THE UNIVERSITY of EDINBURGH

Edinburgh Research Explorer

The governance of innovation in socio-technical systems: the difficulties of strategic niche management in practice

Citation for published version:
Lovell, H 2007, 'The governance of innovation in socio-technical systems: the difficulties of strategic niche management in practice', *Science and Public Policy*, vol. 34, no. 1, pp. 35-44.
https://doi.org/10.3152/030234207X190540

Digital Object Identifier (DOI):
10.3152/030234207X190540

Link:
Link to publication record in Edinburgh Research Explorer

Document Version:
Peer reviewed version

Published In:
Science and Public Policy

Publisher Rights Statement:
The final version was published in Science and Public Policy (2007)

General rights
Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy
The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.

OPEN ACCESS

Download date: 17. Aug. 2022

The governance of innovation in socio-technical systems: the difficulties of strategic niche management in practice

Heather Lovell

School of Geosciences
University of Edinburgh
Drummond Street
Edinburgh, UK
EH8 9XP

This is the author's final draft as submitted for publication. The final version was published in Science and Public Policy by Oxford University Press (2007)

Cite As: Lovell, H 2007, 'The governance of innovation in socio-technical systems: the difficulties of strategic niche management in practice' *Science and Public Policy*, vol 34, pp. 35-44.

DOI: 10.3152/030234207X190540

Made available online through Edinburgh Research Explorer

The governance of innovation in socio-technical systems: the difficulties of strategic niche management in practice

Heather Lovell

Abstract

Strategic niche management concerns how governments can foster the introduction of new technologies, initially through establishing experiments within protected niches. The development of UK low energy housing illustrates some limitations of this model of technology change. Low energy housing niches built during the 1990s have not been driven by government policy, but rather have been initiated by entrepreneurial individuals working outside of government. However, the government has recently become interested in low energy housing niches because of growing concerns about climate change. Several policies and initiatives drawing on the niches have emerged but they do not amount to a coherent niche strategy.

Keywords

Strategic niche management; low energy housing; climate change; socio-technical system change.

Introduction

With the rise of environmental problems the focus of technology policy debate has shifted to consider how governments can catalyse fundamental system-wide change so whole sectors become more environmentally sustainable (Kemp 1994; Berkhout 2002; Smith 2003). In other words, there has been a shift away from a focus on encouraging discrete clean technologies to how to create opportunities for green socio-technical systems. Strategic niche management is one of the models proposed to illustrate how governments can achieve significant, widespread technology change within well-established socio-technical systems (Kemp 1994; Schot, Hoogma et al. 1994; Kemp, Schot et al. 1998; Rip and Kemp 1998; Smith 2003; Weber 2003). It is based on the observation that new radical ideas and technologies tend to develop initially on a small-scale within protected niches and then gradually disseminate. In essence, strategic niche management concerns how governments can help initiate experiments within protected small-scale niches and then encourage these innovations to spread through the introduction of new supportive policies and regulations (Rip and Kemp 1998).

However, the case of low energy housing in the UK highlights some limitations of the managed, staged model of technology change implicit within strategic niche management. Low energy housing niches in the UK have largely been developed by entrepreneurial individuals with strong green values working in non-governmental organisations (Lovell 2004; 2005). In other words, the niches are not the product of a coherent strategy by the government for achieving environmental sustainability in the housing sector. Nevertheless, there is an emerging interest within government in low energy housing niches, driven largely by the problem of climate change. Dwellings account for a third of the UK's final energy

consumption, and the UK government is relying on the residential sector to achieve a quarter of the necessary Kyoto Protocol greenhouse gas emission reductions by 2010 (DTI 2003b). Many of the experimental low energy housing niches developed in the UK during the 1990s require only a small fraction of the energy of conventional homes. This has been achieved through a mix of passive low energy design, a well-insulated energy efficient building structure, and the use of renewable energy technologies (BRECSU 1996; Olivier and Willoughby 1996; BRECSU 2003). Since the turn of the century the government has made several new commitments to mitigate climate change (see for example Beckett 2003; Blair 2003; DTI 2003b; UK Government 2005), not least the ambitious long-term goal of a sixty percent reduction in carbon emissions by 2050 (DTI 2003b). Government involvement in low energy housing niches has taken the form of trying to associate itself with certain high-profile niches, as well as the development of new policies and programmes aimed at creating more niches, and 'mainstreaming' lessons from existing ones. Thus a series of niche-based policies and initiatives have emerged within government, but the situation is much more chaotic, piecemeal and political than the model of strategic niche management currently proposed (see Kemp, Schot et al. 1998; Weber 2003; Wiskerke 2003).

The paper aims to explore some of the tensions with the concept of strategic niche management, drawing on research on low energy housing niches within the UK. It is based on the findings of a three-year doctoral research project examining the production and consumption of low energy housing. Semi-structured interviews have been conducted with over seventy experts involved in low energy housing from a range of housing tenures (social, private and self build), non-governmental organisations and government. Detailed qualitative case studies of a number of low energy housing developments were also conducted in order to explore in-depth questions regarding why low energy housing has been built.

The paper is structured as follows. First, theories about socio-technical system change and strategic niche management are discussed. Second, UK low energy housing niches are introduced and the relationship between the government and these existing niches is explored. In the third section of the paper the relationship between UK low energy housing policies and niches is discussed. Government has tried to disseminate or 'mainstream' innovations used in existing low energy housing niches to the wider housing sector, and funding has also been directed at creating new low energy housing niches. But it is argued that caution is needed before interpreting these actions as evidence of a coherent niche strategy. Government interest in niches has in large part been driven by the limitations imposed on it by the privatisation and liberalisation of the housing and energy sectors in the UK, thus making it difficult to effect radical system-wide change. In conclusion, suggestions are made about how to broaden the idea of strategic niche management to incorporate some of the critical issues raised by the case of low energy housing, such as greater consideration of the complex politics of technology change.

