Personal Carbon Trading: Lessons from Complementary Currencies

by

Gill Seyfang

CSERGE Working Paper ECM 07-01

Personal Carbon Trading: Lessons from Complementary Currencies

by

Gill Seyfang

Centre for Social and Economic Research on the Global Environment (CSERGE),
School of Environmental Sciences, University of East Anglia,
Norwich, NR4 7TJ, United Kingdom

Author contact details:

Gill Seyfang
Tel: ++44 (0) 1603 592956
Fax: ++44 (0) 1603 593739
Email: g.seyfang@uea.ac.uk

Acknowledgements

This research was funded by the Economic and Social Research Council as part of CSERGE's Programme on Environmental Decision-Making. Thanks to Irene Lorenzoni, Jacquie Burgess and Mike Nye for discussions which led to some of the ideas in here, and for helpful comments on previous versions of the text. Any errors or omissions are the author's sole responsibility.

The support of the Economic and Social Research Council (ESRC) is gratefully acknowledged. This work was part of the interdisciplinary research programme of the ESRC Research Centre for Social and Economic Research on the Global Environment (CSERGE).

ISSN 0967-8875

Abstract

Efforts to mitigate climate change through managing carbon emissions are prompting new and imaginative policy proposals. One untested proposal to issue tradable carbon emission allowances (carbon currency) to all UK citizens, with the aim of limiting and reducing carbon emissions, is known as Personal Carbon Trading (PCT). The lack of empirical experience with PCT hinders its development, and so this paper makes a conceptual link with the field of complementary currencies (CCs) to explore similarities and derive lessons for success to aid the development and implementation of PCT. Experience with three models of CC is reviewed, to examine CCs with economic, social and environmental objectives (LETS, Time Banks and NU Spaarpas respectively) and a comparative analysis made with PCT. Five critical success factors emerge: policy context; social context and culture; technology and mechanisms; skills and capabilities; and harnessing collective action. Two key areas for future research and action into PCT are firstly, to identify the carbon literacy skills and culture which will be crucial to the success of PCT, and design a range of tools for boosting and measuring carbon literacy, and secondly to harness the energy and efforts of collective active citizenship to support the introduction and effective use of this new social infrastructure, the carbon currency. While much PCT literature approaches it as a utilitarian market system, this analysis suggests that PCT should instead be approached as a socially-embedded collective endeavour, as 'ecological citizenship' rather than 'ecological modernisation'.

Keywords: carbon reduction, complementary currencies, carbon trading, environmental governance, climate change

1. INTRODUCTION

"*Imagine a country where carbon becomes a new currency*."
(Miliband, 2006b)

The imperative to reduce emissions of carbon dioxide, and so mitigate the extent and cost of harmful impacts of climate change, faces governments, businesses and citizens across the developed world (Stern, 2007). Policy to reduce carbon dioxide emissions to address the threat of climate change has become ever more prominent over the last five years, and the UK government is committed to reducing the country's carbon emissions by 60% of its 1990 levels, by the year 2050 (DTI 2003, 2006; HM Government, 2006). Average per capita carbon emissions currently stand at 9.1 tonnes a year in the UK, compared to 19.7 tonnes in the USA and a global average of 4.0 tonnes (International Energy Agency, 2005). In contrast to this distribution of 'blame' for anthropogenic climate change, developing countries face the prospect of dealing with the lion's share of the impacts of global; warming, particularly sea level rise in low-lying countries (IPCC, 2007). In response, the 'Contraction and Convergence' model proposes that the world reduce (contract) its overall carbon dioxide emissions towards a stabilised atmospheric concentration of 450 parts per million by volume of carbon dioxide by 2100, and simultaneously move toward a globally equal per capita distribution of carbon emissions (convergence) (Meyer, 2000). For developed countries, this requires a drastic reduction of per capita emissions of 60-90%, allowing those of developing countries to rise and converge on a figure of around 5 tonnes per year per person (RSA, 2007). In the developed nations, therefore, policy is concerned with efforts to manage carbon emissions downwards, and so mitigate climate change.

Current regulatory efforts for mitigating climate change largely rely upon voluntary measures (i.e. exhortations to save energy) and an 'ecological modernisation' model whereby informed and motivated consumers send clear market signals to producers through a process of market transformation towards a lower-carbon economy (HM Government, 2006). However this individualistic strategy is not achieving the scale of carbon reduction required to reduce the UK's carbon dioxide emissions by 60% of its 1990 levels, by 2050 (Anderson et al, 2005). While in some industrial sectors, emissions are falling, the household sector continues to increase its carbon emissions (ONS, 2004); carbon mitigation efforts must begin to engage with households and individuals in a new way to achieve these policy goals. This requires a new regulatory phase in governing this low-carbon transition, namely the enrolment of citizenship values and responsibilities in coordinating effective collective action for carbon reduction, and the identification of practical strategies to achieve widespread behaviour change in reducing 'carbon footprints' (Dobson, 2003). This paper addresses that need by examining proposals for a new type of currency – carbon – to be issued through an innovative carbon-management policy proposal currently being considered by the UK government.

Personal carbon trading (PCT) is a new, untried policy proposal to reduce carbon emissions at the household level using carbon rationing and tradable 'carbon currencies'. It is a downwards extension of the 'cap and trade' carbon emissions trading scheme, to individuals. In PCT, Carbon emission credits are traded alongside conventional money, providing market signals and incentives for adaptation to low-carbon consumption and lifestyles. The model demands mandatory participation, and carbon allowances would be issued on a free and equal per capita basis to all citizens (Fleming, 2005). However, despite an emerging body of research into carbon allowances (Starkey and Anderson, 2005; Bottril, 2006) and growing policy interest in these ideas (Miliband, 2006a,b; Roberts and Thumin, 2006; Hillman and Fawcett, 2005; RSA, 2007), there have to date been no trials or feasibility studies to explore how the model might work in practice. Given this lack of empirical experience with PCT, therefore, lessons must be drawn from related experience with alternative allocation

systems, to inform its development and implementation. To this end, this paper makes the first conceptual link between PCT and complementary currencies (CCs).

Complementary currencies have been put forward as a new tool to promote sustainable consumption, due to their ability to shift consumption behaviour towards more localised, inclusive and community-focussed patterns, with lower ecological footprints (Seyfang, 2006). They are systems of exchange which operate alongside conventional money, and which aim to fulfil some of the social, economic and environmental needs which conventional money neglects. They are often based on alternative conceptions of 'wealth' and 'value', and so represent an attempt to create new social infrastructures according to more sustainable principles. They exhibit various objectives relating to economic development, social justice and environmental protection (Boyle, 2002; Seyfang, 2004, 2006; North, 2006; Williams et al, 2001). Taking these in turn, CCs in use today include local money systems (such as Local Exchange Trading Schemes and the German Regiogeld), which aim to rebuild local economies through cashless exchange; Time Banks where time is given and received as currency to build social capital, and green loyalty points systems (such as NU-card) which incentivise green and ethical consumption. This paper presents the first examination of PCT through the lens of CCs, applying existing knowledge to this new policy tool, to draw lessons for PCT on successful implementation, and to consider its role and potential in reducing carbon emissions, and contributing to sustainable consumption more generally.

