The local embedding of technologies through community-led initiatives: the case of sustainable energy

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I hereby declare that this thesis has not been, and will not be, submitted in whole or in part to another University for the award of any other degree.

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Summary

It is widely acknowledged that existing low carbon technologies offer substantial means to reduce the carbon intensity of existing lifestyles. Yet the problem is not simply one of diffusion: commercially developed technologies need to be made to work in diverse local contexts of use. They need to be locally embedded. I approach the study of 'local embedding' through a particular actor, community-led energy initiatives and the broad research question*: how are community-led energy initiatives seeking to integrate sustainable technologies into local contexts of use?* I explore the agency of community activists to locally embed technologies and the context dynamics influencing how their projects develop.

In doing so, I identify a gap in current knowledge between the social embedding of technology by wider society (as conceptualised by sustainability transitions research) and the appropriation of technology by users (as conceptualised by domestication studies) and develop the concept of local embedding as a distinct conceptual contribution. Having identified community initiatives as performing a largely intermediary role I draw on insights from research on innovation intermediaries to understand their agency. A framework is constructed through building blocks from these approaches, then tested and refined through four comparative case studies on community attempts at local embedding.

The research contributes a novel process model on community-based intermediation for local embedding. I identify an ideal-typical sequence to key community-based intermediary processes and identify a variety of context dynamics influencing project development. As such I contribute to current discussions within (a) sustainability transitions research, about actors and their agency, and (b) innovation intermediaries research, identifying an under-studied intermediary working at the user-end of innovation processes and refine an existing framework on key intermediary processes.

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List of abbreviations

3D - three-dimensional

BCECF - Bristol Community Energy Catalyst Fund

BGCP - Bristol Green Capital Partnership

BGDs - Bristol Green Doors

BP - Bristol Power

BPC - Bristol Power Cooperative

BPCIC - Bristol Power Community Interest Company

BSC - Bristol Solar City

BSTE - bounded socio-technical experiments

CERT - Carbon Emissions Reduction Target

CESP - Community Energy Saving Programme

CIC - Community Interest Company

CSE - Centre for Sustainable Energy

DECC - Department of Energy and Climate Change

DEE - Demand Energy Equality

EEG - Easton Energy Group

EPC - Energy Performance Certificate

EST - Energy Saving Trust

FiT - Feed-in Tariff

ICTs - information communication technologies

KWp - kilowatt peak

LEAF - Local Energy Assessment Funds

MIT - Massachusetts Institute of Technology

MLP - Multi-level perspective

Ofgem - Office of gas and electricity markets

SAP - Standard Assessment Procedure

SNM - Strategic Niche Management

Solar PV - Solar photovoltaic

SWI - Solid wall insulation

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Jake Barnes
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Chapter 1.
Introduction

1.1 Research topic

Empirically, this thesis investigates contemporary community-led sustainable energy activity in the UK. It explores the ways in which communities pick up and play around with sustainable, low carbon technologies. Conceptually, it is about community-based intermediary attempts at 'local embedding', which I define as the *integration of technologies into local contexts of use*.

The importance of local embedding comes to the fore when we think about the variety of technologies that currently exist that could, if deployed throughout society, make substantial contributions towards reducing the carbon intensity of existing lifestyles. That the most significant contributions to reducing greenhouse gas emissions will come from the utilisation of existing technologies (c.f. R&D into new technologies whose deployment is a slow process) is increasingly recognised (IPCC, 2014; CCC, 2008). These technologies are for the most part considered 'mature', they are commercially developed and market ready, their application having been established in other countries but not yet widely deployed in the UK. Loft, cavity and solid-wall insulation alongside heat pumps, solar thermal and biomass heating technologies all fall into this category, as do energy generation technologies like solar photovoltaics (PV), wind and hydro. Furthermore, the technologies behind smart metering are generally quite developed (although more 'technical' innovation is still thought necessary) whilst the introduction of heat networks are viewed as promising at a community-scale (see for example DECC, 2009). In each case countries can be named where the technology has been in use for years if not decades. In each case it is not the technical feasibility that holds them back, nor is it economic viability but a range of social, cultural and institutional barriers (Sovacool & Watts, 2009).

The problem, as Steward (2012) suggests, "is not simply one of diffusion" rather "singular technological innovations need to be embedded in innovative systems of household living and personal mobility for them to have a significant impact" (337). Steward approaches this problem from the emerging analytical perspective of sustainability transitions (Smith, Voß & Grin, 2010; Markard, Raven & Truffer 2012) and cautions, such system-level innovation is challenging "because [it] usually involve several different technologies, a variety of social and behavioural

innovations, and a diversity of societal actors" (Steward, 2012, 337). Doing so, he emphasises the need for new types of innovation that address systemic concerns, new innovation actors, often 'local in scope' and new types of knowledge. He brings attention to the contemporary problem of embedding low carbon technologies and, at least implicitly, recognises this challenge as manifesting at multiple scales.

Embedding occurs at different scales. Under the umbrella of the sustainability transitions research perspective the focus is on the scale of entire socio-technical systems of production and consumption and attention is directed to the change from one socio-technical system to another (Geels, 2002: 2004). The perspective highlights how new technologies need to be integrated and aligned within multiple system elements, including regulation and policy, user practices, markets, culture, infrastructure and production systems, to fulfil societal functions. Although actors and their agency are recognised as being important (Geels & Schot, 2010), attention focuses on the norms, rules and configurations rather than sources of agency in those changes and thus gives primacy to the accumulative interactions of multiple actors. Consequently, embedding, as I will suggest it, has been predominantly analysed as the (disruptive) integration of technologies into 'wider society'. In contrast, research into the domestication of technology takes users as its point of departure and studies the embedding of technology by users into everyday life (Silverstone & Hirch 1992; Lie & Sørensen, 1996; Oudshroon & Pinch, 2005; Rohracher, 2005). Both approaches hold insights into how new technologies get embedded, but they analyse this relationship at different scales. Local embedding, as I shall propose it, sits between these scales, above but connected to the way in which users 'acquire', 'place', 'interpret' and 'integrate' technologies (Lie & Sørensen, 1996) and below the embedding of technology into wider society. It concerns the way in which communities and regions build momentum behind particular technologies in accordance with existing physical, social and cognitive structures, supply chains and user understanding at the local scale. It is about the experimentation and innovation involved in adapting market-ready solutions to existing local conditions and getting them to work in diverse circumstances.

I approach the study of 'local embedding' through a particular type of intermediary actor, which is community-led energy initiatives. By intermediary I mean "actors who create spaces and opportunities for appropriation and generation of emerging technical or cultural products by others who might be described as developers and users" (Stewart and Hyysalo, 2008, 296-7). Whilst previous studies have suggested community initiatives might be conceptualised as intermediary organisations (e.g. Steward, Liff and Duncklemann, 2009; Mourik et al., 2009) only recently have various forms of community intermediary been explored (Bird and Barnes, 2014; Hamilton et al. 2015) and none have explicitly approached community-led energy

initiatives through an intermediary lens.

This empirical focus is no accident. Previous research has made a variety of claims about the benefits and distinctiveness of community-led energy activity. Mulugetta, Jackson and van der Horst (2010) argue such initiatives can create space for developing and testing new institutional models, they can develop technical skills, create demand for low carbon technologies and stimulate new markets. Addressing community renewable energy initiatives in particular Walker and colleagues (2006, 9) claim such initiatives are concerned with the "innovation and development of the social, economic and institutional arrangements under which technologies can be deployed", which they argue positions community activity "demonstrably within the conception of innovation as systemic and socio-technical and being involved with social arrangements, infrastructures, institutions and cultural meanings". Steward, Liff and Dunkleman (2009, 159) claim community initiatives are "promoting systemic approaches that link well to the way in which people live their lives" and argue they present a "distinctive contribution to that of other actors", in part because they act "at a 'community' level… outside the 'private' world of the family but still on a meaningful scale". Also addressing the distinctiveness of community-based approaches Hielscher, Seyfang and Smith (2011, 10) suggest communities have the capacity to 'change contexts' and go on to conclude that "models of system change are required which engage with, and respond to, this challenge".

Collectively, this research to date makes claims about the potential of community-led activity to locally embed low carbon technologies. It also challenges current conceptualisations of embedding within theory: neither embedding under sustainability transitions nor theories of domestication adequately address the scale at which contemporary community activity attempts to embed low carbon technologies. This research on community energy suggests a gap in knowledge about the processes involved in local embedding. Specifically, questions remain over the agency of individuals and community-based approaches to affect change (Moloney, Horne & Fien, 2010; Hielscher, Seyfang & Smith 2011; Mayne, Hamilton & Lucas, 2013). In this thesis I engage with this gap in knowledge. I seek to develop a process model of community-based intermediation for local embedding: I explore the agency of community activists to locally embed technologies and the dynamics influencing how their projects develop. The following broad question guides the research:

> **RQ1: How are community-led energy initiatives seeking to integrate sustainable technologies into local context of use?**

I will address this question through employing a specific conceptual framework. I take insights on social embedding from the sustainability transitions literature and insights from

domestication studies to construct a framework on the local embedding of technology. Having identified community initiatives as performing largely intermediary roles I then draw upon insights from research on innovation intermediaries (Stewart & Hyysalo, 2008) to understand their agency. Specific, detailed research questions build on this conceptual framework. By doing so I will not only answer the research question posed above but also make a contribution to the embedding and intermediaries literatures.

RQ2: Are there patterns to key intermediary processes in local embedding and what explains these, if any, patterns?

RQ3: How do context dynamics affect the agency of community intermediaries in local embedding?

The rest of this chapter introduces the thesis in more detail. In section 1.2, I briefly situate embedding with regards to innovation. I then introduce the thesis approach, relevance and contributions in section 1.3. In section 1.4, I introduce contemporary community energy action and briefly review research on community energy activity in section 1.5. In section 1.6, I explain the layout of the thesis.

1.2 Innovation and 'local embedding'

To further substantiate this research topic I will position 'local embedding' with regard to an evolving understanding of innovation and, in particular, phased models of socio-technical transition processes.

Over the past two decades a new perspective of sustainability transitions has challenged innovation and sustainability in quite new terms. Smith, Voß and Grin (2010) explain this as a broadening of inquiry across two dimensions. First, a broadening of the problem frame: they emphasise how the object of study and therefore the purpose and outcomes of innovation have changed, from the study of cleaner technologies to innovating entire systems. Second, they identify a broadening of the analytical frame, by which they mean the ideas and concepts mobilised to understand and explain the development and embedding of innovations has been successively widened. What has resulted is a focus on understanding changes in entire systems of production and consumption through the study of 'system innovations' (Elzen, Geels & Green, 2004). The new perspective draws on two related approaches. One addressing long-term, historical explanations of system change, the other seeking interventions through which the shape, scope and direction of change can be influenced. As Steward (2012) points out, the perspective implies a new 'repertoire of experiments', a focus on networks, learning and expectations, it involves consumers as well as producers and focuses attention on challenging existing, incumbent systems in terms of their unsustainability.

It is within this new perspective that I seek to locate the concept of local embedding because, as I will argue in this thesis, it is about the success of socially desirable technologies serving long-term goals and technologies that continue to face a mis-match with regards to existing infrastructure, market arrangements and user practices etc. This framing is reminiscent of a particular strand of sustainability transitions, Strategic Niche Management (SNM) (which I will introduce in chapter 2) but with a key difference. SNM emphasises real world experimentation with radical technologies in order for new socio-technical trajectories to emerge (with the potential of challenging the existing systems) (Kemp, Schot & Hoogma, 1998; Hoogma et al., 2002). In this thesis I emphasise the work still required to get what are now mature technologies, supported by government policies, industry associations and so on, into local contexts of use. That is to say new trajectories have emerged but rather than experimentation, for many places it is about deployment, i.e. local embedding in particular contexts of use.

A second means of situating the research topic is to draw on phased models of transition processes. At the conceptual level four stylised phases to transitions processes have been outlined by various scholars (Rotmans, Kemp & van Asselt, 2001; van Lente et al. 2003; Geels, 2005; Geels et al., 2008). Each share basic characteristics and are commonly visualised as an S-curve (figure 1.1):

1. A pre-development or exploration phase is typically prolonged, in which articulation processes are important and new options emerge.
2. A take-off phase where networks of actors form, common expectations and visions emerge and user preferences are sought.
3. A breakthrough or embedding phase in which building momentum behind particular socio-technical configurations is important and where such novelty has to compete with established systems.
4. A stabilisation phase in which there is a gradual replacement of existing systems with new.

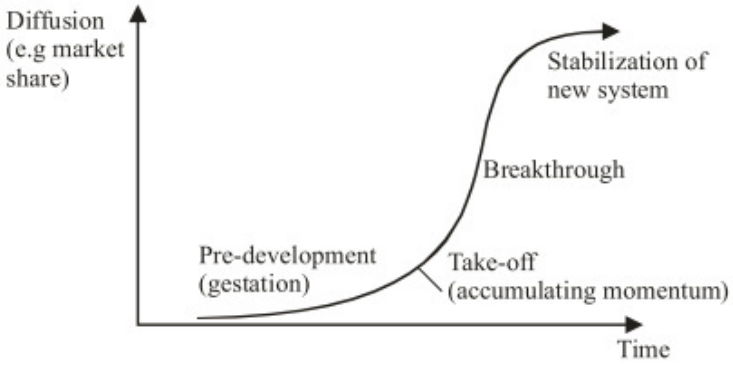

Figure 1.1: Phases of transition

(Geels et al., 2008 based on Rotmans, Kemp & van Asselt, 2001)

Embedding occurs, to different degrees, throughout phases 2, 3 and 4. Local embedding as I situate it, is positioned within phase 3 and 4. It challenges this stylised conception of momentum building and explores the work required to get mature technologies into diverse contexts of use. In doing so I draw attention to how previously 'radical' technologies are now, to a large extent, considered 'normal': the last decade has seen substantial technological advances, the experimentation of various different forms of government support, the creation of new rules and regulations to guide deployment and the creation of new actor networks, such as trade associations, conferences and lobby groups, all of which challenge incumbent systems and support the societal embedding of the new. Yet, there is still much innovative work to be done in taking existing solutions and getting them to actually work in diverse local contexts. The challenge is particularly pronounced at the local scale where users are involved: many struggle to assess their value and utility compared to existing systems, others are likely to question whether they can afford or cope with the hassle involved or simply dismiss them as unnecessary or irrelevant (DECC, 2012; Phillips, 2012; Consumer Focus, 2011: Sovacool, 2009).

Indeed, history and experience demonstrate how even 'superior' technologies can fail to break through (David, 1985; Arthur, 1989). Sustainability Transitions theory is of course more nuanced than this. Transition scholars point out that external dynamics also play an important role, such as changes in the wider environment (e.g. oil shocks) and destabilisation of existing systems (such as selection criteria) in order to create windows of opportunity for emerging socio-technical configurations to challenge incumbent systems (Geels 2005; Schot and Geels, 2008). But even under this nuanced understanding the focus of attention remains with understanding niche trajectories and niche-regime interactions. What is missing in this respect is a better understanding of the deployment and embedding of market-ready technologies into local contexts.

Thus my focus on local embedding reinforces the non-linear, iterative process of change. The point is that previous, admittedly stylised, conceptions of transformation processes viewed the breakthrough and embedding of technologies as the accumulation of niche markets, growing successively in size (Schot & Geels, 2008). Conceptual understanding and appreciation of the innovative work required to make technologies work in particular places and at particular scales has received less attention.

1.3 Thesis approach, relevance and contributions

It is a central contention of this thesis that prevailing literatures on technology and innovation

do not adequately explain community activity with commercially developed low carbon technologies. Conceptually, this thesis takes as its reference point the growing body of work around sustainability transitions (Smith, Voß & Grin, 2010; Markard, Raven & Truffer 2012). Whilst this is not the only feasible reference point, its focus on experimentation, learning processes and interactions between users and producers within networks was thought the most useful to situate and understand contemporary community activity. However, and as indicated above, I take a critical stance towards the perspective's ability to conceptualise and explain community experimentation with developed technologies. It is argued in chapter 2 (literature review and conceptual framework), that the focus of attention has hitherto been placed on (a) the upstream technological development of radical, socially desirable technologies, (b) understanding the emergence of new niche development trajectories, and (c) evolutionary explanations of change. The result, I suggest, is that embedding is currently addressed as the integration of technologies into 'wider society'. In contrast, less attention has been directed towards extending the focus downstream, to the use of mature, market-ready technologies in particular places and scales.

To overcome these perceived deficiencies two complementary science, technology and innovation literatures are mobilised: domestication studies and research on innovation intermediaries. Doing so I seek to develop a conceptual framework on the agency of community-based intermediaries to locally embed energy technologies. Thus the core of this thesis constructs, tests and refines a framework for understanding community-based intermediation for local embedding through four case studies on community experimentation with two technologies; solar PV and solid-wall insulation. Justifications for these case technology choices are given in chapter 3.

I take a particular 'process' approach to my research (outlined in chapter 3): an approach that is comparable to, yet often implicit within, research by Sustainability Transition scholars. Process research is particularly adapt to answering 'how' questions because as a strategy it allows us to inquire into the timing and event structures which produce change (Van de Ven & Poole, 2005). My aim is to search for patterns in processes in how community intermediaries seek to locally embed technologies, and seek to develop an understanding of how context dynamics influence community intermediation.

The thesis is exploratory and theory building. On the one hand it identifies and explores a gap in knowledge - between the social embedding of technology by wider society and the domestication of technology by users - and on the other hand it takes building blocks from both approaches, plus insights mobilised from research on innovation intermediaries to construct a

model of community-based intermediation for local embedding, and tests this model empirically through four case studies.

Academic relevance

I have already indicated above the relevance of the research to academic debate but it is worth spelling this out, clearly and succinctly.

First, with a focus on commercially developed sustainable technologies, I can make a contribution to the study of Sustainability Transitions. Here, there has been much attention to the new, the radical and the long-term development of alternatives. Whilst this attention was clearly justified, the shape of the challenge has changed and in some cases moved on: what were once considered 'radical' technologies are now considered normal by government policies, industry coalitions and trade associations. Yet the problem is not simply about the rate and scale of their diffusion. To utilise such technologies they need to be integrated into existing lifestyles, embedded within new systems of provision at local and community-scales, through regional to national systems. The uneven distribution of low-carbon technologies geographically and socially raises questions about the work needed to locally embed technologies. The thesis therefore contributes to recent debates within the literature about actors and agency, and about the contexts of action and scale (STRN, 2010). Identifying and exploring the often 'hidden work' of community-based intermediary actors at the use-end of technology development and use is one research aim.

Second, I also contribute to the disparate innovation intermediary literature, where the focus of attention has traditionally been placed on upstream technology development (e.g. Howells, 2006). I contribute to the identification of what Stewart and Hyysalo (2008) describe as 'overshadowed' intermediary organisations, the informal yet just as crucial intermediaries working at the user-end of innovation. Moreover, in a search for patterns I refine their existing framework on key intermediary processes into an ideal-typical sequence and specify dynamics influencing intermediation at the user-end.

Societal relevance

Local embedding has not only academic but societal relevance. Moving society onto a more sustainable pathway is thought in the near term to require the utilisation of existing commercially available technologies (CCC, 2008: Skea, 2012; Watson, 2012). As such the challenge is not in the 'technical feasibility' of creating a low carbon economy but in 'making it

happen' (Steward, Liff & Dunkelman, 2009). A variety of technologies exist, and particularly so at the domestic and community-scale, which could, if deployed throughout society, make substantial contributions towards reducing the carbon intensity of existing lifestyles (Defra, 2007). A better understanding of how existing solutions can be made to actually work in diverse local contexts is therefore useful.

Whilst the need to radically re-orientate societal systems has become politically salient, increasing attention and emphasis has been placed on local and community-scale activity as a potential site of innovation for sustainable development (Seyfang and Smith, 2007; Hale, 2010). For example, the UK government has recently developed a community energy strategy - the first of its kind in the UK - which suggests, "communities are central to meeting our energy and climate change challenges", in part because,

> "Community-led action can often tackle the most difficult issues more effectively than government alone. Communities can mobilise and engage people effectively by tailoring their community engagement to an audience that they understand well, using their existing presence and 'representative voice' to good effect. They have more freedom to develop creative solutions that meet local needs." (DECC, 2014a, 14)

Yet in practice, the UK government has taken an instrumental view of increased community participation in energy system development over the last decade. A role for communities was first recognised in the Energy White Paper of 2003 as important for the deployment of renewable energy technologies, like onshore wind (DTI, 2003). More recently DECC's Local Energy Assessment Fund (LEAF, run from January to March 2012) sought the installation of energy efficiency demonstration projects alongside developing capacity for, the feasibility of and community engagement with the local deployment of low carbon technologies (DECC, 2011). Despite this policy focus, where communities are conceived as instrumental to achieving the increased deployment of low carbon technologies, the agency of community initiatives to locally embed technologies has not been analysed from an innovation studies perspective.

The research thus contributes to a more informed policy understanding of the limited forms of agency within community-based approaches to local embedding. It positions community-based activists amongst multiple stakeholders and an evolving context. It critiques and nuances perceived wisdoms about the strength of community approaches, in particular the expectations about community involvement, and suggests key insights into supporting community-based intermediary attempts to locally embed sustainable technologies. Developing a better understanding of community intermediation for local embedding will in turn be important for achieving national carbon reduction targets.

1.4 Community energy action, a brief introduction

So what of contemporary community energy action? Community-scale experimentation with technologies is not new but can be traced back to the alternative technology movement of the 1960's and 1970's (Dunn, 1978) where Schumacher's (1973) 'Small is beautiful' and Lovin's (1976) 'soft energy paths' provided intellectual inspiration for alternative ways of conceptualising energy system development. Since the turn of the century a flourishing of UK community energy activity has been claimed (Walker & Devine-Wright, 2008; Seyfang et al., 2014). However, estimating the size and extend of activity today remains a challenge because of its grassroots and predominantly volunteer-led characteristics. In 2005 over 500 community-led renewable energy projects were observed in the UK (Walker, 2007) whilst in 2012 135 grassroots groups working on energy consumption and generation were recorded in Scotland (Bomberg & McEwen, 2012). Meanwhile, research for the department of Energy and Climate Change (DECC) (DR&S, 2013), drawing on a variety of databases, claims to have found at least 5,000 active UK groups since 2008.

A considerable diversity of activity lies within these figures. The first study (Walker, 2007) included projects led by local authorities, utilities and developers alongside those developed from the grassroots. Where initiatives originate from therefore contributes to this diversity. Diversity also occurs through the institutional and governance structures adopted (open or closed), the degree of participation and role for participants (active, passive, financial etc), patterns of ownership, levels of support and funding arrangements (Rogers et al., 2008; Walker & Devine-Wright, 2008; Hielscher, Seyfang & Smith, 2011). In addition, a variety of potential foci for improving the energy system exist, such as focusing on renewable energy, energy efficiency or behaviour change projects, whilst different approaches can be taken, from greening the existing system to developing radical alternatives (Steward, Liff & Dunkelman, 2009).

A recent web-based survey of UK community energy activity (Seyfang, Park & Smith, 2013) provides some further clarity. Of 190 responses the majority of initiatives were bottom-up, with over half the projects being initiated by individuals and a further third being set up by pre-existing community groups. 89% saw themselves as location-based rather than interest-based communities. Group objectives were found to be multiple and varied (figure 1.2). On average groups cited eight objectives per project. Solar PV dominated the choice of energy generation technology pursued, contrasting with a preference for solar thermal found in 2005 (Walker, 2007). To Seyfang and colleagues (2013), this suggested generous policy incentives for the technology were strongly affecting community approaches. Meanwhile, energy conservation activities used a more diverse set of activities, on average pursuing 7.3 measures per project.

With newsletters and public meetings the most highly cited, Seyfang and colleagues (2013) suggest groups might be pursuing an information deficit approach to change.

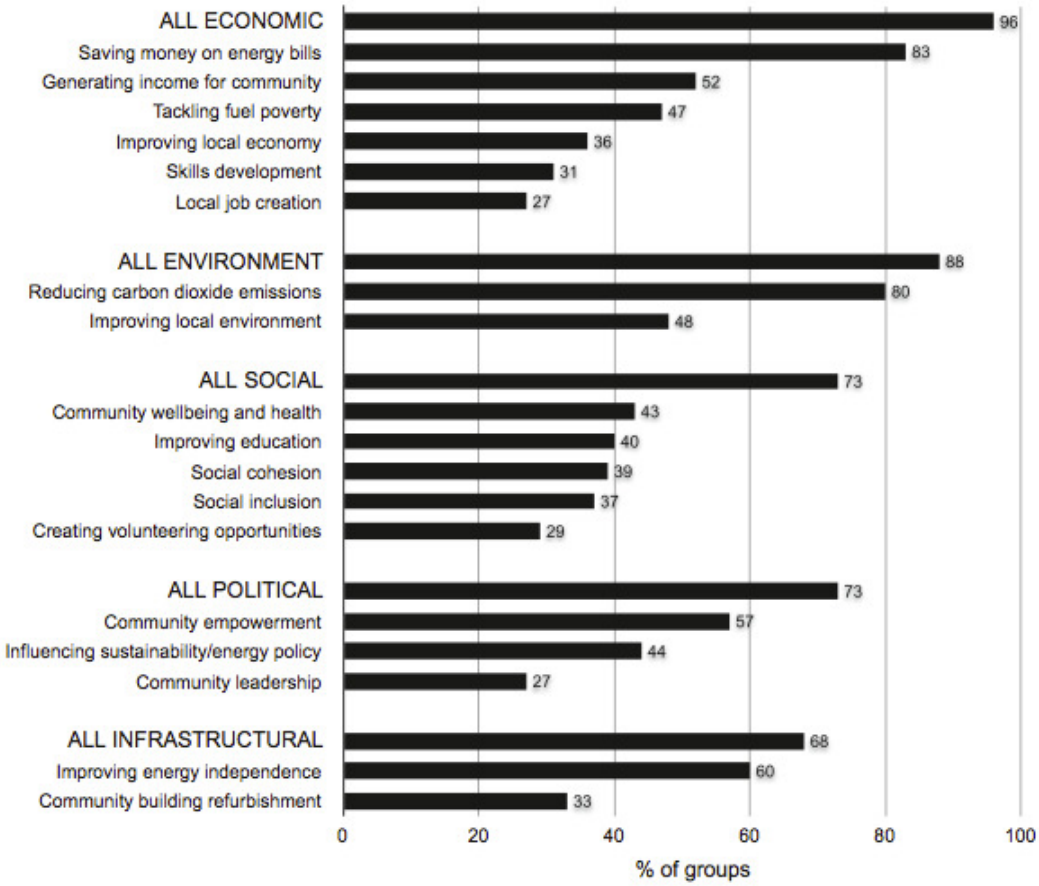

Figure 1.2: Objectives of UK community energy initiatives (Seyfang, Park & Smith, 2013)

Defining community energy precisely, with regard to this diversity, is somewhat problematic. Reviewing the diversity of interpretations used to describe community energy, across practitioners, intermediary organisations and policy makers Walker and Devine-Wright (2008) noted two key dimensions on which community renewable energy projects differed. The first related to concern for who the project is developed by and for, who is involved and who has influence (a process dimension). The second, concerned how project outcomes are socially and spatially situated, who benefits from the project economically and socially (an outcome dimension). As a result, community initiatives were defined as following open and participatory processes leading to local and collective outcomes.

The UK government's first community energy strategy includes elements of this definition, where they understand community energy to mean,

> "community projects or initiatives focused on the four strands of reducing energy use, managing energy better, generating energy or purchasing energy. This included communities of place and communities of interest. These projects or initiatives shared an emphasis on community ownership, leadership or control where the community benefits." (DECC, 2014a, 20)

In this thesis I follow Walker and Devine-Wright's (2008) definition.

1.5 Researching community energy

As community approaches have flourished in the UK so too has research, from a variety of different perspectives, 'on' or 'with' community energy action. There are no neatly delineated theories of community energy instead what emerges is a rich body of work with more or less relevance to one's research interests. In the following I distill various themes pertinent to my research interests. Doing so further substantiates the empirical domain (UK community energy) and situates this research within this emerging body of work.

A first strong theme is the identification of barriers to community initiative development (e.g. Walker, 2008; Viardot, 2013). The most cited barrier is finance[1] (Hoggett, 2010; Houghton, 2010; Walker, 2007:2008). Having the skills, capacity and support to develop community projects is a second regularly mentioned barrier. From the outset, it is clear that a wide variety of skills are needed to develop community-based solutions to climate change (see for example Hargreaves (2012a) or Hielscher (2013)). Here, Middlemiss and Parish (2010) have highlighted how communities are differently endowed and must draw on multiple capacities within their communities to achieve their ambitions. Bomberg and McEwan (2012) argue the existence of government support is by itself, insufficient and instead argue what defines initiative success is the ability of individuals to exploit available resources and mitigate constraints. As such it is not so much the existence of support but how groups' use it that matters. Seyfang, Park and Smith (2013) have subsequently grouped the identification of success factors and obstacles around five levels of activity (table 1.1) and thereby provide an indication of internal and external influences on the agency of community initiatives.

[1]The majority of this research is based around community renewables projects with less attention having been given to financing energy efficiency or demand reduction projects.

Table 1.1: Success factors and obstacles for community projects (based on Seyfang, Park and Smith, 2013)

Level of activity	**Success factor**	**Obstacle**
Group	Having key committed individuals; an effective organising group capable of maintaining momentum	Lack of clear direction or management
Project	Sufficient time, information, skills, money and material resources, financial viability	A lack of time, skills, information and financial and material resources
Community	Project is designed to meet community needs; engages with and builds trust in the community	Overcoming public disinterest and mistrust of new energy systems; tackling a sense of disempowerment
Network	Forming supportive partnerships; sharing information with other groups	The need to consolidate learning and skills so they can be translated to others.
Policy	A supportive national context	A lack of policy support; inconsistent and hard-to-access funding; difficulties with planning and other legal issues

Intermediary organisations, such as the Centre for Sustainable Energy or Carbon Leapfrog, provide a further form of support through, variously, aggregating knowledge, developing infrastructures of support (such as websites, 'how to guides' etc), actively shaping project development through coordinating and framing activity, providing technical and 'soft' support and brokering and managing partnerships with external organisations (Hargreaves et al., 2013; Bird and Barnes, 2014). Such intermediaries are often limited by a lack of resources (Seyfang et al, 2014). Less acknowledged is the degree to which "local networks and partnerships have been vital for the successful development of community energy" (Watson, 2013, see also Houghton, 2010). Finally, a variety of structural barriers and the contextual specificity of initiatives are thought to present further barriers. Misalignments between community needs and the design of programmes, regulations and bureaucratic processes are found to "hinder rather than aid community-led innovation and action" (Houghton, 2010). In part this is because strong emphasis by practitioners is placed in the value of deriving locally appropriate solutions through participatory processes (Capener, 2010; Houghton, 2010; Kellett, 2007). Above all, it is argued "what makes local solutions effective is their local specificity, and the ability of groups to tailor solutions to local contexts" (Blunt and Harris, 2010). Research by Mayne, Hamilton & Lucas (2013) brings attention to how local action is constrained by wider structural barriers beyond the reach of project participants and call attention to the role of local authorities as important partners.

A second theme has explored the conditions under which a space for community energy is being created under national government policy (Walker et al., 2007; Nolden, 2013; Catney et al.,

2014; O'Brien & Hope, 2010; Parag et al., 2013; Hale, 2010). Walker and colleagues (2007) claim government support for community energy was largely the result of a number of instrumental policy needs and objectives coalescing around the notion of 'community'. This resulted in the growth of (and research on) community renewable energy projects. In particular, Walker and Cass (2007) have distinguished five basic modes of renewable energy technology implementation in the UK (public utility, private supplier, community, household and business), each with a distinct combination of social and technical elements. This research highlights socio-technical heterogeneity and diverging implementation patterns. It also brings attention to and demonstrates the need for differentiated socio-technical analysis of technologies and users in the local embedding of sustainable technologies.

Examining the relationship between government policies and practice, O'Brien and Hope (2010) argue for the greater involvement of users within local decision-making and for greater local leadership. The importance and role of local authorities, local politics and governance is also highlighted by Peters, Fudge and Sinclair (2010). Meanwhile, Parag et al. (2013, 1075), through a network approach, highlight central and peripheral actors, information hubs and important resources that are crucial both politically and practically, "to promote energy demand reduction and the uptake of low cost energy efficiency measures" through community approaches. Alongside this work, there has been detailed investigation of the role of participation (Hoffman & High-Pippert, 2009), governance (Ison, 2010), social cohesion and trust (Walker et al., 2010), ownership (Warren & McFadyen, 2010) and community capacity building (Middlemiss & Parish, 2010). Indeed, a focus on participation is said to differentiate community initiatives from other energy approaches (Hoffman & High-Pippert, 2009; Ison, 2010, Steward, Liff & Dunkelman, 2009) even though community boundaries are contestable (Aitken, 2010), dynamic and transient (Walker et al., 2010).

A third theme has investigated community-led initiatives as an alternative means to stimulate individual behaviour change (e.g. Jackson (2005) or Hale (2010)). In particular, Moloney, Horne and Fien (2010) argue the 'problem' of human behaviour needs to be situated within its broader context of norms and values, infrastructures, institutional arrangements and systems of governance and suggest "the potential agency or power of these types of community-based organisations to affect change at varying scales needs further investigation" (7622). In a similar move Heiskanen et al. (2010) challenge the 'fallacy of targeting individuals' and advocate communities as potential sources of social change. These studies share a common approach of situating behaviour change within its broader context and share an emphasis on the holistic change potential of community approaches. Collectively, they argue for a socio-technical approach to community action incorporating multiple elements at various levels. They also

suggests future research should use a broad framework rather than narrow analytical approaches.

This research on community energy activity serves to further introduce the empirical domain but it also suggests some general insights into the local embedding of technology by community initiatives. First, community-led energy activity is strongly context dependent. From developing locally appropriate solutions to locally perceived problems, community initiatives are using locally situated knowledge, skills and capacity and are thought to have a strong capacity for change through an ability to 'change local contexts'. Second, a growing emphasis is being placed on communities working within existing institutions, practices and places and benefiting from timely partnerships with local authorities, businesses and third sector organisations. Third, and leading on from this, exclusive focus on community-initiatives appears to be underplaying a variety of enabling and constraining factors at different scales (spatial, institutional, governance and policy etc). This reinforces the need to take a wider perspective in understanding how community-led groups are enabled to undertake project-based work.

1.6 Layout of the thesis

In chapter 2 I develop the concept of local embedding as a distinct conceptual contribution and develop a framework to explain community-based intermediation for local embedding. To do so I critically review sustainability transitions research and domestication studies for how they understand embedding and what they tell us about contemporary community activity. The review has two aims, to substantiate a gap in knowledge and collect building blocks with which to construct a framework. I then mobilise insights from research on innovation intermediaries to understand the agency of community initiatives and construct a conceptual framework. Chapter 3 explains the research design and analytic strategy adopted in this thesis. Chapter 4 introduces the two focal technologies (solid wall insulation and solar PV) of the subsequent case studies.

In chapters 5 to 8 I present and analyse four case studies of community attempts to locally embed sustainable energy technologies. Each chapter concludes with visual mapping of key intermediary processes and the identification of context dynamics influencing community action. These chapters create the foundations on which I undertake the cross case analysis on patterns and dynamics in chapter 9: the chapter addresses and answers the two detailed research questions. Finally in chapter 10 I bring together the results of the cross case analysis with additional insights from individual case study chapters and revise the theoretical framework into a dynamic model of community-based intermediation for local embedding. I end with reflections for practitioners and policy-makers.

Chapter 2.
Literature review and conceptual framework

There is no specific literature on local embedding as indicated in chapter 1. However, the term is increasingly used by researchers in a variety of ways. For example Schreuer, Ornetzeder and Rohracher (2010) argue that "relatively little attention has so far been given to the process of setting up and locally embedding niche [experiments]" (741). Raven et al. (2008) claim that "sensitivity to local context and the local embeddedness of a project" are key to determining successful deployment projects and suggest that processes of local embedding involves the negotiating and aligning of actors around the technology and local context. Meanwhile, Jalas, Kuusi and Heikanen (2014, 76) explore self-building courses "as a stimulus for user innovations, local embedding and diffusion of renewable energy technology". The term is used both in an ordinary language sense – "to fix (an object) firmly and deeply into a surrounding mass" (OED, 2010) - and a technical sense, to evoke a concept and in particular, a process. Nowhere is the term explicitly explained: it is used freely, its meaning being inferred 'between the lines'. As a result 'local embedding' has characteristics of what Billig (2013) calls a 'semi-technical' term: a term that is neither properly technical nor properly ordinary. One could take this as a pointed critique; I suggest this opens up an avenue for exploration. In the following review I situate these papers.

More broadly, embedding is defined by Russell and Williams (2002, 123), in a review of Science and Technology Studies concepts, as the "process of integrating technologies into local contexts of use". Despite this, no specific literature on embedding exists instead I identify two approaches that provide insights. On the one hand, how technologies get 'socially embedded' in wider society is approached through the study of sustainability transitions (Verbong, Mourik & Raven, 2004; Geels, Hekkert & Jacobsson, 2008). On the other hand, there is a long tradition of studying the 'appropriation of technology' by users of which domestication studies provides a dominant approach (Lie & Sørensen, 1996). Both concepts and approaches share a basic assumption that technology is co-constructed with society but they analyse this relationship at different scales, from individuals to entire societies.

In the following chapter I develop the concept of local embedding as a distinct conceptual contribution, located between the 'appropriation' of technology in everyday life and its 'social embedding' in wider society. The chapter has two aims. First, I seek to substantiate this gap in

knowledge. Second I seek insights and concepts that can be used as building blocks in the construction of a conceptual framework on the local embedding of technology by communities.

Section 2.1 reviews the literature on the social embedding of technology into wider society from the vantage point of sustainability transitions. Section 2.2 then reviews the literature on the appropriation of technology with particular attention to domestication studies. To understand the agency of community initiatives I review and mobilise insights from the literature on innovation intermediaries in section 2.3. Finally, I construct a conceptual framework to understand the agency of community-based intermediaries in locally embedding technologies in section 2.4.

2.1 The social embedding of technology into wider society

At one end of the scale how new technologies are embedded into wider society is captured within the emerging analytical perspective of sustainability transitions. The study of sustainability transitions situates technologies alongside actors and institutions. Four theoretical frameworks have principally been accepted under the perspective: (a) transition management, focuses on the governance of unfolding large-scale change (e.g. Rotmans et al., 2001) (b) strategic niche management (SNM) focuses on the processes through which inventions develop into robust socio-technical configurations (e.g. Hoogma et al., 2002), (c) the multi-level perspective (MLP) addresses the long-term transformation of socio-technical systems (e.g. Geels, 2002), and (d) technological innovation system focuses on emerging technologies and accompanying institutional and organisational changes (e.g. Herkkert et al., 2007)[2]. In the following section I review the MLP and SNM because of my focus on embedding, I seek insights into local embedding by community initiatives. The two remaining frameworks will not be discussed in depth.

The multi-level perspective on sustainability transitions

The multi-level perspective (MLP) on socio-technical transitions (Rip & Kemp, 1998; Geels, 2002: 2004) gives particular attention to how technologies are embedded in wider society. The perspective brings attention to the development of innovative technologies within protected niche spaces, which are in turn embedded at a higher level within larger, systemic socio-technical regimes. Made up of artefacts, actors and institutions socio-technical regimes are the grammar or glue that holds together temporarily stable configurations of provision. The addition

[2] For an overview of the field and introduction to each of these theoretical approaches Markard et al., (2012) provides a very useful introduction.

'that work', indicates they fulfil a societal function, such as transportation, heat or electricity generation and use. In turn and constituting a background context the socio-technical landscape is seen to involve slow changing cultural norms, values and dominant economic and governance ideals which influence and exert pressure on regimes and niches to develop in particular directions.

Socio-technical regimes can thus explain why we often find coherent and interconnected settings where combinations of technologies, social practices, expectations and institutions are joined together in 'seamless webs' (Hughes, 1987) across spaces and scales. Radically new technologies and social innovations pursuing system transformation face significant challenges competing against incumbent socio-technical regimes owing to a number of mutually reinforcing processes which combine to channel developments along existing trajectories (Berkhout, 2002).

The three levels are linked through structuration, their conceptual value pointing towards the 'multi-dimensionality' of socio-technical change processes, the embeddedness of local practices and niche experiments within wider structures, with their own particular history, culture and dynamics (Rohracher, 2005). The core argument of the MLP is that long-term transformative change results from the interaction of levels over time (Geels, 2005). Each level influences developments in their own way. What is being influenced are ongoing local practices, evident at all levels. In other words, local practices are enabled and constrained by a variety of factors and processes acting at multiple scales. The MLP thus provides a means to conceptualise the broader context of an 'innovation journey' (Rip, 2012): how technologies are developed, tested and embedded within wider society. Figure 2.1 depicts the three levels, the arrows representing potential innovation journeys. The figure is a precursor to Geels' (2002:2004) MLP heuristic. I use it here because unlike Geels' later heuristic it emphasises how the three levels influence local practices (depicted at the bottom of the figure).

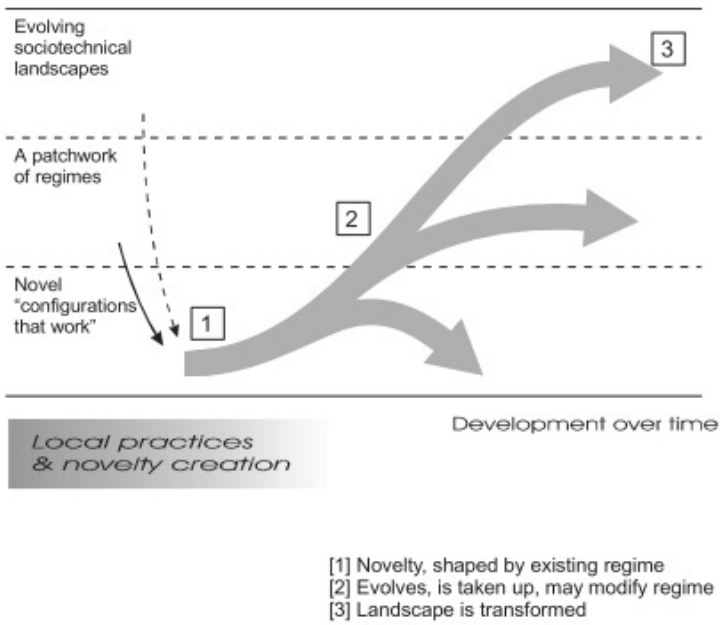

Figure 2.1 The three layers of socio-technical change (Rip, 2000)

Social embedding within the perspective is consequently pervasive and large-scale. Reviewing the field Markard, Raven and Truffer (2012) demonstrate how applications of the sustainability transitions perspective take national systems as their predominant unit of analysis. Whilst increasing attention has been given to regional and local scales in recent years, such as cities and I will attend to this shortly, for now the important insight is that the co-evolution and co-construction of technology and society must be placed within broader contexts of social structures and 'dynamically stable' (Geels, 2005) socio-technical configurations of provision. So to understand the agency of community initiatives we also have to understand the stabilising and directing force of socio-technical regimes where local practices are interlinked with systems and infrastructure, expectations and institutions. Structuration and unfolding change thus provide a means to situate local and community-scale action at a course-grained level.

The perspective emphasises the systemic and interrelated quality of change processes and thereby draws attention to multiple actors. Social embedding is thus conceived as involving interactions between a broad range of stakeholders including firms, policy-makers, consumers, suppliers, civil society, social movements and so forth, each with their own perceptions, motivations, aims and resources etc (Geels et al., 2008). Actors moves are understood through the metaphor of game playing: multiple actors make moves according to the system rules, interpreting, reinforcing and potentially altering the rules of the game as it is played (Geels, 2004). An important insight is that system transformation or social embedding of technology is beyond the direct control of any single actor (Smith, Stirling & Berkhout 2005). For the present study, this point directs attention to community initiatives working alongside or in partnership

with other stakeholders. More broadly, such systems perspective have been criticised for under playing the role of agency (Smith, Stirling & Berkhout, 2005; Shove & Walker, 2008; Genus & Cole, 2008; Farla et al., 2012).

Research using a sustainability transitions perspective has been particularly helpful for explaining the bigger picture (long-term and large-scale) and until recently less attention has been placed on understanding the agency of particular actors. Key proponents nonetheless recognise that actors and their agency are important, as Geels and Schot (2010, 34) assert:

> "actors in functional application domains make choices and perform activities that influence and shape new socio-technical configurations (e.g. regulations, infrastructure design, user behaviour, socio-cultural perception and framing). Impact arises not just from technology, but also from the shaping and alignment of other elements in socio-technical configurations."

Grin, Rotmans and Schot (2010) see potential for the integration and expansion of consumer and grassroots initiatives roles in transition processes, whilst other researchers have called for more attention to be given to the role of users (Brown, Vergragt and Cohen, 2012), new types of innovation actors (Steward, 2012) and grassroots or civil society actors (Seyfang and Smith, 2007). Meanwhile, Markard, Raven and Truffer (2012) suggest, "the field might benefit from more in-depth studies of how systems and regime structures are created and changed through the strategic interplay of different types of actors… [including] the role of civil society and cultural movements in transition processes" (962). Recent research has started to look at actor strategies and agency (e.g. Farla et al., 2012; Penna & Geels, 2012; Budde, Alkemade & Weber 2012).

Finally, that socio-technical systems manifest across all scales has been given little attention until recently. Here, attempts have been made to better incorporate cities (e.g. Hodson & Marvin, 2010, Bulkerly et al., 2010; Rohracher & Späth, 2013) and regions (e.g. Truffer & Coenen, 2012, Dewald & Tuffer, 2012; Späth & Rohracher, 2012) within the perspective. The majority of this work has been situated within the niche development perspective, which I will turn to now. Collectively, this research points towards the spatially blind nature of existing studies. As such a clear limitation of social embedding conceived under sustainability transitions is its limited appreciation of the different scales and contexts of action.

Niche development perspectives

Niche development perspectives focus on the core processes by which inventions and ideas develop into robust socio-technical configurations. Here, Strategic Niche Management (SNM) is the dominant framework. Developed prior to and then alongside the MLP, SNM was designed

as an analytical and a potential policy tool (e.g. Kemp, Schot & Hoogma, 1998; Hoogma et al., 2002)[3].

As an analytical framework early niche-based approaches studied three processes thought key to the emergence and development of radical, socially desirable technologies: (1) the articulation of expectations and visions as providing direction, (2) social network formation to create a constituency behind a technology, facilitate interactions and provide resources, and (3) social learning of both technical facts and data (first-order learning) but also assumptions about use (second-order learning). As an approach, it explores problem framings in a search for solutions, and focuses on experiments, which "make it possible to establish an open-ended search and learning process, and also to work towards societal embedding and adoption of new technologies" (Hoogma et al., 2002, 4).

One of the limitations of SNM as an analytical framework for the present study is the focus on radical, socially desirable innovations serving long-term goals (Kemp, Schot & Hoogma, 1998; Schot & Geels, 2008). Nearly two decades later many of the technologies previously studied (such as biomass, wind and solar) are commercially developed and receive support from national governments etc. As such the (policy) challenge has moved on: the technology is developed but still not being used to the extent desired. Moreover, early studies have had less to say about civil society or community participation because they focused on large industrial actors (e.g. car, bus and battery manufacturers in the case of electric vehicles etc). As Schot and Geels (2008) point out many of these experiments struggled to engage users. These early SNM studies, often based in particular cities, concentrated solely on understanding internal dynamics but clearly situate the development of alternative socio-technical configurations within particular local contexts.

The fore mentioned article by Schreuer, Ornetzeder and Rohracher (2010) sits within this work. They argue that despite the huge potential of cities for undertaking experiments relatively little attention has been placed on the process of setting up and locally embedding niches, nor to the specific problems this entails. Local embedding as used here, is about the ways in which *experiments* are integrated into local contexts, rather than the focal technologies per se. As such it has less relevance to the present thesis but does bring attention to the importance of mobilising local industry, the importance of timing and municipal actors.

A related niche development perspective that brings localised socio-technical systems to the

[3] SNM has roots in *Constructive Technology Assessment* (CTA) (e.g. Rip, Misa & Schot, 1995; Kemp, Schot & Hoogma 1998). It is for this reason that I do not review this separately.

fore is the concept of 'bounded socio-technical experiments' (BSTEs) developed by Brown and Vergragt (Brown et al., 2003). BSTEs "denote a project… [that attempts] to introduce a new technology or service on a scale bounded in space and time (Brown & Vergragt, 2008). Here, time is measured in years not decades and space is measured geographically (i.e a community of place). The concept is useful for highlighting how socio-technical systems manifest at local levels and how experiments can be bounded in space and time. A weakness is the continued focus on early stage technologies.

In the second phase of SNM development (Schot & Geels, 2008), attention has been directed to understanding niche accumulation (e.g. Geels & Raven, 2006) and niche-regime interactions (e.g. Smith, 2007). This work is important for highlighting emerging technological trajectories between multiple localised experiments, in which failures and successful projects can both contribute to learning processes. Here, the niche development perspective has been argued by Raven et al. (2008) to be useful "for analysing the relationship between *processes of the local embedding of technologies* and the lessons that can be taken from this at the level of emerging niche trajectories" (467, my emphasis). Specifically, they developed a framework to understand the translation of generic (niche) rules into local projects and the translation of local experiences (i.e. realised socio-technical configurations) into general lessons for wider niche development. Their framework combines three steps: (1) variation through local contextualisation, analysed through the initial project vision, (2) the negotiation and alignment of stakeholder expectations through analysis of formal and informal participation processes, and (3) the retention and transfer of lessons to the niche level, analysed through lessons which move beyond the specific local context (Raven et al., 2008). Figure 2.2 is a visual presentation of this perspective.

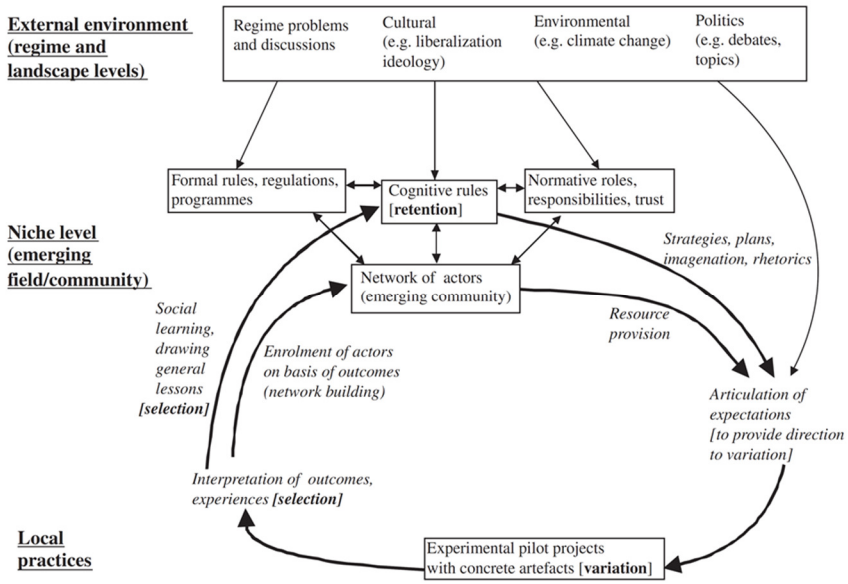

Figure 2.2: Dynamics in the relation between projects and socio-cognitive technology evolution (Raven et al. (2008) based on Geels & Raven (2006))

From an analysis of 28 European projects they claimed that most local projects had to be highly innovative. This points, at least implicitly, towards the extensive work needed to locally embed technologies. They conclude:

> "A central outcome of our meta-analysis was that sensitivity to local context and the local embeddedness of the project were key aspects determining the immediate successfulness of the project. The most successful projects devoted intensive efforts toward local reinvention of the new energy technologies in terms of their linkages to locally available resources and local concerns. We have thus suggested that successful projects should be locally embedded; provide local benefits; establish continuity with existing physical, social, and cognitive structures; and apply locally appropriate communication and participation procedures." (Raven et al., 2008, 469[4])

Beyond emphasising challenges, this also indicates what it means for a technology to be locally embedded. And yet, overall their analysis is grounded in an evolutionary understanding of change and primarily concerned with niche accumulation processes. For this reason it is useful for conceptualising local embedding processes as interactions between multiple levels but has a limited understanding of local embedding processes itself. Specifically, the framework suggests the process of local embedding can be understood as variation (through potential affordances of generic technology to different context specific expectations) and selection (alignment of technological affordances and actor expectations), leading to experimental projects with concrete artefacts (equating to the bottom right-hand corner of figure 2.2). A limitation is that it does not open up for investigation actor strategies or the work required to negotiate expectations.

[4] Note both uses of the term 'local embedding' imply an ordinary language sense (Billig, 2013).

This framework was applied to the study of community energy within the UK and Finland in a recent PhD thesis: Martiskainen (2014) confirms the importance of aligning expectations within local contexts and argues for a greater recognition of internal group characteristics (leadership, pre-existing skills and tacit knowledge) as being important for project success. A limitation with this for the present review is that it remains within a broad evolutionary understanding and is focused on the potential of local projects to support emerging niche trajectories.

In the last few years this previously dominant niche development perspective has been challenged. In particular, Späth and Rohracher (2012) have highlighted that a 'high resolution' analysis of niches and regimes reveals considerable diversity of structures at the local and regional scale and as a result they promote an understanding of cities and regions as being located 'outside' or 'across' MLP levels. Furthermore, they challenge the notion of niche 'experiments' since, they argue, doing so wrongly conflates developments at this scale. They suggest,

> "Most of the activities focused on providing supportive frameworks and socio-technical configurations for the broader application of given technologies, such as local heating networks based on wood-chips and biogas, small hydropower, a wind turbine as well as many installations for solar water heating… The aim is not so much to strategically create technological niches and promote alternative configurations on the basis of an evolutionary understanding of technological change but rather to demonstrate the feasibility of new configurations that differ from those usually entrenched in the regime—technical alternatives combined with matching institutions, practices, etc. The main task of the initiative is to adapt these alternative configurations and implement them in the given socio-economic conditions (framework conditions, priorities, support structures, etc.) of a particular territory" (Späth & Rohracher, 2012, 475)

The research points towards the need for new conceptualisations of change processes. They argue "it is important that conceptual development catches up with" contemporary initiatives at the city and regional level that are seeking to create sustainable systems of provision through local agency (Späth & Rohracher, 2014, 119). The broader point is supported by Heiskanen et al. (2014, 162-163) who challenge SNM ideas about local experiments, claiming "there is also value (and much innovative work) in adapting solutions to existing conditions and getting them to actually work in diverse circumstances" and suggest there is important work to be done in "learning about the deployment and adaptation of market-ready sustainable technologies to local contexts". Here, the interconnectedness of local system elements has been demonstrated by Vergragt and Brown (2012) who argue that change in one element is insufficient to change the system. They find users and local authorities the hardest to change and that knowledge of the system and its key actors is crucial. They conclude by calling for more research into bottom-up approaches in which multiple actors work collaboratively.

Finally, Dewald and Truffer (2012) have suggested a prominent role for 'local citizen associations' acting as intermediary organisations responsible for coordinating and promoting local market formation processes. These associations were citizen-led but included sector professionals, representatives from schools, research organisations, utilities and local government and as such are wider than the community initiatives studied here. Nonetheless, they argue these associations 'provided the necessary background for a successful market formation process to occur'. They suggest an ability to overcome problems was highly dependent on relations to the local context and they identify four contributing aspects to associations capacity to promote market formation: (1) experiments with different support schemes, (2) mobilising stakeholders from conventional sectors, (3) developing market segments, and (4) creating user groups. This research, alongside existing claims made about community energy initiatives, supports closer exploration of local embedding and the intermediaries that do the kind of work identified by Dewald, Truffer and others.

In summary, embedding as conceived within sustainability transitions research is predominantly large-scale and pervasive. The MLP does not fall short of explanation of how technologies get integrated into wider society. But taking the fulfilment of societal systems as its unit of analysis, one of the most important insights from the perspective is the coevolution and co-construction of technology and society over time and across multiple levels. For the present research this broader perspective offers a means to situate local activity, by positioning actor strategies within wider dynamic processes, and a means to conceptualise these change processes as occurring at multiple levels. Yet, the strength of this research - being able to explain long-term transformational change - is a weakness in this case because it has less to say about actors and their agency to effect change. Indeed, the MLP explains the overall dynamics of transitions through the aggregated outcomes of actors, whilst I seek to understand local, project scale activity over a short time period. Nonetheless, understanding change as unfolding across multiple levels is an important building block for this thesis' conceptual framework and in the following pages I build on Raven et al.'s (2008) conceptual work.

Work within the niche development perspective brings the study of embedding to city and regional scales, although the precise scale is rarely defined. As a body of work it draws attention to the emergence and development of alternative socio-technical configurations. But its focus on radical technologies and the development of common niche trajectories means that researchers predominantly 'look up', allured by the MLP and how experiments can support emerging niche trajectories serving long-term goals. A collective concern with developing evolutionary models of change supports this because its logic of variation and selection requires looking up at the wider 'population' or niche trajectory. To better understand community activity I follow a

suggestion by Genus and Cole (2008), to mobilise concepts from Science and Technology Studies.

2.2 The appropriation of technology by users

At the other end of the spectrum to social embedding, has been a focus on how technologies are made to work in 'everyday life'. The appropriation of technology into everyday life defines an area of inquiry and is what some authors call the 'domestication of technology' (Silverstone & Hirsch 1992; Lie & Sørensen, 1996). As an approach domestication aims to "describe and understand the socio-technical situations that require individuals and communities to cope with technologies, while providing and withholding a range of resources for doing this" (Stewart, 2007, 548). In the following I introduce domestication as a framework and approach before reviewing recent extensions.

The domestication of technology

First brought together within culture and media studies, drawing inspiration from anthropology and consumption studies, domestication investigates the contexts in which users experience technologies (Haddon, 2006). It looks beyond the adoption of technologies by users to inquire into what they mean to people, how they are experienced and what roles they come to perform. Initially rooted in the study of information communication technologies (ICTs) in the context of the household – or the 'moral economies of the household' as Silverstone, Hirch and Morley (1992) conceptualised it - domestication has been advance as both a framework and approach.

As a framework, four domestication processes were identified by Silverstone and colleagues in the early 1990's: in brief, 'appropriation' describes the negotiation and consideration of the technology to the point where technology is acquired by households; 'objectification' draws attention to the technology's use within household routines; 'incorporation' refers to where and how technologies are incorporated within the house, and; 'conversion' emphasises how technology is used to construct identities of individuals and households that reflect back on the wider world (Silverstone, Hirsch, & Morley, 1992). This framework was used widely to structure domestication research over the preceding decade within culture and media studies, likely as a result of its mechanistic 'checklist' style (Haddon, 2011, 313).

As an approach domestication studies was further developed by a group of researchers from the Centre for Technology and Society in Trondheim, Norway who linked it with the emerging area of social studies of technology (e.g. Williams & Edge, 1996). Initially concerned with the

'negotiated space' between designers' views and users' needs, the concept of domestication provided a means to explore the dynamics and contingencies between how technology shapes society and society shapes technology (Sørensen, 1994). Domestication thus became aligned within the emerging area of social studies of technology, as a critique to linear models of innovation, which portrayed technical change as driven by the development and supply of new products and technologies into society. As such, domestication studies view users and consumers as active agents of the innovation process rather than passive recipients of immutable technologies. These aspects were re-incorporated into Culture and media studies' exploration of domestication processes but beyond this, two relatively distinct uses of the domestication concept have been deployed. Culture and media studies tends to focus on the 'micro-level of domestication' and concentrates on ICTs (Haddon, 2011) whilst the 'technology studies approach' (Sørensen, 2006) is used more expansively, from the start questioning what they saw as the exclusive focus on 'private lives' within households. It is the latter that is of more interest here because of its link to STS and its focus beyond households.

For Lie and Sørensen (1996) domestication is principally about making the technology 'one's own' but over the years the approach has been applied at larger scales. As a consequence the concept has been used to investigate a diversity of contexts: Sørensen (2006) has applied the approach to the introduction of cars and mobile phones in Norway, Lamvik (1996) describes the Norwegian subculture constructed around American cars as material and symbolic, and Lægran (2005) investigates how youth cultures interact with technologies such as the internet and car. The approach however highlights the importance of local, situated activity. Not only including the way in which technology is appropriated but how appropriation also changes the local context.

Strategies of domestication were consequently thought to involve practical work (users need to develop patterns of use around technologies), symbolic work, through giving meaning to artefacts, and cognitive work in order to learn about the artefacts (Lie & Sørensen, 1996).

In a further adaptation to domestication approach Sørensen, Aune and Hartling (2000) challenge Silverstone, Hirch and Morley's (1992) four processes of domestication as un-necessarily sequential, instead suggesting the appropriation of an artefact is a multidimensional process, where the artefact must be:

1. 'Acquired', that is bought or made accessible in some way,
2. 'Placed' both physically and mentally,
3. 'Interpreted' in the sense of giving meaning within a household or local context and giving symbolic value both internally and externally, and

4. ‘Integrated’ within social practices of action.

Domestication as a multidimensional process is an important building block in understanding local embedding. Specifically, these four dimensions provide insight into how a technology might be locally embedded.

Extensions of the domestication approach

Recent applications of the domestication approach have identified key individuals and organisations in facilitating the adoption and use of technologies. Of note here is the study of ‘local experts’ (Stewart, 2007) and the identification of ‘user-end intermediaries’ (Stewart & Hyysalo, 2008) in domestication processes. Such extensions are useful for further extending domestication approaches beyond individuals and households and provide useful insights into conceptualising community-led initiatives as purposeful actors in local embedding processes. I briefly review the former here and attend to the latter in the following section on innovation intermediaries but first I discuss the fore mentioned article by Jalas, Kuusi and Heiskanen (2014).

Jalas, Kuusi and Heiskanen (2014) analyse self-building courses of solar collectors as sources of consumer empowerment and local embedding. I consider it here as related to the domestication approach because, as they emphasise it, DIY courses allow for the ‘material engagement’ of end-users with the technology, “of inserting the self in the technology” (Jalas, Kuusi & Heiskanen, 2014, 78). They understand the courses “as the sensual appropriation of new technology that involves both changes in the design of, for example, solar collectors but crucially also in the way the devices are to be talked about, understood, assembled, installed and combined with other existing technologies” (78). Their discussion is highly reminiscent of domestication processes. But for local embedding it is the ability of courses to create ‘acceptance’ for the technology that is important and here peer-to-peer learning, demonstration of the technology and social mobilisation is viewed as important.

Their conclusions highlight that users can take an active role in the local embedding of energy technologies, going beyond the particular technology in question to help disseminate general energy awareness and knowledge about energy efficiency. Their findings also contain warnings: despite increased levels of knowledge and increased engagement, participants on the whole did not materially embed the technology following participation. Jalas, Kuusi and Heiskanen (2014) conclude that the course provided an alternative way for people to get involved with the technology, promoting local acceptance by creating “trajectories for processing and adopting more formal knowledge about energy” (94).

In a study of the 'digital divide', Stewart (2000:2007) found local experts emerging as an important feature of "the domestication and everyday use of ICTs for users and non-users alike" (2007, 549): certain people were found to be relatively more knowledgeable and experienced than others and subsequently played a 'special role' in providing a range of information, interpreting what new technologies might mean and providing ongoing practical support. Stewart labels such people as 'local experts' and suggests they perform three roles:

1. Supporting the adoption process: including search, decision-making and set-up, local experts are called upon to provide information and advice
2. Supporting the learning process: Local experts complement formal learning processes (in educational institutions, work place environments) and informal information sources (media, social networking, and neighbours).
3. Maintenance and problem solving: technology adoption is rarely smooth but local experts are there to provide maintenance and problem-solving support.

Underlying Stewart's argument is the pervasiveness of local experts and their relative expertise within heterogeneous social networks. He suggests local experts can be found in all sorts of communities, whether in the home, workplace or amongst groups of friends because their knowledge is always positioned against those around them. Local experts can therefore be novice users but have 'expert' knowledge in relation to others.

Stewart (2007) argues this position allows them to take up a variety of roles and functions in technology adoption and use: local experts can act as bridges or channels, transferring knowledge, skills and demonstrations of use between different settings and contexts; they can act as gatekeepers and interpreters of external expertise and events and thereby act as mediators of 'local appropriation'. Local experts can also be reactive or proactive (providing knowledge and support when asked or actively promoting use and knowledge of technologies).