Socio-technical systems and strategic niche management

Socio-technical systems such as energy and housing[1] are slow to change (Hughes 1983; Rip and Kemp 1998; Geels 2004). This is because such systems, or regimes, comprise "… [a]

[1] It is suggested that the UK housing sector is a type of socio-technical system. It comprises a ubiquitous durable material infrastructure comprising standardised technologies, and has a well-established set of social institutions governing the system including surveyors, planners, and housebuilders. Housing thus displays similar features to other socio-technical systems described in the literature including energy, water, transport and telecommunications (Hughes 1983; Davies 1996; Chatzis 1999; Tarr 1999; Weber 2003).

rule-set or grammar… embedded in institutions and infrastructures." (Rip and Kemp 1998: 338). Well-established, durable institutions and infrastructures favour stability, and thus there is a tendency for socio-technical systems to alter mainly through incremental or conservative innovations, a characteristic variously described as: 'momentum' (Hughes 1983; Davies 1996), 'path dependency' (Phillimore 2001), 'technological lock-in' (Schot, Hoogma et al. 1994; Unruh 2002), 'entrapment' (Walker 2000), 'continuity' (Dosi 1982), and the favouring of 'drop in' innovations (Kemp 1994). The difficulty for governments in trying to effect socio-technical system change, therefore, is in overcoming system momentum. Strategic niche management provides a framework for how governments can help new radical innovations develop and expand from a base of protected experiments, or innovation niches (Kemp 1994; Schot, Hoogma et al. 1994; Schot and Rip 1996; Kemp, Schot et al. 1998). Strategic niche management is thus defined as:

"… the orchestration of the development and introduction of new technologies through setting up a series of experimental settings (niches) in which actors learn about… design, user needs, [and] cultural and political acceptability…"
(Schot 1992: 261).

The need for a staged approach to niche management is stressed, including a long-term strategy about how innovations will diffuse from the niche to the wider socio-technical system (Schot, Hoogma et al. 1994). Although it is acknowledged that niches will fail if it is only government taking responsibility for them (ibid. 1994) and that a multi-actor approach is required (Rip and Kemp 1998), government is still seen as the main actor involved in the management of niches. In general terms the role of government in strategically managing socio-technical change is portrayed as largely unproblematic and apolitical (see for example Kemp 1994; Rip and Kemp 1998; Weber 2003; Wiskerke 2003). It is a normative, prescriptive approach, and it is perhaps no coincidence that few examples of strategic niche management are discussed in the literature, as in practice such well-planned, long-term management is rare. For instance, one case study - the role of the Californian Government in promoting electric vehicles - has been examined by a number of authors (see Kemp 1994; Schot, Hoogma et al. 1994; Schot and Rip 1996; Rip and Kemp 1998). Further, it is assumed that governments are able to make strategic decisions about system change; that they have the power and political will to do so (Schot, Hoogma et al. 1994). Smith (2003) rightly questions this assumption, suggesting that because governments tend to be deeply embedded within socio-technical systems they face difficulties in bringing about radical changes, and policies are therefore typically aimed at encouraging incremental or conservative innovations. The findings from research into low energy housing in the UK similarly highlight the ad hoc, unstrategic and political nature of socio-technical change in practice.

UK low energy housing niches

A number of low energy housing demonstration projects, or innovation niches, have been built in the UK since the 1970s. As mentioned, they have emerged largely without government involvement. As such, they are not the product of strategic niche management, but the niches have subsequently influenced government policy, and the UK government has tried to associate itself with them. In other words, despite the government not being involved in the conception and initial development of these low energy housing niches, a number of them are now intimately bound up with low energy and sustainable housing policy and politics in the UK. It is therefore instructive to discuss these niches with reference to the idea of strategic niche management.

CHARACTERISTC	THE VALES'S AUTONOMOUS HOUSE	HOCKERTON HOUSING PROJECT	BEDZED
No. of dwellings	1	5	82
Date completed	1993	1998	2000
Type of building material	Timber frame & masonry	Concrete, earth sheltered	Masonry
Energy consumption (kWh/household/ year)	c.2,100	c.4,000	c.7,000
Project initiators	Robert & Brenda Vale (Architects)	Nick Martin (Builder)	Bill Dunster (Architect)
Housing tenure	Self-build (later private sale)	Self build (leasehold)	Private and social
Low energy features	Energy self-sufficient; Photovoltaic (PV) panels; Solar hot water; No central heating; Electricity grid connected; Passive solar conservatory; Low energy electrical appliances and light bulbs (CFLs).	No central heating; Small wind turbine; Photovoltaic (PV) panels; Heat pump for hot water; Earth-sheltered; passive solar design; 300mm polystyrene wall insulation; low E window glazing; Low energy electrical appliances and CFLs.	Passive solar design; no central heating; energy-efficient appliances; on-site combined heat and power station using local wood chips; 300mm wall insulation; low E window glazing; heat exchangers and passive ventilation.
References	(BRECSU 1996; White 2002)	(BRECSU 2000; Vale 2001; White 2002; Hockerton Housing Project 2003a)	(BRECSU 2002)

*estimated from an average annual energy bill at Millennium Green of £400 (Nash 2004 pers.comm.). UK average consumption for home built to the 1995 building regulations is 16,300kwH/household/a (BRECSU 1996).

