



## Personal carbon trading: A policy ahead of its time?

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### ABSTRACT

In 2008, the UK government undertook a review of personal carbon trading (PCT) and declared that it was 'an idea currently ahead of its time'. PCT is a radical policy proposal which would entail all adults receiving an equal, tradable carbon allowance to cover emissions from household energy and/or personal travel. The allowance would reduce over time, in line with national emissions reduction goals. The government's key concerns about PCT were its social unacceptability and high cost. This paper reviews the literature and identifies knowledge gaps, and then discusses whether these concerns are justified. Contrary to the government's conclusions, most research shows PCT to be at least as socially acceptable as an alternative taxation policy. People think it could be both fair and effective. Set-up and running costs for PCT will undoubtedly be higher than for alternative taxation policies. However, PCT could deliver benefits from individual and social change motivated by non-economic aspects of the policy. These potential benefits are outlined here. The conclusion is that PCT is a promising and timely policy idea.

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### 1. Introduction

Personal carbon trading (PCT) has developed, over little more than a decade, from a radical idea to a policy proposal of interest to a UK Secretary of State for the Environment. It began life in the mid-1990s being developed and promoted separately by two independent researchers. Ten years later, by 2004/2005, research was underway on PCT in a number of universities and the idea was beginning to attract political support. In 2006/2007 the then Environment Secretary expressed a strong interest in PCT as a contribution to reducing UK emissions. Intellectual and public interest in the idea continued to grow, and by 2008 researchers from a broad range of universities as well as think tanks and policy organisations were developing and debating PCT. However, in mid-2008 the Department for Environment, Food and Rural Affairs (Defra) undertook a review of PCT and declared that:

"...while personal carbon trading remains a potentially important way to engage individuals... it would nonetheless seem that it is an idea currently ahead of its time..." (DEFRA, 2008a: 4)

With this finding, Defra slowed the momentum that had been building behind PCT. This paper describes the journey of PCT as an idea, explains what has been learnt, outlines what remains

to be researched and asks whether PCT has reached the end of the line.

Personal carbon trading is an umbrella concept which covers a number of specific policy proposals (further described in Section 2). The common features of all PCT schemes are: rights for carbon emissions are allocated to individuals for free; emissions from household energy use and/or personal (i.e. non-business) transport are covered; emissions rights are tradable; and emissions allocations reduce year-on-year in line with a declining national carbon cap. By including all personal transport as well as household energy, PCT would cover 42% of the carbon emissions from energy use in the UK (DTI, 2007) (or 50% if the non-carbon climate impacts of air travel are included (Fawcett, 2004)). Two of the best-known PCT schemes – tradable energy quotas and personal carbon allowances – were created by independent researchers (Fleming, 1997; Hillman, 1998). Both these ideas have been developed further (e.g. Fawcett, 2005; Starkey and Anderson, 2005), and the research field has now broadened to include work from a range of universities and research and policy organisations (which will be reviewed in Sections 3 and 4).

PCT has attracted political interest in the UK in recent years. An important expression of this was the introduction of a private member's bill (i.e. not government legislation) to parliament in July 2004 "to introduce a domestic trading scheme for carbon emissions, to set a national ceiling for carbon emissions and for connected purposes." (Anon, 2004). The bill had a first reading and was debated, but was not adopted as legislation. PCT was subsequently promoted by the then Secretary of State for the Environment, David Miliband, in 2006/2007 in the context of all

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parts of society needing to make a contribution to reducing carbon emissions:

“Individuals can play an important part, too, and that is why I have led the debate about personal carbon allowances and so-called carbon credit cards, which could help individuals to see how they can make a contribution that will help the environment and themselves.” (Miliband, 2006)

Miliband's interest in the idea, led to a programme of research work being commissioned by the Department for Environment, Food and Rural Affairs (Defra). In 2008 both Defra and an influential committee of members of parliament published reports regarding PCT. In its synthesis report, based on the research it had commissioned, Defra concluded that PCT was ahead of its time (DEFRA, 2008a). Their key concerns were public acceptability and costs, with doubts whether these issues could be resolved satisfactorily. Defra concluded that the government should remain engaged in the debate around PCT, but that further work should be taken forward by academics and research organisations and not the government itself.

However the influential House of Commons Environmental Audit Committee, which published its report a month later, was more supportive of PCT, and indeed ‘regretted’ Defra's decision to wind down further research work on PCT. Their inquiry concluded that:

“Personal carbon trading could be essential in helping to reduce our national carbon footprint. Further work is needed before personal carbon trading can be a viable policy option and this must be started urgently, and in earnest.” (Environmental Audit Committee, 2008: 3)

The government's response to the Committee's report (House of Commons, 2008) largely restated the findings of its earlier feasibility studies: this report did not change its views. So, despite the Committee's support, PCT has gone down the political agenda.

