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Synthesis report on the findings from Defra's pre-feasibility study into personal carbon trading

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What is personal carbon trading?

Personal carbon trading requires individuals to manage their own CO₂ emissions; a national emissions cap would be set, and emissions rights (in the form of carbon credits) would be allocated across the population as a whole. Individuals would surrender their carbon credits upon the purchase of, for example, electricity, gas or transport fuel. Those who need or want to emit more than their allowance would have to buy allowances from those who emit less. Over time, the overall emissions cap (and hence individual allocations) could be reduced in line with international or nationally adopted agreements.

1. Executive summary

- 1.1. The UK is committed to reducing carbon dioxide (CO₂) emissions by at least 60% by 2050, against a 1990 baseline¹. The Government has asked the Committee on Climate Change to consider whether this should be tightened up to 80% as it considers its advice on the first three carbon budgets. There are many possible points of intervention, and policy tools, which could be used to meet these targets. One key area is emissions from individuals, which accounts for approximately 42%² of all UK CO₂ emissions – largely through electricity use, heating fuels in the home and personal transport. Personal carbon trading (see: 'What is personal carbon trading?' above) has been put forward as one proposed way of reducing

¹ At the time of publication the Climate Change Bill is continuing its progress through Parliament. These details are therefore subject to the outcome of the Parliamentary process: <http://www.defra.gov.uk/environment/climatechange/uk/legislation/index.htm>

² CO₂ emissions attributable to individuals, via their use of electricity and heating fuels in the home (mainly gas) and their personal transport, both domestically and internationally (including international aviation and shipping), accounts for 42% of the total UK emissions (NETCEN 2004 for the Strategy Refresh programme, 2006).

these emissions, and in 2006 the Government committed to investigate this option further. A pre-feasibility study was developed to take an initial view on the potential value of personal carbon trading compared to other approaches to reduce individuals' carbon dioxide emissions. Four areas were identified for further investigation: the potential effectiveness and strategic fit of personal carbon trading; the equity and distributional impacts; public acceptability; technical feasibility and potential cost. This synthesis report draws together the findings from four separate studies looking at these key questions.

- 1.2. The cost/benefit analysis presents a challenge to the introduction of personal carbon trading. The costs identified are large and outweigh, by many times, the estimated potential benefits of personal carbon trading. It is possible that alternative policies could raise the visibility of personal carbon emissions more cost-effectively, such as introducing labelling of CO₂ impacts on airline tickets, and such alternatives should be explored. Although there are circumstances under which personal carbon trading may be cost-effective, a significant reduction in the projected costs or increase in the value of benefits (e.g. increase in energy saving behaviours) delivered by personal carbon trading would be necessary to reach this. Alternative scheme designs that may reduce costs and increase public acceptance could be explored. Further evidence on the effectiveness of the visibility delivered by personal carbon trading should be monitored, and estimates of the benefits revised as appropriate.
- 1.3. The analysis of distributional impacts provides further evidence of personal carbon trading being a financially progressive policy instrument. Some areas of concern have been identified, for instance, some low-income households may lose out from the introduction of personal carbon trading (albeit by a relatively small amount) and rural areas would be worse off than urban populations. However, it is anticipated that these concerns could be addressed through scheme design, allocation methodology or through other measures, such as the existing benefits system. It should be noted that this analysis was based only on the allocation and trading elements of personal carbon trading. A full assessment of equity and distributional impacts would need to take into account costs and revenue associated with implementation, administration and auctioning, paying particular attention to the impact on the taxpayer of funding the scheme.
- 1.4. Concerns over possible vulnerable groups were some of the key challenges raised through the analysis of the public acceptability of personal carbon trading, along with fears over complexity of the system in general, and trading in particular. There is scepticism that such a scheme would be fair, that Government could be trusted to manage it or that it would deliver emissions reductions. In addition there was little evidence that people would be likely to trade – a crucial element of the scheme. However, there was a general sense that action should be taken to reduce emissions from individuals and that Government intervention was preferred to a privately-run scheme. In presenting personal carbon trading to the public, two alternative options involving the use of a price signal to

influence individuals' behaviours were offered (carbon tax and upstream trading, both with revenue recycling). Little support was given for any of the three as they were deemed unfair, 'big brother' and too 'nanny state'. It is indicative of participants' resistance to the proposed measures that they were able to suggest alternatives such as choice-editing³, grants and regulation as preferred actions.

- 1.5. No insurmountable technical barriers were identified to the introduction of a personal carbon trading scheme, however, the costs identified are very significant. Estimates of the likely set-up costs of the type of scheme explored ranged between £700 million and £2 billion, and the running costs £1-2 billion per annum. However, it is important to put these costs into perspective to appreciate the service being delivered and the outcomes. It would seem likely that cost reductions would be necessary in order to justify serious consideration of this policy measure and that these would need to be identified by altering the scheme design. The commercial viability of a personal carbon trading market (and potential to involve the private sector) should be given consideration, as well as further assessment of the likely benefits, in particular the potential for pro-environmental behaviour change as a result of the visibility being delivered.
- 1.6. It is important to note within the context of this project that a number of assumptions were made about how a personal carbon trading scheme may be designed; for instance, a mandatory, economy-wide scheme with free carbon credits to all UK adults was assumed. This was done in order to reduce the number of possible variables, and so limiting the areas of investigation to those considered most important. Through taking this approach, it has been possible to take an initial view on the potential value of personal carbon trading compared to alternative measures for addressing individuals' emissions, and to better understand the issues surrounding the concept. While the conclusions of the research are robust and applicable to a range of scheme designs, there are inevitably a number of limitations to the project approach. For instance, though the research was based on the 'Domestic Tradable Quota' model (as described below), the project approach was to consider the fundamental questions surrounding personal carbon trading, such as could personal carbon trading deliver CO₂ savings, would it be technically possible and at what cost, is it really equitable and would it be acceptable to the public? This is not a full feasibility study, and the research was intended to answer just the high-level questions surrounding the concept, rather than analysing a specific scheme design or undertaking an options analysis of the best scheme design. This approach has made it possible to take an initial view on the potential value of personal carbon trading compared to other measures.

³ 'Choice editing refers to the market improvements that are taking place to provide the public with an improved set of choices when purchasing goods or services' – sometimes by taking poor performing options off the market.

