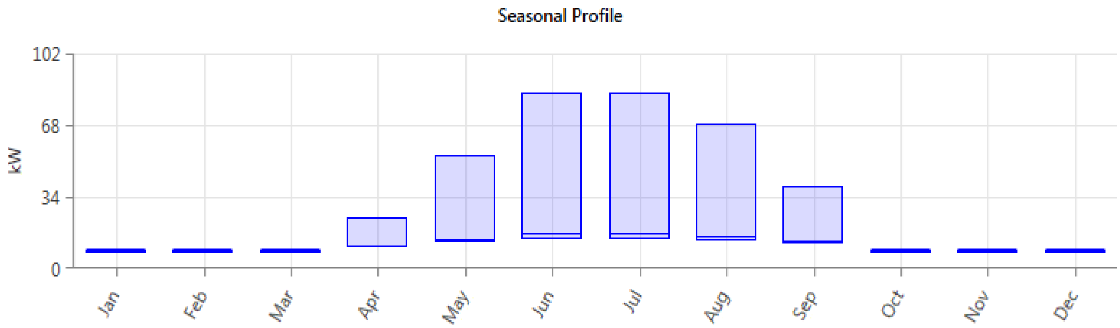

Figure 6.8: Yearly Hot Water Demand in Inis Oírr Developed from HOMER Software (source: Author)

6.2.6 Renewable Power System Components, Generators, PV, Policies and Incentives

As the HOMER software was being utilised to create a feasibility study, data on the technical specifications of chosen brand's technologies were not needed. In this instance, the information on the renewable power system components, generators, photovoltaic panels, policies, and incentives that were available in the software was sufficient for the feasibility study.

Following the development of the energy demand profile for Inis Oírr, findings from the focus groups and individual interviews were used to inform the technical design of the community's low carbon energy transition. These are contained in Chapter Ten – Designing Inis Oírr's Low Carbon Energy Transition, which outlines the technical energy plan characteristics that were developed, the participants' organisational requirements of the technical energy plan for Inis Oírr and the three proposed scenarios that were developed. Building on the development of these energy demand profiles, the effect of geographic isolation on energy demand and practices in Inis Oírr is discussed in the next section.

6.3 Living on the Edge and Energy Demand

Surrounded by water, islands enjoy changeable and sometimes unique environmental histories due to their geographic peripherality (Klaus and Stephen, 2003). Islands have a complex relationship with nature and more particularly with weather. In recent years, Inis Oírr has been at the mercy of repeated storms that have ravaged the coastline causing considerable damage (National Directorate, 2014, Engineers Ireland, 2014) and cutting off external transport connections for weeks as a time. As a result of this forced isolation during the winter months, participants' narratives revealed their perceptions that Inis Oírr has a more adaptive and self-sufficient community than communities on mainland Ireland. Due to the unique and inaccessible way of life in Inis Oírr during these periods, islanders have privileged access to knowledge which others would have to go to great risk or expense to experience (Nightingale, 2016). Several participants used the phrase "backup plans" to describe the energy practices they employed to cope with this unpredictability in their daily lives caused by extreme weather events. Although power outages are less common today, many of the participants' described how their need for backup plans stemmed from their childhood experiences of what they called "blackout winters". These blackout winters were defined as winters where electricity blackouts occurred for long periods during the winter months. During the individual interviews and focus groups, two participants separately chronicled the influence that these blackouts had on the decisions they made when choosing energy technologies when building their houses, saying:

"We do get storms and we do get power outages…"

(Sandra, individual interview)

"When we built the house first, there used to be a lot of electricity interruptions, so we went for the gas … so at least if you were cut out, you would still have the cooking facility or be able to boil the kettle on the ring."

(Enda, focus group 2)

Participants described how these situated energy knowledges and techniques to enable adaptive approaches to energy have been passed-down by generations of families through building norms on the island. Several of the younger participants explained how all houses have two methods of heating, in case there are electrical outages in the future. These participants described how these energy practices are standard in Inis Oírr, with one participant further describing how these energy practices affected the types of energy sources and technologies that were most popular on the island saying:

"Most people… have oil, but they also have an immersion, so at least if the oil goes, at least you can heat your water, and you have a fire as well so you can have a back boiler."

(Melissa, focus group 2)

Participants' narratives revealed that this situated energy knowledge has led to the community's desire for an adaptive energy supply with energy backup facilities (as discussed in Chapter Nine). Although scientific knowledge is often described as being the paradigm of all knowledge (Murdoch and Clark, 1994), as is evidenced in the participants' narratives, local knowledge is developed in the same way as scientific knowledge (Nygren, 1999). Although in today's policy and planning arena the criteria of what constitutes knowledge is often described by developers (ibid.), meaningful insights into what is most appropriate for communities like Inis Oírr cannot be obtained without the inclusion of local knowledge. Participants' narratives revealed that a key component of life in Inis Oírr is the unpredictable nature of daily activities and sporadic isolation from external services. Participants also argued that it is difficult for those from mainland Ireland to fully comprehend how life in Inis Oírr is heavily influenced by the weather. This can be understood best through the narratives of those participants that married islanders and then moved to Inis Oírr from mainland Ireland. During the individual interviews, one participant described her memories of her experiences when she initially moved to Inis Oírr twenty years ago saying:

"It was a bit difficult when I first came here because the ferry only came twice a day… and you had to organise yourself a lot better. And, I suppose, I learnt that over the years that you need to have all the essentials in and that you kind of have to be prepared. That's the biggest difference."

(Aoife, individual interview)

The influence of weather on participants' daily lives was prominent in their narratives. Unpredictability is a driving force that must be considered when technical energy plans are being developed for Inis Oírr's low carbon energy transition. These results highlighted the specific role that geographic isolation had on the participants' understandings of energy in their daily lives. Building on these findings the following section discusses the participants' practical and technical understandings of energy. It also describes the impact of their situated knowledge on their understandings of energy technologies and perceptions of their suitability for use in the case study location.

6.4 Inis Oírr Community's Practical Understandings of Energy

The participants' narratives revealed that they had a high level of knowledge of the technical and practical aspects of low carbon energy technologies and many were quite active in ensuring that they were knowledgeable about new, emerging technologies. During focus group discussions, several participants spoke openly and confidently about their knowledge of low carbon energy technologies. However, others were not quite so confident about their level of knowledge of low carbon energy technologies, but were still happy to openly discuss their level of energy knowledge during both the focus groups and individual interviews. During the distribution of the initial survey, and the enlisting of participants, it was stressed at all times that the research project was focused on the situated energy knowledges of the participants and that they were perceived as the experts in relation to the energy needs and perceptions of island communities. Participants were encouraged to share the energy knowledge that they had in relation to their daily lives, creating a more collaborative environment for situated energy knowledge reconstruction. As a result, many participants who were lacking confidence in their knowledge during the participant enlistment phase, were more confident about their own knowledge and the value of their knowledge in relation to its contribution to the project. All participants in the study were extremely open about both their understandings of energy in their daily lives and their perceptions and experiences of community energy projects.

Several of the participants had an understanding of what connecting to the grid meant and several of them had an awareness of how the ESB "feed-in tariffs"[31] operated. When considering public beliefs about national or complex technical systems, it is common to view the public to have a deficit of information (Wynne, 1992), presuming that the public are ignorant of technical issues and unable to engage with decisions related to energy

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[31] A feed-in tariff is a payment made by the TSO to households or businesses generating their own electricity. This electricity must be created through the use of energy sources that do not contribute to the depletion of natural resources (SEAI, 2011).

supply or technologies. A UK study revealed that public beliefs and understandings of energy supply network technologies are not alone present, but are also varied, with a mix of both positive and negative perceptions (Devine-Wright et al., 2009). Interestingly, Devine-Wright et al. (2009) found that their participants described high voltage transmission pylons as being iconic of power supply, and associated them with both positive and negative beliefs and emotions. The participants' narratives echoed these variances in perceptions of the electricity supply network. During the first focus group, one of the participants (who purchased a considerable amount of photovoltaics) described his resentment because of his perceptions that the ESB pays very little money back in terms of feed-in tariffs making it difficult to invest in renewable electricity. He argued that it would be easier for households and businesses to invest in renewable energy technologies if the ESB were more financially supportive, saying:

"If the ESB would buy it back off ya at the right prices I suppose. Buy it back at all, you know... They, you know... they buy it off you in the North[32] *or in England, or in Denmark or in Germany, but they won't buy it off you in the Republic*[33]*. But that's solar... solar..."*

(Tadhg, focus group 1)

All participants of the study were interested in the prospects of funds being garnered for the island from selling energy back to the grid. Although many participants were aware that energy generated could be distributed back into the grid on the mainland, several were not sure if it would be possible in Inis Oírr. A study on public beliefs of energy in the UK (Devine-Wright et al., 2010) revealed that public perceptions of energy technology were generally not holistic, systematic concepts such as a "grid/transmission system" but rather, related to single components of power networks. The participants' narratives reflected these trends, with data from the focus groups and interviews revealing that they could easily understand how energy is created at its source, or locally, but could not relate this to how energy is distributed throughout the electricity network. Amy's

[32] When Tadhg uses the term "The North" to refer to Northern Ireland.

[33] When Tadhg uses the term "The Republic" to refer to the Republic of Ireland.

narrative revealed that she is quite knowledgeable about sustainable living and had installed renewable energy technologies in her house. However, she explained that she did not understand how this energy tied into the grid saying:

"[The ESB] don't really support that I ...think. I don't even know if you could even do that on that kind of cable [in Inis Oírr]... can you feed back?... [is it] not ... a one-way cable?"

(Amy, focus group 3)

Building on these understandings of the electricity supply structure between the mainland and Inis Oírr, several participants described how they perceive that there is a disconnect between their concepts of electricity supply as something national and how they use energy in their daily lives. In line with research (Devine-Wright et al., 2010), several of the participants described how they conceived of there being a singular organisation having sole responsibility for energy supply. Matthew, who has lived in Inis Oírr for most of his life and does not have a background in sustainable technologies, described how he has an awareness of how energy is created, but that he didn't relate this to how energy is used in his daily life saying:

"But you don't automatically think of where [electricity] is coming from, you just hit the switch on the wall."

(Matthew, focus group 3)

Although several participants acknowledged that when they use energy in their daily activities, they did not consider where it comes from, several other participants described their in-depth knowledge of low carbon energy technologies and how they operated. The participants' narratives revealed that if concepts of renewable energy were easier to understand and had potential to operate locally this would result in widespread support on the part of the participants for some types of renewable energy technologies. Community energy literature argues that increased community support for locally generated energy is common (Rogers et al., 2008). The participants' narratives revealed that deeper understanding of how renewable energy technologies work lead to increased support. For example, Matthew's acceptance of solar panels was revealed when he described in detail how solar panels work saying:

"The new ones, you don't need the sun at all. They're like a bridge they transfer the cold into heat and it does water and everything for you."

(Matthew, focus group 3)

In this instance, participants were stating that when traditional modes of centralised energy generation and provision are used, they do not consider where energy comes from, as it is something state run and not perceived as local. However, when Matthew and other participants spoke about localised renewable technologies, they generally had an in-depth knowledge of their operation and of how they produced energy. Others concurred how easy it was for them to understand how energy is created using both solar and photovoltaic panels. Participants' narratives revealed that when participants found it easier to understand how energy technologies worked and produced energy, they perceived them as being more simple and thus easier to maintain and operate. This subsequently led to participants perceiving these technologies as being dependable and more suitable to island communities with one participant describing solar panels in a positive manner saying:

"They seem to be the most simple thing, because once they're in they're in and there's no major maintenance on them. "

(Kenneth, focus group 3)

The technologies that were discussed most often during the focus groups and individual interviews were solar panels, photovoltaic panels and wind turbines (these discussions are outlined in more detail in Chapter Nine). This could be for a multitude of reasons, including the relative success of the installation of solar panels on the island and the recent portrayal of wind turbines in the media. The media play a key role in reproducing, validating and transforming dominant discourses, meanings and understandings of renewable energy technologies (Ellis, 2016) and this was evident in the participants' narratives. Media attention and discussion of wind turbines in Ireland has become progressively more positive since 2007 and although views are more polarised in recent years, the majority of them are positive in nature (ibid.). The national scale of renewable technology has been the main focus of the media in recent years (ibid.) bringing it to the fore of the Irish public's psyche. This concern with renewable energy and energy provision at a national scale was evident in the participants narratives as discussions centred around wind turbines during the focus groups. Other technologies were also discussed including geothermal, with this being considered as excessively expensive.

Energy efficiency techniques undertaken in Inis Oírr were discussed during the focus groups including the insulation project that has recently taken place in Inis Oírr. Much like the rest of Ireland, until recent years, Inis Oírr had a relatively high residential energy use related to inadequate insulation. A key driver for the recent retrofitting projects in Inis Oírr was the high number of older housing stock on the island which reportedly lost 20 to 30 per cent of their heat before insulation upgrades (Davies et al., 2014). Unfortunately, although there have been extensive retrofitting initiatives in the Aran Islands in recent years (SEAI, 2014), several of the participants expressed reservations in relation to insulation. Several participants spoke about their hesitancy explaining that they were confused about what the best approach was to take. Enda explained why he had undertaken other works on his hotel before getting it insulated saying:

"Some say to pump [the cavity with insulation] and others say it is the worst thing you could ever do. There is good and bad for both sides. Some say it absorbs the dampness … the whole idea of the cavity is that you insulate your inner leaf and there is a gap between, but if you block up that gap, I dunno, I wouldn't be a fan of it. It doesn't add up for me for some reason. Some would go for the insulated slab on the inside wall… [but I don't know which is better] …"

(Enda, focus group 2)

Similarly, Enda spoke about his reservations about other technologies that have been suggested for Inis Oírr describing his experience when the energy co-operative suggested he install photovoltaic panels (PV) in his hotel saying:

"They were pushing PV panels here as well, but financially if you were doing the sums on it, it didn't add up. In California, they reckon the maximum amount would be about

5000 kilowatt hours - that was in California and these boys were maintaining that you would get the same output in Inis Oirr, but it was nowhere near it. They were not really happy with me, they signed me up for it but they never asked me what I wanted. But I did my own bit of research on it and found it wasn't adding up… And I says to [the] man that information isn't correct, I know it isn't correct. I said thanks, but no thanks."

(Enda, focus group 2)

The participants' narratives revealed that the majority of the participants' situated energy knowledges was developed through experiencing the renewable technologies and seeing them in operation on the island. These narratives reflect the argument created by Fazey et al. (2006a) that experiential knowledge is most appropriate for developing knowledge of complex systems which require immediate action. Several participants spoke of their perceptions that solar panels had many positive attributes and described how they perceived solar panels worked well on the island. They also chronicled how their experiences of technologies led them to have negative perceptions of other technologies, such as wood pellet stoves. For example, during the focus groups, Alice and Clara described their perceptions the shortcomings of wood pellet boilers due to difficulties in transporting wood pellets onto the island saying:

"[Another islander] had solar panels and a wood pellet stove. My brother got the pellets … just as an experiment, and again he is not using it… he had to get a special trailer to bring [the pellets] in and to make sure that they were dry and ..."

(Alice, focus group 5)

"The heat out of them was not up to scratch."

(Clara, focus group 5)

"Too much trouble [out here] I think… [getting] the wood pellets [here] anyhow".

(Alice, focus group 5)

During the initial survey, several participants stated that they felt they had a low-level of technical energy knowledge. Participants' narratives revealed a high level of support for technologies such as solar panels that they perceived as being locally based and could easily understand how they operated. Turloch, who described himself as having a low-level of technical energy knowledge revealed his perceptions of solar panels as:

"Solar is the best thing that ever came because it is free ... when you put the solar in, your heating and everything...[is supplied]."

(Turloch, individual interview)

During all of the focus group and interview discussions, participants repeatedly spoke about their perceptions of the merits of solar panels and their narratives revealed they had an understanding of the full possible range of benefits of the use of solar panels, with Turloch explaining:

“The solar is one of the best of the lot because it causes no pollution and no ... [damage]."

(Turloch, individual interview)

Building on these previous discussions of their perceptions of renewable energy technologies, the discussions during both the focus groups and individual interviews delved further into other aspects of the reduction of fossil fuels. Approximately 50% of homes in Ireland are believed to be on the lower spectrum of energy efficiency having an energy efficiency status equivalent to a Building Energy Rating (BER) of between D1 and G1, with A being the highest grade and G being the lowest (Collins and Curtis, 2016). This reflects the urgent need for high level retrofitting in Ireland at present. The participants’ narratives revealed an understanding of the role of insulation and how it affects energy consumption. Several participants spoke about their understandings of the role of insulation in their community’s transition to a low carbon society, with one participant stating:

"The insulation really is the main thing, they have been saying to keep things well insulated and then if you have heat, whatever heating you have is staying in the house as much as possible."

(Edward, individual interview)

During the individual interviews where site-visits to the participants' houses were possible, only one of the participants had insulated their house with external insulation. During the individual interview discussion on insulation several participants stated that they did not like the concept of external insulation and that they were concerned that external insulation would not be suitable for their island location. Evan, the only person on the island to install external insulation spoke on several occasions about how impressed he was with the external insulation. However, other participants' narratives revealed that these discussions did not have any impact on their negative perceptions of external insulation. Alice, who offered accommodation to Irish students throughout the year, discussed how her high heating bills negatively affected her lifestyle, and expressed concern around the installation of insulation explaining that she was more comfortable with upgrading her windows and doors and installing insulation in her roof. Alice continued to describe her negative feeling of external insulation saying:

"My husband is against it, most people on the island are... putting this stuff up outside the house..."

(Alice, individual interview)

External insulation has several benefits in terms of low carbon energy transitions, mainly how it can provide improved comfort and reduce energy expenditure for heating (Byrne et al., 2016) without a large imposition on the homeowners during its installation. An analysis comprised of data from several sources on Irish houses, found that a reduction of running costs of 63 percent can be achieved for pre-1979 houses and as much as 26 per cent for newer housing stock (Ahern et al., 2013). Research on the efficacy of external insulation has revealed that walls that are insulated externally maintain uniform temperatures and reduces heat loss and dampness in corners or rooms (Byrne et al., 2016). However, the participants' narratives revealed that their perceptions of external insulation were more negative. Several of the participants were influenced by anecdotal evidence[34] and stories that they had heard through family members and neighbours when it came to

[34] Anecdotal evidence is defined in this work as evidence collected in a casual manner and relying heavily or entirely on the personal testimony of others.

external insulation. In this instance, the role of CKNs (Catney et al., 2013) on the participants' situated energy knowledges were evident revealing how energy knowledge is both socially and spatially constructed. When discussing her perceptions of external insulation, Alice, explained how the experience of those within her knowledge networks affected her concepts of external insulation saying:

"They say that if you put a ladder up against it [external insulation], that … [it]… can fall through it. Although the … [people supplying] … the insulation told me that no [it can't]… but it is true… [it can]… they might as well tell the truth. I told them that the birds ate one in Clare… But… my sister got it … and she said don't put a ladder against it. And the way we … live out here, we can't get people to clean our gutters [for us, so] we would be putting a ladder up against it…. [so] I don't think it would work [here] …"

(Alice, individual interview)

During her individual interview, Alice elaborated on how special consideration has to be given to the types of technologies that are installed in Inis Oírr due to their unique way of life. During these discussions, the participants' high level of knowledge in relation to renewable technologies was evident and their narratives revealed their understandings of the range of positives and negatives related to their installation. Several participants had an in-depth understanding of the unique nature of their housing vernacular describing their perceptions that this makes some technologies less appropriate to their situation. Alice described her feelings that external insulation is not appropriate for their island situation stating:

"So, yeah, we would be thinking, a house out here on its own, you might reverse a tractor into it."

(Alice, individual interview)

While discussing the suitability of insulation, Mitch, the local post-man, revealed his reservations about the efficacy of external insulation in an island setting. His narratives revealed that, due to the tendency for islanders to have multiple competencies, as outlined in more detail in Chapter Seven, and to play an active role in the building of their own houses, several participants had an in-depth knowledge of construction techniques and how these affected the successful operation of renewable energy technologies. The traditional form of wall construction throughout Ireland is the use of cavity wall construction (Byrne et al., 2016). This type of construction involves the placement of an air cavity between two leafs of brick or blockwork and the placement of insulation into the cavity. The purpose of the cavity was primarily to prevent the penetration of water into the inner leaf through driving rain and also to allow sufficient ventilation of the wall itself during times of high humidity (ibid.). Mitch revealed his concerns about the current practice of filling these cavities with pumped insulation based on his construction knowledge, stating:

"I would …be worried about closing a cavity [in a wall]. But I know… that everybody seems to be doing it... [but] the idea of a cavity … is to stop the water coming through… so if you are closing it … [it won't stop water from driving rain coming through]."

(Mitch, individual interview)

Several studies have highlighted the potential of electric vehicles to improve emission levels when coupled with low carbon generated electricity (Brady and O'Mahony, 2011). Academics have argued for the merits of electric vehicles as a method of stabilising island electricity grids to increase the share of energy from renewable energy in islands (Baptista et al., 2013, Connolly et al., 2011). During the enlisting of participants for the study, it was evident that there was an abnormally high number of old cars on the island. Several houses had a number of cars and many had one car per inhabitant. An emergent theme in this research was the effect of geographic isolation on transport on the island. Although the topic of car ownership did not arise during the focus group discussions, it emerged as an important theme several times during the individual interviews. During the individual interviews, one participant described his perceptions of the level of car ownership in Inis Oírr stating that:

"As you know going around the island here every house... [has] an awful lot of cars … and they are all four wheel drives. When we came here 20 years ago there were no cars ... there was one car on the island and the co-op owned that... and …the nurse had a car.

But other than that...[no-one else had a car]. But ever since then … its year by year and ... there has been... a big increase in the number of cars. And in the last three or four years I've noticed, it's gone to four wheel drives."

(Kenneth, individual interview)

Although several participants discussed their perceptions of the high level of cars on the island, participants' narratives revealed they felt an increased need for cars due to their daily practices. Participants' narratives displayed perceptions that the number of cars in Inis Oírr was unsustainable with one participant stating:

"I think for the island and the amount of people [here], there's a huge amount of cars … I think it's out of proportion [with the population] and I think that the size of the vehicles as well are out of proportion. Because the roads were only … [fixed] … earlier on this year. A new road surface was put in … because... some of the roads were in … bad …condition…. those roads won't last as long as the previous roads because of the traffic on them [now]."

(Kenneth, individual interview)

Three of the participants spoke about the effect that the introduction of compulsory car testing, the national car test (NCT) to Ireland in January 2000 (CIB, 2016) had on the car ownership levels in Inis Oírr. During her individual interview, Clara described her understandings of how the NCT affected car ownership in Inis Oírr saying:

"When they introduced the NCT… from then on any car that was refused or failed the NCT and still looked good [came out here]. You can buy them for a couple of hundred [euro]. So … [cars]… became cheap as result of the NCT and they couldn't be on the roads on the mainland …"

(Clara, individual interview)

During the discussions undertaken in the development of interpersonal relationships with the participants, several described how the isolated nature of the island, meant that it was not possible for NCT tests to be undertaken on the island. The participants stated that the cheap access to cars was a disincentive to the islanders to alter their transport options and adopt more energy efficient strategies. Participants' narratives revealed that many participants perceived electric vehicles to be unsuitable for their isolated island location. When asked about solutions for transport in Inis Oírr, Mitch stated that:

"Oh, are you talking about electric cars? I can't see electric cars working out here…[because of the] … salt air."

(Mitch, individual interview)

Mitch also elaborated on his perceived shortcomings of electric vehicles in island locations stating:

"With electric cars there would be a lot more microchips … inside … [making them] … more easily damaged … I find the newer model cars … are a disaster … here … Because … at least with the old cars you could … hit them with a hammer and they would start ... a … car … that is ten years or older, someone can ... [fix] … it out here … Newer models ... it's a laptop you need, not a hammer ...!"

(Mitch, individual interview)

Participants' narratives revealed that their past experiences of electric vehicles were largely negative and these may have marred their perceptions of electric vehicles. Again, Mitch discusses the electric van that was trialled on the island saying:

"There's the electric van .. [left outside the co-operative office] … and it hasn't moved in three or four years and that cost a fortune. It never really worked out here … but a lot of people use cars out here for maybe work as well and have a trailer on them or something as well … You can't do that with electric cars, not yet anyway. …Because a lot of people out here … are farming so, they could have … drums of water thrown in the back … and… not many electric cars … could [allow you to] start throwing drums of water [in them] … "

(Mitch, individual interview)

When discussing whether there could be an option for a reduction of cars in the future, one of the participants was not hopeful of this occurring saying:

"I can't see [the number of cars] decreasing in the near future".

(Kenneth, individual interview)

The older participants' narratives revealed that they perceived that there were divergences in the use of energy between how the older and the younger generation use energy in their daily lives. Anita who has spent most of her life in Inis Oírr spoke about her perceptions of how her children use energy saying:

"... young people .... they just want to come in and they want hot water straight away. They are not going to wait ... for the solid fuel range ... [which has to be] ... on for an hour ... before it would heat a full boiler... everything is fast now... electric kettle. Everything has to be quick now".

(Anita, individual interview)

Alice argued that the nature of energy provision today and the ease of access to it has resulted in younger members of the island community not being capable of adapting their energy consumption. Alice, who has teenage students attending the Irish school on the island staying in her house throughout the year, explained that she felt that the students were not aware of how to use energy. She also acknowledged that although they lacked awareness, she did not encourage them to decrease energy use saying:

"They wouldn't have a clue. They wouldn't have a clue about electric showers or leaving the lights on or... they wouldn't have a clue. But I wouldn't be too strict on them either, I could be stricter ... they wouldn't understand that the "solars" heat the water and that if there is no hot water, they would never understand that you have to use the immersion."

(Alice, individual interview)

Electricity and water infrastructures only arrived in the islands in the 1970s (Cross and Nutley, 1999) and the use of independent generators to power the islands is still vivid in the minds of many of the participants in the study. The participants' narratives revealed that due to the electrification of Inis Oírr later than on the mainland, the increase in energy use over the decades is still present in the memories of some of the older participants. The participants revealed that this resulted in perceptions among this cohort that there was currently a high level of energy use within their community with one participant stating:

"... originally when electricity arrived [to the island], it was just the lights… people just had the lights. And as the infrastructure improved, people began ... to rely on energy more than they had [previously] … But the more you have and the more possibilities that opened, the greater the usage would be."

(Aoife, individual interview)

The participants' narratives revealed that several were aware of the progressive increase in energy consumption within their community. Traditionally, services in island communities were improved at a slower rate than those in mainland communities leading to feelings of marginalisation and suspicion of those in authority (Cross and Nutley, 1999).

6.5 Conclusion

This chapter begins by discussing the current energy landscape in Inis Oírr. Electricity and heating demand profiles for Inis Oírr are assessed from a technical perspective along with the how the islands unique way of life affected these demand profiles as reported by the participants. Following this, this chapter reveals the range of understandings that participants had of energy in their daily lives. It highlighted the role of geographic remoteness in the development of situated energy knowledges in the case study community. This chapter reports on the participants' perceptions of a range of issues relating to energy and their daily lives in Inis Oírr. These questions established the situatedness of energy issues that were of particular importance to the participants. This empirical evidence revealed the participants' practical understandings of energy in their day-to-day activities. Participants explained the effect of geographic isolation on their daily energy practices and the need for adaptive energy strategies in their daily energy practices. Participants also discussed how the unpredictability of life in Inis Oírr affects choices when purchasing new technologies for their homes. Many participants' spoke of their wariness of newer energy technologies due to concepts of them as overly complex and difficult to fix, making them unsuitable for their remote island location. The participants' narratives also revealed how their unique CKNs facilitate the use of cars that are not compliant with the NCT, increasing car ownership on the island. Along with revealing the unique energy demand profile for Inis Oírr, this chapter revealed the influence of the participants' situated energy knowledge on their capacities to assess the appropriateness of low carbon technologies to their location. The next chapter discusses current situated energy knowledges in the case study community along with the CKNs that influence these.

Chapter Seven: Understanding Situated Energy Knowledges within Inis Óirr

7.1 Introduction

Traditionally, public participation in the development of community energy projects is lacking in island communities both internationally (Kuang et al., 2016, Weisser, 2004) and within Europe (de Groot and Bailey, 2016, Michalena and Angeon, 2009, Duić and da Graça Carvalho, 2004, Butler and Nelson, 1994). This chapter argues that this is due, in part, to predominant universal-policy approaches to community consultation which further marginalise periphery or island communities where, typically, local knowledge is highly valued (Royle, 2002, Cross and Nutley, 1999). This gives more meaning and significance to the economic and social pressure of energy resource dependency than in mainland communities. Offshore island communities typically experience complete energy import dependency and thus, are facing an increasing cost of living if rises in the cost of energy occur (Denny and Keane, 2013).

This chapter argues that proposals for island community low carbon energy transitions must be considered within their situated and socially constructed contexts. It also stresses that understanding how situated energy knowledges and CKNs of island communities interact with the policy arena can help to ensure a more collaborative and participative energy planning process. This chapter concentrates specifically on Research Question Two:

2. What are the key processes that influence situated energy knowledge development and community knowledge network maintenance within island communities?

The following section reports on the response of the study participants around a range of questions relating to energy and their daily lives in Inis Oírr. These questions established the situated energy issues that were of particular importance to the participants. Several key themes emerged in the data and these are explored in this chapter. Similar to chapter Six, results relating to the three previously outlined sensitising concepts; knowledge, governance and communication are presented here. Several themes also emerged during the data collection phase and their relationship to each of these sensitising concepts are discussed in the following sections. This chapter illustrates important themes related to knowledge which emerged from the research including: participants' understandings of situated energy knowledges, the role of place and identity and the effect of geographic isolation on energy needs within the community.

7.2 Understandings of Energy Knowledge in Inis Oírr

Participants' narratives revealed that energy knowledge was understood by participants in a range of ways, with some saying it covered a wide range of aspects, while others were more concerned with energy creation. Many of the participants initially found this question difficult, with some stating that the term "energy knowledge" could mean any number of things. The question posed during the focus group was purposefully quite broad. This was in order to determine whether the participants' narratives would focus on energy knowledge as being something that is situated and local or whether their perceptions of knowledge were more global in scale. The participants stated that they had difficulties defining energy as they felt that the term "energy" was very broad ranging. Interestingly, the participants situated the concept of energy as place-based and considered on a global scale. Although it is often argued that energy infrastructures define how societies perceive and behave towards their surroundings (Calvert, 2015), the participants perceived energy as being something separate from their situated experiences. Literature describes energy as being discursively wrapped up in socio-spatial identities (ibid.) such as "community" (Walker and Devine-Wright, 2008) and "local" (Devine-Wright, 2005b). The situating of energy within place-based, cultural and social contexts was reflected in the participants' difficulties in defining energy as a singular entity. Amy, a local café owner, described the question posed during the interview as very broad, stating:

"I suppose it would depend on the context…That could be anything from the electricity and body heat and power plants … all the way to… [energy production]."

(Amy, focus group 3)

Muireann who works in the local arts centre, acknowledged how expansive the term "energy" was and how understanding energy technologies involves obtaining a vast amount of knowledge. She also explained that the broad ranging knowledge needed for newer energy provision systems often means that the relevant knowledge is not available on Inis Oírr island to fix technologies when they are broken, saying:

"That's very wide isn't it? Well, I suppose… that people know how to save energy. There's a lot of new technologies that lots of people don't know anything about and I feel sometimes when they put new systems in, that sometimes there isn't the backup [for that system]."

(Muireann, individual interview)

As described in Chapter Two, energy is a multi-faceted, socially (Calvert, 2015, Shove et al., 2015), culturally (Shove et al., 2015, Devine-Wright, 2011) and spatially (Fast and Mabee, 2015) constructed entity encompassing multiple disciplinary perspectives (Yildiz et al., 2015). Difficulties in defining energy were reflected in the participants' narratives. However as the focus groups evolved, the participants began to discuss energy in terms of energy production, conservation and how they use energy in their day-to-day activities. Participants' narratives revealed that ideas around energy knowledge were varied and complex. Many participants defined energy knowledge as having an understanding about several different aspects of energy as displayed in Table 7.1.

Table 7.1: Defining Energy Knowledge in Inis Oírr
How energy projects are organised
The technical aspects of energy provision
How global politics affects energy supply
How energy is supplied locally
The financial aspects of energy provision
How energy affects the environment
Knowledge on how to conserve energy

Participants' definitions of energy were not as influenced by their internal CKNs as their definition of local knowledge. As can be seen from Table 7.1, the participants' narratives revealed that definitions of energy were influenced by external sources and were defined at a more global scale. Although many participants commented that they had not thought about energy in such a manner before, all were able to define energy in relation to their daily lives and their understandings of energy knowledge. For most, energy knowledge involved having an awareness of energy sources and how these could be utilised. Kenneth, a retired logistics manager in his 60s stated that energy knowledge was knowing about:

"Electricity, and sources of it... oil, coal, the sun, solar".

(Kenneth, focus group 3)

While Amy, a café owner concurred that:

"... the first thing that would come into my mind [would be] the energy creation, not so much about the energy conservation or energy use, it would be more [about] where the energy is coming from.."

(Amy, focus group 2)

As described in Chapter Two, decreasing efficiencies of oil production (Brandt et al., 2013), highlight a need for lower carbon methods of energy production and consumption. Participants' narratives revealed that although they know more about how energy is produced, this does not necessarily mean that this aspect of energy is more important than conservation of energy, with Amy stating:

"No, [it's] not more important. Just ... if you were asking [about] energy knowledge that would ... come into my head before I would start thinking about the other things."

(Amy, focus group 3)

Inconsistencies related to the divergences between what policymakers prescribed as suitable energy conservation and what the public undertake (Whitmarsh, 2009) may be partially responsible for this gap in knowledge on the part of the participants. As described in Chapter Two, energy use can be understood as a set of practices that combine skills, material conditions and meanings which are embedded in wider social contexts (Shove and Walker, 2014). Recent energy awareness campaigns in the past have had little or no effect on energy consumption (Diffney et al., 2013) while another recent study revealed that 53 per cent of the population had not attempted to cut down on their energy use in the month prior (Lavelle et al., 2012). Kenneth's narrative reflected these findings as he explained his perception that although people might know more about how energy is produced, when it comes to their day-to-day activities, they are not concerned with where energy comes from. Kenneth stated that:

"I think most people would consider … energy just being available as being the most important thing. I don't think most people will consider where energy comes from …"

(Kenneth, focus group 3)

Although some participants stated that people do not consider where energy comes from, several others were fully aware of the rationale behind switching to more carbon neutral resources. As described in Chapter Two, findings from a study in Denmark revealed that ensuring a community understands the motivations behind low carbon energy transitions is crucial to their success (Heaslip et al., 2016). Several participants stated that the key aim of renewable energy provision is, in fact, to reduce consumption of fossil fuels. Orla, a local café owner who also provides student accommodation described how installing solar panels helped her learn more about:

"All the different types of ways to conserve energy… like solar panels … geo thermal and insulation and … Trying to cut down on oil and coal usage."

Orla (focus group 4)

As discussed in Chapter Two, energy consumption, climate change and pro-environmental behaviour are linked, with similar incentives for each (Ellis et al., 2014). This was reflected in the narratives of the participants with several having an awareness of energy as being of global concern, stating that cutting down on energy was of interest to them:

"From a global warming point of view… [and] … climate change"

(Maeve, focus group 1)

However, climate change is rarely the primary incentive for undertaking climate change mitigation actions with financial incentives being more powerful (Whitmarsh, 2009). Similarly, findings from initial fieldwork studies in Denmark highlighted the variety of motivations for communities' desire to transition to low carbon energy sources and how these were situated and socially constructed (Heaslip et al., 2016). Snape et al. (2015) coined the term "hassle factor" when studying the 2014 tariff based renewable heat incentive scheme introduced in the UK. Findings revealed that the effort needed to implement low carbon energy alternatives are more prohibitive than previously considered (Snape et al., 2015) making economic incentives less influential than is currently thought. Within the participants' narratives there were contradictory perceptions of the influence of cost as an incentive for energy behavioural change. Several participants acknowledged that knowledge of the cost of energy was most important while others cited other motivations as being more influential. Melissa described her knowledge of energy as being cost driven saying:

"It's mainly the money side… what you are going to save long term… and short term as well I suppose…"

(Melissa, focus group 2)

While Aoife's perceptions were divergent from Melissa's she explained that her concerns were related to energy security stating:

"I suppose it's not so much the cost as the security of it"

(Aoife, individual interview)

During focus group one, which was comprised of community members that worked in community organisations, discussion around the opportunities of energy tourism in Denmark was discussed at length, as was the possibility of district heating in Inis Oírr. Samsø Island in Demark has a flourishing energy tourism trade as a result of their low carbon energy transition (Heaslip et al., 2016) and participants in focus group one discussed the prospects of creating opportunities similar to the Denmark experience (as described in Chapter Two). Three of the participants in focus group one had previously visited Samsø Island in Denmark and described how they had been influenced by their experiences during the visit. They described how they one of their motivations was to emulate the techniques employed in Samsø Island and the energy tourism industry that had emerged as a result. During his individual interview, Philip spoke about his desire to create another source of tourism in Inis Oírr saying:

"The biggest thing for me, not looking at money at all, is if I could start another industry besides the tourism industry. Or else it could be a tourism industry that is servicing tourism that is not on the island. Because I mean really, we have become over dependent completely on tourism as ... the way of life and living and things like that… If anything happens then, in the world, d'you know what I mean… it's a fickle world ... you, d'you know... a war can start, anything else like that, then you are gonna be left with nothing, only the dole[35]."

(Philip, individual interview)

Although discussion focused on the achievements of Samsø, the participants also described their awareness of the difficulties encountered in Samsø during their low carbon energy transition (Heaslip et al., 2016). Philip described his perceptions of Samsø Island's low carbon energy transition saying:

"Like, you could take it as an example, but they had a lot of resistance when they were starting out as well. It wasn't as simple as just: "here we're going to go… "

(Philip, focus group 1)

The narratives of the participants in focus group one revealed other positive perceptions of the low carbon energy transition in Samsø Island and, although they were aware of the benefits of transitioning, their visit to Samsø Island revealed the difficulties that can be experienced. Evan, one of the participants who had visited Samsø Island in his capacity as the retrofitting co-ordinator for a retrofitting project in Inis Oírr co-operative, described his desire to emulate Samsø Island's low carbon energy transition in Inis Oírr, while

[35] The "dole" is a colloquial term in Ireland used to denote jobseekers benefit.

explaining that not all of the techniques employed in Samsø were appropriate for Inis Oírr saying:

“And I keep mentioning Samsø, but not everything they did in Samsø would do in Ireland.”

(Evan, focus group 1)

Participants’ narratives revealed their perceptions that members of the community in Inis Oírr were not cognisant of energy in their daily lives. Energy use is a set of practices that are embedded in wider social, institutional and political contexts (Shove and Walker, 2014) and are difficult for some to assess independently of daily activities and practices. The participants’ narratives revealed that energy was not something that they considered as local, with several participants stating that this led to community members not having knowledge of energy in general. The participants’ concepts of energy were less at the micro or household level and more at the macro or national level (Reid et al., 2010). Several participants explained that if energy is not considered of local importance, that a large proportion of the community in Inis Oírr will not perceive it as being relevant to their lives. Maeve, a local community organisation manager, spoke about her interaction with members of the community and her perceptions of their level of energy knowledge stating:

“Amongst the people on the street [knowledge of energy] is very low. If you asked anybody... about the oil line that comes from Russia and the trouble in the Ukraine... nobody would know anything about it.”

(Maeve, focus group 1)

Several other participants concurred with Maeve when speaking about their perceptions of knowledge of energy, where it comes from, and global politics’ effects on energy supply. When questioned about whether this “low” level of knowledge is the same for all issues that affect the community in Inis Oírr, Phillip explained that:

"No, I wouldn't [say the same]. They don't see energy as being … local…"

(Phillip, focus group 1)

Maeve concurred with Philip saying:

"It has to have an impact on your [daily] life, before ... [you do anything]".

(Maeve, focus group 1)

Participants explained that their community was extremely active and well informed about issues that they perceived as being of importance to the survival of the community. The participants also discussed how their community did not perceive energy as being crucial to the survival of the population on the island. In this specific time and place, perceptions of energy as something universal, and energy technologies as extremely complex, are leading participants to perceive newer technologies as being unsuitable to their island environment. Many of the participants have, as a result, become apprehensive of installing modern sustainable energy technologies in their homes. Along with discussions of energy and energy knowledge, participants were also encouraged to discuss their perceptions and understandings of how local knowledge was understood within their island community. The results from these discussions are presented in the following section.

7.3 Understandings of Local Knowledge in Inis Oírr

Although participants described their difficulties in defining energy knowledge, they did not face these difficulties when asked to define local knowledge. Although defining local knowledge was relatively easy for the participants, their definitions were much more wide-ranging and varied. "Local knowledge" has a connotation that local people are only observing their immediate surroundings and that their knowledge has no wider application (Nygren, 1999). People, irrespective of whether they are indigenous to a given area, develop complicated, socially constructed understandings of the world relative to their local experiences (Sillitoe, 2004, DeWalt, 1994). Interestingly, due to the socially constructed nature of situated energy knowledges, the range of participants' understandings around local knowledge is wide ranging. These comprised of a myriad of features including everything from the ability to adapt to life in island locations, to how the landscape and weather affects their daily lives. During the coding stage of this research, which is outlined further in Chapter Nine and Figure 9.1, content related to local knowledge was coded under the knowledge theme. Participants' narratives revealed several different perceptions of what local knowledge was and these were coded into 21 themes for investigation in this research, which are contained in Table 7.2 and are not ranked in a particular order.

Table 7.2: Participants' Perceptions of Local Knowledge in Inis Oírr
Being able to adapt to island life
Local knowledge is something that everyone on the island has
Knowing that one must constantly plan-ahead when living on an island
Knowledge of the good quality of life available on an island
Knowing the differences between island life and life on the mainland
Knowing about the landscape of the island
Knowing about how life in an island is weather dependent
Knowing about the people of the island
Understanding the need to have many skills on an island
Understanding the need for self-reliance on an island
Understanding the need for backup plans on an island
Knowing about the services on an island
Knowing about the technical difficulties faced by island life
Understanding that those who do not live on an island cannot understand island life
Understanding about car use on the island
Understanding how the island's community organisations work
Understanding about dealing with the high cost of living on an island
Knowing about the culture of Inis Oírr
Knowing about daily lives of the people in Inis Oírr
Knowing about the depopulation of Inis Oírr's youth
Understanding that it is difficult to get things fixed on the island

Island communities are socially and culturally divergent from mainland communities due to their geographic remoteness (Cross and Nutley, 1999, Royle, 2002). Due to the social construction of knowledge, local knowledge is traditionally highly valued in these peripheral communities (ibid.). In terms of local knowledge, participants described their perceptions that awareness of how a community works as a unit is valuable knowledge. When asked to discuss her understanding of local knowledge, Amy described it as knowing:

"About the history and culture of a place. About the people … [and] how the community is, how it operates as a community, what its strengths are as a community and what things are difficult for the community."

(Amy, focus group 3)

Knowledge of those in positions of authority and the workings of community organisations was perceived to be most useful in terms of local knowledge and of most importance when considering the development of new projects in Inis Oírr. Nightingale (2016) has addressed the problem of multiple epistemologies that exist in community development and planning processes. Ultimately, during the process knowledge integration, expert views gain prominence and the local knowledge is blurred losing its authenticity (Nygren, 1999). Several previous studies have discussed scientists and government officials' practices of ignoring local knowledge in different environmental governance decisions (Weible et al., 2004, Murdoch and Clark, 1994, Wynne, 1992). This bias against local knowledge illustrates the one-directional exchange between local knowledge and the policy sphere in collaborative processes (Nightingale, 2016, Blake, 1999, Nygren, 1999). Echoing this literature, knowledge of community organisations was cited by the participants as crucial to the successful development of any projects within island communities. Alice, a native of Inis Oírr who provides accommodation for students throughout the year, described local knowledge as knowing:

"Who's in charge of things… if you need to get something done…".