Table One - Features of high-profile UK low energy housing niches

Sustainable housing activists first appeared in the early 1970s in the UK (The Ecologist 1972; Bhatti, Brooke et al. 1994; Barton 1998; Smith, Whitelegg et al. 1998; Chappells and Shove 2000), concurrent with an increased public awareness of environmental issues, and an upsurge in radical deep green environmentalism (Sandbach 1980; Weale 1992; Porter and Brown 1996; Dryzek 1997). Examples of environmentally sustainable housing developments from this period include the Centre for Alternative Technology in Wales and the Findhorn Ecovillage in Scotland (Centre for Alternative Technology 1995; Findhorn Ecovillage 2003). More recent low energy housing developments built during the 1990s are typically more socially mainstream and technology focused (Chappells and Shove 2000). Examples include the Hockerton Housing Project and the Vales's Autonomous House, both near Newark in the

East Midlands, and the BedZed development in south London. In these low energy housing developments dramatic decreases in energy consumption have been achieved, and a number of new technologies and construction methods have been experimented with (see Table One).

A common feature of the low energy housing niches is that they have been driven by entrepreneurial individuals and organisations, typically with strong green values (Vale and Vale 2000; Lowenstein 2001b; Vale 2001; Minton 2002). As mentioned, government has not been a key player within any of the project teams. BedZed, for example, is the outcome of a joint initiative between the architect Bill Dunster, the Peabody Trust (a Registered Social Landlord), and the environmental consultancy BioRegional Development Group (BRECSU 2002). Similarly, the Vales's built their Autonomous House in the absence of any significant public funding (Vale and Vale 2000). Thus the construction of low energy housing in the UK has been characterised by the development of discrete low energy housing projects, in most cases not explicitly driven by government policy (Olivier and Willoughby 1996; Pearson 1999; see Lowenstein 2001b; Vale 2001; Synge 2002). In other words, much of the low energy housing that exists in the UK has not been required by national regulations,[2] but rather the dwellings have been built as 'one-off' experimental projects, typically involving an entrepreneurial individual.

But it would be an oversimplification to characterise the government as wholly without influence. Government bodies have contributed grant funding in some instances, and in other cases local government has been supportive. For example, in the Newark and Sherwood District Council area, where Hockerton and the Vales's Autonomous House are located, there is an enthusiastic energy manager within the local authority who has supported and encouraged the low energy housing developments through making connections between key people and helping to develop local low energy policies (Energy Saving Trust 2004; Lovell 2005). Further, Sutton Borough Local Council, where BedZed is situated, has a strong environmental policy, and crucially was willing to set a precedent in selling the building land to the BedZed team despite them not bidding the highest price, because of the extra environmental and social benefits BedZed would bring (BRECSU 2002).

A recent trend has been for national government to try to associate itself with high-profile low energy housing niches such as the Hockerton and BedZed housing developments. BedZed, for example, has been presented as a case study in several government reports, and new low energy government policies and programmes have been launched there (BRECSU 2002; DTI 2002; DTI, ODPM et al. 2003; The Stationery Office 2003; Watts 2003; The Housing Corporation 2004). In this way certain low energy housing niches have become a key part of government discourse about sustainable and low energy housing (Lovell 2004). For example, the authors of a government-commissioned report about BedZed stress how the development represents:

> "… a powerful argument for the feasibility of a zero-carbon target for all new build." (BRECSU 2002: 11).

There are a number of reasons why the UK government has adopted the approach of associating itself with existing low energy housing niches. In particular, a relatively radical policy discourse has emerged from within government about climate change. Climate change

[2] With the exception of the UK social housing sector where higher environmental sustainability regulations are in place for all new publicly funded social housing (see The Housing Corporation 2003).

is now viewed as the most critical environmental issue facing the country (see for example Beckett 2003). In the 2003 Energy White Paper the government first committed to a long-term goal of a sixty percent reduction in carbon emissions by the year 2050 (DTI 2003b). The government has also taken an international lead on the issue of climate change: it has been a strong proponent of the Kyoto Protocol, and has attempted to influence other countries, most notably the United States, to take similar action (Blair 2005; UK Government 2005). But it has been criticised for engaging in rhetoric about climate change, and failing to take appropriate action (RCEP 2000; Sustainable Development Commission 2003; House of Lords Science and Technology Committee 2005). Although UK greenhouse gas emissions have fallen overall by fourteen percent since 1990, energy consumption continues to rise, and in 2003 carbon dioxide emissions also rose for the first time since 1990 by two percent (DEFRA 2004). The government has recently admitted it will not meet its goal of reducing carbon dioxide emissions by twenty percent from 1990 levels by the year 2010 (DEFRA 2006). What is therefore particularly attractive about existing low energy housing niches is that they provide examples of 'ready-made' solutions to climate change that help the government to communicate its aims, and that it can use to show that progress is happening (Lovell 2004). In other words, the low energy housing niches lend credibility to the government's radical climate change discourse. Thus, for instance, in a government-sponsored case study of the successful energy policies and programmes within the Newark and Sherwood District Council, one of the lessons learnt is that:

"exemplar projects bring to life the reality far greater than shelves of strategies."
(Energy Saving Trust 2004: 10).

Interestingly, the niches have been used most commonly not for the purpose of conveying technical information about low energy housing, but rather to demonstrate its social and political feasibility. For example, in a government report examining four low energy housing niches, it is explained in the introduction how:

"These case studies demonstrate the successful integration of renewable energy into new housing projects... [they] should offer *reassurance* and *inspiration* to building designers, consultants and anyone involved in the specification and design of dwellings."
(BRECSU 2003: 1, emphasis added).

Thus although the report is ostensibly technical – it was written and produced by a UK building industry consultancy the Building Research Establishment – it lacks detailed analysis of the performance of the housing developments, including information about any problems with the housing. One or two contentious issues are raised, such as contractors lacking confidence and experience in installing renewable energy technologies (BRECSU 2003: 5), but nothing substantial. The overall tone equates to that of a marketing brochure: the existing housing developments are being promoted as best practice case studies to building industry professionals to encourage them to take similar action.