1.7. The findings of the research indicate that, while personal carbon trading remains a potentially important way to engage individuals, and there are no insurmountable technical obstacles to its introduction, it would nonetheless seem that it is an idea currently ahead of its time in terms of its public acceptability and the technology to bring down the costs. There are some significant challenges to its potential as an effective policy tool, and these would need to be addressed before this option could be considered as a part of the UK's Climate Change Programme. Having said this, this research provides a valuable contribution to the analysis of measures aimed at reducing individuals' CO₂ emissions and encouraging pro-environmental behaviours. The Government is committed to better informing and involving individuals in reducing their emissions, and remains interested in the concept of personal carbon trading. These conclusions point towards Government maintaining engagement in the debate as further research is taken forward by academics and research institutions. The Government will continue to address the challenge of reducing emissions from individuals, and will further consider measures to raise the visibility of personal carbon emissions and influence carbon saving behaviours.

2. Introduction

2.1. The UK is committed to reducing carbon dioxide (CO₂) emissions by at least 60% by 2050, against a 1990 baseline¹. Along with Government, the wider public sector and business, individuals have a role to play in helping the UK meet this target - individuals' emissions currently make up 42% of the UK's CO₂ emissions². Personal carbon trading is just one of a number of potential policy options being explored for making individuals better informed about, and involved in, tackling climate change. Personal carbon trading requires individuals to manage their own CO₂ emissions; a national emissions cap would be set, and emissions rights (in the form of carbon credits) would be allocated across the population as a whole. Individuals would surrender their carbon credits upon the purchase of, for example, electricity, gas or transport fuel. Those who need or want to exceed their allowance would have to buy allowances from those who emit less. Over time, the overall emissions cap (and hence individual allocations) could be reduced in line with international or nationally adopted agreements.

2.2. The idea of a trading system that involved all individuals and organisations, Domestic Tradeable Quotas (DTQs), was proposed by David Fleming – subsequently named Tradable Energy Quotas (TEQs)⁴. Richard Starkey and Kevin Anderson at the Tyndall Centre for Climate Change Research evaluated the feasibility and appropriateness of the

⁴ 'Energy and the common purpose', David Fleming, 2005.
<http://www.theleanconomyconnection.net/>

DTQ model and identified the potential for further work⁵. Mayer Hillman proposed a domestic carbon rationing and trading scheme for individuals⁶. Taking this early research into account, David Miliband made a speech to the Audit Commission on 19 July 2006⁷ outlining how a personal carbon trading scheme might work.

- 2.3. The Government committed, in the 2006 Energy Review, to consider personal carbon trading further. As a result, the Centre for Sustainable Energy (CSE) was commissioned to produce an initial scoping study⁸. One of the key conclusions was that there is little evidence available about key issues critical to the success of a personal carbon trading scheme, including: whether personal carbon trading could be proportionate, effective, socially equitable and financially viable, particularly when compared or combined with existing policies and other options for controlling carbon emissions; whether it could be a practical and feasible option; how such a scheme might work in practice; and whether it would avoid placing undue burdens on individuals. The Government has therefore undertaken a pre-feasibility analysis of personal carbon trading to try and understand the issues surrounding it better, with the aim of delivering an initial view on the potential value of personal carbon trading compared with other approaches to reduce individuals' CO₂ emissions. A commitment to this programme of work was outlined in the Energy White Paper 2007, and an inter-departmental Project Board was established to oversee this pre-feasibility study.
- 2.4. To ensure the research areas were as compatible as possible and could be brought together into this synthesis report it was necessary to provide a baseline description of a personal carbon trading scheme, and setting some key assumptions around scheme design. There are different types of personal carbon trading that vary depending on the emissions covered, who participates and how it might be implemented. For the purposes of this project, a Domestic Tradable Quota (DTQ) model was assumed. A key assumption of this design proposal is that personal carbon trading can either work alongside the EU Emissions Trading Scheme (EU ETS) or that the EU ETS would not exist. It would also require that the design of the Supplier Obligation did not place a cap on domestic energy suppliers. Key features of the scheme included it being a mandatory, economy-wide scheme with 40% carbon credits allocated for free to all UK adults and the remaining 60% auctioned to primary market participants (e.g. banks and large organisations). Carbon credits would need to be surrendered to

⁵ 'Domestic Tradable Quotas: A policy instrument for reducing greenhouse gas emissions from energy use', Richard Starkey and Kevin Anderson, 2005.

http://www.tyndall.ac.uk/research/theme2/summary_t3_22.shtml

⁶ 'How to save the planet', Mayer Hillman, 2004.

⁷ The text of this speech is available from:

<http://www.defra.gov.uk/corporate/ministers/speeches/david-miliband/dm060719.htm>

⁸ 'A Rough Guide to Individual Carbon Trading: The ideas, the issues and the next steps', CSE for Defra, November 2006.

<http://www.defra.gov.uk/environment/climatechange/uk/individual/pca/pdf/pca-scopingstudy.pdf>

cover the CO₂ content of electricity and gas use in the home and for personal transport purchases, with aviation covered indirectly through the airlines' fuel purchases.

- 2.5. Further academic studies and research have progressed in parallel to this project, and a collaborative working relationship has been developed with these organisations to ensure this project compliments and learns from these.

3. **Focus of the study**

- 3.1. The scoping study produced by CSE identified a range of areas where further research would be necessary in order to understand the issues surrounding personal carbon trading better. These questions informed the design of the pre-feasibility study into four key areas:

- 3.1.1. An assessment of the potential effectiveness and strategic fit of personal carbon trading. This study considered the potential economic efficiency of a personal carbon trading scheme covering domestic primary fuel use, domestic electricity use, and leisure road transport fuel and leisure aviation; as well as assessing its strategic fit with policies impacting directly or indirectly on individual's emissions. The approach taken was to analyse where there is potential to deliver additional cost-effective abatement in the UK, defining how personal carbon trading would address the barriers that are preventing these opportunities from being exploited now and judging how effective it would be at reducing the barriers. The benefit of implementing personal carbon trading was then estimated by examining the amount of additional abatement and its value. This valuation of the benefits was then compared with cost estimates provided by a separate study.

