Uptake of Micro-generation among Small Organisations in the Camden Climate Change Alliance

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A Thesis Submitted in Fulfilment of the requirements for the degree of Masters by Research (MSc) in Geography awarded by the University of Durham

September 2010

Abstract

This research uses the case study of the Camden Climate Change Alliance (CCCA) to explore the uptake of micro-generation among small organisations. It assesses the ability of such environmental alliances for helping small organisations to engage with environmental management, and what this means for their uptake of micro-generation.

The future energy mix in the UK will be diverse and low carbon (UK Low Carbon Transition Plan, 2009). Micro-generation is increasingly receiving political attention as a part of this mix, as shown by the recent introduction of feed-in tariffs, the *greener homes, warmer homes* strategy and the consultations on renewable heat incentives and a new Micro-generation Strategy. Policy and research has concentrated on households and few studies have looked at the uptake of micro-generation in small organisations.

The unique multi-level inter-connected CCCA of small organisations is used as a case study to qualitatively assess, through conducting interviews with the representatives of small organisations (17), the uptake of micro-generation among small organisations. The interviews explored their awareness and familiarity with micro-generation, and what they perceived the main installation barriers and incentives to be. How micro-generation is viewed within the CCCA in the context of wider environmental management measures is determined. Interviews also took place with organisations that have potential influence over the uptake of micro-generation at local and/or national scales: Camden Council, London Development Agency, Greater London Authority, DECC, Environment Agency, Energy Saving Trust, British Gas and Ecovolt – a London-based micro-generation installer.

The results show that the responsibility for environmental management tends to come under wider roles such as Senior Managers or Building Services Managers. It is clear that as the size of the organisation increases, the more complex the environmental decision-making process becomes. Many representatives cited the initial costs and long payback times, a lack of awareness of the installation process, and planning permission on protected buildings, as the main barriers. The ‘green’ image and marketing potential of micro-generation and installing for ethical reasons were cited as the main incentives. The interviews (both CCCA and external) highlighted that less expensive energy efficiency measures are prioritised and thus an *Energy hierarchy framework for small organisations* is proposed. 71% of the CCCA organisations taking part in the research had conducted micro-generation feasibility studies though only four had actually installed. It is clear that such alliances can effectively engage small organisations with their environmental management, but their uptake of micro-generation is still limited.

Contents

List of Figures

List of Abbreviations

- **ASHP:** Air Source Heat Pump
- **CCCA:** Camden Climate Change Alliance
- **CO_{2e}:** Carbon dioxide equivalent emissions
- **CRC:** Carbon Reduction Commitment Energy Efficiency Scheme
- **DECC:** Department of Energy and Climate Change
- **EA:** Environment Agency
- **EST:** Energy Saving Trust
- **GLA:** Greater London Authority
- **GSHP:** Ground Source Heat Pump
- **LCBP:** Low Carbon Buildings Programme
- **LDA:** London Development Agency
- **LFB:** London Fire Brigade
- **MCS:** Micro-generation Certification Scheme
- **MIC:** Methodist International Centre
- **Micro-CHP:** Micro-Combined Heat and Power
- **RCP:** Royal College of Physicians
- **Solar PV:** Solar Photovoltaics

Statement of Copyright

Acknowledgements

I would firstly like to thank my supervisors Dr James Casford and Dr Sandra Bell for giving me excellent guidance throughout the research on what was a challenge in engaging with different disciplines. Secondly, I would like to thank all the representatives of the organisations that took part in the research for finding the time to provide their invaluable inputs to the project. Notably I would like to acknowledge the support of Will Routh and David Wilson at the Camden Council and James Barr at the Methodist International Centre (MIC), who allowed me to go into more depth within the case study and gave me the opportunity to apply my research to help develop the CCCA. Thirdly, I would like to thank the Institute of Hazard and Risk Research at Durham University for funding the tuition fees for the degree and Durham University for part funding the costs of my accommodation for the year. Finally, I would like to thank my family and friends for their support, particularly during the more stressful times of the year. Notably I would like to thank my wonderful girlfriend Kate for all her support while we both locked ourselves away for months writing up our respective research. I would also like to give particular praise to my brother Richard and fellow researcher Andres Luque, who provided invaluable feedback on my chapter drafts.

1 Chapter 1: Introduction

1.1 Increasing Importance of Energy Policy

This research explores the ability of environmental alliances of small organisations for helping them to engage with environmental management, and what this means for the uptake of micro-generation in such organisations.

Energy policy is receiving increasing attention in the UK political agenda. The need to reduce carbon dioxide equivalent emissions (CO_{2e} – a baseline in which all greenhouse gases are given equivalent CO_2 values) to help mitigate the impacts of climate change has resulted in the recent publication of low-carbon energy strategies, such as the *Low Carbon Transition Plan* (2009) and the *Renewable Energy Strategy* (2009). Energy production and supply accounted for 39% of UK CO_{2e} emissions in 2009 (*Department of Energy and Climate Change (DECC) Energy Statistics 2010*), so a transformation in the way energy is produced and consumed, could have a large impact on reducing emissions.

Energy policy has concentrated on large-scale energy generation from power stations (macro-generation) and supply-side management, and as Foxon *et al*. (2008) argues, a possible alternative pathway is to put emphasis on decentralised small-scale energy generation and demand-side management. In a series of papers, Foxon suggests that a combination of both supply and demand low carbon options across all scales is needed, but that research must consider the investment required, over what timescales, and the compatibility between different options (Foxon *et al*., 2005; Foxon *et al*., 2008; Foxon, 2010). The UK's current energy production comes from the large-scale burning of carbon-intensive fossil fuels, which make up ~78% of the total energy generation capacity and includes natural gas (~45%), coal (~32%) and oil (~1%) (*UK Low Carbon Transition Plan*, 2009).

The current low carbon sources provide very little of the overall energy supply, with nuclear power providing ~13% (Diesendorf, 2010), macro-renewables accounting for ~6% (Pollitt, 2009) and micro-generation contributing <2% (*UK Micro-generation Strategy*, 2006). The current nuclear power plants are coming to the end of their lifespan and it is important that their generation capacity is replaced (Greenhalgh and Azapagic, 2009). The UK has missed its target of 10% of energy generated from renewable sources by 2010 (European Commission, 2001/77/EC). If it is to meet its higher commitment of 15% by 2020 (European Commission, 2009/28/EC) then not only does the "energy gap" need to

be replaced with low carbon sources, but a large expansion beyond this is needed (Bickerstaff *et al*., 2008; Watson and Scott, 2009). In a recent public lecture at the London School of Economics (LSE), Chris Huhne (the current Secretary of State for DECC) stated that 23 gigawatts (GW = one billion watts) of energy generation capacity would need replacing by 2023, and £200 billion of investment would be required by 2020 to do this (LSE Public Lecture, November 2010).

The transition to a low carbon society is not only driven by the mitigation of climate change, but economic growth through the development of low carbon industries in the UK and the associated creation of jobs and expertise. In his public lecture, Chris Huhne also highlighted the importance of secure energy supplies and reducing a dependency on foreign imports. The UK has historically depended on North Sea gas, but declining supplies have resulted in an increase in the amount imported (Stern, 2004). Boosting a diverse supply of low carbon alternatives at all scales is necessary for the security and reliability of energy supplies, particularly in the face of intermittency issues with macro-renewables (Devine-Wright and Devine-Wright, 2006). However, the Government's current approach is to use mainly macro-generation solutions. For example, replacing nuclear power plants with the safer and more efficient third and fourth generation nuclear reactors and developing carbon capture and storage (CCS) technology on fossil fuel power plants to capture ~90% of their emissions (Marques, 2010; Odeh and Cockerill, 2008). With the latter technology, captured carbon dioxide is geologically stored in saline formations or depleted oil and gas reservoirs. The *Energy Act 2010* brought forward the development of four CCS demonstration power plants, and following the recent *Spending Review*, DECC has committed £1 billion to the development of CCS (HM Treasury, October 2010). Parkhill *et al*. (2009) argue that constructing new power plants on the sites of previous ones is likely to receive less local opposition.

Scaling-up energy production to large power plants is often seen as the most cost-effective option (Parker, 2009). However, producing energy at the small and micro scale has the potential to reduce the inefficiencies and losses of energy during transmission (Costa and Matos, 2009). A recent research project commissioned by the Government (Bergman *et al*., 2009) looked at how energy policy should move towards demand-side management and micro-generation. Micro-generation is defined in the Energy Act (2004) as technologies that produce heat and/or electricity from a low carbon source and are <100 kilowatts (kW) in size. Reducing the demand for energy initially through behavioural change and improving the energy efficiency of buildings in all sectors, coupled with the production of energy at the micro and small scale, are important factors in helping the

switch to a low carbon society (Bergman *et al.*, 2009). The Government outlined in the *Low Carbon Transition Plan* (2009) that the future energy mix will be diverse. In this research I explore the contribution that micro-generation can make to this diversity, with a particular focus on the uptake in small organisations.

1.2 UK Micro-generation Policy

This section chronologically details the energy policies of relevance to micro-generation since the 2003 Energy White Paper, and comments on the implications for small organisations. The policies are summarised in figure 2 on pages 8-9.

DECC estimates that there have been ~100,000 micro-generation installations so far. It has an unofficial target of one million installations by 2020, thus the matching of the current total every year between now and then. A recent report by PriceWaterhouseCoopers (PwC) shows that meeting such a target would only put the UK where Germany currently is (PwC, 2010). Lipp (2007) and Rio and Gual (2007) analysed the different micro-generation policy pathways taken by the UK and other European countries, notably Germany and Spain, which have been hailed as two of the most successful countries in developing sustainable energy policies (Mitchell, 2008). For example, Germany introduced feed-in tariffs in 1990 in contrast to the UK, which only recently introduced them in April 2010 (see below). In Germany, the successful 1,000 solar roof scheme in 1989 became the 100,000 solar roof programme in 1999, the subsidies of which were advertised through clear and effective information campaigns (Lipp, 2007). This resulted in mass-uptake of micro-solar technologies by households.

In 2001, both Germany and the UK introduced a levy on the consumption of electricity from fossil fuels. However, while Germany's levy was non-sector specific and exempted electricity consumed from the burning of coal, the UK's levy (the *Climate Change Levy*) was for the non-residential and non-transport sectors and included all electricity generated from non-renewable sources (Lipp, 2007). Including the residential and transport sectors in the UK's levy and introducing a similar 100,000 solar roof programme (with loans and funding) could help increase the uptake of micro-generation. However, with the recent governmental department budget cuts following the *Spending Review* (October, 2010) it is unlikely that the Government could currently fund such a programme. Helm (2008) alternatively highlights the benefits of converting to a carbon tax instead, as it would better reflect the differences in carbon intensity between energy sources. The *Electricity Market Reform* consultation, which closed in March 2011,

proposes this option through a Carbon Floor Price. Thus, low carbon micro-generation technologies could become a more financially attractive way of reducing energy demand from fossil fuels.

Since the publication of the *Potential for Micro-generation Study and Analysis report* (DTI, 2005), micro-generation has increasingly received more attention in UK energy policy, though specific targets for micro-generation installations have not yet been set. I would argue that a specific target on the number of micro-generation installations would not only help the UK to meet its EU target of 15% of energy from renewables by 2020 (Directive 2009/28/EC), but would also increase the uptake and development of the market, which, as Praetorius *et al*. (2008) argue, is still in its infancy. The UK *Micro-generation Strategy* (2006) acknowledged this latter point by stating that, "even key players in the industry agree that it is too early in the development of a market to set a meaningful target" (DTI, 2006). Nevertheless, the strategy suggested that by 2050 micro-generation could provide 30-40% of the UK's electricity needs (DTI, 2006). The statement is biased towards households and ignores its potential in small organisations, the focus of this research. However, the strategy did bring micro-generation into the energy policy arena.

Since its creation in 2008, DECC is now responsible for micro-generation policy though due to the cross-disciplinary nature of the topic, some strategies have been joint-departmental, particularly the *Warmer Homes, Greener Homes strategy* (2010) with the Department of Communities and Local Government (CLG). Historically, the former Department of Trade and Industry (DTI) was responsible for micro-generation policy, notably publishing the *Energy White Paper* (2003) and the *Micro-generation Strategy* (2006). The limited attention that micro-generation has received in energy policy prior to the 2006 strategy and the creation of DECC, may be explained by the topic being lost between the remits of different departments.

The *Renewable Energy Strategy* (2009) highlighted how the UK would meet its 15% EU renewable energy target. It suggested that small-scale energy production (up to 5 MW of generation capacity per site) could account for ~2% of overall energy by 2020. This is consistent with the statements in the 2006 strategy. However, the strategy is four years old and since then there have been a number of specific developments in the micro-generation policy arena. The introduction of the *Micro-generation Certification Scheme* (MCS) in 2006, the *Low Carbon Buildings Programme* (LCBP) in 2006, and the *Warmer Homes, Greener Homes* strategy in 2010 are helping to stimulate the development of the micro-generation market. The LCBP provided subsidies for both domestic and non-

domestic buildings, though following the *Spending Review* (October, 2010) and the *Budget 2011* the scheme has been cut. However, the LCBP has been replaced by feed-in tariffs (FiTs) (introduced in April 2010) and Renewable Heat Incentives (RHIs) (to be introduced in July 2011).

DECC splits the definition of micro-generation into small-generation (100 kilowatts (kW = 1,000 watts) to 5 megawatts (MW = one million watts)) and micro-generation (<100 kW) though any low carbon generator of up to 5 MW is eligible to receive FiTs (DECC website: www.decc.gov.uk). The introduction of FiTs provides a new financial incentive to help stimulate the uptake of micro-generation. Energy suppliers are required to pay the tariffs shown in figure 1 below for every kilowatt of electricity their customers generate from micro-generation:

Technology	Scale	Tariff level (p/kWh)	Tariff lifetime (years)
Solar electricity (PV)	≤4 kW (retro fit)	41.3	25
Solar electricity (PV)	≤4 kW (new build)	31.6	25
Wind	≤1.5 kW	34.5	20
Wind	>1.5 - 15 kW	26.7	20
Micro-CHP	≤2kW	10	10
Hydro-electricity	≤15 kW	19.9	20

Figure 1: feed-in tariff levels for eligible micro-generation technologies up to 5 MW in size (obtained from the Energy Saving Trust website, 2010)

Owners of micro-generators can also receive 3p/kWh (pence per kilowatt hour) if they export electricity to the grid (Energy Saving Trust (EST) website: www.energysavingtrust.org.uk). RHIs provide feed-in tariffs for renewable heat generation at all scales. The eligible technologies are solar thermal (8.5 p/kWh), ground source heat pumps (4.3 p/kWh), biomass boilers (7.6 p/kWh), and biomethane injection and combustion (6.5 p/kWh) (DECC website, 2011). Both the FiTs and RHIs, which DECC terms *Clean Energy Cashbacks*, should help to increase the incentive for installing micro-generation by reducing the payback periods for the initial investment.

As the FiTs were brought in, the *Carbon Reduction Commitment Energy Efficiency Scheme* (CRC) was also introduced, which may indirectly help stimulate the uptake of micro-generation in large organisations of all sectors. I argue that it is a step in the right

direction away from a concentration of energy policies on households, which Chapter 3 explores and justifies further. The scheme incentivises large organisations to install any environmental measure (such as micro-generation) that reduces their carbon footprint, which is less costly than the price of purchasing more carbon credits if they go above their set allowance. The scheme also gives them a further financial incentive through cost savings from energy efficiency (DECC website, 2010). Organisations that reduce their emissions the most will be higher up published annual league tables and will benefit from 'green marketing' and positive media attention (Environment Agency (EA) website: www.environment-agency.gov.uk). Until recently, a further incentive was that such organisations would receive the revenues from those organisations that had to purchase extra carbon allowances. However, the *Spending Review* (October 2010) has stated that these revenues will go back to the Government instead. It will be interesting to see whether or not 'green marketing' will provide a strong enough financial incentive for organisations to reduce their carbon emissions.

Energy policy has therefore left a large amount of CO_{2e} emissions unaccounted for from small organisations of all sectors. McKeiver and Gadenne (2005) argue that the collective environmental impact of small-to-medium-sized enterprises (SMEs) is substantial and could outweigh the combined environmental impacts of large companies. Add to this all the small charities, independent and public sector organisations and the CO_{2e} emissions are even more significant. Despite administrative difficulties in implementing a CRC for small organisations, I argue that it is a necessary step, which will have knock-on effects for driving the micro-generation market. Nevertheless, how effective the current CRC becomes will determine how appropriate the recommendation is.

As this research was being conducted, a change in Government took place in May 2010. Nevertheless, the Conservative Party's desire to be the "greenest Government ever" (Prime Minister's speech at DECC on 14th May 2010) was reflected in an arguably favourable outcome in the *Spending Review* (October, 2010), where, as the international legal firm Herbert Smith LLP stated, "things could have been a lot worse" for low carbon policy goals (see the Bibliography for the article link).

The new Government is committed to releasing a new micro-generation strategy in 2011 and the consultation closed in March 2011. The strategy will outline how the uptake of micro-generation in the UK can be increased and may set targets for micro-generation installations to help stimulate the market, which the 2006 strategy failed to do. The new strategy shows that the Government is giving attention to the potential of micro-generation for contributing to the future diversity of the energy mix.

Nevertheless, the announcement of the extension of the *Carbon Emissions Reduction Target* (CERT) to the end of 2012 conveys that the Government is partly prioritising the less expensive energy efficiency measures such as insulation (loft and cavity/solid wall) and efficient lighting retrofits. It is leaving the funding to the private sector under an energy suppliers obligation to reduce collectively 262 MtC (mega tonnes of carbon) by improving the energy efficiency of the UK housing stock. Government targets of zero-carbon new homes by 2016 and zero-carbon new non-domestic buildings by 2019 will go a long way to improve the uptake of micro-generation in new-build, as it needs to be integrated (DECC website, 2010). Although the majority of the UK's building stock is not new-build, CERT will contribute towards retrofitting poorly insulated homes, which may include measures such as micro-generation. Such homes are classified as being in fuel poverty if the household spends more than 10% of its income on fuelling the home (Walker, 2008). However, CERT is a further example of how micro-generation policies have been aimed more at households than small organisations. Figure 2 overleaf summarises the energy policies discussed in this section.

Policy	Year	Author	Overview	Relation to Research
Our Energy Future: Creating a Low Carbon Economy	2003	DTI	Approach for switching to a low carbon economy	Small-CHP (district scale) given attention
Sustainable Energy Act	2003	DTI	Ensuring the security and sustainability of energy supplies	Targets made for small-CHP (district scale)
Energy Act	2004	DTI	Outline of future low carbon energy sources	Micro-generation definition clarified
Potential for Micro-generation Study and Analysis	2005	DTI	Assessment of the status of micro-generation and uptake projections	Overview of current micro-generation uptake
Our Energy Challenge: Power from the People	2006	DTI	UK Micro-generation Strategy	Barriers to micro-generation uptake (in households) and how they could be overcome
Low Carbon Buildings Programme (LCBP)	2006	DTI	Funding scheme for energy efficiency measures and micro-generation	Grants available for small organisations
Micro-generation Certification Scheme (MCS)	2006	DTI	Providing a reputable market of micro-generation installers and products	Source of clear information on micro-generation and contact information of certified installers
Climate Change and Sustainability Act	2006	DEFRA	Approach to reduce fuel poverty and emissions	Called for micro-generation targets and a review of permitted micro-generation installations
The Growth Potential for Micro-generation in England, Wales and Scotland	2008	BERR	Assessment of the potential of micro-generation in households in the UK	Updated the findings of the UK Micro-generation Strategy
Carbon Emissions Reduction Target	2008	DEFRA	Target for energy supplies to achieve a combined energy saving of 154 MtC by assisting customers to install energy efficiency measures	Although based on households it encourages energy suppliers to get on board with micro-generation
Micro-generation Strategy Progress Report	2008	BERR	Report on what has happened since the publication of the UK Micro-generation Strategy	Call for a suppliers obligation to be implemented (an extension of CERT)
Low Carbon Industrial Strategy	2009	Joint DECC-BIS	Approach to developing low carbon industries	Mentioned the ability of the UK's energy infrastructure to cope with micro-generation

Low Carbon Transition Plan	2009	DECC	Outline of how the UK will move to a low carbon society	Considers the role of micro-generation in businesses and households
Renewable Energy Strategy	2009	DECC	Strategy for the deployment of renewables at all scales	Discusses the financial incentives that would be implemented to stimulate the micro-renewables market (FiTs and ROCs)
Warmer Homes, Greener Homes	2010	Joint DECC-CLG	Strategy for cutting carbon emissions from homes	Although based on households it deals with the high upfront costs of micro-generation through payments made from energy savings
Low Carbon Skills	2010	Joint DECC-BIS	Developing the necessary skills across all sectors to move to a low carbon economy	Includes micro-generation installers and the micro-generation industry
Carbon Reduction Commitment Energy Efficiency Scheme (CRC)	2010	DECC	Large organisations >250 employees have specific carbon emissions allowances – they can buy or sell excess credits	Although based on large organisations any carbon reduction method, like micro-generation, can be used
Feed-in Tariffs (FiTs)	2010	DECC	Energy companies must pay owners of low carbon electricity generators for every unit they produce and/or export	FiTs increase the financial incentive to install micro-generation (low carbon electricity)
Energy Act	2010	DECC	Outlines how to improve the energy efficiency of homes and businesses and promote secure, low carbon energy supplies	Expands beyond just households to include energy management measures in SMEs
Carbon Emissions Reduction Target (CERT) Extension	2010	DECC	Extension of CERT target to an energy supplier obligation of 262 MtC	Although based on households it encourages energy suppliers to get on board with micro-generation
Renewable Heat Incentives (RHIs)	2011	DECC	Energy companies must pay owners of renewable heat generators for every unit they produce and/or export	RHIs increase the financial incentive to install micro-generation (renewable heat)
New Micro-generation Strategy	2011	DECC	New strategy to address the non-financial barriers to micro-generation uptake	Increasing micro-generation uptake across all of society

Figure 2: the major UK energy policies since 2003 that mention the role of micro-generation in the future energy mix

1.3 Environmental Management in Small Organisations

This research concentrates on the uptake of micro-generation in small organisations and I propose a definition of a small organisation as one that employs <250 employees, has a half-hourly electricity consumption of <6,000 megawatt hours (MWh) (equating to half-hourly electricity bills of <£500,000 per year) and covers all sectors. This is based on the reverse of the CRC's definition of a large organisation. SMEs alone make up ~99% of all UK businesses (Hillary, 2000) and this excludes all the small charities, small public sector organisations and small independent organisations that would come under this definition. Thus, the collective CO_{2e} emissions from small organisations are significant and it has been estimated to make up between a fifth and a quarter of the UK's total CO_{2e} emissions (Camden Climate Change Alliance (CCCA) website, 2010: www.betterclimateforcamden.com). As Hillary (2000) states, "collectively their environmental impact is significant and so their adoption of sound environmental management and production methods is essential for progress towards sustainability".

Brío and Junquera (2003) highlight that limited research has been done on the environmental and energy management of SMEs. Assessments on the uptake of micro-generation in SMEs, let alone other small organisational sectors, are even more limited, so this research aims to provide one of the first studies on the uptake of micro-generation in small organisations of all sectors. Parker *et al*. (2009) gives a good outline of the studies conducted on wider environmental management in SMEs to date. It is clear from the paper that the concentration of research has been on reactive businesses as opposed to environmentally proactive ones. Reactive businesses are those that simply comply with legislation, whereas proactive organisations go beyond this (Parker *et al*., 2009).

Many small organisations are unaware of their (negative) environmental impacts, or view them to be negligible and insignificant (McKeiver and Gadenne, 2005). This could be because they are unaware of how to measure their carbon footprints (CCCA, 2010). Similarly, reactive organisations may feel that implementing an environmental management system is an added cost in time and money, rather than an economic opportunity (Koechlin and Muller, 1992). Hence, they simply comply passively with environmental legislation, such as those listed in figure 3 overleaf.

Legislation	Year
Food and Environmental Protection Act	1986
Environmental Protection Act	1990
Town and Country Planning Act	1990
Water Resources Act	1991
Water Industry Act	1991
Clean Air Act	1993
Environment Act	1995
Producer Responsibility Obligations (Packaging Waste) Regulations	1997
Pollution Prevention and Control Act	1999
Climate Change Levy	2001

Figure 3: the main pieces of environmental legislation that may be relevant to some small organisations (collated from the Environment Agency website, 2010)

Not all of the environmental legislation listed in figure 3 will be directly relevant to all small organisations and I discuss this further in Chapter 3. For example, under the Pollution Prevention and Control Act, organisations that pollute directly to the air, land or water must use the best available techniques to control the pollution from their installations (DEFRA website: www.defra.gov.uk). Thus, this will not affect those small organisations that are office-based. However, the most important piece of legislation, which affects all small organisations, is the *Climate Change Levy*. As previously described, it is a levy on the use of energy generated from non-renewable sources in the non-domestic and non-transport sectors (EA website, 2010). Small organisations have the benefit of reduced tax from the levy if they install micro-generation or switch to a 'green' energy tariff (DECC website, 2010). The rise of 'green' energy tariffs has been in response to increased public and governmental pressure to decarbonise the grid. This has partly been achieved through the *Renewables Obligation*, where all energy companies operating in the UK must supply an increasing proportion of electricity from renewable sources (DECC website, 2010). In 2005/2006 the obligation was 5.5% and in 2006/2007 it was 6.7% (Ofgem website: www.ofgem.gov.uk). However, many energy companies are packaging the obligation and selling it to customers at a premium (Diaz-Rainey and Ashton, 2008). There is a clear need for Ofgem (the Office of Gas and Electricity Markets), which regulates the energy market, to develop regulations that ensure 'green' energy is sold to customers in addition to that required by energy companies under the *Renewables Obligation* (Diaz-Rainey and Ashton, 2008).

Clients, stakeholders and authorities are increasingly putting pressure on small profit-driven organisations to be environmentally sustainable, as McDonagh and Prothero (1997) arguably first highlighted, which has subsequently been cited and stated in influential works, such as Hillary (2000; 2004). Although many SMEs are still reactive, these works, which conducted interviews with SME Directors, highlight that many are starting to realise the competitive edge of being 'green' for attracting clients. This has helped drive these organisations to adopt environmental management systems. For non-profit-driven organisations, many have ethical or public mission statements, where it is more likely that any money generated or donated is channelled into achieving these goals. Thus, I would hypothesis that their adoption of formal or informal environmental management will be more proactive, as a way of complementing other social goals.

The Energy Saving Trust (EST) and the Carbon Trust are the main two independent (though partly government-funded) bodies in the UK for providing advice and support to organisations and households on energy and reducing CO_{2e} emissions. Historically, the Carbon Trust dealt more with businesses and reducing their carbon emissions and the EST was involved with households and improving their energy efficiency, as well as being the main source of public information on micro-generation. Both organisations have now diversified so that the EST gives support to households, small businesses and small public sector organisations, and the Carbon Trust gives support to large businesses and large public sector organisations. However, the EST has tailored its advice on micro-generation more towards households than to small organisations. This is particularly evident on its website (www.energysavingtrust.org.uk), where the 'Generate your own energy' tab under the households section is very detailed with technical, economic and environmental details, but a similar level of detail is not provided for typical buildings of different sectors and sizes for small organisations under the 'Business and public sector' tab. There is a clear need for the EST to improve its website information to take into account the differing and diverse circumstances of small organisations.

Figure 4 overleaf collates data from the EST website on the main types of micro-generation technologies currently accessible: solar thermal, solar photovoltaics (PV), micro-wind turbines, Air Source Heat Pumps (ASHPs), Ground Source Heat Pumps (GSHPs), micro-combined heat and power (micro-CHP) and biomass boilers. The figures are based on an average household electricity consumption of ~4,000 kWh (the typical heat consumption of an average household is ~20,000kWh – EST website, 2010). However, it is clear that small organisations will generally have consumption values much higher than this and thus, the initial costs and payback times of installing micro-generation

will be greater in order to meet an equivalent proportion of consumption. Due to the lack of studies that have been done on the uptake of micro-generation in small organisations, this research fills this knowledge gap by investigating the validity of the statement.

At larger scales, such as at the small-scale (100 kW-5 MW) or large-scale (>5 MW), economies of scale make the installation more cost-effective and cheaper per added mega watt (DECC website, 2010), so there is potential for small organisations in the same geographical area to pool resources and invest in a community low carbon scheme. This could mirror the 2009 DECC *Low Carbon Communities Challenge* aimed primarily at reducing domestic energy consumption in communities. However, I would argue that at the higher end of the micro-scale (10-100 kW), these benefits are not realised if only one small organisation is investing in a micro-generation scheme. Chapter 5 explores in more depth this issue of long payback times for such investments, as well as other barriers, notably the role of micro-generation awareness in influencing uptake. If the EST provided details on the typical energy consumption patterns of different sizes and types of small organisation on its website, possibly through the use of more case studies, as well as effectively publicising itself to small organisations as the main source of information on micro-generation, then I would hypothesise that it is likely to help increase the uptake.