The value of local experts in community energy activity is their intermediary role, promoting and withholding information, shaping decision processes and supporting the local embedding of technology. Relative expertise helps position individual community members within their local context and beyond. It offers a means to differentiate between a core of people within community initiatives - often comprising between 3-10 members (Seyfang, Park & Smith, 2013) - and wider participants of community initiatives, the 'community' as such. Transferring Stewart's notion of local experts to local and community-scale embedding processes offers a means to explain the change strategies of community energy initiatives and their subsequent negotiation within the wider community and context. It suggests differentiating between the

core group of members and the wider community in local embedding processes. In many ways Stewart's concept of local experts carves out a position for ordinary people to take on roles more commonly associated with innovation intermediaries.

Explicitly addressing intermediaries across the full spectrum of technology development and use Stewart and Hyysalo (2008) conclude, "Some of the practices that get discussed in the literature as user innovation may be better understood as user-end intermediary activities in performing the key intermediary roles" (320). I turn to address the literature on innovation intermediaries below.

One of the most important insights from domestication studies is that new radical technologies do not simply diffuse but must be integrated within user practices, local rules and wider cultural meanings. The approach emphasises the active side of technology use and takes users as its point of departure or primary focus (Oudshroon & Pinch, 2005). However, advancing the approach beyond the 'moral economies of the household' has resulted in a challenging and weakening of the conceptual frame (for both the technology studies and culture and media studies versions) (the edited book by Berker et al. (2006) deals with this in some detail). As Haddon (2001, 314) notes, "one problem is that you can always add more context". With this warning in mind one means to provide further clarity would be to combine the domestication approach with concepts from the social embedding of technology (above), specifically drawing on the notion of multiple context layers.

Since community-led energy initiatives are thought to be exploring the social, institutional and economic embedding of technology rather than technological development per se, a back grounding of technological development is a logical step and means focusing solely on the use of developed technology in local contexts. The domestication approach is useful therefore in highlighting the "movement of technology into and within existing socio-technical arrangements" (Sørensen, 2006, 47) but also how technology changes symbolically, cognitively and practically through the way in which it is embedded in the local context.

The approach also highlights questions not addressed by broad-brush evolutionary approaches, such as the MLP and SNM. It asks about the detailed processes involved in the co-construction of technology and society, it introduces a stronger role for agency in the creation of socio-technical systems, creating space for contingency and alternatives and its overall focus on local practices complements the small-scale contingent actions of community initiatives.

2.3 Innovation intermediaries

Research on innovation intermediaries is concerned with understanding how particular actors perform a variety of innovation supporting tasks between two or more things, people or actors. Intermediaries have been defined as "actors who create spaces and opportunities for appropriation and generation of emerging technical or cultural products by others who might be described as developers and users" (Stewart & Hyysalo, 2008, 298). The term is used to explore a variety of actor types, such as individuals, an organisation (e.g. Hargreaves et al., 2013), a network or even a programme (e.g. van Lente et al, 2003). They have been described as differing in their reach across 'supply and use' and the breadth of content, referring to a wide or narrow range of products and/or services (Stewart & Hyysalo, 2008).

Research on innovation intermediaries has developed since the 1990's, where the replacement of linear conceptions of innovation and change gave rise to uncertainty and complex interactions between multiple actors leading to innovation. For the purposes of this thesis[5] the literature can be broadly grouped around those that focus on innovation intermediaries (e.g. Howells, 2006; Bessant & Rush, 1995; Stewart & Hyysalo, 2008), energy intermediaries (e.g. Rohracher, 2009; Breukers et al., 2009; Backhaus, 2010), cities as intermediaries in urban transitions (e.g. Hodson & Marvin, 2010: Hodson & Marvin, 2013) and intermediaries in system transitions (van Lente et al 2003; Klerkx & Leeuwis, 2009; Hargreaves et al., 2013; Kivimaa 2014). These studies cover a broad range of intermediary activity, in varying contexts and from particular analytical entry points. Common to these studies is a focus on intermediaries working on what van Lente and colleagues (2003) call the 'exploration' and 'take off' phases of a technological innovation whilst less attention has been placed with the use of existing, commercially developed technologies.

In a review of existing intermediary research Stewart and Hyysalo (2008) make a similar distinction and argue for the recognition of an 'ecology of intermediaries', with a nascent literature on intermediaries working at the appropriation end of the supply-use continuum. They argue,

> "highly visible supply-side intermediaries…, and the easily identifiable middle-ground agencies …tend to overshadow the often more informal yet just as crucial intermediaries at the user-end of the supply-use relation. Intermediate users, local experts and "tailors" facilitate, configure and broker systems, usages and knowledge about systems and their deployments, helping users to domesticate them and suppliers to respond to actual, realised uses" (Stewart & Hyysalo, 2008, 319).

[5] Grouping the research in this way I follow Kivimaa (2014).

Research by Moss (2009) comes to a similar conclusion but from the investigation of the governance of socio-technical change by intermediaries. He suggests,

> "Research is needed which explores intermediation at the interface between infrastructure and urban development, as well as between new technologies and sustainable forms of production/consumption. Examples could include, in the first case, organisations interconnecting discourses on processes of urban restructuring and infrastructure reform and, in the second, intermediaries seeking to embed technologies in particular social contexts of application." (Moss, 2009, 1489)

Together, these points suggest a potentially fruitful line of inquiry: there has been little research on intermediaries working on the local embedding of technologies in particular contexts. Explicitly addressing user-end intermediaries Mourik and colleagues (2009) claim it is possible to identify new forms of intermediaries emerging as people and communities become aware of energy issues and initiate voluntary projects and programmes from the bottom-up. This work directly connects community initiatives to intermediary processes.

The context of intermediaries

Common across many studies of intermediaries is a focus on their relational work. Moss (2009) argues that what distinguishes them is their 'in-between-ness', their position between actors or between actors and artefacts. In other words it is not their organisational structure or the particular focus of their work which defines them but a shared operational space. Addressing user-end intermediaries in particular, Backhaus (2010) suggests intermediaries act in a common operational space between three key actor groups: policy-makers, providers and consumers (figure 2.3). She highlights these intermediaries in particular, as bringing expertise, independence and a service-orientation and are likely to develop bottom-up approaches that focus on end user needs and concerns.

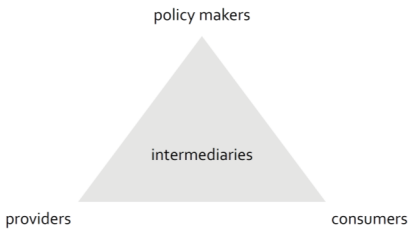

Figure 2.3: The three main actor groups and the operating space of intermediaries (Backhaus, 2010, 90)

Taking a broader view of innovation intermediaries Stewart and Hyysalo (2008, 297) note two crucial features of the context innovation intermediaries engage with: (1) the "unpredictability of technological change, market organisation and user uptake", and (2) "an absence of existing linkages" between potential end-users and suppliers. The latter conceptually defines

intermediaries through the language of innovation: linkages are required in order for innovation and embedding to occur. The former reveals important insights about the context of intermediaries and suggests potential dynamics influencing community intermediary projects.

The context of intermediary action is also emphasised within recent pan-European research on intermediaries and demand-side management projects, led by Eva Heiskanen (Backhaus, 2010; Heiskanen et al, 2010). Seeking to move away from psychology and economic approaches to technology diffusion, the research project developed a conceptual and practical perspective of user-end intermediaries working in a multi-layered context. Each layer consisting of target groups, stakeholders and 'conditions' that may influence an intermediary's project success or failure. The idea of actors being nested in various layers is represented in figure 2.4.

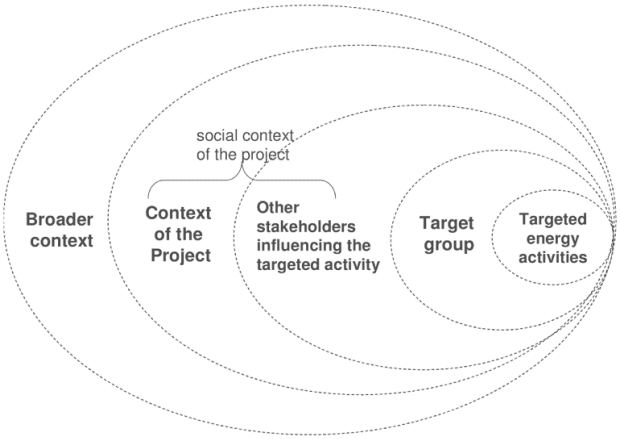

Figure 2.4: Conceptualisation of intermediary actors context as multi-layered
(Mourik et al., 2009)

In brief, their first context layer consists of the targeted energy activity, performed by a particular target group (the second context layer), which have specific problems and needs. Intermediaries are conceived as targeting the first layer, whilst the targeted group of end-users are thought to have most influence on these energy activities with decreasing influence over contexts layers the further removed they are from them. Other stakeholders and the context of the project (third and fourth layers) are thought to affect project opportunities, enabling or constraining project implementation. Stakeholders include local and regional governments, industry organisations and third sector and civil society organisations. Finally the broader context (the fifth layer) influences all others through conventions, culture and shared social practices but also politics, institutions and market mechanisms (Mourik, et al, 2009; Backhaus, 2010).

This layered context of intermediary action builds bridges with the socio-technical understanding of change processes discussed above (section 2.1), with its focus on multiple

actors, timing and context dynamics influencing change processes across multiple layers. Intermediaries are conceived as seeking to influence the socio-technical system that encompasses end-users, stakeholders and context conditions. The perspective emphasises that local embedding requires collective action that must change the contexts of action in order to last. It also takes an important step to conceptualise the context of action, where prior research has emphasised the contingent and contextually specific agency of intermediaries to achieve change (Van Lente et al, 2003; Stewart & Hyysalo, 2008). The location and position of intermediaries is thought to influence their access to resources and their connections to stakeholder groups associated with a particular project. As a result, Mourik and colleagues begin to unpack a working conceptualisation of the context of intermediaries, which is applicable to the local embedding of technology by community energy initiatives.

What do intermediaries do in local embedding?

Understanding the roles and functions of innovation intermediaries is particularly challenging because of what Howells (2006, 718) describes as "the highly eclectic nature of the literature". A simple and regularly practiced (e.g. Van Lente et al., 2003 or Stewart & Hyysalo, 2008) means to approach this diversity is to view some of the pertinent typologies that exist (table 2.1). The following four typologies are selected for their diversity and relevance to the present research interest. Each was constructed after extensive reviews of existing literature and each author attempts to distill the most pertinent functions and roles to their research interest.

Table 2.1: Functions, key processes and roles of intermediaries

Innovation intermediaries		**Intermediaries in transitions**	
Intermediary functions (Howells, 2006)	**Key Intermediary processes** (Stewart & Hyysalo, 2008)	**Intermediary roles as contributors to niche internal processes** (Kivimaa, 2014)	**Roles of systemic intermediaries in transition processes** (Van Lente et al. 2003)
1. Foresight and diagnostics 2. Scanning and information processing 3. Knowledge processing and (re)combination 4. Gatekeeping and brokering 5. Testing and validation 6. Accreditation 7. Validation and regulation 8. Protecting the results 9. Commercialisation 10. Evaluation of outcomes	1. Facilitating as the providing of opportunities to others 2. Configuring users, context, technologies and 'content' 3. Brokering actors, knowledge, resources and technologies	*Articulation of expectations and visions* • Articulation of needs, expectations and requirements • Strategy development, • Acceleration of the application and commercialisation of new technologies • Advancement of sustainability aims *Building social networks* • Creation and facilitation of new networks • Gate keeping and brokering • Configuring and aligning interests • Managing financial resources • Identification and management of human resource needs (skills) *Learning processes and exploration at multiple dimensions* • Knowledge gathering, processing, generation and combination • Technology assessment and evaluation • Prototyping and piloting • Investments in new businesses • Communication and dissemination of knowledge • Education and training • Provision of advice and support • Creating conditions for learning by doing and using	*Articulation of options and demand* • Demand articulation and strategy development *Alignment of actors and possibilities* • Identifying, mobilizing and involving relevant actors • Organizing discourse, alignment and consensus • Management of complex, long-term innovative projects *Support of learning processes,* • Create conditions for learning by doing, using, interacting and searching • Feed actors with tailor-made (strategic) information

Howells (2006) lists 10 functions of innovation intermediaries, although he suggests intermediaries rarely play separate functional roles in practice but develop a range of activities. Stewart and Hyysalo (2008) argue three 'fundamentally different facets' of intermediation can be identified - facilitating, configuring and brokering - which, as generic processes of intermediaries, can be applied to intermediaries working across supply and use. Kivimaa (2014) and van Lente et al. (2003) approach intermediaries in respect to long-term transition processes. Kivimaa (2014) systematically maps previously identified intermediary roles with the three internal niche processes from SNM. Van Lente and colleagues (2003) group intermediary roles around three functions as 'key elements of ongoing innovation and transition processes'. The functions are conceived as applicable across four phases of transitions - exploration, take off, embedding and stabilisation - with particular elements highlighted in each.

These typologies approximate the generic terrain of intermediaries and begin to indicate the types of activities undertaken by intermediaries to locally embed technologies. Clearly, there is also much overlap in these lists. Stewart and Hyysalo's (2008) framework is the only one that explicitly addresses informal, user-end intermediaries such as community initiatives. In contrast, Kivimaa (2014) and van Lente et al. (2003) focus on intermediaries working at a larger scale, such as government-affiliated intermediaries in national energy systems and a fuel cell partnership in California. As a result, Stewart and Hyysalo's framework appears to be the most applicable to answering the broad research question, how are community-led energy initiatives seeking to integrate technologies into local contexts of use? These key intermediary processes are an important building block in my framework development.

Despite this van Lente and colleagues (2003) breakdown of transition phases provides a useful indication, as a first ordering, of what might be expected of community intermediaries within local embedding, in spite of the potentially awkward linear model presented[6] and the caveats this entails. The breakdown further complements and extends the discussion of sustainability transitions literature on social embedding above. Their arguments are summarised in table 2.2.

[6] The authors are aware of and highlight the discussion of transition phases as a 'dangerous step'. They acknowledge this as a potentially backward step and argue that conceptualising transitions processes in phases is useful provided that insights on the complexity, non-linearity, feedbacks and co-evolution are taken seriously.

Table 2.2: Intermediary activities and interventions in transition processes (based on van Lente et al., 2003)

	Exploration	**Take off**	**Embedding**	**Stabilisation**
Key notions	Search processes; creative destruction; heuristics; paradigms	Lock-in; niches; strategic niche management; dominant design; hybrid innovations; bandwagons	Momentum; building new networks; deconstructing obsolete networks; alignment; enrolment; socio-technical regimes; learning by doing	Incremental change; learning by using; economies of scale; creative destruction
Key activities	Awareness; identification of major trends	Mobilisation of relevant actors; development of coherent transition goals; support new technologies; identify niches; identify lock-in dangers	Standards, alignment; enrolment; interrelatedness; creative destruction and construction	Reflection on new goals; identify major trends; awareness
Possible roles of intermediaries	Articulation of societal needs; redefine arenas; stimulate research; develop visions of the future; make variety in options visible	Vision development; systems approach; create niches; identify bandwagons; agenda building; analysis; advise	Strategy development; clearing house; standardisation; pilot project; project management; preventing strategic games; analysis; advise	Define new arenas; make variety in options visible; articulation of societal needs; analysis; advice

The embedding phase, van Lente et al (2003) characterise through momentum building. Learning processes are again crucial, whilst the strategic game in which actors are enrolled may hinder or propel development. Potential intermediary roles are thought to involve strategy development, pilot projects, demonstrations and project management. This basic delineation of phases further sketches the potential activities of community intermediaries in local embedding processes. The implicit assumption within this work is that intermediary actors work across business and government rather than connecting to end-users. The roles therefore may not apply to community-based intermediaries.

The literature on innovation intermediaries is a rapidly emerging field. Until recently very little attention has been given to the role of intermediaries in transition processes but there are indications of the importance of intermediaries for the local embedding of technologies. This diverse literature also offers a way of conceptualising the agency of a particular kind of actor, community initiatives. Furthermore, there are interesting crossovers with the two literatures discussed above. First, between emergent, voluntary-based community activity as employing bottom-up intermediary style approaches and domestication processes. Second, between

intermediary contexts of action and the understanding of change as the interaction between multiple context levels from the MLP. It does not however, provide an answer to the question of what intermediaries do in local embedding. This is unsurprising given the identified gap in the literature. The broad literature does provide some key concepts with which to understand embedding at larger scales and thus complements and extends the discussion of social embedding into wider society above.

2.4 Conceptual framework

In the final section of this chapter I develop a conceptual framework to understand the agency of community intermediaries in locally embedding technologies. This perspective builds upon insights from socio-technical transitions and domestication studies, which suggest the co-construction of technology and society occur at multiple scales, and mobilises insights from the literature on innovation intermediaries.

I start by disaggregating community energy initiatives into core and peripheral actor groups and propose dynamics between the two. I then construct a conceptual framework of local embedding that positions community intermediaries as designing and implementing projects within a layered context on the basis of three key intermediary processes: facilitating, configuring and brokering. Having outlined the framework, the thesis' detailed research questions are revisited and situated in relation to the framework. In the following chapters I test and refine my framework against four empirical case studies on two technologies. In the cross case analysis I seek to identify patterns and dynamics influencing community intermediary activity in locally embedding technologies.

Groups of community activists as the focal actors in community energy initiatives

In this thesis I am concerned with the agency of community-led energy initiatives to locally embed technologies. I use the term 'initiative' because existing literature on community energy highlights considerable diversity within the area, including where the initiative emerges from, its institutional structure, degree of participation, role of participants, patterns of support and funding arrangements. Community initiatives can therefore emerge from existing organisations, including those not normally focused on energy, to loose associations of people coming together to collectively undertake an energy project. For the purpose of the present research it is useful to understand the actors and agency involved in community initiatives.

Community initiatives are said to have 'flourished' over the last decade and have been defined

as following open and participatory decision-making processes leading to local and collective outcomes (Walker and Devine-Wright, 2008). This course-grained definition treats community initiatives as cohesive, homogenous entities and acts to close down contestation and differences between actors. Rather than taking this course-grained definition I will build upon recent empirical observations (e.g. Seyfang, Park & Smith 2013) that indicate community initiatives being comprised of a core, inner group of participants who seek to influence their 'community'. This observation creates a space through which the intermediary property of 'in-between-ness' (Moss, 2009) becomes evident: core groups of activists can be seen to be operating between policy-makers, providers and consumers (Backhaus' (2010) operational space of intermediaries) and they can be viewed as seeking to create linkages between two or more actors or things (Stewart & Hyysalo, 2008). Building upon this observation I develop a fine-grained conceptualisation of community initiatives, with the benefit that it allows for competing ideas to be negotiated between the inner and outer participants of the initiative. The thesis subsequently understands community initiatives as involving groups of community activists and the wider community:

- The group of community activists consists of the core members of the community initiative who are responsible for developing and undertaking projects. As a group they are conceived as an intermediary actor developing and implementing projects which attempt to influence their target audience, the wider community.

- The wider community consists of both the geographical or interest community who consider themselves members of the initiative and/or receive information from and take actions in response to the moves of the core group of activists, and additional members of the core activists' target audience but who are not yet enrolled within the initiative. Once enrolled, wider community participants may have the opportunity to contribute to the initiative's direction but choose not to get involved in the development of specific projects. In the context of local embedding wider community participants are conceived as end-users of the technology.

On the basis of this distinction I can now outline proposed dynamics within community initiatives. The core group of activists is conceptualised as developing projects in which they seek to influence their wider community (arrow 'a', figure 2.5). Yet, they also have to negotiate their initiatives in reaction to the opinions and actions of the wider community (arrow 'b'). These dynamics allow the research to inquire into the inner group's strategy and wider community's response. In the language of STS the separation of core and participant actors is likely to expose the work needed to negotiate and align different actor views around the

technology and the local context: what the technology means, its purpose and use given local issues. This distinction further allows me to (1) mobilise insights from research on innovation intermediaries to conceptualise how the core activists attempt to locally embed technologies, and (2) examine what makes these initiatives 'community-based'.

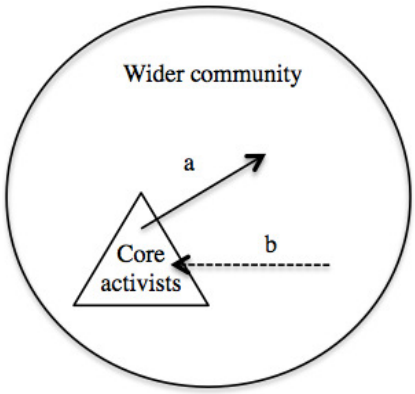

Figure 2.5: Dynamics within a fine-grained conceptualisation of community initiatives

Local embedding as the integration of technologies into local contexts of use

Embedding requires the mutual alignment of multiple elements related to the technology, and that help make the technology work, such as rules and institutions, industry, understanding and culture, user practices and so on, within a socio-technical system. Such systems occur and can be analysed at multiple scales (Rohracher, 2001; Russell & Williams, 2002). Local embedding occurs in relation to a particular local context, a community, city or region. Building on Späth and Rohracher (2012) we can note how these system variations, from the national to local and community scales, are smaller in tightly coupled infrastructure networks such as the electricity system and potentially larger in other systems, such as heat provision. Even within the electricity system the potential development of local smart grids, balancing supply and demand within distribution networks based on renewable generation capacity, highlights the potential for increased decoupling from dominant, national systems of provision. Nonetheless, the primary point is that it is possible to conceive of local socio-technical systems at the city scale.

The alignment of elements (user practices, understanding and culture, regulations, rules, the development of new industries and markets etc) create openings for different actors - actors who have varying interests in and perspectives on the focal technology and system - to engage in moves and interactions (Te Kulve, 2010). In the renewable energy sector, governmental bodies, firms, social enterprises and end-users are all more or less involved in making moves with respect to one or more element of embedding. At the local scale, the number of actors may be

reduced to those who make moves or interact with the technology within a specific socio-technical system. The 'local' of local embedding emphasises both the geographical situated-ness of the embedded technology and the local alignment of technologies, actors and institutions around the new socio-technical configuration. Within city-regions a variety of elements create opportunities for different actors. Local authorities interpret and enforce planning guidelines from national government. They set standards and rules about the appropriate use of technology, its siting and size. Local and national installer companies interact with consumers, manufacturers and trade associations. End-users – whether households, community centres or local businesses – make decisions about the relevance of the technology, its benefit and purpose. As a result, important dynamics about the local embedding of technology play out at the level of the local system rather than at the level of individual actors, such as the local authority or community-led initiatives. Or to phrase this in another way, each actor has limited agency and is dependent on interactions with others.

Building upon recent debates within sustainability transitions and intermediaries research the thesis conceptualises a layered context to local embedding. I combine a layered understanding of the context of intermediary action (Backhaus, 2010: Breukers et al., 2011) with explicit reference to the socio-technical understanding of innovation and change from the niche development perspective (Raven et al., 2008). In doing so I seek to contribute a richer and finer-grained appreciation of the contexts of action within transitions research.

Socio-technical systems manifest at local levels and form the primary context in which actors make moves towards embedding. Significant deviations from socio-technical regimes occur in socio-technical configurations in particular localities (Späth & Rohracher, 2012). Geography, natural resources, local governance structures and actor networks all influence how configurations manifest in particular locations. This socio-technical system is in turn embedded within larger aggregations of systems and influenced by broader social, economic and institutional structures, as conceptualised by concepts of socio-technical regime and landscape or as Raven et al. (2008) define it, external environment. Figure 2.6 represents a static visualisation of this layered context.

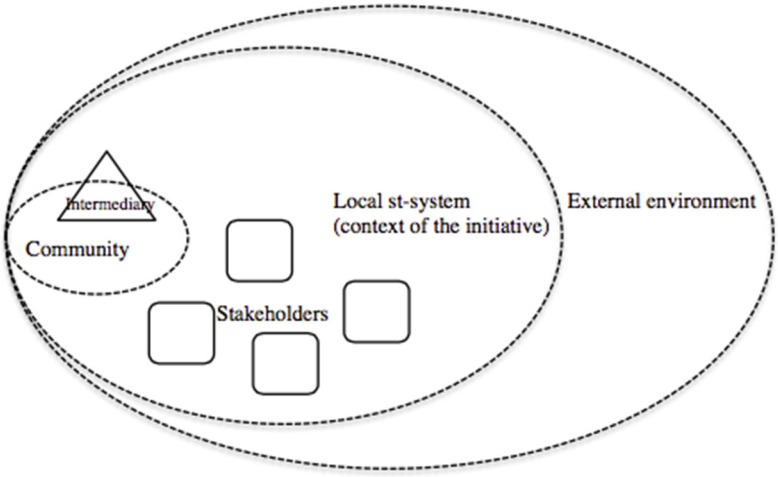

Figure 2.6: Understanding of context as multi-layered
(own figure adapted from Mourik et al., 2010 and Raven et al., 2008)

The local socio-technical system comprises the primary context of the intermediary. It encompasses other stakeholders (for example a local authority, local industry, housing associations, local societal groups and social movements) that may or may not have an influence over the target community, the socio-technical system or elements of it but are nonetheless bound within the city, region or community. These stakeholders may thus form part of the local socio-technical configuration. The community intermediary is also positioned within this layer. The local socio-technical system may affect opportunities for intermediaries by enabling and constraining particular courses of action and providing and withholding resources. Geography and local governance structures play a role here, as do stakeholders making moves with or against community intermediaries.

The community or target audience is also contained and conditioned by the local system (the socio-economic context of which they are a part). The community is comprised of end-users, which in turn are neither static nor homogenous. Multiple ways of thinking and acting are not only possible but expected, alongside multiple motivations for action, e.g. self-interest, altruism and norms and conventions. Through their energy activities and daily practices, communities can change some tangible elements of the local socio-technical system. In particular, user decisions to invest or not strongly influence the embedding of many low carbon technologies. Community intermediaries are conceived as seeking to directly influence their target community through strategies such as awareness raising campaigns, through to demonstration or deployment projects. Through their projects community intermediaries make technologies accessible, they help interpret new technologies and potentially integrate them into local practices.

The external environment includes things like regime problems and discussions, culture and politics and debate, which exerts influence on all other layers through formal, cognitive and normative rules (following Raven et al., 2008). This wider environment can for example comprise national policies, funding schemes, market organisation and mechanisms and national infrastructure provision. Again this layer may affect opportunities for intermediaries by providing and withholding resources.

Together the layers function as an affordance, enabling and constraining the local embedding of technologies. The local system and external environment structure what moves community intermediaries, and other stakeholders, can make. In turn the actions of intermediaries and stakeholders change the context over time. Context and action is mutually shaping (Raven et al., 2008; Mourik et al., 2009).

Figure 2.6 thus emphasises the structured nature of change, communities and community intermediaries situated within a local system, which are in turn embedded within the external environment. At present these layers are static: time is absent. Yet, the discussion above also points to the inclusion of change over time and dynamics between layers. In practice, different elements of context and actors in each layer change over time, sometime rapidly and sometime gradually. Change is the outcome of multiple individual actions. It remains unclear from the literature reviewed above how these context layers influence community intermediation.

The framework therefore emphasises how the local embedding of technology involves multiple actors making moves within a structured context. Intermediary actors are no exception. Local embedding requires the negotiation of technologies into and within the local socio-technical system, in relation to multiple actors.

Key intermediary processes in local embedding

To understand the agency of community intermediaries I mobilise insights from research on innovation intermediaries. Specifically, I draw on Stewart and Hyysalo's (2008) framework that identifies three key intermediary processes applicable to the range of innovation intermediaries across supply and use: facilitating, configuring and brokering. Each process is explained below and discussed with reference to key concepts of local embedding taken from the building blocks above. I also incorporate recent insights on intermediary activity where relevant.

The first intermediary process Stewart and Hyysalo (2008) identify is one of *facilitating*, which they describe as "providing opportunities to others, by educating, gathering and distributing

resources, influencing regulations and setting local rules" (306). Facilitation is thought to involve the creation of various 'spaces': including communities or networks (social), a place or piece of equipment (physical), the providing of funds (economic) but also rules that guide activity and reduce uncertainty (regulatory) and skills and know-how (knowledge). For example a physical space such as a technology demonstration project can provide access to a technology in which end-users can directly experience it for the first time. It therefore makes the technology accessible in some way to the local community and potential end users: it provides an opportunity for the community to 'place' and 'acquire' the technology in the language of Sørensen, Aune and Hartling (2000). Being made accessible is important for knowledge formation about the technology and its use. Moreover, it creates a space in which the technology can be interpreted within the local context, it is given practical and symbolic meaning.

The second key intermediary process that Stewart and Hyysalo (2008) identify, involves the *configuring* of technology, projects, users and producers. This process builds upon and interacts with the creation of facilitation spaces in which elements of these 'spaces' have to be actively arranged. Such configuration can be done in minor ways, according to Stewart and Hyysalo, establishing particular configurations of technologies or projects within local context. It can be technical but also symbolic, providing an interpretation of a technology and its use. However, intermediaries must also be responsive to actor interpretations and expectations (of the technology, project and context) and attempt to modify their actions to reflect or accommodate potentially competing actor views (Stewart & Hyysalo, 2008). Configuration, is thus an interactive process (c.f. Woolgar, 1991), since additional actors and particularly users, are always present and form an integral element to the realisation of a technology's use in the local context.

Lægran and Stewart (2003) highlight how the configuration of projects is a process in which a technology is translated into a specific local context. In this sense the key intermediary process of configuring involves interpreting (giving meaning within the local context) and integrating the technology into local practices (c.f. Sorensøn et al., 2000). Community intermediaries may shape how the technology is used, installed, managed and owned, prioritising certain users and producers over others. For example community-led renewable energy installations offer a distinct mode of implementation compared to a public utility, private supplier or household (Walker & Cass, 2007).

Building social networks, which can be understood as aligning actors through the negotiation of expectations, can also be viewed as involving configuration. Intermediaries may align favourable actors or actively position others in relation to the debate (Hodson & Marvin, 2009).

They may configure who is 'in' or 'out' and shape actors expectations and involvement. In addition, Hodson and Marvin (2009) highlight the importance of intermediaries developing place-based images of potential technological futures. They suggest intermediaries can develop a collective but particular understanding of existing contexts in which they position themselves between technological possibilities and local contexts. It is in this sense, they argue that intermediaries play a prominent role in what transition scholars refer to as creating 'visions'.

Brokering forms the third and final key intermediary role that Stewart and Hyysalo (2008) identify. It is thought to be one of the most direct ways in which different actors can be brought together. For example intermediaries may seek to raise support (financial, human, physical) for the embedding process from other actors such as sponsors and suppliers. Intermediaries may attempt to represent end-users and negotiate on their behalf. They may broker the entry of actors into projects or networks to expand or defend the spaces already created through seeking to increase their access to resources and knowledge and maintain influence over emerging rules and practices around the technology, project or vision.

Stewart and Hyysalo (2008) suggest different intermediaries may focus on one or all of the roles when in a stable environment but also note how the dynamic and unpredictable nature of innovation may lead intermediaries to conduct all three. It remains unclear whether all three processes need to be performed, by the focal intermediary or by others, for innovation to occur and specifically, local embedding to take place. At the same time they do not directly suggest a relationship between the three roles. However, some basic interactions can be inferred.

1. First, in their description of roles, 'facilitation' appears to involve, at least elements of, configuring. The creation of physical demonstrations involves an interpretation of the technology, its meaning and use within a particular setting, i.e. its configuration. Equally, the facilitation of new social networks implies configuring of the content of the new network. Other elements of configuring are conceivably more discrete. The shaping of actor expectations and an interpretation of the technology does not necessary have to involve the creation of new 'spaces'.
2. Second, they highlight 'a balancing act' between maintaining the openness of facilitation spaces and an intermediary's brokering activities, since "brokering is rather a heterogeneous bridging position than representing a particular interest" (Stewart and Hyysalo, 2008, 308). This is conceivably the case in the creation and maintenance of social networks and the development of large-scale, multi-actor projects where it is important to maintain the commitment and interest of multiple actors.
3. Third, their definition of intermediaries includes what they later describe as facilitation, 'the creation of spaces and opportunities' for others. This suggests facilitation is more

important than configuring and brokering roles, in their view. Although a moot point this focus on facilitating is at odds with Klerkx and Leeuwis (2009) who, building on Howells (2006), suggest brokering is central to the role and definition of an intermediary. Again, this is something that can be examined within the following case studies.

4. Fourth, Stewart and Hyysalo (2008) say little about the success of intermediaries in innovation processes in regard to their key processes. They only suggest intermediaries are likely to be more successful if they are able to balance different roles without constraining the innovative activities of those they intermediate between, whether end-users or suppliers.

These four interactions suggest relationships between key processes and the potential identification of patterns between key processes over time. At a more basic level the three key intermediary processes begin to provide a conceptual answer to the broad research question, how are community-led initiatives seeking to integrate sustainable energy technologies into local contexts of use? Application of this framework to the cases will further strengthen and/or challenge its validity in practice and in turn offer insights about the emergence of new community-based intermediaries.

Situating the detailed research questions

Having outlined this thesis' conceptual framework I now return to the secondary, detailed research questions and situate them in their proper place. The first detailed research question (RQ2) seeks to build on Stewart and Hyysalo's (2008) intermediary framework and its potential extension through the observation of patterns between key intermediary processes. The first detailed research question therefore asks: *are there patterns to key intermediary processes in local embedding and how might these be explained?*

The second detailed research question (RQ3) seeks to inquire into the dynamics of local embedding, to investigate context dynamics influencing the agency of community intermediaries to develop and implement projects. It seeks to extend insights from (a) research on community energy, that suggests community initiatives are context dependent and influenced by a variety of factors beyond their control, and (b) theoretical understanding of context dynamics influencing community intermediation. The second detailed research question therefore ask: *how do context dynamics affect the agency of community intermediaries in local embedding?*

Summary conclusions to the chapter

Here, I have conceptualised community intermediaries as experimenting with low carbon technologies, seeking to locally embed them in local contexts of use. In a basic sense they are 'picking up' and 'playing around with' low carbon technologies. It is also important, at this stage, to qualify this potential. Van Lente et al. (2003) argue intermediary actors are "useful and necessary, but not sufficient" for long-term sustainability transitions. Given how low carbon technologies such as solar PV in particular, are diffusing community-based intermediaries also appear to be useful but not entirely necessary. Indeed, Backhaus (2010) views demand-side management intermediaries as instrumental, 'bottom-up policy implementers' that complement, rather than replace government and business approaches.

We can note, however, some characteristics that may be beneficial to community intermediation for local embedding. They have the potential to bring high flexibility, adaptability, expertise, independence and service orientation, to the problematic use of existing, commercially developed technologies. As Backhaus (2009) notes, whilst they may not necessarily perform better than business or government driven programmes, their background as independent actors and their often bottom-up approaches centred on end-user needs and concerns suggests greater chances of success because of increased trust and improved targeting of users.

In this chapter I set out to achieve two things. Firstly, to establish a gap in current knowledge about local embedding - situated between the social embedding of technology by wider society and the appropriation of technology by users -, and secondly, to use building blocks from the literature review to construct a framework capable of understanding and explaining the agency of community intermediaries to locally embed sustainable technologies. The literature review was selective and succinct, covering only those aspects necessary for understanding how technologies get integrated into local contexts of use. The resulting framework combined insights from sustainability transitions, appropriation and innovation intermediaries literatures and situated this thesis' detailed research questions.

In the next chapter I outline the research design and methodology adopted for utilising this conceptual framework and answering the research questions. Because of the focus on patterns and dynamics and their fundamental relationship with time I adopt a process research ontology and epistemology. I then introduce the focal technologies in chapter 4. In the following empirical chapters (5 to 8) I test the framework against four cases on two focal technologies, the cross case analysis (in chapter 9) brings together observations across the four cases and allows me to draw conclusions about this framework and extend it further in chapter 10.

Chapter 3.
Research design and methodology

In the following chapter I explain the research design and methodology of this thesis. In section 3.1 I discuss basic epistemological assumptions and the type of explanations that I am seeking to build. Next I discuss the case study approach utilised and the selection of cases in section 3.2, before outlining the analytical strategy in section 3.3.

3.1 Basic assumptions

Variance versus process research

In this thesis I adopt a specific ontological perspective. Rather than seeking to establish factors or general laws I seek the specification of generative mechanisms in community intermediation of energy technologies, specifically relationships between key intermediary processes of facilitating, configuring and brokering and the influence of context dynamics on key intermediary processes. In doing this I adopt a particular epistemology perspective. Poole et al. (2000), building on the work of Mohr (1982), Abbott (1984) and Abell (1987), distinguish between two fundamentally different research models, variance and process approaches (figure 3.1), which vary in their epistemology perspective and the types of questions asked. In this thesis I adopt a process approach.

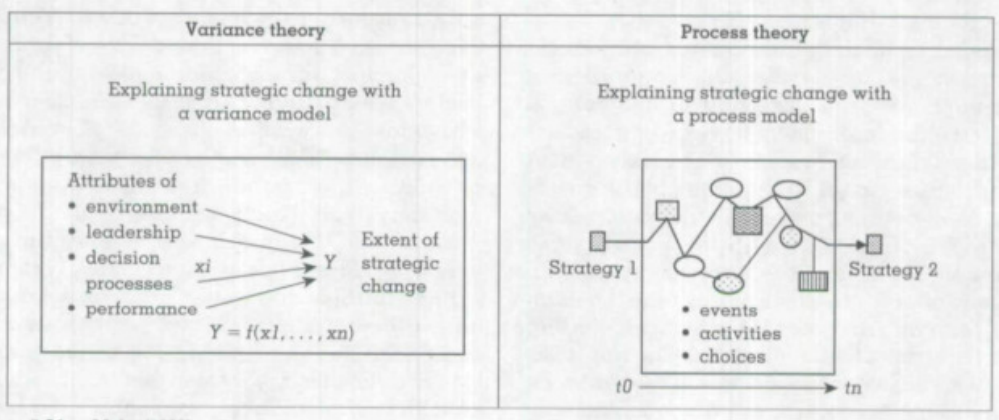

Figure 3.1: Two explanations about strategic change (Mohr, 1982)

Variance approaches explain outcomes in terms of cause and effect, independent variables acting on dependent variables (Poole et al. 2000). Such approaches treat timeless independent variable as acting uniformly on dependent variable 'outcomes'. Each variable takes a single meaning and acts independently of others. Time, and the ordering of variables is not important because emphasis is placed on immediate causation. Variance approaches are generalisable where there is uniformity across contexts. Under this approach, processes are explained in one of two ways. Processes are assumed to occur between inputs and outputs. A process logic explains why the input (independent variable) exerts a causal influence on the output (dependent variable) but the processes are never actually observed. Alternatively, process is used as a category of concepts - such as decision making or strategy formation - that can be distinguished from other categories of concepts, like structure and performance, and which are then put to work as constructs and measured as variables. Here, process variables are assumed to mediate between or affect the causal relationship between input and outcome variables. Generally when process variables are used within variance approaches they can only explain if, not how, a change occurred within a given period of time (Poole et al., 2000). Such approaches in their reductionist, objective usages are therefore useful for explaining 'why' orientated questions. They are less useful to explain 'how' orientated questions (Van de Ven & Poole, 2005).

In contrast, process approaches explain outcomes in terms of patterns and mechanisms (Abbott, 1992; Pentland, 1995; Poole et al., 2000). Time ordering is critical. Rather than fixed entities within which variables do the acting, process approaches assume actors do the acting. Actors or 'central subjects' are individual entities (people, groups, organisations and even artefacts) which may change over time. Process approaches are interested in events (c.f. variables) which central subjects do or is what happens to them, the meaning of which may also change over time. For process approaches the generality of explanations depends on their versatility, or in other words, the degree to which they are able to explain a wide variety of developmental patterns without modification of their essential character (Van de Ven & Poole, 2005). Alongside generality, Langley (1999), Pentland (1999) and Zaheer, Albert and Zaheer (1999) argue that *accuracy* (the degree to which the resulting theory closely resembles the data or story) and *parsimony*, or simplicity, (concerning the number of elements or attributes to a theory) are also important. This triad - generality, simplicity and accuracy - of 'what counts' is an important foundation for assessing process research and one that I will use to assess my own theory development.

Process research therefore has a different epistemological perspective than variance approaches. It focuses on explaining change processes and puts agency and context at the centre of analysis. Pettigrew (1997, 338) explains this well, saying,

> "Actions drive processes but processes cannot be explained just by reference to individual or

> collective agency. Actions are embedded in contexts which limit their information, insight and influence. But the dual quality of agents and contexts must always be recognised. Contexts are shaping and shaped. Actors are producers and products… Crucially for any processual analysis, this interchange between agents and contexts occurs over time and is cumulative."

A variety of analytical strategies have been developed under the process theory approach (Langley, 1999), which can be mixed to achieve the particular research aims. I utilise a narrative approach combined with a visual mapping strategy because a narrative approach "has the great advantage of reproducing in all its subtlety the ambiguity that exists in the situations observed" (Langley, 1999, 695) but also because narratives can contain indicators of an underlying process theory (Pentland, 1999; Van de Ven & Poole, 2005). I follow Pettigrew (1990) using narratives to "reach towards theory presentation", to "clarify sequences across levels of analysis, suggest causal linkages between levels, and establish early analytical themes" (Pettigrew, 1990, 280). Visual mapping is used to further clarify events at different levels of analysis and aid comparison across cases (section 3.3).

A process approach to studying community intermediary activity for local embedding

I utilise a process approach because I am seeking to answer a set of research questions about how processes develop and occur, rather than 'why' orientated questions. Specifically, I am interested in exploring and substantiating the topic of local embedding. The topic is a process with no clear, substantiated 'outcome' criteria. Intrinsic to the topic are developments over time. A clear benefit of the process approach is thus that it takes time and path dependence seriously. This point is also important to answering the two detailed research questions. In the first I am interested in exploring and developing an explanation of how key intermediary processes link together, what relationships there are between these processes and whether any common patterns exist. In the second, I seek to develop an explanation of how context dynamics influence the agency of community-based intermediaries to develop strategies for local embedding. Here, a benefit of a process approach is that it assumes reality to be a dynamic process rather than a steady-state and it allows for a mutual shaping between action and context. Moreover a process approach permits context dynamics (c.f. variables) to have different implications and impacts at different points in time and allows for multiple context layers. As a result a process approach offers a more flexible mode of inquiry, more suited to the topic in hand.

On this basis I can now clarify my detailed research questions. I make the following distinction between patterns and dynamics: patterns are sequences of interrelated events that lead to outcomes; dynamics are influences on the local embedding process. Patterns thus refer to

common sequences within key intermediary processes over time. Whilst time is also central to dynamics, here, the focus is on developing an understanding of how multiple context dynamics interact, supporting and hindering the agency of community activists over time.

Now that I have situated this work within a processual research tradition I can also situate the conceptual framework (outlined in chapter 2) within different types of process explanations. Different types of processes provide explanations at different time and aggregation levels (Van de Ven & Poole, 1995; Geels & Schot, 2010). Whilst evolutionary process explanations are favoured within SNM and the MLP (and provide certain insights) I build on the metaphor of 'socially embedded game playing' because it complements the small-scale and contingent actions of community initiatives. Geels and Schot (2010) describe socially embedded game playing as actors making moves, to change tangible elements that reproduce or change the rule of the game. Explanation, they suggest, derives from the rules of the game and actor moves.

A second means to situate the broad type of explanation that I seek to develop builds on a distinction made by Poole and Van de Ven (1989). They argue process theories should have two complementing components, global and local models:

> "The global (macro, long□run) model depicts the overall course of development of an innovation and its influences, while the local (micro, short-run) model depicts the immediate action processes that create short□run developmental patterns. (...) A global model takes as its unit of analysis the overall trajectories, paths, phases, or stages in the development of an innovation, whereas a local model focuses on the micro ideas, decisions, actions or events of particular developmental episodes" (Poole & Van de Ven, 1989, 643)

On the basis of this distinction, my framework with a specific focus on community-intermediaries and local embedding can be identified as a local model.

3.2 Research Design

To answer the broad research question - how are community-led energy initiatives seeking to locally embed sustainable energy technologies? - I adopt a case study methodology. In the following section I discuss why a case study approach was chosen, the case selection criteria and the following case selection. I finish the section by discussing methods of data collection before explaining methods of analysis in the following section, analytical strategy (section 3.3).

Case study approach

A case study approach is a flexible research strategy that focuses on understanding the dynamics

present within a case (Eisenhardt, 1989). It can involve single or multiple cases and numerous levels of analysis (Yin, 2009). I adopt a case study approach because it offers the potential to study context dependent change (Flyvberg, 2006) and because a case study approach is more sensitive to the nuances of change, the detailed analysis of the twists and turns of events over time (Poole et al., 2000; George and Bennett, 2005). I utilise *rich longitudinal case studies* because they offer a number of advantages to the present topic. In particular, they allow for the tracing of processes at multiple levels (Poole et al. 2000), the search and discovery of patterns (Leonard-Barton, 1990) and make it possible for the researcher to recognise relationships, engage with the unexpected and triangulate findings before reaching closure (Eisenhardt, 1989).

Yet case studies also have drawbacks. Normally they have a small sample size, which leads to the potential for sampling error, cohort effects (the distortion of results due to a shared, common temporal experience) and limits to generalisability. To overcome these conventional criticisms I adopt a multiple case study design (Yin, 2009; Flyvberg, 2006). Poole and colleagues (2000, 112) advocate the use of multiple case studies, because "to identify patterns, uncover narratives, and discriminate among developmental models requires detailed longitudinal data on a number of comparable cases, as well as systematic methods for analysing these observations and the context in which they are embedded". With appropriate sampling strategies and data analysis methods multiple case studies can deepen the understanding and explanation of processes by building external validity (Miles & Huberman, 1994). Furthermore, and to overcome a common 'misunderstanding' (Flyvberg, 2006) about the ability of case studies to generate theoretical knowledge, I seek to generalise to theory (Yin, 2009). That is, I approach generality carefully, using the triad of what counts (section 3.1) whilst seeking to reflect on, build and critique the theoretical framework.

Thus the approach taken in this thesis (process theory) and the topic of study (community-based intermediation for local embedding) both direct the design of the research to using a case study approach. In particular, longitudinal comparative case study method is a logical choice best suited to the research questions.

Case selection criteria

The cases in this thesis are chosen for theoretical reasons (Eisenhardt, 1989; Yin, 2009; Flyvberg, 2006). Such an 'information-orientated' strategy can utilise various section logics (Flyvberg, 2006). For longitudinal process research using comparative case studies Pettigrew (1990) suggests four 'decision rules' to help guide case selection:

1. *"Go for extreme situations, critical incidents and social dramas"* because cases that are unusual or critically important can be useful for making the process clearly observable.

2. "*Go for polar types"* because cases that appear very different in terms of the process under study (e.g. success or failure, types of embedding strategy) and through successive sampling, can cover the potential range of possible cases thereby strengthening external validity.
3. *"Go for high experience levels of the phenomena under study"* because a track record of the process under study or situation where the process is likely to reveal itself through experimentation and learning will aid observation.
4. *"Go for more informed choice of sites and increase the probabilities of negotiating access"* because, he argues, careful selection of cases can be fruitless if one cannot negotiate access: it is therefore a pragmatic strategy to choose cases on the basis of gaining access, balancing the ability to collect data with an information-orientated sampling strategy (Pettigrew, 1990, 275-276).

In outlining these rules Pettigrew (1990) assumes a level of familiarity with potential cases. Whilst in some cases this is not possible in other situations and topics a researcher's prior knowledge of cases can play an important role in why cases are selected. The cases in this thesis are chosen on the basis of "expectations about their information content" (Flyvberg, 2011, 307).

Theoretical considerations, foundational to this thesis, guide the case selection strategy. Specifically, my interest in understanding how community initiatives are seeking to locally embed sustainable technologies means I make two theoretical assumptions, that community activists can be understood as community intermediary organisations (which undertake key intermediary processes of facilitating, configuring and brokering) and that community intermediary processes are undertaken in a dynamic, layered context. In other words, the actions of actors, including the focal community intermediary, are influenced by and change the local system. Thus I am interested in common sequences and relationships to key intermediary processes and the specification of context dynamics.

From these theoretical considerations a number of case selection criteria were established:

1. Each case should emphasise a community-based attempt to locally embed a focal, sustainable technology. That is to say, each case should feature a community-led initiative - an initiative that follows an open and participatory process with local and collective outcomes (see chapter 1 and Walker & Devine-Wright (2008)) - as the focal actor or one of the focal actors within a partnership.
2. Pairs of cases should be selected around two focal technologies. A two-pair strategy recognises the diversity present within UK community energy activity (chapter 1), where previous research found that predefined categories - such as energy generation,

efficiency and behaviour change - became increasingly blurred once entering the field (Hielscher, Seyfang & Smith, 2011; Stewart et al., 2009). A two-pair strategy builds on Pettigrew's (1990) argument for 'polar types' and can be based on 'extremes' and 'maximum variation' (Flyvberg, 2006). Such an approach within and across pairs strengthens the external validity of research insights generated (Yin, 2009). Each pair of cases should be selected on the basis of their strategy for local embedding. Pragmatically, two-pairs provide a reasonable number of cases on which to base broader conclusions and balances the need for depth of process data and external validity (Van de Ven & Poole, 2005).

3. Cases should be selected from a single region with 'high experience levels of the phenomena'. This final criterion is used for theoretical and pragmatic reasons. When seeking to conceptualise context dynamics affecting community-based intermediation, the selection of cases from a single region allows for increasing the robustness of generalisations by comparing and contrasting particular events between cases (Weick, 2007): events are contestable and multiple meanings are identifiable. Moreover, the criterion facilitates a comprehensive understanding of a local system rather than the potential for scattered incomplete knowledge of multiple local systems. It allows for an open and flexible mode of inquiry in relation to my theoretical framework (specifically, multiple context levels), where particular elements of the local system can emerge as relevant in each case rather than being predefined. Pragmatically, it limits the potential for 'data asphyxiation' (Pettigrew, 1990) common to longitudinal process research.

Central subject (Unit of analysis)

Before turning to case selection, I explain the central subject of study. The idea behind an evolving central subject originates in the study of organisational change and innovation processes, where the research questions typically focus on understanding how innovation, decisions, learning and so on occur within a firm (see for example Langley et al. (2013)). The concept of an evolving central subject (c.f. unit of analysis) is therefore closely tied to process theory:

> "The unit of analysis in the narrative approach is an evolving central subject that makes events happen and to which events occur. …Central subjects are individual entities (people, groups, organisations, machines and other material artefacts) around which the narrative is woven. …Central subjects must be identified independently of the events in which they figure, because they are primary and give the narrative its basic unity and continuity." (Poole et al., 2000, 39-41)

The evolving central subject in this thesis is 'groups of community activists'. However, there is an important difference between this research and prior research on organisational change: whilst I take the groups of community activists as central to the research design I am interested in how they attempt to locally embed technologies. In other words, I am interested in analysing

how the central subject interacts with external elements and actors and not solely concerned with developments within a single evolving subject.

The conventional means of expressing this might be to say, my unit of analysis is the local embedding of technology through community intermediaries. This also captures the focal actor (community intermediaries) and the focus of study (local embedding) but suggests a continuity of attributes to the focal actor that do not change over time. A further limitation is, this 'term of art' does not prepare the reader for how the individual case studies are presented and analysed: in the following chapters I utilise a narrative approach, informed by the framework to provide selective analytical focus (see below, section 3.3).

At this point it is also pertinent to explain the start and end point of individual case studies - at what point should the research begin and end? Because I follow community activists in their attempts to locally embed technologies I begin the case study when the group of activists start developing a project around the focal technology, that is when they 'pick up' the technology and develop a strategy for its local embedding. The point at which to end each case study is less obvious not least because some of the initiatives have long-term goals. For analytical and pragmatic reasons I end each case study when the group of activists 'put down' the focal technology or, where this is not possible, I end the case study at the end of a cycle of development. This issue is particularly important for two of the cases selected, which are still continuing as I write this. The decision to end data collection on these cases relies therefore on my interpretation of cycles of development. However, discussion with core activists also helped to confirm a sensible point, given time constraints, at which to close the case.

Case selection

I now introduce the cases and explain how they meet the selection criteria above.

All cases come from the city of Bristol in the south west of England. Bristol, a city of approximately 428,000 residents (Mills, 2012), has a long history of grassroots activism including experimentation in alternative energy (Brownlee, 2011). Of note the Centre for Sustainable Energy (CSE) - originally the Urban Centre for Alternative Technology - was set up in 1979 as a sister organisation to the Centre of Alternative Technology, Wales. More recently, community-led energy activity has flourished within the city (CSE, 2011; Bird, 2012) with CSE now acting as an intermediary between local groups and external organisations (national government and businesses). Further local support and advice organisations include the Bristol Energy Network (an umbrella organisation for all community energy groups in Bristol and the surrounding area), the Converging World (providing community support tools), the Avon

Cooperative Development Agency (providing legal advice) and Forum for the Future (a non-profit campaign and social change organisation). Bristol was the first UK city to be short-listed for the European Green Capital award in 2008 and the first to win the title (2015) in part because of its focus on "innovation, learning and leadership" and in part because "it is leading the way with bottom-up community-based initiatives" (EGC, 2013, 5).

Bristol was chosen for two reasons. First it presents an 'extreme situation' with 'high experience levels of the phenomena'. Outside of London, Bristol has been suggested to comprise a notable geographic cluster of community energy activity (Steward, Liff & Dunkelman, 2009). Second, prior experience and contacts made Bristol an 'informed choice' of research site where the probability of gaining access was significantly increased.

Solid-wall insulation (SWI) and solar PV were the two focal technologies chosen. Both technologies are commercially developed and both have attracted community experimentation in Bristol (table 3.1). Policies to promote the deployment of SWI began in 2008. By 2012 "almost no progress has been made" (Skea, 2012) despite its importance to meeting domestic carbon targets (CCC, 2008). Meanwhile, solar PV has been promoted through national grants since 1998 and "has increased from very low levels (less than 0.1GW in 2008) to 2.7 GW at the end of 2013" (CCC, 2014, 118). Whilst the differing fortunes of each technology is interesting in hindsight, the important point at the time of selecting cases (early 2012) was that both technologies were viewed, to different degrees, as technically feasible, economically viable and socially desirable. Each technology will be further introduced in chapter 4.

Table 3.1: Bristol community energy initiatives active in 2011/2012 (compiled by author with reference to BEN (2010) and CSE (2011))

Name	Short description	Focal technology(ies)
Backwell	A local community group seeking to reduce energy use and increase renewable energy consumption	Exploration into wind
Bedminster Energy Group -	Promoting efficient energy use and renewable energy generation in the area	Predominantly low cost energy efficiency measures (draft proofing)
Bristol Energy Co-operative	Set up to promote community own renewable energy generation projects through community share offers	Solar PV
Bristol Green Doors	Set up to promote domestic retrofitting via eco-open home events	Multiple and various technologies. Particular focus on SWI through demonstration project in 2012
Bristol Power co-operative	Set up to source and provide funding for community solar projects	Solar PV
Demand Energy Equality	Set up to run DIY solar PV workshops to low income households	Solar PV
Easton Energy Group	A local community group set up to offer free advice on energy saving in the home to local residents and help with energy saving grants and funding	Various. Particular focus on SWI in 2012
FLOW (Failand, Long Ashton and Wraxall community Energy)	Local community group seeking ways to reduce energy costs and consumption	Various.
Future Fit Bristol	Long-term collaboration to prepare local homes for a green and digital future	Various mainly digital technologies and low cost energy efficiency measures (draft proofing)
Green community warmth	Set up to promote energy efficiency and renewable energy generation technologies	Various but focus on SWI during 2012
Low Carbon Gordano	A local community group set up with the aim to reduce community energy costs and carbon footprint	Various exploration into solar PV, wind, biomass,
Sustainable Bishopston/Redland	Community group which raises awareness of energy and water use in the local community	No focal technology discernible
Transition Montpelier	Local community seeking to make changes in the face of peak oil and climate change	No focal technology discernible
Sustainable Westby on Trym	A local community group working on issues related to sustainable living	No focal technology discernible

From the range of Bristol-based, community-led energy activity the two selected SWI projects are:

- **Bristol Green Doors' (BGDs) Tackling the terrace.** The project installed SWI to a terrace of six properties using government funding between December 2011 and August 2012. Multiple events, including an eco-open home event, were used to engage Bristol residents and local stakeholders. The project aimed to demonstrate and test (financially and socially) multi-property installations, to engage Bristol homeowners with the

technology and engage community groups, the local authority and local businesses in multi-property installations and how to deliver them.

- **Easton Energy Group's (EEG) energy efficiency project.** Undertaken between April and December 2012, the group of activists partnered with a local consultancy to design and implement an energy efficiency project premised on the installation of SWI. The project used obligated energy company funding through a national programme, to offer building fabric insulation (internal, external wall and loft insulation), draught-proofing and heating system upgrades (boiler replacement and electric to gas conversions) free of charge to local residents in Easton, an inner city area of Bristol. The project aimed to deploy SWI and additional measures to at least 100 local households. No measures were installed.

The two case studies were considered 'polar types' because of the way in which they sought to locally embed SWI. Whilst BGDs sought to materially embed the technology within a small number of properties, the approach principally aimed to *demonstrate* the technology and *engage* multiple target audiences, thereby seeking to raise *awareness* of and build momentum for the technology within the city. In contrast, EEG principally aimed to materially embed SWI within its local community and formed a partnership in order to do so.

The two selected solar PV initiatives are:

1. **Demand Energy Equality (DEE).** A new initiative, launched in November 2011, using 'do-it-yourself' (DIY) solar PV workshops to (a) reduce the cost of solar panels and enable low-income households to access the technology, and (b) increase awareness of energy and promote energy demand reduction. 25 workshops, involving 400 participants, were held between June 2011 and October 2012. A 'solar tree' utilising 36 DIY solar panel 'leaves' was constructed in September 2012.
2. **Bristol Power (BP).** A new initiative launched in June 2011 to research, design and install solar PV installations for communities. The initiative aimed to set up new innovative organisational structures, secure financial backing, offer the technology for free to low-income households and utilise a street-by-street approach to engagement and installation. The activists aimed to materially embed 300 domestic solar PV installations by the end of 2012. They achieved 13.

Again the two cases are considered 'polar types' on the basis of their strategies for local embedding. DEE focused on the transfer of skills and knowledge to promote DIY, off-grid PV systems whilst BP sought the large-scale local embedding of commercially developed and installed PV systems through new institutional structures and an innovative financial model. A

summary of the cases is presented in table 3.2.

Table 3.2: Summary of cases selected in this thesis

Name	Focal technology	Aim	Strategy
Bristol Green Doors' Tackling the terrace	SWI	Demonstrate a multi-property installation and engage local residents, community groups, local businesses and the local authority	Install the technology at a terrace; open the terrace to the public within a city-wide eco-open home event; engage community groups, local businesses and the local authority through targeted engagement events
Easton Energy Group's energy efficiency project	SWI	Materially deploy SWI within the local community	Install the technology through a partnership with a local energy consultancy using of government obligated energy company funding
Demand Energy Equality	Solar PV	Reduce the cost of solar PV to low-income households and increase awareness of energy and promote energy demand reduction	Organise and run DIY solar workshops, in which participants learn the skills and knowledge to construct their own DIY PV systems
Bristol Power	Solar PV	Install solar PV systems on community and domestic rooftops free of charge to local residents	Set up innovative organisational model, city-wide networking, local industry development and community engagement

Thus I collect and analyse data on recent but historical cases. This contrasts with the preferred practice in process research to collect data in real-time, before the outcome of the process under study is realised (Poole et al., 2000). There are tradeoffs in this approach. A retrospective approach allows for a greater insight into the outcomes of the cases before data collection has begun. It also facilitates the bounding of the case study in terms of start and end points. However, retrospective case studies suffer from historical bias on the part of participants (particularly in interviews) and have less capacity to capture the detailed twists and turns of a project under development (Leonard-Barton, 1990). To remedy this meeting minutes and internal project documents were accessed.

Data collection methods used

Three sources of data were used for the analysis of the four cases - interviews, document analysis and participant observation. Using three sources of information later allowed for a strategy of 'triangulation' during analysis (Yin, 2009; Eisenhardt, 1989). In the following sub-sections I outline these three sources in more detail. I will explain the analytic strategy adopted in this thesis in the following section.

Interviews

Three types of people were interviewed for the research: core activists of the community energy initiatives, key project partners and key city-wide actors. A snowballing and information-orientated sampling strategy was used. Instead of random sampling interview subjects were selected on the basis of their position in relation to the case. Through this approach I subsequently interviewed fewer actors, but more in depth and covering multiple perspectives key to initiative development (Leonard-Barton, 1990).

A strategic decision was made early in the research process to gather secondary data on wider community participants (i.e. the householders or end-users of the technology) rather than conduct further interviews. This decision resulted from existing research highlighting the importance of core activists in project development (e.g. Seyfang, Park & Smith, 2013) and from the research focus and questions: my focus on key intermediary processes and context dynamics suggested concentrating on key community activists, partners to initiative development and strategic city-wide actors. To remedy this secondary data about wider community participants was collected from the initiatives themselves (see below).

A common interview strategy, typically spanning three months, was used in each case to negotiate participation, access internal initiative documents and gather sufficient data. First, exploratory interviews with key activists were used to negotiate access to the initiative, provide basic orientation to case development and secure access to internal activists documents. Agreement to participate in the research was also important for gaining access to internal documents because of the limited public information typically available. Furthermore, to prepare for subsequent semi-structured interviews it was important to gather and digest internal initiative documents. These interviews were also used to gather the names of core activists involved in projects design and implementation, project partners or informal relationships with actors outside of the initiative.

Next a series of semi-structured interviews was undertaken with core activists and key project partners. By semi-structured I mean each interview covered a list of topics pertinent to the research but in a way as to allow flexibility to explore and probe relevant and conflicting information as it arose. These interviews were structured around the following topic headings:

- The project: including initiation, aims and objectives and any changes over time, the activists involved and their roles, the target audience, project resources and outcomes.
- The technology: including the choice of technology, its position in the project, lessons learnt about embedding the technology and any additional technologies.
- Interactions or relationships with external parties: including project partners, informal support or relationships as well as attempted agreements.

- Project context: factors and developments that supported and/or hindered the project, the influence of government policy and the influence of technological or market changes.

Again a snowballing technique was used to extend the identification of key actors within each case (although few additional actors beyond those mentioned within the first interviews arose). The focus was on the organisation rather than interviewees as individuals. Interviews continued until a representative coverage of key actors involved in each case was achieved. Each case was ended with an interview with the original core activist(s). This interview was used to verify the sequence of events in each case (the case chronology, see below), cover any remaining issues and key documents, discuss significant unexpected events and clarify development sequences.

Finally, key citywide actors, identified through interviews and early analysis, were interviewed for their strategic influence on the development of each case and to gain further insight into the local system. To select subjects I sought those with maximum knowledge of the empirical topic (the cases) and research focus (local embedding). Six key actors were identified as having influenced the development of at least two cases. These interviews were again semi-structured and followed the following topics:

- The organisation: the organisation's remit and evolution over time.
- Interaction with cases: the organisation's formal and informal role played in each case.
- The broader role of community initiatives in locally embedding technologies: benefits of community initiatives, their challenges.
- Local system dynamics: around the community initiatives, focal technologies and local industry, policy, etc.
- Wider environment: industry dynamics, focal technology, policy and regulations etc.

The basic interview strategy thus moved from a free, exploratory style becoming increasingly structured and detailed before reaching closure. A total of 41 interviews were conducted with 30 interviewees. Three people were interviewed twice, two people three times and one person five times. All interviews were conducted face-to-face apart from one. All semi-structured interviews were transcribed (but not the first exploratory interview or the last clarification interview). A list of all interviews conducted for this research is included in Annex A. Besides these formal interviews, numerous informal interviews were conducted, to clarify events, sequences, interactions and context dynamics, with interviewed subjects and others, as the research progressed. The use of interviewee names was negotiated in each case. In the following chapters I identify participants by name only where it is necessary to do so.

Document analysis

A variety of documents were collected for analysis, corresponding to the layered context of each case: initiative documents, city-regional documents and external environment documents.