2. INTRODUCING PERSONAL CARBON TRADING

> "*[Imagine] we carry bank cards that store both pounds and carbon points. When we buy electricity, gas and fuel, we use our carbon points, as well as pounds. To help reduce carbon emissions, the Government would set limits on the amount of carbon that could be used*."
>
> (Miliband, 2006b)

Households' direct energy consumption (domestic heating, private transport, and electricity for appliances) currently accounts for approximately 40 per cent of the UK's carbon emissions, the rest originating from commercial enterprises and the public sector, and consumed through food, clothing, leisure activities etc (Carbon Trust, 2006). Efforts to move towards a 'low-carbon economy' include promoting energy efficiency, increasing investments in non fossil-fuel energy sources, and raising regulatory standards for the housing and transport sectors, and internalising the carbon costs of emissions and energy use: "A key role for government is to put in place a framework which, by placing a value on carbon, provides a financial incentive for businesses and households to incorporate the climate change impact of their activities" (DTI, 2006, p.27). However, these measures are not delivering the scale of energy demand reduction required, at least partly because they fail to engage ordinary householders – civil society - in behaviour change towards 'de-carbonisation' (Anderson et al, 2005), and secondly because they fail to address the structuring of consumer practices by wider socio-technical 'systems of provision' – for example systems of transport provision in many areas do not offer realistic public transport options, locking individuals into consumption patterns around private car use (Shove, 2004; van Vliet *et al*., 2005). Attending to these wider social structures and forces prompts a consideration of collective action around carbon reduction – something which is also lacking in current policies. New initiatives are needed which engage individuals and businesses in citizenship-based collective endeavours to reduce carbon emissions through new conceptions of environmental rights and responsibilities (Hobson, 2003).

One such proposal is for the mandatory introduction of carbon allowances or personal carbon trading (PCT)[1], as a downwards extension of the EU Emissions Trading Scheme which currently applies to businesses. This 'cap-and-trade' system would set an overall UK carbon budget for a given time period (based on achieving the above emissions reduction target), would auction off 60 per cent to businesses and the public sector, and would divide the remaining 40 per cent (representing household energy-related emissions) into a free and equal per capita allocation for all citizens. These carbon credits might be stored on a 'smart card', and be spent alongside money when purchasing fuel or energy. In essence, it is the creation of a new form of national currency, based on carbon, which would be used by all citizens either explicitly (surrendering carbon units when paying bills) or implicitly (carbon costs being incorporated into petrol pump prices, for instance). High-energy users will need to purchase additional carbon credits, and low-energy users will be able to sell their surplus credits for profit, and each year the overall budget will be reduced. Furthermore, the costs of embedded carbon in other consumer goods and services will be included in market prices (passed down from producers), so ensuring that all carbon emissions are paid for. Having long-run carbon budgets allows individuals and businesses to plan for future restrictions in carbon allowances. Thus, an incentive system exists to encourage adaptation towards a low-carbon economy, rewarding those who adapt early in switching to low-carbon energy sources and reducing energy demand through conservation and efficiency measures In this manner it can be seen as a new form of social infrastructure (or system of provision), designed and implemented to achieve a particular purpose.

The PCT idea was first developed by Fleming in 1996, who coined the term 'Domestic Tradable Quotas' (DTQs – later termed Tradable Energy Quotas or TEQs) and envisaged progressively stricter carbon rationing to be the only plausible method of achieving large-scale cuts in carbon emissions (Fleming, 2005). The benefits of PCT over regulation and taxation, according to Fleming, are that it allows flexibility of response, it engages a sense of common purpose and active citizenship (in contrast to taxation which breeds resentment, as seen with the fuel tax escalator in the UK which prompted fuel blockades), and that it offers the certainty of a predefined cap on emissions. These proposals were examined in depth by climate change researchers at the Tyndall Centre for Climate Change Research, who modelled the implementation of DTQs on the UK economy and found the tool to be potentially more effective, more equitable and more empowering than traditional policy measures of taxation, information and regulation, for the following three reasons. First, low-income households tend to be low-energy users, and would benefit financially from selling their surplus credits, whereas high-income households are more able to afford the extra cost of purchasing additional carbon credits. Second, by engaging with individuals at the household level, PCT encourages a bottom-up adaptive process, whereby individual actions for carbon reduction have immediate personal effect. Third, by allowing individuals to respond to the price signals flexibly, it allows people to choose and make trade-offs between different sources of carbon emissions – e.g. between running a tumble drier, and taking personal flight – and between different carbon-reduction options – e.g. between fitting double-glazing and installing a solar water-heater – to achieve the same overall goals (Starkey and Anderson, 2005).

This model has been enthusiastically endorsed by key actors in the UK government, notably Rt Hon David Miliband, Secretary of State for Environment, Food and Rural Affairs (Miliband,

[1] Several terms are in use to refer to variations on the model: Domestic Tradable Quotas, Tradable Energy Quotas (both from Fleming, 2005), Personal Carbon Allowances (from Hillman, 2004), and Personal Carbon Trading (from RSA, 2007). They vary according to details such as what precisely is included in the allocation (e.g. public transport) and how children are accounted for (e.g. no allowance for children, or a half-allowance). This article is interested not in the minutiae of particular models, but rather in the overall principles, and as Roberts and Thumin assert: "the differences between the schemes appear to be less important at this stage than the largely untested assumptions shared by them all about public response and political feasibility" (2006, p. 3).

2006a,b; see also Roberts and Thumin, 2006), although to date there have been no trials or feasibility studies to explore how the scheme would work in practice. Work is currently underway to explore potential options, costs and benefits, and technical feasibility issues, in addition to legitimacy and acceptability questions (RSA, 2007; Bottrill and Fawcett, 2007). However, the lack of empirical experience hampers the development of the PCT idea. In order to address this knowledge gap, therefore, this paper presents the first analysis of PCT through the lens of complementary currencies (CCs) in order to identify the similarities and differences between these two areas of practice, and to ascertain the knowledge and experience from CCs which can usefully be applied to PCT. The following section reviews experience in the environmental field with CCs.

3. EXPERIENCE WITH COMPLEMENTARY CURRENCIES

Sustainable consumption is gaining currency as an environmental policy objective, requiring widespread changes in behaviour at all levels of society to reduce the environmental impacts of consumption, and a central element of this goal is to decouple economic growth from carbon-intensive energy use, and hence carbon emissions (DEFRA, 2003). The 'new economics' approach holds that sustainable consumption must be seen as an integrated process of redefining societal goals such as 'progress' and 'wealth creation', towards development based upon wellbeing and justice, which incorporates economic, social and environmental change (Ekins, 1986; Jackson, 2004; Robertson, 1999).