Micro-generation technology	Energy output type	Installation cost (£)	Annual cost savings (£)	Annual carbon savings (kg)	Energy needs (%)	Payback time without tariff (years)	Tariff level (p/kWh)	Tariff lifetime (years)	Payback time with tariff (years)
Solar thermal	Heat (hot water)	3,000-5,000	50-85	320	40-60	60	N/A	N/A	60
Solar photovoltaic	Electricity	8,000-14,000	200	1,000	40	40-70	41.3	25	32-62
Small-wind turbines	Electricity	10,000-25,000	380	2,600	50-90	26-66	34.5	20	23-62
Air source heat pumps	Heat (space heating)	5,000-9,000	790	0	95-100	6-11	N/A	N/A	6-11
Ground source heat pumps	Heat (space heating)	7,000-14,000	650	540	95-100	11-22	N/A	N/A	11-22
Micro-combined heat and power	Heat (hot water, space heating) and Electricity	2,500-3,500	150	410	100 (heat) and 50 (electricity)	17-23	10	10	14-21
Biomass boiler	Heat (hot water and space heating)	3,000-9,000	170-410	9,600	100	18-22	N/A	N/A	18-22

**The export tariff is 3 p/kWh for all micro-generation technologies*

**The tariffs are based on generators between 1.5 and 4 kW in size*

**Payback times are calculated based on a building equivalent to a house with a typical consumption of 4,000 kWh electricity*

Figure 4: current information on the main accessible micro-generation technologies (data collated from the EST website, 2010)

The EST promotes an energy hierarchy where the no- and low-cost energy efficiency measures are prioritised first with micro-generation at the top. This is primarily a result of upfront cost. As figure 4 shows, based on single micro-generators of between 1.5-4 kW in size (to meet the equivalent electricity or heating needs of a typical house), most have an initial cost of ~£8,000-10,000 on average. Alternative energy management measures for small organisations include loft insulation, cavity/solid wall insulation, energy efficient lighting (such as T5 Light-Emitting Diodes (LEDs) or Compact Fluorescent Lamps (CFLs)) and behaviour change through staff engagement (EST website, 2010). The implementation of no- and low-cost measures makes good economic sense (Carbon Trust website, 2010), but as Sauter and Watson (2007) point out, it is not simply a question of having short payback periods, as individuals rarely consider future savings fully or act as rational economic agents. They state that, "why do households not invest in some energy efficiency measures where such a short payback can actually be achieved (e.g. cavity wall insulation)?" I argue that this is likely to be due to a lack of awareness of the specific details of the economic and environmental benefits and costs associated with certain measures, as well as the greater value placed on 'new' money rather than savings. As such, the Senior Managers (or equivalent) of small organisations may be less willing to direct limited funds away from core business or mission statement activities (Hillary, 2000). This research tests the validity of these statements by exploring what the attitudes of the Senior Managers (or equivalent) of small organisations are towards micro-generation, and whether or not an enhanced awareness of environmental management, through being involved in an environmental alliance, has resulted in an increased uptake of micro-generation. This is explored further in the next chapter.

The thesis is split into seven chapters. The second chapter discusses the research aims and objectives and details the methodological approach. The third, fourth, fifth and sixth chapters take the important themes of the research questions, review the literature and analyse the interviews. The third chapter discusses environmental decision-making in small organisations, the fourth chapter describes and analyses the research case study, the fifth chapter assesses the barriers to micro-generation uptake in small organisations, and the sixth chapter looks at the current incentives for small organisations to install micro-generation. The seventh chapter concludes the research findings, discusses key policy gaps and gives suggestions for further research.

2 Chapter 2: Methodological Approach

2.1 Case Study

To illustrate the methodology I am advocating here, I would like to detail, as a case study, the example of the *Camden Climate Change Alliance* (CCCA). The CCCA is a unique environmental alliance of small organisations of all sectors in the London Borough of Camden with the collective goal of reducing carbon emissions from the Borough's non-domestic sector by 10% by 2012 (CCCA website, 2010: www.betterclimateforcamden.org). Camden Council is pioneering the way for local authorities as it is unique not only in London but in the UK for setting up an alliance of small organisations sharing ideas for improving environmental performance. This forms the rationale behind using the case study, as its implications for improving the uptake of micro-generation among small organisations could be explored.

The CCCA was set up in November 2008 and at the time of writing its membership has grown to 130 organisations (CCCA website, 2010). Any organisation located in the London Borough of Camden can join for free at any time. Camden Council manages the alliance and has created three marks of achievement that organisations can obtain to give them low-level certification where they cannot afford to implement the ISO 14001 or European Eco-Management and Audit Scheme environmental management systems (the highest international standards for environmental management in organisations – see: www.iso.org and Cleaver, 2001 for further information). The marks of achievement are: *Going Green*, where the organisation measures and submits its carbon footprint to the council and produces an action plan for reducing it, *Cutting Carbon*, where the action plan is implemented and the carbon footprint is recalculated after a year, and *Carbon Champion*, where the organisation helps other organisations to reduce their carbon emissions by spreading best practice and talking at CCCA events. The council also runs various free environmental workshops for members throughout the year on carbon footprint measuring, waste management, energy management, 'green' travelling and staff engagement (CCCA website, 2010). Various alliance members host these workshops. The CCCA also holds an annual event where awards are given (determined by the strength of the applications submitted) for improvements in environmental performance, which are termed EECO (Environmental Excellence in Camden Organisations) awards.

The marks of achievement are awarded through the CCCA *Carbon Confident* programme, which is a series of four workshops designed to teach small organisations how to measure and monitor their carbon footprints, and develop and implement action plans. The first workshop highlights the importance of small organisations engaging with environmental management, both in terms of the environmental and economic opportunities. It is about increasing awareness of their (negative) environmental impacts. The workshop teaches the representatives responsible for the environmental management of their organisation how to measure and monitor its carbon footprint. During the second workshop, a member of the CCCA team comes into the organisation to conduct an environmental audit and provide recommendations for reducing its carbon footprint. The organisational representative is taken through the environmental audit process, so the recommendations can be put in context. The third workshop helps representatives to develop action plans from the recommendations and prioritise measures based on their own individual circumstances. The fourth workshop is a review meeting after six months where a member of the CCCA team checks on progress. The programme is funded directly by the European Union (EU)'s *Regional Development Fund* to spend thirty hours with an organisation to improve its environmental management (CCCA website, 2010).

2.2 Qualitative Approach

The CCCA provides an opportunity not only to explore the uptake of micro-generation among more environmentally proactive small organisations, but also to determine the implications of such an alliance for increasing the uptake of micro-generation (and wider environmental management) in small organisations.

This research takes a qualitative approach through the use of semi-structured interviews with members of the CCCA and organisations with potential influence on the uptake of micro-generation locally and nationally. The interviews are transcribed and the main arguments of the interviewees are presented through quotations. All interviewees signed a declaration form stating their willingness to be recorded and cited in the research. Scanned copies of the signed forms are located in the Appendix (9.1).

During October 2009, I contacted all CCCA members at the time (~75) by email to ask if they would be willing to take part in the research. I specifically requested to interview the representatives responsible for the environmental management of their organisation. Seventeen representatives responded positively stating their interest in organising a meeting, which constituted around a quarter of the members at the time. The

interviews took place between November 2009 and April 2010 at the premises of the organisations and lasted ~45 minutes on average. Figure 5 gives a brief overview of the seventeen CCCA organisations and their representatives that took part in the research. Figure 6 lists the topics covered in the interviews and the rationale behind them.

Name of CCCA Organisation	Background	Representative
	SMEs:	
Sheppard Robson	Architects' firm – have obtained ISO 14001 and many sustainability awards	Sustainability Coordinator
The Office Group	Provides office space for companies - has a sustainable environmental commitment	Director
The Cake Group	Brand entertainment agency	Office Manager
InHolborn	Is a Business Improvement District alliance of 480 local businesses	Managing Director
Methodist International Centre	Small hotel and conferencing centre with a strong ethical commitment	Business Director
Freshminds	Research and recruitment company	Head of CSR Committee
Addison Lee	Europe's largest minicab service	CSR Manager
Envido	Provides environmental consultancy for private and public sector organisations	Lead Consultant
St Athans Hotel	Family-run hotel B&B	Hotel Manager
KXBF	Collective of 2,200 businesses reconnecting business with the wider local community	Director
Alara Wholefoods	Organic muesli manufacturer	Senior Manager
	Small Charities:	
Camden Arts Centre	Contemporary arts space for artists and the public	Gallery Manager
Arthritis Care	Provides support for people with arthritis	Head of Facilities
Quakers	Religious society of Friends in Britain - Friends House is let out for conferences	Recording Clerk's Officer
	Borderline Small/Large Non-Profit Organisations:	
Royal College of Physicians	Educational institution providing services to medical professionals	Building Services Manager
NHS Camden	Provides healthcare for people living in Camden	Facilities and Risk Manager
London Fire Brigade	Largest fire and rescue service in the UK (Camden has 4 fire stations)	Energy and Environmental Officer

Figure 5: overview of the CCCA organisations that took part in the research

Number	Area Explored	Rationale
1	Background to organisation? Type/number of employees/etc.?	For group classification purposes
2	Profit-driven?	For group classification purposes
3	Listed building?	To explore the issue of planning permission
4	Involved in Carbon Reduction Commitment?	For group classification purposes
5	Has an environmental policy statement?	To explore how environmental management is viewed
6	Has a designated environmental or energy manager?	To explore how environmental management is viewed
7	Annual energy consumption (if known)?	For group classification purposes
8	Heard of term 'micro-generation'?	To understand micro-generation familiarity
9	Know of different types of micro-generation?	To understand micro-generation familiarity
10	Have installed micro-generation?	To look at micro-generation uptake in the CCCA and why
11	Have considered micro-generation installation?	To look at micro-generation uptake in the CCCA and why
12	Incentives to installing micro-generation?	To look at micro-generation uptake in the CCCA and why
13	Obstacles to installing micro-generation?	To look at micro-generation uptake in the CCCA and why
14	Know where to go for further information on micro-generation?	To look at micro-generation uptake in the CCCA and why
15	Know of grants for micro-generation?	To look at micro-generation uptake in the CCCA and why
16	Know of feed-in tariffs and how they work? Increase incentive?	To look at micro-generation uptake in the CCCA and why
17	Alternatives to micro-generation?	How micro-generation is viewed compared to alternatives
18	Prioritise energy efficiency/other environmental measures?	How micro-generation is viewed compared to alternatives

Figure 6: the rationale behind the main areas explored in the interviews with the representatives of CCCA organisations

Organisations outside of the CCCA with potential influence over the uptake of micro-generation locally and nationally were also contacted by email during October 2009. Representatives from the Department of Energy and Climate Change (DECC), the Environment Agency (EA), the Energy Saving Trust (EST), British Gas, the Greater London Authority (GLA), the London Development Agency (LDA), Camden Council and Ecovolt (a London-based micro-generation installer) agreed to take part in the research. The interviews also took place between November 2009 and April 2010 at the premises of the organisations and lasted around one hour on average. Figure 8 overleaf gives an overview of the topics covered in the interviews and the rationale behind them. However, it is important to note that this is only a generalised guideline of what was covered, as I asked some questions specific to certain organisations. For example, "what power do you have over the London Boroughs to encourage the uptake of micro-generation?" (to the GLA) and, "as a micro-generation installer, what are your views on the Micro-generation Certification Scheme?" (to Ecovolt). Figure 7 below gives a brief overview of the eight organisations and the roles of their representatives:

Organisation	Background	Representative
London Development Agency	Delivers the Mayor's strategies for London	Head of Project Delivery for the Environment
Camden Council	Local Authority for Camden	Sustainability Officer
Greater London Authority	Develops the policies that the London Development Authority implements	Climate Change Policy and Programmes Manager
Department of Energy and Climate Change	Responsible for national UK energy and climate change policies	Policy Advisor of the Distributed Energy and Heat Team
Environment Agency	Responsible for the regulation and delivery of environmental legislation in the UK	Senior Climate Change Advisor
Energy Saving Trust	Independent, government-funded agency aimed at reducing carbon emissions through energy efficiency	Micro-generation Advice Manager
Ecovolt	Solar PV installer operating in London	Director
British Gas	Large energy supply company in the UK	Policy Manager for British Gas New Energy

Figure 7: background information on the organisations interviewed that have potential influence over the uptake of micro-generation at local and/or national scales

Number	Area Explored	Rationale
1	Background to organisation?	Organisation's influence over micro-generation uptake
2	Role in organisation?	Representative's influence over micro-generation uptake
3	Organisation's relation to micro-generation?	Organisation's influence over micro-generation uptake
4	Micro-generation installed on organisation's own buildings?	Understanding if organisation leads by example
5	Main obstacles to micro-generation uptake in the UK?	To explore micro-generation uptake in the UK and why
6	Main incentives to micro-generation uptake in the UK?	To explore micro-generation uptake in the UK and why
7	Future role of micro-generation in small organisations?	To explore micro-generation uptake in the UK and why
8	Prioritise energy efficiency/other environmental measures?	How micro-generation is viewed compared to alternatives
9	Feed-in tariffs will increase micro-generation installation incentive?	To understand the future uptake of micro-generation
10	Micro-generation's role in future energy mix?	To understand the future uptake of micro-generation
11	Future micro-generation policies for small organisations?	To understand the future uptake of micro-generation

Figure 8: the rationale behind the main areas explored in the interviews with organisations that have potential influence over the uptake of micro-generation at the local and/or national scale

Interviewing these organisations provided the context for understanding the external factors that shape the governance and effectiveness of the CCCA. In the local context, the Camden Council representative was involved in setting up the alliance in 2008 and hence, he provided an interesting insight into the functionality and implications of the CCCA. Camden Council not only manage the CCCA but it is the local authority for the Camden area, with, for example, powers over planning permission, which is a significant consideration in the installation of certain types of micro-generation (Allen *et al*., 2008). The power relationships between the GLA, LDA and the Camden Council, and how this affects the CCCA was an important area explored in the interviews with the GLA and LDA representatives. Interviewing a micro-generation installer operating in London gave an indication into the sorts of technologies that he perceived to be the most suitable for a large urban area like London. In the national context, speaking to representatives from DECC, the EA, the EST and a large, well-known energy company (British Gas) gave an insightful look into the national political and industrial attitudes towards the uptake of micro-generation in small organisations and more broadly.

The approach allows an in-depth understanding of the factors shaping the alliance and the small organisations within it, and what this means for the uptake of micro-generation. I chose semi-structured interviews rather than electronically distributed surveys in line with the arguments of Morse (2008), who highlights the difficulty in going into depth with surveys and achieving a good response rate. Arksey and Knight (1999) argue that unstructured interviews give the interviewee a chance to go off-topic and highly structured interviews do not give the interviewee much chance to go into any sort of depth and provide useful information in addition to the questions asked, which the interviewer might have previously overlooked.

Similar methodological approaches were used by Foxon *et al*. (2008), Allen *et al*. (2008) and Bergman *et al*. (2009), which explored the uptake of micro-generation using (mainly) qualitative techniques (interviews and surveys). Parker *et al*. (2009) provides a useful list of the main academic publications on environmental management in SMEs, alongside the research methods that were employed. The majority used interviews with SME representatives who had the responsibility for environmental management within their remit. Although the numbers of interviews varied, on average it appears to be between ten and twenty interviews, which justifies the number I conducted for this research (17 CCCA organisations and 8 external organisations). Figure 9 overleaf shows the locations of the CCCA organisations taking part in the research, which is where the interviews took place.

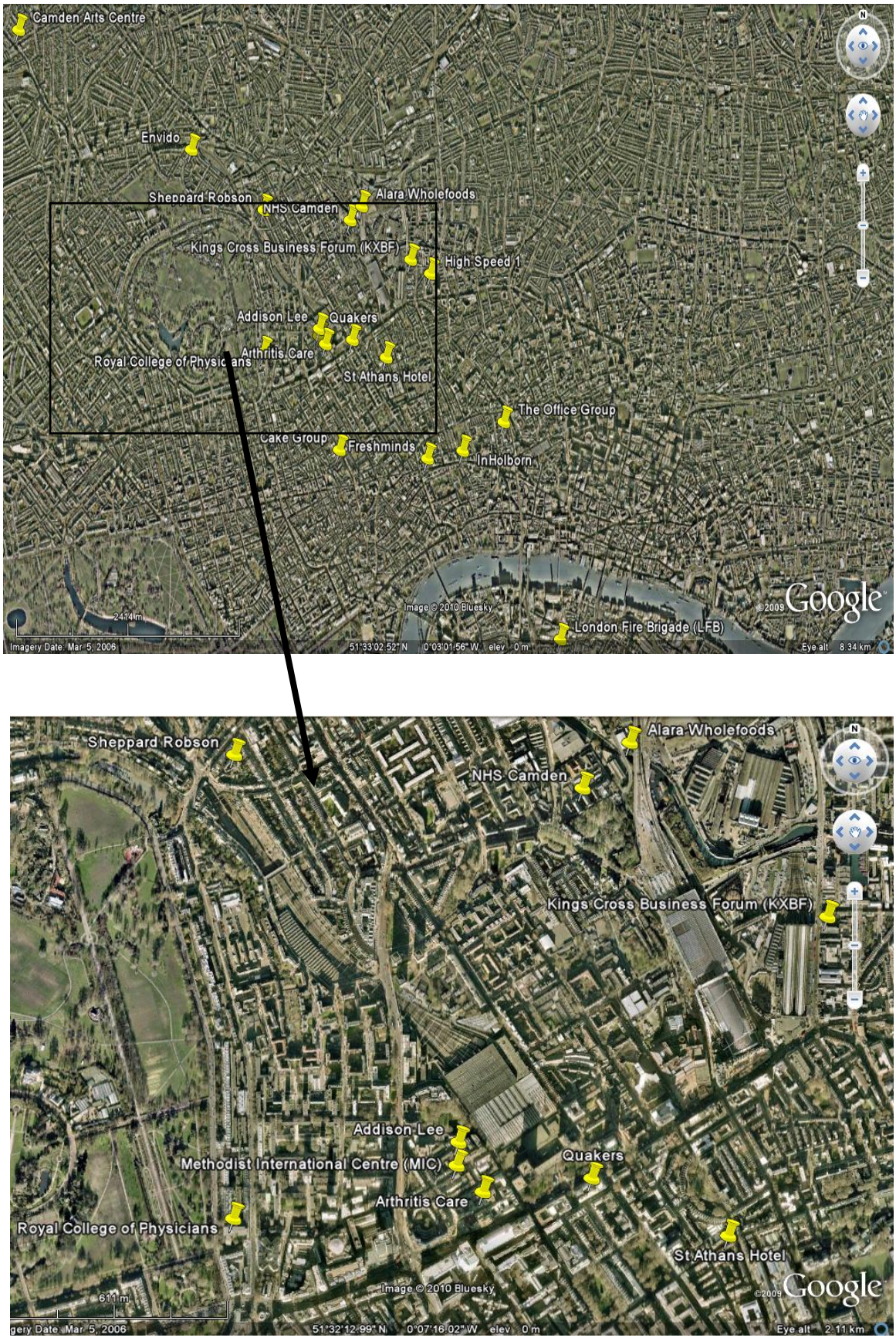

Figure 9: Google Earth map(s) of Camden (London) showing the locations of the 17 CCCA organisations that took part in the research

Following my interview with the Methodist International Centre (MIC), I was offered part-time employment as the organisation's Environmental Manager. This provided me with a good opportunity to go into greater depth within the CCCA through active participatory observation and engagement. For example, I attended a number of CCCA workshops on behalf of MIC to observe through first-hand experience how the CCCA provides support to small organisations. Van Maanen (1979) highlighted the usefulness of participatory observation as an effective qualitative method for organisational research.

However, it is important to note that participant observation was not the primary research method. As such, my direct involvement in the CCCA was used mainly to gain a deeper personal understanding of how the alliance helps small organisations and how it spreads best practice in environmental management locally. Attending the CCCA waste management and staff engagement workshops, and taking MIC through the *Carbon Confident* programme as its representative, was particularly insightful. Despite this, the experience is analysed only indirectly in Chapter 4 in the discussions of the CCCA, and the phrase 'participant observation' is not referred to further, as the interviews form the main method of analysis. Nevertheless, when the opportunity arose, it became a useful tool for helping me to undertake applied research to directly push the micro-generation agenda forward (locally) through discussions with the CCCA management team.

2.3 Aims and Research Questions

This research explores four main areas: the governance of small organisations and how this affects their adoption of micro-generation; the significance of environmental alliances like the CCCA for increasing the uptake of micro-generation and wider environmental management measures in small organisations; the prioritisation of wider energy efficiency measures over micro-generation in small organisations; and the current market barriers and drivers for micro-generation uptake in small organisations. Thus the aims and research questions are:

<u>Aims:</u>

1. To explore the attitudes of the representatives of small organisations towards their uptake of micro-generation

2. To comment on the significance of environmental alliances like the CCCA for increasing the uptake of micro-generation and wider environmental management measures in small organisations

Research Questions:

1. What are the environmental decision-making characteristics of small organisations in the CCCA and how does this differ between different types and sizes of organisation?
2. How does the CCCA function and what is its potential for engaging small organisations with improving their environmental performances and increasing the uptake of micro-generation?
3. How do small organisations in the CCCA view micro-generation in the context of wider energy efficiency or environmental measures?
4. What are the main barriers to micro-generation installation in small organisations?
5. What are the main market drivers of micro-generation in small organisations?

The dissemination of the research results are detailed in Chapter 7. The next chapter explores the first of the four main research areas: how the environmental decision-making characteristics of small organisations affect their adoption of micro-generation.

3 Chapter 3: Environmental Decision-Making in Small Organisations

3.1 Multi-level Nature of Climate Change Governance

The mitigation of climate change through carbon dioxide equivalent emissions (CO_{2e}) reduction may be realised through multi-levels of governance (Bulkeley and Betsill, 2003; 2005). Bulkeley and Betsill (2003) argue that nation-states will be unable to make significant progress on addressing climate change without taking local action through transnational and national networks of sub-national governments and non-state actors. The Earth Summit conference held in Rio de Janeiro, Brazil, in 1992 brought forth *Agenda 21*, which most countries agreed to (UN, 1992). As a part of this, local authorities were expected to draw up their own *Local Agenda 21* with local citizens and organisations (Collier and Löfstedt, 1997), which highlighted the importance of mitigating climate change at the local level. I argue that environmental governance needs to take place at all scales with two-way network flows of connections between them. Figure 10 overleaf, which I developed from the arguments of Bulkeley and Betsill (2003), shows how the historic top-down approach of national governments towards mitigating climate change (a) is being replaced by a multi-level inter-connected network approach (b).

As figure 10(b) highlights, governance is starting to take place at all levels of society, which includes interactions between international, national and sub-national state and non-state actors (Bulkeley and Betsill, 2003). I argue that local authorities have the greatest potential for reducing CO_{2e} emissions and if they work across scales through the formation of sub- and trans-national environmental alliances and networks, a significant impact can be made on reducing emissions. The *Cities for Climate Protection* programme is a good example of a trans-national environmental network of around 550 local governments concerned with promoting local initiatives for the mitigation of climate change (Betsill and Bulkeley, 2004). The *Camden Climate Change Alliance* (CCCA), the focus of this research, is a good example of a sub-national environmental network of around 130 local organisations in the London Borough of Camden working together to reduce the collective CO_{2e} emissions from Camden's non-domestic sector, which is explored further in Chapter 4.

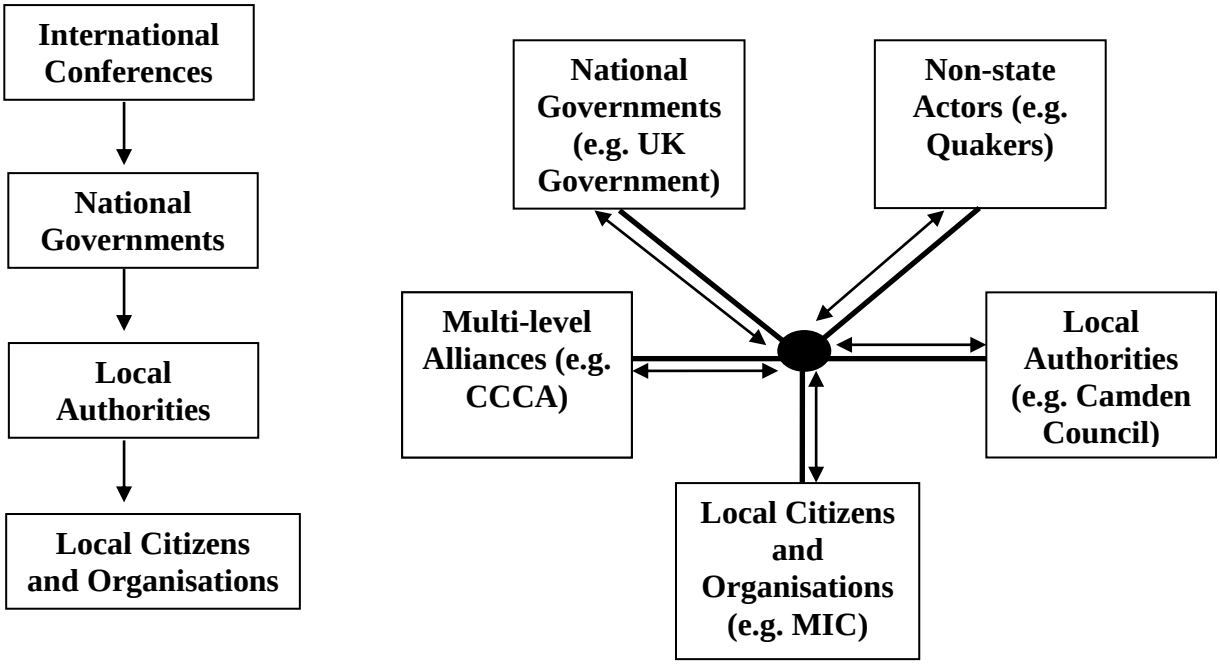

Figure 10: approaches to climate change governance – the historic top-down flow of authority (a) and the multi-level inter-connected network (b). In (b), the CCCA may be used as a case study to explain what the diagram shows. For instance, the UK Government may develop a policy such as the Renewable Heat Incentives (RHIs), which influences the uptake of micro-generation in local authorities and their local citizens/organisations. The policy might also influence the development of similar policies in other countries through international organisations like the European Union (EU). This may also happen vice versa, as national governments are influenced by public demands and international pressure. Non-state actors may act locally, nationally and internationally, and in the case of the Quakers, it is a part of the CCCA as well, which provides it with a more direct avenue for interacting with Camden Council and other local organisations. A further example can be seen in the by-passing of the national scale where Camden Council interacts directly with the EU with regards to CCCA funding

The multi-level approach to mitigating climate change can be seen by taking the example of the urban environment. Cities are sites of mass energy consumption and are thus generally responsible for high levels of CO_{2e} emissions. However, Satterthwaite (2008) argues that this contribution is often overstated at ~75-80% of a country's

emissions, which ignores the contributions of deforestation, agriculture, heavy industries and high-consumption households located outside of cities. Nevertheless, I acknowledge that Satterthwaite (2008) concentrates more on cities in the developing world, so the applicability of the argument to London needs to be considered. Dodman (2009) takes a similar view to Satterthwaite (2008) by using statistics from various greenhouse gas inventories. One of the cities he cites is London, stating that it represented 55.2% of national emissions per capita in 2006, contributing 44.3 million tonnes of carbon dioxide equivalent ($mtCO_{2e}$) or 6.2 tCO_{2e} per capita.

In most UK cities, one local authority is responsible for the development and implementation of city-wide environmental strategies. However, in London there are thirty-three local authorities (including the City of London Corporation) for the different London Boroughs and an overall city authority, the Greater London Authority (GLA), led by an elected Mayor with four-year terms. London is also governed by the GLA Group, which includes: the GLA, the London Development Agency (LDA), Transport for London (TfL), the London Fire and Emergency Planning Authority (LFEPA) and the Metropolitan Police Authority (MPA). The London Assembly, an elected group of twenty-five members, holds the Mayor accountable for his or her strategies and decisions. As part of the GLA's remit, it is responsible for developing city-wide environmental strategies though as my interview with the GLA Climate Change Policy and Programmes Manager highlighted, these can be difficult to implement directly as the local Borough authorities have the direct power over their geographical areas. This is conveyed in the quote below:

The GLA has no direct power over the Boroughs, so that's not to say that the strategy can't talk about actions and things that we want them to do, but what we can't do is insist or direct them – in that sense our power is quite weak...it's about finding avenues and ways of supporting the Boroughs.

(Greater London Authority interview, March 2010)

Although this quote emphasises issues with power, I argue that this is suggestive of a multi-level inter-connected network approach to environmental governance, as "avenues and ways of supporting the Boroughs" have to be found instead of the GLA having direct top-down authority over them.

Due to the global importance of London economically and politically as a central hub of state and non-state actors working at a variety of scales, it is well situated to benefit

from inter-national, national and sub-national environmental networks, such as developing low carbon businesses and industries. This is starting to be acknowledged in the GLA's environmental agenda, for example, the Mayor's draft *Climate Change Mitigation and Energy Strategy* (February 2010) nicely summarises this argument:

There are real economic opportunities and London is well placed to take advantage of them. London already has strengths in areas such as carbon markets, financing, legal services, clean technology, knowledge, and research and development and can use this base to realise an even greater share of this expanding global market by exporting its products and services around the world...London already hosts the world's largest carbon exchange. It is one of the world's top financial centres, making it perfectly positioned to provide innovative financing structures for low carbon businesses not only in the UK but globally. It is a world centre for professional services, such as law firms and engineering companies, which will be essential in designing and delivering new approaches to consuming and producing energy. The UK has a long tradition of scientific and engineering innovation, and London is home to a remarkable concentration of world-leading academic institutions where research and development in new clean technologies is actively underway already.