- 3.1.2. An analysis of the equity and distributional impacts. This study considered how personal carbon trading might affect different groups in society, assessed the impact of different design options, and considered whether personal carbon trading would represent a financially progressive policy instrument. The approach taken was to identify those factors that have a significant relationship with household CO₂ emissions⁹ and to investigate their characteristics. The study focussed on seven variables found to have the most significant impact on household CO₂ emissions and to be the most useful for characterising the population from a social and political perspective. These were: number of adults in the home, number of children, income, urban/ rural, number of rooms, tenure (rented/ owned), dwelling category (detached, semi, etc.).

⁹ Emissions associated with aviation and public transport were outside the scope of this study because inclusion of these sources would have required a much greater amount of data collection and analysis than appropriate for an initial pre-feasibility study. As a result there is a slight inconsistency between the research reports.

- 3.1.3. An analysis of public acceptance of personal carbon trading. This study aimed to provide initial insight into public acceptability of personal carbon trading, focussing in particular on the ideas of personal responsibility, people's response to carbon budgeting, scheme design, trust, fairness, equity and privacy. The approach taken was to carry out a series of deliberative focus group sessions involving a cross-section of participants from different regions, socio-economic status, age and encompassing each of the seven groups described by the Defra environmental segmentation model (which clusters individuals according to their environmental values and attitudes¹⁰). In addition, fifty per cent of participants were contacted after the group sessions for brief follow-up interviews.
- 3.1.4. An analysis of the technical feasibility and potential cost of personal carbon trading. This study aimed to provide a view on the technical feasibility of personal carbon trading and the range of costs associated with the type of scheme under examination, and to compare these costs with those of an upstream trading scheme involving around 5,000 organisations. The approach taken was to utilise the technical expertise of the consultancy carrying out the research to consider the operation of a personal carbon trading scheme by looking at the functions involved, such as enrolment, ID verification, accounting, transactions, and the key components, i.e. the technical instruments required to deliver these functions.

4. Findings

4.1. Assessment of the potential effectiveness and strategic fit of personal carbon trading

- 4.1.1. It is important to address the opportunities to reduce emissions from individuals as part of an efficient reduction of UK CO₂ emissions in line with national targets. Emissions from individuals include those associated with domestic energy (both primary fuels and electricity), leisure use of road transport vehicles and leisure flights. If emissions trading cannot be introduced cost effectively to these sectors then personal carbon trading will have been shown to be inefficient whether it is a distinct scheme for individuals or part of an economy-wide scheme.. The case for introducing personal carbon trading, rather than an alternative policy, relies on any additional cost of implementation being justified by sufficient additional up-take of cost-effective abatement in the UK.
- 4.1.2. Current policies driving improvements in energy efficiency include, for example, obligations on suppliers, product and building regulations, and

¹⁰ <http://www.defra.gov.uk/evidence/social/behaviour/index.htm>

the successor to the voluntary agreements with car manufacturers. Generally these policies are successfully improving energy efficiency, with some exceptions due to barriers that have not been fully addressed by policy - such as the landlord-tenant split, lack of information, lack of up-front capital and so on. Overall energy demand is determined not only by energy efficiency, but also by the level of energy services that individuals demand. Psychological and sociological barriers exist, such as lack of awareness or information, that prevent individuals from making cost-effective behavioural changes that would reduce their demand for energy services. The potential for personal carbon trading lies in reducing these barriers, thereby reducing energy service demand, and in contributing to further take-up of energy efficient measures, will be key to its assessment.

- 4.1.3. Overall emissions are a product of three factors: the carbon intensity of energy supplies; demand for “energy service” (heat, light, motive power etc.) and the efficiency at which energy is used to deliver these services. Energy demand has increased by 0.5% per year on average over the last 25 years, despite improvements in energy efficiency, because individuals are demanding more energy services and rising household numbers. There is apparently a large potential for cost-effective reduction in demand for energy services both from a reduction in the waste of energy services such as turning off lights when leaving a room, and from lifestyle changes such as living in a cooler house, or choosing to holiday locally.
- 4.1.4. Personal carbon trading could address two barriers to the uptake of cost effective abatement opportunities. Firstly, it would be experienced at a micro-level as a carbon price – either through individuals having to pay directly for additional allowances when they have run out, or from the foregone opportunity to sell surplus allowances when undertaking an activity that produces carbon emissions. Secondly, it would raise the visibility of personal carbon emissions through the holding of allowances by individuals, the process of paying with carbon credits when paying bills or buying fuels, and the process of trading allowances. A raised awareness of individuals’ own emissions could be expected to promote reflection by individuals on the impact of personal energy use and to encourage behavioural changes to reduce their emissions in a way that is cost-effective to them personally.
- 4.1.5. The unique selling point of personal carbon trading is this additional visibility it could deliver. The impact of the carbon price alone could not justify personal carbon trading because alternative policies could deliver such a price signal more cost-effectively (e.g. carbon tax or upstream trading). As a result it is necessary to consider the quality of this visibility and how much it would increase awareness of personal carbon emissions beyond that achieved by other policies.
- 4.1.6. Three types of visibility could be delivered by personal carbon trading: indirect feedback; feedback on an individual’s overall carbon footprint; and a ‘stop and think’ moment at the point of payment. Indirect feedback on domestic energy use is expected to be delivered through policies

improving billing and delivering real time feedback and could be achieved on personal transport emissions through regulation. Little additional visibility at the point of use/ purchase could be delivered here. The unique potential of personal carbon trading relies on providing a 'stop and think' moment and feedback on individual's overall carbon footprint. However, such feedback could be compromised by pooling of allowances, business energy use and 'pay as you go' transactions.

4.1.7. Evidence for the effectiveness of indirect feedback suggests a range of reduction in personal emissions of 0-10% - although these figures have been drawn from research on metering and energy displays rather than trials of personal carbon trading¹¹. Due to the limitations of the ability of personal carbon trading to deliver additional awareness, a low range of 0-5% reduction is assumed. Though a 10% reduction would still not be sufficient to balance the cost-benefit assessment more favourably. Further work is needed on the role of feedback on energy using behaviour. Table 1 provides values for the visibility benefits delivered by personal carbon trading alone, which captures the additional cost-effective abatement that it would be expected to deliver over and above an upstream trading scheme, given projected personal carbon emissions of 237million tonnes of CO₂ valued at the Shadow Price of Carbon (£29/tCO₂ in 2013)¹². Table 2 presents the range of additional costs for implementing and administering personal carbon trading over and above an upstream scheme.