(Alice, focus group 5)

Local knowledge in islands is also influenced by a complex relationship with nature and more particularly with weather. In recent years, Inis Oírr has been at the mercy of repeated storms that have ravaged their coastlines causing considerable damage (National

Directorate, 2014, Engineers Ireland, 2014) and cutting off external transport connections for weeks as a time. Chronicling the difficulties faced by those in island communities constituted a large portion of discussion around local knowledge in island communities. Several of the participants described local knowledge as knowledge of environment and their climate. Orla described local knowledge as understanding how weather dependent life in an island setting is, stating:

"Your day ... depends on what the weather is like ... if you were on the mainland you could ... [easily] go [somewhere] or do [something], whereas here you might have the same plan, but ... the weather might [ruin] that plan, so you [need to] have a backup plan ... like if I don't get going ... this is what I will do."

(Orla, focus group 4)

The participants' narratives revealed that they all perceived that geographic peripharilty had the largest effect on local knowledge in island communities. Brenda, a retired air service employee, explained that understanding the role that weather plays in their daily lives is often a difficulty for tourists that visit Inis Oírr. She explained how locals in Inis Oírr constantly explain to visitors the problems that they can face due to the weather, saying:

"People here on holidays - you have to remind them ... if they have to be in Shannon [airport] by ... 11 o'clock [in the morning] ... [you have to remind them that] you have to go the day before... They don't understand, they are not used to it."

(Brenda, focus group 4)

The effect of peripherality does not relate solely to planning for trips to the mainland. Several participants described how changeable weather in Ireland can lead to difficulties when attempting to predict daily tourism numbers during the summer season. Tadhg, a hotel and bar owner, commented that in order to run his business effectively, he must keep abreast of the weather forecast and how this might affect tourism numbers to the island stating:

"Spring tides and the weather forecast is always watched every day."

(Tadhg, focus group 1)

Tadhg elaborated that when he has a good indication of the weather for the day or week ahead, he will order stock for his restaurant accordingly. However, he explained that often, due to the isolated nature of island life, when the weather changes abruptly Tadhg is frequently left with excess food and high levels of food waste. During his individual interview, Tadhg estimated that this high level of food waste costs him up to 12% more than in hotels in mainland communities. Tadhg continued to detail the many ways in which changeable weather and geographic remoteness affects the daily operations of his business, including staff arrangements, maintenance and repairs within his hotel and staff retention on a yearly basis.

There are a myriad of descriptions of the simplistic beauty of island life and the spiritual significance of isolation and closeness with nature. Although Inis Oírr is described in literature as having a unique character that embodies a balance between traditional and modern lifestyles (Leder, 1990), which exudes a calm serenity (Feehan et al., 1994), several of the participants were keen to ensure that the realities of island life were also addressed. Although the participants' descriptions portrayed the difficulties faced by those in remote geographic locations, several participants were keen to ensure that the positives of island living were also revealed. Inis Oírr is one of the three Aran Islands which are renowned for their culture, language and archaeological heritage which leads to their maintaining a successful tourism industry and significant state funded support (Robinson, 1986), helping it maintain its population (Cross and Nutley, 1999). Building on these difficulties faced by living on an island, participants were eager to portray both the positives and negatives of island life. Although they described several difficulties posed by their geographic isolation, Orla (focus group 4) was keen to explain how she felt that this peripherality also led to a much better quality of life for her family. Orla explained that due to its isolation, the small community had more access to services locally than a similar sized community on the mainland. Due to the island's isolation, there was a necessity for three levels of education within the small community. Orla explained that:

"The quality of life… It's great for kids, you have the three levels of education. There are not many communities that have a pre-school, primary and secondary [school]".

(Orla, focus group 4)

However, as Philip, the manager of the local co-operative, explained, although he feels Inis Oírr is a wonderful place to live, crucially any study of island life must acknowledge:

"When you are here for 365 days [a year] … it's not as simple as it looks."

(Philip, individual interview)

He explained that surviving day to day in Inis Oírr requires a significant amount of daily planning and that living on an island involves:

"Planning your day to planning your weeks ahead… School, work, play, you have to plan your freezer, your fridge ... everything ... You have to think ahead always… Forward thinking is a good island thing".

(Philip, focus group 1)

While Martha, who also works in a community organisation on the island concurred that forward planning is a good tool when living in an island setting. Martha explains, due to unpredictable weather, one must always be prepared to change plans stating:

"*Be ready to change that plan!"*

(Martha, focus group 1)

Melissa concurred that:

"You don't just have one [plan, but] a Plan B for everything."

(Melissa, focus group 2)

This element of forward planning extended, not only to their trips to the mainland, but also to their energy practices (described in more detail in Chapter Eight). The participants' narratives also revealed how island life is extremely divergent from life on the mainland. Cathal (focus group 2) who moved to Inis Oírr nine years ago, explained how living in a remote island setting changed how he approached his daily activities:

"I plan my life a lot better. So, if I am going into Galway, I will [wait] until I have a list of things to do and I will attack it with military style precision!"

(Cathal, focus group 2)

Several participants that had originally lived in mainland Ireland chronicled the effect that moving to a remote island location had on their daily energy practices. There are often no (or unstable) grid connections between islands and mainland due to the high cost of underground cables (Kuang et al., 2016) creating the need for several modes of energy provision in order to account for stability in the grid. As a result of these grid instabilities small island communities often need to make adaptations to cope with inaccessibility by maintaining varying degrees of self-reliance, behavioural adjustments and reduced expectations related to energy (Cross and Nutley, 1999). Reflecting this literature, Cathal described how he had become more self-sufficient in his energy practices since moving to Inis Oírr. He explained that decisions over which technologies to purchase when building his house five years ago were based on the need to purchase technologies that could be fixed by people living in Inis Oírr. He explained that:

"If something goes wrong with anything - if your car breaks down or your heating goes at home, you have to be … self-reliant, if you can't fix it yourself, you have to know who else is on the island to help you."

(Cathal, focus group 2)

Participants explained how important history, culture and the Irish language are to the community in Inis Oírr. The participants also discussed how the geographic remoteness of this island community created a need to be more prepared in relation to their daily activities and supplies for their day-to-day activities. Conversations were dominated by descriptions of the powerful influence of weather on their daily lives and subsequently how they use energy. In this specific time and place, perceptions of the unpredictability of island life have created a more adaptive capacity within the case study community.

Many of the participants have, as a result, tended to bulk purchase their provisions (including fuels for energy) in order to ensure security of supply. Several participants revealed that they had multiple fridges and freezers in order to accommodate their high food stocks during the winter months. After the opening discussion in relation to energy and local knowledge, the conversation was allowed to flow relatively freely in order to delve further into certain issues. Several key themes evolved during these subsequent discussions including the relationship between the participants' identity and sense of place, their conceptualisation of the importance of Inis Oírr to Irish culture and their perceptions of having to "fight" for the community's survival. The results from these discussions are presented and discussed in the next section.

7.4 Identity, Place and "Fighting for Survival"

The Aran Islands are known for their unique landscape and for being an Irish speaking island linked to the Gaeltacht area (Feehan et al., 1994). Participants' narratives revealed the strong link between the Irish language and culture and the identity of the participants. Irish islands are depicted in a myriad of ways in Irish literature (McIntyre, 2009, Robinson, 1986, Feehan et al., 1994, Synge, 1934). The Aran Islands have often been romanticised as something from the past which untouched by British rule (McIntyre, 2009). Inis Oírr and the three Aran Islands' heritage led to their becoming renowned for their culture, language and archaeological heritage which aids them in maintaining a successful tourism industry and significant state support (Robinson, 1986). Several of the participants spoke about their wishes to remain living in an area such as Inis Oírr that is steeped in Irish culture. This desire was held by both those who had grown up in Inis Oírr and those who had moved to Inis Oírr from mainland Ireland. Philip, who moved to Inis Oírr in the 1970s after he married an islander, explained that:

"This is a Gaelic island … which [is] … [very] rare. So … you'd do anything to try and hold onto the community and keep it vibrant … ".

(Philip, focus group 1)

The participants also spoke about how these feelings for Inis Oírr, and the community that has developed there, has established a community that is extremely active in keeping it vibrant. Ancestral and cultural connections are important in the development of place belongingness and a strong bond to home and its environment (Hay, 1998). The participants' narratives revealed that this increased level of attachment to place created a community that were active in maintaining and preserving their services and culture. Orla explained that this level of proactivity is because people appreciate Inis Oírr saying:

"People are still very aware that they have a very special place where they live".

(Orla, focus group 4)

Other participants spoke about the benefits of hailing from an island with a high influx of tourism and the positive effects of being exposed to a large number of nationalities. Orla described her perceptions that this exposure created a more open society saying:

"We have a different attitude, a … more open attitude, because we are exposed to... the island life and the elements and tourism and different people and [are a] very open society really."

(Orla, focus group 4)

Participants chronicled what they described as a legacy of "fighting" to preserve their way of life in Inis Oírr. Participants working in community organisations explained their feelings around funding currently awarded to the island to provide essential services. Literature suggests that only low-order and small services are likely to survive on small islands leading to reliance on the mainland for services (Cross and Nutley, 1999). Several of the participants spoke about their perceptions that mainland opinion towards the provision of funding for islands was largely negative due to perceptions that reliance on mainland services is acceptable. Martha, who works in one of the community organisations, explained that:

"When you live on an offshore island, you are conscious of people in Dublin saying: "Oh, well… there's only [a small] amount of people living … there, why are we spending all this money on them? … And is it worth supporting life on an offshore island?"

(Martha, focus group 1)

Participants narratives revealed perceptions that public opinion of the amount of funding awarded to the islands was largely negative. As outlined in Chapter Four, traditionally, tourism is the major source of revenue in Inis Oírr (Cross and Nutley, 1999). Maeve described how when applying for funding to support some of the services for the island she felt that she had to constantly justify to external organisations the value of preserving life in Inis Oírr. She explained that those working in community organisations in Inis Oírr constantly had to argue the value of the island to tourism in mainland Ireland stating:

"The image of Ireland is hugely based on the west of Ireland. And ... that sells Ireland abroad… the images, the culture, the language ... we are always made to feel by the Irish government ... that they are always giving ... handouts. That they ... would much rather we all moved into the cities ... but ... I don't think that the island ... owes this country anything. We already provide them with enough…cultural capital… the people in the west are custodians of that."

(Maeve, focus group 1)

Other participants also commented on the economic importance of Inis Oírr and its culture to the west of Ireland. In 2015 there were over 120,00 visitors to Inis Mór (FailteIreland, 2016) and according to Philip, the Inis Oírr co-operative manager, a similar number visited Inis Oírr. Several participants argued the value of their contributions to the economy of the west of Ireland and felt that this should be cause for them to garner more support from the government for their survival. Maeve further argued that;

"81% of the revenue into the hotels in Galway... a huge proportion of that comes from tourists to the Aran islands… 151,000 people in 2014 went up to Dún Aenghasa[36]... and 80% of them were from abroad… they didn't come and go to Ireland in one night…they stayed someplace [along the way]."

(Maeve, focus group 1)

[36] Dún Aonghasa is the most famous of several prehistoric hill forts on the Aran Islands.

The participants' narratives revealed that justifying the funding awarded to the islands stemmed from feelings of unease on the part of the participants. Several of the participants described how they felt threatened by what they perceived as the government's lack of interest in supporting the island. Participants' narratives revealed perceptions that mainland governance make them feel that they are a drain on the government. Participants' narratives revealed that these perceptions created even more awareness and bitterness towards the recent funding cuts in their locale. Dara (individual interview), who works in Inis Oírr during the summer months and lives in Galway the rest of the year, spoke about his perceptions of how the community within Inis Oírr feels threatened. During the Summer of 2015 (while this study was being undertaken) the government were in the process of renegotiating the contract for the air service on the island (described in Section 4.4). The government had awarded the contract to a helicopter company instead of the Aer Arann company that had been servicing the island for decades. The community felt that a helicopter could not keep up the same level of service as an airplane and were very distressed by this. Dara described how:

"People do feel threatened all the time here… especially with what's in the newspaper now [about the air service] … people are genuinely worried… what's going to be [cut] next?"

(Dara, individual interview)

These feelings of marginalisation and neglect are not uncommon in island communities (Cross and Nutley, 1999) and the participants narratives revealed that this has a negative effect on the amount of time that they can devote to participating in proposed energy projects. Participants described how the majority of their focus tends to be concentrated on "fighting" to maintain their basic services and that, as a result, they do not have the time or manpower to devote to planning for their energy future. Shortcomings in services to island communities are not new phenomena and have been predominant throughout history. Although literature suggests that those in island communities in Western Ireland develop lower expectations of the level of services that are acceptable (Cross and Nutley, 1999), the participants' narratives revealed that this is not the case in Inis Oírr. Several of the older participants chronicled their experiences of fighting to get more services in Inis Oírr in the past, including electricity and a secondary school. These participants were extremely proud of their achievements of the past and of the vibrant community that they played a part in building. These participants also discussed how difficult it is to continue to fight for their services as they get older and how this can often create a strain on their lives. Brenda described how:

"You get tired of fighting though, but you don't mind because the next generation will take over hopefully."

(Brenda, focus group 4)

Brenda continued to speak about the more recent cuts to the air service that the island had encountered and spoke of her relief that the younger generation of islanders were very active in protesting to save the service.

During the initial fieldwork studies in Denmark, findings revealed the importance of government support for the success of community low carbon energy transitions (Heaslip et al., 2016). During the focus group discussions, Evan described his perceptions that the Danish government's support (ibid.) (both financial and political) was instrumental in the success of Samsø's low carbon energy transition saying:

"The Danish government set it up as an energy [community] it's... an example of an energy efficient, self-sufficient community for the whole of Denmark."

(Evan, focus group 1)

Although the participants were proud of the community efforts to save the air service, they did acknowledge that putting in this amount of time and effort had a knock-on effect in other areas of their lives. Findings from the initial fieldwork in Denmark revealed the importance of having an individual, or "key influencer" who can dedicate their time to facilitating projects to transition to low carbon energy sources (Heaslip et al., 2016). Participants described how having to spend time petitioning to save other services on the island has a negative effect on the development of other projects within Inis Oírr. Philip, who acted as the gatekeeper for this research and would be an ideal key influencer in Inis Oírr, explained that he was too busy dealing with other issues on the island to devote enough time to a low carbon energy transition project. Philip explained that they are too busy dealing with the threatened loss of other services to concentrate their efforts into transitioning to low carbon energy sources saying:

"We are too busy firefighting. You know… I mean, it's become really bad in the firefighting service as I'm calling it. The amount of time I am putting into it is just beyond… to me its complete madness. It's just so frustrating that you'd feel like saying; "Here I've enough of this" You can't … one person can't be firefighting all the time, there's nothing being done. You haven't time to go out and see what's happening around …"

(Philip, focus group 1)

Evan explained that initiating the retrofitting projects last year was greatly hindered by the time those that were involved in the project had to put into the protection of other services on the island. Evan built upon Philip's statement saying:

"But that final point that Philip made there as well is very relevant as to where does the energy [plan] come in the scale of things. That Philip… Tadhg… individual groups be they the knitters, be they the hotel that the visitors visit. Everybody is so busy just trying to hold onto what we have, that we… there isn't enough hours in the day. There's only 250 of us. Remember that's babies, old people, working people… there's only a certain amount of us able to actually commit time to the different subjects at the different times. So it's only a percentage of that 250… and it's such a big battle for the day to day stuff, it's very difficult to see how we can keep the energy issue and the sustainable issue, high up there."

(Evan, focus group 1)

Aoife, who works in one of the community organisations, described the difficulties that the islanders face due to the need to petition the government to fund their services. She described how this has a snowball effect on achieving other goals for the island saying:

"When things like this [issue with the] plane happens, all your energies are suddenly diverted into: "we have to save this." It might be the plane today, it might be the school tomorrow, it might be … something to do with the ferry service the day after or... those

bigger issues that normally wouldn't enter peoples' psyche if they are living in an urban area … they don't have to consider those kind of things."

(Aoife, individual interview)

When investigating the processes that influence situated knowledge and CKNs it is important to acknowledge these are socially constructed, and as such, are affected by the daily concerns of the community. Those issues that are common across a community are instrumental in creating those bonds that develop into CKNs (Catney et al., 2013). Past experiences with governance can lead to a lack of trust towards those authorities in power and feelings of marginalisation. Subsequently, as will be discussed in further detail in Chapter Eight, the participants' narratives revealed that these feelings of resentment led to mistrust on the part of the participants towards those in mainland governance. This suspicion and apprehension in supporting projects proposed by mainland governance negatively affected their participation in energy projects proposed for the island. The participants' narratives revealed the negative impact that the legacy of fighting for services on the island had on the participants' trust in the government. Trust is a long term process and a core component of any community initiatives (including low carbon energy transitions) (Letcher et al., 2007). However, trust is easily lost and can be affected by withdrawal of funding, insufficient engagement techniques and changing government priorities (ibid.). Initial fieldwork in Demark and Ireland revealed the importance of utilising existing organisational structures and the trust they have developed within communities in developing community low carbon energy transitions (Heaslip et al., 2016). These organisations had already developed interpersonal relationships and trust with the members of the communities in question (ibid.), making the complex transition to low carbon energy sources more achievable (Fazey et al., 2006a). Muireann, who moved to Inis Oírr from another Gaeltacht region in Ireland, spoke about islanders' perceptions that the government are not acting in their best interests at present. Muireann explained that their perceptions were that the government were not trying to support life in island communities stating:

"It is just so crazy that the little we have they want to take from us. Which does make it … difficult to live on an island… what are they trying to say? Do they want us to leave the island rather than preserve it?"

(Muireann, individual interview)

Building on these comments, several of the participants discussed how, in the last century, several other island communities had been forced to move from their homes to the mainland by the government. Depopulation threatened islands in Ireland during the 1900s and several were evacuated (Mac Conghail, 1987). As described in Section 4.2, the Great Blasket Island and Gola Island were evacuated in the 1950's and 1960's (Mac Conghail, 1987, Aalen and Brody, 1969). During his interview, Philip spoke specifically about Inishark, an island in the west of Ireland, north of Inis Oírr which had been purposefully depopulated in the 1960s by the Irish government (ICC, 2016). In October 1960, the last 23 inhabitants of the island were evacuated as they had been unable to leave the island for several months (ibid.) Rather than invest in building a new pier on the island, the Irish government relocated the community to the mainland. This island, similar to Inis Oírr, had been populated for thousands of years and had many Bronze Age sites of note. Several of the participants relayed their fears that the community of Inis Oírr might be forced into a similar situation and expressed the distress they feel as a result. Philip accurately described the fears of many of the islanders saying:

"There were people living there [Inishark] and … something happened on the island…. and [the community were] gone! That's terrible … you're talking [about] hundreds and hundreds of years of living and forming a community and then suddenly you're just walking off [the island] … it would be a terrible thing to happen."

(Philip, focus group 1)

The participants' narratives revealed a lack of trust in the government and subsequently cynicism of any energy related proposals that might be created for the island. Fears that the government were not willing to support their way of life in Inis Oírr was a key motivation behind the participants proactivity in petitioning to save services that have been threatened with funding cuts in the past. Traditionally, island communities in Ireland have been marginalised by the central power (Cross and Nutley, 1999) and the participants' narratives revealed that this has created a contentious relationship between the participants and those in mainland governance. The government's proposal to discontinue the plane service to the island and to replace it with a helicopter service pushed the community to join forces to actively oppose the proposal and consequently the government. The participants described how, as a community, the island had come together to protest against this proposal as they felt that a helicopter could not provide the services needed to sufficiently service the population of the island. They also argued that the location of the helicopter was too far from its existing location, making commuting more difficult for the community. Evidence of the hostile relationship between the participants and those in mainland governance was revealed in the participants' narratives. Several participants described their perceptions that proposals to cancel the air service were an effort by the government to discontinue funding and services to the island. Several participants described their concerns that this would create a reason for the government to evacuate the residents from Inis Oírr and Orla described her feelings saying:

"I think somebody ... some people are buddy-buddy and they want the helicopter and they want it as an excuse. They tried to get rid of the [air service] before. And… one ... [way around this] … is to… give them the helicopter, it's going to be so awkward everybody is going to be afraid to use it. Then we can say they don't need the service and then we can get rid of the service ... There's no sense to it, this service has been working so well for years. And it's working so well with the ferry company and the location and everything. But the effect on the island it would put us back years."

Orla (individual interview)

Many of the participants were quite distressed and were adamant about their wishes to remain in Inis Oírr. During the data-gathering phase of this research, several protests had been organised at the local government offices and in Dublin. Several hundred people attended at each, comprised of residents from the three Aran Islands and a small cohort from mainland Ireland (Griffin, 2015). The participants' narratives revealed the impact that this legacy of withdrawal of supports for these isolated islands during economic recessions had on the community currently living in Inis Oírr. Participants described feelings of vulnerability and feeling ostracised by those in mainland governance. Orla, who grew up in Inis Oírr, described her feelings upon hearing about the proposed cancellation of the air service saying:

"Well I'm not leaving! ... no-body is going to put me out of my home or my island, no matter how tough it gets. I really believe that if the plane goes, it will be like the Blaskets, it will put the island back fifty years and people won't put up with it, why should they?"

(Orla, focus group 4)

Participants explained how important remaining in Inis Oírr was to them, with some stating it was the only place they want to raise their family. The participants described their affection towards Inis Oírr and the quality of life that had been built there by previous generations. Several participants also expressed the influence that living in a Gaelic island has on their identity and how they perceive preserving Irish culture as their responsibility. Participants also discussed the merits of preserving Inis Oírr and the positive effect it has on the economy of Ireland. This desire to maintain life in Inis Oírr was a key motivation for several of the participants to transition to low carbon energy sources and this will be discussed in more detail in Chapter Nine. Conversations were dominated by descriptions of feelings of being ostracised by the central power and perceptions that mainland opinion toward funding for Inis Oírr was not favourable. In this specific time and place, perceptions of the vulnerability of Inis Oírr community has created a community that is extremely proactive and willing to protest to preserve their services and the survival of their community. Several of the participants described the negative impact that this can have on the community in Inis Oírr, explaining that having to put such effort into protesting can make developing other projects in Inis Oírr more difficult. The findings revealed that the participants' perceptions of energy were embedded in wider societal, spatial and political circumstances. Other community related issues were cited as distracting the community resources from developing successful energy interventions within Inis Oírr. During both the focus group and interview discussions, several key themes evolved including the participants' concepts of the relationship between living in a remote location and the capacity to live adaptive lives, their perceptions of the need to be self-sufficient and have multiple-competences. The results from these discussions are presented and discussed in the following section.

7.5 Remoteness, Adaptability and the Need for Self-sufficiency

Inis Oírr was originally a fishing village and the majority of the community's income came from fishing. Royle (2003) described how the Aran islanders farmed, fished, sealed, took kelp, smuggled and made illicit spirits. Several of the participants described concepts around local knowledge as something passed down through the generations. For many, this was primarily related to fishing and knowledge of the sea. Participants commented on the nature of marine knowledge in Inis Óirr explaining that when living on an island, this type of local knowledge was second nature to everyone growing up in their community. Clara, a retired school teacher, spoke of her perceptions of community developed knowledge saying:

"My husband knew all about the currents and tides and the different piers and they had a vast knowledge handed down from the generation before them and acquired themselves from their own experience."

(Clara, focus group 5)

The participants' narratives revealed the value of marine knowledge to the community in Inis Oírr, with several participants arguing that this type of knowledge was of more importance in an island location. Respect within the community for such situated knowledge was reflective of the participants' attachment to Inis Oírr's landscape. Devine-Wright (2012) argues that this type of attachment to landscape or place drives opposition to renewable energy projects. NIMBYism is described as place-disruption rather than opposition to the renewable energy on principle (ibid.). This level of respect for knowledge related to the landscape of Inis Oírr must be acknowledged when developing any type of energy plan for the island. Several participants' described how having an in-depth knowledge of the unpredictability of the sea and of daily life in Inis Oírr created a more adaptive community and this extended into their daily energy practices. Traditionally, small island communities had to make adaptations to cope with inaccessibility by maintaining varying degrees of self-reliance, behavioural adjustments and reduced expectations (Cross and Nutley, 1999). Philip argues that the concept of forward planning creates an adaptive capacity in those that live in island settings. During our discussions Philip explained:

“Adaption ... how we can adapt… because we mightn’t be able to get something [out here]... so how are you going to adapt to that? And ... people [here] will adapt to some other means of doing something very quickly because it has to be done”.

(Philip, focus group 1)

Philip continued to describe the need for adaptive strategies in their daily lives saying:

"If you have a problem, things ... and ... the solution isn’t going to arrive on a plane or a boat, you are going to try and figure out is there a way [to solve] it yourself… it’s a natural thing for islanders to try and solve problems."

(Philip, focus group 1)

Margaret (focus group 2), a mother of four working in one of the community organisations, explained the need to adapt on a daily basis as a result of the weather saying:

“*We are very ... weather reliant more than anything… so you have to be aware of the weather and you have to adapt accordingly."*

Margaret (focus group 2)

Enda (focus group 2), a local hotel owner, also commented on how the island’s isolation affects their local knowledge stating that:

“*It is not always something that can be fixed here. [If] it happened on Sunday or Saturday morning ... Outside problems can become our problems ...”*

Enda (focus group 2)

Several participants reiterated the concept of “outside problems” and their resentment over outside problems affecting their community. Malachi described how this affects their daily energy practices due to outside problems affecting their electricity supply saying:

"…it's lovely here in the summer but in the wintertime the electricity goes, because of the storm. The … [ESB should try] … to fix that on the island rather than having power cables down in Connemara affecting us …"

Malachi (focus group 2)

Literature describes how concepts of blackouts are associated with a range of negative and positive (e.g. a welcome interaction between strangers) beliefs, emotions and actions (Devine-Wright et al., 2010). The participants' narratives revealed that blackouts to energy supply created resentment towards current energy structures and more adaptive energy practices within Inis Oírr. Enda further explained his feelings on electricity blackouts giving an example of an incident in the past saying:

"The case of the missing swans.... some swans hit the line in Salthill[37] *and the whole of Connemara was out and we were out. If something happens in Salthill, it affects you here...."*

(Enda, focus group 2)

When discussing local knowledge and concepts of community energy projects, many participants' spoke about the desire for self-sufficiency being a driving force behind the aspiration to transition to low carbon energy sources. While interviewing the participants (and during the initial surveys) the backgrounds of the participants' were discussed at length. These discussions revealed the propensity of those living within Inis Oírr to maintain several different competencies simultaneously. In-line with concepts around the need for self-sufficient or adaptive strategies within island communities, several of the participants were engaged in two or three areas of employment or sources of revenue generation. Several participants were employed in over five areas of employment, explaining that maintaining multiple competencies was crucial to surviving on an island. For example Orla (who is in her early forties) explained that throughout her career she

[37] Salthill is a seaside area in the City of Galway in the West of Ireland.

has had over seven competencies and that this was, in part, due to living on an island. These are contained in Table 7.3 and are placed in no particular order.

Table 7.3: Orla's Description of her Competencies
She owns and manages one of the local cafes
She provides accommodation to students throughout the year
She teaches part-time in the local preschool
She was involved in the recycling initiative across the three Aran Islands
She is providing craft tourism classes on the island
She is involved in cultural promotion in the West of Ireland
She has a background in welding
She has a background in business management
She and previously set up a large pharmaceutical company before moving to Inis Oírr to start her family

Several other participants also described their varied competencies and many islanders were responsible for building their own houses without any formal training in construction. The older generation also explained that they had several competencies with Anita describing how she has a background in administration, organisation, hospitality, completed a carer's course, provides accommodation to students and she cares for her 90 year old mother. Malachi, who is in his thirties, qualified as a mechanic and is currently building his own house, explained that this was possible as:

"You would be able to leave your hand to a lot of things … Because you are … stuck here .. more so than … if you were living on the mainland. You could call somebody or whatever. But you kinda have to tackle it here yourself ... you'd have to try and do it; …Because there wouldn't be the same kind of services here"

(Malachi, focus group 2)

The practice of building houses on the island has led to a building stock that had to undergo significant energy retrofitting in recent years, which is discussed in more detail in Section 9.2. Participants' narratives also revealed the importance of self-reliance in relation to the technologies that they purchase and use on a daily basis. Several participants spoke about the need for what they termed "simple technologies" that could be fixed by people living within Inis Oírr. Many participants also described their concepts of simple technologies as older technologies that operate without the need of information technology (for example diesel cars, oil or gas boilers and central heating). Margaret explained that when choosing technologies for her house, she chose technologies that were less technical saying:

"*You see, you don't need anything too complicated, because they are impossible to fix locally."*

(Margaret, focus group 2)

She explained that cost incentives were also a major issue behind her choice of technologies and this led to her choosing older or more "simple technologies", because in an island location, she explained that:

"They have no choice but to fix it themselves because to get somebody in is going to cost … an awful lot."

(Margaret, focus group 2)

The participants' narratives also revealed that the community of Inis Oírr were often sceptical of newer energy technologies. Due to the difficulties that they face in importing technologies themselves, along with having to import the installers to fit the technologies, the participants of the study explained that the community was often slow to embrace newer energy technologies. Evan, who played an instrumental role in the organisation of the recent insulation project on the island stated that special consideration has to be given to technology when living on an island stating:

"We have to be very convinced the technology will work in our environment, in our location".

(Evan, focus group 1)

Evan also revealed the difficulties faced with buying large-scale technologies for their homes and the need to have reliable technologies. He explained that if there is a problem with the technology after installation, they cannot be transported back to the mainland easily. Furthermore, he described an issue he had in the past and stated that those responsible for maintenance of these technologies rarely travel as far as the Aran Islands. Evan explained that:

"It's like buying the washing machine in [Galway] ... we pay ... five hundred euro for the washing machine and [the] man selling it to us… says: "We'll guarantee it [for] 3 years" ... ... but we as a customer ... are saying [to him] ... "You're guarantee means nothing to me where I live. Because when my washing machine breaks down on the Aran Islands, you are going to tell [me] ... "you have to get it into me"... be it a washing machine or a television or a solar [panel] ... we [need to] know that when it goes in… that it is going to not give us trouble within a reasonable shelf life of a washing machine".

(Evan, focus group 1).

The participants' narratives revealed that perceptions of these issues with getting technologies serviced in an island location had a detrimental effect on the adoption of newer technologies in their communities. Any energy plan for Inis Oírr must acknowledge and account for difficulties in getting technologies serviced and attempt to utilise technologies that can be fixed locally where possible.

7.6 Conclusion

The overall aim of this chapter is to reveal the participants' situated energy knowledges through discussion of how living on an island affects the participants' daily energy practices, from becoming self-sufficient to employing more adaptive energy strategies. This chapter also describes the existing CKNs in Inis Oírr and current perceptions of mainland governance, traditional public consultation processes and energy planning processes. This chapter revealed energy knowledge as being situated in wider social, cultural and political contexts and being influenced by the CKNs within which it develops. This chapter begins by discussing the participants' perceptions of energy knowledge, with perceptions of energy being revealed as situated phenomena, less varied and influenced by external factors. In contrast, perceptions of local knowledge were wide ranging and socially constructed and rooted in place. Participants' narratives revealed that situated energy knowledges were influenced by participants' identity and the legacy of having to "fight for survival" in their island location. Participants' narratives revealed that perceptions of a lack of resources and time to commit to undertaking a low carbon energy transition left participants frustrated. Participants' narratives also revealed that geographic isolation and variability in their electricity supply in the past, created adaptive energy practices in the case study community. Participants made decisions that affected their energy practices based on experiences of blackouts and the perceived need for "backups" in every aspect of their lives. Participants' narratives also revealed that for any plan for a low carbon energy transition in Inis Oírr to be successful, the technologies utilised must be perceived by the participants as reliable. This chapter revealed that experiential knowledge and CKNs play a key role in the development of situated energy knowledges within island communities. Building on this empirical evidence of perceptions of energy knowledge, local knowledge and the situated energy knowledges of the participants, the next chapter continues to investigate current energy governance structures in the case study community. The next chapter also investigates the impact of the participants' past experiences of the development of large infrastructural projects on their current perceptions of energy governance and proposals for a low carbon energy transition.

Results Chapter Eight: Energy Governance and Communication within Island Communities

8.1 Introduction

As described in Chapter Three, communication with and within island communities is integral to successful community transitions towards low carbon societies. Energy projects can rise or fall based on their successful engagement and consultation with surrounding communities. Existing negative perceptions of the public consultation process, the agencies and individuals involved, and the timing and methods of consultation can often hinder the development of community energy projects (Catt and Murphy, 2003). When the trustworthiness of the authority is called into question this can affect the acceptance of the information that is shared (Sheppard et al., 2015) and consequently the proposals being proffered. People tend to trust information from what they perceive to be credible (De Fine Licht, 2014). Trust and transparency are linked as third parties need to have confidence in the planning officers for them to maintain their legitimacy (Sheppard et al., 2015). Increasing meaningful participation means ensuring access to information to the greatest extent possible. Public participation in the development of community energy projects is lacking in island communities both within Europe and beyond (Kuang et al., 2016, Weisser, 2004) and within Europe (de Groot and Bailey, 2016, Michalena and Angeon, 2009, Duić and da Graça Carvalho, 2004, Butler and Nelson, 1994). This chapter argues that this is due, in part, to predominant universal-policy approaches to community consultation which further marginalise peripheral or island communities where, typically, local knowledge is highly valued (Royle, 2002, Cross and Nutley, 1999). This chapter explores what impact these insider/outsider distinctions have on low carbon energy transitions within island communities.

Findings suggest that island low carbon energy transitions must be engaged with in a more transparent manner, creating an environment where in-depth consultation can be undertaken. At present, the Irish energy planning system is dominated by positivist approaches to the energy provision problem and local knowledge had long been considered as less valuable in communities' transition to low carbon societies (Heaslip et al., 2016). In recent years, the concept of collaborative approaches to community energy planning processes has gained prominence in academia (Taylor and de Loë, 2012, Weible et al., 2004, Healey, 2003). Collaborative planning processes are beneficial in the energy planning process as they enable local actors to place their knowledge in the broader contexts of what state actors know and vice versa (Innes et al., 2007). Although research in the area of collaborative planning has increased in recent years, this new knowledge has not filtered into the policy arena and the legacy of this information deficit model of public consultation is still evident in the UK and Ireland (Catney et al., 2013, DoEHLG, 2006, Healey, 2003, Blake, 1999). Several previous studies have discussed scientists and government officials' practices of ignoring local knowledge in different environmental governance decisions (Weible et al., 2004, Murdoch and Clark, 1994, Wynne, 1992). This bias against local knowledge illustrates the one-directional exchange between local knowledge and the policy sphere in collaborative processes (Nightingale, 2016, Blake, 1999, Nygren, 1999). Political (and scientific) knowledges' power over local knowledge is seen as a fundamental component of state-societal relations and in determining whether the coexistence of these divergent epistemologies is possible in the decision making process (Murdoch and Clark, 1994). Raymond et al. (2010b) have argued that this epistemological barrier could be overcome through participants becoming more aware of the range of epistemic positions in the decision making process. Along with increased awareness of others' approaches, breaking down traditional boundaries between these epistemic positions is crucial.

This section investigates Research Question Three:

3. What role do situated energy knowledges and community knowledge networks play in island communities' transition pathways to sustainable, low carbon societies?

The following section reports on the responses of the study participants around a range of questions relating to the public consultation process in Inis Oírr. The data analysis established the range of understandings and perceptions that the participants had in relation to past consultation processes and the role of the government in community development projects. Several key themes emerged from the data analysis and these are outlined in the following sections. Similar to Chapters Six and Seven, results relating to the three previously outlined sensitising concepts - knowledge, governance and communication are presented here. This chapter illustrates themes which emerged from the research including participants' understandings of the role of local governance in their island community, their perceptions of the current role of government, the role of planning process in preserving their community's future and the effect of insider/outsider distinctions on the development of projects. The data presented in this research reflects participants' understandings and perceptions of energy and the social and spatial contexts within which these perceptions are developed.

This chapter investigates energy governance in the case study community and the participants' perceptions of traditional public consultation processes. This chapter also investigates the impact of situated energy knowledges and CKNs on the case-study community's transition to a low carbon society. The existing processes and structures shaping both individual and community energy action in the case study community are investigated with the aim of understanding current energy governance structures. Governance is defined as encompassing the various processes and structures shaping individual or collective action solidified through social norms (Cash et al., 2006). This chapter argues that, like energy knowledge and practices, perceptions of energy governance are complex social and spatial constructions. The nature of governance includes interactions among many actors in social networks that span beyond government (Kooiman et al., 2005) including CKNs. This section argues that participation strategies that are culturally appropriate are extremely important in successful low carbon energy transitions (Escott et al., 2015). Historically, unequal power relationships have had a negative impacts on equity in participation in consultation processes, poor governance of which can create project resistance from communities (Baynes et al., 2016).

This chapter begins by discussing current modes of energy governance within the case study community and their current operational structures. Then it moves on to discuss how the participants' perceptions of their past experiences of public consultation processes of other large infrastructure projects have led to distrust of national (non-island) governing authorities. This chapter argues that these past experiences have led the community to become wary of energy project proposals proposed by mainland governance for the island. This chapter discusses how these perceptions have negatively affected their support of large energy infrastructure projects in recent years.

8.1 The Role of Island Co-operatives in Energy Governance in Inis Oírr

As described in Chapter Four, the Inis Oírr Co-operative was set up to facilitate the deliverance of certain basic services to the island and to act as a representative for Inis Oírr community externally. Due to the island's remoteness, the co-operative developed responsibilities similar to larger governing bodies on the mainland (Royle, 1989, Royle, 1986). This co-operative now plays a key role in the daily life of the island with participants saying:

"They are like a mini class of government, everything rolled into one, every issue from the lifeguard on the beach to the rubbish, to the water, every single thing the co-op is involved."

(Orla, focus group 4)

"The co-op is great, I mean, they are just like 999, no matter what goes wrong".

(Anita, individual interview)

In the mid-1980s Comhar na hOileáin, an umbrella group for the islands, was created in order to achieve better services for the islands (Royle, 1986). Individual co-operatives were developed in each of the Aran Islands during the 1970s to deal with the day-to-day running of each of the islands (ibid.). All participants voiced the value of the co-operative as an organisation acting as a communicating body between islanders and external parties. Their narratives highlighted their understandings of its role in their daily lives, with participants explaining:

"….the Comhar Chumann[38] … they facilitate - they are not just pushing it… they see their role as the central role between the community and whoever has the problem."

(Cathal, focus group 2)

[38] The Comhar Chumann is Irish for the co-operative.

"It's a group voice then as well, as opposed to individuals shouting and trying to get something done. It's a group and a community group will always get more ear than individuals."

(Orla, focus group 4)

"And you have somebody to speak out for you when you have the co-op, so I think that is good".

(Brenda, individual interview)

The co-operative, much like co-operatives throughout Europe, is comprised of a board whose members are chosen from within the community (Koppenjan, 2015). It employs a democratic, open and transparent procedure to the implementation of projects and all members of co-operatives have an equal vote in any decisions made (Viardot, 2013). All participants' narratives revealed how they felt this form of decision-making and representation was a relatively effective method of developing new projects. However, some were also aware of the drawbacks of a co-operative, including problems that arise when there is a split in community opinion. Enda, owner of one of the local hotels, described obstacles due to differences of opinion and the difficulties experienced by the co-operative as a result:

"If you have a group split 50/50, one group is pushing the co-op to do this and the other is pushing the co-op to do [that] … what do they do then… ?"

(Enda, focus group 2)

Although the process is democratic, there were times when some participants' narratives revealed resentment towards this approach to decision making. The co-operative employs a "majority rules" approach to voting, which can lead to some being overruled and tensions emerging, with Melissa explaining;

"We normally have to go with the majority."

(Melissa, focus group 2)

Another shortcoming perceived by the participants was that because of the co-operative, there is less need for individuals to represent themselves in the policy arena. The relatively successful operation of the co-operative and the level of trust that it has garnered from the community has created a public that are happy to be represented by others. Some participants' narratives described their perceptions that other residents of the island have become ill-informed, complacent and tend to opt out of participatory processes as a result. Several participants described their frustration with this situation stating:

"In a small place like this a few people end up doing a lot of work and other people just… either aren't interested or just … coast… [and] let somebody else take over... "

(Martha, individual interview)

"I think that people have gotten complacent and they say: "Oh sure the co-op will do that".

(Orla, individual interview)

"… you are inclined to leave it to the co-op to be honest with you."

(Clara, individual interview)

The Inis Oírr co-operative has acquired the existing trust of the community over generations through social interactions. As a result, the co-operative has successfully fostered goodwill towards renewable energy technologies in the community. Although this level of trust led to some residents being perceived as complacent by others, it enabled a more participative community in other terms and 25% of the community participated this study on community energy perceptions and needs. The co-operative is state funded and has responsibilities towards governing bodies on mainland Ireland. As they are connected with the policy arena in this way and their board is comprised of members of the community, they are well positioned to engage in energy governance within Inis Oírr. The level of trust and community collaboration that the co-operative created (as a result of the formation of interpersonal relationships within the community) enables them to act as a relatively successful energy governance organisation. However, trust in Inis Oírr's co-operative does not automatically mean that all members of the community were willing to get involved in the study. Trust does not always mean participation, but sometimes can only mean passive tolerance (Büscher and Sumpf, 2015). Building on these discussions of the influence of trust on low carbon energy transitions, the following section investigates the participants' perceptions of current energy governance in the case study community.

8.2 Perceptions of Current Energy Governance in Inis Oírr

As outlined in Chapter One, energy planning is a large and varied field, comprising several disciplines. Along with the technical aspects of energy planning, regulatory approaches are equally important. Confidence in political bodies plays a large role in the success of energy projects within communities. Centralised governments that are distanced from their public create a difficult environment for effective participation and engagement with communities (Gerring et al., 2005). A decision-making process which is inclusive of all actors is crucial to successful democratic governance (Mendonça et al., 2009). Remote communities, like Inis Oirr, tend to have a sense of isolation from the central governmental power, and thus have negative perceptions of the role of government in planning for their community's energy future (Royle, 2002, Cross and Nutley, 1999). The participant' narratives reveal their perceptions that the government is not concerned with planning for the island's future. Instead, they described their perceptions that government policies, considerations and attitudes stumbled from one party's term in office to the next. An emergent theme in this research was the participants' concerns with difficulties obtaining planning permission for their housing. Comments related to obtaining planning permission and the planning process in general were largely negative. Malachi, who works in recycling on the island and is currently building his first house, described the negative effect this has in relation to planning for the island's future. Malachi had been through the planning process in attempting to get planning permission for his home and was keenly aware of the shortcomings in the process in Ireland. During the planning application phase, he had difficulty obtaining permission to build his house and had to submit his entire application twice. Malachi's understanding of the planning process in Ireland was that:

"There is no plan for the future … it's just whatever comes up on the day..."

(Malachi, focus group 2)

This was of concern to several other participants, especially when it came to the younger generation trying to build their homes on the island. Ireland has a rich and distinct cultural heritage, creating possibilities for culture-led development (Bayliss, 2004). Although culture in Ireland is a vibrant sector, there has been a legacy of inadequate public funding in the past (ibid.). Studies have suggested that for successful spatial planning in small islands, it should be applied and defined at the small island scale rather than the national scale (Vergílio and Calado, 2016, Calado et al., 2014). Participants' narratives revealed that perceptions within Inis Oírr were of a disconnected planning system that did not operate efficiently at the small island scale. Past experiences of the Irish planning process has led participants to perceive the process as being overly onerous. The participants then become unwilling to engage in the development of projects in the future. Malachi argued that the planning process does not have continuity and that he feels it is merely a method of preventing building projects on the island, he explained that:

"[What you were]… being told 20 years ago in the planning permission … makes no sense [in relation] to what is going on today. What they are doing today, won't make sense in 5 years' time. It's not leading to any point, there isn't any thought being put into it."

(Malachi, focus group 2)

If community-led low carbon energy transitions are to be encouraged within small island communities, ensuring that the planning process in Ireland is more accessible and related to the small scale of the islands is paramount. These planning concerns relate not only to residential and community energy project development but also to the survival of the population on the island. Many participants relayed their concerns about the younger population moving off the island due to the planning permission difficulties they were experiencing. Several of the younger generation described their difficulties with getting a site for them to build their house. Fragmented ownership of land in Inis Oírr must be accounted for during the latter stages of large energy-infrastructure planning, as large plots of land will be required. Again, Malachi explained the difficulties with getting sites to build saying:

"The sites are getting scarcer and scarcer now, it's a small island."