This transition to move London and the wider UK to a low carbon economy puts the CCCA in a good position to not only benefit from the increasing political attention (detailed in Chapter 1), but also to aid the transition by influencing the UK Government and other local authorities in London to set up similar environmental alliances. The significance of Camden as the primary focus is explored in Chapter 4 and expands these arguments further. One of the research aims is to use the context of micro-generation uptake in the CCCA as a platform to explore how small organisations can utilise multi-level networks to mitigate their own climate change impacts. However, internal factors are as important as external ones when it comes to environmental decision-making in small organisations, and this is explored in the next section.

3.2 Environmental Decision-making in Small Organisations

This research proposes a definition of a small organisation as one that that employs <250 employees, has a half-hourly electricity consumption of <6,000 megawatt hours (MWh)

(equating to half-hourly electricity bills of <£500,000 per year) and covers all sectors. As stated in Chapter 1, this is based on the reverse of the *Carbon Reduction Commitment Energy Efficiency Scheme*'s (CRC) definition of a large organisation. The broad definition has implications for diversity in organisational structure (McDonagh and Prothero, 1997) and governance as it encompasses many different types and sizes of organisation. This affects not only how wider environmental management is viewed (Bianchi and Noci, 1998), but whether micro-generation is considered a part of it or not. I argue that organisational size is an important factor in the environmental management decision-making process, and I show this in figure 11 overleaf, which I developed based on the environmental decision-making structures of the CCCA organisations taking part in the research.

Almost half of the organisations taking part in this research had 10-100 employees and it was clear that in the majority of them the Senior Manager (or equivalent) made the final decision as to whether or not micro-generation or wider environmental measures were implemented. This was particularly the case with Owner-Managers, who made all of the decisions and clearly wanted to be in control of all operations. McKeiver and Gadenne (2005) argue that this can be an obstacle where they perceive their (negative) environmental impacts to be negligible and hence, engage with environmental management reactively, having little time to spend on it.

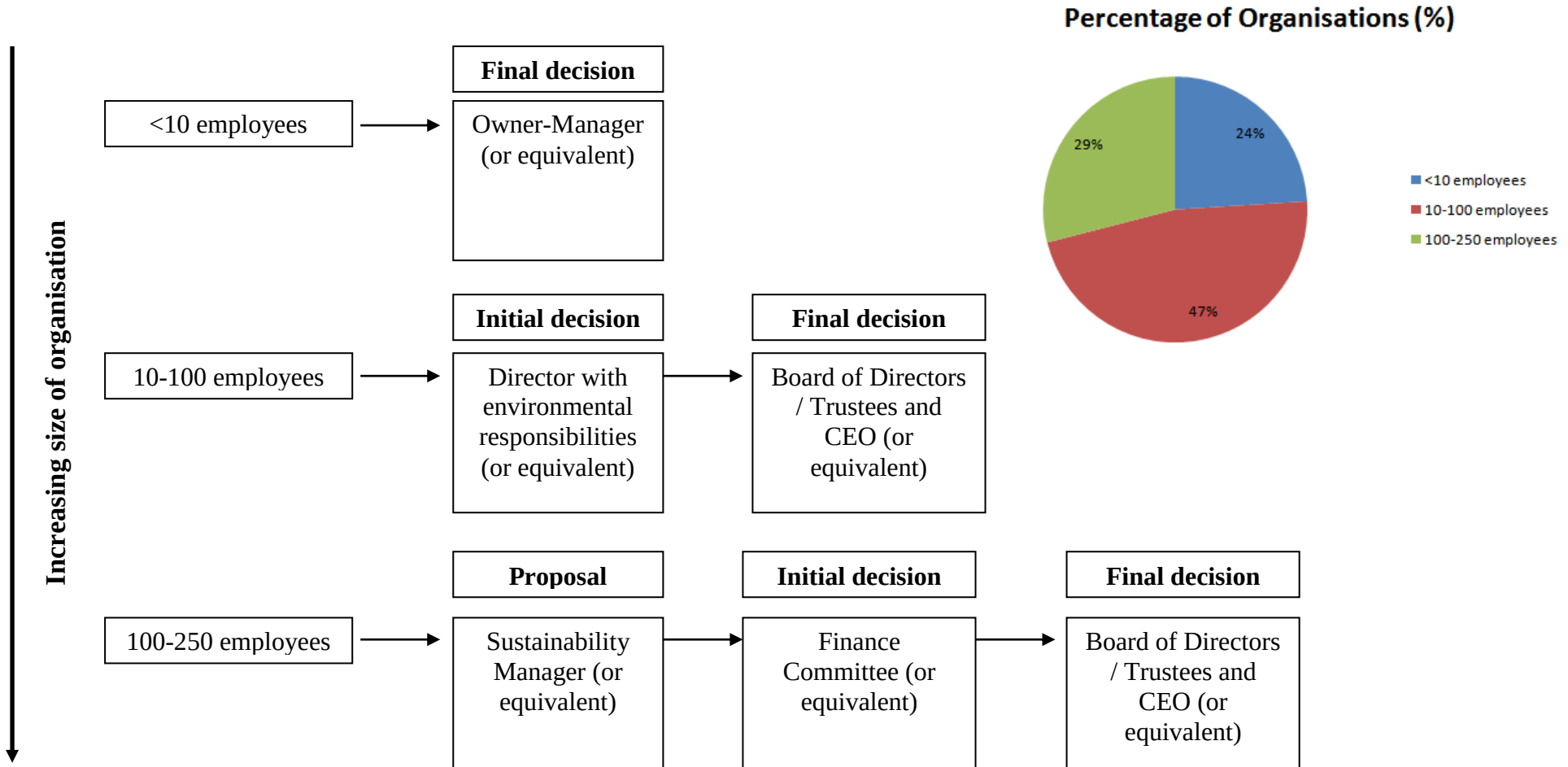

Figure 11: organisational structure for environmental decision-making in different sizes of small organisation – as organisational size increases the decision-making process becomes more complex as power is devolved through various levels and committees

I argue that with environmentally proactive organisations, this structure is actually an advantage as the genuine environmental interest of Owner-Managers diffuses down into the working ethos of the organisation. As McDonagh and Prothero (1997) argue, the private moral positions and attitudes of the Senior Manager (or equivalent) towards the environment are important and this is crucial for determining the levels of staff engagement in environmental management. This is true of the CEOs in organisations of all sizes (including large organisations, as commitments from Tesco and HSBC have shown). This was clearly evident in some of the interviews with representatives of CCCA organisations, for example, in the cases of Cake Group, Quakers and The Office Group:

We want to be as green as possible – the CEO here is all for championing all of this – to do what we can.

(Cake Group interview, November 2009) – Size: 10-100 employees category

Staff attitudes are crucially important – how we use the building...we're working on the staff engagement...and how we can make significant changes.

(Quakers interview, February 2010) – Size: 10-100 employees category

We have an organic Green Roof – you have to make it accessible so that staff can go up there if they want a break or a meeting – we've put wireless up there.

(The Office Group interview, November 2009) – Size: 10-100 employees category

As we can see from the quotes, staff engagement is thus seen as an important factor for helping small organisations reduce their (negative) environmental impacts and improve their general working ethos. Environmental management is likely to be ineffective if employees are not engaged in helping to reduce the demand for energy in the first place. This is both evident from my engagement with the CCCA and from the literature, for example, Cleaver (2001) highlights the importance of staff engagement in the effective implementation of environmental management systems like ISO 14001 or EMAS.

It is clear that as the size of the organisations increase, the decision-making process becomes more complex as the responsibilities for environmental management are delegated away from the Senior Manager (or equivalent) to various individuals or

committees. Thus, the person responsible for environmental management has to pass an environmental proposal through an increasing number of committees and/or individuals as the size of the organisation increases. Examples of this are shown in the quotes below from the representatives of Quakers, the Royal College of Physicians (RCP) and NHS (National Health Service) Camden:

It would have to go through various committees...we have a property and policy group, who have full responsibility for the building, and then we've got trustees we would have to go through as well...we'd have to justify any expenditure.

(Quakers interview, February 2010) – Size: 10-100 employees category

He makes the appeal of the business case to the Finance Officer, who then presents it to the Finances Committee (who assess what is in it for them) – if accepted it will be in the following year's budget.

(Royal College of Physicians interview, November 2009) – Size: 100-250 employees category

It would be me who put forth the Capital Bid, which goes to a Capital Bid committee.

(NHS Camden interview, December 2009) – Size: 100-250 employees category

It is apparent from these quotes that as the size of the organisation increases, many responsibilities, such as financial or administrative duties, are delegated away from the Senior Manager (or equivalent). I have also found that as the size of the organisation increases, the more specialised the role of the individual with environmental responsibilities becomes towards environmental management as the main part of their remit. Environmental responsibilities are likely to come under the Senior Manager (or equivalent) in the smallest organisations (<10 employees). In the medium-sized small organisations (10-100 employees) environmental responsibilities tend to come under the remit of Facilities Managers, who are more specialised in a role that includes environmental management as an integral part of it. Thus, they can spend more of their time on it than Senior Managers (or equivalent). With the larger small organisations (100-250 employees), designated Sustainability Officers (or equivalent) have direct

environmental responsibilities as the main part of their role, spending all or most of their time on it. Figure 12 below captures this from an analysis of the roles of the interviewees that were responsible for environmental management in their organisation.

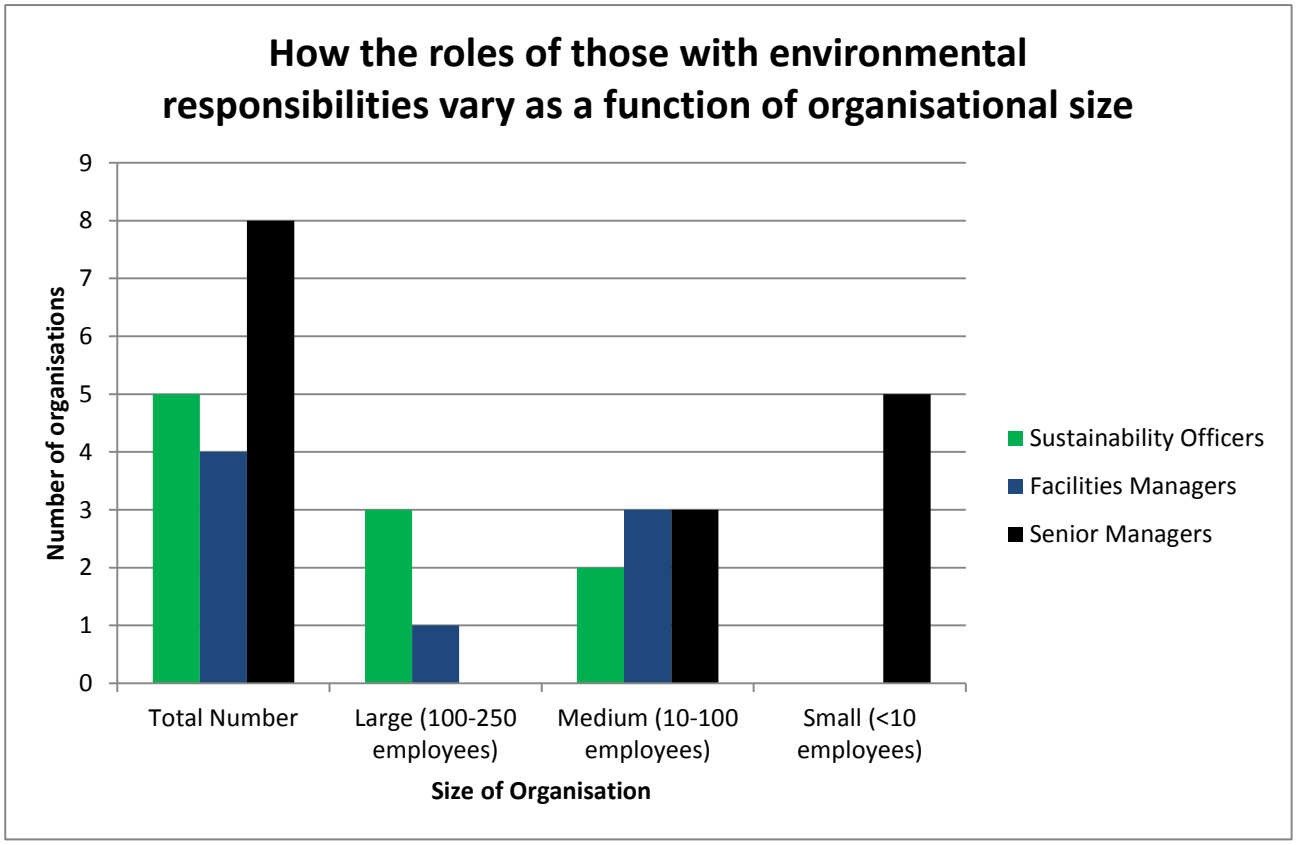

Figure 12: the designation of environmental responsibilities as a function of organisational size in the CCCA organisations that took part in the research

The designation of specific Sustainability Officers or Environmental Managers is partly a result of the rise of Corporate Social Responsibility (CSR) in organisations (May *et al*., 2007). Increasingly environmentally and ethically conscious customers may be responsible for this, and CSR is now commonplace in many large organisations (May *et al*., 2007). My interviews have shown that this is beginning to be prevalent in the more proactive larger small organisations (such as Sheppard Robson and Addison Lee) and some of the medium-sized small organisations (such as Freshminds and Cake Group). I have found that the benefits behind implementing CSR or an environmental management system are not solely ethical as it can result in indirect economic benefits, particularly for more profit-driven organisations, through the effective 'green' marketing of their

environmental and social commitments to attract clients, who are increasingly demanding products and services that are environmentally sustainable (Hillary, 2000).

The benefits of implementing environmental management measures in small organisations are as much economic as they are environmental. Direct cost savings can be made through increasing the energy efficiency of the organisation's premise(s). Such measures include installing energy efficient lighting systems, such as motion-sensor lighting, and/or replacing light bulbs to efficient alternatives, such as T5 Light Emitting Diodes (LEDs) or Compact Fluorescent Lamps (CFLs) (Energy Saving Trust (EST) website, 2010). Other measures include improved insulation through loft and cavity/solid wall insulation. Part of the focus of this research is to explore the incentives for small organisations to install micro-generation as a part of their environmental management.

Apart from social and economic factors, political and legal obligations are also a primary driver for the uptake of environmental management systems in small organisations. Hillary (2004) found that most SMEs tend to be reactive and simply comply with environmental legislation. Figure 3 in Chapter 1 lists the main pieces of environmental legislation that might be of relevance to some organisations, depending on their business or mission/public statement activities. All the CCCA organisations that took part in the research were service-based except one (Alara Wholefoods), which was a manufacturer. Thus, most of the pieces of legislation do not directly affect them. As a manufacturer, Alara Wholefoods would notably need to comply with the Producer Responsibility Obligations (Packaging Waste) Regulations, which requires the recovery and recycling of specified tonnages of packaging waste each year (DEFRA (Department for Environment, Food and Rural Affairs) website: www.defra.gov.uk). However, all the organisations would need to pay the *Climate Change Levy*, which was introduced in 2001 and taxes all energy consumed from non-renewable sources in the non-domestic and non-transport sectors. One benefit for small organisations installing micro-generation is a reduction in the amount of the tax they pay (depending on how much of their energy consumption is covered by the installation).

Thus, environmental decision-making in small organisations is complex as the definition encompasses a broad range of sectors and sizes. From my research, it is clear that as the size of the organisation increases, the more complex this process becomes as responsibilities are delegated away from the Senior Manager (or equivalent) and environmental management proposals need to go through more committees and people, such as a Finance Committee and a Board of Directors/Trustees. There are many benefits for small organisations engaging with wider environmental management, which go

beyond legislative compliance to improving business efficiency through cost-reductions and attracting clients.

3.3 Incentives and Barriers to Micro-generation Installation

This research is interested in how the representatives of small organisations, who are responsible for the environmental aspects of their organisation, view micro-generation as a part of wider environmental management. A primary aspect of the research is to explore what the main incentives and barriers are to micro-generation installation in the organisation. Bergman *et al*. (2009) and Allen *et al*. (2008) looked at the prospects and barriers to micro-generation uptake in households and how the barriers could be overcome. These incentives and barriers are collated and listed in figure 13 below, which are subsequently discussed.

Barriers	Incentives
Lack of awareness and knowledge	Environmental reasons
High initial cost	Interest in technology
Low levels of trust in public actors	"Green" status and reputation
Lack of technical expertise	Long-term economic cost savings
Mis-selling issues	Energy security and self-sustainability
Technological inefficiencies	Encouraging behavioural changes in others
Lack of 'trialability' of micro-generation	Enhancing property values
Low export tariffs	Technological efficiencies

Figure 13: the main incentives and barriers to micro-generation installation (compiled mainly from Bergman et al., 2009 and Allen et al., 2008)

The majority of the work on micro-generation has been concerned with overcoming technical issues or assessing socio-cultural aspects of uptake in the domestic sector. The literature is very limited on the uptake of micro-generation in the non-domestic sector. Thus, this section draws mainly from work that has looked at households and Chapters 5 and 6 compare this with my findings from the interviews with small organisations.

Sauter and Watson (2007) argue that a lack of awareness and knowledge on micro-generation is one of the primary reasons for its limited uptake in the UK. Their analysis of surveys revealed that those with a higher level of knowledge tended to have technical backgrounds, general technological interests, higher incomes and a heightened awareness of environmental issues. This matches up well with the ‘innovators’ and ‘early

adopters' categories of Rogers's (1995) *Diffusion of innovations* conceptual model, which is adapted in figure 14 overleaf. In the context of micro-generation, the 'innovators' feel a greater responsibility to the environment and have the capital to invest in micro-generation (Sauter and Watson, 2007) whereas the 'early and late majority' reflect feelings that the responsibility for environmental sustainability lies with the Government (Lorenzoni *et al*., 2007).

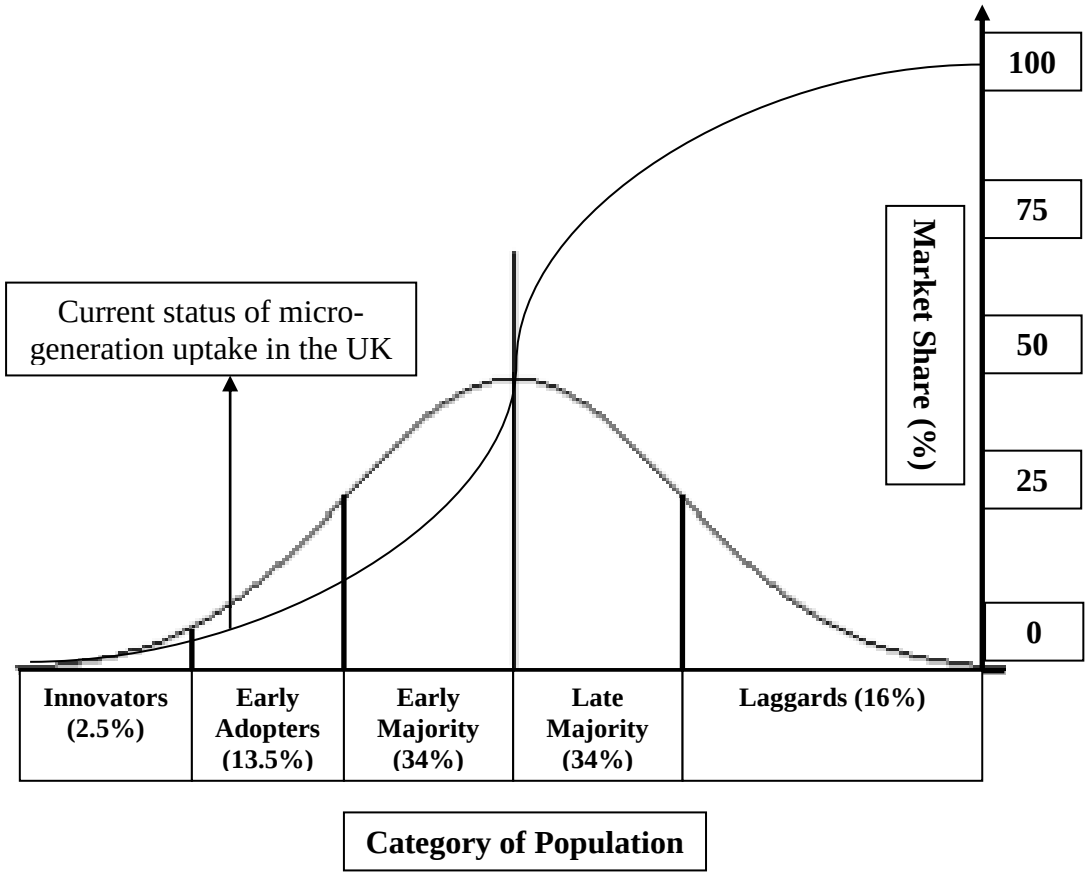

Figure 14: how the current status of micro-generation maps onto Rogers's (1995) *Diffusion of innovations* conceptual model, which was determined by a review of the literature on the current market development of micro-generation in the UK (though it is important to note that this should not be taken as a literal point, but a range), notably from the Bergman *et al*. (2009), Allen *et al*. (2008) and Sauter and Watson (2007) works. The graph shows that micro-generation is still in the 'early adopters' stage and Bergman *et al*. (2009) give suggestions for how this can be moved to the 'early majority' stage, such as bringing in feed-in tariffs for micro-low carbon electricity generation, which were subsequently implemented in April 2010. Alongside the proposed feed-in tariffs for micro-renewable heat generation from April 2011, these measures are likely to go some way in making this shift to the

'early majority'. However, economics is only one aspect of the debate and Bergman *et al*. (2009) highlight that overcoming social issues are equally as important, for example, behavioural shifts and familiarity with micro-generation

The (usually) closely linked nature of familiarity and acceptability in the context of different micro-generation technologies has been shown by Claudy *et al*. (2010) to include not only solar and wind, the more well-known technologies, but increasingly heat pumps and micro-combined heat and power (micro-CHP). London Renewables (2003) carried out a survey of local people that looked specifically at micro- and small-generation in London and found that solar and wind are perceived by people to be "a good idea" due to a high rate of awareness. In contrast, the study highlighted that the more negative perception of CHP, incineration and anaerobic digestion may be a result of a lack of familiarity with the technologies. The LDA is increasingly pushing the development of CHP in London and trying to familiarise people with it, as they argue that it is currently one of the most cost-effective and suitable technologies for London (LDA website: www.lda.gov.uk).

I would argue that many people perceive a typical micro-generation installation to provide them with all of their energy needs and this is evident not only in some of the interviews I conducted, but in some of the micro-generation field trials and reports that have been conducted by the Energy Saving Trust (EST) (which can be found at: www.energysavingtrust.org.uk). As figure 4 in Chapter 1 highlights, the most familiar (and arguably the most accessible) micro-generation technology to people – solar thermal, will on average provide between 40-60% of hot water needs (EST website, 2010). However, it only provides hot water rather than space heating, and the majority of energy consumed in a typical household is in space heating (Druckman and Jackson, 2008). Heat pumps are better designed for this and have the potential to cover 95-100% of space heating needs (EST website, 2010). It has been estimated that 53% of household CO_{2e} comes from space heating, compared with 20% for water heating and 22% for lights and appliances (HM Government, 2006). For comparative purposes, a typical three-bedroom house consumes 20,000 kWh of energy per annum for heating in contrast to 3,000-4,000 kWh of energy per annum for electricity (HM Government, 2006; EST website, 2010). It is clear that this sort of information needs to be made more transparent to people.

One of the main barriers alongside a lack of awareness is the high initial cost. Scarpa and Willis (2010) state that, "while renewable energy adoption is significantly valued by households, this value is not sufficiently large, for the vast majority of

households, to cover the higher capital costs of micro-generation". On a building equivalent to a house with a typical consumption of ~4,000 kWh electricity, most micro-generation technologies would have an upfront cost of between £8,000-10,000 on average (figure 4).

A limitation of both the Bergman *et al*. (2009) and Allen *et al.* (2008) papers is that they do not discuss a third important barrier, which has been brought to light in other research such as Turan *et al*. (2006): planning permission. Most micro-generation technologies do not need planning permission as they are now permitted developments (DECC website, 2010). However, this does not include micro-wind turbines, Air Source Heat Pumps (ASHPs) and small-hydro schemes. However, the current consultation on a new micro-generation strategy has stated that micro-wind turbines and ASHPs will be added to the list of permitted developments when the full strategy is published in early 2011 (DECC website, 2010). Due to ecological reasons, such as protecting migratory fish, small-hydro developments will continue to need planning permission (Environment Agency (EA) website, 2010). Nevertheless, permission is still required for micro-generation on listed buildings or those that are in conservation areas (Cromhall, 2009). The London Borough of Camden is an area consisting of a number of protected Victorian buildings, which makes it an interesting case study to explore, and this is discussed further in Chapter 5.

A lack of awareness, high upfront costs and issues with planning permission may explain why micro-generation uptake in the UK "has lagged behind its European counterparts" (Hart, 2010). This has had an influence on the development of the micro-generation market. The commercial maturity of micro-generation technologies is only just coming out of the research, development and demonstration stages. Over the last few years, the Government has installed micro-generation demonstration projects on community buildings, particularly schools and leisure centres under the *Low Carbon Buildings Programme* (LCBP). Figure 15 overleaf is adapted from the descriptions of Foxon *et al*. (2005) to show the current situation of the UK micro-generation market. As argued previously, Bergman *et al*. (2009) suggest that the current adoption patterns fall under the 'innovators' and 'early adopters' categories of Roger's (1995) *Diffusion of innovations* conceptual model, which matches up with the 'Research and Development' and 'Demonstration' stages shown in the figure.

Policies that aim to diffuse micro-generation to the 'pre-commercial' or 'early commercial' stages must acknowledge that uptake by 'innovators' and 'early adopters' does not guarantee success in diffusion to the 'majority' (Rogers, 1995). This is because

'innovators' are willing to pay more money and take bigger risks when buying a new technology, while the 'majority' require lower prices and a good reputation (Bergman *et al*., 2009). Taking into account the effectiveness of micro-generation policies in other countries, such as Germany's feed-in tariffs and its 100,000 solar roof programme, will help overcome these barriers to diffusion.

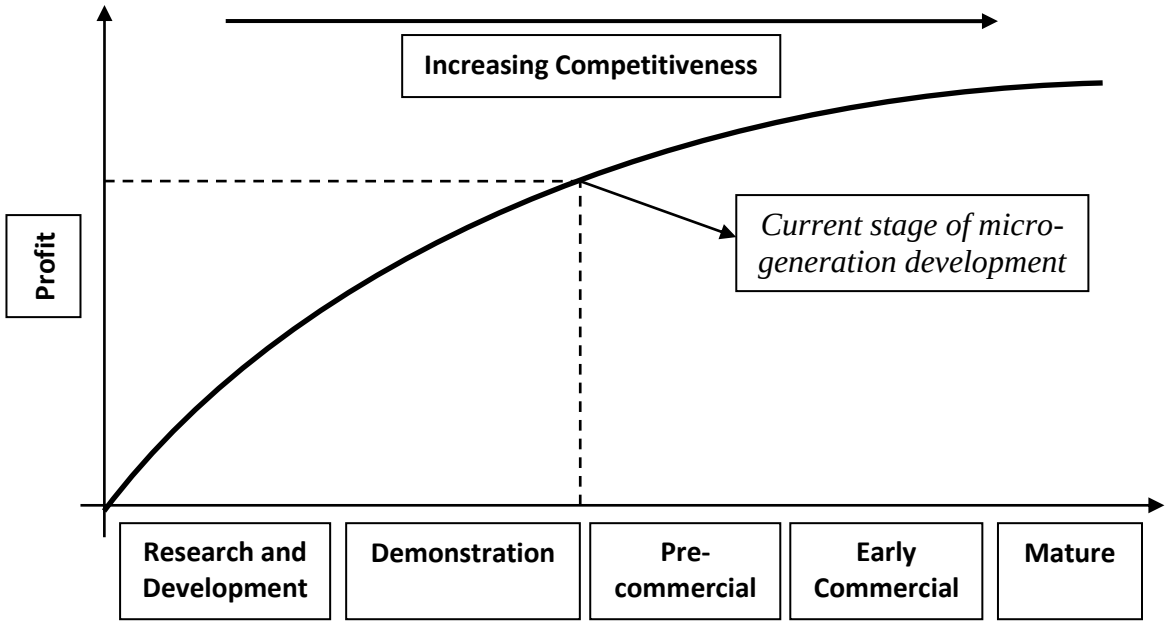

Figure 15: the commercial maturity of micro-generation technologies (adapted from the descriptions of Foxon et al., 2005) – it is important to note that this should not be taken as a literal point, but a range, as different technologies are at different levels of commercial maturity. For example, solar thermal has been on the market for a long time, whereas CHP has only recently become commercially available at the micro scale

Bergman *et al*. (2009) and Allen *et al*. (2008) highlight further issues in the UK micro-generation market. They cite issues of mis-selling and 'green-washing' by companies who are only interested in sales and not concerned with providing customers with reliable information and staying in contact after the installation. However, I would argue that this was more of an issue prior to 2006 as the MCS (Micro-generation Certification Scheme) has come a long way to deal with mis-selling by providing a reputable database of certified installers. The MCS website (www.microgenerationcertification.org) is a good source of information, as it provides unbiased, independent advice on micro-generation. This argument was backed up by the

Director of Ecovolt, a London-based micro-generation installer, which is further discussed in Chapter 6. Chapter 5 explores the familiarity of the representatives of the small organisations interviewed with the MCS and EST websites, which DECC is increasingly pushing as the main sources of public information on micro-generation (DECC website, 2010). The MCS will also go some way to help increase the number of installers and the skills base for micro-generation, which Bergman *et al*. (2009) highlight as a further barrier to installation. Thus, the literature highlights three main barriers: high initial costs, a lack of awareness and familiarity, and planning permission, particularly on listed or protected buildings.