Nevertheless, the need for new policy thinking on delivering carbon savings is stronger than ever. The context for carbon reduction policy is the UK's recently adopted legally binding target of an 80% reduction in national greenhouse gas emissions by 2050, and a reduction of 26% of carbon dioxide by 2020, compared with a 1990 baseline (Climate Change Act 2008). Despite many years of UK and EU policy to reduce energy use and carbon emissions across the economy, including EU energy labels, mandatory minimum standards, voluntary agreements on vehicle efficiency, successive tightening of new home standards under building regulations, subsidies for home insulation and efficient lights and appliances, and EUETS, UK net carbon dioxide emissions only fell by 8.2% between 1990 and 2007<sup>1</sup> (DEFRA, 2008b). Meeting UK's long-term goals implies a reduction in national (and individual) emissions of around 4% per annum to 2050, a rate of change far in excess of anything achieved so far. While this context does not necessarily imply PCT is the right policy solution, it does underline the need for more effective and stronger policies than hitherto introduced.

This paper questions whether Defra was right to suggest PCT was ahead of its time. Does the research literature support its concerns about social acceptability and the costs of the policy? What benefits might PCT deliver, via which mechanisms? In order to answer these questions, this paper describes PCT in some detail

and explains how it would affect individuals in Section 2. Then key research findings are summarised in Section 3, with a particular focus on the most recent publications. The research review informs a debate about whether Defra's concerns are justified. A new framework for assessing PCT benefits is developed in Section 4. Finally, in Section 5, there is a discussion of whether PCT is a policy whose time will come.

## 2. PCT as a policy instrument

### 2.1. Various PCT policy proposals

There are a number of different specific policy proposals which fit under the general description of personal carbon trading. Two of these – personal carbon allowances, tradable energy quotas – are described in some detail, followed by a summary of other PCT schemes. Most of the research described in this article relates to implementations of PCT similar or identical to personal carbon allowances or tradable energy quotas.

Personal carbon allowances (PCA), an idea first developed by Hillman (Hillman, 1998; Hillman and Fawcett, 2004) entails each adult having a tradable carbon allowance which covers the carbon emitted from their household energy use and personal transport (including air travel). Each adult would have an identical allowance for their own use, which would reduce over time. Children would receive a partial allowance, managed by parents on their behalf. PCA would cover more than 40% of the carbon emitted in the UK economy, and would work in parallel with policies reducing carbon in the commercial and public sectors. The idea was inspired by ‘contraction and convergence’, which proposes global convergence towards equal per capita carbon allowances within a reducing carbon budget (Meyer, 2000).

Tradable energy quotas (TEQs), previously known as domestic tradable quotas, was initially developed by Fleming (1997, 2005). This implementation of PCT is broader in scope than PCA, and covers carbon emissions from the whole economy. For individuals, TEQs would be very similar to PCA, except that air travel would not be included in the personal TEQs allowance. The TEQs allowance would comprise a number of ‘carbon units’ which each represent, say, the right to emit 1 kg of carbon dioxide. Organisations would have to buy emissions permits via a national auction, which would replace the EUETS system currently covering the majority of these emissions. All fuels would have a carbon rating and purchasers would have to surrender carbon units to cover related emissions. Transactions would be carried out electronically and all carbon units would be tradable. There would be one national market in carbon units (unlike the PCA proposal, which would most likely result in two separate markets). Fleming views TEQs as providing answers to both climate concerns and the problem of ‘peak oil’.

Another PCT scheme which has been worked out in some detail is Cap and Share (C&S) (Feasta, 2008). C&S covers all the carbon emissions in an economy and each adult is given an annual certificate entitling them to a share of national emissions. Individuals do not need these certificates in order to buy energy services or goods responsible for carbon emissions, but the organisations supplying them do. The idea is that (most) individuals will sell their certificates, via banks or post offices, thereby getting additional income which will offset some or all of the additional cost of goods and services with embodied carbon. Suppliers require surrendering certificates equal to emissions from the use of the fossil fuels that they introduce to the economy, and purchase the certificates they need. While C&S introduces a link between personal consumption and carbon emissions, it does so in quite a different way from PCA or TEQs.

<sup>1</sup> These are actual emissions figures, with no adjustment to national totals made for trading under EUETS. By adjusting for trading activity, in 2006 Defra estimated that the UK's carbon emissions were 12.1% lower than in 1990, compared with a reduction of 6.4% based on actual emissions (DEFRA, 2008c.) For the purposes of this paper, the assumption is that a significant proportion of the UK's mid- and long-term emissions reductions will be met domestically.

Personal carbon trading has also been explored as applied to household energy use only (Niemeier et al., 2008) and land-based travel only (Harwatt, 2008).

Despite the variation between different PCT schemes, their common objective is to limit the overall carbon emissions from society effectively, efficiently and equitably, by engaging individuals in managing their carbon emissions. At the moment none of the versions of PCT is a fully worked-out policy proposal and all require further development.