(Malachi, focus group 2)

Edward, who is in his early thirties and drives a horse and cart to transport tourists around the island, also discussed the difficulties he encountered when applying for planning permission for his house. He explained how he considers himself very lucky to have received planning permission as according to planning regulations his site was too small saying:

"It was way too small; I only barely got it … just the way things have gone now, the sites need to be much bigger."

(Edward, individual interview)

He also explained that he felt the rules for planning permission employed on the mainland should not apply to the islands due to their unique nature of land ownership. Edward explained that:

"People [on the island] don't have plots of land that big…and … most … [people]… don't have all the land in one area … [they] … have three or four fields here and three or four somewhere else."

(Edward, individual interview)

The traditionally agricultural nature of life in Inis Oírr means that plots are small and scattered throughout the island. The Aran Islands have an agricultural landscape comprised of a drystone-wall field-boundary system deemed to be one of Ireland's richest cultural landscapes (Laheen, 2010). As a result, large enough plots of land to build on have historically been very difficult to obtain. Several of the participants felt that the planning system does not encourage them to move forward with plans to develop the island. Participants' narratives reveal that they are concerned that the government would allow an improved quality of life for Inis Oírr to be sacrificed at the expense of preserving the tourism trade in the West of Ireland.

Planning permission and other legislative restrictions are not the only barriers to action perceived by the participants. Several of the participants are keenly aware of the restrictions posed by the ESB, the TSO of Ireland and their feed-in tariffs. It is a statutory corporation whose members are appointed by the Irish Government and is regulated by the Commission for Energy Regulation (CER) (eISB, 2016). The CER sets the allowed feed-in tariffs for the distribution business and has powers to approve the connection policy for suppliers connecting to the network (CER, 2016). Several of the participants were extremely knowledgeable in this area and their narratives revealed perceptions that the ESB monopolises the Irish grid and perceived this to be a disincentive to installing renewable energy technologies. Tadhg (focus group 1) spoke about his perceptions of the ESB and the barriers he faces in terms of investment in energy. Tadhg discussed the current feed-in tariffs in Ireland and how there were no incentives for individuals to invest in renewable energy in their homes. Perceptions of the ESB's monopoly over the electricity supply network was also discussed by other participants as a barrier to action on their part. Again, Evan spoke about the difficulties the island faces in relation to their energy structures and the resentment they feel towards the ESB in relation to their freedoms over their electricity network saying:

"The ESB will tell you… "we own the network, you can't just jump in and jump out of the network." If we own the network within the island, then we can manage it. …They won't even entertain [us managing our network]. They will not entertain it."

(Evan, focus group 1)

Governments in Europe tend to avail of several types of financial support mechanisms including feed-in tariffs, tax incentives, and tradable green certificates (Abolhosseini and Heshmati, 2014). Policy responses in Ireland have typically focused on energy efficiency retrofitting programmes and the creation of more stringent energy efficiency standards (Davies et al., 2014). A sense of frustration is palpable from the participants' narratives, which revealed their understandings of the many barriers posed by the government.

Philip, the manager of the island's co-operative, spoke about his frustration with dealing with governmental bodies and the barriers that he faces as result saying:

"You have… invisible barriers that are there ... the biggest barrier there ... is dealing with... government bodies ... [because]… bodies outside of an island, don't understand ...[island life]."

(Philip, focus group 1)

Martha commented on the difficulties she faces when dealing with governmental bodies and their bureaucracy saying:

"[It] makes it harder to access [any services]."

(Martha, focus group 1)

With Maeve agreeing that:

"Our systems are too centralised."

(Maeve, focus group 1)

Philip also described his perceptions of difficulties in dealing with external governing institutions and what he perceives to be constantly changing personnel explaining that:

"You spend your time going from one [to the other] or else [they] retire… I've had lots of retirements in the last few years and it's like starting the whole [process] again… the frustration!"

(Philip, focus group 1)

As described in Chapter Four, islands' geographic isolation creates peripheral communities in the geographic, economic, political, energy and social sense (Royle, 1989). This economic, social and political marginality can result in neglect by central government (Cross and Nutley, 1999). Enda (focus group 2) spoke about how the islanders feel that they are constantly asking the state for fudnings saying:

"Begging the state for things like … [the] Aer Arann [service]."

(Enda, focus group 2)

Participants' narratives also revealed perceptions of a lack of support from the government that are also discussed in Chapter Seven. Several participants working for community organisations discussed their perceptions of the low level of support that their organisations are receiving from government. Many participants involved in community organisations on the island spoke about how they were overwhelmed with their workload as a result of the lack of support provided. Maeve described how she felt that they were suffering and overburdened with their workload saying:

"[There is] … a lack of resources…. there's only Philip in the co-op and a few workers."

(Maeve, focus group 1)

Philip (focus group 1) concurred that he was under pressure in his daily work and explained:

"People talk about the co-op like there's a crowd over there working..."

(Philip, focus group 1)

Philip explained that there is only him and one administrator in the office. Philip's narrative also revealed the pressure that he was under to achieve targets outlined by the County Council in order to continue to receive funding. Maeve agreed and spoke about how frustrated she was that:

"[The County Council] can't pay off money to these offices … [until they can] … pay them off on actions. Actions that are ... measurable."

(Maeve, focus group 1)

Philip further elaborated on his difficulties with the governmental interactions and the lack of feedback that he gets on his progress. He stated that he sends the County Council progress reports but that he never gets any recommendations or support from them. He explained:

"You send all this information in and … you get absolutely no feedback, the only thing you will get is [if] you will get your grant. And here you are trying to do your best. It isn't just for the grant that you are doing your best, you are doing your best for the community actually."

(Philip, individual interview)

Discussions around communication with the council bodies led to conversations related to whether the government was interested in supporting life in Inis Oírr. Maeve's perception was that Inis Oírr was too small for the government to be concerned about saying:

"Is too micro for (the government) to be concerned about."

(Maeve, focus group 1)

Often, island communities' services are not of the same standard as those in mainland communities, creating antipathy towards mainland governance (Cross and Nutley, 1999) and energy governance structures. Martha discussed her perceptions that mainland communities felt that life should not be supported in Inis Oírr saying:

"... there's this attitude that, "Well if you live out there, that's your choice, so tough luck … you can't expect any special treatment just because you live on an island".

(Martha, individual interview)

The participants explained that they were feeling threatened by the government trying to take their services from them, with Amy explaining that islanders felt that:

"Since 2012, the government seems to be intent on taking the air service link away from the islands and they have tried to do that a number of different ways. The most recent way

was that they capped the tender of it at a third of what it had been in the previous contract… [and you]… can't offer the same service on a third as much of a budget".

(Amy, individual interview)

Participants' narratives revealed their feelings that they were not being sufficiently cared for by the government. Several participants spoke about how this had often led to failed projects in the past. Evan described a failed community energy project (described in detail in Section 9.2) on the neighbouring island of Inis Meáin saying:

"The people in the Inis Meáin project felt badly taken care of and that is why it [failed]".

(Evan, individual interview)

Energy project opposition groups can garner increased support due to motivations spurred on by a lack of trust in the government (Morgan and Osborne, 2016). This section reveals how past experiences of planning processes can lead to legacies of mistrust of those in authority negatively affecting communities transitions to low carbon societies. The following section discusses the impact of insider/outsider distinctions within island communities on successful engagement of small island communities in energy governance.

8.3 Insider/Outsider Consultation in Inis Oírr

At present, Irish Energy planning systems are dominated by technical approaches to the energy problem. The skills and knowledge required to engage in debates around the decision-making processes are restricted to those given authority to speak (Demeritt, 2001) and as a result exclusions are inherent in the process. Collaborative processes do not always result in legitimate shared consensus, but more often a coerced consensus that is contrary to the ideals of collaboration (Kapoor, 2001). This has led to the creation of epistemic boundaries within public consultation processes employed in Inis Oírr in the past. As a result, several participants in the study perceived local knowledge to be of equal or higher value to energy planning processes than other forms of knowledge. There were divergent accounts on this with Philip stating that it is best to have "a mix" of types of knowledges arguing that:

"... the local person who is locally thinking about [energy] doesn't need actually to go in-depth into the technical knowledge as to why it works… we'll say that it is going to save them money and that it is going to help the community and things like that. That's the sort of knowledge they want."

(Philip, focus group 2)

While others argue that local knowledge was of more importance to the success of low carbon energy transitions in island communities, with:

"Well from the point of view of say... of providing energy and that for the island and utilities and that for the island, local knowledge is important because it's people... the local people that know what they need more so than someone coming in and telling them what they need."

(Kenneth, individual interview)

The value of place-based knowledge was a key component of the participants' narratives with many describing how expert knowledges were not appropriate to the islands' individual context. These understandings of the value of local knowledge as something place-based was reiterated by the participants. Sally, who moved to Inis Oírr twenty years ago and provides accommodation to students explained that:

"You have to live here to understand ... And I find that sometimes, I'm not putting down educated people or anything, but ... experience... sometimes experience (is more important) ... of course you need the education to be able to come up with plans [and] ideas… but the whole thing on the ground, talking to people ... experience it yourself."

(Sally, individual interview)

Stemming from this assumption, insider/outsider distinctions can develop during public consultation processes (Devine-Wright, 2012, Moran, 2007), negatively affecting the successful development of energy projects. `

Participants' narratives revealed their perceptions of insider/outsider distinctions within the community. Several of the participants described their feelings around the relationship between islanders and those that consult with them. This emergent concept echoed the theme of trust and several of the participants' perceptions of past experiences of the public consultation process were reflected in their discussion on insider/outsider distinctions in island communities. Muireann who moved to Inis Oírr from the mainland 15 years ago described her perception of the insider/outsider distinction saying that she can understand it, even though she considers herself an outsider, explaining:

"I can see that mistrust all-right, I can kinda understand it [as] something between "Themness" and "Usness" ... and ... you understand where the people here are coming from when they say they don't trust the people on the other side…."

(Muireann, individual interview)

These insider/outsider divides in island communities (Moran, 2011) often means that communities feel ostracised from the energy planning process. Participants' narratives revealed that these insider/outsider dynamics led to the community in Inis Oírr feeling a sense of worthlessness in the consultation process. Muireann further described her perceptions of the interaction between Inis Oírr and mainland governance saying:

"When things are going [well], everything is fine, but ... it goes back to the mistrust when ... they look at us like… the second class citizens living over there, they don't need anything, so let's cut [their funding]... and ... it was complete disrespect the way the fish farm information [was given to] people as if it was decided. We are going to decide how you are going to live".

(Muireann, individual interview)

Participants' narratives revealed how their perceptions of a lack of inclusion of local knowledge in planning processes has resulted in pessimistic perceptions of the policy arena. These tensions stemmed from preceding experiences of the public consultation process during the development of a pier for the island in the 1990s. The design of this pier was deemed by the participants to have been unsatisfactory and many of the participants chronicled the process of consultation and the subsequent design of the pier. In 2016, funding was allocated by the Minister for the Environment, Community and Local Government in order to extend the pier by 90 metres and to attach a breakwater structure along with some rock dredging works (DoHPCLG, 2016). The allocation of this funding highlights the validity of the participants' claims that the design for the pier was ineffective. Several participants explained that local fishermen made recommendations during the consultation phase of the project and they felt that these were not acknowledged by engineers in the final proposal for the project. Several participants described how the pier is unsafe for use at certain times of year due to currents surrounding the island. Participants' narratives recounted how local fishermen warned the developers of the pier that the proposed design would be unsafe but the participants felt that their knowledge was not respected and they were not listened to. Following this, when asked about which type of knowledge was of more importance in the development of energy projects for the island, Matthew, who is in his late forties, described his perception of the value of local knowledge saying:

"Local knowledge [is more important than expert] because the islanders know more about the island than the experts that come in."

(Matthew, focus group 3)

Participants' narratives reveal how these previous experiences have created what Innes and Booher (2010) have termed as "epistemological anxiety" linked to the rejection of local knowledge by scientists and other environmental and energy planning professionals. This anxiety evolves from the underlying differences of opinion regarding which forms of knowledge are valid in environmental decision making (Eden, 1996, Berkes, 2004). Participants described how a practice of ignoring local knowledge was perceived by them and many had become resentful of the process as a result. Participants' unhappiness with the public consultation process was not due solely to their perception of being extrinsic to the process, but also because of their lack of trust in those in authority responsible for the process. Trust is a multi-faceted entity (Misztal, 2013) and debates over its importance in policy implementation and collaborative projects are becoming ever more popular (Büscher and Sumpf, 2015, Misztal, 2013, Walker et al., 2010). Misztal (2013) argues that there has been an *"emergence of a widespread consciousness that bases for social co-operation, solidarity and consensus have been eroded and that there is a need to search for new alternatives".* Trust must be part of any "package" to develop a community energy project to facilitate its success (Walker et al., 2010). Participants' perceived a lack of honesty in the public consultation process in Ireland and this fostered distrust of those involved in the policy arena. This was evident in their narratives with two participants recounting their experience of the public consultation process stating:

"And history just continues to build as to why people from the island are really wary of… consultants or… initiatives or … schemes coming in from the outside. Because history is not good on that "

(Amy, individual interview)

"Trust... how do you know you are getting a fair... interpretation of what is being offered?"

(Evan, individual interview)

Traditionally, public consultation processes in Ireland and the UK were based on the information deficit model (Catney et al., 2013, Burgess et al., 1998). Nightingale (2016) argues that the nature of the information deficit model is unable to deal with the complexities in the interaction between local and expert knowledges. Participants were keenly aware of how their needs were not always heard by those in power, leading them to question who actually benefits from projects in their community. One participant described his perception of the cynicism of others on the island, saying:

"I suppose that they would assume that they are not really doing it for the island. That it is some other grand plan that they have."

(Edward, individual interview)

Participants' narratives described perceptions of an unsympathetic energy planning environment where their values and interests were overpowered by more confident "expert" voices while being expressed using experts' language. Raymond et al. (2010b) have argued that this epistemological barrier could be conquered through all actors becoming more cognisant of others' epistemic positions in the decision-making process. Along with increased recognition, breaking down traditional boundaries between these epistemic positions through collaborative communication is crucial. However, the skills and knowledge required to engage in discussions around the decision making processes are possessed by those with authority to speak (Demeritt, 2001). Participants expressed frustration at the terms and language used to convey information, describing how difficult it was for them to decipher which arguments are most valid. Two participants described how the language used was confusing saying:

"...you need to be able to filter the knowledge ... no matter what it is... if it's from a cup of tea to … there will be people for the cup of tea and people against [it]. And they will have… ten thousand reasons why you shouldn't drink it and then there will be all the reasons why you should. And you will be there in the [end saying]: "What am I doing here?"

(Philip, Focus Group 1)

"Maybe sometimes, if… it was explained simpler… it's kinda technical and you'd be saying: "Oh… what exactly now?" … maybe to keep it simple."

(Margaret, individual interview)

Participants' narratives illustrated their perceptions of the divergences between their knowledge and the knowledge of those in the policy arena. At present, participants' narratives revealed their cynicism of the public consultation process and feelings that the language within which the process is undertaken excluded them from making value-based judgements.

While local knowledge was highly valued by all participants, the concept of local knowledge was discussed from the perspective of it being of increased importance in island decision-making processes. As reviewed in Section 4.4, Royle (1989) chronicled how historically fishing was a primary source of employment in the islands of Ireland. The community perceived that the marine-related knowledge they had developed over generations was of more value than the knowledge of those "expert outsiders" making decisions. Participants' narratives describing their perceptions of past consultation processes were largely negative, with one participant describing their experiences of consultation related to the development of the pier saying:

"The fishermen ... knew all ... the currents and tides ... they had a vast knowledge ... they weren't consulted. ... So it was these highly qualified engineers that ... went ahead with their own plan ... there was a lot of frustration ... because ... a lot of money [has] gone to waste. That pier ... is crooked."

(Clara focus group 5)

Cass and Walker (2009) discuss the two main factors that affect opposition to community renewable energy projects: place attachment and fairness. Devine-Wright (2005a) defines place attachment as emotional bonds between people and places that are affected by local developments. He also defines fairness as the perception of both procedural and distributional justice. The central principle outlined is that a community has the right to be involved in a decision in some way and in the processes of decision making (Cass, 2006, Renn and Webler, 1995). Participants of the study perceived that, thus far, those who were governing the community externally have not given islanders the same consideration and level of inclusion as those on mainland Ireland. Past experiences of the public consultation process have participants feeling that plans for their community have been undertaken without their involvement with one participant saying:

"Well I don't know, I mean, they made these arrangements without contacting us really. But I mean that's the government for you, they have done worse things".

(Anita, individual interview)

Nygren (1999) describes the typical format of indigenous consultation as one where local knowledge is "extracted", categorised by experts' standards and then discarded when not suitable to experts' needs. However, Jasanoff's (2009) concept of the "co-production" of knowledge and social order proposes that the *"way in which we know and represent the world (both nature and society) are inseparable from the way in which we choose to live it".* The importance of community input into proposals for the island due to the socially and place-based construction of their knowledge was reiterated by the participants' narratives with one participant stating:

"I think that the community always needs to be involved, in something as big as the fish farm anyway, the community seriously needs to have a vote on how things are gonna

happen in their future and in their children's future… I don't think a co-op can decide that. They can decide other smaller issues yes… "

(Muireann, individual interview)

At this time, participants' narratives have highlighted a perception of a lack of fairness and inclusion in the planning process in their community, stressing the need for increased involvement of their community in the decision making process. Building on these perceptions of a lack of fairness in the consultation process, participants revealed their resentment towards the government for what they perceived as a lack of meaningful consultation. Dara, who is from Dublin and works in Inis Oírr in the summer months, spoke about his feelings about how the community on the island are treated saying:

"Every time something comes up here, we have to get together and... go shouting up to Dublin. People never come out here; it's an absolute joke to be honest".

(Dara, individual interview)

Participants described their collaborative approaches to knowledge development and how this happened mainly within their isolated community. This is not unusual in relation to local knowledge for, as Nygren (1999) explains, local knowledge is practical, collective and rooted in place. As a result, participants' narratives revealed that islanders felt it was impossible for non-islanders to understand the complexities of their energy needs unless they had lived in Inis Oírr for a period. Participants stated that in terms of external governance, those who make decisions for the island should be:

"Someone that would know the "ins and outs" [of island life] and would have lived here [for] a few summers and winters."

(Anita, individual interview)

"They have no idea and they don't get it. It's the last place on their earth."

(Enda, focus group 2)

This was supported by the participants' narratives, many were keenly aware of the hollow approach employed in the Irish public consultation process with some describing the process as misleading. For 12 of the participants, this perception can be traced to previous experiences of the public consultation process in their area, with one participant saying:

"They just have to tick the box that they've ... [consulted]... they don't have to take on board anything of what any-body says about any of it… There's no box (to tick) that says "Yes, and we've listened", just that they've done it."

(Amy, focus group 3)

The "They" that is "the invisible conspiracy of developers" (Haraway, 1988) was repeatedly used with resentment as a term to describe those who remotely governed and were not from the island. This sense of frustration with mainland governance is commonplace within island communities which has forced them to create self-governing organisations in the past that were outside of the standard governance system (Royle, 2002). Many participants described the struggles for sufficient services in their youth that were outlined in Chapter Seven. They also described their perceptions that their distinct needs were not understood by governing departments on mainland Ireland. One participant described his frustration, when discussing governmental bodies saying:

"They can't actually enter in their heads… the concept of it... they think of it as the same as the mainland. They can't actually think outside of that picture. Very few... civil servants, or anyone else you are dealing with, understand at all ... that you have... a problem to get on and off [the island]... You have to… go over water."

(Philip, focus group 1)

As illustrated in the data gathered, due to the importance of local knowledge in these peripheral communities, the universality of external governance is often lost on these communities. The place-based energy needs of these communities means that they tend to look towards local governance. Several participants described their awareness of how prevalent ubiquitous approaches to governance do not facilitate opportunities for small peripheral communities to have a place in mainland policy spheres. The participants were keenly aware of how typical policy implementations were marginalising communities like theirs with one participant saying:

“Small communities, or small applicants don’t always fit into the rules laid out for the majority. That’s another constant.”

(Maeve, focus group 1)

In this specific time and place, feelings of isolation are leading participants to engage in local governance and operate outside of mainstream governance systems. These internal governance systems must be acknowledged in any low carbon energy transition pathway for Inis Oírr. The following section argues that current CKNs and perceptions of past experiences of the public consultation process play a key role in successful engagement of island communities in energy planning processes.

8.4 Past Experiences of the Public Consultation Process in Inis Oírr

This thesis argues that past experiences of the public consultation process affects current perceptions of external governance within island communities. This research also argues that within these internally uncontested knowledge systems, external governance systems are often perceived as a singular external authority, with negative perceptions of one affecting perceptions of another. In this way, negative perceptions of the planning and public consultation process of one large infrastructure project can negatively affect perceptions of future proposals for large-scale energy infrastructures. Participants stated that due to their analytical approach to the public consultation process their perceptions of their past experiences of the process had been largely negative. One participant highlighted previous interactions with the public consultation process and the information provided to the community during this process saying:

“I had a look at the [EIS] and straight away [I saw] it... It was … like they published this to satisfy uneducated people who might not know … [and say]: Oh there’s a scientific study done, that’s enough". The islanders … are very intelligent and they are … clued

into what is going on… it is not easy to pull the wool over their eyes; they will question everything until they are satisfied with it."

(Cathal, individual interview)

The participants' narratives supported this and many perceived that the Irish public consultation process in its current form lacks depth, with some describing the process as misleading. Several of the participants described perceptions of their previous experiences of policymakers' rejection of local knowledge. Participants described how this affected their perception of the public consultation process, with one saying:

"There has been no meaningful consultation. There's been talking about it, but it hasn't made any difference whatsoever. That project [the proposed fish farm]... it hasn't been changed from day one of [a plan] that was carried out above people's heads. It was a consultation process on a finished product, which is not a consultation process, deeply flawed and yet being pushed by certain interests."

(David, individual interview)

So, in this specific time and place, feelings of frustration that their contributions are being ignored are leading participants to disengage from external policy processes which could negatively affect the development of large energy infrastructural projects in their community. Many of the participants have, as a result, developed mistrust of external governance systems and universal policy processes. Other participants discussed the process of the development of the pier which is described in Chapter Four saying:

"There is a story (from) years ago about when the new pier was being built and some of the local... fishermen who were using it... told the engineer ... building it and designing it that it was not going to work. And they went ahead and built it anyway. But it didn't work because ... when the weather is bad, with winds going a certain direction, ferries have to move to the mainland."

(Kenneth, focus group 3)

Participants' narratives revealed feelings that the council had not listened to them in relation to the pier and that:

"They did what they wanted to do [with the pier] and it doesn't serve the purpose fully now."

(Kenneth, focus group 3)

Participants' narratives revealed their perceptions that the government had not sufficiently interacted with the community when creating the proposal for the pier project. The participants also felt that the government and had not given enough notice that they were undertaking a public consultation process and that the community were not aware that they could take part in the process. Participants' narratives revealed that these past experiences have created cynicism that there can be effective and inclusive consultation in the future, which can negatively affect the acceptance of a proposal for a community low carbon energy transition. Building on these experiences, Amy elaborated by describing issues related to the proposal to retract the air service saying:

"It's not like they said: "We're having a public consultation process", but there should have been a public consultation process and now they are saying: "Oh, yeah, now we have talked to the… people" and we [said] "if you have, you haven't been listening. We have given you this research, we have … been back and forth with politicians … for years and you have obviously not taken any of that on board into your process." So what's the point of even pretending … why pretend this is a democracy if … that democratic process isn't actually working as it should be?"

(Amy, individual interview)

Participants stated that they were less inclined to partake in the consultation process as a result of a lack of trust in those that are responsible for the process. This unhappiness with the public consultation process highlights the importance of trust in the process of participation (Misztal, 2013). Participants cited several different reasons for their lack of trust in the process, which ranged from their perceptions that those in authority had vested interests in the projects, to perceptions that information related to projects were purposely being withheld by authorities. During the focus group discussions of the public consultation process, Cathal described his perceptions that those involved in the pier were not motivated by the desire to improve the quality of life for the community within Inis Oírr saying:

“The reason for that is that the people telling us [the information] had a vested interest in it financially.”

(Cathal, focus group 2)

Participants’ narratives revealed perceptions that the public consultation process is generally engaged with in a dishonest way and that transparent processes in consultation are rare. Amy chronicled her frustration with the process and revealed her cynicism in relation to the integrity of those in authority saying:

"The public consultation process can be engaged with in an honest way, at least it can be. It’s just that I haven’t seen that."

(Amy, individual interview)

These perceptions were echoed by several participants, with some describing their past experiences of the public consultation process. Many participants described perceptions of instances where, when a governmental organisation (or other organisation) engaged with them, they felt they were not given all of the relevant information for the project. Some participants felt that those in authority only shared information that painted proposed projects in a positive light and the drawbacks for the projects were not transparently engaged with. Edward described his feelings of the public consultation process saying:

"…they do seem to … just … just tell you what they want to tell you and they just leave big chunks of it out if it doesn’t suit ... So obviously you would want to know everything about ... [it] ... before it happens, whatever is happening"

(Edward, individual interview)

Many participants discussed their understandings of how proposals for projects can be framed in order to ensure that they are portrayed in a falsely positive light. Several participants described how this creates suspicion within the community towards those in authority. Although several participants spoke about their cynicism with the consultation process explaining that this led to their disengaging from the process itself, other participants stated otherwise. As described earlier, several participants were concerned that the government were eager to stop the services provided to the island and some interpreted the shortcomings in the public consultation process as another method of reducing funding for the islands. Several participants spoke about how these perceptions incentivised them to engage in the public consultation process more actively as Aoife explains:

"I think that we should keep trying and carry on regardless. Because if you give up, you are letting them win. And I would be kind of... I wouldn't be hugely optimistic about getting there."

(Aoife, individual interview)

The cynicism with the public consultation process was not the only disincentive to engagement described by the participants, with some stating that the format of the process itself was intimidating and did not encourage participation. The public consultation process in Inis Oírr generally involves a public meeting organised by the co-operative and held in the local community hall. During the initial fieldwork studies in Denmark, public meetings were cited by the energy managers interviewed as being the most useful and engaging tool for effective public consultation (Heaslip et al., 2016). However, the participants' narratives revealed that this was not the dominant feeling of public meetings in Inis Oírr. Several of the participants spoke about their dislike of these meetings with one participant stating:

"I think those big community meetings are terrible."

(Amy, focus group 3)

Participants' narratives revealed resentment around the public consultation process, with some explaining that the process was only engaged with effectively by a few outspoken people in Inis Oírr, while other members of the community remained silent and on the fringe of the process. Several participants described how a few members of the community were extremely vocal and overshadowed others, with Edward explaining:

“The kinda people who talk at the meetings have too much to say, but I suppose you get the everywhere…"

(Edward, individual interview)

Although some participants’ narratives revealed resentment towards public meetings, other participants’ narratives revealed a sense of guilt related to their inactivity in the public consultation process. Many participants discussed their inaction in the past and chronicled their difficulties opening up and stating their misgivings in a public forum. Amy described her experience with the process, explaining that she has regretted not speaking out in the past saying:

“I mean we have all gone to meetings where we felt we should have said something and we didn’t put our hand up"

(Amy, individual interview)

This section argues that past experiences of the public consultation process has a significant effect on the case study communities’ perception of the energy governance. The following section discusses the participants’ perceptions of knowledge exchange within energy governance processes in their community. Participants’ perceptions of the value of local knowledge are investigated along with perceptions of effective methods of engagement.

8.5 Wariness and Weariness in Inis Oírr

Key components within this theme include how participants perceived the public consultation process and how they viewed the flow of their knowledge into the policy sphere. Participants’ narratives revealed the extent to which they perceived they were ostracised and misunderstood by remote, external governance. Haraway (1988) spoke of the dangers of remote governance and the common mistake of *“romanticising the less powerful while claiming to see from their positions”*. This was one issue that was repeated throughout the participants' discussions with Sandra describing how local and governmental concepts of energy solutions for the island can often be extremely divergent saying:

"I think they would be very different. The Government might have an idea of an overall plan that might have no bearing on island life. We are an island we are a small community... So I think the local input is important."

Sandra (individual interview)

This also led to concern among some with one participant describing her fears about the government making energy planning decisions affecting their quality of life without prior consultation. Orla discussed her distress at a recent government proposal explaining:

"Well the decision ... will move everything backwards and that is why we are fighting it so much... And people will leave the island ... people won't move out here."

(Orla, focus group 4)

While most participants discussed their improved quality of life, when asked about the public consultation process in Ireland, all participants stated that they were on the fringe of the process and that it was not appropriate to their situation in its current form. Others chronicled their previous interactions with the process depicting irregularities and misrepresentations within the process in the past. While at present there is a recommended framework for public consultation in Ireland (EPA, 2016), currently it does not consult effectively with, or meet the needs of, peripheral or isolated communities. This situation echoes Nygren's (1999) description of the domination and hybridisation of local knowledge by decision makers. Selina (individual interview) detailed preceding experiences of public consultation in Inis Oírr saying:

"I don't care how many masters or PhDs or whatever... [you have] *... You've gotta live here to understand."*

(Sally, individual interview)

Many participants perceived the public consultation process as one which didn’t reach their small pocket of the world and was not appropriate to their situation. As a result, participants felt that the mainland governance system did not care what they, as a community, had to say, fostering mistrust of the external governance system. One participant commented:

"They don’t consult us; they don’t really consult us, at all. Was there a meeting...? Well, there probably was, but those meetings are just about dividing the money out or whatever.”

(Alice, focus group 5)

The EIA assessment process attempts to acknowledge social and cultural issues of significance in large-scale infrastructure planning such as energy project development (Cass and Walker, 2009). These social cultural issues are not always deemed valid in the energy planning process, making communities aware of their exclusion from the final decision-making process (ibid.). These issues were reflected in the participants’ narratives, which revealed feelings that their feedback was not authentic when it reached those making the decisions with one participant stating:

"We have these nice little meetings where you can all say what you want and then they go off and find reasons to do something else anyway. I would be quite cynical about them, honestly."

(Aoife, individual interview)

As described in section 3.1, debates around the importance of trust in policy implementation and collaborative projects are becoming ever more popular (Büscher and Sumpf, 2015, Misztal, 2013, Walker et al., 2010). Participants perceived a lack of honesty in the public consultation process in Ireland and this fostered distrust of the external governance system. This was evident in their narratives with one participant recounting his experience of the public consultation process as:

"So, you know, when people are giving information, it depends on where they are coming from and ... they give information that is relevant to that... So that is not good enough,

you know, to leave the homework to the community… information needs to be precise and truthful."

(Muireann, individual interview)

The localised governance system in Inis Oírr acquired the existing trust of the community over generations through social interactions. As a result, the co-operative has successfully fostered goodwill towards renewable energy technologies in the community. Consequently, a more participative community exists and 25% of the community were eager to participate in a study on community energy perceptions and needs. Participants were keen for the information from the study to be included in their own community low carbon energy transition. Pilot studies undertaken for this research highlight how it is important to utilise existing community organisational structures when undertaking low carbon energy transitions (Heaslip et al., 2016). The trust and community collaboration the co-operative created, better enables them to implement proposed community renewable energy proposals than external governance organisations. This is as a result of the formation of interpersonal relationships within the community. This level of interpersonal interaction is fundamental to fostering trust in small peripheral communities like Inis Oírr. According to Lange and Gouldson (2010) trust is something that *"informs personal relationships and can infuse social structures"*. As a result, trust must have an interpersonal dimension not inherent when there is remote governance. However trust in Inis Oírr's co-operative did not automatically mean that all members of the community were willing to get involved in the study as trust does not always mean participation, but sometimes can only mean passive tolerance (Büscher and Sumpf, 2015).

8.6 Conclusion

This chapter investigated energy governance in the case study community and the role of the co-operative as an energy governance structure. Participants' perceptions of past experiences of large infrastructure planning in their community were discussed along with perceptions of proposals for low carbon energy transitions. Following this, this chapter argued that geographic remoteness and perceptions of marginalisation by central governance creates reservations of proposals for energy projects in the case study community. Participants' narratives revealed that perceptions of having services of a lower standard than mainland communities (Cross and Nutley, 1999) has created suspicion among the participants of mainland energy governance. The participants' narratives revealed perceptions that universal modes of governance are not appropriate for their island situation. Empirical findings also revealed perceptions that the public consultation process was exclusionary and that those in authority were not interested in acknowledging the input of communities. Participants' narratives revealed that these perceptions created wariness within the community towards engaging in large-scale infrastructure public consultation processes. Participants' narratives revealed perceptions that public consultation processes are not transparent and that there is a lack of trust towards those in authority. Participants' narratives revealed fears that proposals for low carbon energy transitions might negatively affect their quality of life and not be suitable to their specific situation. Building on these findings, the next section describes the community perceptions of what a low carbon energy transition should mean followed by discussion of the technical data from the study and its relationship to the participants' daily lives. Finally, participants' perceptions of the transdisciplinary energy planning process developed for this research are discussed.

Chapter Nine: Designing Inis Oírr's Low Carbon Energy Transition: A new Approach?

9.1 Introduction

Knowledge of the effect of the geographic, cultural, social and economic peripherality of isolated island communities in the development of situated energy knowledges is severely lacking (Royle, 2002, Cross and Nutley, 1999, Royle, 1989). Due to the isolated nature of island living, bonds of attachment and identity with islands are often stronger than bonds with the neighbourhood people are living in (Hernández et al., 2007) highlighting the strength of place-attachment in island communities. It is argued that NIMBYism and opposition to large-scale energy projects are influenced by disruption to place-attachment (Devine-Wright and Howes, 2010). This thesis argues that understanding the situatedness of perceptions and understandings of energy in island communities, and other isolated communities, is crucial to successful low carbon energy transitions in these areas. Understanding situated energy knowledges and their development processes can facilitate the effective co-creation of low carbon energy transition pathways that are cognisant of the needs of the communities involved. This thesis developed and tested an innovative transdisciplinary methodology for the assessment and inclusion of the participants' situated energy knowledges into planning for their low carbon energy future through the co-creation of a technical energy plan for their community. The innovativeness of this transdisciplinary mode of investigation yielded both qualitative and quantitative results that contributed to a holistic understanding of appropriate pathways for Inis Oírr's low carbon energy transition. This chapter discusses the findings from the application of a holistic transdisciplinary approach to designing low carbon energy transitions in island communities to include the empirical evidence from Chapters Six, Seven and Eight. This chapter describes the findings from the development and application of a transdisciplinary approach in this research and the process of merging the two disciplines.

This chapter concentrates specifically on Research Question Four:

4. What new knowledge can be developed from applying a transdisciplinary approach to the analysis of situated energy knowledge development processes within the case study island community?

This chapter begins by revealing the participants' perceptions of what a low carbon energy transition for Inis Oírr should mean. This chapter also builds on these empirical findings and empirical evidence from Chapters Six, Seven and Eight, to create a table of characteristics for the undertaking a low carbon energy transition in the case study community. This table was created to enable the inclusion of findings from empirical evidence into the technical design of a low carbon energy transition pathway for Inis Oírr. Several technologies are critiqued using this table and then input into the HOMER technical energy simulation software to simulate three draft technical energy plan proposals for the case study community. The first scenario was designed without acknowledgement of the empirical evidence while the second scenario was designed to include findings related to the participants' situated energy knowledges. The third scenario was designed to include findings related to the participants' situated energy knowledges and empirical findings from discussion of their local knowledge in general. Following this, the empirical evidence from the technical energy planning workshops are analysed, as are the participants' perceptions of the energy planning process developed for this research. Following this, this chapter critically reflects on whether the transdisciplinary approach employed in this research was successful in the merging of two divergent epistemologies and disciplines. This chapter also reveals the evidence that emerged from the application of both disciplines and the new knowledge that has been developed as a result. The next section describes the participants' perceptions of what a low carbon energy transition should mean and how these emerged from investigation of the participants situated energy knowledges.

9.2 Inis Oírr Community's Understandings of Low Carbon Energy Transitions

This section builds on findings discussed in Chapters Six, Seven and Eight, which described the participants' situated energy knowledges and their understandings of energy in their daily lives. After discussing perceptions of energy in their daily lives and local knowledge and energy governance within their community, focus was placed on defining a low carbon energy transition pathway for Inis Oírr. During the focus groups and interviews, the participants were asked to describe their understandings of what energy means. These concepts were wide ranging and varied from financial aspects to organisational and are described in Table 9.1 and listed in no particular order.

Table 9.1: How Energy is Defined by the Participants
How energy projects are organised
The technical aspects of energy provision
How global politics affects energy supply
How energy is supplied locally
The financial aspects of energy provision
How energy affects the environment
Knowledge on how to conserve energy

When asked to define their understandings of what a community low carbon energy transition should mean, several participants defined it as a project that would be something local and place-based. Participants' narratives also revealed feelings that a community low carbon energy project should involve energy being generated locally to enable the island's energy independence from mainland Ireland. One of the participants stated that:

"… if there was a development of a sustainable, stand-alone energy where you could have your own energy manufactured or sustained… [and] … generate it here rather than be dependent on outside, even from a cost point of view it would be much better … To get

that surety of supply all the time [is important] even though [the electricity supply stability isn't] … too bad now."

(Kenneth, focus group 3)

During the discussions, the participants were divided on how a community low carbon energy project should be developed, whether it should primarily involve the supply of energy, or whether the reduction of energy demand is more important. As described in Chapter Six, the participants' narratives revealed a high level of understanding in relation to the purpose of the insulation that had been installed on the island in recent years. Many of the participants were very aware of the amount of work that had been recently completed in Inis Oírr with one participant saying:

"Well they've done a lot of work recently on insulation projects… for a lot of the houses, haven't they? There's been loads of [insulation put in] lately, so a lot of that [work is]… done nearly I'd say".

(Amy, focus group 3)

During the discussions, participants spoke about how insulation had benefited their lifestyle. Although discussions focused on the merits of the insulation and the amount of energy savings that had already been achieved, several participants were still aware of the difficulties with Inis Oírr becoming energy independent and the associated costs with this transition. During the insulation project a large portion of the insulation was funded by the government, through the Better Energy Communities Scheme making it more affordable for the community to install (Byrne et al., 2016). However, many of the participants were concerned that the cost of implementing other energy reduction measures would create a scenario that would not be affordable for the community, with one participant saying:

"Well [insulation is] conserving the heat. When you talk about conserving energy, it's really about saving money and making things cheaper, and less expensive. So, if you're conserving energy hopefully you're not spending as much, the whole thing about putting

in processes to conserve energy has to be cost effective from the point of view of it's not going to cost you more conserving it than it cost you before that."

(Kenneth, focus group 3)

The participants also explained that to make a project financially feasible in their location, it was important that investment in a project will not cost the participants too much with one participant saying:

"You need to be able to make [the money] back, in a reasonable amount of time."

(Kenneth, focus group 3)

During the focus groups and interviews the testing of the technologies by the community emerged as an important aspect of the development of a community low carbon energy project for the participants. Several years ago the SEAI facilitated a trial in Inis Oírr that allowed some of the participants to test a range of different technologies including solar panels and wood pellet stoves (SEAI, 2014) in order to determine which might be suitable for their community. The participants' narratives revealed that these tests were well received and well understood by the participants. One participant described these test projects in a positive manner saying:

"There were about 3 different ... [technologies] ... and they tested them and they decided that the solar panels were the most suitable, most economical and less maintenance ... [in an island location]. So a lot of people decided to go and get solar panels, based on their research and it was fantastic. I got them in 6 years ago … and the saving in oil and electricity for heating water [has been huge], there is no cost, the sun heated the water all summer and there is absolutely no other cost, and they overflow into radiators if you need it so that was fantastic."

(Orla, focus group 4)

During discussions of the definition of a low carbon energy transition, the participants' narratives revealed a wide range of perceptions of how this should be defined. Within literature, community renewable energy projects are defined as those that are for and by the people (Walker and Devine-Wright, 2008). However, during the focus groups and interviews, participants' narratives revealed a myriad of different interpretations of what a community low carbon energy project should mean and these ranged from the financial aspects of an energy project to the organisational aspects. For most, the cost of the installation of technologies was a concern with one participant saying:

"I suppose cost would be top of the list, because you are trying to cut down on cost and then environment to me, and then comfort."

(Orla, focus group 4)

Although several of the participants stated that the cost of the project was important, due to the isolated nature of the island community, security was a key issue for others. Although islands can offer autonomy in their energy provision, this can also lead to the need for several modes of energy provision in order to account for instability in the grid (Kuang et al., 2016) creating higher costs of energy provision. As described in Section 6.3, the participants are already utilising several modes of energy provision in their daily energy practices in the form of what they call backup plans. Several participants stated that they would be willing to pay more to install technologies that would give them more security of supply with two participants explaining:

"But… you don't mind paying the extra if you can rely on it. And easy to fix [is important too]."

(Anita, individual interview)

"Yes, and [it's important] that we would have continuous supply, so that whatever you would use, you could depend on it..."

(Orla, focus group 4)

In terms of the organisation of a low carbon energy project, participants' narratives revealed that they perceived that communication, consultation and participation was of paramount importance throughout the process. As described in Section 4.4, traditionally, public participation in island communities has been lacking. This was echoed by the participants' narratives with one participant stating:

"[It's important] to have the local people involved, it very much depends on what the project would be. The local input would be most important, and clear explanations and simple instructions as to how it would work and be maintained and how it's going to work long term. [It's important] that there are no surprises that everyone is on the same level and [that there is] good communication. Good communication is key to a lot."

(Orla, focus group 4)

Building on these previous stipulations for a low carbon energy transition, discussion migrated towards topics related to ownership of the technologies themselves. Several participants stated that community ownership of the project was important with one participant stating:

"[It is important] that it would be community owned as well… that it's not a company doing it for the community."

(Philip, focus group 1)

Participants had several incentives for supporting the low carbon energy transition. Some were conscious of planning for the future of the island and the role that the development of an energy project can play in this. One participant stated that transitioning to a low carbon society was important to her to because:

"We all have kids or grandkids or whatever and …. you don't really just think of yourself."

(Martha, focus group 1)

Participants' narratives revealed that transitioning towards a low carbon society was important to all participants in the study. Several stated that it was very important to them and that they would be willing to alter their habits to a certain extent to achieve this saying:

"Well you would be willing to change it in the long run to help you out personally if its bills, or to help the community out that you are not reliant on others. Because as great as having the ... [energy] ... from the mainland ... because you're out in the middle of the ocean, you do need to go down the route of eventually being self-sufficient. I think that people are willing to change, it might just take ... until they have all the right information or can afford to do it."

(Melissa, individual interview)

Focus group discussions also concentrated on how a low carbon energy transition should be organised in their community. Several participants spoke about the merits of the co-operative and how this may be a good vehicle to facilitate the development of the project. Participants' narratives revealed the significance of each of the villages described in Chapter Four and how they must be considered during the organisation of the project. Participants stated that it would be useful to obtain a representative for each of the villages to speak for them during the planning of the project with one participant stating:

"I'd put somebody in charge in every village, there is only a few houses on the island. ... Put somebody [to represent] every village, just an ordinary man or woman and ... you let them know what is happening at the meetings, if they are not able to go. [They could then] bring back the feedback from the meeting [to their village]. Then you see I would be interested in it ... because I know the people who are there, and [I would] not leave it to the co-op. [Then] it's for everyone."

(Alice, focus group 5)

As described in Chapter Seven, the perceived importance of being able to maintain the technologies locally, influenced the participants' choice of technologies to install. During the focus group discussions of what a low carbon energy transition in Inis Oírr should mean, several participants suggested methods that keep reliance on companies on the mainland for maintenance to a minimum with one participant saying:

"If they are able to train people and make it so that it's only once, twice a year they need to come and service [the technology] ... But if there are people here that can fix it as well ... train a few people ...At least ... you've got a backup plan as well, because if that person

is away or they are sick or they can't fix it or whatever. It's easy in the summer months but in the winter months if you have storms and no boats or planes can come in for seven days, you need to have somebody here that is at least willing to get the basic of it working so that people won't ...[be without]... heat or hot water or electricity or whatever it is that they are getting from this renewable energy source."