Much academic research has concentrated on explaining the limited uptake of micro-generation. However, less research has looked at the current incentives to installation in the UK. To understand what these incentives are it is important to assess the mindset of the 'innovators' and 'early adopters' (Rogers, 1995). Bergman *et al*. (2009) argue that they put more emphasis on personal motivations such as to save money in the long term, for technical interests in the technology and for self-sustainability. In contrast, later adopters put more weight on social motivations such as the social status of having the technology and recommendations by friends and family (Jager, 2006). A BBC radio interview in 2007 (cited in both Crompton, 2008 and Bergman *et al*., 2009) captured the reasons behind a woman installing a solar panel:

One of my friends has got a solar panel on the north-facing roof of her house. When I pointed out to her that [it]'s not necessarily the best place in the UK in order to be generating energy, she pointed out to me that I wasn't understanding why she'd done it. The north-facing part of her house is the part that faces the street.

Despite this, there is a risk that installing micro-generation and wider energy efficiency measures could increase energy use via the rebound effect (Sorrell and Dimitropoulos, 2007). People may feel justified in increasing their energy use due to the cheaper energy they produce (Bergman *et al*., 2009). However, I align my arguments more with Dobbyn and Thomas (2005), who argue that people will have some environmental motivation (underlying any economic motivations under current policies) to install micro-generation so it is more likely to result in positive wider behavioural changes through a greater awareness of their overall energy usage.

As figure 13 shows, the incentives are not always purely ethical or social. Some people are motivated more by the long-term economic cost savings. Payback periods very

between the type and size of the micro-generation installation, but on average (without the feed-in tariffs) it is about 15-20 years after which free energy is supplied and the cost of the installation becomes effectively negative (EST website, 2010). Other people may install to enhance property values, which is particularly the case with property developers, as the Director of Ecovolt highlighted in the interview (see Chapter 6). The Government's policy of making all new domestic buildings zero-carbon by 2016 and all new non-domestic buildings zero-carbon by 2019 (DECC website, 2010) requires the use of on-site renewable energy generation. The *Merton Rule* has been taken up by a number of local authorities in the UK, particularly in London where it was created in the Borough of Merton, which requires all new non-residential developments above a threshold of 1,000m^2 to produce 10% of their energy from renewable sources (GLA website, 2010; Dobbyn and Thomas, 2005). The *London Plan* suggested an increase in this figure to 20% (Mayor of London, 2008).

The feed-in tariffs (FiTs) post-date the Bergman *et al*. (2009) and Allen *et al*. (2008) publications and provide a new direct economic incentive to install micro-generation, as energy suppliers are required to pay the tariffs shown in figure 1 in Chapter 1 for every kilowatt of electricity their customers generate (~10-40 p/kWh depending on the technology). Owners of micro-generators can also obtain 3 p/kWh of electricity exported to the grid. Renewable heat incentives (RHIs) will provide feed-in tariffs from April 2011 for micro-heat-generating low carbon technologies such as solar thermal, heat pumps (air- and ground-source), biomass boilers (using logs or pellets) and renewable micro-CHP (EST website, 2010). The consultation on RHIs is currently open at the time of writing. Both the FiTs and the RHIs, which DECC terms *Clean Energy Cashbacks*, should help to increase the incentive to install micro-generation and this research explores this in the context of small organisations.

Thus, from the literature, it appears that the main incentives to micro-generation installation are more ethical and social rather than economic, such as installing for environmental reasons, for technological interests and for the 'green' status of being seen as environmentally responsible. However, the introduction of *Clean Energy Cashbacks* will help improve the economic incentives to install micro-generation and could play a significant part in the shift from the 'early adopters' to the 'early majority' (Rogers, 1995). Chapters 5 and 6 will compare the barriers and incentives highlighted in this section, which have been taken from studies that have looked primarily at the domestic sector, to those stated by the representatives of small organisations.

4 Chapter 4: Camden Climate Change Alliance (CCCA)

4.1 Background to the CCCA

The *Camden Climate Change Alliance* (CCCA) is used as a case study to explore the attitudes of the representatives of small organisations towards their uptake of micro-generation. It also provides a platform to comment on the significance of such environmental alliances for increasing the uptake of micro-generation in small organisations.

Camden is pioneering the way for local authorities as it is unique not only in London but in the UK for setting up an environmental alliance of small organisations sharing ideas for combating climate change through improving environmental performance. The CCCA is an alliance of small organisations from all sectors in the London Borough of Camden with the collective goal of reducing carbon emissions from the Borough's non-domestic sector by 10% by 2012 (CCCA website: www.betterclimateforcamden.org). Since the setting up of the CCCA in November 2008, its membership has grown to 130 organisations at the time of writing (CCCA website, 2010).

Camden Council manages the alliance, supporting its members through the provision of free environmental workshops (such as on energy management and green travelling) and awarding Marks of Achievement to those organisations that have empirically shown great commitment to reducing their carbon footprints. The alliance holds an annual event where EECO (Environmental Excellence in Camden Organisations) awards are given (determined by the strength of the applications). Such awards include: *Greatest improvement in environmental performance*, *Innovation in energy efficiency and carbon reduction* and *Exceptional contribution by an individual to their organisation's environmental performance*.

The total carbon emissions equivalent (CO_{2e}) of the Camden Borough is ~1.8 million tonnes per year ($mtCO_{2e}$/yr) (CCCA website, 2010), with the non-domestic sector making up the greatest proportion of this at 64% (~1.15 $mtCO_{2e}$/yr – CCCA website, 2010). The significance of this value for setting up the CCCA was conveyed in the interview with one of the initial Managers of the alliance:

We recruited 35 organisations in our first year and we took the carbon footprint of as many of those as we could – it's hard information to get out of people – about 50% submitted

their carbon footprint to us and it came to about 91,000 tonnes, which is 7% of Camden's non-domestic emissions – Camden's total emissions is about 1.8 million tonnes as a whole Borough – 64% of that is about 1.2 million tonnes...they all committed to a 10% reduction target that we asked them to, so if we get there we'll save 91,000 tonnes per annum by 2012 and that's just with our initial 35 members – obviously we want to increase the number of members and the number of people submitting their baseline to us, because they have committed to doing it by signing our 'Climate Commitment'.

(Camden Council interview, February 2010)

He further states how the CCCA was originally formed:

We did this through the Local Strategic Partnership (LSP) of key statutory bodies, which is made up of the council, the fire brigade, the police, the NHS, representatives from the voluntary sector, the business sector – it's supposed to be an overall picture of the local authority area...those organisations signed up to it to work together on this – they were the initial partners...then we started recruiting other organisations in Camden.

(Camden Council interview, February 2010)

The representatives of two of these initial CCCA partners from the Local Strategic Partnership, NHS Camden and the London Fire Brigade (there are four fire stations in Camden), were interviewed. Fifteen other representatives of CCCA small organisations took part in the research and all were responsible for the environmental management of their organisation. The small organisations that they represented tended to be environmentally proactive as they had to sign a 'Climate Commitment' to reduce their carbon emissions when they joined the alliance (CCCA website, 2010). A central part of the commitment, conveyed in the quotes above, is that members must submit their carbon footprints to Camden Council annually in order for the alliance to accurately monitor its overall CO_{2e} emissions. Despite this, the quotes show the difficulty in obtaining this information from some members. A highlighted annotated copy of the CCCA *Climate Commitment* is shown in figure 16 overleaf.

Camden Climate Change Alliance
Climate Commitment

To do this, we will:

- Identify the sources and scope of our carbon dioxide emissions, understand the causes of these emissions, and quantify our carbon footprint
- Set an appropriate and challenging target for the reduction of emissions and adopt an action plan for its achievement
- Embed best practice environmental and carbon management into our daily activities, supported at a senior level
- Communicate and interact with the Camden Climate Change Alliance and our own stakeholders, reporting performance annually and sharing knowledge and expertise for the mutual benefit of all

In return, the Camden Climate Change Alliance will:

- Support the process of quantifying organisations' carbon footprints
- Help organisations to identify practical emissions reduction measures and set a realistic target
- Organise events to share best practice and to introduce new carbon reduction solutions
- Hold workshops to build the capacity of organisations to manage and reduce their emissions
- Manage an information resource to share case studies, register emissions reductions, and keep members informed of new developments

Organisation.....

Signatory Position.....

Date.....

As members of the Camden Climate Change Alliance, we are confident that we can make a positive contribution towards achieving a joint carbon emissions reduction target for the London Borough of Camden.
www.betterclimateforcamden.org

Figure 16: the CCCA Climate Commitment, which all members sign when they join (please note that I have altered the design slightly in order to make it clearer, but the text and general layout are the same)

The *Climate Commitment* makes three points of interest, which I have highlighted in different colours. It is surprising to see that the text in the blue box is not consistent with the 10% CO_{2e} reduction target stated in the quotes previously. However, from working part-time as the Environmental Manager for MIC (Methodist International Centre) I have

seen first-hand how the council frequently recommends a 10% target to its members. The text in the green box portrays the importance of getting support from senior management when implementing environmental measures. In the smaller organisations (<10 employees) the Senior Manager tends to be the person responsible for environmental management, so this point is particularly crucial for larger organisations where the environmental responsibilities tend to fall within middle management. In an influential paper on implementing environmental management systems, Welford (1992) notably argued that:

"To be successful, systems truly need to be company-wide and therefore commitment is required from the Chief Executive as well as the whole workforce. Middle management has an important role to play in not only grasping the concepts themselves but also explaining them to the people for whom they are responsible."

The text in the red box ties closely with that in the blue box. In the quotes cited previously, the Camden Council representative admits that only around 50% of the members submitted their carbon footprints in the first year. Performance reporting is a key part of determining what the CO_{2e} emissions from Camden's non-domestic sector are. This highlights one of the current weaknesses of the alliance, which is clearly an area of priority that the CCCA management team wish to tackle.

4.2 Functionality of the CCCA

The CCCA has a multi-level function in providing environmental support and advice to its members, as shown in figure 17. The growth in funding available from the European Union (EU) direct to local authorities through bids for specific projects (Bulkeley and Betsill, 2003; 2005), resulted in a change in the traditional network flows of authority. The EU Regional Development Fund was set up in 2007 and runs until 2013 (European Commission website: http://ec.europa.eu/regional_policy/funds/feder/index_en.htm), and one of its goals is to provide funding opportunities to help companies (particularly SMEs) with environmental and sustainable innovation. Camden Council has been successful in obtaining funding from this scheme for the CCCA's *Carbon Confident* programme, which involves spending thirty hours with a small organisation (of <250 employees) to improve its environmental performance. Thus, this bypasses the direct authority of the national

government (Bulkeley and Betsill, 2003; 2005) and puts the scope of the CCCA's work in line with EU environmental goals.

However, the limited communication between the CCCA and the Department of Energy and Climate Change (DECC) has resulted in similar alliances not being encouraged in other local authorities in the UK. In the interview with the Camden Council representative, he admitted that the CCCA had only been locally publicised and that as it developed he was confident that the alliance would become more well-known and influential outside of the Borough. The alliance is well situated in London to spread best practice and be used as a case study for the setting up of other non-domestic environmental alliances. Nevertheless, as the CCCA is only two years old, it is necessary for the 2009/2010 CO_{2e} emissions figure to be published to allow comparison with the 2008/2009 baseline year to be made. This will provide quantitative evidence of how effective the alliance has been. The figure is due to be published at the second anniversary event of the CCCA at the end of November 2010.

Figure 17 overleaf shows how international, national and local factors shape how the CCCA functions. At the international scale, the EU part-funds the alliance directly and political conferences on climate change can bring forward key targets and initiatives at the local scale, for example, *Local Agenda 21*, which came out of the Earth Summit held in Rio de Janeiro, Brazil, in 1992 (UN, 1992). As a part of *Local Agenda 21*, local authorities were expected to draw up their own agenda with local citizens and organisations (Collier and Löfstedt, 1997), which highlighted the importance of mitigating climate change at the local level. The ultimate goal was that the agenda would be legislated into local and/or national policies, and local programmes would be set up. Agenda 21 was adopted by more than 178 Governments (United Nations (UN) website: http://www.un.org/esa/dsd/agenda21/). The CCCA can be considered a part of the wider Camden plan for mitigating and adapting to climate change, and thus, international networks have an influence on the CCCA.

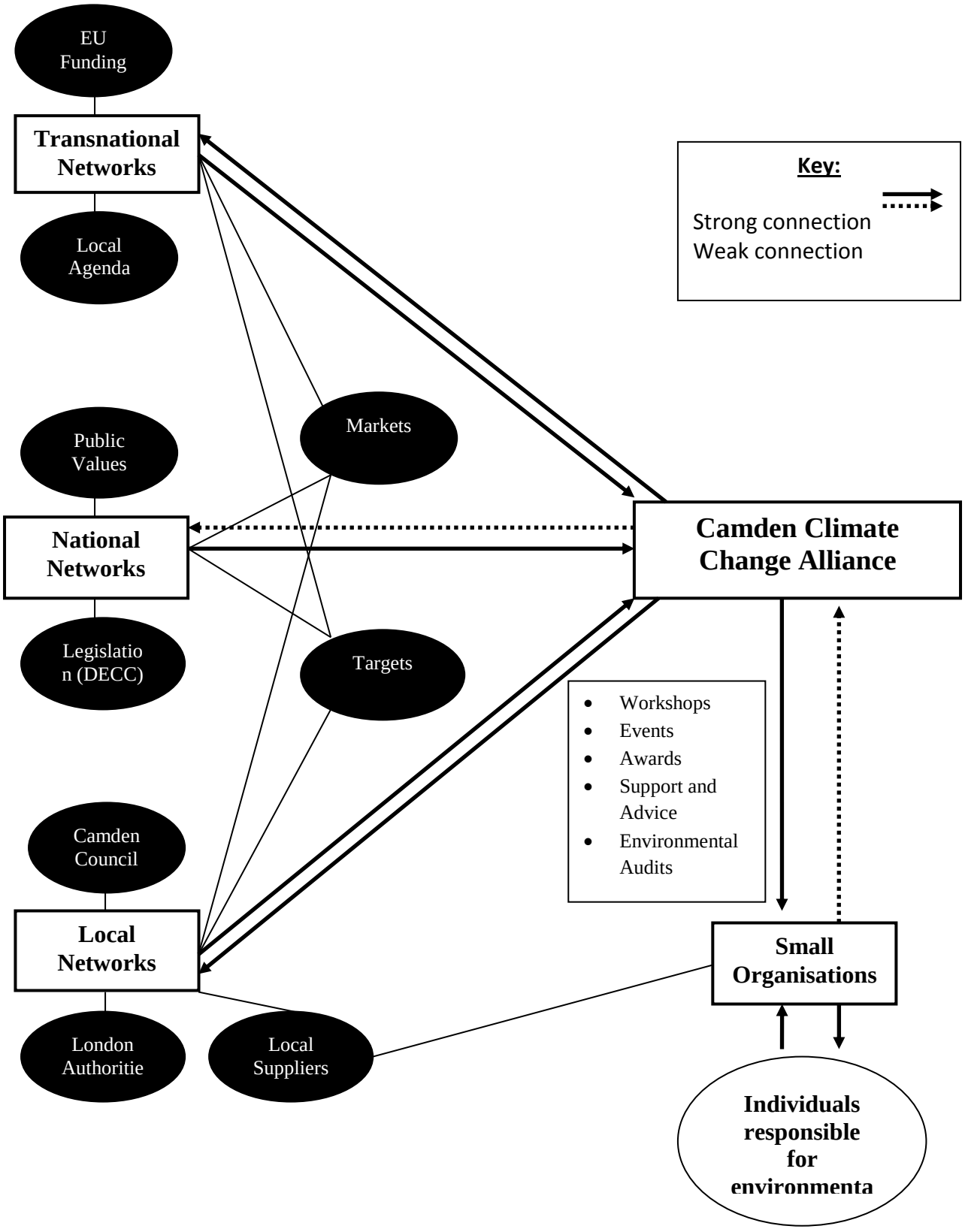

Figure 17: the functionality of the Camden Climate Change Alliance (CCCA) through multi-level networks and connections – I derived this diagram from discussions with the Sustainability Officer of the Camden Council

As figure 17 shows, at the national scale, Governmental policies and legislation also have an influence on the small organisations in the CCCA. These policies are arguably more direct than those of international organisations, for example, DECC introduced the *Climate Change Levy* in 2001, which all non-domestic and non-transport sectors must pay as a levy on energy consumed from non-renewable sources (DECC website, 2010). The representative of the Methodist International Centre (MIC), a small hotel and conferencing centre in Euston, highlighted the importance of public values and how they affect the development of national legislation and initiatives, which has a knock-on impact on the CCCA:

I don't think politicians can be blamed for everything – in a way they reflect the views of the average person...they try and put things on the agenda and people think they are talking nonsense...they cannot necessarily force an agenda.

(MIC interview, December 2009) – Size: 10-100 employees category

More directly, clients, customers and/or stakeholders have an influence on how the organisations they deal with behave, and they are increasingly demanding products and services that are environmentally sustainable (Hillary, 2000).

At the local level, Camden Council has a dedicated team of six who manage the CCCA as part of their roles working to improve environmental sustainability in the Borough. In the context of micro-generation, this is important as the council is also responsible for planning permission in its geographical boundaries and hence has the power to grant, reject or encourage applications (Camden Council website: www. Camden.gov.uk). From the interview with the council representative, it appears that there is some communication between these different departments, particularly when it comes to micro-generation on Listed buildings, though directly incorporating a member of the planning team into the CCCA would strengthen this network and overcome any internal political conflicts (see Chapter 5).

At the citywide-level, the Greater London Authority (GLA) has some influence over the CCCA indirectly through the strategies it implements, such as the Mayor's *London Plan* (2008). The Plan requires all Borough Authorities to act in line with its goals for London as a whole. A notable example relevant to micro-generation is the suggestion that they implement a policy of all new developments over 1,000 m^2 to generate 20% of their energy from on-site renewables, which developed out of the original 10% figure from the

Merton Rule. As the quote on page 28 from the GLA's Climate Change Policy and Programmes Manager conveyed, the GLA has to find "avenues and ways of supporting the Boroughs". Thus, although the GLA cannot tell the Borough Authorities how to act, it can influence them to proceed in accordance with the Mayor's strategies, which are implemented through the formation of partnerships (GLA website: http://www.london.gov.uk).

The CCCA aims to provide an important space not only for small local organisations to share best practice about how to reduce their carbon footprints, but also to network with other members to help strengthen the local economy through the creation of business relationships:

There's a local procurement drive to try and use local people to keep the money in the Borough and build the economy in the Borough – we're trying to get a lot of our local suppliers to go through the scheme, get Marks of Achievement, so when they apply for contracts we know who they are and that they've got a Mark of Achievement – I think Camden's got 18,000 suppliers on its database, though only about 2,000 are based in Camden, some of which are one-man bands, so there are a lot of interesting challenges – we can't force them and say they have to be a member of the alliance to get a contract with Camden, but it will certainly help them get contracts with Camden – it will also help with the sustainable procurement of the council.

(Camden Council interview, February 2010)

Members can network at the CCCA workshops and events, which are generally well attended, as I have found from my own experience and from the interview with the council representative. There is clearly a drive towards local procurement (Brugmann, 1996), which also provides an economic incentive for more local suppliers to join the CCCA:

We have one large event per quarter – a debate, our EECO awards, we get approached by suppliers of low energy lighting – as a council we can't recommend one [supplier] over another, so what we do is we invite them to come into a room, we invite all businesses along, and then they can chat to themselves face-to-face, so we don't have to recommend one over another, which is quite popular.

(Camden Council interview, February 2010)

Despite the popularity of the events and workshops, from my own experience and from the discussions with the council representative, two weaknesses of the CCCA are evident. These centre around the ability for members to provide general feedback to the Camden Council over how the alliance can move forward and develop, and the communication between DECC and the CCCA for encouraging the implementation of similar alliances in other local authorities. Nevertheless, the representative was confident that these aspects would be improved as the CCCA develops. For example, feedback forms are now provided at the end of workshops and all members have access to the email addresses and contact numbers of the CCCA team members if they wish to provide formal or informal feedback directly.

The limited uptake of micro-generation in the UK (Allen *et al*., 2008) can be boosted through local initiatives such as subsidy provision as Ecovolt (a London-based micro-generation installer) points out:

In Germany where they have done this, it is subsidised by the Government – there's that feeling that the British Government don't want to go down the same road...there's more PV in Freiburg then the whole of the UK put together – but then you have individual initiatives by towns, which have boosted it by providing further subsidies.

(Ecovolt interview, March 2010)

Subsidy provision has not yet been realised in the CCCA, which is mainly due to the tight budget constraints available in the council, particularly following the recent budget cuts across government departments. Instead, like the GLA, avenues are found to support small organisations, for example, through workshops. However, the alliance currently does not have a workshop on micro-generation to provide advice on what technologies would be most suitable for specific types and sizes of organisation as well as the general appropriateness of certain technologies in the Camden Borough (alongside information on the estimated initial costs, payback times and carbon savings). Despite this, the council representative showed an interest in setting one up with me (see Chapter 7).

Following my interview with the Business Director of MIC, I was offered the role of part-time Energy and Environmental Manager for the organisation. This gave me a good opportunity to gain a deeper insight into how the CCCA operated. However, this ethnographic approach was not the main method of data collection and will not be discussed in much depth, as the interviews constitute the primary methodological focus.

Nevertheless, I will briefly detail an example of how the opportunity helped me meet the aims of this research. It gave me first-hand experience of the alliance as I could attend the various workshops and events on behalf of MIC. I could interact with the CCCA team and the representatives of other small organisations that I could not organise interviews with previously. This allowed me to directly implement my research and bring my recommendations to the CCCA staff to help them analyse the strengths and weaknesses of the alliance. For example, I organised an environmental audit to be conducted through the CCCA for MIC and it is evident that the recommendations given prioritise the no- and low-cost options, such as staff engagement and switching to energy efficient lighting. Micro-generation was not mentioned in the report.

At the time, the Carbon Trust offered free energy audits for small-to-medium-sized enterprises (SMEs) and for comparative purposes, I organised a survey to be conducted at MIC as well. Although the survey highlighted the importance of staff awareness campaigns, it suggested implementing more expensive, technical solutions for carbon footprint reduction, such as replacing the air conditioning with an evaporative cooling plant and installing voltage optimisation. In contrast to the CCCA report, the Carbon Trust recommended micro-generation in the form of micro-combined heat and power (micro-CHP) and solar photovoltaics (PV) as the most suitable types for the organisation. I pointed out to one of the CCCA staff members that the alliance could benefit from more information on the potential of micro-generation for its members through the environmental audits it conducts and/or through running a micro-generation workshop. This was met with enthusiasm, as highlighted in the quote shown below from the interview with the council representative:

It sounds like a good idea – with this [micro-generation] focus group, would you be willing to run it? I will speak to someone in planning to see if they would be willing to come, though I don't know if they would put themselves in that situation...but we'll keep it in a proactive and positive light – at least we're putting the conversation on the table...we could put a presentation about feed-in tariffs in the focus group to say "this is what is coming in in April"

(Camden Council interview, February 2010)

It was clear from the interview that the CCCA team want to develop the alliance as much as possible. However, it is apparent that those measures that have lower upfront costs

with shorter payback times are prioritised over the longer term investments. This is explored in Chapter 5, particularly in the context of how this mentality compares between different types of small organisation.

4.3 Potential of Environmental Alliances of Small Organisations

As figure 17 on page 48 shows, environmental alliances like the CCCA transcend scales and networks are formed at the international, national and sub-national levels, involving both state and non-state actors. The quote cited previously from the council representative conveyed that 91,000 tonnes of carbon dioxide equivalent (tCO_{2e}) had been measured from ~18 members in the first year of the CCCA, representing 7% of the Borough's non-domestic CO_{2e} emissions. At the time of writing there are 130 members and if all of these organisations measured and submitted their carbon footprints to the council, it would represent ~50% of the non-domestic emissions. This would allow actions to be undertaken in individual organisations with the support of the CCCA to reduce a significant proportion of the Borough's overall CO_{2e} emissions. Hence, the alliance has great potential to help mitigate climate change at the local level.

Small organisations have often been neglected in government policies or initiatives, so such alliances have the potential to reduce the lack of awareness of the Senior Managers (or equivalent) by helping them to realise the economic and environmental benefits of being more environmentally proactive. This would facilitate their understanding of their own (negative) environmental impacts and how to reduce them cost-effectively. Through engaging with state and non-state actors at different scales, local authorities can find avenues for funding the setting up of environmental alliances. In London, local authority partnerships could be set up with neighbouring Boroughs (for example, Camden works very closely with Islington in engaging with the non-domestic sector) and consultations with the GLA could be arranged to source opportunities from both the public and private sectors. At the national and international scales DECC and the EU could be potential funding bodies. These bodies are also important for driving energy markets, usually through financial incentives, at all scales as shown on figure 17. An example of this in the context of the micro-generation market is the recent introduction of feed-in tariffs (FiTs) in the UK, which provides a new financial incentive to install micro-generation and is explored further in Chapter 6.

Chapter 5 explores why in an alliance of environmentally proactive small organisations with a heightened awareness of environmental issues, micro-generation uptake has still been minimal. However, the CCCA is still in its infancy and following my involvement with the CCCA (and MIC), members of the CCCA team are interested in setting up a micro-generation workshop to add to their list of services for members.

5 Chapter 5: Barriers to Uptake

5.1 Passive Consumer to Active Co-Producer

Keirstead (2007) argues that the boundaries between energy supply and demand are becoming blurred at the small scale. Micro-generation is the generation of energy at a very small and local scale and is clearly a form of energy supply. However, as it reduces the demand of energy from the National Grid, it also acts as a form of energy demand management. Thus, it revolutionises the way energy is produced and consumed as it effectively gives the micro-generation owner greater control over their energy resource.

Devine-Wright and Devine-Wright (2004) argue that micro-generation highlights a drastic shift from a passive consumer of energy to an active co-producer of energy. This may partly explain why the uptake of micro-generation in the UK has been low in comparison to other countries, such as Germany, which has ten times the number of installations (Praetorius *et al*., 2008). People may be unwilling to take the drastic shift from passive consumer to active co-producer due to a lack of familiarity and awareness of micro-generation (Sauter and Watson, 2007).

Sauter and Watson (2007) present three conceptual deployment models based on the findings of other studies, notably the London Renewables (2003) and Ellison (2004) works, which used mail surveys and telephone interviews to look at the acceptance of micro-generation in London households, and Oxera (2005), which used similar methods to look more broadly at households in the UK. Sauter and Watson's (2007) first deployment model, 'Plug and Play', involves the consumer owning and financing the micro-generation unit, thus having complete control over it. This model portrays consumers as active co-producers. Their second deployment model, 'Company Control', involves an Energy Servicing Company (ESCo) owning and financing a fleet of micro-generation units as "a virtual power plant". Consumers act passively and simply provide the sites for the units. The company takes into account the energy needs of the consumers to match supply and demand to avoid buying energy from the wholesale market. Their third deployment model portrays consumers and institutions in a particular geographical area putting their resources together to invest in a 'Community Microgrid'. A consumer owns each micro-generation unit and they must help to maintain the supply-demand balance within the microgrid (through exporting energy). By holding shares in the community energy company, the consumer has an economic incentive to take part in the scheme. In the

Camden Climate Change Alliance (CCCA), the four small organisations that had installed micro-generation units in the research sample (24%) came under the 'Plug and Play' deployment model. However, as explained later in the chapter, the Director of InHolborn, a collective of businesses in the same geographical area (Holborn), was interested in setting up a 'Community Microgrid' through having a small-combined heat and power (small-CHP) network. The Greater London Authority (GLA) has a target of meeting 25% of London's energy requirements from decentralised energy, such as combined heat and power (CHP), by 2025 (London Plan, 2008). Thus, through utilising local networks with the CCCA, InHolborn could take advantage of potential funding opportunities from the GLA. The planned locations of the GLA's CHP networks can be found at: http://www.londonheatmap.org.uk.

Sauter and Watson (2007) extend their argument surrounding awareness and familiarity with micro-generation to wider energy management measures. They argue that individuals rarely consider future savings fully or act as rational economic agents, stating, "why do households not invest in some energy efficiency measures where such a short payback can actually be achieved (e.g. cavity wall insulation)?"

However, these studies looked at households and my findings suggest that the majority of the small organisations I interviewed have no difficulty in making the shift from passive consumer, and are actually quite keen to be involved with energy co-production. The representatives view micro-generation as a part of wider environmental management in the organisation. This may partly be explained by their greater access to capital (usually) than the average household, though small organisations tend to occupy larger premises so the costs of the installation proportionally increase. However, the costs are (usually) proportionally even higher for large organisations, though they tend to have higher turnovers than small organisations and have access to greater capital for non-core business or mission statement activities (Hillary, 2000). At this scale, economies of scale make the cost per kilowatt cheaper (MacKay, 2009). The next section explores why this interest has not been converted into actual installation.