Beyond the collection of data from initiative websites, a variety of internal initiative documents were important to understanding how initiatives developed and key intermediary processes were undertaken. Since many of these documents were not publicly available, access was negotiated at the outset, within the first interview. These documents included,

- project proposals and outlines - including draft versions and final proposal, supporting material and any changes made to the proposal during the course of the project,
- project reports and outputs,
- contractor quotes and correspondence,
- grant applications and funding requests,
- meeting minutes,
- participant feedback, and
- publicity materials and correspondence with external actors (householders, community groups, partners).

My initial fear that access to these documents would be denied was in practice, unfounded. However, the access granted did vary. In three of the four case studies access to internal project documents was unconstrained and resulted in the sifting of huge amounts of data (in one case 2.4 GB of data equating to 877 documents, resulted in 227 documents useful to the research). For the final case study a compromise approach was negotiated: I specified the types of documents sought and the key activist provided access.

Further public documents were collected at the levels of the city-region and external environment in relation to the initiatives, focal technologies, local and national policy and industry developments. These documents included: third-party case studies; reports on local community energy activity; Bristol City Council reports, policies and programmes (e.g. housing, energy, climate change, community activity); industry reports (on the Feed-in Tariff scheme (FiTs) and the Community Energy Saving Programme (CESP); national government policy and reports (on the FiTs, CESP, the Carbon Emission Reductions Target (CERT) and Green Deal) and industry and academic reports. Collection and analysis of documents was undertaken between July 2012 and December 2014. Like the interviews, document analysis was undertaken solely by myself. Together these documents and interviews were used to create an event chronology for each case (see below).

Participant observation

The final means of collecting data was through participant observation. As Flyvberg (2011) notes, one of the most advanced forms of understanding is achieved through researchers experiencing, for themselves, the context being studied. Utilising retrospective longitudinal case studies made direct observation difficult. However, participation in community energy activity in Bristol since 2010 and participation in initiative meetings and events prior to the official start of data collection aided the research in a number of ways. This prior involvement gave me a better understanding of group activities from the outset, whilst observation of particular projects during the design of the research helped informed the selection of cases. Participation in meetings and events (e.g. BGDs 2012 eco-open homes event and DEE's DIY solar tree workshops) alongside living in Bristol and coordinating the Bristol Energy Network (July 2012 - October 2013) significantly aided my understanding of activist strategies and local system dynamics. Yet since many of the case events took place before this period, they were inaccessible for observation and as such interviewing and document analysis were important to analysing initiative activity.

The different sources of data have different benefits and weaknesses. Interviews often end up focusing on memorable moments or broader trends whilst documents are often richer and finer grained but may require situating and may miss useful nuances and background information. Participant observation, in contrast, is time and resource consuming and in this instance useful to deepen understanding of the context of community action rather than the detailed understanding of the twists and turns of cases under study. These challenges within and between data sources seem, in many respects, unavoidable and render analysis more difficult. However, the strengths of each source can be used to counter the weaknesses of another.

3.3 Analytical strategy

The following analytical strategy is informed by the research topic (community-intermediary attempts at local embedding) and the research questions. Within the process research tradition, the challenge lies in moving from surface observations to a process theory. As Geels and Schot (2010, 101) state, "process analysis and narrative explanation always involve pattern recognition, which to some degree entails interpretation". Langley (1999, 694) states this metaphorically, suggesting, "this is where the central challenge lies: moving from a shapeless data spaghetti toward some kind of theoretical understanding that does not betray the richness, dynamism, and complexity of the data but that is understandable and potentially useful to others". In the following section I outline how I traverse this path from empirical data through analysis to conclusions. The actual process was not linear but is presented in this way for clarity

of explanation.

Event chronologies (step 1)

From multiple sources of data (interviews, document analysis and participant observation) I first created event chronologies: a simple listing of events relevant to the development of the initiative. Events can be small, such as an email exchange, or large for example the launching of a share offer or engaging the community. Because of the retrospective investigation of case development all events linked to the development of the case were included. The event chronologies included four categories: date, title, details of event, source. An extract of an event listing for DEE is provided in Annex B.

This first step provided a means of organising the empirical data chronologically. In all cases, although to varying degrees, creating chronological event listings was harder than initially thought. In part this is because interview participants recall events in a different order to how they actually occurred and in part because of the predominantly informal nature of community energy initiatives. Volunteer-based and under-staffed few of the cases had an organised means of recording activity and paperwork. These event chronologies can be understood as an organising device, they provided the basis for the next step, writing case narratives.

Case narratives (step 2)

Basic case chronologies were then written to get on top of the data. But as Pettigrew (1997, 399) points out, "the aim of the processual analyst is not to produce a case history but case study". Case studies need to make explicit use of theory. Theory helps overcome the impulse to explain 'one damn thing after another' and requires dedicated and structured work. Moving towards narrative explanation Pettigrew (1990) advises using subplots, to get on top of the data and provide selective analytical focus and reach towards theory presentation. The conceptual framework is important here for providing focus, 'disciplining the narrative' as Pedriana (2005) argues, shaping what is deemed interesting to the analysis. In addition, five typical features of narrative explanation, as outlined by Pentland (1999), served as a useful guide: (1) a sequence in time, (2) focal actor(s), (3) identifiable narrative voice, (4) an evaluative frame of reference, and (5) indicators of context.

In the following case study chapters I present case narratives using plots based on the theoretical framework in an explicit attempt to interpret and explain attempts at local embedding via community intermediaries. Plots derive from the different levels of analysis, which correspond to the theoretical framework's context layers (external environment, local system and community). Attention is directed to narrative elements that display characteristics of key

intermediary processes. The resulting narratives form an intermediate step in theory development: they clarify activity across levels of analysis, suggest causal links and point towards analytical themes taken up in the second half of each chapter. Although each narrative follows chronological ordering, the explanation of some events is given coherence by events being grouped together and introduced in one place only. The task is to tell the story, but not to recant the story 'as it really was' (an impossible task given the variety of actors, the twists and turns over time) but to use narrative plots to provide selective analytical focus. The resulting case narratives retain the ambiguity of observed situations but are also an intermediate step in answering the broad research question - how are community-led energy initiatives seeking to integrate sustainable energy technologies into local contexts of use?

Within case analysis of key intermediary processes (step 3)

The focus of the within case analysis is on understanding and explaining key intermediary processes and context dynamics shaping the agency of the community intermediaries. I use Stewart and Hyysalo's (2008) key intermediary processes as the entry point. The three processes are operationalised in the following protocol: table 3.3 converts this part of the conceptual framework into a set of common and basic questions that can be asked of each case. This approach draws on the method of structured, focused comparison (George & Bennett, 2005).

Table 3.3: Research protocol for key intermediary processes

Intermediary processes	**Definition**	**Indicators**	**General questions**
Facilitating	The providing of opportunities to others through the creation of 'spaces' (social, knowledge, cultural, physical, economic and regulatory)	Creating new communities or networks (social); new skills and knowhow (knowledge); establishing positive images or green values (cultural); places or equipment (physical); providing funds (economic); creation of local rules (regulatory)	1. Why are they going about facilitating in the way they do? 2. What kinds of facilitation activities are envisaged and what restricts their implementation? 3. What is the form and content of these facilitating spaces?
Configuring	The technical, symbolic and cognitive arrangement of technologies and projects, the alignment of actors and the shaping of aims and objectives of projects	Project design (aims and objectives); interpretation of the technology	1. How is the project designed? 2. What influences project design? 3. How is the technology interpreted and presented to others?
Brokering	The representation of actors and networks, negotiation and mobilisation of resources (financial, human and physical) and the connecting and transfer of knowledge between different actors	The representation of the target community; negotiation of the project against stakeholders and funding bodies; the mobilisation of resources	1. How is the project negotiated with stakeholders? 2. What resources are mobilised and where from? 3. Are users represented?

The protocol allows me to analyse key intermediary processes in each case narrative, but the protocol also serves a number of functions in the overall analytic strategy. First, it allows me to test and elaborate the conceptual framework and draw conclusions about its applicability in each case. Second, it provides a basis on which to place key intermediary processes within visual maps (see below), which, when complete across the four cases, become the basis for pattern recognition within key intermediary processes in the cross case analysis in chapter 9. Third, the analysis of key intermediary processes within each case and importantly what influences them, identifies context dynamics influencing community intermediation: table 3.4 depicts the protocol used to allocate context influences to the different levels of analysis. Beyond the obvious allocation of influences (e.g. national government policies to the wider environment) my allocation links influences to where they stem from. The identification of context dynamics from each of the four case studies then becomes the data on which analysis of context dynamics

can be performed in chapter 9. The individual case study chapters therefore prepare the ground on which the cross case analysis can be performed.

Table 3.4: Research protocol for context influences

Context layers	**Definition**	**Indicators**
Wider environment	The set of rules (informal and formal) that enable and constrain the adoption of socio-technical variations, and slower changing developments (Raven et al., 2008)	National government policies and programmes, national infrastructure, (inter)national technical innovation, (inter)national market organisation, development and trends, national user uptake
Socio-technical system	The local alignment of technologies, actors and institutions around emerging socio-technical configurations	Local government policies and programmes, local industry structure and development, local geography and natural resources, local material infrastructure, local user uptake,
Community	The end users of the technology, defined geographically or by interest, which the community initiative seeks to influence	Individual and community energy activities and daily practices, their culture, understanding, motivation and expectations, community uptake of technology,

Visual mapping and pattern recognition (steps 4 and 5)

Next I use visual mapping to further clarify events and interactions between context layers and facilitate pattern recognition. Visual mapping has the benefit of presenting large quantities of information in little space and thus help the development of theoretical ideas because "they allow the simultaneous representation of a large number of dimensions, and they can easily be used to show precedence, parallel processes, and the passage of time" (Langley, 1999; 1998). Furthermore the approach does not force an artificial clarification of the 'unit of analysis' but maintains the focus on central subjects operating within multiple contexts layers. Again, visual mapping relies upon the use of the conceptual framework: it reduces the amount of information and orders it into different levels of analysis. Van de Ven and Poole (2005) claim the results are typically rich but not as detailed as narrative explanation. So in combination with narrative explanation and within case analysis of key intermediary processes, visual mapping aids pattern recognition and is considered to be a useful methodological approach for the present research.

The visual maps included in this thesis (e.g. chapter 5, page 107) were developed over time. In fact, the first visual maps were relatively unstructured, sketched to get on top of the data and

understand the flow of events. Over time they became more sophisticated, incorporating different means of coding events and the linkages between them. For example, horizontal bands were later incorporated to situate events and activities within different levels of analysis, whilst the situating of boxes within these bands indicates where the event or activity took place. Finally key intermediary processes were superimposed over the events they correspond to following in-depth analysis of each case. A detailed key to these maps is presented in Annex C.

Visual maps serve two purposes within the thesis. First, they provide a summary conclusion to each case study. Second, they provide a basis for cross case analysis and the search for patterns between intermediary roles common across all four case studies. They provide a means for answering the detailed research question (RQ2) - are there patterns to key intermediary processes in local embedding and what explains these, if any, patterns?

Analysis of context dynamics (step 6)

To answer the second detailed research question (RQ3) - how do context dynamics affect the agency of community intermediaries in local embedding? - I analyse the influence of context dynamics on community attempts at local embedding across all four cases. In doing so I draw on the advice of Miles and Hubberman (1994).

In short, the process moves through the sorting and collating of data following the above protocol (table, 3.4), through to the partitioning and clustering around concepts of the conceptual framework. A first step was the creation of a meta-matrix, a master chart that assembled descriptive observed influences of context layers (external environment, local system and community) from each of the individual case studies, in one place. From here, I partitioned the data around context layers and ‘clustered’ the data around emergent themes from the cases and ideas from the literature. A variety of analysis techniques were used in the process, including counting, making contrasts and comparisons, noting patterns and themes, partitioning and subsuming particulars into the general (Miles & Guberman, 1994). The aim being to create concept-orientated displays of dynamics within each context layer. The result (cross case analysis, chapter 9) is a series of clustered summary tables on the dynamics within context layers on the agency of community-based intermediaries. These tables move beyond the fragmented within case displays of context influence (e.g. Chapter 5, page 106).

The approach thus takes a particular entry point, privileging the vantage point of the community initiatives and what context dynamics affect their agency to locally embed technologies. The approach is similar to Backhaus, Mourik and Breakers (2010) in that it can only identify those context dynamics that have an influence on community intermediation. The approach is distinct

from that Brohmann et al. (2007) because it does not seek to understand context on the basis of conceptual categories developed a priori and investigated separate to the topic of study (here local embedding, for Brohmann and colleagues the societal acceptance of new technologies). My approach therefore cannot claim to capture all context dynamics on local embedding processes because it is conceivable that additional and/or alternative influences would be felt by a different focal actor. However, this weakness is slight compared to the depth of understanding about how particular context dynamics affect community-based intermediation for local embedding.

Revised dynamic model of community intermediation for local embedding (step 7)

Finally, the two pieces of cross case analysis (pattern recognition of key intermediary processes and analysis of context dynamics) are brought together to revise the initial conceptual framework (chapter 2) with insights from the case studies. In doing so I outline a dynamic model of community-based intermediation for local embedding (chapter 10).

An overview of these seven steps is summarised in figure 3.2.

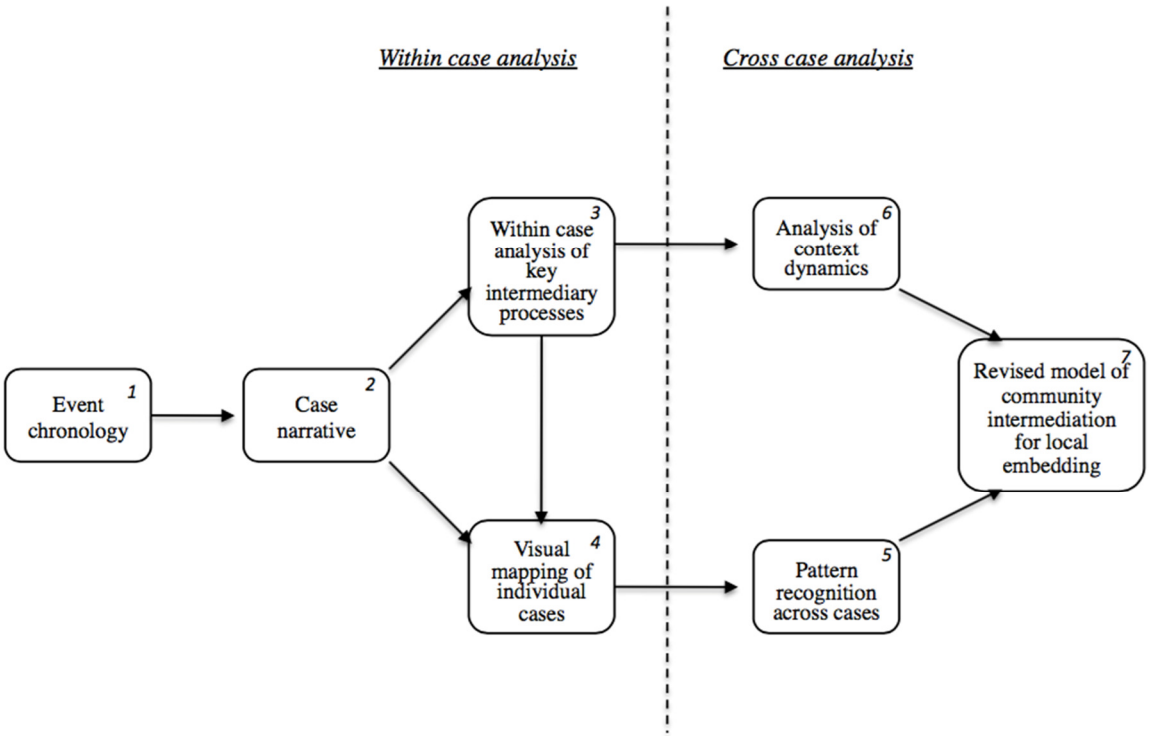

Figure 3.2: Overview of the analytical strategy adopted in this thesis

Note: numbers correspond to the analytical steps listed above.

Summary conclusions to the chapter

In this chapter I have discussed the basic assumptions on which this research rests. In doing so I have made certain methodological choices. Primary amongst these is the choice to situate this research within the process research approach (c.f. variance approaches). This grounding has implications for the design of the research, methods of analysis and how I argue my contribution to knowledge. I have also chosen to focus this study on community activists as the central subject but under the processual research tradition this allows me to inquire into multiple levels of analysis. Focussing on community activists means I approach what constitutes local socio-technical systems from the perspective of local practitioners rather than applying previously deduced categories. It also means that this research has the potential to reveal different and potentially new influential influences on local embedding and transitions more broadly than previous research has found. My second methodological choice is to use multiple longitudinal case studies, in particular two-pairs of cases around two focal technologies. Undertaking multiple cases, chosen based on expectation about their information content, accommodates the diversity of approaches found in current community energy activity (chapter 1) and strengthens research insights through increasing external validity. My third methodological choice pertains to the analytical strategy adopted. I have selected a range of different tools from the process researchers toolkit with which to gather, interrogate and analyse data for patterns, relationships and dynamics, assembling these tools in an analytical strategy that will allow me to revise the framework into a dynamic understanding of community intermediation.

In the next chapter I briefly introduce the two focal technologies on which the following cases are based before turning to the case studies themselves in chapters 5 to 8.

Chapter 4.
Introduction to the focal technologies in context

Before turning to the case study chapters I briefly introduce the two focal technologies around which the case studies are based. I introduce national and local policies in support of the focal technologies and their deployment to date. Further specific context detail is provided in the case studies where relevant. In chapters 5 to 8 I present and analyse the four cases selected.

4.1 Solid-wall insulation

SWI is a term for a variety of different technologies that reduce the energy (heat) lost through walls of a solid construction, a building technique prevalent in the UK up to the 1930's when cavity walls were introduced. Today, seven million solid-walled houses are estimated to be in need of insulation in the UK, of which 1 million are thought to be cost-effective currently (CCC, 2014). SWI can be undertaken internally resulting in reduced living space or externally requiring planning permission and potentially altering the appearance of the property. Hybrid systems combine both internal and external insulation.

In the UK, SWI is seen as increasingly important to reduce carbon emissions from the residential sector, which accounts for 24% of total UK carbon emissions (CCC, 2014). The national deployment of SWI has relied on government policy and particularly, obligations on suppliers of electricity and gas. Prior to January 2013 two supplier obligations[7] were in place: the 'Carbon Emissions Reduction Target' (CERT) and the 'Community Energy Saving Programme (CESP). CERT was the main legislative driver for improving the energy efficiency in existing households in Great Britain, it ran between 2008 to 2012 and followed in line with previous obligations (a good overview is provided by Rosenow, Platt & Flanagan, 2013), aimed to deliver low cost energy efficiency measures nationwide. It was the first supplier obligation to include SWI and resulted in SWI being installed in nearly 60,000 householders (Ofgem, 2013). CESP was much smaller in size and placed emphasis on high cost measures, such as SWI, multiple measures per property and an area-based approach. It came into force in September

[7] Obligations have been placed on suppliers of energy since 1994. Designed to save energy and carbon they have been used as a carbon reduction policy and more recently to address fuel poverty. Commonly referred to as supplier obligations they mandate suppliers of energy to save energy through the deployment of particular technologies and, in some cases, particular segments of society. See Rosenow, Platt and Flanagan (2013) for an overview of supplier obligations in the UK.

2009 and obligated generators as well as suppliers (for the first time) to deliver energy efficiency measures to households in specified low-income areas (lower super output areas). Over 75,000 properties had SWI installed by the end of the obligation, the majority of which were undertaken on social housing (Duffy, 2014).

In January 2013 the Green Deal and ECO, the coalition government's flagship energy efficiency policy, was launched. It aimed to remove the upfront capital cost of energy efficiency measures by providing low interest loans for the installation of measures tied to the house (as opposed to individual homeowners) and repaid through energy bills. A 'golden rule' ensures household energy bills (including repayments) do not increase following the installation of measures. Where this is not possible, ECO (the new supplier obligation) is designed to support the deployment of more costly measures, such as SWI, through providing extra funding for some households. The ECO is further split into three strands, of which one strand specifically focuses on wall insulation, although it is eligible under all three. 84,261 SWI installations had been completed through ECO by the end of March 2015 (DECC, 2015).

Community engagement with SWI was first promoted under DECC's *Local Energy Assessment Funds (LEAF),* a £10 million grant funding pot to support community action on energy efficiency and renewable energy between January and March 2012. Specifically, the funds supported: (1) energy efficiency activities - such as household energy surveys (to gather information), engagement events (to stimulate community interest) and the installation of demonstration technologies and measures such as SWI - and (2) renewable energy activities - such as area-wide feasibility studies, engagement events and developing community capacity for renewable technology deployment (DECC, 2011). The funds could not be used to support capital funding for projects that would qualify under existing or future government support programmes (i.e. the Feed-in Tariff scheme (FiT) or the Renewable Heat Incentive) but it did intend to help equip communities with the means to participate in these policy programmes. Applications were invited under two simultaneous rounds, in which applicants had two or six weeks to develop proposals.

As a result of CERT and CESP, the deployment of SWI increased dramatically in 2012 before falling to previous rates of deployment (below 30,000 per year) following the introduction of the Green Deal in January 2013 (CCC, 2014). 170,000 installations had been completed by the end of 2013 which falls short of the half a million needed to keep within UK carbon budgets (figure 4.1). Figure 4.2 places the deployment of SWI against cavity and loft insulation and replacement boilers for the period 2008 to 2013.

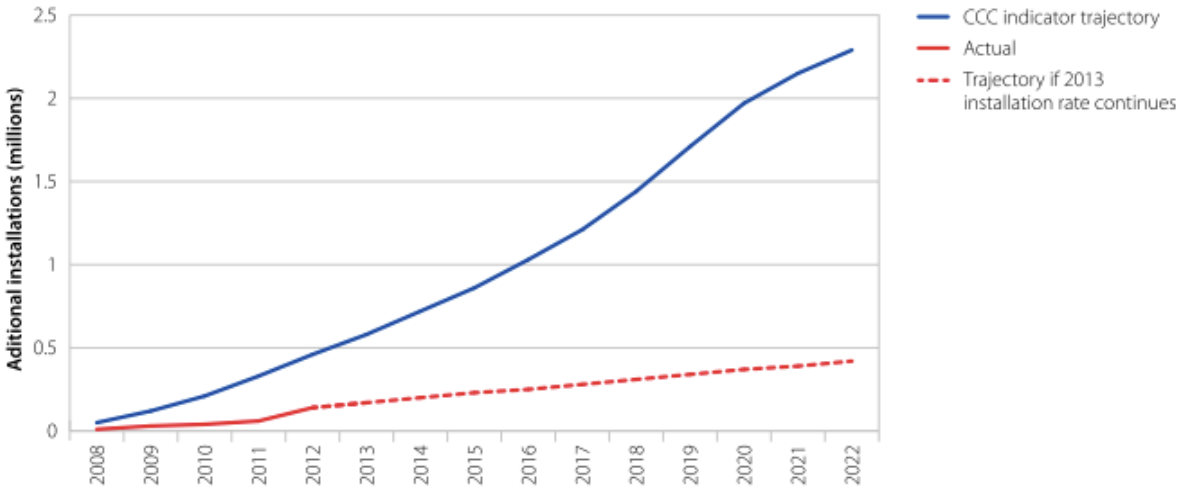

Figure 4.1: National SWI cumulative installations (2008-2012) (CCC, 2014, 163)

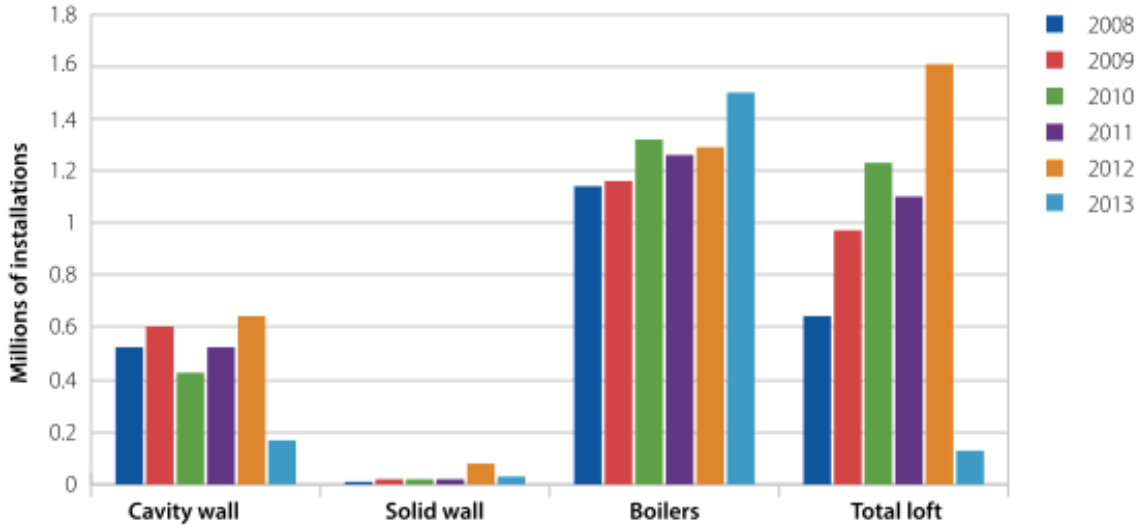

Figure 4.2: National installation of residential energy efficiency measures, 2008 to 2013 (CCC, 2014, 161)

DECC (2013) argues that 'realising the potential' of SWI is important for meeting domestic carbon reduction targets. But, to accelerate the societal embedding of SWI a variety issues have been highlighted. Reducing the cost of installation through innovation is viewed as an important factor (Boardman, 2008; Platt, Cook & Pendleton, 2011) but as the CCC (2014) point out, a reduction in cost by one third would only increase the cost-effectiveness for a further 108,000 properties because gas heated properties would still not be captured. Uncertainty remains over the efficiency of SWI and modelling techniques used to estimate potential savings (DECC, 2012). Potential unintended consequences of SWI include overheating and changes to moisture retention both of which have been linked to the quality of workmanship and mistakes in initial assessments (Bre, 2014). The SWI market itself is 'embryonic' (DECC, 2012) and

underdeveloped (McCelland et al., 2013). Generating demand in SWI and other efficiency measures is thought to require effective engagement and community-based approaches have been suggested (Platt, Cook & Pendleton, 2011; Mallaburn & Eyre, 2013) although the limited number of such groups is thought to restrict their potential to make a significant contribution (Mallaburn & Eyre, 2013). A variety of challenges also exist in implementation. Dowson et al. (2012, 299) argued "weather related issues, planning delays…, cash flow problems due to retrospective payments from energy suppliers, gaining access to eligible house-holds and dealing with resentment from non-eligible house-holders" all provided problems for CESP. Banks and White (2012) highlight the importance of onsite project management to manage customer and contractor expectations and suggest the visibility of SWI requires demonstration properties that can motivate and reassure potential householders. Moreover, there is a growing consensus that SWI will require area-based, local action (Boardman, 2008; Mallaburn & Eyre, 2012; Banks & White 2012; CCC, 2012; DECC, 2013a) where it has been suggested, that multiple installations undertaken simultaneously can further reduce cost (Dowson et al, 2012; Platt, Cook & Pendleton, 2011; CCC, 2015).

Bristol and Solid-wall insulation

In Bristol, approximately 75,000 properties have solid-walls (BCC, 2011) out of a total housing stock of 190,000 (BCC, 2013) representing 39.5% of households. In 2011 the local authority recognised that 'no significant progress' had been made to embed SWI within the city having previously concentrated on simple, cost effective efficiency measures and citing lack of finance and a 'scarcity' of designers and contractors (BCC, 2011). A revised *Climate Change and Energy Security Framework* (BCC, 2012a) adopted in March 2012 included plans to design and deliver an energy efficiency retrofit programme to council owned property by 2020. A citywide programme aiming to tackle both private and rented properties was launched in November 2014.

Deployment of SWI in Bristol over the years has been piecemeal: SWI was applied to a 16-storey apartment block in 2010 (Sustain, 2010); a DECC-backed Green Deal pilot scheme resulted in SWI being applied to 23 properties during 2013 (McClelland et al., 2013), and, the new 4-year programme (2014-2018) is aiming to install 1,000 SWI installations by June 2015.

4.2 Solar PV

The generation of electricity from solar photovoltaic (PV) panels is considered "a mature, proven technology" (DECC, 2013b, 7), discovered in the 1860's by two British scientists and developed over the following century for niche electrical needs where traditional forms of

electricity generation were either unviable or uneconomic (Perlin (2000) provides an historical account). In short, the principals behind solar PV derive from the semi-conducting properties of particular solid materials. When sunlight strikes upon a semi-conductor an internal electrical current is generated through movement of electrons within the material: current and voltage are generated, which result in power. At a manufacturing level, the smallest unit of semi-conductor used for solar power generation is called a 'solar cell', which combined in series within panels form modular units. Solar PV thus forms a scalable technology.

In the UK, the use of solar PV takes two main forms, either building or ground-mounted installations (DECC, 2013b). From 1998 onwards a series of small grant programmes, some directed specifically at community participation, have supported PV deployment in the UK (table 4.1 provides an overview). These programmes resulted in slow but steady deployment but no specific policy provision for PV was in place until May 2012 when DECC announced their updated Renewable Energy Roadmap and a Solar PV strategy was released in October 2013 (DECC, 2013b). By this time 2.5 GW of PV had been installed nationally, primarily as a result of the introduction of the Feed-in Tariff (FiT) scheme.

Table 4.1: Overview of UK government PV demonstration and deployment programmes (based on Smith et al. 2013 but updated)

Name	**Years**	**Funding provided**	**Total capacity installed under the scheme**
SCOLAR Programme	1998-2000	£1 m	100 small systems (2-3 kW each)
PV Field Trials Programme	2000-2006	£9.4 m	1.5 MW
Major Photovoltaic Demonstration Programme	2002-2006	£31 m	8 MW
Low carbon Buildings Programme	2006-2010	£13.4 m (only for PV)	4549 projects
Feed-in Tariff	2010+	£686 m (FiTs payments 01.04.2013-31.03.2014)	2,051.60 MWs: 464,520 projects

Launched in April 2010 the FIT encourages the deployment of small-scale (up to 5 MW) renewable energy generation technologies, including solar PV but also onshore wind, hydroelectric and anaerobic digestion, through three financial incentives: (i) a generation tariff pays a set rate for each unit (kWh) of electricity generated,[8] (ii) an export tariff is paid for each unit of electricity exported to the grid, and (iii) electricity bill savings are generated through the use of electricity generated onsite. The primary beneficiary of the scheme has been solar PV,

[8] The level of the tariff depends upon the generation technology and the size of the installation. Once registered the tariff is guarantee and index-linked.

which accounted for 79% of generation capacity and 98.6% of installations by the end of March 2014 (Ofgem, 2014). The scheme was adjusted multiple times in the first three years to compensate for higher than expected deployment of PV and changing market circumstances, namely declining PV wholesale market prices (Smith et al. 2013 provide a useful overview of the politics of UK PV support). Table 4.2 summarises these changes.

Table 4.2: Changes to the FITs since April 2010

Oct-2010	***Treasury spending review***	Introduced a control framework for levy funded spending by DECC limiting the amount of money that could be raised via levy for DECC's schemes, including the FiT.
Feb-2011	***Fast-Track Review***	Targeted PV installations above 50 kWp. Proposed three new tariff bands and reductions in tariffs for everything over 50 kWs.
Oct-2011	***Comprehensive Review (phase 1)***	Made three key changes: (1) a reduction in tariffs for PV installations below 250 kWs, (2) the linking of PV tariffs to minimum energy efficiency requirements from April 2012, (3) a reduced multi-installation tariff rate (at 80% of standard tariff)
Feb-2012	***Comprehensive Review (phase 2a)***	Explored cost control mechanism for PV tariffs leading to a contingent digression model being implemented in August 2012. Introduced a further reduction to installations below 4 kW from August 2012 and increased multi-installations tariff rate to 90% of standard tariffs.
Feb-2012	***Comprehensive Review (phase 2b)***	Community groups received a distinct status exempting them from minimum energy efficiency standards for PV installations, from the 1st December 2012.

Bristol and solar PV

Because of its dense urban environment, Bristol city-region has limited potential for large-scale renewable energy generation. Nevertheless it was recognised that "significant potential exists to generate renewable electricity from micro-renewable energy systems integrated into buildings" (Regen SW, 2005).

Local policy in support of PV embedding first emerged in February 2010, when Bristol City Council adopted a 'Climate Change and Energy Security Framework' for 2010-2011 which included plans to increase the supply of locally produced sustainable energy and a feasibility study into a local energy company (BCC, 2010). The revised framework (2012-2015) subsequently included specific provisions for solar energy, including plans to reduce emissions from the council's own buildings and operations and installation of 35 Solar PV systems in schools. To aid the local embedding of PV within the city the council developed an online rooftop solar resource map. Launched in February 2012 the online map[9] identified a third of all rooftops (approximately 80,000) in Bristol as being suitable for solar generation: the equivalent

[9] The map can be accessed here: http://www.bristol.gov.uk/page/environment/solar-energy

of approximately 600 MW capacity this represented a 600 fold increase in PV capacity compared to existing installations and a 30 fold increase in renewable electricity capacity in Bristol (Highman, 2011).

The local embedding of solar PV in Bristol has broadly followed a similar pattern to other regions and local authorities. In 2004 there was only one installed solar PV system within the former county of Avon (Regen SW 2005). By March 2014 there were 12,087 recorded solar PV installations, with a combined capacity of 46.91 MW (Regen SW 2014). Figure 4.3 charts this progress over time.

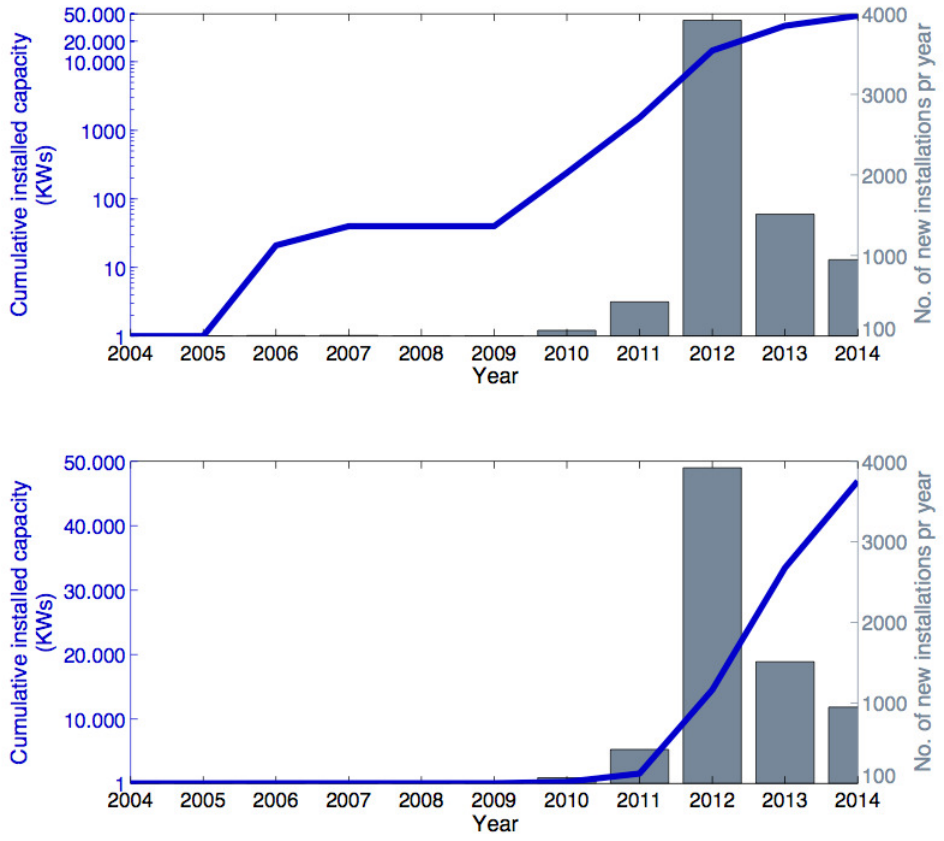

Figure 4.3: Growth of solar PV in Former Avon from 2004 to 2014

Upper figure shows installed capacity on a logarithmic scale, whilst the lower figure is on a linear scale. Dataset compiled by author from RegenSW reports (2003-2014)

To support communities in developing and owning renewable energy projects the second Climate Change and Energy Security Framework included provision for a £40,000 catalyst fund to be administered by the Centre for Sustainable Energy (CSE). The fund was set up in March 2011, providing access to finance to local community enterprises to help them break through key business development hurdles (primarily directed at covering the cost of professional expertise rather than staff time). Six groups applied to the fund in the first year and three were

awarded funding. In addition and prior to the catalyst funding a smaller grant funding pot was set up in 2009 to support grassroots community initiatives develop projects. The Bristol Community Challenge Fund, was administered by Bristol Green Capital, had a total budget of £70,000 per annum and gave out grants of £2,000 to £5,000.

Summary conclusions to the chapter

In this brief chapter I have introduced the two focal technologies central to each community project. I have situated the technology nationally and locally and provided an outline of the current challenges it faces.

In the next four chapters I introduce and analyse each of the four cases in turn. Each chapter begins with a case narrative (using narrative plots). Next I use Stewart and Hyysalo's (2008) key intermediary processes to analyse the activists' activity and agency in relation to context influences. I conclude each case with a discussion of interactions between the three core processes before re-interpreting each case as a visual map and summarising the influence of different context layers. In chapter 9 I will look across the case studies to seek common patterns in intermediary roles and key characteristics of context layers with which to revise the conceptual framework in chapter 10.

Chapter 5.
Bristol Green Doors' Tackling the terrace

5.1 Case narrative

Bristol Green Doors (BGDs) is a community interest company (CIC)[10] that promotes the domestic retrofitting of Bristol homes. It does so by holding eco-open home events in which householders who have installed energy efficiency and renewable energy generation measures open their doors to the general public to share their experience. It was formed in 2010 by Dan Weisselberg and Kate Watson and initially supported by a diverse steering group comprising multiple stakeholders within the city. It was an idea that had been "in the air" for a while (Int_30); they were taking the "simple step to link things together" (Int_2). The core team comprises six directors who each live and work within the city. Additional members have joined the team for particular events. Their first event took place in September 2010 featuring 52 homes across the city. It was followed by two smaller day events in April and June 2011, an 'insulation celebration' and 'Solar Saturday' respectively. As such they were an existing group, strongly connected within the city but struggling to find a sustainable business model when they started a solid-wall insulation (SWI) demonstration project (Hargreaves, 2012b).

From December 2011 to August 2012 the group used a national government grant to demonstrate SWI via a multi-property installation to a terrace of houses in St Andrews, Bristol. In March 2012 two of the houses were opened to the public during the group's fourth eco-open home event. The idea for a SWI project had been under discussion since the group's inception but no action had been taken. They were interested in the technology as key to retrofitting older homes within the city, interested in finding ways to make the technology more accessible and curious as to how the technology would be deployed through the government's forthcoming Green Deal mechanism.

The following narrative traces the story of BGDs from the winter of 2011 when they 'picked up' SWI and began shaping ideas into a project. Their next open homes event was already under development and was developed separately to the terrace project (their SWI demonstration

[10] The New Labour Government introduced community interest companies in 2005. A new type of legally recognized company, CICs are designed for social enterprises who seek to use their profits and assets for the public good.

project). The narrative therefore concentrates on development of the terrace project only, back grounding the management of the open-home event, although the terrace was included within the open home event. The project was catalysed by DECC LEAF awards launched in December 2011 (see chapter 4).

Designing a SWI demonstration project

BGDs' fourth open home event was already under development when LEAF awards were announced. Although their event fitted DECC criteria BGDs activists were against seeking funding for something they were already doing. As far as they were concerned the funding pointed towards exemplar homes and SWI, it provided an opportunity to trial a multi-property SWI installation and test the financial, social and legal implications of doing this. A demonstration SWI project was thought appropriate for a city where terraced, solid-wall housing comprised 36% of total properties. Moreover, a demonstration that local residents could visit through the planned open home event was thought useful to engage communities, local industry and specifically building trades, local and national policy-makers and strategic partners. Previous experience of including SWI within open home events suggested it was best to see the technology during installation (when the wall and materials are exposed) rather than once complete (when the wall looks like any other). Managing the installation meant 'broadening the BGDs brand' from holding open home events and it "meant doing something new that would have impact locally and to some extent nationally" (Int_2). Kate Watson, an active director and former architectural designer, led the project researching and developing the project application. Fellow directors, who had extensive grant application experience, supported her. Dan managed the open home event.

To develop a project application Kate first had to recruit householders and secure a project site, alongside obtaining building quotes for the proposed works. Three potential sites were initially identified from activists existing knowledge, although one included a director's house and triggered a conflict of interest. An open-call for potential groups of householders would have been preferred but the short period in which to develop the application made this unfeasible (Int_1). Instead, Kate had to work quickly. The selected site, a micro-terrace in St Andrews comprised three owner-occupied houses with a fourth house converted into three flats for rent. The terrace was suggested by one activist, who had been advising a resident on energy efficiency via frequent contact at the 'school gates'. The residents were believed to be discussing the use of SWI but were primarily put off by the level of disruption involved in its installation. Letters explaining the proposed project (including works, costs, expectations of householders and next steps) were sent to all seven parties on 20th December (three households, the landlord and three tenants).

The second hurdle involved obtaining at least three building contractor quotes within two weeks in the lead up to Christmas and in time for the DECC application deadline. Four Bristol-based small and medium sized building contractors were identified. To obtain building quotes normal practice suggested arranging for each contractor to visit each of the properties but Kate quickly concluded this was unlikely to work. Instead, Kate visited the terrace, was introduced by the primary contact and took preliminary measurements and site photos. Using this information a basic specification was drawn up. It stipulated, (a) bringing the u-value of the side and rear walls up to current building regulations and (b) that a form of external system should be used. The specification was sent to contractors with the stipulation that the survey couldn't be relied upon, some contingency should be factored in and that a detailed survey would have to be undertaken in the event of a successful grant application. Three local contractors provided quotes for the work. A fourth, specialising in natural finishes, was unable to quote because of illness. Each contractor came back with a different specification, using different materials and at a different thickness of insulation.

Within two weeks Kate submitted an application to LEAF. It aimed to "promote and normalise low carbon retrofitting on 'hard-to-treat' private sector homes and capture key learning points for communities and businesses for the successful delivery of multi-property installations" (BGDs, 2011a). They sought to do this by:

(1) Installing external SWI to six hard-to-treat properties,

(2) Engaging 300 members of the public in SWI during the wider open-home event, and

(3) Engaging community groups, local authorities, local businesses and professional bodies in multi-property installations and how to deliver them.

Their application thus centred on the terrace: it would be open to members of the public within the group's fourth eco-open home event to be held in March; additional events, in partnership with the Federation of Master Builders, Kellaways building suppliers and Bristol City Council would target local building trades; a site visit from Bristol City College was envisaged to engage local students with energy efficiency and SWI, and finally; presentations to local community groups, supported by the Bristol Energy Network, would share progress and learning during the project.

The project sought to: (1) test the potential for financial savings via simultaneous multi-property installations, (2) investigate legal and social issues associated with the work, and (3) the financial viability of installing SWI under the Green Deal 'golden rule[11]'. Partnerships with

[11] The golden rule stipulates that estimated savings on energy bills should always be more than or equal to

local organisations and consultants would carry out energy performance tests (SAPs and EPCs[12]) before and after installation and financially model the project under the forthcoming Green Deal. Preliminary SAP modelling, included in the application, suggested the potential to save a total of 10.2 kg CO2 per year across all six properties.

The application included the three quotations but did not indicate which contractor would be used. Instead they argued it wasn't a choice they could make: "[BGDs] are not in a position to confirm contractors for the capital works associated with this application [because] a final decision on preferred contractor needs to be decided with the householders who have agreed to take part in this project and who will be contributing to the final cost of the works" (BGDs, 2011b). Instead they made a recommendation of their preferred contractor (Footprint), which would be discussed with the householders in early January 2012. The grant requested £77,000 in total, including £47,000 for SWI installation and the remainder for project management and engagement events. Householders and the landlord were expected to pay 20% contribution towards the cost of the overall installation split equally (between £2,000 and £3,500 each depending on the contractor chosen). Alongside the application letters of support were gathered from local stakeholders (the city council, Bristol Green Capital Partnership (a citywide partnership), Bristol Energy Network, CSE, Forum for the Future and national actors (the Great British Refurb Campaign, Carbon Leapfrog and the Federation of Master Builders).

The application built on the individual experience and skills of core activists, the experience of the group and existing activity, their aspirations and existing contacts within the city. It was catalysed by the provision of national government grant funding. Figure 5.1 outlines the core actors involved and their relationships.

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the cost of the energy saving measures and thus the Green Deal packaged offer to the household.

[12] Standard Assessment Procedure (SAP) is the methodology used to calculate the energy performance of a residential building. A SAP contains all the information need to calculate an EPC. An EPC is an energy performance certificate that contains information on the property's typical energy use and energy cost alongside a report on how to reduce energy use and save money. An EPC is mandatory whenever a property is built, sold or rented.

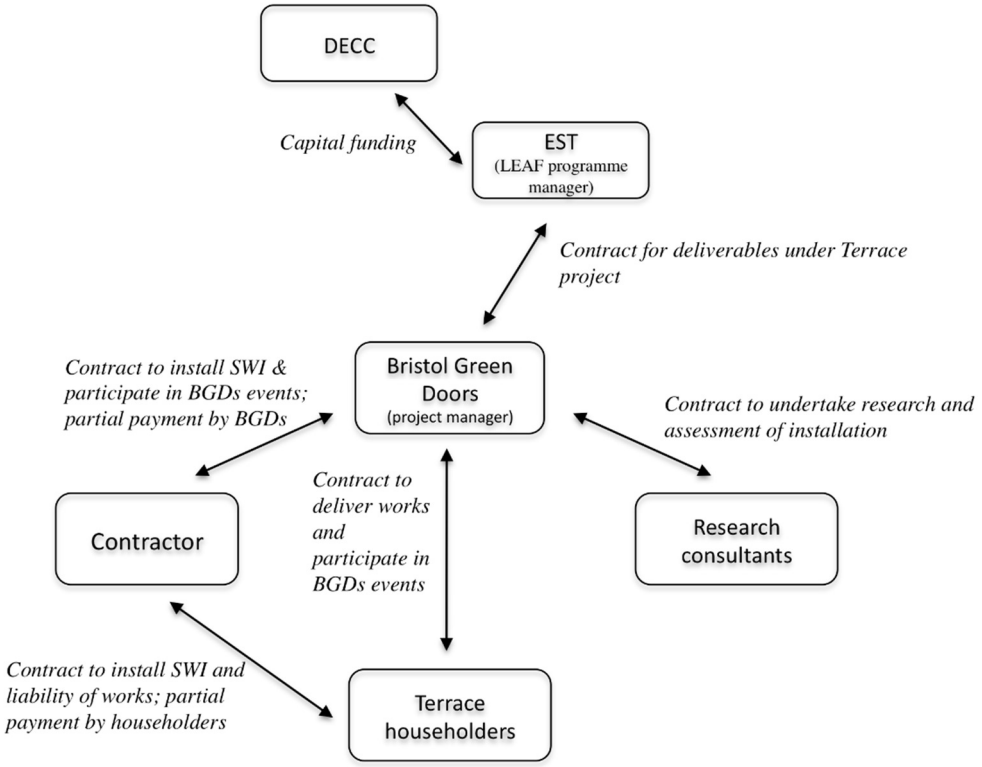

Figure 5.1: Actors and their relationships in the terrace project

Application success

On the 16th January DECC announced 80 projects would be awarded a share of £4 million across the country. The terrace was one of nine projects awarded funding within Bristol (Easton Energy Group and Demand Energy Equality were also awarded funding, chapters 6 and 7). BGDs' application scored the second highest of all applications in this first round (Int_1). They had until the end of March 2012 to complete the project (two and a half months).

Negotiation of project with householders and local planning rules

To get the project started detailed explanation, discussion and agreement of householders first had to be pursued. Local planning rules also had to be negotiated. On the 19th of January 2012 Kate visited terrace residents to discuss the project plan, financing, expectations of their involvement and next steps. Consent forms were sent out a few days later. Footprint was the contractor chosen for the project, aligning with BGDs recommendation and agreeing to the LEAF award payment schedule.

For householders a specification that proved contentious was windowsill extensions arising from cladding the walls with external insulation and effectively deepening the walls and

windowsills. The Victorian terrace included Bath Stone quoins[13] (at the front) and windowsills and some concrete replacement sills. Householders were keen to retain these features and character. As a compromise Footprint suggested using concrete extensions using steel Reid bars. The approach - described as "technically not the best solution" (Int_1) - held the potential for cold bridging and water penetration. The alternative, to remove the windows, add new sills and replace the windows, required additional time and disruption, plus rising costs. Concrete windowsill extensions were agreed as a compromise solution between activists, contractor and residents.

Second, local planning regulations had to be investigated. The terrace was not in a conservation area nor were the houses listed. Despite this, it remained unclear, from the city council's online guidance, whether planning permission was required. Kate emailed the department before Christmas to find out and in the second week of January was told planning permission was required on the side elevations. This response was surprising but not unusual (Int_30). The rear of the terrace was deemed to fall within permitted development rights because it could not be seen from the road. But for a house converted into flats, as one of them was, permitted development rights did not apply. Meanwhile, the side elevations were deemed to require a planning application because they could be seen from the road and because of the Bath stone quoins: the planning department wanted to know how this detailing would be undertaken. The decision was surprising therefore, because it allowed BGDs to proceed with the entire rear elevation, thus ignoring the house converted into flats. An application was made on 30th January for the side elevations. A positive decision was made on the 9th March two weeks earlier than expected. This was possible, according to a council officer (Int_30), because planning is a 'discretionary system'; the project was helped by supportive local councillors making 'judgment calls' about the projects limited visual impacts and its compliance with local sustainability criteria. In effect, permitted development was granted to the entire project without public consultation.

To move the project forward within the LEAF awards strict timeframes and whilst planning consent was secured, work commenced on the rear of the terrace.

Installation and engagement activities

Contractors began work on the 20th February 2012. Scaffolding was erected and proprietary works were undertaken: replacing eaves, extending wall fixtures, boiler flues and windowsill extensions. Additional small pieces of work were identified, agreed and undertaken (replacing

[13] Quions are masonry blocks at the corner of a wall.

roof tiles etc). A period of cold weather then threaten to cause delays, as the application of foam insulation boards required using a bonding layer direct to the wall (before being mechanically fixed to the wall with plastic hammer-in fixings) but the bonding would not set in temperatures below 5°C. Worried about potential delays to the project Kate emailed EST, the LEAF programme administrator. Their response stated they would not penalise the project due to weather related delays (Int_1). The email was kept on file.

Meanwhile multiple engagement events were undertaken. On the evening of 23rd February Kate gave a brief presentation to local community energy groups within a Bristol Energy Network open meeting. The presentation introduced the project, what it set out to achieve and timeframes alongside their forthcoming open homes event. In early March Kate held an event in conjunction with the regional group of the Federation of Master builders supported by the building contractor Footprint. 17 trades people attended this event. Despite the lower than expected turnout, 11 of 12 feedback forms suggested the event was either 'good' or 'excellent', with the majority stating they learnt more about SWI. Regular monthly newsletters and a project blog communicated progress and lessons about the project as it got underway (table 5.1). A local newspaper also covered the start of the project and promoted the eco-open home event in early March (Savil, 2012).

Figure 5.2: The terrace with 'pink Lego bricks' being attached and the first coat of render (at the time of the open home event)

Table 5.1: Summary of terrace project blog posts

Date	Title	Summary
02.03.2012	What's been tackled on the terrace in the first two weeks?	With scaffolding up the blog discusses preliminary and preparatory work - eaves extensions, guttering, additional wall fixtures, boiler flues and windowsill extensions.
14.03.2012	Cladding the terrace with pink Lego bricks	Additional work is identified to fix routine maintenance issues but installation is now underway. The blog recounts how quickly 'large pick Lego bricks - the external insulation - can be applied. It details how the insulation is applied to the wall and what goes on top (a bonding render layer and nylon mesh applied over before a final pigmented render is applied on top). it also shows pictures of detailing work around corners and window sills.
22.03.2012	Nothing to be blue about when it comes to wall insulation	Discusses thermal images of the terrace taken mid installation, explanation of photos and where heat is being lost. The difference between insulated walls and un-insulated walls is drawn out. Additional energy efficiency and behaviour related aspects are discussed in relation to the photos.
10.04.2012	Water everywhere… waste water that is!	Blog deals with existing rainwater, waste water and soil pipes, what challenges and compromises they pose for the SWI (removal and refitting post insulation) and installation process (polythene bag tubes act as temporary water courses).
16.04.2012	Its beginning to look a bit like…a Bristol skyline	Discussion of top coat render, its application and technical detailing

Over the weekend of 17-18th March 40 homes, supported by 58 BGDs' event stewards (all volunteers), opened their doors to the general public receiving nearly 1850 visits in total. This was lower than their previous citywide event in 2010, which received approximately 2,500 visitors across all 52 homes. At the terrace two households were open to the public, receiving approximately 150 visitors over two days, including Bristol West MP Stephen Williams. This number was lower than anticipated and hoped for. A torrential down pour on Saturday afternoon was suspected of keeping people away. A six nations rugby match was also blamed, as was Mothering Sunday. Beyond this activists suggested spring is a harder time of year to engage residents with energy efficiency measures (Int_2). Of those attending the terrace, their response was overwhelmingly positive (box 4.1). In addition, 1,400 separate views to the terrace case study webpage were made prior to the event whilst a further 1,300 visited the dedicated terrace website.

Box 4.1 Results of a BGDs questionnaire to visitors at the terrace
52 responses from approximately 150 visitors (BGDs, 2012c)

Attendance:

- 65% had not attended a BGD event before
- 50% cited either 'wanting to learn more' or 'find out more about external wall insulation' as their primary reason for attendance,
- 88% of visitors to the terrace classed themselves as homeowners. 5% as private tenants and 1 visitor stating either private landlord or builder/tradesperson.

Outcomes:

- 96% stated a good or excellent understanding of the technology following their visit. 4% rated their understanding as average and none as poor or very poor.
- 88% felt they better understood the limitations of the technology following their visit. 7% rated their understanding of the limitations as average.
- 50% stated they were more likely to do something to make their home warmer as a result of their visit. Of these 3% cited solid or external wall insulation as something they wanted to do.

Open responses to the question - What was most useful?

- "Seeing stages of work in progress and practicalities. More info on costs and savings please"
- "Seeing the insulation and how it is applied"
- "Actually seeing the work close up and discussing with the project manager"
- "Being able to retrofit on buildings of a similar vintage to the one we're hoping to get. Figuring out how easy it would be to do self install."
- "Seeing work in progress and discussing with owner"

The following Monday a LEAF delivery team from EST visited the terrace and a short case study was written up on their website, which emphasised the material scale and ambition of the project. This was followed by a case study on DECC's website. By the 31st March all insulation board had been applied and only the topcoat of render remained. As Kate began completing the end of project LEAF report engagement events continued apace. A building trades event was held with Kellaways building suppliers, who advertised the event to their customers through their website and mailing list. The event was free to attend, planned to start at the end of the working day and food and drink was provided. Attendance was again low, at approximately 10 people. Half were made up of Kellaways staff, instructed to find out more about the Green Deal and what it might mean for their customer basis. Activists were unsure why attendance to this and the previous trades event was low (BGDs, 2012a).

From April to July the installation of SWI at the terrace slowed down. The UK experienced a period of exceptionally wet weather, breaking previous rainfall records and resulting in severe flooding in parts of the country. Wet weather posed problems for the application of render; it was likely to run off the walls. Prolonged wet weather severely delayed the project which had been expected to finish mid April. By mid summer and with the breaking of rain clouds, hot weather further delayed the project because the render was likely to crack from setting too

quickly. The installation was finally completed in mid August (figure 5.3) and further surveys were undertaken (table 4.3). The results do not show a significant improvement to the EPC rating because the front of the terrace remained uninsulated. A report on financial savings concluded that in none of the properties was the Green Deal's golden rule met and implied the installations could not be funded under the forthcoming policy (figure 5.4) (Sadler, 2012).

Figure 5.3: The terrace with external SWI fitted

Table 5.2: Energy Performance Certificates, before and after at each terrace address[14]

(1st floor flat not included because of restricted access)

Address	EPC rating before	EPC rating after
119 basement	49(E)	57(D)
119 Ground floor	50(E)	65(D)
121	59(D)	63(D)
123	60(D)	65(D)
125	54(E)	67(D)

[14] EPC's convert the energy efficiency of a building into a single number, between 1 (not very energy efficient) and 100 (very energy efficient) which are then grouped into bands: 1-20 (G), 21-38 (F), 39-54 (E), 55-68 (D), 69-80 (C), 81-91 (B) and 92-100 (A).

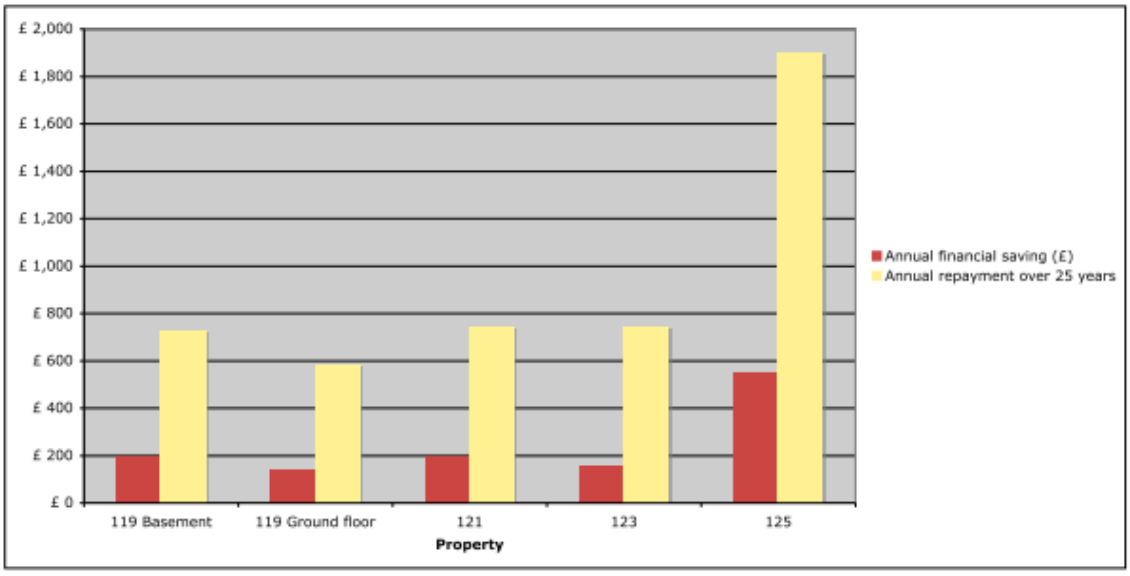

Figure 5.4: Golden rule assessment (Sadler, 2012)

Note: the significant difference between savings and repayments primarily results from the difference between mid-terrace (121 and 123) and end-terrace properties (119 and 125)

Householders had mixed reactions to the finished project.

- "Its hard to tell whether we have saved money by doing the four properties at one time but it looks great because it is been done at the same time using the same system. I think if there had been four different builders putting different systems on it just would have looked a total mess. So i think that is one of the key advantages of working together. It just looks like it is a part of the fabric." (Resident at 123, BGDs, 2012b)
- "I expected to [but did not] hear some good feedback from the tenants, they are spending less money, the house is warmer… [but] I think if I market the property in the future I will include that it is more economical and warmer." (Landlord, 119, BGDs, 2012b)
- "It looks nicer than before but bits on the corners quickly took a few dents so long term I'm not sure how it will last. Also being side entry in an alleyway it made the narrow alley narrower. No big deal for us really but something you notice. I guess it felt cooler on the summer inside which was a plus. …Comfort on the extremes of temperature is also an important factor. The boiler used to break a lot because it was used so much in the depths of winter, [so] maintenance saving etc." (Tenant, 119, Int_3)

Despite delays at the terrace, engagement events continued. Dan presented at the launch of a new regional programme, 'Ready for Retrofit - Supporting your business to be ready for the retrofit market'. Kate participated in a further Bristol Energy Network opening meeting, 'Learning from LEAF', and DECC's national LEAF evaluation event. A variety of case studies were subsequently written up, including one by CSE (2013) and one by RegenSW (2013a). To aid these third-party case studies Kate wrote a project template (BGDs, 2012c). In October 2012 BGDs released a short video about the terrace[15] and CSE developed a second video for their PlanLoCal website[16], each receiving 700 and 900 views respectively within two years. According to these case study reports the group's experience suggested six key learning

[15] http://www.bristolgreendoors.org/about/tackling-the-terrace
[16] https://www.youtube.com/watch?v=Oj2DgdT1vyE

outcomes. First, always check with the local planning department whether permission is required and get written confirmation if its not. Second, check with Building Control that you don't have to pay more for works than is required. Third, the application of external wall insulation is strongly weather dependent. Fourth, building trades can be difficult to engage with in relation to energy efficiency measures. Fifth, engage householders early on in the process and maintain regular contact, take care to explain the process and all potential outcomes. And sixth, share learning and success during and after project completion (BGDs, 2012c; CSE, 2013; Int_1).

In summary the narrative describes a discreet SWI project of an existing group, where activists sought to support the local embedding of the technology through a demonstration linked to an eco-open homes event. The demonstration was made possible by a national grant. The project was undertaken on a tight schedule, overrunning by approximately five months due to adverse weather. SWI was successfully applied and the terrace opened to the public within a citywide eco-open homes event but with less attention than anticipated. Multiple, additional engagement activities (blogs, presentations, events) each linked to the terrace were undertaken helping to spread the impact of the project beyond terrace residents and the city. Intermediary activity is observable here, the group working between government funding and the householders, between the demonstration terrace and city residents, between the terrace and local communities groups and between the terrace and local buildings trades. In the second part of the chapter I analyse the case narrative in relation to the agency of the community activists and key intermediary processes.

5.2 Analysis of key intermediary processes within the case

To understand the case as an example of how community energy initiatives are seeking to embed technologies into local contexts of use I now analyse the case for key community intermediary processes. I do so in three discreet sections with the benefit that I can later map key processes to activity but also because Stewart and Hyysalo (2008) suggest three discreet facets of intermediation - facilitating, configuring and brokering. Each process is analysed according to the research protocol developed in chapter 3 (section 3.3). Each section builds on the previous section. Interactions between processes are briefly discussed at the end before I draw conclusions about key intermediary processes based on the case and map processes to project activity. The resulting visual representation is compared against others generated from the three remaining case studies in chapter 9.

Facilitating

The first key intermediary process facilitation, Stewart and Hyysalo (2008) suggest is defined by the 'providing of opportunities to others'. To understand the activists' facilitating activity I therefore discuss and explain the kinds of facilitation activities envisaged, their form and content, and the influences on their design and implementation. I start by identifying three distinct facilitating activities from the narrative above and then analyse what influenced their design.

The first prominent facilitating activity is that of providing the terrace residents with the opportunity to participate in the project and have subsidised SWI installed. The activists mediated between government funding, the technology, the local planning process and the terrace residents, facilitating the deployment of technology by introducing the opportunity (LEAF financing, the technology and energy saving) to residents and supporting the project through the local planning process. In doing so activists became project managers, a step beyond their previous event management experience. Such facilitation involved channelling funds (economic facilitation) to the benefit of householders (from LEAF), the support of an existing community (terrace residents) (social facilitation) and the creation of rules for the duration of the project (20% householder contribution, the monitoring of energy use, householder involvement in the open home event and external publicity etc.) (regulatory facilitation). This facilitation was made possible but was also constrained by the provision of LEAF awards, originating beyond the local system from the external environment. LEAF limited how activists engaged and recruited potential project participants. As a result of the short application period, activists were forced into selecting a site, telling the residents 'what they wanted to do' rather than facilitating an emergent interest from the community. In other words, short timeframes required a particular (limited) form of facilitating the project opportunity to local residents, in which a particular site was selected and targeted. Their preferred approach (an open call for participants) would have further supported the local embedding of SWI by stimulating emergent user interest and thus raising the technology's profile. Stewart and Hyysalo (2008) and the wider theory do not outline what good facilitation involves. This example however illustrates different potential paths to facilitating opportunities, with more or less value for local embedding. Funding from the external environment constrained the potential value of facilitating here. Overall, activists' project management of the installation formed the cornerstone of their intermediation in this project.