(Melissa, individual interview)

As described in Chapter Seven, one of the main criteria stipulated by the participants for a community low carbon energy transition in their area was the ability for the islanders to test technologies themselves. Understandings of energy technologies that are complex or require specific actions are best developed through experiential knowledge (Fazey et al., 2006a) and this was reflected in the participants' narratives. Several participants described their positive and negative perceptions of being chosen to trial energy initiatives for the SEAI and the experiential knowledge that they developed as a result. Amy spoke specifically about how the implementation of large-scale energy initiatives on the island created perceptions of having been "guinea pigs" in the past. However, participants' narratives also revealed that they are more willing to support a technology that the islanders had chosen and tested themselves as part of the scheme, with one participant explaining:

"[There should be] grassroots methods of undertaking things. I don't think people felt like guinea pigs [when they were testing the technologies in the SEAI project], because it wasn't organisations from the outside coming into us saying: "You should all put wood pellets into your houses". It was people from the island, who said: "We want to investigate these things"... and went about investigating it with people who wanted to be involved. So it came from the island it didn't come from outside of the island."

(Amy, individual interview)

Building on these concepts of being "guinea pigs" the emergent theme of fairness in the distribution of the retrofitting projects in the past began to emerge. Participants' narratives revealed that many perceived the distribution of the previous retrofitting project had been undertaken unfairly and some were given more retrofitting than others. Several participants explained that this had led to resentment between some members of the community. For example, Alice spoke about the grants system and her perception that they were not divided fairly on the island, creating animosity between some islanders saying:

"I would give ... [everyone] ... grants. I think that it's terrible that there are maybe 10 to 20 people that have to pay for it and maybe [have to do] without [other things], [and then others] that are on the dole would have more money than they have and are getting it free. It's ... it's not right really."

(Alice, individual interview)

During the focus group discussions, the topic of the organisation of community low carbon energy transitions was addressed. Literature argues that emphasis should be placed on the community as a mode for behaviour change (Heiskanen et al., 2010) arguing that energy users should be engaged in the role of energy citizens, not consumers. Low carbon communities provide a new context for energy-use behaviour change (Middlemiss, 2008, Middlemiss and Parrish, 2010). In relation to this, the participants were asked to discuss their perceptions of how a community low carbon energy transition should be approached and how consultation with the community should be facilitated. Escott et al. (2015) found that culturally appropriate participation strategies are extremely important to successful integration of indigenous knowledge. Contrary to the findings from the pilot study in Denmark (Heaslip et al., 2016) which found that, from the perspective of energy project managers, meetings play a crucial role in engaging with communities and fostering participation, the participants were largely negative about the idea of public meetings. Many of the participants suggested that the use of a community meeting was not helpful with one participant stating:

"You get your meeting organised, roll out the [project] and explain, there'll only be a certain amount there. The rest of them will hear about it the next day and are sorry they

didn't go to the meeting and it will be explained cock-eyed[39] *... by the person who was there, maybe they took it up wrong."*

(Clara, individual interview)

Several of the participants offered advice in relation to the organisational structure of the proposed community low carbon transition. Although many of the participants spoke about the merits of the existing co-operative as an organisational body for the island, several others suggested that another committee should be created to deal specifically with an energy project. Some stated that the project would garner more support from the community if an entirely new committee was created to deal particularly with the development of a community low carbon energy project, with one participant explaining:

"Because I know that we have co-op structures and I know that we have energy committees, but I think that if you want buy-in from the whole community you should think of setting up a new system, where it is not the same-old, same-old people who are involved and that… people will be more inclined to want to be a part of it."

(Aoife, individual interview)

Building on these discussions of the organisation of the community low carbon energy transition, discussions migrated towards the topic of how such a project should be funded. As described above, many of the participants perceived that the distribution of retrofitting in the island and the associated funds were not distributed in an equitable manner. During the individual interviews, the participants were asked to discuss what they perceived to be an equitable funding structure. All participants felt that a large portion of the funding should be covered by the government, but that it was important that the energy retrofitting was not given to the participants for free. One participant described how the funding should be shared in terms of percentages stating:

"I suppose 75 [percent to] 25 [percent] would be fair. The community would pay 25 [percent] and try and get funding... because it is very difficult for the community to even

[39] "Cock-eyed" is a colloquial term used in Ireland to mean incorrectly.

get 25 [percent] together. So it would be very good if 75 [percent] could be matched from funders."

(Muireann, individual interview)

During the focus groups and individual interviews discussions migrated to the emergent theme of whether the community in Inis Oírr could afford to participate financially in the development of a community low carbon energy project. Several participants stated that although they felt that it was important that the project was partly funded by the community, some perceived that this would be difficult due to the intermittent nature of money generation within the island related to the tourism seasons. Local markets and community funding are key to successful community low carbon energy transitions (Hvelplund, 2006) and co-operatives can be a valuable funding structure within low carbon energy transitions (Yildiz et al., 2015, Koppenjan, 2015, Kunze and Becker, 2015, AEE, 2014, Viardot, 2013), although this is less common in Ireland it has been successful on occasion (Heaslip et al., 2016). Evan, who played a key role in the organisation of the earlier retrofitting projects on the island, spoke about his perception of the feasibility of the island contributing financially to the project, saying:

"To be honest and frank with you, I cannot see it being done by the people of the island for a number of reasons… They don't generate ... the kind of incomes that would be required to fund such a .. [project] … That money isn't here… [so]…who pays for this, how do you pay for this? I know that [this community] can't pay anymore. They haven't got ... the money [at the moment]."

(Evan, individual interview)

However, Evan conceded that although he understands that there may not be significant wealth in the island to financially support a project such as this, he felt that it was important that the islanders attempted to fund a portion of the projects themselves. Evan argued that if a community low carbon energy project is going to be successful that all parties must be willing to contribute financially, otherwise the project cannot be successful. Crowdfunding has been successfully employed in renewable energy projects in the past and this created collaborative approaches to energy projects (Lam and Law, 2016). Evan argued that a willingness to take responsibility for the funding of a project is important for its success saying:

"If the SEAI or [other institutions] take ... the same view [of not wanting to contribute financially] ... if we all take that approach, nothing is going to move."

(Evan, individual interview)

During the focus groups and interviews, discussions also concentrated around the participants perceptions of the disconnect between the community's incentives for a community low carbon energy project and the government's incentives. Although the community spoke about wishing for energy independence and reduced cost, several of the participants discussed their perceptions that the government might have a different incentive for the development of a community low carbon energy project. Participants' narratives revealed their perceptions that the government makes plans for the island that are not suitable to their way of life with one participant stating:

"I think [the government's incentive to develop a community energy project and the community's incentive] ...would be very different. The government might have an idea of an overall plan that might have no bearing on island life. We are an island we are a small community... so I think the local input is important."

(Orla, focus group 4)

Participants' narratives revealed that several participants felt the government were not concerned with the welfare of the community, but were more concerned with achieving their energy targets, with two participants stating:

"I think the Government just want to show Europe what target footprints are being reduced by these schemes. I think for us we want to see is there a saving for us, is it workable, is it feasible, is it reliable?"

(Cathal, focus group 2)

"[The government just want] to hit their targets definitely."

(Orla, focus group 4)

Other participants spoke in more detail about their perceptions of the divergences between government incentives for the development of energy projects and the community's, with one participant stating:

"What the island would want is to be self-sustainable ... What the government will want is [for] us to be ... self-sustainable, but, but that they can sell [the excess energy]..."

(Philip, focus group 1)

Participants' narratives revealed a concern on the part of several of the participants that the development of a community low carbon energy project by the government could have a negative impact on their way of life. Some participants were concerned that decisions made by the government in relation to the reduction of their energy use could result in their losing some of their present services with one participant stating:

"The only [important] thing ... is to ... [ensure] ... that if the island [has a community energy project that it] ... moves us forward ... and ... moves us into the future and not set us back into the donkeys years[40]*. Because kids ... use computers and ... we need to be connected, we need connectivity [in the future]."*

(Margaret, individual interview)

During the interviews and focus groups, the participants were asked to discuss their perceptions and understandings of renewable energy technologies. The participants' narratives revealed that all participants were accepting of the installation of more solar panels in island. The participants also chronicled how they are supportive of renewable energy technologies in general but that they were not accepting of others, including wind turbines. Orla spoke about her perceptions of renewable energy technologies saying:

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[40] "Donkeys years" is a rhyming slang use to denote a very long time ago.

"Well, they are good so long as there are not a load of windmills. [The technologies] would have to blend in with the scenery as well, especially out here … because it's such a special place."

(Orla, focus group 4)

An emergent theme in this research is the impact that previous experiences of renewable energy projects has on perceptions of what community low carbon energy transitions should mean. In 2002 in Inis Meáin(the neighbouring island) the co-operative manager developed a €2 million seawater desalination plant which was powered by three wind turbines and funded by the EU and several State departments and agencies (Ellis et al., 2014, Higgins, 2010). However, the co-operative responsible for managing the desalination plant and wind farm collapsed in controversy several years later (O'Sullivan, 2012). The turbines were never used again and were removed from Inis Meáin in 2013 (CFOAE, 2013). Participants' narratives revealed that they perceived this project to have been a failure. Their narratives also revealed perceptions that wind turbines are unreliable, with some describing their perceptions that a mini wind turbine at the local school has never worked.

Several participants spoke about how the development and perceived failure of the wind turbine project in Inis Meain has developed feelings of mistrust towards authorities and renewable technologies themselves. The participants' narratives revealed that the failure of this project had a significant negative impact on their perceptions of wind turbines. Several participants described their negative perceptions of wind turbines stating:

"I don't think technology is quite there for windmills ... no matter what they say about all this wind power … like we saw … in Inis Meain, they have trouble [and] when you see the [turbine] they have [at the school] for the past few years … it's a … waste of time, that will never produce anything… I think that the technology isn't quite there plus … I think they found it expensive to bring them out, and put them up and next thing you know they are up for six months and they have a major problem… how do you get up there? They have to bring out a specific machine …"

(Enda, focus group 2)

"I don't think [I would have a problem with renewable energy technologies] ... unless windmills... we had wind mills here years ago and they didn't work ... in the strong winds. They blew it away, or it fell down."

(Brenda, individual interview)

"... from an aesthetic point of view. I would be really against [wind turbines] ... because for obvious reasons it's a very picturesque island and we depend on that picturesque quality for tourism. And if it affects adversely tourism which I suspect it would ... then definitely [wind turbines are a] no-no. A windmill, for example ... in my opinion that would be invasive"

(Frank, individual interview)

Building on these understandings of renewable energy technologies, several participants spoke about their perceptions of social or cultural implications of undertaking a low carbon energy transition within their community. Tadhg spoke about his concerns that a proposal for a renewable energy project may result in divided opinions and animosity among different groups within the community explaining:

"But ... one negative would be ... [if] ... only 88 percent of the people join up [to support the project], the other 20 percent would be ...[left out]."

(Tadhg, focus group 1)

While Martha (individual interview) concurred that her concerns centred on whether a community low carbon energy project might create *"a little division"* within the community. Building on the empirical evidence outlined in this section and in Chapters Six, Seven and Eight, the following section outlines the process involved in designing Inis Oírr's low carbon energy transition.

9.3 Designing Inis Oírr's Low Carbon Energy Transition

During the focus group discussions, the participants were asked to describe their understandings of what a community low carbon energy project should mean. The resulting discussion centred around several different aspects of community renewable energy projects and these were coded using NVivo. For the purpose of developing technical energy scenarios for Inis Oírr, these discussions were developed and chronicled in order to create a set of criteria based on the participants' narratives. The participants' narratives revealed that there were many different perceptions of what a community energy project should mean, with a total number of 17 characteristics described during their discussion of what a community energy project should mean. These are contained in Figure 9.1 and are not ranked in any particular order.

1.6 Understandings of the Definition of a community energy project	1	3
Adaptable to individual homes	1	1
Affordable and financial	10	24
comfort	4	6
Ease of use	1	1
Easy for community to understand and fix	1	2
Energyplanning	1	2
Forward looking	1	1
Good for the environment	7	13
Independence	7	20
Local people involved	4	5
Not being affected by outside problems	2	3
Opportunity for community to invest	1	1
Organisation	3	7
Reliable	2	3
Renewable Energy	4	9
Retrofitting	2	2
Security	4	7
State involvement	1	1
Testing things themselves	2	5

Figure 9.1: Screenshot of NVivo Showing the Nodes Containing the Participants' Perception of a Community Energy Project (source: Author)

These characteristics were then ranked in descending order using excel software, with the characteristic mentioned by the most number of participants placed first and the characteristic discussed by the least number of participants placed last. To further organise the characteristics, they were also ranked by how many times each of the characteristics were discussed as detailed in Table 9.2.

Table 9.2: List of Participants' Desired Characteristics for a Community Energy Project		
Characteristics	**No. of focus groups/ interviews discussed in**	**No. of times discussed**
Affordable energy	10	24
Energy Independence	7	21
Energy that is good for the Environment	7	13
Local people involved in the project	5	6
Renewable Energy	4	9
Secure Energy	4	7
Comfortable Houses	4	6
Well Organised Project	3	7
Forward Energy Planning	2	3
Retrofitting of Houses	2	3
Reliable Energy	2	2
Community can Test Technologies Themselves	2	5
Technologies are Easy for Community to Understand & Fix	1	2
Adaptable for Individual Houses	1	1
State is Involved	1	1
Technologies are Easy to Use	1	1

The draft technical energy plan scenarios were then designed based on these characteristics, with those that are ranked higher being of more importance in the design of the draft technical energy plan scenarios. Three technical energy plan scenarios were designed and simulated using HOMER and then presented to the community during the energy planning workshops held in the co-operative workshops. As described in Chapter Eight, during the focus group and interview discussions, the participants narratives revealed their perceived shortcomings in their past experiences of community low carbon energy initiatives like the electric cars. Several participants put forward their recommendations in relation to how to organise and communicate the energy planning process with the community. Maeve, who works in the Islands of Ireland Co-operative and is responsible for managing several projects in Inis Oírr in the past, explained that for a project to be successful it has to:

"... be ... [easily organised]... short to medium term. It has to measurable. [And] you [have to] bring ... [the community] ... [through] from the [initial] vision to the end [of the project]."

(Maeve, focus group 1)

Building on the list of characteristics outlined in Table 9.2, in order to explain how the table of characteristics was utilised in the development of the three technical energy scenarios, the suitability of several energy technologies were assessed using the table of characteristics and these are contained in Appendix L. For the purposes of illustration, the table containing the assessment of wood pellet stove technology against the prescribed criteria is contained in Table 9.3 following.

Table 9.3: Desired Characteristics for a Community Energy Project Applied to Wood Pellet Stoves		
Ranking	**Characteristics**	**Appropriate for Inis Oírr?**
1	Affordable energy	Perhaps
2	Energy Independence	No
3	Energy that is good for the Environment	Perhaps
4	Local people involved in the project	Yes
5	Renewable Energy	Yes
6	Secure Energy	No
7	Comfortable Houses	Yes
8	Well Organised Project	N/A
9	Forward Energy Planning	No
10	Retrofitting of Houses	Yes
11	Reliable Energy	Yes
12	Community can Test Technologies Themselves	Yes
13	Technologies are Easy for Community to Understand & Fix	Yes
14	Adaptable for Individual Houses	Yes
15	State is Involved	Perhaps
16	Technologies are Easy to Use	Yes

The assessment of this technology was undertaken by the researcher however, during the energy planning workshops, the participants were asked whether they agreed with the assessment, and all stated that they did. Building on the findings discussed in this section and the development of the table of characteristics for Inis Oírr's energy plan for their low carbon energy transition, the following section describes the development of the technical energy scenarios themselves. The next section describes the use of HOMER technical energy simulation software to attempt to meet these requirements.

9.4 Developing Inis Oírr's Technical Energy Scenario Simulations

Having gathered all of the data to input into HOMER and the qualitative data to inform the design of the draft technical energy plans, the next step was to run the HOMER simulations. Three different scenarios were simulated – one scenario was designed which was deemed to be most efficient from a technical perspective, but did not take into account any of the qualitative data or the list of characteristics outlined in Table 9.2. The second scenario was designed based on the list of characteristics described in Table 9.2 and was built upon the qualitative phase of the data collection. The third scenario was based on the list of characteristics in Table 9.2, the initial findings from the qualitative data and also considered other issues in the participants' daily lives that were discussed during the qualitative data gathering phases. All scenarios included solar panels to provide hot water for the increased hot water demand during the summer months as a result of the high influx of tourists. Solar panels were proposed as during these months the energy yields from solar panels are at their highest and their installation and running cost are relatively low. The first proposal involved the simulation of a micro-grid system that meets the majority of its energy needs from a 1.5 MW wind turbine to be placed on the northern side of the island (Figure 9.2).

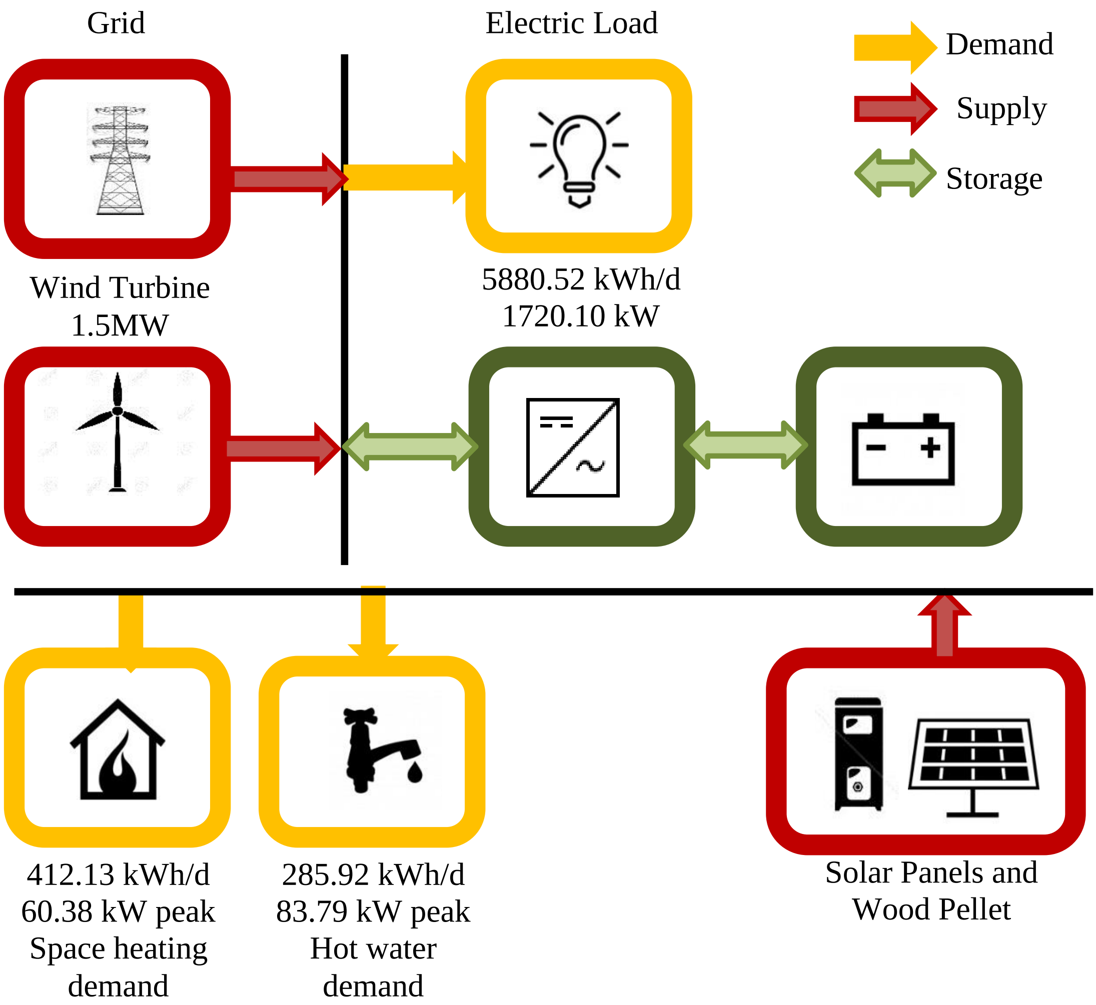

Figure 9.2: Proposed Technical Energy Plan Scenario 1 (source: Author)

This scenario was then presented to the community during the technical energy planning workshop. Each of the particulars of the plan, and how the qualitative data influenced their selection, were explained to the participants and discussed at length. The design of the scenario incorporated a 1.5 MW wind turbine with appropriate sized battery storage. It was proposed that the space heating and hot water demand be met by installing more solar panels on the island and wood pellet boilers. All of the scenarios presented proposed that Inis Oírr remains connected to the grid to account for intermittency in supply and to avail of opportunities to sell excess energy back to the grid for future profits.

The second technical energy plan scenario presented was based on Table 9.2 of preferable characteristics developed from the initial findings from the qualitative data gathering.

During the initial investigative phase of the research, it was clear that the majority of the employment in Inis Oírr was dependent on tourism as detailed in Section 4.4. As discussed in Chapter Eight, several of the participants expressed their concern over the use of wind turbines in Inis Oírr and this, coupled with the large area of the island that is designated as a SAC, as described in Section 4.4, made the inclusion of a wind turbine in a draft technical energy scenario unfeasible. The participants' narratives also revealed negative perceptions of wind turbines and concerns for their effect on tourism on the island. In the second proposed technical energy plan scenario, it was proposed that the bulk of the electrical energy demand be met through PV panels. The hot water and space heating demand is to be met by solar panels and heat pumps while energy storage was provided by hydrogen storage (Figure 9.3).

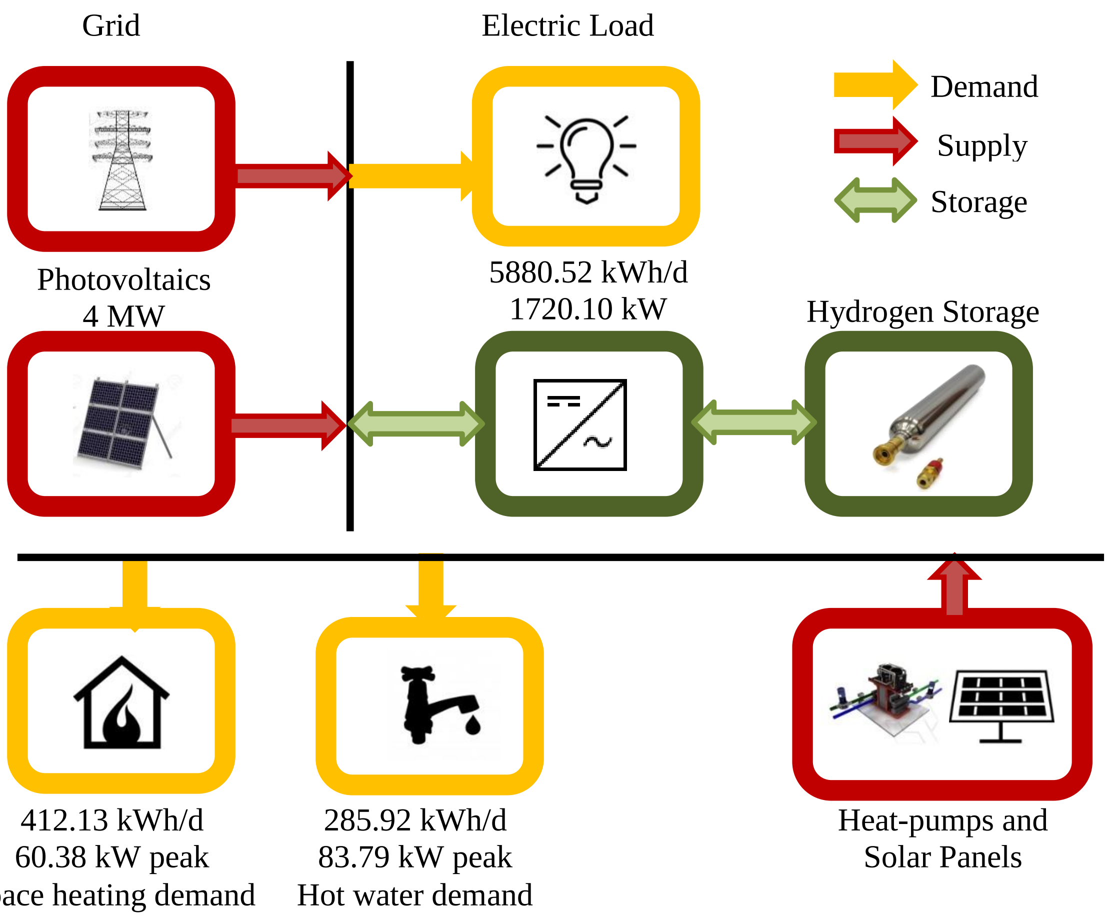

Figure 9.3: Proposed Technical Energy Plan Scenario 2 (source: Author)

Finally, the third proposed technical energy plan scenario drew from several sources of data for its design; the initial qualitative findings, the list of characteristics described in Table 9.2 and the findings based on the participants' situated knowledge and daily lives.

The incentive for the design of the third technical energy scenario was based on the information that the participants' narratives revealed on the effect of geographic peripherality on maintenance of technologies and other aspects of their daily lives as described in Chapter Seven. One of these difficulties includes waste disposal (as described by Tadhg in Section 7.3) and the cost of moving waste off the island, along with the extra emissions as a result of having to transport the waste by sea. Along with these costs, there is also the issue of high food waste during peak summertime periods as a result of the unpredictable Irish weather and how this can impact on tourism numbers (as described by Tadhg in Section 7.3). This can very quickly lead to a build-up in biodegradable waste during the summer months that have to be shipped off the island. The third scenario proposes that this waste is used to supply Inis Oírr with electrical energy from an Anaerobic Digester and photovoltaic panels (PV) with the amount of PV becoming smaller as a result of the anaerobic digester (Figure 9.4).

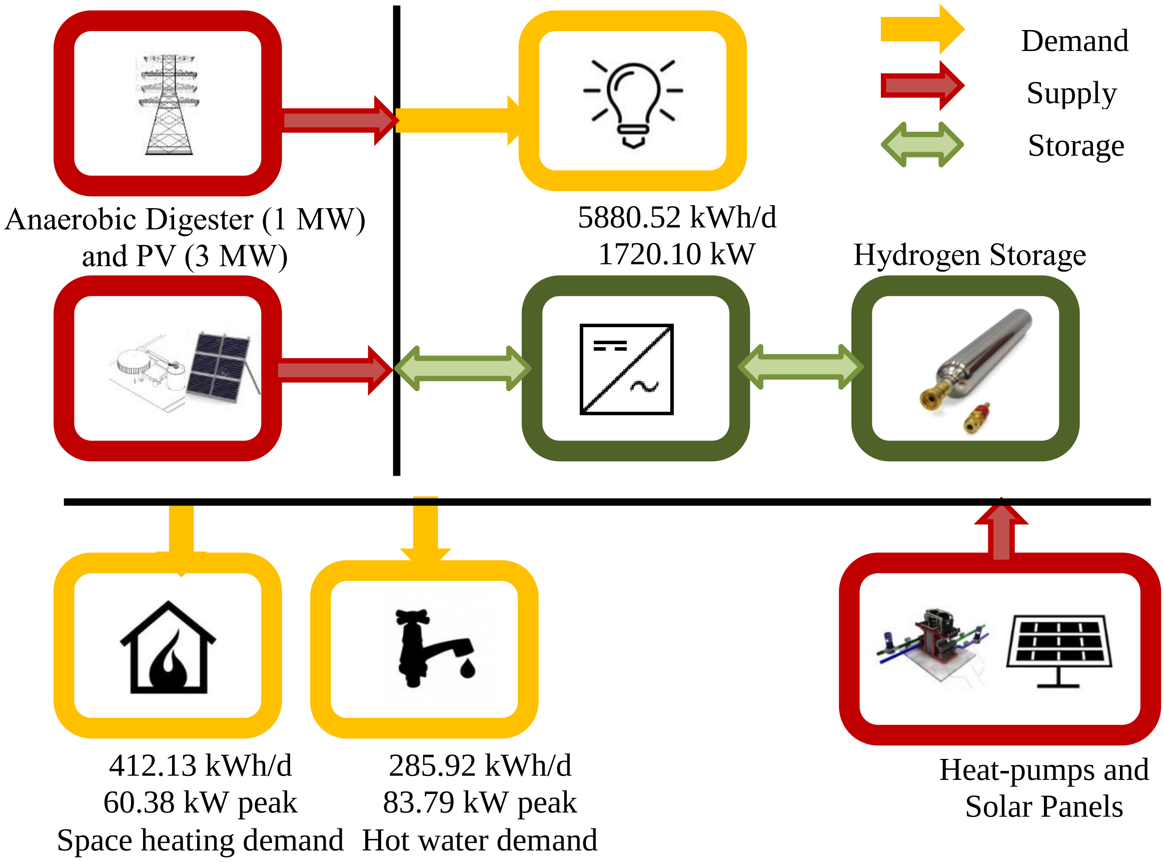

Figure 9.4: Proposed Technical Energy Plan Scenario 3 (source: Author)

The proposed system of storage in order to account for intermittency from the PV is hydrogen storage. Scenario Three also proposes that the space heating and hot water demand are met by solar panels and heat pumps.

As described in Section 5.7, several methods were employed in communicating these scenarios to the participants of the study in order to provoke discussion and feedback. Presenting each of the scenarios involved presenting Figures 9.2, 9.3, and 9.4 and then discussing the advantages and disadvantages of each of the proposed scenarios in relation to the characteristics described in Table 9.2. For example, Scenario One was less successful when compared with Scenario Two due to the difficulty in getting the wind turbine serviced in an island location and the fact that the community do not know how to fix the technology (Tables 9.4 and 9.5).

Table 9.4: Proposed Technical Energy Plan Scenario One Compared Against the Desired Characteristics of Inis Oírr's Low Carbon Energy Transition				
Ranking	**Characteristics**	**Wind**	**Wood Pellets**	**Solar Panels**
1	Affordable energy	Perhaps	Perhaps	Yes
2	Energy Independence	Yes	No	Yes
3	Energy that is good for the Environment	Yes	Perhaps	Yes
4	Local people involved in the project	Perhaps	Yes	Yes
5	Renewable Energy	Yes	Yes	Yes
6	Secure Energy	Yes	No	Yes
7	Comfortable Houses	N/A	Yes	N/A
8	Well Organised Project	Perhaps	N/A	Yes
9	Forward Energy Planning	Yes	No	Yes
10	Retrofitting of Houses	N/A	Yes	Yes
11	Reliable Energy	No	Yes	Yes
12	Community can Test Technologies Themselves	No	Yes	Yes
13	Technologies are Easy for Community to Understand & Fix	No	Yes	Yes
14	Adaptable for Individual Houses	N/A	Yes	Yes
15	State is Involved	Yes	Perhaps	Yes
16	Technologies are Easy to Use	No	Yes	Yes

Table 9.5: Proposed Technical Energy Plan Scenario Two Compared Against the Desired Characteristics of Inis Oírr's Low Carbon Energy Transition				
Ranking	**Characteristics**	**PV**	**Heat Pumps**	**Solar Panels**
1	Affordable energy	Perhaps	Perhaps	Yes
2	Energy Independence	Yes	**No**	Yes
3	Energy that is good for the Environment	Yes	Perhaps	Yes
4	Local people involved in the project	Yes	Yes	Yes
5	Renewable Energy	Yes	Perhaps	Yes
6	Secure Energy	Yes	Perhaps	Yes
7	Comfortable Houses	Yes	Yes	N/A
8	Well Organised Project	Perhaps	Perhaps	Yes
9	Forward Energy Planning	Yes	Yes	Yes
10	Retrofitting of Houses	Yes	Yes	Yes
11	Reliable Energy	Yes	N/A	Yes
12	Community can Test Technologies Themselves	Yes	Yes	Yes
13	Technologies are Easy for Community to Understand & Fix	Yes	Yes	Yes
14	Adaptable for Individual Houses	Yes	Yes	Yes
15	State is Involved	Yes	Perhaps	Yes
16	Technologies are Easy to Use	Yes	Yes	Yes

Scenario Three was much more successful in terms of the required characteristics for a community energy project (Table 9.6), and this was reflected in the participants' narratives.

Table 9.6: Proposed Technical Energy Plan Scenario Three Compared Against the Desired Characteristics of Inis Oírr's Low Carbon Energy Transition					
Rank	**Characteristics**	**AD**	**PV**	**Heat Pumps**	**Solar Panels**
1	Affordable energy	Perhaps	Perhaps	Perhaps	Yes
2	Energy Independence	Yes	Yes	N/A	Yes
3	Energy that is good for the Environment	Yes	Yes	Perhaps	Yes
4	Local people involved in the project	Yes	Yes	Yes	Yes
5	Renewable Energy	Yes	Yes	N/A	Yes
6	Secure Energy	Yes	Yes	N/A	Yes
7	Comfortable Houses	N/A	N/A	Yes	Yes
8	Well Organised Project	Yes	Yes	N/A	Yes
9	Forward Energy Planning	Yes	Yes	Yes	Yes
10	Retrofitting of Houses	N/A	N/A	Yes	Yes
11	Reliable Energy	Perhaps	Yes	Yes	Yes
12	Community can Test Technologies Themselves	Yes	Yes	Yes	Yes
13	Technologies are Easy for Community to Understand & Fix	Yes	Yes	Yes	Yes
14	Adaptable for Individual Houses	N/A	Yes	Yes	Yes
15	State is Involved	Yes	Yes	N/A	Yes
16	Technologies are Easy to Use	Yes	Yes	Yes	Yes

Following the presentation of the three proposed technical energy scenarios, a round table discussion was facilitated to encourage discussion of the scenarios and the process of their design. An evaluative sheet was also distributed to the participants of the study in order to gather data on the participants' perceptions of the study itself and the research processes that were employed (Appendix M). The findings from both the round table discussion workshop and the evaluative sheet are described in the following section.

9.5 Technical Energy planning Workshop Findings

This phase of the research involved the facilitating of two technical energy planning workshops with the participants of the study. Two workshops were held in the Inis Oírr co-operative offices in February 2016. One was held in the evening and another at lunch the next day. All of the participants were contacted and invited to the workshop, however, several were not on the island at the time as it was no longer peak tourism season. 12 participants were available to attend the workshops, one held on a Tuesday and the other on a Wednesday. An overview of the study was presented to the participants along with the rationale, methodology and some of the initial findings. A small portion of the initial qualitative data was also presented and discussion and feedback on these were encouraged. The characteristics table was presented to the community along with the rationale behind its development.

As described in Section 9.4 the technologies that were proposed in each of the scenarios were analysed and presented to the participants using Table 9.2 in order to ensure that the rationale for choosing each of the technologies in the scenarios were fully communicated. Building on these tables, the three draft-technical energy plan scenarios were then presented to the participants, and the electrical and heating demand profiles were also presented and discussed. Presenting each of the scenarios involved presenting illustrations of the scenarios (described in Section 9.4) and then discussing the advantages and disadvantages of each of the proposed scenarios in relation to the characteristics outlined in Table 9.2. Following the presentation of the three proposed technical energy scenarios, a round table discussion was facilitated to encourage discussion of the scenarios and the process of their design. An evaluative sheet was also distributed in order to gather data on the participants' perceptions of the study itself and the research processes that were employed (Appendix M). The findings from both the round table discussion workshop and the evaluative sheet are discussed in this section and contained in Appendix O.

During the energy planning workshop, the participants were encouraged to share their perceptions of the proposed scenarios and the energy planning process itself. During the presentation of the scenarios, the participants engaged with the discussion of each of the proposals. Throughout the presentation of the first scenario, several of the participants were apprehensive about the installation of a wind turbine. Very little discussion occurred after the presentation of this scenario and the discussion moved onto the presentation of the second scenario. Some questions were posed about the first proposal and what each of the elements of the proposal were, highlighting the high level of energy knowledge and the effectiveness of the communication strategies. For example, participants asked:

"So, some elements of this are ... individual homes ... and the rest of it is community [energy]?"

(Maeve, energy planning workshop 1)

"And for the 4MW [wind turbine] that is needed for the island, what [height] of a wind mill would be required?"

(Philip, energy planning workshop 2)

"[A wind turbine like] the ones in Spiddal[41]?"

(Evan, energy planning workshop 2)

"A wind turbine could be imposing and out of scale completely to the island."

(Philip, energy planning workshop 2)

Although the participants' narratives revealed a high level of energy knowledge, the discussion in relation to the first technical energy scenario was relatively short. Throughout the discussion of the rationale behind the second scenario, and how it meets the community's needs, the participants were more engaged and participative in the

[41] Spiddal is a Gaeltacht village on the shore of Galway Bay in County Galway where there is a small wind farm with seven wind turbines. It is 18 km west of Galway city.

discussion. At this point of the discussion, the participants began to open-up about their perceptions of the proposed technical energy scenarios thus far. At this point of the discussion, some of the participants questioned whether the energy created by the community low carbon energy project would be kept within the island's electricity grid for the community to use. Evan's narrative revealed that the concept of the energy created being retained with an independent self-contained grid on the island was important to him. He stated that he perceived this issue was of importance to most islanders and that psychologically it would aid in the acceptance of the project. He felt that it was crucial that the energy created is not sent to the mainland grid prior to being distributed across the island. He stated that:

"[It's important that it goes into] our grid here and stays in our grid, [and does] not [go] onto the grid outside ... It's a big issue for an islander... if we produce it here, and we make it and we [get the] support it to go with it, we have to see the benefit first before anyone else gets their hands on it, because it doesn't work the other way."

(Evan, energy planning workshop 2)

Building on Evan's statements, Philip described his understanding of the energy planning process for large energy infrastructures in Ireland saying:

"[I think the electricity created] ... goes into the grid and ... [you get a] ... measurement of how much power was in it. And that is what you are paid on from the ESB, the normal arrangement is that they would say, Philip ... [has sent] ... 4KW yesterday ... [and they]... agree that you supplied them that much and you get paid for the extra. But ... in our plan we wouldn't be looking for that, that is not the way the we would want to go. it would take... probably ... political decisions to change ... [it so that our energy doesn't have to go into the ESB grid]."

(Philip, energy planning workshop 2)

Other concerns voiced by the participants included the suitability of some of the energy technologies suggested, more specifically the heat pumps that were proposed to supply hot water and space heating. Amy expressed her concern in relation to the use of heat pumps saying:

"... is it going to heat my house without any additional input?"

(Amy, energy planning workshop 2)

However, after discussion of how a heat pump operates, all participants were happy for them to be included in any proposed energy scenario for the island. After discussion of these initial reservations, the participants' narratives revealed that they were very satisfied with one participant stating:

"I'm waiting for the next ... because so far number two is winning!"

(Philip, energy planning workshop 2)

Another participant stated that the second technical energy plan proposal satisfied some of their concerns shared during the focus groups and individual interviews including the need for energy "backups" as described in Section 6.3. Amy stated that she was very impressed with the proposal saying:

"It ... [has] ... everything ... the backup to the backup."

(Amy, energy planning workshop 2)

After the discussion related to the second proposal was completed, the third and final technical energy plan scenario was presented for discussion. The third scenario, which comprised of the anaerobic digester prompted the most questions and discussion from the participants. The participants' narratives revealed that all participants were supportive of the final proposal with some of the participants saying:

"It is fantastic!"

(Evan, energy planning workshop 2)

"The third idea there . it's really a great idea, you know ... I hadn't thought of that one now I must say."

(Philip, energy planning workshop 2)

The participants’ narratives revealed that they were especially impressed with the fact that the third proposal also solved the problem of waste on the island. Several of the participants explained that they were dissatisfied with how their biodegradable waste was sent to Inis Mór to be converted into compost and sold. Philip, the co-operative manager, spoke about his dissatisfaction with the amount of waste that is transported off the island every week, although he stated that the exact amount of waste is not recorded at present. He explained that:

“The amount of waste and the amount of landfill waste coming off of Inis Oírr... it’s very bad … And, we were saying that some of that is actually food waste over the summer because we have no way of using that food waste … All this food waste that is going into the landfill … and they are using 100% of it in Inis Mór, 100% of all their food waste is going to the composting machines. All the cardboard we supply them is going there as well ...and …. they do sell a lot of it ... for Inis Oírr … we were … looking at... at a way to try and (move) the food waste from Inis Oírr altogether.”

(Philip, energy planning workshop 2)

Although the majority of the participants were supportive of the third proposal, one of the participants expressed his concern that there would not be enough biological waste to supply the anaerobic digester. Mitch spoke about how gathering waste from their livestock would be a problem saying:

“Calves here are not in the sheds, they are all in the fields … so I can't see us going around with buckets …collecting!”

(Mitch, energy planning workshop 1)

The discussion then moved on to centre on what types of waste could be used in an anaerobic digester including food waste. This discussion prompted other questions from the participants including Martha’s question;

“ .how to you get the … [food waste] ... from peoples places into it?”

(Martha, energy planning workshop 1)

The majority of the conversations about the proposal were related to the technical aspects of the proposal and how this might affect how they would use energy if it was installed. Amy was concerned about whether the proposal would create more largescale infrastructures on the island asking:

"Those digesters ... is that centralised? ... is it like plugging back into the grid? And would the electric infrastructure be able to facilitate that? [And] …is it not separate lines going around the place?"

(Amy, energy planning workshop 2)

The participants' narratives revealed that there was a high level of support within the participants towards the third proposal. The participants narratives revealed perceptions that their knowledge shared during the focus groups and individual interviews had been listened to and that their input had been prominent in the co-creation of the draft technical energy plans. When the energy planning workshop was completed, all participants were in agreement about the suitability of the third proposal. Philip proposed that more study is needed to be undertaken in relation to the third proposal saying:

"…where to begin … the more I thought about it afterwards, we haven't really quantified the amount of waste that we would have... But there is no point in talking about it unless we know."

(Philip, energy planning workshop 2)

After completion of the technical energy planning workshop, the participants were then asked to complete a short feedback survey on the consultation process. The questions contained in the survey ranged from questions about whether the participants felt that they were listened to, to questions related to their perceptions of the consultation methods employed in general. For the most part, the feedback from the participants was positive, with some shortcomings being cited that more focus should have been placed on the financial aspects of the proposals and another saying that some of the topics that were discussed could have been more interesting. The participants' narratives revealed that from the beginning of the data gathering process, the participants were happy to be taking part in the research project. During the individual interviews, some of the participants expressed their gratitude for the undertaking of the project with one participant stating:

"Thank you for picking the island … we are lucky you didn't go to Inis Meain or to Inis Mór."

(Anita, individual interview)

This sense of gratitude was also apparent in the participants' narratives throughout the energy planning workshops with one participant stating:

"… you have done a great piece of work!"

(Evan, energy planning workshop 2)

Although the participants' narratives revealed their satisfaction with the process involved in the co-construction of their situated energy knowledges and the co-creation of the draft technical energy plans. However, some stated that they found the amount of information shared overwhelming with one participant explaining:

"It's hard to digest all the information …."

(Martha, energy planning workshop 1)

Although the participants were complimentary of the consultation process, several were keen to outline some of the shortcomings in the process. Amy felt that although the interview process was useful, it would be difficult for some participants to envision an energy plan due to what she perceived as their lack of energy knowledge. Amy argued that:

"…the way you had your fourteen categories … were those the things that were mentioned by the participants?... and …It was just things the people said naturally in the course of the discussion? … I get how you have done it ... that makes total sense. But [only] for us as people who would know [about energy and not the others] …"

(Amy, energy planning workshop 2)

As can be seen from this empirical evidence, the participants enjoyed the process and were supportive and accepting of the technical energy planning process developed and tested in this research. This chapter revealed the importance of understanding situated energy knowledge and the value of their inclusion in technical energy planning. This chapter also revealed the participants' capacities to engage in low carbon energy transition planning for their community. This chapter critically assessed the transdisciplinary methodology developed for this work and revealed the capacity of these processes of co-construction of situated energy knowledge, mutual learning among stakeholders and co-creation of technical energy plans scenarios to create holistic and integrated low carbon energy transition plans with shared consensus among stakeholders.