'Complementary currencies' (CCs) have been proposed as a new initiative to achieve these objectives. CCs refers to a wide range of new exchange systems which are designed to address specific economic, social and environmental needs which conventional money neglects, and which complement 'ordinary' monetary exchange. The CC movement has been growing rapidly since the 1990s, and includes a diverse range of systems in developed and developing countries (DeMeulenaere, 2007). The rationale for CCs is this: since money is a socially-constructed institution, it builds in certain characteristics and carries with it specific incentives and inherent values to promote particular types of behaviour. This stance is in stark contrast to the conventional economists' view of money as the neutral technology which oils the wheels of economic activity, and Lietaer states "Money matters. The way money is created and administered in a given society makes a deep impression on values and relationships within that society. More specifically, the *type* of currency used in a society encourages – or discourages – specific emotions or behaviour patterns" (Lietaer, 2001, p. 4). For instance, the usual three core functions of money (as store of value, unit of account and medium of exchange) may be in conflict with each other, e.g. when money is hoarded, preventing its use as exchange medium and so stagnating the economy (Boyle, 2002). Monetary forms have shifted and evolved over time, and there is nothing immutable about the form we currently use, which is structured so that it externalises social and environmental contexts in order to prioritise a narrow range of economic actions and individualistic, competitive behaviour. Mainstream money in its current form thus inhibits sustainable consumption, because of what it – the system of exchange - does not account for.

Taking a 'whole systems' approach to the socially- and environmentally-embedded context of economic activity, new monetary systems can be designed to prioritise different behaviour patterns, to target different groups of users, and to incorporate different 'essential functions' of money (normally considered to be: unit of account, store of value and medium of exchange). For instance, they may reward labour which is normally not valued, or they may shift the balance of market signals to favour local produce over imports. They can operate with notes and coins, smartcards, or through telephone conversations and slips of paper. They may operate as media of exchange, but not as stores of value (Boyle, 2002; Greco,

2001; Lietaer, 2001). These may appear less efficient from a purely economic vantage point, but they incorporate a richer set of information – about community networks, local landscapes, public life, livelihoods and friendships – than 'abstract' mainstream money, and so better reflect the multi-faceted aspects of local sustainable development, and have been described as 'slow money': "it takes more time to process a transaction, time for graciousness, time for building connection with community of place. [It is inconvenient] when compared to the hastiness and anonymity of an internet purchase. But rich with the information needed for conducting public life." (Witt, 2007).

These new monetary systems are the latest in a long history of attempts to reform and redesign money to better serve the needs of local communities and economies – in particular in times of recession when conventional money is scarce or devalued, so preventing local economic flows (Seyfang, 2000; Boyle, 2002). The negative effects of globalisation in local and marginal areas have been a key driving force behind recent development of CCs, and they are often seen as a tool to regenerate local economies in a more self-reliant manner, and build stronger social networks of community support, in relation to the increasingly abstracted, impersonal exchange of the global economy (Seyfang, 2001b; North, 2006; Williams et al, 2001). Sometimes tied in with these goals are implicit or explicit objectives about building a green, sustainable economy, founded on localised economies and an holistic understanding of wealth and value (Seyfang, 2001a). For example, community currencies have arisen in Mexico, Uruguay, Senegal, Thailand, Japan (DeMeulenaere, 2007), and in Argentina, alternative money systems traded in barter markets and conceived as a 'solidarity economy' by local environmentalists became real lifelines for much of the population during the national economic crisis in 2001-2 (Pearson, 2003).

The following sections present a brief overview of three distinct types of CC from Western Europe and North America, in order to examine the fundamental features of each. The three illustrative models are chosen on the basis of their distinct fundamental rationales (they display primarily economic, social and environmental objectives, respectively), and the diversity of their operations (ranging from small neighbourhood projects to city-wide mainstream applications). As such, they demonstrate a variety of CC designs, structures and settings. This information is elaborated on and further presented in Table 1, for comparison.

Strengthening the Local Economy: Local Exchange Trading Schemes (LETS)

In the UK, Local Exchange Trading Schemes (LETS) are the most common type of complementary currency (CC). LETS combines social and economic objectives, but principally operates through a parallel economy designed to strengthen local economic linkages. Members of a LETS exchange goods and services without using cash, using local credits instead. They list their 'wants' and 'offers' in a local directory, and privately arrange transactions, recording credits and debits with the system accountant. Some LETS have evolved to issue local currency notes, enabling the currency to spread further in the area – even through local businesses. No interest is charged or paid, so there is no incentive to hoard credits, and facilitating local exchange becomes the primary objective (Croall, 1997). The majority of LETS are run on a voluntary basis by community activists, though there has also been some financial and institutional support from local authorities as part of Local Agenda 21 strategies, as a tool for local economic renewal, community building and environmental sustainability. The first UK LETS was set up in Norwich in 1985, and they spread and grew over the next 10-15 years, to about 300 schemes in operation at present, with an estimated 22,000 people involved and an annual turnover equivalent of £1.4million (Williams et al, 2001). LETS have been successful at delivering small, but significant, economic benefits to members, providing new opportunities for informal employment and gaining skills, and promoting some specifically localised exchange. They also have large

community-building and social impacts, as they help to build social networks, generate friendships and boost personal confidence, in addition to being socially inclusive. However, despite a great potential, LETS have remained small and marginal in economic terms, due to a number of internal and external factors limiting their growth: there are large 'skills gaps' making it difficult to access staple goods and services through LETS; they tend to operate in 'green niches', attracting people who agree with the principle but have little time to participate, and indirectly excluding others; and government regulations deter benefit-recipients from participating by counting LETS earnings as equivalent to cash income (Seyfang, 2001a, c; Williams et al, 2001).

Building Social Capital: Time Banks

A second wave of complementary currency development on the UK took place from the late 1990s, through 'time banks'. These aim to build social capital through supportive community networks, and institutionalise reciprocal self-help through a central 'broker'. Each hour of service given – dog-walking, DIY, a lift to the shops – is worth exactly the same, one time credit, and participants earn credits by helping others, and spend credits receiving help themselves (Cahn, 2000) They are based on the US time dollar model developed by Edgar Cahn, who brought the idea to the UK in 1997, and the first UK project was established in 1998. Four years later there were 36 active time banks, with 2196 participants in total, and nearly 64,000 hours exchanged (Seyfang and Smith, 2002), and in 2007 there are 78 time banks operating and a further 48 in development (TimeBanks UK, 2007). The projects attract members of the most socially-excluded groups in society (those who normally volunteer least), and for those whose skills are accorded no value in the mainstream economy, the opportunity to be valued and rewarded for one's input into community activity and for helping neighbours, is enormously empowering. Time banks can also be used as a 'co-production' tool to encourage active participation of service users in public service provision, for example health, education, waste management, local democracy, etc (Cahn, 2000; Burns, 2004), and by rewarding and encouraging civic engagement, time banks could invigorate active citizenship. One of their most significant benefits, according to participants, is the ability to redefine what types of labour are considered 'valuable' by explicitly rewarding the unpaid work that people perform to maintain their neighbourhoods and care for others, and instituting a system of income distribution based not upon one's value to, and activity in the formal economy, but rather upon work – broadly defined (Seyfang, 2003, 2004). Aiming to overcome the 'green niche' limitations of LETS, time banks are usually institutionally-based (in health centres, schools, local agencies) and require financial support to pay for the time broker, who plays a significant community development role, especially in deprived neighbourhoods where levels of social trust and engagement are low (Seyfang, 2002). Nevertheless a range of obstacles prevents them from achieving their full potential: 'skills gaps' limit the available services on a time bank; meeting funding needs is a struggle, particularly when projects take a few years to really embed into a community; and reciprocity is difficult to foster when cultural and psychological factors mean that participants are reluctant to ask for help, but keen to offer their time – resulting in system stagnation. Lastly, while the unemployed are officially encouraged to participate in time banking, those in receipt of disability benefits face particular obstacles from the benefit system (Seyfang and Smith, 2002).