Low energy housing niches and UK government policy

In this section it is discussed how the UK government has used low energy housing niches to help develop new policies aimed at 'mainstreaming' low energy housing. The situation therefore bears some parallels with the concept of strategic niche management. But caution is needed in interpreting the government's actions as part of a coherent niche management *strategy*: its interest in niches has been largely driven by political necessity, and learning

from niches has been messy and partial. It is suggested that the planned, goal-orientated model of strategic niche management tends to distract attention from the diversity of ways that niches might emerge and be used by governments.

As discussed, the UK government has associated itself with existing niches, but it has also developed a number of grant programmes aimed at creating new low energy housing niches (see Table Two). Further, some of the social and technical innovations demonstrated within existing niches have been incorporated into new government policies and regulations, thus indicating some upscaling or dissemination of ideas from niches. A number of ideas and technologies from low energy housing niches have disseminated into new government climate change policies and programmes aimed at the residential sector. The Government commissioned detailed reports to assess Hockerton, the Vales's Autonomous House, and BedZed (BRECSU 1996; BRECSU 2000; BRECSU 2002). Findings from these reports have, for instance, informed discussions about changes to the energy building regulations (see ODPM 2000; 2003; 2004). New policies have also been forthcoming at a local level, based on the experience of certain low energy housing niches. Newark and Sherwood District Council developed Supplementary Planning Guidance on wind energy in direct response to problems at Hockerton regarding the installation of a wind turbine (Hockerton Housing Project 2003b). In addition, experience with the BedZed low energy housing development has subsequently helped inform the Unitary Development Plan produced by Merton Borough Council – the neighbouring local authority – which now requires new developments over a certain size to source ten percent of their energy from renewable resources (Forum for the Future 2004). A policy discourse has emerged in the UK low energy and environmentally sustainable housing sector about 'mainstreaming' ideas from existing niches into wider housing policies and practice (see for example Clark 2000; Lowenstein 2001a; TCPA and WWF 2003). In effect the term 'mainstreaming' has been adopted to describe the process of translating radical innovations that have been experimented with in niches into policies aimed at encouraging more conservative, incremental change. Mainstreaming low energy housing is viewed as positive by a range of government actors, for example those promoting sustainability in social housing:

"Well our main objective really now is to try and mainstream sustainable housing within the social housing sector…"
(Interview, Project manager at a Government-sponsored organisation promoting environmental sustainability in social housing, July 2002).

An important national government sustainable and low energy housing policy is the EcoHomes environmental rating scheme, in operation since the year 2000 (ENDS 2000). Points are awarded to new housing developments across a range of sustainability issues, from individual building characteristics such as energy efficiency, to development-scale features including local transport links and biodiversity (BRE 2001). To date, approximately one hundred developments in the UK have an EcoHomes award, amounting to some three and a half thousand dwellings (ENDS 2003). Since April 2003, it has become mandatory for Registered Social Landlords in England and Wales to obtain an EcoHomes 'Pass' rating for new publicly-funded developments (The Housing Corporation 2003). In addition, some public sector bodies in the UK have used EcoHomes as a way of ensuring a minimum standard of environmental sustainability for new developments on land they own. Most notably English Partnerships, the English regeneration agency, requires an EcoHomes 'Very Good' rating (ENDS 2003). What is notable about EcoHomes is how it involves a staged approach to achieving a more environmentally sustainable housing sector in the UK: there

are four levels of award, ranging from pass to excellent. The emphasis of EcoHomes is hence on a gradual transition to the high standard already obtained by niche developments. EcoHomes thus fits with a key principle of strategic niche management regarding the managed dissemination and translation of innovations from niches to the mainstream (Kemp 1994; Rip and Kemp 1998). For example, the Head of Sustainability at the Housing Corporation (the social housing regulator in England and Wales), explains why they decided to select EcoHomes as the rating scheme for Registered Social Landlords, describing it as way of gradually obtaining the kind of standard achieved by BedZed:

> "EcoHomes is reviewed every couple of years to improve its standard, so it's a process of continuous improvement. *Now if we suddenly said to everyone you've got to build to the BedZed standard, the industry would go haywire because they would have no idea how to do it*…. Our way…it will give the social housing industry time to influence their suppliers and their contacts to build to that [BedZed] standard."
> (Interview, Sustainability Manager at the Housing Corporation, May 2003, emphasis added).

As well as drawing lessons from existing niches, the government has also provided funding for the development of new innovation niches, typically through competition for grants supporting low energy projects (see Table Two). The government's new Low Carbon Buildings Programme, for example, aims to "demonstrate on a wider scale emerging micro generation technologies…" and "to raise awareness by linking demonstration projects to a wider programme of activities…" (Low Carbon Buildings Programme 2006). Eighty million pounds is available for the programme, with funding streams directed at individual householders and community groups, as well as public buildings and businesses (ibid. 2006).

Name of grant/programme	**Date**	**Details**
Community Renewables Initiative	2002-present day	Local communities bid for funding for renewable energy projects. Funding from DTI. (see The Countryside Agency 2004)
Clear Skies	2003-2005	Capital grants for household and community renewable projects (see BRE 2003)
Solar PV Programme	2002-2005	£20 million budget was available. Stream one of funding designed for home owners and small businesses, Stream Two for community bids (and large public buildings, businesses etc.) (see DTI 2003a)
Community Energy Programme (CHP)	2002-2007	For combined heat and power and district heating technologies only. (see Energy Saving Trust and The Carbon Trust 2001)
Scottish Community and Householder Renewables Initiative (SCHRI).	2002-present day	Offers funding to householders and community groups for installing renewable energy technologies in Scotland. (see Energy Saving Trust 2006)
DTI's Low Carbon Buildings Programme	2006	Designed to replace Clear Skies and the PV demonstration programme. Minimum energy

(LCBP).		efficiency measures must be undertaken in order to qualify for a renewable energy grant – aims at a more holistic low energy approach than previous government programmes. (see Low Carbon Buildings Programme 2006)
Millennium Communities Programme	1997-present day	Seven communities are being developed as examples of housing best practice – including environmental sustainability, e.g. the Greenwich Millennium Village. (see English Partnerships 2003).