9.6 Conclusion

This chapter began by revealing the participants' perceptions of what a low carbon energy transition for Inis Oírr should mean. Concepts of Inis Oírr's low carbon energy transition ranged from obtaining energy independence and being cost effective to the participants being able to fix technologies themselves. Building on the empirical findings from Chapters Six, Seven and Eight, a table of characteristics for the development of a low carbon energy transition in the case study community was developed and discussed in this chapter. Several technologies were critiqued using this table in order to determine their suitability for the case study community. Following this, HOMER technical energy simulation software was used to simulate three draft technical energy plan proposals for the case study community and the results of this were also discussed. The first scenario was designed without acknowledgement of the empirical evidence while the second scenario was designed to include the participants' situated energy knowledges. The third, and most popular scenario among the participants, was designed to include findings related to the participants' situated energy knowledges and empirical findings from discussions of their local knowledge in general. This chapter also discussed the participants' perceptions of the energy planning process developed for this research, which were largely positive, and revealed how the participants expressed satisfaction with the outcomes of the project. Leading to a significant contribution of this research, this chapter reported on how the transdisciplinary methodological approach developed for this research successfully combined two traditionally divergent epistemologies and disciplines to create a successful, holistic technical energy planning process. This chapter revealed the synergies between the two disciplines with equally interesting findings from both. This illustrated how the development and application of the transdisciplinary approach provided tangible evidence to phenomena that participants spoke about in an abstract way. As described in Chapter Eight, community low carbon energy transitions must be inclusionary of all types of knowledge to be successful. Building on this, and leading to another key contribution, this chapter revealed the participants' capacities to successfully and actively contribute to, and engage in, technical energy planning for their community low carbon energy future.

Chapter Ten: Conclusions, Future Research, Reflections and Policy Recommendations

10.1 Introduction

This study investigated the role of situated energy knowledges and CKNs Inis Oírr's transition to a low carbon society. This research revealed the importance of social scientific approaches to the energy problem and the complex social and spatial construction of understandings of energy and energy demand. Simultaneously, it also assessed the effectiveness of utilising divergent epistemologies and disciplines to approach community low carbon energy transitions in a holistic manner. In employing an innovative transdisciplinary social scientific and engineering approach to evaluate individual and community understandings of energy, this research delved into new territory in creating holistic understandings of community low carbon energy transitions. The transdisciplinary, post-normal science approach employed in this research highlights the increasing urgency to determine how social scientific and engineering approaches can be combined in order to address low carbon energy transitions from multiple disciplinary perspectives. This research therefore sought to explore how a social constructivist perspective embedded in a transdisciplinary, post-normal science approach could be undertaken and what insights into processes influencing perceptions of energy within island communities might be revealed.

This chapter presents the main conclusions of this study, along with recommendations for future work, its range of contributions and implications for policy development. Chapter One described how a key aim of this research was to design and apply a transdisciplinary, post-normal science, problem-centred and holistic approach to the analysis of the role of situated energy knowledges and CKNs in low carbon energy transitions in island communities. Four research questions were developed in order to outline the specific areas to be investigated as follows:

1. How is energy understood by people in island communities in their day-to-day practices?

2. What are the key processes that influence situated energy knowledge development and community knowledge network maintenance within island communities?

3. What role do situated energy knowledges and community knowledge networks play in island communities' transition pathways to sustainable, low carbon societies?

4. What new knowledge can be developed from applying a transdisciplinary approach to the analysis of situated energy knowledge development processes within the case study island community?

This thesis designed, applied and analysed a transdisciplinary methodology to facilitate the inclusion of situated energy knowledges into the energy planning process of community low carbon energy transitions. The purpose of this thesis was to create outputs in the form of empirical findings, technical products and methodological processes. The empirical findings focused particularly on the role of situated energy knowledges and CKNs in development of the participants' perceptions of energy in their daily lives. The technical products developed comprised of the draft technical energy plan scenarios for the case study community, which can provide insights for the case study community, policymakers and academia, on how to encourage more participative community low carbon energy transitions. In terms of the methodological process related outputs, this research aimed to make a practical, transdisciplinary methodological contribution in the form of a transdisciplinary methodological framework to guide transdisciplinary explorations of community low carbon energy transitions. This research also puts forward innovative energy plan scenarios that were based on quantitative and qualitative findings.

This chapter evaluates the work, highlighting the key results and outlines the work's key theoretical, methodological and policy related contributions. This chapter argues that although there are several limitations to the study, the empirical findings from this research successfully address the research questions outlined in Chapter One. Research Question One was addressed in Chapter Six which discussed individual understandings of energy in the participants' daily lives. Research Question Two was addressed in Chapter Seven, which analysed the processes involved in the development of situated energy knowledges and CKNs in the case study community. Research Question Three was discussed in Chapter Eight which assessed how situated energy knowledges and CKNs affected the participants' perceptions of community energy projects and energy governance. Research Question Four was addressed in Chapter Nine, which analysed the findings related to the transdisciplinary approach employed in this research along with the participants' perceptions of the transdisciplinary process itself. Having reported on the quantitative and qualitative results during the results and discussion chapters, this chapter aims to reflect on overall conclusions and the methodological process itself. The first section of this chapter, Section 10.2, summarises the study's main findings and arguments. Sections 10.3.1 to 10.3.3 outline the theoretical, methodological and policy contributions of this research. Following this, Section 10.4 discusses the implications of this study for the case study community itself, while Section 10.5 evaluates the study itself and assesses its limitations. Section 10.6 outlines the proposals for future work and Section 10.7 describes the conclusions for this chapter. The empirical results presented in this study highlight how it was successful in its assessment of the role of situated energy knowledges and CKNs in developing participants' understandings and perceptions of energy. This thesis also highlights the benefit of utilising a transdisciplinary approach when undertaking research in the area of community low carbon energy transitions. However, although this chapter argues that this research successfully answered each of the research questions set out for this thesis, this study was not without its limitations and these are addressed in Section 10.5. The main arguments and findings of the study are outlined in the following section.

10.2 Summary of the Main Arguments and Findings

This study investigated current island community understandings of low carbon energy transitions and how they are socially, culturally, spatially and politically constructed. As described in Chapter Two, policy responses in Ireland have been inadequate in facilitating community low carbon energy transitions effectively. The aim of Chapter Two is to examine policy responses and perspectives of community low carbon energy transitions in the Irish context. This chapter provides an extensive review of the literature on community low carbon energy transitions and the varied way in which the concept is conceptualised within policy in Ireland. This section also outlines the key challenges experienced in the transitioning process and current forms of policy responses. This chapter also describes the initial fieldwork studies undertaken in Denmark and Ireland assessing relatively successful low carbon transitions and its influence on the research design. Building on the findings from these initial fieldwork studies, this chapter argues that low carbon energy transitions are socially constructed and criticises Irish policy's approach to community engagement. Defining community low carbon energy transitions is a focus of this chapter and this provides a foundation for the rest of the thesis. This chapter also outlines how for the context of this research, energy use was understood as a set of practices that combine skills, material conditions and meanings which are embedded in wider social, institutional and political contexts (Shove and Walker, 2014). Low carbon energy transitions are defined in this thesis as the process of decarbonising the energy system through the shift from fossil to low carbon energy sources coupled with a reduction of energy consumption. This chapter also addresses the forms, functions and levels of energy consumption which are defined at the individual, household, community and national level. Chapter One highlighted how current patterns of household energy consumption in Ireland are exceeding the earth's resource capacity, contributing to problems of climate change and resource depletion. This chapter outlines how, despite these trends, there has been limited integrated research on the social and contextual circumstances that shape community low carbon energy transitions. This chapter reveals how traditional economic and regulatory policy tools in Ireland attempting to encourage a reduction in energy consumption in Ireland are not inclusive of social factors and neither is the information-deficit model upon which they are based (Catney et al., 2013). This chapter argues that conventional policy strategies fail to acknowledge the socially constructed and situated nature of energy and the myriad of community perspectives on energy.

Chapter Three describes the three sensitising concepts used to guide this research: knowledge, governance and communication. This chapter reveals how knowledge is situated, socially constructed and never static through the presentation of a comprehensive review of literature. This review of literature reveals the importance of acknowledging the different epistemological positions in community low carbon energy transitions and the unique role of local knowledge in these transitions. This chapter also argues that knowledge plays a key role in communities' participation in community low carbon energy transitions. When discussing governance and communication, this chapter argues how existing organisational processes within communities are important in transitions to low carbon energy societies. This section describes the concept of "Community Knowledge Networks" (Catney et al., 2013) and their important role in situated energy knowledge development. The current public consultation process in Ireland and its lack of inclusion of local knowledge is then critiqued. This chapter also argues that more collaborative and participative approaches can lead to increased integration of local knowledge for more successful low carbon energy project development. Following these arguments, existing governance structures at national, local and island levels, are critically assessed and it is argued that the traditional universal approach does not effectively deal with situated energy knowledges.

Chapters Four and Five outline the research design and the depth and complexity of the transdisciplinary methodological process designed, tested and assessed in this research. Chapter Four concentrates more particularly on the influence of geographic location on the participants' daily energy practices and the current state of energy research in island communities. This chapter reveals the rationale behind the selection of an island as a case study for investigating low carbon energy transitions due to its geographic remoteness, uniquely situated energy knowledges and strong CKNs. This chapter also describes the case study community itself and the rationale behind its selection. This chapter explores the use of a social constructivist perspective embedded in a post-normal science approach, and how it informs the development of the transdisciplinary methodological approach.

Chapter Five describes the transdisciplinary research design, which is concerned with developing a transdisciplinary methodological approach that can sufficiently deal with the varied aspects of island community low carbon energy transitions while addressing the theoretical approaches outlined in Chapter One. A transdisciplinary approach is crucial for investigating the complex issue of community low carbon energy transitions. This chapter outlines six criteria for the development of the research design based on the literature review and research questions. These are: a problem-centred approach, - an approach that transcends disciplinary boundaries, - a holistic, place-based approach, - an in-depth, collaborative and experienced based approach, - an integrative approach and an iterative and reflexive approach. The differing disciplinary approaches to community low carbon energy transitions are then discussed as are their appropriateness for the analysis of community understandings of energy. This section also suggests the importance of the emerging concept of the transdisciplinary individual as crucial to successful energy research and enabling a methodological approach that combines differing disciplines and epistemologies simultaneously. Following this, this chapter describes the implementation of the methodology including the surveys completed by 53 participants, focus groups with 20 participants, individual interviews with 29 participants, energy planning workshops with 12 participants and the exploration and analysis of secondary materials. This chapter also outlines how the technical aspects of this methodology involved the co-creation of three draft technical energy plan scenarios for the case study community, using technical energy plan simulation software. Interestingly, this chapter reveals how the mix of social scientific and engineering techniques created findings that were both qualitative and quantitative in nature. This created a holistic transdisciplinary methodological approach, which gave meaning and context to the material gathered and explored.

Chapter Six, focusing on Research Question One, investigates how participants understand energy in their day-to-day energy practices and reveals how these understandings were varied and wide ranging. This chapter describes the current energy landscape in Inis Oírr followed by discussion of the technical findings developed in the study and its relationship to the participants' daily lives. This chapter describes the energy demand profile of Inis Oírr and reveals its divergences from demand profiles on mainland Ireland. This chapter also describes how in order to effectively determine the current energy profile in Inis Oírr, a proxy energy demand profile was developed. One of the limitations of the project was the difficulty in accessing electricity demand data for Inis Oírr. Due to difficulties in accessing precise electricity demand data, a proxy electricity demand profile was developed from the electricity demand data from the neighbouring island, Inis Mór. This proxy electricity demand profile revealed that there is a huge spike in electricity demand experienced in Inis Oírr in June, July and August as a result of the high influx of tourists during this time. The proxy daily electricity demand profile for Inis Oírr was flatter and more constant that the daily demand profile in mainland Ireland. Again, a level of approximation was needed for determining the hot water demand and this was undertaken with the use of approximated hot water demand per person, creating, again, an approximated hot water demand profile for Inis Oírr. The space heating demand profile for Inis Oírr was not available, and again a level of approximation was required.

The development of the energy demand profiles for Inis Oírr revealed the unusual energy practices on the island and the greater demand for energy during the summer months, which must be acknowledged when designing an energy plan for Inis Oírr.

Following the description of the current energy demand profile for Inis Oírr, Chapter Six explored the participants' situated and technical understandings of energy. This chapter explores the impact of the electrification of the island in the 1970s on the participants' perceptions of knowledge. This chapter also reveals how the island's electrification (several years after it had happened on mainland Ireland) is still vivid in the mind of several of the participants, with memories of frequent electricity blackouts on the island still influencing their energy practices. Participants' narratives revealed that how concepts of "forward-planning" and energy "backups" to cope with erratic weather and the possibility of electricity blackouts moulded their perceptions of energy and their energy practices. The participants had varied concepts of what technical energy information was, and this ranged from the ESB's feed-in tariffs to understandings of how specific technologies operate. This chapter reveals that participants found technologies that operated locally easier to understand than those that were centralised and externally governed. Participants' narratives revealed that their knowledge of the practicalities of technologies were developed through experiential knowledge and moulded by their CKNs. The participants described how their technical and practical knowledge of several energy technologies were experiential based and socially constructed. Perceptions related to external insulation in particular, were described as being socially constructed within their CKNs. Participants described how their perceptions of external insulation were developed without experiential knowledge of their operation, but rather from anecdotal evidence shared within their CKNs. Participants' narratives revealed how these CKNs enabled knowledge sharing related to their specific situation and the suitability of the technologies to their needs, with this type of knowledge being held in more regard than others. This chapter also reveals how policy implemented on mainland Ireland had significant impacts in the island community, particularly related to the NCT test and car ownership on the island.

The purpose of Chapter Seven is to understand the participants' perceptions of energy and local knowledge and to determine the key processes that influence their development.

This chapter revealed how understandings of energy were predominantly context specific while also being wide ranging. Perceptions of energy ranged from how energy is consumed to how it is produced and what this means. The participants' narratives revealed that issues related to energy need to have an impact on their daily lives for them to take action. This resulted in fewer variations in how energy was defined, with technical definitions for energy being cited most commonly. In contrast, local knowledge and defining their energy practices entailed a myriad of interpretations on the part of the participants, due to their spatial and social construction. These ranged from understanding that one has to be adaptive when living on an island to knowing about community networks and culture within a community. Several participants argued that local knowledge was essentially about knowing about life in Inis Oírr. The concept of needing to forward plan was again discussed with several participants explaining that they had many modes of hot water provision to account for electricity blackouts. The participants also explained the importance of being able to fix technologies themselves as coping strategies for when weather prohibits travel to the mainland. This chapter discusses how participants' narratives revealed their attachment with place and perceptions of a legacy of needing to fight for survival, which created a feeling of marginalisation by those in authority. These feelings of marginalisation also created concerns within the participants about maintaining the population of the island. Narratives revealed that these feelings have created a mistrust of those in governance leading to a lack of engagement or faith in the consultation process itself. Due to the insular and uncontested nature of the CKNs within the case study community, the participants' narratives revealed perceptions that local knowledge was of more value to their specific situation than expert knowledge. The participants argued that local knowledge created adaptive energy strategies that were crucial to their survival during the winter months. Similarly, several participants were unhappy that problems in energy provision in mainland Ireland often affected them. Their perceptions were that the electricity supply for the island should be independent and the responsibility of the island community.

Chapter Eight was particularly concerned with the role of governance and communication within the case study community. This chapter explored the use of existing organisational structures within communities and their role in community low carbon energy transitions. Several of the participants spoke about perceptions that the co-operative represented them in governance processes that they would be excluded from otherwise. However, other participants who were active in the energy co-operative of the three islands described their reservations over the existence of the co-operative structure as they felt that it allowed others to relinquish responsibility for their energy governance. Several participants cited their reservations about the universality of external governance and their perceptions that there was no “forward-planning” for the island on the part of mainland governance. This corroborated a previously articulated narrative that universal governance was ineffective for their specific situation and that it increased perceptions of marginalisation. Perceptions of the shortcomings of public consultation processes that the participants had experienced in the past, and their perceptions of insider/outsider dynamics in the process, created wariness towards participation in the future. Discussions as to whether local knowledge or expert knowledge was important revealed perceptions that both are equally important in undertaking effective low carbon energy transitions. Several participants described the importance of situated experience within their specific context of island communities. The participants’ narratives revealed how when the importance of their situated knowledge is not recognised, it led to mistrust of those in authority. Several of the participants described how they were wary of consultants and “outsiders” coming to the island and prescribing universal solutions for their situation. This wariness stemmed from perceptions that local knowledge was not respected and that the language used to describe and discuss the proposals were not accessible for the general community. The empirical results described in this chapter revealed how when engaging communities in low carbon energy transitions, past experiences of large infrastructure planning and engagement with authorities must be taken into account. These experiences create an image and perception within CKNs that can negatively affect future proposals, regardless of the type of infrastructure. The participants’ narratives revealed how perceptions of marginalisation had adverse effects on all interactions with outside authorities due to the nature of CKNs within the case study community. Several of the participants described their perceptions that the current form of public consultation is just a “box-ticking exercise”. They also argued that information is often misrepresented in EIS and consultation was understood as not being inclusive, but that they were being “consulted” on a finished plan that was not going to be altered. The participants described a past example of the pier and how it left participants wary of public consultation processes as they felt that their research was not being listened to by those in governance.

Participants also had perceptions of “vested interests” in the planning process and described how they were wary to engage in these processes in the future.

Building on the findings outlined in Chapters Six, Seven and Eight, Chapter Nine critically assesses the transdisciplinary methodology developed for this research to co-create Inis Oírr’s low carbon energy transition. This chapter was concerned with the participants’ understandings of what a low carbon energy community should mean and their motivations for its development. The most popular of these motivations was the desire for affordable energy and energy independence from mainland Ireland. Other motivations included the desire to create other industries that are not related to heritage tourism but rather energy tourism, similar to the Danish case study outlined in Section 2.4. The first focus group, comprising of those that considered themselves to have a significant amount of energy knowledge, revealed how their knowledge of low carbon energy transitions was developed through visiting other communities that had undertaken low carbon energy transitions. Their narratives revealed how they were keen to emulate some of the techniques Samsø Island had employed, but were aware that Samsø had considerably more support from government. Building on these findings on the technical and situated understandings of energy, this chapter investigates the participants’ concepts of what a community low carbon energy transition would mean for them. The participants’ narratives revealed how these ranged from affordable energy to being able to manage and fix technologies themselves. The motivations for transitioning to low carbon energy communities are also described in this section with several of the participants explaining the differences between their perceptions of what should be undertaken and their perceptions of what the government’s motivations for a low carbon energy project might be. The participants’ narratives revealed how motivations related to the development of low carbon energy transitions were heavily influenced by the participants’ situated knowledges and their incomes. Narratives revealed that negative perceptions of windmills were primarily related to perceptions that their aesthetics might negatively affect tourism income on the island and past experiences of wind turbines in their area.

Other empirical findings revealed that participants were concerned over division within the community in the form of divergent opinions of the most appropriate low carbon energy transition pathway. The participant's narratives revealed several issues related to the development of community low carbon energy transitions. These were varied and wide-ranging, revealing how the motivations for undertaking low carbon energy transitions are situated and socially constructed. This chapter describes the reductionist techniques utilised in order to use the social scientific findings to inform the technical energy planning aspect of this research. During this stage, a certain amount of researcher interpretation was needed in order to create a set of criteria for the development of the technical energy plan. To account for this, the proposed technical energy plan scenarios were presented to the case study community in order to ensure that the participants were satisfied with how their empirical evidence had been interpreted. During this stage of the research, the participants' narratives revealed a high level of understanding of the technical energy plans proposed, with several questions being posed by the participants about the technical specifics of the plans, highlighting their high level of technical energy knowledge.

Building on the empirical evidence and using NVivo software, several different categories were developed for the design of three draft technical energy plan scenarios for Inis Oírr. During the presentation of the three proposals, the participants voiced their opinions that the third proposal, which included the anaerobic digester, was most suitable to their location. The discussions related to this proposal, revealed the participants' high level of engagement, knowledge and participation when they perceived that their input was integrated into the process. The participants' narratives also revealed the perceived importance of keeping the electricity that any energy project generates within their own grid. These discussions were reminiscent of the earlier discussions of a desire for energy independence from mainland Ireland. The majority of the questions related to the proposals were about the technologies themselves and not specifically about the orga

nisation of the proposed project. This was perhaps because participants were relatively confident of the current organisational structures on the island. Interestingly, the participants spoke positively about the energy planning process itself with several expressing their gratitude for the study and for the integration of their knowledge into the process. The participants stated that they were happy with the process and would be willing to participate in a similar process again.

10.3 Theoretical, Methodological and Policy Contributions

10.3.1 Theoretical Contributions

This research engaged with the varied situated and socially constructed ways in which energy is understood by people in their daily lives. The social constructivist perspective allowed the exploration of the socially constructed perceptions of low carbon energy transitions and their association with CKNs. To date these issues, although being posed as areas of importance in academia and policy, have not been a focus of debates in community low carbon energy transitions. In assessing the two main theoretical contributions of this research, it is necessary to consider them relative to both social scientific and engineering fields of inquiry. As Chapters Four and Five describe, these approach the topic of low carbon energy transitions in very different ways. **Firstly, this thesis successfully forged a new method for addressing low carbon energy transitions using two disparate disciplines in a successful manner.** Recently, more research in the area of community low carbon energy transitions have attempted to assess low carbon energy transitions from a socio-technical perspective, but have lacked depth of inquiry related to local knowledge (Büscher and Sumpf, 2015). This thesis approached these questions in a very different way to standard practice through the use of multiple disciplinary lenses. This involved the rejection of the assumption that universal approaches to community engagement can be utilised in island communities, but rather that energy knowledge is situated and socially constructed. This approach involved dealing with how energy practices are understood by people in their daily lives.

The second major theoretical contributions of this thesis are the empirical results garnered from the island-based case study, which deepened insights into the need for socially, culturally and locally sensitive energy policy. This thesis revealed that energy understandings, perceptions and practices are complex and both socially, spatially and culturally constructed. The empirical results from this research revealed how perceptions at community level of energy governance in Ireland are largely critical, and participation in public consultation processes remain low. This study revealed that perceptions of the exclusion of local knowledge and situated energy knowledges are influential in determining levels of engagement within communities.

10.3.2 Contributions to Methodological Debates

In addition to its contributions to theoretical debates, the unique transdisciplinary methodological approach also has three main contributions to methodological debates in the area of low carbon energy transitions. This thesis assessed the implications of a transdisciplinary post-normal science approach with a view to interpreting its significance in understanding community low carbon energy transitions. This research study began with the defining of a set of research questions that dealt with knowledge and energy along with the transdisciplinary approach. **Firstly, this thesis developed, tested and assessed a novel and innovative transdisciplinary methodology and the lessons from this methodology may be useful to debates around low carbon energy transitions. This study provides evidence that transdisciplinary methods can provide data that is holistic, contextual, iterative and socially constructed.** This innovative methodology created data that was grounded in the participants' experiences and within their daily lives providing information on perceptions and understandings of energy within the case study community. This transdisciplinary methodology also revealed several issues when employing a transdisciplinary approach to low carbon energy transitions, including the need to employ reductionist techniques, the heavy time resources involved and the influence of researcher positionality on the process. **Secondly, the development and application of this transdisciplinary methodology revealed the crucial role that the development of relationships has in the successful facilitation of low carbon energy societies. Thirdly, the holistic, transdisciplinary approach proved successful in integrating situated energy knowledges into technical energy planning.** Due to the complex nature of the process developed in this research, and its success in merging two disparate disciplines, the creation of a transdisciplinary methodological framework was necessary for its illustration (as described in Figure 5.12). The transdisciplinary methodological framework illustrates the complexity of the process undertaken and the range of iterative, reflexive and integrative processes employed.

10.3.3 Implications for Policy

This section discusses the relevance of the three main contributions of this study for policy and policy formation in the Irish context. **The first contribution is the empirical findings which reveal the need for greater integration of situated energy knowledges**

into energy policy formation procedures and implementation practices in Ireland. This research reveals how enhancing the role of community engagement and community participation in energy infrastructure planning projects can greatly aid in their development as understandings of them are socially constructed. These social constructions of perceptions can influence community participation and reduce animosity towards large-scale energy infrastructures thus reducing opposition to these proposals. Empirical findings revealed that community participation was discouraged by past experiences of the public consultation process and perceptions of a lack of respect for local knowledge by those in authority. As described in Chapter Ten, this has emphasised the influence of CKNs on the socially constructed nature of community participation in public participation processes and energy governance.

Secondly, empirical findings also reveal that policy that attempts to alter energy practices and engage effectively with communities through increasing awareness must acknowledge place-based influences to be successful. This research revealed the importance of the acknowledgement of existing power dynamics and organisational structures when implementing low carbon energy transitions. Findings revealed that traditional top-down practices of community participation do not play an effective role in community low carbon energy transitions. Energy planning and public consultation techniques are mainly portrayed as objective and rational processes and engagement guidelines, although beneficial; do not provide in-depth insights into effective means of engagement (NESC, 2014). As described in Chapter Four, large energy infrastructures such as wind turbines, are often sited in rural areas which contain already marginalised communities (Walker et al., 2011). Empirical findings in this research provided new knowledge in the area of situated energy knowledges in isolated communities and its effect on participation. This research has revealed that current participation strategies, such as public consultation, do not facilitate the development of interpersonal relationships necessary for the development of trust in those in authority. **Thirdly, the transdisciplinary methodological framework contained in Figure 5.12 in Chapter Five is proposed as a tool to facilitate the inclusion of situated energy knowledges into energy planning processes.** Findings suggest that, when developing large-scale infrastructural developments and attempting to encourage changes in energy practices, communities must be engaged from an early stage. Building on the critique of the SEAI’s

"*Guidelines for a Sustainable Energy Community*" in Chapter Two, this transdisciplinary methodological framework implies that the existing framework developed by the SEAI should be reconsidered in order to include communities' situated energy knowledges earlier in the energy planning process. Establishing opportunities for mutual learning and co-creative energy planning earlier in the energy planning process can help to reveal the energy planning capacities of the communities involved. Findings revealed that through the use of transdisciplinary approaches, community knowledge and perspectives can be integrated into effective energy planning at a local scale.

10.4 Revealing Inis Oírr Community's Capacity to Engage in Planning for their Low Carbon Energy Future

In addition to its contributions to theoretical and methodological debates, this research also makes four meaningful contributions to the lives of the participants in Inis Óirr. This research study began by acknowledging the value of the situated energy knowledges of the participants. During the enlistment phase of the project, the participants were informed of the purpose of the project, and the researcher explained they were considered the experts on energy planning for Inis Oírr's low carbon energy future. The participants responded positively to this, creating a more open and engaged energy planning process. **The first contribution of this thesis is that it went beyond current policy rhetoric of community engagement and was inclusive of the participants' contributions.** During the energy planning workshops, the researcher revealed the process of inclusion of the participants' contributions and their influence on the outcome of the energy planning process. **The second contribution of this thesis are the findings from the transdisciplinary methodology applied and tested in this thesis which reveal to the researcher, policymakers and the community, the participants' capacities to engage effectively in planning for a low carbon energy transition within their community. Thirdly, this research also revealed multiple appropriate pathways for Inis Oírr to transition to a low carbon future that is suitable to their daily energy practices and understandings of energy.** Another output of this research is the development of a report for Inis Oírr island, detailing the co-creative energy planning process based on mutual learning, and the technical energy plan scenario that was the outcome of this. It is envisaged that the innovative approach developed in this research will reveal to funding bodies in Ireland the capacity for Inis Oírr to engage in the design of a suitable energy plan that garners the support of the community. **Finally, the transdisciplinary methodology employed in this research revealed avenues for Inis Oírr community, and other communities, to become more active in planning for their low carbon energy future.** This research also revealed to policymakers that engaging communities early in the energy planning process can provide meaningful insights into their daily energy practices to provide a richer more feasible energy plan.

10.5 Evaluation and Limitations of the Study

Despite careful design of the fieldwork and the triangulation of methods, there were still challenges in the implementation of this transdisciplinary approach. Working within one case study community provided situated individual and group understandings and perceptions of energy within island communities. In-line with all case study research the findings revealed may not be representative of perceptions and understandings of islands elsewhere in Ireland. Although the sample size in this research was significant as it represented 25 per cent of the population of the island, this cannot be deemed to be representative of the island as a whole, but can aid in developing themes as findings from this research.

As described in Chapter Five, the development of strong relationships are crucial to effective transdisciplinary research. The development of these social connections with participants, although it led to a more collaborative research exchange, greatly increased the resources needed to undertake this research. During the course of this study, there were several instances where the benefits of developing interpersonal relationships were evident through the open and engaged participation of the participants. In order to elicit tacit knowledge, the researcher endeavoured to socially engage with the participants to develop strong relationships. This was done through attending community social events with the elderly, visiting the school, maintaining an office in the co-operative offices to socialise with people as they purchased their fuels, social interactions in the local café's and bars, attending local sports events and visiting the participants houses for tea and biscuits. The high level of trust that these social encounters developed became evident during the qualitative data collection and as the methods progressed from focus group dynamics to individual interviews, the participants began to reveal more intimate details and perceptions of their understandings of energy. However, the influence of these social connections was also present during the writing phase of the thesis, and there were several instances where the researcher's writing began to sound advocatory towards the participants when describing some of their past experiences of the public consultation process. The resource intensive nature of this transdisciplinary approach limits its upscaling as this study involved a considerable amount of travel to the island by boat, a basic level of the Irish language had to be learned and, due to the small and close-knit community on the island, considerable time had to be spent developing interpersonal relationships. However, the transdisciplinary methodology can be upscaled, by utilising the framework described in Figure 5.12 in Section 5.3.

To facilitate effective merging of the two disciplines, reductionist techniques needed to be applied to the empirical results in order to create the table of characteristics outlined in Chapter Six. In order to account for the researcher's positionality in the interpretation of the results energy planning workshops were undertaken. The focus of these was to determine whether the participants felt that their narratives had been interpreted effectively. The participants' narratives during the workshops revealed their perceptions that the data from their focus groups and interviews was analysed effectively. Although the participants expressed their satisfaction with the outcomes of the study, the resultant energy plan would not have been possible without the input of the researcher, which may have influenced the solutions designed to meet their energy needs Several scenarios were proposed in an effort to allow participants to engage in the energy planning process in order to overcome these issues.

Similarly, there were several issues with the development of the technical energy plans for the case study community. As described in Chapter Six, there were limitations in relation to the gathering of data for the energy planning software. The difficulties in gathering this data led to the development of proxy data for Inis Oírr's electricity demand profile from the demand profile from the neighbouring island. The use of the Irish language was another limitation in the undertaking of the investigations and the qualitative data gathering. Two participants originally from mainland Ireland, whose primary language was English, were keen to undertake the interviewing process in

English. The majority of the other participants were happy to undertake the interviewing process in either English or Irish. However, several of the older participants spoke about how Irish was their first language but that several of the items related to engineering are always discussed in English, making them more difficult to understand. In order to addresses this issue, as described in Section 5.4, the researcher learned a basic level of Irish in order to make the participants more comfortable with the research process and to communicate more effectively.

Another potential limitation to the methodology employed in this research is that participants may have over emphasised the occurrence of electricity blackouts within their community as perceptions of these are developed within their CKNs. However, this perceived over emphasis does not negate the findings related to the blackouts, as their perceptions of the legacy of these blackouts has created an adaptive capacity within their day-to-day energy practices. A related issue was the participants' need to portray themselves as being on the fringe of energy policy processes in Ireland. This is related specifically to participants' descriptions of themselves and their identification as islanders, as culturally separate from those in mainland Ireland. These perceptions of themselves as being different and unique emboldened a certain pride on the part of the participants, which was reflected in their descriptions of themselves as being marginalised, and that their lifestyles are difficult to understand. The participants' narratives revealed perceptions that universal approaches were not suitable to their situation. These perceptions might be caused by the participants' perceptions of being different from communities in mainland Ireland and feelings that this should be reflected in policy approaches. However, this limitation should not negate the need for more nuanced policy making with situated energy knowledge being considered within the process. The use of the snowballing sampling method when enlisting participants for the study created a risk that only those that were active and interested in community low carbon energy would become engaged in the project. This is because those that are engaged in energy projects might recommend those that are already active in energy projects. Several participants recommended participants for inclusion that they deemed to be quite knowledgeable about energy and were quite proactive about their energy practices meaning that perhaps it is not representative of those that are not. However, as described in Section 5.3.6 the sample size represented over 25 per cent of the island's population, so it can be assumed that with such a large sample a broad enough spread of participants has been achieved.

Another limitation of this study was the lack of resources to realise the technical energy plan created with the community. While the thesis achieved its aims, from an engineering perspective, considerably more needs to be done. Further resources are needed to follow-up this study to facilitate progression of the implementation of the energy plan for the island and significant funding is needed to make Inis Oírr's plan for a low carbon energy future a reality.

10.6 Proposals for Future Work

Although this study was successful in addressing its research questions, more could have been achieved if further resources had been available. As described in Section 10.5, there are many avenues for future research from both a social scientific and an engineering perspective.

To deal with challenges inherent in utilising interview techniques, qualitative researchers can reflect on the influence of interpretations related to their positionality and what conclusions can be drawn from this. During this study, findings revealed that one key area that might have been misinterpreted or misunderstood is the specific role that perceptions of marginalisation from the central power has on the community's propensity to engage in public consultation processes with those in external governance. Due to the development of strong relationships with the participants and the guarantee of anonymity within this research, participants were encouraged to be honest about their perceptions of these past public consultation issues. However, as with all PhD research, this is a description of only a snapshot in time. Therefore the researcher may have over described the concept of geographic marginality in the development of these negative feelings towards those in central power. This limitation suggests a need for further research within island communities that are ethnographic and long term in nature to avoid distortions of events within participation in large infrastructure projects. A comparative analysis of the role of situated energy knowledges and CKNs on energy practices across varied community configurations and cultures would provide more insights into how perceptions of energy are socially and spatially constructed.

During the write up phase of this research, Inis Oírr Island and the neighbouring island, Inis Meain, experienced an electricity power outage for five days due to damage to an undersea electricity cable (Duffy, 2016, Reporter, 2016). This was during the first week of August in 2016, which was Inis Oírr's peak tourism season. Newspaper articles reported on the negative effect of the blackout on the islanders' tourism revenue and how they coped with the electricity blackout (Quigley, 2016). An analysis of energy practices during this electricity blackout would give further insight in the nature of situated energy knowledges and CKNs within Inis Oírr. This would also enable the development of new knowledge and understandings of participants' adaptive energy strategies and their success during energy outages.

10.7 Conclusion

Despite this chapter outlining several limitations to the methodology used in this research, this transdisciplinary design can prove effective in increasing community participation in energy planning processes. This chapter argues that the empirical findings from this study effectively addressed each of the research questions defined. The empirical findings from this research reveal that this transdisciplinary approach, although time-consuming and intensive on the part of the researcher, can provide effective holistic approaches to designing and implementing low carbon energy transitions. The transdisciplinary methodological approach applied in this research revealed itself as a suitable methodology to explore communities' capacities to engage in effective and co-creative low carbon energy planning for their communities.

Although Inis Oírr is a small remote island off the West of Ireland, this research has created an innovative, cutting-edge energy plan for their low carbon energy future. This research produced an innovative energy plan for the island that is feasible and manifests the participants' situated energy knowledges into a coherent technical solution for their energy needs. As described in Section 9.5, the participants were extremely supportive of the energy planning process employed in this work and of the proposed technical energy plan. This research enables the community on Inis Oírr to pursue their aim of achieving energy-independence through the use of a feasible technical energy plan that already has the support of the community. During the energy planning workshops, Philip, the manager of the co-operative, stated that they were going to gather information on food waste in Inis Oírr so that a comprehensive design of the Anaerobic Digester can be created in the future. The participants in the energy planning workshop were keen to see the proposed energy plan come to fruition and were eager for the research to continue in their community. At the completion of the research project, the researcher left the island with plans in place to add to this body of research at a later date. Having strong ties with the participants of the study, the researcher felt that the community had been left with an innovative piece of research to help them in their low carbon energy transition along with the qualitative data to validate the findings. A new, co-creative and inclusive way of community energy planning emerged from this thesis, the formulation of which, both the researcher and the participants are responsible for. While still at the fringe of Europe, Inis Oírr is now at the cutting-edge of energy planning in Ireland with the tools to forge a new low carbon energy future.

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Appendix A: Informed Consent

Dear __________________,

Thank you very much for taking my survey on situated energy knowledges. I am very grateful for your help with my PhD research. Thank you also for agreeing to participate in the two focus groups and one interview and offering to share your knowledge. These focus groups and interviews will involve talking about the things that you currently do in your daily energy use, as well as looking back at how you have developed your energy knowledge over your lifetime. The focus group will take about an hour and a half and the interview will take about an hour. The focus group will be held on ____________________ at ________________ in _______________________ in Inis Oírr and light refreshments will be provided. As regards the interview, we can arrange a date, time and location that is convenient for you. I've attached an information sheet, which tells you more about the study, but feel free to contact me if you have any questions. You can email me at eimear.heaslip@research.gmit.ie, or call on (0861940919). Thank you again for participating in the research.

Best wishes,

____

Eimear Heaslip,
School of Engineering,
Galway-Mayo Institute of Technology

Discipline of Geography,
School of Geography and
Archaeology, NUI Galway,

Research information for focus-group and interview participants

Below is some information about the project. If you have any questions regarding the information, please get in touch using the details below.

Who is doing the research?

I am Eimear Heaslip, a postgraduate student from Galway-Mayo Institute of Technology and NUI Galway. This research forms part of my PhD work, which looks at people's energy knowledge in relation to their daily energy activities.

What is the purpose of this study?

This research aims to determine how and why people's knowledge and perceptions of energy are developed over their lifetime. This knowledge can include both practical knowledge (e.g. energy consumption, renewable energy technologies) and social group knowledge (e.g. energy awareness campaigns, energy planning and policy, involvement in group energy initiatives).

What will the focus-group involve?

The focus-group will take up to an hour and a half and will be recorded if you are comfortable with this. The focus-group will contain 5-7 other people from the community and will be held on ____________________ at ________________ in _______________________ in Inis Oírr where light refreshments will be provided. I will moderate the focus-group. The focus-group will involve talking about your perceptions and knowledge of energy. If you are uncomfortable with any questions you do not have to answer them in the focus-group.

What will the interview involve?

The interview will take up to an hour and will be recorded if you are comfortable with this. I will conduct the interview. The interview will involve talking about your daily energy activities and your knowledge of energy. We will also discuss where you get information on energy and how you use energy in your home (including an energy audit of your home).

What will happen after the focus-group and interview?

The information will be transcribed and your name and personal details will not appear on any part of the transcript. You can request a recording and/or interview transcript and they will be sent to you. Computer files will be stored on password-protected computers and only the researcher and supervisor will see the information. When the project is nearing completion, you will have the opportunity to see the results and to provide feedback on them.

Ethical standpoint

Your name will not be used anywhere within the research and quotes used in the PhD report or in other publications will be checked to ensure that they cannot be used to identify you. I will not use the information you provide for anything other than this project.

Appendix B: Counselling Contacts for Ethical Approval

When undertaking the interview in the participant's home

- Ensure that they are comfortable with this, suggest that the interview can be undertaken in another location if they would be more comfortable

- Allow the participant to dictate what elements of the energy efficiency of the house they reveal to you

- Arrange the meeting prior to the interview so that the participants are ready for the visit

- If other family members enter the room, pause the recording immediately

If a participant becomes distressed during the interview

- Stop recording immediately

- Allow the participant a moment, then ask if they would like to take a break from the interview

- If the participant is very distressed, suggest that the interview can be stopped and continued at a later date

- Furnish the participant with the information sheet containing counselling services in the area and inform them of how to avail of these services

- Ensure that they participant is fully aware of how to avail of these services

- Ensure that the participant is fully aware of their right to leave the study

Counselling services in the Galway region

Aware

The Aware Support Line 1890 303 302
Available Monday – Sunday, 10am to 10pm

Jigsaw Galway

Fairgreen Road, Galway, H91 AXK8
091 549 252

Pieta House West

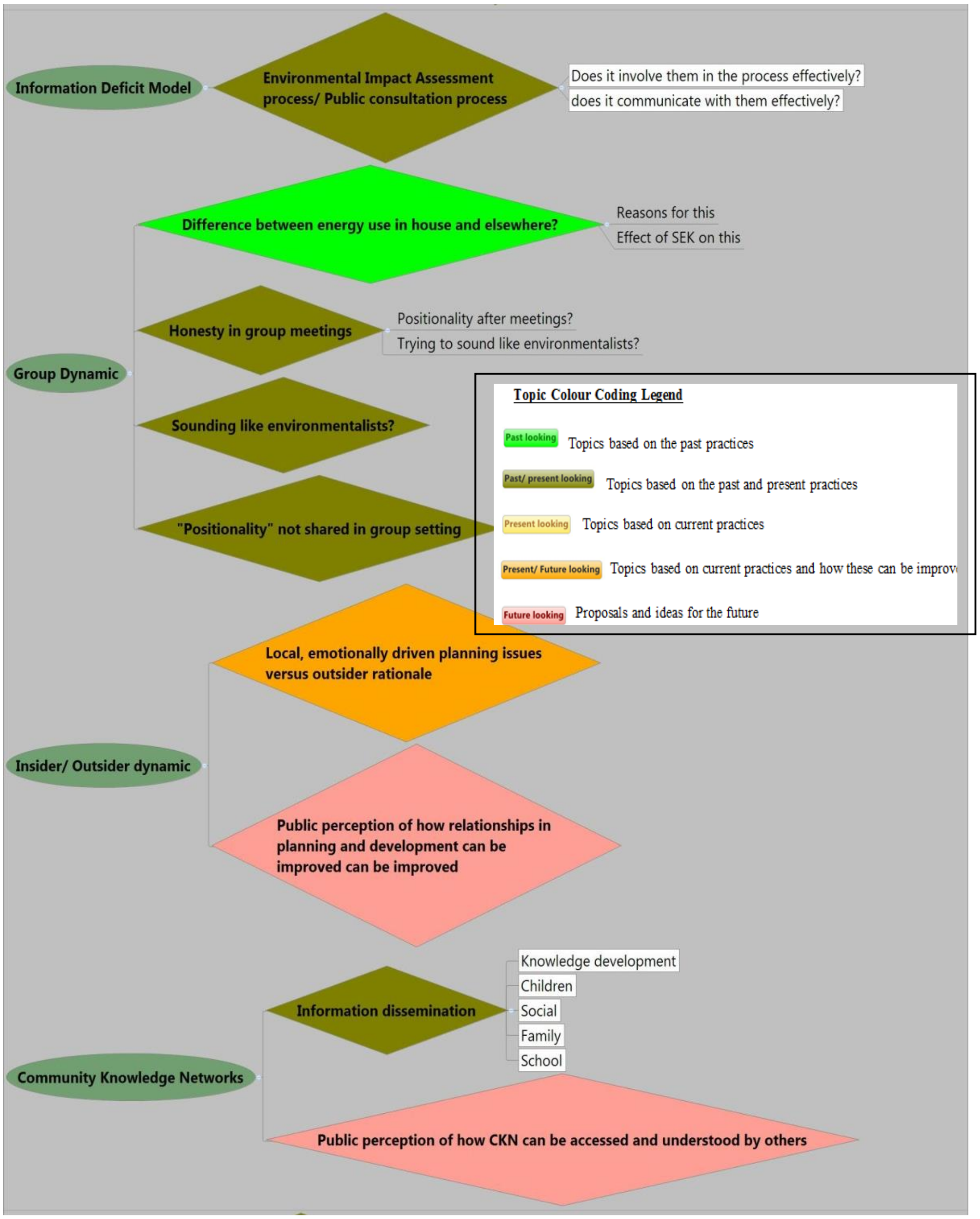
093-25586
Monday, Tuesday, Thursday & Friday: 9am to 5pm
Wednesday: 9am to 8pm
Saturday: 10am to 2pm

Samaritans

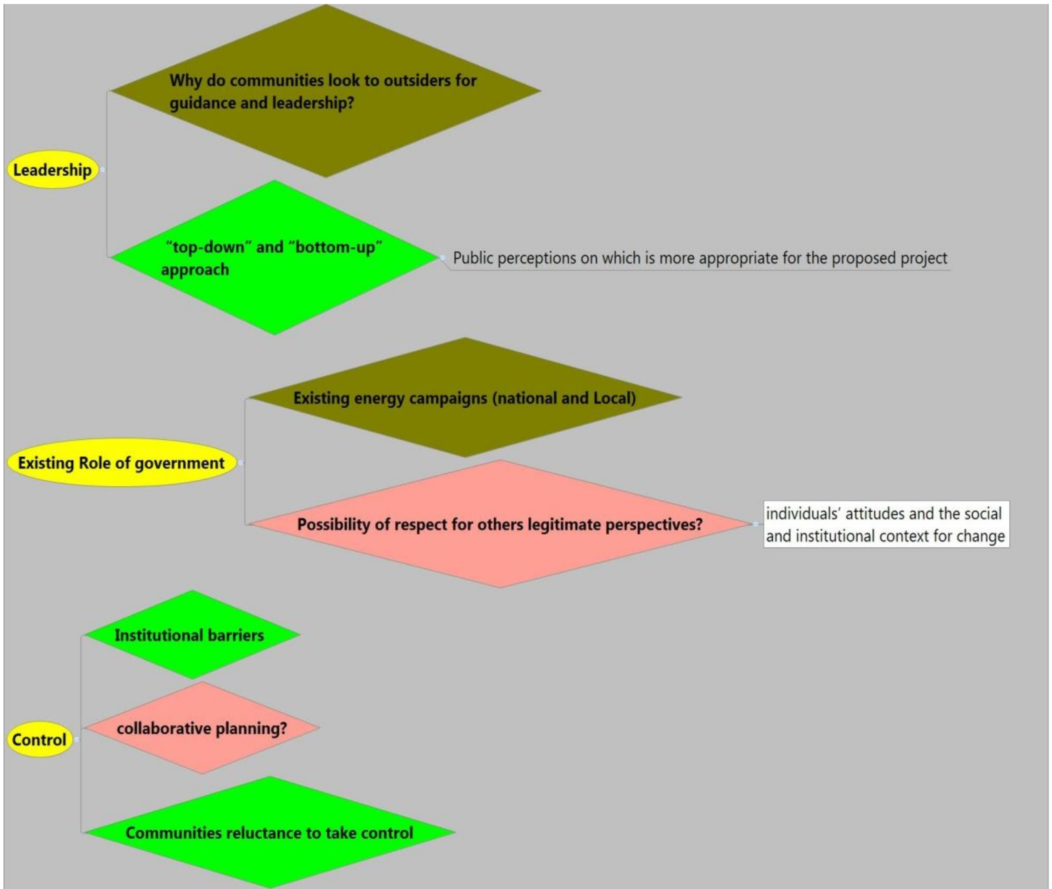
116 123

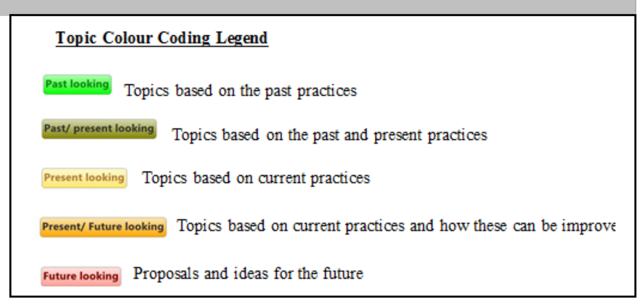
Appendix C: Topical Guides Developed for Analysis in this Research

Sensitising Concept 2: Governance



Sensitising Concept 3: Communication





Appendix D: Initial Survey – English Language Version

Thank you for taking the time to complete this survey, which is a part of PhD research by Eimear Heaslip of GMIT and NUIG.