Table 1: Estimates of additional annual benefits of personal carbon trading in 2013

	Reduction in personal emissions	lower bound	central	upper bound
Benefit per participant	0-5%	£0	£3.45	£6.90
	0-10%	£0	£6.90	£13.80

Table 2: Estimates of additional annual costs of personal carbon trading in 2013

	lower bound	central	upper bound
Cost per participant	£30.50	£52.07	£73.63

4.1.8. In the central case the costs are fifteen times the benefits. Even in the most optimistic case, with the lowest costs and the largest benefits, the costs are 4.5 times the benefits. Therefore, it appears unlikely that personal carbon trading could pass a cost-effectiveness test unless new evidence emerges to allow re-evaluation of the assumption of the effectiveness of feedback.

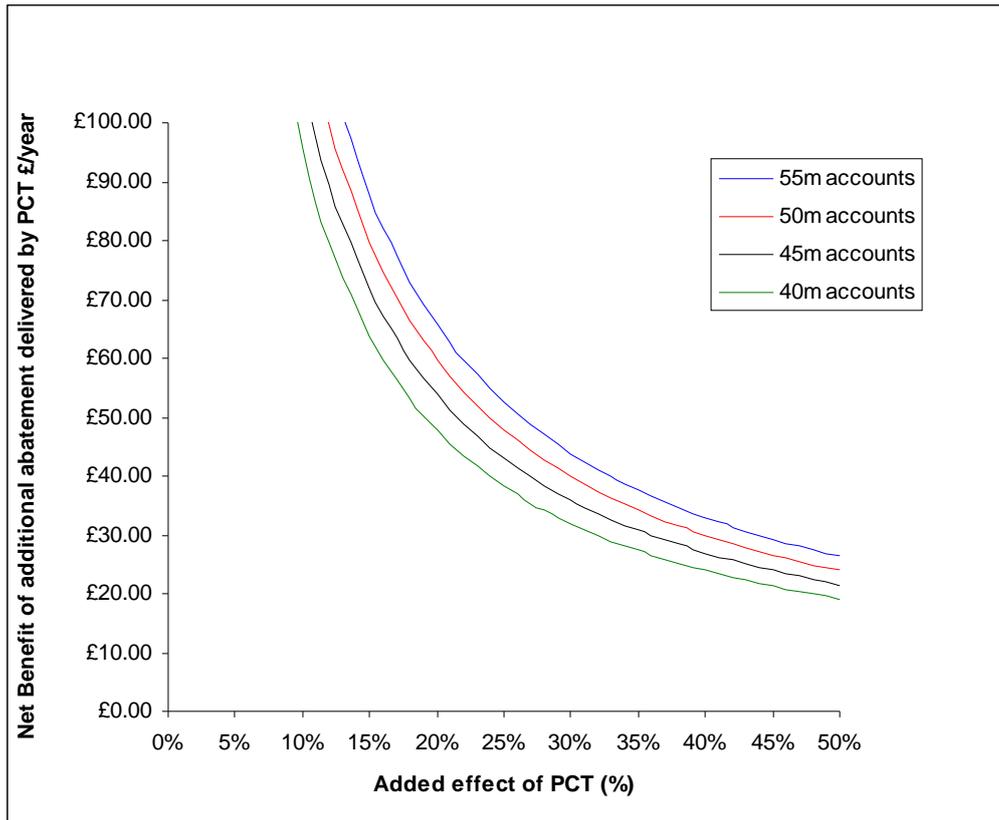
¹¹ 'The effectiveness of feedback on energy consumption: A review for Defra of the literature on metering, billing and direct displays', Sarah Darby, Environmental Change Institute, University of Oxford, 2006.

<http://www.defra.gov.uk/environment/climatechange/uk/energy/research/pdf/energyconsump-feedback.pdf>

¹² Valuing the benefits at this price is a simplification, assuming zero net resource costs to deliver the additional abatement, and assuming that international market prices for abatement approach the Social Price of Carbon.

4.1.9. Figure 1 below illustrates the cost-effective potential for personal carbon trading, based on the central costs. The value of the additional abatement delivered by the visibility personal carbon trading could deliver is plotted against the percentage reduction in personal carbon emissions delivered by this visibility alone, where points above the lines are cost-effective. For example, a valuation of £30/tonne of carbon dioxide abated, the visibility would have to deliver a greater than 40% reduction in personal carbon emissions to be cost-effective. The different lines represent sensitivities to the number of carbon accounts created for participants in the scheme.

Figure 1: Cost-effective potential for personal carbon trading, based on central costs



4.1.10. In conclusion, the present policy mix is not successfully addressing all the barriers to the uptake of abatement. There is a demand for energy services in the personal sector which is increasing faster than improvements in energy efficiency. This highlights the importance of increasing individuals' awareness of their own emissions and demand for energy. However, the quality of the visibility delivered by a policy is important, along with how much this visibility costs. There is clearly a policy space for changing individuals' behaviour towards lower emitting activities. The King Review of low-carbon cars has for instance highlighted the importance of measures to encourage consumers to make more sustainable choices. It has recommended that the Government should seek to strengthen demand-side measures to encourage consumers to

downsize or procure best in class, and develop and reinforce the “Act on CO₂ campaign”¹³.

4.1.11. Some of the benefits offered by personal carbon trading in terms of increased visibility of the impact of consumer choices could potentially be achieved more cost-effectively by a combination of other measures, for instance, including information on the CO₂ impacts associated with purchases on airline tickets, on petrol receipts or at the pump in petrol stations, plus awareness raising and advice activities. These measures could be complementary to a carbon price signal, which could potentially be delivered by a carbon tax, an expansion of the EU Emissions Trading Scheme or an upstream trading scheme. The incremental visibility delivered by personal carbon trading would need to achieve a very significant level of behavioural change, over and above measures such as these, in order to justify the additional costs of such a scheme. However, this conclusion could be revised in future by considering different scheme designs that had much lower implementation costs, for example, if accounts weren't required. However, such revisions could reduce the functionality of the scheme and the incremental visibility delivered, as well as presenting potential security risks. Further consideration of key cost drivers and how these might be reduced, as well as lower cost scheme designs and alternative policy options for tackling emissions from individuals would be areas worthy of further research.