Table Two – UK government grants and programmes promoting the development of new low energy housing niches

However, despite the indications that government is engaging with the idea of niches in a more strategic way, albeit rather belatedly, key aspects of the government's approach raise question whether these shifts can be conceptualised as part of a well-planned strategy. The situation is more chaotic and political than it first appears, driven in large part by the limits set on government by privatisation of the housing and energy sectors. The UK government's policy-making capacity has been significantly eroded through the gradual privatisation and liberalisation of the energy and housing sectors since the 1980s (Whitehead 1993; Ernst 1994; Flavin and Lenssen 1994; Webb 2001). It increasingly lacks the necessary resources and political power to implement sector-wide policies designed to achieve radical change in response to problems such as climate change, and niches are seen as a relatively uncontroversial and more productive way of introducing new technologies. Niches are therefore likely to become an increasingly important element of policy making in the housing and energy sectors in the future, simply because government's capacity to effect macro-level system change has been eroded. However, this trend is not a shift towards strategic niche management, in the sense that it is not part of a conscious, well-planned *strategy* by government. It is more accurately viewed as a type of policy approach that is available to government from a much narrower range of governance options post-privatisation. For example, Unruh's (2002) research on climate change mitigation leads him to conclude that niches might appeal to governments more for political than technical reasons, as he explains:

> "For policy makers constrained by [technological] lock-in, but still seeking to provide incentives for carbon saving alternatives, niches become an attractive policy target." (Unruh 2002: 322).

Thus, according to Unruh, change can be achieved more easily within niches without threatening existing interests. Privatisation also means that agreement is needed from a range of actors in order successfully to proceed with policy change (Berkhout 2002), and, as Winner makes clear, such a situation is rare in contemporary socio-technical systems:

> "In the complex, large scale systems that characterise our time, it is seldom the case that any single individual or group has access to a technological process along the whole of its conception, operation, and result."
> (Winner 1977: 228).

Privatisation has thus had the effect of dispersing power from government. In so doing, it creates difficulties for the governance of radical technology change within socio-technical systems because there is no single actor with the resources to manage long-term fundamental change. In effect, with privatisation government is more deeply embedded within existing socio-technical systems, and it therefore becomes more difficult for policy makers to visualise and effect change; their policy capacity is reduced. Thus, for instance, recent government policies designed to 'mainstream' environmentally sustainable and low energy housing have been criticised for being weak, in particular the changes to the energy building regulations in England and Wales (Part L) and the EcoHomes sustainability rating scheme. Part L of the building regulations covers heating and energy use in the home. New more stringent regulations came into force on the 6th April 2006, which the government claims will yield reductions in carbon emissions of twenty percent compared with a dwelling built to the 2002 standards (ODPM 2005b; ODPM 2005a). But the government has been criticised for not following through on certain promises made with regard to increasing the stringency of Part L. For example, experts have suggested that the regulations were toned down because of heavy lobbying from the construction industry (Renew On-line 2006). It does appear that certain key measures were dropped at the last minute, including those relating to improvement of the existing housing stock (RICS 2006). Other concerns have been raised about the lack of a long term framework for change over next fifteen years, and the lack of enforcement of Part L (House of Lords Science and Technology Committee 2005).

The EcoHomes rating scheme for housing, discussed above, has also been criticised on the grounds that it does not go far enough in encouraging the development of environmentally sustainable housing. For example, it has been suggested that it offers too much flexibility and that minimum standards are needed for certain key areas such as water and energy efficiency (Sustainable Development Commission 2006: 4). Other criticisms include that post-construction reviews are rare, raising concerns about non-compliance, and that the way EcoHomes points are awarded is inconsistent, for example no points are awarded for building with high thermal mass (Priaulx 2004).

Another issue that indicates that the government's interest in low energy housing niches might be somewhat superficial is the lack of a process for objective, independent learning from niches. As discussed previously, existing low energy housing niches have been portrayed in a very positive light in government reports, with little technical analysis. Indeed, there is little sense from an analysis of government policy discourse about low energy housing that the niches are primarily seen as technical experiments (Lovell 2004). Thus, although it is acknowledged in the literature on strategic niche management that niches are for social as well as technical learning, in these instances any technical learning has been eclipsed by the political promotion of the niches as examples for others to follow. For example, in a government-commissioned report on the BedZed housing development in south London (BRECSU 2002) there is no discussion of any problems that have troubled the development, such as its high financial cost (Clark and Smit 2004), technical problems with the on-site combined heat and power plant, or residents placing blinds over their passive solar conservatory windows (Bioregional 2003). Rather, the development is rather uncritically applauded as representing:

"… state-of-the-art for sustainable housing in the UK"
(BRECSU 2002: 3).

A government-commissioned report into the Hockerton Housing Project in the East Midlands similarly offers a positive summary of the development's features and performance (BRECSU 2000). Although some problems with the development are mentioned, such as condensation and damp in one house because the resident failed to use the ventilation system properly, and relatively low winter temperatures inside the homes (BRECSU 2000: 8), there is little sense that an independent, robust analysis has been conducted.