## 2.2. How PCT would affect individuals

PCA and TEQs schemes would affect individuals in a similar way. Every time a person paid an energy bill, filled up the car with fuel or bought a flight (in the case of PCA), they would have to surrender carbon units from their account, or pay the additional cost of buying carbon units at the market price. By allowing trading, people who live low carbon lives, who invest in household efficiency and renewable energy, travel less, and who lead lives with a lower energy input would have a surplus to sell. Those who travel a lot, or who live in large or inefficient homes would need to buy this surplus to permit them to continue with something like their accustomed lifestyle. A market price for carbon would emerge and higher carbon lifestyles would cost more than they currently do. The equal shares would not require that everyone emits equally—instead people would have choice and could adapt to a lower carbon society at a slower pace by buying additional allowances. This allocation system should be economically efficient as it would encourage lower cost carbon savings to be made first (although this is only wholly true if a 'perfect market' exists, which is not the case in reality).

## 2.3. PCT within the wider policy landscape

If PCT were to be introduced to cover personal energy use emissions, it would not be a stand-alone policy. It would simply form the umbrella mechanism within which a wide range of other policies would operate (Hillman and Fawcett, 2004). Product policy using the full range of market transformation tools (regulations, incentives, information, voluntary agreements, etc.) would still be needed to encourage more efficient lights and appliances into the market. New and existing housing energy efficiency and carbon emissions standards would continue to be tightened. Greater take-up of household-level renewable technologies would be supported. Transport and planning policy would also need to find more effective ways of encouraging the use of lower carbon modes and, eventually, lower mobility lifestyles. Not only would these policies enable and encourage people to live lower carbon lives, they could also be used more comprehensively in advance of PCT to broaden the low carbon options available.

Although PCT is put forward as a national policy, it might have potential as an EU-level policy, but that possibility has not been explored as yet in the literature.

## 3. The research landscape

Much of the earlier writing on PCT made a case for the policy, outlining its potential benefits (e.g. Hillman and Fawcett, 2004). There has also been debate about the characteristics of the policy compared with alternatives such as taxation and upstream cap and trade (Hillman and Fawcett, 2005; Keay-Bright and Fawcett, 2005). Most current and recent research on PCT has been investigating various 'practical' aspects of the policy, with the aim of understanding whether there are fundamental barriers to

its introduction. Themes include: technological issues, running and transaction costs, designing a workable policy, links with existing policy, transitions to PCT and social acceptability. In addition, there is continuing research into whether PCT would be 'fair', and what type of fairness it could deliver. Notably, nearly all the research on PCT has been undertaken in the UK. Exceptions include a paper published in this journal by American researchers (Niemeier et al., 2008) and work looking at PCT in the USA (Hillman et al., 2007) and in Denmark (Fawcett et al., 2010). In the following sections, recent research is summarised by theme. In addition, research on social acceptability is presented in detail and used to examine Defra's claim that PCT is socially unacceptable. Finally, there are reflections on the current state of knowledge and identification of future research needs.

### 3.1. Would PCT be fair?

Research on fairness has encompassed in principle and consequential definitions of fairness. PCT is based on the same egalitarian principle of equity as that underpinning the international carbon reduction proposal 'contraction and convergence' (Meyer, 2000), i.e. that everyone has an equal right to emit carbon. Starkey (2008) has used the philosophical literature on distributive justice to interrogate the proposition that equal per capita allocation of emissions rights is fair. His final conclusion is that the literature only gives limited support to equal per capita allocations as being fair. Hyams (2009) has also addressed the question of whether equal allocation of emissions rights would be just (although in less detail than Starkey). He concludes that an unequal distribution of emissions rights may be a more just allocation, despite the loss in simplicity this would bring. Both these studies took equal per capita allocations as their starting points, however, alternative definitions of equity have been debated in the context of international emissions negotiations. These include ability to pay rules (varying according to national well-being) and polluter pays—where abatement costs are distributed in proportion to emission levels (IEA, 2002). Application of these definitions to personal emissions, in comparison with equal emissions rights, is a possible route for future research.

Researchers have also modelled the consequences of allocating equal emissions rights in the UK. Analysis of distributional impacts has looked at how a policy of PCT would affect different groups, that is, who the 'winners' and 'losers' under PCT would be, given current energy patterns. The most detailed early work on this was carried out by Ekins and Dresner (2004). This analysis has recently been updated by Thumim and White (2008) who looked at the distribution of high and low carbon emitters by income, geographical location and household composition. They found that 71% of households in the lowest three income deciles would be 'winners' under PCT, while 55% of households in the highest three income deciles would either have to buy allowances or reduce their emissions (making them 'losers'). Geographically, it is rural dwellers who tend to be high emitters, primarily due to their high household energy emissions (thought to be due to more use of oil as a heating fuel and older and less efficient housing). Not surprisingly, larger households – containing more adults – tend to have surplus allowances. The authors identified 2.1 million low income 'loser' households (from a total of 24.6 m UK households), many of whom live in rural areas and many also live in larger-than-average homes. Their allowance deficit is driven by their heating rather than their transport emissions.