The literature on micro-generation uptake in the non-domestic sector is very limited. Thus, my findings are indirectly backed up from the field of corporate environmental management, where other authors have suggested that a lack of time, information, financial resources and the attitudes of the Senior Manager (or equivalent) are the most important factors for determining the uptake of environmental management systems generally (McKeiver and Gadenne, 2005; Bianchi and Noci, 1998; Perez-sanchez *et al*., 2003; Hillary, 2004, Parker *et al*., 2009). From the interviews I conducted, twelve CCCA

members provided evidence of having actively considered micro-generation (through feasibility studies and/or obtaining quotes), which also suggests that their familiarity with micro-generation is greater than that of the households that took part in similar studies such as Bergman *et al*. (2009), Allen *et al*. (2008) and London Renewables (2003).

The works of Elizabeth Shove and Heather Chappells have provided useful concepts in the sociological aspects of energy use and consumption. Their work has concentrated more on the side of energy demand, for example, Chappells and Shove (2005) highlight how a growing reliance on technologies like air conditioners to keep a specific level of thermal comfort will increase energy demand and CO_{2e} emissions. However, they state that comfort in the indoor environment is "a highly negotiable socio-cultural context" and hence it is about people's (lack of) awareness of unnecessary overconsumption of energy. I have found this to be the case in the CCCA, for example, the CCCA management team recommends to its members to apply an optimum internal temperature of 19ºC (though this may vary slightly seasonally). They suggest that they ensure the heating and air conditioners are not on at the same time to achieve the desired level of comfort, as this is an example of unnecessary added costs through the overconsumption of energy. The importance of awareness and familiarity with what micro-generation can contribute to achieving desired levels of comfort and improving environmental performance is explored in the next section.

5.2 Barriers to Micro-generation Installation in Small Organisations

Much research has looked at the familiarity of households with micro-generation and the barriers to installation. Bergman *et al*. (2009) argue that the initial cost and a lack of awareness are two of the most important factors for explaining the low uptake in the UK. I have found this to be a similar case with small organisations, for example, in the following instances shown below taken from the interviews I conducted with members of the CCCA:

The obstacles are money – it costs more...most of the measures I don't need to do...it cost me £25,000 to put solar panels in, plus another £5,000 to strengthen the structure to accommodate the weight.

(The Office Group interview, November 2009) – Size: 10-100 employees category

This statement was a re-enforcement of ideas commonly held with those interviewed. The initial costs appeared to be the most decisive factor, despite a willingness to install amongst those that were more aware.

Awareness and understanding of the technology and secondly the capital investment...if people aren't aware of what is out there, they will stick with traditional methods.

(InHolborn interview, December 2009) – Size: <10 employees category

The InHolborn quote is suggestive that, despite the CCCA running various workshops throughout the year for members on energy management, carbon footprint measuring, waste management and staff engagement, members could benefit from a workshop on the potential of micro-generation in the Camden area.

Many of the representatives interviewed were unsure what technology would be most suitable. Nevertheless, compared to the findings of Bergman *et al*. (2009) the representatives of the CCCA organisations interviewed appeared to generally have a greater level of micro-generation familiarity and awareness than households. This is likely to be due to their active engagement with environmental management following their willingness to sign the CCCA's *Climate Commitment*. However, I have found that how one defines 'awareness' is inherently difficult to determine and I have taken my own definition of those organisations that have gone to the stage of actively considering micro-generation, through conducting feasibility studies and/or obtaining quotes. This suggests that they are aware of what to do or where to go to find out further information. Under this definition, around half of those interviewed would be considered 'aware'. Thus, in my sample, the initial costs may be considered as the most important determinant of installation with 53% (9 organisations) stating it as the primary barrier.

The Government's *Pay-as-you-save* model, currently being trialled, may have an impact on helping to overcome this barrier as it removes the initial cost, allowing people to pay for micro-generation in instalments through the energy savings they make (DECC website, 2010). The micro-generation unit is financed by a company, which claims the feed-in tariffs (FiTs), with the consumer receiving the energy it produces. The interviews with the Greater London Authority (GLA) and British Gas particularly highlighted this point, as the quotes overleaf convey.

I think the key is cracking that 'Pay-as-you-save' model...if you could find a way of making that investment payback quickly...

(Greater London Authority interview, March 2010)

We're one of the five groups that got money to do a trial of the 'Pay-as-you-save' scheme – we're out selling PV based on that. We're offering it to them at no upfront cost – because of the way the scheme works, we can't charge interest on the loans, so it's a really fantastic proposition for people and it's selling like hot cakes – if you can get the financial propositions right, I think this will fly out the door.

(British Gas interview, March 2010)

The British Gas quote highlights preliminary evidence suggesting that initial costs clearly are a factor with people, as the scheme has so far proved popular and is "selling like hot cakes". The introduction of FiTs and renewable heat incentives (RHIs) should further help to address this issue, which is explored in more depth in Chapter 6.

The importance of the local physical and political context of the Camden area brought to light other issues relevant to micro-generation in an urban setting:

If it's in a conservation area or a listed building it's a different matter...we've got solar thermal on one of the listed buildings...planning permission is not too bad – it's when it comes down to the conservation officers – English Heritage are a little bit more "you can't put that on there".

(London Fire Brigade interview, January 2010) – Size: 100-250 employees category

We thought for about fifteen seconds about drilling a borehole in the ground, but you can't do that in London...they get really annoyed when you go through into a tube line!

(Addison Lee interview, February 2010) – Size: 10-100 employees category

Section 106 on planning applications – there's a 10% renewables requirement for all new developments, which Camden has actually upped to 20%, but a lot of developers argue that it is quite difficult to have on-site renewables in Camden because of your location for renewables and biomass boilers don't count generally because of their air quality accounts – there's a lot of air quality issues already.

(Camden Council interview, February 2010)

In the latter quote, the Camden Council representative draws attention to 'competing' environmental priorities: reducing CO_{2e} emissions and improving local air quality. This was further emphasised by the GLA, as shown in the quote below:

We have an air quality management problem (particulate matter – PM10s) – biomass boilers aren't particularly contusive to making that – they're good for CO_2 but not [PM10s]...if they're built to low spec in terms of the clean-up, they're not particularly good for air quality, so we've got a real balancing act between competing priorities at times, which can be quite challenging.

(Greater London Authority interview, March 2010)

Hence, small-scale technologies such as biomass boilers or energy-from-waste plants, which are considered 'carbon neutral' over their life-cycle (EST website, 2010) may be less suitable for dense urban areas, such as London. The quote from the council representative also highlights another issue – the difficulty of meeting the renewables target on new buildings in London. The target is a local policy that came out of the London Borough of Merton, which sets a 10% renewables target on all new commercial buildings over 1,000 m^2 in size (GLA website, 2010). The GLA has since increased the figure to 20% and is encouraging its take-up in all London Boroughs through the Mayor's *London Plan* (2008). The quote highlights that the council has increased the figure to 20% and in the quote overleaf, he suggests a possible alternative to overcome the difficulty of meeting the target.

There is a bit of an investigation where they can still invest in renewables but why not invest in renewables where they are best placed – offshore wind farms or somewhere where you get a lot more for your money...developers could put money into an offshore wind farm that could be essentially Camden's offshore wind farm that generates electricity for the Camden-Euston buildings to meet that 20% obligation, which is an interesting concept because yes it's not here so you don't get any of the immediate impacts but maybe you get more energy for that money rather than force renewables in an area that isn't suitable for renewables at the moment.

(Camden Council interview, February 2010)

From the interview, it was clear that this suggestion is not to do with the concept of NIMBY (*Not in My Back Yard*) (Devine-Wright, 2005) and difficulties in getting people to agree to renewables in their area in Camden, but practicalities. He discussed the difficulties in finding space to install large wind turbines or the cost of buying up large amounts of roof space for solar panels.

Solar panels (both PV and thermal) and micro-combined heat and power (micro-CHP) were cited by many organisational representatives as the most suitable micro-generation technologies for London. Micro-wind turbines were dismissed as inefficient due to the low wind speeds in the city (except by the River Thames). To validate these arguments, I used the Energy Saving Trust's (EST) wind speed calculator for determining the suitability of small-wind turbines by postcode around the UK. The tool can be found at: http://www.energysavingtrust.org.uk/Generate-your-own-energy/Can-I-generate-electricity-from-the-wind-at-my-home. It is a much more simplistic version of the Department of Energy and Climate Change's (DECC) Wind Speed Estimation Tool (which can be found at: http://www.decc.gov.uk/en/content/cms/what_we_do/uk_supply/energy_mix/renewable/explained/wind/windsp_databas/windsp_databas.aspx), as it gives a general annually averaged figure of wind speeds in certain areas. It puts the minimum wind speed at 5 metres per second (m/s) for a cost-effective installation. Nevertheless, it is a useful tool for getting an initial idea about the suitability of micro-wind turbines.

Using the tool I calculated the wind speeds at the postcodes of all the CCCA organisations that took part in the research and the average came to 2.49 m/s with a maximum wind speed of 2.86 m/s for the Camden Arts Centre, which is located further out in north Camden, and a minimum wind speed of 2.45 m/s for eleven of the organisations,

which are located close together in central Camden. All the results are similar and are about half the EST's recommended minimum wind speed, as figure 18 below shows:

CCCA organisation	Location	Wind Speed Estimate (m/s)
Sheppard Robson	NW1 7PU	2.45
Camden Arts Centre	NW3 6DG	2.86
Royal College of Physicians	NW1 4LE	2.50
The Office Group	WC1X 8UE	2.45
The Cake Group	W1T 1AG	2.50
InHolborn	WC1X 8RW	2.45
MICentre	NW1 2EZ	2.45
NHS Camden	NW1 0PE	2.45
Arthritis Care	NW1 2HD	2.45
Freshminds	WC1V 7DA	2.45
London Fire Brigade	W2 6NL	2.50
Addison Lee	NW1 3ER	2.45
Quakers	NW1 2BJ	2.45
Envido	W1T 4HT	2.50
St Athans Hotel	WC1H 9RE	2.45
KXBF	N1 9AB	2.50
Alara Wholefoods	N1C 4PF	2.45
Average		**2.49**

Figure 18: estimated wind speeds at the locations of the 17 CCCA organisations that took part in the research (data calculated using the Energy Saving Trust (EST)'s *Wind Speed Calculator*). The EST recommends a minimum wind speed of 5 m/s for a cost-effective micro-wind installation. The results show that at all the locations the wind speed is around half of the recommended speed required.

The unsuitability of micro wind-turbines, which were one of the most familiar technologies to the CCCA research participants, may partly explain the limited uptake of micro-generation in their organisations. Nevertheless, four micro-wind installations by three of the organisations (The Office Group, Alara Wholefoods and the London Fire Brigade) had taken place; the reasons for doing so are explained in the next chapter. My conclusions are backed up with evidence from some of the larger small organisations (100-250 employees), which had commissioned feasibility studies into the potential of micro-wind turbines on their buildings, as well as Ecovolt (a London-based micro-generation installer), which deals with solar PV due to the unsuitability of micro-wind turbines in London.

Space issues for Ground Source Heat Pumps (GSHPs) was commonly stated, particularly in relation to the underground tube network and utility cables preventing such installations, as the Addison Lee quote cited on page 59 stated. This adds further complexity to the suitability of micro-generation in London. The shadowing influence of surrounding tall buildings and issues regarding the ownership, accessibility and valuable use of roof space were also raised as obstacles to the installation of solar panels:

As far as using solar PV for us...it's not practical – roof space for us is worth quite a lot of money and that is one of the problems in London – roof space is often rented to phone companies for masts and condensers for air con ventilation systems or big power generators, which you can't store anywhere else because of the premium.

(Addison Lee interview, February 2010) – Size: 100-250 employees category

For PV, I don't think there's enough area to put PV on to generate anything sensible – it's high cost...with a lot of these large developments you get a shadowing effect...it proves to be expensive – it gets a tick in the planning box, costs a lot to put in, doesn't really generate anything and who's going to maintain it if anyone maintains it at all.

(London Development Agency interview, November 2009)

Thus, despite many representatives arguing that solar technology is the most suitable form of micro-generation for London, they are aware to some degree of the issues that may affect its reliability in an urban setting. Parker (2009) highlights how solar PV can still work well in daylight rather than direct sunlight, unlike solar thermal, in the context of larger buildings. The interview with the Director of Ecovolt stated that although solar PV is currently more expensive than solar thermal (see figure 4 in Chapter 1), costs are coming down and it is generally the most suitable micro-generation technology (other than micro-CHP) in the Camden area.

With micro-CHP there is considerable interest – more than with any other micro-generation technology. However, there is a general lack of familiarity with it and the interest of the representatives followed my descriptions of the technology in the interviews. This suggests parallels to the findings of Sauter and Watson (2007), who argue that households tend to view micro-CHP as a more efficient boiler that would simply replace their current one, whereas micro-renewables constitute an additional investment. About

half of the representatives stated that they would consider replacing their boilers with micro-CHP as a part of general maintenance.

Micro-CHP generates both heat and electricity and has a heat-to-power ratio of 7:1 (though this can vary between different technological types), with a thermal efficiency of 85% and an electrical efficiency of 12% (Watson *et al*., 2008). Very efficient new condensing boilers have a thermal efficiency of 92% (EST, 2003) but do not produce electricity. Thus, micro-CHP has potential for reducing both the gas and electricity bills as well as the CO_{2e} emissions of small organisations, even if it is gas-fuelled. Nevertheless, alternatives to gas are biomass (London Development Agency (LDA) website, 2010) and new research is looking into solar through concentrating heat (Yagoub *et al*., 2006). At a larger scale, small-CHP (between ~50 kW and 5 MW) could benefit a network of small organisations located in the same geographical area. The Director of the InHolborn business collective was notably interested in doing this in the Holborn area, describing it as "cost-effective". However, this followed my descriptions of the technology, so his exclamation was only a preliminary idea, not a formal proposal. Alliances such as the CCCA could help in the setting up of such 'Community Microgrids' (Sauter and Watson, 2007), though this has not yet been seen in practice in the CCCA.

The London Fire Brigade (LFB) quote cited on page 59 highlights an important issue with planning permission. Although all micro-generation technologies are now permitted developments, except for Air Source Heat Pumps (ASHPs), micro- and small-wind turbines and small-hydro currently, permission is still required for organisations occupying protected or listed buildings (Cromhall, 2009). As Chapter 3 suggested, it is likely that the current consultation on a new micro-generation strategy will add micro-wind turbines and ASHPs to the list of permitted developments when the full strategy is published in early 2011 (DECC website, 2010). Victorian and Edwardian houses are typical of the Camden area and as such, many CCCA members have found difficulty in obtaining permission to implement measures on their premises. Despite this, the representatives of the Royal College of Physicians (RCP) and the LFB argued that it was only difficult to obtain planning permission initially, as the quotes overleaf exclaim.

We're in a Grade 1 listed building...although I had difficulty getting planning permission initially, as there were lots of bodies to go through (permission is needed from English Heritage, Camden Estates Commission and the Camden Council), now it has been granted, it is much easier to obtain permission for further developments.

(Royal College of Physicians interview, November 2009) – Size: 100-250 employees category

It was initially difficult to obtain planning permission as 33 of our 112 buildings are listed…but then subsequent installations have become easier as we now know exactly what we want so we can send exact details to the local authorities.

(London Fire Brigade interview, January 2010) – Size: 100-250 employees category

Nevertheless, these organisations are larger and have had more funding to explore different micro-generation options, which has allowed them to make the process easier through experience. Some of the other representatives, such as the Hotel Owner-Manager of the St Athans Hotel, were exploring micro-generation for the first time and had discovered that the planning process requires a lot of time and effort, and thus were deterred from applying:

I don't want to ask Camden planning outright...I don't know if you know anyone in planning but they tend to be overworked and tend to reject quickly if it is at all complicated because they have a back-log as they have to by law answer within 28 days or something...I've got friends in different Boroughs and it sounds like it is just everywhere...so I don't hold out very much for it.

(St Athans Hotel interview, February 2010) – Size: <10 employees category

Thus, it appears that there are mixed responses to the issue of initial planning permission. Nevertheless, in contrast to the findings of Hillary (2000; 2004), who looked at reactive small-to-medium-sized enterprises (SMEs), I have found that generally the people responsible for environmental management in their organisations are willing to put the time and effort in to work through such processes. Notable examples include the RCP, the LFB, the Camden Arts Centre, Cake Group and Alara Wholefoods. This is even the case

when the responsibility falls with the Senior Manager (or equivalent), such as in MIC or The Office Group, and this is reflective of their genuine interest in the environment.

Figure 19 below summarises the main barriers to installation, which is tallied from the main two barriers stated by the representatives of the CCCA organisations interviewed:

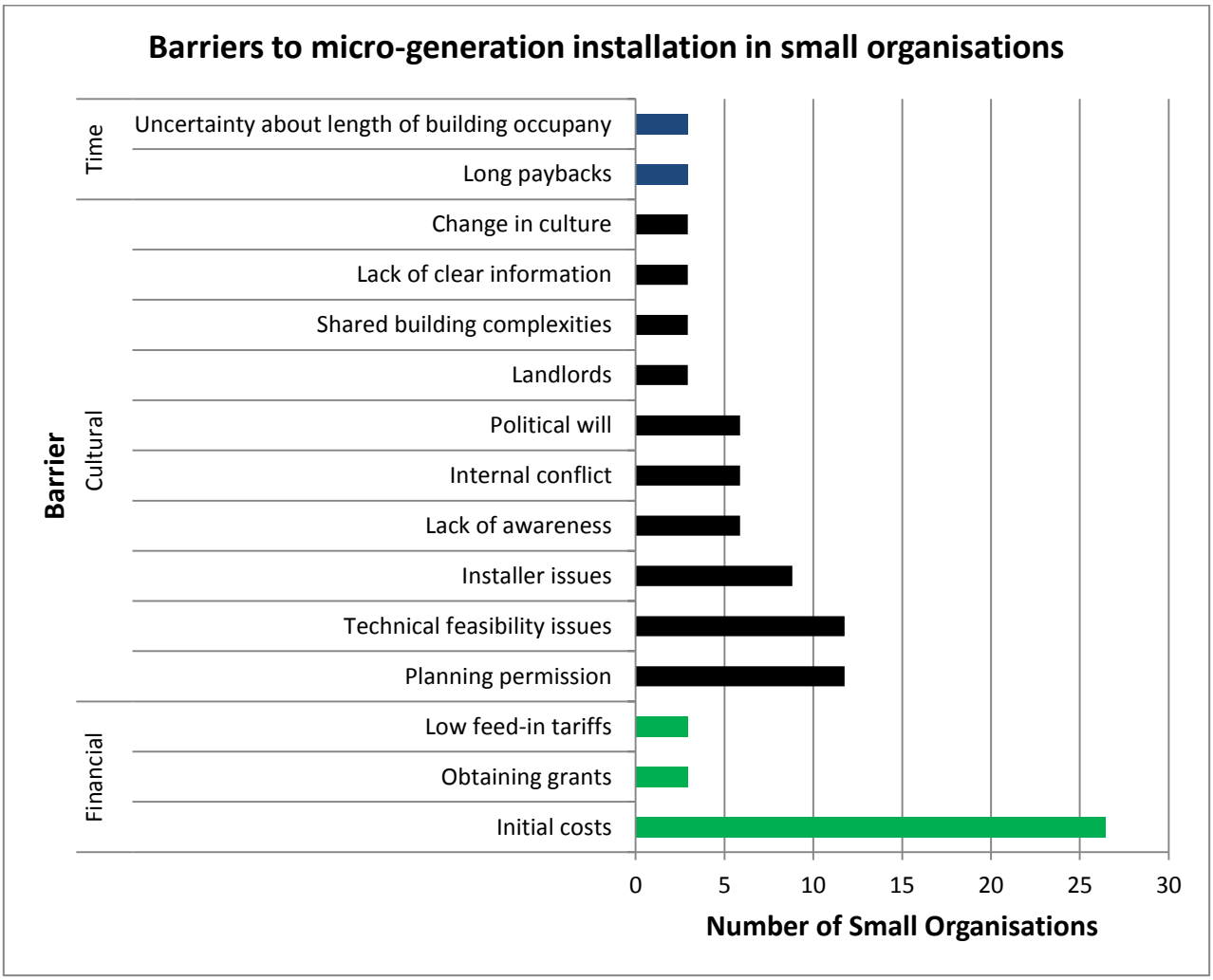

Figure 19: the main barriers to micro-generation installation in small organisations as cited by members of the CCCA – the barriers are sub-divided into three groups: financial, cultural and time. The financial group is concerned with economic issues, the cultural group takes into account societal factors such as the development of the market, social concerns and technical factors, and the time group considers the temporal factors affecting the decision to move from having an interest to actual installation. The main barriers that stand out are: the initial costs, awareness, planning permission, feasibility (suitability), internal (political) conflict and installer issues (such as mis-selling)

As figure 19 shows, the initial costs are perceived to be main barrier to installation. However, another interesting barrier that came to light is internal political conflicts. As Chapter 3 discussed, the environmental management decision-making process usually becomes more complex as the size of the organisation increases (figure 11, pp. 30). Evidence of this was clear in the interviews, for example, in the cases of the representatives of the Methodist International Centre (MIC), Quakers and the RCP:

We need to sell it to our trustees board...though our money comes purely from the commercial aspect...any decisions we made – we would be under pressure to make it commercially viable...or in the long term it would help in the development of the commercial side...and it would pay for itself.

(Methodist International Centre interview, December 2009) – Size: 10-100 employees category

It would have to go through various committees...we have a property and policy group, who have full responsibility for the building, and then we've got trustees we would have to go through as well...we'd have to justify any expenditure.

(Quakers interview, February 2010) – Size: 10-100 employees category

I have to make the appeal of the business case to the Finance Officer, who then presents it to the Finances Committee (who assess what is in it for them) – if excepted, it will be in the following year's budget.

(Royal College of Physicians interview, November 2009) – Size: 100-250 employees category

Thus, in the larger organisations, the process becomes more formalised and is treated in the same way as any other project that is proposed, which needs to go through various committees, particularly a Finance Committee (or equivalent). Internal politics can be an issue even in proactive small organisations, especially in the smallest organisations (<50 employees), where most of the limited funds are directed into core business or mission statement activities (Hillary, 2000; 2004). This is notably highlighted in the quote overleaf, which is taken from the interview with the Facilities Manager of Arthritis Care.

Most of our funding goes into arthritic care rather than environmental measures…though now we have to have a responsibility to the environment… [however] the recession has caused funding issues so we will look for what we can do with what we have already got...people are fed up with the debate as they are not clear either way about climate change...not everyone is pro-'green' in staff and management.

(Arthritis Care interview, December 2009) – Size: 10-100 employees category

She hints at the economic recession as being a cause of yet further strain on limited funds, which provides an interesting insight into how environmental management is viewed in such times. The environment is not seen as a core part of the charity's mission statement, in contrast to some of the other charities that took part in the research, such as MIC or the Camden Arts Centre. The Commercial Director of MIC highlighted that environmental management is intrinsically linked with helping to meet their social and economic goals, for example, through finding cost savings and improving business efficiency. The Camden Arts Centre Gallery Manager similarly pointed to important cost savings that can be made from implementing environmental measures such as low energy lighting and improved insulation.

Contrary to the positive 'green image' of micro-generation, which the majority of the representatives stated (and is explored in Chapter 6), the RCP highlighted another issue with internal political conflicts, as summarised in the quote below:

Installing a small-wind turbine is seen by members as spoiling the building's image...solar PV is less visible so would be more accepted.

(Royal College of Physicians interview, November 2009) – Size: 100-250 employees category

The Arthritis Care quote above similarly highlights this issue of internal political conflicts, as the representative argues that not everyone is committed to environmental management in the organisation, with disagreements over how limited funds should be spent. The main difference between the conflicts is that with the RCP, it is to do with the aesthetics of certain micro-generation technologies, whereas with Arthritis Care, it is a broader debate on environmental management. The Building Services Manager of the RCP was clear in that members were keen for the organisation to take responsibility for its

(negative) environmental impacts, so the debate was more specific. It is interesting to note that the RCP quote above was not reiterated by any of the other representatives interviewed, as they had positive views towards the aesthetics of micro-generation. However, the RCP representative did not share the view of the RCP members and argued that, "I would love to have a wind turbine on the roof!"

FiTs are generally considered by the interviewees to be an effective measure to increase the financial incentive to install micro-generation (as Chapter 6 discusses). However, the Owner-Manager of Alara Wholefoods, who was interested in setting up Europe's first community-scale Anaerobic Digestion (AD) plant, argues that FiTs are not good for certain micro-generation technologies, as the quote below conveys:

Feed-in tariffs for AD plants are 9p/kWh for production and 6p/kWh for feed-in – it is too small and needs to be much higher at ~40p/kWh.

(Alara Wholefoods interview, March 2010) – Size: 10-100 employees category

However, DECC has suggested that the FiTs for AD plants are likely to improve once the FiT scheme has been reviewed in early 2011 (DECC website, 2010). Nevertheless, some of the organisations external to the CCCA similarly made comments regarding the levels of the FiTs:

The feed-in tariffs are good – they are welcome, but it probably doesn't go far enough – if you look at the FiT in Germany for example, it's a much higher level – we have a tendency to do things on the cheap in this country...we are going to be looking at the implications of the FiT for the decentralised energy programme and the heat programme, just to get a feel for what kind of impact it will have.

(Greater London Authority interview, March 2010)

Pretty much everyone in industry thinks the feed-in tariffs are a bit too low – a rate of return of 5 or 6% – we could improve on that – that's probably less than the rate of return of what other member states have built their feed-in tariffs around...it's not a big cost, I think we can afford more.

(Environment Agency interview, February 2010)

Chapter 3 touched upon the underdevelopment of the micro-generation in the UK, particularly in terms of mis-selling and 'green-washing' by companies who are only interested in sales and are not concerned with providing the customer with reliable and adequate information and/or staying in contact with them after the installation (Bergman *et al*., 2009). This was conveyed in a number of the interviews with organisations both internal and external to the CCCA, for example:

There's a lot of cowboys at the moment...nobody knows how to deal with [micro-generation].

(St Athans Hotel interview, February 2010) – Size: <10 employees category

...because consumers are so unfamiliar, because there are a lot of people out there that would get on the band wagon if they could, because there are cowboys out there who would promise elderly people that they are going to get all their [hot] water supplied through [a] solar thermal installation, when in fact they only get a proportion of it and then sell it for £8,000, which is absolutely ridiculous...

(Department of Energy and Climate Change interview, January 2010)

It's an emerging market and a lot of people will tell you that there's a lot of cowboys in the market – it feels like an unregulated market and people don't have one place to go either within government or the industry.

(Environment Agency interview, February 2010)

However, I would argue that the MCS (Micro-generation Certification Scheme) has come a long way to deal with this issue by providing a reputable database of information on MCS-certified installers and products. This argument was reiterated by the Senior Climate Change Advisor at the Environment Agency, as conveyed in the quote overleaf.

I think everyone hopes the FiT will change that – I think that is why DECC are pushing the Micro-generation Certification Scheme so much – the industry hate MCS, you know – it's forcing them to become more professional.

(Environment Agency interview, February 2010)

Figure 19 also portrays concerns regarding the political will with micro-generation and the confusion over how some of the government schemes work, which are viewed as important barriers to installation. For example, in the cases of the representatives of NHS Camden and the LFB:

There is little political commitment as targets are not tough enough so the energy mix could be as it is now in the future unless the political will changes...collectively all 20 NHS Camden properties come under the CRC, but the Government has not made it clear – do we need to do anything between now and 1st April [2010]? A lot of these measures are unquantifiable.

(NHS Camden interview, December 2009) – Size: 100-250 employees category

There is some confusion over registration periods for ROCs and the CRC and whether we can receive feed-in tariffs or not.

(London Fire Brigade interview, January 2010) – Size: 100-250 employees category

As Thollander *et al*. (2007) argues, the confusion surrounding how some policies work can be cleared up through effective governmental information campaigns on the rules and regulations.

Many of the representatives were in favour of setting up a similar scheme to the recently introduced *Carbon Reduction Commitment Energy Efficiency Scheme* (CRC) for small organisations, as the quotes overleaf highlight.

There is no incentive by law to do it – it would make my life easier if it were law.

(Arthritis Care interview, December 2009) – Size: 10-100 employees category

Companies that do not come under the CRC – I mean, what is their incentive really?

(Sheppard Robson interview, November, 2009) – Size: 100-250 employees category

The problem of that policy [the CRC] is that it is targeting big corporate occupiers as it makes good headlines...the majority is instead made up of small office occupiers...you therefore need to hit a much wider audience of building owners in order to take steps to reduce those carbon emissions...the Government legislation is all well and good but it is more about making statements.

(The Office Group interview, November 2009) – Size: 10-100 employees category

I'd say that if you look at innovation in business, then generally speaking that innovation is coming from small businesses...if Government and society wants to drive innovation and that innovation is happening in small businesses at this point, then they need to look at how they can invest and encourage environmental innovation in small businesses as that's where the innovation is actually going to come from.

(Alara Wholefoods interview, March 2010) – Size: 10-100 employees category

McKeiver and Gadenne (2005) argue that the collective environmental impact of SMEs is substantial and could outweigh the combined environmental impacts of large companies. Add to this all the small charities, independent and public sector organisations and the CO_{2e} emissions become even more significant. Despite some administrative difficulties in implementing a CRC for small organisations, as conveyed in the GLA quote overleaf, it is a necessary step that will have knock-on effects for driving the micro-generation market (see Chapter 7).