4.2. An analysis of the equity and distributional impacts

4.2.1. One of the key benefits put forward for personal carbon trading is its inherent fairness - the idea that everyone gets the same share. However, due to people's differing circumstances, an equal share may not be as fair as it first seems. For example, a single parent family living in the countryside in an old detached property may require many more carbon credits than a single person living in the city in a newly built apartment. However, under an adult-only per capita scheme both households would receive the same number of carbon credits. Another potential feature of personal carbon trading is that it would be fiscally progressive as the 'poor' generally emit less CO₂ than average and the 'rich' emit more than average¹⁴. Analysis into how personal carbon trading might affect different groups in society was carried out to explore these ideas. It was based only on the allocation and trading aspects of personal carbon trading, and excluding the costs and benefits associated with implementing the scheme and the auctioning of credits.

¹³ 'The King Review of low-carbon cars, Part II: recommendations for action', March 2008, pp10-12

http://www.hm-treasury.gov.uk/independent_reviews/king_review/king_review_index.cfm

¹⁴ 'The distributional impacts of economic instruments to limit greenhouse gas emissions from transport', S Dresner & P Ekins, Policy Studies Institute, 2004.

4.2.2. The Office of National Statistics (ONS) Expenditure and Food Survey (EFS) was used to gather consumption and emissions data for household and road transport fuels for three years (2003/4 to 2005/6), creating a sample size of 20,000 households. The approach taken was to identify and investigate variables influencing overall per-adult emissions and consider allowance credit/ deficit; segment the households into groups; and investigate the characteristics of those groups identifying relevant trends and exceptions.

4.2.3. There were found to be fifteen significant variables that influenced per adult household emissions (see Table 3). These variables were found to explain 46% of the variation in per adult emissions. Seven of these fifteen were chosen for use in the classification of groups (see *variables in Table 3). There are numerous other factors that influence individuals' emissions, such as number of vehicles, number of electrical appliances and type of heating system, but these were excluded from this analysis in order to focus on those considered to be most useful for characterising the population from a social and political perspective.

Table 3: Significant variables influencing per adult CO₂ emissions (in order of relative importance)

*Number of adults
Number of vehicles
Central heating type
*Number of rooms
*Number of children
*Income (equivalised)
*Tenure
Number of appliances
Age of household reference person (HRP)
*Dwelling type
Government Office region
Economic position of HRP
*Rural/ urban classification
Only adults over 65 in household
Sex of HRP

4.2.4. Distribution by income, geography and household composition revealed that approximately three fifths of UK households would have more credits than they would currently need under a personal carbon trading scheme based on equal per adult allocations and a cap set at current emissions. The distribution is found to be progressive with 71% of low income households identified as 'winners' (more than enough allowances to meet their current emissions) and 55% of high income households 'losers' (insufficient allowances to meet their current emissions). This pattern is enhanced by the finding that low income households tend to gain more and lose less than high income households. Of the 2.1 million households that fall into the low income 'loser' category a high proportion live in rural areas, many live in larger-than-average homes, and the allowance deficit is driven by their heating rather than their transport emissions. In addition, households in Northern Ireland (and low income households in particular)

are disproportionately represented amongst the 'losers' due to a heavy dependence on oil for central heating.

4.2.5. The analysis has revealed some challenges to the notion that personal carbon trading is inherently fair. However, these impacts could be tackled through interventions such as specific initiatives to tackle under-occupancy, the thermal performance of rural homes, and the carbon-intensity of their heating systems. It is likely that such initiatives would also have the benefit of addressing fuel poverty, which is also prevalent in lower income rural 'hard to treat' homes and in 'under occupied' homes in both rural and urban areas. Additionally, allocation methodology and scheme design could limit such negative impacts, for example, modelling of a scheme where each child received 1/3 of an adult allocation produced an outcome with fewest 'loser' households overall. Though this analysis finds personal carbon trading to be generally progressive, it is important to note that the extent to which people do not trade rationally will diminish the progressive nature of such a scheme.

4.2.6. Further consideration of the impact of including implementation costs and benefits and those from auctioning would be worthy of further research, as would the inclusion of aviation emissions and better transport data, an assessment of abatement opportunities available to households and some options analysis based on different scheme models.

4.3. An analysis of public acceptance

4.3.1. Crucial to the success of personal carbon trading is its ability to engage the public and influence people's behaviours. Therefore, public acceptance of such a policy measure is vital. Analysis was carried out exploring the concept of individual responsibility for climate change, the public acceptance of personal carbon trading alongside two alternative policy measures, and elements of scheme design. The approach taken was to carry out twelve deliberative focus groups involving 92 participants from a cross-section of the public from different regions in England, different socio-economic backgrounds and representing each of Defra's seven environmental segments (where individuals are grouped according to their environmental values and attitudes). Following the focus group sessions, approximately fifty per cent of participants were re-contacted for a follow-up structured interview by telephone.

4.3.2. The research was qualitative, rather than quantitative, so it offers depth and insight into the initial views around the issues discussed, and makes it possible to propose a likely response to personal carbon trading from the wider community. However, it does not support discussion around the proportions of participants with specific views. People's understanding of, and attitudes towards a complex policy of this nature will inevitably change over time, so this research can only be taken as a snapshot of the groups very first reaction to the proposal.

4.3.3. Responses to personal carbon trading as a concept ranged from quite positive to very negative:

- *“I’m not saying I agree 100% with this scheme, but I think if they’re serious about reducing it, something like this has got to come in”;*
- *“Just straight away it reminds me of going back to the war and rationing”;*
- *“Look at the Poll Tax... theoretically... a good idea... we all know what happened... The amount we saved was negligible”.*

These quotes are illustrative of the types of initial responses that might be expected if personal carbon trading were to be explored through some form of public consultation.

4.3.4. Overall, the degree of resistance to individual behaviour change was found to be less than expected, as participants were generally willing to accept some responsibility for their emissions. However, there was a clear inconsistency of views whereby participants wanted Government to intervene and take responsibility (choice editing³, grants and regulation were suggested), but there was a strong lack of trust in the Government in doing this and a reluctance for individuals to have to contribute financially. It should be noted that one of the key concerns raised in relation to lack of trust in Government was in holding individuals’ data, and that the timing of the focus group sessions coincided with the heavily publicised loss of Government CDs and laptops holding personal data.