The findings of these studies demonstrate that PCT would be broadly progressive, i.e. lower income groups would benefit from the policy because they have lower carbon emissions, and hence could sell spare allowances to gain extra income. However, some

individuals within lower income groups would be above average carbon emitters, and thus would be worse off. Neither Ekins and Dresner's or Thumim and White's analysis includes air travel, which being largely the preserve of higher income people is likely to make PCT more progressive when included (particularly if a multiplier is used to account for the non-carbon climate impacts of air travel). Until analysis including air travel is completed, the understanding of consequential fairness of PCT will remain incomplete. Further, for TEQs and C&S, there is the issue of how changing embodied carbon costs in goods and services across the whole economy would affect individuals. As the research on social acceptability will show (Section 3.7), the issue of fairness is key to people's views of both PCT and alternative policies such as carbon taxation.

### 3.2. Technology

The consensus to date is that there are no substantial technological barriers to the introduction of PCT. Workshops including industry experts hosted by RSA identified and explored various options for adding personal carbon accounting and trading to existing transport card and banking systems (RSA, 2007a). Research commissioned by Defra did not discover any insurmountable technical obstacles for the implementation of PCT (Lane et al., 2008). It found that the majority of functions could be fulfilled by modifying and/or adding capacity to other systems.

### 3.3. Cost

The most substantial study on the costs of PCT was commissioned by Defra (Lane et al., 2008). They estimated the cost of setting up the PCT scheme could be between £700 million and £2 billion with running costs between £1 and £2 billion per annum. The authors concluded that this cost would be very much more than that of an upstream trading system (costing between £50 and 100 million to introduce and £50 million to run). However, they caution that this research is at a very early stage, with costs still very uncertain. Subsequently, Bird and Lockwood (2009) have re-visited this analysis and suggested a lower range of costs is equally plausible: they suggest running costs of £0.5–1 billion per annum—half those identified in the Defra study. Whatever the correct cost, it is clear PCT would be a relatively expensive policy to introduce and maintain. The potential benefits of PCT are discussed further in Section 4.

### 3.4. Integration with existing policy

If PCT were introduced, it would be into a landscape where many different policy instruments exist. Kerr and Battye (2008) looked at the current range of policy instrument and concluded, as others have before, that the most serious overlap would be with the EU Emissions Trading Scheme (EUETS). Because emissions from household electricity are already counted in EUETS, there would be some double-counting within PCT. They suggest this problem could be overcome by creating different tradable instruments which are not directly comparable. However, whether double-counting would really be a problem in real-life is open to question. The authors also analysed the 'policy space' open to PCT to act, given their estimation of the effectiveness of existing policy, and suggested PCT may be more important in the transport than the domestic sector.

### 3.5. Developing a more detailed policy

For PCT to be a fully workable policy, many details need to be resolved. These include how allowances are allocated, frequency

of issue, inclusion of children, accounting for public transport, regulation of trading, amongst many others. While there has been some work on individual issues (e.g. allowance distribution and regulation in Starkey and Anderson, 2005), many details have still to be fully explored. In the study by Bristow et al. (2008) respondents were asked to state their preference on a number of detailed design issues for both PCT and taxation. Example findings included a preference for carbon allowances for children, and for a scheme which covered household energy use and all forms of transport, including public transport. RSA (2007b) also investigated public views on PCT policy design to a limited extent, as did Howell (2009). Though interesting, this does not replace the detailed analytical work which is still required on policy design.

Parag (2008) looked at the potential for cross-policy learning to enhance understanding of the detailed working of a PCT scheme. She used experience from food labelling and EU appliance labelling to discuss how to determine the most relevant units for carbon labels and information (e.g. on products/energy bills/air tickets), the importance of proximity of the information to the relevant action, and provision of meaningful information enabling people to budget their carbon 'expenditure'. This research showed there is scope for PCT to learn from other policy experiences and that the details of a policy are very important in determining its effectiveness.

### 3.6. Transitions to PCT

There has been limited work looking at the transition towards PCT. One way of testing new policies prior to introduction is to pilot them in a limited geographical area (Sanderson, 2002). However, this would be very difficult for PCT mainly because of likely political and social resistance to one region facing limits on emissions, but also for practical reasons such as participants being able to buy motor fuels from outside the pilot area (Fawcett et al., 2007). This leads to the question of whether some other sort of transition might be possible, in terms of a voluntary scheme for example. At the conclusion of a three year work programme investigating aspects of personal carbon trading, RSA's final report (Prescott, 2008) suggests that 'community carbon trading' could be the first step leading towards introduction of PCT. This would be a voluntary, community-scale initiative. Howell (2009), researched the experience of members of Carbon Reduction Action Groups (CRAGs), a network of voluntary groups who are experimenting with personal carbon allowances (but without a trading element) in the UK and beyond. She concluded that experience within the CRAGs showed that it was possible for a section of the population to make significant cuts in their carbon emissions, if well motivated. However, the research did not enable her to determine whether PCT would provide similar motivation for the general population. It is not yet clear how effective a voluntary scheme with no penalties would be at preparing people for full PCT. However, this is clearly an avenue worth further exploration.