It's a real challenge engaging with SMEs...naturally people are drawn to quick or perceived easier wins – because of their disparate nature they are particularly challenging to reach in any large sort of number – it is often easier to focus on the bigger firms as they have more resources to do things...in things like the CRC there are leaders there that can help and because they are not so disparate – you can capture a large chunk of emissions in one crack, which is probably why they have traditionally been neglected or received less attention than others.

(Greater London Authority interview, March 2010)

From the interviews with organisations both internal and external to the CCCA, it is clear that the main barriers to micro-generation uptake in small organisations are to do with: the initial costs, awareness and familiarity, planning permission on listed buildings, feasibility and suitability of different technologies, internal political conflicts and the current underdevelopment of the market. However, it is apparent that the initial costs are considered the greatest barrier to installation and the next section explores this further in the context of energy management priorities based on cost.

5.3 Prioritisation of Energy Efficiency

Part of the reason why micro-generation uptake among environmentally proactive small organisations in the CCCA has been low is the prioritisation of wider energy efficiency measures. As described in Chapter 4, I signed MIC up to the CCCA's *Carbon Confident* programme, which runs over four sessions and teaches members how to identify, measure and monitor their (negative) environmental impacts and to develop action plans for reducing them. The on-site environmental audit, which is conducted as part of the programme, produced recommendations that clearly prioritise the no- and low-cost options, such as staff engagement and switching to energy efficient lighting. Micro-generation was not mentioned in the report. However, the Carbon Trust survey that I also organised for MIC (see Chapter 4) gave more expensive, technical solutions to carbon footprint reduction, such as replacing the air conditioning with an evaporative cooling plant and installing voltage optimisation. In contrast to the CCCA report, the Carbon Trust recommended micro-generation in the form of micro-CHP and solar PV. Both reports are included in the Appendix (9.2 and 9.3).

The prioritisation of energy efficiency measures over micro-generation may reflect a preference by small organisations to undertake the environmental measures that have a low upfront cost with short payback periods. This was evident in the CCCA workshops I attended and from the interviews, as highlighted in this section. I would suggest that this, rather than the social shift from energy consumer to energy co-producer (Devine-Wright and Devine-Wright, 2004), partly explains why uptake has been low. It appeared that it was not a perception that these measures were considered easier, as twelve of the small organisations (71%) had actively considered micro-generation (through feasibility studies and/or obtaining quotes), and stated that if they had the funds available, they would do so. Four of the organisations (24%) who did have the available funds at the time, had actually installed. The specific incentives behind the installations are explored in the next chapter.

Many of the representatives highlighted that they were unsure how long they would be in their current premises for, so they prioritised the measures that had short payback periods. The reasons for the prioritisation of energy efficiency measures over micro-generation are summarised in the following quotes:

Another consideration is how long the company will stay in the building for. Will it payback in time?

(Sheppard Robson interview, November 2009) – Size: 100-250 employees category

You need to consider all the options, including micro-generation, though there needs to be a balance with what is cost-effective.

(Alara Wholefoods interview, March 2010) – Size: 10-100 employees category

Energy efficient measures are better and more economically beneficial in the short- (and long-) term.

(InHolborn interview, December 2009) – Size: <10 employees category

Everyone should be forced to do energy efficiency measures first…heating, lighting, etc.

(Addison Lee interview, February 2010) – Size: 100-250 employees category

Alternatives are less costly and save a lot of money…they have a quick return and you can do it yourself…once this is all done, then look at micro-generation?

(Camden Arts Centre, November 2009) – Size: <10 employees category

Although twelve representatives (71%) stated that they would view micro-generation and energy efficiency as equal, it is clear that they would prioritise energy efficiency measures in practice. This was evident from discussions on what they had implemented so far and their reasons behind not installing micro-generation, as captured in the previous section. What is clear from the quotes above is that the representatives consider finance and time as the most important factors, particularly in terms of doing measures that have quick returns and low upfront costs. The Camden Arts Centre quote conveys the similarity in mentality between charities and businesses. It is apparent that they would follow their own hierarchy of energy management measures based on initial costs and payback periods. This notion of a hierarchy was brought up in all seventeen interviews, though the term 'hierarchy' was not used.

The prioritisation of energy efficiency measures was similarly brought up in the interviews with the representatives of those organisations that have potential influence over the uptake of micro-generation at local and/or national scales. This has been reflected in policy as well, for example, the March 2007 consultation on an *Energy Efficiency and Micro-generation Strategy for Scotland* by the Scottish Government came to similar conclusions with households. It highlighted the need to prioritise energy efficiency and reducing energy demand over the installation of micro-generation. Thus, the research findings suggest parallels with the domestic sector. The interview with the Micro-generation Advice Manager of the EST highlighted that it encourages energy efficiency measures first, despite having a large part of its website dedicated to micro-generation (under the 'Generate your own energy' tab):

They need to put in all the energy saving measures first and see where micro-gen fits in after that...you look at the fabric first, so solid wall [insulation] is the big one, then it's loft, then it's underfloor, then it's the windows, then it's micro-gen – you look at all the measures – insulation and micro-gen – you look at the upfront cost, annual savings and feedback – you do the no-brainers first with paybacks of only one or two years – you tend to find that micro-gen is quite low down the list...it's a hierarchy. As part of the conditions for our grants, you have to put in 270mm loft insulation and all that, so there is certainly a

hierarchy within the Energy Saving Trust...it makes sense as loft insulation might cost £200 but its lifetime savings are quite big...we always say insulation before all micro-gen technologies – it's just good practice...when it comes to heat pumps, you have to have it...otherwise you could well be paying more money and it could put you into fuel poverty if you're not careful.

(Energy Saving Trust interview, April 2010)

The quote suggests that to get maximum benefit from a micro-generation unit, insulation measures need to be implemented first. The U-value is a figure that determines the heat loss through a building element (such as the walls), so decreasing this figure through improved insulation will reduce the amount of heat lost (Thorpe, 2010, pp. 22). The representative uses the example of a heat pump to suggest how its benefits will lessen if the building is poorly insulated as most of the heat will escape through the walls. This was reiterated by the representatives of DECC and Camden Council as well:

It was a requirement under the Low Carbon Buildings Programme that you couldn't get a grant unless you had some level of insulation already in place – it's not a requirement of the FiT, but it would be pretty silly not to insulate...we've got to look at how our houses are insulated to really make the most of micro-generation, and that's another shift in mentality.

(Department of Energy and Climate Change interview, January 2010)

We work with the energy efficiency hierarchy – we look at energy efficiency first before renewables...until the economics come in that make it [micro-generation] the same cost...there are a lot of efficiency gains to be had before we come alongside renewables...I imagine Camden is going to invest in energy efficiency rather than renewables.

(Camden Council interview, February 2010)

This notion of a hierarchy of energy management measures has not been formalised by DECC or the EST into a specific conceptual model for small organisations. This is likely to be due to the variety and suitability of different measures for such a diverse range of sectors and sizes. The EST follows a more specific framework for households as (despite differences in the age and type of the building stock) the house is generally used for

(predictable) domestic purposes, except in the cases where it is also used for business. This framework has developed out of research that the EST has conducted, such as the EST (2007)'s report on micro-generation.

Thus, I propose a similar framework for small organisations based on my discussions with organisations both internal and external to the CCCA. The framework is shown in figure 20 overleaf and conveys that following an energy management hierarchy would be the most cost-effective and efficient way for a small organisation to reduce its CO_{2e} emissions. I acknowledge that parts of the framework may be more applicable to some organisations over others, depending on their sector and size, but it is designed simply to be a rough guide based mainly on measures that have been promoted by the CCCA in its advice to members.

The CCCA environmental audit report (included in the Appendix – 9.2) highlights the importance of staff engagement as the first crucial step. It suggests that organising regular meetings with staff to get their ideas on how the organisation can improve its environmental performance and what they can do to help, can have a big impact on reducing energy demand. Cleaver (2001) similarly argues that effective staff engagement is a necessary part of meeting the ISO 14001 environmental management standard, which around a third of the organisations interviewed were interested in achieving.

The CCCA report also puts a lot of weight on energy efficient lighting and motion-sensor lighting, as reasonably low-cost measures with quick payback times of <4 years. The report gave little discussion on insulation (except recommendation eighteen on internal draught proofing), but from my discussions with the representatives of the EST and DECC, loft and cavity/solid wall insulation can have a large impact on reducing energy demand at a slightly higher initial cost than lighting retrofits, though with quick payback times of ~2 years. However, the initial costs of different measures are highly dependent on the individual circumstances of the organisation.

It is important to note that lighting is not the only area of electricity consumption at the second stage that could be targeted for energy efficiency. The framework is based on measures that are frequently recommended by environmental consultants, as the CCCA and Carbon Trust audits show. Thus, it should prove useful to most small organisations. A further crucial point to make is that, as the building becomes more energy efficient and the U-value decreases, more heat energy is retained and thus, energy consumption *should* be lower. This would result in lower energy bills, which would increase the payback period of a micro-generation installation. However, this is offset if energy prices rise and the fact that the energy it produces could be wasted if the building was poorly insulated.

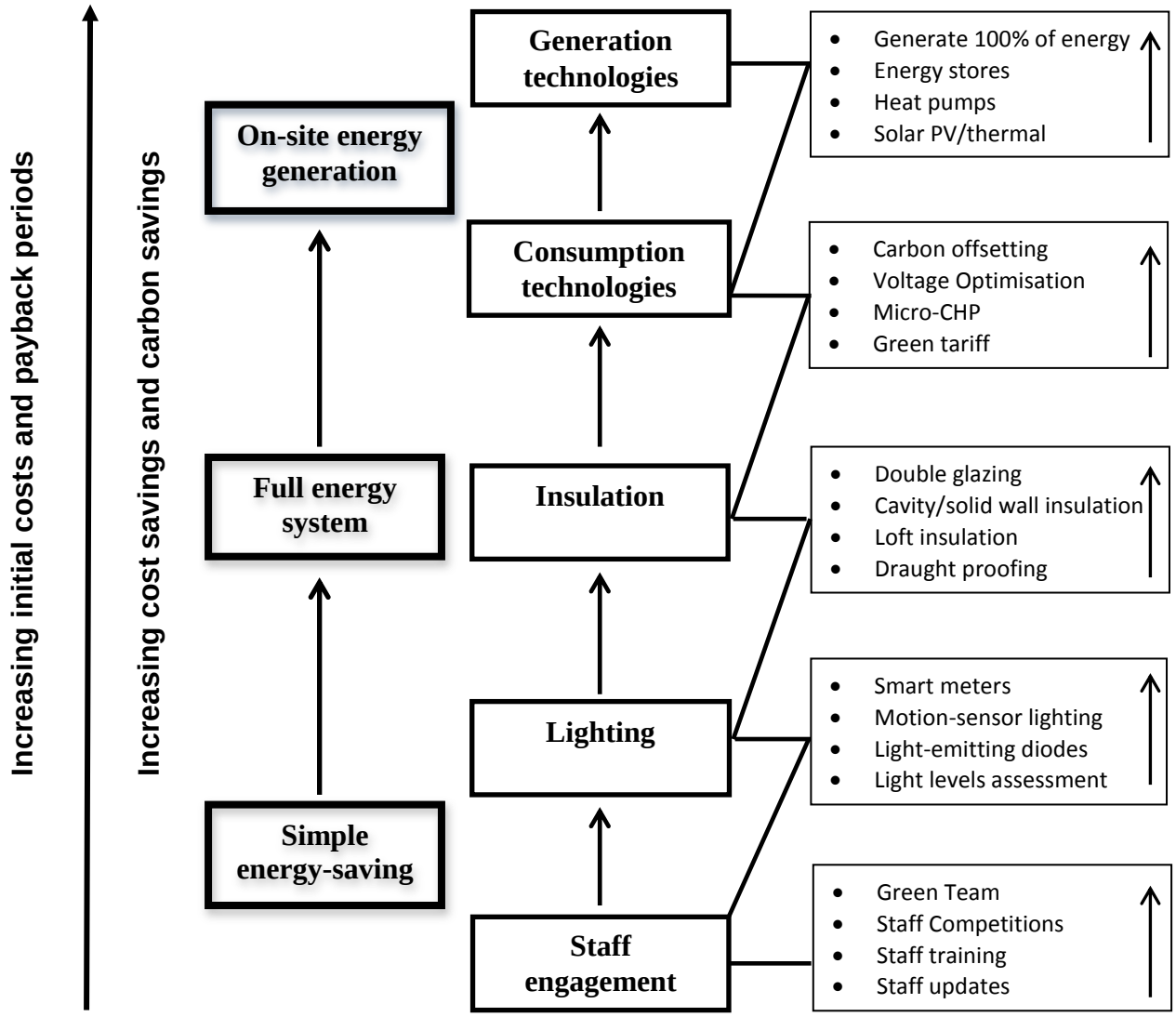

Figure 20: ***Energy hierarchy framework for small organisations*** **– as one moves up the model the costs of energy measures increase and have longer payback times but the long-term carbon and financial savings increase and the organisation becomes more self-sustainable. I derived the framework from discussions with organisations both internal and external to the CCCA. Staff engagement is key to the effectiveness and acceptability of higher stages of the framework, so forms the first stage. Lighting is *usually* less disruptive, cheaper and more visible, so precedes insulation at the second stage. Insulation *should* reduce energy consumption by a greater amount than lighting, so forms the third stage. On-site generation is at the fourth stage due to (currently) higher costs, but it has the *potential* to greatly reduce energy consumption. Water consumption is excluded from the framework, as its impact is *usually* much lower than heating and lighting in most small organisations.**

The Carbon Trust report (included in the Appendix – 9.3) concentrated more on technical measures in the later stages of the framework. For example, micro-CHP, solar PV and voltage optimisation were recommended. Based on my discussions with members of the CCCA management team, I have added switching to a green tariff (energy generated externally from low carbon sources) and carbon offsetting as indirect ways to further reduce an organisation's carbon footprint. However, both of these measures require thorough research by the person responsible for environmental management, as they have been areas of controversy, for example, as the quote from the Policy Manager of British Gas New Energy below states:

The main thing is to try an ensure additionality because in the past you had a lot of green tariffs sort of saying "I'm green – the energy we're selling is green – it just is", but then everybody has got to supply a certain amount of green electricity through the Renewables Obligation anyway – customers are paying £10 per year for the Renewables Obligation anyway at the moment, so for the last few years we've always said that actually with a green tariff you've got to show an additional environmental benefit, so what we're doing now is taking £20 extra from the customer per year, which goes into a fund that funds extra green projects.

(British Gas interview, March 2010)

He highlights the importance of the green tariff providing additional low carbon energy to what is required under the Renewables Obligation, where all energy companies operating in the UK must supply an increasing proportion of electricity from renewable sources (DECC website, 2010).

The ultimate goal of the framework is for the organisation to become completely self-sufficient in meeting its energy requirements and to reduce its carbon footprint as close to zero as is feasible. The framework was presented to the EST representative (the last interview that I conducted), who agreed with it. The framework draws some parallels to the Mayor's 'Energy Hierarchy' in the 2004 *Energy Strategy* for London. However, the Mayor's hierarchy is less specific and arguably less useful, as the first stage encompasses everything except on-site generation and stages two and three appear to suggest the same idea. There is no reason why an organisation could not do stage three before stage two and there is no direction at stage one. Nevertheless, the CCCA audit recommendations clearly followed a hierarchy, which could be a result of this strategy.

6 Chapter 6: Micro-generation Market Drivers

6.1 The Niche Micro-generation Market

There is a growing research field in corporate environmental management, which is looking at environmental management in businesses, both large and small-to-medium-sized enterprises (SMEs). However, the literature is very limited on the uptake of micro-generation specifically in the non-domestic sector. It is even more limited on the uptake in small organisations (not just SMEs), which are estimated to collectively make up between a fifth and a quarter of UK carbon dioxide equivalent (CO_{2e}) emissions (CCCA website, 2010), possibly greater than the combined environmental impacts of large organisations (McKeiver and Gadenne, 2005).

The Energy Saving Trust (EST) estimated in 2007 that there have been ~100,000 micro-generation installations so far in the UK (EST, 2007). The Department of Energy and Climate Change (DECC) has an unofficial target of one million installations by 2020, which means the matching of the current total every year between now and then. PriceWaterhouseCoopers (PwC) recently produced a report showing that meeting such a target would only put the UK where Germany currently is (PwC, 2010). Chapter 3 discussed why the figure is low based on a review of the literature on households and Chapter 5 explored whether these findings suggest parallels to the comments of the representatives of small organisations in the *Camden Climate Change Alliance* (CCCA). Chapter 3 also discussed why some householders have installed micro-generation and similarly this chapter explores the motivations of small organisations. Although the results are based on organisations in the CCCA, which are unlikely to be representative of small organisations in the UK, the interviews with organisations such as DECC and the EST will also help to give an insight into the reasons behind the current status of the micro-generation market and how it can be developed.

I would argue that the micro-generation market in the UK is currently a niche market. Sauter and Watson (2007) suggest that those that have installed micro-generation tend to have technical backgrounds, general technological interests, higher incomes and/or a heightened awareness of environmental issues. This matches the 'innovators' category of Rogers's (1995) *Diffusion of innovations* conceptual model (figure 14, pp. 36). I have found that this draws parallels with the attitudes of the representatives that I interviewed. The interviewees that were Buildings Services or Facilities Managers,

such as the representatives of larger organisations (with higher turnovers) like the Royal College of Physicians (RCP) and the London Fire Brigade (LFB), tended to come from technical backgrounds like engineering:

I am more energy than environment and I work in the property department...I am responsible for energy consumption, utility supplies and reduction, so I get to see every invoice before we pay it, for gas, electricity and water...I am an energy engineer by qualification...you'll find a lot of Energy Managers that are not – they have done it by default.

(London Fire Brigade interview, January 2010) – Size: 100-250 employees category

As the quote highlights, in the smaller organisations (<50 employees), where the responsibility for environmental management tended to come under the remit of the Senior Manager (or equivalent), such as in The Office Group and the Methodist International Centre (MIC), the primary motivations were usually based on a genuine interest in the environment. They believed that they had a responsibility to reduce their (negative) environmental impacts:

This is the big problem I think...we're a small business – we employ 24 people, but we have seven buildings that haven't been carbon footprinted, but if we are aware of that and are taking measures then we know that we in the extreme minority in terms of landlords and building owners who are actually taking responsibility for doing something...the reality is that 50% of emissions in this country come from buildings.

(The Office Group interview, November 2009)

These representatives did not have technical backgrounds and their organisations had smaller turnovers, but they were 'innovators' (Rogers, 1995) for different reasons as explored in the next section.

6.2 Incentives for Micro-generation Installation in Small Organisations

The micro-generation market in the UK has been driven at the margins by 'innovators' and 'early adopters' (Rogers, 1995), and this was clear from my data. Although only four of the

seventeen representatives that I interviewed had installed micro-generation, twelve had actively considered it through obtaining quotes and/or organising feasibility studies. Chapter 5 explored the reasons why these organisations did not go on to the installation stage. This was frequently due to the difficulty in obtaining the required initial investment that would payback over a period longer than the usual horizons of investment decision-making. In almost all cases there was an environmental commitment from the Senior Manager (or equivalent), which diffused throughout the organisation. This was particularly prevalent in the smaller organisations (<10 employees). However, as I discussed in Chapters 3 and 5, the complexity of the decision-making process in larger organisations (10-250 employees) and internal politics can make the implementation of environmental measures more difficult. The latter point relates to the internal conflicts between what the employees responsible for environmental management would like to do and how those with greater authority view the proposed measures, as the Arthritis Care and RCP quotes suggested in Chapter 5 (pp. 67).

Nevertheless, the interviews highlighted the importance of commitment from senior management, as the quote below summarises:

We want to be as green as possible – the CEO here is all for championing all of this – to do what we can.

(Cake Group interview, November 2010) – Size: 10-100 employees category

When asked about micro-generation specifically, the interviewees stated the installation incentives shown in figure 21 overleaf, which overlaps with explaining why many Senior Managers (or equivalent) wanted “to be as green as possible”. The graph is calculated from the main two incentives conveyed by the representatives in the same way that figure 19 in Chapter 5 was created to show the main installation barriers.

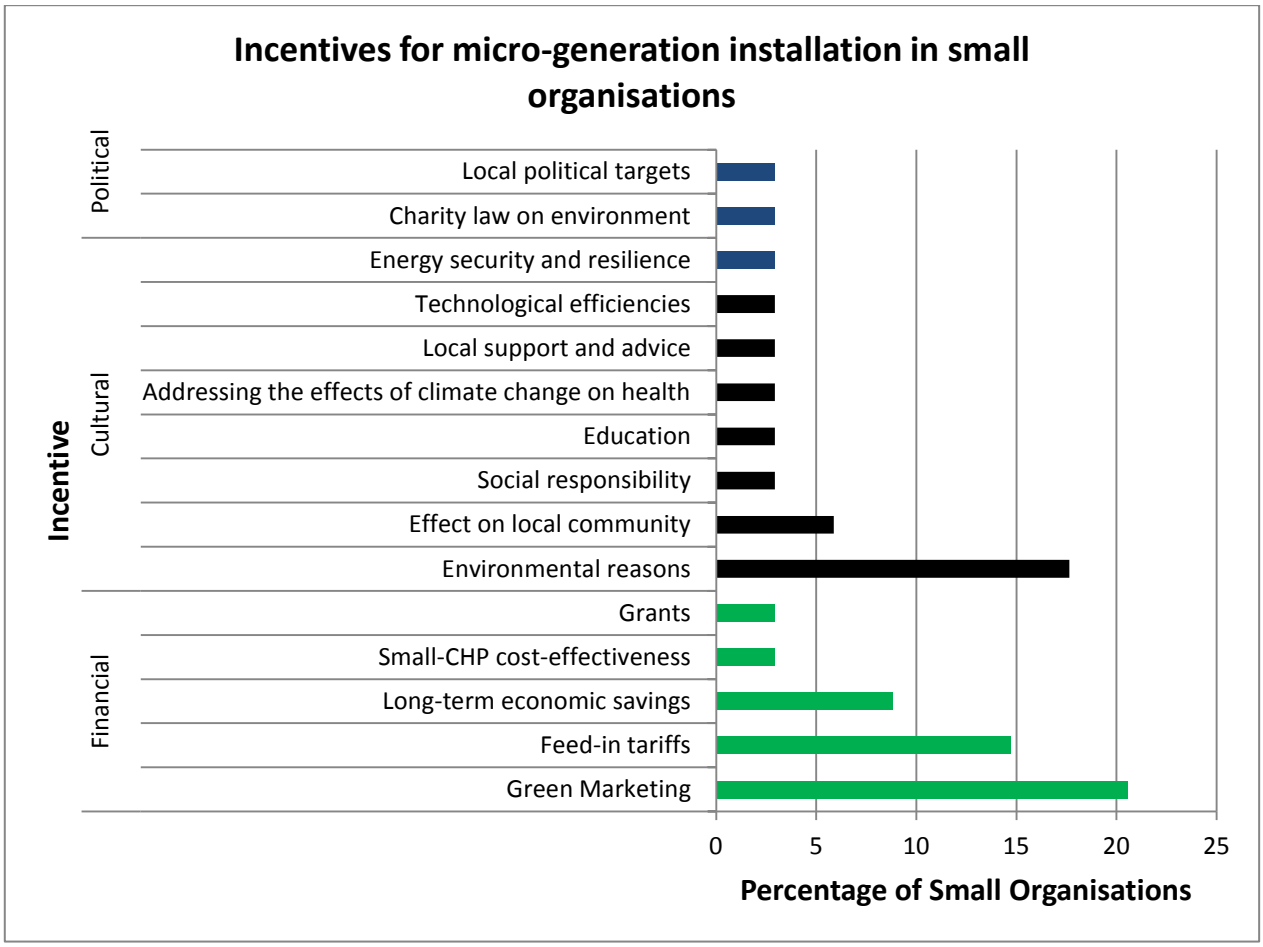

Figure 21: the main incentives for micro-generation installation in small organisations as cited by members of the CCCA – the incentives are sub-divided into three groups: financial, cultural and political. The financial group is concerned with direct and indirect economic benefits, the cultural group takes into account primarily ethical drivers, and the political group considers internal or external environmental targets. The main incentives that stand out are: green marketing, environmental reasons, the feed-in tariffs, the long-term economic savings and the effect on the local community

The research findings suggest that on equal footing with installing for environmental reasons is the significance of the 'green' image of micro-generation in terms of 'green' marketing and the impact on the local community. This is explored in greater depth in the next section.

As figure 21 shows, it appears that in some small organisations (32%) the motivations are more social and cultural rather than environmental or economic. However, few organisations had purely non-economic motivations and it was evident that they were

driven by a combination of social, environmental and economic factors. This could relate to the rise of Corporate Social Responsibility (CSR) in organisations (May *et al*., 2007), which has become commonplace in large organisations and now is becoming widespread in the more proactive larger small organisations (100-250 employees). May *et al*. (2007) argue that CSR can be used for commercial advantage through attracting clients via 'green' and 'social' marketing, where the environmental achievements of the organisation are publicised to show its commitment to sustainability, through the interaction of environmental, social and economic goals.

It is clear that some of the interviewees of the larger organisations were keen to develop their CSR commitments. For example, Addison Lee (a taxi business) wished to help educate people in environmental issues. It is interesting to note that this was equally as prevalent in businesses as it was in charities and non-profit organisations, as the following examples show:

The issue for us is education...the kids can go up there – it's a really safe environment and the kids can look at the massive – it's surprisingly large, system and the efficiency maybe not, but the education of the young people to say "this is solar PV and this is what it does and it's powering a couple of light bulbs in your classroom" – it's not a great efficiency but the fact is it's got a bigger educational benefit.

(Addison Lee interview, February 2010) – Size: 100-250 employees category

Addison Lee had installed a solar panel on the roof of a local school under the *Solar4Schools* programme (further information on the programme can be found at: http://www.solar4schools.co.uk/). The representative takes a different attitude to the Camden Arts Centre (a contemporary arts charity), as he stated that a direct engagement with the local community is a more effective way of engaging individuals or organisations with how they could act in the face of environmental sustainability. In contrast, the Camden Arts Centre representative, like the representative of the RCP (a non-profit organisation), argued that it was more important to make a statement to the local community as a way of showing people and organisations that they are leading the way and that they should follow suit. I extend Devine-Wright and Devine-Wright (2004)'s concept of active and passive energy consumers to include active and passive social participation in engaging others to install micro-generation. Therefore, Addison Lee is an

example of an active social participant and the Camden Arts Centre and the RCP are examples of passive social participants.

Some organisations (18%) had much greater environmental motivations to install, over and above social and economic drivers. The quote below from the Owner-Manager of Alara Wholefoods provides an example of a business with more ethical than commercial drivers:

For me, it's the realisation that the economy is a subset of the environment...it's a very profound change in the way we do things in that I now see money as a tool to move towards sustainability rather than money as an end to things in itself...i'm not doing this to earn more money – i'm earning money to do this.

(Alara Wholefoods interview, March 2010) – Size: 10-100 employees category

This quote highlights an alternative business paradigm for economic growth. The Owner-Manager sees environmental and economic goals as intrinsically related in the pursuit of sustainable growth. By undertaking environmental measures, the efficiency of the business is improved, which increases profits and creates capital to invest in further environmental projects in a "virtuous circle". The Owner-Manager's ultimate goal is to become carbon negative, and the organisation could achieve this as it sequesters its organic waste through composting and sells it on. He has plans to build an Anaerobic Digestion (AD) plant to break down the rest of the waste and convert it into electricity.

Both the Addison Lee and Alara Wholefoods quotes highlight that defining the behaviour of organisations by their sector type is an inaccurate method of understanding the environmental decision-making characteristics of small organisations. Thus, I argue that one cannot simply state that profit-driven organisations have profoundly economic drivers, as it is clear from my interviews that installing micro-generation was a profound combination of ethical and economic factors.

Nevertheless, as figure 21 shows, economic incentives still feature among the most important drivers for micro-generation installation. The majority of the representatives (82%) were aware of the long-term financial savings and those familiar with *Clean Energy Cashbacks* (about half of those interviewed), argued that feed-in tariffs (FiTs) would increase the incentive to install. The following quotes highlight the positive attitude towards the *Clean Energy Cashbacks*.

When the heat tariffs and feed-in tariffs come in – even better.

(London Fire Brigade interview, January 2010) – Size: 100-250 employees category

Yes I think feed-in tariffs will increase the incentive...I hope so anyway – I think it is a good incentive...that is definitely something we'd look at.

(Quaker interview, February 2010) – Size: 10-100 employees category

It looks from my initial analysis of the feed-in tariffs...there is enough of a financial incentive there.

(Envido interview, February 2010) – Size: 10-100 employees category

Despite these comments only half of the representatives were familiar with FiTs and it is clear that the *Clean Energy Cashbacks* need to receive greater publicity so that more small organisations are aware of how they work and how to benefit from them. Chapter 7 discusses this further. However, those that did not know about them were interested in obtaining further information. Although the *Clean Energy Cashbacks* will help improve the economic incentive to install, I argue that the *Pay-as-you-save* strategy is one of the most significant policies that is being trialled at the moment for developing the micro-generation market. The policy effectively deals with what is currently perceived to be the main barrier to installation: the initial costs of micro-generation. The strategy encourages people to pay in instalments for micro-generation over a period of time through the energy savings they make, rather than paying for everything in one lump sum. As explained in the next section, some micro-generation companies (Energy Servicing Companies – ESCos) are offering free installation in exchange for claiming the FiTs, with the consumer providing the space for the unit and benefiting from reduced energy bills.