A second form of facilitation is evident in the design and management of the eco-open home event, which was undertaken alongside but separate to the terrace management. To the project

manager the wider event was a means to disseminate knowledge about the demonstration project and the technology to other local residents (physical facilitation), to provide them with the opportunity to learn first-hand and during construction about the technology and its implementation (knowledge facilitation). It is worth briefly reflecting on the wider eco-open home event here because it formed such an important part of the terrace demonstration project. As a form of facilitation the wider event turned each participating house into a physical demonstration, it created a space in which knowledge, learning and experience could be shared between users and non-users and it attempted to create new social networks (between participating homeowners, event volunteers and visitors) (social facilitation). This network is weak compared to those envisaged under SNM (i.e. Kemp, Schot & Hoogma, 1998; Hoogma et al., 2002) and is primarily supportive. The event also supported the formation of local rules (about how, when and where users and non-users could participate) (regulatory facilitation). Consequently, this form of facilitation is quite different to the direct and targeted facilitation of the technology to terrace residents. I will explore this difference shortly but for now seek only to emphasise how activists facilitated a range of householders, including terrace residents, to 'open their doors' and share their experience, in effect facilitating a form of peer-to-peer communication. The event was successfully held over the weekend 16-17th March. Its success was moderated by low turnout due to bad weather and competing events, which in turn suggests the timing of events is important.

A third form of facilitation is evident in the range of engagement events undertaken. These events were envisaged to communicate information about the project to a variety of audiences (local community groups, businesses and the local authority) (knowledge facilitation). Different events targeted different audiences. Yet as a means of facilitation each is defined by the transfer of knowledge to others: each event provided an opportunity to others to learn about SWI and its deployment. As a form of facilitation it is less comprehensive than project management or the holding of an eco-open home event because the events did not physically utilise the material demonstration of the technology and they did not involve the creation of local rules (regulatory facilitation). A variety of influences limited the implementation of these events, for instance: activists had restricted time within the two local LEAF events because of the number of successful LEAF applicants within the city-region; their engagement of local businesses was curtailed by limited interest and low turnout; a site visit by college students was halted by an inflexible timetable, and finally; limited interest from the local authority's planning department.

A significant breadth of activity can be observed within these facilitation activities, primarily resulting from the wide variety of audiences being targeted. Through the three facilitation activities identified above the activists sought to provide opportunities to (1) terrace residents,

(2) wider city residents, (3) community groups, (4) local business, and (5) the local authority. Two principal reasons explain this. First and foremost, activists were drawing on previous experience of organising eco-open home events. Such events were thought useful for engaging the public and stimulating greater local demand for energy efficiency and renewable energy technologies. Independent research conducted by Bristol University but with collaboration from activists, on the first citywide event had confirmed this, suggesting previous event participants valued the direct contact with homeowners, learning from the experience of others and experiencing the technology-in-use (Cole, 2012). Moreover, previous open home events had featured SWI and from this experience activists' suggested the added value came from seeing the technology during installation, because "you don't really see that much once it has gone up…so it is quite hard to get that understanding around what this stuff is, you really want to show how it can work…learning how things are done, its best to see it in construction" (Int_1). Their experience suggested a demonstration project combined with an eco-open home event in which visitors could see the technology in various stages of installation was required to facilitate a better understanding of the technology by local residents. Working with the contractor and fortuitous timing meant different stages of the project could be shown to terrace visitors. Beyond targeting local residents their prior experience also suggested that eco-open home events could encourage more local companies to train employees and become certified installers of the technology.

This indicates a second reason for the breadth of facilitating activity. Activists' knowledge of the local system suggested that it was insufficient to only target end-users of the technology. In short, their existing knowledge and understanding of national policy, national and local SWI deployment rates and local industry shaped what they aimed to achieve and how they went about it. At its most basic the inclusion of building trades is captured in the following quote:

> "I always felt that bringing in the trades was integral to it's success, and we were the first to really go and get sponsorship, this wasn't going to be a folksy transition, this was about bringing in professionals and it's an opportunity for people to make money, stimulate the green economy. …Not just user demand but stimulating the building industry," (Int_2).

Beyond this activists recognised the low national installation rate up to 2012 - approximately 15,000 installations per year - was an order of magnitude below the desired installation rate of 150,000 installations per year needed to achieve national targets. They also recognised that previous installations were being undertaken by large national contractors on social housing, whilst the majority of private sector renovation was undertaken by local, small and medium-sized enterprises (SMEs). Kate's experience suggested large national contractors weren't interested in individual SWI projects but might be interested if individual households were grouped together. In the meantime, stimulating the interest of local SMEs has been recognised

as important by a variety of commentators (e.g. Vergragt & Brown, 2012). Kate's knowledge of these debates, combine with knowledge of the local system where only four local builders offered SWI at the time, suggested engaging local SMEs would be an important element to locally embedding the technology. Thus knowledge of the local system (the Bristol SWI industry) explains why the activists attempted to engage local building trades: activists identified the limited number of SWI installers at the time as a significant stumbling block to increasing uptake. I observe knowledge of local industry in the context of national government targets shaping what the activists set out to achieve, in particular engaging with stakeholders beyond their target community audience, comprised of residents of the city, and including local building trades and the local authority.

These two aspects, prior experience and situated knowledge, I suggest explain the breadth of facilitating activities attempted. The breadth is notable because the activists seek to engage more than their target community (Bristol residents) as would be expected from existing community energy research (e.g. Seyfang, Park & Smith, 2013; Steward, Liff & Dunkelman, 2009) and the conceptual framework (chapter 2). Here, activists sought to facilitate the local embedding of SWI by stimulating the formation of local industry.

From this discussion I draw the following conclusions about the activists facilitation activity. First, multiple facilitation activity can be observed, each activity branching out from the material demonstration of the technology. Second, activists attempt to go beyond the facilitation of end-users (their target community) to facilitate local system actors (industry and the local authority) in the local embedding of the technology. This is perhaps not surprising in the context of innovation intermediaries but less recognised as coming from community initiatives. In turn this suggests community initiatives can target non-community actors (such as local businesses) as the targets of their embedding strategies but doing so is tricky and requires additional, dedicated work to understand the targeted actors' position, their motivations and constraints. Activists recognised the importance of engaging builders and tried to target them but were inexperienced at doing so. Third, the timing of facilitation activities is important, as demonstrated by the low turnout of participants to the terrace open home event.

Configuring the technology, project and stakeholders

The second key intermediary process involves the active configuring of projects, technologies and potential users and producers (Stewart and Hyysalo, 2008). For example an understanding of the technology and its value in the local context needs to be ascertained and presented to others (that is, configured), whilst particular elements of facilitation activities have to be

actively configured and assembled. At the forefront of BGDs configuring activity sits the design of the demonstration project. But how the demonstration links with the design of multiple engagement events is also important for understanding the case and community intermediation for local embedding. In the following section, I start by analysing how the terrace project was designed. I then discuss the design of linked engagement activities before discussing how the technology was interpreted and presented to others. In doing so, I thereby complement the analysis of facilitation activity. I end the section with broader observations about the activists configuring role.

Designing the demonstration project and engagement events

The project aimed to demonstrate SWI through a material installation in the local context. It had three objectives: (1) installation, (2) engaging city residents with the demonstration and (3) engaging community groups, local business and the local authority with the demonstration. The project thus hinged not only upon the design and implementation of the demonstration but also the creation of productive links between the demonstration and these actors. A variety of elements influenced how the project was designed. First, their decision to seek LEAF backing made the project viable but also influenced what was latter possible. Following their decision to apply, the funding criteria restricted how activists recruited participants (as detailed above), restricted the time available for delivery and the type of technology used. In practice, short timeframes contributed to limited technological options. The two-week application window ended with three out of four targeted contractors providing quotes. Each quote used similar synthetic materials and application procedures. The fourth, missing quote was from a contractor specialising in natural, breathable materials (such as wood fibre, hemp and sheep wool). The quote would likely have been more expensive, the process more disruptive and time consuming because it would have involved removing existing, likely concrete render before application (fixing breathable insulation material and render). The short period in which to design and implement the project thus effectively reduced what kind of technology was feasible. I conclude the short timeframes restricted the type of material used rather than cost competitiveness criteria, because this wasn't an explicit requirement of the funding (applicants merely had to explain the reason for their chosen contractor) (DECC, 2011).

Beyond the funding criteria, the material installation was also influenced by the existing fabric of the building, activists' understanding of the technology and resident expectations, each influence providing a partial explanation for why the project only insulated the rear and side elevations of the terrace. To insulate the front, internal SWI was required because of a Bath stone facade. But the project manager had concerns about internal SWI; from a technical point of view she was concerned about moving the dew point inside (the point at which condensation

forms) and from a project management perspective she was concerned about the level of disruption this would impose on the residents. Disruption was also a vocal concern of residents. Together these physical, social and knowledge influences resulted in the rear and side elevations being treated only, with concomitant reductions in the energy performance of the insulated houses. But this also indicates a variety of internal (what activists were willing to do) and external influences (from existing infrastructure and terrace residents) on the group's intermediary agency: it suggests limitations to intermediation activity, not limited to community-based intermediation but likely applicable across all forms of intermediation.

The third and final influence on project design resulted from activists' knowledge of the technology and their understanding of what was required to support its local embedding. Again drawing on their situated knowledge of the technology and deployment rates, activists' designed the project in order to test (financially and socially) a new means of embedding the technology, through multi-property installations in the private sector (c.f. social housing). As such it sought to test potential financial savings, social and legal implications associated with the work and the forthcoming Green Deal mechanism. Each of these elements had some impact on the design of the project: they required a row of consecutive properties, willing participants and performance modelling before and after installation.

These influences explain the detailed design of the project. Explanation of why a demonstration project was undertaken in the first place draws on the activists' knowledge of the technology, local system and wider environment (as discussed in the facilitation section above). Together, they explain how the demonstration project was configured, resulting from a combination of physical, social, cultural and institutional dynamics from the community, through the local system to wider environment: activists had to balance the external funding criteria with local circumstances, physical limitations and social considerations alongside what they perceived as desirable for building momentum behind the technology in the local system. I will further clarify where these influences stemmed from at the end of the section.

Linked to and building out from the demonstration of the technology multiple events sought to engage various target audiences. These events also required some active configuring by activists. Here, the design and management of the eco-open home event required the most configuring. Designing the event required dedicated and concerted effort: promotional materials had to be designed, as did case studies of each participating house, households and volunteers needed to be recruited and sponsorship negotiated. However, activists already had experience of this from previous events, had developed clear guidelines and had been planning the March event before the project began (Hargreaves, 2012b). It was relatively easy therefore to

incorporate the project into this existing activity. The eco-open home event subsequently provided an opportunity for terrace residents to talk about the technology and their experience.

Additional engagement events required less configuring than the eco-open home event because they were undertaken with the support of partners (Bristol Energy Network, Kellaways and the Federation of Master Builders but also the building contractor, Footprint). Engaging different audiences core activists were attempting to draw on the knowledge and experience of these partners. However, they did still have to make decisions about how to present the technology and project. Of note here, is the use of the building contractor to engage with building trades. The idea resembles that of the eco-open homes events where direct experience is used to promote and disseminate understanding of the technology from one project participant to an audience of similar stakeholders. Here configuring activity thus involved creating the opportunity for the contractor to discuss the project with other builders. The low turn out at these events suggests further points about community intermediation. The reliance upon partners engaging potential event participants starts to soften the boundaries of the group's intermediary role. The group limited the amount of configuring they did themselves and invited others to take some of this responsibility: project partners also play a role in configuring the events in which others can find out about the project. However, relinquishing some control also represents a means to recruit partners, giving them a stake in the project and the engagement events, which may be a necessary condition for accessing wider audiences. The interest of building trades in SWI and its local installation was less than assumed by activists, whilst the involvement of partners in the design of the engagement events did not help the activists to engage in a meaningful way. By extension, this suggests that configuring facilitation activities requires developing a detailed understanding of the target audience so that their position, motivation and constraints can be understood and the activity designed to meet their needs. What remains unclear is how far community intermediaries can encourage certain trades and where the intermediation boundaries lie, beyond which regulations are required to make industries do stuff that is non-routine.

Interpreting the technology and presenting it to others

According to Stewart and Hyysalo (2008) configuring activity involves the technical and symbolic arrangement of technologies. From the discussion thus far it is clear that BGDs activists actively interpreted the technology, what it was, it's meaning and value to the local system. Moreover their interpretation underpinned how the project was designed. What is less clear is how and whether they presented this interpretation to others. This is because the open home event and, to a lesser extent, additional engagement events, created an opportunity for others (householders and partners) to communicate their own interpretations.

How the activists interpret the technology is most clearly demonstrated within the project application (BGDs, 2011a), the final LEAF report (BGDs, 2012a) and their template for case studies (BGDs, 2012c), in which they situate the technology as important for increasing the efficiency of solid-walled houses both locally and nationally. Yet, these documents do not present the technology to their target audiences (local residents, builders and community groups) because they are not publicly available. In contrast the way in which the technology is presented to these various target audiences is detached and flexible. This can be illustrated in a number of ways. Introducing the project through a newsletter, activists did so with little fanfare, effectively saying they had won some money and this is what they were going to do with it. Project blog posts discuss the technology and installation process in an informal but informative manner: they talk about potential complications to consider during installation as well as the benefits of the SWI to the terrace and similar properties. Yet, most revealing of all is the fact the group's main form of presenting the technology is through the experience of others, the terrace residents within the eco-open home event. Here, they do not attempt to impose their interpretation of the technology on to visitors but support householder presentations of the technology: the householder opens his/her door and engages visitors. As such activists support the transfer and dissemination of the user's experience rather than their own understanding and presentation of the technology.

As such there is an important difference between the activists' interpretation of the technology and the interpretation of the technology conveyed to the wider community. The former, I suggest, is thought through and persuasive, the latter open and flexible to a variety of competing understandings, interpretations and presentations. This appears to be the strength of eco-open home events - allowing others to communicate their interpretation of the technology - the role and agency of the core activists is limited (by choice) to supporting a space where these interpretations can be shared. This suggests an interesting observation about technological configuring for local embedding. The technical, symbolic and cognitive arrangement of the technology within the project was important in securing funding and its material deployment but a flexible presentation of the technology through others was used when presenting SWI to wider stakeholders and building momentum behind the technology within the local system. Their configuring activity amounts to what Stewart and Hyysalo (2008) suggest as 'minor', establishing a particular configuration of the technology within the local context. Activists do not attempt to directly shape or argue for, how future installations of the technology are undertaken; rather their approach appears to be based more on 'experimental suggestion', taking existing ideas about what might support the local embedding of technology and trying them out. Activists did not try and create actor networks around the technology or visions of future

technological pathways. This intermediary position is more reserved than might be expected, particularly against the conceptualisation of intermediation by Hodson and Marvin (2009), and suggests a further limitation of community intermediation (that it is not possible for community initiatives to create a shared technological trajectory), although more support, potentially from the other three case studies is necessary to confirm such a limitation.

From this discussion it is clear that multiple dynamics influence how the project and engagement events were designed and how the technology is interpreted and presented to others. I conclude the project was designed under LEAF but strongly influenced by wider environment dynamics. Here, the prior rate of SWI installations, who was undertaking them (large contractors) and where (on social housing) played a role, as did forthcoming changes to the policy environment (the Green Deal). Important local system dynamics included the number of local installers (four) and the local physical infrastructure (proportion of solid-walled and terraced housing, plus detailed features). Community dynamics included the perception of the technology and the level of disruption deemed acceptable. Second, I observe an important difference in the activists detailed yet flexible configuring of the terrace project, particularly around the interpretation of the technology, that sits in contrast to the less configured presentation of the technology to the wider community and local stakeholders. This is interesting for community intermediation for local embedding because it suggests different amounts of configuring maybe needed to achieve different local embedding aims.

What is noticeable throughout the analysis so far is the degree to which activists are attempting to change multiple system elements. From the demonstration of the technology, activists attempted to engage multiple local stakeholders, engaging local residents being viewed as important but insufficient for local embedding to occur. This points towards a systemic understanding and approach to local embedding by the activists, supported but not proven by the following quote:

> "[BGDs] is bottom up, but you've got to engage the other organisations that are out there, there's not going to be a revolution, you just have to try to influence what's already going on" (Int_2).

There are a number of points that can be made about this position. First, it situates community intermediary activity within a particular context and time. The design and implementation of projects is not removed from local system and external environment. Second, it suggests limitations to the agency of activists, the quote suggests community intermediation can at best influence current events. Third, this points towards a common, potentially local trajectory of change, where activists seek to build upon existing activity to assist the local embedding of technology.

Brokering the project

The third key intermediary process Stewart and Hyysalo (2008) identify involves raising support from additional actors, representing end-users and negotiating on their behalf, negotiating the entry of additional actors into the intermediaries space and seeking to maintain influence over emerging rules and practices around the technology, project or vision. I analyse the brokering in this case in accordance with the research protocol, investigating how the project is negotiated, what resources are mobilised and whether users are represented.

As the project unfolds it is negotiated amongst a variety of stakeholders. First the project is negotiated between the activists and LEAF programme managers, EST. Here the project application can be viewed as a form of negotiation in which activists argued the value of their project against funding criteria. Beyond this activists successfully negotiated their non-commitment to a particular building contractor within the application process, arguing that this was for terrace residents to decide. Although this was a potential point of conflict, EST accepted the activists' argument and no further negotiation was required. This negotiation mobilised the majority of financial resources for the project and forms the only period of brokering against a funding body.

All other negotiation involved project stakeholders. Negotiation between activists and contractor involved the basic specification of the project, their agreement to the funding terms and their participation in engagement events with buildings trades. Activists also negotiated the participation of terrace residents (who were generally very supportive of the project), providing access to government funds and project management in return for 20% contribution, agreement to monitor energy performance and residents' participation in events and publicity etc. This brokering primarily involved the detailed negotiation of the project, such as windowsill extensions, because the participation of terrace residents was more assumed than secured by activists at the start and negotiation only really began after the LEAF grant had been secured. Here, how to insulate around windows provided the most contestation with terrace residents. The issue was resolved through activists being open to new ideas whilst listening to and respecting the wishes of residents and resulted in activists brokering a comprise between residents and the installer.

Finally, the project required negotiation through local planning in order for the project to proceed. Indeed, planning could have become a significant barrier to the overall project. Activists skilfully negotiated local planning rules by starting early (during the design of the project), being proactive throughout (clarifying planning requirements in December 2011 and

then chasing up outcomes and later decisions in the spring) and engaging and demonstrating to local politicians and people on the planning committee what the project was about and what they aimed to achieve. In the process activists brokered support and negotiated the project through local rules.

Significant negotiation of the project against stakeholders and funding bodies is subsequently observed, yet there are some important differences. There is a clear difference in this case between funders and stakeholders, although EST becomes a stakeholder by providing project finance. Resources are primarily negotiated from one external funder, with a small contribution from householders. However, the activists do not accept the funder's demands outright, in particular arguing against selecting a contractor without terrace residents' participation and later getting verification that weather-related delays were ok. Because the project was made possible by this successful negotiation of resources I suggest this forms the primary period of brokering. The later negotiation of the project with stakeholders therefore amounts to the detailed (yet minor in Stewart and Hyysalo's (2008) terms) configuring of the project in the local context. This suggests activists' brokering activity managed to maintain a degree of flexibility and adaptability throughout the design and implementation of the project. In particular, early negotiation with EST over the particular contractor and weather-related delays provided important flexibility to delivering the project in later stages.

In terms of project resources, I have already indicated that these were primarily mobilised through the LEAF grant application in combination with contributions from householders. Meanwhile, activists do not represent Bristol residents or the users of the technology as Stewart and Hyysalo (2008) suggest is possible. From this I conclude that brokering activity is present, its primary purpose being to negotiate resources and participation of actors within the demonstration project.

Summary conclusions about the case study

Because I have already summarised conclusions at the end of each process I use this conclusion to the chapter to bring these sections together, discuss interactions between key processes and summarise findings. I end the chapter by reinterpreting the case in terms of key intermediary processes and layers of analysis.

In brief, the case study analyses how a group of activists seek to embed SWI into the local context of use through a demonstration project. Activists utilised national grant funding to become project managers in the deployment of the technology at a terrace. This demonstration

of the technology was then incorporated within a planned eco-open home event in which residents of the terrace opened their doors to visitors to share their experience. Additional engagement events were held with a range of partners to disseminate knowledge about the demonstration alongside online communication and case studies by third parties.

From the case narrative I observed multiple facilitation activity: (1) providing the opportunity to terrace residents to have the technology installed, (2) the opportunity to city residents to experience the technology first-hand, and (3) the opportunity for community groups and building trades to learn about the project and technology. I argued this demonstrated a breadth of facilitating activity beyond what was expected by the conceptual framework: here activists targeted local system stakeholders (local building trades and the local authority) and not solely their target community, Bristol residents. Analysing how the project was configured I suggested the core demonstration project was influenced by multiple dynamics. Of these the LEAF grant criteria played a key role but was not the only one, activist knowledge of the technology, local industry and local physical (existing building fabric) and social (resident expectations) influences also played a role in shaping what was possible. Perhaps the most interesting aspect of the activists configuring process was the detailed interpretation of the technology but open presentation to others. The group clearly had a strong understanding of the technology and its current deployment both nationally and locally but did not seek to force their own understanding onto their target audiences. It is partly for this reason that activists brokering activity was limited to the negotiation of the material installation into and within the local context. They did not seek to represent existing or potential users of the technology. Nonetheless, the project did involve significant brokering in order to install the technology. The important point here is that activists do not attempt to position themselves between the technology and its future embedding in the local context as might be expected by Hodson and Marvin's (2009) conceptualisation of intermediaries. On the contrary, I conclude that the activists limited ambition, to project manage the installation and share that experience with multiple target audiences, provides a key reason for the realisation of the project.

Four points can be made about the interaction between key intermediary processes in this case. First, the primary purpose of the project appears to be the facilitation of opportunities in which others (householders, volunteers, the building contractor) can share their knowledge and experience of the technology with contemporaries (Bristol residents and local building trades). Second, in order to undertake facilitating activity the activists have to undertake configuring and brokering: Configuring and brokering processes are mobilised to support facilitation activity. Third, the 'minor' configuring involved in arranging the material installation was important to providing the opportunity to terrace residents but was also the root from which all other

facilitation activity branched out. Fourth, early negotiation of the project, between EST and local system constraints provided flexibility that was later important in the delivery of the project. This final point providing a concrete example of what Stewart and Hyysalo (2008) seem to suggest when talking about the balancing of key intermediary processes.

Thus my analysis of key intermediary processes suggests some salient points about the case study as an example of community intermediation for local embedding. First, community intermediation can target more than their community of end-users, seeking to influence local industry and the formation of local rules, but doing so is tricky and requires dedicated work. The activists had limited success engaging building trades, relying too heavily on the involvement of partners for effective communication. To effectively engage community intermediaries require a significant understanding of the audience and/or have existing connections to that audience. Second, the breadth of facilitating activity branching out from the demonstration project suggests a holistic or systemic understanding of local system dynamics and local embedding on the part of activists. The activists indicate that engaging end-users is insufficient: their actions suggest that community intermediation can be more effective if it also targets non-community actors (even if this did prove tricky and potentially ineffective). Related to this is a third point about activists' agency in the process. How activists design the project demonstrates an awareness of their limited agency to locally embed SWI, they merely seek 'to influence what is already going on'.

Construction of intermediary process patterns

In this final section I reinterpret the unfolding of the case in terms of layers of analysis and key intermediary processes to construct a pattern of community intermediation (figure 5.5) (see section 3.3). I will compare the resulting pattern with the other cases in chapter 9 to seek to identify a common pattern of key intermediary processes. Constructing this pattern also allow me to summarise the key influences affecting the case.

After a period of ferment the project opportunity emerged in the form of national LEAF grants. The design and criteria of LEAF subsequently set the pace of the project requiring the selection of a potential terrace, influencing the means and type of technology deployed. The core demonstration project was configured to the LEAF opportunity but also drew on activists knowledge of the local system and their experience to date. An intense period of activist configuring followed the announcement of the LEAF grant competition in which the activists designed the project and recruited terrace participants and partner organisations. Because of the financial enabling provided by LEAF, the initial period of intermediary brokering was directed towards securing the LEAF grant. Once successful, further configuring of the project was

required in relation to households and local planning. In each case it involved the negotiation of the project in relation to the local context. As the project was implemented and SWI installed at the terrace, a variety of engagement activities began. The installation of SWI at the terrace itself saw the facilitation of the technology to local residents. Multiple engagement events with community groups and local building trades facilitated the transfer of knowledge from the core activists to others. The eco-open home event created a physical demonstration of the technology, new communities of householders and volunteers, local rules about interaction and the transfer of knowledge. The terrace project was completed approximately five months behind schedule due to weather related problems. All project objectives set by the activists were achieved although to different levels of success. Table 5.3 summarises these influences on project development according to my conceptual levels of analysis.

Table 5.3: Summary influences on the development of BGDs' tackling the terrace project

Level of analysis	Summary influences on project development
External environment	• LEAF- catalysed project, set constraints, • Historical SWI deployment rates and locations influenced how activists' designed the project and what they sought to achieve, • National targets created expectations about direction of travel
Local system	• Number of local certified SWI installers influenced design and aims of project, • Proportion of SW houses and proportion of terraced housing influenced project design as experimentation in multi-property installations, • Previous limited industry experience of private sector properties shaped how activists' designed the project, • Mixed interest from building trades, local authority and local college • Planning process delayed start of the project
Community	• Interest in energy efficiency helped recruit households, • Expectations about windowsills resulted in compromise approach, • Mixed interest in open home event, • Existing skills and knowledge provided basis for eco-open homes event

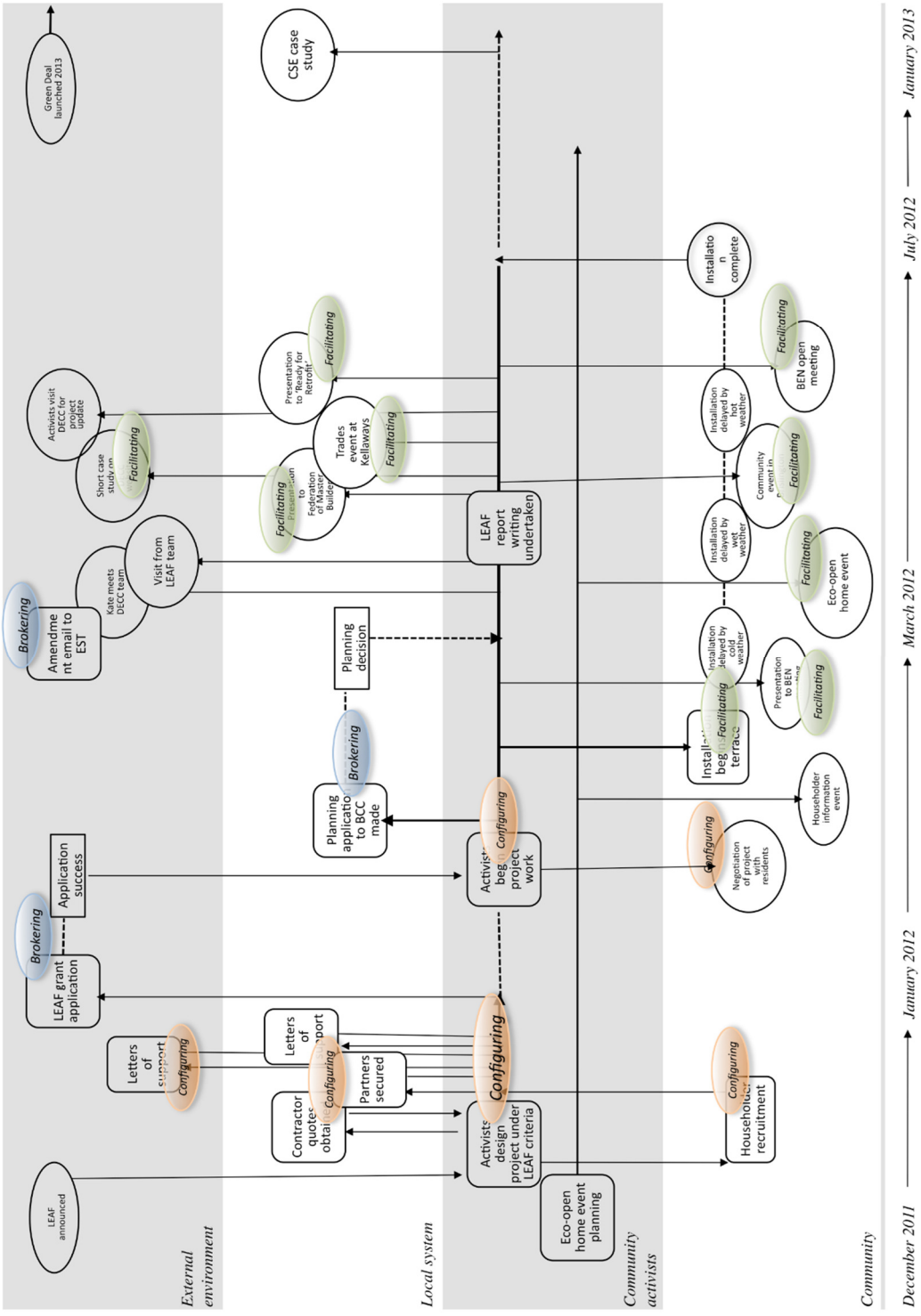

Figure 5.5: Visual map of Bristol Green Doors tackling the terrace project with key intermediary processes indicated

Chapter 6.
Easton Energy Group's energy efficiency project

6.1 Case narrative

In May 2012 Simon White, a project manager from local consultancy Sustain, sat down with four core activists from Easton Energy Group to propose a short-term, energy efficiency project to households in the group's local area, Easton. He proposed using government-obligated funding from a large energy company to retrofit 100 plus houses before the end of the calendar year when the current obligation period came to an end and was replaced by the introduction of the coalition government's new flagship energy efficiency policy, the Green Deal. Sustain was formed in 1997 as a limited company, had a turnover of £7.5 million (Sustain, 2013), employed 11 people and specialised in developing and managing carbon reduction projects for private and public sector organisations using government-obligated funding from the major energy companies. The proposed project would utilise Community Energy Saving Programme (CESP) funding and was expected to start in June 2012.

On the other side of the table sat four activists from Easton Energy Group (EEG), a small, voluntary community group formed in May 2009 to promote increased awareness of energy in their local community and take action where possible. The group had been set up by four young professionals who lived locally, had gained relevant knowledge and expertise in their professional lives and sought to share that information and understanding with others. The group had been supported by a series of small, local grants and was largely based out of the local community centre. Since 2009, the group had promoted a greater understanding of energy and sustainability through information stalls at local events, guided energy walks and information displays. They had carried out energy monitoring of local community buildings and developed an energy advisor course with the Centre for Sustainable Energy (CSE). Sitting down with Sustain, the group had recently completed a small research and engagement project supported by DECC's Local Energy Assessment Funds. The project had shown the potential for household retrofitting through a housing stock analysis (CSE, 2012), had increased their understanding of individual barriers to energy efficiency improvements by local residents (APM, 2012) and given new life to the group through increased publicity and the recruitment of new volunteers. The group now sought to expand their activity and in the process become a social enterprise.

The group's local community consists of residents of Easton, an inner city area and ward just east of the centre of Bristol. Easton is culturally diverse with a high proportion of black and other ethnic residents, has a thriving community centre, three mosques, a synagogue, a Sikh temple and several churches of different denominations. The majority of Easton houses (88 percent) are terraced, with 89 percent having been built before 1945 (CSE, 2012). Three quarters of households are classified as 'hard-to-treat' (having no mains gas heating and/or being of a solid wall construction), compared to a national English average of 37 percent. The group's housing stock assessment report (CSE, 2012) suggested 70 percent of properties could benefit from solid-wall insulation. Local residents on the other hand were found, within the group's small LEAF survey, to have low awareness of energy issues, knowledge of potential energy efficiency improvements or of what help was available (APM, 2012). As such, high upfront costs, a lack of information and being in rented accommodation were identified as the primary barriers to increased uptake of energy efficiency improvements (APM, 2012).

The proposed energy efficiency project was timely: the group were revitalised, they had a better understanding of their local community and its physical environment and were keen to scale up activity. Simon explained how Sustain were seeking to work with a local delivery partner in Easton to offer a bundle of energy efficiency measures to local residents for free. The offer included building fabric insulation (internal, external wall and loft insulation), draught proofing and heating system upgrades (boiler replacement and electric to gas conversions). The high proportion of solid-walled properties in the area combined with the emphasis from CESP on SWI meant the focus of the project was on this particular technology, albeit in combination with other measures where possible.

From the introduction of focal actors and local context I now outline how the project unfolded. Central to the narrative is the negotiation of the project between the community activists and Sustain as project manager. Prior group experience and future aspirations play a role in their approach and subsequent moves. Outside of the group's influence Sustain negotiated the project with the energy company funder and managed the survey and delivery contractor, Bullock Construction. Different layers of the story are identifiable. I concentrate on the negotiation of the group's role (engaging the local community) and the group's interactions with the community therein as a means to understanding this case as a community attempt to locally embed SWI.

The project opportunity

To understand the opportunity window it is useful to quickly consider the external context in

which the energy efficiency project was proposed. CESP came into force in October 2009 “to drive a whole house, area intensive approach to increasing the energy efficiency of the housing stock, building on local partnerships”, with targets for emissions reductions to be completed by the end of December 2012 (Ofgem, 2012b, 4). Yet, by the end of 2011 Ofgem calculated that from 304 nationally proposed schemes estimated savings amounted to only 67.9 percent of the overall CESP target, whilst actually installed measures represented only 15 percent of the overall target (Ofgem, 2012a). To comply with the legislation obligated companies had to significantly increase activity in the final year (Watson & Bolton, 2013; Duffy, 2013). The majority of existing CESP projects were being carried out on social housing (Duffy, 2013) with additional finance being provided by third parties to secure project delivery (Iposos MORI et al. 2014; Int_10). However, existing projects were not meeting density targets needed to achieve project bonuses (‘the elevated cost of carbon’ in the programme’s language) and fewer combinations of measures were found possible per property than had been initially expected (Int_10). In early 2012 obligated companies were beginning to look more closely at how to tackle the private sector, both owner occupied and rented (in part to meet density targets in areas where social housing had previously been targeted) and were also willing to provide higher capital costs per installation to meet the obligation (Int_10).

Following a steer from their energy company client, EDF, Sustain began looking at how to undertake private sector retrofitting. Seeking to create an exemplar private sector retrofit project within Bristol, Easton was highlighted due to the high concentration of eligible houses, the small size of properties in the area (CESP funding was allocated and carbon saving calculated on the basis of the number of bedrooms per property), and the high proportion of terraced housing (which further reduced the cost of SWI per property). In addition Sustain sought to encourage and support local community action (Int_10) and sought to replicate prior experience of working with social housing providers and local authorities in Bridgend, South Wales (Sustain, 2012), and had delivered one of the first CESP projects in the UK, external SWI to Rawnsley House in Bristol in partnership with the city council (Sustain, 2010). Prior to meeting with Easton activists, Sustain were negotiating financial backing from EDF energy. Their proposal was based on installing a package of measures with costs estimated through a small sample of household surveys combined with prior experience of installing measures on social housing properties. To undertake the project Sustain proposed using an existing contractor of theirs, Bullock Construction, a national company who had the capacity and experience (at least on social housing) to undertake surveys and installation of measures. Figure 6.1 outlines the actors involved and their relationships.

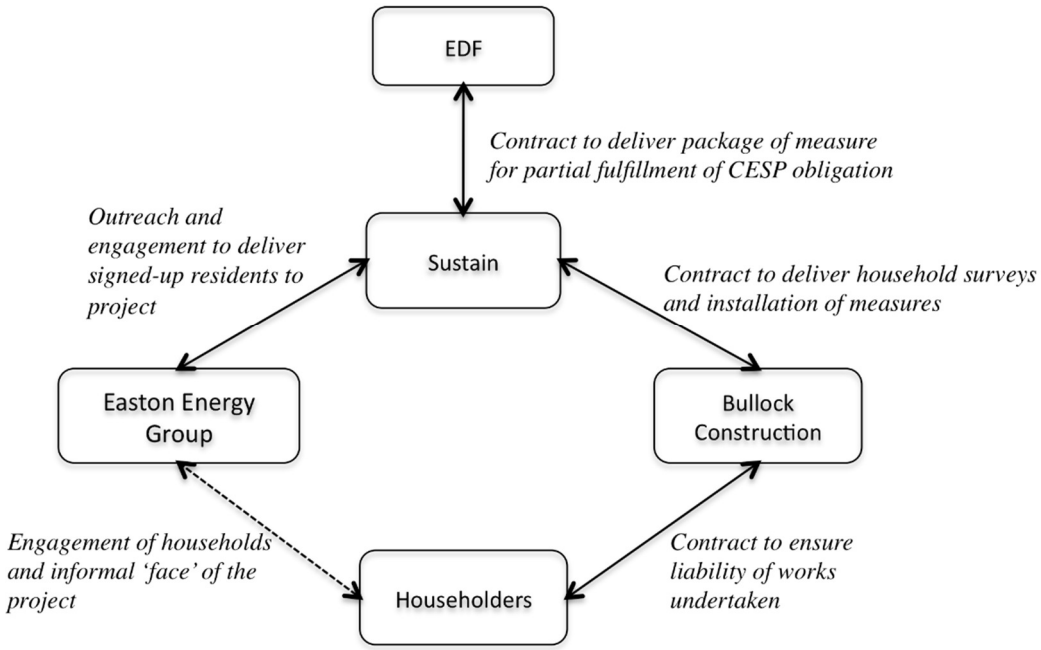

Figure 6.1: Actors and relationships in the energy efficiency project

The project was thus made possible by a national government obligation and Sustain's work to design a project within the programme criteria. Between early 2012 and August 2012 Sustain revised the project design, negotiated financial resources and attempted to align expectations and roles between the various parties. The project was expected to launch in June 2012 with the upper number of houses and measures included limited by the time available and the particular characteristics of the houses involved. However, delays to finalising the project with EDF and securing building control requirements with Bristol City Council significantly delayed the launch of the project but are not covered here.

Negotiation of Easton Energy Group's role in the project

EEG activists had three years of experience in the community but no prior experience of promoting particular projects or measures. The group had limited knowledge and experience of the SWI but proceeded on the basis of Sustain having 'done it before' so 'we can do it again' (Int_7). Confident in Sustain, the activists saw little reason to engage and learn from BGDs (chapter 5) despite knowledge of significant delays to the Terrace project (Int_9).

Project negotiation began in May 2012 and continued to December 2012 when the project collapsed. Three rounds of project negotiation are identifiable resulting from an evolving context and shortening timeframes. Negotiation concerned the particular method of engaging local residents and the depth of engagement. For Sustain, the total number of households signed-up to the project was the primary metric of success.

The first round of project negotiation was undertaken in May and early June. By June a five-page project outline summarised the activists' proposal (EEG, 2012a). It suggests the activists' sought to incorporate the project within their existing activities and aspirations and included linking engagement activity to the development of a 'community energy advisors' programme and the extension of the project to facilitate local understanding and demand for energy efficiency measures in the future.

The activists suggested engaging local residents though general publicity (leaflets, letters to residents, posters and media exposure), a variety of events (some in partnership with local organisations), drop-in energy advice sessions and community energy advisors. The advisor programme was a long-standing idea of the group, in which they suggested individuals enrolled from each street or community sector (e.g. Somali, Muslim or elderly) could be recruited and trained to become a "trusted person that local residents can turn to for impartial advice on reducing their energy bills and making their homes more comfortable" (EEG, 2012a, 2). The programme had four aims: to increase energy awareness, to increase the uptake of insulation and renewable energy generation technologies, to reduce fuel poverty and to increase the number of people participating in community energy issues (EEG, 2012b). Activists' believed a network of advisors would be well placed to recruit households to the energy efficiency project and if they received measures first, could gain knowledge of the process and potentially use their homes as demonstrations to others. The project was thought equally complementary to the advisor programme: it offered a potential reward for volunteer participation (free insulation measures) but also provided a catalyst to the idea because advisors "had something solid to do" (Int_6). Sustain were supportive of utilising the advisor programme but unwilling to fund it entirely through the project. Concerned only with the number of sign-ups, advisors were viewed as an additionality, 'great if that is something people are willing to do' (Int_10). To finance the advisor programme activists sought a small grant (£1,400) from their local neighbourhood well-being fund. In July the grant was secured and the programme was launched in August 2012.

Together with the advisor programme the activists argued the project was an opportunity to engage the wider community in energy efficiency issues. In particular they sought "a legacy beyond the insulation of the housing stock" (EG, 2012a) and suggested the monitoring of individual households involved, energy training and wider energy efficiency engagement for those that could not have the measures installed. Their rationale suggested the project was a good basis to engage the whole community in the government's forthcoming Green Deal.

Activists conceived their role as comprising four elements: liaising with Sustain and contractors,

undertaking the advisor programme, promoting the offer and project administration. Neither the group nor Sustain had prior experience of what might be appropriate financial remuneration for such activities. Consultation with CSE also offered little guidance since they were unaware of prior examples of community groups partnering under CESP projects. The project outline suggests the group's fees would be split between start up costs (£5,600) and referral fees (£350 per referral) so that neither party was overworked or overpaid for their services relative to sign-up rates. In part the high fees were argued to be necessary because their previous LEAF experience had shown "it is difficult to run a successful project with the desired level of involvement without dedicated (paid) staff to manage and coordinate the project" (EEG, 2012a).

The project outline was informally approved by Sustain but no contractual arrangements made. Activists were cautious of pursuing this point, hesitant of causing more problems than necessary. Instead, the project proceeded on trust.

In early August decreasing time and the return of a core activist to the group stimulated a second round of project negotiation. The returned activist, a charted building services engineer, had concerns about the practical measures on offer (particularly SWI and the potential for poor installation) and the liability of the group:

> "I was very sceptical from the very beginning. Not necessarily about Sustain and not necessarily about the funding source but… about what was being proposed, the technologies and the actual work. That was my initial thing as an engineer, …the impact on people and the houses and the unknowns and uncertainties. Secondary to that was how do we deliver the project as a group. …I've done quite a lot of 'sussing' out of various energy saving work… – mainly on a much bigger scale and for different sectors - but the general premise of making a work specification to say what you're going to do, and how you are going to deliver, and how much it might cost, I just basically applied that to this and to make it a bit more professional.
> …whether the technology is right, whether it will go in, how long it will take to put in, what this proposal does is abstain the group from any of the responsibility. That was my main goal from the beginning because I could see that was where it was going to fall down." (Int_8)

Whilst there were existing delays, the group's role was again discussed and reviewed with Sustain. The second project outline (EEG, 2012c) sought to clarify the role of the group, what they were agreeing to deliver and the risks involved. It removed the focus on engagement via advisors and introduced an approach based on the employment of short-term 'engagement staff' who would undertake targeted home visits to particular areas. It included a revised fees proposal and outlined four stages to the project: engagement, surveying, installation and legacy (figure 6.2). The primary aim of the group's proposed work would be within stage 1, generating successful sign-ups for Sustain to proceed with survey and installation, but they continued to pressure for their involvement in stage four. Their recommendations built on previous suggestions and included: (1) monitoring of energy usage to 'evaluate the real impact of installation works'; (2) continued engagement with households to further reduce their energy

demand and improve their understanding of energy use; (3) the recording of common questions and feedback from residents about the project and measures, and; (4) a report on the project's challenges and successes, the real time scales involved and recommendations that could be shared with local and national organisations.

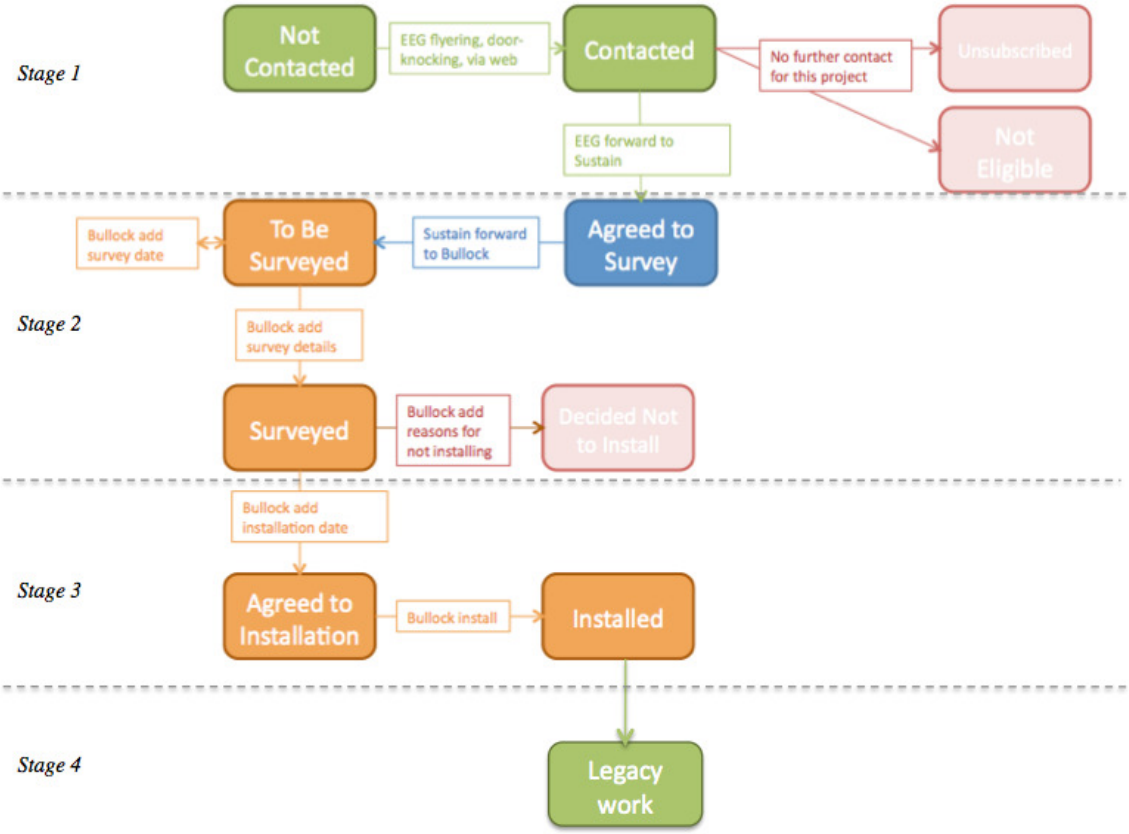

Figure 6.2: Workflow diagram of the energy efficiency project
(adapted from internal initiative documents)

Engaging the community and launching the project in Easton

Whilst the project was negotiated the activists discussed the project with local residents and businesses. In July activists were offered desk space within a local estate agent to help promote the scheme and handle concerns. In addition, the estate agent and a local social housing provider offered a number of potential demonstrator homes. The project appeared to be gathering pace.

By early August activists were keen to start engaging the local community. Existing planned events were perceived by activists as the best time to launch the project and engage the community. Pressure was subsequently applied on Sustain:

> "We kept asking 'can we get this signed? ..because we're going out today and asking people, we are signing people up, because we can't hang about. If you want us to do this we've got to get out there when the sun's shining, people are in and we've got festivals going on'. We needed to get on." (Int_6)

Sustain verbally conceded to the groups' argument. On the afternoon 16th August the project was launched at the local community centre. The event celebrated the installation of an 18 kW solar array on the roof of the community centre[17] and launched both the project and new energy advisors programme. The project was further promoted through the group's website, their Facebook page and word-of-mouth. Letters were sent to local residents who had responded to the group's LEAF survey and leaflets explaining the project were distributed around the community (figure 6.3). Within a month 27 sign-ups had resulted from this flurry of activity:

> "we really got on the case. It was August bank holiday we went into action at the Roots fair down near the station in Easton. The problem was we were going out not having anything signed, so we were sticking our necks out a bit." (Int_6)

Figure 6.3: EEG leaflet explaining the offer

Sustain broker support of EDF

In late September EDF agreed to finance the project from their CESP commitments[18]. The activists had been promoting the project for the previous six weeks whilst Sustain were locked in negotiation with EDF. Whilst risky, Simon explained the activity of the group "in some ways meant that we could demonstrate to the energy supplier and say look there is interest in this" (Int_10). Sustain were attempting to demonstrate interest and a viable project to EDF without incurring too many costs, the actions of the group thus made it easier to demonstrate and sell.

[17] (installed by Bristol Energy Cooperative with support from the group)
[18] Details of the agreement are not disclosed for commercial sensitivity reasons.

EDF's support was viewed as the final obstacle to the project going ahead but shortened timescales (now three months) instigated a third round of project negotiation.

Continued negotiation of engagement activities

Sustain advised the group that installation would have to be completed by mid-December because of the Christmas break and that 100 properties would take the contractors approximately eight weeks to carry out. Interested householders would therefore need to be signed up by mid-October. A third project plan (EEG, 2012d) indicates that a phased approach was under discussion whereby a smaller number of households would be targeted before a second phase expanded out.

Confident the project was now going ahead, an action plan was developed and a final list of requirements was passed to Sustain including, amongst other things, the delivery of promotional material. An online management portal was created, for Sustain, Bullock construction and EEG to upload and track householder progress through the project. A list of frequently asked questions was developed and posted on the group's website. Door-to-door sales experience was gained from a 'door sales' induction course, from which a door knocking script was written and a short survey form developed. Short-term job opportunities were advertised. Staff were recruited and trained. The first 27 sign-ups were passed over to Sustain for surveys to be arranged. The use of potential demonstrator homes was dropped because of the shortening timeframes.

In mid-October the target number of sign-ups was reduced to 40-50 households not including those already received. Discussion continued about how best to approach residents but no formal agreement was reached. Communication between the group and Sustain became strained: project management decisions were deferred and delayed, leaving the group unsure what to do.

By early November the group had spent approximately 60 hours responding to resident inquiries. The activists found themselves as a primary point of contact for interested residents and then a fall back when issues started arising. They were called upon to chase up missed survey appointments and later on, the survey results. In each case the activists had to follow up with the project manager, who in turn had to ask the contractor what was going on? Project management via the online portal did not work because the contractors weren't updating it. Despite this, a further 11 households had signed up to the project by November, as a result of the original publicity. No further outreach was undertaken.

Survey results, increased cost and the unravelling of the project

By early November Sustain had received the first 18 surveys results. They showed a worrying trend: in nearly all cases additional costs were being identified that were beyond the contingency price previously agreed with EDF. In short, the surveys revealed how the private housing sector contained greater variety and modifications to homes than had previously been thought. Both internal and external SWI to the front and back of properties were looking increasingly problematic.

At each property internal detailing had to be individually priced. The project manager from Sustain explained

> "we had priced the work based on a number of sample properties but the costs were higher than those anticipated and the contingency wasn't enough per property to make sure those works were fully funded. So a lot of it was around detailing, so things like coving, skirting boards, window sill extensions, what people's expectations of the works were, [and] what we were able to deliver in funding" (Int_10)

In many cases the available funding (£60 paid directly to a local decorator or in DIY vouchers) did not meet residents expectations about the quality of work expected. In part, this was not helped through older residents reminiscing of a previous housing upgrade project in the late 1990's which had left a number of properties without a roof for months on end as the project collapsed mid way through (Int_6).

Externally, the variety of extensions to the rear of properties posed individual challenges to external wall cladding. Again Simon explained,

> "we had assumed the vast majority were a set shape in terms of the walls that would need to be treated but we were finding properties with a lean-to on this and a lean-to on that. Some would receive external wall insulation but others wouldn't but actually the additional costs of scaffolding above and around those, alongside were they safe or were they not, and removing fixtures and fittings, so if you have a lean-to there do you insulate round it? Do you take it off, insulate and put it back on?" (Int_10)

The discovery of asbestos in a number of properties further increased installation costs. Together the number of additional complications was described as 'unforeseen' and attributed to the difference between social and private housing (Int_10). Without SWI the project wasn't viable. Additional funding was necessary to make the measures fully funded for householders.

Sustain went back to EDF and attempted to negotiate a higher price per install. The prospect of success was limited. Whilst EDF considered the future of the project, Sustain attempted to broker financial resources through alternative avenues, presenting three possibilities to the activists: the potential extension of CESP funding to April 2013, the possibility to undertake the work through a different energy company or match funding. In each case the project offer and

conditions were likely to change. No alternative financial backing was found and delaying their decision EDF made the project unachievable in the remaining time.

Negotiating the remains of the project

As Sustain sought additional funding the activists continued to receive information requests from confused residents. In most cases, residents simply wanted to find out what was going on:

> "I had the survey done on this property about four weeks ago, but have not heard anything since. I was wondering what is happening. I have some concerns about the measures proposed and the process. It seems that the solid wall insulation is affixed directly to the inner wall with no air gap or ventilation holes, even on lime mortar walls, which need to "breathe" on both sides. There is a lot of evidence that solid wall insulation done incorrectly, plus reducing air changes, on traditional buildings can lead to black mould growth. Additionally, I have some concerns about the process, which seems to involve a survey, recommendations and then seven days to accept or refuse, on a take it or leave it basis. Is this so and is it a case of accepting all the measures proposed or none?" (Resident 1, 19th November)

> "I'm a bit concerned because I've still not had any contact from a surveyor, and if the work needs to be done by the end of the year, then it's getting very late in the day. Please can you let me know what's happening?" (Resident 2, 26th November)

> "I'm just dropping you this email as I'm slightly concerned that I haven't received any written documentation through the post despite having chased it several times. Whilst I appreciate the pace of this project is such that it is being scheduled before the year end, my obvious concern is that with Christmas now 4 weeks today there is a lot of preparation I need to organise prior to the works commencing. I've had the survey done and a recent asbestos survey, but no scaffolders have yet visited the premises?" (Resident 3, 27th November)

> "Bullock came and did a site survey at our house about 3 or 4 weeks ago, and said that they were still intending to do the job before Christmas. He said that we'd get something in the post which we'd need to sign within 7 days. We didn't get anything so I rang …[they] said there'd been a delay but we should get something soon. Still nothing - I rang and left a message on Monday but he hasn't yet called back" (Resident 4, 5th December)

The group responded as far as they could and pressured Sustain for further information and later, to formally write to the individual householders to explain why there were delays. As one of the activists explained "We were the face [of the project] because we introduced them to it. That would have been ok, but that wasn't what we were signed up to do" (Int_6). Letters were sent out in the second week of December and marked the end of the project.

Overall, the narrative emphasises multiple layers of activity taking place concurrently. Influences from these different layers interact, propelling and hindering the local embedding of the technology. It highlights the importance of multiple actors as playing a role in and making moves which affect how and if the local residents access the technology. Intermediary activity is prevalent here, by the two focal actors, the community activists and Sustain as the project manager but also the contractor Bullock Construction undertaking surveys. The activists mediate between the technology and the energy efficiency project introducing the project to the local context (which was less well known than anticipated) and proposing multiple ways in which to engage people with the project and technology.

In the following section I analyse the case narrative in relation to the agency of the community activists and key intermediary processes. I pay particular attention to multiple ways in which the activists envisaged outreach activities, the engagement undertaken and the form and shape of these engagement spaces.

6.2 Analysis of key intermediary processes within the case

I now analyse the three key intermediary processes in three different sections and following the research protocol (chapter 3), the advantage being that I can later situate key processes temporally. Again each section builds on the previous section. I conclude the chapter by visually mapping the development of the project, situating the key processes within this map and finally summarising influences on community intermediation.

Facilitating

The group of activists were enrolled by Sustain to assist the integration of the technology into and within the local context of use. In other words, Sustain proposed working through the group as an intermediary - a bridge between project manager and local residents - to deliver their project. Meanwhile, the activists interpreted the project in their own way. I suggest these two entry points influence how the activists go about developing facilitation activities in this particular case. In short, Sustain directed the group's intermediation activity to a certain extent, whilst the group's understanding of the project influenced what they set out to achieve. In this section I first outline the implication of Sustain's proposal and the group's understanding of the opportunity before identifying and comparing three distinct and envisaged community approaches to facilitation from the narrative. At the end of the section, I bring these two arcs together to explain how the community activists sought to develop facilitation spaces and what restricted their implementation in practice. In doing so I answer the general questions about facilitation in the case.

Sustain's proposal indicates two reasons for the shape of facilitation activity. First, by virtue of Sustain's initiation the project is not community-led. Instead, the case is an example of a business-community partnership in which the community group acts as the delivery partner. Although the activists appear to have a free hand in designing outreach and engagement their activity is also limited because, second, Sustain's proposal suggested the group mediate in a particular direction, from the project manager to the community. This can be simply illustrated. First, the group's activity was measured in the number of sign-ups achieved. Second, the project

manager explained the groups' role as aligning the expectations of residents to the project: "ensuring that through the outreach work [residents] are expecting what is going to be done to their property and they are able to visually see what it is going to look like, they are aware of the level of the disruption that is going to happen in their home" (Int_10). In other words, what we see is that outreach work needed to align resident expectations with what the project was offering and the partners were able to deliver. This suggests a particular kind of embedding process, in which the local context, including resident expectations but also the existing material infrastructure, had to be brought in line with the project. Thus, proposed community intermediation was one-way, to facilitate residents' engagement with the project opportunity rather than facilitate Sustain's understanding of the community and thereby help to modify or adapt the project to embed it within the local context. As I will demonstrate, Sustain's initial conception of the group's role can be seen to frame activists' subsequent facilitation activity.

To further understand why the group intermediate in the way they do is to understand what Sustain's proposal meant to the group. From the way in which the activists designed their facilitation activities I suggest that the project was viewed as entailing significantly more than a small window through which to implement the project and upgrade the physical fabric of community houses. On the one hand activists' project materials (e.g. figure 6.3 above) present the project as an opportunity to reduce fuel bills, increase living temperatures and potentially improve the community's health and wellbeing as a result of the materially embedded technology. But their project proposals also suggested they viewed the project as a means to raise awareness of and interest in energy efficiency technologies and engage residents with forthcoming opportunities, such as the Green Deal. Furthermore, how they envisaged outreach suggests the project presented an opportunity to incentivise volunteer participation in the group's activities and to develop knowledge of the community (in terms of the local housing stock condition and potential opportunities to make upgrades). Understanding what the project meant to the group helps explain why they went about facilitating activity in the ways that they did.

These two entry points provide a basis on which to discuss the various facilitation activities envisaged by the activists. I argue that three distinct approaches to facilitating the project can be identified. They relate to the first project proposal, the second and third proposals and the launch of the project in mid-August. I now discuss the approaches, how they were envisaged, their qualities as facilitation spaces and what restricted their implementation, before comparing the approaches and drawing conclusions about the agency of the group. The following discussion is also relevant to the key intermediary process of brokering because each proposal was negotiated against Sustain. Here, I concentrate on the activists' envisaged facilitation and

discuss the three proposals as evidence of brokering in the later section.

The first approach to community outreach evident in the first project proposal (July) is characterised by the development of a community energy advisor programme. The approach can be understood as an attempt to integrate the project within existing group activity and aspirations. In short, the activists suggested recruiting and training volunteers from the community to share this knowledge and the opportunity presented by the project. I suggest this project proposal indicates a particular form of facilitation activity. It aimed to create a new network of grassroots activists empowered with new skills and knowledge that could reach out to and engage local residents. It also suggests an understanding of the local community by the group, as consisting of multiple overlapping social networks (recall the culturally diverse community), and recognition of their limited agency to effectively engage across these different communities. As such it attempts to integrate the project within the local context by building on existing social relationships. Of note here (to the discussion of the form and content of the envisaged facilitative approach), is the overlap between the communication of the opportunity (i.e. group facilitation activity) and the engagement of households and individuals: the envisaged approach attempts to recruit members of the target community to engage the wider community. There are two important and interesting aspects to this in terms of community group facilitation processes. First, the approach allows value to be added to the message through (a) tailoring by the individual advisor to the particular social network they are seeking to engage, and/or (b) potentially, through personal experience of the technology and project. Second, the means of communication becomes dynamic. It is no longer the simple communication of an opportunity but can include personal experience of the project and technology that may influencing the message, its content and capacity to mobilise others. This overlap presents a space in which knowledge of the technology can develop. In short, it was the activists desired means of facilitating the project and suggests a form of facilitation based on peer-to-peer exchange.

Implementation of the approach was restricted for a number of reasons. Whilst the approach had the support (but not financial backing) of Sustain it was viewed as additional: “great, if the community is willing to do that” (Int_10). Second, time and resources were needed to mobilise the approach and as time progressed activists suggested a quicker method of engaging residents was required. Third, the advisor programme was overshadowed by the energy efficiency project. Implicit within interviews with each project activist (Int_5-9) was the notion that the project was more valuable to the group (and community), the advisor programme only a means to engage the community and of lesser value in itself. However, this result can also be read as an indication of the power relations involved. The energy efficiency project was more valuable to

Sustain and they had a stronger negotiating position, backed by EDF, with which to direct the community-based intermediation activity.

The second approach to community outreach is evident in the second and third project proposals and is characterised by the use of short-term, paid staff undertaking home visits. The approach was proposed in response to shortening timeframes, it was thought to produce results quickly, and because it limited the groups liability within the project, to "a method of letting households know about it and getting them to sign up to the project but that was the extent [of it]" (Int_8). I suggest the approach represents an abrupt change in the means of facilitating the project opportunity to local residents. The use of paid engagement staff going from door-to-door is reminiscent of commercial outreach approaches, of salesmen attempting to sell their wares through door knocking. It suggests direct and one-way facilitation in which information on the opportunity is presented to local residents on a 'take it' or 'leave it' basis. The use of door knocking scripts further indicates limited knowledge transfer. Furthermore, the approach transfers responsibilities for householder knowledge and understanding of the technology further down the line, to the surveyor should the householder proceed to the next step. Overall, I suggest this form of community facilitation is based on the idea of consumers making rational decisions about the technology, the offer and its benefits. The groups' particular approach sought to use local residents and potentially people who were having the technology installed on their own home but I argue the approach represents a fundamentally different means to facilitate the opportunity. Again the approach wasn't put into practice. Shortening project timeframes and narrowing project scope combined with technical challenges emerging from the first batch of detailed surveys meant the green light was not given to the community group to proceed.

The third and final approach to community outreach is evident in the groups' launch of the project in mid-August and is characterised by the use of existing, planned community engagement events combined with existing channels of communication. The approach is interesting for the present analysis because it formed the basis of the activists' facilitation activity, it motivated them to launch the project in mid-August (before official agreement had been secured) and was the only approach deployed: 27 households signed-up within a month whilst a further 11 subsequently trickled in. I suggest the use of existing activity and means of communication can be viewed separately to the previous facilitation approaches because it displays characteristics of integrating the project and its facilitation into the community (c.f. attempting to aligning the community to the project). In this light the approach builds on the position of the group as an independent volunteer-led community group and its existing activity. The approach was curtailed but not halted, by Sustain because the project development timeline did not fit with the timing of community events.

Each of these approaches can be thought of as different modes of facilitation because each approach has different qualities. This is most clearly observed between the two envisaged facilitation approaches. Peer-to-peer engagement (via advisors) presented a dynamic, evolving form of communication with the potential to create new social networks and deep knowledge spaces in which the technology could be learnt about, interpreted and placed by the community. In contrast, the door knocking approach limits potential knowledge creation and transfer because it is a succinct one-off event in which the household either dismisses or engages with the project. In other words, door knocking is a one-way communication of the opportunity to local residents whilst peer-to-peer engagement has the potential to engage residents in ongoing and multiple ways. Moreover, peer-to-peer facilitation encourages the community, to work together with the group of activists to understand the technology, the project and the proposed changes to the local community. It therefore encompasses the idea of doing something *with,* rather than principally *for,* the community. Or to phrase this differently, peer-to-peer engagement creates a facilitation space in which the community can participate in the co-construction of the technology and context. What is also apparent is that peer-to-peer engagement represented the community ideal, door knocking the group's fall-back option. From this I conclude that initial attempts by activists to envisage facilitating activity were deeper and more rounded than their fall-back position in subsequent proposals.

The third approach (utilising existing events) sits 'outside' of the envisaged activity discussed above because it was secondary to all three proposals and because it was implemented whilst project negotiations continued. Yet, as a mode of facilitation it sits in between peer-to-peer and door knocking approaches because it held the potential for an ongoing, evolving form of communication in which learning could occur but did not create new social networks and thus limited the extent of community participation with the project and technology.