### 3.7. Is PCT socially acceptable?

The most active area of PCT research is 'social acceptability'. Using different methodologies, researchers have explored what people think of PCT, either on its own or in comparison with alternative policies (Table 1). Some of these studies have also asked people how they think they would react to PCT or alternatives. Because PCT's lack of social acceptability was one of the key weaknesses Defra identified, research is presented in some detail so that this conclusion can be considered in light of the evidence.

**Table 1**  
Research methods used to consider whether PCT is socially acceptable.

Researcher(s)	Method	Number of participants	Policy context
Low (2005)	Focus groups	30–40	PCT compared with increased carbon taxation
Howell (2007)	Focus groups	30–40	PCT compared with increased carbon taxation
von Knobelsdorff (2008)	Questionnaires by post and email	300+	PCT in isolation, no comparison with other policy
Harwatt (2008)	Interviews, using questionnaires and unstructured replies	60+	PCT for transport only, compared with increased fuel taxation, with personalised information on extra costs
Bristow et al. (2008)	Questionnaires	300	PCT compared with increased taxation and revenue recycling, with personalised information on extra costs
IPPR (2008)	Opinion poll, on-line	1000+	PCT compared with carbon taxation and upstream cap and trade
Owen et al. (2008)	Focus groups	80–90	PCT compared with carbon taxation and upstream cap and trade

Low (2005) carried out the first focus group study of PCT, and developed a methodology which subsequent researchers have adapted and used with different social groups. Her aim was to begin to determine whether, and in what circumstances, individual members of the public find the proposal acceptable. She found that people were quick to grasp the proposal and keen to discuss the details, and put forward their own ideas. There was a variety of responses to PCT from enthusiasm to dislike. The key factors affecting participants' attitudes to PCT were their beliefs about the relative importance of the role of the state and the rights of the individual, and their opinions on the equity, practicality, environmental effectiveness and negative aspects of the PCT scheme (including complexity, risk of fraud and civil liberties issues).

Howell (2007) used a similar methodology with five focus groups (mostly comprised of students) comparing PCT with carbon taxation. PCT was preferred to carbon taxation by a large majority of the 35 participants, particularly after group discussion, mainly because they were perceived to be fairer and more effective. The judgement about the relative equity of PCT was influenced by the fact that a majority of the participants conceived of fairness in terms of outcomes more than process. Positive keywords associated with PCT that emerged in the discussions included 'empowerment' and 'choice'.

von Knobelsdorff (2008) surveyed people about PCT using paper and on-line questionnaires. The paper questionnaires were sent to randomly selected residents within Cambridge city, whereas the (identical) on-line questionnaire was sent to students at Cambridge University. Each survey was completed by more than 150 respondents. Unlike most other studies, PCT was not compared with carbon taxation—it was the only policy respondents were only asked to give their views on PCT. Results from the surveys were largely similar, despite the different demographic groups surveyed. From the combined sample, 44% supported PCT, 43% said they had 'mixed feelings', with the remainder rejecting PCT. Perhaps surprisingly, almost half said they had already heard of PCT. Support for the idea was not correlated with previous knowledge of PCT, knowledge of climate change or how important people perceived their own individual actions to be. The 'mixed feelings' largely arose from concerns about equity issues and the practical implementation of the scheme.

Harwatt (2008) researched responses to a 'tradable carbon permit' (PCT for transport only) and fuel price increases for private road transport. Her research used bespoke low carbon software to help people understand how each policy would affect them financially into the future, up to 2030, based on travel diaries they had previously completed. Respondents were asked in individual interviews how they would respond to these policies, with further questions about impacts on lifestyle, costs and benefits, fairness, effectiveness and acceptability. Harwatt concluded that while the sample was small (60 people), there was

a clear difference in attitudes towards the policies—respondents were much more positive about the tradable carbon permit (TCP) scheme than the fuel price increase. The TCP scheme was viewed more positively in terms of fairness, effectiveness and social acceptability. This was thought to be largely due to the view taken by respondents that TCP would be much more effective at changing behaviour.

A larger scale study with some similarities to Harwatt's work has been carried out by Bristow et al. (2008). With a sample of just under 300 people, they used questionnaires to compare responses to a PCT scheme, covering household energy use and personal transport, to increased carbon taxation with tax refunds up to the average carbon consumption (so the schemes were as close to financially identical as possible). Initial carbon footprint estimation was used with all respondents to ensure the information they were given to enable them to compare PCT and taxation was tailored to their own situation. Respondents were given a list of carbon and energy saving actions and asked which they would undertake if either policy was introduced. They were also asked about the comparative effectiveness, fairness and acceptability of the different options. In this survey, more people said they would change their behaviour in response to a tax than to PCT, but those responding to PCT chose to make greater savings giving higher expected savings overall from this policy. 'Acceptability' for PCT was higher than for taxation, but neither measure achieved majority support. The authors concluded that extensive further work would be required before any substantive conclusions could be drawn on the behavioural response to PCT and taxation.