4.3.5. There was concern around the concept of imposing notional ‘limits’ on activities - this was the perception despite explanation that there wouldn’t be limits on individuals or their actions. Additionally, initial reactions to the options proposed (personal carbon trading was presented alongside carbon tax and upstream trading, both with revenue recycling) were all unfavourable, with views focussed on a strong reluctance to the use of a price signal to influence individuals’ behaviours.

4.3.6. Participant’s responses to various aspects of personal carbon trading are well illustrated by the following quotes:

- i. PCT is too complex – *“I can’t imagine my mother being able to sell credits. I think it would worry her to death”;*
- ii. Personal carbon trading is unlikely to achieve emission reductions – *“If you’ve got the money and the wealth and don’t care you will frankly continue, you will just buy more credits”;*
- iii. Some interesting moral concerns were raised – *“They are appealing to people’ greed by saying; well you can sell some of these credits”;*

- iv. There was reluctance to participation in trading – *“Have you really got time to start bartering on the market with credits, if you’ve got three children and a household to run and to work?”*.

4.3.7. Personal carbon trading polarised participants’ views to a greater extent than the other two options presented; although there was a strong tendency for participants’ views to be ‘very negative’ about personal carbon trading compared to the other two options, a ‘quite positive’ view was more common than with carbon tax or upstream trading.

4.3.8. Despite an apparent great deal of opposition, many of the challenges to the options proposed or personal carbon trading in particular would have been relevant to any measure aiming to tackle individuals’ emissions: research elsewhere shows that people are resistant to any measure that will significantly impact on their individual lifestyle¹⁵. Individuals’ attitudes could be different if some of their key concerns, for instance around vulnerable groups, were addressed, and if more detail were given on how personal carbon trading could work in practice. Feedback seemed to support these approaches as some participants suggested some form of trialling without involving money. The way personal carbon trading is presented and described, and the context in which it is set, was found to have a considerable impact on the findings. This should be taken into account in any further research. Further research of the acceptability to the public of taking personal responsibility and action for the CO₂ emissions associated with individuals, and further probing into the use of personal carbon trading as a tool do so, would be worthwhile. Analysis could usefully explore different scheme design options, greater detail on scheme design, different engagement techniques and a longer period of engagement with participants.

4.4. **An analysis of the technical feasibility and potential cost**

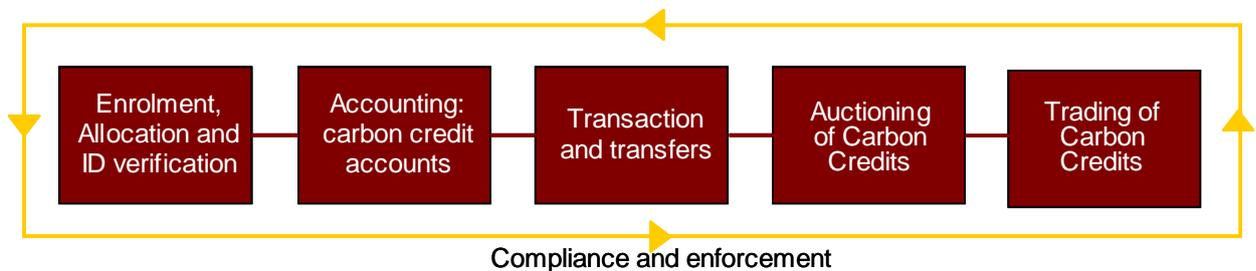
4.4.1. The introduction of personal carbon trading will require a comprehensive system to assign ownership of carbon allowances to around 50 million participants, to track allowance usage by participants across all relevant retail points (petrol stations, energy suppliers, travel agents etc.) and reconcile usage against their account holdings. An analysis of the technical feasibility and potential cost of implementing personal carbon trading is a key part of this pre-feasibility study. Analysis was undertaken to describe how a personal carbon trading scheme would work in practice, looking at the potential functionality needed to operate such a scheme, and the components required to provide these functions. The costs of setting up and running a personal carbon trading scheme were then estimated by assessing the costs of the main components and tasks involved; and these cost estimates were compared to those for an

¹⁵ Pro-environmental behaviours framework

upstream trading scheme. The analysis of both technical feasibility and cost are based on internal estimates rather than detailed modelling or costing exercises.

4.4.2. No insurmountable technical barriers were identified to the introduction of a personal carbon trading scheme. Most functions were found to be able to be fulfilled by adapting existing systems, and a timescale of 6-8 years was estimated as a requirement for implementation. Six functions were identified, as described in Figure 2 below. Enrolment, allocation and ID verification were thought to be able to be delivered by altering an existing system: DWP's Customer Information System was suggested as one possible system¹⁶. An assumption was taken that a Government organisation should run this system and that participants would need to enrol themselves via one of a number of channels (e.g. telephone, online, etc.).

Figure 2: Functions of a personal carbon trading system



4.4.3. Following ID verification it is suggested that a national account system should transfer carbon credits to individual accounts, which would be run by private sector organisations (e.g. banks and building societies). Allocations of carbon credits were thought to be most cost-effective and least disruptive on a staggered, annual basis. Carbon credit accounts could be set-up alongside current accounts, with multifunctional contact smartcards¹⁷ suggested as the best means of facilitating transactions allowing carbon credits to be integrated onto existing customer cards.

4.4.4. Transactions could be made at the point of sale of goods and services, as well as via direct debit for utility bills, i.e. gas and electricity bills. In addition, it would be necessary to provide for 'pay as you go' transactions for UK citizens not in possession of a carbon credit card, and for visitors to the UK. Billing and payment systems and infrastructures would need to be adapted to accommodate this.

4.4.5. A trading platform or exchange would be required to facilitate the market and while banks and many other businesses would be the principal operators in the auction of credits, individuals would play a full part in the

¹⁶ It should be noted that DWP were not consulted as a part of this research.

¹⁷ A contact smartcard is a card with a microprocessor embedded that can facilitate transaction from multiple accounts.

market. Individuals could place trades through brokers or financial intermediaries (e.g. banks) in the same way individuals access existing commodity markets or buy and sell foreign currency.