From the identification of two envisaged approaches to community outreach I identify a narrowing of the group's proposed facilitation activity. From this I conclude that activists proposed facilitation of the opportunity was increasingly influenced by project constraints (namely timing and funding) and their position as the outreach partner in the project (Sustain were only interested in one-way community intermediation and the number of sign-ups). Second, as time progressed the particular form of local embedding becomes more apparent. There was little scope to modify the project or installation of the technology even with the knowledge being generated by the activists and the surveys feeding back the need for some project adaptations in order to embed the technology: the community was expected to conform to the project. Third, only one period of facilitation is apparent within the case narrative and it

sits outside of the activists' negotiation of the project with Sustain. Here the activists argued for the launch of the project before it was agreed and used an alternative approach to the ones under discussion.

Configuring the technology, project and stakeholders

The second intermediary process involves the active configuring of projects, technologies and potentially users and producers (Stewart and Hyysalo, 2008). For example particular elements of facilitation spaces have to be actively arranged and assembled whilst an understanding of the technology and its value in the local context needs to be ascertained and presented to others. My research protocol thus suggests looking at how the project is designed and what influences this alongside how the technology is interpreted.

The project was identified and designed by Sustain. They invited partners to join them (Bullock Construction and EEG) and negotiated funding from EDF. The project was designed to partially fulfil the CESP obligations placed on EDF. It therefore targeted particular, higher cost energy efficiency measures, sought the installation of multiple measures per property and targeted particular areas to achieve 25% density targets. The community had to be classed as a *Lower Super Output Area*[19] (LSOA) to qualify. Sustain chose Easton because it included a collection of neighbouring LSOAs and because houses were predominantly terraced and (thought to be) uniform in size. As such, characteristics of the local community determined if it qualified under CESP whilst the local physical context determined what measures were needed and thought viable. Sustain navigated these aspects to identify a viable project. For their part Easton activists had no control over the broad design of the project, they had no choice over the use of local or national delivery contractors and could not and did not negotiate the project with EDF. As a result I identify Sustain as the stronger intermediary, with a larger role in the configuration of the project than Easton activists.

Yet, against this background EEG activists chose to partner with Sustain. They made the decision with limited knowledge: across all interviews with core activists (Int_5-9) only one had a clear understanding of which government obligation the project was supported by (CESP or CERT). From this two points can be noted. First, the group did not have to partner with Sustain but as one activist pointed out, not being involved would have undermined the group's existence and purpose (Int_9). Although this hints towards a negative reason for participating, Sustain's proposal was also seen as an opportunity for the reasons presented above. Nonetheless, from

[19] LSOA are relatively small containing approximately 1,500 residents in each area.

this ‘free’ move activists’ subsequent agency was curtailed, later ‘forced’ moves - about the design of community outreach for instance - resulted from the interaction between the external environment (e.g. national policy) and the early decision of the group. Second, it is worth briefly noting the tradeoffs made in this relationship. Partnering with Sustain, made it possible (or so activists thought) to access significant capital investment with which to upgrade their community’s housing stock but, as is clear from the case narrative, partnering also involved risks. The group was made vulnerable in the process because they could not oversee the design of the project in its entirety. They were unequal partners to Sustain’s experience, knowledge and financial backing. Instead, the project proceeded on the basis of trust, flowing both ways, that Sustain and EEG could deliver what each claimed. Activists took a gamble, with their reputation at stake, on the opportunity to deliver substantial material and social outcomes.

Unable to influence the broad design of the project the group’s primary (intermediary) configuring activity was in the design of community outreach. However, they also attempted to shape the form and depth of the project, and therefore local embedding, by arguing for (a) their involvement throughout the project and (b) the inclusion of ‘legacy work’. I start by inquiring into their interpretation of the technology and how it was present to the community.

Interpreting the technology and presenting it to others

For SWI and this case study limited technical configuring was possible by the activists. Again they had no choice about the particular type of SWI used or where on the property it was installed. Internal SWI was to be used on the front of properties to avoid the need to obtain local planning permission. External SWI was to be used on the back. Both were a decision of Sustain and the contractor in response to local system rules (i.e. internal SWI to the front of properties circumnavigated local planning) and what was thought feasible. The group had some control over how the technology was interpreted and presented to local residents through outreach activities.

Presenting the technology to the community through outreach material (i.e. figure 6.3) the activists focused on the potential to save money on fuel bills and the economic value of the project offer: ‘free insulation worth £15,000’. Some additional benefits were also highlighted, as mentioned above, but economic arguments came first. It is unclear whether this was a strategic choice of the group or Sustain because seemingly generic, project promotional materials were provided by Sustain. Despite this, I note that there was limited attempt to relate SWI to the local context: to make it meaningful to their local community. In addition, no attempt was made to configure and foster the formation of a common vision within the community.

The presentation of the technology mirrors the one-way intermediation of facilitation space discussed above. It aims to attract interest in the offer and includes only as much information as is necessary to understand the technology and installation process. As such it side lines a greater understanding and knowledge about the technology and Easton properties in order to communicate the offer succinctly. From this I conclude that the activists played only a minor role in configuring the technology. Their outreach material reflects the resignation of the group to one-way communication of the offer.

Designing outreach activity whilst attempting to influence the depth of the project

The three different approaches to outreach activity identified in the preceding section each required designing and as such display elements of configuring processes by the activists. Having already introduced the approaches, here I expand this discussion by focusing on how they were designed.

The use of planned events and existing communication channels involved the least configuration by activists because, by definition, they were already created: the project and technology only required being fitted into these activities and channels of communication. Decisions about the interpretation and presentation of the technology and project could have been important here but were largely informed by Sustain's previous activity and generic materials. It was felt the existing materials and events were adequate to the task (getting households signed up) and did not require reconfiguring. In contrast the advisor programme and door knocking required substantial configuring by activists. For the former decisions about what the advisor programme was for and who the target group would be had to be made. The approach required recruiting and training individuals, giving them confidence in what they were undertaking. The latter, door knocking, also involved configuring but in different ways. This short, discreet engagement with householders required decisions about how to present the technology and project. The use of scripts suggests detailed configuring of the interaction compared to looser, less controlled communication of the offer via the two other approaches.

What is notable is the internal project management required. Substantial activist effort was dedicated to devising the internal management structures and procedures to undertake door knocking. The advisor programme conceivably required the same scale of dedicated work but was not evident within project development. The key point here is that both approaches required significant internal project work. It is a point that is not currently visible within Stewart and Hyysalo's (2008) understanding of intermediation, which places attention with the external configuring of projects between stakeholders and the technical and symbolic arrangement of technological configurations.

Extending beyond configuring of outreach activities the activists also attempted to configure the form and extent of embedding resulting from the project. Throughout activists design of outreach activity they argued for their participation to extend beyond the simple delivery of signed-up households. This is most notable in the use of advisors but also present in the design and use of an online portal to track household progress through the project. In both cases the activists were concerned with making sure the physical installation of measures was properly undertaken, that it met residents' expectations and that residents learned how to get the full benefits from measures. From this I suggest the activists were arguing for a deeper and more rounded form of local embedding than the initial project plan represented. This is most clearly visible in what activists vocalised as the need for 'legacy work'. Here, the activists were principally concerned with establishing "a legacy beyond the insulation of the housing stock" (EEG, 2012a) or in others words, moving beyond the material embedding of the technology. In particular the activists were concerned to use the project for wider engagement in energy efficiency by local residents, they suggested for those unable to have the measures installed - for technical or logistical reasons - the project could be used to disseminate knowledge of the government's forthcoming Green Deal. On the other hand their desire to measure the impacts of measures on energy use, carbon emissions and temperatures alongside the desire to work with residents to further reduce energy demand and improve understanding of household energy systems suggests the activists wanted the project to have impact beyond the material embedding of the technology.

Despite repeated attempts to persuade Sustain of the value of activists' involvement throughout the project and the inclusion of legacy work, neither was incorporated within the project. The simple explanation is that insufficient funding restricted what was possible but behind this the particular form of embedding resides: community intermediation was expected to facilitate the adaptation of the local context into the project structure. The project was only concerned with achieving material embedding that would satisfy EDF's CESP obligations at least cost. Again the agency of the group to configure the project and local embedding process comes up against external environment constraints.

From this discussion I conclude activists configuring of the technology and project is observable but their ability to configure is limited as a consequence of their first free move (partnering under Sustain's project) later restricting their agency. Second, I suggest their principal configuring activity was directed towards the design of facilitation spaces and extending the scope of the project through the inclusion of legacy work. Third, I suggest three periods of configuring activity are discernible within the case narrative, corresponding to the three project

proposals.

Brokering

The third key intermediary process Stewart and Hyysalo (2008) identify involves raising support from actors, representing end-users and negotiating on their behalf, negotiating the entry of additional actors into the intermediaries space and seeking to maintain influence over emerging rules and practices around the technology, project or vision. From the research protocol it involves investigating how the project is negotiated with stakeholders, what resources are mobilised and whether users are represented.

The dominance of Sustain as the project manager and intermediary again strongly influences the potential for activists' brokering. This challenges the thesis conceptual framework where brokering implies negotiation with external actors or stakeholders. Yet in this case negotiation is principally external to EEG but within the project: community brokering happens in relation to the project manager Sustain. I argue that this can still be understood as an intermediary process of brokering because it involved activists attempting to negotiate the project and resources with an outside actor, even if that actor had initially invited the group to partner. As such it depends on how external actors are defined, external to the intermediary under study or external to the project. Again it should now be clear that the activists' position within the project likely limits their brokering activity. Their brokering activity principally involves (a) the negotiation of the project into the activist space (energy in the community) and amount of resources (for outreach) and (b) the representation of the local community.

Negotiating the entry of Sustain and attempted mobilisation of resources

The activists played on their position to negotiate the project with Sustain: "given the low levels of energy awareness and general lack of trust of large companies, partnering with a local group such as EEG is crucial to succeeding in this project" (EEG, 2012a). In particular, they sought resources beyond what Sustain was offering, to develop the advisor programme as their preferred means of engagement. As explained above Sustain's apathy to the advisor programme stemmed from the programme being dispensable to the material embedding of the technology. Unsuccessful, the activists were able to broker some limited financial resources from a local neighbourhood partnership fund. More broadly, the three project proposals include evidence of significant brokering of activists' financial remuneration.

The second key area in which activists exhibit brokering activity is around the shaping of the project (their involvement throughout and in particular envisaged outreach activity) and

potential for legacy work. Three periods of brokering were undertaken in relation to each of the three project proposals. As discussion under envisaged facilitation activities above, activists first tried to negotiate the use of the advisor programme before then negotiating a door knocking approach to engage local residents with the project. These detailed project negotiations and the potential inclusion of legacy work were all undertaken to help facilitate the local embedding of the technology: detailed project negotiations sought to support the community through the process and legacy work sought to further deepen the embedding of the technology and stimulate greater demand for energy efficiency measures from the local community. The project manager granted some concessions but the activists brokering did not substantially alter the design of the project. Over time the activists became resigned to their basic, one-way form of mediating but they continued to argue for additional resources and the chance to further support the embedding process within the community. Although they framed this as additional legacy work, it is clear they viewed such action as necessary to make the most of the project and embed the technology.

Representing end users and negotiating on their behalf (mobilising community voice)

Within the case there are a number of examples of what Stewart and Hyysalo (2008) might refer to as the representation of users and negotiation of the project, technology and resources on their behalf. First, the negotiation of the project by the community group is itself a form of community representation. Second, the group's insistence on launching the project in August - to coincide with existing activities - was a negotiation of project on behalf of the community. Activists attempted to shape the project, to make it fit in with the community calendar. Third, as delays and issues with installations emerged the activists represented discontented residents to Sustain and negotiated information on their behalf.

Pressuring Sustain to launch the project before it had been officially signed-off is particularly interesting because it suggests a particular means of brokering. Pressure from the group was translated by Sustain as interest and support for the project by the local community. Sustain used the group's determination to launch the project in its own negotiation of the project with EDF, it was used to demonstrate the project was viable. A channelling affect is visible here, whereby activists' knowledge of the community created internal group pressure to launch the project in August, which necessitated pushing Sustain into agreement. In turn Sustain used this pressure as a strength of the proposed project its own negotiations. The later representation of discontent is equally interesting. Here, activists' channel discontent from local residents to Sustain as the project experienced delays. Activists performed a role of mediator between the community and project manager, pushing the project to a conclusion. Yet these two instances are qualitatively different. The former was intentional, activists knew August was the right time

to launch the project and so argued for it. The latter was unintentional, or a spontaneous reaction of the group left 'holding the bag'. Together these instances suggest a particular form of community brokering: the mobilisation and channelling of a community voice. The activists took their own desire and latter nascent vocalisations from residents and channelled this to where it might have the greatest impact. It suggests a particular form and support for demand creation not currently incorporated within Stewart and Hyysalo's (2008) understanding of brokering. Its nature suggests that it might be more applicable to community intermediation. With this particular brokering role in mind, rather than mediating and effectively defending Sustain in the latter period the activists could have used nascent community demand as a means to further pressure the project manager into embedding the technology. Alternatively, this community voice could have been mobilised towards EDF as project funders or the City Council as a large owner of local social housing. Alternative avenues, and potential outcomes, are conceivable. What makes this a particularly interesting point is that it went unrecognised by the activists but could present an additional tactic in a community-based intermediary arsenal.

From this I conclude brokering by activists is present, the primary purpose being to support facilitating activity and more broadly their degree of involvement in the project and embedding process. Brokering by activists thus entailed the negotiation of their role in the project and resources for engagement activities. As such the case suggests that brokering is an important intermediary process even where community initiatives are enrolled in professionally-led projects as trusted partners to undertake facilitation roles. In addition the case suggests a particular manner of representing local communities and brokering resources, which here I have labeled the mobilisation of community voice: as the fostering of nascent articulated demand and channelling to where it might take effect. I conclude that brokering by the community group was intrinsic to the negotiation of the groups' role in the project but that their weaker position as a partner to the project and the structuring of multiple context layers limited the agency of the group to substantially shape the form and content of the local embedding process.

Summary conclusions about the case study

Having drawn conclusions about individual intermediary processes above I use this conclusion to draw these sections together. First, I summarise the case study and key community intermediary processes. Next I draw general conclusions about the case and community intermediation for local embedding. Finally I construct the pattern that has emerged from EEG's attempt to embed SWI in terms of levels of analysis and key intermediary processes.

In brief, the case study analyses how a group of community activists seek to integrate SWI

through a partnership with a local consultancy using government-obligated funding from a large energy company. The project was identified by Sustain, the managing partner. It ran over a period of nine months and resulted in 38 households signing up but no installations. The project collapsed in December 2012 after technical (diversity of housing, asbestos etc) economic (insufficient funding) and social (resident expectations) challenges.

Looking across community intermediary processes I conclude that EEG's intermediation was premised on playing a facilitating role, the degree to which configuring and brokering activity is present is undertaken in support of facilitating activity. This supports the conceptualisation of key intermediary processes being interlinked and in some respects interdependent of each other within the case.

In the analysis of facilitation above, I argued that from multiple envisaged approaches to outreach can be identified a narrowing of the groups facilitation activity. Starting from an ideal form of community facilitation (based on peer-to-peer dissemination) moving to a unilateral, one-way communication of the offer (based on door knocking). The former sought to create new, embedded social networks in which knowledge could be shared and social learning could occur. The latter sought only to recruit households to the project and pass on responsibility for end-user understanding and knowledge of the technology and installation process to project partners (namely the surveyors). I conclude this narrowing of approach resulted from the project structure (designed under CESP by Sustain) demanding quicker and simpler communication of the offer and the collection of sign-ups. Cost and time demanded a particular form of community facilitation, which undermined the ability of activists to locally embed the technology.

The community group's configuring activity is also limited by the partnership. The activists did not identify or design the project. The basic project was configured by Sustain. Instead their choice to partner with Sustain limits their agency. I argued activists' primary configuring activity involved the design of multiple approaches to outreach activities but project constraints restricted the potential depth of approach. Here activists do not exercise their ability to interpret and present the technology to the local community as would have been expected from the conceptual framework. Instead they use generic promotional material from Sustain. Additional configuring by activists attempted to alter the form and extent of local embedding within the project by extending their role throughout the entire project and the inclusion of legacy work.

Finally, the case demonstrates that even where a community initiative is enrolled to facilitate the engagement of the local community this still involves active community brokering. Agreeing to

partner with Sustain can be understood as the negotiation of the project into and within the community group's space - energy in Easton. This highlights that significant brokering activity is also involved within project partnerships where, in particular, the activists negotiate the design of outreach activities and attempt to mobilise additional resources (from Sustain) for their involvement throughout the project and legacy work. However, in this case the most interesting aspect to community brokering is the extension of Stewart and Hyysalo's (2008) notion of representation, to include, what I have termed, the mobilisation of a community voice. I argue this suggests a particular form of community intermediation in which nascent articulated demand is fostered and channelled to where it might have effect. Activists, intentionally and unintentionally, took their own desire and later emergent vocalisations from the community in an attempt to broker the project and local embedding of the technology. This represents a potential addition to Stewart and Hyysalo's understanding of intermediation.

At the forefront of my explanation of community intermediation sits the limited agency of the community group. From the analysis above I conclude that such limited agency derives from a variety of reasons. The activists were principally enrolled in the project to mediate between Sustain and the local community, to undertake outreach activity that would facilitate the introduction of the technology into the local context. The project was thus not community-led. From the agreement of activists to partner followed subsequent forced moves. Furthermore, the activists were unequal partners to Sustains' experience, knowledge and financial backing. Partnering with Sustain was thought to offer the potential of significant capital investment within the community but relied on trust. From this initial entry point the activists found their ability to shape and guide the project was restricted.

Nonetheless the activists brought their own understanding of the opportunity and project to the table. The narrative and my analysis suggest they sought to utilise the project for more than the material embedding of the technology into the community: to use the project to increase understanding of and demand for energy efficiency measures and SWI in particular. As a result they attempted to negotiate and extend not only their role as outreach and engagement partner (beyond the sign-up of interested households) but also the scope of the project, to include unfeasible/ineligible households (under the auspices of CESP) and post-installation legacy work. The activists subsequently make moves to support the local embedding of the technology by attempting to build momentum and support the learning processes of local end-users.

Thus my explanation of community intermediation draws on two particular features of the case study: the particular form or direction of local embedding and its partnership approach. On the one hand, the local embedding approach is one-way: the local context was expected to align

with what the project had to offer, EEG were enrolled to engage the community and despite the knowledge generated (firstly transferred from EEG and later through surveys) the project was unable to adapt to the local context. On the other hand, the partnership approach suggests a collaborative form of intermediation. Partnering opened up new opportunities for the group. But it also involved tradeoffs. The activists risked their reputation to deliver substantial material and socio-economic outcomes. Partnerships therefore open up new avenues and means to local embed technologies. Local embedding is conceived as involving the potential for multiple stakeholders, with varying interests in the focal technology, to make moves which influence how, if and when a technology is locally embedded. In this case the partnership is no exception but serves to clearly highlight how activists agency is constrained by those around them.

Construction of intermediary process patterns

In this final section I reinterpret the unfolding of the case in terms of levels of analysis and key intermediary processes to construct a pattern of community intermediation (figure 6.4) (see section 3.3). I will compare this pattern with the other cases in chapter 9 to identify common patterns to key intermediary processes. Constructing this pattern also allows me to summarise the key influences affecting the case.

The project, in which the community group sought to integrate SWI into their local community, emerged because of national policy (CESP) obligating large energy companies to undertake energy efficiency improvements to the most deprived areas of England and Wales. The energy company EDF decided which projects would be supported (as a contribution to their obligation) and at what price. The project was identified and designed by local consultancy Sustain in which the community of Easton was chosen as the target and EEG were invited to partner. Broad project configuring was undertaken by Sustain within the local system. Sustain also brokered financial resources and project backing from EDF (indicated with a dotted outline in figure 6.4). Agreeing to partner with Sustain, EEG activists embarked on three rounds of project design, first suggesting a peer-to-peer and later a door knocking approach to outreach activities. Each project proposal was subsequently negotiated with Sustain the project manager. Additional mobilisation of financial resources towards the peer-to-peer engagement was brokered via a grant from EEG's local neighbourhood partnership. Only one period of facilitation is apparent within the case narrative and sits outside of the group's negotiation of project because it did not use either of the proposed outreach approaches and was undertaken before the conclusion of formal project design and negotiation. This facilitation activity resulted in 38 households signing up to the project within two months. Detailed household surveys followed. They indicated technical and social complications to the installation of the technology. Sustain returned to EDF to broker additional resources to the project whilst EEG were left dealing with

confused householders. With mounting concern and reducing time EEG vocalised the concerns of residents to Sustain who finally brought the project to a close. Table 6.1 summarises these influences on project development.

Table 6.1: Summary influences on the development of EEG's energy efficiency project

Level of analysis	**Summary influences on project development**
External environment	• Introduction of CESP created a market for SWI, created the project opportunity and set project constraints • Commissioned by EDF resulted in protracted project negotiations
Local system	• Invitation to partner from Sustain • Diversity of housing (size and shape resulting from adaptations) increased installation costs, • Local industry experience on social housing undermined project design.
Community	• Resident expectations suggested minimum finishing standards, • Negative previous housing renovation experience made residents cautious of the project • Local events provided a platform on which EEG could engage

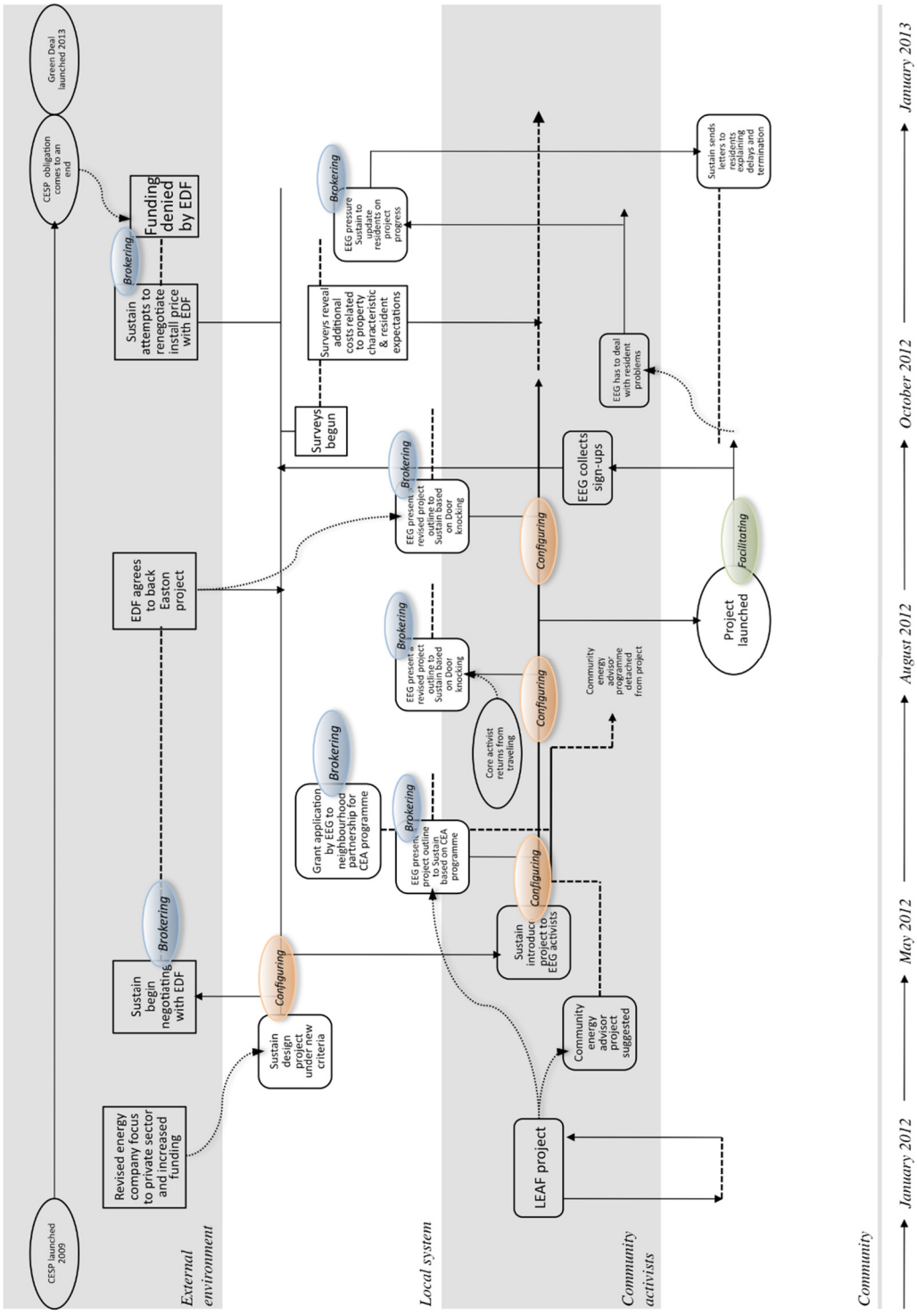

Figure 6.4: Visual map of Easton Energy Group's energy efficiency project with key intermediary processes indicated

Chapter 7
Demand Energy Equality's DIY solar workshops

7.1 Case narrative

Demand Energy Equality (DEE) is a community interest company (CIC) and a small grassroots initiative lead by three core activists. It organises do-it-yourself (DIY) solar PV workshops to low income earners in Bristol and further afield. Launched in November 2011 the initiative aimed initially to make solar PV more (financially) accessible to low-income earners and make energy more tangible to end-users, in the hope this would lead to a greater awareness of personal energy use and the need for energy demand reduction. Informal workshops, held over five months preceded the formal launch of DEE. Between April and September 2012, and in partnership with a local sculpture artist and local food growing initiative, DEE undertook a project to construct a 'solar tree'. The tree, consisting of 36 DIY PV panel 'leaves' connected to a battery storage system, is used to power a rain-fed irrigation system onsite at a local food growing initiative. In November 2012 a visioning day was held between DEE's three core activists and associated members which resulted in a revised business strategy being written in the following months.

In the following narrative I trace the development of the initiative from its emergence through launch and solar tree project to the writing of a business strategy in the winter of 2012.

Early experimentation and workshops
January 2011 - October 2011

DEE began life as a 'glorified hobby' (Int_12) of a local energy activist Dan Quiggin. Dan had begun experimenting with the construction of solar photovoltaic (PV) panels using recycled materials in early 2011. He had a background in physics and had just started a PhD at Loughborough University researching renewable energy scenarios to 2050. In doing so Dan quickly came to realise that it was not possible to produce sufficient energy for societal needs from renewable energy technologies alone. Furthermore, contemporary research on the uptake of PV through the FiT scheme showed higher income earners were taking advantage of the scheme whilst the guaranteed revenue for their electricity generation was being paid for by all bill payers, including poorer households (figure 7.1). Both aspects came to effect the

development of the DEE initiative.

The initiative was catalysed in early May 2011 when, following a 'skill-swap' day, Dan was encouraged by friends to turn his DIY PV session into a discreet workshop for others. In the following months and aided by a small grant (£1,400) from a national charity 'UnLtd', Dan bought the tools and materials to run three DIY workshops. The idea was to teach participants how to construct and use DIY PV panels. He also aimed to equip participants with the skills and knowledge to run subsequent workshops; participants were asked to become workshop facilitators, and preferably, reach out to low income earners, thereby spreading the skills and knowledge to build and use DIY PV systems. Dan suggested the panels from each workshop be kept by the facilitator as 'payment' for their time.

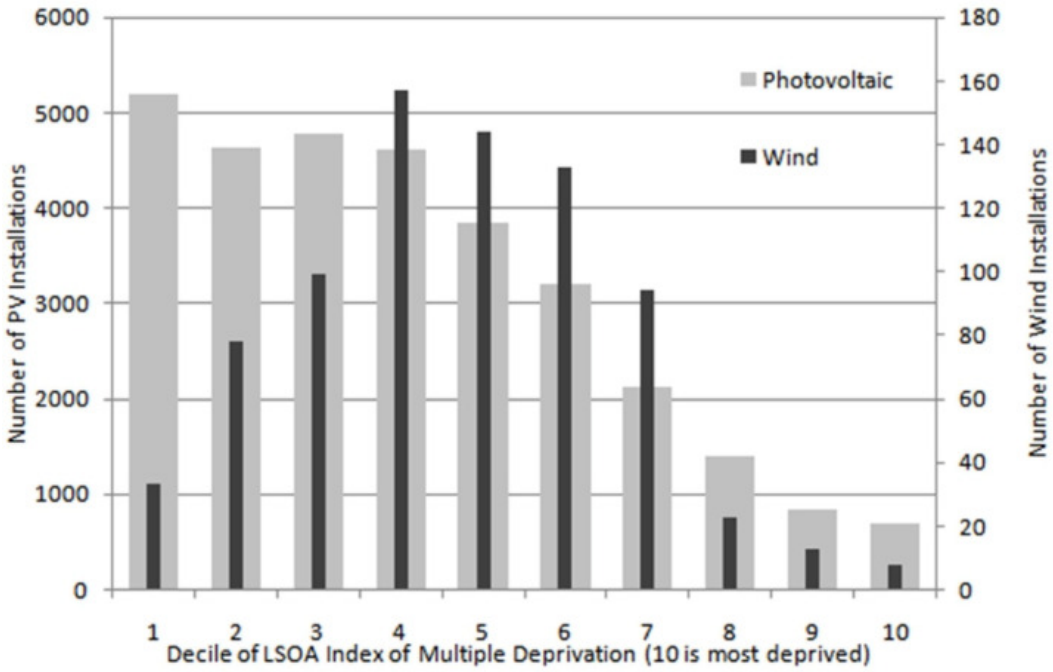

Figure 7.1: Diffusion of PV and wind under FIT by relative wealth
(Leicester, Goodier & Rowley, 2011)

The workshops used discarded window units from local builders and wood from used wood yards. Chipped or cracked solar cells were sourced as waste from the solar industry[20]. The panels were constructed by soldering together these damaged or incomplete cells[21].

If PV was a useful low carbon technology, the high cost of installation was viewed as the

[20] In transporting solar cells from abroad, some get broken. These cells subsequently cannot be used within commercial solar panels and get discarded as waste.
[21] It was possible to combine cells to form a panel because each cell's output is proportional to their surface area.

primary factor limiting access to it and its further use within society (Quiggin, 2011a). A DIY approach was useful therefore in reducing its cost. At the time Dan estimated that through his recycled DIY approach he was able to build a solar PV system for half the price of a commercial system's component costs[22]:

> "A typical 1kW solar system will cost £1,200 for just the materials, for the installation of a 1kW system you would be set back around £4,500. To compare like for like it's only fair to use the materials cost. So that's £1.20 per watt of power. If you follow the guidelines set out here and make sure you "tat" [find or reclaim] all you can (including the batteries) I calculate you will spend 55 pence per watt. Less than half of the price, which I hope makes this technology much more accessible to the less financially affluent of us." (Quiggin, 2011b)

The logic was, therefore, simple: if costs were the primary factor limiting use of the technology, reducing the cost would allow more people to access the technology. By extension, it was thought that if more low-income earners could access the technology through a DIY approach this would help to reduce the inequality brought about by current deployment patterns based on the government's national FiT mechanism. The broader point was about access to the technology; there was little the workshops could do to stop the transfer of wealth from low-income earners to wealthier FiT registered, PV system owners. Dan argued the workshops were timely and necessary in order for the technology and its perceived benefits, to be made accessible to all in society,

> "The recent increase in small renewable projects and technologies is a fantastic opportunity for sustainable energy usage within our communities. Currently this is not benefiting low-income households and individuals, indeed through the feed-in-tariff new inequalities in energy provision is becoming evident. This project seeks to skill and educate groups within Bristol who cannot afford these technologies and associated benefits." (Quiggin, 2011a)

To extend the reach and impact of the DIY workshops Dan sought to utilise a 'skills sharing' and open-source model: inspiring and sharing knowledge and knowhow, the workshops could be replicated quickly and more low-income individuals reached. Under the model Dan taught groups of individuals how to make the panels. These workshop participants were provided with materials to run their own workshops in which they would charge participants the material cost price. The money would be returned to buy more materials and the process started again. The successful grant application from UnLtd allowed the process to begin in June 2011.

The following workshops were designed to cover a wide variety of aspects within one day (7 hours). They introduced the project, the socio-economic context in which the project sat (climate change, FiTs, onsite use, energy consumption), the project's replication logic and the knowledge and skills to construct a functioning PV system (including basic knowledge of

[22] As the quote makes clear, the majority of costs for a solar home system at this time came from installation not material costs. Rather than make Dan's argument invalid, this reinforces the value of a DIY approach, taking it to below an eight of the price of a commercial system.

electricity – current, amps, volts – and the steps in making the panels) (table 7.1). This self-assembly approach was thought to lead to knock on effects about energy consumption. Through making and using DIY solar panels, Dan argued, "we are more likely to marry up supply of power, to demand for power and through this awareness start to reduce our consumption of power" (Quiggin, 2011b).

Table 7.1: DIY solar workshop timetable[23], June 2011

Time	Activity and Description
10:00	Why this project and why now?
10:30	Outline of workshop format- skills share
11:00	*Making the solar panels* - Basics - Multimeters, Solar Cells, Outputs, Tabbing and Circuits
11:30	*Making the solar panels* - The frame and glass, sizing and tabbing
12:00	*Making the solar panels* - More tabbing and bussing
12:30	*Making the solar panels* - Encapsulation and securing the cells and alternatives
13:00	*Making the solar panels* - Securing the glass
13:30	Lunch
14:15	*Making the solar panels* - Weather proofing *Making the solar panels* - Connecting panels to panels, panels to batteries and panels to stuff.
14:45	Angles of inclination
15:15	*Making the solar panels* - Questions, clarifications and alternative framing methods
16:00	Your workshop - materials, group discussions, question
16:45	Feedback, extra roles and videos
17:00	Close

To recruit participants to the workshops Dan publicised through activist newsletters and groups who were already engaged with low-income households. Three workshops (8 participants each) were subsequently held at his house during the summer of 2011. Feedback from participants suggested the workshops were accessible and stimulating. In addition, Dan held mini workshop sessions at three local festivals in and around Bristol (Bristol Harbourside Festival, Larma Tree and Fieldview Festival). To accompany the workshops he wrote a *Handbook of Materials and Instructions* (Quiggin, 2011b), which was posted online, free to download. At one of these festival workshops Dan was introduced to the idea for a 'solar tree'.

[23] This timetable presents the format for the early workshops held over the period June 2011 to December 2011. The timetable was subsequently adjusted to fit specific workshops formats later on.

Figure 7.2: A DIY solar panel workshops during summer 2011

A young American called Aidan, who in a project to win the 'Young Naturalist award', had studied the complex design of trees and how they might hold the 'secret' to the efficient collection of energy from the sun, advanced the idea for a 'solar tree'. Aidan had designed and built a test model based around the pattern of an oak tree. In place of leaves he used small PV cells and compared the output of his 'solar tree' to that of the same number of solar cells arranged in a south-facing flat panel array (figure 7.3). He found the tree captured 20% more energy and collected 2.5 hours more sunlight during the day.

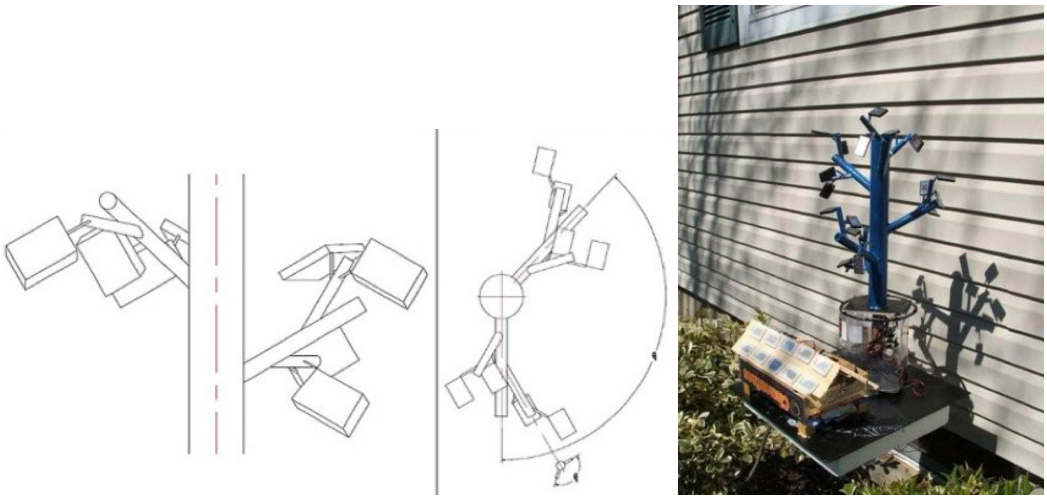

Figure 7.3: Aidan's drawings and model of the solar tree (in Sigler, 2012)

Aidan's work led Dan to research on three-dimensional (3D) PV system designs by researchers at the Massachusetts Institute of Technology (MIT). Their results showed a range of improvements, making the team conclude, "3D PV structures using simple shapes and electrical connections largely outperform flat panels of the same base area, and show promise for embedding PV systems in the urban environment beyond the flat panel form on rooftops"

(Bernardi et al, 2012, 6883). They went on to suggest the greatest potential improvements came from locations far from the equator, in winter months and on cloudier days.

Dan saw the potential to replicate Aidan's experiment using DIY solar panels and thereby further test the MIT research. Moreover, a solar tree was thought to hold the potential to engage people as a large public art installation. In September 2011, Dan presented the idea to the Sustainability Team of Bristol City Council. Supportive of the idea but unable to financially back it, the team were only able to assist by putting Dan in contact with local businesses that might be able to host the installation in the centre of the town (Int_30). Deflated by the team's response the idea was put on hold.

The launch of Demand Energy Equality

November 2011 - March 2012

In November 2011, the DIY workshops were launched as a grassroots initiative, under the name Demand Energy Equality (DEE). The initiative was led by Dan but included a growing band of trained facilitators who worked independently. Two objectives of the initiative were expressed:

> 1. "To reduce the cost of solar panels and enable low income households to gain access to empowering solar PV technology as there is a growing divergence between those who can afford renewable power [and those who cannot].
> 2. To utilise the potential these technologies offer in reducing household energy demand. Energy demand reduction is possible when people have a greater understanding and relationship with these technologies." (DEE, 2011)

Alongside the two stated objectives, Dan began elaborating the logic behind the initiative:

> "Solar Panels have the potential to be hugely educational. By building a panel in a workshop and learning how to manipulate circuits, power and energy are much more tangible concepts. Because the panels are not Feed-In-Tariff certified they **can't be used to generate money by exporting to the electricity grid**. This means people must learn how to connect the panels to their homes and use the power within their homes. The combined effect of making something and using it within your home means a far greater understanding and respect of energy is achieved, leading to reducing demand." (Emphasis in original. DEE, 2011)

Over the following 4 months, the initiative was pursued using a variety of means. A project was set up on the crowd-funding website peoplefund.it to generate funding to run further workshops. The project page explained the workshops and what the initiative sought to achieve. Potential supporters were asked to help remove the financial barrier to participation by low-income participants and a total of £25,000 was sought. The project was undersubscribed. Then, in December 2011, DECC announced LEAF grants (chapter 4). The grants provided an opportunity to expand the workshops, but rather than applying directly, DEE decided to support other local groups in their application. From a total of 10 LEAF grants awarded to groups in Bristol and the surrounding area, three groups included the DIY workshops: Bedminster Energy

Group, Windmill Hill City Farm and Sustainable Backwell. Four workshops were held between February and April for these groups, reaching a further 38 people recruited by the groups. At one of these workshops Dan was told about a local sculpture artist who had developed designs for a solar tree[24]. In the meantime various, additional grant applications were written by Dan and organisations that sought to partner with the initiative. They included an application to Lush to run a series of workshops at another city farm and a proposal to 'Awards for all' to fund the construction of a solar tree. Additional workshops were held during the spring where time and finances allowed. Dan gave a talk and demonstration to 40 people at University College London, a full workshop to 30 participants at the University of Loughborough and a workshop was set up with the Bristol University Sustainability Team. The Student Union Engagement Officer assisted Dan in vetting applicants, running the workshop and encouraging participants to go on to hold their own workshops with low-income individuals. During this period 7 workshops and talks were given in total, reaching a further 117 participants.

Experience from these workshops and feedback from participants made Dan question some of the basic elements of the initiative. Few participants were going on to construct their own off-grid PV system. Meanwhile, he estimated only 1 in 10 participants were going on to hold workshops of their own. The recycling of money, to buy more materials and tools, was therefore not happening but more importantly, the workshops weren't being replicated with skills and knowledge being shared with low-income earners. Instead, a church in south Bristol and a local food growing initiative amongst others approached Dan requesting he construct and install a system for them. Dan was opposed to the idea in principle, maintaining that people had to take the opportunity for themselves. In addition, Dan was realising how tricky it was to engage low-income individuals: in short, he could not rely on others to do this. Yet, his capacity to lead more workshops was limited, as was his capacity to find new ways of engaging low-income individuals. Consequently, in March 2012 he invited two individuals (the Engagement Officer from Bristol University and a community outreach worker from the city farm) who had been involved in the initiative over previous months to take a more active role in its development.

The construction of a solar tree

April 2012 - October 2012

By April 2012 DEE had coalesced around a core group of three activists, who together decided the direction of the initiative. Surrounding this core group, a growing number of workshop

[24] The idea for a solar tree sculpture had been independently developed in 2010 following the largest roof mounted solar PV array at Holsworthy Farm – the host of Glastonbury festival. Designs had been drawn up and funding sought from the festival to make the tree. Glastonbury festival had turned down the idea and so the designs had been shelved.

facilitators operated, drawn from previous participants. Wider community participants consisted of workshop participants. In April 2012 the core group set out to construct a solar tree using DIY solar workshops.

The solar tree would be designed and built by a local sculpture artist before the tree's leaves were assembled and connected onsite at a local food growing initiative, Edible Futures. Edible Futures had the space to site the 'tree' and run the workshops, they also had a potential use for the electrical output in an off-grid rain-fed irrigation system, to be designed and built at the same time. The local sculpture artist brought the knowledge and skills to construct the trunk and branches of the tree. Edible Futures arranged the irrigation system. These partners brought their own motivations and objectives to the project. To Edible Futures it provided an opportunity to link sustainable food and energy together (Int_14). To the artist the project provided an opportunity for visual communication, to create connections between nature and energy, to help "normalise" solar PV in the eyes of the public: "taking it from a should do thing, to a natural association" (In_15).

The tree was presented as an educational project: it aimed to further the community's understanding of energy and food systems thereby helping to build community resilience and self-sufficiency (DEE, 2012a). Core activists argued the scale of the climate change challenge required "not just a few solar panels but huge reductions in our consumption of energy and new respect for food" (DEE, 2012a), they suggested education was necessary to increase understanding and avoid potentially negative 'rebound effects' from financial savings generated and they argued that attempts to tackle climate change should also consider social equality in the process.

To fund the project, a second crowd-funding project was launched on Peoplefund.it in late April. The site, in partnership with British Gas and Energyshare had pledged to match fund the first five projects to reach £5,000. Within 6 weeks the project secured £5,145 from 105 backers and became one of two projects to receive match funding. These pledgers formed a second group of wider participants to the initiative, alongside workshop participants - shaping the direction of the initiative by providing funding or not. To receive match-funding DEE had to be legally constituted. Out of necessity and with little deliberation, DEE was incorporated as a CIC in July 2012. By June however, a funding shortfall began to emerge. The material cost of the tree had been underestimated, whilst sourcing a sufficient quantity of secondhand double-glazing units for the solar panel leaves, proved problematic. New units had to be brought in. A grant application to Lush's Charity pot (an international company with a philanthropic department) was submitted for £7,644.08 to run six workshops and six facilitator-training

workshops. The grant was secured in July 2012.

After funding, community engagement became the second major challenge. Basic advertising through existing contacts brought some interest from local individuals, who were asked to complete short application forms. These forms highlight education as the dominant motivation for taking part (13 out 20 responses), followed by a desire to replicate the project (6), and professional and social motivations (2 each). Of the educational motivations, nine explicitly stated learning about the technology, six stated learning new skills, four learning about the energy system, and two learning about the solar tree or sustainable energy. In short, individuals were coming to the workshops expecting to be educated. To engage low-income individuals a target list of 54 Bristol-based organisations was drawn up, including those working with young people and ethnic minorities, to those focusing on housing, the arts, local energy groups and community centres. Blanket emailing and phoning brought limited interest: each organisation was found to focus their activities on particular interest groups and to tailor their services accordingly. The offer of a discreet activity (the DIY workshops), fitted the interest and daily practices of some organisations, but not others. For example, initial contact with Bristol Refugee Rights was positive but the offer was declined because it was not possible to state in advance whether any services users would be in a position to participate on the day (Int_12). In another instance, activists were invited to engage *Bristol Drugs Project* users in person. The offer was taken up and a 30-minute talk and discussion resulted in 13 people participating in the following workshops.

To recruit workshop facilitators' previous participants were contacted. Three facilitator-training days were held in August in the run up to the tree workshops. 20 people participated in the training with nine going on to run at least one of the 15 tree workshops.

As the workshops approached one further issue arose. DEE activists planned on installing a 12-volt system whilst the architect of the rain-fed irrigation system had experience of commercial, mains-connected, 240-volt irrigation systems. The problem was matching electrical output with demand and for a while it looked like the tree would provide insufficient power (because of the concomitant loss of power through using a convertor). On closer inspection the proposed 240-volt irrigation system was over engineered for the site's needs and with help offered to source and install a specialist 12-volt pump from a sailing supplier, the architect conceded to the 12 volt system. In late August a two-day workshop was held by Edible Futures to install the irrigation system.

Construction of the UK's first community-built solar tree happened over the course of two

weeks in mid-September 2012. 15 workshops were held over three days with five groups running in parallel each day. 72 people had signed up, with 65 people participating. Of the 72, 45 came as interested individuals, the remaining 27 came from three local organisations: Bristol Drugs Project (13), Knowle West Media Centre (10) and Trinity (4). All participants were invited to the official 'switch on' event later that week and the site was opened to the public the following weekend. A documentary film of the tree was shot in the run up to, during and after the workshops by a local filmmaker[25]. Participant feedback was collected (box 7.1) and many gave short interviews for inclusion in the documentary.

[25] The documentary can be accessed here: http://www.demandenergyequality.org/solar-tree-short-film.html

Box 7.1: Solar tree participant feedback

Participants of the solar tree workshops were asked to fill out a simple paper feedback form at the end of the day. 24 responses were collected from 65 participants (representing over a 3rd of participants).

Section 1 ask respondents to rate the following statements

	Strongly disagree	Disagree	Agree	Strongly agree
I enjoyed the experience of the course	0	0	5	19
I was satisfied with the level of communication from DEE prior to the course	0	0	9	14
I was satisfied with the quality of teaching	0	0	4	20
I was satisfied with the facilities	0	0	11	13
I feel satisfied with my accomplishments today	0	0	6	18
I would participate again in the course	0	1	2	20

Section 2 asked a number of questions:

What did you enjoy most about the day?

Everything - people, learning, environment, food was brilliant too. | Great Atmosphere and the explaining of the solar panel and energy used. | Learning something new and lunch! | Learning to solder & seeing solar cell generate 19v | Lunch V tasty & learning |Making the panel | Just to see how they were built | Getting stuck in and helping create a solar panel | Lunch! and learning tech side | Great practical/hands on experience + learnt new stuff about physics! | Making a working panel | Food, people, place | Satisfaction of making a panel | Doing the panels and meeting new people | Learning new things and meeting new people | Being onsite, practical learning | Learning how to make a panel. The lunch. Tour of polytunnel | Final construction of the panels | Making solar panels | Friendly enthusiasm| Built something that I have never done or tried before | Lunch! | Learning about energy and injustices etc. | The people, the vibe

Are there any improvements you would suggest for future workshops?

Herb teas, healthy snacks. | More electricity to finish the panel. | It was very cold, maybe find an indoor venue, especially on rainy days | More shelter | Was very windy and cold, better shelter would help | Possibly more diagrams of how it all works, i.e. amps/volts/etc. or a handout. | More energy context stuff | Didn't know the day would be outside | Make sure equipment works/is available e.g. drill bit | Handout of step by step processes taken | Better power for soldering irons | Warm workshop (out of wind) | More power! | Need more power | Information about being outside

Further feedback and comments

Don't stop!!! | Fun event and very enjoyable | Love the food and cookies | Had a great day keep up the good work | Inspiring people and project | Thank you | It was a fun, constructive day out, Phil was a good teacher and our team was cool | To create small solar packs which you sell to individuals so we can make our own affordably! | Thanks for a good day and great lunch | Love the tree

	Yes	No
Would you recommend the day to others?	24	0

The project was deemed a success by DEE activists because: of the number of people participating (35 of which were suggested to come from low income backgrounds and/or community groups); written feedback was viewed as universally positive; video interviews were viewed as demonstrating the project's ability to generate awareness, interest and engagement in the content of the workshops; the project increased DEE's status within Bristol (for instance via

a BBC radio Bristol interview[26]) and nationally (via the website, figure 7.4); it had resulted in the successful production and use of energy onsite, with live data streaming of the tree's output to DEE's website[27]; and, they had successfully established a living experiment between the tree and a separate flat panel array and could begin monitoring the output from the two systems.

Figure 7.4: Web page views per week to the DEE's website, between January 2012 and January 2013

Visioning and moving forwards

October 2012 onwards

In the following months a few workshops were undertaken but the majority of time was dedicated to tying up loose ends of the solar tree, reflecting on the initiative thus far and the development of a revised strategy moving forwards. A visioning day was held in late October 2012 and business plan (2013-2015) was written over the following months.

At the visioning day activists reflected on achievements to date - approximately 400 people had participated through 25 workshops and talks and a functioning off-grid solar PV system had been installed - but they were also mindful of the need to continue developing and improving the workshops. Concern lay with what was felt to be the educational side of the project, educating people about the need for demand reduction compared to the deployment of solar panels. It was agreed that 'putting people first' was a priority but that engagement was the hardest part. Moreover, working with individuals through the workshops was perceived as being too 'transient' to achieve 'real change'. In turn, this led to the suggestion of working with a single community to help them engage with energy and solar PV in a completely different way. Meanwhile, the presentation to and subsequent involvement of Bristol Drugs Project participants was praised and viewed as a potential template for more engaged partnership working in the future (DEE, 2012b).

[26] A recording of the interview can be heard at http://www.demandenergyequality.org/solar-tree-explained.html

[27] http://www.demandenergyequality.org/solar-tree-output.html

To further consolidate DEE an updated DIY solar panel handbook was created in December 2012, again posted online free to download. The first version of the handbook had been downloaded 503 times before being replaced. The second version was accompanied by an online video tutorial[28]. Since then the updated handbook has been downloaded 359 times and the complete set of 16 videos (split into 15 steps, plus welcome and introduction) has been watched 4796 times in total[29].

By January 2013 DEE's first business plan had been written, signposting a range of adaptations to the initiative moving forwards (DEE, 2013):

1. Free workshops to low-income households would be paid for through a paying workshop series.
2. A specific week long training course for facilitators would be developed, covering (a) in-depth training in the social, political, and economic context of the initiative and its mission, values and aims, (b) practical skills and understanding to construct the panels and assemble a 12volt off-grid system, and (c) the confidence and ability to teach others.
3. A national network of 'workshop leaders' would be set up to extend and support workshop facilitators.
4. To extend the scope and reach of the initiative a new work stream would be developed that would explore open-source smart metering as a new avenue to increase decentralised and cooperative community control over energy use.
5. And finally, the initiative sought to develop its national profile and influence, in order to potentially challenge dominant narratives around energy.

In summary, the narrative describes the emergence and development of a grassroots initiative that, at least initially, sought to locally embed solar PV. Intermediation by activists is observable here, between the material technology and potential end users. The focal technology taking a particular form (self-made), distinct from the commercially produced and installed solar PV systems being deployed in increasing numbers nationally. How the initiative changed over time is also a key feature of the narrative, the extent to which the case study remains an attempt by community activists to embed PV locally being a salient point for the following analysis. In the second half of the chapter I address this issue first because of the way it influences the following discussion. I then analyse the case against key intermediary process and in accordance with the

[28] The tutorial can be viewed at www.demandenergyequality.org
[29] 4796 is the accumulative number of viewings for the 16 videos from 22.12.2012 to 22.05.2014 (approximately 17 months).

research protocol (chapter 3).

7.2 Analysis of key intermediary processes within the case

From the initiative's emergence to the writing of a business plan 18 months later the aims of the initiative changed. I approach the case study as a 'polar' case of a community-led attempt to locally embed solar PV, but the change is such that I have to address, explicitly, whether the case is still appropriate to the research study. I shall be upfront here and claim that it is: in fact the shift in focus reveals limitations and challenges in the initiative's facilitating, configuring and brokering activity and relationships between these key processes. I am jumping forwards here because I have not yet analysed the case against the research protocol yet this shift is crucial to understanding the case and critical to intermediary processes. Before analysing the case against intermediary processes I first identify and explain this shift.

Three phases of case development can be analytically distinguished. Analytical because I distinguish turning points in the case whilst in practice these changes unfolded gradually over time. Nonetheless, from early experimentation to the launch of the initiative the focus was on spreading the knowledge and skills to construct DIY panels as a means to reduce cost and thereby increase access to the technology. Between November 2011 and April 2012 less emphasis was placed on removing financial barriers and increased emphasis was given to placing, interpreting and integrating PV within the lives of workshop participants. Finally, within the solar tree project the initiative's focus shifted firmly towards using the workshops as a means of material engagement with the technology: the workshops sought to question participants' existing relationship with the technology and their relationship to energy supply and use. This shift was consolidated through the visioning day and business plan in late 2012. The activists' strategy - the use of workshops - stayed the same throughout. It was the aim of the initiative that changed and with this implications for local embedding of PV. Table 7.2 summarises the changes in workshop aims, logic and outcomes.

Table 7.2: Workshop aims, logic and outcomes over time

	Workshop aim(s)	**Logic**	**Outcomes**
1	*Lower financial barrier to technology*	Diffusion of knowledge and skills for off-grid PV systems; Workshop replication	Interest; Little replication (1/10); Financial unsustainability; Activist realisation of workshop potential to challenge relationships
2	*Lower financial barrier to technology,* *Use material engagement to increase understanding of technology and energy use*	Diffusion of knowledge and skills; Workshop replication; Some direct targeting of low-income demographics	Positive feedback; Increased publicity; Potential facilitators required support; Increased core group of activists;
3	*Use material engagement to increase understanding of technology and energy use*	Direct targeting of low-income demographics, Engage through art; Support potential facilitators through discreet training & multiple simultaneous workshops; Demonstrate PV in local context	Demonstration of DIY PV; Increased publicity; Recognition that users are diverse;

Three salient points can be made about this. The first and obvious point, is the initiative's aims changed over time. In the following I suggest this is because of internal learning by activists about the workshops rather than the activists agency being affected by context dynamics. Conceptually this points towards a re-configuration of the initiative over time. Second, internal path dependency can be observed. The workshops were positively received. They attracted the attention of the public (at festivals during 2011), community groups (e.g. the number of LEAF commissioned workshops), university students (at Bristol, UCL and Loughborough) and local media (Bristol Post, 2012a: 2012b). This interest brought momentum to the initiative and I suggest, in part explains why the workshops were continued despite the difficulty in achieving their initial aim, the material embedding of self-made PV systems. Third, there is a change in the form of local embedding being sought. That is to say the initiative moves away from seeking to embed the *material object* towards seeking to support the *immaterial embedding* of PV. Specifically, the latter workshops make the technology accessible to a wider range of potential end-users, they place the technology and give it meaning within the local context. This suggests a more indirect route to local embedding that tackles less tangible elements of embedding processes.

I will substantiate these points in the following analysis.

Facilitating

Stewart and Hyysalo (2008) suggest the process of facilitation involves the creation of spaces that provide opportunities to others. Here, core activists provide an opportunity to individuals to materially engage with Solar PV through designing and carrying out DIY workshops. These workshops are the primary form of facilitation activity within the case, with handbooks and online tutorials providing secondary, supportive forms. The workshops started early on in the initiative (May 2011) and continued throughout, totalling 25 workshops over 18 months. Furthermore, the basic form and content of the workshops stayed the same over this period. In line with the research protocol I start by analysing the form and content of the workshops as the initiative's primary facilitating activity. Next I analyse why activists go about facilitating the embedding of PV in this way before discussing the facilitation envisaged and what restricted this envisaged facilitation being achieved.

The workshops created a physical space in which individuals could find out about the technology, the construction of the solar tree extending this space to a demonstration of the technology in the local context. Activists provided the tools and materials through which participants could experiment with and learn about PV and they provided the skills and knowhow to construct a panel. Beyond this, workshops served to transfer and disseminate knowledge. This is supported by participant motivations to attend solar tree workshops and learning featuring highly on feedback forms (box 7.1). The dominance of learning outcomes in this feedback suggests workshops were effective in this regard. Outside of the workshops, knowledge and know-how was further disseminated through the DIY handbooks and accompanying online tutorial guides. Again the high number of downloads (503 and 359 respectively) and views (4796 cumulative) suggest interest in the technology and DIY approach but not how effective they are.

The initiative did not seek to create new communities or networks around the technology, provide funds or create local rules about its adoption and use. The workshops principally transferred knowledge about a particular form of PV within a discreet event. To phrase this differently, the workshops introduced potential end-users to the technological artefact and imparted the knowledge and skills with which, it was hoped, they could become engineers and users through the construction of off-grid DIY solar systems.

Two principal reasons explain why workshops were used in an attempt to facilitate the material embedding of PV. First, the core activist, through experimentation, had found a means to easily and cheaply construct PV panels. Second, high upfront cost and a lack of knowledge were

thought to be the primary barriers preventing access to and use of the technology. These two, basic reasons explain why DIY workshops were thought to provide an opportunity to others to locally embed PV. Particular, pragmatic reasons further explain the approach subsequently taken. For example a skills sharing and open source approach were initially attempted because of the limited capacity of the single activist.

To further understand why workshops were used I now explain how this facilitation activity was envisaged and the reasons why it did not result in the local material embedding of PV. The initial logic is simple and only needs to be briefly restated. If cost was the principal barrier, workshops provided the knowledge and skills for participants to construct their own PV panels at a substantially reduced price. Replication of workshops would spread this knowledge further. Over 18 months numerous workshops were undertaken, even if the replication strategy failed. So the interesting question in this case is not what restricts the implementation of envisaged facilitation activities (following the research protocol, page 66) but ***why the workshops did not result in the material embedding of PV?*** I identify a range of reasons why workshops failed to embed PV. These reasons provide insights into the requirements and limitations of community facilitation activity.

First, through workshops activists' capacity to support local embedding was limited. For local embedding to occur, activists were reliant upon subsequent participant actions, over which they had no control. Under the initial replication strategy core activists were a further step removed from the potentially embedded technology because of the additional reliance on potential facilitators running workshops (figure 7.5). From the start therefore, the core activist and later the initiative, had limited agency to direct the local embedding of PV by end-users because they only engaged through workshops.

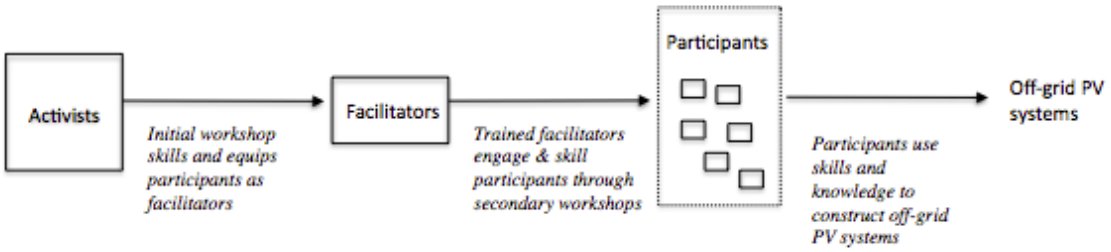

Figure 7.5: Flow diagram of DIY workshop replication model

Second, reasons why workshops were not being replicated suggest a variety of requirements for facilitation via workshops to take place. The workshops were designed to convey knowledge of energy and electricity in particular, and the skills and knowhow to construct PV panels. The

replication model also sought to provide materials and tools. But beyond this, potential facilitators required a physical space to hold the workshops and moreover, they required the confidence to teach others. Feedback from a workshop participant in 2011 highlights this point clearly:

> "I have to admit still feeling unsure of my basic physics skills enough to run a workshop and to be able to answer all questions. Our intention is, therefore, to hold a preliminary workshop with [friends] (who would both be able to understand the basic principles while standing on their heads), so we can teach them how to do the construction bit. Then we intend to perhaps run a bigger workshop. Failing that, we are holding our annual local sustainability fair next May and thought of preparing one quarter-, one half-, one three quarter- and one completed- panel for guidance and then to use them to hold a workshop in a back room to teach all the skills we learned from you." (Personal feedback from a workshop participant in July 2011)

That potential facilitators lacked confidence was recognised by activists over time and steps were taken to remedy the situation. For example under the solar tree project dedicated facilitator training was provided and the workshops were designed for inexperienced facilitators to practice facilitation and build confidence. That potential facilitators required the confidence was initially overlooked and explains in part why early workshops did not replicate and result in material embedding. A second, implicit assumption about workshop replication was potential facilitators' ability to engage and recruit workshop participants. The conceptual framework does not stipulate any requirements for creating facilitation activities. On the basis of this case and for this particular form of facilitation activity four aspects can be identified as being important: (i) physical materials, tools and space, (ii) knowledge and knowhow, (iii) teaching and engagement skills and techniques, and (iv) confidence. Beyond this particular form of facilitation the broader point is that effective intermediation requires people with the confidence and skills to facilitate.

Engagement provides an entry point to a third reason: during the period studied, activists' had only a loose idea of the 'community' they were trying to influence. It was only over time and by the end of the period studied that an understanding of this community, still loosely formulated, began to emerge. Indeed, when interviewing activists (approximately 6 months after the completion of the solar tree) who the target audience was remained a point of contention. In this sense the case narrative is in part a story of how core activists learnt about whom they wanted to engage. The point being that without understanding the target audience activists could not know what participant motivations might be or what restricted their agency to embed PV. This is further reflected in activists' explanation of why participants did not go on to construct their own PV systems. One activist suggested workshop participants lacked resources, including the financial means to buy materials (despite reduced cost), time to construct the panels and system or the physical space in which to site it (Int_12). Another suggested participants lacked the motivation to make the most of knowledge gained (Int_11). In short, the initiative failed to

achieve local embedding because of assumptions and generalisations about who they were targeting and a lack of knowledge about their target audience.

Fourth, activists misunderstood what workshops provided. To the core activist workshops were conceived as the first stage of a longer participant journey with the technology: once participants understood 'the hard part' of constructing a panel, the assumption was they would be able to take this learning and build a functioning PV system for themselves. The initial core activist explained,

> "We are not trying to get people to make, in any one workshop, 500 Ws of panel. People need to take that initiative themselves… They could, with those skills, go out and make all the panels… For me, making the panel is the hard bit. After that you've just got to connect it to a charge control and then to a battery. It may sound difficult but its not…[because] there is loads of products that you can buy, in car stuff, 12v light, phone chargers, laptop charges. It has been fascinating to see that my assumption, that people would get that really quickly has been misplaced…So that has definitely been a failing of the project. A failing on my part. but I do still struggle to see why its tricky." (Int_11)

Consequently, increased knowledge of electricity and about the electricity system, combined with skills and knowhow to construct a PV panel were insufficient to lead to participants installing the technology. In turn, this suggests that workshops alone were insufficient to lead to material embedding and further follow-up activities were required.

Finally, the particular socio-technical configuration promoted by activists (DIY and off-grid) was removed from the existing configuration workshop participations were used too. The construction of DIY off-grid PV systems required being directly linked to a suitable demand source and one that used direct current (c.f. alternating). This was not what people were used to and had in their household (see comment above about buying in car equipment). In that sense the construction of DIY PV systems did not help to meet people's existing energy needs but required them to buy new equipment and change daily practices. Thus the particular configuration of the technology was more challenging to embed than initially suspected and provides a further reason for the lack of material embedding in this case.