An opinion poll survey in February 2008 to determine public response to PCT showed that respondents were less opposed to the idea of "personal carbon credits" than other alternatives (IPPR, 2008). Over 1000 people were questioned in an on-line survey. Although less than a third of respondents (31%) said they supported or strongly supported PCT, this compared to 23% who supported a corporate cap-and-trade approach and 19% who supported a carbon tax.

Finally, Defra has also commissioned research about PCT (Owen et al., 2008). Twelve focus groups discussed PCT, carbon taxation and upstream carbon trading. Participants were chosen to represent members of seven segments identified by the Defra segmentation model (DEFRA, 2008d). However, there were no clear differences in attitude by segment. A questionnaire at the end of group discussions asked people to sum up how they felt about each option. PCT received the highest 'very negative' score (41% of respondents) but lower combined figures of 'quite negative' and 'very negative' (54%) than the other options (carbon tax 57%, upstream trading 68%). PCT also received the highest proportion of 'very positive' and 'quite positive' responses—26%, compared with 13% for carbon tax and 8% for upstream trading. In discussion, PCT was seen as the most complex policy option, with a lot of concerns raised around the

practicalities of implementation. Based primarily on this study, Defra concluded that lack of public acceptability is one of the key challenges for PCT.

Research on social acceptability has used several different methodologies including: giving people quite detailed information on different options in advance of focus group discussions; presenting participants with personalised information about the impact of different policies, based on their actual carbon footprints and asking for instantaneous responses to an opinion poll. Participants have varied from small numbers unrepresentative of the general population, to a large representative sample. Questions about PCT have been asked in the context of all personal energy use, for transport emissions only, and in comparison with other policies, or as a stand-alone policy. Despite the variation in methods and sample types, the results are remarkably similar: when PCT is compared with carbon taxation (or other policies) it is usually preferred. For those who prefer PCT, its key benefits are seen as fairness and effectiveness. For those against, their main concerns are about implementation and unfairness. There is no evidence that views of PCT are linked to socio-economic or demographic characteristics.

Based on the body of research about social acceptability, or even simply its own commissioned study, it is very difficult to see how Defra reached the conclusion that public acceptability was particularly problematic for PCT compared to alternative policies. The evidence does not support their argument. This is not to say that the evidence to date on the acceptability of PCT and alternatives can be regarded as definitive or unproblematic—as discussed in the following section.

### 3.8. Discussion and identification of research gaps

PCT research could be summarised under the questions ‘is it a good idea in principle?’, ‘can it be introduced in practice?’ and ‘will it work?’ (i.e. significantly reduce carbon emissions). The key principles on which PCT is based are fair shares and an effective and reducing carbon cap, with trading as a mechanism to help people adapt. As research has demonstrated, there is more than one definition of fairness and the actual impacts of a ‘fair’ scheme may end up seeming far from fair. It is important to continue debate the definition of fairness and explore plausible alternatives to equal distribution of emissions rights, a debate which Starkey (2008) has already begun. Distributional analysis has shown that PCT should be a progressive policy overall, but some poorer individuals will be worse off. However this analysis is currently incomplete, with a significant omission being the impact of air travel. For this reason, there is an urgent need for a representative UK sample of individual carbon footprints, based on measured household energy use and personal transport data, and including demographic and housing data. Without this quality of information, an understanding the distributional effects of any low carbon policy will be seriously deficient (a conclusion shared by the Environmental Audit Committee’s inquiry into PCT (Environmental Audit Committee, 2008)).

The most active areas of research question whether the policy could be introduced in practice, which includes looking at technical as well as social and political barriers. Research has established PCT as a possible alternative to increased energy taxation or upstream cap and trade, with some understanding of what institutions and systems would be needed to introduce it. Some aspects of introduction should be straightforward, for example, the technology to enable an electronic card PCT system already exists. However, other issues, such as the interaction with existing policy including EUETS, may be more problematic. Two reports have identified the broad range of research still required across many disciplines (Keay-Bright, 2009; Roberts and Thumim,

2006). There are undoubtedly many detailed aspects of the policy still to be debated and developed. However, it seems unlikely these areas of enquiry will reveal new and significant barriers to the introduction of PCT. Instead the research will develop the best available policy design, allowing policy makers to understand its pros and cons.