How many occupants are within your household? ______________________________

What is your occupation? ____

Please rate the level of individual action you undertake aimed at deliberately reducing your energy use (for example, use energy efficient light bulbs, install renewable energy sources in your home).

Extremely low Extremely high

1 2 3 4 5 6 7 8 9 10

If you take individual action to reduce your energy use, please give examples of how and how often you do this (for example, changed all lights in your home to energy efficient lights, installing renewable energy sources in your home).

____
____
____

Please rate the level of group energy action you undertake aimed at deliberately reducing energy use (for example, taking part in community energy initiatives, talking to your neighbours about energy practices).

Extremely low Extremely high

1 2 3 4 5 6 7 8 9 10

If you undertake group energy action aimed at deliberately reducing energy use, please give examples of how and how often you do this (for example, go to a community energy group meeting – once a month).

____
____
____

How would you rate the opportunities for improvement in your level of energy use in your normal daily activities?

Extremely low Extremely high

1 2 3 4 5 6 7 8 9 10

What factors do you think influence your level of energy use most?

____
____

What is your estimated total average monthly household energy spend (including transport, electricity, heating etc.)? ____________________________________

What is your age?

☐ 18 – 24 ☐ 25 – 44 ☐ 45 – 64 ☐ 65 or over

Name: _________________________ Phone number: ______________________

Email address: ____

What is your gender? ☐ Male ☐ Female

Thank you very much for taking the time to complete this survey. If you have any questions please contact the researcher by email (eimear.heaslip@research.gmit.ie) or phone (086 1940919). Please tick the boxes below to confirm that you consent to have your responses used in this research.

☐ I consent to participate in survey research on situated energy knowledges and sustainable energy communities.

☐ I would be interested in having a conversation with the researcher about my daily energy practices.

☐ I understand that all information I provide is confidential and will not be seen or used by anyone other than the researcher and supervisors. I understand that the information will be used in a PhD thesis and related publications and that my name and other identifying features will not be used anywhere in these publications.

☐ I understand that I may withdraw from the project, so that none of my information is used, at any time until 31st October 2015.

Signed: __________________________ Date:____________________________

Appendix E: Initial Survey – Irish Language Version

Go raibh maith agat as am a chaitheamh chun an suirbhé seo a chomhlánú, ar chuid de thaighde PhD é le hEimear Heaslip de chuid GMIT agus NUIG.

Cé mhéad áititheoirí atá sa teaghlach? _________

Cén tslí bheatha atá agat? ____

Ar mhiste leat leibhéal na gníomhaíochta aonair a dhéanann tú atá dírithe d'aon ghnó ar úsáid fuinnimh a laghdú a rátáil (mar shampla, bolgáin solais atá tíosach ar fhuinneamh a úsáid, foinsí fuinnimh in-athnuaite a shuiteáil i do theach)?

An-íseal An-ard

1 2 3 4 5 6 7 8 9 10

Má ghníomhaíonn tú i d'aonar chun d'úsáid fuinneamh a laghdú, ar mhiste leat samplaí den chaoi agus de cé chomh minic agus a dhéanann tú é sin (mar shampla, na soilse go léir sa teach a athrú go soilse atá tíosach ar fhuinneamh, foinsí fuinnimh in-athnuaite a shuiteáil sa teach).

____

____

____

Ar mhiste leat rátáil a dhéanamh ar an ngrúpghníomhaíocht a dhéanann tú atá dírithe d'aon ghnó ar úsáid fuinnimh a laghdú (mar shampla, páirt a ghlacadh i dtionscnaimh fuinnimh pobail, labhairt le do chomharsana faoi ghnásanna fuinnimh).

An-íseal An-ard

1 2 3 4 5 6 7 8 9 10

Má thugann tú faoi ghrúpghníomhaíocht fuinnimh atá dírithe d'aon ghnó ar úsáid fuinnimh a laghdú, ar mhiste leat samplaí a thabhairt den chaoi agus de cé chomh minic agus a dhéanann tú é sin (mar shampla, dul ar cruinniú grúpa fuinnimh pobail – uair sa mhí).

____

____

Cén rátáil a dhéanfá ar na deiseanna atá ann le feabhas a chur ar do leibhéal úsáide fuinnimh sna gnáthghníomhaíochtaí laethúla de do chuid?

An-íseal An-ard

1 2 3 4 5 6 7 8 9 10

Céard iad na tosca dar leat is mó a imríonn tionchar ar do leibhéal úsáide fuinnimh (mar shampla, teaghlach mór a bheith agat, an teach inslithe go done, easpa feasachta/tuisceana maidir le caomhnú fuinnimh)?

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Cé mhéad airgid ar an meán a chaitheann teaghlach ar fhuinneamh in aghaidh na míosa? ____________________________________

Cén aois thú?

☐ 18 – 24 ☐ 25 – 44 ☐ 45 – 64 ☐ 65 nó níos airde

Ainm:__________________________ Uimhir theileafóin: ____________________

Seoladh rphoist: ___________________________________

Inscne le do thoil? ☐ Fireann ☐ Baineann

Go raibh míle maith agat as am a chaitheamh chun an suirbhé seo a chomhlánú. Má tá ceisteanna ar bith le cur agat, déan teagmháil le do thoil le rphost leis an taighdeoir (eimear.heaslip@research.gmit.ie) nó fón (086 1940919). Ar mhiste leat tic a chur sna boscaí thíos lena dheimhniú go bhfuil tú toilteanach go mbainfí úsáid as do chuid freagraí sa taighde seo.

☐ Táim toilteanach páirt a ghlacadh sa suirbhé taighde ar eolas áitiúil i dtaca le fuinneamh agus le pobail fuinnimh inbhuanaithe.

☐ Bheinn sásta labhairt leis an taighdeoir faoi mo cuid gnásanna laethúla fuinnimh.

☐ Tuigim go mbeidh an t-eolas go léir a thugaim faoi rún agus nach bhfeicfidh duine ar bith é agus nach mbainfidh duine ar bith úsáid as seachas an taighdeoir agus na maoirseoirí. Tuigim go mbainfear úsáid as an eolas i dtráchtas PhD agus i bhfoilseacháin ghaolmhara agus nach mbainfear úsáid as m'ainm agus as gnéithe aitheantais eile in áit ar bith sna foilseacháin sin.

☐ Tuigim gur féidir liom tarraingt siar as an tionscadal, ionas nach mbainfear úsáid as faisnéis ar bith de mo chuid, am ar bith go dtí 31 Deireadh Fómhair.

Sínithe: _____________________________ Dáta: ________________________

Appendix F: Focus Group Compositions

Focus Group 1 (Group Energy action rating of ≥ 8)					
	Pseudonym	**Occupation**	**Level of Group energy action**	**Age group**	**Gender**
1	**Martha**	Community development officer	10	> 65	Female
2	**Philip**	Manager of Inis Oírr Co-operative	9	45 - 64	Male
3	**Maeve**	Office worker	8	45 - 64	Female
2	**Evan**	Working in FÁS	10	45 - 64	Male
4	**Tadhg**	Hotelier	9	25 - 44	Male

Focus Group 2 (Group Energy action rating of ≤ 3)					
	Pseudonym	**Occupation**	**Level of Group energy action**	**Age group**	**Gender**
6	**Enda**	Hotelier	1	25 - 44	Male
7	**Margaret**	Office worker	1	25 - 44	Female
8	**Cathal**	Teacher	1	25 - 44	Female
9	**Malachi**	Recycling	8	25 - 44	Male
10	**Melissa**	Administrator and Secretary	1	25 - 44	Female

Focus Group 3 (Group Energy action rating of 1 - 5)					
	Pseudonym	**Occupation**	**Level of Group energy action**	**Age group**	**Gender**
11	**Amy**	Owns a café	4	25 - 44	Female
12	**Tony**	Works for part-time employment scheme	5	45 - 64	Male
13	**Matthew**	Unemployed	5	25 - 44	Male
14	**Edward**	Tour operator	1	25 - 44	Male
15	**Kenneth**	Student	2	45 - 64	Male

Focus Group 4 (Group Energy action rating of 6 - 9)					
	Pseudonym	**Occupation**	**Level of Group energy action**	**Age group**	**Gender**
16	**Orla**	Café owner, provides accomdation for students	9	25 - 44	Female
17	**Anita**	Part-time library manager	6	45 - 64	Female
18	**Brenda**	Pensioner	8	45 - 65	Female

Focus Group 5 (Group Energy action rating of 2 - 6)					
	Pseudonym	**Occupation**	**Level of Group energy action**	**Age group**	**Gender**
19	**Alice**	Provides accomodation for students	6	45 - 64	Female
20	**Clara**	Retired national school teacher	2	45 - 64	Female

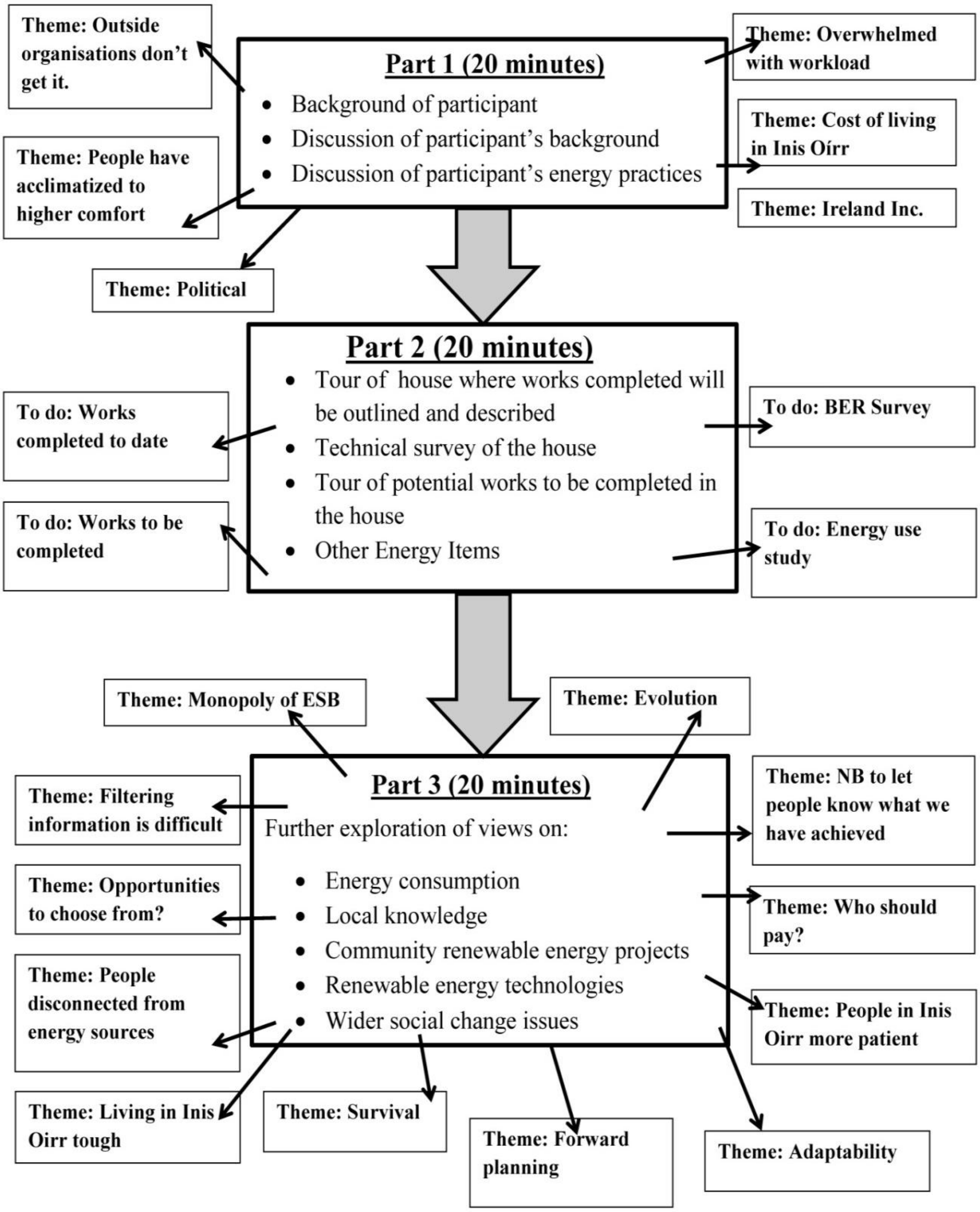
Appendix G: Individual Interview Participants

Individual Interview Participants					
	Pseudonym	**Occupation**	**Level of Group energy action**	**Age group**	**Gender**
1	**Martha**	Community development officer	10	> 65	Female
2	**Philip**	Manager of Inis Oírr Co-operative	9	45 - 64	Male
3	**Maeve**	Office worker	8	45 - 64	Female
2	**Evan**	Working in FÁS	10	45 - 64	Male
4	**Tadhg**	Hotelier	9	25 - 44	Male
6	**Enda**	Hotelier	1	25 - 44	Male
7	**Margaret**	Office worker	1	25 - 44	Female
8	**Cathal**	Teacher	1	25 - 44	Female
9	**Malachi**	Recycling	8	25 - 44	Male
10	**Melissa**	Administrator and Secretary	1	25 - 44	Female
11	**Amy**	Owns a café	4	25 - 44	Female
12	**Tony**	Works for part-time employment scheme	5	45 - 64	Male
13	**Matthew**	Unemployed	5	25 - 44	Male
14	**Edward**	Tour operator	1	25 - 44	Male
15	**Kenneth**	Student	2	45 - 64	Male
16	**Orla**	Café owner, provides accommodation for students	9	25 - 44	Female
17	**Anita**	Part-time library manager	6	45 - 64	Female
18	**Brenda**	Pensioner	8	45 - 65	Female

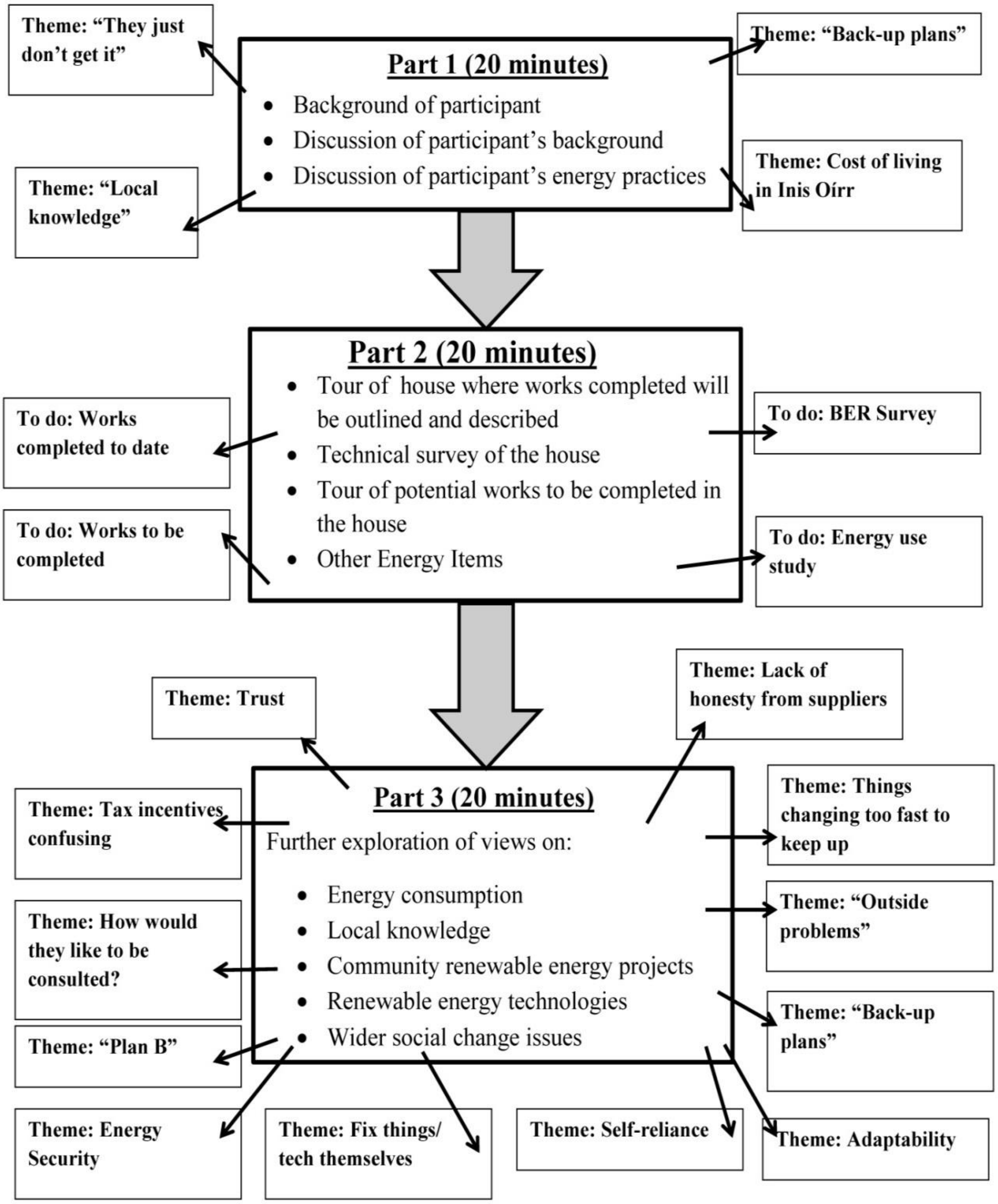
Individual Interview Participants (Continued)					
	Pseudonym	**Occupation**	**Level of Group energy action**	**Age group**	**Gender**
19	**Alice**	Provides accommodation for students	6	45 - 64	Female
20	**Clara**	Retired national school teacher	2	45 - 64	Female
21	**Sally**	Provides accommodation for students	8	25 - 44	Female
22	**Aoife**	Community Development Manager	8	45 - 64	Female
23	**Mitch**	Postman	3	25 - 64	Male
24	**Dara**	Bar man	2	25 - 64	Male
25	**Frank**	Runs the local craft shop	8	25 - 64	Male
26	**David**	Works in the community arts centre	8	45 - 64	Male
27	**Muireann**	Works in the community arts centre	8	45 - 64	Female
28	**Turloch**	Third officer on a ship	6	25 -44	Male
29	**Selina**	Provides accommodation for students	6	25 -44	Female

Appendix H: Individual Interview Guides

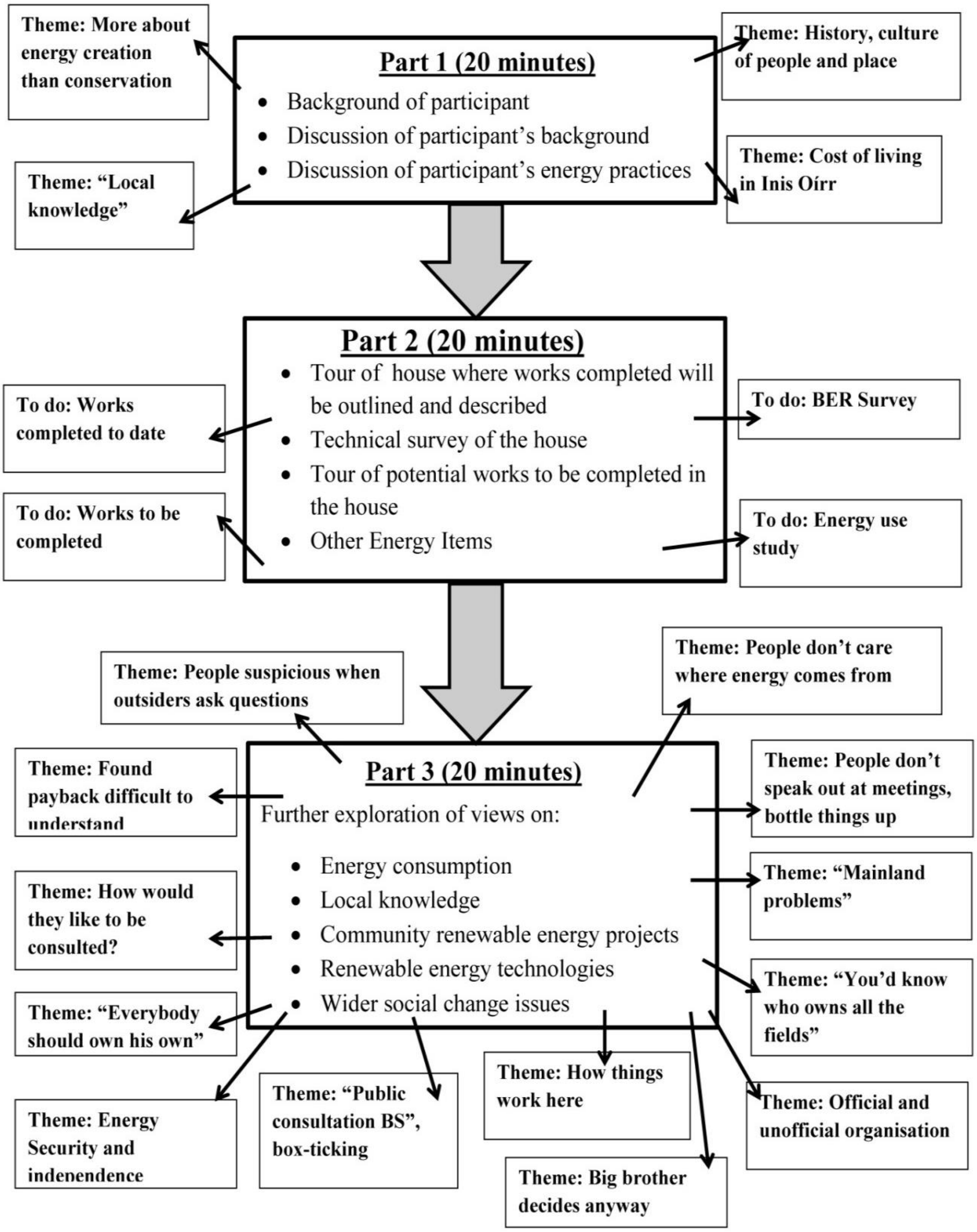
Follow-up Individual Interviews, Focus Group 1



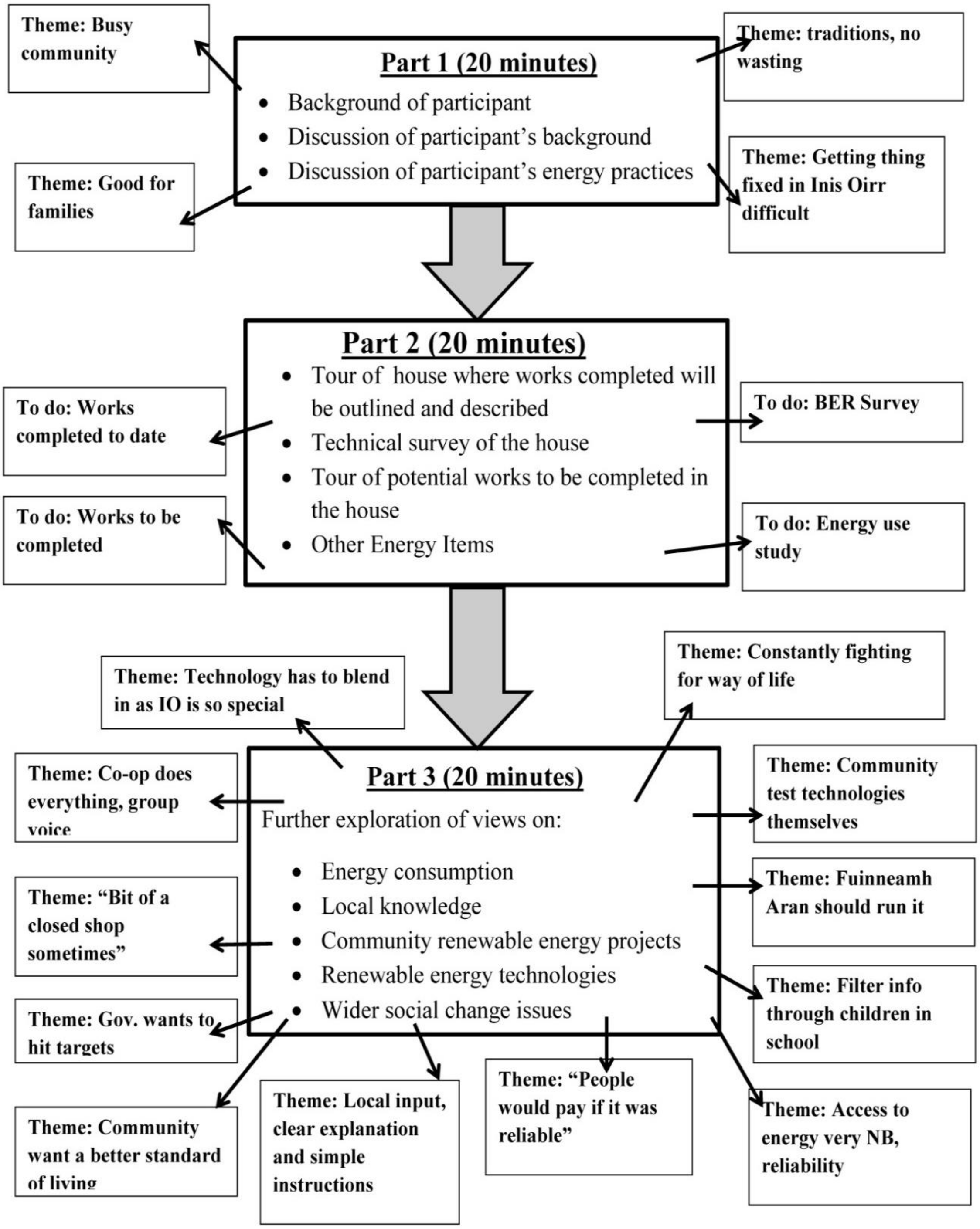
Follow-up Individual Interviews, Focus Group 2



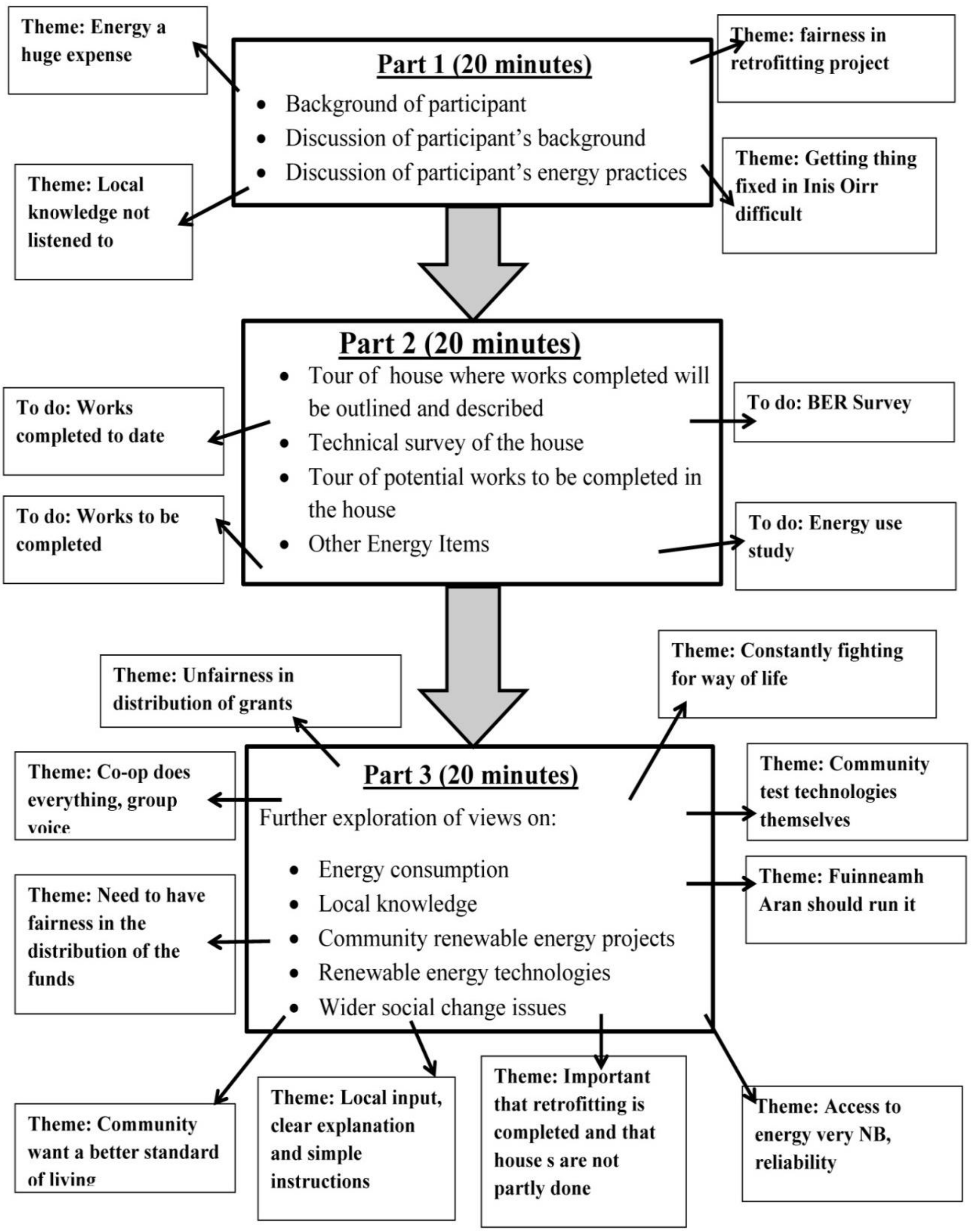
Follow-up Individual Interviews, Focus Group 3



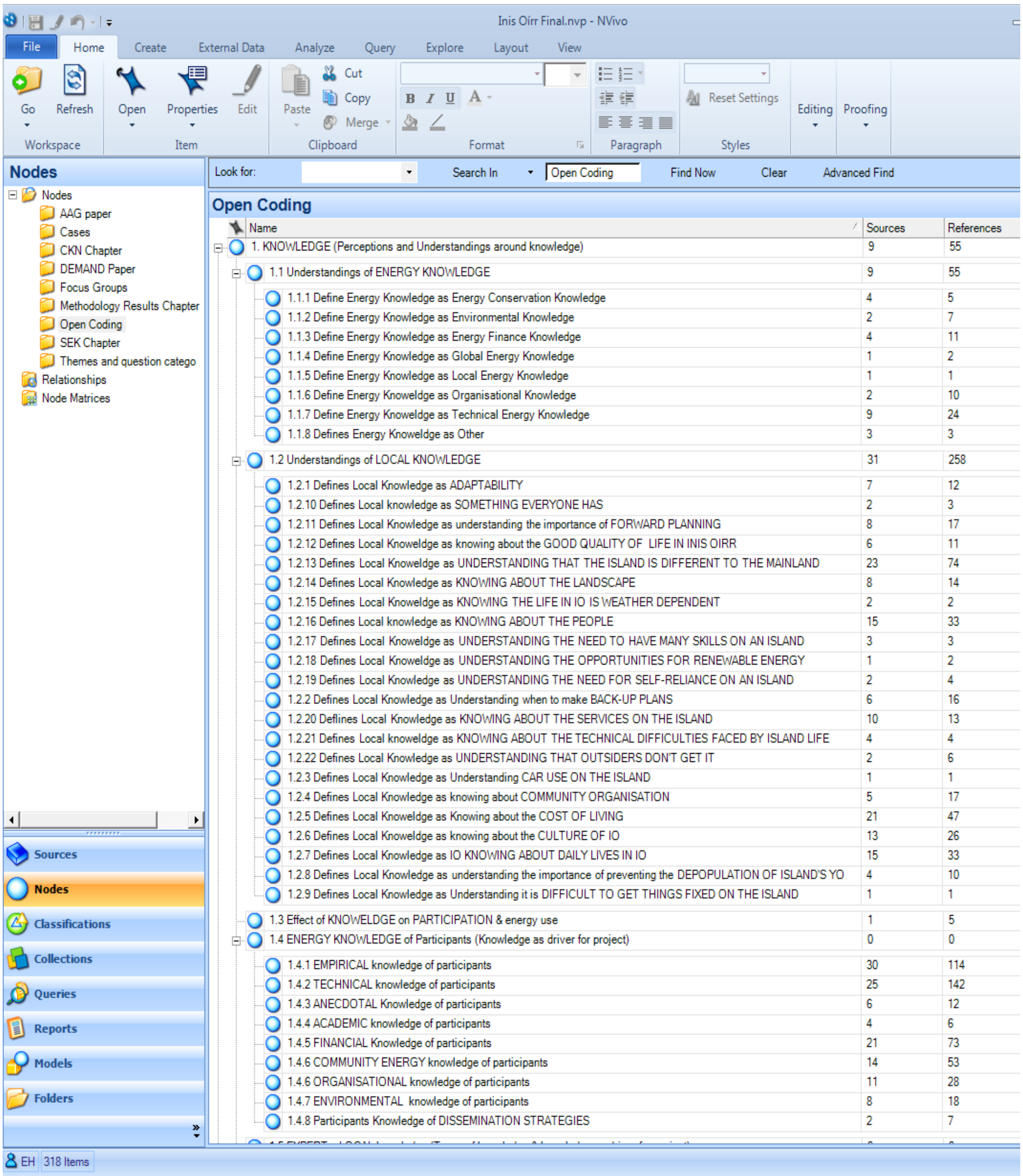
Follow-up Individual Interviews, Focus Group 4



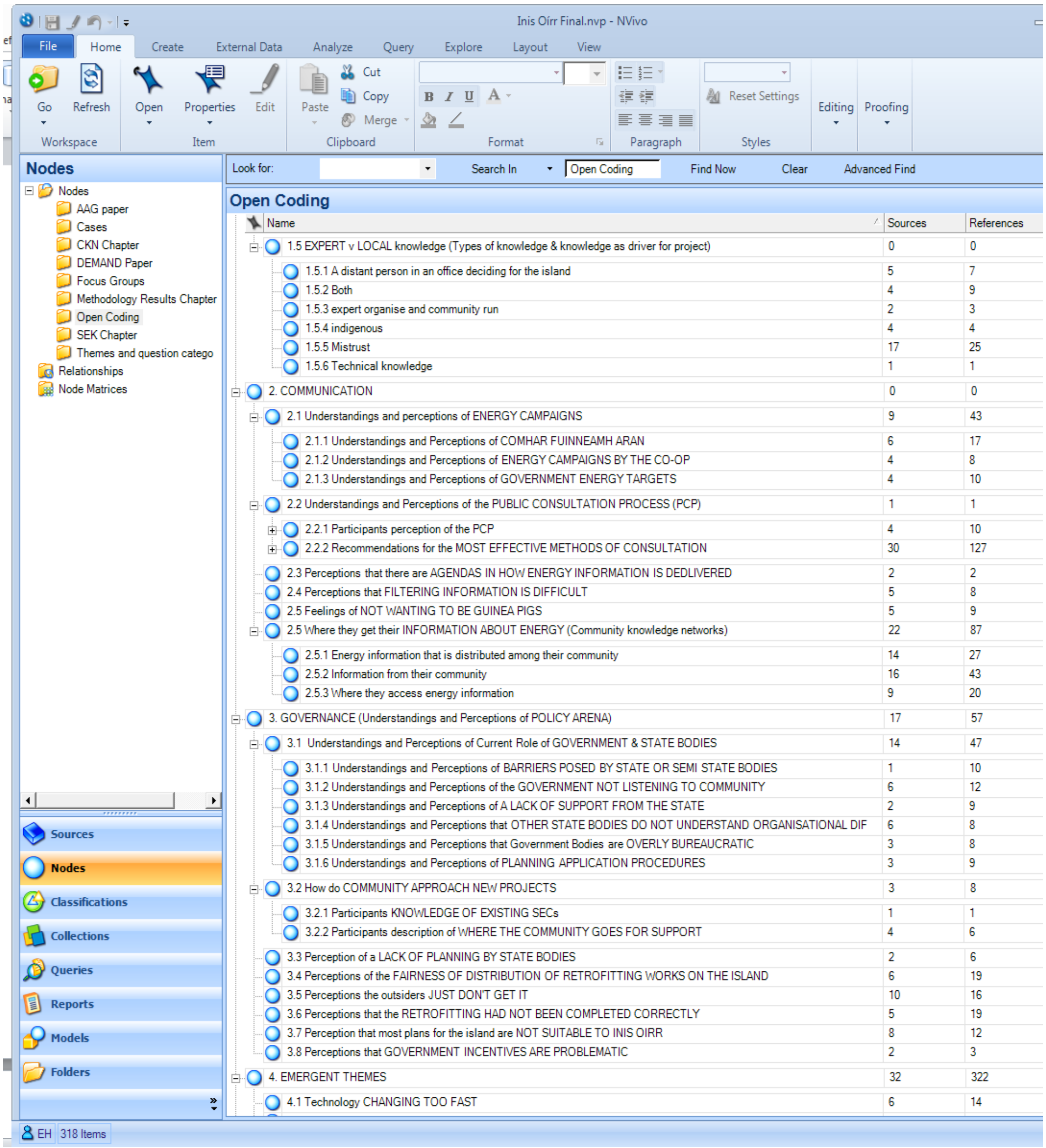
Follow-up Individual Interviews, Focus Group 5



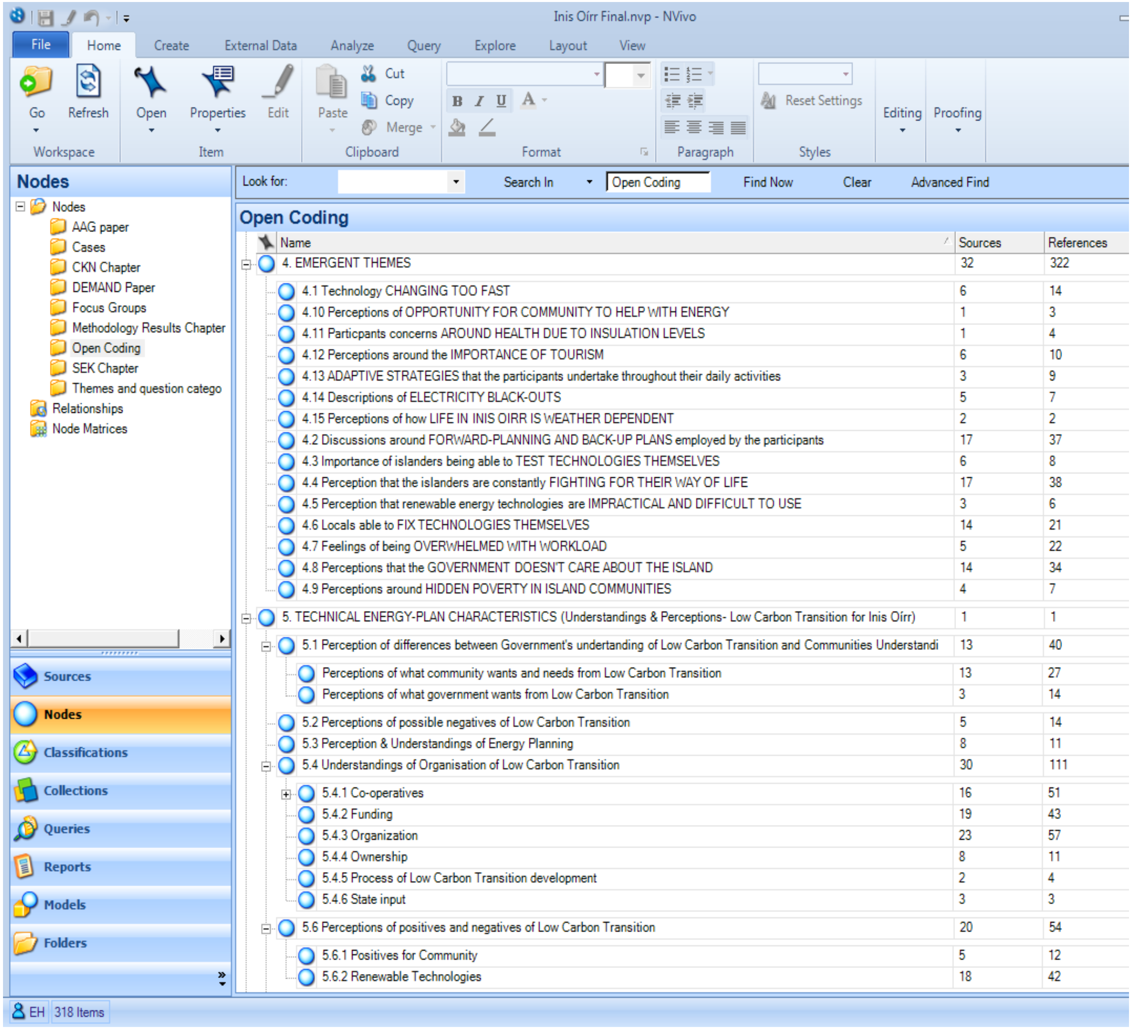
Appendix I: Screenshot of Codes from NVivo