I draw the following conclusions about facilitation within the case study. First, workshops as spaces of knowledge transfer formed the primary means of facilitating local embedding within the case. Activist facilitation activity therefore began early in the initiative and remained relatively stable throughout the period studied. Second, the envisaged facilitation was premised on reducing cost as the principal barrier to local embedding but a variety of reasons explain why workshops failed to result in the materially embedded PV systems. The workshops gave activists limited agency to intermediate for local embedding, they required further follow-up activity. In short the transfer of knowledge and skills was insufficient to lead to the material

embedding of PV. The challenge of replicating workshops demonstrated a number of pre-requisites for community intermediation particularly around the art of facilitation, which required people with the confidence and skills (alongside various material aspects) to be facilitators.

Through this discussion I have explained why workshops did not result in the local embedding of PV. In the following section on activists configuring activity I explain why the initiative changed over time and the consequence this had on the initiative's facilitating activity.

Configuring

According to Stewart and Hyysalo (2008) configuring is a key intermediary process that involves the design of projects, the arrangement of technologies in local contexts of use and the situating of users and producers. Since I have already covered the basic design of the project I use this section to explain how changes in the project design occurred before discussing the multi-faceted interpretation of the technology.

Configuring the initiative, workshops and solar tree

In short, the initiative is designed around the organisation of DIY solar PV workshops, which stayed relatively stable through the period studied. Workshop design does not, therefore, help explain the shift in the initiative's focus over time (recall table 7.2). Instead, this shift suggests changes in how the overall project was configured, which as I have already suggested were precipitated by internal learning. To explain this change I explore and analyse influences on the design of the initiative.

At the outset a variety of influences were brought to the design of the workshops and initiative. Here, knowledge of current PV deployment rates based on the FiT (figure 7.1) suggested lower-income earners were not only missing out on the benefits of solar PV use but were also being negatively impacted by current deployment patterns. Second, knowledge of future renewable energy scenarios (which the core activist was researching) suggested the pursuit of PV, alongside other renewable technologies, would not produce sufficient electricity for future societal needs: in turn, this suggested reducing demand for energy would also be important. Third, this combination amounted to distrust of existing energy actors (utilities, government and regulators) and supported the critical engagement of current PV deployment and use. Over time, one of the most important aspects of the workshops was the perceived need to engage participants in changes to the energy system, changes that were perceived as necessary and perhaps already underway. Together these influences suggest a detailed technical and policy

knowledge of the context of PV embedding (but less knowledge of the target community), which on the one hand supported the increased deployment of renewable energy generation technologies (to deal with climate change) and yet, was highly critical of current approaches on the other. These influences can all be characterised as broad trends within the external environment. They relate to long-term changes rather than specific events or programmes within the local system or external environment. They do not provide a reason for why activists shifted the focus of the initiative.

Instead I suggest learning by activists explain why the initiative was reconfigured. Recalling table 7.2 three phases of the initiative's development can be analytically distinguished. In each case the outcomes of previous activity impacted how activists conceived and configured the initiative moving forwards. Such learning can be demonstrated on a number of levels. For example, early workshops revealed how potential workshop facilitators required additional support and dedicated training, which was subsequently undertaken in the solar tree project. This suggests activists learnt about the workshops and what was required to replicate them. Alternatively, early workshops demonstrated to the core activist a potential to challenge existing participant relationship with the technology and, more generally, energy. This aspect was used to re-configure the purpose of the workshops. In the absence of context changes, activist learning explains the re-configuring of the initiative.

A basic feedback loop can therefore be identified between the outcomes of workshops and the focus of the initiative. Workshops, the activists' primary facilitating activity, resulted in learning by activists (and hopefully participants). This learning, about the workshops and participants, resulted in the reconfiguring of the initiative, which was then applied to future workshops. Figure 7.6 depicts this learning feedback between workshops and changes in the configuring of the initiative.

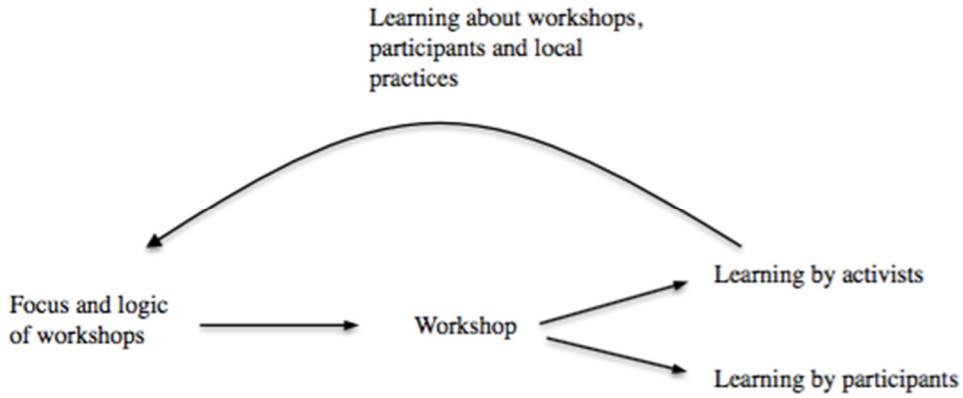

Figure 7.6: Reconfiguring of the initiative as the result of learning by activists about the workshops

Beyond workshop design activists had to configure the design and installation of the solar tree. Stewart and Hyysalo (2008) suggest this form of configuring can be thought of as 'minor' - it involved decisions about the particular technological set up, its purpose and use. In this case, the seemingly simple task of configuring the PV system to its intended use (the irrigation system) required significant work. In fact, the irrigation system had to be configured to the particular off-grid, 12-volt PV system. The challenge involved, reinforces the earlier point about their desired socio-technical configuration being removed from existing technical and social arrangements.

Interpreting the technology and presenting it to others

Activists interpret and present the technology in multiple and potentially conflicting ways. I identify four ways before analysing what this means. First, PV is viewed as useful for generating renewable energy to move society on to a low carbon pathway. Second, PV is interpreted as having limited technological capacity to deliver large quantities of renewable electricity within the UK in the future. Third, DIY PV is thought to hold the potential to reduce household vulnerability to electricity price rises because, fourth, it is interpreted as being able to facilitate a greater understanding of energy demand and use. Within the workshops activists introduce participants to each of these interpretations.

Activists did recognise the tension within these interpretations. For example, in November 2011 promotional material announced "SOLAR PANELS ARE NOT A SOLUTION" going on to say, "this might sound mad coming from a project that is encouraging people to buy solar panels" (DEE, 2011). Multiple interpretations resulted in confused potential outcomes from the workshop. The following quote from an interview with a core activist in March 2013 highlights this tension:

> "always the question comes up at the end of the day, so you've got your panel what can I do with it? And the answer is usually absolutely nothing until you build at least another two and link them up in series you're not going anywhere. [But] that's the interesting point, because then it becomes a bit clearer that the workshop was not primarily about the solar panel - it's a useful skill, its an interesting skill and it's a bit of fun but for most people it will remain just a bit of fun - even though it is about lowering barriers to access and it does theoretical definitely have that potential" (Int_12)

So rather than promoting a particular interpretation and vision of a technological future as would be expected of intermediaries by Hodson and Marvin (2009), the workshops opened up a space in which participants could engage critically with the material object. Here multiple presentations of the technology are beneficial because they can be explored and debated. This points towards a key aspect of DIY workshops. Rather than configuring being a process of

alignment as suggested by Stewart and Hyysalo (2008), here intermediation via workshops seeks to dealign existing relationships between participants and the technology, between energy production and consumption. It is in this sense that workshops challenge participant understanding of the technology. They challenge participants' technical understanding about how energy is generated and converted into useful power; they challenge the symbolic meaning of the technology as a technological fix and emblem of the green middle classes and the cognitive understanding of energy use and demand. Withdrawing from seeking the material embedding of the technology, activists instead seek to de-align or de-configure existing relationships. It is in this sense that the initiative is still a case of local embedding: activists attempt to break pre-existing relationships even if they do not seek to establish new ones. Multiple presentations of the technology aid this process.

'Deconstructing obsolete networks' is highlighted as important to embedding by Van Lente et al (2003) although they do not go into any detail. More broadly, that creating new socio-technical systems requires 'creative destruction' (Schumpter, 1942/1993) is widely appreciated but has received little attention until recently[30] The important point is that the need for dealignment does not feature within Stewart and Hyysalo's (2008) current conception of configuring, whilst the case suggests that community intermediation for local embedding can be more about this process of dealignment than active configuring of new technologies and systems.

In summary I conclude that activists' principal configuring occurred in the design of workshops and more broadly, the overall initiative. On this basis I analytically identify four main periods where activists configured the initiative. Workshops were configured in May 2011 with the principal aim to increase access to the technology. A second period of configuring can be identified around the launch of the initiative in November 2011, which built on experience and contained an additional aim. The initiative was further altered in the design of the solar tree project towards education and engagement, with this re-configuring process being consolidated through reflection and strategy writing in a fourth period of configuring during the winter 2012.

Second, I conclude activists configuring became increasingly focused on de-aligning existing relationships between participants and the technology than it was about creating new alignments. This is in part explained by activists' limited capacity to materially embed PV locally. Third, I conclude that internal learning by activists explain why the initiative was re-configured rather than particular influences from the local system or external environment.

[30] In the last few years the destabilisation of existing regimes has started to receive more attention: for example Turnheim and Geels (2012) have explored the destabilisation of the British coal industry but less attention has been directed towards the dealignment of socio-technical configurations at local scales.

Based on broad trends within the external environment (climate change, the extent and pattern of PV deployment through FiTs) the agency of activists to achieve their original aim was not directly affected by external events or programmes.

Brokering

The third and final key intermediary activity Stewart and Hyysalo identify is one in which the intermediary acts to raise support for the local embedding of technology through representing local users, mobilising resources and negotiating the use of the technology and project between a variety of actors within the local context (Stewart and Hyysalo, 2008). Again, DEE does not appear to follow Stewart and Hyysalo's (2008) conception of brokering. Core activists do not attempt to represent users during the development of the initiative; meanwhile the solar tree project is the only point in which activists negotiate the use of the technology with local actors. However, the initiative still has to be negotiated with stakeholders and there are continual attempts to mobilise financial resources during the period studied. In the following section I briefly explore this aspects in accordance with the research protocol.

First, activists do not negotiate with the types of stakeholders that are suggested within the conceptual framework, such as local installers, manufacturers or the local authority. In fact installers are actively rebuffed during the development of the initiative whilst negotiation with the local authority is limited to seeking resources to develop the solar tree (October 2011). Instead, a variety of less obvious stakeholders are key to negotiating the initiative. In order for workshops to take place commercial and informal relationships with equipment manufacturers and suppliers were developed. These relationships provide materials (damaged PV cells, batteries etc) for the workshops without which they could not function. These relationships are either commercial (the purchase of damaged cells) or informal and did not involve the negotiation of the project itself. Beyond this, the project is negotiated with a range of informal and third sector organisations, such as community groups, activist networks and charities providing services to low income participants. Again the workshops and initiative is not negotiated as such, but rather presented to these organisations as potentially interesting for their members or users (for example the presentation of workshops to local community energy groups under LEAF). Later learning by core activists during the solar tree project suggested that to be more effective they had to work more closely with particular organisations. The implication being, that negotiation of the project with particular stakeholders was needed.

Next, the solar tree project involved the negotiation of partners, yet this process was relatively smooth. Each partner had distinct aims and ambitions for the project, which came together

without much difficulty. The only complication being the alignment of the solar tree's electrical output with the input needs of irrigation system.

It is in this sense that the clearest negotiation of the project with stakeholders involved the negotiation and mobilisation of financial resources. Two different sources are mobilised. First, from the external environment via national grant providing bodies (UnLtd, Lush and LEAF). Second, from local members of the community through crowd-sourcing. Both sources required multiple, repeated attempts to negotiate funding. Early rejections suggested changes to latter attempts. But for grant applications activists reflected that in most cases it is more about if the application fits the grant criteria than a reflection on the project itself (Int_2, Int_4). In relation to crowd-funding supporters voted with their feet and it is not possible to say why the solar tree project was successful whilst the original crowd funding attempt was not, from data collected.

From this I conclude that activists brokering activity primarily consisted of the negotiation and mobilisation of financial resources in order to undertake workshops. The search and brokering of capital support was a continual challenge for the initiative. Moreover, brokering was primarily undertaken in the support of creating facilitation spaces rather than negotiating the material embedding of the technology into and within the local context of use. The case therefore demonstrates how brokering is an important process even when undertaking the relatively simple and discreet facilitation activities (workshops).

Summary conclusions about the case study

To conclude the chapter I summarise the case study and key community intermediary processes drawing general conclusions about the case and community intermediation for local embedding. I then construct the pattern that has emerged from EEG's attempt to embed SWI in terms of levels of analysis and key intermediary processes.

The case study traces the emergence and development of a group of activists that use DIY solar PV panel workshops to critically engage participants with the technology and its use. Approximately 400 people participated in the workshops over 18 months, 65 of which constructed a solar tree with 36 solar panel 'leaves', forming a demonstration of the technology in a local context of use. These workshops were the activists' principal facilitating activity but despite the number of workshops held a variety of reasons explain why they did not lead to the material embedding of PV as originally hoped; activists had little capacity to direct material embedding because increased knowledge and skills alone proved insufficient to support the material deployment of PV without further follow up activities. The workshops themselves

demonstrated how community intermediation requires people with the confidence and skills to facilitate.

The initiative, originally conceived with the aim of increasing access to the technology, was later reconfigured towards being a means to critically engage with the technology and participant understanding of energy generation and use. I demonstrated that this was the result of internal learning by activists and further inferred a basic feedback loop between activist facilitation activity (the workshops) and the reconfiguration of the initiative. This shift suggests community intermediation can be reconfigured over time and that learning plays an important role. Furthermore, the case suggests the community-based intermediary process of configuration, can be as much about de-alignment of existing relations as it is about configuring new alignments between technologies and end-users. The case therefore challenges the conceptual framework to broaden the conception of embedding and include further immaterial aspects. Activists' retreat from seeking the material embedding of PV does not, in this case, mean they withdrew from attempting to embed PV completely, rather they learnt about the limitations of their approach and instead focused on its perceived strengths. Momentum, I suggested significantly contributed to the continuation of the approach in the face of clear weaknesses. The reconfiguration of the initiative and their ambitions thereby covering over what was otherwise a failed strategy.

Finally, activists brokering activity (principally about mobilising financial resources) was undertaken in support of creating facilitation spaces. Activists do not attempt to represent end-users, establish actor networks or seek to negotiate the entry of the technology into the local context of use beyond the demonstration of the technology within the solar tree. Resources are negotiated against national grant bodies and local community supporters, both of which influence the initiative but do not directly have a say in its shape or design.

From this I conclude that the initiative was premised on undertaking a facilitating role, in both its original and reconfigured forms, because the extent of configuring and brokering activity undertaken, was done in support of facilitating activity. How the initiative was reconfigured suggests a basic relationship between key intermediary processes: activists learnt about intermediation and in particular facilitation, through holding workshops; experience suggested the re-configuring of facilitation activity and the purpose of the initiative; subsequent workshops built upon this experience. My explanation of the case therefore draws on the changing focus of the workshops and learning by core activists. In this case community intermediation takes a simple idea and through experimentation and learning create an initiative that challenges existing community relations with the technology and energy generation and use. The initiative

seeks to support local embedding by upsetting and dealigning existing connections even if it does not and cannot create new connections.

Construction of intermediary process patterns

DEE as an initiative emerged through experimentation of the core activists with solar PV. Three periods of development are identifiable, each involving periods of facilitating, configuring and brokering. In the firsts period, Dan configured the DIY workshops under a replication model and brokered financial resources via a grant. The period ended with further configuring of the workshops as a distinct grassroots initiative and some adaptations to what they sought to achieve. The second period is dominated by workshops undertaken with resources brokered from LEAF awards. The third period is defined by the construction of a solar tree. Prior attempts to design the project had previously been undertaken alongside failed attempted to broker resources (against the local authority and a grant making body). In April 2012 the tree was thought possible after a partnership was negotiated between DEE, Edible futures and a local sculpture artist. Resources were then brokered via crowd-sourcing, match funding and a grant, while minor configuring of the 'tree' into the local context occurred. Multiple workshops and open events facilitated access to the technology in its context of use. The case study ends with further configuring about the future purpose of the initiative and the writing of a business strategy (figure 7.7).

Finally my explanation of the case demonstrated that the initiative was premised on broad trends within the external environment rather than particular events or programmes within either the local system or external environment. However, context dynamics do affect the agency of the community intermediary. On the one hand, these broad trends exert pressure on the initiative to take a particular route, critical of government supported market mechanisms and commercially produced and installed PV systems. On the other hand, and despite the limited integration of the initiative within the local system particular local and community dynamics influence project development. Table 7.3 summarises the influence of these context dynamics on how the initiative developed.

Table 7.3: Summary influences on the development of DEE's DIY solar workshops

Level of analysis	**Summary influences on project development**
External environment	Introduction of the FiT scheme and take-up of PV catalysed initiative, Research on FiTs suggested inequality of access to technology, Government targets suggested need to stimulate demand reduction and expectations about future development trajectories, Emergence of crowd funding platforms provide means to gather financial resources, Distrust of energy actors influenced initiative aim and approach
Local system	Physical geography restricted space to install DIY approaches, Green milieu brought momentum to initiative Interested stakeholders brought opportunities to partner with initiative,
Community	Low knowledge levels negatively impacted potential of workshops to materially embed PV, A lack of confidence from potential facilitators limited the replication of workshops

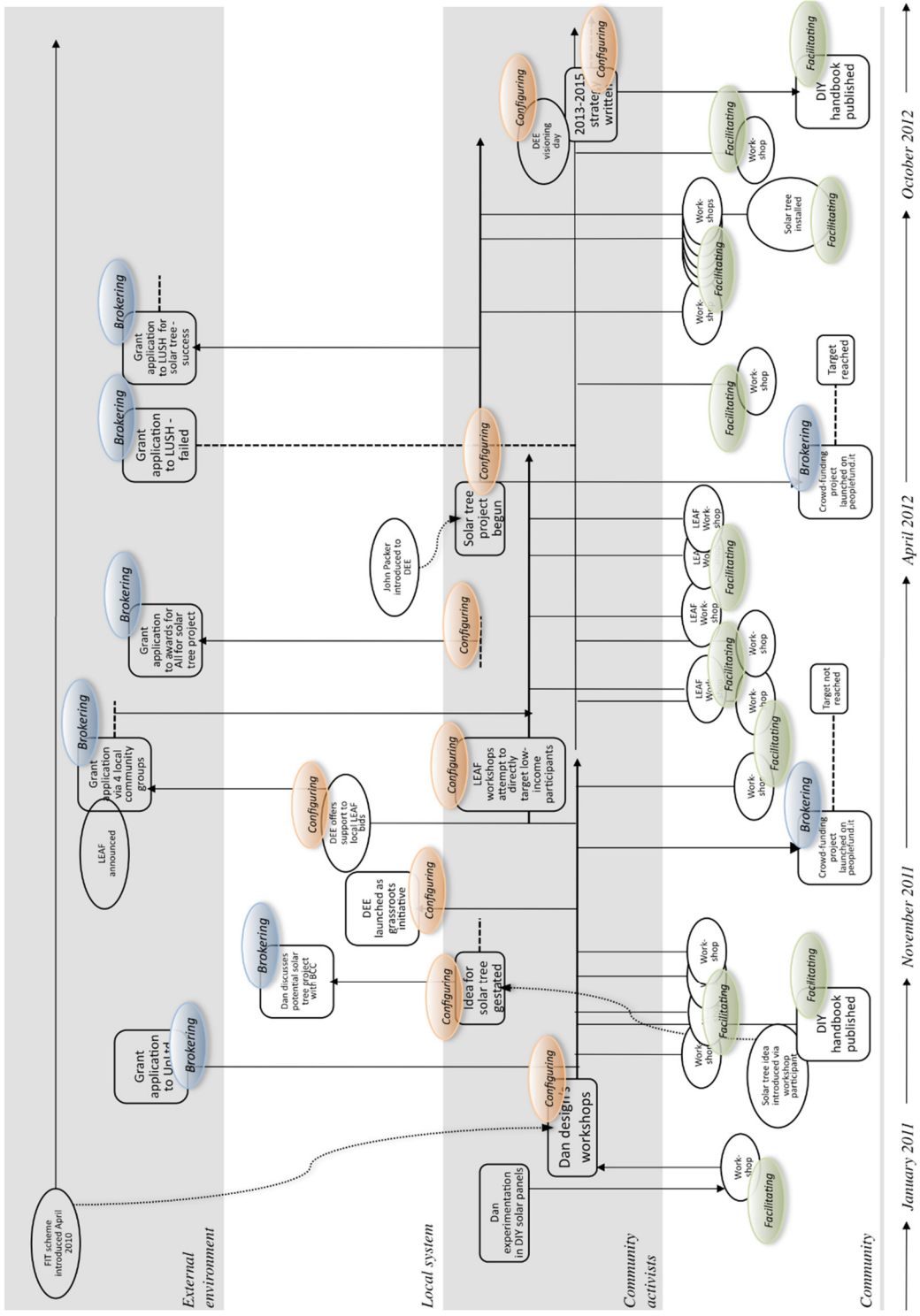

Figure 7.7: Visual map of DEE's DIY solar PV project with key intermediary processes indicated

Chapter 8
Bristol Power's 'Streets of Solar'

8.1 Case narrative

The idea behind Bristol Power, for community owned and operated renewable energy installations was first advanced in October 2009 in a proposal by a single charismatic individual, David Saunders. It was developed in response to a Bristol City Council-backed peak oil report (Osborn, 2009) and presented to the Bristol Green Capital Partnership, a collaboration of public, private and voluntary sector organisations seeking to make Bristol a 'green capital'. The proposal presented a high-level vision suggesting there was an 'historic opportunity' to move towards community-owned and operated energy infrastructure and it argued for a "co-ordinated and locally-integrated approach" (BP, 2009). The partnership did not endorse the proposal. Instead, the basic idea was maintained and nurtured over the following year within a collection of Sustainability projects under a new initiative, Zero Carbon Bristol (ZCB), led by David before being pursued as a distinct initiative.

At the time there were an estimated 19 solar PV installations within the city, half of which had been installed at a community self-build site in 2006 (AVAG, 2014; RegenSW, 2006). By June 2010 this had risen to 90 installations (190 kWp) (RegenSW, 2010). The local deployment of PV was not progressing quickly. But the idea for community-led renewable energy installations was not new either. A report, by CSE (Smith, 2009) had recommended the City Council become a partner in developing a local Energy Service Company and in February 2010 the Council adopted its first *Climate Change and Energy Security Framework* (2010-2011) which included support for community action on climate change and the aim to increase renewable energy generation (BCC, 2010). As community renewables picked up local interest, the national Feed-in Tariff scheme was introduced leading to the accelerated deployment of PV nationally and locally (figure 4.3 page 76).

It was within this context that Bristol Power (BP) was conceived and developed by an evolving group of activists. David Saunders, a consultant at Connolly and Callaghan (a Bristol-based construction and social housing provider), sat at the heart of the project. David was strongly influenced by involvement in the computer revolution during his early career. A colleague, specialising in accountancy, at Connolloy and Callaghan, provided further continuity to the

initiative whilst additional retired accountants, project managers, energy consultants and media specialists joined and left the initiative over time. Between 2009 and May 2011 BP was pursued under ZCB before a discreet initiative was launched. From June 2011 the initiative coalesced around the idea of installing 'streets of solar' under a 'free' solar model based on the negotiation of commercially backed loans. A subsequent pilot project aimed to install PV systems on 300 households during 2012. 13 PV systems were installed. In addition a 20 kWp demonstration array was installed on a community building in December 2011.

In the following narrative I trace the development of the BP. Central to the story is the development and negotiation of the free solar model with local stakeholders and the target community. Local and external context dynamics support and hinder community intermediation over time. I concentrate on the actions of core activists within this dynamic context to explain how they seek to locally embed PV.

Idea development

April 2010 - May 2011

From the initial rejection of the visionary proposal in 2009, the basic idea for community renewables was carried by ZCB. ZCB was set up by David under Connolly and Callaghan in April 2010, to "question, co-ordinate and catalyse new projects" by "helping multiple diverse stakeholder groups recognise a common purpose and vision" (ZCB, 2010). Through network events, David sought to bring together diverse local stakeholders to develop shared projects, such as community renewables. In June 2010 he wrote a small grant application seeking funding to pursue three project areas: renewables, food and leadership. Support was again declined. But by the end of the year David had assembled a group of five activists to develop the idea behind BP. During this time BP consisted of a call for leadership on community renewables and was presented to a broad collection of local city stakeholders. Through the original proposal and subsequent actions of ZCB, David sought to influence this collection of stakeholders, facilitating the creation of a new project and negotiating resources behind it.

Meanwhile in 2010 but with different origins, a group of grassroots activists coalesced under the banner *Bristol Energy Cooperative* (BEC) with the idea of developing a community renewables initiative. By late 2010 and having learnt of each other, the emerging groups (around BEC and BP) discussed the potential amalgamation of their nascent initiatives. Both were focusing on solar PV but key differences emerged. BEC activists were motivated by the new financial viability of installing PV under the FiT scheme, were exploring community buildings as potential hosts and a community share offer to finance them (Int_21). In contrast, David saw the

FiT as supporting the large-scale deployment of PV and suggested a community share offer would be insufficient and otherwise unnecessary to finance installations because, he suggested, the large-scale deployment of PV was capable of attracting commercially based loans (Int_16). As such he saw no reason why PV could not be installed on community centres, commercial buildings and domestic properties across the city. Unable to settle on common ground the two emergent initiatives continued to pursue their own development strategies.

In March 2011 the *Bristol Community Energy Catalyst Fund* (BCECF) was launched by CSE on behalf of the Council. The fund was designed to help communities overcome key business development hurdles in the creation of new community renewable, social enterprises (Int_27) (see chapter 4, page 79).

An application by BP activists sought £10,000 to set up a community-owned energy cooperative, Bristol Power Cooperative (BPC). They argued that a lack of knowledge and available finance were the primary reasons why PV was not being utilised to its full potential locally and in turn it suggested the initiative would make it easy for end-users to access the technology by developing a community-orientated 'free' solar scheme. 'Free solar' or 'rent-your-roof' schemes had emerged nationally following the introduction of the FiTs, were primarily run by large companies and offered the material installation of the technology to households with the household typically receiving the generated energy for free whilst the company received the generation and export tariff. In effect, households signed agreements in which they loaned the use of their roof to the company thereby foregoing the potentially lucrative investment opportunity if only they could finance the installation themselves. BP activists sought to replicate this model but retain ownership (and therefore profits) within 'the community'. Their BCECF proposal therefore suggested: (1) sourcing 100% finance from large institutional investors, (2) the setting up of a new social enterprise that could manage and own solar PV installations for 'the community', and (3) bringing together potential end-users alongside local PV manufacturers and installers. Specifically, their proposal suggested a demonstration array on a community centre; three or four more 10-50 kWp community centre installations and 80-100 domestic installations of 2-5 kWp by the end of the year (ZCB & Egregoria, 2011).

The BCECF award panel rejected the application. It was felt the proposal needed refining around finances and the sourcing of capital, whilst there was insufficient detail on how the catalyst funding would be used (CSE funding coordinator, personal communication, July 2013). Despite this set back, the *Bristol Power Cooperative* (BPC) (one of two new social enterprises set up by BP activists) was launched (although not legally registered until August 2012) to the

public in June 2011 at a ZCB network event.

In July 2011 a solar working group called *Bristol Solar City* (BSC) was set up[31] bringing together local solar installers, the new energy cooperatives (BPC and BEC), academics and the city council to assess the market and seek the means to further embed solar technologies (both solar PV and thermal) within the city (BSC, 2013). The idea behind BSC was first raised by a local installer and promoted within a local newspaper a year prior (Savill, 2010; Fergusson, 2010) but it was the actions of BP activists during the first half of 2011 that catalysed the formation of BSC and drove it forwards: they "helped crystallise what we were trying to do" through providing a vision and a focus for action (Int_23). BP activists and local stakeholders were slowly building support and momentum for PV within the city.

Refining their approach and demonstrating the technology

June 2011 - December 2011

Following the rejection of BCECF funding but having launched BPC to the public, BP activists renewed their efforts. The initiative was split into two projects. The first sought to develop their 'free solar' model and incorporated the idea of rolling out 'streets of solar' through an area-based approach. The second, sought to install a demonstration array on Hamilton House, a community building in central Bristol. Both projects were pursued simultaneously.

Streets of solar pilot

Inspiration for an area-based approach came from two previous initiatives. Braunstone Solar Streets (Leicester) had installed PV tiles on 45 homes during a building retrofit programme in 2004 (EST, 2006). Transition Streets (Totnes), had developed a street-by-street approach in which 141 domestic PV systems had been installed through self-organising neighbourhood groups and the central negotiation of bulk purchasing discounts between 2009 and 2011 (Ward, Porter & Popham, 2011). Core activists viewed these projects as demonstrating an efficient approach to PV installations and sought to replicate and improve on this experience using the FIT scheme to create a self-financing model.

They suggested an area-based approach would result in significant economies of scale, including: a simplified planning process through duplication of calculations 'from the house next door'; reduced material costs through bulk purchasing; reductions in the price of scaffolding; reduced labour costs through limited downtime, and; diminished 'back office

[31] There are disagreements about who exactly set up the group with a local installer, the council and Bristol University each claiming the credit.

overheads' through standardisation (Streets of Solar, 2011). In total, savings of 20% were estimated. In addition, the creation of localised 'social movements' was thought would stimulate interest in the technology and initiative (Int_22).

To pilot the approach Lockleaze, an area in the north of the city, was chosen as a suitable location. The target area contained approximately 1,500 households (half of which were council houses), fell within the most deprived 10% of areas in England and was considered a front-runner under the coalition government's 'Big Society' localism plans. A participatory planning process had been started in 2007 by the Council (BCC, 2009) and local rooftops were identified as being a favourable size and orientation to PV. To the core activists these factors suggested the area was 'under the microscope' of both local and national government, a suitable location to demonstrate the initiative, get the council on board and disseminate the results (Int_16). Through the leader of the Council core activists were led to local councillors and then *Lockleaze Voice* an association of community leaders. Meanwhile the Council offered support to engage local residents but no capital backing. Moreover, the Council refused to commit their own social housing to the pilot.

In August 2011 the first of two enterprises was set up: *Bristol Power CIC* (BPCIC) was established as the 'at-risk' project development vehicle, which would use high interest loans to research and install PV installations before selling them on. A second enterprise BPC, already launched to the public but not legally constituted, would be set up in August 2012 to manage and own the completed installations over the course of their 25-year lifetime. The idea, to split project development from on-going management, resulted from the investigation of potential funding sources where different types of finance were found to be available (at different rates) at different stages of project development. Developing the project to installation involved upfront development costs generally perceived as 'at-risk', whilst the long-term repayment of loans against a secured income (the FiTs) attracted lower interest rates. It was hoped the organisational split would create a stronger foundation to BPC in the future development of projects.

Then in September 2011 a second application was made to BCECF. The application focused on the Lockleaze pilot and sought £12-15,000 to develop a feasibility study (BPCIC & BPC, 2011). The BCECF panel was 'supportive of the revised submission' but sought additional detail on the specific elements: the panel wanted to know where the catalyst funding would be used and to see detailed financial plans in light of the proposed revisions to the FiTs (author's personnel correspondence with fund coordinator, July 2013). Funding was finally released in April 2012 following strong pressure exerted on the board by BP activists (Int_18, Int_23, Int_27).

A demonstration project

In December 2011 and under the second project stream, a 40 kWp PV array was installed on the roof of Hamilton House in the centre of the city. Bristol's first community-led renewable energy installation, it was a joint project between BP and BEC. BP activists had previously claimed there was sufficient space to install up to 140 kWp of PV panels (BPC, 2011b) but a variety of context dynamics prevented this from being realised. First, the comprehensive review of the FiTs scheme announced by DECC on the 31st October put pressure on activists to install before new tariff rates were imposed. Second, competition from BEC resulted in a sharing of the roof resource[32]. Third, and more importantly, by December BP activists had only managed to negotiate the support of one private investor, with sufficient investment to install a PV system of 20 kWp. The combined array (40 kWp) was installed on 8th December, three days before the cut off date.

Delivering the Streets of Solar pilot

December 2011 - August 2012

Following the demonstration project activists turned their attention to the Lockleaze pilot. Here DECC's LEAF awards (chapter 4) announced in December 2011, presented an opportunity to progress the pilot through a national grant rather than a local repayable loan (the BCECF) (Int_27) and yet, through two application rounds the activists were unable to secure support. Instead, BP activists had to rely on brokering financial support through a variety of other means.

Meanwhile the context of action was changing. In January the Council announced plans to established a citywide energy services company that would "spearhead renewable energy… primarily through investment in solar energy generation" (BCC, 2012a) and an updated *Climate Change and Energy Security Framework* (2012-2015) was agreed in February that both promoted the local embedding of PV (through a public online resource map (BCC, 2012)) and brought PV deployment in house, within the new energy services company. Results from online resource map showed the majority of Lockleaze roofs as being 'good' or 'very good' for solar generation.

To build momentum behind the pilot project, BP activists drew on the support and backing of

[32] To install a 20 kWp array Bristol Energy Cooperative signed an agreement with a local installer. The agreement meant the system would be installed before the drop in FiTs and BEC would be able to purchase half (10 kWp) within six months and having completed a community share offer. The second half would remain with the installer.

the newly formed Bristol Solar City. Participants to the working group shared a common ambition - the large-scale deployment of solar PV within the city, including a one-gigawatt of solar PV in Bristol by 2020 target - but as yet, the group was unclear how this aim would be achieved. BP activists, with the Lockleaze pilot, brought a plan to the table, suggesting PV could be installed streets at a time, driving scale efficiencies and leading to the rapid diffusion of the technology. The model appeared novel to the majority of installers present (Int_23) and resulted in two key endorsements. First, activists persuaded six installers to loan BP £1,000 each, so that community engagement activity could begin. Second, activists negotiated the case for a single combined installer capable of undertaking large-scale PV installations of the type planned in the pilot. They argued the large-scale deployment of solar was beyond the capacity of individual local installers and if solar was to take off as hoped, there was a significant danger of local installers missing out to larger, national contractors. Convinced of the argument and potential rewards, eight local installers created the *Bristol Area Solar Installers Cooperative* (BASIC), launched in June 2012 and believed to be the first multi-installer cooperative in the country.

BASIC was subsequently written into the BP business plan (being written between April and July 2012). Three project partners were outlined as being fundamental to Bristol Power (BP, 2012): BPCIC (as project developer), BPC (to own and manage the completed installations) and BASIC (to install the technology). Activists argued that using local installers would allow the project to use local labour, retain and develop skilled jobs within the city and keep money within the local economy. The business plan sought approximately £1.5 million financial backing to install 300 domestic PV systems (less than £5,000 per 2.5 kWp system). A local marketing company was recruited to coordinate external publicity and a designer to develop promotional materials (figure 8.1). In figure 8.2 I outline the key actors and their relationships within the case.

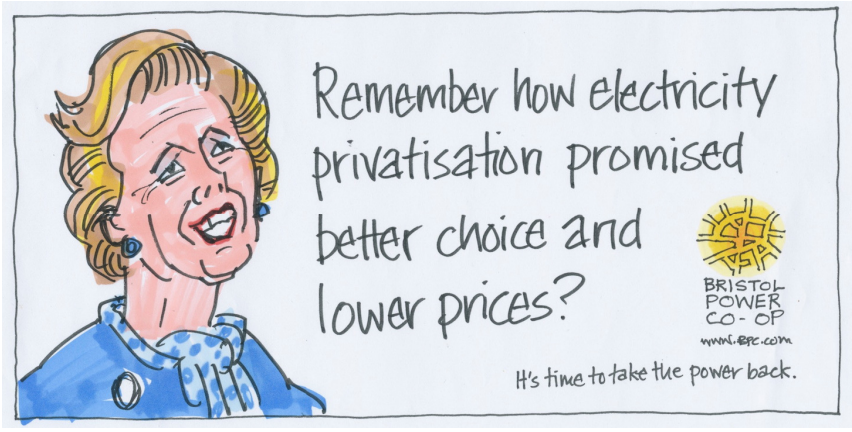

Figure 8.1: Bristol Power draft promotional material

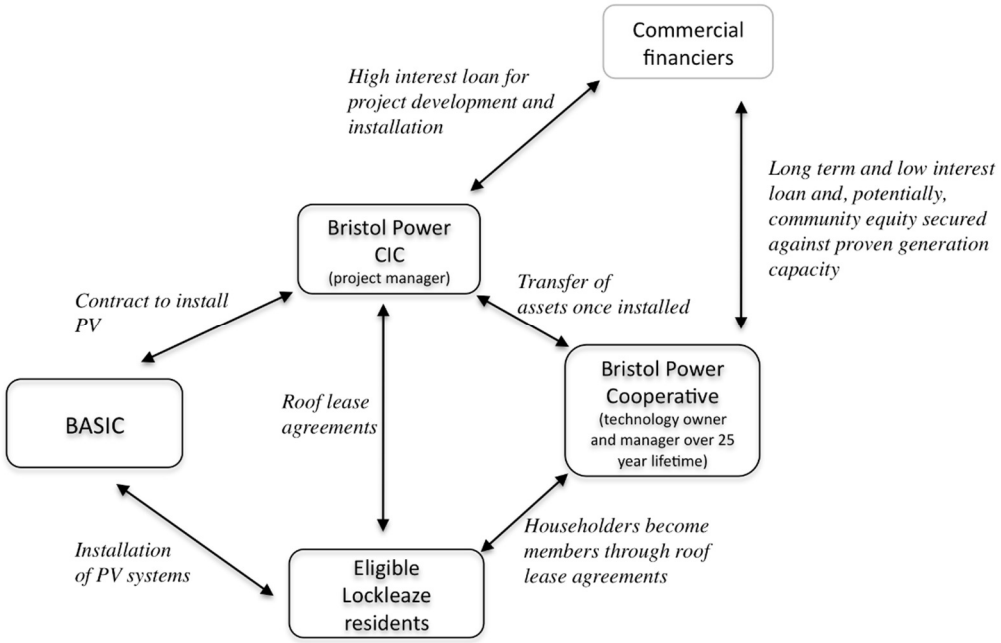

Figure 8.2 Key actors and their relationships in the pilot project according to the Bristol Power business plan

Note: BP activist comprised both Bristol Power CIC and Bristol Power Cooperative, once it was set up.

In an attempt to secure financial backing, activists explored three types of finance. Traditional bank loans were explored via organisations such as Triodos Renewables, who funded commercially viable projects using proven renewable energy technologies. At the domestic scale PV was viewed as too small for commercial investment. Asset-backed finance was explored through organisations such as 'Lombard', a leading asset finance company. By June 2012 the company had over £200 million invested in solar PV within the UK (according to Int_16), typically assessing loans on the basis of the value of the asset and its generation potential, offering 70% debt to a project's 30% equity. However, by July 2012 the company was reassessing its position in expectation of further digressions to the FiT. Finally, supplier-orientated finance was explored. Burdens, a national building supplier with a head office in Bristol, was approached as one such avenue. Like other companies at the time, Burden's provided consumer loans for domestic PV installations. Activists asked for 300 of their domestic loans. In response, Burdens came back saying that side of the business was going bankrupt due to changes in national policy.

Meanwhile, community engagement began in April 2012 with an announcement in the Lockleaze Neighbourhood trust e-bulletin. Three open meetings were held in a local community centre in quick succession during May. The big idea was presented, financial projections outlined and questions taken from the floor (box 7.1). Approximately 100 residents attended in total. To a local community development worker the activist's approach was analogous to

knowledgeable middle-class outsiders "rolling into the community and saying we are going to do this, but without having any idea of the community, what the community was like, how to engage with the community, what the best communication is with that community and how to speak to them" (Int_20). Despite this impression, the community development worker was sympathetic to the idea and offered support to the activists (later becoming a director of BPC). As a result, activists advertised in a local newsletter delivered to 3000 households locally and used the community centre to create interest in the pilot. The response was described as 'unprecedented' (Int_20) with overwhelming support for the initiative. Three further e-bulletins featured the pilot project and a website was created. At the city-scale, a local newspaper dedicated a front page spread to the project in early May: 'PEOPLE POWER, Solar panel cooperative could save residents up to 40% off bills and help the environment' (Onion, 2012). By early June 80 households had signed-up to the pilot.

Box 8.1: Questions asked by local residents to BP activists during open meetings (May 2012)

Technology questions: (11)

- *What happens at night?*
- *Does the installation do any damage to the roofs?*
- *What kind of equipment do you need in the house and where does the cabling run?*
- *What is the size of the inverter?*
- *Will the roof take the weight of the panels?*
- *What happens if my house doesn't face south?*
- *Will insurance companies worry about the risk of fires from the solar equipment? Will it affect premiums?*
- *Where does the power access go?*
- *What about hot water, can I use it to heat my hot water?*
- *What about maintenance?*
- *Is there a limit on the number of panels on the roof?*

Pilot project questions: (17)

- *Who pays the installers?*
- *How long is the "feed in" before there is a dividend?*
- *Has anyone done anything like this elsewhere?*
- *How many years do you have to sign up for?*
- *Who pays for installation?*
- *What about council tenants?*
- *How many homes do you need?*
- *Have you got figures to show savings / profit?*
- *What about insurance?*
- *What money do I have to pay first?*
- *Where do the profits from the panels go, can it go to local organisations?*
- *What happens if I want to sell my house?*
- *Is the Co-op set up yet?*
- *Do we need to tell our insurance company?*
- *What happens if I want to put in a roof conversion in 5 years time?*
- *What about flat roofs?*
- *Can you put them on sheds?*

By July a further digression of the FiT scheme seemed inevitable at the start of August. Activists feared lower tariff rates would make the pilot financially unviable (given sunk community investments). BASIC offered to finance the installation costs (materials and labour) of approximately 20 PV systems in the short-term whilst capital backing was secured: activists were given until September to purchase the installations or BASIC would take over ownership. BASIC's subsequent quote gave small benefits of volume (small because of the limited number of installations and because of declining system prices reduced ability to bulk purchase) and assumed technical and EPC surveys were not included, a common mounting system was used and the system would be installed on a single roof at each site. Standard equipment would be used whilst additional costs - such as work on slate, metal or flat roofs – would be priced separately (BASIC 2012). Whilst 20 roofs seemed low compared to their initial target of 300, further complications meant only 13 installations could be realised. Two limiting factors emerged. On the one hand, detailed surveys of the 80 interested households revealed that approximately 75% were in fact unsuitable because they were either too small or had significant roof shading, were council tenants (and were ineligible) or required energy efficiency improvements to qualify for FiTs. On the other hand, BPCIC had to find the capital for the creation of roof lease agreements (between the householder and the BPCIC) and cover the cost of energy performance certificates. 13 PV installations were undertaken in July 2012 costing £63,000 for materials and installation. In addition, project start up costs had accumulated to £35,000. A Solar Picnic was held with local residents to celebrate the first PV installations with the community.

Paying for panels through a community share offer

September 2012 to March 2013

By September no commercial loan had been agreed. In the meantime installations were presented by activists as being owned by BPC and as such, owned by the community. As a result and because they could see no feasible alternative BASIC became resigned to holding on to the assets until such a time when the BPC could purchase them (Int_23; Int_21).

Failing to secure a commercial loan BP activists were forced to recognise the success of BEC in raising £128,000 from 150 investors (£40,000 more than initially aimed for), through a community share offer between April and May earlier that year. BP activists saw this as a way out and sought the advice and support of BEC, suggesting they run a share offer for their pilot. Before a reply was made BPC launched its first share offer on 29th October 2012. The share offer sought to raise £255,000 to buy the 20 kWp demonstration project and the 13 domestic

installations and to install a 40 kWp system on a Lockleaze primary school and up to 33 kWp across 10 domestic properties (BPC, 2012). The share prospectus was marketed informally through activist contacts. After six weeks £38,000 had been raised, the share offer was extended to the end of January and then again to the end of March. At its close £148,000 had been raised from 30 investors spread across the country (Int_20). These shareholders thus becoming a new 'community of interest', geographically dispersed.

The 13 Lockleaze installations were brought by BPC (for £80,000) from BPCIC using finance from the share offer in February 2013. In turn, BPCIC first had to buy the installations from BASIC (eight months after they had been installed). As the installations passed to the Cooperative, BPCIC made a loss of approximately £20,000, because the total cost of the project (including outreach, engagement and legal work etc.) had reached approximately £100,000. Charging the full amount was deemed unfeasible since the returns would be insufficient to pay off the capital costs, pay dividends to shareholders and thereby make the investment financially attractive. The core activists wrote down the loss as a developmental cost of the organisational model (Int_16), made possible by a combination of the installer engagement loans and BCECF loan. 18 months later (June 2013) installer loans had still not been repaid, whilst it had taken 7 months for BP to repay the capital installation costs to BASIC (at a time when the FiTs market was contracting and putting pressure on installation companies). It thus left local installers with misgivings about how the pilot was managed and highly reluctant to work with BP activists in the future (Int_23). Ownership of the demonstration project stayed with BPCIC until the summer of 2013 before being sold on to the Cooperative. The approach had resulted in elevated development costs and limited numbers of installations: average cost per household amounting to just over £7,500 rather than the expect cost of below £5,000. Project development costs accounted for above one third of the total cost (£35,000 out of £98,000). This was significantly higher than industry averages from 2012, where overheads were suggested to represent 28% and 23% of total costs for commercial and social aggregator schemes respectively (PB, 2012). Unable to secure commercial rates of investment the logic of having two social enterprises had failed.

In summary the narrative describes the emergence and development of a discreet initiative dedicated to the local embedding of PV. Central to the story is the development and negotiation of a particular model, based on commercial 'free solar' schemes but with a local bias. The initiative had installed 14 PV systems (one community building and 13 domestic) amounting to 52.5 kWp whilst a total of 4887 PV systems had been installed across former Avon by April 2012, totalling 14,528 kWp. Activists mediate between Lockleaze residents and the technology/project, between local installers and the project and between the local authority and

project. In the second half of the chapter I analyse the case for evidence of key intermediary processes and following the research protocol.

8.2 Analysis of key intermediary processes within the case

Facilitating

From the start the actions of BP activists were premised on providing opportunities to others: the first project proposal (BP, 2009) attempted to provide leadership; citywide events attempted to create the space for local stakeholders to develop a PV project, and finally; the project itself attempted to provide an opportunity to a particular community and a diverse set of stakeholders (including local installers and social housing providers) to participate in the installation of PV systems locally. A vision of the technology's potential within the city was the common thread on which these multiple opportunities hung. As such, BP activists attempted to provide multiple opportunities to multiple actors.

In the following section I analyse and explain why activists were going about facilitating in the way they did. I then explain activists' envisaged facilitation activities, the form and content of these activities, and what restricted the implementation of these activities.

To understand why activists made the decisions and moves they did, I suggest, is to understand what activists' perceived as the opportunity presented. The first project proposal in 2009 states this clearly, arguing 'there is an opportunity to shift from energy owned by utilities' to 'renewable energy owned and operated by communities for the benefit of communities' using existing skills and knowledge already contained within the city (BP, 2009). AS such, they perceived an opportunity to catalyse such activity, by others and so set out to support others develop a project through citywide events. Between 2009 and 2011 activists watched as their original, identified opportunity grew, supported by the introduction of the FiT but still with little action being taken. Activists' subsequent pursuit of a discreet project, from April 2011 onwards, can be explained by the identified opportunity and the perceived lack of action thus far. Underpinning this opportunity was activists' interpretation of PV and its potential within the city.

Two things can be said about this. First, from April 2011 activists increase their facilitating activity, moving to a more advanced form of facilitation where they seek to develop a community PV project themselves rather than relying on others. This positions their prior activity as a form of soft or 'hands off' facilitation. I identify their first catalyst fund proposal

(April 2011) and the launch of Bristol Power Cooperative to the public (June 2011) as a turning point symbolising activists' intent to increase their intermediation role. Activists were taking matters into their own hands. If others did not see the opportunity, they would develop the project.

Second, the actions of BP activists deviate from the conceptual framework, which conceives community initiatives as primarily seeking to influence, through their activities, their 'wider community' composed of end-users of the technology. The residents of Lockleaze fit this description but play no part, even as a recipient of actions, in the above explanation. Instead, activists sought to influence local stakeholders, principally diverse members within Bristol Green Capital Partnership. This raises questions about the community basis of the case. Yet, despite this lack of connection to a specific community of citizens, interest or location-based, BP as an initiative, remains within Walker and Devine-Wright's (2008) definition of community energy initiatives (chapter 1): the initiative is developed by local actors and seeks local and collective outcomes. As such, the initiative is qualitatively different to, for example, a utility installed wind farm designed and operated remotely and with profits distributed to remote shareholders. Nonetheless, activists were less connected to the community of residents and more connected to a broader network of citywide stakeholders and this disconnect to local residents provided its own problems, as I will explain. For now, the fact that activists targeted local stakeholders challenges the framework. It suggests that non-community actors can be the primary targets of community-based intermediation.

Next I explain activists' envisaged facilitation activity, its form and content and what restricted its implementation. I do so on the basis of the two phases identified above.

In the first phase activists envisaged facilitating the emergence of common visions and a discreet project through citywide events. Two events were held (during 2010 and 2011) but no visions or projects emerged. What is interesting about this facilitation activity is how the events contributed to a range of activity that by July 2011 had resulted in the formation of a new technology-orientated actor network, *Bristol Solar City*. This suggests a limited but influential role of community-based intermediaries in the creation of new social spaces within the local system, in this case an actor network at the city level. The new network brought together local stakeholders with a shared ambition and helped to create momentum for the technology within the city. The importance of which, is demonstrated by the fact members of the network later provided resources to BP activists. Activists limited but important role in catalysing BSC suggests they had some agency to support a nascent and local technological trajectory even if they later struggled to facilitate the formation of a discreet PV project.

In the second phase activists envisaged two discreet facilitation activities. First, the installation on Hamilton House was envisaged as a material demonstration of the technology (with a range of panels types providing a test) and envisaged as demonstrating the viability of the wider project (embedding PV through a social enterprise backed by private finance). Although installed, a variety of reasons restricted the facilitation 'capacity' of the installation. Most notably the comprehensive review of the FiT influenced the timing of the installation (bringing it forwards), its size (reducing it) and aim (from demonstration to deployment 'whilst we can'). Furthermore local politics (in this case competition BEC) required negotiation and compromise. The installation did create a 'physical space' in which potential users could learn about the technology but it was underutilised as such: there is no evidence to suggest tours or communication about the array were given to the general public, interested local actors or building occupants. Neither was information on the performance of the different types of panels used or the overall performance of the array communicated outside of the initiative. Activists' facilitation via the demonstration array was subsequently limited, restricted to being proof (they claimed) that their model worked and was replicable, used in subsequent funding proposals and business plans. The extent it proved this is, however, debatable: it involved no community engagement and, furthermore, for the first 18 months was not owned by the community, since BPC was not set up yet.

Second, the pilot project was envisaged to provide opportunities to a range of actors. The pilot was envisaged to make PV accessible to local residents in Lockleaze, by providing funds and creating local rules (about who installed the technology and who benefitted). Here, specific facilitation activities involved holding open meetings and the use of promotional materials, through which residents could find out about the technology and project. The pilot was also envisaged as presenting a variety of opportunities to local stakeholders: it sought to align local installers with new customers and introduce the technology to the local authority and local social housing providers and provide a means to install it. Furthermore the project sought to provide an opportunity to these local stakeholders to access finance. In this sense the project was envisaged as creating a novel institutional structure with associated 'rules' that could reduce uncertainty and guide activity. Finally, in the later stage of the project and not originally envisaged by activists, the share offer provided an opportunity for individuals both locally and nationally to own PV.

A variety of influences restricted the implementation of the pilot project and as such, activists' envisaged facilitation activities. From the external environment changes to the FiT scheme and reductions in PV wholesale prices, continually challenged the ability of activists to design a

financially viable project and dictated which properties were eligible. Limited interest from commercial banks and potential financiers curtailed project viability. Without significant and favourable loans activists struggled to offer free PV systems to local residents and social housing providers, which in turn, reduced the opportunity presented to installers. From the local system the local authority's reluctance to participate meant half of Lockleaze residents were excluded whilst physical characteristics of the local system such as small roofs, roof shading, low EPCs results and so on further restricted which residents could access the technology.

In summary I suggest two distinct facilitation phases can be identified in the case, moving from broad facilitation activities (events) to the detailed facilitation of a project. Opportunities identified by activists explain why they go about facilitation in this way. In the first phase I identify facilitation activities as principally involving network events. In the second phase the launch of BPC promised future opportunities although the scope of the opportunity was severely diminished in the event. The installation of the demonstration array can be understood as a missed, facilitation opportunity whilst the main period of facilitation came late in the initiative's overall development, in the presentation of the project to Lockleaze residents and the realisation of the project for a select few.

A variety of context influences restrict the realisation of envisaged facilitation activity from the external environment and local system. Absent from the discussion so far are community participants because of activists' focus on local system stakeholders. To further understand what restricted these facilitation activities is to understand how the project was designed, that is activists' configuring activity, because central to the narrative is a particular vision and project model, developed independently of any understanding of or connection to their community.

Configuring

As previously suggested, the case narrative is in large part a story about the negotiation of a particular model into and within the local system followed by reluctant alterations to the project due to local context conditions and limitations stemming from the external environment. Activists' ability to configure the project they sought was severely constrained by a variety of influences beyond their control. In the following section I begin by briefly discussing how the technology is interpreted and presented to others. Next I analyse how the pilot project was designed and the influences on it.

Interpreting the technology

Activists interpret the technology as holding the potential to provide significant amounts of

renewable electricity to local residents and the city of Bristol. This interpretation became increasingly pronounced over time. By 2012 they were arguing that PV was, since 2004, 'the fastest growing energy-generating technology in the world' and that a solar 'revolution' was underway including 'exponential growth' and 'a tipping point'. In this way, activists developed a particular narrative about PV and its future technological potential within the city. The pilot was thus part of a planned, longer-term rollout of solar across the city.

This interpretation of the technology and big vision was presented to multiple stakeholders. It caught the attention of some (local installers in particular) but not others (the council, BEC, the BCECF board etc.). I chose, strategically, to black box this interpretation and vision: I will not explore its validity or basis because it is not crucial to answering my two detailed research questions (RQ2 and RQ3) and presents a labouring detour. Rather, the important point is how this interpretation and vision influenced how activists designed the project and sought to configure actors around it.

Configuring the pilot project

The pilot project was designed on the basis of this interpretation of the technology, vision and their identified opportunity. To achieve their scale of ambition a variety of elements had to be brought together, resulting in a particular project design. A partnership approach was thought necessary to bring the skills, knowledge, experience and credibility to the project. The national FiT scheme was thought to provide a secure revenue stream that could be scaled up indefinitely and an existing (at least for large commercial providers) 'free solar' model provided the business plan. As such, activists sought to design a project that would bring together a supportive policy context, existing producers and installers and new user groups.

A few points can be made about this logic. First, their identified opportunity - that the introduction of the FiT scheme would not lead to the rapid deployment of PV because end-users did not understand the technology, its potential or economic viability - proved critically unfounded. Activists did not challenge their own assumptions even as deployment of PV rapidly increased, leading, for instance, to sharp tariff reductions. Second, activists assumed they could translate the free solar model, successfully deployed by large commercial business, into a social enterprise model and secure the same, or comparable, financial underwriting. Third, activists did not question the viability of their model even as other companies who had been successfully deploying the model assessed their situation follow tariff reductions (e.g. Burdens). Fourth, the project design relied on considerable cooperation between multiple stakeholders, cooperation that had not materialised during the first phase of the initiative. Emphasis was placed on local system stakeholders such as installers and social housing providers, but activists also had to

configure external financiers (who refused). Moreover, the project rested on the ability of activists to bring these stakeholders together. Whilst they displayed some capacity to do this (e.g. BSC) overall activists were working from a limited position, with no track record and only a vision. Fifth, the desired model proved unnecessarily complicated (figure 8.2 above), confusing both the core activists let alone those on the outside (e.g. Int_23). Sixth, developing the project in this way activists' took a chance: promising a model that could deliver the large-scale embedding of PV if each element and stakeholder played their part. If one element was out of place the edifice crumbled, resulting in unfulfilled promises and broken expectations. The alternative approach, personified by BEC, was to start small and embed the technology where possible.

It is in this sense that the project design appears 'holistic' since it incorporates and attempts to influence multiple elements of the local system. Indeed, the use of systemic approaches is claimed as a strength in the community energy literature (Walker et al., 2006; Steward, Liff & Dunkelman 2009). Moreover, Vergragt and Brown (2012) argue that local embedding must address multiple system elements to be effective. Yet, the particular holistic design in this case, is also a clear weakness. Activists misread their community (e.g. expectations and knowledge), local system (politics) and external environment (FiTs, technical change) and were unable to make links with key elements (the Council and finance). Whilst, attempting to influence multiple stakeholders and system elements ran the risk of no change at all.

Moving from activists' vision to implementation a variety of elements influenced project design. Shifting policy contexts played a big role, with knock on effects for (not) attracting commercial loans. Here, activists argued the project would stay 'ahead of the curve' of falling FiT revenues. In practice, the opposite was true. The FiT scheme provided the very basis on which the project could be built and guided where PV systems could be installed. They clearly had no control over national government policy but were also unable to respond to changes over time. Their interpretation and claimed knowledge of the technology should have put them in a good position to respond to policy and market changes but in practice their financial modelling remained one step behind the FIT at each point. Moreover, activists subsequently had to shape the project around shifting policy contexts. The limited number of installations achieved demonstrates the degree to which the project was shaped around the FiT: only those roofs that fitted FiT criteria could go ahead. Thus the FiT scheme guided where PV could be materially embedded on the basis of local infrastructure characteristics. Activists had no control over these elements.

The failure to secure commercial loans also had big implications for project design. Multiple

sources were pursued, each with limited results. In an interview with a core activist (Int_18), he reflected that detailed financial plans were never actually written and submitted. While he suggested this resulted in 'a lack of clarity', I suggest this demonstrates an under-configuring of the project. This is supported by the two local catalyst fund applications in which both attempts were returned with requests for further financial details. Beyond this, what is notable is how the failure to attract finance did not result in a reassessment of the approach taken. Such limited progress should have forced a reconfiguration of the initiative but instead activists stuck to their chosen path, continually arguing that finance was 'around the corner' (Int_23). This suggests that activists failed to learn about their intermediation capacity and approach.

Activists limited capacity to configure local actors subsequently influenced how the project was designed, but only in minor ways, and in retrospect should have influenced it much more. Activists experience was mixed. They had some success configuring local installers, and installers expectations about the viability of the project cohered with BP activists. As one installer explained,

> "It was something novel. And we were being told a lot of things that we wanted to hear… All [the streets of solar project] needed was a bit of 'photo-shopping' because they had the idea. It was such a clear vision. It was great." (Int_23).

Furthermore, activists altered their original project design to accommodate installers outside of BPC and succeeded in negotiating the formation of one large installer cooperative. Such configuring of installers demonstrates in practice, how community-based intermediaries need to modify their approach in order to accommodate different actor positions (Stewart and Hyysalo, 2008). It demonstrates the importance of a reciprocal configuring process and the importance of flexibility of project designs to new knowledge about actors and local contexts. Activists were flexible on certain project aspects, accommodating, selectively, elements that cohered with their vision and ignoring or dismissing elements that did not: for example the rapid reduction in PV wholesale prices aligned with their understanding of the technology but changes in tariff levels (to reflect cheaper installation costs) challenged their financial modelling. Their attempts to align the local authority within the initiative also failed. Limited movement from the local authority, with hindsight, should have resulted in activists' reconfiguring the project. Moreover, this suggests activists did not read the local context well enough and raises issues about the kinds of expertise needed to locally embed technologies. Activists not only required expertise in the technology, national policy, community engagement and so on but also knowledge of local politics and policy. Premised on significant collaboration, their failure to align the local authority in their model coupled with a failure to alter their alignment strategy, significantly undermined activists' ability to locally embed PV.

Finally, the way in which activists presented the project to Lockleaze residents highlights the overall configuring approach taken. Here, the message was simple and short - through BP 'you can lower your energy bills'. It thus created a narrow, confined space in which residents could engage with the project and technology. Questions asked at open meetings (box 8.1) supports this: to residents the project was about the technology, bills and money; they had little interest in the cooperative ownership model. Thus activists sought to configure the project for local residents, presenting the project as a *fait accompli,* requiring limited participation from the community. As with other elements and stakeholders, the community only had to play its part, according to the vision and broad plan. This presentation of the pilot allowed for limited negotiation and explains in part a lack of enthusiasm or even interest by local residents to the idea of an energy cooperative despite the unprecedented interest in the technology. However, the broader point is about the direction of embedding. Fixated on their vision, activists sought to align local stakeholders and the community within their broad project plans and muddled on regardless when this did not happen. As a form of intermediary configuring it is detached from local realities, only loosely connected to broader external environment dynamics and not very successful in practice.

From this discussion I draw the following conclusions about activists configuring role. First, the project is premised on significant configuring of multiple local and external system elements. Yet the activists agency to configure stakeholders was limited, compounded by their inability to learn, to move beyond their broad vision to a detailed project plan (particularly in regard to project finances) and to reconfigure their emergent plan in response to various stakeholder positions. Second, and as a result, I observe a narrowing of the project plan over time, where activists reluctantly resign themselves to elements of the local system (physical infrastructure characteristics and the position of the council for instance) and external environment (predominantly shifting policy context) over which they have little to no control, in order to achieve some local embedding. Third, I conclude that activist configuring activity was present throughout the period covered, starting with the configuring of the project vision, then slowly moving towards a detailed project plan in July 2012. That is to say, activists relied on their vision and as such I identify key periods where they were forced into configuring the project, primarily by the need to secure project finance. These include the two local catalyst fund applications, the project proposal for the demonstration array and the writing of a business plan in 2012.

Brokering

How activists negotiate stakeholders and users around the project and mobilise resources is

central to the narrative. Activists focus their attention on the alignment of local system stakeholders over and above their attention to Lockleaze residents. In the following section I first discuss the negotiation of the project with stakeholders before explaining the mobilisation of resources and finally I identify a missed opportunity to represent users.

Negotiating with stakeholders

Negotiation with stakeholders began within the Bristol Green Capital Partnership but primarily took place within Bristol Solar City (BSC). It was within BSC that activists convinced local installers of the viability of their model and secured small catalyst loans to begin community engagement. The working group was also the primary place to engage the local authority. What is particularly interesting here is the use of BSC as a negotiation space: it suggests a relationship between the three key intermediary processes. As I have already argued, BSC was in part, a result of activists' earlier facilitating activity. The outcome was a working group with a shared vision and purpose (seeking ways to support the local embedding of solar technologies). The working group built momentum behind PV within the city by bringing stakeholders under a common vision. It therefore has an intrinsic benefit to local embedding, broadly conceived. But for activists it also created a new arena in which the project could be configured and resources brokered. Thus the outcome of activists' earlier facilitation activity created a new opportunity to configure and broker the project moving forwards (figure 8.3).

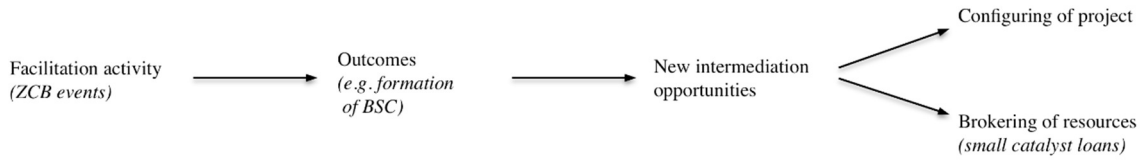

Figure 8.3: A basic relationship between key intermediary processes based on activists support for the formation of BSC

This pattern can also be seen within the creation and use of BASIC (figure 8.4) but with a key difference: the facilitation of opportunities was promised rather than realised. Activists presented an opportunity and on this basis BASIC was formed. BASIC then provided new opportunities to the activists, which they used to further configure the project. It also resulted in the further brokering of resources: BASIC offered to finance the material and labour costs of the pilot installations.