Promoting Sustainable Consumption: Nu Spaarpas

The third complementary currency examined here is Nu Spaarpas (NU), a specifically environmental CC. It is a 'green loyalty point' currency which was recently piloted in the city of Rotterdam in the Netherlands from 2002-3 and is currently being further developed for wider implementation (similar experiments are described by Verheyen, 2006). It functions as a reward card, similar to supermarket loyalty points, and targets environmentally-friendly

consumer behaviour, so providing incentives to switch consumption patterns (Bibbings, 2004; Holdsworth and Boyle, 2004). 'Green points' are earned when city residents separate their waste for recycling, use public transport, or shop locally, for example (card scanners in participating shops feed data into a central set of accounts) and they can be redeemed for public transport tickets or discounts on sustainable products. Thus there are incentives to change consumption behaviour when both earning and spending the points, and private businesses benefit at the same time as public goals are met. The pilot was instigated by Barataria, a sustainability consultancy, and partnered by local government and businesses – in particular Rotterdam Municipal Authority, who aimed to reduce the volume of waste going to landfill and promote public transport use. NU is the most mainstream of the three CC models described here. It operates through familiar channels – smartcards – and is transacted easily and efficiently in regular use. With a high-profile and professional marketing strategy, NU achieved a far higher level of public awareness and participation than LETS or time banks, and attracted business involvement too; by the end of the pilot period, 10,000 households had the card, over 100 shops were participating, and 1.5 million points had been issued (Van Sambeek and Kampers, 2004, p.77). The main barriers to success faced during the project related to the experimental nature of the pilot, and to developing the project as it evolved – creating publicity material that successfully attracted participants, persuading retailers to take part and install the card scanners, etc. Future plans include a financially self-sustaining model, and wider implementation, and refining the pilot in light of this first experience.

Table 1: Characteristics of Three Complementary Currencies, and Personal Carbon Trading

	Local Money Systems (LETS)	Time Currencies (Time Banks)	Green Reward Points (NU)	Personal Carbon Trading
Principal objectives	*Local economic development.* To strengthen the local(ised) economy and community through trading in a parallel currency.	*Social justice.* To build social capital in a neighbourhood through rewarding participation and volunteering.	*Environmental protection.* To reduce waste going into landfill, and promote public transport use. Also to incentivise more sustainable consumption choices, eg fair trade, local, organic, low-energy etc.	*Mitigating climate change: therefore economic, social and environmental.* To implement national carbon budgets and reduce carbon emissions over time.
Mechanism	Local money system – cashless exchange among members of a geographically-based trading community, facilitated by a members' directory of goods/services on offer.	Time-based volunteering-reward system, managed through a broker. One hour equals one credit, regardless of the service provided.	Loyalty points system on smartcards, rewarding sustainable consumption/behaviour.	Equal per capita allocation of carbon allowances, to be spent or traded. National carbon budget reduces year on year.
Origins and development.	LETS originally designed by Michael Linton in 1985; idea spread from Canada across world, primarily to UK, Australia, New Zealand, being adapted and evolving in new contexts.	Designed by Edgar Cahn in 1985, developed in the US and spread to the UK in 1997. Different models in development in UK, experimenting with agencies, public services, etc.	Dutch NGO Barataria developed the idea, piloted it with Rotterdam local government and businesses (2004-5). Since the pilot ended the idea has continued to develop and new applications are sought.	Top-down policy proposal by David Fleming, 1996. Research by Starkey and Anderson at the Tyndall Centre caught imagination of UK policymakers in 2006 (Miliband), prompting action research to develop and test PCT models.
Set up by	Mainly by individual volunteer activists, many with strong green commitments; sometimes by local government.	Mainly by local public service agencies/NGOs/local government.	Partnership between NGO, local government and businesses.	Government.
Scale	UK LETS size on average 73, city-wide or neighbourhood-based. LETS peaked in UK in late 1990s with approx 300 schemes.	Average size 77 members, usually neighbourhood-based. Currently 78 active time banks in UK.	Pilot ran from May 2004 till October 2005, and attracted 10,000 cardholders and 100 businesses in a city-wide project.	UK-wide: compulsory participation for all adult citizens in the UK.

Opportunities – beneficial contexts	LETS grow in times of recession, providing an alternative labour market, opportunities for informal employment and cash-free access to goods and services.	Time banks provide mediated social care services in neighbourhoods where mutual support networks have been eroded. In the USA time banks provide more essential services, because there is no effective welfare safety net; this is less urgent in the UK.	A direct way to support and promote locally-owned businesses and local produce – timely social concerns – and to meet government policy goals on waste and energy. Uses a familiar trading mechanism – the public are accustomed to trading with virtual currencies eg nectar cards and supermarket loyalty points.	Climate change and Stern review – need for policy instruments to achieve high levels of carbon reduction. Growing public understanding of 'carbon footprints'. Public are accustomed to trading with virtual currencies eg nectar cards and supermarket loyalty points.
Achievements	Offers opportunities to gain skills, build social contacts, earn income and access interest-free credit. Participants enjoy being able to put their values into practice through the new system of exchange.	Delivers social inclusion, wellbeing, health and mental health improvements; also skills development. Participants cherish the space to enact egalitarian and non-market values.	Pilot project gave indicative benefits of achieving government waste reduction objectives and stimulating more local/green consumption.	Untested
Internal weaknesses	Limited range of goods and services available. High levels of social skills required to participate. People join because they like the idea, but don't participate – stagnation. Green cliques - exclusionary.	Limited range of services available – 'skills gap'. People prefer to give than receive - stagnation.	Slow to recruit businesses. In the pilot the scheme was changed to expand the range of businesses and goods which attract green points, to allow participants to reap the benefits more easily. Ongoing development and evolution hampered by time-limited pilot.	High cost of implementation compared to taxation and regulation.
External threats and barriers	Government social policy – LETS income counts against unemployment benefits.	Requires funding to manage the scheme. Government policy on disability payments. UK social security system provides adequate safety net – not the same imperatives as in USA.	Pilot project was time-limited due to funding constraints, and a refined version has not yet been implemented. Supermarkets are issuing their own green loyalty points – eg Tesco	Public acceptability, especially if linked with ID cards?
Key research, resources and further information	Croall (1997) Seyfang (2001a, c) Williams et al (2001) LETSLink UK: www.letslinkuk.net	Seyfang and Smith (2002) Cahn (2000) Burns (2004) Time Banks UK: www.timebanks.co.uk Time Banks USA: www.timebanks.org	Van Sambeek and Kampers (2004) Verheyen (2006) Holdsworth and Boyle (2004) Bibbings (2004) NU: www.nuspaarpas.nl	Starkey and Anderson (2005) Hillman (2004) Bottril (2006) Roberts and Thumin (2006) RSA: www.rsacarbonlimited.org Fleming/TEQS: www.teqs.net