The topic which has attracted most research is the social acceptability of PCT. Although findings from the many different studies point to similar conclusions, caution is needed. The way in which PCT is presented and the context in which opinions are sought are likely to influence outcomes. In particular, carbon taxation with revenue recycling may be perceived much more positively in terms of fairness than carbon taxation in isolation, and this option has not been included in most studies. Some methodologies may be less robust than others, for example, the use of opinion polls is problematic when asking about a relatively unknown policy. Prior to any further research on acceptability, a detailed critical review of methodologies is essential, with findings to date re-evaluated. In addition, the meaning of this research and its use by decision makers should be interrogated. If fewer people in a study dislike PCT than other options, does that make it socially acceptable? Or do 50%/75%/90% of the sample have to prefer PCT? How do the opinions of people today affect government views of a policy which is not likely to be introduced for some years? The question of what social acceptability is taken to mean, and by whom, has yet to be answered.

Assuming a good case can be made for the attractiveness of PCT in principle, and that no insurmountable barriers to its introduction are identified, we are left with the question of whether the policy will deliver the hoped-for benefits. Will it work? All new policy proposals face this question, and with it the challenge of providing an evidence-based answer. This difficulty is particularly acute in the case of PCT, where there is no good parallel in previous policy history, and no comprehensive model of human (energy-related) behaviour to use to estimate its effects. By contrast, analysis of the effects of increasing carbon taxation can make use of previous experience of price and taxation changes and existing economic models (e.g. Callan et al., 2009). A PCT trial would be one way of answering the ‘would it work’ question (Fawcett et al., 2007). A research trial would be a real-world experiment that as closely as possible replicated a real PCT scheme, but on a small scale and for a limited period (this would not be a ‘pilot’ scheme as described in Section 3.6). The trial would gain insights into attitudes and behaviours in response to a simulated PCT policy. Inevitably, a trial of a very ambitious policy such as PCT cannot fully replicate the conditions of the real scheme, but arguably it would provide valuable insights not available via other research methods.

In order to advance research on whether PCT would work, the following section offers a preliminary analysis of the mechanisms by which PCT could deliver carbon savings.

## 4. A new research agenda: valuing the benefits of PCT

The most challenging and, arguably, most urgent need in PCT research is to identify and, if possible, quantify the benefits it could deliver beyond its economic effect. It is already clear that if PCT can deliver little more in the way of social change and carbon savings than a taxation or upstream cap-and-trade alternative, then it would prove a very expensive policy per tonne of carbon saved, and be of little policy interest. However, if considerably greater carbon savings can be accessed, both immediately and in the longer term, there may be a case for introducing PCT as a policy despite expected high set-up and running costs (identified by both DEFRA (2008a) and Bird and Lockwood (2009)).

Contrary to Defra research, which assessed PCT primarily as an economic instrument (which motivates people to reduce their emissions due to the financial costs/benefits of being over-/under-emitters) PCT can be conceptualised as a policy which operates primarily through a number of psychological and social mechanisms. A review of the literature showed that a number of potentially positive outcomes, based on psychological responses, have been anticipated (but not tested) by researchers considering PCT (Capstick and Lewis, 2008). There are indications in the social acceptability literature that people see PCT as different from carbon taxation and expect to respond differently to either policy. These results are from studies which were designed so that PCT and taxation options had similar financial effects on the individuals questioned, so the differences in response could be attributed to perceived differences between the policies, rather than price differences (Bristow et al., 2008; Harwatt, 2008). Combining this evidence with experience from other areas of energy policy, a preliminary description of the possible non-economic effects of PCT can be developed. Nevertheless, it must be stressed that this understanding of how PCT might work is very much a hypothesis at this stage.

There are a number of reasons why PCT could be expected to affect individuals (and lead to carbon savings) beyond its financial impact:

- Visibility of carbon at point of decision making (energy use, energy purchase, product purchase).
- Frequent feedback on behaviour delivered via a carbon account.
- The psychological effect of having an allowance, which will decrease by a known amount over time, and trying to live within that.
- Collective shared goal of carbon reduction as hitherto (largely) private consumption decisions become a principal focus of public policy, and of legitimate interest for others.
- The radical nature of the policy (in comparison with current UK policy).

Other authors have also explicitly described possible non-economic effects of PCT, suggesting mechanisms similar to those listed above (e.g. Bird and Lockwood, 2009; Parag and Strickland, 2009). The evidence to date for each potential effect is presented briefly below, followed by specific suggestions for further investigation.

The importance of visibility of energy efficiency at the point of decision making, specifically at the point of product purchase, is already acknowledged by the wide use of EU energy labelling. Only when consumers have the salient information when they are making a decision, can they take it into account. PCT would add to this visibility by attaching carbon 'costs' to every purchase of motor fuel, plane tickets and payment of household energy bills. Feedback has been shown to be an important tool in enabling people to reduce their own energy use, even without further intervention (Darby, 2006). PCT would offer ample timely, highly relevant feedback through individuals' carbon accounts. Together visibility and feedback would provide the service called for by Burgess and Nye (2008) of 're-materialising energy use', which they contend could enhance consumer understanding of the links between energy and lifestyles, and thus be a powerful driver for a change in the way individuals understand and define themselves and their relationship to the earth and its energy resources. They suggest this in turn could lead to pervasive and lasting reductions in energy use. The carbon saving benefits of increased feedback and visibility under PCT are the most well-characterised of the proposed non-economic effects. To further investigate these

effects, especially those which would be unique to PCT, a more detailed vision of how to deliver PCT information must first be developed, so that effects on behaviour can then be measured in laboratory and field studies.