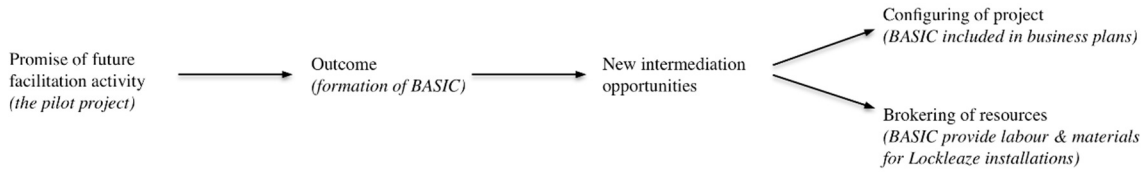

Figure 8.4: A basic relationship between key intermediary processes based on activists support for the formation of BASIC

Two additional strategies were employed to negotiate the project with the Council. First, local councillors were approached, often resulting in the endorsement of the initiative but no material progress. Second, at events and through local media coverage activists repeatedly stated how the Council was backing the project (through local catalyst funding, although this point was rarely mentioned) in an attempt to persuade the Council that this was in fact what they were doing. Their approach was self described as 'banging on doors' (Int_16) and considered politically naive by others, "[they] completely underestimated the political situation regarding social housing and the fact that the Council was not going to give them 500 roofs let alone 5000" (Int_26). Unable to align the Council resulted in nearly half of the pilot area's housing effectively being 'off-limits' to the project. It also made it harder to secure commercial finance, which "were interested in us because [we had] always promised that we would get the Council onboard and we could therefore bring a big portfolio of properties and for the big institutional investors that is where you get the volume" (Int_18).

This points towards a further brokering strategy of activists. Activists played off different stakeholders, claiming the support of one to position another. In the quote above, the support of the Council is used in an attempt to gain commercial loans. The promise of installations on social housing is also used within the negotiation of local installers. Again this reinforces the activists' attempts to configure stakeholders within their vision, rather than creating a plan based on local system characteristics. The approach proved misplaced, souring relationships and destroying trust between BP and local installers when promises repeatedly failed to materialise.

Mobilising resources

Here, I focus on activists' attempts to negotiate financial resources because, I will suggest, it is indicative of their approach to social and human resources also. Activists attempted to mobilise financial resources from a variety of places (table 8.1).

Table. 8.1: BP activists' attempts to mobilise financial resources

	Project development finance		**Project installation finance**	
	Secured	*Attempted but not secured*	*Secured*	*Attempted but not secured*
Local system	BCECF, Installer catalyst loan,	CCF seed grant	Short-term loan from BASIC	
External environment		LEAF award	Single private investor, Community share offer	Traditional bank loans, Asset-backed finance, Supplier orientated finance

Table 8.1 highlights how activists struggled to negotiate finance from the external environment (e.g. LEAF and institutional finance). Development finance was only secured from within the local system where activists were able to persuade stakeholders of the viability of their project through presentation of the project vision (c.f. detailed project plans). How activists secured installer loans clearly illustrate this. Securing development finance through the BCECF also supports this with closer inspection: the BCECF board (in both instances) wanted detailed financial plans before releasing funds and finally did so without detailed plans but following strong political pressure. From this I conclude it was the project vision carried by supporters that exerted political pressure on the fund board and resulted in the releasing of funds. Broadly this suggests that the project was under configured and points towards a particular form of negotiation, reliant upon the alignment of actors within the project vision rather than detailed business plans. Project finance was secured through similar means. The one exception being the community share offer in which project finances were actually written down.

Meanwhile, a local marketing company and graphic designer were recruited on the basis of the project vision (Int_22), as was the local community development worker in Lockleaze (Int_20). Thus activists' mobilisation of human and social resources mirrored that of financial resources. The approach led to a churn of project activists and partners around a charismatic focal activist (Int_18). This reinforces the observation that failing to move beyond their own project vision activists struggled to realise the material implementation of the pilot project.

A missed opportunity to represent users

Activists do not attempt to represent Lockleaze residents during the pilot project. On the contrary, their approach to local residents - as passive recipients of the project - suggests a missed opportunity to support the formation of a 'community voice' and, perhaps more importantly, support their own project. I draw this conclusion on the basis of reflections by the

community development worker who suggested activists misjudged their approach to local residents:

> "The problem that I came across in the meetings was they were saying yes 'we can do everyone, yes we can do flat roofs, yes we can do council tenants' but when push came to shove they didn't have the finance, they couldn't do flat roofs and they definitively couldn't do council tenants." (Int_20)

Instead she outlined an alternative approach to engaging residents and their concerns, an approach that might have motivated them into taking action to support the project:

> "If you are going to keep people with you, you have to be quite fast or at least be realistic with them and not promise them things that won't happen. Alternatively, you put it in people's heads or at least empower them so that if they say 'I have got a council house can I have it?' We say no but we have a standardised letter, send it whoever was the leader of the council then and George now and if enough of you send it they will start listening and will have to respond. Keep us updated with what response you get. Why don't you join together and write a joint letter, but that bit is much better than just saying no or yes either way. If you say yes then you are promising something that you can't deliver and if you say no then you disempower people and create an inequality in the fact that they can't have it." (Int_20)

The point is viewing local residents as passive recipients of the technology was problematic and detrimental to the project. It was problematic because it did not allow for the community to get involved in the project, to make it their own. It was viewed as yet another idea forced on the community from the 'outside' (Int_20). This, in itself self suggests a further important addition to the community-intermediation framework: to truly be a community-based approach, activists need to allow the space and flexibility for the wider community to domesticate the project, embedding it within their community.

The approach was detrimental because there was clearly interest from local residents. Interest that was turned away if their roofs were too small, their homes too energy inefficient or if they were council tenants. And it is here that a particular form of community brokering could have helped residents domesticate the project and achieve project goals. Activists could have sought to mobilise and channel a nascent community voice for the technology, as the quote above suggests. The obvious recipient being the Council who, when it came to any serious discussion, refused to engage with BP activists. By simply stating that they would broker the participation of the Council, activists disempowered end-users, blocked resident participation in the initiative and undermined their own chance of success.

From this discussion I conclude the project was principally negotiated with local stakeholders within the newly formed BSC (itself an outcome of previous facilitation by activists). Second, that the activists principally sought to align stakeholders to their vision and emergent project plan oblivious to the realities of the local system and external environment, the vulnerability of the plan and its dependence on aligning multiple elements. Third, that resources were

principally mobilised through the alignment of stakeholder expectations with the project vision over and above any detailed project plan and that as a result nearly all resources were mobilised from the local system where activists had more agency to 'talk round' potential supporters. Fourth, activists' passive approach to local residents not only undermined their own project but missed an opportunity to support the formation of local user demand for the technology. From this I identify activists brokering activity as occurring regularly throughout the initiative, as occurring across levels of community, local system and external environment. Key periods of brokering including funding applications and negotiations with commercial financiers, the brokering of the project and actors within the BSC working group and finally brokering financial support through a share offer.

Summary conclusions about the case study

Having concluded each section in turn this chapter conclusion brings together and builds on each discussion.

In summary, the case describes an attempt by a single, charismatic individual and an evolving group of activists to design and implement a pilot project that would be the start of a much large embedding of PV within the city. Central to the narrative is the emergence of a strong vision about the technology and its future potential within the city. Activists subsequently attempt to align multiple local system stakeholders around their vision whilst negotiating over time the particular project design. The project is principally directed to these local stakeholders to the neglect of local residents and the successful local embedding of PV. A PV array is installed on a local community centre and 13 domestic PV systems are installed at great hassle and expense.

From the above discussion of key intermediary processes I conclude that the premise of the initiative was to facilitate access to the technology for local residents and social housing providers. It was above all else an attempt to configure local stakeholders into a particular model of deploying PV systems in which the group of activists were central, mediating between installers, users, the local authority and other social housing providers, national policy and the physical characteristics of the local system.

In particular two phases of facilitation can be analytically distinguished: the first phase around the broad facilitation of local stakeholders, to create a common vision and catalyse the development of a shared project; the second phase when the first phase failed involved a more advanced form of project-led facilitation. The primary reason why their facilitation failed to produce opportunities for others was their approach to configuring overestimated their agency in

a number of key respects. How they designed the project, that is to say configured, relied on significant cooperation between local stakeholders that was so far unprecedented. Their ability to configure stakeholders was limited, further hindered by their inability to learn, to go beyond the project vision to develop a functioning project and to reconfigure their approach when obstacles were presented. Rather than being flexible with the project plan activists carried on regardless arguing that they had superior knowledge of the technology and its future potential. Activists brokering activity was primarily directed towards aligning local stakeholders within their preferred model and repeatedly attempting to negotiate financial resources from multiple different stakeholders.

A variety of different interactions can be observed between key intermediary processes from the case study. First, premised on the providing of opportunities to others, the project clearly involved considerable configuring and brokering activity. By itself this suggests interdependence among key intermediary processes. Second, failure to secure catalyst funding suggested that further configuring of the project was necessary (particularly around the financial plans) in order to mobilise resources (brokering) with which to realise the project and provide opportunities to others (facilitating). Third, the initiative's early facilitation activities (such as events) resulted in outcomes (e.g. BSC) that in turn then changed the network of local stakeholders and provided new opportunities for activists (such as support in configuring the project and new opportunities to mobilise resources). I will explore these relationships in more detail in the next chapter.

Construction of intermediary process pattern

Finally I reinterpret the case in terms of levels of analysis and key intermediary processes to construct a process pattern (figure 8.5). Meanwhile table 8.2 summarises the key influences on the development of the initiative.

The overall initiative emerged because of a perceived opportunity identified by activists. This led activists to attempt to support the emergence of a common vision among local stakeholders and a shared project through facilitating citywide events. During this time a broad project was outlined (configured) and a number of attempts were made to broker resources and support. In June 2011 Bristol Power Cooperative was launched with the promise of future opportunities to multiple stakeholders. These opportunities were subsequently configured around two discreet projects, the facilitation of a demonstration array and a pilot project in Lockleaze. The demonstration array was brokered between a rival community enterprise, the building owners, a single financial backer and shifting FiT support. Meanwhile, with the formation of Bristol Solar City in July 2011 activists used this new space to further configure the pilot project and broker

project development finance from local installers. From September 2011 onwards activists attempted and repeatedly failed to broker commercial loans for the pilot. Facilitation of the technology and project began in the local community in April 2012 three months before PV systems were installed. Unable to secure commercial finance activists brokered support from local installers covering the cost of materials and labour before eventually securing the necessary finance from a community share offer.

Table 8.2: Summary influences on the development of BP's streets of solar project

Level of analysis	**Summary influences on project development**
External environment	• Little user uptake nationally, influenced project design • Introduction of the FiT scheme encourages and provides a foundation to project approach, • Existing 'free solar' model provided business template, • Changes to FiT undermines replication of 'free solar' model, • Declining FiT returns challenges financial project viability, • Changes in PV wholesale market undermine activists' ability to bulk purchase equipment and financial modelling, • Little commercial investor interest undermines activists ability to install PV, • Some geographically dispersed private investor interest in owning PV and becoming a member of the Cooperative,
Local system	• BGCP provides forum to promote ideas, • Local 'Peak oil' report catalysed search for alternatives, • Local project funding (CCF), • Little stakeholder interest in developing community renewables project from BGCP • Local catalyst funding (BCECF) provide necessary project development capital and catalyst to project, • BSC helped build momentum behind PV locally and BP specifically, and a space to interact with installers and local authority, • Little installer interest to join Bristol Power Cooperative, • Supportive and then closed down position of the Council (2010/2011 and 2012 onwards, respectively) limited potential roof space on which activists could install PV, • Little interest from social housing associations reduced number of roofs BP activists could install on, • Supportive local installers providing project support and project finances, • Local infrastructure (housing) limited potential installations (small roofs, shading etc),
Community	• Scepticism from community about project promise and the promises of outsiders due to being an 'isolated council estate', • Low levels of knowledge about PV challenge activists to increase awareness, • Little community interest in cooperative ownership model, • Little community cohesion on which to base community dissemination of the 'offer', • Support from community centre helps create interest,

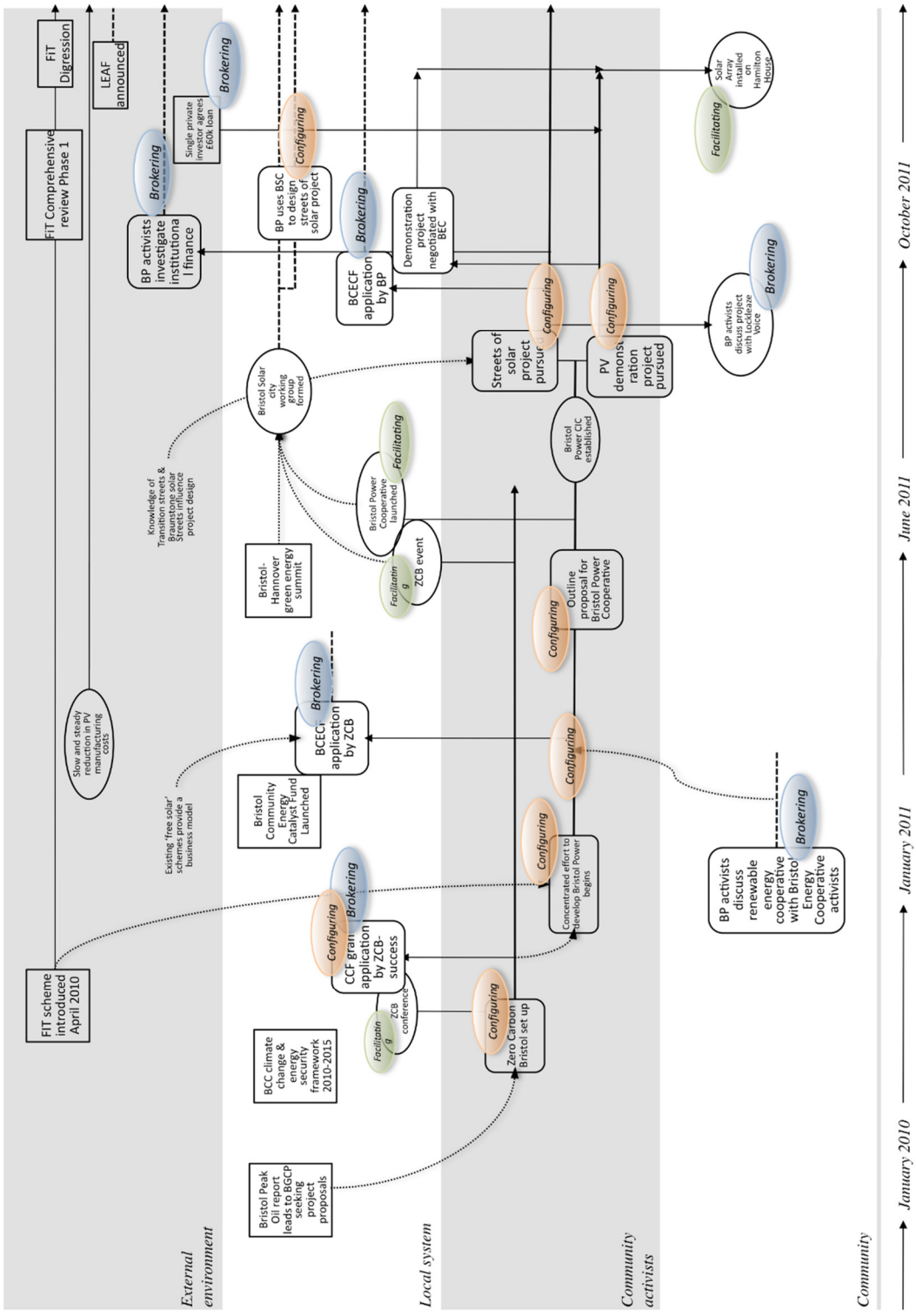

Figure 8.5: Visual map of BP's streets of solar project with key intermediary processes indicated. Note: Figure continues on next page

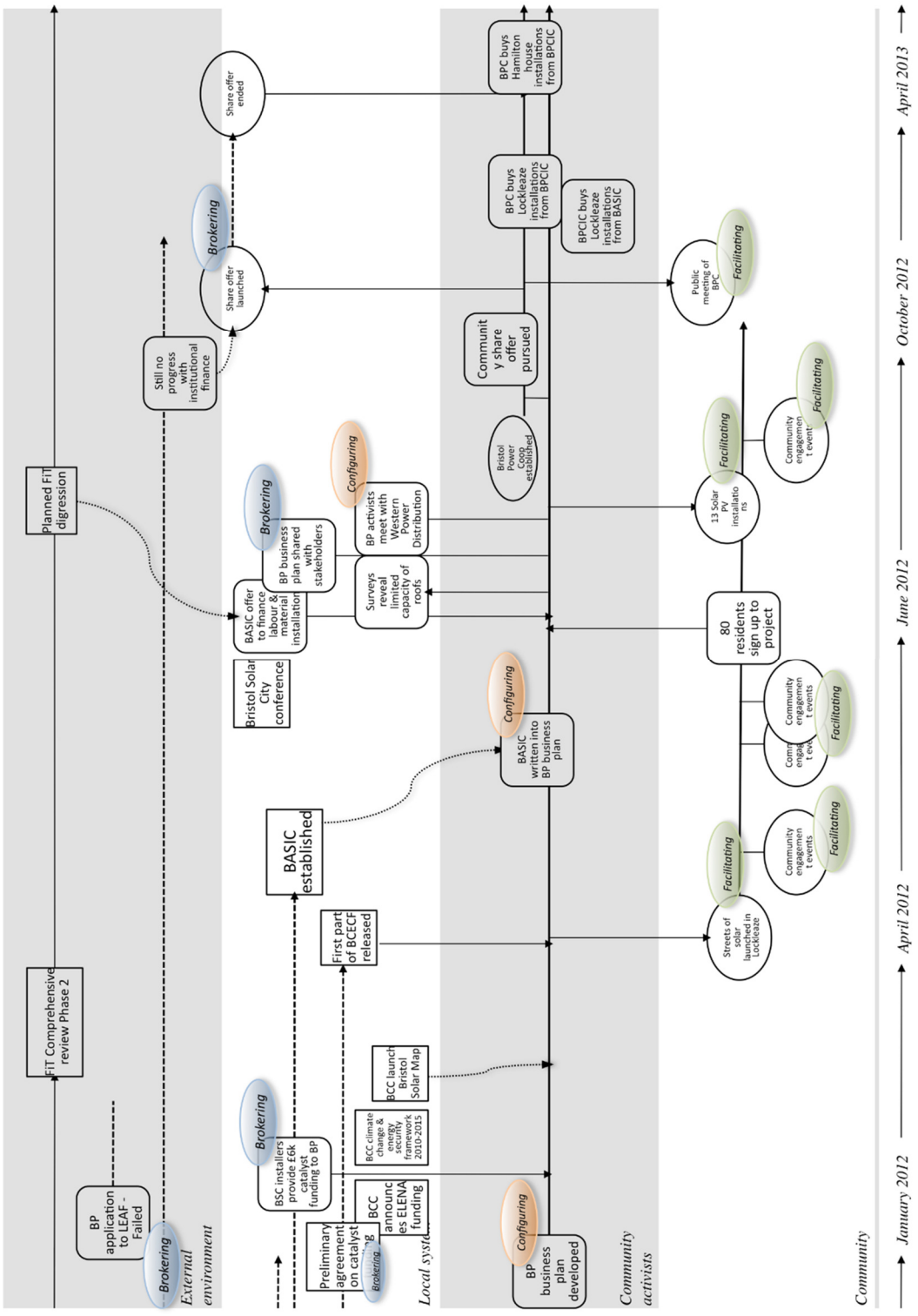

Figure 8.5 continued: Visual map of BP's streets of solar project with key intermediary processes indicated. Note: Figure starts on previous page

Chapter 9
Cross case analysis: Patterns and dynamics in community-based intermediation of two focal technologies

In this chapter I look across the cases studies to answer the research questions. The main research question was: how are community-led initiatives seeking to integrate sustainable energy technologies into local contexts of use? To investigate this question I developed a conceptual framework on intermediary activity for local embedding using building blocks from the social embedding of technology and domestication studies and insights mobilised from research on innovation intermediaries. This resulted in two additional, theoretically informed research questions:

> RQ2: Are there patterns to key intermediary processes in local embedding and what explains these?
>
> RQ3: How do context dynamics affect the agency of community intermediaries in local embedding?

In this chapter I attend to these questions.

In section 9.1 I discuss the relationship between key intermediary processes and observe a common pattern through which community initiatives seek to embed technologies locally. On the basis of this pattern I incorporate insights from the case studies to suggest two feedback loops based on learning and outcomes. In section 9.2 I focus on external dynamics influencing community intermediation by investigating context influences at different levels of analysis: external environment, the local system and community. I explain how and why broad dynamics influence how activists' projects unfold and the agency of activists in this layered context. I conclude the chapter by comparing the case studies on the basis of the two focal technologies in section 9.3. This comparison serves to highlight the differences between them, thereby strengthening the identification of common patterns and context dynamics.

On the one hand, these sections are an elaboration of the main research question: they identify patterns and dynamics that explain how community energy initiatives attempt to locally embed energy technologies. On the other hand, they contribute to filling a gap in current knowledge, taking a semi-technical term 'local embedding' (Billig, 2013) and building a conceptual

framework capable of understanding and explaining how community-based intermediaries attempt to integrate, what they deem to be a socially desirable, economically feasible low carbon technology into local contexts of use. Chapter 10, the following and last chapter, brings together insights from the individual case studies (chapters 5, 6, 7 and 8) with the following cross case analysis to refine my conceptual framework into a dynamic understanding of community-based intermediation for local embedding.

9.1 Patterns of key intermediary processes

To facilitate the identification of patterns and dynamics of local embedding by community initiatives over time I mobilised narrative explanation and process theory methods (chapter 3). By patterns, I refer to common sequences between key intermediary processes over time. In the following I extend the thesis framework by identifying and explaining patterns of key intermediary processes in local embedding. I start by identifying a common pattern about how attempts at local embedding unfold before detailing two observed feedback loops.

A common pattern about how attempts at local embedding unfold

All four case studies are characterised by attempts at creating opportunities for others: their primary purpose being the facilitation (and realisation) of opportunities (the overriding aim being to get the focal technology into the local context). BGDs' activists attempted to demonstrate SWI, stimulate user interaction and local market formation. EEG activists attempted to engage local residents with the technology and provide a means to access it. DEE activists set out to facilitate access to solar PV via the transfer of skills and knowledge whilst BP activists attempted to 'make it easy' for users and consumers to access PV by developing a cooperative social enterprise. Yet, in each case study significant configuring and brokering activity was required to achieve these opportunities, for example workshops had to be designed and resourced, common visions established and actors aligned. This suggests that, at the very least, in order to create opportunities activists needed to undertake configuring and brokering activity.

Building on the main narrative of each case study presented above, I observe a basic pattern about how attempts at local embedding through community initiatives unfold (table 9.1). Each group of activists moved through a basic sequence of intermediary processes in developing their initiatives. Following the identification of a project opportunity the first intermediary role which groups of community activists undertook consisted of shaping the goals and design of projects. This involved configuring processes, such as interpreting the technology and local context,

designing the project and designating desired roles to stakeholders. After a period of configuring activity, activists typically attempted to broker the interest, support and resources of local and national actors in order to be able to undertake their project. If brokering activity was unsuccessful aspects of the project were reconfigured - for example by re-configuring the goal of the project or the actors involved - in order to better negotiate actor support or resources. Where activists brokering was successful, activists typically moved to the creation of facilitation spaces, for example by implementing a demonstration project. Within each of the case studies this facilitating stage was the point in which activists' projects were enacted and resulted in the realisation of the initial opportunity, if successful.

Table 9.1: Basic pattern of key intermediary processes against the four case studies

	Aims	*Identify opportunity*	**Configuring** *Design project*	**Brokering** *Negotiate resources*	**Facilitating** *Create opportunity space*	*Outcomes*
Bristol Green Doors	Promote domestic retrofitting of Bristol homes	Opportunity to demonstrate SWI via grant funding	Design project & write funding application	Secure grant application	Install tech and hold eco-open home event	SWI installed on six properties, 150 people visit the terrace during event, 2700 visit project website, information on project shared at 6 events
Easton Energy Group	Increase awareness of energy in the local community and take action where possible	Opportunity to install SWI in community using government obligated funding via large energy companies	Research and design project. Devise community engagement plan	Secure funding from energy supplier + additional sources	Engage community, survey households, install tech	No SWI installed; 38 residents expressed interest, nascent community voice articulated
Demand Energy Equality	Lower financial barrier to technology and use material engagement to increase understanding of technology and energy use	Increase access to Solar PV via reductions in cost & DIY approach	Design DIY workshops to transfer knowledge and skills	Secure financial support to acquire tools and materials	Undertake workshops	400 workshop participants, Solar tree constructed, 862 DIY solar PV handbook downloads and 4796 accumulative video views
Bristol Power	Move towards community-owned and operated energy infrastructure	Increase deployment, ownership & control of solar PV via social enterprise	Devise business plan	Negotiate financial support and alignment of actors	Engage households, survey properties, install tech & share profits	Formation of BSC and a common vision for the city, formation of BASIC, a 20 kWp demonstration array installed and 13 domestic PV systems, 80 local residents expressed interest in technology

To create opportunities for others the case studies demonstrate how facilitation relies upon configuring and brokering processes. The basic sequence and interaction between intermediary

roles can subsequently be depicted as follows (figure 9.1):

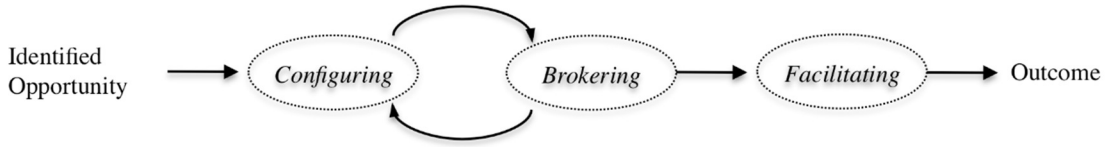

Figure 9.1: Basic pattern in key intermediary processes for local embedding

This basic pattern incorporates two additional elements outside of key intermediary processes that together ground the basic sequence of intermediation: the identified opportunity and outcomes. These additions derive from investigating cases over time and are both contextually and temporally dependent. The former, opportunities, recognises that activists' intermediation is not arbitrary but undertaken with intent following the identification of a perceived opportunity. Identifying opportunities is subjective: an opportunity for one group maybe a barrier to technological deployment for another (e.g. the different approaches of BP and BEC, chapter 8). Outcomes close the sequence of intermediation. I argue that whilst they can be positive or negative (supporting local embedding or delaying and frustrating embedding), intended or unintended and be of minor or major significance, outcomes are always present. The outcomes of the four cases studied are multiple and varied. Together these two elements position, temporally and contextually, key intermediary processes.

This basic pattern fits the generic description of events and their relationships for each case: it encompasses the key developmental pattern of intermediary activity without modification to its essential character. Assessed against theory development criteria (outlined in chapter 3) we can say that the pattern has high generality (the degree to which it fits a diverse set of cases), high simplicity (a low number of elements or attributes to the theory) but low accuracy because the pattern only resembles the narratives at a course-grained level. To further test and refine this pattern I now explore each case study in turn. Doing so not only tests the pattern but also provides a means for explaining why this pattern exists.

Within case analysis of identified intermediary process pattern

In the case studies I utilised a mapping technique based on my conceptual framework. Four horizontal bands situated events, installations and activities relevant to the case studies across levels of analysis. Key intermediary processes were then superimposed (figures 5.5, 6.4, 7.7 and 8.5 (pages 103, 130, 158 and 185/6)). In each case study these visual maps created project development patterns. Here I present the patterns again before using them to inquire into the sequence of key intermediary processes in each case.

In Figure 9.2 I have mapped key intermediary processes in four figures. The first figure represents the development of BGDs' SWI demonstration project, the second figure represents the development of EEG's SWI deployment project, the third represents the development of DEE's DIY solar workshops and the fourth represents the development of BP's streets of solar project[33].

[33] The figures are reproductions of those presented in individual case study chapters and are compressed in order to facilitate easy comparison between cases. The lack of detail is actually a benefit here, since it helps us observe basic patterns to intermediary roles without getting caught up in the detail of each case. However, to fully comprehend the figures I refer readers back to the individual chapters.

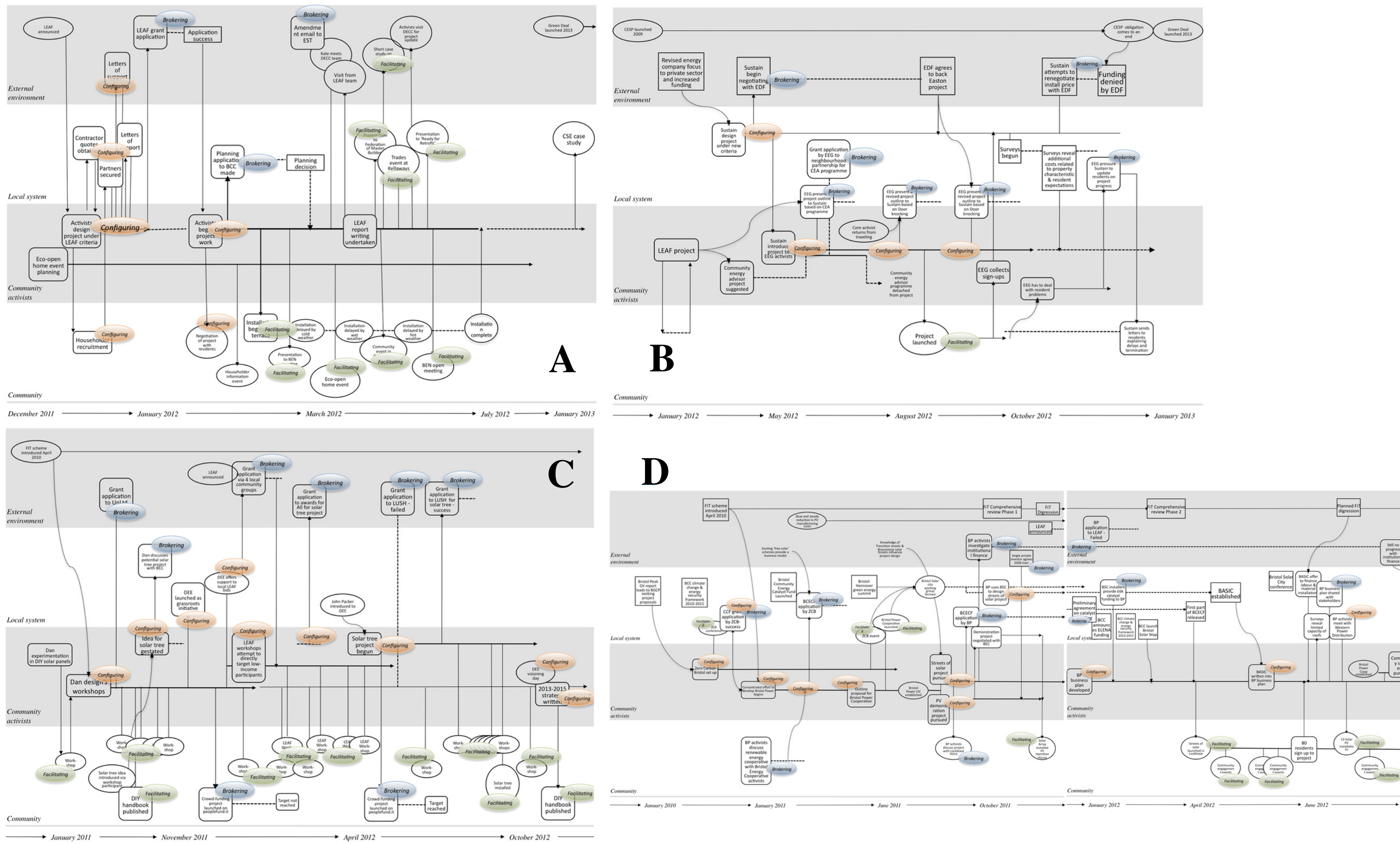

Figure 9.2: Key intermediary process patterns for Bristol Green Doors (A), Easton Energy Group (B), Demand Energy Equality (C) and Bristol Power (D). Note: *configuring* is depicted by orange ovals, *brokering* by blue ovals and *facilitating* by green ovals.

I now review each case study in turn, moving from the generic description of events above to the detailed development of projects. I highlight deviations from the basic pattern and draw conclusions about the observed pattern.

Bristol Green Doors

For BGDs' there is a concentration of configuring activity across all levels of analysis at the start, corresponding to the design of the project and the writing of the grant application. There is also a clustering of facilitating activity towards the end of the case study period, again spread across levels of analysis. The main period of brokering activity involved securing the LEAF grant in January 2012, on which the project was financially dependent. Working backwards, this suggests that in order to undertake the demonstration project and thereby facilitate the local embedding of SWI required prior configuring and brokering activity. Creating facilitation spaces entailed the successful negotiation of resources that in turn was reliant upon configuring of the design and goals of the project.

Additional configuring and brokering activity following the successful grant application suggest deviations from the basic pattern. On further inspection they appear during the implementation of the project, first in the negotiation of planning permission with the Council and second as an amendment to the original project plan. Consequently, the former suggests increasingly detailed configuring and brokering of the project, the latter the adaptation of the project to local circumstances (in this case delays caused by wet weather). As such I suggest these configuring and brokering activities can be viewed as demonstrating the flexibility of the project to developments in the local context. To the basic pattern they suggest flexibility, moving backwards and forwards through the basic sequence. Consequently, I observe the project moving through the basic intermediary sequence once.

Easton Energy Group

The visual map of EEG's energy efficiency project shows a dominance of configuring and brokering activity over facilitation. Configuring and brokering activity again precedes facilitation (recall the time and effort dedicated to designing and negotiating the project with Sustain). Three rounds of configuring and brokering activity can be observed, each time undertaken in relation to Sustain, the project manager. Each round refining the project plan and preceding the facilitation activity the activists thought they would undertake (using 'community advisors' and then 'door knocking'). The launch of the project, the only period of facilitation activity undertaken, sits somewhat outside of the logical development of the project, occurring before agreement of the engagement approach and utilising different means (events and newsletters). Facilitation can therefore be said to have taken place before the conclusion of

configuring and brokering processes. I suggest the project therefore moves through one sequence of intermediary processes, since multiple rounds of configuring and brokering preceded the creation of envisaged facilitation spaces. The project moves through the basic sequence once, before the project collapsed in December.

The partnership element of the project does not, therefore alter the basic intermediary pattern. Instead, I observe the initial opportunity (increased funding from energy companies under CESP) as being identified by Sustain for Easton activists. Sustain also undertook the primary configuring and brokering of the project in relation to EDF, Bullock Construction and EEG. However, this does not alter the sequence of key intermediary processes for activists. Furthermore, brokering activity at the end of the case can subsequently be explained as issues arising from project implementation: they represent actions by activists and Sustain in attempting to overcome these problems. Consequently, I suggest they can be viewed as an indication of insufficient configuring and brokering of the project earlier on. Challenges emerging in project implementation started a new sequence of configuring and broker (in relation to EDF) and created a search for new opportunities and potentially the beginning of a new intermediary sequence.

Demand Energy Equality

Moving to the solar PV case studies there is a clear difference in the length of projects, undertaken over years rather than months. As such there is a question about how and if the basic pattern still fits? Above, I followed DEE activists' basic logic, that workshops provide an opportunity to others, to identify the basic intermediary pattern. Yet, within the case I observe multiple workshops, repeated attempts at negotiating resources (both successful and unsuccessful) and various configuring periods. Two explanations account for this and suggest DEE activists cycle through the basic pattern multiple times. First, multiple workshops were run under each funding stream, explaining multiple facilitation spaces under one period of configuring and brokering. Second, changes in the focus of workshops suggest reconfiguring of the project over time. The project was revised in each sequence, compared to EEG activists who refined their project through three rounds of project negotiation.

From three phases of initiative development I identify three cycles of the basic intermediary process pattern. In the first cycle an identified opportunity (that DIY approaches offered a means to increase access to solar PV) lead to workshops being designed and resources secured (through a grant from UnLtd). A series of workshops were then undertaken and a handbook written. The cycle resulted in the launch of DEE and an additional objective was added (using workshops to increase awareness of energy and demand reduction). The second cycle is

observable beginning with the opportunity presented by LEAF awards. The workshops were designed to work through existing local community groups and facilitation spaces (workshops) were created using the resources brokered from LEAF. The solar tree with its focus on material engagement represents the third cycle: the workshops were again re-configured, resources were brokered from crowd funding and grants and the solar tree was constructed through a series of workshops. In each cycle, workshops form the facilitation activity.

Additional configuring and brokering throughout the case - such as the negotiation of a solar tree project with the local authority in October 2011, the application for a solar tree project in February 2012 or the first attempt at crowd-funding in January 2012 - obscure these cycles. In each instance the negotiation of resources was unsuccessful and alternative means to secure resources and undertake workshops was sought. As such, I suggest they indicate iterations of unsuccessful configuring and brokering activity and thereby give further support to the basic pattern of intermediary roles.

Bristol Power

The length of the BP case also obscures the basic pattern. Yet observed changes in how activists seek to embed PV alongside the differentiation of the demonstration project provides evidence for different cycles of the basic intermediary process pattern. For the first year and a half the project was carried by ZCB, primarily through holding events. In this phase configuring and brokering activity was directed at organising and gathering resources to hold these events, the facilitation space. When this approach failed to produce the desired outcomes a discreet project was formed to pursue the deployment of PV: the project was revised. The second phase quickly split into two strands (the demonstration and pilot projects) following the first configuration of the project and its rejection by the catalyst fund board. The demonstration project subsequently presents the clearest cycle of intermediary processes in this case: the project was conceived, designed, resourced and implemented over a period of six months. For the pilot project an extended period of configuring and brokering is observable, where the activists attempt to broker resources from LEAF, installers and institutional investors amongst others. Facilitation of the opportunity to Lockleaze residents was grasped by activists when they had a minimum of resources: failure to broker sufficient resources (capital backing) limited the amount of facilitation possible (PV systems installed) and lead to difficulty later on (how to pay for the limited number of installations). Again I observe insufficient configuring and brokering by activists resulting in a return to these key intermediary processes, in the re-configuring of the business plan and an alternative form of brokering pursued. For BP three cycles of key intermediary processes are apparent. One (the demonstration project) nested within another (the streets of solar pilot).

The first conclusion I can draw from this discussion is that the basic pattern of key intermediary activity captures the finer-grained detail of activists' intermediation as well as the generic description of events and their relationship. Second, the basic pattern is not necessarily unidirectional: movement backwards and forwards is observed. Insufficient attention to configuring and brokering or activists attempts to skip over key process often cause difficulties later on (during implementation) and require returning to (such as in the case of Bristol Power) or at times stop implementation altogether (such as in Easton).

Third, the visual maps and discussion of the basic pattern highlight different streams of activity within phases or cycles of intermediation. This suggests that key intermediary processes can be undertaken in parallel over time. For example DEE activists attempted to configure and broker future facilitation spaces whilst at the same time continuing to undertake workshops, whilst BP activists' demonstration project was undertaken alongside the development of their pilot project. This can be explained as intermediary processes being undertaken in relation to different actors. Yet, different streams of activity also suggests the basic sequence can be observed operating within larger sequences. For example BP activists' demonstration project was conceived as connected to but distinct from the pilot project, which in turn was the first step of the wider rollout of solar across Bristol. By extension this suggests the basic sequence could be identified at an even finer-grained level of analysis, for instance in the study of day-to-day events or within project meetings. Here, I have taken the analysis of key intermediary processes to a level commensurate with the data collected - based on the identification of events relevant to initiative development derived from document analysis, interviews and participant observation - but this observation suggests a wider applicability of the basic pattern.

Fourth, I observe key intermediary processes as never being 'complete'. Further configuring and brokering may be undertaken during implementation. The basic pattern is, in this sense, ideal-typical of key intermediary processes in local embedding: it outlines the pattern that would be observed under a perfect scenario. An alternative way of thinking about this would be to say the pattern highlights the impacts of preceding processes on those taken afterwards. This, in turn constitutes the basic explanation for the existence of the patterns: latter processes build on and require elements of former processes.

Overall, the basic pattern confirms and extends my framework. Specifically, that facilitation does involve elements of configuring and brokering, and suggests that in order to create successful facilitation spaces prior configuring and brokering activity is required. This supports the first observation made in Stewart and Hyysalo's (2008) framework, that facilitation of

opportunities is key to at least community intermediary activity. Regarding the second and fourth observation of their framework – that balancing is required between brokering and facilitating activity and that success depends on balancing all three roles – it is harder to come to any definitive conclusions. Questions remain over what is sufficient configuring of the project, technology or actors? How can we know when an appropriate amount of brokering has been undertaken? What would too much facilitation look like? Even through ex post analysis of intermediation, these questions are tricky to answer and fall outside the scope of the present research. For this we would likely need definitive criteria of what local embedding entails, something, which we have not got.

By itself, this basic pattern suggests an ideal-typical sequential model of intermediation for local embedding, of 'doing the right thing at the right time'. Although useful for understanding the internal dynamics of key intermediary processes I argue this offers only a partial explanation of local embedding by community intermediaries. Recalling the conceptual framework, a fuller understanding of community activists' agency in local embedding requires placing activity within the wider, structured context. In other words, we need to look beyond the specific activities of the community activists shown in the central band of the visual maps and captured in key intermediary processes, to the variety of dynamics enabling and constraining action over time. I turn to address these dynamics and refine the conceptual framework based on the case studies in the following section (9.2). Before doing so, I outline two feedback loops on the basis of this generic pattern to intermediation.

A learning feedback loop

In the analysis of DEE's solar workshops I suggested learning accounted for changes in the focus of workshops overtime. In other words, reflecting and learning about activity resulted in adjustments to later activity. Here, I take this insight and incorporate learning as a feedback loop within the identified pattern of key intermediary processes. I then discuss the presence or absence of a similar feedback in the other three cases and on this basis extend the explanation of how and why the projects unfolded in the way they did.

Figure 9.3 incorporates activist learning as a feedback loop from the outcomes of intermediation activity to activists' configuring activity and to the identified opportunity. It sets out a generic mechanism in which learning-by-doing is incorporated within an understanding of community-based intermediation for local embedding.

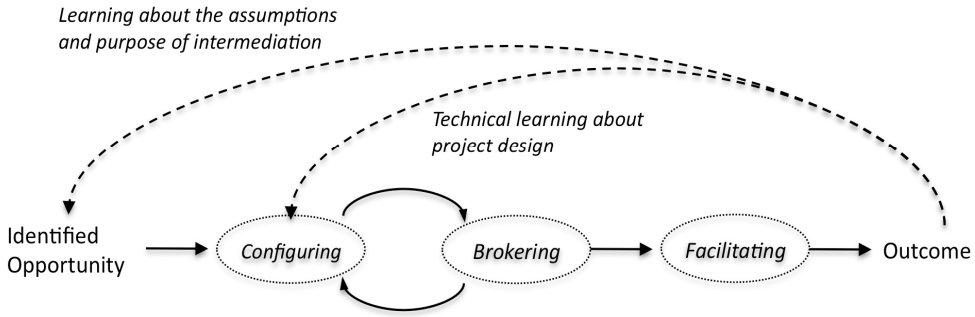

Figure 9.3: Learning feedback loop in community intermediation for local embedding

The smaller feedback loop characterises technical learning about intermediation processes: how the technology is interpreted, projects are designed and opportunities disseminated. For example, DEE activists moved from using a workshop replication strategy to direct targeting of low-income participants because of learning about the barriers participants faced in moving on to run their own workshops subsequently. The longer loop characterises learning about the assumptions and purpose of intermediation activity and is reminiscent of second-order 'niche' learning (e.g. Hoogma et al., 2002). For DEE, this second-order feedback loop is observed in the changing focus of the workshops: as the initiative progressed, activists realised the limitations of the workshops for the material deployment of the technology but at the same time identified the opportunity to use the workshops as an educational experience. Under the new identified opportunity the workshops were re-configured to educate and empower participants about the technology, energy and energy systems. As such the workshops aimed to stimulate second order learning (i.e. challenging assumptions) about energy and energy demand reduction rather than the narrowly technical transfer of knowledge and skills to construct PV panels.

Internal, activist learning is evident in the case of BGDs in a variety of ways although a clear feedback loop is not evident. First, the design of the demonstration project is built on the prior experience of the activists' intermediation activity (holding eco-open home events). Second, capturing and sharing learning was built into the project from the outset and delivered through project blogs, events and case studies. Third, learning outcomes are explicitly sought by activists and reported by intermediaries in case studies. These points suggest learning formed a conscious and active component of the project but the concise, discreet nature of the project and case study provides little time for feedback loops to emerge.

Activist learning is less apparent in the intermediation performed by EEG and BP activists. In project proposals EEG activists argued the project posed an opportunity for learning but during project implementation there is little evidence to suggest experiences were captured, reflected

upon or shared. With hindsight, it is possible to identify a point, following the launch of the project to the local community, where learning could have fed back into the design and continued negotiation of the project with Sustain. On the one hand activists could have walked away from the project. The fact they did not, suggests a strength and weakness of community intermediation: they have the vision and values to proceed where perhaps, others do not, but this single-mindedness can also mean they go beyond what is feasible or do not see project realities. On the other hand, reflection on their experience by September 2012, achieving significant numbers of interested householders through existing community events, might have suggested alternative means of engaging the community than the door knocking approach proposed. The absence of active learning, I suggest, is a contributing factor to the project's overall failure: aspirations to capture learning remain unrealised in practice.

A similar conclusion can be arrived at in the case of BP's intermediation activity, where learning is predominantly absent or simply ignored. The change of approach from phase 1 to phase 2 suggests potential learning about the limitations of early activity but the intention of activists suggests they just sought to get on with it, with or without the support of local stakeholders. In other instances learning about their intermediation activity is stubbornly absent: repeated stumbling blocks include an inability to move beyond the project vision, their approach to the Council and financial negotiations. Once again, the absence of a learning feedback loop helps to explain why these activists faced multiple, repeated setbacks.

Beyond DEE, there is little evidence of second-order learning taking place and in two of the cases basic first order learning is absent. First order learning about intermediation is most apparent in the two cases with discreet intermediary activity: workshops and demonstration projects. In addition, these two projects achieved higher degrees of success against their own aims and objectives. This suggests, and supports findings from other studies (e.g. Backhaus, 2010; Mourik et al, 2009: Heiskanen et al, 2014), that cultivating a capacity to learn - to learn about a plurality of things, such as the community, facilitation activities, local politics, government policies and so on - is important for the realisation of both intermediary and community projects.

The absence of a learning feedback loops in two of the cases does not therefore negate the identification of such a loop. Rather it suggests that additional consideration needs to be given to larger and/or partnership-based projects. Here, and arguably, there is a qualitative difference between short, discreet intermediary activity such as workshops, and the long-term creation of visions, momentum and actor alignment within BP and to a lesser extent EEG. In the former, opportunities for reflection and learning on experiences can be expected to occur at the end of

each cycle of key intermediary processes. But for the latter, intermediation becomes a bigger, multifaceted challenge because of the number of stakeholders involved, the scale of the project and its complexity. Incorporating spaces in which reflection and learning can occur become more important as the project becomes more complicated.

An outcome-based feedback loop

In the second feedback loop I build on an observation made in the analysis of Bristol Power's streets of solar project and an observation above, that cycles of intermediation are discernible, to construct an outcomes-based feedback loop in the basic pattern. In the case study of BP, early outcomes of intermediation activity contributed to the formation of new actors (BSC and BASIC). These new actors changed the number and composition of stakeholders within the local system and were subsequently incorporated within activists' later intermediary activity. In both instances, BP activists used these actors in support of their project: BSC was used to widen and extend a shared vision of a local technological future, BASIC, to design the project and negotiate resources. This sequence of events suggests a feedback loop from the outcomes of intermediation to changes in the local system and therefore changes in the opportunities for future intermediary activity (figure 9.4).

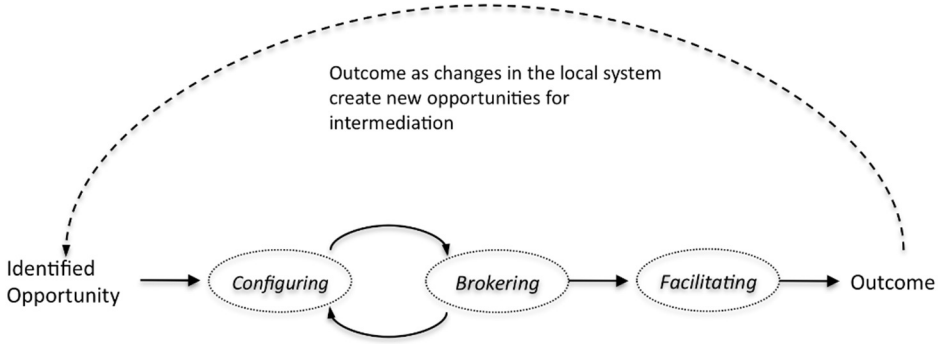

Figure 9.4: Intermediary activity leading to outcomes which change the local system and create new opportunities for future activity

The character of the feedback loop suggests we are only likely to see evidence for it in longer term projects, that is to say within the case study on BP and DEE, or in the subsequent activities of BGDs or EEG, where activists carry their experience to the next project. In the case of DEE, the only outcomes-based feedback loop is self-supporting: prior workshop participants are used as workshop facilitators under the solar tree project. Beyond this, the workshops result in few outcomes as changes to the local system or target community. In contrast, the remaining two case studies are too short to see outcomes of their activity resulting in feedbacks for what they do next.

From this, I conclude that for larger projects and longer-term programmes intermediation can be continuous and circular: outcomes of intermediation can change the local system, which in turn may create new opportunities in the next cycle of intermediation. This feedback loop supports the conception of intermediary action as being *shaped by* and *shaping of* their local context (Raven et al., 2008).

In line with the process research stance and methodological approach taken in this thesis, analysis of the four case studies has supported the identification of an ideal-typical pattern to key intermediary processes. Such a sequential understanding is a common form of progression within process models (Van de Ven, 2007). Its identification uncovers relationships between key intermediary processes and provides us with a conceptual understanding of how community initiatives are seeking to locally embed energy technologies. Feedback loops extend the explanation of relationships as common mechanisms within key intermediary processes. The basic pattern and feedback loops answer the research question on patterns posed above. In the following section I address the external dynamics influencing how activists' projects develop.

9.2 Context dynamics influencing local embedding by community activists

That community energy activity is context dependent is widely recognised and yet, the underlying context dynamics influencing how community projects developed were not well understood. Existing research on community initiatives is underplaying a variety of enabling and constraining factors at different scales resulting in questions about community agency and who the community is. In this research I took the decision to focus on a more discernible core group actor, which has assisted in better appreciating their contexts of action.

The narrative explanation of individual project development highlights the contextually specific development of community projects. Or, in the language of STS, multiple context dynamics were observed influencing how groups of activists identify, configure, broker and facilitate projects that attempt to locally embed technologies. In the following section I extend and qualify understanding of why community action is context dependent by identifying key dynamics with influence on community activists intermediation: I answer the research question how do context dynamics affect the agency of community intermediaries in local embedding?

Analysis of the cases identified 75 influences on how community activists' projects unfolded from the three layers of analysis: external environment, local system and the community. Just under half originated within the local system, just under a third from the external environment and a quarter from the community. For each layer I group influences into key dynamics and

briefly explain their influence on initiative development. This analysis thus combines strategies aimed at understanding case development with systematic identification of context dynamics (see also chapter 3). I will outline key dynamics of each layer in three sections.

External environment

Across the four case studies I identify four dynamics of the external environment influencing community-based intermediation: government policies, market organisation, technical change and user uptake. Table 9.2 presents a clustered summary table of these dynamics with example influences from the cases studies.

Table 9.2: Dynamics of the external environment with influence on community activists' intermediation of energy technologies

Dynamics	Influence on case studies
Government policies	• Targets created expectations, i.e. the need for demand creation and industry support if desired SWI installation rate is to be achieved, and influence aims of intermediation (BGDs) [+] • Renewable energy targets suggested need for greater understanding of demand reduction, influencing aims of intermediation (DEE) [+] The FiT: • Provided a catalyst to initiative development (DEE) [+] • Influenced project design (BP) [+] • Comprehensive review (phase 1) introduced multi-installation tariff at 80% of normal rate, whilst tariff reductions challenged project configuration (BP) [-] CESP: • Stimulated market creation and technology deployment search via large energy companies, influencing opportunities (EEG) [+] • Set project criteria and constraints, impacting project design (EEG) [mixed] Green Deal: • Created expectations and impacted project design (BGDs) [neutral] • LEAF created opportunities (with constraints) (BGDs, DEE) [+]
Market organisation	• Skills shortage in workforce suggested particular aims of intermediation activity (BGDs, BP) [+] • Provided business model (BP) [+] • Perceived distrust of large energy companies suggested particular intermediation activity (DEE) [+] • No institutional investor interest in financial model (BP) [-] • Crowd funding platforms created new opportunities for brokering support (DEE) [+] • Working for EDF impacted (EEG): (a) Protracted project negotiation delayed project start [-]; obligations achieved elsewhere [-]; activists subject to their demands [mixed]
Technical change	• Declining PV wholesale market price (BP, DEE) [mixed]
User uptake	• Prior low technology uptake influenced design of intermediation activity and its outcomes (BGDs, BP) [mixed] • User demographic suggest particular intermediation activity (DEE) [mixed] • Undermined fundamental argument of project (BP) [-]

Note: Brackets indicate the case study the example refers to. Parenthesise indicate the type of influence on activists' intermediation activity: positive, negative, neutral or mixed.

Across all four case studies, national government policies have a strong influence on how community intermediaries identify, configure, broker and facilitate projects, evident by their regular and frequent influence. Government targets create expectations about the long-term technological trajectory of focal technologies. Grant funding provides support. The presence of specific supportive government policies, like the FiT, is another obvious influence: in three out of four cases national policies helped catalyse activists experimentation with technologies (BGDs, EEG and DEE). Yet, such policies are moderated by their stability, challenging community-based intermediation to regularly reconfigure financial models (in the case of BP for

example) or adapt to shifting policy contexts (EEG). Yet where such changes are clearly articulated and planned months or years in advance (e.g. the replacement of CESP with the Green Deal), this suggests activists' projects were over ambitious in what could be achieved within their identified opportunity.

That community initiatives are influenced by national government policy is no surprise. However, this demonstrates, in practice, Seyfang, Park and Smith's (2013) survey-based conclusion, that government financial incentives for technology deployment have a strong influence on the development of community projects. It explains how and why government policies play such an important role. From this it is also possible to identify different types of policy having different impacts on community intermediation. To elaborate this I first explain market organisation dynamics.

National market organisation presented a second large group of influences on community intermediation from the external environment. Here, influences included trust of large energy companies, the growth of crowd funding platforms and interest of financial markets for PV investment. These dynamic play out at the local level as well, but here it is activists' perception and understanding of national dynamics that is important on the one hand. So for both technologies a national shortage of a skilled workforce suggested particular aims of intermediary activity (e.g. for BGDs and BP activists). On the other hand, particular aspects of national markets were also apparent. For solar PV, the growth of the so-called 'free solar' schemes provided a business model for BP activists. Whilst for Easton activists the design of CESP and the market it produced, entailed working for a large energy company, protracted project negotiations (between Sustain and EDF) and constraints on project design. It is here that we get to the influence of different national policies on community intermediation.

National government policy frames and supports the technologies differently, thus resulting in different marketplace dynamics. Historically, grant-funding programmes and more recently revenue-based support via the FiT scheme have supported PV. The latter, in particular, has resulted in a rapidly expanding competitive marketplace with many dedicated small, medium and large companies forming alongside existing market actors diversifying into solar PV installation (Smith et al. 2013; RegenSW, 2014). In contrast SWI has historically been supported by supplier obligations (Rosenow et al., 2013), has promoted limited uptake predominantly within social housing (Duffy, 2013) and has supported fewer, larger and often national installation companies. These dynamics, stemming from government policy influence the shape and form of community intermediation possible. PV projects were undertaken by dedicated groups of community activists set up to run a long-term technology-orientated project,

where large-scale visions of alternative technological futures were created and negotiated in the local context. In contrast, SWI projects were undertaken by existing groups, were discreet, time-limited projects with moderate technological visions (adaptations to existing housing systems). The choice of case studies, in part, accentuates this point because both DEE and BP focus exclusively on PV. However, the emergence of what Willis and Willis (2013) claim to be a standardised community renewable energy model in the last 15 years explains how and why new groups can form around particular renewable technologies. In contrast, no large-scale, community, energy efficiency 'model' currently exists.

Government policy and market arrangements thus created different community intermediation opportunities. The FiTs presented an ongoing opportunity facilitating the emergence of dedicated, long-term projects. CESP presented a contained, time-limited opportunity that only established groups could engage with. Importantly, CESP targeted suppliers whilst FiTs targets the end-user: the former an obligation, the latter a reward. The introduction of the Green Deal has the potential to change community intermediation for SWI and a range of potential community intermediation roles have been identified (e.g. CSE & University of Bristol, 2012) but the legal requirements and challenges communities face in doing so are prohibitively high.

Two additional influences, from the external environment include broad technical change and user uptake. Declining PV wholesale market prices contributed to regular reconfiguring of BP business models and reduced savings from using DIY approaches. Perceived user take up at a national scale influenced the design of projects for BP and BGDs, whilst the demographic of national solar PV users suggested a particular form of intermediary activity for DEE. These dynamics had an influence on intermediaries' configurational activity - how they designed projects – and by extension, their implementation, where project designs no longer worked.

Overall, I observe these four characteristics of the external environment as background influences on activists' intermediary activity. Their presence is observable within the case narratives, some like government policies, to a larger extent than others. Market organisation and technical change influences are more apparent within the PV cases than SWI cases. On the one hand, this is attributable to a methodological bias in the research: the longer duration of PV cases provided time for changes to emerge. On the other hand, these differences reflect the maturity of each technology and their respective markets. It is also possible to identify the impact of particular government policies on the types of intermediation possible by communities.

Local system

Across the case studies I identify four broad dynamics of the local system that influence key intermediary activity: local politics and policy, local market organisation, geography and a green milieu. Table 9.3 summarises these dynamics with examples of their influence from the case studies.

Table 9.3: Dynamics of the local system with influence on community activists' intermediation of energy technologies

Dynamics	Influence on case studies
Local politics and policies	• Providing local resource opportunities (BP, EEG) [+] • Building momentum behind technology (BP) [+] • Developing alternative technology pathways (BP) [-] • Support (BGDs, DEE) and disinterest (BGDs, BP, EEG) from local authority [mixed] • Disinterest from local stakeholder network (BP) [-] • Planning and building control posed hurdle and delay to project (BGDs, EEG) [-] • Catalysing projects (BP) [+]
Local market organisation	• Suggested objectives of intermediation (BGDs, BP) [neutral] • Previous market experience undermined project (EEG) [-] • Limited interest undermining intermediation activity (BGDs, BP) [-] • Supportive installers (BP) [+]
Geography	• Physical, infrastructural characteristics influenced design of project (BGDs, EEG) [neutral] • Restricted resources (DEE) [-] • Challenged technology deployment (EEG, BP) [-]
Green milieu	• Brought momentum to project (DEE) [+] • Supportive network of organisations (BGDs, DEE, BP, EEG) [+]

Note: Brackets indicate the case study the example is linked to. Parenthesise indicate the type of influence on activists' intermediation activity: positive, negative, neutral or mixed.

Local politics and policies can catalyse projects. They also provide resource opportunities to community intermediation: for example local catalyst and grant funding. Less obvious are potential cultural (e.g. inspiration and moral support), social (e.g. credibility, publicity), physical (e.g. technology deployment sites) and human and organisational (e.g. skills, knowledge, experience, labour) resource opportunities. Of these natural resources requires further explanation. Sites for technology deployment (such as social housing in Lockleaze) are often owned and managed by the Council and as a result their policies (e.g. to housing) therefore impacts how and if community initiatives can access these physical resources. Together these dynamics are observed influencing identified opportunities for community action but they also have influence across all key intermediary processes. They shape how community activists configure projects, how and where activists broker resources and support, and influence the aims of facilitation.

Local policies also create and uphold local rules. The clearest example is of local planning and building control regulations in SWI projects, in which the Council plays a key role interpreting and enforcing national planning guidelines. Negotiating planning permission was a challenge in both SWI projects. This is because councils locally interpret national planning guidelines, the guidelines are variable, they evolve over time and are negotiated by multiple stakeholders and activity.

Less recognised is how local policies can also build momentum behind particular technologies and particular visions for their integration into the local context, which can be beneficial, in the broad sense, to community activists (e.g. BP). Conversely, key stakeholders can develop alternative and competing technological development pathways diverging from those proposed by community activists. Whilst the former may build support for community activists and make it easier to align local actors and broker resources, the latter may close down and move attention away from activists initiatives. The changing position of Bristol City Council to solar PV is a good example of this, moving from an open, supportive stance in 2010 to developing their own plans from January 2012 onwards and thereby, simultaneously closing down alternative PV embedding pathways (under BP for example) but opening up new opportunities for others. This leads to a further observation. Stakeholder positions often evolve during the course of longer community activity: the interests of stakeholders are thus not static and unchanging but exert dynamic influences over time. Moreover, it suggests that community-based strategies for local embedding positioned within a local technological trajectory (e.g. BGDs) will be easier to realise than developing new or alternative local technological trajectories (c.f. DEE).

From this I suggest local politics and policies include local political stakeholders (local authorities, neighbourhood trusts and quasi-autonomous working groups, e.g. BGCP or BSC), local policies (both formal, such as Bristol City Council's Climate Change and Energy Security Framework, through to housing and neighbourhood planning, and informal, such as the 'one-gigawatt for solar PV' target), reports and events.

Both local market organisation and geography can be considered 'objective' influences, in that they can be statistically quantified. However, here I observe activists' interpretations being key to influencing community intermediation objectives. Few, locally certified SWI installers suggested engaging the local buildings trade for BGDs, whilst capacity building of local solar PV installers was an additional objective of BP. Thus, activists' knowledge and interpretation of local markets dynamics is found to strongly influence their identification of opportunities and how they configure projects. Alternatively different interpretations of physical resource opportunities and constraints shape identified and realisable projects. For example existing local

infrastructure, such as the shape and size of housing, influenced identified intermediation opportunities, project objectives and implementation across the cases. Most notably, the existing material landscape challenged and undermined the installation of focal technologies because the realisable technological potential (given project constraints) was often over estimated in the design of projects, as was the case in Easton and Lockleaze. Again activists' knowledge, understanding and interpretation of geographical characteristics influenced how they designed their projects.

Local market organisation also influences the number and spread of potential stakeholders in activists' projects. This is an obvious point but less recognised at present within community energy research or research on innovation intermediaries. In three of the cases local market actors were the primary stakeholders with whom activists attempted to configure and broker projects. In turn the experience and interests of local market actors influenced activists projects by providing or withholding resources. Consequently, I suggest local market organisation dynamics include local market actors (namely installers but also manufacturers, trades men and consultants etc) and the shape of the local market: its vibrancy, size and rate of growth. It exerts influence across intermediary activity, shaping the identification of opportunities, influencing the configuration of projects, providing and withholding resources and influencing facilitation activities. Meanwhile, geography relates to the physical situatedness of the local context, its natural and material infrastructures.

Finally, the local system displays characteristics of a 'green milieu' (Ornetzeder & Rohracher, 2006; Seyfang & Smith, 2007) as supporting the development of community activity. This should be unsurprising given the location of the research. Yet the dynamics this exerts are often subtle, providing support for and bringing momentum to particular community-based approaches (e.g. DEE) whilst supportive local organisations provide inspiration, moral support and common platforms through which ideas could be formulated, shared and developed.

These four dynamics are observed as the primary influences of the local system, which in turn constitute the primary context of the community initiative. The local system thus mediates externally generated opportunities and contextually situates broader dynamics of the external environment. For example the cost, scope and viability of SWI depends on the type and age of local housing whilst the amount of solar radiance for PV depends on geographical location. National market organisation manifests in particular dynamics at the local level and influence opportunities and the design of projects. As such there is a logical coherence maintained with external environment dynamics: the local system is conceived as linked to and nested within the external environment and so background external environment dynamics manifest in the local

context. The local system contextualises activity and situates activists, geographically and politically, in local networks and stakeholder groups.

Community

I identify four community dynamics with influence on how activists identify, configure, broker and facilitate projects: interest and empowerment, history, expectations and knowledge, skills and confidence. Table 9.4 summaries these dynamics with example influences from the case studies.