4. CRITICAL SUCCESS FACTORS FOR COMPLEMENTARY CURRENCIES

The previous two sections have described current experience with personal carbon trading (PCT) and three different types of complementary currencies (CCs), with the aim of assessing similarities between the two contexts, and bridging a conceptual divide to derive lessons for success in PCT. To facilitate this process, profiles of the four models are presented in Table 1. These add depth and detail to the descriptions given above, and offer a distilled picture of the initiatives in question, thereby allowing comparisons to be made. This section draws on those profiles to consider the extent to which PCT can be considered a type of CC, and to then ask what are the critical success factors for CCs, and how can these be applied to PCT?

An initial survey of the profiles in Table 1 might indicate that there is little in common between CCs and PCT: their scope, scale and development are vastly different. Whereas, for example, LETS and Time Banks typically comprise 50-100 members in small community networks, often run by volunteers on a shoestring, PCT proposals require a compulsory scheme for all UK citizens with huge set-up and administration costs. However, looking beyond these differences, there are a great many similarities between PCT and CCs, justifying a comparative analysis. Carbon trading is clearly introducing a new, parallel currency (a medium of exchange and a unit of account, if not a store of value) to be issued and spent alongside conventional money – it therefore fits the definition of a CC. Furthermore, like other CCs, it is designed and structured in a particular way in order to achieve a particular goal which mainstream money cannot adequately address – in this case, carbon emissions reductions, which in turn captures each of the economic, social justice and environmental objectives covered by the three CCs. Given this fundamental similarity, what lessons for success can be gleaned from experience with CCs?

Examining CC development across different objectives, scales, actors and institutions, as is done in Table 1, produces insights into the generalisable aspects of their development which can be transferred across contexts, regardless of the specificities of design, structure and target audience. This comparative analysis reveals four critical success factors for CC development which are likely to be of central importance to the successful adoption and effectiveness of PCT. These are: context and culture; technology; skills; and collective action. Each will now be addressed in turn.

Policy Context

First, the policy context is a key factor. Clearly, aligning the interests of an initiative with policy goals is key to attracting large scale funding and support, but even this is no guarantee, and projects dependent in funding often struggle for survival. The NU pilot was halted when funding ran out, despite being instigated by local government, and despite government backing, TimeBanks UK (2007) report that there are currently 48 time banks being developed, but a further 41 have ceased operating. The policy context can be inconsistent too, as both LETS and time banks participants face an inhibitive government policy on CC income and welfare payments, including disability benefit, which deters participants who could otherwise benefit from the schemes as a source of informal employment or occupational therapy.

In contrast, PCT will be implemented and fully supported by government, and will doubtless be accompanied by high-profile marketing campaigns and advanced technology to ease its adoption. Nevertheless, the issue of 'policy fit' is important, and lack of policy coherence can still hinder the development of government actions. The interactions between PCT and related policies (transport, trade and industry, tourism, energy) will need careful attention. Potential policy routes from the current Emissions Trading System to PCT have been

outlined by Starkey and Anderson (2005), who envisage an extension and evolution of current carbon trading mechanisms to be a likely mechanism for introducing the policy. But deeper questions need to be asked about the extent to which PCT – a market mechanism – should be run in a *laissez faire* manner. Osborn asks, for instance, whether a carbon market will be sufficient in itself to drive through all supplementary technology and behaviour changes necessary to move to a low-carbon economy – and therefore whether government regulations could be loosened – or whether conversely, planning and regulation of transport, building controls, etc is a prerequisite for the introduction of PCT (in Hillman and Fawcett, 2005). Further theoretical work is needed on the economic foundations of PCT markets, and their fundamental role as tools for ecological modernisation – or ecological citizenship, as we discuss below.

Social Context and Culture

Second, the social context within which CCs develop must be considered. Usually CC initiatives arise as a response to a social need or a policy objective, either spontaneously from the community-level grassroots, or from above through a government-supported programme. This context provides an enabling and nurturing political and cultural environment within which it can spread and grow. For instance LETS is an economic self-help tool and appeared to peak during the 1990s recessions, and time banks emerged in the USA where a lack of public provision meant that essential social services were non-existent in the poorest areas; the UK's welfare state ensures that social need is not so urgent and time banks have taken on a different character in this country. In each of these cases, the social context strongly influenced the profile of founders and early participants, and the 'culture' of the projects: green pioneers in the case of LETS, and social justice activists in time banks.

These illustrative cases display very different social profiles, both in terms of the participants, and the type of engagement they demand of users. In the UK, a common stumbling block with both LETS and time banks is that members find it easier to offer help and services to others (earning credits) than to ask for help themselves (spending). This is partly due to the limited range of goods and services available, making it difficult to access the services required, but has also been described as a cultural block, due to a perceived stigma attached to asking for help. Time bank participants are often experienced volunteers, but less comfortable with the idea that they themselves might request assistance with something, and so the reciprocal nature of the scheme can founder (Seyfang and Smith, 2002; Seyfang, 2002). In turn, and without dedicated effort to broaden the scope of the projects, these cultural and political groupings tend to mitigate against mainstreaming, as they attract like-minded members who saw the projects as an expression of contested political culture: LETS particularly is often described as an *alternative to* the mainstream, a challenge to globalisation (North 2006). This brings benefits in terms of building social movements and strengthening group identity, perhaps as radical activists, but can appear exclusionary to other social groups who feel that the initiatives are not aimed at them (Williams et al, 2001).

To counter these effects, time banks situated themselves within mainstream social care settings, and NU intended from the outset to have widespread appeal, and simultaneously captured the rather different public ethos around responsibility for action on environmental issues which exists in the Netherlands. This pre-existing 'political culture' (Jasanoff, 2005) is implicitly supportive of the NU scheme, and would presumably similarly benefit the introduction of PCT, both of which might therefore not be so successful in a country with a different political culture. In the UK, ecological citizenship (a commitment to reducing the negative social and ecological impacts of personal and community activities) is less well developed, and needs to be nurtured (Dobson, 2003).