Summary and Conclusions

In summary, low energy housing niches in the UK have belatedly drawn the attention of government, and a series of niche-based policies and initiatives have emerged. Most of the existing low energy housing niches have been initiated and developed by non-governmental actors including architects, community groups and businesses. Government has been keen to associate itself with these existing niches in order to gain credibility for its climate change policies: the niches prove that action is being taken. A number of grant programmes has also been devised aimed at encouraging the development of new niches. Further, ideas and innovations from niches have been taken into account in the development of new government policies such as the Part L energy building regulations and the EcoHomes environmental rating scheme. However, it is argued that these actions do not amount to a co-ordinated and coherent niche management strategy on the part of government. It is suggested rather that niches are an attractive policy target compared with the political and organisational difficulties of implementing sector-wide change in the privatised housing and energy sectors.

In light of these findings, it is argued that the concept of strategic niche management needs to be broadened to take account of some of the issues raised. First, it is suggested that the literature on strategic niche management needs to pay more regard to the messiness of socio-technical system change. The case of low energy housing in the UK highlights some of the generic difficulties of governments being involved in niches in a well-planned, rational and ordered way. In practice the neat, staged model of strategic niche management has few real world examples that bear relation to it, and serves as a distraction from analysis of the variety of ways in which niches originate and are used by governments. Second, and relatedly, the politics of socio-technical system change need to be considered in more depth. There are reasons why policies to encourage niches might appeal to governments more than sector-wide regulatory changes, in particular because niches are less likely to threaten powerful interests embedded within the existing socio-technical system. Third, greater allowance needs to be made for non-governmental actors taking a lead role with regard to niche management at different stages of technology change. In the case of low energy housing, social and commercial organisations have been active in terms of the initial development of low energy housing experiments, rather than government. The model of strategic niche management could be further developed along interesting lines by concentrating more on the interplay between a wide range of different types of organisation in the process of governing socio-technical change, thereby acknowledging the often complex and diverse origins of niches.

References

Barton, H. 1998. Eco-neighbourhoods: a review of projects. *Local Environment* **3**(2), 159-177.

Beckett, M. 2003. *Secretary of State for the Environment - Speech to the Environment Agency National Conference*. Available at <www.defra.gov.uk/corporate/ministers/speeches/mb031028.htm>, last accessed 28th October 2003.

Berkhout, F. 2002. Technological regimes, path dependency and the environment. *Global Environmental Change* 12(1), 1-4.

Bhatti, M., J. Brooke, et al. 1994. Housing and the New Environmental Agenda: an Introduction. In *Housing and the environment: an Introduction*. eds. M. Bhatti, J. Brooke and M. Gibson. Southampton: Chartered Institute of Housing.

Bioregional 2003. *Technical Tour of BedZed Housing Development*. H.Lovell. Sutton, South London.

Blair, T. 2003. *'Concerted international effort' necessary to fight climate change*: 10 Downing Street - Prime Minister's speech on release of Energy White Paper. Available at <www.number-10.gov.uk>, last accessed 9th May 2003.

Blair, T. 2005. *Speech to the Confederation of British Industry Conference - 29th November 2005*: 10 Downing Street. Available at <http://www.number-10.gov.uk/output/Page8606.asp>, last accessed 3rd March 2006.

BRE 2001. *EcoHomes - The Environmental Rating for Homes*: Building Research Establishment. Available at <www.bre.co.uk/ecohomes>, last accessed 17th January 2003.

BRE 2003. *Clear Skies - Renewable Energy Grants*: Building Research Establishment (BRE), Department for Trade and Industry (DTI). Available at <www.clear-skies.org>, last accessed 21st May 2003.

BRECSU 1996. *General Information Report 53: Building a sustainable future - homes for an autonomous community*. Watford: Building Research Establishment (BRE), UK.

BRECSU 2000. *New Practice Profile 119: The Hockerton Housing Project - design lessons for developers and clients*. Watford, UK: Building Research Establishment (BRE).

BRECSU 2002. *General Information Report 89: BedZED - Beddington Zero Energy Development, Sutton*. Watford, UK: Building Research Establishment (BRE).

BRECSU 2003. *Renewable energy in housing - case studies*. Watford, UK: Building Research Establishment (BRE).

Centre for Alternative Technology 1995. *Crazy Idealists? The CAT story*. Machynlleth: The Centre for Alternative Technology.

Chappells, H. and E. Shove 2000. Sustainable Homes and Integration. In *Domestic Consumption Utility Services and the Environment (DOMUS)*. eds. H. Chappells, M. Klintman, A.-L. Lindenet al, pp.105-128. Wageningen: Universities of Lancaster, Wageningen and Lund.

Chatzis, K. 1999. Designing and operating storm water drain systems: empirical findings and conceptual developments. In *The Governance of Large Technical Systems*. eds. O. Coutard, pp.73-90. London & New York: Routledge.

Clark, M. 2000. Mainstreaming environmental innovation. *Town & Country Planning* July/August 2000, 218-221.

Clark, P. and J. Smit 2004. Dream Over. *Building*(10), 1-3.

Davies, A. 1996. Innovation in Large Technical Systems: The Case of Telecommunications. *Industrial and Corporate Change* **5**(4), 1143-1180.

DEFRA 2004. *Press release: Climate change emission statistics*: Department for Environment, Food and Rural Affairs. Available at <www.defra.gov.uk/news/latest/2004/emissionsstats_250304.htm>, last accessed 25th March 2004.

DEFRA 2006. *Climate Change: the UK Programme 2006*. London: Department for the Environment, Food and Rural Affairs (DEFRA), HMSO.

Dosi, G. 1982. Technological paradigms and technological trajectories: a suggested interpretation of the determinants and direction of technical change. *Research Policy* **11**, 147-162.

Dryzek, J. 1997. *The politics of the Earth: environmental discourses*. Oxford: Oxford University Press.

DTI 2002. First stage of major PV Demonstration Programme launched. *New Review* **52**, 1.

DTI 2003a. *DTI Major Photovoltaics (PV) Demonstration Programme*: Department for Trade and Industry. Available at <www.est.co.uk/solar>, last accessed 26th March 2003.