Table 9.4: Community dynamics with influence on activists' intermediation of energy technologies

Dynamics	Influence on case studies
Interest/ Empowerment	• Fewer visitors than anticipated to event (BGDs) [-] • Community culture of disempowerment leading to scepticism & disinterest (BP) [-] • Widespread interest in DIY workshops (DEE) [+]
History/experience	• Negative housing renovation experience from 1990's (EEG) [-] • 'isolated council estate' (BP) [-]
Expectations	• Managing expectations between project participants (BGDs, EEG, BP) [neutral] • 'They wanted it to look like it did at the moment' (BGDs) [neutral] • Compromised technical efficiency over aesthetics [BGDs] [mixed] • Minimum standards for finishing (EEG) [neutral] • Technical performance and liability (BP) [mixed]
Knowledge, knowhow, Skills & confidence	• Limited experience of technology (BP) [-] • Potential facilitators required engagement skills to recruit workshop participants (DEE) [-] • Willing open home volunteers (BGDs) [+] • Potential workshop facilitators lacked confidence (DEE) [-]

Note: Brackets indicate the case study the example is linked to. Parenthesise indicate the type of influence on activists' intermediation activity: positive, negative, neutral or mixed.

Levels of community interest and empowerment have a fundamental impact on how activists' projects developed. They reflect a basic characteristic of a community - e.g. the levels of interest community members have in local issues - but also the ability of community activists to frame issues and projects in a manner appropriate for that community. The cases demonstrate that to be successful community projects need to overcome community disinterest and tackle any sense of disempowerment. In doing so they add further weight to Seyfang, Park and Smith's (2013) identification of common obstacles (see page 13). In turn, apathy and 'cultures of disempowerment' point towards community history as further influencing activist ability to embed technologies, for example in Lockleaze and Easton.

More important for community-based intermediation are community and individual user

expectations. Expectations about what is involved, timeframes, outcomes and benefits all had to be negotiated with users. This is evident in both SWI projects. For the demonstration project terrace residents expected 'it to look as it did at the moment' which subsequently involved modifications to the original project plan. Resident expectations about the quality of finishing work in Easton also presented a challenge. Knowledge and expectations about the technology and project are also observed being negotiated within BP open-meeting with local residents. Expectations also evolve over time, as users learn more about the technology and project. Moreover, expectations are important for 'domesticating the project' (e.g. BP).

Finally, where activists sought to create peer-to-peer approaches to facilitation (for example within DEE, BGDs and to a lesser extent EEG) further characteristics of the community influenced how feasible this was. Here, pre-existing levels of knowledge (across various domains such as energy, technology and the community) and skills (e.g. technical and social) all effected how easy it was for core activists to recruit, train and utilise community participation within their initiatives. Individual levels of personal confidence affected the ability of activists to mobilise community participation.

These four community dynamics have influence across all intermediary processes although they are often more easily observed within facilitation activity where problems typically arise. In many ways it can be characterised as the community pushing back against activists' ideas and aspirations, making itself felt by not providing a good fit. This points to the connection and proximity of community activists to their community as being important for overcoming some of these issues in implementation. The more activists know and understand their target community the greater chance of recognising and being able to respond to the needs and aspirations of the community.

This suggests a wider point about the cases observed. Each group of activists' attempts to embed their particular strategy or approach that is many ways envisaged independently of their community. In this sense BP activists did not just try to embed PV, but their particular model for PV, and chose a community that they thought was particularly suited to the project. This is perhaps the most extreme example within the four cases because they have such a disembodied sense of community but all of the cases do this to a certain degree and in part because of external environment constraints (e.g. CESP for EEG or LEAF for BGDs). In short, the cases vary in terms of their reflexivity towards their target community.

From this investigation into context dynamics I come to three further conclusions about activists intermediation for locally embedding technologies. First, community-based voluntary

intermediaries have limited power and agency to locally embed technologies. Their actions are both enabled and constrained by dynamics across context layers. The external environment primarily acting as background influences, way beyond the control of activists but providing opportunities that activists' can seize. The local system situates broad dynamics of the external environment according to local conditions (geography, politics, market organisation and culture) and situates activists within stakeholder networks. Activists have greater, although again very limited, influence over developments at this level. In part this is because local embedding involves the alignment of multiple elements within the local system, each influenced by multiple local actors. What activists can and cannot do is dependent upon the support and backing of local stakeholders. Finally the target community enables and constrains possible courses of intermediation in subtle but significant ways.

Second, analysis of target 'community' dynamics suggests a sceptical view of the degree to which activists are community based. Whilst, activists' projects often target a specific community their connection to that community should be viewed as relative rather than given. In two of the cases (BP and DEE) activists' connection and proximity to their target community was tangential rather than being 'embedded within'. As a result these initiatives had to learn about their target community and experienced more issues implementing their projects. Moreover, the disaggregation of core activists from their target community reveals the 'target community' as only one of multiple, potential target audiences which community-based intermediation seek to engage, local installers, builders or the local authority being others. Knowledge and connection to a specific community should not be assumed but is nonetheless important to the development of realisable local embedding projects.

Third, to be successful, community-based intermediation needs to be flexible and adaptable to fit in with or make use of changing context dynamics and opportunities. Local embedding is a contextually and temporally contingent process. The case studies demonstrate how context dynamics evolve and stakeholder positions change. On the other hand, flexibility and adaptability is important because activists learn about local context conditions and target audiences as projects unfold. Without flexibility projects cannot adapt to requirements of target audiences or physical characteristics of the local system.

In summary, through analysis of all influences on the four case studies I have identified three sets of context dynamics at three levels of analysis. The differentiation of these context layers is analytical and as such they are interlinked in practice. From the activists perspective I have identified local system elements with importance on local embedding. Doing so I have substantiated how community-based initiatives are influenced by a variety of enabling and

constraining dynamics at different scales. This analysis of context dynamics answers the detailed research question posed above.

The cross case analysis thus far has concentrated on common patterns across cases and the identification of common context dynamics. I have highlighted differences between focal technologies where apparent. In the final section to this chapter I take a closer look at differences between the two focal technologies studied in this thesis, their particular characteristics and the impacts this has on community-based intermediation. The choice of focal technologies and cases was originally taken on the basis of differing characteristics of the technologies (one demand, one supply) and that these features of the technology may have an impact on how local embedding occurs. These technological differences subsequently contribute to the diversity of cases studied.

9.3 Technology comparison

The focal technologies come from two distinct categories: renewable energy generation and energy conservation. They are different in terms of policy context, market competition and stakeholders involved (as discussed above). Their embedding in local contexts of use is also quite different: physically, economically and socially. Yet, at present my conceptual framework does not distinguish between the focal technologies being embedded. Thus the focus of this final section is on how technology affordances (differences between SWI and PV) affect community-based intermediation. In the following I address scale, ownership, investment, installation and use.

First, the scale at which the focal technology was materially embedded (or not) varied subtly across the cases. BGDs and EEG sought to install SWI on domestic properties, whilst DEE sought to facilitate small-scale DIY systems of a few hundred watts and BP installed 13 2.5 kWp PV systems on domestic properties and a 20 kWp PV system on a community building. The difference primarily results from SWI being a retrofit technology, the size and scale at which it is deployed being determined by the characteristics of the particular building. In contrast, PV is eminently scalable from the installation of a few panels on a small roof, through 50 panels on a community building to thousands of panels making up a ground-mounted solar farm. Community intermediation of PV therefore has a choice over the scale of the embedded technology (c.f. SWI).

Related to the size of installations are questions of who owns the embedded technology and who benefits monetarily or otherwise? For solar PV multiple ownership structures are currently

possible (household, social housing, community or business, (see also Walker and Cass, 2007)) and result from multiple means of financial return (electricity savings, generation tariff and export tariff). For example, a self-financing household can purchase a PV system and retain all benefits. Alternatively, a business or a social enterprise (a community or social landlord) such as BP can finance the system (typically retaining ownership) and receive the generation and export tariff, whilst the householder receives the generated electricity for free or at a reduced price. For SWI there are arguably only two ownership models. Either a householder acts as owner and beneficiary or a social housing provider acts as owner and the occupant receives the benefits. This is because the single means of return from SWI is derived through financial saving on heating energy not used. The introduction of the Green Deal in 2013 changed this situation and opens up a space in which (necessarily large) companies can take on a position close to that of an 'energy services company' (ESCo).

Thus in both SWI cases activists attempted to support SWI embedding strategies based on household ownership and return. Meanwhile in the two solar PV cases, a collective community strategy (BP) and individual household ownership strategy (DEE) were pursued. BGDs and EEG activists had little choice in the matter, whilst DEE and BP did. Extending this, I note the emergence of a common community-orientated renewable energy business model in recent years (as outlined by Willis and Willis, 2013). A comparable SWI or broader energy efficiency model has so far remained elusive. In short, it may not be possible to collectively invest in making other people's homes more energy efficient in the same manner people invest in local solar cooperatives. Thus the difference in potential ownership structures between the focal technologies again necessitates different embedding strategies. This distinction is broadly applicable across energy generation and energy efficiency technologies because of current government policies (e.g. the FiT and Renewable Heat Incentive for generation technologies and principally the Green Deal and ECO for energy efficiency technologies[34]).

Third, the level of financial investment required to materially embed focal technologies varies. The situation is complex and dynamic. For commercially made and installed PV systems there have been significant cost reductions, from £5,000 per kW in 2010 to £2,070 per kW in 2014 (chapter 4). For DIY PV utilising DEE methods, I extrapolate the cost as being £550 per kW (according to Quiggin, 2011). For SWI the situation is more complicated because of differences between internal and external insulation techniques, the potential for hybrid systems and the design of the market (under CERT, CESP etc., which makes actual costs commercially sensitive information). The result is a wide variety of estimates: for example CSE's Warm Streets

[34] Note on the 23rd July 2015 DECC effectively announced that it was bringing to an end the Green Deal scheme. It is not yet clear what will replace it.

Scheme (2009-2010) reported average cost of external SWI as £15,750 (ranging from £12,500 to £19,000) and £5,600 for internal SWI (Morris, 2010), whilst later estimates calculate external SWI to range from £10,500 to £14,500 and internal SWI to range from £5,500 to £8,500 (CSE, 2012). Meanwhile Rosenow et al. (2014) calculate SWI to average £9,000 whilst DECC calculate SWI to cost £5,970[35]. What DECC's calculation do not include is the cost of additional works, which Consumer Focus (2011) argue typically amount to 37% of SWI installation costs.

Installing either technology is a significant financial commitment. Yet there are also clear differences. For PV the cost is (relatively) straightforward to calculate, whilst for SWI there are multiple site-specific characteristics and installation specific variables to include (variables which ultimately made the EEG case collapse). The community intermediation involved in financing the installation of SWI is therefore likely to be harder than for PV. At the very least it suggests if community intermediaries are to take on the role of project manager under a supplier obligation (e.g. Sustain, under CESP in the EEG case) additional skills, knowledge and project management expertise are required. Even so, different community-based intermediary opportunities are apparent, stemming from the added complexity of financing SWI: such intermediation may involve guiding households through detailed site-specific installation calculations, navigating and guiding the community through externally funded programmes or potentially encouraging multiple property or area-based installations that may reduce material costs.

How the focal technologies are installed also present different opportunities and challenges for community intermediation. The installation of SWI is a highly disruptive activity, compared to the installation of commercial PV systems. It typically lasts for months, rather than days, involves significant disruption to household lives (room clearance, the disconnection of waste pipes etc) and the potential for delays is much greater. This suggests that the material installation of SWI is harder in practice and perhaps more challenging to community intermediation. But the installation of SWI also opens up new intermediation challenges and opportunities to communities, for instance via project management (e.g. BGDs), ongoing mediation between parties (e.g. EEG) or potential peer-to-peer support (again, EEG). Indeed, Banks and White (2011) signal the importance of on-site project management to manage expectations and deal with complications as they arise. Both SWI cases in this thesis support this, alongside previous suggestions (e.g. Platt, Cook & Pendleton (2011) and Consumer Focus

[35] Based on DECC's Green Deal Home Improvement Fund providing funding for 67% of the costs of installation up to a maximum of £4,000. See DECC (2014) Green Deal home improvement funds announced, https://www.gov.uk/government/news/green-deal-home-improvement-fund-details-announced. Each of these estimated figures are calculated on the basis of installing SWI to a semi-detached three-bedroom house.

(2011)) that trusted community intermediaries could have a role to play building interest in the technology, mediating between parties and potentially developing area-based approaches. They also demonstrate that doing so is far from easy.

Yet, despite the relative ease of installing commercially made PV, challenges were also present in the installation of DIY PV system. The installation of off-grid, DIY PV systems necessitated further knowledge and skills of workshop participants (beyond how to construct a panel) and additional equipment to use the generated electricity.

As a result the focal technologies have different configurational requirements. In the language of Späth and Rohracher (2012), SWI sits within a loosely coupled heating and household system: SWI needs little to no integration with other technologies in order to work (although Platt, Cook and Pendleton (2011) suggest the beneficial coupling of SWI with heat pumps). In contrast, PV requires being embedded in a tightly coupled electricity system. It is a 'configurational' technology (Flex, 1994), where the challenge is to get multiple technical components to work together. Experimentation with this configuring is however, settled through rules and regulations on the connection of PV panels to households and local distribution networks. Yet this only applies to PV as installed under BP. This type of configuring was really important (and challenging) for DEE because they sought to facilitate people in building off-grid systems, unconnected to local distribution systems (which provided its own challenges) and removed from how people normally interact with their electricity in the household. Thus DEE's choice of technology later impacted on the type and extent of intermediation required: entirely new socio-technical systems had to be created around the DIY panel, battery storage and new equipment.

Finally, this points towards differences in the use of focal technologies. SWI can be characterised as 'install and forget' since it requires no ongoing interactions or changes in user practices[36]. With PV there is the potential for ongoing interaction, changes in user practices and routines to make the most of the electricity generated. This is particularly acute in the use of DIY PV systems that necessitate changes in user practices in order to utilise the direct current electricity generated.

Thus particular features of focal technologies have implications on how local embedding occurs and the strategies available to community-based intermediaries. Particular affordances of the

[36] Whilst in principle this is the case, in reality the installation of SWI may require changes to users practices depending on how well the installation was undertaken and how well ventilated the house is as a result.

technology - including their potential scale, means of ownership and return, cost, installation and use - all contribute to the diversity in the cases studied. It is likely that each and every technology will have particular characteristics that affect community-based intermediary attempts at local embedding. However, it is clear that greater variety in PV ownership and return coupled with its ability to be scaled, opens up a wider variety of potential embedding strategies to community intermediaries than compared to community intermediation of SWI. It is also clear that particular characteristics of technologies ease or complicate community intermediary attempts at embedding. This is most clearly demonstrated in the two PV cases, where seemingly indistinguishable technologies actually have different affordances resulting from being made commercially or by users. Finally, the challenges involved in calculating the costs of SWI and long installation process create new opportunities for community intermediation not apparent in PV embedding processes.

Summary conclusions to the chapter

This chapter has looked across the case studies to answer the research questions. Firstly, using the visual maps to seek common patterns within key intermediary processes a basic ideal-typical sequence of key intermediary processes was identified. This basic pattern makes a claim concerning the specific way in which community intermediaries attempt to locally embed energy technologies. I have argued and illustrated that the pattern is identifiable within the basic and detailed sequence of project events and their relationships. Two feedback loops extend explanation of how activists' projects unfolded. I argued that internal learning by the activists can and should account for changes in the project over time, whilst outcomes ground the intermediation sequence and they also create feedbacks for ongoing or future intermediation.

Second, I explored and analysed context dynamics influencing how activists' projects unfolded via an analysis of influences. External environment dynamics were found to act as the broad context of initiative development, whilst local system characteristics mediated and situated these broad characteristics. I argued that situating activists and their project within their wider context was necessary for understanding how and why projects develop. In brief, how activists interpreted external and local dynamics influences the identification of opportunities and project design. Brokering was principally undertaken in relation to the local system and opportunities were created for actors here. Activists' facilitation activity was undertaken within the local system in respect to local communities and local system stakeholders. On the basis of these context dynamics and basic pattern to key intermediary processes I am now in a position to refine the conceptual framework into a dynamic understanding of community intermediation for local embedding.

Third, I discussed differences between the focal technologies, extending the identification of differences already highlighted (around policy context, market competition and stakeholders involved) and drawing out the implications for community-based intermediation. Doing so highlighted some key differences between the technologies and the diversity of cases studied and on this basis it strengthen the identification of sequences and patterns.

The following chapter concludes this thesis. I do so by synthesising insights from within each case study and from the cross case analysis. On the basis of these conclusions I refine my conceptual framework to create a dynamic understanding of community intermediation for local embedding. I end by drawing implications for future research, practitioners and policy-makers.

Chapter 10
Discussion and conclusions

The integration of existing low carbon technologies into everyday life remains a challenge. As Watson (2012, 102) suggests "most of the technologies required to deliver the dramatic reductions in emissions that are necessary already exist". The challenge is not their technical feasibility but integrating them into local contexts of use. In this thesis I have approached the study of local embedding through a particular type of actor, community energy initiatives, to explore their agency to locally embed sustainable energy technologies and the context dynamics influencing how their projects develop. I have been guided by the broad research question,

> **RQ1: How are community-led energy initiatives seeking to integrate sustainable energy technologies into local context of use?**

From this particular problem framing and empirical entry point I exposed a gap in knowledge, between the social embedding of technology into wider society and the domestication of technology by users: little is known about the innovative work involved in adapting existing technological solutions to existing 'on the ground' conditions and getting them to actually work in local contexts. In this thesis I have built a framework capable of understanding the agency and context of community-based intermediaries, using building blocks from Sustainability Transitions, domestication studies and insights from research on innovation intermediaries. This approach led to two, detailed research questions:

> RQ2: Are there patterns to key intermediary processes in local embedding and what explains these, if any, patterns?
>
> RQ3: How do context dynamics affect the agency of community intermediaries in local embedding?

Having applied the framework to four case studies, I will now extend it into a process theory on community-based intermediation for local embedding. In others words I move from the static conceptualisation of community activity presented in chapter 2 to a dynamic understanding of community-based intermediary agency for local embedding. Application of the framework to four case studies also resulted in a number of additional conclusions about community-based intermediation. So before revising the framework I bring together key insights emerging from the research as a set of conclusions about community intermediation for local embedding in section 10.1. Next I revise the framework into a dynamic understanding of community

intermediation for local embedding in section 10.2. I state my conceptual contributions clearly in section 10.3 before concluding with reflections for practitioners and policy makers in sections 10.4 and 10.5.

10.1 Key insights emerging from the research

In this section I draw together insights from the research as a set of conclusions. I start by drawing conclusions about the detailed research questions. In the following I discuss their generality, simplicity and accuracy (based on the theory development criterion laid out in chapter 3), their implications and limitations.

Conclusion 1: An ideal-typical sequence to key community intermediary processes in local embedding is observable

From the observation that all four case studies were premised on playing a facilitating role in local embedding I observed a common pattern to key community intermediary processes. The pattern suggested an ideal-typical sequence to community-based intermediation for local embedding (figure 10.1). Because all four cases moved through this basic sequence I conclude that the pattern is robust and because of this suggest the pattern can be generalised to other community-based intermediation seeking to locally embed sustainable energy technologies. To be clear, I do not claim that the cases fit the pattern neatly. Deviations to the pattern were present but such deviations are explained by setbacks and problems within each project: they provided further explanations for how and why the projects unfolded in the way they did. This basic pattern explains how preceding processes impact on those taken afterwards.

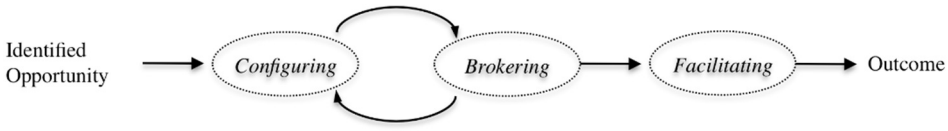

Figure 10.1: Basic pattern of key community intermediary processes in local embedding

This conclusion answers the first detailed research question. It also has important implications for the conceptual framework because on the basis of this pattern I can begin to situate key intermediary processes temporally and contextually. In part this is based on the addition of two further elements to the key processes, the identified opportunity and outcomes. I will use this pattern to construct a dynamic understanding of community intermediation below.

Some reflections on this sequence are timely and justified. First, developing process theories

through pattern recognition is a challenging analytical strategy. Geels and Schot (2010, 101) put this mildly when saying, “process analysis… always involves pattern recognition, which to some degree entails interpretation”. Langley (1999, 708) is more explicit, claiming, “there is a step in the connecting of data and theory that escapes any deliberate sensemaking strategy…Whatever strategy is used, there will always be an uncodifiable step that relies on the insight and imagination of the researcher”. With this aspect of process research at the forefront of the cross case analysis I tested the pattern against the broad and fine-grained understanding of the case studies. The patterns subsequent accuracy, generality and simplicity combined with the number of cases studied, suggests a robust, generalisable sequence has been conceptualised: indeed Langley (1999) argues narrative explanation and visual mapping techniques require several cases in moderate detail to identify patterns and mechanisms, whilst this research is also in line with previous process research (e.g. Hoogma et al. 2002, Geels, 2005) where four case studies provides a satisfactory number on which to base a conclusion about patterns. Yet, we should remain cautious and sceptical of the pattern on this basis. Here, I have demonstrated that the pattern has a robust fit for community-based intermediaries, bound in a single city-region and undertaken during a single period in time. The pattern therefore maybe context dependent and/or have cohort effects, respectively. To further test the generality of this pattern additional research at alternative sites and in different time periods would be required.

A second, perhaps more troubling, reflection concerns the degree to which none of the cases are clear examples of local embedding success. Their mixed results makes us ask the question, is this a sequence of failure? In turn I argue that the long-term, contextually and temporally contingent focus of local embedding means that none of the cases were likely to be unmitigated success stories from the outset. In this regard each of the cases indicate progress towards the local embedding of focal technologies to greater or lesser extents. Despite this it is still useful to ask a set of hypothetical questions, such as what would facilitation look like if the intermediary actor started off by facilitating? Would this lead to better or more successful intermediation for local embedding?

I will briefly answer this question by drawing on an insight in chapter 9, that smaller cycles of the basic pattern can be identified the closer one gets to the unfolding events. For instance DEE emerged from a skills share day where the first workshop was held. Does this mean it was started through a facilitation activity? The workshop still had to be configured - that is its purpose and intent still had to be decided upon - and resources mobilised, such as materials and tools - if not from outside - before the facilitation activity (workshops) could take place. One could also hypothesise an event or meeting, perhaps similar to ZCB’s citywide events (Chapter 8), as being an opportunity presented to others to learn, instigate or broker a project. But again it

is likely that some configuring of the space would be undertaken, even if minor, and such spaces often require the brokering of resources in order to realise them. In chapter 9 I took the analysis of key intermediary processes to a level commensurate with the data collected. I am postulating then, that the basic pattern could be applied at lower or higher scales of analysis (e.g. a meeting or a national programme). This remains as a further aspect that could be followed up in future research.

Conclusion 2: Context dynamics support and constrain the agency of community intermediaries to locally embed energy technologies in multiple ways

The context of community energy initiatives is known to matter. But answering the question in what ways? and how? is more subtle. The second detailed research question sought to investigate how context dynamics influence the agency of community intermediaries to locally embed energy technologies. In chapter 2 I argued that context can be usefully distinguished between community, local system and external environment dynamics. In doing so I built on arguments of structuration as used within sustainability transitions research. To systematically identify particular dynamics at each level of analysis I first analysed the cases for context influence before grouping according to the level of analysis and clustering influences of the same type (see chapter 3). The cross case analysis (chapter 9) reveals each context level influencing community intermediation in its own way. Table 10.1 summaries these dynamics. Note that some example influences appear to contradict others under the same dynamic. This is to be expected because the same dynamic can support and hinder community-based intermediation at different periods of time. For example, government policies (e.g. CESP) created an opportunity for EEG to (potentially) embed SWI, whilst the later introduction of government policies (e.g. the Green Deal) hindered the realisation of EEG's project.

Table 10.1: Summary of context dynamics at different levels of analysis with influence on community-based intermediation for local embedding

Level of analysis	**Dynamic**	**Influence on community-based intermediation**
External environment	Government policies	Create expectations about future technological trajectories; create opportunities and catalyse initiatives; influence aims; support and hinder project design and implementation; set rules; influence market organisation; provide resources;
	Market organisation	Create opportunities; influence aims; set project constraints; provide business models; limit agency;
	Technical change	Create expectations; create new opportunities; support and hinder project design and implementation;
	User uptake	Catalyse activity; undermine purpose; support design and implementation
Local system	Local politics and policies	Catalyse initiatives by providing opportunities; create expectations; set local technological trajectories; provide resources; build momentum; set local rules; undermine design and implementation;
	Local market organisation	Influence aims and objectives; provide key stakeholders; provide resources, partners and challengers; support and undermine the creation of facilitating spaces;
	Geography	Set physical, infrastructural characteristics; influence project design; provide and withhold resources; challenge implementation;
	Green milieu	Catalyse activity; build momentum; provide resources, encouragement and support;
Community	Interest and empowerment	Support and undermine activity; create opportunities and provide resources;
	History and experiences	Create opportunities; influence project design; provide resources; undermine facilitation activity and project implementation;
	Expectations	Create opportunities; provide support; challenge project design; challenge implementation;
	Knowledge, knowhow, skills and confidence	Create opportunities; influence project design; challenge implementation, support and hinder activity;

Beyond highlighting the particular dynamics of each context layer and explaining how context layers interact it was not possible to directly link dynamics to key intermediary processes. This is because each dynamic at each level, more or less had influence on all key intermediary processes. In turn, I argue that the key to understanding each dynamic is to understand how core activist interpret what is going on: it is not just the dynamic that is important but how actors interpret and respond to events as they unfold.

Again some situating of these dynamics is timely. Within the thesis I chose to focus on a particular type of actor and their agency. The dynamics established above are therefore identified because they have influence on the way in which community-based intermediaries seek to locally embed technologies. The two limitations mentioned above also have relevance here: these dynamics may be particular to the individual context studied and there may also be

cohort effects from studying a range of cases but from the same period of time. To further confirm the importance of these dynamics further research should be undertaken in different locations and preferably during different periods of time.

Second, the focus on a particular actor means that further dynamics with effects on local embedding may have been missed. For instance for other forms of intermediaries - such as quasi-governmental organisations (studied by Kivimaa, 2014), actor networks (studied by Hodson & Marvin, 2009), larger third sector organisations or indeed public or private actors seeking to locally embed energy technologies - additional and/or different dynamics may be important. I cannot therefore generalise these dynamics beyond community-based intermediation. Although this could be seen as a limitation of the present research the identified gap in knowledge about local embedding and community groups indicates that this is in fact a significant move forwards. In other words, I do not and cannot claim to have systematically identified all context dynamics with influence on local embedding, only those most pertinent to local embedding via community-based intermediaries.

Through investigating these questions I have come to two further conclusions about community-based intermediation, that also represent alterations to the existing framework.

> ***Conclusion 3: Community-based intermediaries have the capacity to mobilise a nascent community voice for energy technologies and direct it to where it might have the greatest impact.***

I suggest the 'mobilisation of community voice' represents a distinct community-based brokering strategy hitherto unrecognised within broader innovation intermediary research. In chapter 6 and on the basis of EEG's energy efficiency project I argued the mobilisation of community voice entailed the articulation of community needs and desires and the channeling of demands for technologies to where they might have impact. Conversely, in chapter 8 I identified a missed opportunity for BP activists to support the formation of a nascent community voice for solar PV. The obvious recipient for this 'voice' was the local authority. Not using this community-based intermediation strategy I argued, was detrimental to the wider community's ability to embed the project and detrimental to achieving the initiative's aims.

The potential importance of developing a community voice stems from the fact that demand creation is argued to be a perpetual challenge of many energy efficiency and demand reduction technologies (Platt, Cook & Pendleton, 2011; Mallaburn & Eyre, 2012) and to a lesser extend important to renewable energy technologies. Developing a community voice therefore entails

creating a greater understanding of and desire for the focal technology. It can nonetheless be classed as a brokering strategy because community-based intermediaries can use this community voice to represent and negotiate projects and resources in relation to others.

Conclusion 4: Community-based projects should aim to maintain flexibility and adaptability throughout design and implementation

I substantiate and refine Stewart and Hyysalo's (2008) claim that successful intermediary organisations need to balance key intermediary processes (chapter 2). Although this claim was supported within this research, it was argued (in chapter 9), to be hard to externally validate in practice. So whilst the evaluation of balance maybe desirable analytically, in practice I found that being flexible and adaptable during project design and implementation was achievable and important for the projects. Project flexibility allows for learning about contexts of action, users and stakeholders. It means that new information derived in the facilitation of opportunities can be used to adjust or reconfigure aspects of the project to suit new circumstances or increasing knowledge. This alteration to Stewart and Hyysalo's framework is done for both practical and analytical reasons. The importance of maintaining flexibility within projects is useful advice to practitioners whilst observing flexibility of projects is also empirically more achievable to future researchers.

Finally this research has generated two further conclusions about community energy initiatives more broadly. These conclusions stemmed from the disaggregation of community initiatives into two distinct component parts, a core group of activists and wider community participants. Beyond the empirical fit with the cases studied the disaggregation of community energy initiatives proved to be conceptually useful. First, it allowed for the introduction of insights from innovation intermediaries research. Second it created a space in which to question and substantiate the relationship between core activists and their target community, leading to the following two conclusions.

Conclusion 5: the proximity and connection of community activists to their target community is often overstated and under-developed

By disaggregating core community activists from wider community participants I was able to question the relationship between the two, coming to the conclusion that practitioners, policy-makers and researchers alike often overstate this relationship. The significance of this conclusion is brought to the fore when thinking about existing research undertaken on community energy activity (chapter 1). Collectively, this literature implicitly assumes cohesive,

homogeneous community energy projects in which there is a close connection between the community initiative and the primary recipients of their change strategies, the community. Community initiatives are suggested to develop projects in locally appropriate ways, employing bottom-up and participatory approaches, involving increased trust and centred on the concerns and needs of particular communities (e.g. Steward, Liff & Dunkelman, 2009; Walker & Devine-Wright, 2008; Backhaus, 2010). Indeed, Hielscher and colleagues (2011), in part, claim their participatory potential contributes to community approaches offering 'something distinct' to business and government approaches. Yet, from the four cases examined in this thesis, I conclude that the proximity and connection of core groups of community activists with their local community is often presumed, inadequately known for sure, and underdeveloped. In each case activists had to learn about their target community as they developed and implemented projects. A lack of knowledge about 'their community' often caused difficulties to locally embedding technologies and realising their projects.

Proximity and connection requires an understanding of community history, interest and empowerment, knowledge of community demographics, motivations, constraints and social practices. It requires knowledge of the community's material landscape, the size and shape of buildings and natural resources. The case studies demonstrate that gaining this knowledge is not easily achieved but requires work. As such I do not seek to dismiss community-based intermediation but, rather, to draw attention to their greatest (theoretical) asset being their biggest weakness. At least in the cases examined the proximity and connection of community activists to their target community was often assumed and under-developed.

Conclusion 6: Community initiatives need to target non-community actors but doing so is tricky and requires additional, dedicated work

Through disaggregating community initiatives it becomes clear that community initiatives also target non-community actors as recipients of their change strategies. Prior research on community energy has typically focused on community approaches being able to engage individuals in collective action, to 'develop and demonstrate' alternatives (to use the phase of Steward, Liff & Dunkelman 2009). But as such, the degree to which community-based intermediation can also target non-community stakeholders, such as local installers, builders and local authorities is less recognised. Community approaches have been promoted as an alternative to the "fallacy of targeting individuals" (Heiskanen et al., 2010, 7587) but such studies also neglect the ability of community-based approaches to target and change local system stakeholders.

Similar caveats apply here as to the targeting of communities: engagement is tricky and requires developing an understanding of the audience that is 'to be changed'. Two case studies in this thesis (BGDs and BP) demonstrate that engaging and influencing non-community stakeholders can be desirable and possible. They also demonstrate that it requires additional, dedicated work. This conclusion supports prior research findings by Mourik et al. (2009) on the need for intermediaries to thoroughly understand their target audiences in order to be most effective.

Extending this point, Vergragt and Brown (2012) argue that change in one system element is insufficient to alter the local system, to locally embed technologies. Their argument is supported by the cases in this study. Simply engaging end-users, the wider community, is insufficient. To locally embed technologies community-based intermediaries must engage non-community actors, the local system stakeholders, and collaborate with them to achieve change. This points towards a further insight on community-based intermediation: that to locally embed technologies community intermediaries *must* engage with and work alongside local stakeholders. It also supports the contemporary UK government policy focus on seeking to foster local and community-scale approaches including their local system and local stakeholders, rather than specifically 'community' approaches alone (DECC, 2014a: 2014b).

10.2 Summary of revised dynamic model of community-based intermediation for local embedding

Taking the above conclusions into account, I can now refine the conceptual framework into a dynamic understanding of community-based intermediation for local embedding. This has resulted from studying a small number of embedded case studies temporally and contextually. Its basis should be treated with caution: only through more studies of intermediary processes of local embedding, perhaps from different empirical entry points, may we be more confident in the framework. Despite this the four cases illustrate five stages to the 'moves' of community-based intermediaries within local contexts. The model is visualised in figure 10.2.

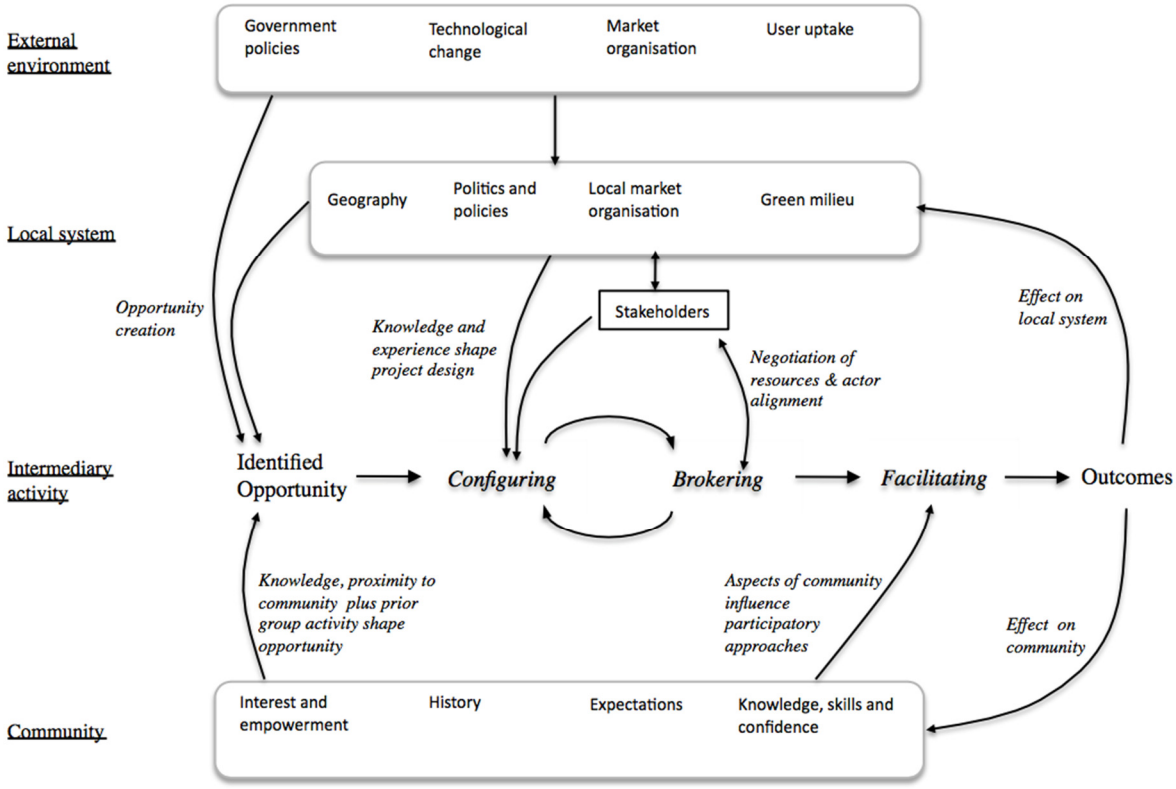

Figure 10.2: Dynamics in the relation between context and the local embedding of technology via community-based intermediaries

Three context layers situate community-based intermediation. National policies, market organisation, technical change and (inter)national user uptake act as broad dynamics of the external environment with influence on local activity. National government targets and policies often directly influence the aims and objectives of community activists, catalyse activity and set project constraints. Identified opportunities may also arise from localised problems and challenges within the local system. The local system nonetheless mediates externally generated opportunities and contextually situates broader dynamics of the external environment: opportunities for intermediation, whether locally or nationally generated, are shaped by local context conditions. The target community is the third layer situating community intermediation. It suggests particular forms and purposes of intermediation based on the community's own demographic, history, expectations and knowledge. The community's actions are conditioned by the institutional contexts of which they are a part, their actions constrained and enabled by dynamics at the local system and from the external environment levels.

Thus one story told by this visualisation is about multiple layers creating a dynamic context for local embedding, each layer influencing in their own way and evolving in their own right. They have different dynamics that exert influence on community intermediation. Yet, they are also

interlinked, community nested within the local system in turn residing within the external environment. Each layer enables and constrains local embedding and the moves of community intermediaries and local stakeholders.

The second story told by this visualisation is about community intermediation processes: how community groups identify project opportunities, and then configure and broker the project, technology and actors to facilitate the local embedding of technology. In turn community intermediation results in outcomes (positive and negative) that affect the local system or target community. It is in understanding how community initiatives seek to integrate technologies into local contexts of use that this thesis has been concerned with and which can be laid out as an ideal-typical model:

1. To identify opportunities activists draw upon knowledge and experience across context layers. Activists interpret and contextually situate national policies and national market dynamics within their local system. Their experience of and connection to their local community as well as their prior group experience, expertise and knowledge further inform their understanding of potential intermediary opportunities. Having identified a potential opportunity, the first step is to design a viable project.
2. Initial attempts to design a project involve intermediary configuring processes. It involves interpreting the technology and its use within the local system, the development of place-based images of potential socio-technological futures and the configuring of users and stakeholders within projects. Technologies have to be assembled in particular configurations within the local context: such configuration is technical but also symbolic (providing an interpretation of the technology and its use) (Stewart and Hyysalo, 2008), social and institutional (creating new ownership and management structures). Configuration activity may also build social networks behind particular configurations of technology and use and their projects.
3. Having internally designed a project, activists seek to broker support from various local and external stakeholders as well as their own community and target audience(s). Brokering is important for a variety of reasons. In the early stages of technological embedding, technological visions are explored with local stakeholders and expectations are developed. Community-based intermediaries may broker the entry of local actors into their visions and projects, increasing credibility and access to resources. Brokering between external and local actors can also negotiate resources (financial, social, technical, physical etc.) with which to undertake projects. Here, intermediaries may attempt to represent their local community, negotiating on their behalf by channelling nascent demand for technologies, resources and projects to where it may have greatest impact. Brokering is not one-way however. Interactions with stakeholders may reveal

alternative interpretations of the technology, local contexts and visions and may reveal competing ideas about the appropriate form of projects. Brokering, therefore, is likely to result in alterations to the design and aims of projects since intermediaries need to be responsive to alternative interpretations and reflect or accommodate different stakeholder positions: negotiation with stakeholders and communities often results in reconfiguring of the meanings and form of technologies, contexts and projects. In this way, projects are co-constructed with stakeholders and communities in local systems. The more complicated the project (the scale of ambition, number of partners), the likelier it is to have higher number of iterations between configuring and brokering processes.

4. Following a period of configuring and brokering, community activists typically materially undertake their projects and in doing so begin creating a variety of facilitation 'spaces', in the language of Stewart and Hyysalo (2008). Examples from the case studies include events, awareness raising campaigns, workshops, demonstration projects and so on. Bundles of approaches and spaces are often used around key aspects of the project. For example, the physical installation of SWI to six properties was accompanied by a project website, blogs and a range of events to community, local industry and academic audiences. Facilitation rarely relies on a single means of communication and retention, rather multiple different approaches are used around the basic project to extend the reach and impact as far as possible.
5. Activists' facilitation activity results in outcomes on local embedding. These might be intended or unintentional, positive or negative and be of more or less significance, such as increasing knowledge, stimulating demand, a demonstration project or the technology's widespread deployment in the local context. Activists intermediation may create new stakeholders or actor networks in the local system, build momentum behind technological visions or conversely, demonstrate how not to do things. Outcomes may therefore be changes in the local system or target community but can also include internal learning by the activists. For instance, activist learning may affect the identification of future opportunities.

Thus an ideal-typical sequence to community intermediation explains how community energy projects seek to locally embed energy technologies. There are two points to consider within this sequence.

First, configuring and brokering activity may result in early facilitation of opportunities for local stakeholders. Intermediary activity may create spaces in which local actors can learn about technologies, the local system and future technological scenarios. Momentum can be built

behind particular technologies, with or without the intermediary situated between these visions and their realisation. Here, it is important to note, the potential of intermediation by or with other actors. Intermediation via other stakeholders may build momentum behind particular technologies, which may be beneficial, in the broad sense, to community-based intermediaries but they may also develop diverging visions which compete for attention. The point is that non-material local embedding maybe facilitated as a result of community intermediation configuring and brokering of projects, stakeholders and visions. That is before the material implementation of the project through the community intermediaries designed facilitation spaces.

Second, as projects are undertaken additional unforeseen problems frequently emerge. Intermediaries learn about the limits and constraints of the technology, the project and actor network on the one hand. Previously unknown characteristics of the local context may emerge hindering the realisation of facilitation spaces. The existing material landscape can challenge or undermine projects where the realisable technical potential is often over-estimated in the design of projects. On the other hand, the dynamic evolution of context layers, such as changes to national policies since the configuration of the project, can also setback and even stop project development. As a consequence, challenges to project delivery may result in additional configuring and brokering activity. The project might have to be negotiated with local rules (such as planning) and additional resources secured to ensure project delivery. Larger, more significant challenges can require fundamental re-configuring of projects or the re-negotiation of resources.

Overall, the key argument is that local embedding via community intermediaries is temporally and contextually dependent. The dynamics are shaped by the interaction of actors across different context layers. Community intermediary action is concerned with identifying opportunities, gathering and assimilating information into projects (configuring), the outward negotiation of stakeholders and resources (brokering) and the creation of opportunities for others (facilitating).

10.3 Summary of thesis contributions

This thesis began with the basic problem that many of the technologies required to reduce the carbon intensity of existing lifestyles already exist but are not being used to the extent desired. Using the recent flourishing of community energy initiatives in the UK I established a gap in knowledge. I situate this gap between knowledge of the way in which socially desirable technologies serving long-term goals are socially embedded by wider society and the way in which technologies are appropriated by end-users. Both branches of research investigate the co-

construction of technology and society but less is known about the way in which a variety of market-ready, that is existing technological solutions, actually get made to work in diverse local contexts of use. On this basis I have subsequently outlined an original perspective on local embedding via community intermediaries. I have done so by first constructing a conceptual framework using building blocks from sustainability transitions, domestication and innovation intermediaries literatures and then incorporating insights emerging from its application to four case studies. The result is a significant contribution to knowledge embodied by the process model.

The primary contribution to knowledge is thus a process model of community-based intermediation for local embedding. In constructing the model I have demonstrated how insights from domestication studies can be fruitfully combined with existing sustainability transitions research: the study of contingent actor moves, of protracted struggles in which various views, elements and actors need to be aligned complements the evolutionary perspective of how new technological trajectories emerge. More specifically, a contribution has been made by developing a new perspective on the agency of community-based intermediaries to locally embed technologies. The model will be useful to practitioners and policy-makers alike because it succinctly outlines the way in which community intermediaries develop projects and the dynamic context through which they must navigate. It also provides a reply to Hielscher, Seyfang and Smith's (2011) call for models of system change which engage with and respond to the need for change within the socio-technical systems within which people live (chapter 1) and Späth and Rohracher (2014) who call for 'conceptual development' to explain the agency of initiatives at city levels to create new sustainable systems of provision (chapter 2). I position the resulting model (following Van de Ven and Poole, 1989) as a 'local model' compared to the 'global model' of the MLP and in particular, the development of emerging niche development trajectories.

The model moves conceptual understanding beyond the development of new, radical technologies in protected niche spaces to understand how market-ready technologies get made to work in diverse local circumstances. It goes beyond lists of factors influencing community-led energy initiatives by providing a socio-technical perspective incorporating technical and material dimensions (technologies, geography, infrastructure) and social and cultural dimensions (expectations, knowledge) as well as politics and market organisation. It also moves beyond static understanding of community action incorporating coevolution and dynamic change processes at different levels.

Within the overall model sit two specific contributions to knowledge. First I have identified an

ideal-typical sequence to key community-based intermediary processes. Community intermediation for local embedding moves through a five-stage sequence: opportunities are identified before projects are configured and then brokered against external actors, finally the facilitation of opportunities occurs and outcomes are achieved. I claim that the ideal-typical sequence is generalisable across community intermediary attempts for local embedding. The sequence thus extends Stewart and Hyysalo's (2008) framework on key innovation intermediary processes. I have been able to do this through studying intermediary organisations over time, thereby temporally and contextually situating activity. To the best of my knowledge Stewart and Hyysalo's (2008) model has not been studied over time before. This explains, in part, why I choose to foreground key intermediary processes (facilitating, configuring and brokering) whilst back-grounding concepts taken from studies of societal embedding and domestication (momentum, expectations, visions, networks and learning and acquiring, placing, interpreting and integrating respectively).

Second, I have systematically mapped dynamics influencing community-based intermediary projects across three context layers: external environment, the local system and community. The identification of multiple analytically coherent levels of change is a significant outcome of this work and builds upon a multi-level understanding of change from transitions research and the empirical case studies. Moreover, the distinction between community activists and their target community identifies the often-uneasy relationship between the two. Systematically mapping dynamics in this way is also significant for emergent interest in local embedding because it contributes a richer and fine-grained appreciation of context within transition processes, which is part of a larger problem with a lack of spatial awareness at present (STRN, 2010). It also challenges and reinforces the notion that socio-technical systems are scalable and that they can and do manifest at local scales. The evidence provided in this thesis gives weight to the inadequacy of course-grained explanations provided by the MLP (of niche markets growing successively in size) and niche development perspectives specifically, to explain the innovation required to get existing technologies to work in local contexts of use.

10.4 Reflections for practitioners: doing community intermediation

Although this thesis aimed for analytical explanations the research has relevance for practitioners. The model builds up an understanding about the way in which community activists attempt to integrate low carbon technologies into local contexts of use. It situates activity within an evolving local and national context and over time. In addition the model recognises the challenges activists regularly face in getting their projects to work, including for example changing national policies and activist learning.

The basic sequence of project development that this thesis offers provides an overview of the local embedding process: each of the five steps represent typical stages of initiative development. Learning feedback loops identify how learning can play an important role as projects develop or how learning can be incorporated in the future design of projects. Increased understanding about how learning takes place will help to make projects more successful. Outcome-based feedback loops will also help practitioners reflect on their impact, aid them in assessing future opportunities and the design of future projects.

The model also incorporates useful insights for practitioners about their contexts of action. The model clearly situates how activists and their 'wider communities' are constrained by wider social, political and economic forces, over which they have little control. One of the most important insights from the model is how multiple layers create a dynamic context of action. Meanwhile, the model suggests the successful integration of technologies into local contexts of use will involve the coordination of multiple actors. The identification of three context layers will help practitioners situate and sort different context events and influences thereby aiding their understanding and facilitating easier navigation. Finally, thinking about context in terms of three layers will further help practitioners identify their position in relation to their community, local stakeholders and policy-makers and potentially the local embedding process itself.

Overall, the model draws attention to the limited agency of activists: multiple context dynamics and the need to coordinate multiple stakeholders suggests the deployment of low carbon technology through community activity is challenging. Nonetheless community action still has a potentially important role to play because of its often independent and trusted position. Many community initiatives would benefit from a closer connection to the people who end up using the technologies. Below I list six specific reflections for practitioners on the basis of the model.

1. The importance of context

The integration of low carbon technologies requires activists to strive for and maintain a thorough understanding of multiple, dynamic context layers. Consequently, to understand 'context' means having knowledge of an initiative's position next to local stakeholders. It also means understanding how events at various scales, from local community calendars through local politics and industry development to national policies and programmes, influence the implementation of their projects. Some of this knowledge maybe contained within core activists, other aspects may require active appropriation but in all cases should not be taken for granted but continually reassessed and developed.

2. Knowing your target audience(s)

Activists' connection to and knowledge of their target community is one of their greatest strengths but also potentially a significant weakness. This is because successfully delivering projects requires knowing the various, multifaceted backgrounds of different groups in the community but also understanding how their aims, motivations and constraints relate to the project. Communities often comprise diverse groups of people. Recognition of this is crucial to providing opportunities and implementing projects. In addition, community projects can also target non-community actors, such as local installers, builders and local authorities. These stakeholders can be important for brokering resources, developing common visions and technological trajectories, creating local supply chains and building up local industry capacity. Yet, influencing these stakeholders is tricky and requires additional, dedicated work. Again this is because activists need to understand the position, motivations, aims and constraints of these additional audiences, so that engagement can be effective and shared expectations about project goals can develop.

3. Technological trajectories

The integration of low carbon technologies into local contexts of use takes time. Building momentum behind technologies in particular contexts becomes important. As a result, aligning community-based projects within existing or emerging technological trajectories (both nationally and within the local system) makes it easier for activists to mobilise resources and align local stakeholders. Local council policies and local industry developments become important. Both of the PV cases studied here demonstrate this but in different ways. For Bristol Power, it took two years to build momentum and support behind solar PV (2009-2011): support, which activists could then benefit from in subsequent years. In contrast, Demand Energy Equality attempted to initiate a new technological trajectory around DIY off-grid PV systems, which had historical precedent but little ongoing support. As such they attempted to stimulate a new technological trajectory divorced from current user practices and heading in a different direction to local and national government aspirations. These examples suggest that working within existing ideas about technologies and places is therefore easier than pursuing new ideas.

4. Partnership working

Business partnerships may create opportunities otherwise 'beyond the reach' of the community initiatives acting alone, but this also brings with it additional challenges and risks. When undertaking partnership work developing clear expectations and roles is important, as is effective channels of communication. Beyond these challenges, partnership working brings risks. First there are always questions about whether actors can deliver what they say. Second,

for activists to maintain an overview of the project gets harder. Third, activists are likely to be unequal partners in any relationship because of the experience, knowledge and financial backing of business partners. Partnership working subsequently results in tradeoffs. Partnerships may provide access to financial, social and human resources but they may also risk reputational damage to activists should things go wrong, will likely decrease the independence and impartiality of activists and will certainly, restricted their agency.

5. The importance of flexibility and adaptability of project design and implementation

Whilst initial project designs are important, contexts of action are not static but continually evolve. Context dynamics can challenge and even halt projects during implementation. Equally, learning about local target audiences, the local system and wider national contexts can influence initial project designs. Maintaining flexibility and adaptability of projects therefore becomes important to achieving project fruition. Such qualities also help the target community or wider audiences to domesticate the project, to make it their own. However, there is a balance to be struck, between over designing projects (which allow no movement and internalisation of goals) and under-designing projects, in which aims and objectives are too vague. Building in flexibility to project plans can help achieve this balance.

6. Reflection, evaluation and learning

Alongside project flexibility is the need for internal reflection, evaluation and learning on the part of community activists. Reflection and learning about the initiatives' position, project plan and current progress will increase the chances of reaching desired outcomes. For shorter projects this maybe appropriate at the end of a project. For longer-term projects building in periods to reflect, learn and adjust should be considered. Reflection and learning will, by itself, serve little purpose, being able to act on new knowledge is equally important. This issue is made more relevant and harder by limited funding and the continual struggle to survive. Moreover, the existence of strong values and idealism by some community activists may cloud their ability to reflect and learn.

10.5 Reflections for policy makers: supporting community-based intermediaries

Finally the research has relevance for policy makers both national and local. The model fills a gap in current understanding of how market-ready technologies get made to work in diverse contexts of use. It moves beyond an 'information-deficit' as well as a policy-focussed understanding of technology diffusion, to understand the process as being both time and place dependent.

The basic community intermediation sequence again provides a high-level overview of the key steps involved in developing community projects. From the policy makers' perspective an increased understanding of project development highlights the importance of multiple stakeholders as playing a role in supporting or hindering community-based intermediary attempts at local embedding. It stresses community activity as being integrated within rather than distinct from the actions of others. In turn this necessitates understanding community action as an important component of local embedding rather than a distinct aspect of UK energy policy.

Understanding the integration of technologies into local contexts of use as being undertaken within three context layers also has implications for both national and local policy-makers. The model draws attention to how national policies have an important role in shaping contexts of action but this wider context is always and necessarily mediated through local context conditions. This suggests that whilst national policy maybe important local policies and politics, local market organisation and local geography also play an important role. As such, this understanding opens up a space in which local technological trajectories can emerge, in which visions of placed-based socio-technical futures can play a guiding role. This has two implications. For national policy makers it suggests increasing the rate of local embedding involves the recognition and support of local technological trajectories, of supporting actions by local governments to develop supportive politics and policies alongside local market formation. For local policy-makers it suggests increased agency to shape and guide local aspirations around technological futures. The model with its attention to multiple context layers therefore compliments and builds an understanding of how cities and regions can drive forward low carbon agendas.

From this discussion I identify five specific insights for policy makers.

1. Support the formation of local technological trajectories

With the reduction of key national technology support mechanisms and the complete withdrawal of others it is increasingly important to recognise and support the development of local placed-based technological trajectories. Local politics and policies can guide local expectations and in turn open up access to resources that are vital to developing and implementing projects. Where cities and regions are attempting to set ambitious targets this should be supported.

2. Support community-based intermediaries as an integral yet distinct part of UK energy policy

Community initiatives are argued to have distinct capacities for sustainable innovation and as

such make a valuable contribution to the radical reorientation of the way society generates and uses energy. Over and above their distinct capacity to 'work on the ground', make links between daily practices, policy and industry and increase participation they often entail dedicated activists with values and idealism which drive such initiatives to engage in activity beyond what is possible by either government or business. Moreover, they embody a distinct capacity to challenge common practices, de-align existing relationships between technology and use and open up spaces for creative experimentation with alternative ways of generating and using energy.

Yet, community activity is not peripheral to existing energy policy and key energy policy actors: community approaches interact with and rely on the support and cooperation of multiple local and national stakeholders. They can be catalysed by national programmes and also constrained by policy instability. So recognition of the work community intermediaries do, such as within DECC's (2014a) Community Energy Strategy is a welcome step, but to really support community action and put users at the heart of UK energy policy, policy makers need to consider and support community action as an integral yet distinct part of the UK's future energy policy, not a separate sphere of activity that may or may not contribute to achieving current energy policy targets.

3. Recognise that national policy both catalyses and hinders the realisation of community-based initiatives

Policy makers have a role shaping the broader context of action, often creating the background context of community activity through the way in which policies create markets and set rules. The provision of dedicated funding is an obvious example which directly influences community activity but the design of national energy efficiency programmes such as CERT and CESP or in the present day the Green Deal and ECO influence the opportunities for community action and sets constraints over their ability to participate. The cases demonstrate that it is rare for community projects to operate outside of existing institutions and frameworks (and doing so is as hard as seeking to work within). The key point is that government needs to think of community action as being part of, as interlinked with existing and planned activity. Current institutional arrangements, market organisation and regulatory frameworks continue to restrict potential community opportunities (e.g. the limited potential for communities to get involved in the Green Deal) and where such opportunities can be identified, they are shaped and channelled by these wider dynamics. Continuing to treat community activity in isolation will not result in desired policy outcomes because of wider forces influencing and shaping what is possible on the ground. To fully realise the potential of community intermediation the design of future policies needs to consider what space is created for community action.

4. Funding and support needs to be flexible enough to allow for projects to adapt to local circumstance and learning

In recent years there has been a turn towards challenge-led funding programmes, such as within the LCCC, and more open and flexible funding schemes, such as LEAF. Such open and flexible funding and support is recognised to have resulted in increased activity and more community experimentation and learning-by-doing. Whilst welcome, this knowledge has not been carried through to the design of national policy and programmes which seek to utilise community-based intermediation, for example within the current Green Deal Communities Scheme or the Green Deal more widely. The combination of large commercial interests and a government focus on competition and cost-effectiveness is likely to restrict the space in which community-based activity can engage with national programmes, forcing them to intermediate in particular ways. These circumstances restrict and undermine community activity, serving to reinforce the negative idea of bottom-up policy implementers rather than independent, trusted mediators of local communities and wider interests. Policy-makers therefore have a limited but important role to play in the shaping of national programmes, markets and legislation that could support a space in which communities can develop bottom-up solutions which mediate between local communities and wider dynamics rather than instrumental delivery agents of national policy and market interest. The cases in this thesis demonstrate that being able to embed the project within the local context is likely to have a greater positive impact on local embedding than forcing the local context to conform with current policy and market arrangements.

5. Recognise the limited agency of community-based approaches and the power imbalance involved in partnership working

From the way in which national policy shapes opportunities for community intermediation comes the recognition that community-based approaches have limited agency to locally embed technologies. Recently, attention has been given to the potential of partnership working between local community initiatives and local authorities, businesses and third sector organisations (e.g. DECC, 2014a). This research demonstrates the potential benefits of partnership working, for the embedding of energy efficiency as well as renewable energy technologies, for increasing the potential extent and outcomes of community intermediation but it also highlights the risks involved. Community based initiatives are likely to have different knowledge and expertise than their partners and the relationship is likely to be unequal in terms of financial resources and access to capital. So whilst there are clear synergies in partnership working, care and attention should be taken in making sure that community initiatives are not used for instrumental gains, that knowledge generated by community intermediaries is listened to and appropriate forms of participation are developed.

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Appendices

Appendix A – Interviews conducted in this research

ID#	Interviewee	Organisation	Date(s)
Int_1	Director / Events manager	Bristol Green Doors	22/02/2013 15/03/2013
Int_2	Director	Bristol Green Doors	21/03/13
Int_3	Participant	Bristol Green Doors	04/04/13
Int_4	Partner organisation	Energy Consultancy	20/03/13
Int_5	Director	Easton Energy Group	22/05/2013 22/07/2013
Int_6	Director	Easton Energy Group	27/05/13
Int_7	Director	Easton Energy Group	05/06/13
Int_8	Activist	Easton Energy Group	04/06/13
Int_9	Director	Easton Energy Group	05/06/13
Int_10	Senior Associate	Sustain Ltd	09/09/13
Int_11	Director	Demand Energy Equality	01/07/2012 05/02/2013 22/02/2013 13/05/2013
Int_12	Director	Demand Energy Equality	01/07/2012 15/02/2013
Int_13	Director	Demand Energy Equality	01/07/2012 15/02/2013 13/05/2014
Int_14	Director	Edible Futures	04/03/13
Int_15	Sculpture artist	NA	13/03/13
Int_16	Director	Bristol Power C.I.C and Bristol Power Cooperative	19/04/2013 22/05/2013 23/05/2013 03/06/2013 26/07/2013
Int_17	Employee	Bristol Power C.I.C	22/05/13
Int_18	Director	Bristol Power C.I.C and Bristol Power Cooperative	10/06/13
Int_19	Former Director	Bristol Power C.I.C	17/06/13
Int_20	Director and Health community development worker	Bristol Power Cooperative and Bristol City Council	09/07/13
Int_21	Former Director	Bristol Energy Cooperative	28/05/13
Int_22	Director	Quayside Media Ltd	19/06/13
Int_23	Manager	SolarSense Ltd	02/07/13
Int_24	MSc Student	University of Surrey	24/06/13
Int_25	Director and Project Officer	Bristol Energy Network	18/03/13
Int_26	Manager	Bristol Green Capital Partnership	18/03/13
Int_27	Senior Community Projects Manager	Centre for Sustainable Energy	02/04/13
Int_28	Officer	Cooperative Development Agency, Avon	18/06/13
Int_29	Sustainability Officer	Bristol City Council	21/03/13
Int_30	Climate Change & Built environment co-ordinator	Bristol City Council	16/04/13

Appendix B: Extract from DEE event listing

Date	*Event title*	*Event details*	*Source*
Aug-2011	*DIY solar workshop (Fieldview festival)*	Led by Dan with 20 participants. A workshop participant tells Dan about ideas for a solar tree by an American teenager. The discussion also leads to recent MIT research into 3 dimensional solar designs.	Workshop log sheet / Int_11
Aug-2011	*£1,391.70 funding awarded from UnLtd*	Dan wins a level 1 grant from UnLtd to run DIY solar workshops within Bristol, allowing participants to "gain from the opportunity solar PV offers for sustainable energy use". Grant provides means to buy materials and equipment necessary to run 5 workshops. By this point the money had already been spent.	Level 1 UnLtd Millennium Award application / Int_11
Sep-2011	*DIY solar workshop (St Pauls)*	Led by Dan with 8 participants	Workshop log sheet
18/09/2011	*DIY Solar Handbook completed*	First draft of handbook, outlining materials and sourcing, construction steps and usage.	Handbook of materials and instructions
Oct-2011	*Dan meets CB (BCC) to discuss building a solar tree in Bristol*	Discussion with CB from BCC about a large public art work in the centre of town. The idea builds upon MIT research and young American's designs for a Solar tree. It is suggested the leaves be made through DIY solar workshops, run over a number of weeks to the general public. The structure could be temporary or permanent. Council supportive and enthusiastic but could not offer financial assistance to the project.	Int_11 / Int_30
Oct-2011	*HL approaches Dan to install Solar PV at Edible Futures*	HL seeks help from Dan to install Solar PV at Edible Futures with panels powering a rain-fed irrigation system. The idea fits with capacity of solar tree design (small amount of power required, off grid location and space to install it) only downside is remote location, providing little public engagement.	Int_14
Oct-2011	*DIY solar workshop (St Pauls)*	Led by Dan with 8 participants	Workshop log sheet
Nov-2011	*Demand Energy Equality set up as a new Bristol community energy initiative*	Consolidation of DIY workshops into a formal initiative. "We are trying to get as many people trained up to run workshops as possible, so the skills and knowledge spread. … The workshops help households access solar panels at less than half the price of the cheapest commercial panel, helping to address the growing social inequality in access to affordable clean power. ...SOLAR PANELS ARE NOT A SOLUTION. This might sound mad coming from a project that is encouraging people to buy solar panels. But without huge reductions in our demand for energy the challenge to meet climate change CO2 reduction targets will be impossible to solve."	www.bristolenergynetwork.org/node/34 / www.peoplefund.it/demand-energy-equality

Annex C – Key to visual maps

1. Boxes - the boxes presented on the flow charts contain brief description of the main elements of the case chronology relevant to the local embedding process via community initiatives.

1. Oval boxes represent events carried out by the focal intermediary.
2. Circles represent material installations of the focal technology.
3. Round-cornered rectangles present activities carried out by the focal intermediary.
4. Square-corned rectangles present events and decisions outside the control of the intermediary

2. **Four horizontal bands -** Each event, installation and activity can be classified as occurring in relation to a particular context represented by the four different horizontal bands on the flow chart. The lower central band to which all boxes are connected contains activity of the core group of community activists. Whether designing a project, interpreting a technology or internal group dynamics such as the return of a core activist. The other bands situate events, installations, activities and x according to the context in which they are performed. Boxes that cut across more than one band are used to indicate events, installations or activities that can be associated with two or more domains. For example a project plan formed between the focal actor and its project partner.

3. Vertical arrows - Vertical arrows leading from one domain to another indicate direct influences from events, installations and activities on subsequent events, installations or activities.

4. Horizontal arrows - Horizontal arrows within bands are used to indicate continuity of event or activity over time. Continuous arrows show strong and stable activity over time. Whilst dotted horizontal arrows show disruption and disturbance within the activity.

5. Curved dotted arrows - are used to indicate indirect influences on events, installations and activities.

6. Time scales - the time scales along the bottom of each flow chart is distorted in order to keep the size of the charts to a minimum whilst including periods of high velocity events.

7. Key intermediary processes – finally key intermediary processes of facilitating, configuring and brokering are superimposed over the events, installations and activities they correspond to following analysis of the cases according the research protocols.

Together the charts can be read as a brief overview of the main events, installations and activities within the narrative history. It presents a visual depiction of the complete case study within a single page incorporating narrative subplots. They provide a visual summary of the case study and with key intermediary roles superimposed a graphical sequence to key intermediary activity from which sequence analysis can be undertaken.