This comparison illustrates very strongly the need to consider political cultures, and the issue of where CCs emerge, by whom, and for what purpose, and who takes part in them, when assessing their effectiveness and potential for success. Yet in the PCT literature, social and cultural matters are given little attention, other than cursory mentions of government information and awareness campaigns to promote public acceptability (Starkey and Anderson, 2005). It is certainly true that acceptability issues will need to be addressed in order that PCT and carbon allowances becomes seen as a legitimate and fair tool for the job of reducing carbon emissions. But as experience with environmental issues has shown, information campaigns are not necessarily effective at changing hearts and minds. This rationalist approach lacks the power to engage citizens in a shared endeavour, and a risk with introducing a large scale, mandatory, utilitarian market-based mechanism such as a *laissez faire* PCT scheme is that it alienates the committed social movement activists who operate in smaller niches, and prefer value-based initiatives with a strong political ethos. In contrast, Fleming (2005) is alone in addressing political culture within the PCT literature. He emphasises the 'common purpose' which PCT engenders, whereby one's economic self-interest in cutting carbon emissions is ultimately served by enabling others to reduce their emissions too, so lowering the carbon market price. This perspective is discussed below.

Technology and Mechanisms

A third critical success factor is the nature of the new socio-technological system itself, and related issues around credibility, ease of use, transaction costs, and mainstreaming. Some CCs operate using paper cheques or notes, sometimes these are fed to an accountant for processing, and sometimes everything is recorded over the telephone. In all cases, the transaction costs are significantly higher than using cash, and furthermore they are an additional, unfamiliar and distinct means of exchange to cash, which potentially complicates the exchange. In these cases, it is reasonable to assume that these transaction costs and unfamiliar mechanisms (whatever their benefits) are an inhibiting factor which deter some people from participating, and which consequently consigns the CCs to small niches (North, 2000). In order to overcome these problems, NU adopted a different approach by using smartcards and point-of-sale card-readers in regular stores, not unlike current supermarket loyalty cards or air miles, which are widely accepted, understood and used by consumers. By adopting a familiar, efficient and straightforward technology, therefore, NU ensured a much greater mainstream penetration of the project, and successfully integrated their technology into the shopping habits of consumers.

Current predictions about PCT suggest that it too would be managed on smartcard technology, and Starkey and Anderson (2005) review a range of technical systems and options. The presumption is that spending carbon credits will be a seamless operation when paying bills and purchasing fuel, so lowering the transaction costs and ensuring ease of use, thereby promoting its widespread acceptance (Roberts and Thumin, 2006 also cite the rapid take-up of supermarket loyalty cards to illustrate the technical ease and general acceptability of virtual smartcard virtual currencies, suggesting that this bodes well for PCT). However, PCT is often linked in the literature with ID cards, a politically unpopular proposal, which raises a further set of acceptability and civil liberty issues in addition to technical matters of security and fraud prevention.

Other aspects to consider are the mechanisms of the carbon currency system of exchange itself. Within CCs, although they are designed as a means of exchange rather than a store of value (no interest is paid on positive balances; in come CCs the currency's value diminishes over time to promote rapid circulation), hoarding is still a problem which contributes to system stagnation. This happens for a variety of reasons including reluctance to ask for help, inability to find goods and services to purchase, and a desire to save for a rainy day – in

many cases, acting 'irrationally' in neo-classical economics terms. Transferring these experiences to PCT, a crucial issue will be the design of the currency, and whether allowances are carried over from one period to the next, allowed to be stored up for the future, and so on, and understanding the social factors influencing carbon market behaviour. Fleming's proposals include issuing carbon allowances for the first year, and then topping up on a weekly or monthly basis, so that there is always 11-12 months-worth of credits on the market, ensuring that carbon credit scarcity is relative and foreseen, rather than actual and sudden (ie motorists will not be left stranded on the forecourt as there are no carbon units left available). The question of hoarding/storing requires further attention.

Skills and Capabilities

The next critical factor to examine is the combination of skills, capabilities and confidence required to use the currency: previous experience with LETS and time banks demonstrate that it is not sufficient to simply introduce new systems of exchange and expect people's behaviour to adapt to the new infrastructure. One barrier to participation in LETS is the high levels of social skills and personal confidence required to initiate a transaction by browsing through a directory and telephoning someone to arrange a trade, which might involve visiting the person's home. This is amplified if people are not keen to transact, and the process must be repeated, with the effect of discouraging participation. In addition, some LETS can be perceived as alternative or green enclaves, effectively (but not literally) closed to 'outsiders', and again easily deterring participation from less confident and articulate people (Williams et al, 2001). Time banks seek to overcome this obstacle by operating through a broker, who builds the confidence and participation of members, and who actively recruits people from more socially excluded groups, and accompany participants in the early days to overcome nervousness about visiting people's homes. However, a time bank transaction is even further removed from the normal mode of exchange in society, as it requires a great deal of personal interaction to organise an activity, which is heavily regulated by the organisation itself. This may in fact be a deterrent to participation, as much as it is an attractive feature of the initiative for some (Seyfang, 2003, 2004). In contrast to these models, NU adopted a modern technology – smartcard systems in retailers - specifically to present the currency in a format with which consumers are already familiar and skilled, and which required little in the way of additional effort, interaction and skills, to use. PCT would certainly mirror this approach, as discussed above, to reduce the cultural and technical barriers to adoption, however, the issue of skills and capabilities is another matter.

While PCT envisages that carbon trading will be a technically trivial matter, taken for granted and almost invisible in everyday transactions, the deeper issue of really understanding carbon budgets and how to manage them through behaviour change – what we might call 'carbon literacy' as an analogue to financial literacy – is a previously unidentified and undeveloped competency. Moreover, while time and money are easily understood concepts for people to trade, the rather abstract idea of carbon emissions, and one's personal responsibility for them, is an extremely new phenomenon to be applied to individual decision-making. Indeed, it has always been an externality of economic activity, which consumers are now being asked to account for, budget and reduce. This requires a new set of carbon literacy skills, but there is very little acknowledgement of this in the PCT literature; the presumption appears to be that simply introducing the carbon trading system will be sufficient to redirect (rational, utilitarian) consumer decision-making towards low-carbon behaviour. Additionally, Fleming (2005), and Starkey and Anderson (2005) claim that understanding is not a prerequisite of using the scheme, and that consumers could legitimately sell their allowances immediately, and 'pay as they go' instead, without directly engaging in carbon budgeting at all. Of course, this approach would cost more, as consumers lose out on the differentials between selling and buying prices, as with foreign currency. Fleming likens this 'reward for competence' (2005, p.21) to many other economic

transactions, but there is an equity issue here about carbon allowances costing more to use for those who do not understand or accept the mechanisms.

In order for PCT to achieve its objectives of inducing behaviour change towards carbon reduction, individuals must have a good grasp of the causes of carbon emissions, the role they themselves play in producing them, the scope for reductions in one's personal life, and how to manage a carbon budget, where to get help and information, and so on. Some initiatives are currently working to develop these carbon literacy skills, for example the RSA's Carbon DAQ voluntary online (virtual) carbon market, and further evidence of this vital cultural shift is appearing as the concept of 'carbon footprints', for example, has become widespread over the last year or so (Siegel, 2007; see also www.carbonfootprint.com). This is something we return to below.