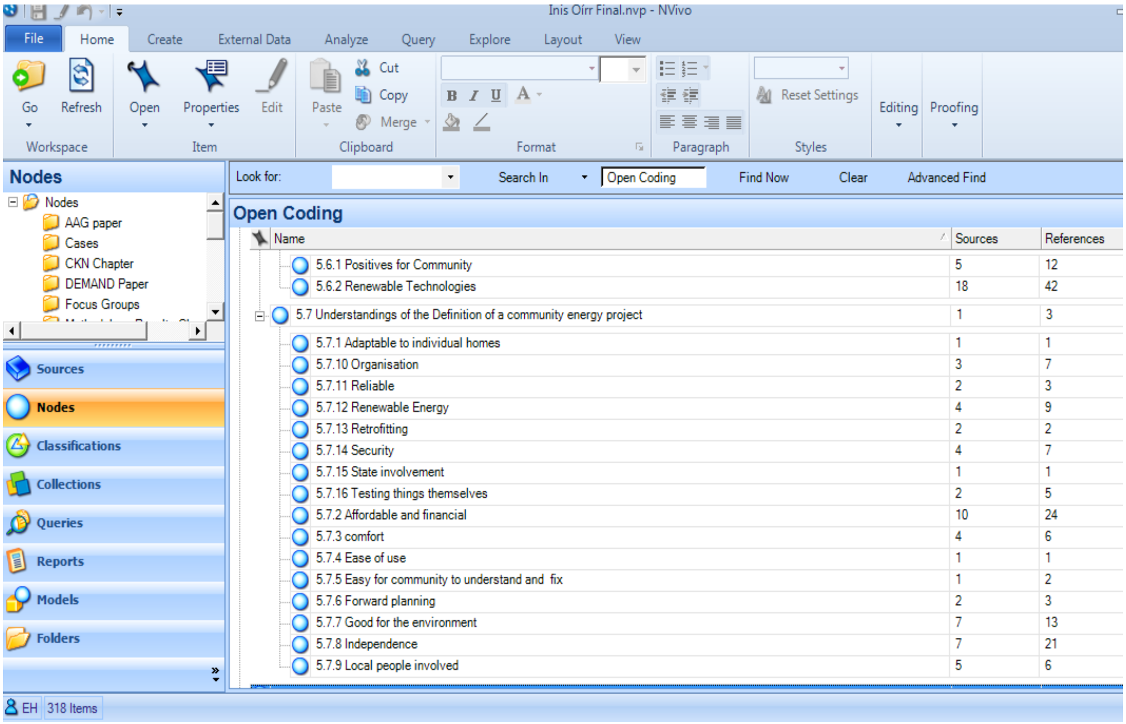
Name	Sources	References
1. KNOWLEDGE (Perceptions and Understandings around knowledge)	9	55
1.1 Understandings of ENERGY KNOWLEDGE	9	55
1.1.1 Define Energy Knowledge as Energy Conservation Knowledge	4	5
1.1.2 Define Energy Knowledge as Environmental Knowledge	2	7
1.1.3 Define Energy Knowledge as Energy Finance Knowledge	4	11
1.1.4 Define Energy Knowledge as Global Energy Knowledge	1	2
1.1.5 Define Energy Knowledge as Local Energy Knowledge	1	1
1.1.6 Define Energy Knowledge as Organisational Knowledge	2	10
1.1.7 Define Energy Knowledge as Technical Energy Knowledge	9	24
1.1.8 Defines Energy Knowledge as Other	3	3
1.2 Understandings of LOCAL KNOWLEDGE	31	258
1.2.1 Defines Local Knowledge as ADAPTABILITY	7	12
1.2.10 Defines Local knowledge as SOMETHING EVERYONE HAS	2	3
1.2.11 Defines Local Knowledge as understanding the importance of FORWARD PLANNING	8	17
1.2.12 Defines Local Knowledge as knowing about the GOOD QUALITY OF LIFE IN INIS OIRR	6	11
1.2.13 Defines Local Knoweldge as UNDERSTANDING THAT THE ISLAND IS DIFFERENT TO THE MAINLAND	23	74
1.2.14 Defines Local Knowledge as KNOWING ABOUT THE LANDSCAPE	8	14
1.2.15 Defines Local Knoweldge as KNOWING THE LIFE IN IO IS WEATHER DEPENDENT	2	2
1.2.16 Defines Local knowledge as KNOWING ABOUT THE PEOPLE	15	33
1.2.17 Defines Local Knowledge as UNDERSTANDING THE NEED TO HAVE MANY SKILLS ON AN ISLAND	3	3
1.2.18 Defines Local Knowledge as UNDERSTANDING THE OPPORTUNITIES FOR RENEWABLE ENERGY	1	2
1.2.19 Defines Local Knowledge as UNDERSTANDING THE NEED FOR SELF-RELIANCE ON AN ISLAND	2	4
1.2.2 Defines Local Knowledge as Understanding when to make BACK-UP PLANS	6	16
1.2.20 Deflines Local Knowledge as KNOWING ABOUT THE SERVICES ON THE ISLAND	10	13
1.2.21 Defines Local knowledge as KNOWING ABOUT THE TECHNICAL DIFFICULTIES FACED BY ISLAND LIFE	4	4
1.2.22 Defines Local Knowledge as UNDERSTANDING THAT OUTSIDERS DON'T GET IT	2	6
1.2.3 Defines Local Knowledge as Understanding CAR USE ON THE ISLAND	1	1
1.2.4 Defines Local Knowledge as knowing about COMMUNITY ORGANISATION	5	17
1.2.5 Defines Local Knoweldge as Knowing about the COST OF LIVING	21	47
1.2.6 Defines Local Knowledge as knowing about the CULTURE OF IO	13	26
1.2.7 Defines Local Knowledge as IO KNOWING ABOUT DAILY LIVES IN IO	15	33
1.2.8 Defines Local Knowledge as understanding the importance of preventing the DEPOPULATION OF ISLAND'S YO	4	10
1.2.9 Defines Local Knowledge as Understanding it is DIFFICULT TO GET THINGS FIXED ON THE ISLAND	1	1
1.3 Effect of KNOWELDGE on PARTICIPATION & energy use	1	5
1.4 ENERGY KNOWLEDGE of Participants (Knowledge as driver for project)	0	0
1.4.1 EMPIRICAL knowledge of participants	30	114
1.4.2 TECHNICAL knowledge of participants	25	142
1.4.3 ANECDOTAL Knowledge of participants	6	12
1.4.4 ACADEMIC knowledge of participants	4	6
1.4.5 FINANCIAL Knowledge of participants	21	73
1.4.6 COMMUNITY ENERGY knowledge of participants	14	53
1.4.6 ORGANISATIONAL knowledge of participants	11	28
1.4.7 ENVIRONMENTAL knowledge of participants	8	18
1.4.8 Participants Knowledge of DISSEMINATION STRATEGIES	2	7



Name	Sources	References
1.5 EXPERT v LOCAL knowledge (Types of knowledge & knowledge as driver for project)	0	0
1.5.1 A distant person in an office deciding for the island	5	7
1.5.2 Both	4	9
1.5.3 expert organise and community run	2	3
1.5.4 indigenous	4	4
1.5.5 Mistrust	17	25
1.5.6 Technical knowledge	1	1
2. COMMUNICATION	0	0
2.1 Understandings and perceptions of ENERGY CAMPAIGNS	9	43
2.1.1 Understandings and Perceptions of COMHAR FUINNEAMH ARAN	6	17
2.1.2 Understandings and Perceptions of ENERGY CAMPAIGNS BY THE CO-OP	4	8
2.1.3 Understandings and Perceptions of GOVERNMENT ENERGY TARGETS	4	10
2.2 Understandings and Perceptions of the PUBLIC CONSULTATION PROCESS (PCP)	1	1
2.2.1 Participants perception of the PCP	4	10
2.2.2 Recommendations for the MOST EFFECTIVE METHODS OF CONSULTATION	30	127
2.3 Perceptions that there are AGENDAS IN HOW ENERGY INFORMATION IS DEDLIVERED	2	2
2.4 Perceptions that FILTERING INFORMATION IS DIFFICULT	5	8
2.5 Feelings of NOT WANTING TO BE GUINEA PIGS	5	9
2.5 Where they get their INFORMATION ABOUT ENERGY (Community knowledge networks)	22	87
2.5.1 Energy information that is distributed among their community	14	27
2.5.2 Information from their community	16	43
2.5.3 Where they access energy information	9	20
3. GOVERNANCE (Understandings and Perceptions of POLICY ARENA)	17	57
3.1 Understandings and Perceptions of Current Role of GOVERNMENT & STATE BODIES	14	47
3.1.1 Understandings and Perceptions of BARRIERS POSED BY STATE OR SEMI STATE BODIES	1	10
3.1.2 Understandings and Perceptions of the GOVERNMENT NOT LISTENING TO COMMUNITY	6	12
3.1.3 Understandings and Perceptions of A LACK OF SUPPORT FROM THE STATE	2	9
3.1.4 Understandings and Perceptions that OTHER STATE BODIES DO NOT UNDERSTAND ORGANISATIONAL DIF	6	8
3.1.5 Understandings and Perceptions that Government Bodies are OVERLY BUREAUCRATIC	3	8
3.1.6 Understandings and Perceptions of PLANNING APPLICATION PROCEDURES	3	9
3.2 How do COMMUNITY APPROACH NEW PROJECTS	3	8
3.2.1 Participants KNOWLEDGE OF EXISTING SECs	1	1
3.2.2 Participants description of WHERE THE COMMUNITY GOES FOR SUPPORT	4	6
3.3 Perception of a LACK OF PLANNING BY STATE BODIES	2	6
3.4 Perceptions of the FAIRNESS OF DISTRIBUTION OF RETROFITTING WORKS ON THE ISLAND	6	19
3.5 Perceptions the outsiders JUST DON'T GET IT	10	16
3.6 Perceptions that the RETROFITTING HAD NOT BEEN COMPLETED CORRECTLY	5	19
3.7 Perception that most plans for the island are NOT SUITABLE TO INIS OIRR	8	12
3.8 Perceptions that GOVERNMENT INCENTIVES ARE PROBLEMATIC	2	3
4. EMERGENT THEMES	32	322
4.1 Technology CHANGING TOO FAST	6	14



Name	Sources	References
4. EMERGENT THEMES	32	322
4.1 Technology CHANGING TOO FAST	6	14
4.10 Perceptions of OPPORTUNITY FOR COMMUNITY TO HELP WITH ENERGY	1	3
4.11 Particpants concerns AROUND HEALTH DUE TO INSULATION LEVELS	1	4
4.12 Perceptions around the IMPORTANCE OF TOURISM	6	10
4.13 ADAPTIVE STRATEGIES that the participants undertake throughout their daily activities	3	9
4.14 Descriptions of ELECTRICITY BLACK-OUTS	5	7
4.15 Perceptions of how LIFE IN INIS OIRR IS WEATHER DEPENDENT	2	2
4.2 Discussions around FORWARD-PLANNING AND BACK-UP PLANS employed by the participants	17	37
4.3 Importance of islanders being able to TEST TECHNOLOGIES THEMSELVES	6	8
4.4 Perception that the islanders are constantly FIGHTING FOR THEIR WAY OF LIFE	17	38
4.5 Perception that renewable energy technologies are IMPRACTICAL AND DIFFICULT TO USE	3	6
4.6 Locals able to FIX TECHNOLOGIES THEMSELVES	14	21
4.7 Feelings of being OVERWHELMED WITH WORKLOAD	5	22
4.8 Perceptions that the GOVERNMENT DOESN'T CARE ABOUT THE ISLAND	14	34
4.9 Perceptions around HIDDEN POVERTY IN ISLAND COMMUNITIES	4	7
5. TECHNICAL ENERGY-PLAN CHARACTERISTICS (Understandings & Perceptions- Low Carbon Transition for Inis Oírr)	1	1
5.1 Perception of differences between Government's undertanding of Low Carbon Transition and Communities Understandi	13	40
Perceptions of what community wants and needs from Low Carbon Transition	13	27
Perceptions of what government wants from Low Carbon Transition	3	14
5.2 Perceptions of possible negatives of Low Carbon Transition	5	14
5.3 Perception & Understandings of Energy Planning	8	11
5.4 Understandings of Organisation of Low Carbon Transition	30	111
5.4.1 Co-operatives	16	51
5.4.2 Funding	19	43
5.4.3 Organization	23	57
5.4.4 Ownership	8	11
5.4.5 Process of Low Carbon Transition development	2	4
5.4.6 State input	3	3
5.6 Perceptions of positives and negatives of Low Carbon Transition	20	54
5.6.1 Positives for Community	5	12
5.6.2 Renewable Technologies	18	42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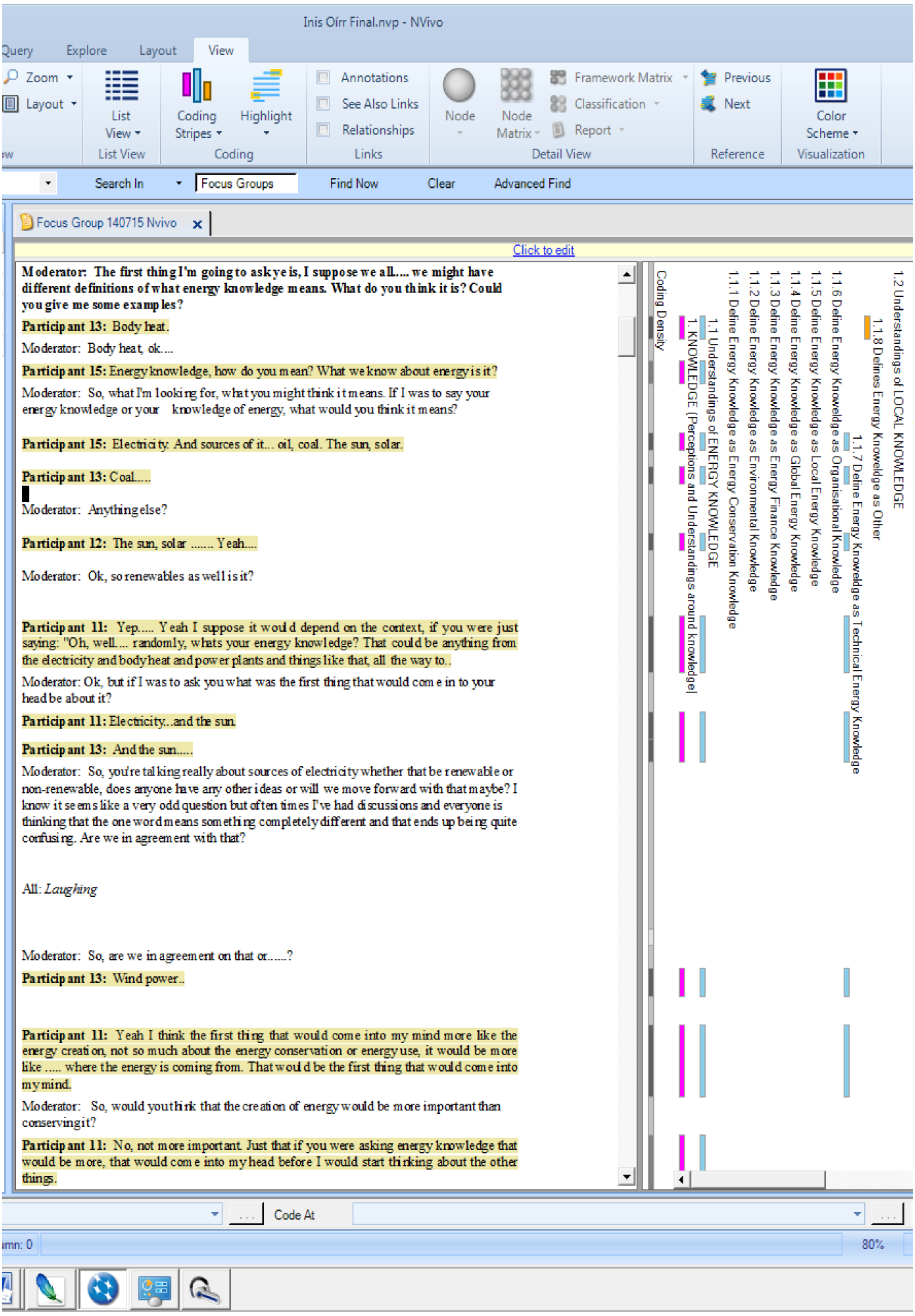
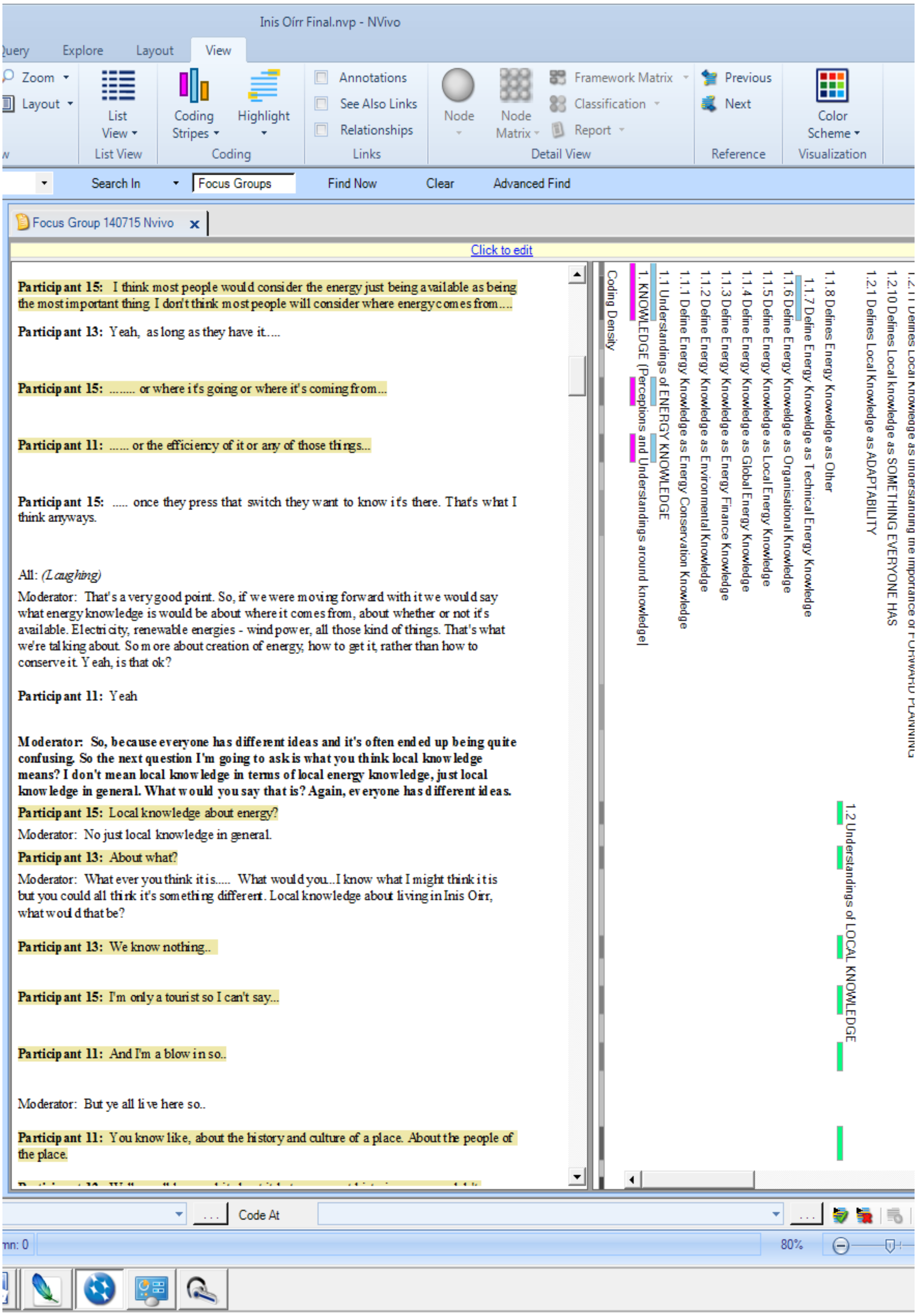
References
5.6.1 Positives for Community 5 12
5.6.2 Renewable Technologies 18 42
5.7 Understandings of the Definition of a community energy project 1 3
5.7.1 Adaptable to individual homes 1 1
5.7.10 Organisation 3 7
5.7.11 Reliable 2 3
5.7.12 Renewable Energy 4 9
5.7.13 Retrofitting 2 2
5.7.14 Security 4 7
5.7.15 State involvement 1 1
5.7.16 Testing things themselves 2 5
5.7.2 Affordable and financial 10 24
5.7.3 comfort 4 6
5.7.4 Ease of use 1 1
5.7.5 Easy for community to understand and fix 1 2
5.7.6 Forward planning 2 3
5.7.7 Good for the environment 7 13
5.7.8 Independence 7 21
5.7.9 Local people involved 5 6
EH
318 Items

Appendix J: Focus Group 3 Screenshot of Coded Transcript





Participant 15: I think most people would consider the energy just being available as being the most important thing. I don't think most people will consider where energy comes from….

Participant 13: Yeah, as long as they have it….

Participant 15: …….. or where it's going or where it's coming from…

Participant 11: …… or the efficiency of it or any of those things…

Participant 15: ….. once they press that switch they want to know it's there. That's what I think anyways.

All: *(Laughing)*

Moderator: That's a very good point. So, if we were moving forward with it we would say what energy knowledge is would be about where it comes from, about whether or not it's available. Electricity, renewable energies - wind power, all those kind of things. That's what we're talking about. So more about creation of energy, how to get it, rather than how to conserve it. Yeah, is that ok?

Participant 11: Yeah

Moderator: So, because everyone has different ideas and it's often ended up being quite confusing. So the next question I'm going to ask is what you think local knowledge means? I don't mean local knowledge in terms of local energy knowledge, just local knowledge in general. What would you say that is? Again, everyone has different ideas.

Participant 15: Local knowledge about energy?

Moderator: No just local knowledge in general.

Participant 13: About what?

Moderator: What ever you think it is….. What would you...I know what I might think it is but you could all think it's something different. Local knowledge about living in Inis Oirr, what would that be?

Participant 13: We know nothing..

Participant 15: I'm only a tourist so I can't say…

Participant 11: And I'm a blow in so..

Moderator: But ye all live here so..

Participant 11: You know like, about the history and culture of a place. About the people of the place.

Appendix K: Example of a Postscript

Participant: Philip (09/08/15 at 1pm): 62 years, 80 minutes
Place of interview: It was at the co-operative office and during his lunch break. The room that we were in was upstairs in the building and was nice and quiet.
The first impression: The first impression of Philip was quite good. I had met Philip several times previously and he is very active within the community. He was very busy during the data collection phase as this was the peak time for tourism on the island. He had difficulty putting the time aside for the interview and we had to rearrange it twice. He turned up for this interview 20 minutes late, but this is quite normal in Inis Oírr. He was very interested in the project and was willing to help in any way that he could. He took the interview very seriously and understood the relevance of the research. He was eager to help and excited to chat about his life.
Behaviour of the participant: Philip was unsure of himself at the beginning of the conversation and did not seem to understand what the interview would be about. Once we got talking about his past, it became evident that he knew a lot about the island that would be of great use to the research project. He works as a manger in the local co-operative offices and was very active in facilitating the energy efficiency program that has been ongoing on the island for several years. As a manager, he has many different skills and has a vast knowledge of several different aspects of island life. His position as a community leader means that he has to talk publicly several times a week. This meant that he was very at ease with the interview situation and found it quite easy to open up. Due to our having met several times before, we had developed a friendly rapport with each other, making the interview very enjoyable.
The flow of the interview: He started to talk about his background at first, because he was not originally from the island and was comfortable talking about this. He was also aware about how discussions on energy would relate to his house and he was very well informed about insulation in his home etc. He found the open ended questions very easy to deal with and the discussion was very fluid. The participant was very at ease and flowed through each of the topics with little guidance.
Education: Completed a Degree in Textile Mechanics.
Activities with regard to employment and work: He works as the manager of the co-operative and has been working there for twenty years. Before that he worked as a fisherman and prior to that he worked fixing the machines used in textile factories.

Appendix L: Energy Planning Workshop – Assessment of Technologies

(using the table of characteristics developed during this research)

Desired Characteristics for a Community Energy Project Applied to Solar Panels		
Ranking	**Characteristics**	**Appropriate for Inis Oírr?**
1	Affordable energy	Yes
2	Energy Independence	Yes
3	Energy that is good for the Environment	Yes
4	Local people involved in the project	Yes
5	Renewable Energy	Yes
6	Secure Energy	Yes
7	Comfortable Houses	N/A
8	Well Organised Project	Yes
9	Forward Energy Planning	Yes
10	Retrofitting of Houses	Yes
11	Reliable Energy	Yes
12	Community can Test Technologies Themselves	Yes
13	Technologies are Easy for Community to Understand & Fix	Yes
14	Adaptable for Individual Houses	Yes
15	State is Involved	Yes
16	Technologies are Easy to Use	Yes

Desired Characteristics for a Community Energy Project Applied to Insulation		
Ranking	**Characteristics**	**Appropriate for Inis Oírr?**
1	Affordable energy	Yes
2	Energy Independence	N/A
3	Energy that is good for the Environment	N/A
4	Local people involved in the project	Yes
5	Renewable Energy	N/A
6	Secure Energy	N/A
7	Comfortable Houses	Yes
8	Well Organised Project	Yes
9	Forward Energy Planning	Yes
10	Retrofitting of Houses	Yes
11	Reliable Energy	N/A
12	Community can Test Technologies Themselves	Yes
13	Technologies are Easy for Community to Understand & Fix	Yes
14	Adaptable for Individual Houses	Yes
15	State is Involved	Yes
16	Technologies are Easy to Use	Yes

Desired Characteristics for a Community Energy Project Applied to Photovoltaics		
Ranking	**Characteristics**	**Appropriate for Inis Oírr?**
1	Affordable energy	Perhaps
2	Energy Independence	Yes
3	Energy that is good for the Environment	Yes
4	Local people involved in the project	Yes
5	Renewable Energy	Yes
6	Secure Energy	Yes
7	Comfortable Houses	Yes
8	Well Organised Project	Perhaps
9	Forward Energy Planning	Yes
10	Retrofitting of Houses	Yes
11	Reliable Energy	Yes
12	Community can Test Technologies Themselves	Yes
13	Technologies are Easy for Community to Understand & Fix	Yes
14	Adaptable for Individual Houses	Yes
15	State is Involved	Yes
16	Technologies are Easy to Use	Yes

Desired Characteristics for a Community Energy Project Applied to Heat pumps		
Ranking	**Characteristics**	**Appropriate for Inis Oírr?**
1	Affordable energy	Perhaps
2	Energy Independence	**No**
3	Energy that is good for the Environment	Perhaps
4	Local people involved in the project	Yes
5	Renewable Energy	Perhaps
6	Secure Energy	Perhaps
7	Comfortable Houses	Yes
8	Well Organised Project	Perhaps
9	Forward Energy Planning	Yes
10	Retrofitting of Houses	Yes
11	Reliable Energy	N/A
12	Community can Test Technologies Themselves	Yes
13	Technologies are Easy for Community to Understand & Fix	Yes
14	Adaptable for Individual Houses	Yes
15	State is Involved	Perhaps
16	Technologies are Easy to Use	Yes

Desired Characteristics for a Community Energy Project Applied to Wind Turbine		
Ranking	**Characteristics**	**Appropriate for Inis Oírr?**
1	Affordable energy	Perhaps
2	Energy Independence	Yes
3	Energy that is good for the Environment	Yes
4	Local people involved in the project	Perhaps
5	Renewable Energy	Yes
6	Secure Energy	Yes
7	Comfortable Houses	N/A
8	Well Organised Project	Perhaps
9	Forward Energy Planning	Yes
10	Retrofitting of Houses	N/A
11	Reliable Energy	**No**
12	Community can Test Technologies Themselves	**No**
13	Technologies are Easy for Community to Understand & Fix	**No**
14	Adaptable for Individual Houses	N/A
15	State is Involved	Yes
16	Technologies are Easy to Use	**No**

Desired Characteristics for a Community Energy Project Applied to Anaerobic Digestion		
Ranking	**Characteristics**	**Appropriate for Inis Oírr?**
1	Affordable energy	Perhaps
2	Energy Independence	Yes
3	Energy that is good for the Environment	Yes
4	Local people involved in the project	Yes
5	Renewable Energy	Yes
6	Secure Energy	Yes
7	Comfortable Houses	N/A
8	Well Organised Project	Perhaps
9	Forward Energy Planning	Yes
10	Retrofitting of Houses	N/A
11	Reliable Energy	Yes
12	Community can Test Technologies Themselves	Yes
13	Technologies are Easy for Community to Understand & Fix	Yes
14	Adaptable for Individual Houses	N/A
15	State is Involved	Yes
16	Technologies are Easy to Use	Yes

Appendix M: Energy Planning Workshop Evaluation Sheets

Your feedback will help us learn how to improve this consultation process.

Please rate the following statements by placing a tick in the appropriate box:

The focus group was better than I expected:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

The topics discussed were interesting:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

The questions were easy to understand:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

I enjoyed discussing this topic with others in my community:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

We were given enough time for discussion:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

The facilitator encouraged participation:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

I got a chance to have my say:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

I felt that I was listened to:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

A focus group is a good way of consulting with members of the community:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

I would participate in another focus group if needed in the future

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

The facilitator was guided the focus group well:

Completely Agree Completely

Disagree

1 2 3 4 5 6 7 8 9 10

Was there something you think we should have discussed in the focus group and interview but didn't?

What did you enjoy most about this method of consultation?

What did you enjoy least about this method of consultation?

____

____

Have you any recommendations on how this method of consultation could be improved?

____

____

Any other comments?

____

____

Thank you!

What is your age?

☐ 18 – 24 ☐ 25 – 44 ☐ 45 – 64 ☐ 65 or over

What is your gender? ☐ Male ☐ Female

Thank you very much for taking the time to complete this survey. If you have any questions please contact the researcher by email (eimear.heaslip@research.gmit.ie) or phone (086 1940919). Please tick the boxes below to confirm that you consent to have your responses used in this research.

☐ I consent to participate in feedback on the Consultation Process that I engaged in.

☐ I understand that all information I provide is confidential and will not be seen or used by anyone other than the researcher and supervisors. I understand that the information will be used in a PhD thesis and related publications and that my name and other identifying features will not be used anywhere in these publications.

Signed: ______________________________ **Date:**________________________________

Appendix N: Developing Inis Oírr's Energy Demand Profile

Kerosene Demand Inis Oírr 2014 (Heating)			
Description	**Qty**	**Value**	
400 ltr kero @ €0.98 per litre	1	345.37	January
204.12ltr kero @ €0.98/ltr	1	176.21	
1450ltr kero 750ltr house 700ltr sa chalet @ €0.98/ltr	1	1,251.98	
500ltr Kero @ €0.80/ltr	1	352.42	
470ltr kero @ €0.98/ltr	1	405.81	
500ltr kero @ €0.98/ltr	1	431.72	
240ltr kerosene @ €0.98 an ltr	1	207.22	
500ltr Kero @ €0.98/ltr	1	431.72	
600ltr Kero @ €0.80/ltr	1	422.91	
500ltr kero @ €0.98/ltr	1	431.72	
500ltr Kero @ €1.03/ltr	1	431.72	
500ltr Kero @ €0.98/ltr	1	431.72	
470ltr kero @ €0.98/ltr	1	405.81	
500ltr Kero @ €0.98/ltr	1	431.72	
500ltr kero @ €0.98/ltr	1	431.72	
500ltr Kero @ €0.80/ltr	1	352.42	
300ltr Kero @ €0.98/ltr	1	259.03	
200 ltr kero @ €0.98 an ltr	1	172.69	December

*Note: Approx. 9.821 kWh of heat can be generated from 1 litre of Kerosene

Sum	**9534**	**Litres**
Heat Generated	**93634.59252**	**kWh**

Coal Demand Inis Oírr 2014 (Heating)			
	Description	**Qty**	**Value in Kg**
Smokeless Coal (1 bag = 40kg)	3 x Mála Gual Smokeless	3	49.43
Polish Coal (1/2 tonne)	1/2 tonna gual	1	197.71
Coal (1 bag = 40kg)	12 x Mála Gual Cosyflame	12	208.28
Bitumous Coal (1 bag = 40kg)	4 x Mála Slack	4	44.32
Polish Coal (1 tonne)	1/2 Tonna Gual Polish	12	208.28
Polish Coal (1 bag = 40kg)	Tonna Gual Polish	1	411.89
Polish Coal (1 bag = 40kg)	2 x Mála Polish	2	32.95
Peat Briquettes (1 bale = 12.6 kg)	10 x Bales of Briquettes	10	37.89
Peat Briquettes	Bricíní Móna	5	18.94
Polish Coal (1 tonne)	Tonna Gual Polish	1	411.89
Polish Coal (1/2 tonne)	1/2 Tonna Gua Polish	12	197.71
Polish Coal (1 tonne)	Tonna Gual Polish	1	411.89
Polish Coal (1/2 tonne)	1/2 Tonna Gua Polish	12	197.71
Polish Coal (1 bag = 40kg)	10 x Mála Gual Polish	10	164.76
Polish Coal (1 bag = 40kg)	2 x Mála Gual Polish	2	32.95
Peat Briquettes (1 bale = 12.6 kg)	3 x Bales Briquettes	3	11.37
Polish Coal (1 bag = 40kg)	2 x Mála Gual Plish	2	32.95
Peat Briquettes (1 bale = 12.6 kg)	3 x Bale Briquettes	3	11.37
Polish Coal (1 bag = 40kg)	2 x Mála Gual Plish	2	32.95
Peat Briquettes (1 bale = 12.6 kg)	3 x Bale Briquettes	3	11.37
Peat Briquettes	2 x Mála Gual Polish	2	32.95
Peat Briquettes (1 bale = 12.6 kg)	3 x Bricíní Móna	3	11.37
Polish Coal (1 tonne)	1 x tonna polish gual	1	411.89
Polish Coal (1 bag = 40kg)	1 Pallet Gual Polish	40	659.03
Polish Coal (1 bag = 40kg)	Nollag - 4 x Mála Gual Polish	4	65.90
Polish Coal (1 bag = 40kg)	10 Mala Polish	10	164.76
Peat Briquettes (1 bale = 12.6 kg)	10 bale briquettes	10	37.89

*Note: Approx. 7,734 kWh of heat can be generated from 1 tonne of coal

*Note: Approx. 5,152 kWh of heat can be generated from 1 tonne of peat briquettes

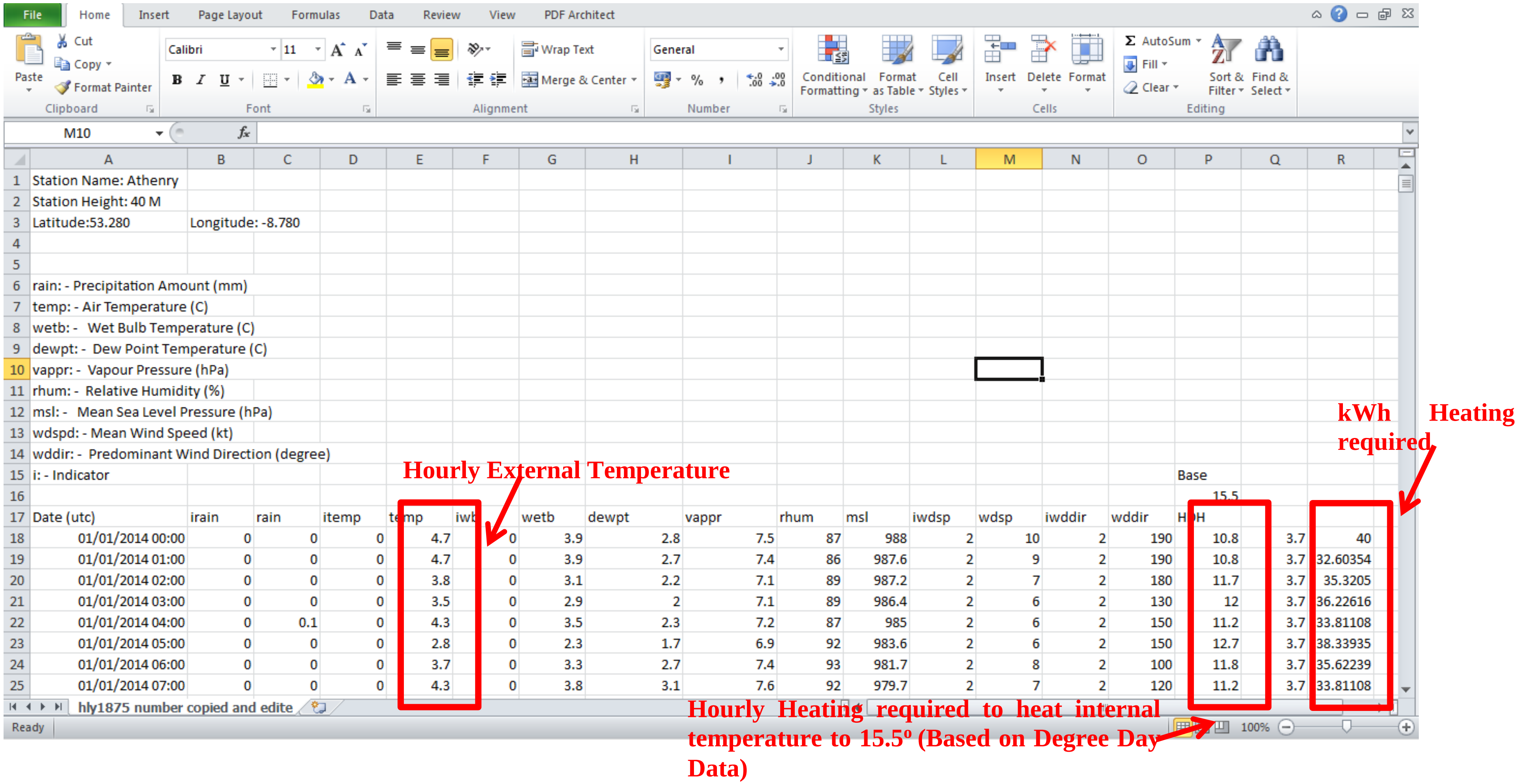
		kg		**tonne**	**Heat in kWh**
Total Coal		**24680**		**24.68**	**190875.12**
Total Peat		**491.4**		**0.4914**	**2531.6928**

Diesel Demand Inis Oírr 2014 (Heating)				
Description	Qty	Price	Vat Rate	Value
04/07 58.10ltr diesel @ €1.03/ltr	1	52.7224	13.50	52.72
31/07 50.62ltr diesel @ €1.03/ltr	1	45.9383	13.50	45.94
57.74ltr Diesel @ €0.80/ltr	1	40.7000	13.50	40.70

Total Diesel	**166.46**	**Ltr**
Heat generated	**1692.73**	**kWh**

Total Heat Demand Inis Oírr 2014	
Fuel Type	Heat in kWh
Kerosene	93634.59252
Diesel	1692.73174
Coal	190875.12
Peat	2531.6928
Total Heat	**288734.1371**

Screenshot of Excel Calculation of Heating Demand for Inis Oírr (in 2014 based on Degree Day Data)



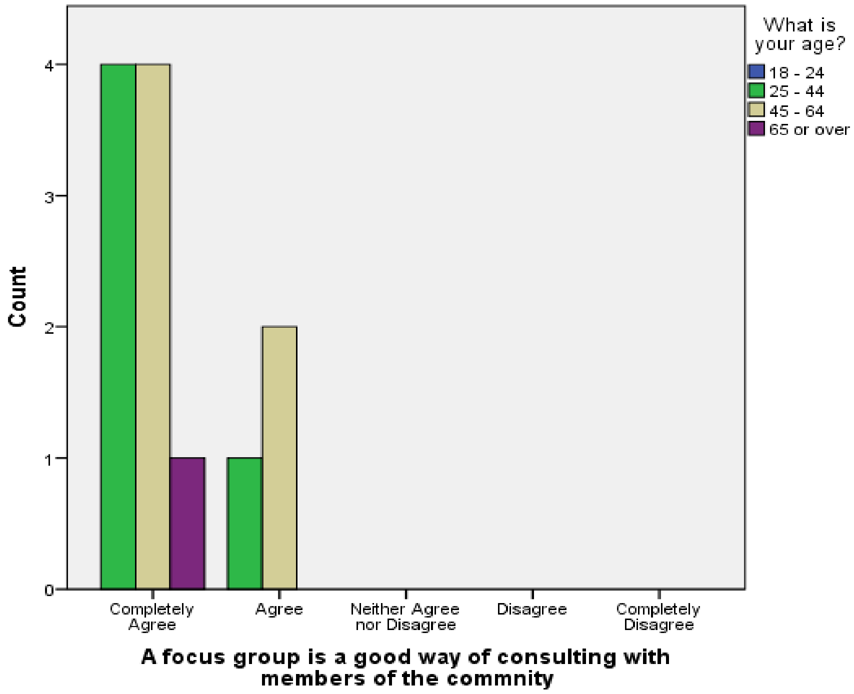
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1	Station Name: Athenry																	
2	Station Height: 40 M																	
3	Latitude:53.280	Longitude: -8.780																
4																		
5																		
6	rain: - Precipitation Amount (mm)																	
7	temp: - Air Temperature (C)																	
8	wetb: - Wet Bulb Temperature (C)																	
9	dewpt: - Dew Point Temperature (C)																	
10	vappr: - Vapour Pressure (hPa)																	
11	rhum: - Relative Humidity (%)																	
12	msl: - Mean Sea Level Pressure (hPa)																	
13	wdspd: - Mean Wind Speed (kt)																	
14	wddir: - Predominant Wind Direction (degree)																	
15	i: - Indicator															Base		
16																15.5		
17	Date (utc)	irain	rain	itemp	temp	iwb	wetb	dewpt	vappr	rhum	msl	iwdsp	wdsp	iwddir	wddir	HDH		
18	01/01/2014 00:00	0	0	0	4.7	0	3.9	2.8	7.5	87	988	2	10	2	190	10.8	3.7	40
19	01/01/2014 01:00	0	0	0	4.7	0	3.9	2.7	7.4	86	987.6	2	9	2	190	10.8	3.7	32.60354
20	01/01/2014 02:00	0	0	0	3.8	0	3.1	2.2	7.1	89	987.2	2	7	2	180	11.7	3.7	35.3205
21	01/01/2014 03:00	0	0	0	3.5	0	2.9	2	7.1	89	986.4	2	6	2	130	12	3.7	36.22616
22	01/01/2014 04:00	0	0.1	0	4.3	0	3.5	2.3	7.2	87	985	2	6	2	150	11.2	3.7	33.81108
23	01/01/2014 05:00	0	0	0	2.8	0	2.3	1.7	6.9	92	983.6	2	6	2	150	12.7	3.7	38.33935
24	01/01/2014 06:00	0	0	0	3.7	0	3.3	2.7	7.4	93	981.7	2	8	2	100	11.8	3.7	35.62239
25	01/01/2014 07:00	0	0	0	4.3	0	3.8	3.1	7.6	92	979.7	2	7	2	120	11.2	3.7	33.81108

Screenshot of Excel Calculation of Hot Water Demand for Inis Oírr During the Summer of 2014

		List of accomodations in								
			No of rooms	People per						
		Ostan	14	2	28					
		Tigh Ruairis	20	2	40					
		Aran lodge	8	2	16					
		Single BnBs total rooms	9	2	18					
		Radharc na Mara BnB	6	2	12					
		Radharc na Mara Hostel	5	4	20					
		Self catering houses	16	3	48					
		Irish College	10	5	50					
		Houses taking scolairi	10	5	50					
				total per	282					
		Accounting for catering at lunchtime:				Say full house for 3 total overnights	26226			
			kWh							
		Cooker working for an	2							
		Kettle working for an hour:	2							
		Dishwasher	1.5							
		total per hour:	5.5	Per day visitor per						
		Lets say 1 hour per 4 people that visit per day								
		if 80,000 visit Aran islands per summer								
		if 40% of them go to Inis Oírr then:	320000	visiors to Inis Oírr over the						
		If summer season is April, May, June, July, August,								
extra visitor per day	overnights per day	Divide it up this way:	Percentage per month	Percentage as decimal		Visitors per month	extra visitor per	total overnights	overnights per month	overnights per day
516	42	april	5%	0.05	3E+05	16000	516	26226	1311.3	42.3
1548	127	may	15%	0.15	3E+05	48000	1548	26226	3933.9	126.9
2581	212	june	25%	0.25	3E+05	80000	2581	26226	6556.5	211.5
2581	212	july	25%	0.25	3E+05	80000	2581	26226	6556.5	211.5
2065	169	august	20%	0.2	3E+05	64000	2065	26226	5245.2	169.2
1032	85	september	10%	0.1	3E+05	32000	1032	26226	2622.6	84.6
			100%	1		320000	10323			

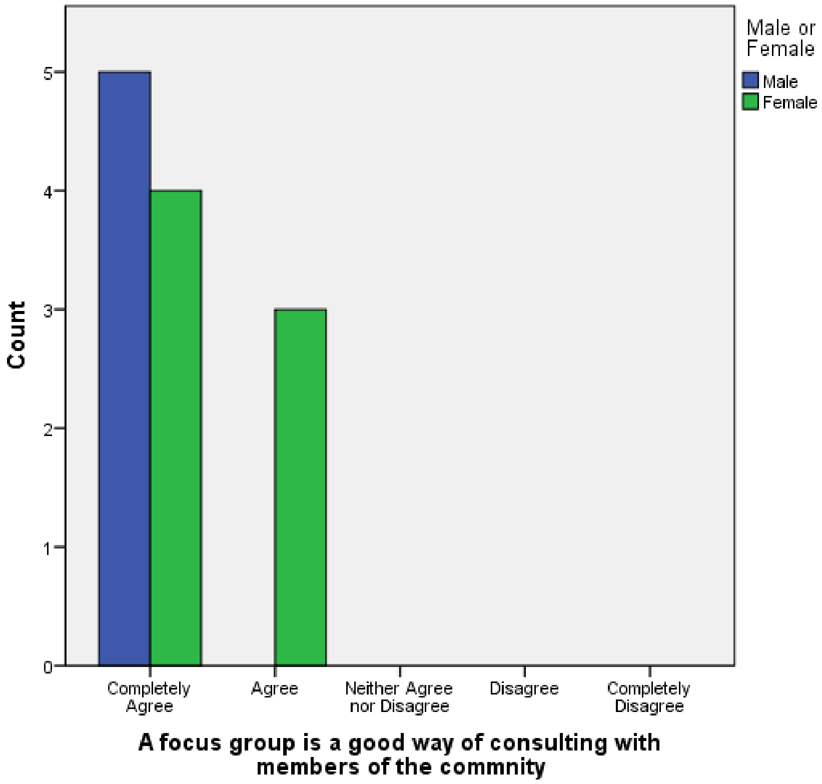
Appendix O: Energy Planning Workshop Evaluation Results

In response to Survey Question One, the only participant in the "65 or over" age category agreed that it was useful, while four participants in the "25-44" age category and four in the "45-64" age category completely agreed that focus groups are a good method of consultation.