4.4.6. Cost ranges are large due to the large number of participants in the scheme (50 million adults). Total set up costs of a personal carbon trading scheme being delivered to around 50 million adults were estimated to be between £700 million and £2 billion, and running costs estimated at £1–2 billion per annum. Compared to estimates of the set up of an upstream trading scheme involving around 5,000 organisations of £50-100 million, and running costs of around £50 million per annum, personal carbon trading certainly appears the more costly option. However, these costs do not take into account the potential benefits generated by the auction of credits, or the benefits delivered by the scheme in terms of awareness raising and behavioural change (as examined in section 4.1). In addition, it is very important to put these costs into perspective to appreciate the service being delivered and the outcomes. For example, the estimated cost of administering £16.6 billion worth of housing benefit and council tax benefit to four million households is estimated by DWP to be in the region of £800 million to £1 billion per annum. By way of comparison, the Government's Act on CO₂ campaign received £10 million in funding in 2007/08, while Climate Change Agreements deliver 1.9–2.5 million tonnes of carbon savings a year at an administrative cost of £1.2 million a year and a tax revenue cost of £350 million a year.

4.4.7. It would seem likely that cost reductions would be necessary in order to justify serious consideration of this policy measure. Such cost reductions could be identified by altering the scheme design, technological developments, and by considering the commercial viability (and potential to involve the public sector), as well as further assessment of the likely benefits (i.e. potential for behaviour change as a result of the visibility delivered). One proposed option for reducing the large administration costs would be to remove the requirement for accounts, however, this could present a number of security risks.

4.4.8. Consultation with the industries affected to further investigate costs, commercial viability and risks would be necessary, as well as a clear need for further consideration of the key cost drivers and how these might be reduced. Different scheme designs and alternative policy options for tackling individuals' emissions would be additional areas to requiring further consideration.

5. External research studies

5.1. The Royal Society for the Encouragement of Arts, Manufactures and Commerce (RSA) are carrying out a three year research project looking at

a number of areas including better understanding individuals' carbon profiles through their CarbonDAQ online tool (where individuals can register, complete their carbon footprint online and compare with others)¹⁸. RSA are looking at design, economic efficiency, social impacts and public acceptability. RSA's project aims are to:

- better understand individuals' carbon profiles (their CarbonDAQ project whereby individuals can register their carbon footprint online and compare with others);
- look at how business and the financial sector would respond to the introduction of personal carbon trading (focusing on market design and technology issues);
- look into the role of transport and whether/ how it should be included within a personal carbon trading system;
- compare personal carbon trading with upstream trading.

This project is due to reach its conclusion at the end of 2008.

5.2. The Tyndall Centre for Climate Change Research previously evaluated the feasibility and appropriateness of the DTQ model in terms of equity, effectiveness and efficiency, and identified the potential for further work. More recently, they have been investigating issues of equity and justice; principally questioning whether an equal per capita allocation is really fair¹⁹. In addition, they are considering potential future focus group work and philosophy on equity, looking in more detail at the concept of an equal per capita right to emit without focussing on specific scheme design. Other future work may involve further research on distributional issues looking at the impacts on individuals of involving businesses in a personal carbon trading scheme.

5.3. The University of Oxford's Environmental Change Institute, as part of its work within the UK Energy Research Centre, is looking at personal carbon trading as a tool for demand reduction and influencing consumer behaviour²⁰. It has recently produced a report on trialling personal carbon trading, which investigates the value and feasibility of trialling as a research method to advance understanding of personal carbon trading. Their current work is now focussing on examining the political and policy obstacles to personal carbon trading in the UK context. This will involve considering the policy features that are important for bringing personal behavioural change. ECI are also starting to look more closely at CRAGs²¹ and transition towns in order to understand better the role of groups and communities in supporting personal behavioural change. ECI's future work may involve assessment of the place for personal carbon trading in a broader policy framework for carbon emissions reduction. ECI also intend

¹⁸ Further details are available from: <http://www.rsacarbonlimited.org/default.aspx>

¹⁹ 'Allocating emissions rights: Are equal shares, fair shares?', Richard Starkey, Tyndall Centre for Climate Change Research, University of Manchester, Forthcoming.

²⁰ Please see: <http://www.eci.ox.ac.uk/research/energy/lcfprojects.php#pct> for further details.

²¹ Carbon Rationing Action Groups

to include personal carbon trading in appropriate scenarios of the UKERC “Energy 2050” project which looks at the long-term future of the UK energy system.

- 5.4. The IPPR (Institute for Public Policy Research) is carrying out a one-year project assessing the pros and cons of personal carbon trading, and focussing on fairness, fit with other policies, political acceptability and environmental effectiveness. Their approach is to compare personal carbon trading with other policy options for reducing CO₂ emissions, such as upstream trading and taxation, assessing them both for their policy and political effectiveness. They have been exploring whether the policy will provide unique visibility of emissions and motivation for emissions reduction, along with an opinion poll to test the public's reaction. The project will also look at the distributional implications of personal carbon trading and what kind of policies might be needed to mitigate negative impacts as well as providing an estimate of how much it would cost to set up and run. The project is due to conclude by the end of 2008.
- 5.5. The Lean Economy Connection – whose Founder Director is David Fleming, originator of the Tradable Energy Quotas model - is continuing research, as well as an outreach programme of speaking engagements, in order to help inform and generate support for this model. They are assisting De Montford University with a project examining the effect of TEQs on the local economy of Leicester, and are working with a number of organisations giving public talks and presentations, including the Transition Towns movement in the UK and the Carbon Equity group in Australia. In addition, they are assisting the All Party Parliamentary Group on Peak Oil and Gas and the Californian State Government in examining TEQs, and are contributing to a submission to the Australian Government's Garnaut Climate Change Review.
- 5.6. A variety of other personal carbon trading schemes are under consideration by academics and research institutions, for instance Feasta's Cap and Share model, which involves allocation of emissions rights to individuals who then sell these back to industry (primary oil, gas and coal companies). Also, the US-based Sky Trust proposal, which involves an upstream auction of units, the revenue of which is shared equally amongst individuals. In addition to investigation of different schemes, the personal carbon trading concept is being considered further and various forms of personal carbon allocations are being trialled by community groups and organisations. For instance, the UK-based network of CRAGS (Carbon Rationing Action Groups) and PACT – the Personal Allowance Carbon Tracking scheme that has been developed and run by WSP Environmental. PACT is a voluntary scheme for WSP staff that requires participants to sign up to a 6 tonnes carbon annual allocation to cover their energy consumption at home and their personal travel. Small financial incentives/ penalties account for surplus or deficit at the end of the year. Analysis from a first-quarter survey revealed that the scheme had encouraged the majority of participants (71%) to think about their energy use and travel, and had encourage them to change their energy use (71%)

and transport activities (to a lesser extent – 43%). Most participants felt that they would change the way they use energy in the home and their transport habits through the rest of the year.