Harnessing Collective Action

The final critical success factor to examine is that of harnessing the efforts of collaborative active citizenship to support the initiative and achieve its goals. In CCs this is expressed through participants collectively creating and using an alternative system of exchange - new social infrastructure – based upon values distinct from the mainstream economy. For many LETS and time banks members, it is this symbolic act of taking control and co-creating new social institutions (for example, valuing all labour time equally) which represents the biggest benefit of participation. It is an act of empowerment, a means of expressing values such as ecological citizenship which are not adequately incorporated into mainstream systems of provision.

The lesson here for PCT is to harness this creative collaboration to achieve the goal of reducing carbon emissions, operating not simply through the summation of individualistic rational decision-making activities, but also through a collective, community-based process of behaviour change based on civic engagement around practised environmental responsibilities. By working with this grassroots citizenship activity, PCT could achieve its aims more effectively, while simultaneously contributing towards the growth of carbon literacy and carbon awareness culture, and generating a positive social context for carbon trading. Fleming (2005) engages fully with this principal, citing collective motivation, or 'common purpose' as a key element of his design for PCT, and likening the entire scheme to a collective endeavour. There are three interlinked aspects of this: first, with a fixed limit on carbon units there is a clear signal that one person's consumption results in less for others, and so mutual interdependency is built into the system; second, the carbon price is dependent on overall demand, so by helping others to reduce their carbon dependency an individual ensures lower prices for themselves; and third, carbon units can be pooled and utilised for the local cooperative efforts, e.g. setting up community energy projects, which will be necessary. Fleming asserts that a PCT scheme *must* design-in this shared incentive to reduce carbon emissions, and that it will be in turn a powerful basis on which to build a new shared social and ecological ethic, because all citizens will be, by definition, equal stakeholders in the environment.

In the absence of PCT trials, we can look instead to the growth of Carbon Rationing Action Groups (CRAGS) springing up around the UK, for experience in generating common purpose. There are currently around 25 groups for people to voluntarily measure, budget and ultimately reduce their carbon emissions, and they can be seen as a prototype community-based carbon-reduction initiatives (see www.carbonrationing.org.uk). Although CRAGS do not trade carbon units, they set carbon allowances and offer a small financial reward (a few pence per kilogramme of carbon) for under-emitting, and penalise over-emitters. In addition to being the only carbon-related activity for individuals comparable to PCT, they offer a test-bed for the development of carbon literacy skills and nurturing

collective motivation. Members display a shared commitment and this fosters a sense of community around carbon reduction, in contrast to a purely individualist approach to carbon reduction; as such they will be important barometers for measuring the impacts of collective endeavour in this area.

5. CONCLUSIONS

Personal carbon trading (PCT) is an untested policy proposal to issue carbon currency to all UK citizens, with the aim of limiting and reducing carbon emissions. The lack of empirical experience with PCT hinders its development, and this paper has reviewed experience with complementary currencies (CCs) in order to identify critical success factors and lessons to aid the development and implementation of PCT. Firstly, it is useful to state that the introduction of a carbon currency alongside cash is not the monetary upheaval it might first appear; while they might not normally be described as such, complementary currencies are in widespread use in the UK today, in the form of air miles, nectar points, supermarket loyalty cards, and so on. There is a level of general familiarity and acceptance about these new socio-technological systems, from which PCT will very likely benefit. In addition, previous research with CCs shows that there are five critical success factors to consider: policy context; social context and culture; technology and mechanisms; skills and capabilities; and harnessing collective action.

This analysis has highlighted two key areas for future research and action into PCT. The first challenge is to identify the carbon literacy skills and culture which will be crucial to the success of PCT, and design a range of tools for boosting and measuring carbon literacy. Using financial literacy as an analogue, it will be possible to define the key competencies comprising carbon literacy and from this, derive a series of indicators with which to measure an individual's carbon literacy, and importantly, to measure changes in carbon literacy following interventions and experiences. Fundamentally, a culture of carbon awareness and literacy will be required to shift people's thinking into these frameworks, which then encourages and enables people to make appropriate environmental decisions in their private lives. The second challenge is to think carefully about how collective active citizenship can be harnessed to support the introduction and effective use of this new social infrastructure, the carbon currency, as experience shows that a key benefit of CCs is enabling participants to act collectively to reshape social infrastructure. How can PCT be implemented in such a way as to nurture and reinforce collaborative action to reduce carbon emissions within a context of community engagement, as opposed to being an entirely individualistic tool? What techniques and tools will work best at encouraging community engagement around carbon trading activities? Current experience with voluntary Carbon Rationing Action Groups will be a rich source of data for examining both the development of carbon literacy skills, and generating a collective sense of 'common purpose' among citizens to reduce carbon dependency.

The key finding of this analysis is that there are important social and political factors which will influence the development and success or otherwise of PCT. A carbon allowance and trading scheme will be socially embedded in a culture, and it will require the engagement of millions of people in a normative project to reduce carbon dependency. Yet most PCT literature describes the scheme in purely systemic terms (as indeed, do some CC writings), as a neo-classical economist might describe a market: simply put the PCT system in place and the market will take care of everything. While proponents of PCT talk in terms of *ecological modernisation* - incorporating the environment into markets (Young, 2000) - what we are really dealing with is a matter of *ecological citizenship* - collaboration and shared environmental values (Dobson, 2003). The next phase of research into the feasibility of PCT must surely begin to address this paradox.

References

Anderson, K., Shackley, S., Mander, S. and Bows, A. (2005) *Decarbonising the UK: energy in a climate conscious future.* Technical Report 33, (Tyndall Centre, Norwich).

Bibbings, J. (2004) *A Sustainability Reward Card for Wales*, (Welsh Consumer Council, Cardiff).

Bottril, C. (ed) (2006) *Personal Carbon Trading: An exploratory research and policy workshop,* Workshop Summary Report, 24th October 2006, UK Energy Research Centre Headquarters, London (UKERC, London).

Bottrill, C. and Fawcett, T. (2007) *A Scoping Study Into The Trialling Of Personal Carbon Allowances* Workshop 2: designing research trials (UKERC, London).

Boyle, D. (ed) (2002) *The Money Changers: Currency Reform From Aristotle To E-Cash,* (Earthscan, London).

Burns, S. (2004) *Exploring Co-Production: An overview of past, present and future*, (New Economics Foundation, London).

Cahn, E. (2000) *No More Throwaway People: The co-production imperative* (Washington, Essential Books).

Carbon Trust (2006) *The Carbon Emissions Generated In All That We Consume* (Carbon Trust, London).

Croall, J. (1997) *LETS Act Locally: The growth of Local Exchange Trading Systems,* (Calouste Gulbenkian Foundation, London).

DEFRA (2003) *Changing Patterns: UK Government Framework for Sustainable Consumption and Production* (Defra, London).

DeMeulenaere, S. (2007) '2006 Annual Report of the Worldwide Database Of Complementary Currency Systems', *International Journal of Community Currency Research* Vol 11 < www.le.ac.uk/ulmc/ijccr//>

Dobson, A. (2003) *Citizenship and the Environment*, (Oxford University Press, Oxford).