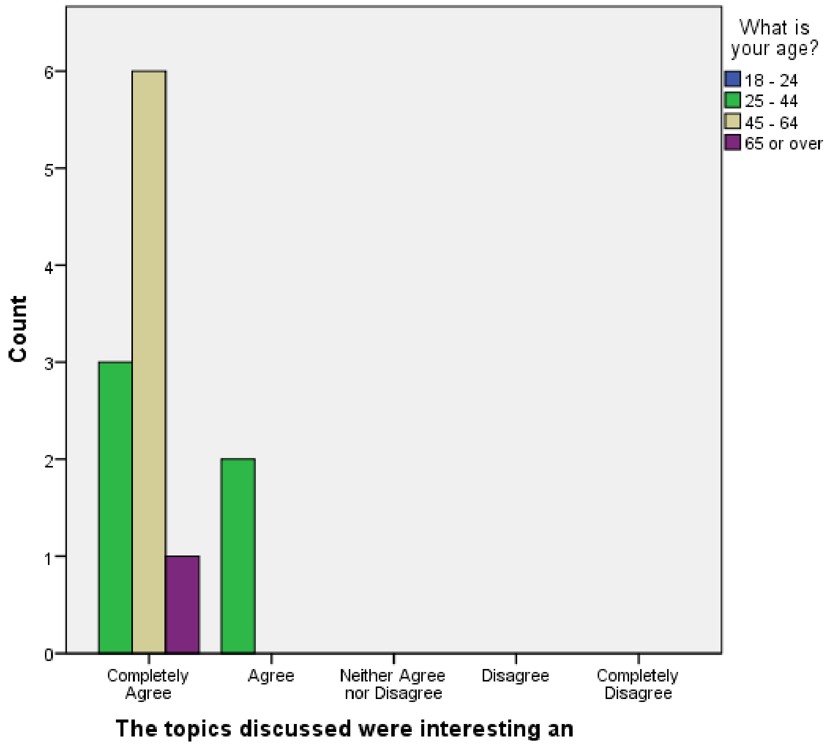
Results of Survey Question One

In response to Survey Question One the perceptions the suitability of focus groups as a consultation tool varied slightly across the participants genders. All of the men completely agreed that they perceived the focus group technique to be useful, while four women completely agreed and three agreed.



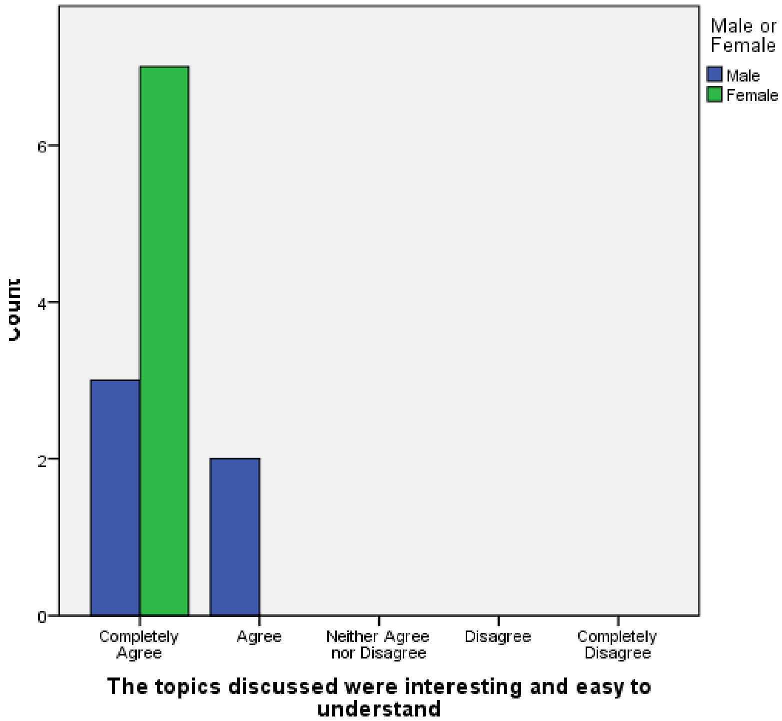
Results of Survey Question One

In Survey Question Two the participants were asked to rate on a Likert scale from one to five (with one being completely agree and five being completely disagree) whether they felt that the topics discussed were interesting. All participants either completely agreed or agreed that the topics were interesting, with ten completely agreeing and two agreeing. The only participant in the "65 or over" age category completely agreed that the topics discussed were interesting. Six participants in the "25-44" age category and three in the "45-64" age category completely agreed that the topics were interesting, while the remaining two in the "25-44" age category agreed.



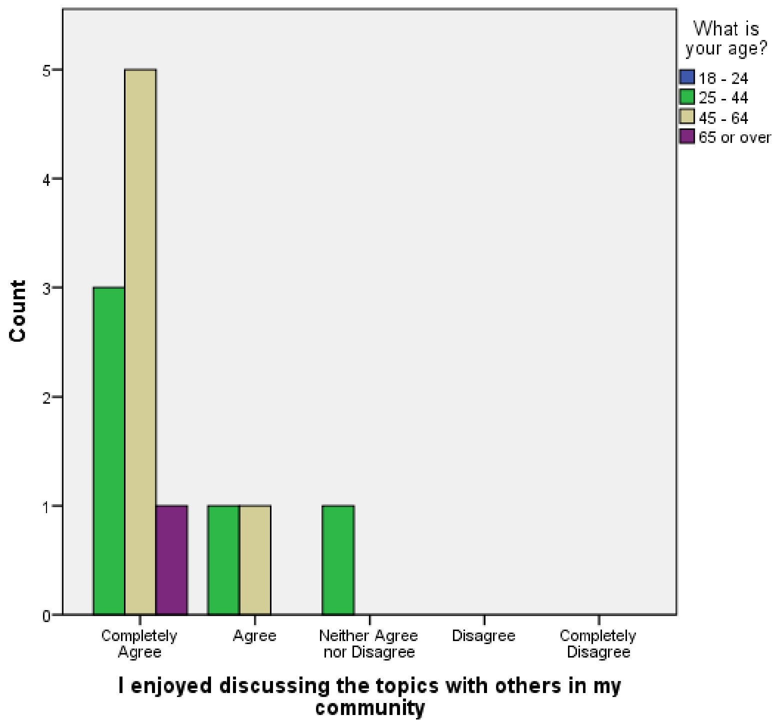
Results of Survey Question Two

Perceptions of whether the topics discussed were interesting varied slightly across the participants genders also. All of the female participants and three of the male participants completely agreed that the topics were interesting, while two women agreed.



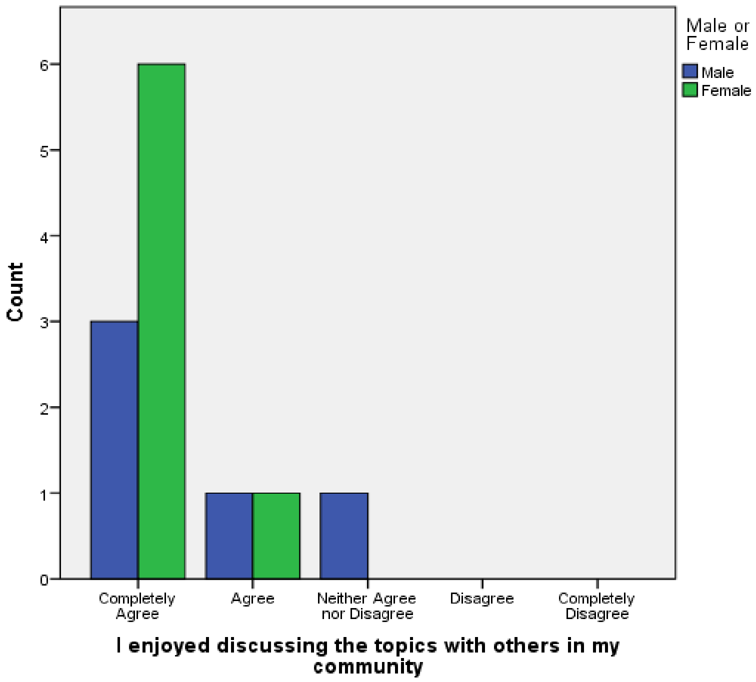
Results of Survey Question Two

Survey Question Four asked the participants to rate on a Likert scale from one to five (with one being completely agree and five being completely disagree) whether they enjoyed discussing the topics with others in their community. Nine participants completely agreed and two agreed and one participant saying they neither agree nor disagree. The only participant in the "65 or over" age category completely agreed that they enjoyed discussing the topics with others in their community. Three participants in the "25-44" age category and five in the "45-64" age category completely agreed that they enjoyed discussing the topics, while the remaining two in the "25-44" age category and "45-64" age category agreed, with one participant from the "25-44" age category neither agreeing nor disagreeing.



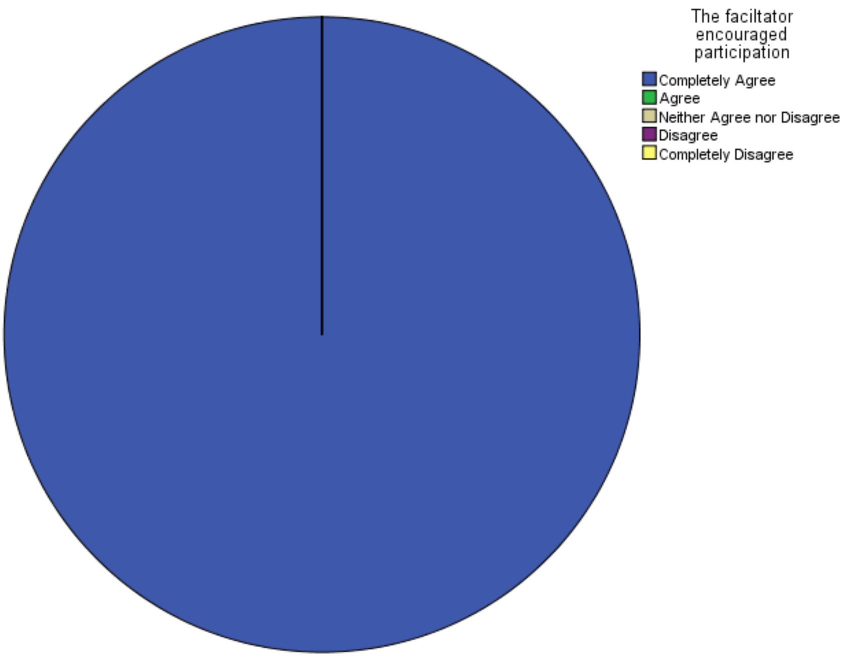
Results of Survey Question Four

Perceptions of whether they enjoyed discussion the topics with their community also varied across the participants genders. Three of the male participants and six of the female participants completely agreed that they enjoyed discussing the topics, while one woman and one man agreed. The remaining man neither agreed nor disagreed that he enjoyed discussing the topics with his community.



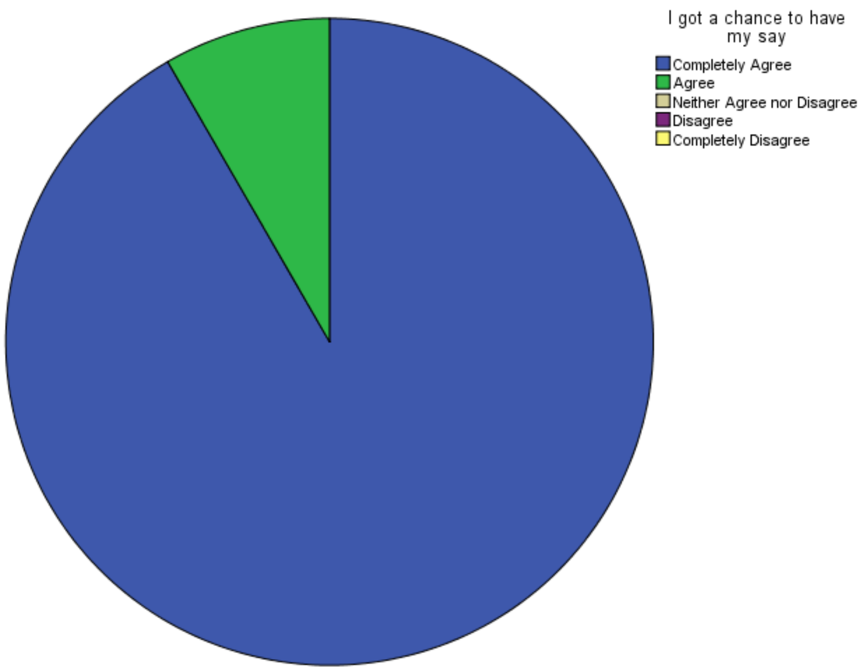
Results of Survey Question Four

The participants were next asked to rate on a Likert scale from one to five (with one being completely agree and five being completely disagree) whether they felt they were given enough time for discussion with ten participants completely agreeing and two agreeing. The participants were next asked to rate on a Likert scale from one to five (with one being completely agree and five being completely disagree) whether they felt that the facilitator encouraged participation and all participants completely agreed.



Results of Survey Question Five

The participants were next asked to rate on a Likert scale from one to five (with one being completely agree and five being completely disagree) whether they felt that they had a chance to have their say. Eleven participants completely agreed that they were given the opportunity to have their say and one participant agreed.



Results of Survey Question Seven

The participants were next asked to rate on a Likert scale from one to five (with one being completely agree and five being completely disagree) whether they felt that they were listened to with all participants completely agreeing).

Survey Question Eleven asked the participants to scale from one to five (with one being completely agree and five being completely disagree) whether they felt the researcher guided the focus group well and they all completely agreed.

Appendix P: Published Paper

Assessing Good-practice Frameworks for the Development of Sustainable Energy Communities in Europe: Lessons from Denmark and Ireland

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Cite as: Heaslip, E., Costello, G. J., Lohan, J., Assessing Good-practice Frameworks for the Development of Sustainable Energy Communities in Europe: Lessons from Denmark and Ireland, J. sustain. dev. energy water environ. syst., 4(3), pp 307-319, 2016, DOI: http://dx.doi.org/10.13044/j.sdewes.2016.04.0024

ABSTRACT

This paper presents findings from initial fieldwork studies of sustainable energy community development methodologies in two islands in Denmark and one rural village in Ireland. The main goals of this study were to determine the enablers and barriers to their successful development and to assess the successful elements of these previously implemented sustainable energy community development methodologies. The study involved extensive semi-structured interviews with the managers of the sustainable energy community projects and comprehensive site visits of each project. The evidence presented in this paper indicates that social barriers are interconnected and often reinforce each other. This article suggests that a comprehensive understanding of how barriers can be transformed into enablers supports the successful development of sustainable energy communities at local level in Europe. The findings in this research indicate that although each of the sustainable energy communities studied did not have any specific implementation framework developed for their projects, many of the successful tools and methodologies used across all communities were similar. The significant contribution of this work is the illumination of key factors influencing the successful development of sustainable energy communities in Ireland and Europe.

KEYWORDS

Sustainable energy communities, Community participation, Public acceptance, Renewable energy in Denmark and Ireland.

INTRODUCTION

This research sought to investigate existing frameworks for the motivation, structuring and implementation of Sustainable Energy Communities [†] (SECs). The research consisted of the analysis of two relatively successful SECs in Denmark and one in Ireland in order to determine how their methodologies could be redeployed in other

[*] Corresponding author
[†] The author recognises that many different types of communities exist, that communities are not homogeneous and that there can be multiple communities of practice within a spatial community [1]. The term "community" is used here to designate a spatial community or a community of place

communities throughout Europe. There are several guidelines, frameworks and networks available to inform the development of sustainable energy communities including: the Sustainable Energy Authority of Ireland's (SEAI) "Guidelines for a Sustainable Energy Community" [2], the "CONCERTO Guide to a Sustainable built Environment" [3], the Local Governments for Sustainability (ICLEI) [4] and the Covenant of Mayors [5]. As defined in several of these documents, a SEC is a community that draws a significant portion of its energy from sustainable energy sources. Building on this, the SEAI defines a SEC as a community "in which everyone comes together to create a sustainable energy system" [2]. There are a number of existing SECs in Europe including: the Isle of Eigg in Scotland, the Marstal community in Aerø Island in Denmark, Samsø Island in Denmark [6], the region of Güssing in Austria [7] and Cloughjordan eco-village in Ireland [8] (Figure 1).

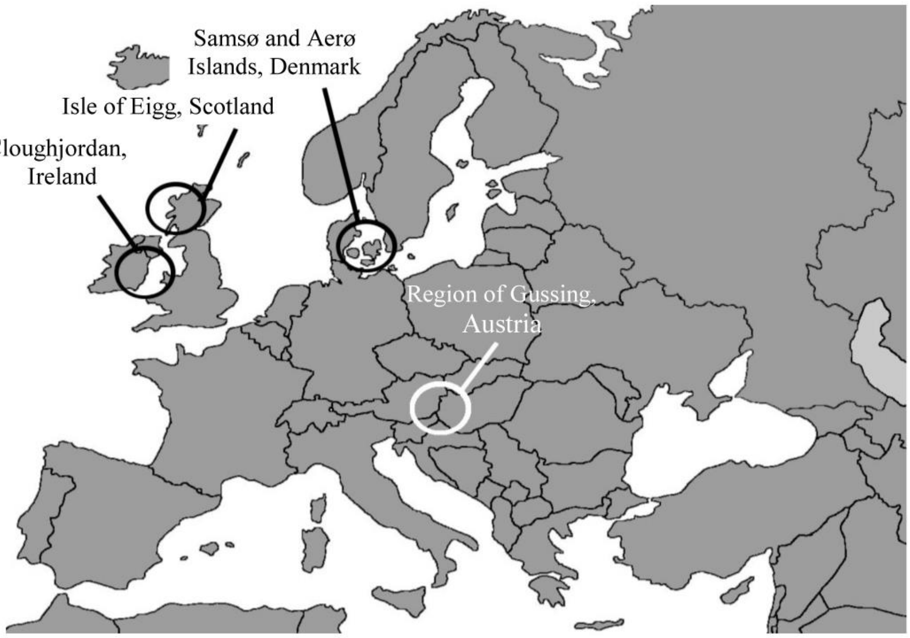

Figure 1. Location map of some existing Sustainable Energy Communities

Several academics argue that the successful development of SECs is rooted in community acceptance and societal integration of sustainable energy technologies. While discussing models and incentives for community ownership of renewable energy projects, Walker [9] describes several barriers to the successful development of community energy. These barriers include legal conditions, economic and technical viability of projects and finally the need for extensive liaison with communities. Furthermore, Blake's [10] discussion of the value-action gap highlights several barriers to action including, but not limited to: individuality, responsibility, practicality and the involvement of public and expert knowledge in the development process. Büscher and Sumpf's [11] work also highlights the importance of fostering trust between stakeholders in the development process in order to achieve a more collaborative community energy project. This paper leverages previous studies analysing public perceptions and understandings of community renewable energy projects [12, 13] and builds on these bodies of research in the context of sustainable communities and the social aspect of energy integration and acceptance. The paper is structured as follows; firstly the context to the research and sustainable energy and communities is described. Next the methodology used for this initial fieldwork is outlined. Following this the findings are detailed including a discussion in relation to literature studied. Finally conclusions and recommendations for future work are proposed.

ENERGY POLICY IN DENMARK AND IRELAND

The European Parliament's "Energy 2020" set Europe wide sustainable energy targets including: a 20% reduction in greenhouse gases, a 20% share of renewable energy and a 20% reduction in primary energy consumption by 2020 [14]. Although many countries in Europe are actively trying to achieve these targets, Denmark is leading the way in the race to increase their share of energy obtained from renewables. Historically, Denmark has been a pioneer in wind energy due to the co-operative nature of its wind energy provision. Denmark can provide useful lessons on the importance of financial incentives and ownership structures for community renewable energy ownership as well as the social, cultural and political aspects of SEC development. Mendonça *et al*. [15] describe how SEC development in Denmark was originally driven from the "bottom-up", beginning with enthusiasts influencing the political process. This forced the government to provide incentives to encourage development of the renewable energy sector [14]. As a result, a combined "top-down" and "bottom-up" approach (which is still favoured by the EU today [3]) was created. In an attempt to continue their past successes, in 2012, the Danish government created very ambitious energy targets with the aim of reducing greenhouse gas emissions by 40% by 2020. Furthermore Denmark aims to have all their electricity and heating supply completely based on renewable energy by 2035 and have all energy consumption, including the transport sector, based on renewables by 2050 [16].

Meanwhile, in 2009, the Irish government released it's first "National Renewable Energy Action Plan" [17] which described Ireland's commitment to reach 40% renewable electricity and 12% renewable heating by 2020. In an effort to contribute towards achieving these targets the SEAI released their "Guidelines for a Sustainable Energy Community" in 2010 [2]. These guidelines implied that a move from a fossil fuel based economy to an economy sustained by renewable energy sources is a societal rather than a technological issue. In order to attend to this issue the SEAI set up the SEC Programme [18]. The vision of the SEC programme was to stimulate a national move towards sustainable energy practice through the creation of 6 exemplar SECs by 2015. However, Ireland has considerably more work to undertake in order to achieve its 2020 targets. Electricity generated from renewable energy reached 20.9% of gross electricity consumption in 2013 [19] highlighting how Ireland is facing a considerable challenge to meet its energy targets by 2020. In 2014, Ireland imported 85% of its energy requirements (ibid.) leaving the country vulnerable to fluctuations and instabilities in the price of energy resources. Furthermore, recent renewable energy development guidelines released by the National Economic and Social Council (NESC) in Ireland have outlined the increasing need for meaningful consultation in the development process of sustainable energy projects [20] to ensure more successful outcomes. Responding to these events, Irish policymakers released the government White Paper; "Ireland's Transition to a Low Carbon Energy Future" in 2015 [21]. More consideration was afforded to the role of communities in Ireland's energy policy than in preceding white papers [22] on Ireland's sustainable energy future. The complexities of community engagement with the energy issue have been earmarked for considerable focus in the coming years [21]. In order to delve into these issues further, the following sections discuss the current state of SECs in Europe. Following this the barriers and enablers outlined in literature are presented and discussed.

SUSTAINABLE ENERGY AND COMMUNITIES

Several studies describe the importance of the technological integration of sustainable energy systems [23-25] but there is a lack of knowledge on the enablers and barriers associated with the social issues surrounding the community acceptance of these technologies. As previously described, many academics have highlighted the importance of community engagement in community renewable energy projects. Walker and Devine-Wright's [26] discussion of community energy highlights how the varied mix of interpretations around community energy create a complex social dimension to the concept. However little research is available on suitable techniques and frameworks for engaging with communities in order to increase their acceptance of renewable energy projects.

The drivers behind the development of SECs can often have the most influence over a community's acceptance of the project. This can regularly create resentment towards the project early in the development process. According to Jørgensen *et al.* [6] the driving force behind the success of the Samsø project was the community's need for economic recovery (due to high unemployment rates). Although the reduction of greenhouse gases is often cited by policy makers as drivers for SECs, this is not generally the case at grass-roots level [10, 11]. It is important for SEC developers to discuss with communities the positives of energy autonomy and energy security [27] and ensure that the aims of SECs are aligned with the needs and wants of the communities involved. The early identification of the type of community involved will affect the ease of development of a SEC and can be useful information when designing a development strategy. Schweizer-Ries [28] identifies two types of communities: the "conscious community" (who still have to implement the realization) and the "realizing community" (who have a lack of public consciousness) stating that the methods used for the successful development of each SEC may be quite different. Determining the best method for dealing with different types of communities can lead to differing approaches during the early stages of a project.

In their work Rogers *et al.* [12] outline the barriers to the acceptance of SEC projects and reasons for members of the community's reluctance to participate and support these projects in their areas. These include technical and economic factors and chiefly public opposition to wind farms. Furthermore research indicates that willingness to get involved in projects is often much lower than willingness to support it, possibly due to the "value-action gap" [10]. Value action gaps are the difference between what people say and what people do and arise because of individuals' attitudes and the social and institutional context for change (ibid.). Studies in England have shown that although the aim of community energy projects may be to involve locals, regularly they are reluctant to take control and look to outsiders for guidance and leadership (ibid.). This reluctance to engage can often create barriers to the successful development of SECs and foster an environment where opposition to projects can thrive. The negative phenomenon of Not In My Back Yard (NIMBYism [*]) and Locally Unwanted Land Use (LULU[†]) can easily be taken advantage of by opposition parties when participation of locals is not present. Unfortunately, opposition to renewable energy projects is quantitatively different from support for projects and not just its binary opposite [29]. Often in cases of opposition to renewable energy projects, emotion is used by objectors to gain support while supporters challenge objections with facts [30]. This frequently leads to developers dismissing the

[*] According to Cass and Walker [30] the term NIMBYism is often used to describe the attitude of objectors to LULUs

[†] A LULU is a land use that is useful to society, but the neighbours or community object to it [30]

concerns of communities as emotional, even though some of those concerns highlighted, although emotionally driven, may still count as "valid planning issues" (ibid.).

Furthermore, the insider/outsider distinctions inherent in small communities [29] often means that emotions involved in the planning process of a SEC are more powerful than the logic that it is assumed is applied to the planning process. The Environmental Impact Assessment (EIA) process currently used in planning in Ireland clouds the ideal nature of the planning process as one devoid of emotion and operating solely on logic [30]. The EIA process operates on an "information-deficit model" and regularly gives opposition parties a clear platform to highlight their emotional ideas of a lack of justice and fairness in the project development (ibid.). This emotional aspect often leads to what Janis [31] described as "Groupthink" whereby groups norms that bolster (or harm) morale are created at the expense of critical thinking. One tool for overcoming NIMBYism due to LULU's and the power of Groupthink, is to encourage communities to financially invest in part of the renewable energy project. Warren and McFadyen [13] undertook a comparison of public attitudes towards a community-owned wind-farm on the Isle of Gigha with attitudes towards several developer-owned wind-farms on the adjacent Kintyre peninsula. Their findings showed that the Gigha respondents were consistently more positive about wind power than were the Kintyre residents due to community ownership. Although the Gigha residents were more positive it was a difference of degree of positivity and not completely opposing views. The authors suggest that this may be due to communities gaining positive experiences of a wind-farm situated locally. It has been shown that attitudes to wind-farms have a longitudinal dimension, following a U-shaped curve over time (ibid.). When questioned about wind-farms, communities generally have positive initial responses, but these are often replaced by more negative appraisals when a local wind-farm is proposed. Fortunately, these negative appraisals are generally followed by a return to positive attitudes once the community has experienced the wind-farm. This method of developing communities' understanding of sustainable energy leads to more acceptance of renewable energy developments and better support for projects in the future. Rogers *et al.* [12] conclude that a clearer framework and more standardised processes with demonstration of renewable energy technologies to raise awareness of community renewable projects are needed. In the next section, the nominated case study is outlined and the methodology used for this initial fieldwork study is described.

METHODS

Building on the literature and existing SEC frameworks in Ireland, a set of themes were developed for analysis during this initial fieldwork. One framework analysed was the SEAI's "Guidelines for a Sustainable Energy Community" [2]. These guidelines define a five step process to the development of SECs and are outlined in Figure 2 below.

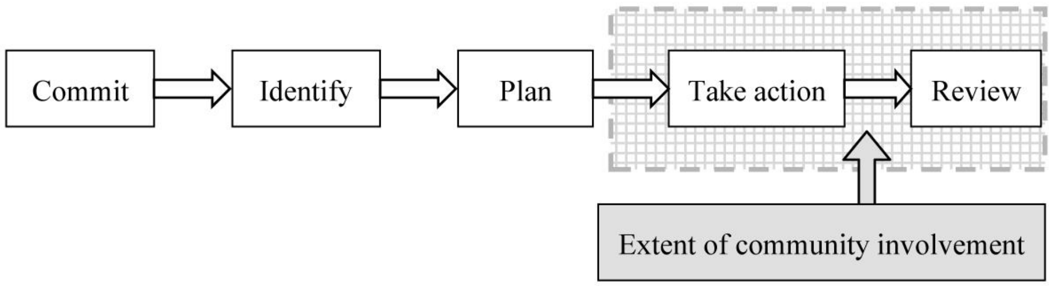

Figure 2. Summary of SEAI's "Guidelines for a Sustainable Energy Community" [2]

As Figure 2 illustrates, the SEAI do not recommend community involvement until late in the development process, when the plans have already been finalised and construction of the project is to begin. As a result the level of community involvement was a key theme for analysis in this initial fieldwork study. The primary research in this initial fieldwork involved the undertaking of semi-structured interviews. Building on the literature several themes were identified for analysis in the initial fieldwork studies and are described in Table 1 below.

Table 1. Research themes identified for analysis and the related literature

	Themes	References
Societal 1	Driver and local concept, previous situation, mission statement and the local concept	[28, 12, 27, 30]
Societal 2	Local community involvement and communication	[10, 13, 15, 26, 29, 32, 33]
Societal 3	Organizational structure	[1, 3-5, 15]
Economic & political	Financing, policy and planning	[13]
Miscellaneous	Unexpected positives and negatives	[13, 30]

Questions for the semi-structured interviews were guided by the themes in Table 1. These interviews were undertaken with project managers from three successful SEC communities, two in Denmark and one in Ireland (Table 2). The study involved extensive semi-structured interviews with the managers of each of the SEC projects and comprehensive site visits of each project. The interviewees who took part in the study were the renewable energy project managers from the following: Marstal community in Aerø Island, Denmark, Samsø Island, Denmark and Cloughjordan eco-village in Ireland.

Table 2. Profile of SECs studied during initial fieldwork

	Marstal, Aerø Island, Denmark	Samsø Island, Denmark	Cloughjordan, Ireland
Population	6,669 inhabitants	3,806 inhabitants	140 inhabitants
Area	88 km²	114 km²	0.271 km²
Electricity	Over 80% self sufficient	100% wind power	From national grid
Heating	Over 80% self sufficient	75% from solar power + biomass energy	District heating 100% biomass + solar power
Exporting	None	84 million kWh	None

FINDINGS AND DISCUSSION

The following section reports on the response of the participants in the study in relation to a range of questions relating to the SEC development methodologies employed within their communities. These questions established the SEC development issues that were of particular importance to the participants. Several key themes emerged in the data and these are outlined in the following sections.

Societal 1 findings: driver and local concept, previous situation, mission statement and the local concept

As proposed earlier in this paper, the driver for the development of a SEC can often create prejudices or good will early in the development process. During the interviews, all respondents stated that their projects were financially motivated, giving the community a clearer understanding of the reasons for their SEC development (Table 3). When questioning what community renewable energy means, Rogers *et al.* [12] analyse what stakeholders feel is distinctive about community renewable energy projects and state that the best type of project is one that is both for and by the people. In each of the communities studied in this initial fieldwork, the community perceived that the SEC was being created in order to bolster their local economy and to reduce their energy costs. This led to increased support and acceptance of the project in the long term.

Table 3. Societal 1 findings: driver and local concept, previous situation, mission statement and the local concept

	Marstal, Aerø Island	Samsø Island	Cloughjordan
Driver and local concept	The high cost of oil in the 1970's	High level of unemployment and economic recovery was needed	The eco-village community wished to create a sustainable village
Current/previous situation	1970's: Completely dependent on imported energy	1990's: Completely dependent on imported energy & high unemployment	1990's: Existing village of Cloughjordan was in decline
Mission statement	To convert from oil to renewable energy	To create a 100% renewable energy island	To create a sustainable/ eco-village community
Local concept	Local concept was not an issue, it was important that the cost of heating was reduced	Community input to encourage revival of the local economy and employment kept local	Community input to ensure that the existing community accepted the new residents of the eco-village

Societal 2 findings: local community involvement and communication

Moran's [29] highlighting of the problems experienced during expert-lay interactions indicates that communication methods used by those with expert knowledge and those used by members of the community with lay knowledge are often incompatible. This often leads to feelings of resentment and a perceived lack of fairness. All parties interviewed described how difficulties were experienced in the early stages of the project in relation to expert-lay communication. The solution used in all cases was the use of public meetings (Table 4) where the public can voice their concerns as a group to experts and developers. Lund [33, 34] describes how "Discourse theory" perceives social reality as a linguistic construction and states that different organizations perceive and articulate things differently. As a result, different stakeholders perceive things differently, leading to different ways of approaching the same problem. In this regard, academic institutions can play a lead role in the dissemination of information in an easily understood manner.

All interviewees had academic involvement during the development process and expressed the benefit of this experience in terms of community interaction.

Table 4. Societal 2 findings: local community involvement and communication

	Marstal, Aerø Island	Samsø Island	Cloughjordan
Local community involvement and communication	Public meetings, no survey of opinion, opinions voiced at meetings, existing school involved in communication	Public meetings, no survey of opinion, people voiced opinions at meetings	Public meetings, no survey of opinion, people voiced opinions at meetings, existing school was involved in communication

Societal 3 findings: organizational structure

Both the Samsø and Cloughjordan project successfully used aspects of the "Bottom-up" approach in the development of their SECs (Table 4). Schweizer-Ries [28] outlines how the "Bottom-up" approach should be the basis for any long-term successful community renewable project. A bottom-up process is defined by individual voluntary support and networking within the community in order to realise a certain energy project. Schweizer-Ries (ibid.) concluded that taking social aspects into account increases successful realization of sustainable energy supply and demand in the future. The attention to the social aspect of both of these projects ensured that they have been successfully integrated into community life in the long-term. A key finding from these interviews was the importance of the "Key influencer" (Table 5). The key influencers within a community are people who already have the attention of the community as a whole. In the case of SECs, the singling out of a single key influencer can often prove to be of benefit and this was very successfully done in Samsø and Cloughjordan. Cass and Walker [30] state that, when dealing with emotion attached to place (as is very common in small communities), it is better to deal with individuals rather than a group. In this situation, it is often better to deal with a single representative for the group, or the key influencer. Barriers exist as both individual (personal barriers) and external barriers (due to participating in a group dynamic) [24]. The use of the key influencer can be used to combat both individual and external barriers through allaying personal fears and challenging barriers suggested by opposing groups. As support for projects is generally more widespread than a wish to participate [12] the importance of the key influencer as a project manager and instigator is clear.

Table 5. Societal 3 findings: organizational structure

	Marstal, Aerø Island	Samsø Island	Cloughjordan
Organizational structure	The organizational structure was already defined in the form of the district heating co-operative	The master-plan was sub-divided into different topics and these were dealt with by different sub-groups	Sustainable developments limited co-operative was set up and this company was used to organise the project
Key influencer	Manager at Marstal district heating	Director, energy co-operative	Project manager of the eco-village project

Economic and political findings: financing, policy and planning

In all SECs studied in this initial fieldwork, the funding models were described as "mixed funding" with funding from the government, the community and bank loans (Table 6). This was described as a very successful method, as community investment led to more community action, participation and support for the development of the project. Warren and McFadyen [13] argue that mixed financing is the best model for a long term successful SEC and this was clear from the findings in this initial fieldwork study.

Table 6. Section 4 findings: financing, policy and planning

	Marstal, Aerø Island	Samsø Island	Cloughjordan
Financing	20% seed funding from the Danish Ministry of Climate, Energy and Building, profits from existing district heating co-operative and a loan from Danish green bank (community gave guarantee for the loan)	20% seed funding from the Danish Ministry of Climate, Energy and Building, energy project set up on a co-operative basis and a loan from the Danish green bank (community gave guarantee for the loan)	The company was set up on a co-operative basis, received a loan from Clann Credo ethical bank and EUR 700,000 from the EU through the SERVE project
Policy and planning	Given exemptions due to intervention by the ministry	Given exemptions due to intervention by the ministry	Submitted a proposal to the county council to zone the proposed site for sustainable development so there were less planning application refusals

Miscellaneous findings: unexpected positives and negatives

In both the Samsø and Cloughjordan projects (however not in the Aerø project), the interviewees stated that they were pleasantly surprised with the unexpected positives from the development of the SEC. They both had a large increase in tourism and this led to the creation of education and enterprise centres in order to provide sustainable development education (Table 7). Warren and McFadyen's [13] research would indicate that this is commonplace, as tourists in their study stated that the presence of community renewable energy projects did not negatively affect whether they would return or not. The positives that have resulted from these SEC developments are contrary to communities' notions that a SEC project may lead to minor benefits for the community in question while there is large local imposition [30]. However, all communities cited negatives that occurred as a result of the projects including inter-community rivalries and a loss of privacy for the residents.

As can be seen from the findings in this research, each of the SEC communities studied experienced similar barriers and enablers in the development of their SECs. The findings in this research indicate that although each of the SECs studied did not have any specific implementation framework developed for their projects, many of the successful tools and methodologies used across all communities were similar. These similarities and lessons are discussed in the conclusion following this section.

Table 7. Miscellaneous findings: unexpected positives and negatives

	Marstal, Aerø Island	Samsø Island	Cloughjordan
Unexpected positives	None cited	Increase in tourism, creation of an education centre, increased pride in the islanders and increased employment	Increase in tourism numbers, the creation of an enterprise centre and a better quality of life for the residents
Unexpected drawbacks	Consumers of the heat are still not aware where energy comes from as the district heating company just delivers heat at the touch of a button	Complexity of the project, bitterness has evolved between some islanders in relation to certain aspects of the project	Privacy of the residents is compromised by the constant flow of visitors to the eco-village, the residents had to move from their original homes to the eco-village

CONCLUSION

The semi-structured interview methodology used in this research was chosen in order to gather knowledge on the barriers and enablers to SEC development in two communities in Denmark and one in Ireland. There were similarities in the findings across all communities analysed and the major findings are outlined below:

- The driver for the project needs to be shared with the community and align itself with the wants and needs of the community involved;
- Public meetings are the best method for communicating with communities;
- It is important to use any existing organizational structures or networks where possible;
- The "Key influencer" is often the most important person in the development process and a determined proactive key influencer can mean the success or failure of a SEC project;
- Using mixed methods of financing for SEC projects was cited by all interviewees as the most successful method of financing projects. These should involve funding from government, community investment and bank loans;
- It is important to be aware that unexpected drawbacks to the project may occur and to make the community aware that these may happen as early in the project development as possible.

FUTURE WORK

There is a need for future studies in Europe in terms of developing a framework for the introduction of SECs. The level of community involvement recommended in the SEAI's "Guidelines for a Sustainable Energy Community" [2] are significantly later in the SEC development process than in the successful methodologies used by both Samsø and Cloughjordan SECs (Figure 3).

The findings from this initial fieldwork study would suggest that for a framework for the development of SECs to be successful, community involvement needs to play a larger role earlier in the process. Future work will involve the investigation of methodologies for achieving this. Exploring the following as future research strategies can facilitate the attainment of this goal:

- Assessing a strategy for embedding community involvement into SEC development process;
- Assessing the effect that the participation of communities and the key influencers have on the success or failure of SEC development methodologies.

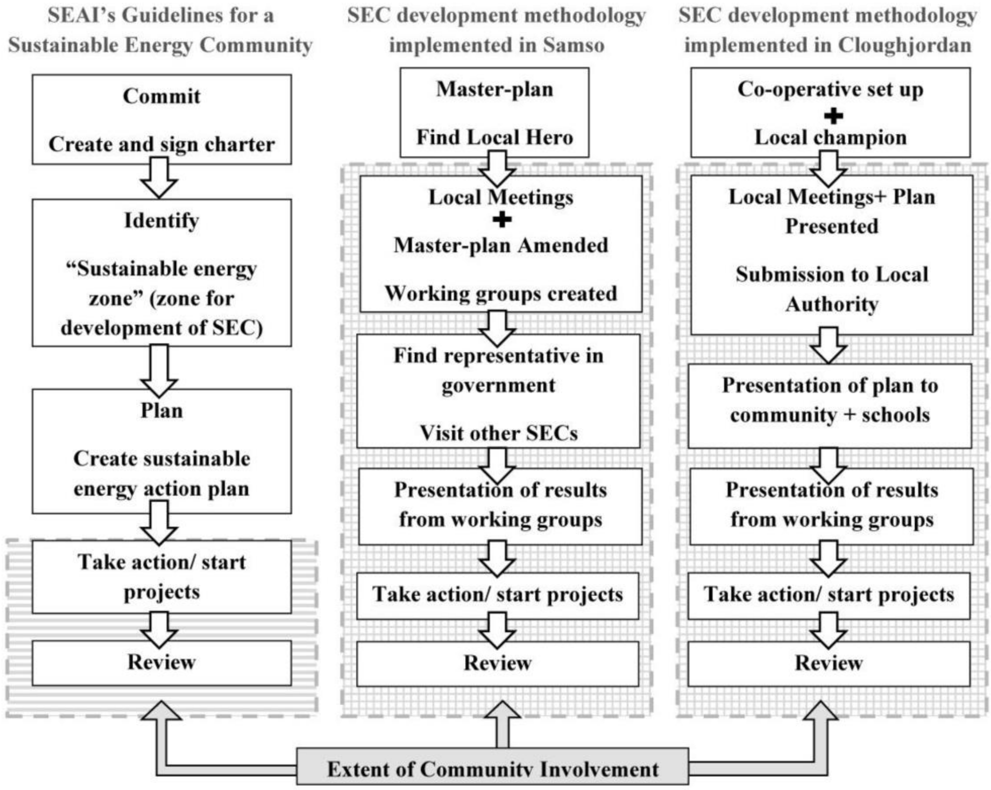

Figure 3. Comparison of SEAI's "Guidelines for a Sustainable Energy Community" (ibid.) and the findings from this study of methodologies used in Samsø and Cloughjordan SECs

LIMITATIONS TO THIS STUDY

Although only three semi-structured interviews and site-visits have been undertaken in this initial study, these were comprehensive in nature. The knowledge garnered from this study has led to initial themes being identified for future work, which will be built upon over the coming years.

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