DTI 2003b. *Energy White Paper 'Our Energy Future - creating a low carbon economy'*. London: HMSO.

DTI, ODPM, et al. 2003. *Better Buildings Summit Issues Paper*. London: HMSO.

ENDS 2000. BRE revamps environmental rating scheme for housing. (Issue no.303), 8.

ENDS 2003. Demand grows for sustainable homes. (Issue no.343), 31-32.

Energy Saving Trust 2004. *Newark and Sherwood District Council case study: a guide for local authorities*. London: Energy Saving Trust for the Energy Efficiency Best Practice in Housing Programme.

Energy Saving Trust 2006. *Scottish Community and Householder Renewables Initiative*: Energy Saving Trust, The Scottish Executive. Available at <http://portal.est.org.uk/uploads/documents/myhome/guidancenotes_jan05.pdf>, last accessed 14th April 2006.

Energy Saving Trust and The Carbon Trust 2001. *Community Energy Programme*: DEFRA. Available at <www.communityenergy.org.uk>, last accessed 11th November 2003.

English Partnerships 2003. *Millennium Communities Programme*: English Partnerships. Available at <www.englishpartnerships.gov.uk>, last accessed 21st May 2003.

Ernst, J. 1994. *Whose Utility? The social impact of public utility privitisation and regulation in Britain*. Birmingham: Open University Press.

Findhorn Ecovillage 2003. *Findhorn - an Introduction*. Available at <http://www.ecovillagefindhorn.com/.>, last accessed 23rd April 2003.

Flavin, C. and N. Lenssen 1994. Reshaping the electric power industry. *Energy Policy* 22(12), 1029-1044.

Forum for the Future 2004. *Merton Borough Council - a radical planning decision to promote renewable energy*: Regional Futures. Available at <http://www.regionalfutures.org.uk/newsdigest/mertonboroughcouncil_page2181.aspx>, last accessed 24th August 2004.

Geels, F. W. 2004. *Technological Transitions and System Innovations: a co-evolutionary and socio-technical analysis*. Cheltenham, UK: Edward Elgar.

Hockerton Housing Project 2003a. *Hockerton Media Coverage*: Hockerton Housing Project. Available at <http://www.hockerton.demon.co.uk/media/index.html>, last accessed 23rd April 2003.

Hockerton Housing Project 2003b. *Wind Turbine Special News Story*: Hockerton Housing Project. Available at <www.hockerton.demon.co.uk/news/windturbine.html>, last accessed 19th March 2003.

House of Lords Science and Technology Committee 2005. *Energy Efficiency Report*: House of Lords Science and Technology Committee. Available at <http://www.publications.parliament.uk/pa/ld200506/ldselect/ldsctech/21/21i.pdf>, last accessed

Hughes, T. P. 1983. *Networks of Power: Electrification in Western Society 1880-1930*. Maryland: The John Hopkins University Press.

Kemp, R. 1994. Technology and the Transition to Environmental Sustainability. *Futures* **26**(10), 1023-1046.

Kemp, R., J. W. Schot, et al. 1998. Regime shifts to sustainability through processes of niche formation: the approach of Strategic Niche Management. *Technology Analysis and Strategic Management* **10**(2), 175-195.

Lovell, H. 2004. Framing sustainable housing as a solution to climate change. *Journal of Environmental Policy and Planning* 6(1), 35-56.

Lovell, H. 2005. *The governance of emerging socio-technical systems: the case of low energy housing in the UK*. Department of Geography. Cambridge: Cambridge University.

Low Carbon Buildings Programme 2006. *DTI Low Carbon Buildings Programme - Frequently asked questions*: Energy Saving Trust. Available at <http://www.est.org.uk/housingbuildings/funding/lowcarbonbuildings/faq/>, last accessed 22nd April 2006.

Lowenstein, O. 2001a. From BedZed to eternity. *Building for a Future* 11(3), 16-21.

Lowenstein, O. 2001b. Zero energy homes come to the United Kingdom. *Building for a Future* 11(3), 8-14.

Minton, A. 2002. Eco experiments. *Estates Gazette*, 62-63.

Nash, T. 2004. *Email correspondence - Managing Director of Gusto Construction*. H.Lovell. Newark.

ODPM 2000. *Current thinking on possible future amendments of energy efficiency provisions*: Office of the Deputy Prime Minister. Available at <http://www.odpm.gov.uk/stellent/groups/odpm_buildreg/documents/page/odpm_breg_600333.hcsp>, last accessed 23rd February 2005.

ODPM 2003. *Industry Advisory Group (Working Party 4) Low and Zero Carbon Energy Systems Meeting Minutes - 16th October 2003*: Office of the Deputy Prime Minister. Available at <www.odpm.gov.uk>, last accessed 25th April 2004.

ODPM 2004. *Proposals for amending Part L and implementing the EU Buildings Energy Directive*: Office of the Deputy Prime Minister. Available at <http://www.odpm.gov.uk/stellent/groups/odpm_buildreg/documents/>, last accessed 2nd December 2004.

ODPM 2005a. *Draft Approved Document: Part L - L1A Work in new dwellings (2006 edition)*: Office of the Deputy Prime Minister. Available at <http://www.odpm.gov.uk/stellent/groups/odpm_buildreg/documents/page/odpm_breg_040280.pdf>, last accessed 6th October 2005.

ODPM 2005b. *Press Release: Revised Building Regulations to tackle Climate Change*: Office of the Deputy Prime Minister (ODPM). Available at <http://www.odpm.gov.uk/pns/displaypn.cgi?pn_id=2005_0191>, last accessed 13 September 2005.

Olivier, D. and J. Willoughby 1996. *General Information Report no.38: Review of ultra-low-energy homes - a series of United Kingdom and overseas profiles*. Watford: Building Research Establishment.