DTI (2003) *Our Energy Future: Creating A Low-Carbon Economy*. Energy White Paper (DTI, London).

DTI (2006) *The Energy Challenge: Energy Review Report*. (TSO, Norwich).

Ekins, P. (ed) (1986) *The Living Economy: A New Economics in the Making*, (Routledge, London).

Fleming, D. (2005) *Energy and the Common Purpose: Descending the energy staircase with Tradable Energy Quotas (TEQs)* (The Lean Economy Connection, London).

Greco, T. (2001) *Money: Understanding and Creating Alternatives To Legal Tender* (Chelsea Green, Vermont).

Hillman, M. (2004) *How We Can Save The Planet* (Penguin, London).

Hillman, M. and Fawcett, T. (2005) *Living In A Low-Carbon World: The policy implications of carbon rationing* Meeting Report, 30th June 2005, Policy Studies Institute, London (UKERC, London).

HM Government (2006) *Climate Change: The UK Programme 2006* (HMSO, Norwich).

Hobson, K. (2003) 'Thinking habits into action: the role of knowledge and process in questioning household consumption practices' *Local Environment,* Vol 8 pp. 95-112.

Holdsworth, M. and Boyle, D. (2004) *Carrots Not Sticks: The possibilities of a sustainability reward card for the UK*, (New Economics Foundation and National Consumer Council, London).

International Energy Agency (2005) *Global CO_2 Emissions From Fuel Combustion* (IEA, Paris).

IPCC (2007) *Climate Change 2007: Impacts, Adaptation and Vulnerability* Summary for Policymakers (IPCC, Geneva).

Jackson, T. (2004) *Chasing Progress: Beyond Measuring Economic Growth*, (New Economics Foundation, London).

Jasanoff, S. (2005) *Designs On Nature: Science and Democracy In Europe and the United States* (Princeton University Press, Princeton NJ).

Lietaer, B. (2001) *The Future Of Money: Creating new wealth, work and a wiser world*, (Century, London).

Meyer, A. (2000) *'Contraction and Convergence': The global solution to climate change* (Green Books, Totnes).

Miliband, D. (2006b) *The Great Stink: Towards An Environmental Contract*, speech by the Rt Hon David Miliband MP at the Audit Commission annual lecture, Wednesday 19th July 2006, available online at <www.defra.gov.uk>, accessed 15/02/07.

Milliband, D. (2006a) *Carbon Allowances* <www.davidmiliband.defra.gov.uk/blogs/ministerial_blog/archive/2006/07/19/1557.aspx>

North, P. (2000) 'Complementary Currencies And Community Economic Development In International Perspective: Problems and how they might be overcome' paper presented to *International Network of Engineers and Scientists for Global Responsibility Conference*, Stockholm, Sweden, June 2000.

North, P. (2006) *Alternative Currency Movements As A Challenge To Globalisation? A case study of Manchester's local currency networks* (Ashgate, Aldershot).

ONS (2004) *The Impact Of UK Households On The Environment Through Direct And Indirect Generation Of Greenhouse Gas Emissions* (ONS, London).

Pearson, R. (2003) 'Argentina's Barter Network: New currency for new times?' *Bulletin of Latin American Research* Vol 22(2) pp.214-230.

Roberts, S. and Thumin, J. (2006) *A Rough Guide To Individual Carbon Trading: The ideas, the issues and the next steps* (DEFRA, London).

Robertson, J. (1999) *The New Economics Of Sustainable Development*, (Kogan Page, London).

RSA (2007) Carbon*Limited* <www.rsacarbonlimited.org/>

Seyfang, G. (2000) "The Euro, The Pound And The Shell In Our Pockets: Rationales For Complementary Currencies In A Global Economy" *New Political Economy,* Vol 5, No 2, pp 227-246

Seyfang, G. (2001a) 'Community Currencies: Small Change for a Green Economy' *Environment and Planning A* Vol 33 (6), pp.975-996.

Seyfang, G. (2001b) 'Money That Makes A Change: Community Currencies North and South', *Gender and Development,* Vol 9, No 1, pp 60-69.

Seyfang, G. (2001c) 'Working For The Fenland Dollar: An Evaluation Of Local Exchange Trading Schemes (LETS) As An Informal Employment Strategy To Tackle Social Exclusion' *Work, Employment and Society*, Vol 15 (3) pp.581-593.

Seyfang, G. (2002) 'Tackling Social Exclusion With Community Currencies: Learning from LETS to time banks' *International Journal of Community Currency Research* Vol 6 http://www.geog.le.ac.uk/ijccr/.

Seyfang, G. (2003) 'Growing Cohesive Communities, One Favour At A Time: Social exclusion, active citizenship and time banks', *International Journal of Urban and Regional Research*, Vol 27 (3) pp.699-706.

Seyfang, G. (2004) 'Working Outside The Box: Community currencies, time banks and social inclusion', *Journal of Social Policy* Vol 33(1) pp.49-71.

Seyfang, G. (2006) 'Sustainable Consumption, the New Economics and Community Currencies: developing new institutions for environmental governance' in *Regional Studies* Vol 40(7) pp.781-791.

Seyfang, G. and Smith, K. (2002) The Time Of Our Lives: Using time banking for neighbourhood renewal and community capacity-building (New Economics Foundation, London).

Shove, E. 2003, *Comfort, Cleanliness and Convenience: The Social Organisation of Normality* Berg, Oxford.

Siegel, L. (2007) 'The Low-Carbon Diet', *Observer Magazine* 21/1/07.

Starkey, R. and Anderson, K. (2005) *Domestic Tradable Quotas: A Policy Instrument for Reducing Greenhouse Gas Emissions from Energy Use*, Technical Report 39, (Tyndall Centre for Climate Change Research, UEA, Norwich).

Stern, N. (2007) *The Economics Of Climate Change: The Stern Review* (CUP, Cambridge).

TimeBanks UK (2007) *Time Banking To Date* <http://www.timebanks.co.uk/about_timebanking.asp> accessed 3 March 2007.

van Sambeek, P. and Kampers, E. (2004) *NU-Spaarpas: The sustainable incentive card*, (Stichting Points, Amsterdam).

Van Vliet, B., Chappells, H. and Shove, E. (2005) *Infrastructures Of Consumption: Environmental Innovation In The Utility Industries*, (Earthscan, London).

Verheyen, J. (2006) *Can We 'Save' The Environment: Research into the feasibility of bonus cards to stimulate environmentally-friendly consumption* (Public Waste Agency of Flanders).

Williams, C. C., Aldridge, T., Tooke, J., Lee, R., Leyshon, A. and Thrift, N. (2001) *Bridges into Work: an evaluation of Local Exchange Trading Schemes (LETS)* (Policy Press: Bristol).

Witt, S. (2007) *Slow Money – Reimagining Economic Exchange* (E. F. Schumacher Society, Great Barrington).

Young, S. (2000) *The Emergence of Ecological Modernisation: Integrating the Environment and the Economy?* (London, Routledge).