6. **Synthesis**

- 6.1. The economic analysis suggests the visibility delivered at the point of purchase (and so the potential for behaviour change as a result of this visibility driving greater awareness of, and reflection on, personal carbon emissions) is the only justifiable argument for personal carbon trading. The level of emissions savings that could be delivered as a result of visibility is indicated to be between 0-10% for indirect feedback, and 5-15% for direct feedback. This figure could be called into question as the study it derives from was on smart metering²². It could be argued that a personal carbon trading scheme has the potential to raise a greater level of visibility as it sets a sectoral budget, and by allocating a certain amount of emission 'rights' individuals are provided with an equal per capita entitlement of personal emissions, as well as a sense of ownership or responsibility for them. Without further research it is difficult to know how people would respond to this sort of stimulus, or whether they would take rational choices to reduce emissions, take part in trading, or purchase additional credits.
- 6.2. The cost-benefit analysis reveals that there could potentially be circumstances under which the Government might choose to introduce personal carbon trading, but this would require significant changes to one or all of three key variables: the costs of implementation, the value of carbon savings and the degree of savings delivered by the policy. Further assessment of where this might be and what level and quality of visibility this would deliver would be a sensible next step and necessary in taking this work forward. Analysis of ways to reduce the costs associated with personal carbon trading would be best focused on further investigation of the key cost drivers, as well as an options analysis of different scheme designs. In addition to costs, further examination of public acceptability would be necessary as attitudes could be quite different if some key concerns were addressed and more detail were given on how the scheme would work in practice.
- 6.3. As noted earlier (section 1.6), there are some limitations to the project approach taken. Though this research was based on the DTQ model, the project approach was to consider the fundamental questions surrounding personal carbon trading, such as could personal carbon trading deliver CO₂ savings, would it be technically possible and at what cost, is it really equitable and would it be acceptable to the public? The research was based on a broad outline of a scheme design, to find out more about the

²² See footnote 12.

key issues surrounding the concept, rather than analysing a specific scheme design or undertaking an options analysis of the best scheme. The findings of the research therefore provide robust conclusions that would also be applicable to other personal carbon trading models. This approach has made it possible to take a view on the potential value of the personal carbon trading concept compared to other measures.

- 6.4. This project has delivered a detailed assessment of the economic efficiency and strategic fit of such a scheme, as well as setting out an approach for assessing the costs and benefits of policies aimed at reducing individuals' emissions. It has also assessed individuals' emissions by income, geographic location, household, and other factors. An assessment has been made of the initial public acceptance of measures designed to reduce individual's emissions; and experts have delivered an assessment of the technical feasibility and cost of personal carbon trading. This research makes an important contribution to the analysis of measures aimed at reducing individuals' CO₂ emissions and encouraging pro-environmental behaviours.
- 6.5. It would seem that the case for a full impact assessment and feasibility appraisal into personal carbon trading cannot be justified at this stage. However, there could be potential for personal carbon trading at some future point under certain conditions, for instance, if the social cost of carbon increased and balanced the assessment of costs and benefits in favour of personal carbon trading; if the costs of implementing a scheme could be greatly reduced; if it were found to be more publicly acceptable to take personal responsibility for, and action to reduce, emissions associated with your behaviours; or if the estimate of visibility benefits were found to be higher. If these conditions were found, personal carbon trading should be one of the policy options considered.

7. **Next steps**

- 7.1. These findings present a number of challenges to the personal carbon trading concept, but do indicate there may be circumstances in the future where personal carbon trading is a cost effective and desirable policy option. Though our findings indicate that the concept does engage people at some level, it does so at a high cost.
- 7.2. The Government maintains its view that personal carbon trading is an interesting idea, but considers the concept that is currently ahead of its time. It could be argued that a sensible next step to test the findings of the technical feasibility and public acceptability analysis in particular would be a form of trialling or pilot. However, to get the most out of such an activity further analysis would be needed to determine the best technical option, that combines acceptable cost with public acceptability. Even then, there are risks to testing in public as pilot systems are inevitably unrefined and fault-ridden, which could lead to failure and subsequent public distrust and ridicule. Furthermore, a pilot would not be able to test the mandatory and

national nature of a scheme, therefore making it unrepresentative of the real world²³.

- 7.3. These conclusions point towards Government maintaining engagement in the debate by keeping a watching brief as further research is taken forward by academics and research institutions, but not moving forward to a full feasibility study at this stage. Defra are currently developing a Research Centre on Sustainable Behaviours in conjunction with the Economic and Social Research Council and other funding partners. Should this go ahead as planned the Research Centre could be used to monitor the ongoing personal carbon trading projects in the academic/research community and provide a synthesis of findings. This role will be further considered throughout the development of the Centre. In addition, the Government remains committed to the challenge of reducing emissions from individuals. Following the conclusions of personal carbon trading research being carried out outside of Government, it may be worthwhile reviewing what this may mean for efforts to reduce individuals' CO₂ emissions and Government's involvement and interest in personal carbon trading.
- 7.4. Further research on the evidence gaps is needed, in particular, further assessment of the key cost drivers and how these costs might be reduced. Another clear challenge is to better determine the degree of behavioural influence a personal carbon trading scheme might have. Further analysis of the impact of policies on individuals' behaviours would have much wider benefits within Government than just the assessment of personal carbon trading.

²³ The view of CSE in their scoping study 'A Rough Guide to Individual Carbon Trading: The ideas, the issues and the next steps', CSE for Defra, November 2006. (See footnote 8 for weblink).

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