Pearson, A. 1999. Green fingers. *Building*(22 October 1999), 30-31.

Phillimore, J. 2001. Schumpeter, Schumacher and the Greening of Technology. *Technology Analysis and Strategic Management* 13(1).

Porter, G. and J. W. Brown 1996. *Global Environmental Politics*. Boulder: Westview Press Inc.

Priaulx, M. 2004. EcoHomes. *Building for a Future* Spring 2004, 3-5.

RCEP 2000. *Energy - The Changing Climate, 22nd Report*. London: HMSO.

Renew On-line 2006. *Energy efficiency: mixed reviews*: Renew On-line (extracts from NATTA's journal Renew Issue 159 Jan-Feb 2006). Available at <http://eeru.open.ac.uk/natta/renewonline/rol59/9.htm>, last accessed 14th April 2006.

RICS 2006. *To Part L and back*: Royal Institute of Chartered Surveyors (RICS). Available at <http://www.rics.org/Property/biz_part_l_0406.htm>, last accessed 6th April 2006.

Rip, A. and R. Kemp 1998. Technological Change. In *Human Choices and Climate Change Volume 2 - Resources and Technology*. eds. S. Rayner and E. Malone, pp.327-399. Columbus Ohio: Battelle Press.

Sandbach, F. 1980. *Environment, Ideology and Policy*. Oxford: Basil Blackwell.

Schot, J. W. 1992. Constructive Technology Assessment and Technology Dynamics: the case of clean technology. *Science, Technology and Human Values* **17**(1), 36-56.

Schot, J. W., R. Hoogma, et al. 1994. Strategies for Shifting Technological Systems: the case of the automobile system. *Futures* 26(10), 1060-1076.

Schot, J. W. and A. Rip 1996. The Past and Future of Constructive Technology Assessment. *Technological Forecasting and Social Change* 54(2/3), 251-268.

Smith, A. 2003. Transforming Technological Regimes for Sustainable Development: a role for Alternative Technology niches? *Science and Public Policy* 30(2), 127-135.

Smith, M., J. Whitelegg, et al. 1998. *Greening the Built Environment*. London: Earthscan.

Sustainable Development Commission 2003. *Policy audit of United Kingdom Climate Change Policies and Programmes*. London: The Edinburgh Centre for Carbon Management Ltd.

Sustainable Development Commission 2006. *The Response of the Sustainable Development Commission to the Code for Sustainable Homes*: The UK Sustainable Development Commission. Available at <http://www.sd-commission.org.uk/publications/downloads/CSH-Response-060306.pdf>, last accessed 6th March 2006.

Synge, D. 2002. Welcome to the green living machine. *The Financial Times*, 6.

Tarr, J. A. 1999. Transforming an energy system: the evolution of the manufactured gas industry and the transition to natural gas in the United States (1807-1954). In *The Governance of Large Technical Systems*. eds. O. Coutard, pp.19-37. London: Routledge.

TCPA and WWF 2003. *Building sustainably: how to plan and construct new housing for the 21st Century*. London: Town and Country Planning Association (TCPA) & World Wide Fund for Nature (WWF).

The Countryside Agency 2004. *The Community Renewables Initiative*: The Countryside Agency. Available at <http://www.countryside.gov.uk/NewEnterprise/Economies/CRI.asp>, last accessed 1st January 2005.

The Ecologist 1972. *Blueprint for Survival*. London: The Ecologist Magazine.

The Housing Corporation 2003. *Sustainable Development Strategy*. London: The Housing Corporation.

The Housing Corporation 2004. *BedZed case study for Housing Associations*. Available at <http://www.housingcorp.gov.uk/resources/sustain.htm#tools>, last accessed 22nd October 2004.

The Stationery Office 2003. *The official yearbook of the United Kingdom of Great Britain and Northern Ireland.* London: HMSO.

UK Government 2005. *G8 Gleneagles 2005: Policy issues - climate change*: UK Government - Secretary of State for Foreign and Commonwealth Affairs. Available at <http://www.g8.gov.uk>, last accessed 29th January 2005.

Unruh, G. C. 2002. Escaping carbon lock-in. *Energy Policy* 30(4), 317-326.

Vale, B. and R. Vale 2000. *The New Autonomous House*. London: Thames & Hudson.

Vale, R. 2001. *Hockerton Housing Project - Case Study 7.7b*. Canberra: Australian Greenhouse Office, Institute for Sustainable Futures.

Walker, W. 2000. Entrapment in large technology systems: institutional commitment and power relations. *Research Policy* 29(7), 833-846.

Watts, C. 2003. Housing for the Future. *The Source Public Management Journal* 13th July 2002, 1-2.

Weale, A. 1992. *The new politics of pollution*. Manchester and New York: Manchester University Press.

Webb, S. 2001. Transforming Homes or Privatizing Social Housing? *Public Money and Management* October-December, 6-7.

Weber, K. M. 2003. Transforming Large Socio-technical Systems towards Sustainability: on the Role of Users and Future Visions for the Uptake of City Logistics and Combined Heat and Power Generation. *Innovation: the European Journal of Social Science Research* 16(2), 155-175.

White, N. 2002. *Sustainable Housing Schemes in the United Kingdom*. Hockerton: Hockerton Housing Project.

Whitehead, C. M. E. 1993. Privatizing Housing: An assessment of United Kingdom Experience. *Housing Policy Debate* 4(1), 101-139.

Winner, L. 1977. *Autonomous Technology: technics-out-of-control as a theme in political thought*. Cambridge: MIT Press.

Wiskerke, J. S. C. 2003. On promising niches and constraining sociotechnical regimes: the case of Dutch wheat and bread. *Environment and Planning A* 35, 429-448.