A further long-term economic incentive was highlighted by the Energy and Environmental Officer at the LFB, as expressed in the quote overleaf.

At the moment the paybacks are horrible on it [the FiTs] financially, but if the price of electricity doubles, then my paybacks halve...it can easily double between now and then...i'm probably the only one in the country who wants a price rise!

(London Fire Brigade interview, January 2010) – Size: 100-250 employees category

Although it is clear that the direct economic incentives are based on long-term environmental decision-making, some organisations (12%) were driven mainly by politics and legislation rather than economics or ethics. The representative of Arthritis Care (a charity) notably made some comments regarding the need for an incentive to do it by law, which is more characteristic of a reactive organisation rather than a proactive one (Hillary, 2004):

Under the charity law now, the directors have a responsibility to the environment, so it's within their remit to do something about it.

In response to whether she thought a *Carbon Reduction Commitment* for small organisations was a necessary step forward, she stated:

It would make my life easier if it were law.

(Arthritis Care interview, December 2009) – Size: 10-100 employees category

The comment further highlights the difficulty the representative has with internal political conflicts and diverting money away from core mission statement activities. Despite joining the CCCA, Arthritis Care appears to be more representative of a passive consumer (Devine-Wright and Devine-Wright, 2004) and a reactive organisation, which views the economic and social goals as separate from environmental concerns. The quote suggests that she would have an incentive to engage more with environmental management as a whole if it was a legal requirement. As such, it would allow her to overcome the need to get the staff and trustees to agree on action, making it easier to divert funds away from the core mission statement activities.

The Head of Project Delivery for the Environment at the London Development Agency (LDA) raised similar comments, as shown in the quote overleaf.

As an Engineer, I never really realised how much policy can change practical things...if the market is not adopted as it should do to be environmentally responsible, they should bring in a law that makes you do it.

(London Development Agency, November 2009)

He highlights that under circumstances where the micro-generation market is not developing as politicians want it to, they should bring in policies that help stimulate it. Recent examples of this include the introduction of the FiTs, the consultation on RHIs, the consultation on a new micro-generation strategy and the trialling of the *Pay-as-you-save* scheme. The representative suggests that if the culture is not changing quickly enough to adopt micro-generation, then politically enforcing change may be the most effective strategy.

Some organisations, such as the LFB highlighted the influence of (local) political targets:

Our driver was partly political – we seemed to be doing something...we've got quite stringent carbon targets – driven by the Mayor.

(London Fire Brigade, January 2010) – Size: 100-250 employees category

As a public sector organisation playing a crucial and well-known service for London, the political drive was a result of the Mayor wanting to show the public his desire for the city to move to a low carbon economy. Thus, as the representative explained, the Mayor provided grants for the LFB to do this, which has allowed the organisation to publicise this 'green' image, as explored later in the chapter. These quotes highlight the effectiveness of political targets and laws for reducing the carbon footprints of organisations.

Ethical drivers, direct economic drivers and legal drivers are important findings that can explain why some small organisations have or would install micro-generation. However, I would argue that the most significant finding from my research is the considerable weight that many small organisations put on the indirect economic drivers, most notably the 'green marketing' potential of micro-generation, which is discussed in the next section.

6.3 Driving at the Margins of the Micro-generation Market

The micro-generation market for small organisations is currently being driven at the margins by 'innovators' and 'early adopters' (Rogers, 1995), which tend to have technical backgrounds, general technological interests, higher incomes and/or a heightened awareness of environmental issues (Sauter and Watson, 2007). It is a niche market as the uptake of micro-generation has been limited and subjected to the indirect economic incentives and installing for ethical reasons, rather than for the direct economic benefits. However, with the introduction of the FiTs, the RHIs and the *Pay-as-you-save* scheme, this could change and it will be interesting to see what effect they will have. Nevertheless, the representatives of both commercial and non-profit small organisations argued that one of their primary drivers to install currently is the powerful 'green' image of the more visible micro-generation technologies, notably solar panels and micro-wind turbines.

Four of the small organisations taking part in the research had installed micro-generation: the LFB, The Office Group, Addison Lee and Alara Wholefoods. All four had installed for different reasons though the representatives all acknowledged the potential of 'green' marketing their installations as a strong incentive. As previously discussed, Addison Lee installed solar photovoltaic panels (PV) on a local school as part of the *Solar4Schools* programme, which the representative stated had helped to develop the marketing of their CSR programme, despite his exclamation that education was one of the primary drivers. He stated that it was a "good thing" to put on their website and to help them win sustainability awards, such as the Green Environmental Diamond Award, which has helped to give the business good publicity. Thus, there are indirect economic drivers underlining the ethical motivations.

Similarly, the Owner-Manager of Alara Wholefoods described his micro-wind turbine and his proposed Anaerobic Digestion (AD) plant as a "virtuous circle":

I do use it in PR as well – i'm trying to generate a virtuous circle out of it – we do these things and it gives us good PR and exposure [which] helps us sell more stuff [which] generates more money and we can do more things – as we do more things we generate good PR and you get into a virtuous circle.

(Alara Wholefoods interview, March 2010) – Size: 10-100 employees category

Alara Wholefoods, alongside MIC, are two examples of businesses that are pursuing an alternative, more sustainable business paradigm to economic growth. They view environmental, social and economic goals as inter-linking and complementary. As the quote above conveys, not only are there direct economic benefits from engaging with environmental management through cost savings, but indirect economic benefits from 'green marketing' the environmental achievements to attract clients, who are increasingly putting pressure on organisations to be environmentally sustainable (Hillary 2000; 2004).

The LFB had been very successful in obtaining funding under the *Low Carbon Buildings Programme* (LCBP) Phase 2 and the Greater London Authority's (GLA) *Buildings Energy Efficiency Programme* (BEEP). The success of the LFB was primarily due to a political drive from DECC and the Mayor of London to install energy efficiency measures and micro-generation in all public sector buildings (GLA website, 2010; DECC website, 2010). To date it has installed a total of 21 solar PV panels, 20 micro-combined heat and power units (micro-CHPs), 9 solar thermal panels, 2 micro-wind turbines and one air source heat pump (ASHP) across all of its premises (including the four Camden fire stations). A further 3 solar PV panels, 3 solar thermal panels, 2 micro-wind turbines, one ground source heat pump (GSHP) and one combined solar photovoltaic thermal (SPVT) panel have been given planning permission. Thus, at the time of the interview in January 2010 the LFB had 54 micro-generation installations across all of its premises and 10 installations planned.

However, if the LFB is excluded from those interviewed, only four micro-generation installations had been done among the sixteen other organisations that took part in the research (one solar PV panel (Addison Lee), one solar thermal panel (The Office Group) and two micro-wind turbines (Alara Wholefoods and The Office Group)). Under the *Carbon Emissions Reduction Target* (CERT) for energy companies, a similar scheme to BEEP is being driven in the domestic sector as well, but it is clear that the non-public sector small organisations have been excluded from similar support.

However, I find that one of the most interesting examples is The Office Group, which represents an innovative small business that has found commercial benefits through the effective 'green' marketing of its solar thermal and micro-wind installations. Although these benefits are difficult to quantify (Quazi, 1999), it shows that analysis needs to move away from simple assessments of upfront costs and payback periods to an understanding of the less tangible benefits, which are helping to develop the micro-generation market at its margins. Walker (2008) makes reference to the difficulty in quantifying the economic benefits of implementing Environmental Management Systems like ISO 14001. A similar

point is highlighted by one of the Founding Directors of The Office Group as shown in the quote below:

Clients will always look at two or three other companies, so for me, I want to give them a way of remembering us...but I guarantee that every single time they will remember the fact that we have solar panels and a wind turbine...so we need to make an investment that we wouldn't otherwise make to try and make a return that we can't actually tell investors or the bank what it is – it is completely intelligible and is an investment of time and money. There's absolutely no question that it ['green' marketing] has helped our business...I know for a fact that companies have come to us because of the green measures that we have put into place...and they cite it as their sole reason for coming to us and sometimes pay a bit more for it.

(The Office Group interview, November 2009) – Size: 10-100 employees category

Thus, The Office Group has found that by implementing environmental measures, particularly those that are more visible, such as solar panels and micro-wind turbines, it has managed to attract more clients, which in many cases are willing to pay a higher premium to rent a more environmentally sustainable office. As previously stated, this suggests parallels to the arguments of Hillary (2000; 2004) and Biggart and Lutzenhiser (2007), who claim that clients and customers are increasingly demanding products and services that are environmentally sustainable.

For non-profit organisations, the commercial potential of 'green' marketing is less important. Instead, I have found that a different aspect of 'green marketing' is used, which is based more on leadership statements and status symbols. The powerful visual image of some micro-generation technologies and their effect on the local community to show leadership on environmental sustainability is considered important. Some of the representatives argued that it is about making a visible top-down statement to encourage local people and organisations to do the same, as conveyed in the quotes from the representatives of the Camden Arts Centre and the RCP overleaf.

We are in an area with more affluent housing nearby, so their adoption of greener technologies, if there were a few demonstration or pilot schemes here, would be quite high.

(Camden Arts Centre interview, November 2009) – Size: <10 employees category

...but it's still a statement to the local community...we've got to make these statements public – we've got to give some kind of visual impact because people will always say "we'll cross that bridge when we come to it"...the encouragement for the effort...the ones to enthuse are predominately the children.

(Royal College of Physicians interview, November 2009) – Size: 100-250 employees category

These quotes suggest a top-down approach by making a statement of leadership to the local community to inform them of how they should act in the face of environmental sustainability. In the case of the RCP, this may be due to the highly educated and well-connected background of its members, who believe that the local community need to be educated and guided in what to do. This is suggestive of a class and power imbalance, where the more educated medical professionals believe it is their social responsibility to inform those less educated than them in how to act.

The RCP and Camden Arts Centre representatives highlighted how the visibility of solar panels and micro-wind turbines makes them the most appropriate micro-generation technologies for making 'green' statements. Sauter and Watson (2007) convey how micro-CHP is invisibly located in a utility room whereas solar PV panels or micro-wind turbines are visible externally. Nevertheless, small organisations may find that installing micro-CHP is less hassle as it simply involves replacing the existing boiler as opposed to representing something additional (Sauter and Watson, 2007).

The interviews also suggested that the 'green' image of micro-generation is intrinsically linked to 'green' status, as clients increasingly prefer organisations with environmentally sustainable products and services (Biggart and Lutzenhiser, 2007). A parallel can be suggested with households, as an interview cited in Crompton (2008) and Bergman *et al*. (2009) (shown on page 41), highlights how a woman installed a solar panel on the side of her house that faced the street, which was not necessarily the most efficient place to put it. Instead, she wanted to show her neighbours that she was environmentally

sustainable and responsible. It is clear that the Government needs to enhance the status of micro-generation, as this will help drive the market further at the margins over and above the direct economic benefits.

Micro-generation in small organisations may thus be considered as a niche market, which is driven by a number of different socio-economic, political and cultural factors, rather than direct economic ones. Although it is currently developed at the margins through 'innovators' and 'early adopters' (Rogers, 1995), this potentially could have a large impact on the whole market. My discovery of the higher value that small organisations put on 'green' marketing above the direct cost savings (from reduced energy bills) of micro-generation, has the potential, particularly for small businesses, to drive the market through 'green' competition. This was notably emphasised in the interviews with the representatives of The Office Group and InHolborn, as shown in the quotes below:

Landlords and developers are missing a trick as by taking out those measures it gives us a marketing edge and makes us more attractive...The payback is twenty-five years, which is a waste of everyone's time...but when I take people up onto the roof and show them the wind turbine, it has that non-tangible contribution...it might be conscious, it might be sub-conscious...clients will always look at two or three other companies, so for me, I want to give them a way of remembering us.

(The Office Group interview, November 2009) – Size: 10-100 employees category

Green marketing – particularly for property developers...where I used to work, a lot of clients would pay the premium for green energy, so they got the certificate, which they could put in their reception.

(InHolborn interview, December 2010) – Size: <10 employees category

The literature on 'green' marketing has mainly concentrated on the adoption of wider environmental management systems such as ISO 14001 or the European Eco-Management and Audit Scheme (the highest international standards for environmental management in organisations – see: www.iso.org and Cleaver, 2001 for further information), and how organisations can utilise them to attract more clients (Charter, 1992; Welford and Gouldson, 1993; Sayre, 1996). As clients and customers become increasingly environmentally aware, competitions will arise between how 'green' the

products and services are that different organisations offer. Due to its visible external image, micro-generation is likely to have a greater marketing impact as less visible measures, such as energy efficient lighting, recycling and staff engagement, become the norm. The quotes from The Office Group cited previously provide an indication that this is starting to happen.

Driving the market through the 'green' image of micro-generation will have knock-on effects for improving the direct and quantifiable benefits. As uptake increases, the upfront costs will reduce and the payback periods will shorten. For example, the payback period for solar PV panels is currently ~10-15 years on average for households, but this has reduced significantly over the last few years (Harrison, 2010; EST website, 2010). Small organisations have the additional benefit of a reduction in the amount they pay for the *Climate Change Levy* if they install micro-generation or switch to a 'green' energy tariff (DECC website, 2010). This latter point was highlighted in the interview with the Micro-generation Advice Manager of the Energy Saving Trust (EST), as shown in the quote below:

SMEs have to pay the Climate Change Levy – 43p for electricity – it goes up and up to coal, so it's in their interests to reduce that heavily...if you install micro-gen you pay less levy because it's renewable.

(Energy Saving Trust interview, April 2010)

This could help shift the uptake of micro-generation to the 'early majority' (Rogers, 1995), as shown in figure 14 on page 37 (adapted from Foxon *et al*., 2005).

Energy companies are likely to have a significant role to play in this shift to the 'early majority'. A survey by London Renewables found that 46% of Londoners thought that energy companies should force the market uptake of micro-generation (London Renewables, 2003, pp. 26). FiTs are effectively financed by energy companies as they are obliged to pay their customers for each unit of electricity they produce and/or export to the grid. Hence, there is potential for them to drive the micro-generation market by getting involved in conducting feasibility studies for customers and installing and servicing the technologies. As the Policy Manager for British Gas New Energy highlighted in the quote overleaf, if energy companies do not get on board with the micro-generation market, they will effectively reduce their profit margins through simply financing the FiT scheme.

This is being developed at the moment and is really being pushed. You have to get on board with micro-generation as an energy supply company otherwise it will eat into your profits if you do not get involved in installation and simply buy energy from customers through feed-in tariffs.

(British Gas interview, March 2010)

British Gas is currently in the process of training its installers to fit different micro-generation technologies, such as micro-CHP and solar panels. In 2010, the company became the second micro-CHP installer to become MCS (Micro-generation Certification Scheme) certified. At the time of writing, this figure has increased to seven certified installers (further information can be found on the MCS website: www.microgenerationcertification.org). As I argued in chapter 5, the MCS was introduced in 2006 to provide a reputable market of micro-generation installers and products and will go a long way to address issues of mis-selling, which was brought up by a number of the representatives interviewed. For example:

The MCS is certainly there to stop any old plongit – you know you're running with government money, which is what the grants were, then they had to have somebody that they knew wasn't going to be a shy to them – for that I think it works...I think now they are letting a lot of others do the MCS accreditation, so I'm not sure what will happen.

(Ecovolt interview, March 2010)

With the exception of British Gas and the three main 'green' energy companies: Ecotricity, Good Energy and Green Energy UK, which obtain 100% of their energy from renewable sources, most energy companies in the UK have yet to adapt to the micro-generation market, as highlighted by the British Gas representative:

The next company after ours, who will go after this in a big way, will probably be Scottish and Southern Power. I would say we were the company going after it the most, then Scottish and Southern Power, then npower and E.On are much less, EDF don't want to do anything unless it helps nuclear...heat pumps work really well with nuclear power...it makes them much better in terms of carbon savings, and then lagging behind everyone

else is Scottish Power because they are quite a small company and they only do things if you really force them to do things – that's my take on where everyone sits.

(British Gas interview, March 2010)

The quote highlights that even in the core market of energy generation there are active and passive adopters of the micro-generation market. The British Gas representative acknowledges that as the UK's main gas supplier and one of the large conventional electricity suppliers operating in the UK, the company needs to engage with the "inevitable move to a future low carbon society". He argues that if energy companies are to stay competitive in a low carbon economy, they need to start getting on board with low carbon energy:

The main business is selling energy, but we see that as we are moving into a more low carbon world there will be increases in energy efficiency, which will hit gas sales – there will be less gas sales in the future. For example, there are initiatives like zero-carbon homes by 2016 coming in, which means that most new homes can't be fitted with gas, so we can see that our core business is declining, but we are an electricity supplier as well – we must supply about 20% of Britain's households and out of all the electricity supplied in the UK we're at about 12-15%, so we're still quite a major electricity supplier and that will grow in the future...we have taken the view that we can either resist the change to a low carbon world for as long as possible, which is only going one way, or we can actually help our customers save on their bills by helping them reduce their energy – I work in a new part of British Gas called 'British Gas New Energy'...our vision is to help Britain's homes and businesses to use less energy and to use greener energy – what that means is energy efficiency and micro-gen.

(British Gas interview, March 2010)

Thus, 'green marketing' is central for British gas, as an active adopter of the micro-generation market, as it wants to promote itself as reputable installer of energy efficiency measures and micro-generation as well. Such energy companies could have a large impact on the micro-generation market, as they are familiar household names. In the quote overleaf, the British Gas representative lists what has already been done and what he is planning to do in the British Gas New Energy team.

We bought a company called Solar Technologies, which is a leading solar PV installer to businesses and we're rolling that out to domestic this year and they're taking on new technologies like wind and solar thermal...we own 20% of a company called Ecology, which is the leading biomass heating installation company in the UK...we've got an exclusive agreement with Baxi to sell their eco-gen micro-CHP boiler in the UK, which we'll be rolling out this year...we own 9% of Ceres Power, which are developing a solid oxide Fuel Cell-CHP boiler – we'll hopefully be launching their boiler next year into the market.

(British Gas interview, March 2010)

As I argued previously, the commitment from senior management is important in the environmental decision-making process, which partly explains British Gas's desire to diversify into low carbon energy markets:

The Managing Director of British Gas and the CEO of Centrica are always shouting about this, which is good – they are saying that this is our major growth opportunity for the next ten years – there's real commitment at the top level of our business.

(British Gas interview, March 2010)

The senior management have identified that the inevitable move to a low carbon economy in the face of climate change (CO_{2e} emissions) and energy security (reduced oil and gas stocks) concerns, opens up a large growth area in alternative forms of energy supply. By adapting now, the company can get ahead of its competitors, rather than "resist[ing] the change to a low carbon world for as long as possible", as it appears many of the other energy companies are doing.

Thus, energy companies could have a large role to play in driving the development of the micro-generation market. It is clear that this drive needs to come from all aspects of society across all scales, which takes into account the significance of not only the direct economic incentives, but the indirect, less quantifiable economic benefits (Quazi, 1999), the social and environmental drivers, carbon commitments through national and local legislation, and the encouragement and support of energy companies wishing to diversify to a low carbon economy.

In conversations with members of the CCCA management team since the interview I conducted with the Sustainability Officer at Camden Council, it is clear that they are keen

to develop advice and support for members wanting to know more about micro-generation. Without the support, twelve (71%) of the organisations taking part in the research have still actively considered micro-generation through obtaining quotes and/or undertaking feasibility studies into technological suitability, with four (24%) having actually installed. With greater CCCA support in this respect, an increased awareness regarding costs, grants (particularly the FiTs and the *Pay-as-you-save* scheme), technological suitability and installers is likely to result in more members installing micro-generation. I would argue that environmental alliances like the CCCA have great potential for not only increasing the uptake of micro-generation in small organisations, but wider environmental management measures. Thus, the promotion of similar environmental alliances in other local authorities in the UK forms one of the main recommendations of my research, as further discussed in the next chapter.

7 Chapter 7: Conclusion

7.1 Uptake of Micro-generation among Small Organisations in the CCCA

The research aimed to explore four main areas: the governance of small organisations and how this affects their adoption of micro-generation; the significance of environmental alliances like the CCCA for increasing the uptake of micro-generation and wider environmental management measures in small organisations; the prioritisation of wider energy efficiency measures over micro-generation in small organisations; and the current market barriers and drivers for micro-generation uptake in small organisations. These areas were broken down into two aims and five research questions, with a greater weighting given to the first aim and the last two research questions:

Aims:

1) To explore the attitudes of the representatives of small organisations towards their uptake of micro-generation
2) To comment on the significance of environmental alliances like the CCCA for increasing the uptake of micro-generation and wider environmental management measures in small organisations

Research Questions:

1) What are the environmental decision-making characteristics of small organisations in the CCCA and how does this differ between different types and sizes of organisation?
2) How does the CCCA function and what is its potential for engaging small organisations with improving their environmental performances and increasing the uptake of micro-generation?
3) How do small organisations in the CCCA view micro-generation in the context of wider energy efficiency or environmental measures?
4) What are the main barriers to micro-generation installation in small organisations?
5) What are the main market drivers of micro-generation in small organisations?

This section will show how the research conclusions map onto the aims and research questions.

Micro-generation is receiving increased political attention as a part of the diverse future energy mix in the UK, as highlighted by the UK Low Carbon Transition Plan (DECC, 2009), the introduction of feed-in tariffs (FiTs) in April 2010, and the current consultations on Renewable Heat Incentives (RHIs) and a new Micro-generation Strategy. Academic research and policy has given little attention to the potential of micro-generation in small organisations, as it has concentrated on the domestic sector.

As chapter 4 explored, The *Camden Climate Change Alliance* (CCCA) is a unique alliance of small organisations collectively trying to reduce carbon dioxide equivalent (CO_{2e}) emissions from the non-domestic sector in the London Borough of Camden, which accounts for 64% of the Borough's emissions (CCCA website, 2010). The CCCA operates on multi-levels of governance, as it is directly part-funded by the European Union (EU), with a complex relationship to national levels of authority (Aim 2; Research Question 2).

The alliance is still in its infancy, as it was set up in 2008, and there are areas that need further development, most notably improved communication between the CCCA and the UK Department of Energy and Climate Change (DECC) and the European Union (EU) in order to help set up similar alliances in other local authorities (Aim 2; Research Question 2). This is important, as the collective CO_{2e} emissions from small organisations are significant, possibly greater than the combined environmental impacts of large organisations (McKeiver and Gadenne, 2005). The *Carbon Reduction Commitment Energy Efficiency Scheme* (CRC), introduced in April 2010, now regulates and monitors the CO_{2e} emissions from large organisations. However, those of small organisations still go largely unaccounted for and have been estimated to make up between a fifth and a quarter of the total UK emissions (CCCA website, 2010), which is a significant political oversight. However, I acknowledge that the success of the CRC will determine how effective the emissions from small organisations can be accounted for in policy.

In the smaller organisations (<10 employees) that took part in the research, the responsibility for environmental management tended to lie with the Senior Manager (or equivalent), though in the medium (10-100 employees) and larger (100-250 employees) organisations, designated Building Services Managers or Total Quality Managers were present, where environmental management was an important part of the role (Aim 1; Research Question 1).

It is clear that energy efficiency and wider environmental measures are prioritised over micro-generation not just in the CCCA but also at the citywide and national scales of authority, as chapter 5 explored (Research Question 3). Micro-generation appears to be at the top end of an energy hierarchy based on initial costs and payback periods. Thus,

those measures that have lower initial costs and shorter payback times (<~4 years) are prioritised. This is intrinsically related to the short timescales over which many small organisations make their decisions. As the size of the organisation increases (based on employee numbers), my data has shown that the environmental decision-making process becomes more complex, as various financial and administrative committees have to assess the proposals (Aim 1; Research Question 1). Under budget constraints, those measures that have a lower capital outlay and entail a good financial saving will be accepted. This could explain why, despite 71% (12) of the CCCA research participants having actively considered micro-generation through obtaining installation quotes and/or undertaking technological feasibility studies, only 24% (4) had actually installed.

Nevertheless, this does suggest that these environmentally proactive organisations have a higher awareness of micro-generation than studies that have looked at households, such as Bergman *et al*. (2009) and Allen *et al*. (2008). However, it is apparent that there is still limited support provided by the CCCA on the initial costs, the payback periods and the suitability of certain technologies for organisations (Aim 2). This could be improved by adding a micro-generation workshop to its list of events, and the CCCA management team seemed interested in developing this further. My findings are partly in opposition to the Bergman *et al*. (2009) and Allen *et al*. (2008) studies, as I have found that a lack of awareness is a factor, but not one of the most significant factors, for explaining the limited uptake of micro-generation. A further barrier, which was not considered in these studies, is the issue of planning permission on listed buildings or buildings in conservation areas. This was judged to be the primary or secondary barrier to installation by 12% of the small organisations; thus one of the most significant barriers. However, like these studies, I have found that the initial cost is the most important obstacle to adoption, and this was mentioned by all the representatives either as the primary or secondary barrier (Aim 1; Research Question 4).

The majority of the representatives did not see the shift from passively consuming energy to actively producing it as a barrier to installing micro-generation. They instead follow an energy hierarchy and are inclined to prioritise the no- or low-cost energy efficiency options, such as staff engagement and improving insulation, which have quick returns (Aim 1; Research Question 3). This attitude was similarly conveyed in the interviews with representatives from DECC, the Environment Agency (EA), the Energy Saving Trust (EST), British Gas, the Greater London Authority (GLA), the London Development Agency (LDA) and Camden Council. I take a similar view and propose an *Energy hierarchy framework for small organisations*, where the no- and low-cost options

with short payback periods are implemented first, such as staff engagement and replacing the lighting to more energy efficient alternatives (such as Light Emitting Diodes (LEDs)). After this, more expensive measures are installed, such as installing motion-sensor lighting and voltage optimisation. Despite their longer payback times, they have the potential to achieve much greater cost and carbon savings. At the top end of the hierarchy, micro-generation is installed, with the ultimate goal of the organisation becoming completely energy self-sufficient. The framework is shown in figure 20 in chapter five (page 78), and is not supposed to be a literal step-by-step guide to environmental management in small organisations, as the suitability of certain measures will depend on the characteristics of the individual organisation, such as sector type and size.

Installing micro-generation for ethical (environmental and/or social) reasons appears to be one of the strongest drivers with 50% of the organisational representatives citing this as the primary or secondary incentive (Aim 1; Research Question 5). In contrast, only 9% highlighted the (long-term) direct economic benefits as their primary or secondary motivation. However, many of the more knowledgeable representatives argued that the feed-in tariffs (FiTs) would increase the direct economic incentive to install. I would align my arguments with the representatives of DECC, the EST and the EA to state that the *Clean Energy Cashbacks*, such as the FiTs and the Renewable Heat Incentives (RHIs), and the *Pay-as-you-save* scheme, will go some way to improving the direct financial incentive to install. Although many of the representatives were aware of the long-term economic benefits, the incentive was not strong enough to warrant installation, which they argued to be a result of the uncertainty of how long the organisation would be in its current premises for and the short-term nature of their decision-making processes.

However, the most important finding of this research is the high value that many of the small organisations place on the ‘green’ image and ‘green’ marketing potential of micro-generation. Almost all the representatives interviewed saw the indirect economic benefits of ‘green’ marketing as either the primary or the secondary incentive to install (Aim 1; Research Question 5). As chapter six discussed, such value will help drive the micro-generation market at the margins, and it may have a significant role to play in helping to push the uptake from the ‘innovators’ and ‘early adopters’ categories of Rogers’s (1995) *Diffusion of innovations* model to the ‘early majority’. As clients put increasing amounts of pressure on organisations to be environmentally sustainable (Hillary, 2000; 2004), ‘green’ competitions are likely to arise, where the powerful visual image of micro-generation could give an organisation the competitive edge as energy efficient lighting, recycling, improved insulation and staff engagement become the norm.

For non-commercial organisations, the ‘green’ image is still important as a sub-set of ‘green’ marketing. The encouragement of the local community to be environmentally sustainable and follow their leadership is most powerfully driven through visible technologies such as solar panels or small-wind turbines. Micro-generation therefore becomes a symbol or statement to the local community to show them how they should act, and it also serves to help familiarise people with the technologies (Aim 1; Research Question 5). However, the organisations differed in their approaches to this. Some were more active adopters and went into the community to directly engage with the local population, whereas others were passive adopters and wanted to make a statement in the hope that others would follow their example.

Analysis thus needs to move away from simple assessments of costs and payback times to look at the less quantifiable (Quazi, 1999) and less tangible benefits of micro-generation. My findings suggest that it is not an accurate description to simply state that small commercial organisations will install micro-generation and wider environmental management measures for economic reasons and non-commercial organisations will install micro-generation for ethical (environmental and social) reasons. I have found that some small businesses are more ethically driven and install because the Senior Managers (or equivalent) want to take responsibility for their organisation’s (negative) environmental impacts. In contrast, some small non-profit organisations have difficulty getting approval from senior management without sound economic reasons for implementing certain measures (Aim 1; Research Questions 1 and 4). In either case, it highlights the importance of commitment from senior management.