Capstick and Lewis (2009) undertook preliminary experimental research looking at the effects on energy-related decision making of having a carbon budget under a simulated PCT scheme. The results demonstrated that people did understand the concept of a personal carbon allowance and made choices to try and keep their emissions within the budget they had been given. However, comparisons with stated behavioural intentions under other simulated policies, including carbon taxation, were inconclusive in this pilot study. Capstick and Lewis have developed a methodology which should be used to investigate further whether the proposed psychological effect of operating within a carbon budget exists and, if so, whether it is likely to significantly affect behaviour.

PCT introduces a very explicit collective shared goal in a way that carbon taxation would not. Based on her interviews, Harwatt suggested that "the perceived response of others appeared to be very important in influencing the decision to change behaviour" (2008: 24). There is widespread interest in reducing carbon emissions at a local level in the UK (CSE, 2009) and research into the impacts of community-based initiatives may tell us something more about the importance of shared goals and comparison with others.

PCT is a radical policy: it introduces new rights and responsibilities in a way which will affect people in their everyday lives. It puts conscious consideration of carbon emissions at the heart of many purchasing decisions. By its introduction people may begin to understand the profound changes which will have to be made to achieve a low carbon society:

"...it's a big scheme for people to take on which would help to make people realise the scale of the problem and what needs to be done"

(respondent talking about PCT acceptability—Harwatt 2008: 23)

Further qualitative work on understanding views of PCT may give insights into whether the radical nature of the policy could be a positive attribute (in terms of leading to additional carbon savings).

In addition to these effects on individuals, PCT may have other benefits:

- It could open up a new policy space, i.e. increase the range of options which can be considered by policy makers (largely because it does not rely wholly on economic effects to achieve savings).
- It could be introducible in a way that increased carbon taxation would not, for reasons including perceived (and real) fairness and effectiveness.

These hypotheses could first be investigated with reference to the public policy analysis literature, to see if there are any theoretical grounds for believing them to be plausible. This could be followed by more applied research, such as interviews with policy makers, civil servants and politicians.

Having suggested a list of possible benefits, it will be important to test these ideas further using the methods suggested above, and developing new research approaches where necessary. Some of the benefits suggested might also be achieved in a taxation scheme when revenues are recycled, or might be delivered in part by options such as smart meters—an important consideration in future research design. This paper has not

presented sufficient evidence to counter Defra's cost benefit analysis (or IPPR's broadly similar conclusions), but it has shown that there is evidence for suspecting PCT could deliver a wide range of non-economic benefits, which have been elaborated with possible research routes outlined.

## 5. Summary and conclusions

PCT has attracted high-level political interest from a UK Environment Secretary and gained support from the parliamentary Environmental Audit Committee. However, a government department review concluded that PCT was an idea ahead of its time. The chief weaknesses of PCT were identified as a lack of social acceptability and that its costs would far outweigh its benefits.

Research on PCT has made progress in several different dimensions including social acceptability, cost, technical implementation, distributional aspects and fit with existing policies. Many details remain to be explored and developed: PCT is not yet a fully worked-out policy. More research is urgently needed on the distributional impacts of PCT, both so that its social implications can be understood, but also because (perceived) fairness is at the heart of public response to PCT. Potential winners and losers under PCT need to be much more clearly identified.

Contrary to the government's view, most research evidence (including their own commissioned report) shows that PCT is considered to be more acceptable than the alternatives of direct or indirect carbon taxation. However, there is no clear definition of 'socially acceptable' and neither has this concept been unpacked to explore what it means to different actors. Both these questions needed to be addressed, and the methodologies used to measure social acceptability reviewed, in order to make further progress on this issue.

PCT would cost considerably more to implement than increased carbon taxation with recycling of revenues. The challenge for PCT research is to identify more clearly what the non-economic benefits of this policy might be. In order to be successful, it would have to elicit significant behavioural responses, lead to a profound and ongoing change in social norms around energy use and carbon emissions, and to achieve sustained social and political acceptability. The paper has taken a first step towards identifying the mechanisms by which PCT might achieve this, using evidence from other areas of energy research. It has also highlighted the need for research trials to increase knowledge in this challenging area.

The phrase 'ahead of its time' describes an idea that is too radical, too different from current trends and mainstream thinking to be accepted at the time it was first put forward. This is the charge against PCT, but it could be made with equal justice against the UK government's recent adoption of a target of 80% carbon reductions by 2050. Based on current policy and carbon emissions trends, an 80% target is extremely radical. A government with such an ambitious target should be positively supporting and exploring ideas which are ahead of their time, because nothing else is likely to be capable of delivering the radical changes which will be needed for a low carbon society.

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