Alliances such as the CCCA have an important role to play in helping to facilitate a greater uptake of micro-generation among small organisations through the sharing of knowledge (Aim 2; Research Question 2). The CCCA has multi-level inter-connected networks (Bulkeley and Betsill, 2003), which by-pass historical flows of authority and has been effective at engaging small organisations of all sectors with mitigating their own climate change impacts. For example, the workshops provided by the CCCA cover all aspects of environmental management and are also free, which some of the CCCA management team admitted was unique, as previous Boroughs they had worked for had charged for similar services. The CCCA *Carbon Confident* programme has notably been effective at teaching the representatives of small organisations how to measure, monitor and reduce their carbon footprints. The alliance goes beyond this though by encouraging its members to engage with their supply chains and other local organisations to spread best practice and promote the benefits of engaging with environmental management. How

effective the CCCA has been on its path to reduce CO_{2e} emissions from the non-domestic sector by 10% by 2012 will be established at the second year anniversary event in November 2010, where the CO_{2e} emissions in the 2008/2009 baseline year will be compared to that of the 2009/2010 year. The interviewees' positive attitudes towards the CCCA for helping them to see both the economic and environmental benefits of environmental management, demonstrates its success in engaging small organisations.

However, the alliance has some limitations, which this research has highlighted. For example, it has so far had little impact on the uptake of micro-generation among environmentally proactive small organisations, though this could be due to its concentration on recommending the no- and low-cost measures by following an energy hierarchy (Aim 2; Research Question 2). It would be interesting to see what effect a micro-generation workshop for members would have on the uptake of micro-generation. There is also a need for greater communication between the CCCA and DECC, to encourage the setting up of similar alliances in other local authorities in the UK, so that small organisations in other areas can benefit economically and environmentally from similar support. This will allow steps to be taken towards accounting for the CO_{2e} emissions of small organisations in the UK. Despite these limitations, it is important to note that the CCCA management team are keen to use the research findings to help improve the support they give to members. My observations of the alliance through working as the Environmental Manager of one of the small organisations (MIC), has aided my understanding of how the CCCA operates in practice. The opportunity arose whilst conducting the fieldwork and although participatory observation was not the main research method, it became a useful tool for directly pushing the micro-generation agenda forward.

7.2 Policy Gaps

My research has shown that in order to improve the uptake of micro-generation among small organisations, policy incentives need to take into account not only the direct economic incentives, but the indirect, less quantifiable (Quazi, 1999) economic benefits, the social and environmental drivers, the importance of carbon commitments through national and local legislation, and the encouragement and support of energy companies wishing to diversify to a low carbon economy.

It is not the role of a Masters project to make political recommendations, particularly based on a single case study. However, the interviews with the representatives of DECC, the EA, the EST, British Gas, Ecovolt, the GLA and the LDA have highlighted the same

themes regarding the uptake of micro-generation installation, as those stated by the representatives of small organisations. Thus, the following eight points highlight where there are policy gaps, which if filled, could help stimulate the micro-generation market, as well as the adoption of wider environmental management in small organisations.

1. *The setting up of similar alliances of small organisations to the CCCA in other local authorities*

The rationale behind the first point is to spread the success of the CCCA to other local authorities in the UK, so that similar alliances can be set up to help engage small organisations with reducing their CO_{2e} emissions.

2. *The consideration of a Carbon Reduction Commitment for small organisations to provide a legal incentive to engage with environmental management measures such as micro-generation*

The second point is linked to the first point in that it aims to provide a legal incentive for small organisations to reduce their carbon footprints. This has the potential to cut a large chunk of the UK's CO_{2e} emissions and to allow a more accurate calculation of the emissions from the non-domestic sector (alongside the data from the CRC for large organisations). In both points, micro-generation could play an important part in making carbon savings.

3. *The CCCA could improve the support it gives to members on micro-generation by adding a micro-generation workshop to its list of events*

The third point, if taken into consideration, should help enhance the awareness of the practical aspects of micro-generation installation among small organisations in the CCCA, which could increase the uptake. I am working closely with the CCCA management team to organise a workshop on micro-generation, as they are keen to develop this.

4. *The Clean Energy Cashbacks (FiTs and RHIs) and the Pay-as-you-save scheme could be publicised more to small organisations*

The fourth point is concerned with increasing the awareness of the new *Clean Energy Cashbacks* among small organisations. Only half of the representatives of small organisations that I interviewed were familiar with FiTs and how to benefit from them.

5. *The status of micro-generation could be enhanced and its 'green marketing' potential highlighted through effective information and engagement campaigns to small organisations*

The fifth point could be achieved through increasing the practical awareness of micro-generation and highlighting the current benefits of installation. Increasing the familiarity of small organisations with micro-generation should help to dispel myths over technological suitability and efficiencies, mis-selling and the over estimation of initial costs and payback periods. It is important that these benefits include the notion that small organisations should take responsibility for their (negative) environmental impacts and that micro-generation is a visible way of showing this, which will have knock-on benefits for attracting clients and customers through 'green' marketing. Clients and customers could also be encouraged to choose only those organisations that are environmentally responsible.

6. *Large energy companies could be encouraged to get on board with micro-generation installation and servicing*

The sixth point is based on discussions that took place in the interview with the Policy Manager for British Gas New Energy, which highlighted how the energy supply industry is starting to engage with new low carbon markets. DECC could play a large part in facilitating and encouraging this diversification. However, I would argue that through local and national state and non-state actors, the domestic and non-domestic sectors similarly need to be encouraged to install energy efficiency measures, micro-generation and switch to 'green' energy tariffs, so that the demand for such services increases. The case study of the CCCA highlights one effective way of engaging with the non-domestic sector in this respect.

7. *The EST and MCS websites could be publicised more as the main sources of information on micro-generation for small organisations*
8. *The EST website could be updated to take into account the differences between organisations and households when it comes to the practical aspects of micro-generation installation*

The points all inter-link and the seventh and eighth points will help enhance the practical awareness and familiarity of small organisations with micro-generation. The advice provided by the MCS and EST websites is very useful, though it is clear that the EST website needs to improve its non-domestic section so that small organisations can relate

to the initial costs, payback periods and suitability of certain technologies more easily, based on their sector, building characteristics and size. Producing a more detailed database of case studies with averaged values for certain building sizes, building types, organisation sizes and sector types, would be more useful to small organisations than the current information, which is based on a typical house with an electricity consumption of 4,000 kWh – usually a much lower value than that of a small organisation.

7.3 Further Research

A report summarising the research results has been emailed to all the research participants, and an academic paper has been submitted to *Business Strategy and the Environment* and the DECC Distributed Energy and Heat Team, so that the policy gaps can be highlighted directly. I have worked with the CCCA team to set up a workshop on micro-generation for members, which is taking place in April 2011. My research findings will also be publicised in the CCCA's newsletter. To test the usefulness of my proposed *Energy hierarchy framework for small organisations*, I am directly implementing it into MIC, which I continue to work for part-time as its Environmental Manager.

A longer project could use the same approach and undertake a comparative study with small organisations in other local authorities, particularly those that are more reactive and not part of any environmental initiative. An extended research project, such as a PhD, could then compare the results with other countries that have been more successful in developing the micro-generation market, such as Germany and Spain, and assess whether or not their micro-generation policies have primarily concentrated on households, as has been the case in the UK. It would also be interesting to interview small organisations in other London Boroughs to assess differences in how they are supported, and if the *Clean Energy Cashbacks* have encouraged them to install micro-generation.

The approach was suitable to answering the research questions. However, interviewing a greater number of CCCA members through the use of focus groups would have made the findings more representative of the alliance's views. Similarly, formalising the use of participatory observation as a primary method through keeping an ethnographic diary and working more closely with Camden Council could have provided a deeper understanding of the role of the CCCA, and how this may have affected the responses of the research participants. However, what was clear from my approach was that the CCCA had positively enhanced the knowledge and enthusiasm to act of those responsible for environmental management, which was causing positive organisational behaviour change.

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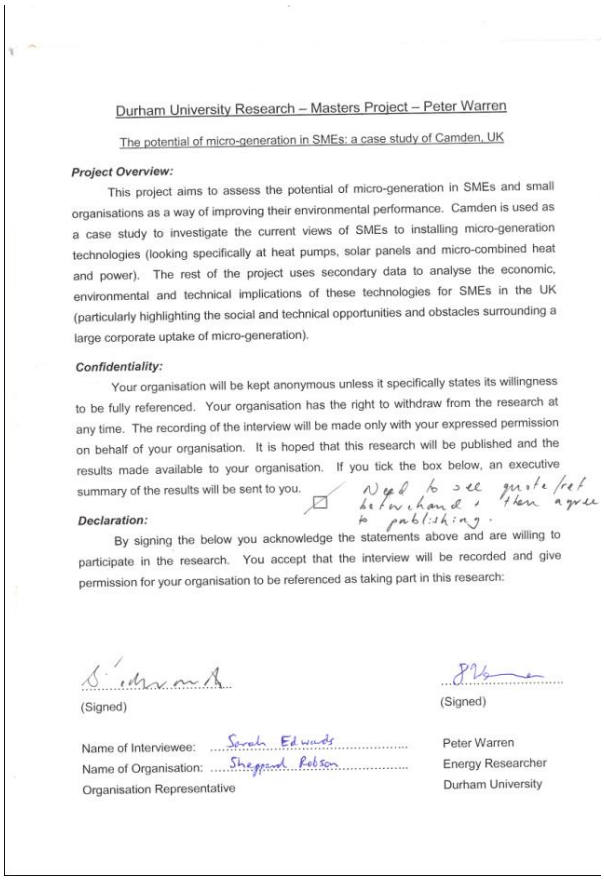
9 Appendix

9.1 Declaration of Consent Forms



Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

Project Overview:

This project aims to assess the potential of micro-generation in SMEs and small organisations as a way of improving their environmental performance. Camden is used as a case study to investigate the current views of SMEs to installing micro-generation technologies (looking specifically at heat pumps, solar panels and micro-combined heat and power). The rest of the project uses secondary data to analyse the economic, environmental and technical implications of these technologies for SMEs in the UK (particularly highlighting the social and technical opportunities and obstacles surrounding a large corporate uptake of micro-generation).

Confidentiality:

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Declaration:

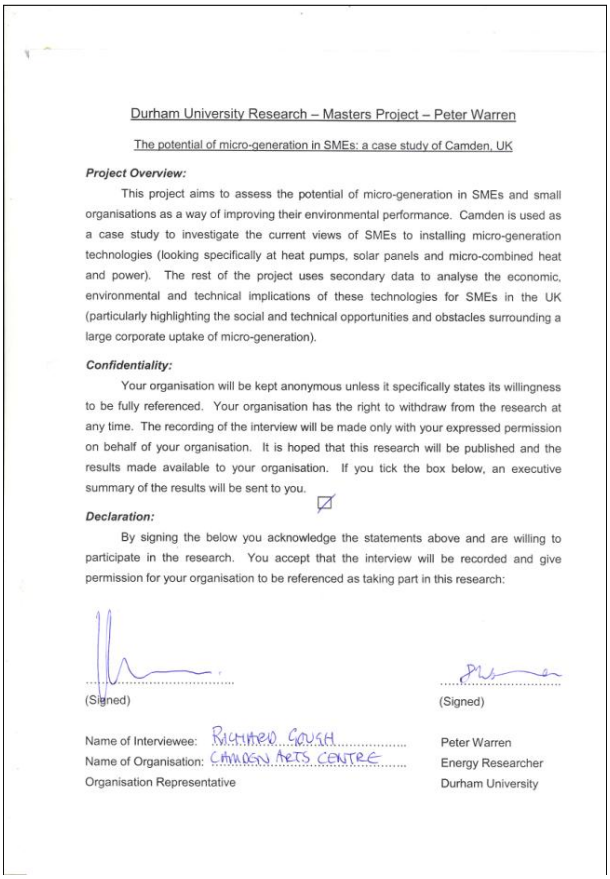
By signing the below you acknowledge the statements above and are willing to participate in the research. You accept that the interview will be recorded and give permission for your organisation to be referenced as taking part in this research:

(Signed) (Signed)

Name of Interviewee: Sarah Edwards — Peter Warren

Name of Organisation: Sheppard Robson — Energy Researcher

Organisation Representative — Durham University



Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

Project Overview:

This project aims to assess the potential of micro-generation in SMEs and small organisations as a way of improving their environmental performance. Camden is used as a case study to investigate the current views of SMEs to installing micro-generation technologies (looking specifically at heat pumps, solar panels and micro-combined heat and power). The rest of the project uses secondary data to analyse the economic, environmental and technical implications of these technologies for SMEs in the UK (particularly highlighting the social and technical opportunities and obstacles surrounding a large corporate uptake of micro-generation).

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(Signed) (Signed)

Name of Interviewee: RICHARD GOUGH — Peter Warren

Name of Organisation: CAMDEN ARTS CENTRE — Energy Researcher

Organisation Representative — Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

Project Overview:

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(Signed) (Signed)

Name of Interviewee: Glen Price — Peter Warren
Name of Organisation: Royal College of Physicians — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

Project Overview:

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(Signed) (Signed)

Name of Interviewee: Peter Warren
Name of Organisation: Energy Researcher
Organisation Representative Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

Project Overview:

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(Signed) (Signed)

Name of Interviewee: Charlie Green — Peter Warren
Name of Organisation: The Office Group — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

Project Overview:

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Name of Interviewee: Peter Warren
Name of Organisation: Energy Researcher
Organisation Representative Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

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(Signed) (Signed)

Name of Interviewee: Alice Wilson — Peter Warren
Name of Organisation: Cake Group — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

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Name of Interviewee: Peter Warren
Name of Organisation: Energy Researcher
Organisation Representative Durham University

Durham University Research – Masters Project – Peter Warren

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(Signed) (Signed)

Name of Interviewee: A Childers — Peter Warren
Name of Organisation: Meekcat Associates Limited — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

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(Signed) (Signed)

Name of Interviewee: Peter Warren
Name of Organisation: Energy Researcher
Organisation Representative Durham University

Durham University Research – Masters Project – Peter Warren

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(Signed) (Signed)

Name of Interviewee: JAMES BARR — Peter Warren
Name of Organisation: METHODIST INTERNATIONAL CENTRE — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

Project Overview:

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(Signed) (Signed)

Name of Interviewee: NEIL THOMAS — Peter Warren
Name of Organisation: NHS CAMDEN — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

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(Signed) (Signed)

Name of Interviewee: J LAWLEY — Peter Warren
Name of Organisation: METHODIST CHRC — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters Project – Peter Warren

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(Signed) (Signed)

Name of Interviewee: Danielle Rodin — Peter Warren
Name of Organisation: FreshMinds — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

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(Signed) (Signed)

Name of Interviewee: IAN SHALL
Name of Organisation: LONDON FIRE BRIGADE
Organisation Representative

Peter Warren
Energy Researcher
Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

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(Signed) (Signed)

Name of Interviewee: Lee Wickes
Name of Organisation: Addison Lee
Organisation Representative

Peter Warren
Energy Researcher
Durham University

Durham University Research – Masters Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

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(Signed) (Signed)

Name of Interviewee: JOHANNA KOCIEJOWSKI
Name of Organisation: THE RELIGIOUS SOCIETY OF FRIENDS IN BRITAIN
Organisation Representative

Peter Warren
Energy Researcher
Durham University

Durham University Research – Masters Project – Peter Warren

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(Signed) (Signed)

Name of Interviewee: ED NIEWSTEK
Name of Organisation: ENVIDO
Organisation Representative

Peter Warren
Energy Researcher
Durham University

Durham University Research – Masters by Research Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

Project Overview:

This project aims to assess the potential of micro-generation in SMEs and small organisations as a way of improving their environmental performance and helping them to meet their Carbon Reduction Commitment targets. It uses Camden as a case study to investigate the current views of SMEs to micro-generation technologies (looking specifically at heat pumps, solar panels and micro-combined heat and power). The rest of the project uses secondary data to analyse the economic, environmental and technical implications of these technologies for SMEs in the UK (particularly highlighting the opportunities and issues surrounding a large uptake of micro-generation by SMEs).

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Declaration:

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..... (Signed)	..... (Signed)
Name of Interviewee: Stefan Geyer	Peter Warren
Name of Organisation: St Mary Hall	Energy Researcher
Organisation Representative	Durham University

Durham University Research – Masters by Research Project – Peter Warren

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..... (Signed)	..... (Signed)
Name of Interviewee: JUDITH HUNT	Peter Warren
Name of Organisation: KNAF	Energy Researcher
Organisation Representative	Durham University

Durham University Research – Masters by Research Project – Peter Warren

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..... (Signed)	..... (Signed)
Name of Interviewee: A SMITH	Peter Warren
Name of Organisation: A.C.A.R.A	Energy Researcher
Organisation Representative	Durham University

Durham University Research – Masters Project – Peter Warren

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..... (Signed)	..... (Signed)
Name of Interviewee: PETER NORTH	Peter Warren
Name of Organisation: LONDON DEVELOPMENT AGENCY	Energy Researcher
Organisation Representative	Durham University

Durham University Research – Masters Project – Peter Warren

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Your organisation will be kept anonymous unless it specifically states its willingness to be fully referenced. Your organisation has the right to withdraw from the research at any time. The recording of the interview will be made only with your expressed permission on behalf of your organisation. It is hoped that this research will be published and the results made available to your organisation. If you tick the box below, an executive summary of the results will be sent to you. ☐

Declaration:

By signing the below you acknowledge the statements above and are willing to participate in the research. You accept that the interview will be recorded and give permission for your organisation to be referenced as taking part in this research:

(DECC documents, MSC, ~~ECCC~~)

P'ship lead

(Signed) (Signed)

Name of Interviewee: Alison Bailey — Peter Warren
Name of Organisation: Dept. Energy & Climate Change — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters by Research Project – Peter Warren

The potential of micro-generation in SMEs: a case study of Camden, UK

Project Overview:

This project aims to assess the potential of micro-generation in SMEs and small organisations as a way of improving their environmental performance and helping them to meet their Carbon Reduction Commitment targets. It uses Camden as a case study to investigate the current views of SMEs to micro-generation technologies (looking specifically at heat pumps, solar panels and micro-combined heat and power). The rest of the project uses secondary data to analyse the economic, environmental and technical implications of these technologies for SMEs in the UK (particularly highlighting the opportunities and issues surrounding a large uptake of micro-generation by SMEs).

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NB WILL NEED PRESS OFFICE SIGN OFF PRIOR TO PUBLISHING

(Signed) (Signed)

Name of Interviewee: WILLIAM PRATT — Peter Warren
Name of Organisation: CAMDEN COUNCIL — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters by Research Project – Peter Warren

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(Signed) (Signed)

Name of Interviewee: Kathy Hutton — Peter Warren
Name of Organisation: EA — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters by Research Project – Peter Warren

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(Signed) (Signed)

Name of Interviewee: C. WANDER — Peter Warren
Name of Organisation: ECUS LTD — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters by Research Project – Peter Warren

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(Signed) (Signed)

Name of Interviewee: PETER JAW — Peter Warren
Name of Organisation: SLA — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters by Research Project – Peter Warren

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(Signed) (Signed)

Name of Interviewee: CHETAN LAD — Peter Warren
Name of Organisation: BRITISH GAS — Energy Researcher
Organisation Representative — Durham University

Durham University Research – Masters by Research Project – Peter Warren

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(Signed) (Signed)

Name of Interviewee: Ian Cuthbert — Peter Warren
Name of Organisation: Energy Saving Trust — Energy Researcher
Organisation Representative — Durham University

9.2 CCCA Survey

Technical

No.	Emission scope	Name	Number	Cost / unit	total cost	Annual saving			Annual saving	Annual CO2 reduction	Lifetime of measure	Payback Period	Lifetime savings	Lifetime savings
	1/2/3			£	£	BAU	RES	Energy Saving	£	tnCO2	yrs	yrs	£	tnCO2
Lighting														
1	2	Replace T8 58w lamps with T5 Save - it - easy convertor kit	22.0	£23.7	£521.0	6229.0	2234.0	4195.6	£377.6	2.3	10.0	1.4	£3,776.0	22.5
2	2	Turn off Atrium lighting during daylight hours	N/A	£0.0	£0.0	2448.0	2448.0	2448.0	£220.3	1.3	10.0	0.0	£2,203.2	13.1
3	2	Replace 20w Halogen Bulbs with 4 Watt LED equivalent	247.0	£7.5	£1,852.5	24886.0	19975.6	4910.4	£441.9	2.6	10.0	4.2	£4,419.4	26.4
4	2	Exchange all Tri-Phosphor (old style) ligt bulbs in student accommodation and hotel rooms with CFL energy saving, A rated 7w bulbs	84.0	£2.0	£167.2	7257.6	6007.7	1249.9	£112.5	0.7	5.0	0.0	£562.5	3.4
		Totals			£5,415.6				£1,556.5	9.3			£15,002.6	89.5

Environmental Management

No.	Name	Benefits	Implementation options	Costs
1	Set up a small 'Green' team responsible for implementing the recommendations in this report. There is support for this through the Greener Workplace Survey.	Recommendations have ownership and are more likely to be implemented.	There should be an incentive for being part of the new team, for example, and extra day annual leave. The team should meet regularly and formally report to senior management. Five staff indicated interest in joining a Green Team in the greener workplaces survey.	Dependant on incentives.
2	As part of the refurbishment work due to take place, implement the changes recommended in the Carbon Trust Survey (19.04.10)	The carbon trust survey suggests that there could be significant annual cost (£28k) and carbon (204tn co2(e)) savings should all the recommendations be implemented.	The recommendations from the carbon trust are focused on replacement of lighting fittings, boiler plant, air conditioning equipment and the introduction of renewable technologies all of which could be partly funded by applying for a Carbon Trust Loan: www.carbontrust.co.uk/loans www.carbontrust.co.uk/loancalculator 0800 917 3030	See full report - implementing all measures = £41k capital.
3	Join the Mayor of London's Green Procurement Code to help improve and measure efforts at greening procurement of supplies and services.	General environmental improvement through procurement and a method for monitoring performance.	http://www.greenprocurementcode.co.uk/	£0, unless certification / audit sought.
4	Install water hippos in older toilet cisterns	Reduced water by up to one litre per cistern.	Brick, full bottle of water, Thames water hippo, anything that is solid, will not dissolve, and will displace water fitting into the cistern.	Free
5	Set a policy for the Atrium that the lights are not to be turned on during daylight hours	The full savings are included in the technical recommendations section 3 above but this could save significant energy consumption and also cost as the electricity cost for the day time is much higher than during the night. The natural light provided to the atrium is more than adequate for the area use (1000lux or more at various times of the day)	A policy should be agreed and set with staff that the lights in the atrium are not switched on during daylight hours through the year.	Free

No.	Name	Benefits	Implementation options	Costs
6	Change power settings on PCs to put monitors and PCs on standby quicker.	Staff can reduce the time from leaving a monitor to it going onto standby from 20minutes saving energy	Internal ICT support staff, or provide staff with guidance via email on how to do it themselves.	Free
7	Introduce instructions on how to use the Heating, Ventilation and Air Conditioning (HVAC) units.	Providing instructions on how to use the equipment for conference centre users and staff a like, suggesting a suitable temperature setting will reduce over use and could save up to 10% electricity consumption annually.	Signage around the control panels can easily be downloaded from the Carbon Trust website: http://www.carbontrust.co.uk/publications/pages/publicationdetail.aspx?id=PFL313	Free
8	Implement a staff behaviour change campaign. Specific actions to be based on implementing the recommendations in this report and the findings of the greener workplaces survey and could include: * Removing deskbins * Ensuring waste is separated for recycling and correctly stored *Providing information on performance *Monitoring the space temperature policy	Additional 5-10% CO2 reduction to the technical recommendations in section 3 of this report.	See preferred communication methods stated in greener workplaces survey. Also consider induction and other regular training / communication opportunities.	Low
9	Consider a Carbon Trust interest-free loan for SMEs to provide the funding for the invest-to-save measures listed in the technical recommendations.	Provides the funding to pay for the implementation of energy efficiency technology.	www.carbontrust.co.uk/loans www.carbontrust.co.uk/loancalculator 0800 917 3030	Interest free but must be paid back
10	Install radiator reflectors	Up to 60% of the heat provided by the radiator is lost through the wall. Installing these is cheap and they are easy to fit.	The on-site maintenance team will be able to fit this quickly and easily on all radiators in shared areas and particularly in the shared areas and conference centres.	Low: £10 for 5m x 5m
11	Increase provision and improve signage for recycling points in student accommodation.	Increased recycling and reduced general waste collections (which are more expensive) possibly generating a cost saving	Signage can be downloaded from Waste and Resources Programme website: www.wrap.org.uk and installed at bins sites and in student's rooms.	Free

No.	Name	Benefits	Implementation options	Costs
12	Take advantage of the free TFL enterprise services for organisation travel planning. Draft report has already been produced on behalf of MIC and includes recommendations such as: * Increase staff and student cycling through provision of changing facilities, storage facilities and training.	Staff commuting is a relatively small proportion of MIC's carbon footprint but improvements could be made. This could reduce carbon emissions and increase staff awareness.	See Enterprise Staff Travel Plan	Free
13	Re-use any unwanted furniture	This could be a cheap disposal option for any furniture which is not required as part of the planned refurbishment work.	Restore community re-use company will collect for free where the furniture is in a decent condition	Free
14	Re-introduce a sustainable food procurement policy for the restaurant.	Reputational benefits in providing, local, Fair Trade, Organic and certified fish (MSC) and meat.	A Guide to procuring healthy and sustainable food is available via the Camden Council website: www.camden.gov.uk/food	Low
15	Display information about environmental measures, improvements and practices.	Reputational benefits.	MIC already demonstrates good practices and should let clients, customers and guests know what measures are in place through posters and also including MIC's environmental policy in the hotel guest's welcome pack.	Free
16	Setting a space temperature policy	Introducing a space temperature policy can deliver co2 savings	70% of staff in the Greener Workplace Survey said they would be very supportive or supportive of a space temperature policy. This will need to be implemented through engagement with senior management and agreed. Seasonal temperatures will need to be agreed and set and this may not be appropriate for the hotel rooms.	Free
17	Re-introduce the staff garden area to include herbs and salad leaves which can be used in the on site catering facilities.	Staff engagement and reputational benefits in producing some herbs for use in the kitchen on site. This will also reduce air miles related to procuring herbs.	There is already an existing herb garden which as fallen into disuse. This could be a project for the Green Team to re-invigorate.	Low
18	Install internal draught proofing onto windows, like that already used on the windows and doors in the dining area in the atrium	This can typically save 10 - 30% on energy requirements which could deliver a noticeable carbon and cost saving	A guide to choosing the right type of draught proofing can be found on the Carbon Trust website: http://www.carbontrust.co.uk/Publications/pages/publicationdetail.aspx?id=CTL063 Installing the draught proofing measures could be undertaken by the in house maintenance team.	Low (£150 - £200)

9.3 Carbon Trust Survey

Priority:	Recommendations	Estimated annual savings			Estimated cost (£)	Payback period (years)	Calculations & assumptions
		(£)	CO_2 (tonnes)	(kWh)			
1	Awareness Campaign	5,247	38.3	104,368	500	<1	5% of Gas = 51,472 kWh / £1,544 / 9.5 tCO2 5% of Elec. = 52,896 kWh / £3,703 / 28.8 tCO2 Costs are assumed to be around £500 in staff time and materials
1	Metering and Monitoring	5,247	38.3	104,368	1,000	<1	5% of Gas = 51,472 kWh / £1,544 / 9.5 tCO2 5% of Elec. = 52,896 kWh / £3,703 / 28.8 tCO2 Costs are assumed to be around £1000 in staff time and materials
2	Lighting Replacement	3,576	27.8	51,088	12,800	3.6	Replace T8 luminaires with LED equivalents. Total number of fittings = 120 @ £100 per fitting Initial consumption (120 x 95 circuit watts) x 8,760 hours = 99,864 kWh. If PIR's are fitted then it is assumed that working hours will be reduced by 20%. Cost is assumed to be 20 * £40 = £800 Reduced consumption = 120 x 58W x 7,008 hours = 48,776 kWh Saving is 51,088 kWh
2	Add variable speed drives to pumps and ventilation fans	991	7.7	14,154	1,009	1.0	Approximately 2 pumps with a rating of 3kW (estimated) operating for 3,500 hours per year See measure for online calculation
2	Voltage Optimisation	3,703	28.8	52,896	15,000	4.0	Typical savings of 5% on total electricity spend. 5% of Elec. = 52,896 kWh / £3,703 / 28.8 tCO2

Priority:	Recommendations	Estimated annual savings			Estimated cost (£)	Payback period (years)	Calculations & assumptions
		(£)	CO_2 (tonnes)	(kWh)			
2	Replace air conditioning with evaporative cooling plant	5,662	44.0	80,880	0	0	At this stage an 80% reduction on current cooling load is assumed: TFA of building is approximately 3,033 m2 Say 60% of this is comfort cooled i.e. 2,022 m2 A small hotel would consume 50kWh / m2 per year for a/c =101,100 kWh p.a. 80% saving is 80,880 kWh. Cost is assumed to be part of general maintenance
1	Replacement of gas boilers	2,779	17.0	92,649	0	0	About 75% of total gas use is likely to be due to space heating as opposed to hot water. Modern boilers are likely to be about 12% more efficient than older ones, the saving is likely to be greater than this in practice due to other consequential improvements. 12% of 772,075 is 92,649 kWh p.a. Cost is assumed to be part of general maintenance
2	Solar PV	1,258	1.6	2,918	11,000	8.7	The estimated yield from the panels is 2,918 kWh per year. The power generated offsets imported power at 7p per kWh, and attracts a feed in tariff of 36.1p per kWh. Therefore for every kWh generated the benefit is 43.1p. 2,918 * £0.431 = £1,258 per year
TOTAL	**–**	**28,463**	**204**	**503,321**	**41,309**	**1.4**	**–**